Panasonic®

Motion Controller GM1 Controller User's Manual

Operation Edition

WUME-GM1OP-02

(MEMO)

Introduction

Thank you for purchasing a Panasonic product. Before you use the product, please carefully read through the installation instructions and the manuals, and understand them in detail to use the product properly.

Types of Manuals

• There are different types of manuals for the GM1 series, as listed below. Please refer to a relevant manual for the unit and purpose of your use.

These manuals can be downloaded from our website: https://industry.panasonic.com/ global/en/products/fasys/plc/mc/gm1

Manuals for GM1 series

Manual name	Manual code	Manual description
GM1 Series Reference Manual (Hardware Edition)	WUME-GM1H	Explains the functions and performance of each GM1 unit.
GM1 Series Reference Manual (Instructions Edition)	WUME- GM1PGR	Explains the specifications of each instruction that can be used with the GM1 Series.
GM1 Series Reference Manual (Analog I/O Unit Edition)	WUME- GM1AIO	Explains the functions and performance of the GM1 Analog Expansion Unit.
GM1 Series Reference Manual (Pulse Output Unit Edition)	WUME-GM1PG	Explains the functions and performance of the GM1 Pulse Output Unit.
GM1 Series Reference Manual (Serial Communication Unit Edition)	WUME-GM1SC	Explains the functions and performance of the GM1 Serial Communication Unit.
GM1 Series User's Manual (Operation Edition)	WUME-GM1OP	Explains how to use GM Programmer and PANATERM Lite for GM, set up each function, create projects, and perform other operations.

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Compliance with IEC 61131

International standard IEC 61131 is the international common standards in which the International Electrotechnical Commission (IEC) defines programming languages for PLC. IEC defines the following five programming languages:

- Ladder Diagram (LD)
- Structured Text (ST)
- Sequential Function chart (SFC)

- Function Block Diagram (FBD)
- Instruction List (IL)

Glossary

RTEX

Stands for Realtime Express, which is the name of the motion-specific network connecting the GM1 Controller RTEX and servo amplifier.

* Realtime Express is the name of the network servo system manufactured by Panasonic Corporation.

GM Programmer

A configuration tool for the GM1 Controller RTEX. Using GM Programmer makes it possible to set positioning data and various positioning parameters, and perform various monitoring. As this tool is equipped with tool operation mode that starts a motor independently without using user programs, it is convenient especially to verify operations at the time of initial startup.

PANATERM Lite for GM

A setup support tool for the MINAS series servo amplifiers manufactured by Panasonic Corporation. When GM Programmer is installed, "PANATERM Lite for GM" is also installed at the same time. By using this tool, parameter setup within servo amplifiers, control status monitoring, setup support, machine analysis, and other operations can be executed on the PC screen.

P-point control

Refers to control passing through a "Pass Point". In this manual, this control is referred to as "P-point control" for the sake of convenience.

This method is used when target multi-stage velocities are specified in a sequence of motions.

C-point control

Refers to control passing through a "Continuance Point". In this manual, this control is referred to as "C-point control" for the sake of convenience. This method is used to execute consecutive E-point controls by one-time startup.

E-point control

Refers to movement up to an "End Point". In this manual, this control is referred to as "E-point control" for the sake of convenience. This method is used for single-speed acceleration / deceleration control. It is also called "trapezoidal control".

Automatic operation

An operation that is automatically performed. It means position control.

Manual Operation

An operation that is performed at initial startup or during adjustment. Home return, JOG operation, and pulser operation are manual operations.

Position control

A generic term for E-point control, P-point control, and C-point control. For each control, control for single axes and interpolation control for multiple axes can be performed. Interpolation control can be selected from 2-axis linear interpolation, 2-axis circular interpolation, and 3-axis linear interpolation.

Home return

The reference position for positioning is called a home position and an operation to travel to a home position is called home return. Each axis is moved to the preset home position and the coordinates of the home position are defined as absolute position zero. The motor rotation is reversed automatically when the limit input (+) or the limit input (-) is input and the home position or near home position is searched to return to the home position automatically.

JOG operation

Refers to an operation in which the motor is rotated only while operation commands are being input. This is used to forcibly rotate the motor using inputs from external switches during startup or adjustment, for example. This can also be applied to unlimited feed.

■ Limit input (+), limit input (-)

A limit switch input that is used to limit the motor movement. Limit input (+) is the limit point on the side where the elapsed value increases and limit input (-) is the limit point on the side where the elapsed value decreases.

Dwell time

For E-point control, the time from the completion of a position command until the operation done contact turns ON can be specified as a dwell time. For C-point control, similarly, the time from deceleration stop until execution of the next positioning table can be specified as a dwell time.

Software limit

Limits in software can be set for the absolute coordinates managed by the GM1 Controller. The motor decelerates and stops according to the deceleration of the dynamic limit so as not to exceed the soft limit range. Deceleration time can be set individually.

Torque control

The output torque of the servo amplifier can be limited arbitrarily.

Servo ON / Servo OFF

The operation that changes the servo free state to a servo lock state is called "servo ON", and the operation that changes the servo lock state to a servo free state is called "servo OFF".

Linear interpolation

Interpolation control that controls straight lines as loci for the operations of 2-axis motors with grouped X-axis and Y-axis or 3-axis motors with grouped X-axis, Y-axis, and Z-axis. There are two setting methods, which are a composite speed specification and long axis speed specification.

• Circular interpolation

Interpolation control that controls arcs as loci for the operation of 2-axis motors with grouped Xaxis and Y-axis. There are two setting methods, which are a center point specification and pass point specification.

Edge Detection

One of the methods for detecting the request signals allocated to this unit. It executes each requested process by detecting a trigger that is the rising edge when the request signal turns ON.

Therefore, the next request cannot be accepted until the current request signal turns OFF.

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Table of Contents

1	Before Using This Product	.1-1
	1.1 Safety Precautions	.1-2
	1.2 Security precautions	.1-3
	1.3 Handling Precautions	.1-4
	1.4 Software License Agreement	.1-5
2	GM1 function overview	.2-1
	2.1 System Configuration Diagram	
	2.2 Product Lineup	
	2.2.1 GM1 controller	2-4
	2.2.2 Expansion Unit	
	2.3 Functional limitations	
	2.3.1 Restrictions on the Number of Expansion Units 2.3.2 Version limitations	.2-0 2-6
	2.3.3 Restrictions on Functions	
2	Overview of the CM Dreammen	2.4
3	Overview of the GM Programmer	
	3.1 System Requirements 3.1.1 Usage Environment of the GM Programmer	
	3.2 Version System	
	3.2.1 Version Relationship	
	3.3 Installation and Uninstallation	
	3.3.1 Installing GM Programmer	
	3.3.2 Uninstalling GM Programmer	
	3.4 Basic Operations 3.4.1 How to start	
	3.4.2 How to quit	
	3.5 Component Names	.3-14
	3.5.1 Menu Bar	
	3.5.2 Toolbar 3.5.3 Navigator Pane	
	3.5.4 Main Pane	
	3.5.5 Status Bar	3-31
	3.6 Window Operations	
	3.6.1 Moving the Pane Location 3.6.2 Showing / Hiding Panes	
	3.6.3 Switching the Tab of the Main Pane	
	3.6.4 Operating the Object Window	3-36
	3.6.5 Full-screen Display	
	3.7 Other Functions 3.7.1 Option Setting Function	
	3.7.2 Display Language Setting Function	
	3.7.3 Version Display Function	3-43
	3.7.4 Customize function	3-45

4	Project Operations	.4-1
	4.1 Project Creation Flow	4-2
	4.2 Project operations	
	4.2.1 Creating a New Project	
	4.2.2 Device Tree Configuration	
	4.2.4 Saving a Project	
	4.2.5 Closing a Project	. 4-10
	4.2.6 Opening a Project	. 4-11
	4.3 Setting up the GM1 Controller	4-12
	4.4 Adding Objects 4.4.1 List of objects	
	4.5 Other project settings	
	4.5.1 Setting up a Project	
	4.5.2 Setting up a project save	. 4-19
	4.5.3 Printing a Project and Object	
	4.5.4 Comparing Projects 4.5.5 Exporting and Importing Objects	. 4-26
	4.5.6 Project File Conversion	. 4-35
	4.5.7 Saving and unzipping the project archive	
5	Program Creation	5-1
J	5.1 Flow of Program Creation	
	5.2 Program Creation Window 5.2.1 Main Pane	
	5.2.2 Declaration Editor	
	5.2.3 Auto Declaration	
	5.2.4 Toolbox 5.2.5 Setting up the Program Input Window	
	5.2.6 Window Operations for the Program Input Window	
	5.3 Creating a Program Object (POU Object)	
	5.4 Types of Programming Language	
	5.5 Function and Function Block	
	5.5.1 Function	
	5.5.2 Function Block	. 5-24
	5.6 User Library Function	
	5.6.1 Creating a Library and Adding to the Library Repository	
	5.6.2 Using Created Libraries	
	5.7 POU for implicit checks 5.7.1 Setting up POU for implicit checks	
	5.8 Tasks	
	5.8.1 Adding Programs	
	5.8.2 Adding a UserTask	
	5.8.3 Task Configuration Window	
	5.9 Build	
	5.9.1 Build	
	5.9.2 Rebuild 5.9.3 Code Generation	

5.9.4 Clean	
5.9.5 Clean All	5-50
5.10 Program Creation Support Functions	5-51
5.10.1 Bookmark	
5.10.2 Call Tree View	
5.10.3 Cross reference List View	
5.10.4 Function Block Guidance	
5.10.5 Short Form Function	5-58
5.10.6 Input Assistant Function	5-59
5.10.7 Argument / Variable Input Support (Component Lis	
5.10.8 Global Renaming (Refactoring)	
5.10.9 Code Analysis (Static Analysis Light)	
5.10.10 Displaying Programs in Multiple Languages (Proje Localization)	
5.10.11 Start Instruction Help Function	5-71
6 Entering programs in each Programming language an 6.1 Programming in Ladder Diagram (LD)	6-2
6.1.1 Inserting Contacts, Coils, and Function Blocks	6-2
6.1.2 Inserting Contacts in Parallel	
6.1.3 Inserting a Network (Circuit)	
6.1.4 Inserting a Branch	
6.1.5 Input of Title and Comment (LD)	
6.1.6 Commenting out a Network (Circuit)	6-13
6.2 Programming in Structured Text (ST)	6-14
6.2.1 ST Program Syntax	
6.2.2 Commenting out Code in ST Program	
6.3 Programming in Sequential Function Chart (SFC)	
6.3.1 Inserting Elements from Menu	
6.3.2 Inserting Elements from Toolbox	
6.3.3 Inserting Elements from Toolbar	
6.3.4 Setting up the SFC Editor	
6.3.5 Setting SFC Program Execution Conditions	
6.4 Programming in Function Block Diagram (FBD)	
6.4.1 Entering Function Blocks	
6.4.2 Inserting and Commenting out a Network (Circuit)	
6.4.3 Input of Title and Comment (FBD)	
6.4.4 Settings in FBD Program	
6.5 Programming in Instruction List (IL)	
6.5.1 Entering Instructions and Operands	
6.5.2 Settings in IL Program	
6.6 Programming in Continuous Function Chart (CFC)	
6.6.1 Inserting and Connecting Elements	
6.6.2 Connection Mark	
6.7 Variables	
6.7.1 Standard Data Types	
6.7.2 STRING type	
6.7.3 WSTRING type	
6.7.4 Array	
6.7.5 Subrange Types	

	6.7.6 Structure, Enumeration, Alias, and Union Data Types	
	6.7.7 Constants 6.7.8 Object for Global Variable Declaration	0-52 6-53
	6.7.9 Global Variables	
	6.7.10 Persistent Variables	
7	Connecting the GM1 Controller and PC	7-1
	7.1 Flow of Operation Check	7-2
	7.2 Connecting the GM1 Controller and PC	7-3
	7.2.1 Selecting a Connection Port for GM Programmer	
	7.2.2 Connecting the GM1 Controller and PC with a Cable	7-3
	7.3 Communication Setting	7-4
	7.3.1 Setting the LAN Port	
	7.3.2 Adding USB Ports	7-5
	7.4 Time Function	7-7
	7.4.1 Settings Based on GM Programmer	7-7
	7.4.2 Settings Based on Function Blocks	7-7
	7.5 Connecting to the GM1 Controller	7-8
	7.6 Login / Logout	7-10
	7.6.1 Login	
	7.6.2 Logout	
	7.6.3 Download	
	7.6.4 Online Change	
	7.7 Source Upload	
	7.8 Other Settings	
	7.8.1 Changing the Device Name7.8.2 Sending Echo services	
	7.8.3 Device preference management	
	7.8.4 Confirmed online mode	
~		0.4
8	Debug	
	8.1 Running and Stopping the GM1 Controller	
	8.1.1 Running and Stopping the GM1 Controller	
	8.2 Breakpoint 8.2.1 Setting a Breakpoint	0-0 8-6
	8.2.2 Setting an Execution Point	
	8.2.3 Call Stack View	
	8.3 Debug Operations	
	8.3.1 Writing Values and Forcibly Changing Values	
	8.3.2 Watch	
	8.3.3 Flow Control	
	8.4 Monitoring Function	
	8.5 Simulation Function	
	8.6 Trace Function	
	8.6.1 Setting up Trace	
	8.6.2 Trace Menu 8.6.3 Executing Trace	
		0-55

	8.6.4 Saving Trace	. 8-34
	 8.7 Visualization Function	. 8-40 . 8-56 . 8-64 . 8-65
	 8.8 Reset of Controller	. 8-98 . 8-99
	 8.9 Checking the Status of GM1 Controller	. 8-101 . 8-103 . 8-104 . 8-104
	 8.10 Checking the Performance of GM1 Controller 8.10.1 Checking Missing RTEX Command or EtherCAT Packets 8.10.2 Performance Check Based on Device Trace 	. 8-112
	 8.11 Error Notification Function 8.11.1 Overview of Errors	. 8-116 . 8-117 . 8-118 . 8-121
	8.11.5 Error Code List	. 8-123
9		
9	 8.11.5 Error Code List Motion Control 9.1 Basic Setting 9.1.1 Setting the Master axis 9.1.2 Basic Settings of the Axis 9.1.3 Axis Extended Setting 9.1.4 Adding and Setting up Free Encoder and Virtual Drive 	.9-1 .9-2 .9-2 .9-2 .9-2 .9-7
9	Motion Control 9.1 Basic Setting 9.1.1 Setting the Master axis 9.1.2 Basic Settings of the Axis 9.1.3 Axis Extended Setting	.9-1 .9-2 .9-2 .9-7 .9-7 .9-15 .9-19 .9-21
9	Motion Control 9.1 Basic Setting 9.1.1 Setting the Master axis 9.1.2 Basic Settings of the Axis 9.1.3 Axis Extended Setting 9.1.4 Adding and Setting up Free Encoder and Virtual Drive 9.2 Initial Setup for Servo Amplifiers 9.2.1 RTEX parameter settings for servo amplifier	.9-1 .9-2 .9-2 .9-7 .9-15 .9-19 .9-21 .9-22 .9-23 .9-23 .9-24 .9-28
9	Motion Control 9.1 Basic Setting 9.1.1 Setting the Master axis 9.1.2 Basic Settings of the Axis 9.1.3 Axis Extended Setting 9.1.4 Adding and Setting up Free Encoder and Virtual Drive 9.2 Initial Setup for Servo Amplifiers 9.2.1 RTEX parameter settings for servo amplifier 9.2.2 EtherCAT parameter settings for servo amplifier 9.3 Preparation for Operation 9.3.1 Checking Wiring 9.3.2 Checking Safety Circuit Design 9.3.3 Operation Mode Switching	.9-1 .9-2 .9-2 .9-7 .9-15 .9-19 .9-21 .9-23 .9-23 .9-23 .9-24 .9-28 .9-29 .9-32 .9-32
9	 Motion Control 9.1 Basic Setting 9.1.1 Setting the Master axis 9.1.2 Basic Settings of the Axis 9.1.3 Axis Extended Setting 9.1.4 Adding and Setting up Free Encoder and Virtual Drive 9.2 Initial Setup for Servo Amplifiers 9.2.1 RTEX parameter settings for servo amplifier 9.2.2 EtherCAT parameter settings for servo amplifier 9.3 Preparation for Operation 9.3.1 Checking Wiring 9.3.2 Checking Safety Circuit Design 9.3.3 Operation Mode Switching 9.3.4 Operation Check 9.4 Operation up to running 9.4.1 Servo ON or OFF 	.9-1 .9-2 .9-2 .9-7 .9-15 .9-19 .9-21 .9-22 .9-23 .9-23 .9-24 .9-28 .9-29 .9-32 .9-32 .9-33 .9-35 .9-35

	 9.7 Cam synchronous Control	9-38 9-41 9-61
	 9.8 CNC Control 9.8.1 Overview of CNC Control and How to Use It	9-75 9-77 9-85
	 9.9 Motion Function Errors. 9.9.1 Overview of Motion Function Errors. 9.9.2 Error Check Method. 9.9.3 Clearing Errors. 	9-91 9-92
10	EtherCAT Function	.10-1
	 10.1 EtherCAT Axis Settings	10-2 10-7 10-14
	10.2 Conducting Commissioning for Servo Amplifiers	
	10.3 Home Return.	
	10.4 Functional limitations	
	10.4.1 Restrictions on the Combination of the GM1 Controller and Serve)
	Amplifiers 10.4.2 Restrictions on Servo Amplifier Parameters	
11	RTEX Function	
	11.1 Setting up the RTEX axis11.1.1 Setting up the RTEX master11.1.2 Adding and Setting up Servo Amplifiers	11-2 11-3
	11.1.3 Setting an Address for Each Servo Amplifier	
	11.2 Conducting Commissioning for Servo Amplifiers	
	 11.3 Home Return	. 11-11
	position (Z phase) based on front edge] 11.3.3 DOG method 2 (Edge detection of near home switch) 11.3.4 DOG method 3 [Edge detection of near home switch + Home	11-14
	position (Z phase) based on rear edge] 11.3.5 Limit method 1 [Edge detection of limit switch + Home position (Z phase) based on front edge]	
	11.3.6 Limit method 2 (Edge detection of limit switch)11.3.7 Home position method [Edge detection of home position (Z	11-17
	phase)]	
	 11.3.8 Stop-on-contact method 1 11.3.9 Stop-on-contact method 2 [Stop-on-contact detection + Home position (Z phase) based on front edge] 	
	11.3.10 Data set method	

	11.3.11 High-speed home return111.3.12 Settings and operations of home return1	
	11.4 Functional limitations	
	Amplifiers 1 11.4.2 Restrictions on Servo Amplifier Parameters 1	
12	Jnit Function1	2-1
	12.1 Overview of Unit Control1	2-2
	12.2 Setting up the GM1 units112.2.1 IO Parameters for Unit Control112.2.2 I/O Mapping for Unit Control112.2.3 General-purpose I/O112.2.4 PWM Output112.2.5 High-speed Counter Function1	2-5 2-6 2-7 2-12
	12.3 Expansion unit settings112.3.1 Adding Expansion Units112.3.2 Settings of I/O Unit112.3.3 Analog I/O Unit112.3.4 Pulse Output Unit112.3.5 Serial Communication Unit1	2-73 2-76 2-79 2-79
-	Communication Function1	-
	13.1 Overview of Communication Function 1 13.1.1 Adding a Protocol to Be Used for the LAN Port 1 13.1.2 Adding Serial Communication Devices 1 13.1.3 List of Devices 1	3-3 3-8 3-10
	 13.2 General-purpose Communication	3-11
	13.3 MODBUS 1 13.3.1 What is Modbus TCP? 1 13.3.2 Modbus-TCP Master Communication 1 13.3.3 Modbus-TCP Slave Communication 1 13.3.4 Modbus-RTU Master Communication 1 13.3.5 Modbus-RTU Slave Communication 1	3-13 3-13 3-18 3-21
	13.4 EtherNet/IP 1 13.4.1 What is EtherNet/IP? 1 13.4.2 Cyclic Communication Function 1 13.4.3 EtherNet/IP Scanner Function 1 13.4.4 Setting up the EtherNet/IP Scanner Function 1 13.4.5 EtherNet/IP Scanner Operation 1 13.4.6 EtherNet/IP Adapter Function 1 13.4.7 Setting up the EtherNet/IP Adapter Function 1 13.4.8 EtherNet/IP Adapter Operation 1	3-33 3-33 3-33 3-34 3-41 3-44 3-44
	13.5 Communicating with Display Units1 13.5.1 Symbol Configuration1	
	13.6 OPC UA Server	

	13.6.2 OPC UA Server Settings	3-56
	13.7 FTP Server Function1313.7.1 Overview of FTP Server Function1313.7.2 Setup Procedure1313.7.3 List of Setting Items1313.7.4 FTP Server Standards1313.7.5 SSL/TLS Certificate Settings13	3-58 3-58 3-59 3-60
	13.8 MQTT Client	3-63
	13.9 DNS client	
	13.10 NTP client	
14	Management Function14	4-1
	14.1 Security Function 14 14.1.1 User Management 14 14.1.2 Encryption 14 14.1.3 Write-protection 14	4-3 4-16
	14.2 Interface Function 14 14.2.1 Setting up an Interface Object 14 14.2.2 Implementing in New Function Block 14 14.2.3 Implementing in Existing Function Block 14 14.2.4 Extending the Interface 14	4-26 4-29 4-31
	14.3 SD Card Access Function 14 14.3.1 Overview of SD Card Access Function 14 14.3.2 File Manipulations Using the CAA File Library 14	4-37
	14.4 External File Functions	
	14.5 Recipe Manager Functions 14 14.5.1 Setting the Recipe Manager 14 14.5.2 Setting the Recipe Definition 14 14.5.3 Recipe Operation Using the GM Programmer 14 14.5.4 Recipe operation using instructions in the POU 14 14.5.5 Saving and restoring persistent variables 14	4-41 4-44 4-46 4-49
	14.6 Project Management Function 14 14.6.1 What is Project Management Function? 14 14.6.2 Backup (Operation by the controller) 14 14.6.3 Restore (Operation by the controller) 14 14.6.4 Backup and Restoration (Function Blocks) 14	4-56 4-58 4-59
	14.7 SD card log storage function	4-61
	14.8 Firmware Version Upgrade Function 14 14.8.1 Checking Unit Configuration 14 14.8.2 Unit Version Upgrade 14	4-63

	14.9 Servo Amplifier / Motor Operation Function (PANATERM Lite for GM).	14-66
	14.9.1 Starting PANATERM Lite for GM	. 14-66
15	Overview of PANATERM Lite for GM	.15-1
	15.1 System Requirements 15.1.1 Operating Environment of PANATERM Lite for GM	15-3 . 15-3
	15.2 Installation and Uninstallation15.2.1 Installing PANATERM Lite for GM15.2.2 Uninstalling PANATERM Lite for GM	. 15-4
	15.3 Connecting with servo amplifier15.3.1 Connecting the Servo Amplifier and PC15.3.2 Disconnecting the Servo Amplifier from the PC	. 15-5
	15.4 Basic Operations 15.4.1 How to Start 15.4.2 How to Exit	. 15-6
	 15.5 Component Names	. 15-12 . 15-13 . 15-13 . 15-14
	15.6 Window Operations15.6.1 Moving the Pane Location15.6.2 Switching the Tab of the Main Pane	. 15-15
	15.7 Connection settings Servo Amplifier to the GM1 Controller 15.7.1 Selecting the Device to Connect	
	 15.8 Parameter Window	. 15-26 . 15-28 . 15-29 . 15-31 . 15-32
	 15.9 Object Window 15.9.1 Configuration of Object Window 15.9.2 Setting Objects	. 15-36 . 15-39
	15.10 Monitor Window15.10.1 Configuration of Monitor Window15.10.2 Checking the Monitor Window	. 15-42
	15.11 Alarm Window15.11.1 Configuration of Alarm Window15.11.2 Checking Alarms	. 15-45
	15.12 Other Functions15.12.1 Language Setting Function15.12.2 Version Display Function	. 15-50
	15.13 Troubleshooting	15-52

15.13.1 Troubleshooting for Servo Amplifiers and Mo	otors 15-52
Appendix Warranty / Cautions for Proper Use	Арр-1
Warranty	Арр-2
Warranty Period	
Warranty Scope	App-2
Cautions for Proper Use	Арр-3

1 Before Using This Product

1.1	Safety Precautions1-2
1.2	Security precautions
1.3	Handling Precautions1-4
1.4	Software License Agreement1-5

1.1 Safety Precautions

This section explains important rules that must be observed to prevent personal injury and property damage.

• Injuries and damages that may occur as a result of incorrect use are classified into the following levels and safety precautions are explained according to the level.

Indicates that there is a risk of death or serious injury
Indicates that there is a risk of minor injury or property damage

\bigcirc	Indicates an action that is prohibited
	Indicates an action that must be taken

0	 Take safety measures outside this product to ensure the safety of the entire system even if this product fails or an error occurs due to external factors.
\oslash	 Do not use this product in atmospheres that contain flammable gases. Doing so may result in explosion.
\bigcirc	 Do not throw this product into the fire. Doing so may cause the batteries or other electronic parts to explode.

0	• To prevent abnormal heat generation or smoke generation, use this product with some leeway from the guaranteed characteristics and performance values of the product.
\oslash	 Do not disassemble or modify this product. Doing so may result in abnormal heat generation or smoke generation.
\oslash	 Do not touch any terminals while the power is on. Doing so may result in electrical shock.
0	Configure emergency stop and interlock circuits outside this product.
0	 Connect wires and connectors properly. Failure to do so may result in abnormal heat generation or smoke generation.
\oslash	 Do not perform work (such as connection or removal) with the power turned on. Doing so may result in electrical shock.
0	• If this product is used in any way that is not specified by Panasonic, its protection function may be impaired.
0	This product has been developed and manufactured for industrial use only.

1.2 Security precautions

When using this product, the following damages may occur.

- (1) Information leakage or outflow through this product
- (2) Fraudulent operation of this product by a malicious third party
- (3) Obstructing or stopping this product by a malicious third party

Sufficient network security measures, including the following measures, should be taken at your own risk to prevent such damages.

- Use this product on a network where safety is secured by using a firewall.
- When using this product on a system where a PC is connected, make sure that checking and cleaning of infection by computer virus or malicious program is performed periodically.
- In order to prevent malicious attacks, set user name and password to limit users who can log in.
- To prevent leakage of authentication information (user name, password), FTP server information, etc. on the network, take measures such as restricting access by user authentication.
- Be sure to close all browsers immediately after accessing this product as an administrator.
- Periodically change the administrator's password.
- Do not install this product in a location where the product or cables can be easily damaged.
- Furthermore, it is recommended that the product be used in an environment that has VPN (Virtual Private Network) or leased line network.

In addition, if this product is discarded, transferred, repaired, etc., important information recorded on this product or the SD memory card used may remain. At your own risk, please be careful when handling it, such as erasing it.

If you use this product, important information such as confidential information may remain on the terminal. When this product is no longer needed, take measures such as uninstalling this product from the terminal and deleting related files under the customer's responsibility.

1.3 Handling Precautions

In this manual, the following symbols are used to indicate safety information that must be observed.

Stop	Indicates an action that is prohibited or a matter that requires caution.
	Indicates an action that must be taken.
f Info.	Indicates supplemental information.
Note	Indicates details about the subject in question or information useful to remember.
1 ₂ Procedure	Indicates operation procedures.

1.4 Software License Agreement

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[Contact e-mail address: oss-cd-request@gg.jp.panasonic.com]

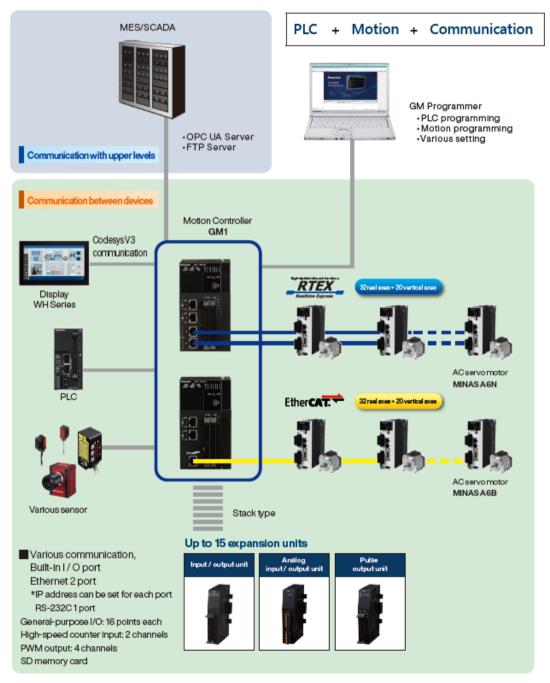
2 GM1 function overview

2.1 System Configuration Diagram	2-2
2.2 Product Lineup	2-4
2.2.1 GM1 controller	2-4
2.2.2 Expansion Unit	2-4
2.3 Functional limitations	2-6
2.3.1 Restrictions on the Number of Expansion Units	2-6
2.3.2 Version limitations	2-6
2.3.3 Restrictions on Functions	2-7

2.1 System Configuration Diagram

GM1 is a motion controller that integrates the PLC and motions.

It communicates with a host device and other various devices to provide a wide variety of motion control.



Overview of functions

Function name		Overview of the function		
Program		Structure		
		Union		
		Enumeration		
		IEC61131-3 (LD,ST,IL,FBD,SFC)		
		G code(CNC)		
		Synchronous cam control		
Debug function		Online change		
		Breakpoint		
		Watch		
		Monitoring function		
		Simulation function		
		Trace function		
		Visualization function		
Host communication fu	Inction	FTP server		
		SNTP		
		OPC UA		
		MQTT		
Device-to-device	Serial protocol	General-purpose communication		
communication function		MODBUS RTU master		
		MODBUS RTU slave		
	LAN protocol	TCP/IP		
		UDP		
		MODBUS TCP master		
		MODBUS TCP slave		
		Ethernet/IP		
Management function	Security function	User management		
		Encryption		
		Write-protection		
	Project management	SD backup and SD restore using unit operations		
	function	SD backup and SD restore using FBs		
	Firmware version upgrade function	Firmware update using GM Programmer		
	-	Interface function		
	-	SD card access function		
	-	External file functions		
	-	Recipe Manager functions		

2.2 Product Lineup

2.2.1 GM1 controller

Name	Specifications					Product No.	
	Communica tion	High- speed counte r	PWM output	Input	Output	Number of axes controlled	
GM1controll er	Ethernet : 2 ports RS-232C : 1 port	2 ch	4 ch	16 points	16 points Transistor output Sink Type (NPN)	RTEX Max. 32 axis	AGM1CSRX16T
	port				Transistor output Sink Type(NPN)	EtherCAT Max. 32 axis	AGM1CSEC16T
					Transistor output Source Type(PNP)		AGM1CSEC16P

2.2.2 Expansion Unit

Digital I/O Unit

Name	Specifications	Product No.		
	Input	Outpt		
GM1 Digital Input Unit	64 points	-	AGM1X64D2	
GM1 Digital Output Unit	-	64 points Transistor output Sink Type (NPN)	AGM1Y64T	
		64 points Transistor output Source Type (PNP)	AGM1Y64P	
GM1 Digital I/O Unit	32 points	32 points Transistor output Sink Type(NPN)	AGM1XY64D2T	
		32 points Transistor output Source Type (PNP)	AGM1XY64D2P	

Analog I/O Unit

Name	Specifications	Product No.
GM1 Analog Input Unit	8 ch voltage input / current input	AGM1AD8
GM1 Analog Output Unit	4 ch voltage output / current output	AGM1DA4

Pulse Output Unit

Name	Specifications	Product No.
	4 axis Transistor output	AGM1PG04T
GM1 Pulse Output Unit	4 axis Line driver output	AGM1PG04L

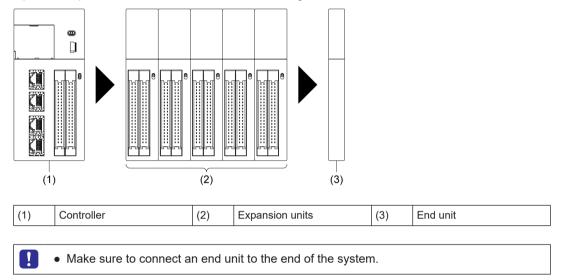
Serial Communication Unit

Name	Specifications	Product No.
	RS-232C × 2ch	AGM1NSCS2
GM1 Serial Communication Unit	RS-422A/485 × 2ch	AGM1NSCM2
	RS-232C × 1ch RS-422A/485 × 1ch	AGM1NSCS1M1

2.3 Functional limitations

2.3.1 Restrictions on the Number of Expansion Units

Up to 15 expansion units can be mounted on the right side of the GM1 Controller.



2.3.2 Version limitations

For the RTEX-compatible GM1 Controller and expansion units to be used, compatible GM Programmer versions are as follows.

Туре	Model number	Version of GM Programmer
RTEX-compatible GM1 Controller (sink type)	AGM1CSRX16T	Ver.1.0 or later
Digital input (64 points)	AGM1X64D2	Ver.1.0 or later
Digital output (64 points) (sink type)	AGM1Y64T	Ver.1.0 or later
Digital output (64 points) (source type)	AGM1Y64P	Ver.1.2 or later
Digital I/O (64 points) (sink type)	AGM1XY64D2T	Ver.1.0 or later
Digital I/O (64 points) (source type)	AGM1XY64D2P	Ver.1.2 or later
Analog input (8 points)	AGM1AD8	Ver.1.2 or later
Analog output (4 points)	AGM1DA4	Ver.1.2 or later
Pulse output (transistor output type)	AGM1PG04T	Ver.1.2 or later
Pulse output (line driver output type)	AGM1PG04L	Ver.1.2 or later
Serial input/output (RS-232C × 2ch)	AGM1NSCS2	Ver.1.5 or later
Serial input/output (RS-422A/485 × 2ch)	AGM1NSCM2	Ver.1.5 or later
Serial input/output (RS-232C × 1ch,RS-422A/485 × 1ch)	AGM1NSCS1M1	Ver.1.5 or later

2.3.3 Restrictions on Functions

Function name	GM Programmer version
Firmware update function	Ver.1.2 or later
Recipe function (SD card)	Ver.1.2 or later
OPC UA function	Ver.1.3 or later
FTP server function	Ver.1.3 or later
Project management function (SD backup and SD restore by unit operation)	Ver.1.3 or later
Project archive function	Ver.1.3 or later
Tool customization function	Ver.1.3 or later
Recipe function (Backup and restore of persistent variables)	Ver.1.3 or later
Enable/Disable EtherCAT devices	Ver.1.4 or later
MQTT client function	Ver.1.4 or later
DNS client function	Ver.1.4 or later
SNTP client function	Ver.1.4 or later
Project management function (SD backup and SD restore by FB)	Ver.1.4 or later
Visualization function	Ver.1.4 or later
Expansion cam editor function	Ver.1.4 or later
Start instruction help function	Ver.1.4 or later
Source download timing configuration	Ver.1.5 or later
Symbol set function	Ver.1.5 or later
SD card log storage function	Ver.1.6 or later

(MEMO)

3 Overview of the GM Programmer

3.1 System Requirements3.1.1 Usage Environment of the GM Programmer	
3.2 Version System3.2.1 Version Relationship	
3.3 Installation and Uninstallation3.3.1 Installing GM Programmer3.3.2 Uninstalling GM Programmer	3-6
3.4 Basic Operations.3.4.1 How to start.3.4.2 How to quit	3-12
 3.5 Component Names 3.5.1 Menu Bar 3.5.2 Toolbar 3.5.3 Navigator Pane 3.5.4 Main Pane 3.5.5 Status Bar 	3-14 3-24 3-28 3-30
 3.6 Window Operations. 3.6.1 Moving the Pane Location	3-32 3-34 3-35 3-36
 3.7 Other Functions	3-39 3-41 3-43

3.1 System Requirements

3.1.1 Usage Environment of the GM Programmer

Programming software

Product name	Applicable language
GM Programmer	Japanese / English / Chinese

(Note 1) When GM Programmer is installed, MINAS setup support software "PANATERM Lite for GM" is installed at the same time.

Software operating environment

Item	Description
OS	Microsoft(R) Windows(R) 10 : 32bit/64bit Microsoft(R) Windows(R) 11 : 64bit
PC	 PC with the following installed: Microsoft.NET Framework 4.6.1 or higher Microsoft Visual C++ 2010 SP1 Redistributable Package (x86) Microsoft Visual C++ 2010 SP1 Redistributable Package (x64) Microsoft Visual C++ 2013 Redistributable Package (x86) Microsoft Visual C++ 2013 Redistributable Package (x64) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x64) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x64)
HDD	At least 4 GB of free space
Memory	At least 8 GB
Communication port	LAN port (for Ethernet connection) USB 2.0 port (for USB connection)

3.2 Version System

This chapter explains versions used for GM Programmer and the GM1 controller.

3.2.1 Version Relationship

This chapter explains how GM Programmer versions, project versions, and firmware versions are related with one another.

Objects subject to version management

GM Programmer, project files, and firmware for the GM1 controller are each managed with fourdigit version numbers.

Each version number is made up of four digits (A . B . C . D).

Version type	Description and way of checking version
GM Programmer version	The version of the GM Programmer installer can be checked by following "3.7.3 Version Display Function".
Project version	The version of project files created by GM Programmer. You can check it on the "Information" tab of the Device object. (described later)
Firmware version of GM1 controller	Please refer to "14.8.1 Checking Unit Configuration" for the firmware version installed on the GM1 controller.

Relationship between GM Programmer versions and project versions

The version of GM Programmer indicates versions of projects that can be created. (The GM Programmer version provides only backward compatibility)

For example, with GM Programmer version 1.4.1.0, project version 1.4.1.0 and earlier of project files can be created.

<u>GM Programmer</u>		Project file (.project)	
	Project files of versions earlier than or equal to that of GM Programmer	Project version: 1.4.1.0	
	can be created	Project version: 1.3.2.0	
GM Programmer version: 1.4.1.0		Project version: 1.3.1.0	
1.4.1.0		Project version: 1.2.2.0	
	l	Project version: 1.2.1.0	

Relationship between project versions and GM1 controller firmware versions

When connecting to the GM1 controller, the first two digits (A . B) of the project version and the firmware version are required to match.

Combinations whereby connection is allowed are shown below.

Project file (.project)	GM1 controller firmware	
Project version: 1.4.1.0	Firmware version: 1.4.0.0	•
Project version: 1.3.2.0	Firmware version: 1.3.0.2	
Project version: 1.3.1.0		
Project version: 1.2.2.0	Firmware version: 1.3.0.1	
Project version: 1.2.1.0	Firmware version: 1.2.0.0	
Convert project file to upgrade project version	←→ : combination whereby	Upgrade firmware version to change firmware version

For example, if your PC with a project of project version 1.3.2.0 is connecting to the GM1 controller whose firmware version is 1.4.0.0, a message indicating connection failure appears because the first two digits of the versions do not match $1.3 \neq 1.4$.

To upgrade the project version and thereby make them match, perform "Converting Project File (.project) Version".

To downgrade the firmware version and thereby make them match, perform "14.8.2 Unit Version Upgrade" so that the firmware version is downgraded.

GM Programmer			×
If you want to change the p	established because the upper two digits o project version, click the "Project File Conve irmware version, click the "Firmware Updat	rsion" button.	ersion do not match.
Project Version: Firmware Version:	1.3.2.0 1.4.0.0		
	Project File Conversion	Firmware Update	Cancel

Note

• To create a library for users, select a template whose version is the same as the project version.

Example: When a library is used for projects of project version 1.4.1.0, select template version 1.4.1.0.

• The project version of a project you are editing can be confirmed at "Version" on the "Information" tab of the Device object.

Device X		
Communication Settings	General	
Date and Time and Settings		Name: AGM1CSRX16T Vendor: Panasonic Corporation Categories: SoftMotion PLCs
Applications		Type: 4102 ID: 163 0001
Log		Version: 1.4.1.0 Order Number: 0
Users and Groups		Description: Panasonic GM-series, Standard-Model, RTEX-type: 16axis
Access Rights		
PLC Setting		
PLC Parameter		
Task Deployment		
Status		
Information		

3.3 Installation and Uninstallation

3.3.1 Installing GM Programmer

Before installing the GM Programmer on a PC, log on to the PC as an account with Administrator privileges.

If other applications are running, be sure to close all the applications before installing GM Programmer.

¹² Procedure

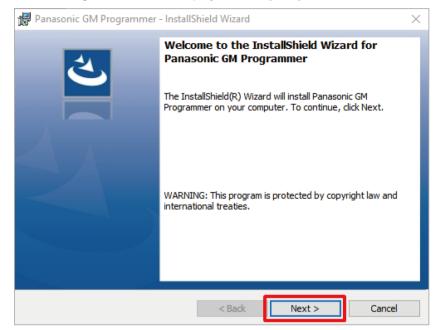
1. Double-click "setup.exe".

The following window will be displayed. Click [OK].

Panasor	nic GM Programmer - Install	Shield Wizard	\times
ع	Select the language for the in	istallation from the ch	oices below.
	English (United States)		~
		ОК	Cancel

 The following window will be displayed. Click [Install]. The display content differs according to the PC environment that you use. (This window may not be displayed at all, depending on the situation.)

Panasor	nic GM Programmer - InstallShield Wizard
ځ	Panasonic GM Programmer requires the following items to be installed on your computer. Click Install to begin installing these requirements.
Statu	s Requirement
Pendi	ing GM_USB_Driver_Win10_x64
	Install Cancel



3. The following window will be displayed. Click [Next].

 The following window will be displayed. Select [I accept the terms in the license agreement] and click [Next].

🙀 Panasonic GM Programmer - InstallShield Wizard	×
License Agreement Please read the following license agreement carefully.	と
Software License Agreement Panasonic Corporation ("PANASONIC") grants to you this Software on condition that you accept this Agree read this Software License Agreement (this "Agree before using this Software. Only in case that Agreement, you may start your use of this Software. Your unsealing the package of this Software, or you installing or launching this Software or the like shall be	ement. You must ement") carefully you accept this our downloading,
● I accept the terms in the license agreement	Print
I do not accept the terms in the license agreement	Open Source Licenses
< Back Next	> Cancel

5. The following window will be displayed. If you change the installation destination folder, click [Change] and specify a desired installation destination. If you do not change the installation destination folder, click [Next].

3.3 Installation and Uninstallation

🛃 Panason	nic GM Programmer - InstallShield Wizard 🛛 🕹
	ion Folder xt to install to this folder, or click Change to install to a different folder.
Þ	Install Panasonic GM Programmer to: C:\Program Files (x86)\Panasonic Corporation\GM Programmer\ Change
InstallShield -	< Back Next > Cancel

6. The window below will be displayed. Click [Install] to start the installation.

🙀 Panasonic GM Programmer - InstallShield Wizard	×
Ready to Install the Program The wizard is ready to begin installation.	さ
Click Install to begin the installation.	
If you want to review or change any of your installation settings, exit the wizard.	, click Back. Click Cancel to
InstallShield	
< Back	nstall Cancel

7. The following window will be displayed while the installation is in progress.

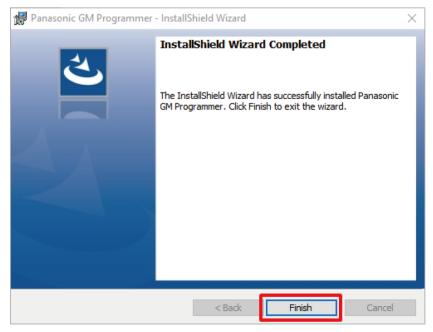
🙀 Panason	ic GM Programmer - InstallShie	ld Wizard		_		\times
	Panasonic GM Programmer ram features you selected are bei	ng installed.			Ś	4
P	Please wait while the InstallShiel This may take several minutes.	d Wizard installs	s Panasonic GM	4 Progra	ammer.	
	Status:					
InstallShield –		< Back	Next >		Cance	el

Following this installation, the three packages below will be installed. (The segments indicated by * differ according to the version of the software.)

- CODESYS SoftMotion*.*.*_P
- GMPLibrary (*.*.*)
- PANATERM-Lite for GM V*.*

These packages take a long time to install. Take care not to click [Cancel] while the installation is in progress.

8. When the installation of all the packages is completed, the following window will be displayed. Click [Finish].



This completes the installation procedure.

i Info.

• When the GM Programmer is installed, PANATERM Lite for GM, Gateway (CODESYS Gateway), and CodeMeter applications are installed at the same time.

3.3.2 Uninstalling GM Programmer

¹² Procedure

1. From the Start menu, select **Windows System>Control Panel**, and then click "Uninstall a program".

A list of installed programs will be displayed.

 Double-click "Panasonic GM Programmer". The following window will be displayed. [Yes]



3. Click the [Yes] button.

The GM Programmer will be uninstalled.



- When the GM Programmer is uninstalled, PANATERM Lite for GM and Gateway are also uninstalled at the same time.
- CodeMeter will not be uninstalled at this time. Uninstall it separately.

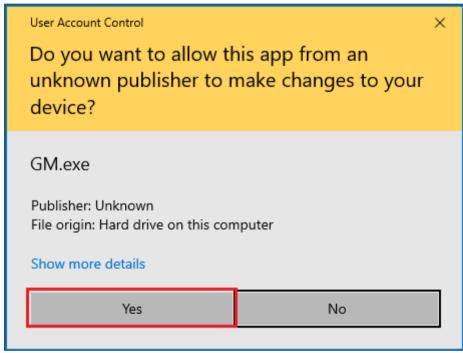
3.4 Basic Operations

This section explains how to start and quit GM Programmer.

3.4.1 How to start



 Click the [Start] button and select Panasonic Corpration>GM Programmer. The "User Account Control" dialog box will be displayed. Click [Yes].



GM Programmer will be started.



3.4.2 How to quit

1

 Before closing GM Programmer, be sure to save any project files that you are editing and must save.

2 Procedure

1. From the menu bar, select File>Exit.

If changes have not been saved, the following window will be displayed. If exiting without saving, select [No].

If changes need to be saved, select [Yes] to perform the save process.

GM Prog	rammer	×
?	The current project has been changed. Do you want to save the changes?	
	Yes <u>N</u> o Cancel	

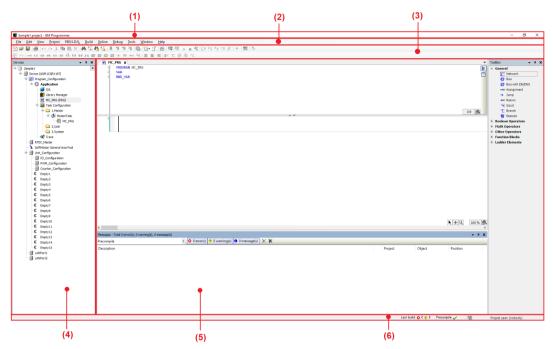
Click the [Yes] button.
 GM Programmer will be closed.



• You can also close GM Programmer by clicking the [×] button on the title bar.

3.5 Component Names

This section presents the name and display content of each component of GM Programmer.



No.	Name	Description
(1)	Title bar	The title bar displays the project file name, [minimize] button, [maximize] button, and [close] button.
(2)	Menu bar	The menu bar displays the menu commands for each purpose in list format.
(3)	Toolbar	The toolbar displays each command as an icon.
(4)	Navigator pane	The navigator pane displays the objects (such as devices, applications, and programs) added to the project in a tree structure.
(5)	Main pane	The main pane displays a program, function settings, messages, and other data. The window can be switched by selecting a desired tab.
(6)	Status field	The status bar displays the build status, logged-in users, and other information.

3.5.1 Menu Bar

The menu bar displays the following menus:

<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>P</u> roject	FBD/LD/I <u>L</u>	<u>B</u> uild	<u>O</u> nline	<u>D</u> ebug	<u>T</u> ools	<u>W</u> indow	<u>H</u> elp
--------------	--------------	--------------	-----------------	-------------------	---------------	----------------	---------------	---------------	----------------	--------------

■ File

Item	Function	Refer
New Project	Creates a new project.	"P.4-3"
Open Project	Opens a project that is stored.	"P.4-11"

Item		Function	Refer
Close Project	t	Close the project that is currently viewed.	"P.4-10"
Save Project	t	Saves the project that is currently viewed, in overwrite mode.	"P.4-9"
Save Project	As	Saves the project that is currently viewed, as a different file name.	"P.4-9"
Projetct	Unzip the archive.	Unzip the archive.	"P.4-41"
Archive	Save the archive.	Save the archive.	"P.4-39"
Source Uplo	ad(Device→PC)	Loads the project source code as a project archive.	"P.7-15"
Print		Prints the active editor screen.	"P.4-25"
Print Previev	V	Displays the active editor screen in print preview mode.	-
Page Setup		Opens the Page Setup dialog box to configure a print layout.	-
Recent Proje	ects	Displays the recently used projects.	-
Exit		Closes GM Programmer.	"P.3-13"

Edit

Item		Function	Refer
Undo		Reverses the results of a previous editing action.	-
Redo		Allows the user to redo the last editing action after Undo.	-
Cut		Cuts data.	-
Сору		Copies data.	-
Paste		Pastes data.	-
Delete		Deletes data.	-
Select All		Selects all text.	-
	-	Used to find and replace a string.	-
	Find	Opens the"Find"dialog box.	-
	Replace	Opens the"Replace"dialog box.	-
	Find in Project	Opens the "Find" dialog box to find the target within the entire project.	-
	Replace in Project	Opens the "Replace" dialog box to find the target within the entire project.	-
Find Replace	Find Next	Finds the next match from the selected cursor position within the project.	-
	Find Next (Selected)	Finds the next match from the selected cursor position within the editor.	-
	Find Previous	Finds the previous match from the selected cursor position within the project.	-
	Find Previous (Selected)	Finds the previous match from the selected cursor position within the editor.	-
	Toggle Field for Incremental Search	Searches for the character string within the POU editor each time a single character is entered.	-
	-	Used to browse the positions where the declaration part of a defined variable is referenced or used.	-
	Go To Definition	Allows the cursor to move to the position where the variable or function specified by the cursor is defined within the editor.	-
Browse	Browse Cross References	Allows the positions where the variable specified by the cursor is used to be displayed in the "Cross reference List" view.	-
	Browse Call Tree	Allows the callee and caller of the variable specified by the cursor to be displayed in the "Call Tree" view.	-
	Go To Reference	Displays the declaration position of the variable to which the pointer variable specified by the cursor refers.	-
	Go To Instancev	Displays the instance of the function block specified by the cursor in the new editor.	-
Insert File as T	ext	Inserts the contents of the specified text file in the cursor position.	-
Advanced		Executes functions related to the text editor.	-

ltem		Function	Refer
	Overwrite Mode	Switches the text input mode from insert mode to overwrite mode.	-
	View Whitespace	Displays the control characters of spaces and tabs.	-
	View Indentation Guides	Inserts a broken line between indents when an indent is inserted in the program code.	-
	Go To Line	Displays a line number dialog box and moves the cursor to the specified line.	-
	Make Uppercase	Converts the selected character string in the text editor to uppercase letters.	-
	Make Lowercase	Converts the selected character string in the text editor to lowercase letters.	-
	Go to Matching Bracket	Moves the cursor to the corresponding bracket when the cursor is positioned in a bracket in the code.	-
	Select to Matching Bracket	Selects the entire code in brackets when the cursor is positioned in either of the brackets in the code.	-
	Expand All Folds	Unfolds the indented code segment.	-
	Collapse All Folds	Folds the indented code segment.	-
	Comment out selected lines	Comments out the selected line.	-
	Uncomment selected lines	Uncomments the selected line.	-
	Enable inline monitoring	Sets whether to enable or disable the function that displays the value of each variable on the code during online mode.	-
	-	Allows the cursor to move to bookmarked locations. Used to browse the positions where the declaration part of a defined variable is referenced or used.	"P.5-51"
	Toggle Bookmark	Saves the position selected in the active editor as a bookmark.	-
Bookmarks	Next Bookmark (active editor)	Moves to the previous bookmark in the active editor.	-
	Previous Bookmark (active editor)	Moves to the next bookmark in the active editor.	-
	Clear All Bookmarks (active editor)	Removes all bookmarks in the active editor.	-
Input Assistar	t	Allows the user to select variables, function blocks, operators, types, or other data that can be inserted in the cursor position from a category and insert them in the cursor position.	"P.5-59"
Function Block Guidance		Invokes the Function Block Guidance.	"P.5-54"
Auto Declare		Opens the Auto Declare dialog box to support variable declaration.	"P.5-8"
Next Message)	Selects the next message in the message view	-
Previous Mes	sage	Selects the previous message in the message view.	-
Go To Source	Position	Moves to the position of the source code applicable to the message selected in the message view.	-

3.5 Component Names

Item	Function	Refer
Refactoring	Displays the positions where the changed variable name is used and allows changes to be made collectively.	"P.5-61"

View

Item		Function	Refer
Devices		Displays the device view.	"P.4-6"
POUs		Displays the POU view.	-
Messages		Displays the message window.	-
Element pro	operties	Displays element properties.	-
	-	Displays the toolbox.	"P.5-10"
Watch	Watch 1 to Watch 4	Displays a list of user-defined variables for the purpose of value monitoring.	-
	Watch all Forces	Displays a list of value-forced variables.	-
Cross Reference List		Displays the cross reference list window.	"P.5-52"
Bookmarks		Displays the bookmark window.	"P.5-51"
Breakpoints	3	Displays the breakpoint window.	"P.8-6"
Call Stack		Displays the call stack window.	"P.8-10"
Start Page		Displays the start page.	-
Security Screen		Displays the certificate creation and registration screen.	"P.13-57"
Full Screen		Displays the window in full-screen mode.	"P.3-37"
Properties		Displays the properties dialog box.	-
		I	

Project

Item		Function	Refer
Add Object		Adds an object.	"P.4-13"
Add Folder		Adds a folder.	"P.3-37"
Edit Object		Allows the user to edit an object.	-
Online Config	Mode	Removes the applications downloaded to the GM1 controller and allows connection to the GM1 controller.	"P.9-33"
Project Informa	ation	Allows the user to set project author information or check project file information.	-
Project Setting	S	Allows the user to configure project-related settings.	"P.4-17"
Project File Co	nversion	Allows the user to convert project files from the old project version to the new version.	"P.4-35"
	-	Allows the user to translate and register comments, titles, and other information in the program to display the translated content in the program window.	"P.5-67"
Localization	Create Localization Template	Creates and saves a localization template.	"P.5-67"
	Manage Localizations	Imports a localization template that has been created.	"P.5-67"
	Toggle Localization	Switches the language in the project.	"P.5-67"
Document		Allows the user to print the entire project.	"P.4-23"
Compare		Compares the displayed project with the stored project.	"P.4-26"
Commit accep	ted changes	Commits the difference between the objects compared by selecting Project>Compare from the menu bar.	"P.4-26"
Export		Outputs an object from the displayed project as an XML file.	"P.4-31"
Import		Imports an object into the displayed project.	"P.4-33"
User	-	Allows execution permissions for operations (such as executing menu commands and adding, editing, and deleting objects) to be assigned to each group in which users are registered.	"P.14-3"
Management	User Logon	Logs in to the displayed project.	-
	User Logoff	Logs off from the displayed project.	-
	Permissions	Logs off from the displayed project.	"P.14-8"

Build

Item	Function	
Build	Verifies the syntax of objects.	"P.5-47"
Rebuild	Verifies the syntax of all objects again.	"P.5-47"
Generate code	Generates application codes.	"P.5-48"
Clean	Deletes application build information.	"P.5-49"
Clean all	Deletes all application build information in the same way as "Clean".	"P.5-50"

Online

Item		Function	Refer
Scan Network		Connect to the GM1 controller.	-
Add USB Port		Adds a USB port as a communication interface.	"P.7-5"
Login		Downloads the applications generated by code generation to the GM1 controller at the time of login.	"P.7-11"
Logout		Logs out from the device to which the user logged in.	"P.7-12"
Download		Downloads a program while the user is logged in.	"P.7-12"
Online Chang	e	Allows the user to change applications without having to stop the GM1 controller during operation.	"P.7-14"
Source Downl Device	oad to Connected	Downloads the source to the connected GM1 controller.	-
Status		Allows the user to check any errors that are currently occurring in the GM1 controller.	"P.8-103"
System Data	History	Allows the user to check any errors that occurred in the GM1 controller.	"P.8-104"
Reset Warm		Initializes variables other than the RETAIN and PERSISTENT variables.	"P.8-98"
Reset Cold		Initializes all variables. Removes active applications from the GM1 controller.	"P.8-98"
Reset Origin		Initializes all variables. Removes active applications from the GM1 controller.	"P.8-98"
Simulation		Allows the user to perform a login operation without connecting to the GM1 controller and check behaviors in the same way as if the user logged in.	"P.8-19"
	-	Allows the user to configure user management, project encryption, and other settings.	"P.14-2"
	Logoff Current Device User	Logs off the users who are logged in to the device.	-
Security	Add Device User	Adds users who can log in to the device.	-
	Change Password Device User	Changes the passwords of users who are logged in to the device.	-
	Remove Device User	Removes users who can log in to the device.	-
SSL / TLS Ce	rtificate Management	Allows the user to register or delete the SSL / TLS certificate of the FTP server function.	"P.13-61"
-		Allows the user to prevent some debug operations from being executed.	-
Operation	Debug	Allows all debug operations to be executed.	-
Mode	Locked	Prohibits some operations such as adding new breakpoints or forcing variable values.	-
	Operational	Prohibits any changes other than writing variables.	-
Unit Composition Confirmation		Allows the users to confirm the configuration of the main unit being connected	"P.14-63"
Unit Version Upgrade		Allows the users to update the firmware version of the unit.	"P.14-64"

Debug

Item	Function	Refer
Start	Starts the application.	"P.8-3"
Stop	Stops the application.	"P.8-3"
Single Cycle	Executes the application in every single cycle.	"P.8-4"
New Breakpoint	Creates a new breakpoint.	"P.8-8"
Edit Breakpoint	Allows the user to edit breakpoints.	-
Toggle Breakpoint	Allows the user to set or delete breakpoints.	"P.8-6"
Disable Breakpoint	Disables invalid breakpoints.	-
Enable Breakpoint	Enables valid breakpoints.	-
Step Over	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the next line.	-
Step Into	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the first line of the called block.	-
Step Out	When the program is executed within the called block, the execution continues until control returns to the calling block. When the program is executed outside the called block, the execution continues until control returns to the beginning of the program.	-
Run to Cursor	Executes the program up to the line specified by the cursor.	-
Set next Statement	Regards the line specified by the cursor as the next statement to be executed and skips processes over to that line.	
Show next Statement	Jumps the cursor to the program line to be executed as the next step.	-
Write Values	Sets a value (to be changed later) only once. This value can then be changed by the program.	"P.8-11"
Force Values	Values Sets a value to be changed in every cycle and maintains the value.	
Unforce Values	Cancels forced value change.	"P.8-11"
Toggle Flow Control Mode	Performs monitoring by using different colors in positions where the program is executed and in positions where the program is not executed.	"P.8-14"
Display Mode Allows the user to select binary, decimal, or hexadecimal as the display format of the variable value to be displayed.		

Tools

Item	Function	Refer
PANATERM Lite for GM	Allows the user to select a device to which PANATERM Lite for GM is to connect.	"P.14-66"
Library Repository	Allows the user to install a created library in the library repository in order to use the functions or function blocks in the library.	"P.5-27"
Customize	Allows the user to change the layout of the menu bar and toolbar, and the shortcut assignment.	"P.3-45"
Options	Allows the user to set up each function of GM Programmer.	"P.3-39"

Window

Item	Function	Refer
Next Editor	Displays the next window.	"P.3-36"
Previous Editor	Displays the previous window.	"P.3-36"
Close All Editors	Closed all windows.	"P.3-36"
Reset Window Layout	Resets the layout of the window to its initial state.	
New Horizontal Tab Group	Moves the selected window downward.	"P.3-36"
New Vertical Tab Group	Moves the selected window to the right.	"P.3-36"
Float	Sets the selected window in a floating state.	"P.3-32"
Dock	Sets the selected window in a docking state.	"P.3-32"
Auto Hide	Minimizes the window.	"P.3-34"
Next Pane	Switches the pane between the declaration section (first pane) and the implementation section (second pane).	"P.3-34"
Previous Pane	Switches the pane between the declaration section (first pane) and the implementation section (second pane).	"P.3-34"
Window	Displays a list of open windows.	-

Help

Item	Function	Refer	
About	Displays version information.	"P.3-43"	

3.5.2 Toolbar

The toolbar displays the following icons:

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Name	Icon	Function
New Project		Creates a new project.
Open Project	*	Opens a project that is stored.
Save Project		Saves the project that is currently viewed, in overwrite mode.
Print	6	Prints the active editor screen.
Undo	5	Reverses the results of a previous editing action.
Redo	2	Allows the user to redo the last editing action after Undo.
Cut	ж	Cuts data.
Сору		Copies data.
Paste	r B	Pastes data.
Delete	\times	Deletes data.
Find	₫¢	Searches for a particular character string that appears in the active editor.
Find Replace	≜ se	Searches for a particular character string that appears in the active editor and replaces it with another character string.
Find in Project	¢ <u>م</u>	Searches for a specified character string within the current project.
Replace in Project	۹4	Searches for a specified character string within the current project and replaces it with another character string.
Toggle Bookmark		Saves the position selected in the active editor as a bookmark.
Previous Bookmark (active editor)	*1	Moves to the previous bookmark in the active editor.
Next Bookmark (active editor)	N*	Moves to the next bookmark in the active editor.

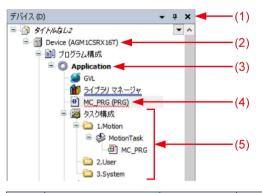
Name	Icon	Function
Clear All Bookmarks (active editor)	*	Removes all bookmarks in the active editor.
Function Block Guidance		Displays the Function Block Guidance.
Properties	i.	Displays the properties.
Add Object	***	Adds an object.
Edit Object	Ľ	Opens an object.
Build		Compiles an object in the application.
Login	СŞ	Downloads the applications generated by code generation to the GM1 controller at the time of login.
Logout	Qģ	Logs out from the device to which the user logged in.
Start	•	Starts the application.
Stop		Stops the application.
Online Config Mode	*	Removes the applications downloaded to the GM1 controller and allows connection to the GM1 controller.
Step Over	Ģ≣	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the next line.
Step Into	Ē	Executes the program line by line. When a block (function or function block) is executed in the block invocation location, the cursor moves to the first line of the called block.
Step Out	(†	When the program is executed within the called block, the execution continues until control returns to the calling block.When the program is executed outside the called block, the execution continues until control returns to the beginning of the program.
Run to Cursor	→ <u>≡</u>	Executes the program up to the line specified by the cursor.
Set next Statement	<u>7</u> 47	Regards the line specified by the cursor as the next statement to be executed and skips processes over to that line.

Name	Icon	Function
Show next Statement	⇔	Jumps the cursor to the program line to be executed as the next step.
Toggle Localization		Switches the language to the one enabled in [Default Localization] in the window displayed by selecting [Project Localization] and then [Manage Localizations] from the [Project] menu.
Commit accepted changes	$\pi_{\mathcal{J}}$	Commits the difference between the objects compared by selecting the [Project] > [Compare] from the menu bar.
Insert Network	I	Inserts an empty network.
Toggle network comment state	(***)	Changes the comment status of the selected network.
Insert Assignment	-068	Inserts a new assignment in the specified position.
Insert Coil	43	Inserts a coil in the specified position.
Insert Set Coil	63	Inserts a set coil in the specified position.
Insert Reset Coil	60	Inserts a reset coil in the specified position.
Insert Contact	4.6	Inserts a normally open contact in the specified position.
Insert Negated Contact	4/1-	Inserts a normally closed contact in the specified position.
Insert Contact (right)	41	Inserts a normally open contact on the right side of the specified position.
Insert Contact Parallel (below)	La al	Inserts a normally open contact below and in parallel with the contact at the specified position.
Insert Negated Contact Parallel (below)	L ^{[[]}	Inserts a normally closed contact below and in parallel with the contact at the specified position.
Insert Contact Parallel (above)	r0 01	Inserts a normally open contact above and in parallel with the contact at the specified position.
Insert Box	1	Opens the Input Assistant to insert a box in the specified position.
Insert Empty Box	1	Inserts an empty box in the specified position.

Name	Icon	Function
Insert Box with EN/ENO	1	Opens the Input Assistant to insert a box with EN/ENO in the specified position.
Insert Empty Box with EN/ENO	:	Inserts a box with EN/ENO in the specified position.
Insert Jump	→	Inserts a jump in the specified position.
Insert label		Inserts a label in the selected network.
Insert Return	-	Inserts a return value in the specified position.
Insert Input	₩.	Adds an input to the specified box.
Negation	7	Adds a negation to the selected element.
Edge Detection	P _M	Adds an edge detection (rising edge detection) to the selected element.
Set/Reset	-5	Converts the selected coil to a set coil or reset coil.
Set output connection	ŀ	Converts box output to forwarding box output.
Insert Branch	Ť	Inserts a branch on the right side of the selected contact.
Insert Branch below	↓	Inserts a new branch below the selected branch.
Insert Branch above	- <u>*</u> +	Inserts a new branch above the selected branch.
Set Branch Start/End Point	*5	Sets the selected line as the branch starting point.

3.5.3 Navigator Pane

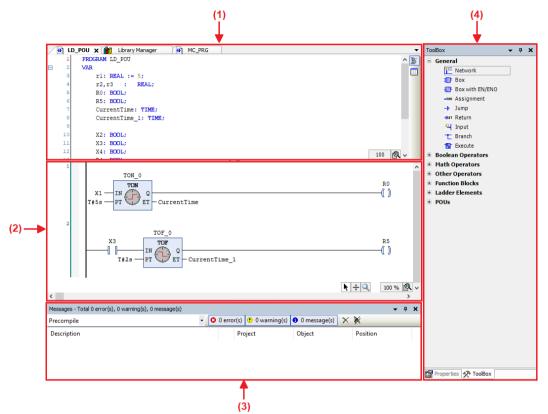
The navigator pane displays the following tree:



No.	Name	Icon	Function
(1)	Window Position	•	 New Horizontal Tab Group Moves the selected window to the right. New Vertical Tab Group Moves the selected window downward. Float Sets the selected window in a floating state. Dock Sets the selected window in a docking state. Auto Hide Minimizes the navigator pane to hide it.
	Auto Hide	₽ -₽	Always shows the navigator pane. Minimizes the navigator pane to hide it.
	Close	×	Closes the navigator pane.
(2)	Device object		Sets up device objects.
(3)	Application object		Sets up application objects.
(4)	Program object (POU o	bject)	Sets up program objects (POU objects).
(5)	Task object		Sets up task objects.

3.5.4 Main Pane

The main pane displays the following sub-panes:



No.	Name	Function
(1)	Declaration section (first pane)	Allows the user to declare variables.
(2)	Implement section (second pane)	Allows the user to enter a program.
(3)	Message view	Displays any error or warning messages.
(4)	ToolBox	Allows the user to place elements in the implementation section by selecting them and then dragging and dropping them in the implementation section.

3.5.5 Status Bar

The status bar displays the following icons:					
Last build: 😮 0 😗 0 🛛 Precomp	Project user: (nobody)				
Name	Icon	Function			
Last Build	00	Displays the number of errors in the results of the build process.			
	• 0	Displays the number of warnings in the results of the build process.			
Precompile	_	Displays the results of the precompile process.			
Application Information	6	Compares the application information of the displayed project with the application information downloaded to the GM1 controller.			
Project user	_	Displays the users who are logged in to the displayed project.			

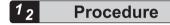
3.6 Window Operations

This section explains operations related to common windows for GM Programmer.

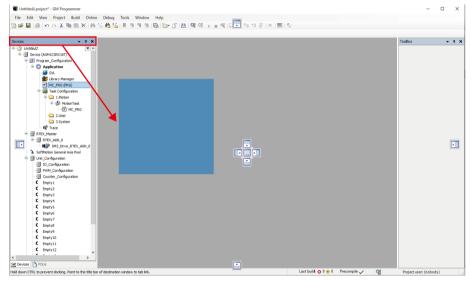
3.6.1 Moving the Pane Location

You can freely change the layout of each window for GM Programmer.

For example, use the following procedure to move the navigator pane from the left edge to the right edge of the window.



 Click the title bar of the navigator pane and then drag it to the main pane. The navigator pane will stay in a floating state and arrows indicating movable directions will be displayed.

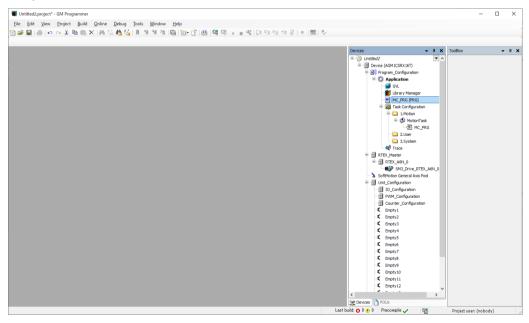


2. Drag the navigator pane in the direction in which you want to move it. The relocation destination will be displayed in light blue.

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3. Release the left mouse button.

The navigator pane will be docked into the existing pane and the relocation will be completed.



i Info.

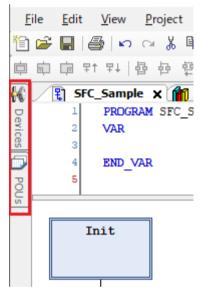
- You can return the changed layout of the window to its initial state.
- From the menu bar, select Window>Reset Window Layout.
- You can put a pane in a floating or docking state. To put a pane in a floating state, select **Window>Float** from the menu bar. To put a pane in a docking state, right-click the title bar in the window in a floating state and then select Dock from the context-sensitive menu that is displayed.

3.6.2 Showing / Hiding Panes

You can normally hide the navigator pane and some sub-panes in the main pane and show them only when you use them.

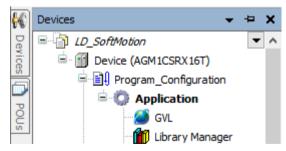


 Click on the title bar of the navigator pane. The navigator pane will be minimized and hidden.



2. Click the minimized pane.

The navigator pane will be displayed. Clicking in another pane automatically hides the navigator pane again.



 Click not the title bar of the navigator pane. The navigator pane will always be displayed.

1 Info.

• You can also hide the navigator pane from the menu bar. From the menu bar, select **Window>Auto Hide**. To always display the navigator pane again, select **Window>Auto Hide** again from the menu bar.

3.6.3 Switching the Tab of the Main Pane

You can switch the tab of the main pane.

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¹² Procedure

 Press the shortcut keys "Ctrl+Tab" simultaneously. The window for switching the tab of the main pane will be displayed.

EtherCAT_Master_SoftMotion [Device] Device			
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🔀 Devices 🛠 ToolBox	MC_PRG General Content of Content o		
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2. While holding down the "Ctrl" key, press the "Tab" key until the desired tab is selected.

3. Release the "Ctrl" key.

The current tab will be switched to the selected tab.

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	¢			2		
					1	
	Bookmarks			- + x		
		×		* 9 X		
	M Previous Bookmark M Next Bookmark	x		* 4 X		
		×		* 4 X		

3.6.4 Operating the Object Window

The following operations can be performed on the object window displayed in the main pane.

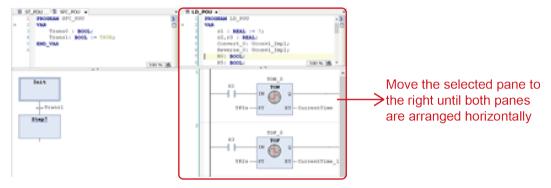
Operation	Menu	Shortcut keys
Displaying the next window	Window>Next Editor	<ctrl> + <f6></f6></ctrl>
Displaying the previous window	Window>Previous Editor	<ctrl> + <shift> + <f6></f6></shift></ctrl>
Closing all windows	Window>Close All Editors	None
Moving the selected window downward	Window>New Horizontal Tab Group	None

Operation	Menu	Shortcut keys
Moving the selected window to the right	Window>New Vertical Tab Group	None

<Moving the selected window downward (New Vertical Tab Group)>



<Moving the selected window to the right (New Horizontal Tab Group)>



3.6.5 Full-screen Display

You can display each window of GM Programmer in full-screen mode.

¹² Procedure

- From the menu bar, select View>Full Screen.
 Then GM Programmer window will be displayed in full-screen mode.
- From the menu bar, select View>Full Screen again.
 Then GM Programmer window will return from full-screen mode to normal display mode.



• You can also switch to full-screen mode by pressing shortcut keys "Ctrl+Shift+F12" simultaneously.

3.7 Other Functions

3.7.1 Option Setting Function

GM Programmer allows the user to set up each function from the "Options" dialog box. The settings will be applied to all projects created with GM Programmer.

1₂ Procedure

1. From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.

Options	>
 CFC Editor Debugging Declaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor 	General View Print Image: Construct the system of the convex
1	<u>Q</u> K <u>C</u> ancel
(1)	(2)

No.	Name	Function
(1)	Categories pane	Displays option categories.
(2)	Setting pane	Displays the settings of the selected category and allows the user to configure settings.

Option categories

Category name	name Function	
	Allows the user to configure settings related to editing and printing CFC programs.	-

Category name	Function	Reference page
FBD, LD and IL editor	Allows the user to configure settings related to editing, commenting, and printing FBD, LD, and IL programs.	"P.6-11"
		"P.6-33"
SFC editor	Allows the user to configure settings related to the sizes and fonts of SFC editor elements, the behavior at the time of action element insertion, the display of embedded objects in the navigator pane, the display of properties, stepwise execution time during online operation, and other items.	"P.6-23"
SmartCoding	Allows the user to configure settings related to the functions for supporting program creation, such as Input Assistant.	"P.6-14"
		"P.5-8"
		"P.5-60"
Text editor	Allows the user to configure settings related to program editing and inline monitoring.	"P.8-16"
Device editor	Allows the user to configure settings related to displays for the device editor.	-
Debugging	Allows the user to configure settings regarding whether to restore breakpoints after resetting.	-
Monitoring	Allows the user to configure settings related to displays for monitoring.	-
Refactoring	Allows the user to configure settings for the valid range of refactoring.	"P.5-61"
Load and save	Allows the user to configure settings regarding whether to enable backup and auto saving of project files.	"P.4-21"
		"P.4-19"
International Settings	Allows the user to set a display language for GM Programmer and PANATERM Lite for GM, as well as a display language for the manual.	"P.3-41"
Declaration Editor	Allows the user to configure settings related to the display format (text format or table format) for the declaration section.	"P.5-5"

- Select a desired category from the Categories pane.
 The setting items for the selected category will be displayed in the setting pane.
- **3.** Change the setting items as appropriate and click the [OK] button. The setting items will be applied.

3.7.2 Display Language Setting Function

This function allows the user to change the display language setting for GM Programmer. The default setting is the same language as the one used in the operating system. If you want to use a different language from the one used in the operating system, change the display language setting. After you change the language setting, you must restart GM Programmer.

¹ 2 Procedure

- 1. From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.
- Select "International Settings" from the Categories pane. The "International Settings" pane will be displayed.

Options		×
 CFC Editor Debugging Dedaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor 	International Settings User Interface Language Same as Microsoft Windows Specific language: Please note: Changing the user interface language will not be effective until this application is restarted. Some components may not be available in the selected language and will then appear in their default culture (typically English). Help Language Same as user interface language Specific language:	×
	<u>O</u> K <u>C</u> an	cel

- **3.** Select **User Interface Language**>**Specific language** option and specify a desired language in the field.
- **4.** Click [OK].

The "Options" dialog box will be closed. At this stage, the language has not been changed yet.

 Close GM Programmer and then start GM Programmer again. After GM Programmer is started, the selected language takes effect.

1 Info.

• The display language setting of GM Programmer is linked with that of PANATERM Lite for GM. Therefore, if the display language setting of PANATERM Lite for GM is changed, the display language setting of GM Programmer will also be changed automatically.

3.7.3 Version Display Function

This function allows the user to check the version, license, and other information for GM Programmer.



1. From the menu bar, select Help>Version Info.

The GM Programmer version is displayed in parentheses on the title bar.

Information(1.4.1.0)		×
11		F.
2	8.2.2	
	CM Braggammer VI 4	
	GM Programmer V1.4	

2. Click a desired button at the bottom of the window.

Button	Description
Version Info	Displays information about the plug-ins that have been applied and the operating system of the PC that is used.
License Info	Displays license information for the software used by GM Programmer.

Clicking the [Version Info] button displays the "Version Info" dialog box.

Version Info			×
Programing System :			
GM Programmer V1.1			
Component		Version	^
Action Editor		3.5.15.0	
Action Object		3.5.15.0	
Alarm Configuration Edi	tors	3.5.15.0	
Alarm Configuration Obj	ects	3.5.15.40	
Application Object		3.5.15.0	
ARM Codegenerator		3.5.15.0	
ARM64 Codegenerator		3.5.15.40	
AutoDeclare		3.5.15.20	
Binary Archive		3.5.15.0	
Bookmarks		3.5.15.0	
Breakpoints		3.5.15.0	
BrowserCommands		3.5.15.30	
Build Commands		3.5.15.0	
Cam Editor		4.6.0.0	
Cam Implementation Ob	ject	4.6.0.0	
CFC Editor		3.5.15.0	
CFC Implementation Ob	ject	3.5.15.0	
CNC Editor		4.6.0.0	
CNC function blocks		4.6.1.0	
Codegenerator for ×86-	64 architecture	3.5.15.0	~
Operating System :			
OS Version :	Microsoft Wi	ndows NT 10.0.1	18363.0
.NET Version:	4.8 or later		
	E	xport(<u>E</u>)	Close(<u>C</u>)

Clicking the [License Info] button displays the "License Information" dialog box.

License Infomation	×	:
This product incorporates the following software: (1) the software developed independently by or for Panasonic Corporation, (2) the software owned by third party and licensed to Panasonic Corporation, (3) the software licensed under the GNU General Public License, Version 2.0 (GPL V2.0), (4) the software licensed under the GNU ESSER General Public License Version 2.0 (LGPL V2.0) or Version 2.1 (LGPL V2.1) (5) open source software other than the software licensed under the GPL V2.0, LGPL V2.0 or LGPL V2.1. • For the details of software that categorized as (3) - (5), please refer to Start > GM Programmer > FOSS Components.	^	
 For software categorized as (5) include Magic. Please check the following website for Magic. http://www.dotnetmagic.com The software categorized as (3) - (5) are distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY, without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. 		
At least three years from delivery of products, Panasonic will give to any third party who contact us at the contact information provided below, for a charge no more than our cost of physically performing source code distribution, a complete machine-readable copy of the corresponding source code covered under GPL/LGPL. Please note that we cannot respond to any inquiries regarding the source code.		
Contact Information oss=cd=request@gg.jp.panasonic.com	~	
	Close(<u>C</u>)	

3.7.4 Customize function

You can use custom functions to change the configuration of the menu bar and toolbar. You can also change the assignment of shortcut keys and menu command icons.

Changing the menu bar

You can add menu commands to the category.



Procedure

 Select [Tools] → [Customize] in the menu bar. The [Customize] dialog box appears.

lenu	1	Foolbars Keyboard Command Icons		
Ŧ		File	^	Add Command
Ŧ		Edit		Add Separator
±		View		Add Scharger
±		Project		Add Popup Menu
Ŧ		Libraries		Edit Popup Menu
Ŧ		CFC		call Popup Melia
Ŧ		Declarations		Delete
Ŧ		FBD/LD/IL		Move Up
Ŧ		SFC		Hove op
Ŧ		Recipes		Move Down
Ŧ		Trace		
Ŧ		Build		
±		Online		
±		Debug		
Ŧ		Tools		Reset
±		Window		Load
±		Help		LUdu
±		Cam	~	Save
±		Cam	~	Save

- 2. Select the category you want to add a new command to and expand the menu.
- **3.** Select the menu below where you want to add the menu.

Select the whitespace symbol () if you want to add it to the bottom of the category.

 Click [Add Command]. The [Add Command] dialog box appears.

Categories		Commands	
Bookmarks Breakpoints Browse Project Build Cam CFC Clipboard CNC Declaration Device Communication Devices FBD/LD/IL File	^	 Clear All Bookmarks Clear All Bookmarks (active editor) Next Bookmark Next Bookmark (active editor) Previous Bookmark Previous Bookmark (active editor) Toggle Bookmark 	
Find/Replace GVL Commands Help Installation Library Manager Message View	v		

A list of commands that can be added by category appears.

5. Select the command you want to add and click the [OK] button.

The command is added to the menu of the [Customize] dialog box. You can change the order of the menus by clicking the [Move Up] and [Move Down] buttons.

You can add a border between the menus by clicking the [Add Separator] button.

6. Click the [OK] button.

The [Customize] dialog box closes and commands are added to the menu bar.



- When the version of GM Programmer is updated, it will return to the default settings, so save the necessary settings before performing.
- You can delete the menu command by clicking the [Delete] button.
- When the [Reset] button is clicked, the menu configuration returns to the default state.
- You can save the menu configuration by clicking the [Save] button. The file extension of the saved menu configuration is ".opt.menu".
- You can load the saved menu configuration file by clicking the [Load] button.

Adding a Popup Menu

You can add a popup menu to the menu bar. A menu command can be added to the popup menu.



- Select [Tools] -> [Customize] in the menu bar. The [Customize] dialog box appears.
- 2. Select the whitespace symbol () at the bottom of the hierarchy where you want to add a menu to the menu tree.

	1	Toolbars Keyboard Command Icons		
Ŧ		File	^	Add Command
Ŧ		Edit		Add Separator
±		View		
±		Project		Add Popup Menu
-		Libraries		Edit Popup Menu
		🛃 Add Library		Eale Popup Mellum
		Try To Reload Library		Delete
		Properties		Marcalla
		Placeholders		Move Up
		Export Library		Move Down
Ŧ		CFC		
Ŧ		Declarations		
Ŧ		FBD/LD/IL		
Ŧ		SEC		Reset
Ŧ		Recipes		
÷		Trace		Load
÷		Build	v [Save

 Click the [Add Popup Menu] button. The [Add Popup Menu] dialog box appears.

Add Popup Me	nu	×
Default text		
Localized text	s Text	
		Add Language > Remove Language
		OK Cancel

- 4. Enter a name for the new popup menu in the default text field. You can use the [Add Language] button to add the name of the language you want to change. After selecting the language, click in the text field and enter text in the selected language.
- 5. Click the [OK] button.

A popup menu is added to the menu of the Customize dialog box.

You can change the order of the popup menus by clicking the [Move Up] and [Move Down] buttons.

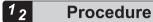
6. Click the [OK] button.

The [Customize] dialog box closes and a popup menu is added to the menu bar.



- When upgrading the version of GM Programmer, it will return to the default settings. Therefore, when upgrading the version of GM Programmer, please save the necessary settings in advance.
- You can edit the display of the added popup menu by clicking the [Edit Popup Menu] button.
- You can delete the added popup menu by clicking the [Delete] button.
- When the [Reset] button is clicked, the menu configuration returns to the default state.
- You can save the menu configuration by clicking the [Save] button. The extension of the saved file is ***.opt.menu.
- You can load the saved menu configuration file by clicking the [Load] button.

Adding a toolbar



- Select [Tools] -> [Customize] in the menu bar. The [Customize] dialog box appears.
- 2. Select the [Toolbar] tab. The list of toolbars appears.

ıstomize	
Menu Toolbars Keyboard Command Icons	
🗄 🕴 Standard	Add Toolbar
	Add Command
■ FC	Add Separator
Irrace ICNC	Delete
	Move Up
	Move Down
	Show
	Reset
	Load
	Save
	OK Cancel

- **3.** Select the toolbar and click the [Add Toolbar] button. A new toolbar is added above the selected toolbar.
- 4. Enter a name for the toolbar.

The toolbar is added to the [Customize] dialog box.

You can change the order of the toolbars by clicking the [Move Up] and [Move Down] buttons.

This completes the addition of the toolbar.

- **5.** This section explains how to add commands to the toolbar you've added. Expand the toolbar tree where you want to add new commands.
- 6. Select the whitespace symbol ().

7. Click [Add Command].

The [Add Command] dialog box appears. A list of the commands you can add by category appears.

 Select the command you want to add and click the [OK] button. The command is added to the toolbar. You can change the order of the commands by clicking the [Move Up] and [Move Down] buttons.

You can add a border between the commands by clicking the [Add Separator] button.

9. Click the [OK] button.

The Customize dialog box closes and the toolbar and commands are added.



- When upgrading the version of GM Programmer, it will return to the default settings. Therefore, when upgrading the version of GM Programmer, please save the necessary settings in advance.
- You can delete added toolbars or commands by clicking the [Delete] button.
- Select the toolbar and click the [Hide] button to hide the toolbar. Click the [Show] button to make the toolbar visible again.
- Click the [Reset] button to reset the toolbar to the default state.
- You can save the toolbar by clicking the [Save] button. The extension of the saved file is ***.opt.tbar.
- You can load a saved toolbar by clicking the [Load] button.

Changing command shortcut keys

You can change the shortcut keys assigned to commands.

¹² Procedure

- Select [Tools] -> [Customize] in the menu bar. The [Customize] dialog box appears.
- Select the [Keyboard] tab. A list of commands by category appears.

Menu Toolbars Keyboard Co	mmand	Icons	
Categories		Commands	
Bookmarks	^	Clear All Bookmarks (active editor)	
Breakpoints		Mext Bookmark (active editor)	
Browse Project		Previous Bookmark (active editor)	
Build		Toggle Bookmark	
Cam			
CFC			
Clipboard			
CNC			
Dedaration			
Device Communication			
Devices			
Derived			
FBD/LD/IL			
	~		
FBD/LD/IL	•	✓ Remove Reset	
FBD/LD/IL File	•	Remove Reset Assign Load	

- **3.** Select a category from the list in the Categories column. The list of commands is displayed in the Commands field.
- Select the command for which you want to set the shortcut key.
 If a shortcut key is assigned to the selected command, it is displayed in the Shortcut field of the selected command.
- 5. In the shortcut key field, press the shortcut key you want to assign.
 - If the key you pressed appears in the field to press the shortcut key, it can be assigned.
 - <Ctrl>key + alphanumeric key or <F2>key to <F12>key
 - <Alt>key + alphanumeric key or <F2>key to <F12>key

- <Ctrl>key + <Shift>key + alphanumeric key or <F2>key to <F12>key
- <Shift>key + <F2>key to <F12>key
- Oel>key
- Ins>key
- 6. Click the [Assign] button.

The shortcut that is assigned to the shortcut field for the selected command is shown.

7. Click the [OK] button.

The [Customize] dialog box closes and shortcut key is assigned to the command.



- When upgrading the version of GM Programmer, it will return to the default settings. Therefore, when upgrading the version of GM Programmer, please save the necessary settings in advance.
- If you want to delete the shortcut key assigned to the command, select the command and click the [Delete] button.

Click the [OK] button to confirm the command shortcut key deletion.

- Select the toolbar and click the [Hide] button to hide the toolbar. Click the [Show] button to make the toolbar visible again.
- Click the [Reset] button to return the shortcut key assignment to the default state.
- You can save the shortcut key by clicking the [Save] button. The saved file has the extension ***.opt.keyb.
- You can load the saved shortcut key file by clicking the [Load] button.

Changing command icons

You can change the icon assigned to a command.

¹² Procedure

- Select [Tools] -> [Customize] in the menu bar. The [Customize] dialog box appears.
- Select the [Command Icon] tab. A list of commands by category appears.

Menu Toolbars Keyboard C	Command Icons			
Categories		mands		
Add Devices	^	Add Device		
Bookmarks		Device Management		
Breakpoints		Plug Device		
Browse Project		Unit Management		
Build				
Cam				
CFC				
Clipboard				
CNC				
Declaration				
Device Communication				
Devices	~			
Icon: Not set	Assign	Remove	Res	set
			Loa	d
			Sav	e

- **3.** Select a category from the list in the Categories column. The list of commands is displayed in the Commands field.
- 4. Select the command for which you want to set the icon.
- **5.** Click the [Assign] button on the small icon and select an icon file (***.ico). The selected icons are displayed.

6. Click the [OK] button.

The Customize dialog box closes and an icon is assigned to the command.

f Info.

- When upgrading the version of GM Programmer, it will return to the default settings. Therefore, when upgrading the version of GM Programmer, please save the necessary settings in advance.
- You can delete the icon assignment by clicking the [Delete] button.
- Click the [Reset] button to return the icon assignment to the default state
- You can save the icon assignment state by clicking the [Save] button.
- You can load the saved file by clicking the [Load] button.

4 Project Operations

4.1 Project Creation Flow	4-2
4.2 Project operations	4-3
4.2.1 Creating a New Project	
4.2.3 Project Configuration	
4.2.4 Saving a Project	
4.2.5 Closing a Project	
4.2.6 Opening a Project	4-11
4.3 Setting up the GM1 Controller	4-12
4.4 Adding Objects	4-13
4.4.1 List of objects	4-16
4.5 Other project settings	4-17
4.5.1 Setting up a Project	4-17
4.5.2 Setting up a project save	
4.5.3 Printing a Project and Object	4-23
4.5.4 Comparing Projects	4-26
4.5.5 Exporting and Importing Objects	4-31
4.5.6 Project File Conversion	4-35
4.5.7 Saving and unzipping the project archive	4-39

4.1 Project Creation Flow

1. Setting up the GM1 controller(Refer to "4.3 Setting up the GM1 Controller")

Set up parameters for the GM1 controller.



- 2. Setting up motion control(Refer to "9 Motion Control")
- This section explains how to add device objects for servo amplifiers to a project and set them up.
- This section explains how to add device objects for free encoders and virtual drives to a project and set them up.

- 3. Setting up unit control(Refer to "12 Unit Function")
- This section explains how to set up general-purpose I/O, PWM output, and high-speed counter for the GM1 controller.
- This section explains how to add device objects for expansion units to a project and set them up.

╼

- 4. Setting up the communication function(Refer to "13 Communication Function")
- This section explains how to add an object of the protocol to be used for the LAN/COM port to a project and set it up.
- ╼

5. Program Creation(Refer to "5 Program Creation")

• Create the program.

4.2 Project operations

This section explains how to create a new project, open and close it.

4.2.1 Creating a New Project

When creating a program using the GM Programmer for the first time, create a new project. For the new project, set a device and a programming language to be used.

This section describes how to create a new project.

Given below is an example that explains the procedure to create a project for the GM1 controller (product number: AGM1CSRX16T) in Structured Text (ST) format.

¹² Procedure

1. Start up the GM Programmer.

For details on how to start up, refer to "3.4.1 How to start".

When the GM Programmer is successfully started, the Start Page will be displayed.



 Select "New Project" under "Basic Operations". The "New Project" dialog box will be displayed.

管 New Pro	ject	;	×
<u>C</u> ategories	1	<u>T</u> emplates	
	raries ojects	Standard project	
A project o	ontaining one device, one appli	ication, and an empty implementation for MC_PRG	
<u>N</u> ame	Untitled 1		
<u>L</u> ocation	C:¥Users¥Documents	~	
		OK Cancel	

- **3.** Select **Project**>**Standard project**, and specify a project file name in the "Name" field and a project storage location in the "Location" field.
- 4. Click the [OK] button.

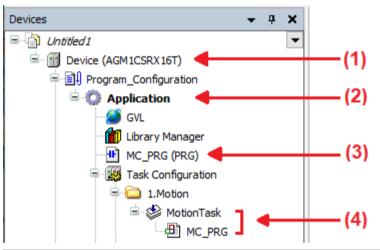
The "Standard Project" dialog box will be displayed.

Stand	lard Project			×
ľ	Create a standard projec Please select a device an		gramming language.	
De	vice(<u>D</u>):	AG	M1CSRX16T (Panasonic Corporation)	~
Pro	oject Version(⊻):	1.3	3.1.0	~
Pro	ogram in(P):		uctured Text (ST)	~
			ОК	Cancel
No.	Name		Function	
(1)	Device		Sets up Device.	

No.	Name	Function
		AGM1CSRX16T:RTEX communication
		AGM1CSEC16T/P : EtherCAT communication
	Draiget version	Sets up Project version
(2)	(2) Project version	Refer to "3.2 Version System".
		Sets up Programming language.
(3)	Programming language	Refer to "6 Entering programs in each Programming language and Variable".

5. Select "AGM1CSRX16T(Panasonic Corporation)" in the "Device" field and "Structured Text (ST)." in the "Program in" field, and click the [OK] button.

A new project will be created. Device and other objects including objects for ST programs are arranged in the navigator pane.



<Uses of objects arranged in the navigator pane>

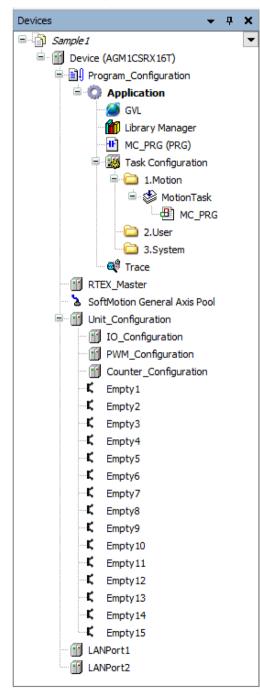
No.	Name	Function
(1)	Device object	Sets up device objects.
(2)	Application object	Sets up application objects.
(3)	Program object (POU object)	Sets up program objects (POU objects).
(4)	Task object	Sets up task objects.

f Info.

• A new project can also be created from the menu bar by selecting File>New Project.

4.2.2 Device Tree Configuration

When a new project is created, it is started in the device tree configuration shown below.

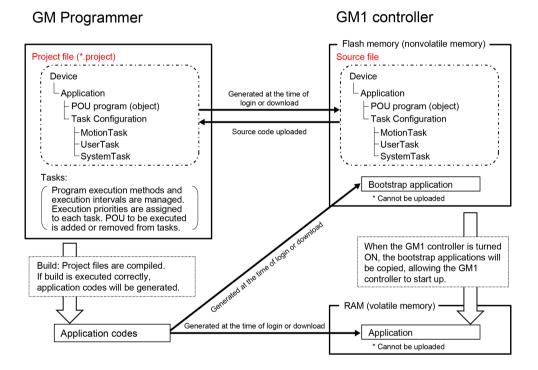


Name	Overview
Sample1	Project name
Device	GM1 Controller device
Program Configuration	Object that defines applications including source codes
Application	Application object
GVL	Global variable object
Library_Manager	List of all libraries linked to the project
MC_PRG(PRG)	Main program
Task Configuration	Configuration of tasks invoking application programs
1.Motion	User program tasks for motion control
MotionTask	
MC_PRG	
2.User	User program task for any control other than motion control
3.System	Task used by the system
Trace	Object that monitors variable data graphically
RTEX_Master	Object that is the parent node of servo amplifiers for RTEX (RTEX only)
EtherCAT_Master_SoftMotio	Object that is the parent node of servo amplifiers for EtherCAT (EtherCAT only)
SoftMotion General Axis Pool	Object that is an interface for inserting a free drive unit
Unit_Configuration	Object that is the parent node of I/O related devices
IO_Configuration	General-purpose I/O incorporated in GM1 controller
PWM_Configuration	PWM output incorporated in GM1 controller
Counter_Configuration	High-speed counter incorporated in GM1 controller
Empty1	Objects for adding I/O for expansion unit
Empty2	
Empty3	
Empty4	
Empty5	
Empty6	-
Empty7	-
Empty8	
Empty9	
Empty10	
Empty11	
Empty12	
Empty13	

4.2 Project operations

Name	Overview
Empty14	
Empty15	
LAN Port1	Objects that are the parent node of devices that use the Ethernet
LAN Port2	protocol

4.2.3 Project Configuration



4.2.4 Saving a Project

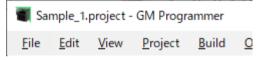
Save a project that is created. The project will be saved as a file with extension " ".project" ". Unsaved projects are indicated by "*" on the right side of their project file names on the title bar.

👅 Sai	mple_1.	projec *	- GM Prog	rammer
<u>F</u> ile	<u>E</u> dit	<u>V</u> iew	<u>P</u> roject	FBD/LD/ <u>I</u> L

¹² Procedure

 From the menu bar, select File>Save Project, or press the shortcut keys "Ctrl+s". A project that has been created will be saved.

" "*" " displayed on the right side of the project file name will disappear.



i Info.

- Before saving a project, you can change its project name. From the menu bar, select **File>Save Project As**.
- Project files can be saved automatically. For details, refer to "Automatically Saving Project Files".
- Before updating a file, you can save it as a backup file. For details, refer to "Creating a Backup when a Project Is Saved".

4.2.5 Closing a Project



1. From the menu bar, select File>Close Project. The project that has been created will be closed.



• If you select "Close Project" without saving a project file that has been updated, a confirmation dialog box will be displayed, asking whether to save the project. Click the [Yes] button to save the project.

GM Prog	rammer	×
?	The current project has been changed. Do you want to save the changes?	
	Yes <u>N</u> o Cancel	

4.2.6 Opening a Project

1₂ Procedure

1. From the menu bar, select File>Open Project. The "Open Project" dialog box will be displayed.

📕 Open Proje	t				2
Look įn	GM program		G 🤌 📂 🛄 🗸		
<u>_</u>	Name	^	Date modified	Туре	
	Sample_1		2020/11/09 15:31	File folder	
Quick access	Sample_2		2020/11/09 15:32	File folder	
	Sample_3		2020/11/09 15:32	File folder	
	Sample_4		2020/11/09 15:32	File folder	
Desktop	Sample_5		2020/11/09 15:32	File folder	
Libraries					
Network					
	<				
	File <u>n</u> ame:			~ <u>Op</u>	en
	Files of type:	Project files(* project)		✓ Can	cel
		Open as read-only			

2. Select a project file and click the [Open] button. The selected project file will be opened.

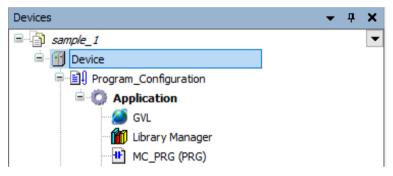
👅 Open Projec	t			×
Look in:	Sample_2		🖂 🧿 🎓 🛄 🗸	
<u>_</u>	Name	^	Date modified	Туре
Quick access	Sample_2.p	roject	2020/11/09 15:55	GM Programmer
Desktop				
-				
Libraries				
This PC				
٢				
Network				
	<			>
	File <u>n</u> ame:	Sample_2 project		∼ Open
	Files of type:	Project files(* project)		✓ Cancel
		📙 Open as read-only		

4.3 Setting up the GM1 Controller

This section explains how to set up parameters for the GM1 controller.

¹² Procedure

1. Double-click the [Device] object in the navigator pane.In the Device pane, the Communication Settings sub-pane will be displayed.



2. Click the "PLC parameters" tab.

The parameter settings sub-pane will be displayed.

Device X					
Communication Settings	Category Selection(T)	+ •	Parameter Setting (R)		
Date and Time and Settings	B-PLC		Parameter	Value	
	- A unit error occurred Network setting		LAN port1 IP Address	192.168.1.5	
Applications	- FTP server setting		LAN port1 Subnet Mask	255.255.255.0	
Log	Project management setting		LAN port1 Default Gateway	192.168.1.1	
			LAN port2 IP Address	192.168.2.5	
Users and Groups			LAN port2 Subnet Mask	255.255.255.0	
			LAN port2 Default Gateway	0.0.0.0	
Access Rights			Reflect address setting to PLC	Reflect	
PLC Setting PLC Parameter					
PLC Shell					
Task Deployment					
Status					
Information					

3. Change the values of the parameters that you want to update.

A unit error occurred : Select whether to stop or continue operation when an error occurs(For details, refer to "Unit Error" of high-speed counter function.)

Network setting : IP address, subunet mask, and defalt gateway of LAN port 1 and LAN port2, Reflect address setting to PLC

FTP server setting : Set parameters related to FTP server (For details, refer to "13.7.3 List of Setting Items".)

Project management setting : Set parameters related to project management (For details, refer to "14.6 Project Management Function")

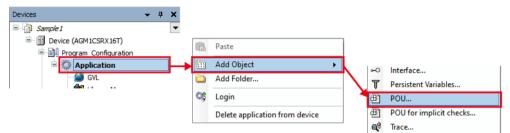
4.4 Adding Objects

Program creation objects (POU objects) and objects with various functions can be added to applications within a project.

For example, use the following procedure to add POU objects for ST programs.



1. Right-click the [Application] object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.



The "Add POU" dialog box will be displayed.

Add POU >	×
Create a new POU (Program Organization Unit)	
Name	
20U]
Туре	
• Program	
○ Function <u>b</u> lock	
Extends	
Implements	
Final Ab <u>s</u> tract	
Accessspecifier	
~ ~	
Method implementation language	
Ladder Logic Diagram (LD) 🗸 🗸	
○ <u>F</u> unction	
<u>R</u> eturn type	
Implementation language	
Continuous Function Chart (CFC) ~	
Add Cancel	

4.4 Adding Objects

2. Enter a program name in the "Name" field, select a programming language from the "Implementation Language" drop-down list, and click the [Add] button.

Add POU >
Create a new POU (Program Organization Unit)
<u>N</u> ame
SampleProgram_1
Туре
• Program
○ Function <u>b</u> lock
Extends
Implements
Final Ab <u>s</u> tract
<u>A</u> ccess specifier
×
Method implementation language
Continuous Function Chart (CFC)
○ <u>F</u> unction
Return type
Implementation <u>l</u> anguage
Structured Text (ST) \sim
Add Cancel

A [POU] object for the programming language selected in the "Implementation Language" drop-down list will be added to the navigator pane.

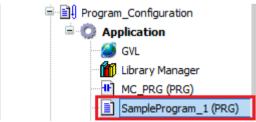
Sample1.project* - GM Programmer		- 🗆 X
File Edit View Project Build Online Deb	oug Iools <u>Window</u> Help	
🗎 😅 📓 😂 이 이 종 ங 🛝 🗙 🖓	「「「」」「「」」「「」」「「」」(「」」(「」」(「」」(」)「」」(」)」(」)	
Devices 👻 🕂 🖹	SampleProgram_1 X	ToolBox 👻 🛱 🗙
Sample I	1 PROGRAM SampleProgram_1	
Device (AGM1CSRX16T) Program_Configuration	3 BND_VAR	
Application	4	
- 🎑 GVL		
Ubrary Manager		
MC_PRG (PRG)		
Task Configuration		
🖹 😂 1.Motion		
B 🕼 MotionTask	100 🙉	
2.User	1	
3.System		
- et Trace		
RTEX_Master		
- Unit_Configuration		
IO_Configuration		
PWM_Configuration		
Counter_Configuration		
K Empty2		
-K Empty3		
C Empty4		
K Empty6		
-K Empty7		
C Empty8		
C Empty9		
K Empty11		
Empty 12		
C Empty13		
Emph/15		
< >>	100	Properties 🥀 ToolBox
Messages - Total 0 error(s), 0 warning(s), 0 message(s)		M Hohe nes X. 100B0X
E riceseges - recar e error(s), e warning(s), e message(s)	Last build: 🗿 0 🈗 0 Precompile 🧹 🛛 🥂	Project user: (nobody)

i Info.

- You can also add objects by selecting the [Application] object in the navigator pane and then selecting **Project>Add Object** from the menu bar.
- To remove an object, select the object in the navigator pane and then press the "Delete" key or right-click the object and then select "Delete" from the context-sensitive menu that is displayed.
- You can add folders under the [Application] object in the navigator pane. By adding objects under each folder, you can create a hierarchical structure.

Right-click the [Application] object in the navigator pane and then select "Add Folder" from the context-sensitive menu that is displayed. The "Add Folder" dialog box will be displayed. Enter a folder name and click the [OK] button.

Example: When a [POU] object is added under an added folder (program for project A)



• You can also add an object for creating functions and function blocks. For details, refer to "5.5 Function and Function Block".

4.4.1 List of objects

Check the following list for objects that can be added.

Addition source	Added object
Device	DeviceTrace
Application	CNC program CNC setting
	DUT
	POU
	Interface
	Cam table
	Global variable list
	Symbol Configuration
	Trace
	Visualization
	Recipe manager
	External file
	Extended Cam table
	Persistent variable
	POU for implicit checks
POU	Action
	Transition
	Property
	Methods
Interface	Interface property
	Interface method
Global Variables	Property
Persistent variable	Property
MotionTask	Program call
"2.User" folder	UserTask

4.5 Other project settings

4.5.1 Setting up a Project

Projects can be set up using the "Project Settings" dialog box. The settings will be applied to only the project that is set up.

1₂ Procedure

From the menu bar, selectProject>Project Settings.
 "Project Settings"dialog box will be displayed.

Project Settings	×
Compile options Compiler warnings Page Setup Security SFC SoftMotion Source Download Static Analysis Light Users and Groups Visualization	Compile options Compiler Version Fix version 3.5.15.40 Settings Version Settings Version Replace constants
예트 Visualization	Enablelogging inbreakpoints Compiler Warnings Maximum number of warnings 100
(1)	OK Cancel

No.	Name	Function
(1)	Categories pane	Displays project setting categories.
(2)	Setting pane	Displays the settings of the selected category and allows the user to configure settings.

Project setting categories

Category name	Function	Reference page
SFC	Allows the user to configure settings related to variables used in SFC and code generation.	"P.6-23"
SoftMotion	Displays the version of the SoftMotion package.	"P.9-15"

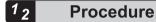
Category name	Function	Reference page
Sraric Analysis Light	Allows the user to configure settings regarding whether to enable code analysis during code generation.	"P.5-64"
Compiler warnings	Allows the user to configure settings regarding whether to enable warnings output during build.	"P.14-31"
Compile options	Allows the user to configure build-related settings such as whether to enable Unicode for the program objects (POU objects) and the number of compiler warnings to be output.	"P.8-8"
Security	Allows the user to configure settings related to project file encryption using passwords.	"P.14-16"
Source Download	Allows the user to configure settings related to the timing of source download.	-
Visualization	Allows the user to configure Visualization to be used for debugging.	"P.8-39"
Page Setup	Allows the user to configure printing-related settings.	_
Users and groups	Allows the user to add, edit, and remove users and groups for project user management.	"P.14-3"

- Select a desired category from the Categories pane.
 The setting items for the selected category will be displayed in the setting pane.
- **3.** Change the setting items as appropriate and click the[OK]button. The setting items will be applied.

4.5.2 Setting up a project save

Automatically Saving Project Files

Project files can be saved automatically during editing. Even if data disappears when GM Programmer terminates abnormally, a file up to the point in time when it was saved automatically can be restored. The extension of backup files is ".autosave".



- 1. From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.
- Select the "Load and Save" category. The "Load and Save" pane will be displayed.

Options	2	<
 CFC Editor Debugging Decide editor FBD, LD and IL editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor 	Load and Save Create backup files Automatically save every 10 to minutes Save before build Create project recovery information	
	Advanced Settings	
	<u>QK</u> <u>C</u> ancel	

 Select the "Automatically save evey" check box and click the [OK] button. The automatic save interval can be changed in minutes (default value: 10 minutes).

Options		×
 CFC Editor Debugging Declaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor 	Load and Save ✓ Create backup files ✓ Automatically save every 10 → minutes ✓ Save before build ✓ Create project recovery information	
	Ōĸ	<u>C</u> ancel

After auto save is set, project files will be automatically saved as files with extension ".autosave" at the specified interval during editing.

After a project file is closed due to abnormal termination of GM Programmer, when you open the project file again, you can select either the original project file with extension ".project" or the automatically saved project file with extension ".autosave". To open the automatically saved project file, click the [Open Auto Save File] button.

Auto Save Backup		\times
The project which you attempt to open has not been closed correctly. However, there is an automatic backup.		
Project:	Untitled6.project	
Location	C:¥Users¥Documents	
Date of the original file	2020年11月13日 9:46:16	
Date of the auto save file	2020年11月19日 13:51:01	
Open <u>A</u> uto Save File	Open <u>O</u> riginal File Cancel	

Creating a Backup when a Project Is Saved

When saving a project, you can create a backup file of the project file to be updated. The extension of backup files is ".backup".



- 1. From the menu bar, select **Tools>Options**. The "Options" dialog box will be displayed.
- Select the "Load and Save" category. The "Load and Save" pane will be displayed.

Options		×
 CFC Editor Debugging Decide editor FBD, LD and IL editor FBD, LD and IL editor International Settings Load and Save Monitoring SFC editor SFC editor SmartCoding Text editor 	Load and Save Create backup files Automatically save every 10 Save before build Create project recovery information	
	Advanced Settings	
	<u>Q</u> K <u>C</u> ancel	

3. Select the "Create backup files" check box and click the [OK] button.

Then, whenever a project is saved, the project file to be updated will be automatically saved as a backup file (with extension ".backup").

Options		×
 CFC Editor Debugging Dedaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor 	Load and Save Create backup files Automatically save every Save before build Create project recovery information	
	QK Çancel	

<Restoring backup files>

To restore a project file that has been backed up, manually change the extension of the file from ".backup" to ".project" and then open the project file in GM Programmer.

4.5.3 Printing a Project and Object

Printing a Project

You can print the entire project.

¹₂ Procedure

 From the menu bar, select Project>Document. The "Document Project" dialog box will be displayed.

Document Project		×
Please select the objects which are to be printed		
Sample_1		•
Program_Configuration		
GVL		
🛛 🗹 🎁 LibraryManager		
MC_PRG		
SampleProgram_1		
🗐 🗹 🎆 Task Configuration		
🗐 🗹 🔂 1.Motion		
🖻 🔽 👹 MotionTask		
MC_PRG		
POU		
		~
		Preview
☑ Table of <u>c</u> ontents		
Select > Deselect >	ОК	Cancel

2. Select the check boxes of the devices and objects for which documents are to be printed, and click the [OK] button.

The "Print" dialog box will be displayed. Select a printer to be used and click the [OK] button.

Documents will be printed.

f Info.

- By clicking the [Preview] button in the "Document Project" dialog box, a print preview window is displayed, so that you can check what a hard copy would look like when printed.
- You can edit page orientation, margin, header, footer, table of contents, and title page details. From the menu bar, select **File>Page Setup**. The "Project Settings" dialog box will appear with the Page Setup pane displayed.

Select the tab of the item to be changed and change the settings.

Project Settings			×
Compile options Compiler warnings Page Setup Security SFC SoftMotion Static Analysis Light Users and Groups	Orientation	Header and Footer Document Title Pag	e Preview Options
	<u>F</u> ormat <u>S</u> ource <u>Q</u> uality	A4 210 x 297 mm 自動選択 600 x 600 dpi	▼▼▼
			OK Cancel

Printing an Object within a Project

¹² Procedure

 With the object editor opened, from the menu bar, select File>Print. The "Print" dialog box will be displayed. Execute printing.

Print	×
Printer	
Name:	✓ Properties
Status: Type:	
Where:	
Comment:	Print to file
Print range	Copies
All	Number of <u>c</u> opies: 1
Pages from: to:	123 123 Collate
○ <u>S</u> election	123 123 Collate
	OK Cancel

4.5.4 Comparing Projects

You can compare the opened project file with another project file to display and merge the differences between them.

Project Comparison Method

Compare the opened project file with another project file.



 From the menu bar, select Project>Compare. The "Project Comparison" dialog box will be displayed.

Project Comparison		×
Compare the current	y open project with	
<u> Project on disk</u>		
O Project in a <u>s</u> ourc	e control database	
<u>H</u> ost		
P <u>o</u> rt		
<u>L</u> ocation		
Compare Options		
☐ Ignore <u>W</u> hitespace (Semantically rele	æ zvant whitespaces, e.g. in string literals, are never ignored)	
Ignore Comment	5	
Ignore Proper <u>t</u> ies (Folders, access	rights, exclusion from build, POU bitmaps, etc.)	
	ОК Са	ancel

 In the "Project on disk" field, specify a project file to be compared with and click the [OK] button.

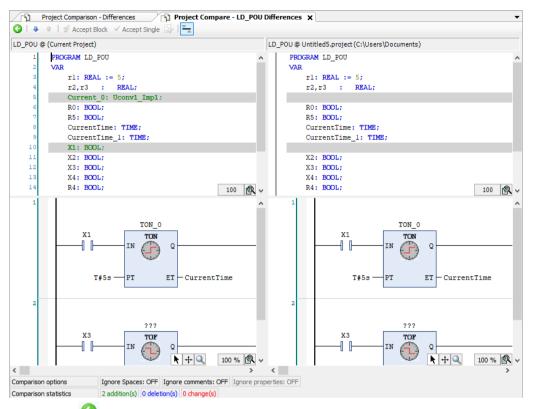
The comparison results will be displayed in the main pane.

The backgrounds of object lines with differences are displayed in gray. The text color of each object indicates the type of difference.

Project Comparison - Differences X		
Image: Second state of the second	Untitled5.project (C:\Users\Documents)	
		— (1) — (2) — (3)
	RTEX_Master SoftMotion General Axis Pool Unit_Configuration LANPort1 LANPort2	— (4
Comparison options Ignore Spaces: OFF Ignore commer Comparison statistics 1 addition(s) 1 deletion(s) 2 changes		
(5)	(6)	

No.	Description
(1)	Removed object
(2)	Object with a difference in contents
(3)	Object with a difference in properties
(4)	Added object
(5)	Opened project
(6)	Specified project

Double-clicking an object line with a difference in contents displays the object comparison results.



Clicking the 🥯 icon returns the display to the comparison view in the navigator pane.

Clicking the icon switches to the mode in which comparison results including removed object lines are displayed. The above window in which comparison results are displayed will be switched to the window shown below. If the differences displayed as variable bVar0 and empty lines that have been added differ from the specifications of variable bVar0, differences will be displayed as changes in variable bVar0.

)_POU @	(Current Project)	L	_D_POU @ Untitled5.project (C:\Users\Documents)	
1	PROGRAM LD_POU	^	PROGRAM LD_POU	
2	VAR		VAR	
3	rl: REAL := 5;		rl: REAL := 5;	
4	r2,r3 : REAL;		r2,r3 : REAL;	
5	Current_0: Uconv1_Imp1;			
6	Revarce 0: Uconv1 Imp1;			
7	R0: BOOL;		R0: BOOL;	
8	R5: BOOL;		R5: BOOL;	
9	CurrentTime: TIME;		CurrentTime: TIME;	
10	CurrentTime_1: TIME;		CurrentTime_1: TIME;	

Merging Differences

Differences displayed by comparing projects can be merged into the opened project.

When there are differences in the contents of objects, the differences can be merged by using the [Accept Block] button or [Accept Single] button.

For example, use the following procedure to merge the differences in the contents of programs.

¹² Procedure

1. Perform project comparison.

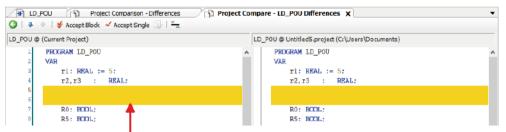
Project comparison results will be displayed.

For details on how to perform project comparison, refer to "Project Comparison Method".

2. Move the cursor to the difference location and click the [Accept Block] button or [Accept Single] button.

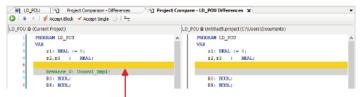
The difference will be merged into the opened project. The background of the merged section will be displayed in yellow. At this stage, the merged content has not been reflected in the project yet. To reflect the merged content, approval operation is required as below.

[Accept Block] button: Merges the entire block containing the difference at the cursor position



Merge the entire block containing the difference at the cursor position (delete two lines)

[Accept Single] button: Merges the difference at the cursor position



Merge the difference at the cursor position (delete one line)

3. From the menu bar, select Project>Commit accepted changes.

The merged content will be approved and reflected in the opened project. Because the reflected content has not been saved yet, save the project as necessary.

1 Info.

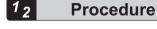
• To merge between objects whose properties are different, select an object with differences and click the icon. The "Accept" dialog box will be displayed. Select the "Properties" check box and click the [OK] button.

Accept	×
Which meta information do you want to	accept?
Acceptablegroups	Not acceptable groups (missing in either project)
Properties	
	OK Cancel

4.5.5 Exporting and Importing Objects

Objects in a project can be exported as XML files. The extension of exported files is ".export". Files that are being exported can be imported to GM Programmer.

Exporting Objects



 From the menu bar, select Project>Export. The "Export" dialog box will be displayed.

Export	×
Please select the objects which are to be exported: Devices POUs	
Sample 1 Image: Second system Image: Second system	
Storage version GM Programmer V1.0	~
Gir Frogrammer VI.0	
	OK Cancel

f Info.

- To import an object into GM Programmer, select only one object below the [Application] object and export it.
- Select objects to be exported. Normally, there is no need to make changes.
- **3.** Click the [OK] button. The "Export" dialog box will be displayed.

If necessary, change the file name and save destination.

👅 Export							\times
\leftarrow \rightarrow \checkmark \uparrow \square \rightarrow This PC \rightarrow	Desktop > GM programmer > Sample_	1 > Export	~	ۍ د	earch Export		9
Organize 🔻 New folder							?
📰 Pictures 🖈 🐴 Name	e	Date modified	Туре	Size			
len OneDrive		No items match yo	ur search.				
💻 This PC							
🧊 3D Objects							
E. Desktop							
Documents							
🕂 Downloads							
Music							
Pictures							
📑 Videos							
🏪 Windows (C:)							
💣 Network 🗸 🗸							
File name: Sample_1.expo	ort						~
Save as type: Export files (*.e	export)						~
 Hide Folders 				L	<u>S</u> ave	Cancel	

4. Click the [Save] button. Export will be executed.

GM Prog	rammer	×
1	Export completed successfully.	
	ОК	

Importing Objects

This section explains the procedure for importing objects exported to a project into GM Programmer.

For example, use the following procedure to import objects below the "Application" object.



1. Select the [Application] object in the navigator pane and then select **Project>Import** from the menu bar.

The "Import" dialog box will be displayed.

👅 Import								×
\leftrightarrow \rightarrow \checkmark \uparrow \Box > This PC > Desktop > GM programmer > Sample_1 > Export \checkmark \circlearrowright See				Search	Export		Q	
Organize 👻 New fold	er					== -		?
🕂 Downloads 🖈 ^	Name	Date modified	Туре	Size				
🚔 Documents 🖈	Sample_1.export	2020/11/09 16:52	EXPORT File		4,972 KB			
📰 Pictures 🛛 🖈								
OneDrive								
💻 This PC								
🗊 3D Objects								
E Desktop								
🔮 Documents								
🖶 Downloads								
b Music								
Pictures								
Videos								
🏪 Windows (C:)								
ight Network								
File <u>n</u>	ame:			~	Export	files (*.export)		\sim
					<u>0</u>	pen C	ancel	

 Select a file with extension ".export" and click the [Open] button. The "Import" dialog box will be displayed.

Objects that can be imported will be displayed in the "Insertable items" area.

Import
Please select the items which should be imported. All items will be imported below the node which is currently selected in the navigator. You can change this selection while this dialog is open.
Currently selected target object: Application [Device: Program_Configuration]
Insertable items:
✓ DUT ✓ ➡ FB_ADD ✓ ➡ FunctionBlock_Sample ✓ ➡ LD_POU ✓ ➡ MC_PRG ✓ ➡ PLC_PRG ✓ ➡ ST_POU ✓ ➡ ST_Sample ✓ ➡ Task Configuration
Show Contents OK Cancel



- To import an object into GM Programmer, select an export file where only one object below the [Application] object is selected.
- **3.** Clear the check boxes of the objects that do not need to be imported and click the [OK] button.

Import will be executed.

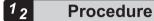
The objects that have been imported will be displayed below the [Application] object in the navigator pane.

GM Programmer	\times
Import completed successfully	
ОК	

4.5.6 Project File Conversion

Converting Project File (.project) Version

Example: Converting the project version of a RTEX project file from 1.2.2.0 to 1.4.1.0



1. Open a project file.

The "Project File Conversion" dialog box will be displayed.

Project File Conversion							
Project version is out of date. If you want to convert the project file, click the "Convert" button.							
Do not show this dialog again(C)							
	Convert	Do Not Convert					

2. Click the [Convert] button.

The Project File Conversion dialog box will be displayed.

Confirm that the converted project version is shown at "Project version after conversion".

Project File Conversion		×
Current Project Version:	1.2.2.0	
Converted Project Version:	1.4.1.0	~
	ОК	Cancel

3. Click the [OK] button.

A confirmation dialog box will be displayed. Check the confirmation items about project file conversion.

4.5 Other project settings

Content				
Can not revert to	the original project.			
The parameters o	f the high-speed counter ar	e set to default va	lue.	
The parameters o	f the analog input unit are s	et to default value	2.	
The parameters o	f the analog output unit are	set to default val	ue.	
The parameters o	f the pulse output unit are :	set to the default v	/alue.	
Event				
Event				
	original project version aft	er project file conv	ersion.	
	original project version afte	er project file conv	ersion.	
	original project version aft	er project file conv	ersion.	
	original project version aft	er project file conv	ersion.	
	original project version aft	er project file conv	ersion.	
	original project version aft	er project file conv	ersion.	
	original project version aft	er project file conv	ersion.	

4. Click the [Execute] button.

Conversion of the project file starts.



- The project version of project files cannot be converted to any project version older than the current project version before conversion.
- You can also convert the version of a project file by selecting Project > Project File Conversion from the menu bar.

Converting Library Project File (.library)

¹² Procedure

1. Open a library project file.

The "Project File Conversion" dialog box will be displayed.

Project File Conversion						
Project version is out of date. If you want to convert the project f	ile, click the "Conv	ert" button.				
Do not show this dialog again	(C)					
	Convert	Do Not Convert				

2. Click the [Convert] button.

The Project File Conversion dialog box will be displayed.

Confirm that the converted project version is shown at "Project version after conversion".

Project File Conversion	×
Converted Project Version:	RTEX: 1.4. 1.0 / EtherCAT: 1.4. 1.0 ~
	OK Cancel

3. Click the [OK] button.

A confirmation dialog box will be displayed. Check the confirmation items about project file conversion.

4.5 Other project settings

Project File Conversion		×
Start the Project file conversion. Check the Content column.		
Content		
Can not revert to the original project.		
	_	
Event		
Event Can not revert to original project version after project file conver	sion.	^
	sion.	^
	sion.	^
	sion.	
	sion.	
	sion.	
Can not revert to original project version after project file conver	sion.	
Can not revert to original project version after project file conver	sion.	•
Can not revert to original project version after project file conver	sion.	
Can not revert to original project version after project file conver	sion.	

4. Click the [Execute] button.

Conversion of the project file starts.



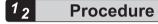
- The project version of project files cannot be converted to any project version older than the current project version before conversion.
- You can also convert the version of a project file by selecting Project > Project File Conversion from the menu bar.

4.5.7 Saving and unzipping the project archive

You can save project files and user libraries that have been added to the project together as a project archive file. You can extract the saved file in GM Programmer on another PC and edit the project file.

Project archive files have the extension ".projectarchive."

Saving the project archive



- Select File → Project Archive → Save Archive from the menu bar. The "Project Archive" dialog box appears.
- Specify a file to save to the project archive. Select the user libraries to add to the project archive, specify the files to add, and provide any comments that will be displayed during decompression.

Project Archive	\times
Include the following information into the archive	
Referenced libraries	
Additional Files Comment	
Save Cance	:1

3. Click the [Save] button.

The "Save Project Archive" dialog box appears. Specify a file name and save location, and then save.

Unzip Project Archive

¹² Procedure

- Select File → Project Archive → Extract Archive from the menu bar. The "Extract Archive" dialog box appears.
- 2. Select the project archive file to unzip.

Once selected, the "Extract Project Archive" dialog box is displayed. Specify the location to extract the project archive, select the user libraries to extract, and review the comments.

Click the [Advanced] button to display the "Advanced" dialog box where you can specify where to extract the added files.

Extract Project Archive	\times
Extract into the same folder where the archive is located Extract into the following folder	
C:¥GMProgrammer Advanced	
Contents Items Comment	
Extract	Cancel

3. Click the [Extract] button.

The project files are extracted to the specified location.

(MEMO)

5 Program Creation

5.1 Flow of Program Creation	5-3
5.2 Program Creation Window5.2.1 Main Pane5.2.2 Declaration Editor	5-4
5.2.3 Auto Declaration	
5.2.4 Toolbox 5.2.5 Setting up the Program Input Window	
5.2.6 Window Operations for the Program Input Window	
5.3 Creating a Program Object (POU Object)	5-16
5.4 Types of Programming Language	5-17
5.5 Function and Function Block	5-20
5.5.1 Function	
5.5.2 Function Block	
5.6 User Library Function 5.6.1 Creating a Library and Adding to the Library Repository	
5.6.2 Using Created Libraries	
5.7 POU for implicit checks	5-36
5.7.1 Setting up POU for implicit checks	
5.8 Tasks	
5.8.1 Adding Programs 5.8.2 Adding a UserTask	
5.8.3 Task Configuration Window	
5.9 Build	
5.9.1 Build	
5.9.2 Reputed	
5.9.4 Clean	5-49
5.9.5 Clean All	
5.10 Program Creation Support Functions	5-51
5.10.1 Bookmark	
5.10.3 Cross reference List View	
5.10.4 Function Block Guidance	
5.10.5 Short Form Function	
5.10.6 Input Assistant Function 5.10.7 Argument / Variable Input Support (Component List)	
5.10.8 Global Renaming (Refactoring)	

5.10.9 Code Analysis (Static Analysis Light)	5-64
5.10.10 Displaying Programs in Multiple Languages (Project	
Localization)	5-67
5.10.11 Start Instruction Help Function	

5.1 Flow of Program Creation

1. Creating a POU object(refer to "5.3 Creating a Program Object (POU Object)")

Create an object (POU object) for the program.

╼

2. Entering program data (refer to "6.1 Programming in Ladder Diagram (LD)" through to "6.7 Variables")

Open the POU object. Enter program data, declare variables, and perform other necessary work.



3. Executing build(refer to "5.9 Build")

- Execute build and check the program.
- If there are any errors, return to "Step 2" and correct the program.

4. Registering for a task (refer to "5.8 Tasks")

Register the POU objects (to be executed on the GM1 controller) for a task.

i Info.

- GM Programmer provides support functions that can be used to create programs efficiently. For details on support functions, refer to "5.10 Program Creation Support Functions".
- Programs consisting of functions and function blocks can be created. For details on functions and function blocks, refer to "5.5 Function and Function Block".

5.2 Program Creation Window

This section explains the window for creating programs in GM Programmer.

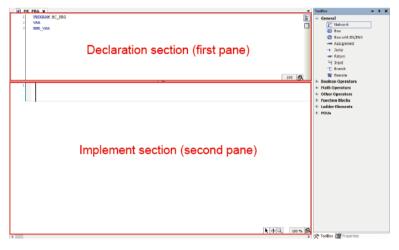
5.2.1 Main Pane

The upper section of the main pane is the declaration section where variables are declared.

The lower section of the main pane is the implementation section where program processes are coded. The declaration section and implementation section may be called the first and second panes, respectively.

The editing method in the implementation section differs according to the program. Refer to the section related to each program creation.

Example: Main pane for LD programs



i Info.

- The selected pane can be switched between the declaration section (first pane) and the implementation section (second pane). To switch the selected pane, from the menu bar, select **Window>Next Pane** or "Previous Pane".
- You can also hide the declaration section (first pane) or the implementation section (second pane).

To hide the declaration section, from the menu bar, select **Window>Switch First Pane**. To hide the implementation section, from the menu bar, select **Window>Switch Second Pane**.

- When the cursor stays in a variable position in the implementation section, the cursor can be moved to the declaration position of the variable by selecting **Edit>Browse>Go To Definition**.
- You can also declare variables of user-defined types such as structure. User-defined types must be defined in DUT objects beforehand. For details, refer to "6.7.6 Structure, Enumeration, Alias, and Union Data Types".

5.2.2 Declaration Editor

The declaration editor is used to declare variables.

The display format of declarations is divided into table format and text format. The table format and text format can be switched using the switching button on the top right of the declaration editor.

Table format

				De	claratio	on hea	eader Display format			ning button
्रि ज	POU X									6
۰ 🌾	• 🗙 🗌				PI	ROGRAM ST_	POU		1	¥ .
<u>^</u>	Scope	Name	Name Address Data type Initialization Comment				Attributes		^ E	
1	VAR	r1, r2, r3		REAL						
2	🔅 VAR	×1		INT						
3	🕸 VAR	x2 INT								
4	🔅 VAR	х3		INT						
5	VAR	t_d1		TIME_OF_DAY					~	
<									>	

- To add a new declaration, click the [>>] icon ("Insert") to add a new row. Enter a variable name in the "Name" column. For other items, double-click each cell to set the cell in an input-enabled state, and enter values as necessary.
- To sort variables, use the [* *] icon ("Move up" or "Move down").
- To delete variables, use the [X] icon ("Delete").
- When adding a program name or program name comment, click the declaration header section.

The "Edit Declaration Header" dialog box will be displayed.

Edit Declaration Header	×
Declaration PROGRAM V MC_PRG	
Comment	^
<	>
Automatically adapt all references on rename.	
Attributes OK	Cancel

Text format

```
        Image: ST_POU ×

        1
        FROGRAM ST_POU

        2
        VAR

        3
        r1,r2,r3 : REAL;

        4
        x1: INT;

        5
        x2: INT;

        6
        x3: INT;

        7
        t_d1: TIME_OF_DAY;

        6
        d1: DATE;

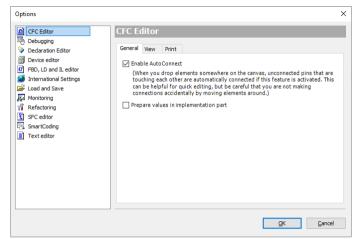
        7
        END_VAR
```



- As is the case with the text editor, enter variables to be declared.
- You can use single-line comments (prefixed with //) and multiple-line comments (enclosed with *).
- Pressing the "F2" key starts Input Assistant, which allows the user to enter variable types and other items by selecting them. For details on Input Assistant, refer to "5.10.6 Input Assistant Function".

1 Info.

- You can set the display format to be used, as below.
 - 1. From the menu bar, select **Tools>Options**.
 - The "Options" dialog box will be displayed.



2. In the Options dialog box, select the "Declaration Editor" category.

Options		×
	Declaration Editor Tabular only Switchable between textual and tabular Default Always textual Always tabular Remember recent setting (per object) Remember recent setting (globally)	
	QK Qancel	

3. Select a desired display format.

5.2.3 Auto Declaration

If a variable that has not been declared in the declaration section is entered in the implementation section, the "Auto Declare" dialog box will be displayed.

If you change any necessary items and click the [OK] button, the variable will be declared in the declaration section.

Example: When the variable name of a contact is entered as bVar0 in an LD program

Auto Declare			×
<u>S</u> cope VAR	~	<u>N</u> ame bVer0	Type BOOL V >
Object LD_POU [Application]	~	Initialization	Address
Elags <u>C</u> ONSTANT <u>R</u> ETAIN <u>P</u> ERSISTENT		Comment	^ V
			OK Cancel

Address

In the Address field, you can specify the address of input data or output data for the GM1 controller or expansion unit. In such a case, the variable assigned to the input data or output data corresponding to the entered address is declared.

Flag

If you select the CONSTANT, RETAIN, and PERSISTENT check boxes in the Flag section, you can set variable attributes.

CONSTANT

Declares the variable as a constant. Enter a default value.

RETAIN

Declares the variable as a retain variable. For retain variables, values are not reset even if warm reset is performed. For details on warm reset, refer to "8.8.1 Reset Warm, Reset Cold, and Reset Origin".

PERSISTENT

Declares the variable as a persistent variable. To declare a persistent variable, you must also select the RETAIN check box. For persistent variables, values are not reset even if cold reset or warm reset is performed.For details on cold reset or warm reset, refer to "8.8.1 Reset Warm, Reset Cold, and Reset Origin".

f Info.

 You can also prevent the "Auto Declare" dialog box from being displayed when a variable that has not been declared is entered in the implementation section. From the menu bar, select Tools>Options>SmartCoding category and clear the "Delcare unknown variables automatically (AutoDeclare)" check box.

Options		×
	SmartCoding Dedare unknown variables automatically (AutoDedare) Enable for ST editor Show all instance variables in input assistant Show symbols from system libraries in input assistant Usits components after typing a dot (.) List components immediately when typing Insert with namepace Convert igeywords to uppercase automatically (AutoFormat) Automatically list selection in gross reference view Underline grors in the editor Jinghight gymbols Max degree of parallelism	
	<u>Ok</u>	<u>C</u> ancel

.

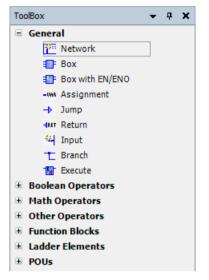
• Using the Array Wizard, you can declare an array only by entering an index and base type. Click on the right side of the Type field and select "Array Wizard".

Туре	
INT ~	>
Address	Input Assistant
	Array Wizard

5.2.4 Toolbox

Programs can be created by dragging the programming elements displayed in the toolbox. For programs other than ST programs, programming elements are displayed in the toolbox.

For details on how to create programs, refer to the section related to each program creation. Example: Toolbox for LD programs



5.2.5 Setting up the Program Input Window

You can change settings related to the text editor.

From the menu bar, select Tools>Options to open the "Options" dialog box.

In the "Options" dialog box, select the "Text editor" category and change the settings.

Theme

CFC Editor	Text editor
Debugging	Theme Editing Text Area Margin Monitoring
Device editor	
FBD, LD and IL editor	Theme
International Settings	Default
Load and Save	
Monitoring	Preview
Refactoring	1 {attribute 'qualified_only'} E 2 VAR GLOBAL
SFC editor	A Variable: INT:= 7; // Just a brief preview
SmartCoding	4 sString : STRING := 'Demostring!';
Text editor	<pre>5 pString : POINTER TO STRING := ADR(sString);</pre>
Text Editor	6 bDemo : BOOL := TRUE;
	<pre>7 out7 : BYTE = %QB7 (* output byte 7 *);</pre>
	8 END_VAR
	100

Item name	Default value	Settings
Theme	Default	Sets a color scheme theme for the text editor
		Default / Dark

Edit

Options			×
CFC Editor Declaration Editor Declaration Editor Declaration Editor To FBD, LD and IL editor Thermational Settings Code and Save Monitoring Refactoring SFC Editor SmartCoding Text editor	Text editor Theme Editing Text Number of undos Eolding Word wrap Wrap margin Tab width Indent width AutoIndent	t Area Margin Monitoring 100 Indent None 0 0 0 = Wrap at the window boundary) 4 Smart with code completion	
		<u>Q</u> K <u>C</u> ancel	

Item name	Default value	Settings		
Number of undos	100	Sets the maximum number of times [Edit] - [Undo] can be executed from the menu bar Setting range: 1 to 1000 (times)		
		Specifies the method for defining the code structure		
		None: Does not collapse code		
Folding	Indent	Indent:		
		Combines all lines indented from the previous line as a unit		
		Explicit:		
		Explicitly marks a unit of code sections as a comment		
		Sets a rule for wrapping entered text automatically		
	None	None:		
		Does not collapse code		
		Soft:		
Word wrap		If the number of characters entered in a single line exceeds the value specified in "Wrap margin", a code continuation mark (:) will be added and a line break will be inserted automatically. If "0" is selected in the "Wrap margin" drop-down list, a line break will be inserted at the right edge of the editor window.		
		Hard:		
		If the number of characters entered in a single line exceeds the value specified in "Wrap margin", a line break will be inserted automatically. However, a code continuation mark (":") will not be added. If the number of initially entered word characters exceeds the value specified in "Wrap margin", a line break will not be inserted.		
Wrap margin	0	Specifies the number of characters per line that triggers a line feed		

Item name	Default value	e Settings	
		Setting range: 0 to 240	
Tab width	4	Specifies the number of space characters equivalent to the code to be inserte when the Tab key is pressed Setting range: 1 to 16	
Keep tabs	Selected	Specifies whether to insert space characters or a tab character when the Tab key is pressed Selected: Inserts a tab character when the Tab key is pressed Cleared: Inserts space characters when the Tab key is pressed	
Indent width	4	Inserts tab spaces with the specified width when "Auto" or "Auto coding" is selected from the "Auto indent" drop-down list. However, if the "Keep tabs" check box is cleared, space characters will be inserted. Setting range: 1 to 16	
Auto Indent	Smart with code completion	Specifies the behavior to be performed when auto indentation is performed None: Does not insert indentation automatically Block: Inserts indentation with the same width as that of the previous line at the time of line feed Auto: Inserts indentation automatically for lines following a line containing keywords (such as VAR) according to the setting of "Indent width" Smart with code completion: Inserts applicable keywords such as "END_IF" and "END_VAR" automatically, in addition to the behavior performed by "Auto"	

Text Area

Options		×
Image: CPC Editor Image: CPC Editor	Text editor Theme Editing Text Area Margin Monitoring Highlight current line Matching brackets End of line markers Wrap guide	
	Fogt (dick onto the sample to edit): AaBbCcXxYyZz	
	<u>Q</u> K <u>C</u> ance	1

Item name	Default value	Settings
Highlight current line	Selected	Highlights the line selected by the cursor Selected / Cleared

Item name	Default value	Settings
Matching brackets	Selected	Highlights the corresponding bracket when the cursor is positioned at a bracket within code Selected / Cleared
End of line markers	Cleared	Indicates the end of a line as a small dash mark (".") with the color specified for the theme Selected / Cleared
Wrap guide	Cleared	Displays a guide as the vertical line specified for the theme, in the column used as the base of wrapping. If any value other than "0" is specified in "Wrap margin", a guide will be displayed. Selected / Cleared
Font	-	Displays a font dialog box for setting fonts.

Margin

Options			×	
CFC Editor CFC Editor Constraints CFC Editor Constraints CFC Editor CFC E	Text editor Theme Editing Text Area Margin U Line numbering Highlight current line Show bracket scope	Monitoring Mouse Actio <u>C</u> lick Shift-Click C <u>t</u> rl-Click <u>A</u> lt-Click	Toggle fold V Select fold V Toggle fold fully V None V	
	Font (dick onto the sample to edit): AaBbCcXxYyZz QK Çancel			

Item name	Default value	Settings
Line numbering	Selected	Displays line numbers in the variable declaration section and program implementation section
	Selected	Selected: Displays line numbers
Highlight current line		Cleared: Does not display line numbers
		Highlights the line selected by the cursor by changing the color of the line number.
		If the "Line numbering" check box is cleared, the current line will not be highlighted.
		Selected: Highlights the current line by changing the color of the line number
		Cleared: Does not change the color of the line number
Show bracket scope	Selected	Displays a scope in the space on the left side of the line number to indicate the beginning to the end of a keyword (such as "IF" to "END_IF")
		Selected: Displays a scope
		Cleared: Does not display a scope

Item name	Default value	Settings
		Assigns a mouse action to be performed when "+" or "-" in a space is clicked
		None: Assigns no mouse action
Mouse Actions	-	Select fold: Selects all lines within the area enclosed in brackets
		Toggle fold: Expands or folds the area enclosed in brackets
		Toggle fold fully: Expands or folds all nested areas when areas are nested
Font	-	Displays a "Font" dialog box for setting fonts

Monitoring

Options		×
CFC Editor	Text editor	
 Debugging Declaration Editor 	Theme Editing Text Area Margin Monitoring	
 Device editor FBD, LD and IL editor 	Enable inline monitoring	
International Settings Load and Save	Number of displayed digits 3 🗢 Digits	
Monitoring	String <u>l</u> ength 10 🗢 characters	
SFC editor		
 SmartCoding Text editor 		
	Monitoring sample Flow control sample	
	AaBbCcXxYyZz AaBbCcXxYyZz	
	QK Gancel	

Item name	Default value	Settings
Enable inline monitoring	Selected	Displays a monitoring field in the program implementation section in online mode
		Selected: Displays a monitoring field
		Cleared: Does not display a monitoring field
Number of displayed digits	3	Sets the number of digits after the decimal point that are displayed in the monitoring field Setting range: 1 to 20
String length	10	Sets the maximum length of string variables in the monitoring field Setting range: 1 to 80

(4)

(5)

5.2.6 Window Operations for the Program Input Window

You can perform window operations such as increasing the display size in the program input window.

The window operation icons are displayed in the bottom right corner of the window.



Number	Item	Description		
(1)	Normal mode	This mode allows the user to select a component by clicking it.		
(2)	Move mode	This mode allows the user to moves the window by clicking in the window and then dragging the mouse.		
(3)	Enlarged view tool	Clicking the icon opens the enlarged view tool window. The display at the cursor position is enlarged in the window.		
(4)	Current display size	This section indicates the current display size of the program input window		
(5)	Change display size			

(2)

(3)

5.3 Creating a Program Object (POU Object)

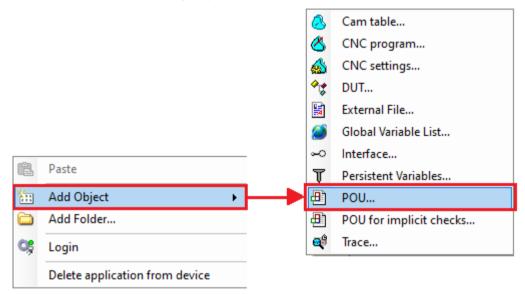
Creating programs

Programs are created within POU objects. A single POU object allows the use of only one program. If you want to use different programs within a project, you must add POU objects.

Adding POU objects

To add POU objects, right-click the [Application] object in the navigator pane and then select **Add Object>POU** from the context-sensitive menu that is displayed.

For details, refer to "4.4 Adding Objects".



5.4 Types of Programming Language

GM Programmer supports five programming languages that comply with IEC 61131-3, the international standard for PLC programming languages.

f Info.

• Continuous Function Chart (CFC) and Page-Oriented CFC are not included in the five programming languages compliant with IEC 61131-3. However, the third edition of IEC 61131-3 defines them as object-oriented programming languages.

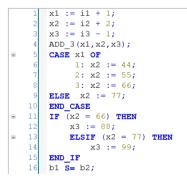
Ladder Diagram program (LD program)

Ladder Diagram is a graphical programming language used to create a program by arranging ladder logic elements such as contacts and coils on a network (circuit). It also allows the use of functions and function blocks with various functions.

		R1 ()
2	708_0 709 715s-17 7155-17 7155	

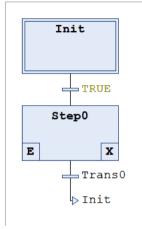
Structured Text program (ST program)

Structured Text is a programming language that creates expressions, conditional statements, and other program elements in text format. It is based on the Pascal programming language and suitable for numerical calculation, data processing, and processing such as conditional branch and repetitive processing.



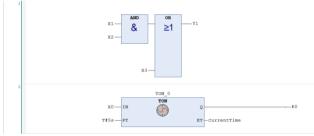
Sequential Function Chart program (SFC program)

Sequential Function Chart is a graphical programming language used to create a program by arranging steps, transitions, actions, and other elements sequentially from top to bottom. It is suitable for processing that describes state transitions.



Function Block Diagram program (FBD program)

Function Block Diagram is a graphical programming language used to create a program by arranging functions and function blocks on a network (circuit). Unlike Ladder Diagram programs, contacts, coils and other ladder logic elements cannot be arranged in Function Block Diagram programs.



In addition to the five programming languages compliant with IEC 61131-3, Continuous Function Chart (CFC) and Page-Oriented CFC can also be used.

Instruction List program (IL program)

Instruction List is a programming language that creates assembler-like instructions sequentially in text format. This language is suitable when you want to perform high-speed processing, restrict the memory usage, and perform other similar operations.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	
2	mark1:		
	LD	bVar2	
	S	bVar3	

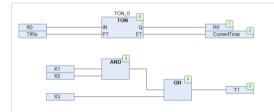
In addition to the five programming languages compliant with IEC 61131-3, Continuous Function Chart (CFC) and Page-Oriented CFC can also be used.

Continuous Function Chart (CFC) and Page-Oriented CFC programs

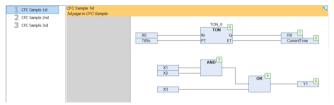
Continuous Function Chart (CFC) and Page-Oriented CFC are graphical programming languages used to create a program by arranging function blocks and other elements on the screen. Elements can be freely arranged on the screen and the order of execution can be specified.

CFC allows the user to create a program on a single screen, while Page-Oriented CFC allows the user to create a program while switching the screen called a page.

<CFC program>



<Page-Oriented CFC program>



5.5 Function and Function Block

Functions and function blocks can be invoked from programs. Functions and function blocks can be created with POU objects.

The differences between functions and function blocks are as below.

Function (FUN)

- Functions can be used without being declared in the declaration section.
- Only one output is generated. However, additional outputs can be defined.
- Output variable and internal variable values are not saved.
- Function block (FB)
- Function blocks can be used by declaring instances in the declaration section.
- Multiple outputs can be generated.
- Output variable and internal variable values are saved.
- Object-oriented definitions can be made by using EXTENDS (inheritance), IMPLEMENTS (interface implementation), or access qualifiers.

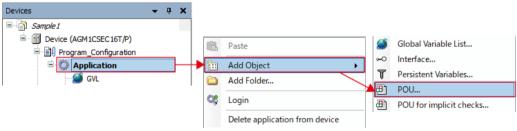
5.5.1 Function

A function generates one output in response to one or more inputs. Functions can be used without declaring variables.

For example, use the following procedure to create and invoke function "ADD_SUB", which uses three INT type arguments as inputs, calculates (first argument) + (second argument) - (third argument), and output the result.

¹₂ Procedure

1. Right-click the [Application] object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.



The "Add POU" dialog box will be displayed.

Add POU ×
Create a new POU (Program Organization Unit)
Name
POU
Type
• Program
○ Function <u>b</u> lock
E <u>x</u> tends
Implements
Final Ab <u>s</u> tract
<u>A</u> ccess specifier
\sim
Method implementation language
Ladder Logic Diagram (LD) 🗸 🗸
○ <u>F</u> unction
Return type
Implementation language
Continuous Function Chart (CFC) V
Add Cancel

 Select the "Function" radio button, enter appropriate values in the Name and Return type fields, and select an appropriate programming language from the Implementation Language drop-down list.

In the Name field, specify a function name. In the Return type field, select a return value to be output when the function is executed. From the Implementation Language drop-down list, select a programming language that is used to code function processing.

Add POU X
Create a new POU (Program Organization Unit)
Name
ADD_SUB
Type
○ <u>P</u> rogram
○ Function <u>b</u> lock
E <u>x</u> tends
Implements
Final Ab <u>s</u> tract
Access specifier
~
Method implementation language
Ladder Logic Diagram (LD) 🗸 🗸
<u>Function</u>
<u>R</u> eturn type INT
Implementation language
Structured Text (ST) \checkmark
Add Cancel

3. Click the [Add] button.

A POU object of the function will be added.

The POU object is displayed as "function-name (FUN)" in the navigator pane.

4. Enter function processing.

Open the POU object of the function and create a function. In "VAR INPUT", declare input variables for the function.

Substitute function output for the variable of the function name.

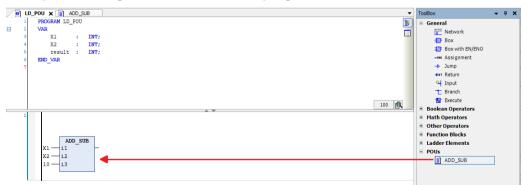


This completes the function creation procedure.

Next, the procedure for invoking the created function is explained below.

 Open the POU object from which the function is to be invoked, and invoke the function. The function can be invoked by using its name. To invoke the function, there is no need to declare variables.

Example: Invoking the function from LD program



Example: Invoking the function from ST program





- Additional outputs can be defined for the function. Declare an additional output as variable "VAR_OUTPUT" in the declaration section of the POU object that defines the function.

Example: Definition of function "ADD_SUB" to which variable iOut that outputs the sum of three input variables is added

1) AI	DD_SUB X														-
8	2	VAR_INE	UT												^	3
	з	il		INT	1											
	4	i2	1	INT	12											
	5	13		INT	12											
	6	END_VAR	2													
Β	7	VAR OUT	PUT													
	8	01		INT	12											
	9	END_VAR	2													
	10	VAR														
	11	END_VAF	2													
	12	_											3	100	R ~	
	1	ADD SUE	3 :=	11	+	12	-	13;		▼						_
	2	01	:-	11	+	12	+	13;								
	з															

Invoking function "ADD_SUB" from LD program



Invoking function "ADD_SUB" from ST program



5.5.2 Function Block

A function block generates one or more outputs in response to one or more inputs. To use function blocks, variables (instances) must be declared.

For example, use the following procedure to create function block "FB_ADD", which uses three INT type variables as inputs and outputs the sum of three arguments, and to invoke an instance.

¹ ² Procedure	
-------------------------------------	--

1. Right-click the [Application] object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

Devices	₹ Ф	×				
Sample1						
Device (AGM1CSEC16T/P)			Ē	Paste		Global Variable List
Application		\rightarrow		Add Object 🕨	~	
🧭 GVL			6	Add Folder	T	Persistent Variables
			_		▲ ₽	POU
			¢,	Login	₽	POU for implicit checks
				Delete application from device		

The "Add POU" dialog box will be displayed.

Add POU X						
Create a new POU (Program Organization Unit)						
Name						
POU						
Туре						
• Program						
○ Function <u>b</u> lock						
E <u>x</u> tends						
Implements						
Final Abstract						
Accessspecifier						
~						
Method implementation language						
Ladder Logic Diagram (LD) 🗸 🗸						
○ <u>F</u> unction						
<u>R</u> eturn type						
Implementation language						
Continuous Function Chart (CFC)						
Add Cancel						

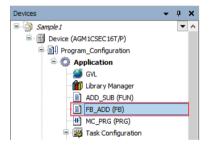
Select the "Function block" radio button, enter a name in the Name field, and select a
programming language from the Implementation Language drop-down list.
In the Name field, specify a function block name. In the Implementation Language dropdown list, select a programming language that is used to code function block processing.

Add POU X
Create a new POU (Program Organization Unit)
Name
FB_ADD
Туре
○ <u>P</u> rogram
Function <u>b</u> lock
Extends
Implements
Final Ab <u>s</u> tract
<u>A</u> ccess specifier
×
Method implementation language
Structured Text (ST) 🗸 🗸
○ <u>F</u> unction
Return type INT
Implementation language
Structured Text (ST) 🗸 🗸
Add Cancel

3. Click the [Add] button.

A POU object of the function block will be added.

The POU object is displayed as "function-block-name (FB)" in the navigator pane.



4. Enter function block processing.

Open the POU object of the function block and create a function block. In "VAR_INPUT", declare input variables to the function block. In "VAR_OUTPUT", declare output variables from the function block.

	1	FUNCTION_BLOCK FB_ADD	^
в	2	VAR INPUT	
	з	il : INT;	
	4	12 : INT;	
	5	13 : INT;	
	6	END_VAR	
	7	VAR_OUTPOT	
	8	ol : INT;	
	9	END_VAR	
	10	VAR	
	11	END_VAR	
			100 🔍 🗸
	1	ol := il + i2 + i3;	

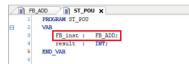
This completes the function block creation procedure.

Next, the procedure for invoking the created function block is explained below.

5. Open the POU object from which the function block is to be invoked, and declare an instance of the function block in the declaration section.

Declare an instance that is a copy of the function block.

Declare an instance name in the form of "instance-name: function-block-name".



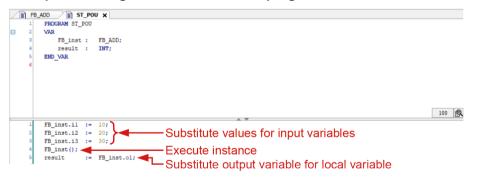
6. Invoke the instance of the function block.

Invoking the instance of the function block executes the processing defined with the function block. Input variables and output variables can be accessed by specifying "instance.variable-name".

Example: Invoking the instance from LD program



Example: Invoking the instance from ST program



Þ

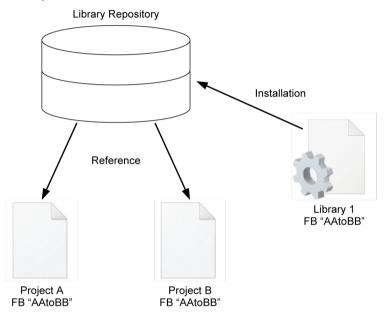
5.6 User Library Function

Combining created functions and function blocks as a library enables other projects to use these functions and function blocks.

The library that has been created must be installed in the library repository. Adding the library installed in the library repository to the project makes it possible to use the functions and function blocks in the library. Libraries in the project are managed by the "Library_Manager" object.

The following sections describe a procedure for creating a library, installing the created library into the library repository, and adding libraries to a project.

Example



5.6.1 Creating a Library and Adding to the Library Repository

This section explains the entire procedure from creating a project for libraries through to installing libraries in the library repository.



 From the menu bar, select File>New Project. The "New Project" dialog box will be displayed.

管 New Pro	ject		×
<u>C</u> ategories		Templates	
	raries ojects	Standard project	
A project c	ontaining one device	one application, and an empty implementation for MC_PRG	
<u>N</u> ame	Untitled 1		
<u>L</u> ocation	C:¥Work	, ,	×
		OK Can	el .:

2. Select "Libraries" in the Categories pane and then "Standard library" in the Template pane.

New Pro				
	araries ojects	Iemplates		
An standar <u>N</u> ame	d library			
<u>L</u> ocation	C:¥Work			~
			OK Car	ncel

3. Click the [OK] button.

The "Standard library" dialog box will be displayed.

Standard Library		\times
Please select a library ty	pe and project version.	
Library Type:	RTEX(AGM1CSRX16T) ~	
Project Version:	1.4.1.0 ~	
	OK Cancel	

4. Click the [OK] button.

A project for libraries will be created. The extension of project files for libraries is "library". For libraries, the POU view is displayed in the navigator pane. Add objects required for creating libraries to the POU view.

Untitled1.library - GM Programmer	- 🗆 ×
Eile Edit View Project Build Online Debug Tools Window Help	
1912年目囲(ののより)に入れなぬな(目気気気)に同時(1913年)のののトロペロのははの(の)を	
Polis • 4 X	
e in Unsteel	
1 Ubrary Manager	
Messages - Total 0 error(s), 0 warning(s), 0 message(s)	- ∓ ×
Build 🗸 🗸 O error(s) 🕐 O warning(s) 🕐 O message(s) 🗙 💥	
Description Project Object	Position
Last build: 📀 0 🛞 0 Precompile 🗸 🛛 Pr	roject user: (nobody)

5. Double-click the "Project Information" object in the POU view.

The "Project Information" dialog box will be displayed.

If necessary, change the settings in the "Company", "Title", and "Version" fields. The information set in these fields will be displayed in the selection window when created libraries are added to the project.

If the "Release" check box is selected, a confirmation message will be displayed when an attempt is made to change a library.

Project Information Summary File		
<u>C</u> ompany:	Company	
<u>T</u> itle:	Title	
<u>V</u> ersion:	1.0.0.0	Released
Library Categories:		
De <u>f</u> ault namespace:		
<u>A</u> uthor:		
Description:		< >
The fields in bold let	ters are used to identify a library.	Ţ
Automatically generate	'Library Information' POUs	
Automatically generate	'Project Information' POUs	
	OK	Cancel

6. Click the [OK] button.

The project information will be set.

 Right-click the <file name> object at the top of the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed. The "Add POU" dialog box will be displayed.

POUs		→ ₽ X			
🖃 📋 Untitled 1	(ces	Descrition			
👔 Library Manager		Properties.			
Project Information	***	Add Object	t 🕨	*	DUT
Project Settings		Add Folder			External File
	_			1	Global Variable List
				⊶	Interface
				≞	POU

 Select the "Function block" check box, enter a name in the Name field, and select a programming language from the Implementation Language drop-down list.
 For details on functions blocks, refer to "5.5 Function and Function Block".

Add POU ×
Create a new POU (Program Organization Unit)
Name
Sample_Library
Type
○ <u>P</u> rogram
Function <u>b</u> lock
Extends
Implements
Final Ab <u>s</u> tract
Accessspecifier
×
Method implementation language
Continuous Function Chart (CFC) $\qquad \qquad \smallsetminus$
○ <u>F</u> unction
Return type BOOL
Implementation language
Structured Text (ST) \checkmark
Add Cancel

9. Click the [Add] button.

An object of the function block will be added to the POU view in the navigator pane.



10. Enter a program in the function block.

After entering a program, from the menu bar, execute **Build>Check All Pooled Objects**. Build will be executed to perform a syntax check. After the above command is executed, if any error is displayed, correct the program and execute build again.

11. From the menu bar, select **File>Save Project and Install into Library Repository**. The library that has been created will be installed in the library repository.

12. From the menu bar, select **Tools>Library Repository**.

The "Library Repository" dialog box will be displayed. Check that the created library is displayed in the "Installed library" section.

	System V	Edit Locations.
	(C:¥ProgramData¥Panasonic Corporation¥GMP¥Managed Libraries)	
Installed lib	aries:	Install
Company	Company ~	Uninstall
4) 🗄 🗧	liscellaneous)	
🖻 - 📘	Title Company	Export
		Find
		Details
		Trust Certificat
Cal Consume la	y category	Dependencies.
Group		

Clicking the [Detail] button enables the user to check information such as function blocks included in the library.

This completes the procedure for installing the library in the library repository.

f Info.

• Difference between libraries (.library) and complied libraries (.compiled-library).

If a library is installed as a library file into the repository, the user can refer to codes by step-in execution during debugging and check execution details.

The user cannot execute codes in any compiled library while referring to the codes.

MC_PRG X							•
Device.Application	n.MC_PRG						
Expression	Туре	Value	Prepared value	Address	Comment		ÿ
🗄 < 🗛	FB_sample						
🖗 aaa	INT	12					
bbb	INT	20					
<						>	
4 5 6 7 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	12 :=aaa 12 , 0 :=12; 12 :=aaa 12 , 0 om Title] x C 1.MC_PRG.AA	uebugging is p	20); possible in the lil		in execution.	••	•
Expression	Type REFERENCE TO INT	Value 12	Prepared value	Address	Comment		
To OUT	INT	20				L	<u> </u>
<	2111					>	
1 ¢ 007 20]:=IN <mark>[12]</mark> ≠10;	ETURN				100	

• Method for installing a compiled library

In Step 10, select **File>Save Project as Complied Library** from the menu. The library is saved as a complied library file (.compiled-library).

Then, click the [Install] button in the "Library Repository" dialog box and select the saved complied library file.

5.6.2 Using Created Libraries

This section explains how to add libraries installed in the library repository to the project.

¹² Procedure

- Open the project file and select the "Library Manager" object. The "Library Manager" window will be displayed.
- 2. Click the [Add Library] button.

The "Add Library" dialog box will be displayed, showing the libraries added to the library repository.

Add Library		×
String for a fulltext search		
Library	Company	
Advanced	OK	Cancel

3. Select a created library and click the [OK] button.

The selected library will be added to the application in the project. The title and company name specified when the library was created will be displayed.

Library	Company
	Company
Application	
■ o locs	
= ⊕ (Miscellaneous)	
CmpErr/Ing	Panasonic Corporation
CmpPGShm	Panasonic Corporation
	Panasonic Corporation
CmpStateMng	Panasonic Corporation
CmpSysDataMng	Panasonic Corporation
CmpTimeMng	Panasonic Corporation
Panasonic_ETC	Panasonic Corporation
Panasonic_GM_System	Panasonic Corporation
Panasonic_MC	Panasonic Corporation
Panasonic_PG	Panasonic Corporation
	Company

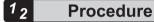
This completes the procedure for adding the library to the application. The function blocks in the added library can be used in the program.

5.7 POU for implicit checks

POU for implicit checks is an object with functions that check the range of array indexes or subrange type variables, validity of pointer addresses, and division by zero. Adding this object to the project makes it possible to automatically call these functions and perform checks, without calling the functions explicitly within the program.

5.7.1 Setting up POU for implicit checks

This section explains how to add POU for implicit checks objects.



 Right-click the [Application] object in the navigator pane and then select Add Object>POU for implicit checks from the context-sensitive menu that is displayed.

The "Add POU for implicit checks" dialog box will be displayed.

Add POU for implicit checks	×
Create special check functions for an application (for checking array bounds, divisions and pointer)	
A <u>v</u> ailable functions	
Bound checks	
Division checks	
Range checks	
LRange checks	
Pointer checks	
Note: Adding a check function will provoke a full recompile and prohibit an online change	

2. Select the check box of a function that you want to add.

Multiple functions (objects) will be added, depending on the item that you select.

Check type	Function name (object name)
Bound checks	CheckBounds
	CheckDivDInt
Division checks	CheckDivLInt
	CheckDivLReal
	CheckDivReal
Range checks	CheckRangeSigned
Range checks	CheckRangeUnsigned
I Panga abaaka	CheckLRangeSigned
LRange checks	CheckLRangeUnsigned
Pointer checks	CheckPointer

3. Click the [Add] button.

The function (object) for the selected item will be added.

If necessary, edit the implementation section of the object that has been added.

The check details of each check item are as below.

Bound Checks

Checks whether the bound is violated.

Division Checks

Checks whether anything is divided by zero.

Range Checks

Checks whether values of DINT or UDINT subrange type variables are within the specified range.

LRange Checks

Checks whether values of LINT or ULINT subrange type variables are within the specified range.

Pointer Checks

Checks whether the returned pointer refers to a valid memory address or whether the contents of a memory address that is referred to match the variable type that refers to the pointer. For Pointer Checks, a program must be created for the function.

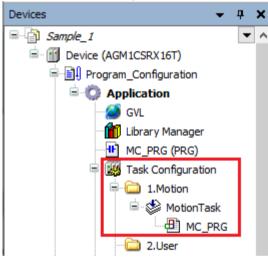
5.8 Tasks

The GM1-series motion controller executes the following three tasks.

Task	Description
MotionTask	This is a user program task to perform motion control. It is given the highest priority. Only one MotionTask is allowed for each project.
UserTask	This is a user program task to perform control other than motion control. The user can set the level of priority. Up to 50 tasks can be registered in a single project.
SystemTask	This is a task that is used by the system and cannot be added by user programs. It is processed while other tasks are inactive.

To execute a user program, the program (POU object) must be added to tasks.

Add motion control programs to MotionTask. Add other control programs to UserTask.



5.8.1 Adding Programs

POU objects of programs can be added to tasks.

For example, use the following procedure to add program "LD_POU" to task "MotionTask".

¹² Procedure

1. Double-click the "MotionTask" object in the navigator pane.

tionTask 🗙			
ype: MotionTask			
y (33): ³			* *
llow the setting period of RTE	X_Master.		
hdog			
Enable			
le(T):			× ×
sitivity(<u>S</u>):			
Add Call(<u>A</u>) 🗙 Remove Ca	sll(ℝ) 💋 Change Call(C) 🖈 Mo	ove Up(U) ♦ Move Down(D) ◄ Open POU(O)	
Add Call(<u>A</u>) X Remove Ca	ill(இ) 💋 Change Call(C) ⊕ Mc	ove Up(U)	v
Add Call(<u>A</u>) 🗙 Remove Ca	sll(இ) 📝 Change Call(C) ⊕ Mc		Ţ
Add Call(<u>A</u>) X Remove Ca	ıll(®) 💋 Change Call(⊆) 🕆 Mo		¥
Add Call(<u>A</u>) X Remove Ca	ıll(®) 💋 Change Call(©) ⊕ Mo		· · · · · · · · · · · · · · · · · · ·
Add Call(<u>A</u>) X Remove Ca	ll(இ 💋 Change Call(C) ⊕ Mo		×
Add Call(<u>A</u>) X Remove Ca	ll(ℝ) 📝 Change Call(⊆) ⊕ Μα		· · · · · · · · · · · · · · · · · · ·
Add Call(<u>A</u>) X Remove Ca	ll(ੴ 🗹 Change Call(C) ⊕ Mo		· · · · · · · · · · · · · · · · · · ·
Add Call(<u>A</u>) X Remove Ca	ll(ੴ 💋 Change Call(C) ⊕ Mc		

2. In the "MotionTask" window, click the [Add Call] button.

POUs + Add Call(A) × Remove Call(R) Z Change	Call(C) ⊕ Move Up(L) ⊕ Move Down(D) → Open POU(Q)
POU	Comment
MC_PRG	

The "Input Assistant" dialog box will be displayed.

Input Assistant				×
Text Search Categories				
Program	Application	Type Application PROGRAM	Origin	
Structured view		⊡ Insert	with arguments	Insert with <u>n</u> amespace prefix
				^
				OK Cancel

3. Select the POU object (LD_POU) of the program to be added to the task and click the [OK] button.

ogumentation PROGRAM LD_POU	Assistant				
Anolication Anolication PROGRAM Insert with arguments Insert with gamespace pref	Search Categories				
Structured view Structured view Ogumentation PROGRAM LD_POU	gram		Туре	Origin	
Structured view Sgumentation PROGRAM LD_POU					
ogumentation Insert with arguments Insert with namespace pref		LD_POU	PROGRAM		
ogumentation Insert with arguments Insert with mamespace pref					
ogumentation Insert with arguments Insert with mamespace pref					
ogumentation Insert with arguments Insert with mamespace pref					
ogumentation Insert with arguments Insert with mamespace pref					
ogumentation Insert with arguments Insert with mamespace pref					
✓ Insert with arguments Insert with namespace pref Dogumentation PROGRAM LD_POU					
✓ Insert with arguments Insert with namespace pref Dogumentation PROGRAM LD_POU					
✓ Insert with arguments Insert with namespace pref Dogumentation PROGRAM LD_POU					
ogumentation Insert with arguments Insert with mamespace pref					
ogumentation Insert with arguments Insert with namespace pref					
ogumentation Insert with arguments Insert with mamespace pref					
ogumentation Insert with arguments Insert with mamespace pref					
o <u>c</u> umentation PROGRAM LD_POU	tructured view				
o <u>c</u> umentation PROGRAM LD_POU			✓ Insert v	vith arguments	Insert with <u>n</u> amespace prefix
	mentation				
					OK Cancel

The POU object of the program will be added to the task.

ask type:	MotionTask		
iority (33):	3		* *
ype			
Follow the se	etting period of RTEX_Master.		
Vatchdog			
Enable			
Time(T):			×
Sensitivity(S)):		*
Sensitivity(<u>S</u>): POUs			×
POUs Add Call(C) ✿ Move Up(U) ➡ Move Down(D) → Open POU(O)	Ŷ
POUs Add Call(POU		C)	▲ ▼
POUs POU POU MC_PRG			
POUs Add Call(POU			A V
POUs POU POU MC_PRG			A v
POUs POU POU MC_PRG			
OUs Add Call(POU MC_PRG			
OUs Add Call(POU MC_PRG			
POUs POU POU MC_PRG			
POUs Add Call(POU MC_PRG			

Selecting a cell in the "Comment" column allows you to edit the comment.

The task will also be added to the navigator pane.

Devices 👻	џ	×
Sample_1	-	^
🖻 👔 Device (AGM1CSRX16T)		
□ 🗐 Program_Configuration		
🖹 🔘 Application		
- 🧭 GVL		
👘 Library Manager		
LD_POU (PRG)		
🖹 🎆 Task Configuration		
🖻 🗀 1.Motion		
🖻 👙 MotionTask		
LD_POU		
🗀 2.User		

1 Info.

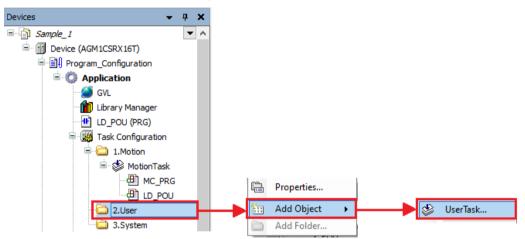
• You can also add a POU object to a task by dragging the POU object in the navigator pane and dropping it onto the task object.

5.8.2 Adding a UserTask

UserTask can be added to a project.

1₂ Procedure

1. Right-click "2.User" in the navigator pane and then select Add Object>UserTask from the context-sensitive menu that is displayed.

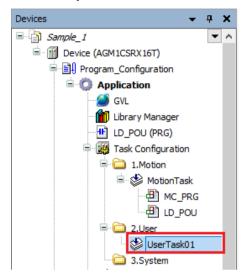


The "Add UserTask" dialog box will be displayed.

Add UserTask	×
Create new user task object.	
Name(<u>N</u>):	
UserTask01	
Add Cano	el

2. Enter a task name in the Name field and click the [Add] button.

The task object will be added.



3. Add a POU object to the UserTask.

The added POU object will be executed as a UserTask.

Double-clicking the object of the added UserTask displays a task configuration window where task settings can be configured.

UserTask01	^					
Fask type:	UserTask					
Priority (715):	7					•
Туре						
🕑 Cyclic	✓ Interval(<u>I</u>):	4000				🜩 🛏 🗸
Watchdog						
Enable						
Time(<u>T</u>):						×
Sensitivity(S):						*
🕂 Add Call(/) 🗙 Remove Call(R) 🛛	쉽 Change Call(<u>C</u>) 🔒	Move Up(<u>U)</u> 🐥 Move Dow	/n(D) → 🗍 Open POU(O)		
POUs) 🗙 Remove Call(R) 🛛	🖉 Change Call(<u>C</u>) 😭	Move Up(U) 🖶 Move Dow Comment	/n(<u>D)</u> → ∰ Open POU(<u>O</u>)		
🕂 Add Call(/) 🗙 Remove Call(<u>R</u>) 🗌	🖞 Change Call(<u>C</u>) 😭		m(D) → Open POU(O)	_	
🕂 Add Call(/	رون 🗙 Remove Call(R) 🛛	🖞 Change Call(C) 🕈		m(D) → 🗍 Open POU(O)		
🕂 Add Call(/	ي 🗙 Remove Call(R) 🛛	🖁 Change Call(C) 🕈		m(D) → Open POU(O)		
🕂 Add Call(/	3) 🗙 Remove Call(<u>R)</u> 🛛	nge Call(C) │ 🕈		m(D) [→] ¶ Open POU(O)		
🕂 Add Call(/	ر (X Remove Call(ß)	nge Call(<u>(</u>) ↔		n(D) → Open POU(O)		
🕂 Add Call(/)) 🔀 Remove Call(<u>R</u>) 🛛	Change Call(C) 🖈		n(D) → E Open POU(O)		
🕂 Add Call(/	3) 🔀 Remove Call(<u>R</u>) 🛛	Change Call(<u>C</u>) 🕈		n(<u>D</u>) → Open POU(<u>O</u>)		

5.8.3 Task Configuration Window

The task configuration window allows the user to configure settings related to task execution, such as execution priorities, execution methods, execution intervals, and watchdog timer. For the procedure for displaying the task configuration window, refer to "5.8.1 Adding Programs".

Example: Task configuration window for task "MotionTask"

	tionTask [Device: Program_Configuration: Applicatio		
ask type:	MotionTask		
iority (33):	3		* *
ype			
Follow the s	etting period of RTEX_Master.		
/atchdog			
Enable			
Time(T):			📥 ms 🗸
Sensitivity(S).		
oenonente) (<u>o</u>	<i>,</i>		
🕂 Add Call	(A) × Remove Call(ℝ) Z Change Call(C) 1	Move Up(U) Move Down(D) → Open POU(O) Comment	
+ Add Call	(A) × Remove Call(R) Z Change Call(C) 1	Move Up(U) Move Down(D) Open POU(O) Comment	
🕂 Add Call	(A) 🔀 Remove Call(ℝ) 📝 Change Call(C) 1	,	
+ Add Call POU MC_PRG	(실) 🔀 Remove Call(图) 📝 Change Call(C) 1	,	
+ Add Call POU MC_PRG	(실) 🔀 Remove Call(图) 📝 Change Call(C) 4	,	
+ Add Call POU MC_PRG	(A) × Remove Call(B) 🗹 Change Call(C) 4	,	
+ Add Call POU MC_PRG	(실) 🔀 Remove Call(문) 📝 Change Call(C) 1	,	
+ Add Call POU MC_PRG	(A) × Remove Call(®) 📝 Change Call(©) 1	,	
Add Call POU MC_PRG	(A) × Remove Call(®) 🗹 Change Call(©) 1	,	
POU MC_PRG	(A) 🗙 Remove Call(®) 📝 Change Call(©) 1	,	

Item	Description
Task type	This field displays the type of the task.
	It displays MotionTask, UserTask, or SystemTask.
Priority	This field displays the priority of the task. The smaller the value, the higher the priority.
	For UserTask, the priority can be set between 7 and 15 inclusive.
	This section specifies the processing method for the task.
	For UserTask, one of the following two types can be selected.
	Cyclic:
Туре	Processes the task at intervals. Specify a task interval in the "Period" field.
	Event:
	Starts task processing as soon as a rising edge of the global variable specified in the "Event" field is detected
	If the "Enable" check box is selected, when the program execution time exceeds the preset time, the task will enter an error state and comes to a halt.
Watchdog	The stop conditions are divided into the following two cases:
	• Case where the program execution time exceeds the number of times specified in "Sensitivity" or the time specified in "Time"

Description				
• Case where the program execution time exceeds "Sensitivity" × "Time" during a single cycle (Example: If "Sensitivity" is set to "3" and "Time" is set to "#20ms", when the execution time exceeds 60 ms during a single cycle, the task will stop.)				
er causes the	task to stop, the ever	nt will be recorded	in the "Log" tab of	
1 0 warning(s) O error(s)	E 2 exception(s) 194 information(s)	0 debug message(s) <all components=""></all>	- Logger	
Offline logging UTC ti	me			
Severity Time Stamp	Description		Component	
27.11.2020 09	31:10.374 "SOURCEPOSITION" App=[Appl	ication] area=0, offset=0	CmpIecTask	
E 27.11.2020 09	31:10.374 *EXCEPTION* [Watchdog] occur	red: App=[Application], Task=[MotionTask	k] CmpIecTask	
•	27.11.2020 09	27.11.2020 09:31:10.374 *EXCEPTION* [Watchdog] occur	27.11.2020 09:31:10.374 *EXCEPTION* [Watchdog] occurred: App=[Application], Task=[MotionTas	

5.9 Build

When a created program is subject to a build process, objects in the application are compiled. If code generation is executed after the build process is executed, an application to be downloaded to the GM1 controller will be generated.

5.9.1 Build

The syntax of all objects is verified when the build process is executed for the first time.

The syntax of only differences is verified when the build process is executed a second time and thereafter. No application code will be generated.

5.9.2 Rebuild

Verifies the syntax of all objects again.

As is the case with build, no application code will be generated.

¹² Procedure

1. From the menu bar, select **Build>Rebuild**.

The syntax of all objects will be verified. If an error or warning occurs, an error or warning message will be displayed in the message view.

Check the message displayed in the message view and correct the program as necessary. After correcting the program, execute rebuild again.

5.9.3 Code Generation

The GM1 controller generates codes (application codes) to be executed when the application starts.

Displays the remaining program capacity and variable capacity during code generation.

¹² Procedure

1. From the menu bar, select **Build>Code Generation**.

Tests will be executed to check memory allocations, data types, and library availability and code size (in bytes), data size (in bytes), allocated memory contents, and most frequently used address (in bytes) will be displayed in the Messages view.

Example: Messages view displayed when code generation is completed correctly

Messages - Total 60 error(s), 1 warning(s), 9 message(s)				
Build • O error(s) • 1 warning(s)	🛛 9 message(s) 🗙 💥			
Description		Project	Object	Position
Build started: Application: Device. Application				
Typify code				
Generate code				
Generate global initializations				
Generate code initialization				
Generate relocations				
Size of generated code: 677460 bytes				
Size of global data: 137471 bytes	Remaining amount (%)			
Total allocated memory size for code and data: 806008 bytes				
Memory area 0 contains Code: size: 16777216 bytes, highest used address: 677480 largest cont	sguous memory gap: 16099736 bytes (95 %)			
Memory area 1 contains Data: size: 16777216 bytes, highest used address: 128528, largest continued address: 128528, la	guous memory gap: 16648688 bytes (99 %)			
Memory area 2 contains Input: size: 200960 bytes, highest used address: 200960, largest contiguent contiguent and the second	uous memory gap: 0 bytes (0 %)			
Memory area 3 contains Output: size: 200960 bytes, highest used address: 200960, largest conti	guous memory gap: 0 bytes (0 %)			
Memory area 4 contains Memory: size: 16384 bytes, highest used address: 16384, largest contiguent of the size o	uous memory gap: 0 bytes (0 %)			
Memory area 5 contains Retain data and Persistent data: size: 196584 bytes, largest contiguous	memory gap: 196459 bytes (99 %)			
Build complete 0 errors, 1 warnings : Ready for download				

Memory area 0	Program capacity	For the maximum capacity, refer to the GM1 Series Reference Manual (Hardware).
Memory area 1	Variable capacity (non-hold)	For the maximum capacity, refer to the GM1 Series Reference Manual (Hardware).
Memory area 2	Input variable	Automatic assignment during code generation
Memory area 3	Output variable	Automatic assignment during code generation
Memory area 4	Internal memory	Automatic assignment during code generation
Memory area 5	Variable capacity (hold)	For the maximum capacity, refer to the GM1 Series Reference Manual (Hardware).



• After application codes are generated, if some codes are changed and code generation is executed again, differential compilation will reallocate memory to only newly added and changed blocks and variables. If memory fragmentation occurs as a result of memory reallocation, the amount of memory that can be actually used will be reduced. To eliminate memory fragmentation, you must perform the procedure described in "5.9.4 Clean".

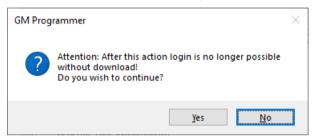
5.9.4 Clean

Deletes application build information.

¹² Procedure

1. From the menu bar, select **Build>Clean**.

If "Clean" is executed, the following confirmation message will be displayed.



Clicking the [Yes] button executes "Clean".

f Info.

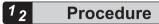
- If "Clean" is executed, online change can no longer be performed. Therefore, to log in to the GM1 controller again, you must download the applications.
- If you copy a program object (POU object), execute "Clean" for the copied POU object.

Note

• Even if "Clean" is executed, the variables registered in the global persistent variable list will not be initialized. Other variables and persistent variables will be initialized.

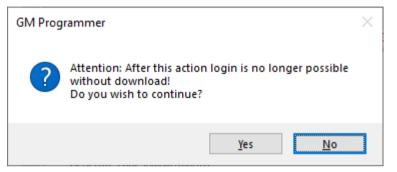
5.9.5 Clean All

Deletes all application build information in the same way as "Clean".



1. From the menu bar, select **Build>Clean All**.

If "Clean All" is executed, the following confirmation message will be displayed.



2. Clicking the [Yes] button executes "Clean All".

If variables have been registered in the persistent variable list, the following confirmation message will be displayed.

GM Prog	rammer	\times
?	The project contains persistent variables lists with internal data (e.g: placeholders for deleted or changed variables). Do you want to delete the internal data? The persistent variables may have to get initialized after the next download.	
	<u>Y</u> es <u>N</u> o	

3. If you delete internal data, click the [Yes] button. If you do not delete it, click the [No] button.



• If you have made changes such as "Add new variables to the top of persistent variable list", note that actual variable values could become different values because the memory areas for retaining variables have become misaligned.

5.10 Program Creation Support Functions

This section explains the program creation support functions used to create programs.

5.10.1 Bookmark

The bookmark function allows the cursor to move to bookmarked locations.

The bookmark function can be used in all programs other than SFC programs.

This section explains the procedures for setting bookmarks and moving the cursor between bookmarks, using an LD program as an example.

¹ 2 Procedure

 Select the network (circuit) where you want to set a bookmark. From the menu bar, select Edit>Bookmarks>Toggle Bookmark, or click the <Ctrl> key + <F12> key simultaneously.

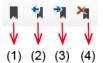
A bookmark (I) will be set in the selected network (circuit). Performing the above operation again clears (deletes) the set bookmark.



2. To move to the next bookmark, press the <F12> key. To move to the previous bookmark, press the <Shift> key + <F12> key simultaneously.

i Info.

- To clear (delete) all the set bookmarks, from the menu bar, select Edit>Bookmarks>Clear All Bookmarks.
- You can also perform bookmark operations by clicking appropriate icons on the toolbar.



No.	Item
(1)	Toggle Bookmark
(2)	Previous Bookmark
(3)	Next Bookmark
(4)	Clear All Bookmarks

5.10.2 Call Tree View

Opening the Call Tree view enables the user to search the callers and callees of blocks such as functions, function blocks, or POU.



1. From the menu bar, select View>Call Tree. The Call Tree view will be displayed.

	→ # X
✓ ◆ Q Ξ < >	

 Enter a block to be searched in the POU Name field and press the <Enter> key. The caller and callee of the block will be displayed in tree structure.

Double-clicking in any search result line displays the corresponding window in the main pane.

Example: Searching the caller and callee of FunctionBlock_Sample

Call Tree	→ ₽ X
POU name FunctionBlock_Sample	✓ ➡ 🔍 🖅 ►
Symbol	Location
FunctionBlock_Sample is called by:	Line 1 (Ded)
ST_Sample	Line 22, Column 1 (Impl)
FunctionBlock_Sample calls:	Line 1 (Ded)

f Info.

- Pressing the <F4> key moves the cursor to the next search result line. Pressing the <Shift> key + <F4> key simultaneously moves the cursor to the previous search result line.
- Position the cursor on a block in the implementation section. From the menu bar, select **Edit>Browse>Browse Call Tree**. The Call Tree view will be displayed with a search conducted for the block at the cursor position.

5.10.3 Cross reference List View

Opening the Cross reference List view allows the user to search the locations of variables and other elements used within the entire project.

¹ 2 Procedure

1. From the menu bar, select View>Cross Reference List.

The Cross reference List view will be displayed.



2. Enter a variable name (or another element name) to be searched in the search field and press the <Enter> key.

The locations of the variable (or element) used will be displayed in list form.

Double-clicking in any search result line displays the corresponding section in the main pane.

Cross Reference List							- ₽ X
iVar0	Var0 🔍 🔶 🍸 Filter by Symbol, POU, Variable, Access, 🔹 🕨 📑 🔠					• • 🖅 🖅 🎒	
Symbol	POU	Variable	Access	Туре	Address	Location	Object ^
iVar0	FB_ADD	iVar0	Declaration	INT		Line 3 (Ded)	FB_ADD [Device: Pr
···· iVar0	FB_ADD	iVar0	Read	INT		Line 1, Column 10 (Impl)	FB_ADD [Device: Pr
····iVar0	MC_PRG	iVar0		INT		Line 1, Column 8 (Impl)	MC_PRG [Device: Pi
FB_inst.iVar0	ST_POU	iVar0	Write	INT		Line 1, Column 9 (Impl)	ST_POU [Device: Pr
iVar0	MC_PRG	iVar0	Declaration	INT		Line 3 (Ded)	MC_PRG [Device: Pi
<	10 000					11 4 6 1 6 6 B	

Example: When variable iVar0 is entered



- Pressing the <F4> key moves the cursor to the next search result line. Pressing the <Shift> key + <F4> key simultaneously moves the cursor to the previous search result line.
- For searches, you can use an asterisk (*) that represents any character string or a question mark (?) that represents a single character.
- Position the cursor on a variable in the implementation section. From the menu bar, select **Edit>Browse>Browse Cross Reference**. The Cross-reference view will be displayed with a search conducted for the variable at the cursor position.

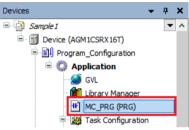
5.10.4 Function Block Guidance

The Function Block Guidance allows the user to enter motion function blocks into a program. The Function Block Guidance can be used in LD programs, ST programs, FBD programs, and CFC programs.

The following procedure is explained, using an example in which "Power" is searched and function block "MC_Power" is inserted into an LD program.



1. Double-click the [MC_PRG(PRG)] object in the navigator pane.



The "MC_PRG" window will be displayed.

MC_PRG X	•
1 PROGRAM MC_PRG	
2 VAR 3 END_VAR	
	100
	t la re m
<	▶ + Q 100 % இ >

 Select the network in the implementation section and, from the menu bar, select Edit>Function Block Guidance.

The "Function Block Guidance" dialog box will be displayed.

E Function Block Guidance	×
Search (S):	
Function Block List (F)	+ -
Name	Description
Single axis control	
Synchronous control	
Multi-axis control	
Motion communication control	
Auxiliary function	
Document	
	Operand (Q) >> K Cancel

3. Enter a character string in the Search field.

Function blocks related to the entered character string will be displayed in the Function Block List table.

E Function E	Block Guidance		×
Search (S):	Power		
Function Blo	:k List (F)		+ -
Name			Description
	axis control		
	ervo ON		
	MC_Power (Servo ON)		Set the axis into ser
Document			
With EN/EN	10 (<u>W</u>)	0K.	Operand (Q) >> Cancel

Select a function block that you want to insert into the program.
 A description of the selected instruction will be displayed in the Document tab pane.

Search (S): Power			
unction Block List (F)			
Name		Description	
Single axis control			
😑 Servo ON			
MC_Power (Servo ON)		Set the axis into :	ser
Document			
Document			
Document MC_Power (Servo ON)			
MC_Power (Servo ON)	o the carry loci	lad state to	/
MC_Power (Servo ON) This is a function block (FB) that sets the axis t	o the servo loci	ked state to	
MC_Power (Servo ON)	o the servo loci	ked state to	
MC_Power (Servo ON) This is a function block (FB) that sets the axis t	o the servo lock	ked state to	
MC_Power (Servo ON) This is a function block (FB) that sets the axis t allow operations.	o the servo loci		
MC_Power (Servo ON) This is a function block (FB) that sets the axis t allow operations.	o the servo loci	>	
MC_Power (Servo ON) This is a function block (FB) that sets the axis t allow operations.	o the servo loci		0) >

5. Click the [Operand] button.

The instance and operand input fields will be displayed.

Search (S): Power			Name (<u>N</u>)	MC_Pov	ver_0	
nction Block List (F)		+ -	× I/0			
ame	Description		Axis			
Single axis control			Enabl			
Servo ON				ulatorOn		
	Set the axis into		bDriv	eStart		
MC_Power (Servo ON)	Set the axis into	o ser	✓ Outp			
			Statu			
				ulatorRealSt		
				eStartRealSt		
			Busy Error			
			Error	D		
ocument			Error	D	<u> </u>	
ocument MC_Power (Servo ON)		Ŷ	Error	D		
	o the servo locked state to	-	Error	D		
MC_Power (Servo ON) This is a function block (FB) that sets the axis to	o the servo locked state to	~	Errori	D		

6. Enter an instance name in the Name field and values in each operand field. If the operand for which a value has been entered is a variable that has not been declared, the "Auto Declare" dialog box will be displayed, so that the variable can be declared.

S Function D	llock Guidance							
Search (<u>S</u>):	Power			N	erne (<u>M</u> C	MC_Por	ver_1	
Function Bloc	k List (F)		+ -	~	1/0			
Name			scription		Ada		SN3_Drive_RTEX_AS	N
			support	×	English English		18.6	
	axis control				b Reculation		N/m1	
- e- se	arvo ON				bOrivet8		THE P	
					Ostout	at.	INCE	-
				ľ	2 stat		N/m2	
					bReculat			
					bD1/efs			
					Derv			12
					Dror			-
					EverID			
Document								
MC_P	ower (Servo ON)		<u> </u>					
This is a f allow ope	lanction block (FB) that sets the as rations.	is to the servo locked	state to					
<			>					
wish פאו/פא	0 (W)		Operand (() <-					
		OK	Cancel					

7. Click the [OK] button.

If an instance name has not been declared, the "Auto Declare" dialog box will be displayed, so that an instance can be declared.

The function block will be inserted into the program.

1 P	M	C_PRG X	-
	1	PROGRAM MC_PRG	
B	2	VAR	
	3	bVarl: BOOL;	
	4	bVar2: BOOL;	
	5	bVar3: BOOL;	
	6	bVar4: BOOL;	
	7	MC_Power_0: MC_Power;	
	8	END_VAR	
		10	0
	-		
	1		
		MC_Power_0	
		MC_Power SM3_Drive_RTEX_A6N - Axis Status	
		bRegulatorRealState - bVar3	
		TRUE bDriveStartRealState bVar4	
		Enable Busy - ???	
		Enable Busy 777	
		bRegulatorOn	
		TRUE	
		bDriveStart	
1			

fi Info.

- To insert a function block into a CFC program, insert a box first and, with the box selected, start the Function Block Guidance.
- If the "With EN / ENO" check box is selected, a function block with EN input and ENO output will be inserted. When the value of EN input is TRUE, the function block is executed. Similarly, when the value of EN input is FALSE, the function block is not executed. The same value as EN input is output to ENO output.
- The Function Block Guidance can also be started using the following operations:
 - Click the "Function Block Guidance" icon on the toolbar.
 - Press the <Alt> key + <F2> key simultaneously.
 - Select the network in the implementation section, and then right-click and select "Function Block Guidance" from the context-sensitive menu that is displayed.

5.10.5 Short Form Function

Using the short form function in the declaration section in character string format enables variables to be declared by entering fewer characters.

Example: Declaring Boolean variables bVar0 and bVar1 with the short form function

¹² Procedure

 Enter variables bVar0 and bVar1, and press the <Ctrl> key + <Enter> key simultaneously. "bVar0, bVar1:BOOL;" will be entered automatically.



The table below shows examples of input using the short form function. Strings entered following a semicolon (;) are treated as comments.

Input in short form	Result after the <ctrl> key + <enter> key are pressed simultaneously</enter></ctrl>
bVar0	bVar0:BOOL;
iVar0 iVar1 I 6	iVar0, iVar1: INT := 6;
strVar S 8	strVar: STRING(8)
wVar w; wVar comment	wVar: WORD; // wVar comment

100 👰

5.10.6 Input Assistant Function

By using the Input Assistant Function, variables, function blocks, operators, types, and other elements that can be inserted in the cursor position can be selected from categories.

¹² Procedure

1. Move the cursor to the position where you want to insert a desired element and press the <F2> key.

The "Input Assistant" dialog box will be displayed.

Select a desired element from the "Categories" tab pane or the "Text Search" tab pane.

Variables	 Name 	Туре	Address	Origin
Module Calls		Library		CAA SerialCom, 3.5
Instance Calls	I FILE	Library		CAA File, 3.5.15.0
Function Blocks	🗉 🧭 Io Config_Globals	VAR_GLOBAL		
Keywords	🗉 {} IoDrvEthernet	Library		IoDrvEthernet, 3.5
Conversion Operators	■ {} IoDrvRTEX	Library		IoDrvRTEX, 0.6.8.2
	I NBS	Library		CAA Net Base Servi
	Image: Barrier Bar	Library		Panasonic_GM_Syst
	🕀 {} SM3_Basic	Library		SM3_Basic, 4.6.1.0
		Library		SM3_CNC, 4.6.1.0
		Library		SM3_Error, 4.6.1.0
	· ↔ ↔ SM3_Math	Library		SM3_Math, 4.6.2.0
Structured view	¢		<u>F</u> ilter None	
	٢	⊡ Insert with arguments	_	ert with namespace prefix
	<	⊡ Insert <u>w</u> ith arguments	_	
	٢	⊡ Insert with arguments	_	
	<	⊡ Insert with arguments	_	
	<	✓ Insert with arguments	_	
]§tructured view gumentation	<	⊡ Insert with arguments	_	
	<	⊡ Insert with arguments	_	

2. Click the [OK] button.

The selected element will be inserted.



• You can also open the "Input Assistant" dialog box by selecting **Edit>Input Assistant** from the menu bar.

5.10.7 Argument / Variable Input Support (Component List)

This section explains the functions (component list) that support input of arguments and other data for function blocks during program creation.

The following three input support functions are available.

Displaying candidates for arguments that can be entered

Entering a dot (.) after a name such as a function block name or structure name displays a list of candidates for arguments that can be entered.

To enable this function, in the Options window, select **SmartCoding>List components after typing a dot(.)**.

Example: Displaying a list of members of structure variable stVar after structure variable stVar and a dot are entered



Displaying candidates for variables or other components starting with the entered character string

Entering any character string and then pressing the <Ctrl> key + <Space> key simultaneously displays a list of elements that can be inserted.

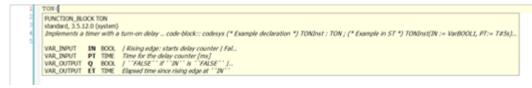
Example: Entering "TI" and pressing the <Ctrl> key + <Space> key simultaneously selects and displays the positions of variables or other components starting with "TI"



Displaying a description of function block or function

Entering a function block name (or some other name) followed by a left parenthesis displays a description of the function block in a pop-up window.

To open the closed pop-up window again, press the <Ctrl> key + <Shift> key + <Space> key simultaneously.



5.10.8 Global Renaming (Refactoring)

When a POU object name in the navigator pane or a variable name in the declaration section is changed, the sections where the changed name is used are displayed, so that the name can be changed collectively (this function is called "refactoring").

This section explains the procedure for changing the variable name of input variable " iVar2" in function block "FB_ADD" and using the refactoring function to change the variable name in the sections where the variable is called.

🖉 🖬 мо								-	
	• X						PROGRAM FB_ADD		1
^	Scope	Name	Address	Data type	Initialization	Comment	Attributes		
1	🐐 VAR_INPUT	iVar0		INT					
2	VAR_INPUT	iVar1		INT					
3	VAR_INPUT	iVar2		INT					
4	VAR_OUTPUT	oVar0		INT					
<									>
							A 🛡		



1. Change the name of variable "iVar2" in the declaration section of the function block to "iVar3".

The "Automatic Refactoring" dialog box will be displayed.

Automatic Refactoring: Rename		×
You did rename the variable iVar2 to iVar3. references within the project?	Do you want to automatically adapt all	
Configure Refactoring	Yes <u>N</u> o <u>C</u> ancel	

2. Click [Yes].

The "Refactoring" dialog box will be displayed.

Each section where the changed variable is used is displayed in red and the background of the section is displayed in yellow.



By clicking an object in the navigator pane, you can check the change details of the object. At this stage, the changes have not been reflected yet.

When ST_POU object is selected:



Click the [OK] button.
 All changes will be reflected.

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• When the sections where the changed variable is used are displayed by the refactoring function, you can individually select whether to reflect the change. Right-click in the sections where the changed variable is used and select whether to reflect the change, from the context-sensitive menu that is displayed.

"Reject this change": Does not reflect the change in the selected section

"Accept this object": Reflects the change in the object

"Reject this object": Does not reflect the change in the object

<pre>FB_inst.iVar0 := 10; FB_inst.iVar1 := 20;</pre>		
<pre>FB_inst.iVar3 := 30; FB_inst() result := FB_inst.oVar0</pre>	Reject this change Accept this object Reject this object	
		100

In the Options window, you can specify the situations where the refactoring function is enabled.
 Open the Options window (by selecting **Tools>Options**), select the "Refactoring" category, and specify the situations where the refactoring function is enabled.

Options		×
CFC Editor Constraint Editor	Refactoring Suggest refactoring for the following operations: Auto declare: O n adding or removing variables, or on changing the scope O n renaming variables Mapping editor: O n renaming variables Navigator: O n renaming objects Tabular declaration editor: O n renaming variables	
		ancel

5.10.9 Code Analysis (Static Analysis Light)

Code analysis (Static Analysis Light) can be conducted on programs that are created. Code analysis can check for the following errors.

Error number	Description
SA0033	Unused variables
SA0028	Overlapping memory areas
SA0006	Write access from several tasks
SA0004	Multiple write accesses on output
SA0027	Multiple uses of identifiers
SA0167	Report of temporary function block instance



 From the menu bar, select Project>Project Settings. The Project Settings dialog box will be displayed.

Compile options Compiler warnings Page Setup	SFC Flags	Build		
Security	Use	Variable	Declare	Description
SFC		SFCInit		All steps and actions are reset. T
SoftMotion		SFCReset	\checkmark	All steps and actions are reset. T
Static Analysis Light		SFCError	\checkmark	Gets 'TRUE', if a time check failed
Users and Groups		SFCEnableLimit	\checkmark	Enable time check on steps
		SFCErrorStep	\checkmark	Contains the name of the step th
		SFCErrorPOU	\checkmark	Contains the name of the POU th
		SFCQuitError	\checkmark	Execution is stopped. SFCError is
		SFCPause	\checkmark	Execution is stopped. SFCError is
		SFCTrans	\checkmark	Gets 'TRUE', if a transition switch
		SFCCurrentStep	\checkmark	Contains the name of the active :
		SFCTip	\checkmark	Switches the next transition on a 🗸
	<			>
	Арр	bly to All		

2. In the "Project Settings" dialog box, select the "Static Analysis Light" category.

Project Settings		×
 Compile options Compiler warnings Page Setup Security 	Static Analysis Light Additional Compile Checks	
SFC SoftMotion Static Analysis Light Users and Groups	Unused variables Overlapping memory areas Write access from several tasks Multiple write access on output Multiple uses of identifiers Report temporary FunctionBlock instances	
	ОК	Cancel

3. Select the check boxes of the items to be checked.

Project Settings		×
Compile options Compiler warnings Page Setup	Static Analysis Light Additional Compile Checks	
 Security SFC SoftMotion Static Analysis Light Users and Groups 	Unused variables	
	OK Car	ncel

4. Click the [OK] button.



• If the items to be checked are set beforehand, code analysis will be performed automatically during login.

5.10.10 Displaying Programs in Multiple Languages (Project Localization)

The project localization function allows the user to translate and register comments, titles, and other information in the program to display the translated content in the program window.

¹² Procedure

- From the menu bar, select Project >Project Localization >Create Localization Template. The "Create Localization Template" dialog box will be displayed.
- **2.** Select information to be translated.

To translate comments and titles in a program, select the "Comments" check box. To add location information to a template, select "First Appearance" or "All" in the Location information drop-down list.

Create Localization Template	\times
Include the Following Information	
Names	
Identifiers	
Strings	
Comments	
Position information	
First Appereance 🗸 🗸	
Create Cancel	

3. Click the [Create] button.

The "Save As" dialog box will be displayed.

・ → 、 小 - 、 This PC > Documents > POT			✓ Ö Search	POT	۶
Organize 🔻 New folder					- (
Pictures A Name	Date modified	Tura	Size	Ū	
Pictures 🗶 ··· Name	Date modified	Туре	Size		
 OneDrive 	No items m	atch your search.			
💻 This PC					
3D Objects					
Desktop					
Documents					
🖶 Downloads					
b Music					
E Pictures					
Videos					
L Windows (C:)					
🔿 Network					
File name: LD_Translation.pot					
Save as type: POT translation template (*.pot)					

- Enter a file name and click the Save button.
 A POT translation template file (".pot") will be created.
- **5.** For localization, use an editor such as PoEditor to enter translations. Create a localization file (".po").

Source text — Japanese	Translation — English
// TONの現在時間	// TON Current Time
// 入力X1	// Input X1
自己保持回路	Self-holding circuit
TONファンクションブロックの実行	Execute TON FunctionBlock

- From the menu bar, select Project >Project Localization>Manage Localizations. The "Manage Localizations" dialog box will be displayed.
- 7. Click the [Add] button.

The "Open Localization File" dialog box will be displayed. Select a localization file (".po") that has been created.

The added localization file will be displayed in the "Available Localizations" area.

Manage Localizations	×
Available Localizations	
Files	Add
ld_sample-en-US.po <original version=""></original>	Remove
Default localization	
Switch Localization	
Switch Localization	OK Cancel

8. Click the [OK] button.

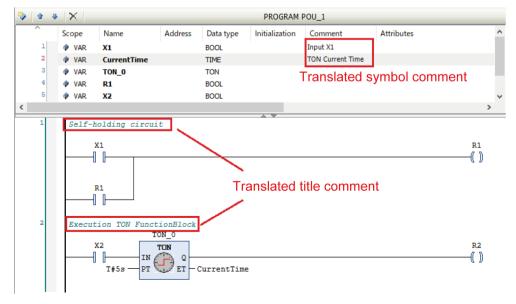
The "Manage Localizations" dialog box will be closed.

This completes the localization file creation procedure.

Next, the procedure for switching the display is explained below.

 From the menu bar, select Project >Project Localization > Switch Localization. Symbol comments and title comments will be displayed according to the translations in the added localization file.

To return the display to its original state, select "Switch Localization" again.



1 Info.

• You can also switch the localization file by clicking 🐱 on the toolbar.

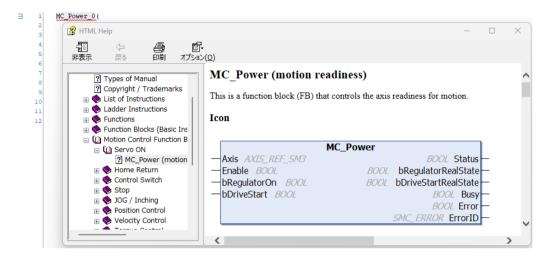
5.10.11 Start Instruction Help Function

The start instruction help function can be used to check the functions of instructions supported by the GM1 controller.

.IICk		
	an instruction.	
For I	LD	
		MC_Power_0
		MC Power
	Axis	- Status
	-Enable	bRegulatorRealState
	-bRegulatorOn	bDriveStartRealState
	- bDriveStart	Busy
		Error
		ErrorID
		······
For \$	ST	
=or \$	ST	1(
		1(Axis:= ,
	1 MC Power	AA
	1 <u>MC Power</u>	Axis:= ,
	1 <u>MC Power</u> 2 3	Axis:= , Enable:= ,
	1 <u>MC Power</u> 2 3 4	Axis:= , Enable:= , bRegulatorOn:= ,
	1 <u>MC Power</u> 2 3 4 5	<pre>Axis:= , Enable:= , bRegulatorOn:= , bDriveStart:= , Status=> ,</pre>
	1 <u>MC Power</u> 2 3 4 5 6	<pre>Axis:= , Enable:= , bRegulatorOn:= , bDriveStart:= , Status=> , bRegulatorRealState=> ,</pre>
	1 <u>MC Power</u> 2 3 4 5 6 7	<pre>Axis:= , Enable:= , bRegulatorOn:= , bDriveStart:= , Status=> , bRegulatorRealState=> ,</pre>
	1 <u>MC Power</u> 2 3 4 5 6 7 8	<pre>Axis:= , Enable:= , bRegulatorOn:= , bDriveStart:= , Status=> , bRegulatorRealState=> , bDriveStartRealState=></pre>
	1 <u>MC Power</u> 2 3 4 5 6 7 8 9	<pre>Axis:= , Enable:= , bRegulatorOn:= , bDriveStart:= , Status=> , bRegulatorRealState=> , bDriveStartRealState=> Busy=> ,</pre>

2. Press the"Ctrl + F1"keys.

You can check the description of the selected instruction.





- The GM1 controller references the *GM1 Series Reference Manual (Instruction Edition)* to display the help contents of instructions.
- The start instruction help function can also be activated by selecting a structure and then following the above steps.

6 Entering programs in each Programming language and Variable

6.1 Programming in Ladder Diagram (LD)	
6.1.1 Inserting Contacts, Coils, and Function Blocks	
6.1.2 Inserting Contacts in Parallel	
6.1.3 Inserting a Network (Circuit)	
6.1.4 Inserting a Branch	
6.1.5 Input of Title and Comment (LD)	
6.1.6 Commenting out a Network (Circuit)	. 6-13
6.2 Programming in Structured Text (ST)	.6-14
6.2.1 ST Program Syntax	
6.2.2 Commenting out Code in ST Program	
6.3 Programming in Sequential Function Chart (SFC)	
6.3.1 Inserting Elements from Menu	
6.3.2 Inserting Elements from Toolbox	
6.3.3 Inserting Elements from Toolbar	
6.3.4 Setting up the SFC Editor	
6.3.5 Setting SFC Program Execution Conditions	
6.4 Programming in Function Block Diagram (FBD)6.4.1 Entering Function Blocks	
6.4.2 Inserting and Commenting out a Network (Circuit)	
6.4.3 Input of Title and Comment (FBD)	
6.4.4 Settings in FBD Program	
6.5 Programming in Instruction List (IL)	
6.5.1 Entering Instructions and Operands	
6.5.2 Settings in IL Program	. 6-37
6.6 Programming in Continuous Function Chart (CFC)	.6-38
6.6.1 Inserting and Connecting Elements	. 6-39
6.6.2 Connection Mark	. 6-43
6.7 Variables	6-44
6.7.1 Standard Data Types	
6.7.2 STRING type	
6.7.3 WSTRING type	
6.7.4 Array	
6.7.5 Subrange Types	
6.7.6 Structure, Enumeration, Alias, and Union Data Types	
6.7.7 Constants	
6.7.8 Object for Global Variable Declaration	
6.7.9 Global Variables	
6.7.10 Persistent Variables	

6.1 Programming in Ladder Diagram (LD)

This section explains how to create programs (LD programs) in Ladder Diagram compliant with IEC 61131-3, the international standard for PLC programming languages.

To create LD programs, POU objects for LD programs are required. Set the object setup language to Ladder Diagram (LD).

6.1.1 Inserting Contacts, Coils, and Function Blocks

This section explains how to create an LD program that consists of the normally open contact, coil, and function block TON shown below.

H MC_PRG X		*
1 PROGRAM MC_PRG 2 VAR 3 bVar0: BOOL; 4 bColl0: BOOL; 5 TON_0:TON; 6 CurrentTime: TIME; 7 END_VAR	Declaration section	•
1 bVar0 [N] T#55 - DT 0 ET - CurrentTime		100 🙊
	Implement section	
٤	[▶ + Q 100 % @ >

¹₂ Procedure

1. In Toolbox, select Ladder elements>Contact and drag the mouse until "Start here" is displayed in the main pane.

"Start here" will be displayed in the implementation section.



When you drag the mouse until the position of "Start here" is reached, the display of "Start here" turns green.



When you stop dragging the mouse at the position of "Start here", a normally open contact will be placed in the network (circuit).

	1						
--	---	--	--	--	--	--	--

f Info.

- You can also insert a normally open contact in the network (circuit) using the following procedure:
 - Right-click in the network (circuit) and select "Insert Contact" from the context-sensitive menu that is displayed.
 - Click the
 icon on the toolbar.
 - From the menu bar, select FBD/LD/IL>Insert Contact.
 - Press the <Ctrl> key + <k> key simultaneously.
- 2. Select "???" of the normally open contact and enter variable bVar0, and then press the <Enter> key.

The "Auto Declare" dialog box will be displayed.

Auto Declare		×
<u>S</u> cope VAR ∽	<u>N</u> ame bVar0	Type BOOL >>
Object MC_PRG [Application] ~	Initialization	Address
Elags CONSTANT RETAIN PERSISTENT	Co <u>m</u> ment	^ ~
		OK Cancel

3. Click the [OK] button.

Variable bVar0 will be declared in the declaration section.



4. In Toolbox, select Ladder elements>Coil and drag the mouse until "Add output or jump here" is displayed in the main pane.

When you drag the mouse until the position of "Add output or jump here" is reached, the display of "Add output or jump here" turns green.

	ToolBox 👻 🕂 🗙
1 PROGRAM MC_ERG	🗏 General
	Tetwork
5 DVaro: Book;	📰 Box
4 END_VAR	Box with EN/ENO
	-ver Assignment
	-> Jump
	-4447 Return
	44 Input
	T Branch
100	"M" Execute
	Boolean Operators
	Math Operators
	Other Operators
bVar0	Function Blocks
	Ladder Elements
Add output or jump here	Metwork
	I IF Contact
	4/1 Negated contact
	In Parallel contact
	4/1 Parallel negated contact
	Coil
	<si>set coil</si>
	A coil coil
	IOI TON

When you stop dragging the mouse at the position of "Add output or jump here", a coil will be placed in the network (circuit).



5. Select "???" of the coil and enter variable bCoil0, and then press the <Enter> key. The "Auto Declare" dialog box will be displayed.

<u>S</u> cope		<u>N</u> ame	Type	
VAR	\sim	bCoil0	BOOL	~ >
<u>O</u> bject		Initialization	<u>A</u> ddress	
MC_PRG [Application]	~			
Elags		Co <u>m</u> ment		
CONSTANT RETAIN				1
PERSISTENT				

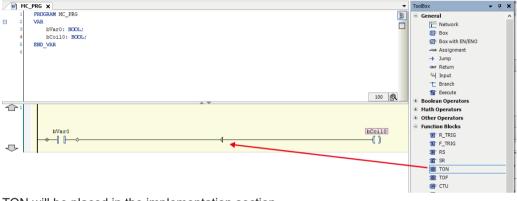
6. Click the [OK] button.

Variable bCoil0 will be declared in the declaration section.



7. In Toolbox, select **Function block**>**TON** and drag the mouse until *◄* is displayed in the main pane.

Function block TON will be displayed.



TON will be placed in the implementation section.



8. Select TON and enter a variable name, and then press the <Enter> key. The "Auto Declare" dialog box for TON will be displayed.

Auto Declare			×
<u>S</u> cope VAR	~	<u>N</u> ame TON_0	Type TON V >
Object MC_PRG [Application]	~	Initialization	Address
Elags <u>C</u> ONSTANT <u>R</u> ETAIN <u>P</u> ERSISTENT		Co <u>m</u> ment	•
			OK Cancel

9. Click the [OK] button.

The name of TON will be declared as variable TON_0.



10. Enter "T#5s" for input PT ("IN PT") and "CurrentTime" for output ET ("O ET"), as shown below.

In the declaration section, declare "CurrentTime" as a TIME type variable.

/ P	м	IC_PRG_X	~
	1	PROGRAM MC_PRG	
8	2	VAR	
	3	bVar0: BOOL;	
	4	bCoil0: BOOL;	
	s	TON_0: TON;	
	6	CurrentTime: TIME;	
	7	END_VAR	
		A ¥	100 🔍
	1	TON_0	
			-()

This completes insertion of a normally open contact, coil, and function block TON. The network (circuit) is now complete.

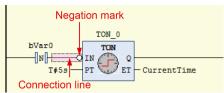
1 Info.

- To remove an element that has been placed, select the element and press the <Delete> key. You can also remove an element by right-clicking the element and selecting "Delete" from the context-sensitive menu that is displayed.
- The normally open contact that is placed can be set as a normally open contact for detecting a rising edge (1.). To do so, perform the following procedure with the normally open contact selected.
 - Right-click the normally open contact and select "Edge Detection" from the contextsensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Edge Detection.
 - Press the <Ctrl> key + <e> key simultaneously.
 - Click the
 icon on the toolbar.

If the above procedure is performed one more time, the normally open contact that is placed can be set as a normally open contact for detecting a falling edge ($\exists n b$).

- Input to the function block can be negated. To do so, perform the following procedure with the connection line to the input selected.
 - Right-click the function block and select "Negation" from the context-sensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Negation.
 - Press the <Ctrl> key + <n> key simultaneously.
 - Click the 🔁 icon on the toolbar.

A negation mark will be displayed on the left side of the input ("IN").



• The LD program can be converted and displayed as an FBD program. From the menu bar, select **FBD/LD/IL>View** and select a post-conversion programming language.

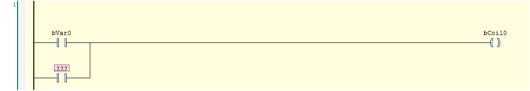
6.1.2 Inserting Contacts in Parallel

This section explains how to place a contact in parallel with a normally open contact.

In Toolbox, select **Ladder elements**>**Parallel contact** and drag the mouse until the position of ∇ displayed on the right side of the normally open contact is reached.

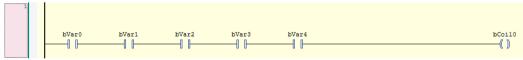


The normally open contacts will be placed in parallel with the other one.

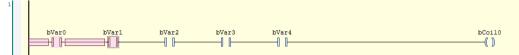


Placing a contact in parallel with multiple contacts

The following explains how to place a contact in parallel with multiple contacts.

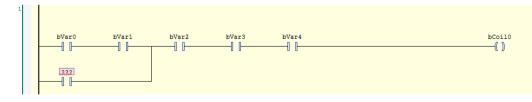


While holding down the <Ctrl> key, select relevant contacts and then right-click.



Ж	Cut
₽ <mark>₽</mark> ₽	Сору
Ē.	Paste
\times	Delete
	Browse +
e	Insert Box
1	Insert Empty Box
1	Insert Empty Box with EN/ENO
- E 8-	Insert Execute Box
-00-	Insert Contact
-10- -1/0-	Insert Contact Insert Negated Contact
-1/1-	Insert Negated Contact
1/1 1	Insert Negated Contact Insert Contact (right)
4/0- 470- 16 al	Insert Negated Contact Insert Contact (right) Insert Contact Parallel (below)
473- 473- 1612 1612	Insert Negated Contact Insert Contact (right) Insert Contact Parallel (below) Insert Negated Contact Parallel (below)
473- 473- 1610 1610	Insert Negated Contact Insert Contact (right) Insert Contact Parallel (below) Insert Negated Contact Parallel (below) Insert Contact Parallel (above)
478 478 1619 1619 1619	Insert Negated Contact Insert Contact (right) Insert Contact Parallel (below) Insert Negated Contact Parallel (below) Insert Contact Parallel (above) Paste Contacts

Select "Insert Contact Parallel (below)" from the context-sensitive menu that is displayed. A contact will be placed in parallel with the selected contacts.

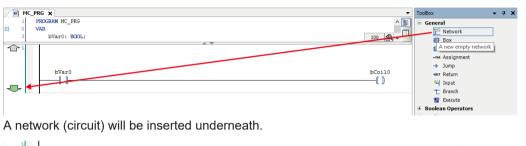


6.1.3 Inserting a Network (Circuit)

This section explains how to insert a new network (circuit).

¹² Procedure

1. In Toolbox, select **General>Network** and drag the mouse until — displayed in the network (circuit) in the main pane is reached.



	bVar0				 ьСоі10 ————————————————————————————————————
2					
			1		

Added network



- You can also insert a network (circuit) underneath using the following procedure:
 - Right-click in the network (circuit) and select "Insert Network (Below)" from the contextsensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Insert Network (below).
 - Press the <Ctrl> key + <t> key simultaneously.
- To add a network (circuit) above the existing network, in Toolbox, select **General>Network** and drag the mouse until the position of *is* reached.



• To remove a network (circuit), select the network (circuit) and press the <Delete> key.

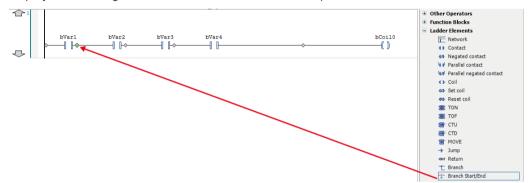
6.1.4 Inserting a Branch

This section explains how to add a branch by specifying the starting point and end point of the branch.

Example: Creating a branch in the following network (circuit) that extends from a point between contacts bVar1 and bVar2 to a point between contacts bVar3 and bVar4

¹² Procedure

1. In Toolbox, select Ladder elements>Branch Start/End and drag the mouse until displayed on the right side of contact bVar1 in the main pane is reached.



When you stop dragging the mouse, a red square mark indicating the starting point of a branch is displayed between contacts bVar1 and bVar2. Blue square marks indicate candidates for the end point of the branch.



2. Click the blue square mark between contacts bVar3 and bVar4.

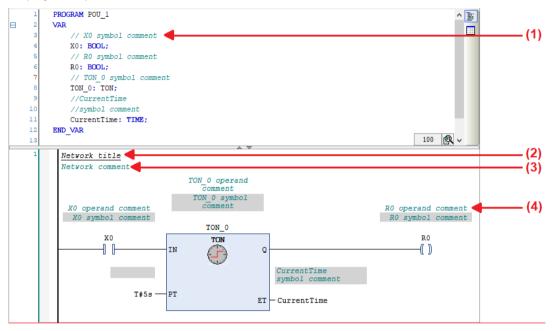
A branch that extends from the point between contacts bVar1 and bVar2 to the point between contacts bVar3 and bVar4 will be inserted.



6.1.5 Input of Title and Comment (LD)

The Ladder Diagram programming language allows the user to enter the following four types of titles and comments.

Display examples of titles and comments are shown below.



No.	Item	Description
(1)	Symbol comment	This is a comment on a declared variable. The same comment is displayed for the same variable. Enter a comment on a variable in the declaration section.
		The comment will be displayed in a cell with a black background.
	Network title	A title can be assigned to each network (circuit).
(2)	(circuit title)	Click the top left of the network (circuit) and enter a title.
	Network comment	A comment can be assigned to each network (circuit).
(3)	(circuit comment)	Click the top left of the network (circuit) and enter a comment.
(4)	Operand comment	This is a comment on a variable. Different comments can be assigned to the same variable. Click a position above each variable in the implementation section and enter a comment.

To display titles and comments, you must configure settings.

Open the Options window (by selecting **Tools>Options**), select the "FBD, LD, and IL editors" category and then the General tag, and select the items to be displayed in the Display section.

Options		×
 CFC Editor Debugging Dedaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring SFC editor SmartCoding 	FBD, LD and IL editor General FBD LD IL Print View Show network title Show network comment Show box icon Show box icon Show symbol comment Show symbol comment Show symbol address Show network separators	Behavior Placeholder for new operands Empty operands for function block pins
Text editor	Font (click onto the sample to edit) AaBbCcXxYyZz	Eixed size for operand fields:
		<u>Q</u> K <u>C</u> ancel

i Info.

• Titles and comments can be displayed as those translated in a particular language beforehand. For details, refer to "5.10.10 Displaying Programs in Multiple Languages (Project Localization)".

6.1.6 Commenting out a Network (Circuit)

Networks (circuits) can be commented out. A network (circuit) that is commented out cannot be executed.



1. Select a network (circuit) to be commented out.



 Click the icon (Toggle Network Comment State) on the toolbar. The network (circuit) will be commented out. To cancel the comment-out state, perform the same operation again.

	TON 0
	X0 TON Ty55 PT O ET CurrentTime

i Info.

- You can also comment out the selected network (circuit) using the following procedure:
 - Right-click in the network (circuit) and select "Toggle network comment state" from the context-sensitive menu that is displayed.
 - From the menu bar, select FBD/LD/IL>Toggle network comment state.
 - Press the <Ctrl> key + <o> key simultaneously.

6.2 Programming in Structured Text (ST)

This section explains how to create programs (ST programs) in Structured Text compliant with IEC 61131-3, the international standard for PLC programming languages.

- To create ST programs, POU objects for ST programs are required. Set the object setup language to Structured Text (ST).
- An ST program is made up by combining expressions and instructions. Expressions and instructions can also be executed under certain conditions or within a loop. Each instruction must end with a semicolon (;).

/ 📄 P	0U X
1	PROGRAM POU
2	PROGRAM 200
3	END VAR
4	-
	Declaration section
	Declaration section
	100 🙊
1	
	Implementation section
	100 0
<	

6.2.1 ST Program Syntax

For ST programs, the following syntax can be used.

Item	Example
Assignment statement	The value of the right side is set on the left side. Example: iVar1 : = 4;
Set assignment statement	If the value of the right side is judged to be TRUE, TRUE will be set on the left side. Once the value of the left side is judged to be TRUE, the left side will maintain TRUE even if the value of the right side is judged to be FALSE. Do not leave any spaces between "S" and "=". Example: bVar0 S= bVar1;
Reset assignment statement	If the value of the right side is judged to be TRUE, FALSE will be set on the left side. Once the value of the left side is judged to be FALSE, the left side will maintain FALSE even if the value of the right side is judged to be FALSE. Do not leave any spaces between "R" and "=".

Item	Example
	Example: bVar0 R= bVar1;
IF instruction	Conditions are judged and subordinate instructions are executed according to the judgment result. Example: IF (iVar0 = 4) THEN iVar1 : = 5; ELSIF (iVar0 = 7) THEN iVar1 : = 10; ELSE iVar1 : = 15; END_IF;
FOR instruction	Subordinate instructions are executed repeatedly the specified number of times. Example: FOR iVar0 : = 1 TO 10 BY 1 DO iVar1 : = iVar1 + 1; END_FOR;
WHILE instruction	Conditions are judged and subordinate instructions are executed repeatedly as long as the conditions are satisfied. Example: WHILE (iVar0 <> 0) DO iVar1 : = iVar1 * 2; END_WHILE;
CASE instruction	Conditions are judged and subordinate instructions are executed according to the judgment result. Example: CASE iVar0 OF 1 : iVar1 : = iVar1 / 2; 2 : iVar1 : = iVar1 / 4; ELSE iVar1 : = iVar1 / 8; END_CASE;
REPEAT instruction	Conditions are judged and subordinate instructions are executed repeatedly as long as the conditions are satisfied. Example: REPEAT iVar0 : = iVar0 + 1; UNTIL iVar0 = 100 END_REPEAT;
EXIT instruction	The EXIT instruction is used to terminate a loop within the FOR, WHILE, or REPEAT instruction.
RETURN instruction	The RETURN instruction is used to terminate a program organization unit (POU). Instructions within POUs following the RETURN instruction will not be executed.
JMP instruction	The JMP instruction is used to unconditionally move control to the line indicated by the JMP label. Example:

Item	Example
	iVar0 : = 0;
	Label1 : iVar0 : = iVar0 + 1;
	IF (iVar1 = 5) THEN
	JMP Label1;
	END_IF;
CONTINUE instruction	The CONTINUE instruction is used to move control to the beginning of the loop within the FOR, WHILE, or REPEAT instruction.

1 Info.

• Entered keywords are converted to uppercase letters automatically (AutoFormat). To disable this function, clear the "Convert keywords to uppercase automatically (AutoFormat)" check box in the Options window.

Options	×
CFC Editor Debugging Declaration Editor Device editor FBD, Da All Leditor International Settings Load and Save Monitoring Monitoring SFC editor SmartCoding Text editor	SmartCoding Pedare unknown variables automatically (AutoDedare) Enable for ST editor Show all instance variables in input assistant Show all instance variables in input assistant Usits components after typing a dot (.) List components immediately when typing Insert with namepace Convert keywords to uppercase automatically (AutoFormat) Automatically list selection in gross reference view Underline grors in the editor Highlight gymbols Max degree of parallelism
	QK Cancel

6.2.2 Commenting out Code in ST Program

In ST programs, code can be commented out. Program code that is commented out cannot be executed.

Comment type	Description
Single line	Program code from // to the end of the line is treated as a comment. Example: bVar1 := 2; // Single-line comment
Multiple lines	Program code from (* to *) is treated as a comment. (* *) can also be inserted into another comment enclosed between (* and *). Example: (* Multiple-line comment 1 Multiple-line comment 2 *)

Example: Single-line and multiple-line comments

```
1 X1 := 2; //Single line comment

2 (*

3 Multi-line comment 1

4 Multi-line comment 2

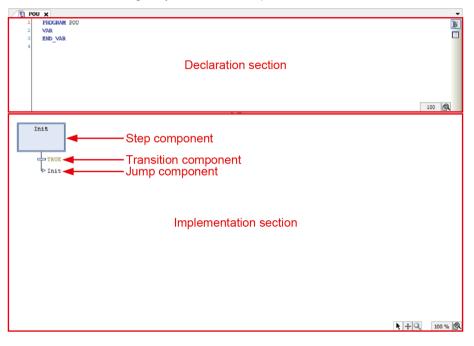
5 *)

6
```

6.3 Programming in Sequential Function Chart (SFC)

This section explains how to create programs (SFC programs) in Sequential Function Chart compliant with IEC 61131-3, the international standard for PLC programming languages.

- To create SFC programs, POU objects for SFC programs are required. Set the object setup language to Sequential Function Chart (SFC).
- The SFC program editor is divided into the declaration section and implementation section. Three elements are originally coded in the implementation section.



6.3.1 Inserting Elements from Menu

For example, step elements and transition elements can be inserted from the menu, as below.

¹ 2 Procedure

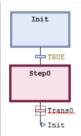
1. Select the TRUE transition element in the implementation section. The selected transition element will turn red.



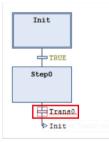
2. Click the right mouse button and select "Insert Step-transition After" from the contextsensitive menu that is displayed.

¢ 5	Init Step Add Entry Action
Ģ	Add Exit Action
	1
†	Insert Step-transition
₽T ₽↓	Insert Step-transition

"Step0" step element and "Trans0" transition element will be inserted below the TRUE element.



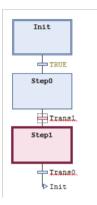
3. Select the "Trans0" element.



4. Click the right mouse button and select "Insert Step-transition" from the context-sensitive menu that is displayed.

¢	Init Step
-	Add Entry Action
Ţ	Add Exit Action
1 7	Insert Step-transition
₽↑ ₽↓	Insert Step-transition Insert Step-transition After

"Step1" step element and "Trans1" transition element will be inserted above the "Trans0" transition element.



6.3.2 Inserting Elements from Toolbox

Each element can be inserted from Toolbox.

This section explains the procedure for inserting elements from Toolbox, using a step element as an example.



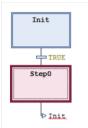
1. In Toolbox, select "Step" and then drag the step element to the position where you want to insert it.



When you drag the step element to the insertion position, the step element is transformed into



2. Stop dragging the mouse. The step element will be inserted.



6.3.3 Inserting Elements from Toolbar

For example, step elements and transition elements can be inserted from the toolbar, as below.

¹² Procedure

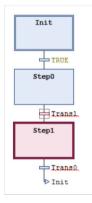
 Select the TRUE transition element in the implementation section. The selected transition element will turn red.

Ir	nit
Ē	TRUE

Click the ⁺ icon ("Insert Step-transition After") on the toolbar.
 "Step0" step element and "Trans0" transition element will be inserted below the TRUE element.

3. Select the "Trans0" transition element and click the ^{₹↑} icon ("Insert Step-transition") on the toolbar.

"Step1" step element and "Trans1" transition element will be inserted above the "Trans0" transition element.



6.3.4 Setting up the SFC Editor

For SFC editor elements, you can change step specifications, fonts, and other settings. From the menu bar, select **Tools>Options** to open the "Options" dialog box. In the "Options" dialog box, select the "SFC editor" category and change the settings.

Layout

Options		×
CFC Editor Declaration Editor Declaration Editor Control Editor FBD, DL and Ll editor FBD, DL and Ll editor FBD, DL and Ll editor FREfactoring FG Editor SmartCoding Text editor	SFC editor	IbCoxtyZz
	L	<u></u>

Item name		Default value	Function		
	Step height	2	Sets the height of a step.		
		2	Setting range: 1 to 100 matrix units ^(Note 1)		
	Char width	6	Sets the width of a step.		
	Step width	0	Setting range: 2 to 100 matrix units ^(Note 1)		
Elements	Action width	6	Sets the width of an action.		
Elements		0	Setting range: 2 to 100 matrix units ^(Note 1)		
	Qualifier width	3	Sets the width of a qualifier.		
		3	Setting range: 2 to 100 matrix units ^(Note 1)		
	Due ve entre estimate		Sets the width of a property.		
	Property width	6	Setting range: 2 to 100 matrix units ^(Note 1)		
Font		-	Sets a font to be displayed on the SFC edited		
			Sets the operation to be performed when an action is added to a step.		
Step Actions and Transition	Default insertion method	Always check	Copy reference: When a step is copied, a link to the step action is also copied. The step that is copied invokes the same action.		
S			Copy implementation:		
			The step action of a step that is copied is embedded. A new action object is copied to a new step.		

Item name		Default value	Function
			Always ask: Which of the above operations is to be executed is checked each time an action is initially added to a step.
			This check box is used to specify whether to display the actions embedded in steps in the navigator pane when an action is added to a step by "Copy implementation".
Embedde d Objects	Show actions and transition objects in navigator pane	Selected	Selected: An action that is embedded in a step by "Copy implementation" is displayed in the Device view or POU view.
			Cleared: An action that is embedded in a step by "Copy implementation" is not displayed in the Device view or POU view.

(Note 1) "1 matrix unit" is equal to the font size specified in Font in **Options>Text editor>Text area** tab.

View

Options				×
CFC Editor Debugging Dedaration Editor Device editor	SFC editor Layout View Property Visbility			
 FBD, LD and IL editor International Settings Load and Save 	Property	Value	With name	^
Monitoring Refactoring SFC editor	Comment Symbol			
SmartCoding Text editor	Specific Section Times Minimal active			
	Actions			¥
	Online ☑ Show step time			
			<u>O</u> K	<u>C</u> ancel

Item name		Default value	Settings	
Property Visibility		Cleared	Specifies whether to display property values and names beside steps, etc.	
			Selected: Displays property values and names	
			Canceled: Does not display property values or names	
Online Display step Selected time		Selected	Specifies whether to display step active time beside the step in online mode	
			Selected: Displays active time	
			Cleared: Does not display active time	

6.3.5 Setting SFC Program Execution Conditions

Setting SFC program execution conditions

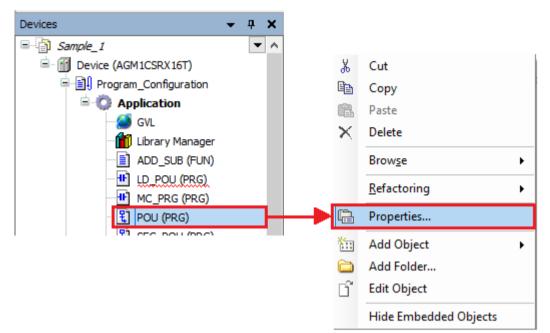
For SFC programs within a project, you can specify whether to generate code for variables used to check processing or for active transitions during build.

From the menu bar, select **Project>Project Settings**. In the Project Settings dialog box, select the "SFC" category.

The settings will be applied to all SFC objects.

Project Settings			>
Compile options	SFC		
Page Setup	Flags Build		
Security	Use Variable	Declare	Description ^
SoftMotion	SFCInit	\checkmark	All steps and actions are reset. T
Static Analysis Light	SFCReset	\checkmark	All steps and actions are reset. T
Static Analysis Light	SFCError	\checkmark	Gets 'TRUE', if a time check failed
Sers and Groups	SFCEnableLimit	\checkmark	Enable time check on steps
	SFCErrorStep	\checkmark	Contains the name of the step th
	SFCErrorPOU	\checkmark	Contains the name of the POU th
	SFCQuitError	\checkmark	Execution is stopped. SFCError is
	SFCPause	\checkmark	Execution is stopped. SFCError is
	SFCTrans	\checkmark	Gets 'TRUE', if a transition switch
	SFCCurrentStep	\checkmark	Contains the name of the active :
	SFCTip	\checkmark	Switches the next transition on a 🗸
	<		>
	Apply to All		
			OK Cancel

The "Properties" dialog box for SFC objects can be enabled for only particular SFC objects. Right-click the POU object in the navigator pane and then select "Properties" from the contextsensitive menu that is displayed.



In the "Properties" dialog box, select the "SFC Settings" tab and clear the "Use default" check box.

Properties - POU	[Device: Program_Configuration: Application]	×	Properties - P	OU [Device: Program_Con	figuration: Ap	plication]
Common SFC S	ettings Build Access Control Bitmap		Common SF	C Settings Build Access	Control Bitma	ар
			Flags	Build		
E	POU		Use	Variable	Declare	Description ^
Full name	POU [Device: Program Configuration: Application]			SFCInit	\checkmark	All steps and actions are reset. Th
- an name	roo [sencerrogram_comgaration represent]			SFCReset		All steps and actions are reset. Th
Object type	POU			SFCError		Gets 'TRUE', if a time check failed.
Open with	Default SFC-POU Editor			SFCEnableLimit	\checkmark	Enable time check on steps
				SFCErrorStep		Contains the name of the step tha
				SFCErrorPOU		Contains the name of the POU tha
				SFCQuitError		Execution is stopped. SFCError is I
				SFCPause		Execution is stopped. SFCError is I
				SFCTrans		Gets 'TRUE', if a transition switche
				SFCCurrentStep		Contains the name of the active s
				SFCTip		Switches the next transition on a r
				SFCTipMode		If 'TRUE', transitions can only be s
				SFCErrorAnalyzation		Contains the possible variables the 🗸
			<			>
			UseD	efaults		
	<u>QK</u> <u>Cancel</u> <u>App</u>	9			9	QK <u>C</u> ancel Apply

Clearing the check box allows settings to be changed and the Properties dialog box to be enabled for only particular SFC objects.

6.4 Programming in Function Block Diagram (FBD)

This section explains how to create programs (FBD programs) in Function Block Diagram compliant with IEC 61131-3, the international standard for PLC programming languages.

- To create FBD programs, POU objects for FBD programs are required. Set the object setup language to Function Block Diagram (FBD).
- The editor for FBD programs is a window like the one shown below. It consists of the declaration section used to declare variables and the implementation section used to enter program data. Elements can be arranged in the implementation section by selecting them from Toolbox and then dragging and dropping them in the implementation section.

POL		-
1	PROGRAM POU	•
2	VAR RID. JAD	
4	END_VAR	
	Declaration section	
	Beolaration Section	
		100 🖻
1		
	Implementation section	
	inplementation sector	
		k 🕂 🔍 100 % 🕅
۲.		>

6.4.1 Entering Function Blocks

This section explains the procedure for entering function blocks, using an FBD program consisting of the following variables and function block TON as an example.

		_	
0	PO	UΧ	· · · · · · · · · · · · · · · · · · ·
	1		DGRAM POU
8	2	VAR	
-	2		TON_0: TON;
	2		byac: Bol; byac: Bol;
	4		
	5		CurrentTime: TIME;
	6		bVarl: BOOL;
	7	END	D_VAR
	8		
			100 🙊
	1		
			TON_0
			TON
			bVar1 DVar1
			I#5s - PT 😾 ET - CurrentTime

1. In Toolbox, select **Function block>TON** and drag the mouse until the mouse pointer reaches the position where "Start here" is displayed in the implementation section.

"Start here" will be displayed in the implementation section.



When you drag the mouse until the position of "Start here" is reached, the display of "Start here" turns green.



When you stop dragging the mouse at the position of "Start here", function block TON will be placed in the network (circuit).



Procedure

12

 Select TON and enter variable TON_0, and then press the <Enter> key. The "Auto Declare" dialog box will be displayed.

Auto Declare			:
<u>S</u> cope VAR	~	<u>N</u> ame TON 0	Type
<u>O</u> bject			Address
POU [Application]	~		
CONSTANT		_	^
PERSISTENT			~
			OK Cancel
			OK Cancer

3. Click the [OK] button.

Instance variable TON_0 for function block TON will be declared in the declaration section.

0	PO		-
	1	PROGRAM POU	
Β	2	VAR	
	3	TON_0: TON;	
	4	END_VAR	
	ь		
		10	0 🔍
	1	A V.	
		TON_0	
		TON	
		222 IN 0 0 FT - 777	
		.222 PI LET 222	

4. Select "???" beside IN of function block TON and enter variable bVar0, and then press the <Enter> key.

The "Auto Declare" dialog box will be displayed.

Auto Declare		×
<u>S</u> cope VAR	Name bVar0	Type BOOL V
Object POU [Application]	Initialization	Address
Elags CONSTANT RETAIN PERSISTENT	Comment	^
		OK Cancel

5. Click the [OK] button.

Variable bVar0 will be declared in the declaration section.

1						
0	POU	J X				•
	1	PROGRAM POU	J			E
	2	VAR				
	3	TON_0:	TON:			
	4	bVar0:				
	5	END_VAR				
	6					
						100 🔍
	1					
	1					
			TON_0			
			TON			
		bVar0	- IN () 0			
		.2.2.2 -				

 In function block TON, enter "T#5s" for input PT ("IN PT") and variable "CurrentTime" for output ET ("O ET").

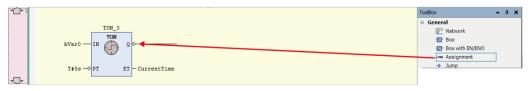
When "CurrentTime" is entered, the "Auto Declare" dialog box is displayed.

Auto Declare				×
<u>S</u> cope VAR	~	<u>N</u> ame CurrentTime	<u>T</u> ype	>
Object POU [Application] Elags	~	Initialization	Address	
CONSTANT RETAIN PERSISTENT				\sim
			OK Cancel	

When making a declaration, check that the type is "Time".

1	POL	U X	
	1	PROGRAM POU	*
8	2	VAR	
	3	TON_0: TON;	
	4	EVar0: BCCL;	
	5	CurrentTime: TIME;	
	8	END_VAR	
	7		
		100	<u>e</u>
[1		
		ION_0	
		bVar0 IN Carlos Commenter State Stat	
		T#5s-PT UP FT CurrentTime	

7. In Toolbox, select **General>Assignment** and drag the mouse until a diamond-shaped icon appears on the right side of output "Q" in function block TON.





When you stop dragging the mouse, "???" appears on the right side of output "Q".

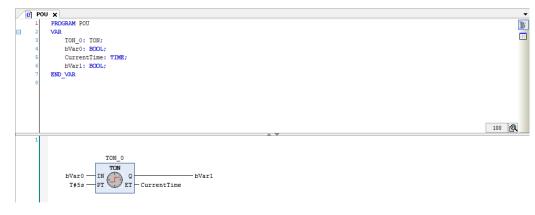


8. Select "???" on the right side of output "Q" and enter variable bVar1, and then press the <Enter> key.

The "Auto Declare" dialog box will be displayed.

Auto Declare		×
<u>S</u> cope VAR	Name bVar1	<u>T</u> ype BOOL ∨ >
Object POU [Application]	Initialization	Address
Elags	Comment	^ ~
		OK Cancel

Declare variable bVar1.



f Info.

• The FBD program can be converted and displayed as an LD program. From the menu bar, select **FBD/LD/IL>View** and select a post-conversion programming language.

6.4.2 Inserting and Commenting out a Network (Circuit)

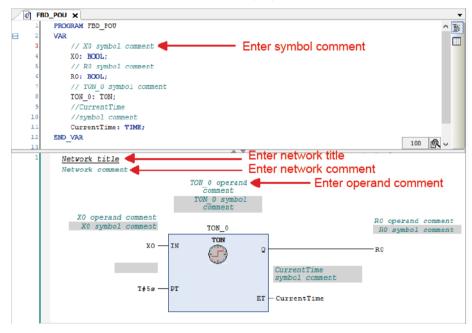
The procedure for inserting a new network (circuit) is the same as for LD programs. Refer to "6.1.3 Inserting a Network (Circuit)".

Networks (circuits) can be commented out. The procedure for commenting out a network (circuit) is the same as for LD programs.

Refer to "6.1.6 Commenting out a Network (Circuit)".

6.4.3 Input of Title and Comment (FBD)

In FBD programs, titles and comments can be entered in the same way as for LD programs. Refer to "6.1.5 Input of Title and Comment (LD)".



6.4.4 Settings in FBD Program

For FBD programs, the following settings can be configured.

Open the Options window (by selecting **Tools>Options**), select the "FBD, LD and IL editors" category and specify settings in the "FBD" tag window.

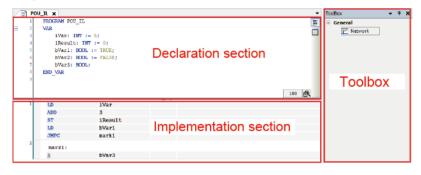
Options			×
 CFC Editor Debugging Dedaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor 	FBD, LD and IL editor Genera FBD <ld< td=""> L Print View Networks with line breaks Onnect boxes with straight line Connect boxes with straight line Onnect boxes with straight line</ld<>	Behavior Default network content After insertion select	Empty V Network V
		<u>O</u> K	<u>C</u> ancel

Туре	Item	Description
View	Networks with line breaks	Selects whether to arrange elements by inserting line breaks automatically so that the display fits in the lateral width of the main pane.
	Connect boxes with straight line	Selects whether to fix the shortest length of a line connecting boxes.
Behavior	Default network content	Selects whether to arrange elements and variables automatically or arrange nothing when a network (circuit) is inserted.
	After insertion select	Selects whether to select a circuit or element after a network (circuit) is inserted.

6.5 Programming in Instruction List (IL)

This section explains how to create programs (IL programs) in Instruction List compliant with IEC 61131-3, the international standard for PLC programming languages.

- IL programs are text-based programs that consist of instructions and operands.
- To create IL programs, POU objects for IL programs are required. Set the object setup language to Instruction List (IL).
- The editor for IL programs is a window like the one shown below. It consists of the declaration section used to declare variables and the implementation section used to enter program data.



- To use POU objects for IL programs, the "Enable IL" check box must be selected as below.
- From the menu bar, select **Tools>Options>FBD**, **LD** and **IL** editors> and select the "Enable IL" check box in the "IL" tab.

6.5.1 Entering Instructions and Operands

This section explains how to create an IL program that consists of the following instructions.

- 11	U	Y UOS				
	1	PROGRAM II	L_POU			
		VAR				
	3	iVar:	INT := 5;			
	4	iResul	lt: INT := 0;			
	5		BOOL := TRUE			
	6	bVar2	BOOL := TRUE	ŧ.		
	7	bVar3	BOOL;			
	8	END_VAR				
-	9					
	3					
	1	LD	iVar 3		-	
		ADD	3			
		ADD ST	3 iResult			
		ADD ST LD	3 iResult bVar1			
	1	ADD ST LD JMPC	3 iResult bVar1			

¹² Procedure

 Select the cell in the first row and the first column, and enter instruction "LD". The LD instruction will be entered.

- Press the <Tab> key to move to another cell and enter operand "iVar". The operand will be entered and the "Auto Declare" dialog box will be displayed. In the "Auto Declare" dialog box, declare a variable.
- Press the <Ctrl> key + <Enter> key simultaneously. The cursor will move to the next row.



In the second and subsequent rows, enter instructions and operands in the same way as above.

1	LD	iVar
	ADD	3
	ST	iResult
	LD	bVar1
	JMPC	mark1

In Toolbox, select General>Network and drag the mouse until
 displayed in the
 network (circuit) in the main pane is reached.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	
2			

A new network (circuit) will be inserted.

 From the menu bar, select FBD/LD/IL>Insert label. "Label" will be inserted.

LD	iVar	
ADD	3	
ST	iResult	
LD	bVar1	
JMPC	mark1	
Label:		

6. Enter label name "mark1" and add instructions and operands to the network (circuit) that has been inserted.

1	LD	iVar	
	ADD	3	
	ST	iResult	
	LD	bVar1	
	JMPC	mark1	
2	mark1:		
	LD	bVar2	
	S	bVar3	

f Info.

- To create IL programs, the "Enable IL" check box in the Options dialog box must be selected. Refer to "6.5.2 Settings in IL Program".
- To delete a row, select the row and press the <Ctrl > key + <Delete> key simultaneously.
- Networks (circuits) can be commented out. The procedure for commenting out a network (circuit) is the same as for LD programs.
 Refer to "6.1.6 Commenting out a Network (Circuit)".
- The IL program can be converted and displayed as an LD or FBD program. From the menu bar, select **FBD/LD/IL>View** and select a post-conversion programming language.

6.5.2 Settings in IL Program

For IL programs, the following settings can be configured.

Open the Options window (by selecting **Tools>Options**), select the "FBD, LD and IL editors" category and specify settings in the "IL" tab window.

Options			×
Options Image: CPC Editor <	FBD, LD and IL editor General FBD LD L Print View Enable IL	Behavior Default network content After insertion select	Empty V Network V
		ОК	Cancel

Туре	Item	Description
View	Enable IL	Enables the use of IL programming language.
		If this check box is cleared, IL will not be displayed in the list of programming languages for setting objects when a new project is created.
Behavior	Default network content	Selects whether to arrange elements and variables automatically or arrange nothing when a network (circuit) is inserted.
	After insertion select	Selects whether to select a circuit or element after a network (circuit) is inserted.

6.6 Programming in Continuous Function Chart (CFC)

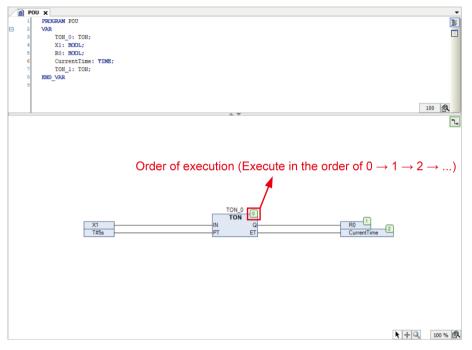
Continuous Function Chart is a graphical programming language that allows programs to be created by arranging elements within the CFC editor. Elements can be freely arranged within the editor and the order of execution is determined according to the list of elements inserted.

- CFC programs are classified into standard CFC programs and page-oriented CFC programs. Page-oriented CFC programs allow page-based switchover.
- To create CFC programs, POU objects for CFC programs are required. Use "Add Object" to add POU objects for CFC programs.

<u>्री</u> F	DU X	
1	PROGRAM FOU	•);;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
2	VAR	
3	END_VAR	
4		
	Declaration section	
	Declaration section	
		100 😰
		٩.
	Implementation section	
	Implementation section	
		k + 🔍 100 % 🕅

6.6.1 Inserting and Connecting Elements

This section explains how to create a CFC program that consists of the variables and function block TON shown below.





1. In Toolbox, select CFC>Box and drag the box element and drop it in the implementation section.

The box element will be placed in the implementation section.



2. Enter an instance name in "???".

The box element will be transformed into function block TON and an instance name can be entered for function block TON.



3. Select TON and enter variable TON_0, and then press the <Enter> key. The "Auto Declare" dialog box will be displayed.

Auto Declare			×
<u>S</u> cope VAR	~	<u>N</u> ame TON_0	<u>T</u> ype TON ✓ >
Object POU_1 [Application]	~	Initialization	Address
Elags <u>C</u> ONSTANT <u>R</u> ETAIN <u>P</u> ERSISTENT		Co <u>m</u> ment	Ŷ
			OK Cancel

4. Click the [OK] button.

Variable TON_0 for function block TON will be declared in the declaration section.

POU	x •
	PROGRAM ECU B
	VAR
3	
5	END_VAR
2	
 _	100 🙊
	N
	TON_0
	TON

5. In Toolbox, select **CFC**>**Input** and drag the input element and drop it in the implementation section.

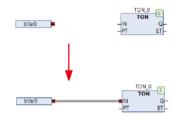
The input element will be placed in the implementation section.



 Enter variable bVar0 in input element "???" and press the "Enter" key. The "Auto Declare" dialog box will be displayed. Declare Boolean variable bVar0.

		· · · · · · · · · · · · · · · · · · ·	
Auto Declare			:
<u>S</u> cope VAR	~	<u>N</u> ame bVar0	Type BOOL >
Object POU_1 [Application]	~	Initialization	<u>A</u> ddress
Elags CONSTANT RETAIN PERSISTENT		Comment	~
			OK Cancel
		bVar0 -	

7. Select the pin on input element "variable bVar0" and drag it to "IN" on TON. Input element "variable bVar0" and "IN" on TON will be connected with a line.



8. In Toolbox, select **CFC**>**Input** and drag the input element and drop it in the implementation section.

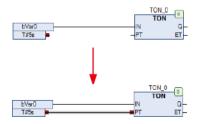
The input element will be placed in the implementation section.



9. Enter "T#5s" in "???" and press the "Enter" key.

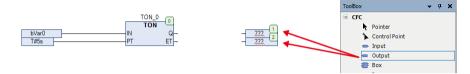


10. Select the pin on input element "T#5s" and connect it to "PT" on TON. Input element "T#5S" and "PT" on TON will be connected with a line.



11. In Toolbox, select **CFC>Output** and drag the output element and drop it in the implementation section.

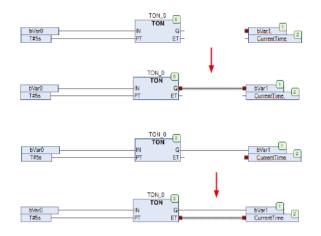
The output element will be placed in the implementation section.



12. Enter variable bVar1 and "CurrentTime" in output element "???" and press the "Enter" key. The "Auto Declare" dialog box will be displayed. Declare a Boolean variable for variable bVar1 and a Time variable for variable "CurrentTime".

Auto Declare		×	
<u>S</u> cope VAR ✓	Name bVar1	<u>T</u> ype BOOL ✓ >	
Object POU_1 [Application]	Initialization	Address	
<u>F</u> lags	Comment		
<u>CONSTANT</u> <u>R</u> ETAIN <u>P</u> ERSISTENT			
		OK Cancel	
	sVar0 #5s	TON_0 TON 0 PT ET	bVar.11 22221
Auto Declare		×	
<u>S</u> cope	Name	Туре	
VAR	CurrentTime	TIME >	
Object POU_1 [Application]		Address	
<u>F</u> lags	Co <u>m</u> ment		
<u>CONSTANT</u> <u>R</u> ETAIN <u>P</u> ERSISTENT		<u>~</u>	
		OK Cancel	
			_

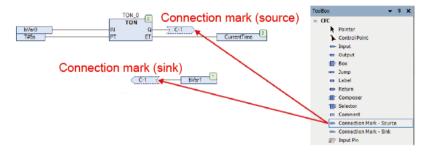
13. Connect output element "variable bVar1" and "Q" on TON and connect output element "CurrentTime" and "ET" on TON.



6.6.2 Connection Mark

Connection marks can be used to separate connection lines.

In Toolbox, select **CFC>Connection Mark - Source** and **CFC>Connection Mark - Sink**, arrange them in the implementation section, and enter the same name for them.





• You can also separate a connection line as a connection mark by selecting **CFC>Connection Mark** from Toolbox or clicking the = icon on the toolbar, with the connection line selected . Conversely, you can restore the connection mark to a connection line by selecting **CFC>Connection Mark** from Toolbox or clicking the = icon on the toolbar, with the connection mark selected.

6.7 Variables

Variables are declared in the main pane of POU objects for programs.

6.7.1 Standard Data Types

GM Programmer allows the following data types to be used as standard data types.

Туре	Туре	Range	Size (in bits)
Truth	BOOL	TRUE (1) and FALSE (0)	8
Integer	BYTE	0 to 255	8
Integer	WORD	0 to 65535	16
Integer	DWORD	0 to 4294967295	32
Integer	LWORD	0 to 2 ⁶⁴ -1	64
Integer	SINT	-128 to 127	8
Integer	USINT	0 to 255	8
Integer	INT	-32768 to 32767	16
Integer	UINT	0 to 65535	16
Integer	DINT	-2147483648 to 2147483647	32
Integer	UDINT	0 to 4294967295	32
Integer	LINT	-2 ⁶³ to 2 ⁶³ -1	64
Integer	ULINT	0 to 2 ⁶⁴ -1	64
Floating-point number	REAL	-3.402823e+38 to 3.402823e+38	32
Floating-point number	LREAL	-1.7976931348623158e+308 to 1.7976931348623158e+308	64
Character string	STRING		(Number of characters + 1) × 8
Character string	WSTRING		(Number of characters + 1) × 16
Time	TIME	0 to 4294967295	32
Time	LTIME	0 to 213503d23h34m33s709ms551us615ns	64
Time	TIME_OF_DAY(TOD)	0 (00:00:00:000) to 4294967295 (11:59:59 PM:999)	32
Date	DATE	0 (1970-01-01) to 4294967295 (2106-02-07)	32
Date and time	DATE_AND_TIME(DT)	0 (1970-01-01,00:00:00) to 4294967295 (2106-02-07,06:28:15)	32

1 Info.

• You can also use user-defined data types such as structure, enumeration, alias, and union. For details, refer to "6.7.6 Structure, Enumeration, Alias, and Union Data Types".

6.7.2 STRING type

The STRING type data can be used by enclosing the data with single quotation marks. Usable characters are half-width English letters (a to z and A to Z), Arabic numerals (0 to 9), symbols, and space characters in the ASCII code.

Characters other than ASCII characters cannot be used correctly.

Possible to set the memory size when declaring variables.

Declaration example of a 35-letter character string:

str : STRING(35):= 'This is a String';

i Info.

• In principle, there are no restrictions on the length of a character string. However, when using character string functions, only the length of 1 to 255 characters are processed. Any characters exceeding 255 characters will be truncated from the right.

6.7.3 WSTRING type

The WSTRING type data can be used by enclosing the data with double quotation marks.

Usable characters are Unicode characters.

Typical example: ASCII characters, hiragana characters, katakana characters, kanji characters, symbols, ancient characters, Korean characters, etc.

Some of them may not be used correctly.

Possible to set the memory size when declaring variables. Declaration example of a 35-letter character string: wstr : WSTRING(35):= "This is a WString";

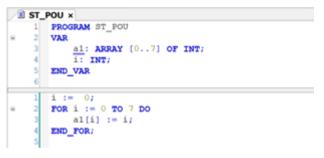
6.7.4 Array

GM Programmer allows the use of arrays.

Using arrays enables multiple data items to be used as a single variable.

This feature is useful when variables of the same type are handled collectively.

Example: When one-dimensional array a1 with eight INT type data items is declared and used in an ST program



i Info.

- Whether indexes are within the declared range can be automatically checked when variables in an array are accessed. Use a POU for implicit checks that checks boundaries. For details, refer to "5.7 POU for implicit checks".
- Using the array wizard for auto declaration enables array variables to be declared only by entering index and base types. For details, refer to "5.2.3 Auto Declaration".

6.7.5 Subrange Types

GM Programmer allows the use of subrange types. Subrange types allow the user to specify the range of values for standard data types.

The following is a declaration example of subrange type variables in character string format. If an attempt is made to substitute an out-of-range value for a variable, an error will be displayed during build.

	ST_	POU ×
	1	PROGRAM ST_POU
	2	VAR
	3	i : INT (-255255);> INT type value within the range between -255 and 255
	4	$ui : USINT (0100); \longrightarrow USINT type value within the range between 0 and 255$
	5	END_VAR
	6	
	1 2 3	$i := \frac{300}{105};$ Out-of-range error

Subrange types can also be declared in table format.

ST_POU X													
۰ ای	$\mathbb{P}\left[X \right]$				PROGRAM ST_POL								
^	Scope	Name	Address	Data type	Initialization	Comment	Attributes						
1	🖗 VAR	i		INT (-255255)									
2	🖗 VAR	ui		USINT (0100)									



• Whether values are within the declared range can be automatically checked when subrange type variables of the DINT, UDINT, LINT, or ULINT data type are accessed. Use a POU for implicit checks that checks ranges. For details, refer to "5.7 POU for implicit checks".

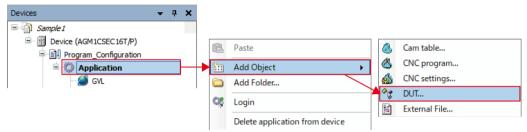
6.7.6 Structure, Enumeration, Alias, and Union Data Types

User-defined structure, enumeration, alias, and union data types can be declared using DUT objects.

When using these data types, add DUT objects to the project.



1. Right-click the [Application] object in the navigator pane and then select Add Object>DUT from the context-sensitive menu that is displayed.



The "Add DUT" dialog box will be displayed.

The name in the "Name" field will be used as the name when the data unit type is accessed by programs.

Add DUT	×
Create a new data uni	it type
<u>N</u> ame	
DUT	
<u>Type</u> ⊚ <u>S</u>tructure	
Extends	
<u>E</u> numeration <u>T</u> extlistsupport	
○ <u>A</u> lias Base type	>
○ <u>U</u> nion	
	Add Cancel

2. Select a data type to be defined, enter the necessary information, and then click the [Add] button.

A DUT object for defining the selected data type will be added to the navigator pane.

Example: Adding a structure data type



3. Select an object to be added and enter definitions in the main pane. How to define and use each data type is described below.

Structure

The following is an example of declaring structures struct1 and struct2. struct2 is an extended structure of struct1.

To extend a structure before declaration, select the "Extends" check box in "Step 2" and enter an extension declaration.

Add DUT	X
Create a new data unit type	
Name struct2 Iype © Structure	
Extends struct1 Enumeration Textistsupport	
○ Alias Base type ○ Union	
Add Cancel	
♦ struct1 ×	♦ struct2 x
1 TYPE struct1 :	1 TYPE struct2 EXTENDS struct1 :
STRUCT 3 member1 : INT:	STRUCT 3 member3 : BOOL:
<pre>3 member1 : INT; 4 member2 : INT;</pre>	<pre>3 member3 : BOOL; 4 member4 : BOOL;</pre>
5 END STRUCT	5 END STRUCT
6 END TYPE	END_STRUCT
7	7

The variable declared as a variable for structure struct2 can access the members of struct1 and struct2.

	5T_POU 🗙 🏘 struct1 🏘 struct2
1	PROGRAM ST_POU
3 2	VAR
3	C : struct2;
4	END_VAR
5	
	C.member1 := 10;
1	
1	

Example: An ST program that accesses members of structure struct2

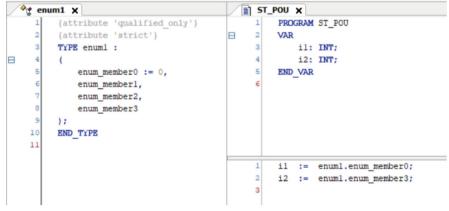


• The BIT data type can be used as members of a structure. TRUE (1) or FALSE (0) can be used as a value. The size of the BIT data type is one bit.

Enumeration

The following are a declaration that defines enumeration enum1 and an example of an ST program that accesses members of enum1.

"0" and "3" are substituted for variables iVar0 and iVar1, respectively.

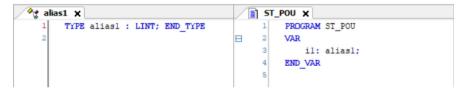


Alias

An alias can be used to assign a user-defined name as the name of a data type. Declare a variable by using an alias defined in the declaration section.

The following are an alias declaration that defines alias "alias1" for LINT and an example of a declaration section that declares variable iVar0 of the alias1 data type.

Variable iVar0 declared as the alias1 data type is handled as a variable for the LINT data type.



Union

The following are a union declaration that defines union "union1" and an example of an ST program that accesses members of union1.

ి uni	on1 X			۱ :	5T_P(DU :	×		
1	TYPE union1 :			1	1	PROC	RAM	ST	POU
2	UNION		B	2	1	VAR			
з	memberl :	BOOL;		3			u	:	union1;
4	member2 :	BOOL;		4			bl	:	BOOL;
5	member3 :	BOOL;		5			b2	:	BOOL;
6	member4 :	BOOL;		e	1	END	VAR		
7	END_UNION			7					
8	END_TYPE								
9									
				1	. 1	b1	:=	u.1	nemberl;
				2	1	b2	:=	u.I	nember3;
I									

6.7.7 Constants

GM Programmer allows the use of constants. Constants are declared according to the following syntax. VAR CONSTANT Constant name:Type:=Default value; END_VAR

Туре	Constant type	Description				
BOOL	BOOL	TRUE (1), FALSE (0)				
Integer	Types that can be used as numerical values	Binary, octal, decimal, and hexadecimal numbers For numbers other than decimal numbers, integer constants are entered after number base and #. Examples: 14, 2#0101, 8#27, 16#34AB				
Decimals and exponents	REAL / LREAL	Decimals and exponents Examples: 1.4, 2.34e+008				
Time	TIME	32-bit time constants compliant with IEC 61131-3 Syntax: t#, T#, time#, TIME# Examples: T#12ms, T#12h32m24s				
Time	LTIME	64-bit time constants In addition to TIME constants, the following units can be used. Microsecond: m Nanosecond: ns Syntax: LTIME# Example: LTIME#123m456ns				
Time	TIME_OF_DAY	Time Syntax: tod#, TOD#, time_of_day#, TIME_OF_DAY# Example: tod#12:24:20.123				
Date	DATE	Date Syntax: d#, D#, date#, DATE# Example: d#2018-01-01				
Date and time	DATE_AND_TIME	Date and time Syntax: dt#, DT#, date_and_time#, DATE_AND_TIME# Example: dt#2018-01-01-07:04:13				
Character	STRING	Enclosed with single quotation marks Example: 'Hello World'				
string	WSTRING	Enclosed with double quotation marks Example : "Hello World"				

6.7.8 Object for Global Variable Declaration

GM Programmer allows the use of global variables that can be used within the entire project.

Global variable list

This is an object for declaring global variables.

Variables declared in the global variable list can be accessed by using "object-name.global-variable-name" in the global variable list.

Example: When variables in global variable list "Object GVL" are accessed by an ST program



For details, refer to "6.7.9 Global Variables".

Persistent variable list

This is an object for declaring global variables that are persistent variables. From "Add Object", select "Persistent Variables".

For details, refer to "6.7.10 Persistent Variables".

6.7.9 Global Variables

GM Programmer allows the use of global variables that can be used with all projects. Global variables are declared within the global variable list (GVL) object. This section explains how to declare global variables and access the declared variables.

1₂ Procedure

1. Double-click the GVL object in the navigator pane.

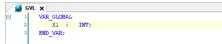


The GVL window will be displayed in the main pane.

GVL	LX	•
1	VAR_GLOBAL	1
2	END_VAR;	
		100 🕵

2. Declare variables in the global variable list (GVL).

Example: Declaring global variable g_iVar0 of INT data type



The declared variable can be accessed from the program by using "name.variable name".

¥

Example: Substituting value "5" for global variable g_iVar0





f Info.

- Variables declared before the build process can be imported and exported in XML format.
 - Right-click the object in the global variable list and then select "Properties" from the contextsensitive menu that is displayed. The "Properties" dialog box will be displayed. Open the "Link To File" tab window, select either the check box for import or the check box for export, and enter the path to the file to be imported or exported in the File name field.

Properties - GVL [Device: Program_Configuration: Application]	×
Common Link To File Build Access Control	
 File name Import before compile Export before compile 	
<u>O</u> K <u>C</u> ancel <u>Apply</u>	

6.7.10 Persistent Variables

GM Programmer allows the use of global variables that are persistent variables which hold values without initializing them at the time of reset.

Persistent variables that can be used as global variables are declared within the persistent variable list object.

Only one persistent variable list object can be registered.

¹² Procedure

1. Right-click the [Application] object in the navigator pane and then select Add Object>Persistent Variable from the context-sensitive menu that is displayed.

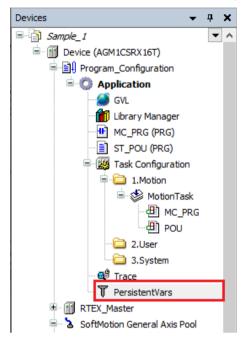


The "Add Persistent Variable" dialog box will be displayed.

Add Pe	ersistent Variables X
T	Create a new global variable list
Name	
_	tentVars
	Add Cancel

Enter a name for the persistent variable list and click the [Add] button.
 A "Persistent variable list" object will be added to the navigator pane.

Example: Persistent variable list object with name "PersistentVars"



3. Declare variables in the persistent variable list.

Example: Declaring global variable g_iVar0 that is a persistent variable of INT type

) MC	IC_PRG Service Structure Service Se	▼
	1	{attribute 'qualified_only'}	I I I I I I I I I I I I I I I I I I I
8	2	VAR_GLOBAL PERSISTENT RETAIN	
	з	g_iVar0 : INT;	
	4		
	5	END_VAR	
			100 🔍

The declared variable can be accessed from the program by using "name.variable name".

Example: Substituting value "6" for global variable g_iVar0 that is a persistent variable



f Info.

- Persistent variables used as local variables can be declared (as VAR PERSISTENT RETAIN) in the declaration section for each POU object.
- If you update the variable registered in the persistent variable, the retained data of the persistent variable will be cleared at the time of download, so perform the "14.5.5 Saving and restoring persistent variables" operation.
- Instance paths of persistent variables declared in each POU object can be added to the persistent variable list.

With the persistent variable list declaration section selected, from the menu bar, select **Declare>Add All Instance Paths**.



B

7 Connecting the GM1 Controller and PC

7.1 Flow of Operation Check	7-2
7.2 Connecting the GM1 Controller and PC 7 7.2.1 Selecting a Connection Port for GM Programmer 7 7.2.2 Connecting the GM1 Controller and PC with a Cable 7	7-3
7.3 Communication Setting. 7 7.3.1 Setting the LAN Port 7 7.3.2 Adding USB Ports 7	7-4
7.4 Time Function 7 7.4.1 Settings Based on GM Programmer 7 7.4.2 Settings Based on Function Blocks 7	7-7
7.5 Connecting to the GM1 Controller	7-8
7.6 Login / Logout 7 7.6.1 Login 7 7.6.2 Logout 7 7.6.3 Download 7 7.6.4 Online Change 7	7-11 7-12 7-12
7.7 Source Upload	
7.8 Other Settings 7 7.8.1 Changing the Device Name 7 7.8.2 Sending Echo services 7 7.8.3 Device preference management 7	7-17 7-18
7.8.4 Confirmed online mode	7-22

7.1 Flow of Operation Check

This chapter explains how to connect the PC where GM Programmer is installed and the GM1 controller and operate the GM1 controller from the PC.

First, this section explains the flow of operation check for a program that is created.

1. Build(Refer to "5.9 Build")

Execute build to check a program that is created. If an error occurs, correct the program and execute build again. If code generation is executed after build is completed normally, an application will be generated.



2. Connecting to the GM1 controller(Refer to "7.3 Communication Setting")

Connect the PC where GM Programmer is installed to the GM1 controller.

3. Login(Refer to "7.6.1 Login")

Log in to the GM1 controller. When you log in to the GM1 controller, applications are downloaded to the GM1 controller.



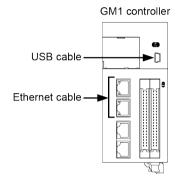
4. Debug(Refer to "8 Debug")

Execute the application and perform debugging. If there are any problems with behaviors, log out of the GM1 controller, correct the problem, and execute build again.

7.2 Connecting the GM1 Controller and PC

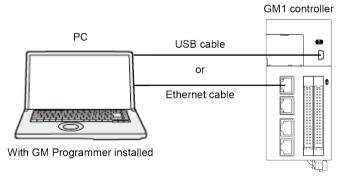
7.2.1 Selecting a Connection Port for GM Programmer

Select either LAN port connection or USB port connection.(Image is the GM1 RTEX)



7.2.2 Connecting the GM1 Controller and PC with a Cable

Use an Ethernet cable or USB cable to connect the GM1 Controller and a PC on which the GM Programmer is installed.



7.3 Communication Setting

7.3.1 Setting the LAN Port

Configure communication settings for the LAN port using "Network setting" in the "PLC Parameters" tab.

When connecting GM Programmer and the GM1 Controller via the LAN port, match the network settings of the PC with those of the GM1 Controller.



- Double-click the "Device(AGM1CSEC16T/P)" object in the navigator pane. The device editor will open.
- 2. Open the "PLC Parameters" tab.

nmunication Settings	Parameter	Туре	Value	Default Value	Unit	Description
	👝 🖗 A unit error occurred	Enumeration of BYTE	Stop operation	Stop operation		Please select the operation when a unit error occurred.
e and Time and Settings	🖹 - 🔌 Network setting					Network setting
olications	🖹 - 🖗 LAN port1					LAN port1 network settings
pricacions	🧼 🖗 IP Address	STRING	'192.168.1.5'	'192.168.1.5'		Specify the ip address for LAN port1.
	🖤 🖗 Subnet Mask	STRING	'255.255.255.0'	'255.255.255.0'		Specify the subnet mask for LAN port1.
209	Default Gateway	STRING	'192.168.1.1'	'192.168.1.1'		Specify the default gateway for LAN port1.
ers and Groups	🖹 - 🖗 LAN port2					LAN port2 network settings
	IP Address	STRING	'192.168.2.5'	'192.168.2.5'		Specify the ip address for LAN port2.
ess Rights	🖤 🖗 Subnet Mask	STRING	'255.255.255.0'	'255.255.255.0'		Specify the subnet mask for LAN port2.
	Default Gateway	STRING	'0.0.0'	'0.0.0.0'		Specify the default gateway for LAN port2.
C Shell						

- **3.** Check the network settings of the GM1 Controller and match the network settings of the PC with those of the GM1 Controller.
- 4. Open the "Communication Settings" tab and click "Network scan".
- 5. Select a GM1 Controller to which you want to connect and click the [OK] button.

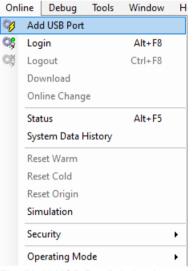
 If the network settings of the GM1 Controller have been changed, the changes will take effect after the project is downloaded.

7.3.2 Adding USB Ports

This function allows the user to set a USB port as the communication interface between a tool such as GM Programmer or PANATERM Lite for GM and the GM1 Controller.

¹² Procedure

- 1. Connect the GM1 Controller and PC with a USB cable.
- 2. From the menu bar, select Online>Add USB Port.



The "Add USB Port" dialog box will be displayed.

Add &USB Port		\times
USB Port		
Device:	Panasonic GM USB-COM	
Port:	COM3	
	OK Cancel	

3. Click the [OK] button.

A dialog box to restart the Gateway will be displayed.



4. Click the [OK] button.

The "Select Device" dialog box will be displayed.

elect Device Select the network path to the controller:		;
🖃 🦂 🖕 Gateway-1	Device Name:	Scan Network
AGM1CSEC16T/P [0005]	Gateway-1	<u>W</u> ink
	Driver:	
	TCP/IP	
	IP-Address:	
	localhost	
	Port:	
	1217	
		<u>C</u> ancel

 Select a GM1 Controller to which you want to connect and click the [OK] button. When the connection is completed, a dialog box will be displayed to notify successful connection.

GM Programmer	×
USB port added successf	ully.
0	K

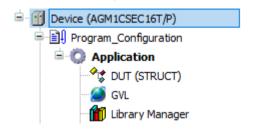
6. Click the [OK] button.

A USB port will be added as the communication interface between the PC and GM1 Controller.

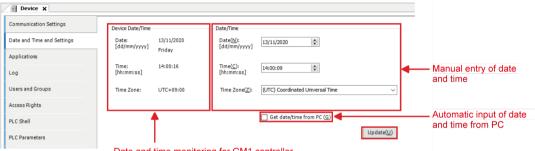
7.4 Time Function

7.4.1 Settings Based on GM Programmer

Date and time settings and monitoring for the GM1 controller can be performed using the "Date and Time Settings" window of GM Programmer. Connect to the GM1 controller and select the "Date and Time Settings" tab of the "Device" window.



Date and Time Settings pane





The "Device Date and Time" frame on the left side of the pane displays the date / time information of the GM1 controller. To set date and time, enter date and time in the "Date and Time" frame on the right side of the pane and click the [Update] button. The entered date and time will be set in the GM1 controller.

If the "Get date / time from PC" check box is selected, the date/time information of the PC will be automatically set in the GM1 controller. In this case, the time zone of the PC will be automatically set in the GM1 controller.

7.4.2 Settings Based on Function Blocks

With the GM1 controller, you can obtain and set the current time, obtain and set a time zone, and obtain the SNTP time.

For details on how to use this function, refer to the *GM1 Series Reference Manual (Instruction Edition)*.

7.5 Connecting to the GM1 Controller

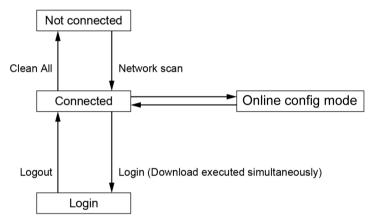
Connect the PC where the GM Programmer is installed to the GM1 Controller.

The connection status of the PC includes "Connected", "Connection as a device user", "Login", and "Online config mode".

Depending on the connection status, operations that can be executed are different. If the Controller is provided with a device user registration, connection must be made as the

device user.

Without device user registration



List of available GM1 Controller operations

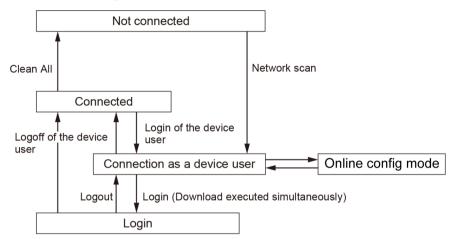
Function	Not connected	Connected	Login	Online config mode
Setting / acquiring Controller information	×	0	_O (Note 1)	×
Application management	×	×(Note 2)	0	×
Reset	×	×(Note 3)	0	×(Note 4)
Security	×	×	0	0
Debug	×	×	0	×
Commissioning	×	×	×	0

(Note 1) Not possible to operate the PLC Shell.

(Note 2) Possible to upload the source.

(Note 3) Possible to reset the device (PLC initialization) or to delete device application from the device.

(Note 4) Possible to reset the device (PLC initialization).



With device user registration

List of available GM1 Controller operations

Function	Not connected	Connected	\as a device user	Login	Online config mode
Setting / acquiring Controller information	×	×	0	_O (Note 1)	×
Application management	×	×	×(Note 2)	0	×
Reset	×	×	×(Note 3)	0	×(Note 4)
Security	×	×	_O (Note 5)	0	0
Debug	×	×	×	0	×
Commissioning	×	×	×	×	0

(Note 1) Not possible to operate the PLC Shell.

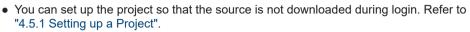
(Note 2) Possible to upload the source.

- (Note 3) Possible to reset the device (PLC initialization) or to delete device application from the device.
- (Note 4) Possible to reset the device (PLC initialization).
- (Note 5) Addition of the device user, changing the password for the device user, or deletion of the device user cannot be made if the user of the Device Editor is not synchronized with "Synchronization" of the group tab.

7.6 Login / Logout

GM Programmer allows the user to log in to the GM1 controller.

• During login, the application and source code generated by code generation are downloaded to the GM1 controller.



- The combination of the application and source code downloaded to the GM1 controller differs according to the operations shown in the table below.
- o: Downloaded

×: Not downloaded

Operation	Boot application	Source code
Login	0	0
Initial download	0	0
Downloading after changing the program "Update boot project"check box: Selected	0	0
Downloading after changing the program "Update boot project"check box: Cleared	×	x
Downloading after changing the project	0	0
Online change "Update boot project"check box: Selected	0	0
Online change "Update boot project"check box: Cleared	×	x
Generating a boot application	0	0

After logging in to the GM1 controller, you can perform debug operations such as starting or stopping the GM1 controller.

7.6.1 Login

GM Programmer allows the user to log in to the GM1 Controller. When "Login" is executed, applications are downloaded to the GM1 Controller.

¹² Procedure

1. From the menu bar, select **Online>Login**, or press the <Alt> key and the <F8> key simultaneously.

A confirmation message will be displayed, asking whether to download the applications to the GM1 controller (device).

GM Prog	rammer X
?	Application 'Application' does not exist on device 'Device'. Do you want to create it and proceed with download?
	Yes No Details

2. Click [Yes].

The applications will be downloaded to the GM Programmer at the same time as you log in to the GM1 Controller (device).

"connected" will be displayed at the [Device] object in the navigator pane and the status of the downloaded applications will be displayed.

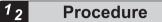




- You can also log in by clicking 🌋 on the toolbar.
- If you log in again after the applications have been downloaded, the confirmation message will not be displayed.

7.6.2 Logout

This function allows the user to log out from the device to which the user logged in.



 From the menu bar, select Online>Logout, or press the <Ctrl > + <F8> key simultaneously. You will be logged out.

f Info.

You can also log out by clicking ^{III} on the toolbar.

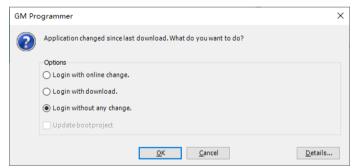
7.6.3 Download

After changing programs and logging in without executing online change, you can download applications while being logged in.

The boot application is also updated during download.



1. When executing"login", select"Login without any change"and click the[OK]button.



Applications will not be downloaded to the GM1 controller.

2. From the menu bar, selectOnline>Download.

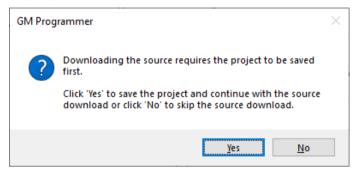
A confirmation message will be displayed, asking whether to download the source code to the GM1 controller.

GM Programmer	\times
Po you really want to perform the operation 'Download'?	
<u>Y</u> es <u>N</u> o	

3. Click[Yes].

If the project has not yet been saved, a confirmation message will be displayed, asking whether to save the project.

4. If you do not save the project, the source code will not be downloaded. In this case, click the[Yes]button.



1 Info.

- To delete the downloaded source code from the GM1 controller, execute "Reset Device". For details on reset, refer to "8.8.1 Reset Warm, Reset Cold, and Reset Origin".
- You can set up the project so that the source is not downloaded while the application is downloaded. Refer to "4.5.1 Setting up a Project".

7.6.4 Online Change

Online change allows the user to change applications without having to stop the GM1 controller during operation. Executing online change downloads only different applications to the GM1 controller.

If the applications generated by build during login differ from the applications within the GM1 controller, the following dialog box will be displayed.

GM Pro	ogrammer	×
?	Application changed since last download. What do you want to do?	
	Options	_
	Login with online change.	
	🔿 Login with download.	
	🔿 Login without any change.	
	Update bootproject	
	· · · · · · · · · · · · · · · · · · ·	
	<u>QK</u> <u>Cancel</u> <u>D</u> etails	

Login with online change

Executes login by downloading only different applications without stopping the GM1 controller

Login with download

Executes login by downloading applications generated by build with the GM1 controller stopped

Login without any change

Executes login without downloading the applications generated by build

1 Info.

- Do not clear the "Update bootproject" check box. If you clear the check box, the applications will not be saved when the GM1 controller is turned OFF.
- When changing the initial value of a variable with online change, be sure to add "attribute 'init_on_onlchange'" declaration to the attribute of the target variable.

If the declaration is not added, the initial value changed with online change will not be applied.

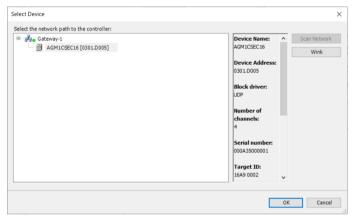
1	📄 МС	PRG 🗙						
🦻 🕆 🔅 🗙				PROGRAM MC_PRG				
	^	Scope	Name	Address	Data type	Initial Value	Comment	Attributes
	1	🖗 VAR	data		INT	5		attriute 'init_on_onlchange'

7.7 Source Upload

Upload the source code from the GM1 controller to the PC and retrieve it, as below.



 From the menu bar, select File>Source Upload(Device→PC). The "Select Device" dialog box will be displayed.



2. Select the GM1 controller from which the source code is to be retrieved and click the [OK] button.

The "Extract Project Archive" dialog box will be displayed.



i Info.

• If the source code does not exist in the selected GM1 controller, the following error message will be displayed.



3. Specify the upload destination folder and click the [Extract] button.

A confirmation dialog box will be displayed, asking whether to open the uploaded source code as a project file. Click the [Yes] button to open the uploaded source code as a project file.

GM Prog	rammer	\times
?	Do you want to open the project which has been extracted from the project archive?	
	<u>Y</u> es <u>N</u> o	

4. In the folder specified as the upload destination, "Archive.prj" and "<project name>.project" will be created.

Name	Date modified	Туре
Archive.prj	2020/11/11 13:43	PRJ File
Sample1.project	2020/11/11 13:43	GM Programmer

7.8 Other Settings

For the connected device, configure settings described in "Change Device Name", "Sending Echo services", "Device preference management", and "Confirmed Online Mode".

7.8.1 Changing the Device Name

This section explains how to change the name of the device connected via "Network Scan".



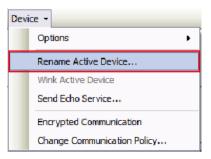
1. Double-click the "Device" object in the navigator pane.



The setting pane will be displayed in the main pane.

Communication Settings	Scan Network	Gateway 🔹 Device 👻	
Date and Time and Settings			
Applications			
Log			
		Gateway	
Users and Groups		Gateway-1	✓ [0347.A064] (active) ✓
Access Rights		IP-Address: localhost	Device Name: AGM1CSRX16T
PLC Shell			Device Address:
		Port: 1217	0347.A064
PLC Parameters			Target ID:
Task Deployment			16A9 0001
Status			Target Type: 4102
			Target Vendor:
Information			Panasonic Corporation
			Target Version: 1.0.0.0

 Select "Rename Active Device" from the "Device" menu. The "Change Device Name" dialog box will be displayed.



3. Enter a new device name and click the [OK] button. The device name will be changed.

Change Device	Name		×
Device name			
Current	AGM1CSRX16T1		
New	Device		~
		ОК	Cancel

7.8.2 Sending Echo services

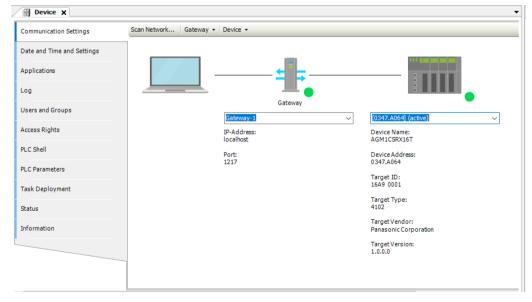
This section explains how to send Echo services to the device connected via "Network Scan". Echo services can be used to conduct a network test.

¹² Procedure

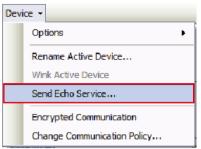
1. Double-click the "Device" object in the navigator pane.

	Sample 1	^
ė	Device (AGM1CSRX16T)	
	Program_Configuration	

The setting pane will be displayed in the main pane.



2. Select "Send Echo Service" from the "Device" menu.



The results of five transmissions with no data size followed by five transmissions with data size will be displayed.

GM Prog	rammer	Х
1	Average echo time for 5 services: 24.54ms Each service was sent and received with a payload of 0 bytes. #1: 13 ms #2: 50 ms #3: 14 ms #4: 25 ms #5: 21 ms	
	Average echo time for 5 services: 2202.11ms Each service was sent and received with a payload of 95736 bytes. #1: 2215 ms #2: 2219 ms #3: 2202 ms #4: 2172 ms #5: 2200 ms	
	ОК	

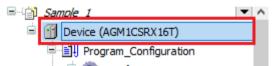
7.8.3 Device preference management

Devices connected via "Network Scan" can be managed by registering them as favorite devices.

Devices registered as favorite devices will be displayed in the device selection list in the Communication Settings window.

¹² Procedure

1. Double-click the "Device" object in the navigator pane.



The setting pane will be displayed in the main pane.

Communication Settings	Scan Network Gateway - Device -	
Date and Time and Settings		
Applications		
Log		
Users and Groups	Gateway-1	y (0347.A064) (active) ✓
Access Rights	IP-Address:	Device Name:
PLC Shell	localhost Port:	AGM1CSRX16T Device Address:
PLC Parameters	1217	0347.A064
Task Deployment		Target ID: 16A9 0001
Status		Target Type: 4102
Information		Target Vendor: Panasonic Corporation
		Target Version: 1.0.0.0

2. From the "Device" menu, select "Options" and then "Add Current Device to Favorites". The connected device will be registered as a favorite device.

Devi	ce 🕶		
	Options •		Add Current Device to Favorites
	Rename Active Device		Manage Favorite Devices
	Wink Active Device	~	Filter Network Scans by Target ID
	Send Echo Service		Confirmed Online Mode
	Encrypted Communication	~	Store Communication Settings in Project
	Change Communication Policy	[

i Info.

• Devices registered as favorite devices can be viewed in the "Manage Favorite Devices" dialog box.

The "Manage Favorite Devices" dialog box can be displayed by selecting "Options" and then "Manage Favorite Devices" from the "Device" menu.

Manage Favorite Devices			×
🕂 Add 💻 Delete 🔹 M	ove down 🕆 Move up		
Identifier	Description		
PC-PA2011C0084R	Connect using device name		
[0F40.A064]	Connect using device address		
The topmost item will be	the default for new projects or devi	ices.	OK Cancel

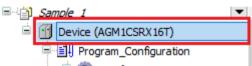
7.8.4 Confirmed online mode

A confirmation message can be displayed when an attempt is made to implement the following actions.

- Login
- Operation
- Stop
- Single Cycle
- Force Values
- Write values
- Unforce Values

1₂ Procedure

1. Double-click the "Device" object in the navigator pane.



The setting pane will be displayed in the main pane.

Device X					
Communication Settings	Scan Network Gateway	Device 🔹			
Date and Time and Settings					
Applications					
Log			—		
Users and Groups		Gateway-1	Gateway	~	[0347.A064] (active)
Access Rights		IP-Address: localhost			Device Name: AGM1CSRX16T
PLC Shell		Port: 1217			Device Address: 0347.A064
PLC Parameters		1217			Target ID:
Task Deployment					16A9 0001
Status					Target Type: 4102
Information					Target Vendor: Panasonic Corporation
					Target Version: 1.0.0.0
	1				

2. From the "Device" menu, select "Options" and then "Confirmed Online Mode".

Devi	ce 🔻		
	Options •		Add Current Device to Favorites
	Rename Active Device		Manage Favorite Devices
	Wink Active Device	~	Filter Network Scans by Target ID
	Send Echo Service		Confirmed Online Mode
	Encrypted Communication	~	Store Communication Settings in Project
	Change Communication Policy	_	

When an attempt is made to log in with "Confirmed Online Mode" selected, the following message is displayed.

GM Prog	rammer	\times
?	Are you sure you want to login to the node 'Device' with address '0F40,A064'?	
	<u>Y</u> es <u>N</u> o	

(MEMO)

8 Debug

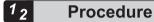
 8.1 Running and Stopping the GM1 Controller	8-3
 8.2 Breakpoint	8-6 8-8
 8.3 Debug Operations	8-11 8-13
8.4 Monitoring Function	8-16
8.5 Simulation Function	8-19
 8.6 Trace Function	8-20 8-29 8-33
 8.7 Visualization Function	8-40 8-56 8-64 8-65
 8.8 Reset of Controller	8-98 8-99
 8.9 Checking the Status of GM1 Controller	8-101 8-103 8-104 8-104
 8.10 Checking the Performance of GM1 Controller	8-112

8.11 Error Notification Function	8-116
8.11.1 Overview of Errors	
8.11.2 Checking and Clearing Errors Using GM Programmer	
8.11.3 Obtaining Error Information Using User Programs	
8.11.4 Error Recovery Processing	
8.11.5 Error Code List	8-123

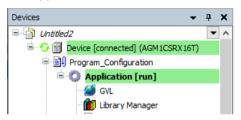
8.1 Running and Stopping the GM1 Controller

This section explains how to run and stop the GM1 controller and how to run a single cycle operation that is executed in units of a cycle.

8.1.1 Running and Stopping the GM1 Controller



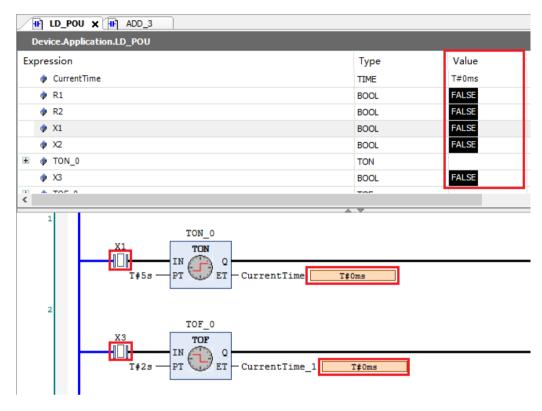
1. After logging in, from the menu bar, select **Debug>Start** or press the <F5> key. The applications downloaded to the GM1 controller will start running.



2. From the menu bar, select **Debug**>**Stop**, or press the <Shift> key + <F8> key simultaneously.

The applications will be stopped.

During debug operation, you can check the current value of each variable in the declaration section and implementation section.

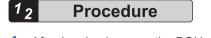




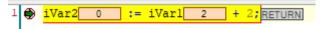
- You can start the GM1 controller by clicking ▶ on the toolbar and also stop it by clicking .
- You can select binary, decimal, or hexadecimal as the display format of the variable values to be displayed. From the menu bar, select **Debug>Display Mode** and select a display format from those shown.
- If you select confirmed online mode, a confirmation message will be displayed before you start or stop the GM1 controller. For confirmed online mode, refer to "7.8.4 Confirmed online mode".

8.1.2 Single Cycle

You can execute the application in simulation mode in a single cycle to check whether a created program is executed as intended.



1. After logging in, open the POU.



2. From the menu bar, select Debug>Single Cycle or press <Ctrl+F5>.

The opened POU will enter a state in which it has been executed in a single cycle.

1 (ivar2 4 := ivar1 2 + 2; RETURN

8.2 Breakpoint

By setting a breakpoint in a particular position in a program, you can forcibly stop executing the program and check the variable values.

All programming languages support breakpoints.

8.2.1 Setting a Breakpoint

¹₂ Procedure

 Select a position where you want to set a breakpoint. From the menu bar, select Debug>Toggle Breakpoint or press the <F9> key. The breakpoint will be enabled.

Example: Setting a breakpoint in line 12 in an ST program

11	•	FB_inst.iVar0 0	:=10;
12			:=20;
13	•	FB_inst.iVar2 0	:=30;
14	•	FB inst() ;	

If operation is started, the operation will be stopped when the position of the set breakpoint is reached.

11 🔴	FB_inst.iVar0 10	:=10;
12 🔿	FB_inst.iVarl 0	:=20;
13 🔴	FB_inst.iVar2 0	:=30;
14 👄	FB inst() ;	

In the stopped state, the following debug operations can be executed.

From the menu bar, select "Debug" and then one of the following menu items.

Menu item	Shortcut key	Icon on the toolbar
Step Over	<f10></f10>	Ç≡
Step Into	<f8></f8>	۴I
Step Out	<shift> + <f10></f10></shift>	¢.
Run to Cursor	None	+重
Set next Statement	None	3
Show next Statement	None	\$

To cancel set breakpoints, from the menu bar, select **Debug>Toggle Breakpoint** or click the <F9> key again.

100 🔍 🗸

100 🔍 🗸

1 Info.

• You can specify conditions under which operation is stopped when a breakpoint is reached. From the menu bar, select **Debug>New Breakpoint**. The "New Breakpoint" dialog box will be displayed. Select the "Condition" tab and specify conditions under which operation is stopped when a breakpoint is reached.

New Breakpoint	×
Condition Location Execution Point Settings	
Tasks	
Only break if the breakpoint is hit in one of the following tasks	
☐ MotionTask ☐ UserTask01	
Hit Count	
Break always 🗸 🗸	
Condition	
Break, if true	
Enable breakpoint immediately OK Can	icel

• The Breakpoint view allows the user to check a list of set breakpoints. You can check breakpoint positions, break conditions, and the hit count was reached. You can also add, delete, enable, and disable breakpoints.

To display the Breakpoint view, from the menu bar, select View>Breakpoint.

Application: Application [Device: Program_Configuration] Image: Configuration [Device: Program_Configuration] Image: Configuration [Device: Program_Configuration] POU Location Instance Path Tasks Condition Hit Count Condition Current Hit Count Watched Value DepOU Network 1/Operand TON_0' (Impl) (any) (any) Break always Break always Break always Break always 	Breakpoints							→ ∓ ×
LD_POU Network 1 / Operand 'TON_0' (Impl) (any) (any) Break always Break always 0	Application: Ap	plication [Device: Program_Configuration]			- Q	New 🗙 🕅 🗐 🛛	🖅 🗞 🦉 🤄
	POU	Location	Instance Path	Tasks	Condition	Hit Count Condition	Current Hit Count	Watched Values
LD_POU Network 2 / Operand 'TOF_0' (Impl) (any) (any) Break always Break always 0	O LD_POU	Network 1 / Operand 'TON_0' (Impl)	(any)	(any)	Break always	Break always	0	
	LD_POU	Network 2 / Operand 'TOF_0' (Impl)	(any)	(any)	Break always	Break always	0	
O ADD_3 Network 1 / Operand 'r0' (Impl) (any) (any) Break always Break always 0	ADD_3	Network 1 / Operand 'r0' (Impl)	(any)	(any)	Break always	Break always	0	

8.2.2 Setting an Execution Point

If an execution point is set, when the position of the execution point is reached, processing that is specified beforehand can be executed and the execution result can be output to the log of the GM1 controller. The application does not stop at the position where an execution point is set.

¹² Procedure

1. Select a position where you want to set an execution point. From the menu bar, select **Debug>New Breakpoint**.

ondition Location E	Execution Point Settings	
Location		
POU	POU [Device: Program_Configuration: Application]	`
Position	Line 1, Column 1 (Impl)	`
Instances selected:	: 0	

The "New Breakpoint" dialog box will be displayed.

 Click the "Execution Point Settings" tab. The Execution Point Settings window will be displayed.

New Breakpoint	х
Condition Location Execution Point Settings	
Execution point (Execution does not stop at breakpoint)	
Execute the following code	
Image: 1 Image: 1	~
You can include the value of variables in the message by enclosing their name with {}	
Enable breakpoint immediately OK Cancel	

3. Select the "Execution point" check box and enter the code to be executed at the execution point and the message to be output to the log.

In the "Execute the following code" area, enter executable code in structure text format. In the "Print a message in the device log" field, enter the message to be output to the log.

Example: Multiplying the value of "x3" by 5 and outputting the value to the log

New Breakpoint	Х
Condition Location Execution Point Settings	
Execution point (Execution does not stop at breakpoint)	
Execute the following code	
1 x3 := x3 * 5;	
100 🕲	
Print a message in the device log	
x3 is set to {x3}	
You can include the value of variables in the message by enclosing their name with {}	
Enable breakpoint immediately OK Cancel	

4. Click the [OK] button.

The execution point will be set. When the execution point is enabled,
 appears at the execution point.

i Info.

 To output a message to the log when an execution point is reached, from the menu bar, select Project>Project Settings. In the "Project Settings" dialog box, select the "Compile options" category. Change the setting in Setting>Enable logging in breakpoints to "Enabled".

8.2.3 Call Stack View

In the Call Stack view, you can check a stop position when operation is stopped due to a breakpoint or for some other reason. If the position is called from another block, the position of the block can also be checked.

2 Procedure

1. From the menu bar, select View>Call Stack. The Call Stack view will be displayed.

Call Stad	k	
Applicatio		Task:
POU	Location	Instance Path

Set a breakpoint and stop the application.
 The stop position and the POU calling the POU at the stop position will be displayed.

Example: When operation stops at line 1 of function "ADD_3" and "ST_POU" calls "ADD_3"



8.3 Debug Operations

This section explains how to perform debug operations such as writing values and watch.

8.3.1 Writing Values and Forcibly Changing Values

Variable values for the GM1 controller can be changed. There are two methods for changing values: Writing values and forcibly changing values.

Writing values: Sets a value (to be changed later) only once. This value can then be changed by the program.

Force Values: Sets a value to be changed in every cycle and maintains the value.

For example, use the following procedure to change the value of Boolean variable "x1" from FALSE to TRUE by writing the value.

¹ 2 Procedure

 In the implementation section, double-click the element whose value is to be changed. A new value will be preset.

You can also preset a value by clicking a cell in the "Preset value" column of the declaration section.

Dev	rice.Application.LD_POU			
Expre	ession	Туре	Value	Prepared value
\$	CurrentTime	TIME	T#0ms	
<i>.</i>	R1	BOOL	FALSE	
\$	R2	BOOL	FALSE	
\$	X1	BOOL	FALSE	TRUE
\$	X2	BOOL	FALSE	
± 🔶	TON_0	TON		
c		A 7		
	1 TON_0 X1 <true> N O T#5s PT O ET - CurrentTime</true>	T#Oms		

2. From the menu bar, select **Debug>Write Values**, or press the <Ctrl> key + <F7> key simultaneously.

The preset value will be written.

H LD_POU X H ADD_3			
Device.Application.LD_POU			
Expression	Туре	Value	Prepared value
CurrentTime	TIME	T#0ms	
R1	BOOL	FALSE	
R2	BOOL	FALSE	
X1	BOOL	TRUE	
X2	BOOL	FALSE	
	TON		
1 TON_0	X		
IN CURRENT OF CURRENT	T#Oms		

From the menu bar, select **Debug>Force Values**, or press the <F7> key. The variabsle value will be forcibly changed. P appears in front of a variable whose value has been forcibly changed, and then the value will not be updated by the program.

HE LD_POU X HE ADD_3			
Device.Application.LD_POU			
Expression	Туре	Value	Prepared value
Ø CurrentTime	TIME	T#0ms	
🖗 R1	BOOL	FALSE	
🖗 R2	BOOL	FALSE	
X1	BOOL		
X2	BOOL	FALSE	
± φ τον_0	TON		
<			
1 X1 TON_0 TON_0 TON Q TON CurrentTime	T‡0ms		

From the menu bar, select **Debug>Unforce Values**, or press the <Alt> key + <F7> key simultaneously. Forced value change will be canceled.

8.3.2 Watch

By registering variables in the watch view, you can perform variable value management such as checking or changing variable values.

You can use up to four watch views (Watch 1 to Watch 4).

For example, use the following procedure to register variable "x1" in watch view "Watch 1".

¹² Procedure

 From the menu bar, select View>Watch>Watch 1. Watch view "Watch 1" will be displayed.

Watch 1					→ ∓ X
Expression	Application	Туре	Value	Prepared value	Execution point

2. Drag the variable "x1" element in the implementation section and drop it in the watch view. Variable "x1" will be registered in the watch view.

You can also register the variable in the watch view by dragging it from the declaration section and dropping it in the watch view.

		ET - Curr		oms p it into the wa	atch view	R1
Watch 1	+					- ‡ X
Expression LD_POU.X1	Application Device, Application	Type BOOL	Value FALSE	Prepared value	Execution point Cyclic Monitoring	Address

This completes the procedure for registering the variable in the watch view. You can check variable values in the Value column.



• Variables whose values have been forcibly changed are automatically registered in the "Watch all Forces" view.

From the menu bar, select View>Watch>Watch all Forces.

If an execution point has been set, the timing of display in the watch view can be set to the
point in time when the execution point is reached. In the "Execution point" column, select the
execution point that has been set. For details on how to set execution points, refer to
"8.2.2 Setting an Execution Point".

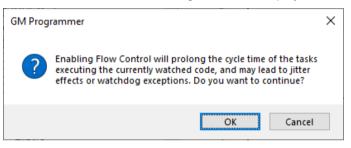
8.3.3 Flow Control

Flow control enables monitoring to be performed by using different colors in positions where the program is executed and in positions where the program is not executed.

Flow control can be used in LD programs, ST programs, and FBD programs.



 After logging in, from the menu bar, select Debug>Toggle Flow Control Mode. The flow control notification dialog box will be displayed.

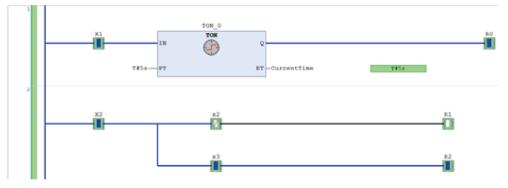


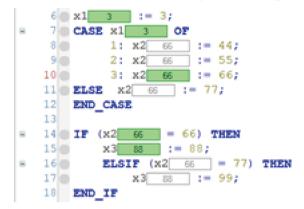
2. Click the [OK] button.

The display will be switched to flow control display.

The positions where the program was executed are displayed in green and the positions where the program was not executed are displayed in white.

Example: Flow control display for LD programs





Example: Flow control display for ST programs



• By using confirmed online mode, you can have a confirmation message dialog box displayed before you execute flow control. For confirmed online mode, refer to "7.8.4 Confirmed online mode".

8.4 Monitoring Function

The monitoring function allows the user to check the variables in the program and the current values of the device parameters in real time while being logged in the GM1 controller.

Monitoring variables in the declaration editor

The variables declared in the declaration editor can be monitored.

appears in front of forcibly changed values. For details on forced value change, refer to "8.3.1 Writing Values and Forcibly Changing Values".

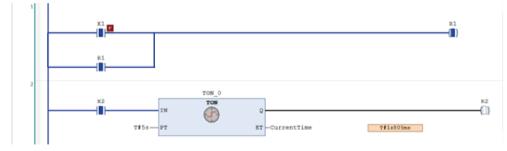
Expression	Туре	Value	Prepared value	1
Ø CurrentTime	TIME	T#0ms		
🖗 R1	BOOL	TRUE		
R2	BOOL	FALSE		
X1	BOOL			
X2	BOOL	FALSE	TRUE	

Current values

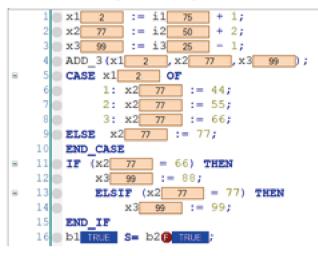
Monitoring variables in the implementation section of the program

- Variables can be monitored in the implementation section of the program (inline monitoring).
- The current value is displayed on the right side of each variable, such as ^{1+1s805ms} or
 2
 .
- Contacts, coils, and connection lines are displayed in blue when the current value is TRUE.

<Inline monitoring for LD programs>



<Inline monitoring for ST programs>



f Info.

 Inline monitoring can be disabled. Open the Options window (by selecting Tools>Options), select the "Text editor" category and then "Monitoring" tab, and clear the "Enable inline monitoring" check box.

Options		Х
CFC Editor Debugging Debugging Declaration Editor FBD, LD and IL editor FBD, LD and IL editor FID, LD and Save For and Save For and Save For And Save For Editor Text editor Text editor For Editor	Number of displayed digts 3 0 Digits String length 10 0 characters	
	Monitoringsample Flow control sample AaBbCOXYYZz AaBbCOXYYZz	
	<u>Q</u> K <u>C</u> ancel	

Monitoring variables in the watch view

By registering variables in the watch view, you can monitor the variables.

You can use up to four watch views, as well as a dedicated view where variables whose values are forcibly changed are automatically registered.

For details on how to register variables in the watch view, refer to "8.3.2 Watch".

Watch 1					- ₽ ×	
Expression	Application	Туре	Value	Prepared value	Execution point	Address
LD_POU.X1	Device.Application	BOOL	🚺 TRUE		Cyclic Monitoring	
LD_POU.X2	Device.Application	BOOL	TRUE		Cyclic Monitoring	
LD_POU.Cur	Device. Application	TIME	T#0ms		Cyclic Monitoring	
			1 I I I I I I I I I I I I I I I I I I I			

Current values

8.5 Simulation Function

Simulation mode allows the user to perform a login operation without connecting to the GM1 controller. It also allows the user to check behaviors in the same way as if the user logged in.

¹² Procedure

1. From the menu bar, select **Online**>**Simulation**.

Simulation mode will be invoked and "Simulation" will be displayed on the status bar.

Device X						•
Communication Settings	Scan Network Gateway 👻	Device +				
Date and Time and Settings						
Applications	-	<u></u>				
Log					•	
Users and Groups		Gateway <simulation mode=""></simulation>	~	<simulation mode=""></simulation>	-	
Access Rights						
PLC Shell						
PLC Parameters						
Task Deployment						
Status						
Information						
	1					
<						>
			Last build: 👩 0 📀) 0 Precompile 🧹		Projec

2. From the menu bar, select **Online>Login**, or press the <Alt> key and the <F8> key simultaneously.

Login will occur in simulation mode. When login occurs in simulation mode, the device object is displayed in italic.

Devices 🗸 🗸	џ	×
🖃 🎒 Untitled3	-	^
🖹 🛆 📆 Device [connected] (AGM1CSRX16T)		
□ III Program_Configuration		
🖹 🔘 Application [stop]		

Simulation will start.



• • • is displayed in front of the object of a device that is operated in simulation mode.

8.6 Trace Function

The trace function allows variable value changes in the GM1 controller over time to be displayed in graph form and be checked. Thus, you can check a motion operation locus and log whether a process or communication computed at high speeds is properly dealt with. You can save obtained trace data in an external file and check such data by an external tool. Saved files can also be read offline.

8.6.1 Setting up Trace

To use the trace function, after adding a trace object, you must register variables to be traced. This section describes a procedure for setting up a trace.

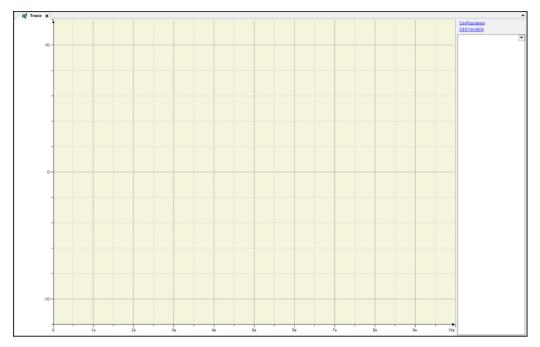


1. Right-click Application in the navigator pane and then select "Add Object>Trace" from the menu that is displayed.

The "Add Trace" dialog box will be displayed.

Add Trace	×
A tool to monitor variables graphically.	
Name of the Trace	
Trace	
Add C	ancel

Enter a desired trace name and click the "Add" button.
 When the trace is added, a trace object screen appears.



3. Configure trace settings.

Click "Configuration" at the upper right of the object screen to display the settings pane. Configure record settings shown in the table below and after that, click the OK button.

Trace Record Trace	Record Settings Enable Trigger			
Hate	Trigger variable 🔹	Trace_PRG.Triger		
	Trigger <u>e</u> dge	🗗 positive 🗸 🗸		
	Post trigger (samples	5001	20s	
	Trigger Level			
	<u>T</u> ask	MotionTask		~
	Record condition	[
	Comment			
Presentation (diagrams)				
- Time axis				
B Diagram 1				
 Y axis Shown variables 				
Showin variables	Resolution	ms ~		
	Automatic restart			
	A <u>d</u> vanced			

• Record settings

Trigger and record time settings can be primarily configured.

Setting items	Overview
Enable Trigger	Trigger is enabled. If trigger is not enabled, data is always sampled after the start of a trace, and old data is deleted depending on the number of samples.
Trigger variable / parameter	Set a variable that constitutes a trigger condition. When the variable is an integer or a real number other than Booleans, you must set a trigger level.
Trigger edge	Set a trigger detection edge.
Posttrigger (samples)	Set the number of samples recored after detection of a trigger. Record time depending on the number of samples set at the right side is displayed.
Trigger Level	Set a value at which an edge is detected according to the variable set in Trigger edge.
Task ^(Note 1)	Select a task from MotionTask and a created UserTask. The cycle of the selected task is a cycle of the trace.
Record condition	Set a condition for executing a trace. A trace is executed only when the set condition is met. Description example: Trace_Record (Boolean type) = TRUE, Axis.Velocity (Integer type) = 100
Comment	Write a comment. If data is saved in a trace file and a trace dump file, details of the comment are also output.
Resolution	Set trace time resolution. You can select us or ms. ^(Note 2)
Automatic restart	Do not use.
Advanced settings	Details will be described later.

(Note 1) To start the trace function, you must set a task.

(Note 2) You must set the trace resolution that is smaller than the task cycle. If the task cycle is 1 ms or less, you must set the trace resolution to us.

• Advanced trace settings

The number of measurement cycles and a buffer size can be specified. Click the [Advanced...] button to display the setting window.

<EtherCAT>

Advanced Trace Settings	×
Measure in every n-th cycle	1 v 4ms
Recommen <u>d</u> ed runtime buffer size (samples)	501 2s
\bigcirc O <u>v</u> erride runtime buffer size	
Trace editor <u>b</u> uffer size per variable (samples)	10001 40s
<u></u> K	<u>C</u> ancel

<RTEX>

×
~
501
0001
Cancel

Setting items	Overview
Measurement frequency (number of cycles)	Set a sampling interval. ^(Note 3) Sampling interval = Number of cycles × task cycle Settable number of cycles: 1 to 20, 100, 200, 500, 1000
Recommended runtime buffer size (sample)	A value is automatically specified to suit the set measurement frequency (number of cycles). This setting is not displayed in RTEX. ^(Note 3)
Override runtime buffer size	You can change the runtime buffer size. When the check box is not selected, the recommended runtime buffer size is adapted. (Note 3)
Trace editor buffer size for each variable (sample)	Set the maximum sampling number for each variable. When the maximum sampling number is exceeded, pieces of the sampling data are deleted in the order of their occurrence. ^(Note 3) (Note 4)

(Note 1) In RTEX, record time depending on the set number of samples is not displayed.

(Note 2) You must set this buffer size to at least twice the runtime buffer size.

4. Next, register a variable to be traced.

Click "Add variable" at the upper right of the object screen to display the Variable settings pane.

Variable settings			
Variable •	Axis 1. fSetPosition		
Graph <u>c</u> olor	Blue	~	
Line type	/ Line	~	
Point type	• Dot	~	
Activate minimum warning			
Critical Iower limit	0		
Warning minimum color	Black	×	
Activate maximum warning			
Critical upper limit	0		
	Red		
	Graph golor Line type Point type Activate minimum warning Critical lower limit Warning minimum color	Variable Axis 1.fSetPosition Graph color Blue Line type Line Point type Dot Activate minimum warning Critical lower limit Warning minimum color Black Activate maximum warning Critical upper limit Critical upper limit 0	Variable Axis 1.fSetPosition Graph color Blue Line type Line Point type Dot Activate minimum warning Critical lower limit Varning minimum color Black Activate maximum warning Critical upper limit Critical upper limit 0

5. Enter a variable you want to trace and set a line color, type, and other items.

Either directly enter a variable or click the ... button to select a desired variable from the Input Assistant window. The registered variables are displayed in the Trace Record pane at the upper left.

• Variable settings

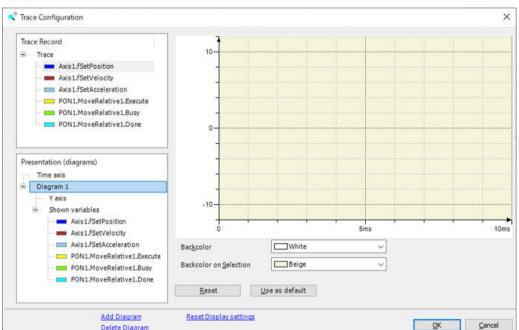
You can set a graph color and line/point types for the variable.

Setting items	Overview
Variable / Parameter	Specify a variable or parameter to be traced.
Graph color	Set the line color of the graph.
Line type	Set the line type of the graph.
Point type	Set the point type of the graph.
Activate minimum warning	When the trace value is smaller than the critical lower limit, the graph is displayed in warning minimum color.
Critical lower limit	Set the lower limit for minimum warning.
Warning minimum color	Set the color of the graph for minimum warning.
Activate maximum warning	When the trace value is larger than the critical upper limit, the graph is displayed in warning maximum color.
Critical upper limit	Set the upper limit for maximum warning.
Warning maximum color	Set the color of the graph for maximum warning.

6. Configure diagram settings.

From the Presentation (diagrams) pane at the lower left, you can configure diagram settings. Configure settings to add a diagram or assign a variable to be traced.

• Diagram settings



You can add a diagram and set a background color. Click "Diagram" to display the settings pane on the right side. For two or more diagrams, settings of each diagram can be configured.

Overview
Add one diagram you want to display on the trace screen.
Delete the specified diagram.
All display settings return to default values.
Set the background color of the diagram.
Set the background color of the diagram that is selected (active).
Display settings of the diagram return to default values.
Default display settings of diagrams change to the current settings.

• Setting of assigning variable to be displayed on diagram

Assign a variable to be displayed on the diagram. Right-click "Shown variables" to display a menu for variable assignment.

H	Axis1.fSetPosition					
	Axis1.fSetVelocity Axis1.fSetAcceleration					
	PON1.MoveRelative1.Exe					
	PON1.MoveRelative1.Bus PON1.MoveRelative1.Dor					
			_			
2 1						
	ation (diagrams)					
Tim	ne axis					
Tim						
Tim	ne axis agram 1					
Dia	ne axis agram 1 Y axis Shown variables Axis1.fSetPosition	+	Add New Variable		_	
Dia	ne axis agram 1 Y axis Shown variables Axis 1.fSetPosition Axis 1.fSetVelocity		Add Existing Variable	PON1.MoveRelative1.Execute		
Dia	ne axis agram 1 Y axis Shown variables Axis1.fSetPosition	~		PON1.MoveRelative1.Busy		
Dia	ne axis agram 1 Y axis Shown variables Axis 1.fSetPosition Axis 1.fSetVelocity	× %	Add Existing Variable			
Dia	ne axis agram 1 Y axis Shown variables Axis 1.fSetPosition Axis 1.fSetVelocity	~	Add Existing Variable Enabled	PON1.MoveRelative1.Busy		
Dia	ne axis agram 1 Y axis Shown variables Axis 1.fSetPosition Axis 1.fSetVelocity	× %	Add Existing Variable Enabled Cut Ctrl+X	PON1.MoveRelative1.Busy		

Setting items	Overview
Add new variable	A new variable to be traced is registered and added to the diagram.
Add existing variable	Select a registered variable to add it to the diagram.

• Time axis settings Click "Time axis" in the Presentation pane to display the settings pane on the right side.

Trace Record	Display Mode			
Trace Axis1.fSetPosition	Auto O F	ixed length O Fixed		
Axis 1.fSetVelocity Axis 1.fSetAcceleration	Minimum	0		
PON1.MoveRelative1.Execute	Maximum	10s		
PON1.MoveRelative1.Busy PON1.MoveRelative1.Done	Length	10s		
	Grid	Gray	~	
Presentation (diagrams)	Tick Marks			
Time axis	Fixed spacing			
 Diagram 1 Y axis 	Distance	15		
Shown variables	Subdivisions	1		
Axis1.fSetPosition				
Axis1.fSetVelocity	Eont		Preview	
PON1.MoveRelative1.Execute	Reset	Use as default		
PON1.MoveRelative1.Busy PON1.MoveRelative1.Done				

Setting i	tems	Overview				
Display Mode		 Set the time axis display mode. Auto: Time axis tick marks suitable for the trace are automatically displayed. Fixed length: The display width of the time axis is fixed to a value set in "Length" and the time axis is displayed by automatic scrolling. Fixed: The time axis is displayed in a range between points that are fixed to values set in "Minimum" and "Maximum". 				
Grid		A grid that fits tick marks is displayed. Also set the color of the grid.				
Tick Fixed spacing Marks		The space between the tick mark and auxiliary tick mark can be set. (Note 5)				
	Distance	Set the space between tick marks in units of time.				
	Subdivisions	Sets the number of auxiliary tick mark.				
Font		Set the display font of the time axis.				
Preview		Display a preview.				
Result		Time axis settings return to default values.				
Use as d	efault	Default time axis settings change to the current settings.				

(Note 1) The auto display mode cannot be specified.

• Y axis settings Click "Y axis" to display the settings pane on the right side.

Trace R		Display Mode	xed	
	Axis1.fSetVelocity Axis1.fSetAcceleration PON1.MoveRelative1.Execute	Mi <u>n</u> imum Ma <u>x</u> imum	-12	
PON1.MoveRelative1.Busy PON1.MoveRelative1.Done		 ⊡ Grid	Gray	~
		Description		
Ti	tation (diagrams) me axis iagram 1	Tick Marks		
1	Yaxis	Distance	1	
8	Shown variables Axis1.fSetPosition Axis1.fSetVelocity	Subdivisions	1	Preview
	Axis1.fSetAcceleration	Reset	Use as default	<u>Heren</u>
	 PON1.MoveRelative1.Execute PON1.MoveRelative1.Busy PON1.MoveRelative1.Done 			
		<u>Reset Display s</u>	ettings	QK Çancel
tting	items	Overview		
splay	mode	Set the Y ax	is display mode.	
			ixis tick marks suitable	e for the trace are automatically

Setting it	ems	Overview
		• Fixed: The Y axis is displayed in a range between points that are fixed to values set in "Minimum" and "Maximum".
Grid		A grid that fits tick marks is displayed. Also set the color of the grid.
Descriptio	n	Display a label on the Y axis.
Tick Marks	Fixed spacing	The space between the tick mark and auxiliary tick mark can be set. (Note 6)
	Distance	Set the space between tick marks in units of time.
	Subdivisions	Sets the number of auxiliary tick mark.
Font	·	Set the display font of the Y axis.
Preview		Display a preview.
Result		Y axis settings return to default values.
Use as de	efault	Default Y axis settings change to the current settings.

(Note 1) The auto display mode cannot be specified.

7. After the settings are configured, click the "OK" button.

This completes the procedure for registering variables to be traced and configuring trace settings.

8.6.2 Trace Menu

The trace menu allows you to perform actions, such as operating a trace or the display screen and saving a file, on the trace object.

Trace menu

To display the trace menu, select Trace from the menu bar or right-click the trace screen with the mouse cursor put on it.

	Add Variable
*	Download Trace
	Start Trace
	Stop Trace
	Reset trigger
~	Autoscroll
\$	Cursor
┶	Mouse Zooming
8	Reset View
<u>‡</u> y	AutoFit
쓦	Compress
¥11	Stretch
	Convert to single channel
	Convert to multi channel
	Online List
	Upload Trace
	Configuration
	Load Trace
	Save Trace
	Export symbolic trace config
	Statistics

Setting items	Overview
Add Variable	The Variable settings pane (Trace Configuration) appears.
Download Trace	A trace is downloaded and starts.
Start Trace	The stopped trace starts again.
Stop Trace	Stop the active trace.

Setting items	Overview
Reset trigger	Reset the trigger in progress and put the trace in a state of waiting for trigger again.
Autoscroll	The trace screen automatically scrolls in response to the latest trace data.
Cursor	A maximum of two cursors can be displayed. A trace value at the cursor place is displayed.
Mouse Zooming	The mouse pointer changes to a zoom cursor to allow a selected trace part to be enlarged.
Reset View	Trace object display settings return to default values.
AutoFit	The Y axis tick marks of the diagram are automatically optimized.
Compress	Shorten the time (X) axis of the diagram.
Stretch	Lengthen the time (X) axis of the diagram.
Convert to single channel	Display all variables registered in Trace Record on one diagram.
Convert to multi channel	Display all variables registered in Trace Record on separate diagrams.
Online List	Display a list of variables saved in the runtime buffer.
Upload Trace	Display trace data saved in the runtime buffer.
Configuration	The Trace Configuration window appears.
Load Trace	A trace file (.trace / .trace.csv) is imported and displayed.
Save Trace	The trace is saved as a trace file (.trace / .txt / .trace.csv).
Export symbolic trace config	Not supported. Do not use.
Statistics	Display trace statistics. Display the upper limit, lower limit, mean value, median, root-mean-square (RMS), and suchlike of trace data by variable.

1 Info.

• Diagram reduction/enlargement

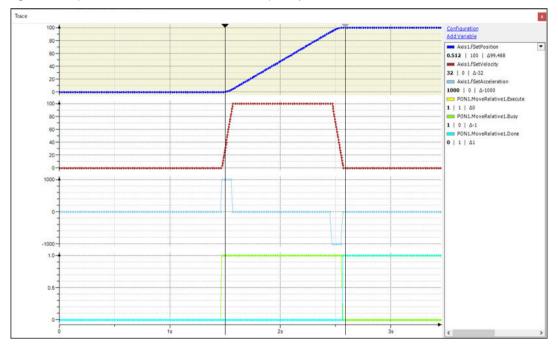
You can reduce or enlarge a diagram by operating a mouse or a keyboard. The operation method is shown below.

Operation items	Mouse operation	Keyboard operation
Shorten time (X) axis	Rotate the mouse wheel rearward.	""
Lengthen time (X) axis	Rotate the mouse wheel forward.	"+"
Shorten Y-axis	With "Ctrl" held depressed, rotate the mouse wheel rearward.	"Ctrl" + "-"
Lengthen Y-axis	With "Ctrl" held depressed, rotate the mouse wheel forward.	"Ctrl" + "+"

Cursor Function

A maximum of two cursors can be displayed on the trace screen, and a value at the cursor place can be displayed. Whenever you select Trace>Cursor from the menu bar, the cursor display toggles through "one cursor display > two cursors display > no cursor display". Values are displayed under the name of each variable on the right side of the trace object, as shown below.

A value at the left cursor place | A value at the right cursor place | A Δ value (the value at the right cursor place - the value at the left cursor place)



Trace Statistics Function

The trace statistics function is used to display the upper limit, lower limit, mean value, median, root-mean-square (RMS), and suchlike of trace data by variable. When you select **Trace>Statistics** from the menu bar, trace statistics are displayed as shown below. For two cursors display, statistics of trace data between the cursors are displayed.

Signal	Index	N	Min	Avg	Median	RMS	StdDev	Max	Integral	Min ∆t [s]	Avg ∆t [s]	Median ∆t [s]	StdDev ∆t [s]	Max ∆t [s
Axis1.fSetPosition	0	271	0.392	51.6578302583026	51.8	60.2040662319663	30.9192199750799	100	57.2728800000001	0.003	0.0041	0.004	0.00034651745	0.00
Axis1.fSetVelocity	1	271	0	91.9409594095941	100	94.4161564168392	21.477210605021	100	102.112	0.003	0.0041	0.004	0.00034651745	0.00
Axis1.fSetAcceleration	2	271	-1000	-25.830258302583	0	399.069903826181	398.233079861353	1000	-29	0.003	0.0041	0.004	0.00034651745	0.00
PON1.MoveRelative1.Execute	3	271	1	1	1	1	0	1	1.107	0.003	0.0041	0.004	0.00034651745	0.00
PON1.MoveRelative1.Busy	4	271	0	0.988929889298893	1	0.994469927061558	0.104824185573267	1	1.099	0.003	0.0041	0.004	0.00034651745	0.00
PON1.MoveRelative1.Done	5	271	0	0.011070110701107	0	0.105407102379458	0.104824185573267	1	0.008	0.003	0.0041	0.004	0.00034651745	0.00

Variable Menu

To display the variable menu, right-click a registered variable on the right side of the trace screen with the mouse cursor put on it. The selected variable can be operated.

	Add Variable
	Cut
	Сору
	Paste
	Delete
~	Visible
	Display Settings
	Configuration

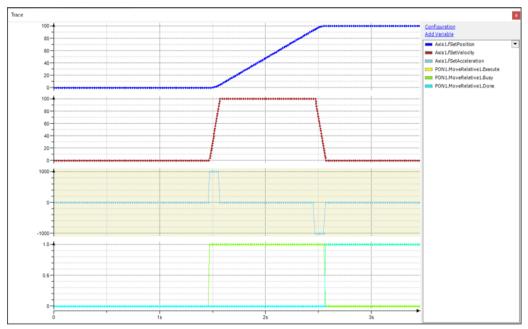
Setting items	Overview
Add Variable	The Variable settings pane (Trace Configuration) appears.
Cut	Cut the selected variable.
Сору	Copy the selected variable.
Paste	Paste the copied variable.
Delete	Delete the selected variable.
Visible	The diagram display for the selected variable switches. With check box selected: Display, With check box not selected: No display
Display settings	The Display settings pane (Trace Configuration) appears.
Configuration	The Trace Configuration window appears.

8.6.3 Executing Trace

By executing a trace, you can check values of the variables registered in the object.

1₂ Procedure

- **1.** Connect the PC where GM Programmer is installed and the GM1 controller and log in to the GM1 controller.
- From the menu bar, select "Trace > Download Trace".
 A trace will be started. The values of the variables assigned to each diagram are recorded, and trace data is displayed in graph form.



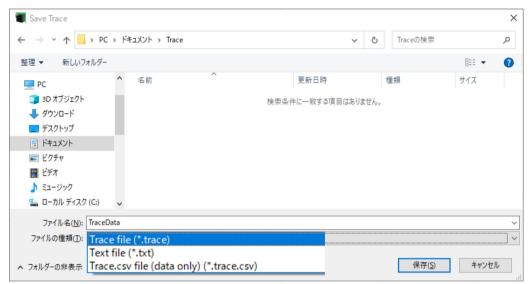
 From the menu bar, select "Trace > Stop Trace". The trace will be stopped. To automatically stop the trace, enable Trigger in the trace settings.

8.6.4 Saving Trace

Data recorded through execution of the trace can be saved.

¹² Procedure

- 1. From the menu bar, select "Trace > Save Trace".
- 2. The Save Trace pop-up window appears. Specify a destination where the trace data is saved, as well as a file name. From the File Type menu, select a file format in which the trace data is saved.



- **3.** After the settings are configured, click the "Save" button.
- If the data is saved in trace file (*.trace) format, you can open it on the trace object screen by selecting "Trace > Load Trace" from the menu bar.

Trace File Types

There are three trace file formats.

Through the trace file (.trace) format, all of recorded variable values (hereinafter referred to as trace data) and trace configuration data can be saved. By importing a file saved in this format, you can display a trace waveform identical to that shown when the file was saved. A file in trace file format can be imported offline to change the save format to trace dump file or text file.

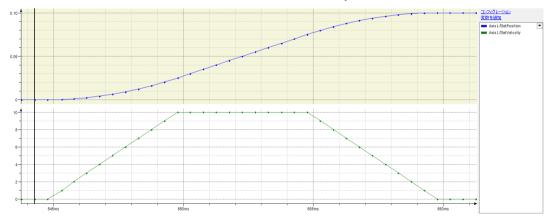
Thus, when you use such data, you are recommended to save it in trace file (.trace) format.

Setting items	Extension	Overview
Trace file	*.trace	Trace data and trace configuration data are output in XML format. You can import output trace files and analyze trace data offline.
Trace dump file	*.trace.csv	Trace data and part of trace configuration data are output in CSV format. You can import output trace files and analyze trace data offline. ^(Note 1)
Text file	*.txt	Trace data is output in text (ASCII) format. You can edit such a file using an external tool. However, text files cannot be imported.

(Note 1) To output a trace dump file, do not set any record condition in the record settings.

Examples of Output Trace Files

Examples in which trace object data as shown below is output into trace file. Variable0 = Axis1.fSetPosition, Variable1 = Axis1.fSetVelocity



Example of output trace file (.trace)

```
<Trace>
<TraceConfiguration>
 <Single xml:space="preserve" Type="{f7aa3620-8073-4c91-b6ec-86ed9eb60303}" Method="IArchivable">
 <Dictionary Type="System.Collections.Hashtable" Name="TraceDataConfig" />
<Dictionary Type="System.Collections.Hashtable" Name="TraceOutputConfig" />
   :
              Configuration Data
   :
              Trigger setting Data
              Variable setting Data
   ٠
 </TraceConfiguration>
 <TraceData Version="1.0.0.0">
  <TraceRecord>
   <TriggerState>3</TriggerState>
   <StartTime>10534190988</StartTime>
   <TriggerStartDate>2022/11/11 1:11:11</TriggerStartDate>
   <TriggerTimeStamp>10534609669</TriggerTimeStamp>
   <TriggerHistory>418681</TriggerHistory>
   <TraceVariable VarName="Axis1.fSetPosition" VariableIndex="0" Type="System.Double">
    <Values>0,0.00025,0.001,0.00225,0.004,0.00625,0.00901,0.01225,0.016,0.02025,0.02505,0.03006
            0.035,0.04008,0.04505,0.05,0.05507,0.06005,0.065,0.07,,,,</Values> Trace Data (Axis1.fSetPosition)
  <Timestamps>419187,419734,420175,420676,421205,421678,422176,422676,423188,423677,424182,424681,
            425210,425675,426175,426681,427196,427676,428177,428676,,,,</Timestamps>
   </TraceVariable>
   <TraceVariable VarName="Axis1.fSetVelocity" VariableIndex="0" Type="System.Double">
    <Values>0,1,2,3,4,5,6,7,8,9.018,10,10,10,
                                                                             Trace Data (Axis1.fSetVelocity)
            10,10,10,10,10,10,10,10,,,,,</Values>
    <Timestamps>419187,419734,420175,420676,421205,421678,422176,422676,423188,423677,424182,424681,
            425210,425675,426175,426681,427196,427676,428177,428676,,,,</Timestamps>
   </TraceVariable>
  </TraceRecord>
 </TraceData>
</Trace>
```

Example of output trace dump file (.trace.csv)					
Name; A Applicati Applicati IecTaskN	0x03050000 pplication.Tra onName; Ap	plication 0000000-0000-0000-0000-00000000000000			
	Configuration Trigger settir Variable0 set	ng Data			
0.Data; ; 419187; 0 ; 419734; 0.00025 ; 420175; 0.001 ; 420676; 0.00225 ; 421205; 0.004 ; 421678; 0.00625 ; 422176; 0.00901 : 1.Variable; Axis1.fSetVelocity					
:	Variable1 setting Data				
1.Data; ; 419187; 0 ; 419734; 1 ; 420175; 2 ; 420676; 3 ; 421205; 4 ; 421678; 5 ; 422176; 6 :		Variable1 Trace Data ; Time Stamp(µs); Axis1.fSetVelocity			

Example of output text file (.txt)

```
GM Programmer V** Trace: Trace
E:¥GMP Trace.project
Timestamp(us) Axis1.fSetPosition Axis1.fSetVelocity
191 0 0
687 0 0
            191□0□0
1198 0 0
            Time stamp(µs)_Axis1.fSetPosition_Axis1.fSetVelocity
1686 0 0
                          ↑ space
                                           ↑ space
2186 0 0
2684 0 0
3184 0 0
419187 0 0
419734 0.00025 1
420175 0.001 2
420676 0.00225 3
421205 0.004 4
421678 0.00625 5
422176 0.00901 6
422676 0.01225 7
423188 0.016 8
423677 0.02025 9.0018
424182 0.02505 10
424681 0.03006 10
425210 0.035 10
425675 0.04008 10
426175 0.04505 10
426681 0.05 10
427196 0.05507 10
427676 0.06005 10
428177 0.065 10
428676 0.07 10
```

8.7 Visualization Function

By using the visualization function, POU variables can be read or written from the tool elements such as switches and check boxes that are placed on the visualization object. It can be used when performing a debug or other application.

You can create a visualization object that can be used to check parameters during axis operation as shown below.

Servo ON	Axis Movement-			
	Positive	Negative	St	top
	Velocity [u/s]	10.0	Hor	ning
Monitor				
Communication Available	\bigcirc	Item	Set Value	Actual Value
Available	\bigcirc	Position [u]	11. <mark>5</mark>	11. <mark>5</mark>
		Velocity [u/s]	10.0	10.0
Axis State co	ntinuous_motion			

8.7.1 Setting of Visualization

This section explains how to add and set a Visualization object.

¹² Procedure

 Right-click the "Application" object in the navigation pane and then select Add Object>Visualization from the context-sensitive menu that is displayed.

The "Add Visualization" dialog box will be displayed.

• First addition

ame:	
/isualization	
Symbol libraries 📳 VisuSymbols (System)	Active
visualization symbol library is raphics and graphical objects.	

• After the Second addition

Add Vis	sualization >	<
	Creates a visualization object	
<u>N</u> ame: Visuali	ization_1	
	Add Cancel	

2. Enter a desired visualization name and then click the [Add] button. When the addition is completed, the Visualization pane will be displayed.

Visualization X		
□ インタフェースエディタ □ ホットキーの構成 圓 要売リスト		
1 VAR_IN_DUT		基本 【 一般的な制御 】 測定制御
3 END_VAR		【Lamps/Switches/Bitmaps 】日時制御 】お気に入り
	(1)	
	(1)	
		四角形 角丸四角形 橋円
	à V	
		ライン 多角形 和5-15
		「ライン 多角形 赤 バライン」
		ペジェ曲線 風形 フレーム
	(2)	
	(2)	(3)
		(0)
		9 iter
		110 8 食 * 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

The Visualization pane displays the following:

No.	Name	Function
1	Declaration section	Declare variables for using the visualization as a dialog. Refer to "About editor of the Visualization".
2	Implementation section	Place the tool element.
3	Visualization tool box or properties	Displays the tool element and the properties of the tool element that you want to place in the visualization.
		The available tool elements are described below.

3. For placing the tool element, select a tool element in the visualization tool box, and then click a desired point in the visualization section.

For the list of tool elements that can be used by GM Programmer, refer to "8.7.3 List of Available Tool Elements".

Visualization ×				-	Visualization ToolBox		- 0 X
Interface Editor Hotkeys Configuration	E Elementist						
1 VAR_IN_OUT					Basic Comr	non controls Me	asurement controls
S END_VAR					Lamps/Swite		Special controls
					Date/Tim	e controls	Favorite
			Select tool element to				
			Select tool element to				
				100 🙊			
		* 4		^	Rectangle	Round rectangle	Elipse
						-	\sim
					Line	Polygon	Polyline
							100
					2		$\langle \cdots \rangle$
					Bézier curve	Pie	Frame
					base are		
	Click where to place						
		1 1					
					-	्	9 items
<			100	× 🕸 v	Properties 🗿 Vis	ualization ToolBox	
`				>		ourseour rodbox	

4. Set the properties of the tool element.

[Properties] will be displayed. On the displayed [Properties], set POU object variables, [Input configuration] that can be used to switch variables by mouse operation. For the list of [Properties] of tool elements, refer to "8.7.4 List of Properties of Tool Elements".

	Properties	- a
📾 Interface Editor 🗌 Hotionys Configuration 🔠 Bernentist	V Filter • Sort by •	Sort order • 🗹 Advanced
1 VAR_IN_007	Property	Value
2 ERD VAR	Bement name	GenElemInst_1
 TERT_ANK 	Type of element	Rectangle
	Position	
	x	583
	Y	215
	Width	150
	Height Center	30
100 🔮	* Center	
	Use gradient color Gradient setting	Inear, Black, White
	* Element look	
	* Texts	
	Text properties	
	Horizontal alignment	Centered
	Vertical alignment	Centered
	Text format	Default
	Font	Default
Select tool element	Font color	Fontcolor
	* Absolute movement	
± • ±	Relative movement Text variables	
	Dynamic texts	
	Font variables	
	* Color variables	
	* Look variables	
	* Input configuration	
100 100		
110 % 🕅 >	Properties 🖓 Visualizatio	on ToolBox
	THE PAPER OF THE PERSON	

This completes the Visualization setting procedure.

About editor of the Visualization

There are three editors (tabs) in the declaration section of a visualization object

Editor	Function
InterFace Edeitor (InterFace Edeitor Tab)	Declares variables for when the visualization is used as a dialog
HotKeys Edeitor (HotKeys Configuration Tab)	Do not use.
Elementlist Edeitor (Elementlist Tab)	You can change the position and size of placed tool elements.

InterFace Edeitor (InterFace Edeitor Tab)



- You can use VAR_IN_OUT, VAR_OUTPUT, and VAR_INPUT.Use them according to the input/output variables, output variables, and input variables used in the dialog.
- They can only be used when the visualization is used as a dialog. If you declare variables in the interface editor when using it as a visualization, it will not work as a visualization.
- Initial values cannot be set for declared variables. (NG example : iVariable : INT := 5;)

Elementlist Edeitor (Elementlist Tab)

Visualization ×		-					
🖽 Interface Editor 🔲 Hotk	eys Configuration	Ele Ele	mentist				
Type	x	Y	Width	Height	Id	Name	Access Rights
#0 Rectangle	252	213	150	30	0	GenElemInst_1	

A list of tool elements placed in the visualization and their positions and other information are displayed.

items	Function
Туре	The object name of the placed tool element is displayed. The number after # indicates the order in which the tool elements are placed. #0 is the tool element that resides farthest to the rear.
X	X position of tool element Can be changed on the visual element list editor.
Y	Y position of tool element Can be changed on the visual element list editor.
Width	Width of the tool element Can be changed on the visual element list editor.
Height	Height of the tool element Can be changed on the visual element list editor.
ID	Internally set identification number of the tool element
Name	Element name of the tool element Can be changed on the visual element list editor.
Access Rights	Do not use.

Visualization Menu

The Visualization Menu allows for the alignment and grouping of tool elements.

Visualization Menu

Select "Visualization" from the Menu bar, or right-click on the object screen in the Visualization area to display it.

Ж	Cut	
	Сору	
ß	Paste	
×	Delete	
	Create Global Text List	
	Orde <u>r</u>	
	<u>A</u> lineamento	•
5	Group	
jų.	Ungroup	
	Frame Selection	
	Background	
14	Multiply visu element	

Items	Overview
Create Global Text List	Create a GlobalTextList from the [Text] currently used in each Visualization.
InterFace Edeitor	Open the InterFace editor of the Visualization.
HotKeys Edeitor	Do not use.
Elementlist Edeitor	Open the Elementlist of the Visualization.
Order	Change the order in which selected tool elements overlap with other tool elements.
Allineamento	Align multiple selected tool elements.
Group	group multiple selected tool elements.
	Grouped tool elements are treated as a single object and cannot be selected and edited individually.
Ungroup	Ungroups the selected tool elements.
Frame Selection	Open the "Frame Configuration" dialog for the selected frame object or tab control object.
Background	Set the Background in Visualization.
	 User color: Fill the background with the selected color.
	• Use image : Do not use.
Multiply visu element	Expand the selected tool element and text variables to the specified number of rows and columns.

About Matrix Expansion of Visualization Elements

To use this function, you need to set the properties of the tool element according to the conditions.

- Conditions
 - · Array type variables are set to [text] or [Text variable] of the tool element.
 - · The format of the variables to be set for the property is as follows
 - 1st dimension array:"variable name"[\$FIRSTDIM\$]
 - 2nd dimension array:"variable name"[\$FIRSTDIM\$, \$SECONDDIM\$]
 - When expanding Array type variables of 3rd dimension or higher, set fixed values except for the 2 indices that set \$FIRSTDIM\$ and \$SECONDDIM\$.
- Expansion settings

Select a tool element that can be expanded and choose "Multiply visu element" from the menu to open the configuration window for expansion. After setting the necessary parameters and pressing the "OK" button, the tool element is copied according to the description and each element of the Array type variables is assigned.

· Basic Settings tab

Basic Settings Advanced Settings		
Total Number of Elements Horizontal 2 Vertical 2 Offset Between Elements Horizontal 0 Vertical 0	Arrangement of Elements From top left From top right From bottom left From bottom right Orientation Line by line Column by column 	Preview

Items		Overview	Overview		
Basic Settings	Total Number of Elements	Horizontal	Number of elements in each row As an initial value, the number of indices corresponding to \$FIRSTDIM\$ of the set Array type variables is set.		
		Vertical	Number of rows required to place all elements The number of indexes corresponding to \$SECONDDIM\$ (or \$FIRSTDIM\$) of the set Array type variables is set as the initial value.		
	Offset Between Elements		 Distance (pixels) between tool elements created when expanded 0: The tool elements will be expanded with their borders overlapping by 1 pixel. 1: The tool elements will be expanded so that they touch each other. 		

Items	tems			
		 n: The to by n - 1 p 	ol elements are expanded so that they are separated ixels.	
		Horizontal	Distance between tool elements in row direction (pixels)	
		Vertical	Distance between tool elements in columns (pixels)	
	Arrangement of	Specify the o	direction of placement after expansion	
	Elements	 From top left,From top Right,From bottom left,From bottom right 		
		From left,From right		
		From top,From bottom		
		Orientation	Specification of the direction of \$FIRSTDIM\$ increment after expansion	
			 Line by line,Column by column 	

Advanced Settings tab

Multiply Visu	Element		
asic Settings	dvanced Settings		
Array Access	1st dimension	2nd dimension	
Start index	1	1	
Increment	1	1	
		ليشبا	

Items		Overview	
Advanced Settings	Array Access	Start index	Specify Start index of Array type variables to be expanded
		Increment	Specify the Increment of the index of the Array type variables to be expanded
		1st dimension	Set for \$FIRSTDIM\$.
		2nd dimension	Set for \$SECONDDIM\$

- Example: A 5 × 10 STRING type array declared in GVL is expanded with a Rectangleobject.
 - Declaration (GVL)

strVars : ARRAY [1..5, 1..10] OF STRING;

· Setting Properties on Rectangle Objects

Item1	Item2	Description
Text		strVars[\$FIRSTDIM\$, \$SECONDDIM\$]

· The result of matrix expansion with default settings

strVars[\$FIRSTDIM\$, \$SECONDDIM\$]



	22			
strVars[1, 1]	strVars[2, 1]	strVars[3, 1]	strVars[4, 1]	strVars[5, 1]
strVars[1, 2]	strVars[2, 2]	strVars[3, 2]	strVars[4, 2]	strVars[5, 2]
strVars[1, 3]	strVars[2, 3]	strVars[3, 3]	strVars[4, 3]	strVars[5, 3]
strVars[1, 4]	strVars[2, 4]	strVars[3, 4]	strVars[4, 4]	strVars[5, 4]
strVars[1, 5]	strVars[2, 5]	strVars[3, 5]	strVars[4, 5]	strVars[5, 5]
strVars[1, 6]	strVars[2, 6]	strVars[3, 6]	strVars[4, 6]	strVars[5, 6]
strVars[1, 7]	strVars[2, 7]	strVars[3, 7]	strVars[4, 7]	strVars[5, 7]
strVars[1, 8]	strVars[2, 8]	strVars[3, 8]	strVars[4, 8]	strVars[5, 8]
strVars[1, 9]	strVars[2, 9]	strVars[3, 9]	strVars[4, 9]	strVars[5, 9]
strVars[1, 10]	strVars[2, 10]	strVars[3, 10]	strVars[4, 10]	strVars[5, 10]

- Example: A2 × 5 × 10 STRING type array declared in GVL is expanded with a Rectangleobject.
 - Declaration (GVL)

strVars : ARRAY [1..2, 1..5, 1..10] OF STRING;

• Setting Properties on Rectangle Objects

ltem1	Item2	Description
Text		strVars[\$FIRSTDIM\$, 3, \$SECONDDIM\$]

• The result of matrix expansion with default settings

strVars[\$FIRSTDIM\$, 3, \$SECONDDIM\$]



strVars[1, 3, 1]	strVars[2, 3, 1]
strVars[1, 3, 2]	strVars[2, 3, 2]
strVars[1, 3, 3]	strVars[2, 3, 3]
strVars[1, 3, 4]	strVars[2, 3, 4]
strVars[1, 3, 5]	strVars[2, 3, 5]
strVars[1, 3, 6]	strVars[2, 3, 6]
strVars[1, 3, 7]	strVars[2, 3, 7]
strVars[1, 3, 8]	strVars[2, 3, 8]
strVars[1, 3, 9]	strVars[2, 3, 9]
strVars[1, 3, 10]	strVars[2, 3, 10]

Visualization Properties

Visualization Properties can be set to use the created Visualization as a dialog.

Properties List

Right-click on the Visualization object in the Navigator window and select "Properties" from the menu that appears. Select the "Visualization" tab in the Properties window.

Properties -	Visualiza	ation [Device:	Program_Config	guration: Application] X
Common	Build 4	Access Control	Visualization	
 Vis Dia Nu Dia Us Us Visuali Width 	alog is op e automat Include e specifie zation Size	ypad/Dialog fo aque tic detected vis e background i ed visualization	mage	ation
Item				Overview
Use Visualiza	ation as	Visualizati	on	Use as normal window.
		Dialog		Use as a Pop-up window.
			eypad/Dialog onfiguration	Do not use.
Dialog is opa	que			Do not use.
Use automati	c detected	d visualization s	ze	All tool elements will be sized and displayed as they appear.
Include back	graund ima	age		Do not use.

Item	Overview
Use specified visualization size	The visualization will be displayed in the size specified in the "Height" and "Width" fields.
Internal	Do not use.

Visualization Option

The Visualization Option allows you to configure grid display and other settings.

Option list

It is displayed by selecting **Tool>Option** from the menu bar. **Option Category**

Category name	Function
Visualization styles	Do not use.
Visualization user management	
Visualization	Configure settings such as the display of Visualization.

•

Options			>
 CFC Editor Debugging Declaration Edit Device editor FBD, LD and IL International Se Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor Visualization sty Visualization use 	editor ettings /łes	Presentation Options (V Fixed I Use scaling options Antialiased drawing Device Image Show offline Show in visuali Show online Editing Options	
Setting items			Overview
Presentation Fixed	Fixed		Visualization is displayed in its original size.
Options	Isotropic		Visualization will be scaled to fit on the screen while

Setting items		Overview
	Anisotropic	Visualization will be scaled to fit within the screen, but the aspect ratio will not be preserved.
	Use scaling options for dialogs	If checked, the Isotropic / Anisotropic setting will also be applied to dialogs displayed by the input configuration.
Device Image	Show offline	Do not use.
	Show in visualizations with parameter interface	
	Show online	
Editing Options	Link to toggle/tap variable where approproate	If checked, the variables set in [Input configuration] - [Tap] or [Toggle] will be automatically applied to the tool element property [Color variables] - [Toggle color].
		The variable set to [Tap] will be used first.

Grid Tab

Options		×
 CFC Editor Debugging Dedaration Editor Device editor FBD, LD and IL editor International Settings Load and Save Monitoring Refactoring SFC editor SmartCoding Text editor Visualization Visualization user management 	Visualization General Grid File Options Global Settings Grid Visible Active Size 10	
< >		<u>D</u> K <u>C</u> ancel

Setting items	Overview
Visible	If checked, grid points are displayed in Visualization.
Active	If checked, placement of tool elements in Visualization is restricted to grid points.
Size	Specify the distance between grid points in pixels.

File Options Tab

Options	×
Debugging Declaration Editor	isualization eneral Grid File Options Global Settings Text file for textual "List components": Visualization Directories Text list files Visualization Directories Visualiza
Setting items	Overview
Text list files for textual "List components"	Set up a .csv file in text list format. When entering text for tool element properties, the text in the text list file will be displayed as input candidates.
Text list files Image files	Do not use.

Global Settings Tab

Options	×
Debugging Declaration Editor Device editor	isualization eneral Grid File Options Global Settings Device Setting for Libraries and Global Visualizations No limitation by device settings Use settings of the following device: Currently selected device Name: none Version: none Select Device Operive device automatically Derive device automatically Cancel
Setting items	Overview
No limitation by device settings	Fixed to selected state
Currently selected device	Do not use.
Select Device	
Derive device automatically	

8.7.2 Setting of TextList

TextList is an object that lists texts identified with ID numbers. When using TextList to create visualization, add a TextList object.

The following section explains how to add and set a TextList object.

1₂ Procedure

 Right-click the "Application" object in the navigation pane and then select Add Object>TextList from the context-sensitive menu that is displayed.

The "Add TextList" dialog box will be displayed.

Add Text Lis	st Itilanguage tex	ct list config	uration		×
Name TextList					
			Add	Cancel	

Enter a desired TextList name and click the [Add] button.
 When the addition is completed, the TextList pane will be displayed.

TextList X		
ID	Default	

The TextList pane displays the following contents.

Name	Function	
ID	Set the ID number for the text described in "Default".	
	The same ID number cannot be set.	
Default	Set the text to be listed.	
	If the text is set with "ID" left blank, an ID is automatically set.	

3. Set the TextList object.

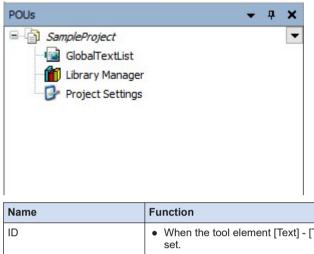
Shown below is an example of the display when "Apple", "Orange", and "Grape" are described in this order in the "Default" field, 10 is assigned as an ID number, and "Banana" is described in the "Default" field.

ID	Default	
0	Apple	
1	Orange	
2	Grape	
10	Banana	

This completes the TextList setting procedure.

GlobalTextList

GlobalTextList is automatically added to the POU tree when you set the [Text] property or other properties of a tool element.



Name		
ID	When the tool element [Text] - [Text] is set: The [TextID] value is automatically set.	
	 When the tool element [Text] - [ToolTip] is set: The [HintID] value is automatically set. 	
Default	When the tool element [Text] - [Text] and [Text] - [Tooltip] are set: The text is automatically described.	



- The contents of the GlobalTextList cannot be edited.
- By using the "Import Replace File" described below, you can replace the text of all tool elements associated with GlobalTextList at once.

TextList Menu

The TextList Menu allows you to add other languages and import and export TextLists.

TextList Menu

Select "TextList" from the menu bar or right-click on the TextList object screen.

Ж	Cut	
	Сору	
ß	Paste	
\times	Delete	
	Select All	
₫	Insert Text	
D.	Add Language	
F	Remove Language	
	Rename Language	
8	Import/Export Text Lists	
8	Export All .txt Text List Files	
	Export All Unicode .txt Text List Files	
1	Update Visualization Text Ids	
	Check Visualization Text IDs	
50	Remove Unused Text List Entries	

Remove Unused Text List Entries

Items	Overview
Cut	Cut the selected text.
Сору	Copy the selected text.
Paste	Paste the copied text.
Delete	Delete selected text.
Select All	ID, selects all text.
Browse	Do not use.
Insert Text	Insert text. The "ID" will be set automatically.
Add Language	Add a new language column.
Remove Language	Delete selected language. You cannot delete the "default" language.
Rename Language	Rename the selected language. "Default" cannot be renamed.
Import/Export Text Lists	Import/Export TextList.

Items	Overview	
	See below for details.	
Export All .txt Text List Files	Do not use.	
Export All Unicode.txt Text List Files		
Update Visualization Text Ids	Add the text currently used in the visualization to the GlobalTextList. Can be used on a GlobalTextList.	
Chek Visualization Text IDs	Do not use.	
Remove Unused TexT List Entries	Remove text from the GlobalTextList that is not currently used in the visualization. Can be used on a GlobalTextList.	



- By adding or writing other languages to TextList, languages other than the default language can be displayed in the visualization.
- You can change the language displayed in the visualization by setting the "Language switch" in the "Input configuration" property of the tool element.

About Import/Export

TextList can be imported and exported for saving and reuse. In the "Import/Export TextList" menu of the TextList Menu, set and execute the following items

Choose file to compare or	compore	
hoose export file		
Import/Export Type		
Import		
 Import replacement f 	file	
O Export		
 Export only text diffe 	rences	

Setting Item	Overview	
Choose file to compare or to import	Specify a tab-delimited CSV file to import.The contents of the CSV file to be imported will be reflected in all TextLists in the project.	

Setting Item		Overview
		 If a CSV file contains a TextList name that does not exist, a TextList will be generated in the device tree.
Choose export file		 Specify CSV file to export TextList. All TextList and GlobalTextList in the project are exported. If the specified file does not exist, a new tab-delimited CSV file is created.
Import/Export type	Import	Import the specified tab-delimited CSV file into TextList Incorrect CSV files, such as using the same ID number or the same language name, will not be imported correctly.
	Import repacement file	Replaces the contents of GlobalTextList based on the contents of the specified replacement file. The replacement file must follow the specified format, and an error will occur if a file with a different format is specified.
		For details, please refer to the example below.
	Export	Export TextList to a specified tab-delimited CSV file.
	Export only text differences	Do not use.



• When "Import" is executed on GlobalTextList, the new TextList by TextList file is imported into the POU tree.

Example 1: "Export" is executed

The following TextList exists in the project, and in the visualization object there is a button object with the text 'ON'.

The "Export" is performed on one TextList object.

TextList

TextList name	ID	Default	ja
TextList1	0	Apple	りんご
	1	Orange	みかん
	2	Grape	ぶどう
TextList2	0	Lemon	れもん
	1	Cherry	さくらんぼ
	2	Peach	もも

Visualization

Tool element	Item1	Item2	Description
Button	Text	Text	ON

GlobalTextList

	TextList name	ID	Default	ja	
	GlobalTextList	21	ON		
h	peregult of "Export" is as follows				

The result of "Export" is as follows

Text used in visualization is also exported.	TextList GlobalTextList	Id	Default ON	ja
'ID' is not exported.	TextList2	0	Lemon	れもん
	TextList2	1	Cherry	さくらんぼ
	TextList2	2	Peach	もも
	TextList1	0	Apple	りんご
	TextList1	1	Orange	みかん
	TextList1	2	Grape	ぶどう

Object names are displayed

in the 'TextList' column.

Example 2: "Importing a replacement file

Change the contents of GlobalTextList using a replacement file.

• Before replacement

ID	Default
836	Text_Before
124	ToolTip_Before

Replacement files

Each is created as a tab-delimited file.

defaultold	defaultnew	REPLACE
Text_Before	Text_After	REPLACE
ToolTip_Before	ToolTip_After	REPLACE

• After replacement

ID	Default
836	Text_After
124	ToolTip_After

Visualization

8.7.3 List of Available Tool Elements

Tool element

The following tool elements can be used with the GM Programmer.

Class	Name	Description
Basic	Rectangle	Displays a rectangle.
	Rounded rectangle	Displays a rounded rectangle
	Ellipse	Displays an ellipse.
	Line	Displays a straight line.
		Place a line by clicking two points as the both ends of the straight line.
	Polygon	Displays a polygon.
	Polyline	Displays a polyline.
	Bezier curve	Displays a Bezier curve.
	Pie	Displays a pie.
	Frame	The visualization created in the project will be displayed as a frame.
		By setting the frame switching variable, you can switch between multiple visualizations.
Common controls	Label	Displays a text.
		The text cannot be rewritten in the online mode.
	Tab control	The visualization created in the project will be displayed as a frame that can be switched with tabs.
	Button	Displays a button. The button can be used to switch between TRUE and FALSE of the BOOL type variable.
	Group box	Displays a box for grouping tool elements. Group name can be set.
	Table	Data array is displayed as a table. Data such as one-dimensional array, two-dimensional array, array of arrays, structures, or function blocks can be set.
	Text field	Displays a text box. The text can be rewritten even in the online mode.
	Scroll bar	Displays a scroll bar. Variable value can be set according to the scroll bar position.
	Slider	Displays a slider bar. Variable value can be set according to the slider position.
	Spin control	Displays a spin control. The variable value can be increased or decreased by a specified numerical width each time one of the arrow buttons is pressed.
	Invisible input	A rectangle object that is not displayed in the online mode can be added.
	Check box	Displays a check box.

Class	Name	Description
		Depending on whether it is checked or not, the BOOL type variable is switched between TRUE and FALSE
	Radio button	Displays radio buttons grouped together. The number of the selected radio button is identified by an integer value.
	Progress bar	Displays a variable value in the progress bar.
Measureme	Bar display	Displays a variable value in the bar.
nt controls	Meter 90°	Displays a variable value with a meter.
	Meter 180°	
	Meter	
	Potentiometer	Displays a variable value with a potentiometer. The value can be changed by moving the pointer position.
	Histogram	One-dimensional array data is displayed as a histogram.
Lamps/ Switches/ Bitmaps	Lamp	Displays a lamp. Displays a BOOL type variable value with the lamp turned ON or OFF. TRUE: Lamp is ON., FALSE: Lamp is OFF
	DIP switch	Displays a DIP switch.
	Power switch	It can be used to switch between TRUE and FALSE of the BOOL type variable.
	Push switch	
	Push switch LED	
	Rocker switch	
	Rotary switch	
Date and time control	Analog clock	Displays an analog clock.

8.7.4 List of Properties of Tool Elements

The following properties can be used with the GM Programmer. If the same property set values exist in more than one tool element items, repeated descriptions are omitted.

Class: Basic

Setting item		Overview	Tool element
Element name		Name of the tool element. The name is assigned automatically.	Common
Type of element		The object name of the tool element is displayed.	
Center		Set the coordinates of the center point of the tool element.	
Color	Normal state Alarm state	Set the frame color and fill color for the normal state and alarm state and also set the transparency of each one.	•
Use gradient colo	br	If this item is checked, the object is filled with the contents of [Gradient setting].	

Setting item		Overview	Tool elem
Gradient setting		Set the fill gradation of the tool element. On the "Gradient editor" dialog box, specify the gradation type, color, etc.	
Element look	Line width	Set the frame line width.	
	Fill attributes	Set the fill format of the tool element. Filled, unfilled	
	Line style	Set the line style. Solid line, dashed line, dotted line, dash-dotted line, dash-dotted-dotted line, outline line	
Texts	Text	Set the text to be displayed on the tool element. When using text variables, specify the numerical format.	-
	Tooltip	Set the text to be displayed on the tooltip of the tool element. When using tooltip variables, specify the numerical format.	-
Text properties	Horizontal alignment Vertical alignment	Set the position where the text is displayed.	
	Text format	Set the display method when the text protrudes from the tool element.	
	Font	Set the font and size of the text.	1
	Font color	Set the font color and transparency of the text.	
Absolute motion	Movement	Specify the distance from the current coordinates in the online mode.	
	Rotation	Set the angle to rotate around the center point in the online mode.	
	Scaling	Set the reduce/enlarge ratio from the center point in the online mode. The original size is 1000.	-
	Use REAL values	If this item is checked, the [Absolute motion] value is set as a REAL type value. Therefore, the movement becomes smoother than when the item is not checked.	
Relative move	Movement top- left Movement	Specify the distance that the Movement top-left or the Movement bottom-right of the tool element moves in the online mode.	
	bottom-right	Since it is a relative move, the size of the tool element changes.	
Text variable	Text variable	Set the variable of the text to be displayed on the tool element.	
	Tooltip variable	Set the text variable to be displayed when a mouse cursor is placed over the tool element.	
Dynamic text	TextList	Set the TextList name to be used.]
	Text index	Set the TextList ID. The content of the corresponding "ID" is displayed in the text.	

Setting item		Overview
	Tooltip index	Set the TextList ID. The content of the corresponding "ID" is displayed on the tooltip.
Font variables	Font name	Set a STRING type variable.
	Size	Set the numerical data type variable.
		Units: <pt> = point, <px> = pixel</px></pt>
	Flags	Set a DWORD type variable. The following display formats can be used and their combined use is possible. • 2#0001: Italic • 2#0010: Bold • 2#0100: Underline • 2#1000: Strikethrough
	Character set	Do not use.
	Color	Set a DWORD type variable. 16#[Transparent_8bit][R_8bit][G_8bit][B_8bit]
	Flags for text alignment	Set a DWORD type variable. The following display formats can be used and their combined use is possible. 2#0000: Align top and left 2#0001: Center horizontally 2#0010: Align right 2#0100: Center vertically 2#1000: Align bottom
Color variables	Toggle color	Set a BOOL type variable for switching colors.
		 In the initial state, the variable set in [Tap] or [Switching] for [Input configuration] is linked. TRUE: Alarm state settings are used.
		• FALSE: Normal state settings are used.
	Normal state	Set the frame color and fill color for the normal state and alarm state using variables.
	Alarm state	
Look variables	Line width	Set the frame line width using variables.
	Fill attributes	 Set the fill format of the tool element using variables. 0: Fill 1: Unfill
	Line style	Set the line style using variables. 1: Solid line 2: Dashed line 3: Dash-dotted line 4: Dash-dotted-dotted line 5: Outline line
Status variables	Invisible	Set the BOOL type variable that switches between Show and Hide of the tool element in the online mode. When set to TRUE, the tool element is hidden.
	Deactivate inputs	Set the BOOL type variable that switches between Enable and Disable of the character input or mouse operation in the online mode.

8.7 Visualization Function

Setting item		Overview	Tool element
		When set to TRUE, mouse operation is disabled.	
Input configuration	OnDialogClosed	When the dialog is closed, the event is raised.	
	OnMouseClick	An event is fired when the mouse button is pressed and released on a tool element.	
	OnMouseDown	An event occurs when the mouse button is pressed on a tool element.	
	OnMouseEnter	An event occurs when the mouse pointer enters the tool element.	
	OnMouseLeave	An event occurs when the mouse pointer leaves the tool element.	
	OnMouseMove	Do not use.	
	OnMouseUp	An event occurs when the mouse button is released on the tool element (regardless of where it is pressed) or when the mouse button is pressed and released on the tool element (regardless of where it is released).	
	Тар	• Variable: Set the BOOL type variable that switches between TRUE and FALSE while the mouse remains clicked on the tool element.	
		 If "Change to FALSE using Tap" is checked, the set variable switches from TRUE to FALSE while the mouse remains clicked. 	
		• If "Tap enter if captured" is checked, the tool element is considered to be tapped even when the mouse is placed over the tool element while the mouse remains clicked after it is clicked in the area outside the tool element.	
	Toggle	 Variable: Set the BOOL type variable that switches between TRUE and FALSE when the mouse is clicked on the tool element. 	
		 If "Tap up arrow if captured" is checked, the variable changes even when the mouse click is released in an area outside the tool element while the mouse remains clicked after it is clicked on the tool element. 	
	Hot key	Do not use.	
Position		Set the coordinates, width, or height of the tool element.	Common
		Operate the tool element using the mouse to change the coordinates, width, or height.	
		Set the coordinates of each vertex of the tool element.	Polyline
		Operate the tool element using the mouse to change the vertex coordinates.	Bezier curve Polygon
Radius setting	Radius	Set the style of the corner rounding radius.	Rounded
		• From the style: The corner is rounded to the radius that matches the visualization style.	rectangle
		 Proportional to the element size: The corner is rounded to the radius that matches the size of a rounded corner rectangle object. 	
		• Explicit: The corner is rounded to the set radius.	
Line width variable	Integral value	Set the line width using variables.	Line

Setting item		Overview	Tool element
Line style variable	Integral value	Set the line style using variables.	
Begin End		Set the begin and end angles of the pie.	Pie
Variable for begin Variable for end		Set the variables that specify begin and end angles of a sector.	
Only show cirde I	ine	If this item is checked, only the portion of an arc is displayed.	
Dynamic points	Array of points	Do not use.	Polyline
	Number of points	Do not use.	Bezier curve Polygon
Clipping	If you check the box, only the visualization within the frame of the tool element will be displayed.		Frame
Show frame		You can set the visibility of the frame of the tool element.	
Scaling type	Leff-Right Scroll	 You can set the type of zoom for the image: Isotropic: The visualization will be scaled while maintaining the aspect ratio of the image. Anisotropic: The visualization will be scaled without maintaining the aspect ratio of the image. Fixed: Only the size of the frame of the tool element will be changed. The visualization will be displayed in its original size. Fixed and Scrollable: Only the part of the visualization within the frame of the tool element will be displayed. You can scroll to view different parts using scrollbars. 	
Scroll bar settings	Left-Right Scroll Position Variable Vertical Scroll Position Variable	Do not use.	
Deactivate background drawing		Do not use.	
Reference		Set the visualization to display on the frame object.	
Switch frame variable	variable	Sets the index number of the visualization to display on the frame object. Integer type variables can be set.	

Class: General control

Setting item		Overview	Tool element
Value, variable, d	ata array	Set the variable, array, etc.used by the tool element.	Common
Tab Width		Set the tab width.	Tab controll
Tab height		Set the tab height	
References	Header	Set the heading text to be displayed on the tab.	
	ImageID	Do not use.	
Bitmap info	Static ID	Do not use.	Button
Bitmap ID variabl	e	-	

Setting item		Overview	Tool element
Columns	Show row header	Set the title of the show row header.	Table
	Show colum header	Set the width of the column.	
	Image column	Do not use.	
	Image configuration	Do not use.	
	Alignment of headline text	Set the position of the headline text.	-
	Use template	If this item is checked, [Templates] is displayed. In the online mode, cells are drawn in the style according to the settings set in [Templates].	
	Alignment of template headline text	If this item is checked, the headline is drawn in the style according to the settings set in [Templates] in the online mode.	
Maximum array ir	ndex	Set the maximum number of items of each data array to be displayed.	
Row height		Set the row height.	
Scroll bar size		Set the scroll bar size.	
Display the row h Display the colum		If this item is checked, the row header and column header are displayed.	
Row header width	า	Set the width of the row header.	
Selection	selection color	Set the display color of the selected cell.	
	Selection font color	Set the font color of the selected cell.	
	Selection type	Set the type of the cell selection.	
	Frame around selected cells.	If this item is checked, the border of the selected cell becomes thicker.	
	Variable for selected column Variable for selected row	Set the variable that indicates the number of the selected columns or rows.	
	Variable for valid column selection Variable for row valid selection	Set the BOOL type variable that reflects the selected state of column or row.	
Shadow type		Set the shadow type of the border.	Text field
Selection and caret	Caret position	Set the variable that indicates the position of the caret (that displays the insertion point).	
configuration	Selection start Selection end	Set the variable that indicates the selection start position and selection end position when multiple texts are selected.	
	All selected	Set the BOOL type variable for selecting all texts. When set to TRUE, all texts are selected.	
Minimum value Maximum value		Set the maximum value and the minimum value of the bar.	Scroll bar Progress bar

Setting item		Overview	Tool element
Page size		Set the movement amount of a value when the scroll area is clicked.	Scroll bar Slider
Move to click		If this item is checked, the tab moves to the position (value) where the mouse is clicked in the scroll area.	
Bar	Diagram type (slider only)	Set the position where the scale is displayed.	-
	Orientation	Set the orientation of the scale.	
	Running direction	Set the direction in which the scale values increase.	-
Scale	Show scale	If this item is checked, the graduations are displayed.	Slider
	Scale start Scale end	Set the maximum value and the minimum value of the scale.	
	Main scale	Set the interval between the main scale graduations.	
	Sub scale	Set the interval between the sub scale graduations. If set to 0, the sub scale is disabled.	-
	Scale format	Set the numerical value format.	
	Scale proportion	Set the ratio (%) occupied by the scale to the entire object size.	
		The default is 0.	
Number format		Set the numerical value format.	Spin control
Interval		Set the interval in which the scale value increases or decreases when the arrow button is pressed.	
Value range	Minimum value Maximum value	Set the maximum value and the minimum value.	
Text properties	roperties Usage of If this item is checked, select whe default for the text style or to indiv		Check box Radio button
Number of colum	ins	Set the number of columns for displaying radio buttons.	Radio button
Radio button ord	er	Set the radio button placement order.	
		• From left to right: Radio buttons are placed in order from the left top to the right direction for the number of set columns.	
		• From top to bottom: Radio buttons are placed from the left top to the bottom direction equally for the number of set columns.	
Radio button settings	Radio button	New creation of buttons: Newly create radio buttons.	
		• Area: Individually set the text or tooltip to be displayed on the radio button.	
		Set the offset value that shifts the radio button downward for the line height (pixel).	
		Delete button: Used to delete the selected radio button.	

Class: Measurement control

Setting item		Overview	Tool element	
Background	Image color	Set the image color of the tool element.	Bar display	
	Own Image	 Set the background image. Image: Use in the initial state (< default >). Transparent color: Set a color that makes the background transparent. 	Meter Meter 90° Meter 180° Potentiometer	
	Optimized drawing	Please use the initial state (with the checkbox checked).		
Scale	Refer also to scale	e settings under "Class: General control".		
	Sub scale position	Set the position where the sub scale is displayed.		
	Scale type	Set the type of graduations indicated on the scale. Line, dot, square		
	Scale line width	Set the width of the scale graduation line.		
	Scale color	Set the color of the scale graduation line.		
	scale in 3D	If this item is checked, a gray shadow is added to each graduation of the scale.		
	Element frame	If this item is checked, a frame line is displayed outside the tool element.		
	Inside frame Outside frame	If this item is checked, a frame line is displayed inside and outside of the scale.		
	Base line	Set the baseline value for the histogram to be displayed.	Histogram	
Bar	Refer also to bar	efer also to bar settings under "Class: General control".		
	Optimum size for bar	If this item is checked, the bar width is expanded to match the element size.		
Positioning	Horizontal offset Vertical offset	The scale position is offset by the specified value from the original position. If a positive value is specified, the position is offset to the right direction and downward direction.		
	Horizontal scaling Vertical scaling	The scale size is enlarged or reduced by the specified value from th original size. If a positive value is specified, the size in the horizontal direction is reduced to the center direction and the one in the vertical direction is reduced to the downward direction.		
Arrow	Arrow type	Set the type of the arrow mark.	Meter 90°	
	Color	Set the color of the arrow mark.	Meter 180° Meter	
	Angle range	Set the direction of the meter.	Potentiometer	
	Aditional arrow	If this item is checked, an arrow mark is added to the scale portion of the meter.		
Subrange array	Use subrange	Do not use.	Histogram	
	Start Index End Index			
Display type		Set the type of the histogram.		

Setting item		Overview	Tool element	
		Bar, line, curve	-	
Line width		Set the line width (pixel) of the histogram to be displayed.		
Relative bar width		Set the bar width of the histogram relative to the graph area.		
Color - Color areas	Dorable Color areas	If checked, the colors within the range set in the color areas will always be displayed in the tool element.	Bar display Meter 90°	
		If neither "Persistent Color areas" nor "Use Color areas on Scale" is checked, the tool element will display the set color when the value in the "Value" field is within the range of the color range.	Meter 180° Meter Potentiometer Histogram	
	Use color areas for scale	If checked, the colors within the range set in the color areas will be applied to the scale and number parts of the tool element.		
		If unchecked, the color areas settings will be applied to the background of the scale when the checkbox is not selected.		
Color - color	Begin of area	Set the starting value of the color area.		
areas -Areas	End of areas	Set the ending value of the color area.		
	Color	Set the display color of the color area.		

■ Class: Lamps/Switches/Bitmaps

Setting item		Overview	Tool element	
Image setting	Transparent Transparent color	If [Transparent] is checked, the color set in [Transparent color] becomes transparent.	Dip switch Power switch Push switch	
	Isotropic type	 You can set the type of zoom: Isotropic: The image will be scaled while maintaining the aspect ratio of the width and height. Anisotropic: The image will be scaled without maintaining the aspect ratio of the width and height. Fixed: Only the size of the frame will be changed. The elements inside will remain at a fixed size. 	LED switch Rocker switch Rotary switch	
	Horizontal alignment Vertical alignment	The display will appear when the "Isotropic" option is selected in the Isotropic Type. Set the position of the elements within the frame.		
Element behavior	r	 Set the switch operation to "Toggle" or "Tap". Image toggler: Toggles between TRUE and FALSE of the set "Variable" every time the tool element is pressed. Image tapper: The set "Variable" remains TRUE while the tool element is pressed. 		

• Class: Date and time control

Setting item		Overview	Tool element
Display time	Use system time	If this item is checked, the system time is displayed.	Analog clock

Setting item	Overview	Tool element
	If this item is not checked, the time of the TOD type variable set in the displayed [Variable] is displayed.	

Numerical value format

The following table shows numerical value formats that can be set in properties.

Numerical data type	Numerical value format	Overview
Integer type	%d	Decimal notation
	%0	Unsigned integer in octal notation
	%x	32-bit unsigned integer in hexadecimal notation (with the letters a to f in lower case)
	%X	32-bit unsigned integer in hexadecimal notation (with the letters A to ${\sf F}$ in upper case)
	%u	Unsigned integer in decimal notation
Float	%f	Decimal notation with decimal point
	%e	Exponent notation
Time	%t[d] %t[dd]	Date display %t[d]: 1 to 31 %t[dd]: 01 to 31 (with 0 prefix if single digit)
	%t[H] %t[HH] %t[h] %t[hh]	Hour display • %t[H]: 1 to 24 • %t[HH]: 01 to 24 (with 0 prefix if single digit) • %t[h]: 0 to 12 • %t[hh]: 00 to 12 (with 0 prefix if single digit)
	%t[m] %t[mm]	Minute display • %t[m]: 0 to 59 • %t[mm]: 00 to 59 (with 0 prefix if single digit)
	%t[s] %t[ss]	Second display • %t[s]: 0 to 59 • %t[ss]: 00 to 59 (with 0 prefix if single digit)
	%t[ms] %t[us] %t[ns]	Milli/micro/nano-second display • %t[ms]: 0 to 999 • %t[us]: 0 to 999 • %t[ns]: 0 to 999
	%t[yyy] %t[yy] %t[y]	 Year display %t[yyyy]: The year is displayed in four digits. %t[yy]: The year is displayed in two digits (00 to 99) %t[y]: The year is displayed in one or two digits (0 to 99)
	%t[MMMM] %t[MMM] %t[MM] %t[M]	 Month display %t[MMMM]: The month is displayed in English (Example: January) %t[MMM]: The month is displayed in abbreviated English (Example: Jan) %t[MM]: The month is displayed in two digits (01 to 12)

Numerical data type	Numerical value format	Overview	
		%t[M]: The month is displayed in one or two digits (1 to 12)	
	%t[ddddd]	Day display	
	%t[dddd] %t[ddd]	 %t[ddddd]: The day of the week is displayed in numerals (1 = Monday,, 7 = Sunday) 	
	%t[dd] %t[d]	 %t[dddd]: The day of the week is displayed in English (Example: Monday) 	
		 %t[ddd]: The day of the week is displayed in abbreviated English (Example: Mon) 	
		 %t[dd]: The date is displayed in two digits (01 to 31) 	
		• %t[d]: The date is displayed in one or two digits (1 to 31)	
	%t[jjj]	Day of year display	
		%t[jjj] = 001 to 366	
String	%s	The character string is displayed in STRING type or WSTRING type.	
Other	%%	The percent symbol is displayed.	
The percent notation can be displayed by addir numerical value format to the beginning. (Exam %% will display "decimal number" %.)		The percent notation can be displayed by adding another numerical value format to the beginning. (Example: Specifying %d %% will display "decimal number" %.)	
%c Hexadecimal notation character is displayed in A		Hexadecimal notation character is displayed in ASCII.	
		Example: "16#41" is displayed as "A" in the tool element.	

Regarding the main property settings of the tool elements

Below are the main properties and their corresponding settings for each tool element.

Tool Element	Property	Setting Value
Lamp	Variable	BOOL type variable
DIP Switch		
Power Switch		
Push switch		
Push switch LED		
Rocker Switch		
Rotary switch		
Checkbox		
scroll bar	Value	Numeric variables
Bar display		
Meter 90°		
Meter 180°		
Meter		
Slider	Variable	
Spin Control		
Potentiometer		
Radio button		
Progress bar		
Analog Clock	Variable	TOD type variables
Table	Data arrays	Array type variables

Tool Element	Property	Setting Value
Histogram		
Rectangle	Input configuration	Set in each Input configuration
Round rectangle		
Ellipse		
Pie		
Button		

1 Info.

• About the display priority of input text

Tool elements, such as Rectangle, have several display settings: Text, Text Variable, Dynamic Text (text index) and Tooltip, Tooltip Variable, and Dynamic Text (tooltip index). If you set them at the same time, the display order is fixed.

Setting item 1	Setting item 2	Items to display
Texts	Text variable	Texts
Tooltip	Tooltip variable	Tooltip
Texts	Dynamic text(Text index)	Dynamic text
Tooltip	Dynamic text (Tooltip index)	Dynamic text
Text variable	Dynamic text(Text index)	Dynamic text
Tooltip variable	Dynamic text (Tooltip index)	Dynamic text

Input Configuration

The properties of some tool elements, such as "Rectangle" and "Button", include [Input Configuration], which enables opening a dialog or rewriting a variable by a mouse click or other action.

List of input configuration items

The following [Input Configuration] items are available.

Setting item	Overview	
OnDialogClosed	When the dialog is closed, an event occurs.	
	This setting item applies to dialogs that are opened by [Input Configuration] of the same tool element as OnDialogClosed.	
OnMouseClick	When the mouse button is pressed and released on the tool element, an event occurs.	
OnMouseDown	When the mouse button is pressed on the tool element, an event occurs.	
OnMouseEnter	When the mouse pointer is placed on the tool element, an event occurs.	
OnMouseLeave	When the mouse pointer is moved away from the tool element, an event occurs.	
OnMouseMove	Do not use.	
OnMouseUp	When the mouse button is released on the tool element (regardless of where it is pressed) or when the mouse button is pressed and released (regardless of where it is released), an event occurs.	
Тар	While the tool element remains clicked, the set BOOL type variable is switched between TRUE and FALSE.	
Switching	Every time the tool element is clicked, the set BOOL type variable is switched between TRUE and FALSE.	
Hot key	Do not use.	

f Info.

- Do not set more than one [Input Configuration] for one tool element.
- Do not set more than one event for one [Input Configuration].

List of events

The following events are available depending on the input configuration. Details on each event will be described later.

Setting item	Overview	
Close Dialog	Close the set visualization dialog.	
	The variables declared in the interface editor can be used.	
Open Dialog	Open the set visualization dialog.	
	The variables declared in the interface editor can be used.	
Change the language	Change the language to be displayed in the visualization.	
	You can change to the language displayed in the Language field, which you added to the TextList/GlobalTextList as text.	
Change shown visualization	Change the visualization that will be displayed.	

Setting item	Overview	
Write a Variable	Write a value to the set variable.	
	Enter the value to be written from the keyboard of the PC.	
Toggle a variable	Switch the BOOL type variable between TRUE and FALSE.	

Close Dialog

Double-click "Close Dialog" to display the settings pane on the right side.

Input Configuration	×
OnMouseClick	
Image: Second system Image: Second system <td< th=""><th>Close Dialog Dialog: FileOpenSave ~ Result OK ~</th></td<>	Close Dialog Dialog: FileOpenSave ~ Result OK ~
Setting item	Overview
Dialog	Set the visualization name for the dialog to be closed. ^(Note 1)
Result	Set the return value when the dialog is closed. None, OK, Cancel, Abort, Retry, Ignore, Yes, No

(Note 1) Do not use set values other than those of the visualization in the project.

Open Dialog

Double-click "Open Dialog" to display the settings pane on the right side.

Input Configuration	10		×
OnMouseClick			
OnMouseClick Close Dialog Open Dialog Change the language Change shown visualizati Write a Variable Toggle a variable	on	8 Open Dialog	Open Dialog Dialog Image: Constraint of the second
			Open dialog modal Position to Open Centered Position X Y OK Cancel
Setting item		Overvi	ew
Dialog		If any v visualiz are dis • Para	name of the visualization to be opened as a dialog. ariable is declared in the interface editor for the ation to be opened as a dialog, the following setting values olayed in the blank field under "Dialog". ameter: The variable name declared in the interface editor splayed.
		disp	e: The type of the variable declared in the interface editor is layed. Ie: The variable declared in the project is set.
Update		Define	the return value for the dialog. DK, Cancel, Abort, Retry, Ignore, Yes, No
Open dialog modal		on the	ked, the visualization displaying dialogs can only operate dialogs. the initial state (checked state).
Position to Open	Centered	The dia	log will open in the center of the implementation section of alization being displayed.

Setting item		Overview
	Position	Do not use.

1 Info.

• For visualizations used in "Open Dialog" and "Close Dialog", you need to set "Use visualization as" to 'Dialog' in the object's properties settings.

For details, refer to "Visualization Properties".

• Variable declared in the interface editor and return value

"Open Dialog" and "Close Dialog" use the variable declared in the interface editor. The behavior of the variable differs depending on the variable type declared.

- Variable declared in VAR_INPUT
 This is used as an input variable to the dialog.
 When a dialog is opened by "Open Dialog", the variable value set in "Parameter" is substituted for the variable set in "Value".
- · Variable declared in VAR_OUTPUT

This is used as an output variable from the dialog. When a dialog is closed by "Close Dialog", if the return values specified for "Open Dialog" and "Close Dialog" are the same, the variable value set in "Value" is substituted for the variable set in "Parameter".

• Variable declared in VAR_IN_OUT

This is used as an input/output variable for the dialog. It performs the above two operations.

Change the language

Double-click "Change the language" to display the settings pane on the right side.

Input Configuration		×
OnMouseClick		
 Close Dialog Open Dialog Change the language Change shown visualization Write a Variable Toggle a variable 	Change the language	Change the language
		OK Cancel

Setting item	Overview
Language	Set the name of the language you want to display from those specified in the TextList.
	If this field is left blank or set to a nonexistent language name, the language specified in the 'Default' field will be set.



- The following shows the range in which "Change the language" will change the language when executed.
 - Text of the visualization that executed "Change the language"
 - Text of dialogs opened from the visualization that executed "Change the language"
 - Text of visualizations opened from the visualization that executed "Change the language"
- For text of visualizations that do not execute "Change the language", the language will not be changed.
- If you close the visualization being displayed, the language will return to the language specified in the 'Default' field.

Change shown visualization

Double-click "Change shown visualization" to display the settings pane on the right side.

Close Dialog Open Dialog Change the language Change shown visualization Write a Variable Toggle a variable < <	nput Configuration OnMouseClick	
	 ^𝔅 Close Dialog ^𝔅 Open Dialog ^𝔅 Change the language ^𝔅 Change the language ^𝔅 Change shown visualization ^𝔅 Write a Variable ^𝔅 ^{𝔅 ^𝔅}</sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup></sup>	Zoom to visualization Selection Assign: Assign expression: Previous shown visualization

Setting item		Overview		
Selection Assign		Specify the visualization to change to as an object name.		
	Assign expression	Specify the visualization to change to as a STRING type variable.		
Previous shown visualization Next shown visualization		The previously displayed visualization is displayed. You can return to up to nine previous visualizations.		
		If the visualization is changed by "Previous shown visualization", the visualization before the change is displayed.		

Write a Variable

Double-click "Write a Variable" to display the settings pane on the right side.

Input Configuration		×		
OnMouseClick				
 Close Dialog Open Dialog Change the language Change shown visualizati Write a Variable Toggle a variable 		e a Variable Write a Variable Input type Choose variable to edit Observation Use text output variable Use another variable Initial display format Min Max Dialog title Password field Position to open input dialog Use global setting (from Visualization manager) Centered Position X ElementRectangle.ptTopLeft.iX can t Y		
		OK Cancel		
Setting item		Overview		
Input type	Default	You can enter a numerical value or text in the input field that will be displayed.		
	Text input			

Text input	be displayed.
Limited text input	You can enter a numerical value or text in the input field that will be displayed as a dialog.
	When "Min" and "Max" are set, the lower and upper limits of the input range will be displayed in 'Min' and 'Max', respectively. If you enter a value outside the input range, the value in 'Min' or 'Max' will be displayed in red.
VisuDialogs.Keypad	Do not use.
VisuDialogs.Numpa d	
VisuDialogs.Numpa dExtended	

8.7 Visualization Function

Setting item		Overview		
Choose variable to edit	Use text output variable	Use the variable set in the tool element property [Text variable]- [Text variable] as the variable to be written.		
Use another variable		Set a variable to be written.		
Initial display format		Do not use.		
Min		Set the lower limit of the input range. ^(Note 1) The value will not be written if it is less than the lower limit.		
Мах		Set the upper limit of the input range. ^(Note 1) The value will not be written if it is more than the upper limit.		
Dialog title		Do not use.		
Password field		If checked, the variable value to be written will be displayed as asterisks (*).		
input dialog (from Visualization manager) Centered		Do not use.		
		An input dialog will open in the center of the implementation section of the visualization being displayed.		
		Do not use.		

(Note 1) Set the value so that "Min" is less than "Max".

Toggle a variable

Double-click "Toggle a variable" to display the settings pane on the right side.

Input Configuration	×
OnMouseClick	
Ø Open Dialog P Change the language Ø Change shown visualization Write a Variable Toggle a variable Toggle a variable >	Diggle a variable Variable Variable Uariable Uariable
Setting item	Overview
Variable	Set a BOOL type variable to switch between TRUE and FALSE.

8.7.5 Visualization examples

Visualization Example1 : axis movement and Moniter window

Create a monitor window to execute a jog or axis stop and to retrieve each parameter of the axis.

	Positive	Negative	St	top
	Velocity [u/s]	10.0	Hor	ning
Communication		Item	Set Value	Actual Valu
	\bigcirc	Item Position [u]	Set Value 37.7	Actual Valu 37.7
Communication Available	tinuous_motion			

1₂ Procedure

1. Place the tool elements required for visualization.

The tool elements used for this visualization are as follows.

Tool element	volume
Rectangle	1
Label	3
Button	4
Group box	3
Table	1
Spin control	1
Lamp	1
Power switch	1

2. Set "Text" for each Tool element.

Tool element	Setting item1	Setting item2	Description
Rectangle	Text	Text	%s
Label1	Text	Text	Velocity [u/s]
Label2	Text	Text	Communication Available
Label3	Text	Text	Axis State
Button1	Text	Text	Positive
Button2	Text	Text	Negative
Button3	Text	Text	Stop
Button4	Text	Text	Homing
Group box1	Text	Text	Servo ON
Group box2	Text	Text	Axis Movement
Group box3	Text	Text	Monitor

- Write a program that works with Visualization.
 Add a POU object to the project named 'MC_PRG' and include the following
 - Declaration section

```
// Motion
MC_Power_0 : MC_Power;
bRegON : BOOL;
MC_Jog_0 : MC_Jog;
bForward : BOOL;
bBackward : BOOL;
lrVel : LREAL:=10;
lrAcc : LREAL:=10;
lrDec : LREAL:=20;
MC_Stop_0 : MC_Stop;
bStop : BOOL;
ETC_CO_SdoWrite_0 : ETC_CO_SdoWrite;
bExe_SdoWrite : BOOL;
wIndexW : WORD;
bySubIndexW : BYTE;
diWriteData : DINT;
eWriteSize : CAA.SIZE;
MC_Home_0 : MC_Home;
bExe_Home : BOOL;
bHome : BOOL;
iStep : INT;
// Monitor
alrParameters : ARRAY [1..3] OF ARRAY [1..3] OF LREAL:=[[0,1,2],[0,0
,0],[0,0,0]];
```

• Implementation section

```
MC Power 0(
   Axis:=Axis1,
   Enable:=TRUE,
   bRegulatorOn:=bRegON,
   bDriveStart:=TRUE,
);
MC Jog 0(
   Axis:=Axis1,
   JogForward:=bForward,
   JogBackward:=bBackward,
   Velocity:=lrVel,
    Acceleration:=lrAcc,
    Deceleration:=lrDec,
);
MC Stop 0(
   Axis:=Axis1,
    Execute:=bStop,
    Deceleration:=10000,
);
ETC CO SdoWrite 0(
   xExecute:=bExe SdoWrite,
   uiDevice:=1001,
    wIndex:=wIndexW,
   bySubIndex:=bySubIndexW,
    udiTimeOut:=5000,
   pBuffer:=ADR(diWriteData),
    szSize:=eWriteSize
);
MC Home 0(
   Axis:=Axis1,
   Execute:=bExe Home,
    Position:=0,
);
// MC Home Sequence
CASE iStep OF
    0:
        diWriteData:=16#21;
        wIndexW:=16#6098;
        eWriteSize:=1;
        IF bHome = TRUE THEN
           bExe SdoWrite:=TRUE;
        END IF
        IF ETC CO SdoWrite 0.xDone = TRUE THEN
            bExe_SdoWrite:=FALSE;
            iStep:=1;
        END IF
    1:
        diWriteData:=16#D55550;
        wIndexW:=16#6099;
        bySubIndexW:=1;
        eWriteSize:=4;
```

```
bExe SdoWrite:=TRUE;
        IF ETC CO SdoWrite 0.xDone = TRUE THEN
            bExe SdoWrite:=FALSE;
            iStep:=2;
        END IF
    2:
        diWriteData:=16#155550;
        wIndexW:=16#6099;
        bySubIndexW:=2;
        eWriteSize:=4;
        bExe SdoWrite:=TRUE;
        IF ETC CO SdoWrite 0.xDone = TRUE THEN
            bExe SdoWrite:=FALSE;
            iStep:=3;
        END IF
    3:
        diWriteData:=16#F42400;
        wIndexW:=16#609A;
        bySubIndexW:=0;
        eWriteSize:=4;
        bExe SdoWrite:=TRUE;
        IF ETC CO SdoWrite 0.xDone = TRUE THEN
            bExe SdoWrite:=FALSE;
            bExe Home:=TRUE;
            iStep:=4;
        END IF
    4:
        IF MC Home 0.Busy = FALSE THEN
            bHome:=FALSE;
            bExe Home:=FALSE;
            iStep:=0;
        END IF
END CASE
// Monitor Table
alrParameters[2][1]:=Axis1.fSetPosition;
alrParameters[2][2]:=Axis1.fSetVelocity;
alrParameters[2][3]:=Axis1.fSetAcceleration;
alrParameters[3][1]:=Axis1.fActPosition;
alrParameters[3][2]:=Axis1.fActVelocity;
alrParameters[3][3]:=Axis1.fActAcceleration;
```

4. Set the variable required for each Tool element to work.

Tool element	Setting item1	Setting item2	Setting item3	Description
Rectangle	Text variable	Text variable		Axis1.nAxisState
Button1	Input configuration	Toggle	variable	MC_PRG.bForward
Button2	Input configuration	Toggle	variable	MC_PRG.bBackward
Button3	Input configuration	Toggle	variable	MC_PRG.bStop

8.7 Visualization Function

Tool element	Setting item1	Setting item2	Setting item3	Description
Button4	Input configuration	Toggle	variable	MC_PRG.bHome
Table	Data arrays			MC_PRG.alrParameters
Spin control	variable Number format			MC_PRG.lrVel
				%3.1f
	Interval			1
	Value range	Minimum value	9	1
		Maximum valu	e	500
	Input configuration	OnMouseDown ation		Refer to the next image for details.
Lamp	variable			Axis1.bCommunication
Power switch	variable			MC_PRG.bRegON

• Input configuration of Spin control

Close Dialog	Mrite	Write a Variable	
Open Dialog Change the language		Input type	
Change shown visualization		Default 🗸	
Write a Variable		Choose variable to edit	
Toggle a variable		Use text output variable	
		O Use another variable	
			1
	>		
	<	Initial display format	
		Min	
		Max	
		Dialogtitle	
		Password field	
		Position to open input dialog	
		O Use global setting (from Visualization manage	1
		Centered	

5. Create a TextList.

Add the TextList object to the project as 'TextList' and describe the following The contents described here will be used in the Table object.

ID	Default
0	Position [u]
1	Velocity [u/s]

ID	Default
2	Acceleration [u/s^2]

6. Set the properties of the Table.

Set the header of the item to be displayed in the [Show row header] of each [Columns] in the table.

Setting item1	Setting item2	Setting item3	Setting item4	Description
Columns	Columns	[0]	Show row header	Item
		[1]	Show row header	Set Value
		[2]	Show row header	Actual Value

Next, uncheck [Display the row header] and check [Columns] - [Use template] for each column. In the [template] field that appears, set the contents to be displayed in each column of the Table.

• Creation of 'item' column

Setting item1	Setting item2	Setting item3	Setting item4	Description
[0]	template	Dynamic text	TextList	'TextList'
			TextIndex	MC_PRG.alrParameters[1] [INDEX]

• Creation of 'Set Value' column

Setting item1	Setting item2	Setting item3	Setting item4	Description
[1]	template	Text	Text	%3.1f

• Creation of 'Actual Value' column

Setting item1	Setting item2	Setting item3	Setting item4	Description
[2]	template	Text	Text	%3.1f

Adjust the alignment, size, etc. of each Tool element.

Visualization Example2 : Language Change and Dialog Window

Use the textList language addition to change the language displayed on the Visualization window or to create a parameter setting window using a dialog box. In this example, the language is changed from Japanese to English.



1₂ Procedure

1. Create a Visualization that will serve as the main window.

Add the Visualization to the project and place the necessary Tool elements. Then, set each property (text, variable, etc.).



Of these, the following tool elements are used to change the language and display dialogs.

Tool element	Setting item1	Setting item2	Description	purpose
Rectangle	Text	Text	日本語	Language Change
Rectangle	Text	Text	English	Language Change
Rectangle	Text	Text	Setting	Displaying Dialogs

 Create a Visualization for the dialog window.
 Add Visualization to the project and declare the variables to be passed in the dialog in InterFace Edeitor.

```
VAR_IN_OUT
Velocity : LREAL;
Acceleration : LREAL;
END VAR
```

Next, place the required Tool element and set its properties.



Descriptions of the main properties are shown below.

The "Text variable" set in Rectangle1 and Rectangle2 refers to the variable declared in the InterFace Edeitor.

Item	Setting item1	Setting item2	Description
Rectangle1	Text	Text	%f
	Text variable	Text variable	Velocity
	Input configuration	OnMouseClick	Writing Variables
Rectangle2	Text	Text	%f
	Text variable	Text variable	Acceleration
	Input configuration	OnMouseClick	Writing Variables
Rectangle3	Text	Text	ОК
	Input configuration	OnMouseClick	dismiss a dialog
Rectangle4	Text	Text	Cansel
	Input configuration	OnMouseClick	dismiss a dialog

Setting background and Visualization properties

Item	Setting item1	Setting item2	Description
Background	Color setting	User color	Enable
			White
Visualization property	Visualization tab Use Visualization as follows		Dialog
		Use the specified Visualization size	Enable
		Visualization size	Width : 500 Height : 200

For the Input configuration of Rectangle 3 and Rectangle 4, set "dismiss a dialog".

- For "Dialog," select the Visualization for the created dialog screen. (In this example, the Visualization name for the Dialog is "EX02_Dialog".)
- In the "Result" section, select the text that is to be included in each Rectangle object.

Input Configuration				×
OnMouseClick				
 <i>Ø</i> Close Dialog <i>Ø</i> Open Dialog <i>Ø</i> Change the language <i>Ø</i> Change shown visualization <i>№</i> Write a Variable <i>№</i> Toggle a variable 	>	8 Close Dialog	Close Dialog Dialog: EX02_Dialog Result OK	
				OK Cancel

3. Add the language to be changed to TextList.

Add "en" column to GlobalTextList in the device tree. Put 日本語 in the "Default" column and the English translation for the "Default" column in the "en" column.A partial example is shown below.

GlobalTextList

ID	Default	en
943	English	
365	キャンセル	Cansel
108	サーボ ON	Servo ON
588	日本語	
238	速度 [u/s]	Velocity [u/s]

4. Set [Input configuration] for language change.

In the properties of each Rectangle object for language change on the main screen, set the "Change language" action to [Input configuration] - [OnMouseClick].

Input Configuration		×
OnMouseClick		
 <i>Ø</i> Close Dialog <i>Ø</i> Open Dialog <i>Ø</i> Change the language <i>Ø</i> Change shown visualization <i>№</i> Write a Variable <i>№</i> Toggle a variable 	Change the language	Change the language Language en
		OK Cancel

Set the language of each Rectangle object as follows. For "日本語," the "Language" field in [Input configuration] should be left blank, since the content is listed in the "Default" column of the TextList.

Text	Language
日本語	
English	en

5. Set [Input configuration] to display a dialog.

Set the "Open Dialog" action to [Input configuration] - [OnMouseClick] in the properties of the Rectangle object for displaying the main window language.

Close Dialog	5	Open Dialog	0 011
Open Dialog			Open Dialog
Change the language			Dialog
Change shown visualization			EX02_Dialog
Write a Variable Toggle a variable			Parameter Type Value Velocity LREAL Visu_PRG,IrVel
	>		Acceleration LREAL Visu_PRG.IrAcc
	<		
			Update 🍫 and 🐞 parameter in case of result
			Use Value
			None OK
			Cancel
			Abort
			Retry
			Open dialog modal
			Position to Open
			Centered
			Centered Position

- Set the "Dialog" to the Visualization name created in step 2.
- Set "Value" to the variable on the POU that reflects each "Parameter" entered in the dialog.
- For the "Update" part, check the "Value" is "OK" checkbox to reflect the value in the POU only when the "OK" button in the dialog is clicked.
- The other settings are to be used as they are in the initial state.

This completes the settings.

8.8 Reset of Controller

Reset operation resets the active applications and initializes the variables and settings.

Reset is divided into the following four types and variables and settings that are initialized differ according to the reset type.

Reset Warm

Initializes variables other than the RETAIN and PERSISTENT variables.

Reset Cold

Initializes variables other than the PERSISTENT variable.

Reset Origin

Initializes all variables. Active applications are deleted from the GM1 controller.

Device Reset

Initializes all variables and device user management information. Applications and source code are deleted from the GM1 controller.

- The following table shows the items that are initialized by reset or other tool operation or controller operation.
- O: Retained ×: Initialized Update: Updated

* : If you change the structure of the data by adding or deleting variables, the persistent variables will be cleared if you download it as it is, so please implement it together with "14.5.5 Saving and restoring persistent variables"

Operation	1	Variable s other than "RETAIN / PERSIS TENT"	RETAIN variable (RETAIN)	PERSIS TENT Variable s (PERSIS TENT)	(Boot) Applicati on	User manage ment	Source file	IP address	RTC time zone
Tool operation	Stop	0	0	0	0	0	0	0	0
operation	Reset warm	×	0	0	0	0	0	0	0
	Reset Cold	×	×	0	0	0	0	0	0
	Downloa d	×	×	0*	Update	0	Update	Update	0
	Online change	0	0	0*	Update	0	Update	0	0
	Reset Origin	×	×	×	×	0	0	0	0
	Resetting "Device"	×	×	×	×	×	×	0	0
Controlle r	Power cycling	×	0	0	0	0	0	0	0
operation	Resetting "Device" by means of	×	×	×	×	×	×	0	0

C	Operation	Variable s other than "RETAIN / PERSIS TENT"	RETAIN variable (RETAIN)	PERSIS TENT Variable s (PERSIS TENT)	(Boot) Applicati on	User manage ment	Source file	IP address	RTC time zone
	hard switching								

8.8.1 Reset Warm, Reset Cold, and Reset Origin

Execute Warm Reset, Cold Reset, and Reset Origin by selecting them from "Online" on the menu bar. This section explains the execution procedure, using Warm Reset as an example.

¹² Procedure

1. From the menu bar, select Online>Reset Warm.

Example: "Reset Warm" execution procedure

GM Programmer	×
? Do you real	want to perform the operation 'Reset Warm'?
	<u>Y</u> es <u>N</u> o

 Click the [Yes] button. Reset warm will be executed.

8.8.2 Executing Device Reset from GM Programmer

Device reset can be executed from the GM1 controller as well as from GM Programmer.

To execute device reset from GM Programmer, right-click in the navigator pane and execute device reset from the context-sensitive menu that is displayed.

1₂ Procedure

1. Right-click the [Device] object in the navigator pane and then select "Reset Origin" from the context-sensitive menu that is displayed.

A confirmation message will be displayed, asking whether to execute device reset.

GM Programmer	\times
Do you really want to perform the operation 'Reset Origin Device [Device]'?	
<u>Y</u> es <u>N</u> o	

2. Click the [Yes] button.

Device reset will be executed. When device reset is executed, you are logged out.



• If you right-click the [Application] object in the navigator pane and select "Delete application from device", the selected application will be removed.

8.8.3 Executing Device Reset from GM1 Controller

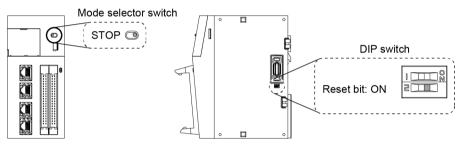
Device reset can be executed from the GM1 controller.



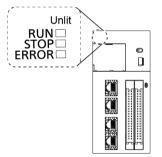
1. Confirm that the power supply is turned OFF, set the mode selector switch to STOP, and set the reset bit (SW2) of the DIP switch to ON.

f Info.

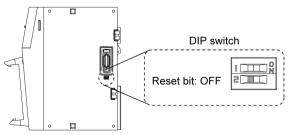
• Confirm that SW1 of the DIP switch is turned ON.



- Turn the power ON. Device reset will be executed.
- 3. When the "RUN", "STOP", and "ERROR" LEDs go out, device reset is completed.



After device reset is completed, turn the power OFF and set the reset bit of the DIP switch to OFF.



8.9 Checking the Status of GM1 Controller

8.9.1 Checking Logs

You can check logs of GM1 controller startup, shutdown, application download, and other events.

¹² Procedure

 Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "7.5 Connecting to the GM1 Controller". Double-click the [Device] object in the navigator pane.

	/	Ŭ	
=-: ()	Sample 1	-	^
ė	Device (AGM1CSRX16T)		
	☐ I Program_Configuration		

The Device setting window will be displayed.

Communication Settings	Scan Network Gateway	Device		
Date and Time and Settings				
Applications		<u>+</u> [
Log				
Users and Groups		Gateway	~	[0347.A064] (active)
Access Rights		IP-Address:	Ť	Device Name:
PLC Shell		localhost Port:		AGM1CSRX16T Device Address:
PLC Parameters		1217		0347.A064
Task Deployment				Target ID: 16A9 0001
Status				Target Type: 4102
Information				Target Vendor: Panasonic Corporation
				Target Version: 1.0.0.0

 Click the [Log] tab. The log window will be displayed.

ommunication Settings	🙂 0 warning(s)	O error(s) E 0 excep	tion(s) 🚯 0 information(s) 🕖	0 debug message(s)	All components> -	Logger <default logger=""></default>	• 🗠 🖻 🖬 💈
ate and Time and Settings	🗌 Offline loggi	ing 🔲 UTC time					
	Severity	Time Stamp	Description			Component	
oplications							
9							
sers and Groups							
cess Rights							
C Shell							
C Parameters							
sk Deployment							
tus							
ormation							

3. Click the 🎂 icon.

The log will be displayed.

Communication Settings	🙂 0 warning(s) 😳 9 error(s) 📧 0 exception(s)	● 165 information(s) ● 0 debug message(s) <all components=""> • Logger <def< th=""><th>ault logger> 🔹 🕫 🗐 🗐</th></def<></all>	ault logger> 🔹 🕫 🗐 🗐
	C Offline loo	iging 🗍 UTC time		
Date and Time and Settings				
	Severity	Time Stamp	Description	Component
Applications	0	11.11.2020 15:25:40.135	Setting router 2 address to (0064)	CmpRouter
	•	11.11.2020 15:25:40.135	Network interface <interface>COM<100></interface> at router <instance>2</instance> registered	CmpRouter
Log	0	11.11.2020 15:25:40.135	Network interface <interface>COM<100></interface> unregistered	CmpRouter
Users and Groups	•	11.11.2020 15:25:40.135	Reregister port 100, local address: 0x100	CmpBlkDrvCom
oacra unu croupa	0	11.11.2020 15:25:37.953	CODESYS Control ready	CM
Access Rights	0	11.11.2020 15:25:37.953	CH_INIT_FINISHED	Panasonic_GM_System
	0	11.11.2020 15:25:37.948	Application [Application] denied to start locked mode	СтрАрр
PLC Shell	0	11.11.2020 15:25:37.947	CH_INIT_COMM	Panasonic_GM_System
	0	11.11.2020 15:25:37.937	CH_INIT_TASKS	Panasonic_GM_System
PLC Parameters	0	11.11.2020 15:25:37.844	Setting router 3 address to (2ddc:c0a8:0105)	CmpRouter
	0	11.11.2020 15:25:37.844	Setting router 2 address to (0000)	CmpRouter
Fask Deployment	0	11.11.2020 15:25:37.844	Setting router 1 address to (0005)	CmpRouter
	0	11.11.2020 15:25:37.844	Setting router 0 address to (0005)	CmpRouter
Status	0	11.11.2020 15:25:37.841	Bootproject of application [Application] loaded	CmpApp
information	0	11.11.2020 15:25:37.839	Retains matched to bootproject of application [Application]	СтрАрр
, in offination	0	11.11.2020 15:25:37.834	UpdateConfig DataSet End	<16A90080>



- The displayed log can be exported (by clicking in) or imported (by clicking in) as an XML file.
- You can save the logs to an SD memory card. For details, refer to "14.7 SD card log storage function".

8.9.2 Checking the Status

You can check only one error item that has the highest severity level among all errors currently occurring in the GM1 controller.

¹² Procedure

- **1.** Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "7.5 Connecting to the GM1 Controller".
- 2. From the menu bar, select Online>Status.

The "Status" dialog box will be displayed. You can check only one error item that has the highest severity level among all errors currently occurring in the GM1 controller.

atus				
PLC Date Time: 11/11/2020 15:37:01	🗌 UTC	RTEX Reset(<u>R</u>)	Error Clear(<u>E</u>)	Close(<u>C</u>)
Error Name				Operation
RTEX AMP node number setting error				stop
Error No.: 1021				
	20200			
	20200			
	20200			
Error No.: 1021 Explain: 16A93003 00000004 0000E000 620	20200			

3. Click the "Close" button.

The "Status" dialog box will be closed.



Error types

The following table shows the types and recovery methods of errors that are displayed. Clicking the [Error Clear] button or [RTEX Reset] button deletes the target status item.

Error type	Recovery method
System error (power cycle)	Turn the GM1 controller OFF and then ON.
System error (Reinitialize)	Reinitialize the system. (Applications will be downloaded without executing a reset and the mode will be set to RUN.)
System error (Stop operation)	Click the [Error Clear] button.
System error (Continue operation)	Click the [Error Clear] button.
Incorporation / expansion error	Reinitialize the system.
Unit error	Click the [Error Clear] button or reinitialize the system.
RTEX error	Click the [RTEX Reset] button.

Refer to "8.11.2 Checking and Clearing Errors Using GM Programmer".

8.9.3 Checking the System Data History

You can check histories of errors that have occurred up until now.

¹² Procedure

- **1.** Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "7.5 Connecting to the GM1 Controller".
- 2. From the menu bar, select **Online>System Data History**.

The "System Data History" dialog box will be displayed. You can check errors that have occurred up until now.

Clicking the [Update] button collects system data histories again.

Clicking the [Export] button outputs the system data histories displayed in the dialog box to a ".csv" file.

Clicking the [Clear History] button deletes the system data histories that are displayed.

Update(<u>U</u>) Clear His	tory(<u>C</u>) UTC	Export(<u>E</u>)
Time Stamp	Error Name	
11/19/2020 14:25:37	CODESYS error	
11/19/2020 12:00:12	CODESYS error	
11/18/2020 15:17:37	CODESYS error	
11/18/2020 15:17:37	CODESYS error	
11/18/2020 15:17:37	RTEX Network communication timeout	
11/18/2020 09:40:50	CODESYS error	
11/18/2020 09:36:35	CODESYS error	
11/18/2020 09:35:33	CODESYS error	
11/12/2020 15:08:49	RTEX AMP node number setting error	
11/12/2020 09:50:02	RTEX AMP node number setting error	
11/12/2020 09:43:32	RTEX AMP node number setting error	
** ** 20000 00 04 05		
Error No.: 0300		·

3. Click the "×" button.

The "System Data History" dialog box will be closed.

i Info.

For details, refer to "8.11.2 Checking and Clearing Errors Using GM Programmer".

8.9.4 Task Monitoring

You can check the task status, the number of cycles, cycle time, and jitter while being logged in the GM1 controller.

Double-click the "Task Configuration" object in the navigator pane and select the "Monitor" tab.

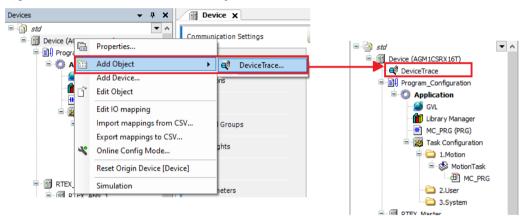
8.9.5 Device Trace Function

The Device Trace function of GM Programmer can monitor the CPU load factor of the GM1 controller.

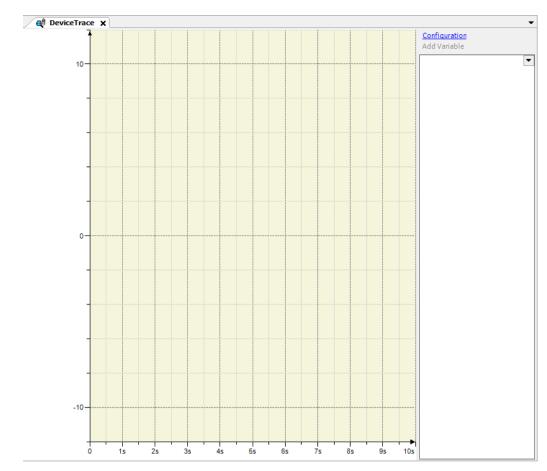
This function allows you to check whether the entire task falls within the appropriate CPU time range.

¹ ² Procedure

1. Right-click "Device" and select Add Object>DeviceTrace....



- 2. You will be logged in to the device.
- **3.** Double-click the "DeviceTrace" object that has been added. The "DeviceTrace" window will be displayed.

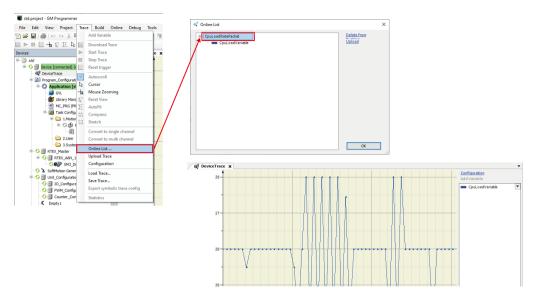


8.9 Checking the Status of GM1 Controller

- 4. From the menu bar, select Trace>Online List....
- 5. The "Online List" window will be displayed. With "CpuLoadRatePacket" selected, click "Upload".

Plotting the CPU load factor will start.

Note: As the Online List window is still open, click the [OK] button to close the window.

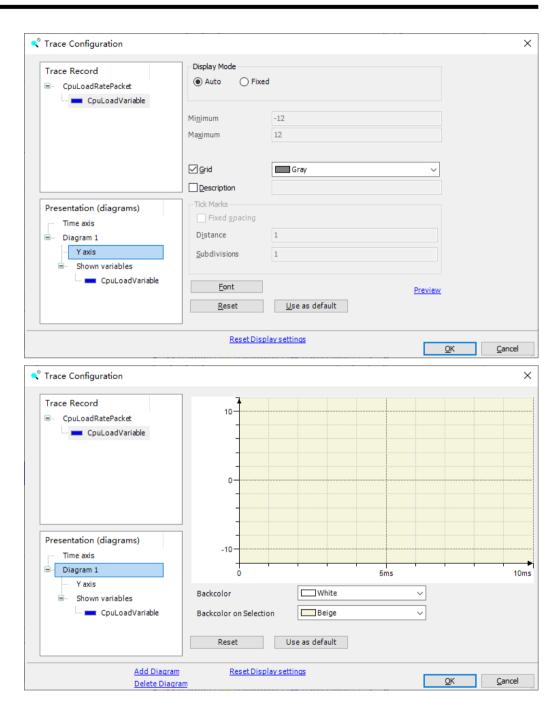


6. To change the graph display settings, click "Configuration" in the top right corner of the "DeviceTrace" window to open the "Trace Configuration" window.

Trace Configuration			×
Trace Record	Record Settings Enable Trigger Trigger variable * Trigger edge Posttrigger (samples Trigger Level Task Record condition		····
Presentation (diagrams) Time axis Diagram 1 Yaxis Shown variables CpuLoadVariable	Comment Re <u>s</u> olution Automatic restart Advanced	htta 	
Add Variable	Reset Displa	y settings	<u>Q</u> K <u>C</u> ancel

Trace Record	Variable settings			
CpuLoadRatePacket	Variable	OpuLoadVariable		
CpuLoadVariable	Graph <u>c</u> olor	Blue		~
	<u>L</u> ine type	Line		~
	<u>P</u> oint type	• Dot		~
	Activate minimum	warning		
	Critical Iower limit	0		
	Warning minimum	color Black		~
	Activate maximum	warning 🗸		
Presentation (diagrams)	Critical <u>upper limit</u>	80		
Time axis	Warning <u>m</u> aximum			~
B. Diagram 1	warning <u>m</u> aximum			Ť
Y axis Shown variables				
CpuLoadVariable				
Trace Configuration		splay settings	<u>Ö</u> K	Ca
Trace Configuration Trace Record CpuLoadRatePacket	Display Mode	xed length O Fixed	QK	Car
Trace Record	Display Mode Auto O Fix	red length O Fixed	Ōĸ	Car
Trace Record	Display Mode Auto O Fix Mi <u>n</u> imum		QK	<u>C</u> ar
Trace Record	Display Mode Auto Fix Mi <u>n</u> imum Ma <u>xi</u> mum	ed length O Fixed	<u>Q</u> K	Car
Trace Record	Display Mode Auto Fix Minimum Maximum Length	ted length O Fixed	<u>QK</u>	Car
Trace Record	Display Mode Auto Fix Mi <u>n</u> imum Ma <u>xi</u> mum	ed length O Fixed	<u>QK</u>	Car
Trace Record	Display Mode Auto Fix Minimum Maximum Length Grid	ted length O Fixed	<u>о</u> к	Car
Trace Record ■ CpuLoadRatePacket	Display Mode Auto Fix Minimum Maximum Length Grid Tick Marks	ted length O Fixed	<u>QK</u>	Car
Trace Record	Display Mode Auto Fix Minimum Maximum Length Grid Tick Marks Fixed spacing	ted length O Fixed 0 10ms 10ms Gray	<u>о</u> к	Car
Trace Record CpuLoadRatePacket CpuLoadVariable Presentation (diagrams)	Display Mode Auto Fix Minimum Maximum Length Grid Tick Marks	ted length O Fixed	<u>о</u> к	Car
Trace Record CpuLoadRatePacket CpuLoadVariable Presentation (diagrams) Time axis	Display Mode Auto Fix Minimum Maximum Length Grid Tick Marks Fixed spacing	ted length O Fixed 0 10ms 10ms Gray	<u>QK</u>	<u>C</u> ar
Trace Record CpuLoadRatePacket CpuLoadVariable Presentation (diagrams) Time axis Diagram 1 Y axis Shown variables	Display Mode Auto Fix Mingimum Length Grid Tick Marks Fixed spacing Distance	xed length O Fixed 0 10ms 10ms Gray Ims	<u>QK</u>	Car
Trace Record CpuLoadRatePacket CpuLoadVariable Presentation (diagrams) Time axis Diagram 1 Yaxis	Display Mode Auto Fix Mingimum Length Grid Tick Marks Fixed spacing Distance	xed length O Fixed 0 10ms 10ms Gray Ims		Car
Trace Record CpuLoadRatePacket CpuLoadVariable Presentation (diagrams) Time axis Diagram 1 Y axis Shown variables	Display Mode Auto Fix Minimum Maximum Length Grid Tick Marks Fixed spacing Distance Subdivisions	xed length O Fixed 0 10ms 10ms Gray Ims	<u>QK</u>	Car

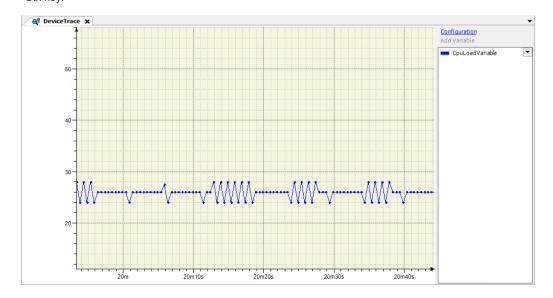
Г



Trace Record CpuLoadRatePacket	Display Mode	red		
CpuLoadVariable	Mi <u>n</u> imum	-12		
	Ma <u>x</u> imum	12		
	<u> ⊡ G</u> rid	Gray	~	
	Description			
Presentation (diagrams) Time axis	Tick Marks			
⊟… Diagram 1	D <u>i</u> stance	1		
Y axis	<u>S</u> ubdivisions	1		
CpuLoadVariable	<u>F</u> ont		Preview	
	<u>R</u> eset	<u>U</u> se as default		

7. The following operations can be performed on the graph.

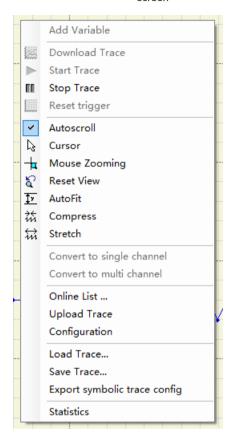
Dragging the mouse:To move the time axisDragging the mouse
while holding down the
Ctrl key:To move the Y-axisScrolling the screen:To lengthen or shorten the time axisScrolling the screen
while holding down the
Ctrl key:To lengthen or shorten the Y-axis



8. The following right-click menu items can be selected.

Save Trace:Allows you to save the data plotted on the graph as a fileLoad Trace:Allows you to load the trace file saved by selecting "Save Trace" onto the graph

screen





• Use the GM1 controller so that the average CPU load factor is no more than 90%. If 90% is exceeded, stable operation may not be achieved.

8.10 Checking the Performance of GM1 Controller

The GM1-series motion controller is a system in which multiple tasks run.

To ensure that the GM1 controller operates as a system normally, CPU resources must be allocated to each task properly.

- If CPU resources are insufficient: MotionTask and cyclic tasks cannot be operated at the specified intervals. Refer to "8.9.5 Device Trace Function" and keep the CPU load factor at 80% or less as a guideline.
- If the CPU load factor exceeds 80%:

Review the program in either one of the following ways.

- Extend the interval of MotionTask and cyclic tasks.
- For the program that does not require high speed processing, reassign to the tasks with long intervals.

Also, if the CPU load factor is high, missing RTEX command may occur. This section explains how to check missing RTEX command.

8.10.1 Checking Missing RTEX Command or EtherCAT Packets

The GM1 controller allows POU to be executed by allocating the POU to a task. To execute POU normally, the processing time ("cycle time") of the task must be smaller than the specified interval (*1) of the task.

*1:In the case of "MotionTask"

RTEX:Equivalent to the control cycle of the "RTEX_Master"

EtherCAT:Equivalent to the cycle time (control cycle) of "EtherCAT_Master_SoftMotion"

Task processing time

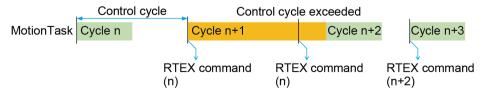
Task processing time can be viewed via the navigator pane and **Task Configuration>Monitor**. In the following example, cycle times of "MotionTask" can be viewed.

Monitor Va	ariable Usage	System Events Proper	rties							
Task	Status	IEC-Cycle Count	Cycle Count	Last Cycle Time (µs)	Average Cycle Time (µs)	Max. Cycle Time (µs)	Min. Cycle Time (µs)	Jitter (µs)	Min. Jitter (µs)	Max. Jitter (µs)
🞸 MotionTa	ask Valid	0	125624	82	83	358	59	-	-	-

Because cyclic communications are performed over the RTEX network, if the cycle time exceeds the task interval, the RTEX command will not be updated in the next cycle, causing the commanded position to remain the same as the previous value. (Missing RTEX command)

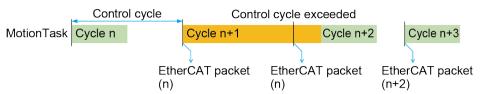
Example of missing RTEX command

In the following example, missing RTEX command occurs because the cycle time of cycle n+1 exceeds the control cycle.



Example of missing EtherCAT command

In the following example, missing EtherCAT command occurs because the cycle time of cycle n +1 exceeds the control cycle.



The occurrence of missing RTEX or EtherCAT command can be checked in the following ways.

1. Checking in POU

Function block "RTEX_GetTrackingCommandError" can be used to monitor the occurrence situation of missing RTEX command on the program.

Using the "IoDrVEtherCAT.GetStatistics.udiLostFrameCount" method, the occurrence situtation of the missing EtherCAT packet can be checked on the program.

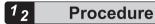
refer to the GM1 Series Reference Manual (Instruction Edition).

2. Checking with GM Programmer settings

Using the task watchdog timer function makes it possible to check whether the cycle time has exceeded the target value. In the example shown in the figure above, if time=1ms and sensitivity=1 are set, a watchdog timer error will occur in cycle n+1, causing the program to stop.

8.10.2 Performance Check Based on Device Trace

The GM1 controller allows multiple tasks to run. However, use the GM1 controller so that the CPU load factor (processing load of all tasks) is no more than 80%. The CPU load factor can be checked using the "Device Trace" function.



 Right-click the [Device] object in the navigator pane and then select Add Object>DeviceTrace from the context-sensitive object that is displayed.

Ē.	Properties			
*	Add Object	•	@ ₿	DeviceTrace
	Add Device			
ß	Edit Object			
	Edit IO mapping			
	Import mappings from CSV			
	Export mappings to CSV			
*	Online Config Mode			
	Reset Origin Device [Device]			
	Simulation			

The "Add DeviceTrace" dialog box will be displayed.



The selected "DeviceTrace" object will be added to the navigator pane.





• If the CPU load factor constantly exceeds 95%, the GM1 controller will judge the system to be out of control, causing the system to terminate with an error.

8.11 Error Notification Function

8.11.1 Overview of Errors

The GM1 controller has a self-diagnostic function which identifies errors and stops operation if necessary.

Indications concerning self-diagnosis are as follows.

■ LEDs related to self-diagnostic errors

		. . ,		(·/	
	LED displa	у			Description	Operation
	RUN	STOP	ERROR	ALARM	Description	status
Normal	•	0	0	0	Normal operation	Operating
	0	•	0	0	STOP mode	Stopped
Error	•	0	•	0	When a self-diagnostic error occurs (Operation continues.)	Operating
	0	•		0	When a self-diagnostic error	Stopped

•

•: Lit, ▲: Flashing, ○: Unlit, -: Indefinite (Lit or unlit)

PLC parameter setting

•

_

Ο

Operation mode at the time of error can be set to continue operation or stop operation in the PLC parameter setting.

occurs (Operation stops.)

System error

			Default Value	0	Description
A unit error occurred	Enumeration of BYTE	Stop operation	Stop operation		Please select the operation when a unit error occurred
Network setting					Network setting
🖹 🖤 🖗 LAN port1					LAN port1 network settings
IP Address	STRING	'192.168.1.5'	'192.168.1.5'		Specify the ip address for LAN port1.
Subnet Mask	STRING	'255.255.255.0'	'255.255.255.0'		Specify the subnet mask for LAN port1.
Default Gateway	STRING	'192.168.1.1'	'192.168.1.1'		Specify the default gateway for LAN port1.
🖹 🖤 🖗 LAN port2					LAN port2 network settings
IP Address	STRING	'192.168.2.5'	'192.168.2.5'		Specify the ip address for LAN port2.
🖤 🛷 Subnet Mask	STRING	'255.255.255.0'	'255.255.255.0'		Specify the subnet mask for LAN port2.
Default Gateway	STRING	'0.0.0.0'	'0.0.0'		Specify the default gateway for LAN port2.
	Vetwork setting Vetw	Vetwork setting Vetw			

Stopped

8.11.2 Checking and Clearing Errors Using GM Programmer

Error information can be checked in the status window of GM Programmer. In case of an operation continue error, the error can be resolved by RTEX Reset / Error Clear.



• Since the error resolution method varies depending on the error, refer to "8.11.5 Error Code List".

		Clearin	g errors	
Status				×
PLC Date Time : 11/11/2020 16:04:29	🗌 итс	RTEX Reset(<u>R</u>)	Error Clear(<u>E</u>)	Close(<u>C</u>)
Error Name				Operation
RTEX AMP node number setting error				stop
Error No.: 1021				~
Explain: 16A93003 00000004 0000E000 6203	20200			
	г	Error display		
				Y

8.11.3 Obtaining Error Information Using User Programs

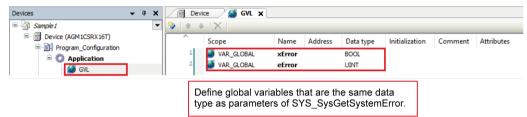
The following function block can be used to obtain error information for the GM1 controller.

• SYS_SysGetSystemError

This function block is used to obtain error information for the GM1 controller from external devices such as display units.

¹² Procedure

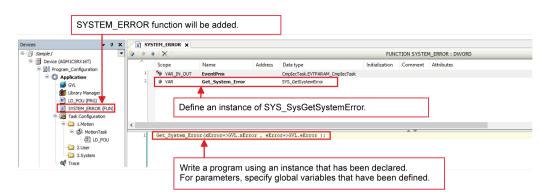
1. Define the variables to be used in the SYS_SysGetSystemError function block, as global variables.



2. Select "Task Configuration" and then the "System Events" tab, and register the function to be executed when a particular event occurs.

		Select an event. Select "After Reading In	puts".	
Devices		age System Events Properties		
Device (Addition Configuration Orgram_Configuration Of Application Of Application Of Application	Name	dler X Remove Event Handler () Event la	c	ontext Debugging
Image: Configuration Image: Configuration	Implementation De	Iler Event AfterReadingInputs on to call SYSTEM_ERROR Scope Application OPOUs language Structured Text ST) escription Called after reading inputs. Context Debugging=Enabled ter the function name (arbitecuted when the event occ	OK Cancel	

3. In the function that has been added, write a program for SYS_SysGetSystemError.



4. Map the defined global variables to the I/O map of the ModbusTCP Slave Device to allow external devices to get error information for the GM1 controller.

Sample 1 Sample 1 Ovice (AGM1CSRX16T)	General	Find	Filter Sho	w all		- 🖶 Ad	d FB for IO	O Channel * Go to Instance	
- Program_Configuration	Modbus TCP Slave Device I/O	Variable	Mapping	Channel	Address	Туре	Unit	Description	_
Application	Mapping			输入	%IW40	ARRAY [09] OF WORD		Modbus保持寄存器	
- 🎑 GVL	Modbus TCP Slave Device IEC	ė. 1 9		输出	%QW34	ARRAY [09] OF WORD		Modbus输入寄存器	
- 👔 Library Manager	Objects	8-10		输出[0]	%OW34	WORD			
LD_POU (PRG)	Modbus TCP Slave Device Parameters	 Application.xError 	20	Bit0	%/OX68.0	BOOL			
- SYSTEM_ERROR (FUN)	Parameters	- **		Bit1	%QX68.1	BOOL			
= 🧱 Task Configuration	Information	- **		Bit2	%QX68.2	BOOL			
🖻 🇀 1.Motion		- **		Bit3	%QX68.3	BOOL			
🖹 🍪 MotionTask	Status	- 10		Bit4	%QX68.4	BOOL			
B LD_POU		-70		Bit5	%QX68.5	BOOL Degie	~ + h	a declared aleb	
- 🗀 2.User		- **		Bit6	%OX68.6		Register the declared glol variables on the I/O map.		Jai
- California System		10		Bit7	%QX68.7	BOOL variab			
🚭 Trace		- 50		Bit8	%QX69.0	BOOL		n alle n e linepi	
TEX_Master				Bit9	%QX69.1	BOOL			
RTEX_A6N_1		**		Bit10	%QX69.2	BOOL			
SM3_Drive_RTEX_A6N_1				Bit11	%QX69.3	BOOL			
SoftMotion General Axis Pool				Bit12	%QX69.4	BOOL			
Init_Configuration				Bit13	%QX69.5	BOOL			
LANPort1		- **		Bit14	%QX69.6	BOOL			
ModbusTCP_Slave_Device				Bit15	%QX69.7	BOOL			
LANPort2		Application.eError	~ *	輸出[1]	%QW35	WORD			
T I		B-50		輸出[2]	%QW36	WORD			
		B- 🍫		輸出[3]	%QW37	WORD			
•				输出[4]	%QW38	WORD			
"ModbusTCP Slave [Device"	B- 🖗		输出[5]	%QW39	WORD			
	201.00	B- * ø		輸出[6]	%QW40	WORD			
		B- 5 0		输出[7]	%QW41	WORD			
		8-50		輸出[8]	%QW42	WORD			
		<u>iii - "p</u>		輸出[9]	%QW43	WORD			

5. If an error occurs, the error code will be set in the variable, so that external devices can get error information for the GM1 controller.

8.11 Error Notification Function

General	Find	Filter	Show all		- 4 4	dd FB for IO Channel
Modbus TCP Slave Device I/O Mapping	Variable	Mapping	Channel	Address	Туре	Current Value
Modbus TCP Slave Device IEC			Inputs Outputs	%IW40 %QW34	ARRAY [09] OF WORD ARRAY [09] OF WORD	
Objects	÷*		Outputs[0]	%QW34	WORD	
Modbus TCP Slave Device Parameters	Application.xError	~ >	Bit0	%QX68.0	BOOL	TRUE
r di diffecera	*		Bit1	%QX68.1	BOOL	FALSE
Information	* *		Bit2	%QX68.2	BOOL	FALSE
	*		Bit3	%QX68.3	BOOL	FALSE
Status	* *		Bit4	%QX68.4	BOOL	FALSE
	*		Bit5	%QX68.5	BOOL	FALSE
	* *		Bit6	%QX68.6	BOOL	FALSE
			Bit7	%QX68.7	BOOL	FALSE
	* *		Bit8	%QX69.0	BOOL	FALSE
	*		Bit9	%QX69.1	BOOL	FALSE
	**		Bit10	%QX69.2	BOOL	FALSE
	*		Bit11	%QX69.3	BOOL	FALSE
	* @		Bit12	%QX69.4	BOOL	FALSE
	*		Bit13	%QX69.5	BOOL	FALSE
	*		Bit14	%QX69.6	BOOL	FALSE
			Bit15	%QX69.7	BOOL	FALSE
	Application.eError	~ ` \$	Outputs[1]	%QW35	WORD	16#0300

If errors occur, error codes will be updated. Error codes can be obtained from external devices such as display units.

8.11.4 Error Recovery Processing

1 Info.

• For errors during simulation, check the log window or each function block. When an error occurs, normally, stop the operation.

When ERROR_LED flashes

A self-diagnostic error has occurred.

Solution

Check the condition according to the following procedure.

- 1. On the GM Programmer, select **Online>Status** and check the error content (error code).
- 2. Switch the mode to the PROG mode.
- 3. Cancel the situation in accordance with the error code.

When ALARM_LED lights up

Timeout of the system watchdog timer has been detected.

Solution

Check the condition according to the following procedure.

1. Turn the controller OFF and then ON. If the problem persists, consult your Panasonic representative.

Sample code

For a program that is used for error recovery processing, refer to the following.

<Sample program>

```
PROGRAM RTEX_ERROR_CLR
      VAR
       // SYS GetSystemError instance
      SYS_GetSystemError_0: SYS_GetSystemError;
  4
      bSYS Error: BOOL:
      uiSYS_ErrorID:UINT;
      iSequence: UDINT;
       // SYS ClearSystemError instance
      SYS_ClearSystemError_0: SYS_ClearSystemError;
       // MC_Reset instance
      MC_Reset_0:MC_Reset;
14
15
       // RTEX Reset instance
16
      RTEX Reset 0: RTEX_Reset;
      // SMC ReadFBError instance
19
      SMC_ReadFBError_0:SMC_ReadFBError;
      // SMC CheckAxisCommunication instance
      SMC_CheckAxisCommunication_0:SMC_CheckAxisCommunication;
      END VAR
-
      SYS GetSystemError 0
               Error=>bSYS Error,
      ErrorId=>uiSYS_ErrorID);
IF bSYS Error = TRUE THEN // Select Reset target from Error ID
          IF (uISYS_ErrorID = 16#0106) OR (uISYS_ErrorID = 16#0200) OR ((uISYS_ErrorID >= 16#0221) AND (uISYS_ErrorID <= 16#0227)) OR (uISYS_ErrorID
               iSequence := 1;
          END IF
 a
      END_IF
      IF uISYS_ErrorID <> 0 THEN
          CASE iSequence OP

1: // GM1 SystemError Clear

SYS_ClearSystemError_0 (
14
                           xExecute := TRUE):
15
                   IF SYS_ClearSystemError_0.xDone = TRUE THEN
16
17
                       iSequence := 2;
                  END IF
18
              2: // Call MC_Reset only on the error axis
                  IF Axisl.nAxisState = errorstop THEN
20
                       MC Reset 0(
                                Axis:=Axis1,
22
                                Execute:=TRUE);
                   END IF
24
                   IF (Axisl.nAxisState <> errorstop) THEN
25
                       iSequence := 3;
26
                   END_IF
27
28
              3: // Call RTEX_Reset
                  // Note: Do not call RTEX_Reset in succession
// It takes time to complete the reset (RTEX_Reset.Done = TRUE)
29
30
                   RTEX_Reset_0(
31
                       Execute := TRUE);
33
                   iSequence := 4;
33
              4: // Wait for RTEX Reset to complete
34
                   IF RTEX_Reset_0.Done = TRUE THEN
35
36
                       // FB initialization
SYS_ClearSystemError_0(
                            xExecute:=FALSE);
3'
                       RTEX_Reset_0(
38
35
                           Execute:=FALSE);
40
                       MC_Reset_0(
41
                           Axis:=Axis]
42
                            Execute:=FALSE);
43
                       iSequence := 5;
44
                  END IF
45
              5: // FB error check and clear for each axis
44
                   SMC_ReadFBError_0(
4'
                           Axis := Axisl,
48
                           bEnable := TRUE);
                  IF SMC ReadFBError_0.bFBError = TRUE THEN
43
                       SMC_ClearFBError(
                               pDrive:=ADR(Axisl));
52
                   END IF
53
                   // Check the communication status of the axis
55
                   SMC_CheckAxisCommunication_0(
5
                            Axis:=Axisl,
5'
                            bEnable:=TRUE);
58
5
                   IF SMC_CheckAxisCommunication_0.bOperational = TRUE THEN
6
                       iSequence := 6;
                   END IF
61
63
               6: //End
63
64
65
           END_CASE
      END_IF
```

8.11.5 Error Code List

Error No.	Operatio n	Name	Error description and action method	Recover y method
0x0001	Stop	System error (serious)	Notify us of the error information or system data history information displayed on the status window of GM Programmer.	Power cycle
0x0002	Stop	System error (CODESYS)	Notify us of the error information or system data history information displayed on the status window of GM Programmer.	Power cycle
0x0003	Continue	System error (minor)	Notify us of the error information or system data history information displayed on the status window of GM Programmer.	Power cycle
0x0106	Continue	Device date and time, RTC error	Because the duration of the power failure exceeded the guaranteed period (14 days), the RTC time information was initialized.	Clear the error
			The device must be left ON for at least 10 minutes. (Time information is reset to April 1, 2019.)	
0x0110 to 0x113	Continue	PWM Frequency setting error	The cycle setting is out of range. Check whether the duty ratio is within the allowable range.	Re- downloa d
0x0120 to 0x123	Continue	PWM Duty ratio setting error	The duty ratio setting is out of range. Check whether the duty ratio is within the allowable range.	Re- downloa d
0x0130 to 0x131	Stop	Counter Overflow error	The counter value exceeds the upper limit. Perform reset or preset operation so that the counter value falls within the range between the upper and lower limits.	Re- downloa d
0x0140 to 0x141	Stop	Counter Underflow error	The counter value drops below the lower limit. Perform reset or preset operation so that the counter value falls within the range between the upper and lower limits.	Re- downloa d
0x0150 to 0x151	Continue	Counter Reset abnormal error	The count value becomes 0 under the reset conditions and goes out of the range between the upper and lower limits. Check the settings of the upper and lower limits of the counter. If 0 does not exist in the range between the upper and lower limits, make a preset request.	Re- downloa d
0x0160 to 0x161	Continue	Counter Preset abnormal error	The count value goes out of the range between the upper and lower limits under the preset conditions. Check whether the preset value falls within the range between the upper and lower limits.	Re- downloa d
0x0170 to 0x171	Continue	Counter Current value change abnormal error	The count value goes out of the range between the upper and lower limits when the current value is changed. After the current value is changed, check whether the new value falls within the range between the upper and lower limits.	Re- downloa d
0x0200	Continue	Expansion unit Communicatio n error	An expansion unit communication error has occurred. Check connections.	Clear the error
0x0201	Stop	Expansion unit	More than 15 expansion units are connected. Check connections.	Power cycle

8.11 Error Notification Function

Error No.	Operatio n	Name	Error description and action method	Recover y method
		Number of connections exceeded		
0x0203	Stop	Expansion unit Startup error	An attempt to upgrade the expansion unit could have failed. Upgrade again.	Re- downloa d
0x0205	Stop	Expansion unit Startup wait timeout error	Waiting for expansion unit startup has timed out. Check connections.	Re- downloa d
0x020C	Stop	Expansion unit Connection number mismatch	The number of expansion units in the project does not match the number of expansion units mounted. Check connections.	Re- downloa d
0x020D	Stop	Expansion unit Model code mismatch	The expansion unit model in the project does not match the expansion unit model mounted. Check connections.	Re- downloa d
0x020E	Stop	Expansion unit Version mismatch	The version of the expansion unit registered in the project does not match the version of the expansion unit mounted.	Re- downloa d
0x020F	Stop	Expansion unit Unit initialization error	Expansion unit initialization has failed. Check connections.	Re- downloa d
0x0221 to 0x022F	Continue	Expansion unit I/O data error	An I/O data error has occurred in the expansion unit. Check the installation environment.	Clear the error
0x0300	Continue	CODESYS error	A CODESYS error has occurred. Check the error details in the log window of GM Programmer.	Clear the error
0x1000 to 0x100F ^{(N} ote 1)	Continue	RTEX Amplifier alarm	An alarm has occurred in the servo amplifier. Use PANATERM Lite to check the alarm number.	Reset the amplifier
0x1010 to 0x101F ^{(N} ote 1)	Continue	RTEX Amplifier warning	A warning has occurred in the servo amplifier. Use PANATERM Lite to check the warning number.	Reset the amplifier
0x1020	Stop	RTEX AMP node duplication error	There are duplicate MAC IDs among servo amplifies. Check the MAC ID settings of servo amplifiers.	Power cycle
0x1021	Stop	RTEX AMP node number setting error	The number of axes in the project does not match the number of axes for the servo amplifiers. Check the number of axes in RTEX_Master.	Re- downloa d
0x1022	Stop	RTEX AMP node number setting error	The MAC ID in the project does not match the MAC ID of the servo amplifier. Check the settings.	Re- downloa d

Error No.	Operatio n	Name	Error description and action method	Recover y method
0x1023	Stop	RTEX Over the number of amplifier connections	The number of servo amplifiers that are connected is more than the maximum allowed number. Check connections.	Power cycle
0x1024 ^{(N} ote 1)	Stop	RTEX Amplifier parameter error RTEX function enhancement setting 1	There is an error with the settings of the servo amplifier parameter (RTEX function enhancement setting 1 "Pr7.22"). Review the settings.	Power cycle
0x1025	Stop	RTEX Amplifier connection error	The connected servo amplifiers are not supported by the GM1 controller.	Power cycle
0x1026	Stop	RTEX Communicatio n / Control Cycle setting error	RTEX_Master Communication / Control Cycle settings do not match the settings for the servo amplifiers. Review the settings.	Re- downloa d
0x1030 ^{(N} ote 1)	Stop	RTEX Amplifier parameter error RTEX function enhancement setting 1	There is an error with the settings of the servo amplifier parameter (RTEX function enhancement setting 1 "Pr7.22"). Review the settings.	Power cycle
0x1040 to 0x104F ^{(N} ote 1)	Stop	RTEX Amplifier parameter error RTEX speed unit setting	There is an error with the settings of the servo amplifier parameter (RTEX speed unit setting "Pr7.25"). Review the settings.	Reset the amplifier
0x1050 to 0x105F ^{(N} ote 1)	Stop	RTEX Amplifier parameter error Absolute encoder setting	There is an error with the settings of the servo amplifier parameter (absolute encoder setting "Pr0.15"). Review the settings.	Reset the amplifier
0x1060 to 0x106F	Stop	RTEX Amplifier parameter error RTEX function enhancement setting 2	There is an error with the settings of the servo amplifier parameter (RTEX function enhancement setting 2 "Pr7.23"). Review the settings.	Reset the amplifier
0x1070	Stop	RTEX	An attempt to clear a servo amplifier alarm has failed.	Reset the amplifier

8.11 Error Notification Function

Error No.	Operatio n	Name	Error description and action method	Recover y method
		Amplifier alarm clearing timeout		
0x1071	Stop	RTEX Amplifier communication error	An RTEX communication error has occurred. Check the network connection / installation environment.	Reset the amplifier
0x1072	Stop	RTEX Network communication timeout	RTEX communication has timed out. Check network connections.	Reset the amplifier
0x1077	Continue	RTEX Reset error	An attempt to reset RTEX has failed. Check network connections.	Reset the amplifier
0x1200 to 0x121F	Continue	RTEX Amplifier alarm	An alarm has occurred in the servo amplifier. Use PANATERM Lite to check the alarm number.	Reset the amplifier
0x1240 to 0x125F	Continue	RTEX Amplifier warning	A warning has occurred in the servo amplifier. Use PANATERM Lite to check the warning number.	Reset the amplifier
0x1280 to 0x129F	Stop	RTEX Amplifier parameter error RTEX function enhancement setting 1	There is an error with the settings of the servo amplifier parameter (RTEX function enhancement setting 1 "Pr7.22"). Review the settings.	Clear the error
0x12C0 to 0x12DF	Stop	RTEX Amplifier parameter error RTEX function enhancement setting 1	There is an error with the settings of the servo amplifier parameter (RTEX function enhancement setting 1 "Pr7.22"). Review the settings.	Power cycle
0x1300 to 0x131F	Stop	RTEX Amplifier parameter error RTEX speed unit setting	There is an error with the settings of the servo amplifier parameter (RTEX speed unit setting "Pr7.25"). Review the settings.	Reset the amplifier
0x1340 to 0x135F	Stop	RTEX Amplifier parameter error Absolute encoder setting	There is an error with the settings of the servo amplifier parameter (absolute encoder setting "Pr0.15"). Review the settings.	Reset the amplifier

(Note 1) For project version V1.3.3.0 or earlier, these error codes are reported.

9 Motion Control

 9.1 Basic Setting	. 9-2 . 9-2 . 9-7
9.2 Initial Setup for Servo Amplifiers9.2.1 RTEX parameter settings for servo amplifier9.2.2 EtherCAT parameter settings for servo amplifier	. 9-21
 9.3 Preparation for Operation	. 9-23 . 9-24 . 9-28
9.4 Operation up to running9.4.1 Servo ON or OFF9.4.2 Commissioning	. 9-32
9.5 Single-axis Operation9.5.1 Overview of Single-axis Operation9.5.2 Switching the Control Mode	. 9-35
9.6 Synchronous Control 9.6.1 Overview of Synchronous Control	
 9.7 Cam synchronous Control 9.7.1 Overview of Cam Control and How to Use It 9.7.2 Creating Cam Data 9.7.3 Types and Setting of Cam Curves 9.7.4 Cam Control (POU Programming) 	. 9-38 . 9-41 . 9-61
 9.8 CNC Control 9.8.1 Overview of CNC Control and How to Use It	. 9-75 . 9-77 . 9-85
 9.9 Motion Function Errors. 9.9.1 Overview of Motion Function Errors. 9.9.2 Error Check Method. 9.9.3 Clearing Errors. 	. 9-91 . 9-92

9.1 Basic Setting

9.1.1 Setting the Master axis

Refer to the following for how to set the master axis. RTEX:"11.1.1 Setting up the RTEX master" EtherCAT:"10.1.1 Setting up the EtherCAT master"

9.1.2 Basic Settings of the Axis

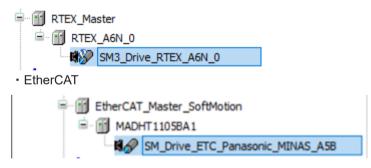
To use the motion function, configure the RTEX and EtherCAT axes. See below for how to add an axis. RTEX: "11.1.2 Adding and Setting up Servo Amplifiers" EtherCAT: "10.1.3 Adding and Setting up Servo Amplifiers"

Be sure to set the axis

¹² Procedure

1. Double-click the servo amplifier object in the navigator pane.

RTEX



2. From the displayed menu, select "Edit Object".

The settings window will be displayed in the main window.

RTEX

General	Axis type and limits	Software limits	Velocity ramp type
Scaling/Mapping	Virtual mode	Activated Negative [u]:	Trapezoid Sin ²
Commissioning	Finite	Positive [u]: 8388608	Quadratic
Home Return Settings		Software error reaction Deceleration [u/s ²]: 8388608	Quadratic (smooth)
SM3_Drive_RTEX_Panasonic: IEC Objects		Max. distance [u]: 0	ID: 0
Status	Dynamic limits Velocity [u/s]:	Acceleration [u/s ²] Deceleration [u/s ²] Jerk [u/s ³]:	Position lag supervision deactivated ~
Information	10	100 8388608 10000	Lag limit [u]: 1.0

EtherCAT

General	Axis type and limits				Velocity ramp type
Scaling/Mapping	Virtual mode	Software limits	Negative [u]:	0.0	 Trapezoid Sin²
commissioning	Finite		Positive [u]:	1000.0	○ Quadratic
SM_Drive_ETC_Panasonic_MINAS_ ASB: I/O Mapping		Software error reac	tion Deceleration [u/s²]:	0	Quadratic (smooth)
M_Drive_ETC_Panasonic_MINAS_ 5B: IEC Objects			Max. distance [u]:	0	ID: 0
tatus	Dynamic limits Velocity [u/s]:	Acceleration [u/s ²]	Deceleration [u/s²] J	erk [u/s³]:	Position lag supervision deactivated ~
nformation	5	100	100	10000	Lag limit [u]: 1.0

General Settings

Select the "General" tab and set the following items.

General Axis type and limits Velocity rate	np type
(1) Scaling/Mapping Virtual mode Software limits 0.0 (2) Scaling/Mapping Modulo Activated Negative [u]: 0.0	
(2) Commissioning © Finite Positive [u]: 8388608 O Quadra	ic ic (smooth)
Home Return Settings Deceleration [u/s ²]: 8388608 Identification	
SM3_Drive_RTEX_Panasonic: IEC Max. distance [u]: 0 ID: 0bjects	0
(5) Dynamic limits Velocity [u/s]: Acceleration [u/s ²] Deceleration [u/s ²] Jerk [u/s ³]: deactivate	supervision d v
Information 100 8388608 10000 Lag limit [u]: 1.0

(1) Virtual mode

You can set the real axis or virtual axis.

Use of the real axis: The real axis is used to actually control the servo amplifier.

Use of the virtual axis: A virtual servo amplifier is created in the GM1 Controller and its virtual axis is used.

(2) Modulo / Finite

The axis type can be specified.

Modulo

Modulo: The motor rotates infinitely (belt drive, etc.) without limiting the travel range.

- The command position value keeps looping between 0 and modulo value.
- The maximum settable modulo value is "255×units in application" (*1).
 - *1: Set the units in application in the Scaling / Mapping.
- · A negative value cannot be set. (A warning is issued. If the data is downloaded as is, an error will occur when executing the GM1.

Axis type and limits —		
Virtual mode	Modulo settings	
Modulo	Modulo value [u]:	8388608
○ Finite		

• Finite

The set value for the command position is a finite value.

Software limit can be set. Note that an error will occur if a 32-bit real number is exceeded.

Axis type and limits			
Virtual mode	Software limits	Negative [u]:	0.0
🔿 Modulo			8388608
Finite		Positive [u]:	000000

(3) Software limit

A software limit can be set if the axis type is set to "Finite".

If the command position is outside the software limit setting range, an error stop occurs and operation stops.

When operation is stopped by exceeding the software limit, the shortest time from the start of deceleration to the stop among the following settings is applied: the value set for the deceleration in response to the software error, for the maximum distance in response to the software error, or for the dynamic limit.

Axis type and limits	- 0 - h - 1		
Virtual mode	Software limits	Negative [u]:	0.0
O Modulo			
Finite		Positive [u]:	8388608

(4) Software error reaction

Settings can be made to stop operation when an error occurs.

Software error reaction		
	Deceleration [u/s ²]:	8388608
	Max. distance [u]:	0

i Info.

- When operation is switched from Run to Stop, an emergency stop is made regardless of the software error reaction.
- For the stop operation that takes place when an error stop occurs or when the software limit is exceeded, the shortest time from the start of deceleration to the stop among the following settings is applied.
 - · Deceleration in software error reaction
 - · Maximum distance in software error reaction
 - Dynamic limit
- If the deceleration and maximum distance in software error reaction are set to 0, these become invalid. In that case, operation stops according to the deceleration rate set in the dynamic limit.

(5) Dynamic limit

Speed, acceleration, and deceleration settings cannot be set to 0. If they are set to 0, a warning is issued.

Dynamic limits			
Velocity [u/s]:	Acceleration [u/s²]	Deceleration [u/s²]	Jerk [u/s³]:
10	100	8388608	10000

The values set in the dynamic limit can be checked if they are exceeded during axis operations using the "SMC_CheckLimits" function block Note that an excess of the jerk cannot be detected using the "SMC_CheckLimits" function block. Therefore, do not use the jerk column.

Scaling / Mapping Settings

Select the "Scaling/Mapping" tab and set the following items.

	General	Axis type and limits	Software limits	Velocity ramp type
(6) 🔶	Scaling/Mapping	Virtual mode	Activated Negative [u]:	 Trapezoid Sin²
	Commissioning	Finite	Positive [u]: 8388608	○ Quadratic
	Home Return Settings		Software error reaction Deceleration [u/s ²]: 8388608	Quadratic (smooth)
	SM3_Drive_RTEX_Panasonic: IEC Objects		Max. distance [u]: 0	ID: 0
	Status	Dynamic limits Velocity [u/s]:	Acceleration [u/s ²] Deceleration [u/s ²] Jerk [u/s ³]:	Position lag supervision deactivated ~
	Information	10	100 8388608 10000	Lag limit [u]: 1.0

(6) Scaling/Mapping

• Rotary type

When the axis type is set to modulo, the ratio in the conversion from the drive increment to the application unit is set.

The unit on the servo amplifier and the unit on the application (POU) are converted. Example:

One rotation of the MINAS A6N is 0x800000. To treat one rotation as 360 on the application, set this to 360.

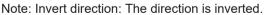
Motor Type	Scaling	on	
Rotary	16#800000	increments <=> motor turns	1
🔵 Linear	1	motor turns <=> gear output turns	1
	1	gear output turns <=> units in application	360

Note: Invert direction: The direction is inverted.

• Linear type

When the axis type is set to finite, the ratio in the conversion from the drive increment to the application unit is set.

Motor Type	Scaling		
O Rotary	16#800000	increments <=> units in application	360
Linear			



9.1.3 Axis Extended Setting

Configure Axis extended settings as required.

Right-click the object in the navigator pane and then select"Edit Object"from the contextsensitive menu that is displayed. The"RTEX or EtherCAT Axis Setting"dialog box will be displayed.

General	Axis type and limits				Velocity ramp type
Scaling/Mapping	☐ Virtual mode ○ Modulo	Software limits	Negative [u]:	0.0	 Trapezoid Sin²
Commissioning	Finite		Positive [u]:	8388608	O Quadratic
Home Return Settings		-Software error rea	tion Deceleration [u/s²]:	8388608	Quadratic (smooth)
SM3_Drive_RTEX_Panasonic: IEC Objects			Max. distance [u]:	0	ID: 0
Status	Dynamic limits	Acceleration [u/s ²]	Deceleration [u/s ²] Je	rk [u/s³]:	Position lag supervision deactivated ~
Information	10	100		0000	Lag limit [u]: 1000

Select the "General" tab and set the following items.

Velocity ramp type (2)
 Trapezoid Sin²
O Quadratic (smooth)
ID: 0
Position lag supervision (1) deactivated
Lag limit [u]: 1000

■ (1) Position lag supervision

Axis operations automatically stop when the difference (absolute value) between the command position of the axis and the actual position has exceeded the value set in Lag limit. The following stop methods are available.

You can enter a positive real number greater than or equal to 0 in Lag limit. Negative values cannot be entered.

The axis state is Errorstop after the operation stops with an error. Execute MC_Reset to recover from the error.

Stop methods	Details
deactivated	The position lag supervision function is disabled. (Default)
disable drive	Power is turned Off. In the program, the bRegulatorOn parameter of the axis structure (AXIS_REF_SM3) is forcibly switched to OFF.
do quickstop	The axis operation comes to a quick stop. Do not use.
stay enabled	The axis is brought to a stop according to the settings in Software error reaction. The axis remains powered On.

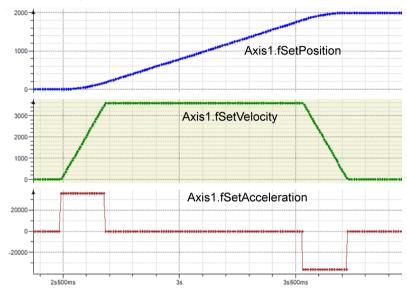
■ (2) Velocity ramp type

Velocity profiles are defined for each axis.

Trapezoid

In the trapezoidal velocity profile, velocity continues linearly. The refore, acceleration can rise sharply.

In this mode, jerk restriction does not work in each function block.



■ sin²

In the velocity profile defined with the sin² function, transition motion within each section of the velocity profile is smooth and acceleration does not rise discontinuously.

In this mode, jerk restriction does not work in each function block.

However, if you are using GM Programmer version 1.4.1.0 or earlier, jerk restriction works only when the acceleration is not zero at the start of function block execution.

i Info.

• If you are using GM Programmer version 1.4.2.0 or later, jerk restriction is enabled when the acceleration is not zero at the start of function block execution only with the following setting. Right-click the "Application" object in the navigator pane and then select "Properties" from the context-sensitive menu that is displayed.

In the Properties window, click the "Build" tab and add "SM3 BASIC SINSQUARE ACC RAMP" to the "Compiler constant definitions".

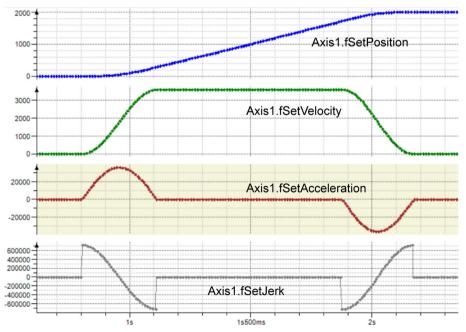
• To use the GM Programmer version with jerk restriction enabled, set an appropriate jerk value for the function block.

A sin² curve has a characteristic that the acceleration before and after the velocity profile is zero.

If motion in a sin² curve is interrupted and the current acceleration is not equal to zero, the acceleration value is gradually reduced to zero in order to start from zero acceleration.

Within this section, jerk restriction works due to the jerk input of the function block.

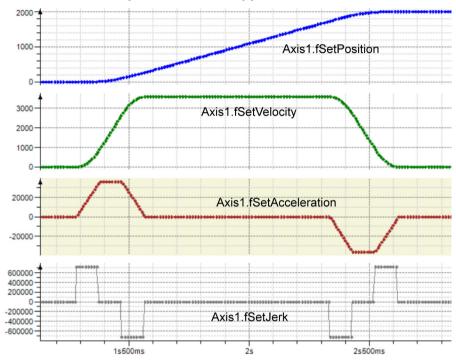
If the jerk value is too low at this time, this interval will become longer. This is dangerous because it may cause continuous motion in the opposite direction to the target value.



Quadratic

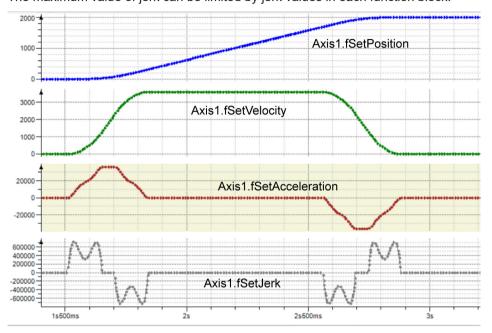
This is a trapezoidal acceleration profile with jerk restriction.

Acceleration changes partially linearly and continuously and jerk rises sharply. The maximum value of jerk can be limited by jerk values in each function block.



Quadratic (Smooth)

This is similar to "Quadratic", except that jerk does not rise sharply. The maximum value of jerk can be limited by jerk values in each function block.



■ (3) Axis state window in online mode

When "Modulo" is selected

Axis type and limits	s					Velocity ramp type
Virtual mode	- Modulo settings		0.0			 Trapezoid Sin²
Finite Software error reaction		Quadratic Quadratic (smooth)				
	bortmare	De	celeration [u/s x. distance [u]	-	8388608 0	Identification ID: 0
Dynamic limits Velocity [u/s]:	Accelerati	on [u/s²] Decele	eration [u/s²]	Jerk	[u/s³]:	Position lag supervision
10	10 100 8388608 10000		00	Lag limit [u]: 1.0		
Online						
variable	set value	actual value	Status:	S	MC_AXIS_STATE.p	ower_off
Position [u] Velocity [u/s]	360.00 0.00	360.00 0.00	Communicat	Communication: error (1000)		
Acceleration [u/s²] Torque [Nm]	0.00 0.00	0.00 0.00	Errors Axis Error: 0 [16#0000]	
	T		FB Error: SMC_ERRO uiDriveInte		C_CGR_INVALID_P(DSPERIOD

strDriveInterfaceError:

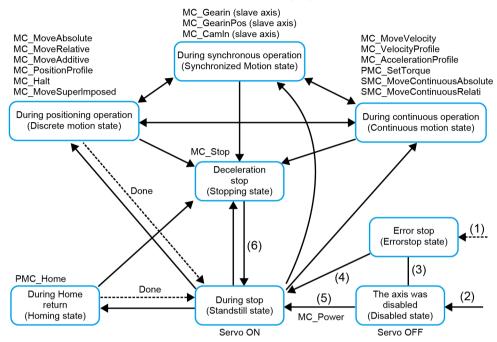
Modulo period invalid (<= 0 or > half bus bandwidth)

When "Finite" is selected

Virtual mode Software limits 0.0 0.0 Modulo Positive [u]: 0.0 Sin² Finite Software error reaction Deceleration [u/s²]: 8388608 Dynamic limits Max. distance [u]: 0 0 Dynamic limits Max. distance [u]: 0 Position lag supervision Velocity [u/s]: Acceleration [u/s²] Deceleration [u/s²] Jerk [u/s³]: 0 10 100 8388608 10000 Deceleration [u/s²]: Image: set value Status: SMC_AXIS_STATE.power_off Communication: communication: communication: perational (100) Errors Axis Error: 0 0.00 0.00 Fib Error:: SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError:	Axis type and limits						Velocity ramp t	ype
Modulo Positive [u]: 8388608 Quadratic © Finite Software error reaction Deceleration [u/s ²]: 8388608 Quadratic (smooth Dynamic limits Max. distance [u]: 0 Identification ID: 0 Dynamic limits Max. distance [u]: 0 Position lag supervision deactivated Lag limit [u]: 10 10 100 8388608 10000 Identification Lag limit [u]: 1.0 nline set value actual value Status: SMC_AXIS_STATE.power_off Communication: operational (100) Colorgue [Nm] 0.00 0.00 0.00 Firors Axis Error: 0 [16#0000000] FB Error: SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError: uiDriveInterfaceError: 10	Virtual mode						Trapezoid	
Positive [u]: 8388608 Quadratic Quadratic (smooth Deceleration [u/s ²]: 8388608 Dynamic limits Max. distance [u]: 0 Dynamic limits Position [u] 0 Velocity [u/s]: Acceleration [u/s ²] Deceleration [u/s ²] Deceleration [u/s ²]: 10 100 8388608 10000 Deceleration [u/s ²]: 10 100 8388608 10000 Deceleration [u/s ²]: 10 100 8388608 10000 Deceleration [u/s ²]: Lag limit [u]: 1.0 Inline Status: SMC_AXIS_STATE.power_off Communication: operational (100) Errors Axis Error: 0 [16#00000000] FB Error: SMC_ERROR.SMC_NO_ERROR uDriveInterfaceError:		Activ	ated Ne	gative [u]:	ative [u]: 0.0		⊖ Sin²	
Software error reaction Deceleration [u/s ²]: 8388608 Identification Dynamic limits Max. distance [u]: 0 ID: 0 Dynamic limits Position lag supervision deactivated Lag limit [u]: 1.0 10 100 8388608 10000 deactivated Lag limit [u]: 1.0 online Status: SMC_AXIS_STATE.power_off Communication: operational (100) Errors Axis Error: 0 [16#0000000] FB Error: SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError:			Positive [u]:		8388608	Quadratic		
Max. distance [u]: 0 Dynamic limits ID: Velocity [u/s]: Acceleration [u/s²] Deceleration [u/s²] 10 100 8388608 100 8388608 10000 Inline Status: SMC_AXIS_STATE.power_off Communication: operational (100) Communication: operational (100) Prosition [u/s²] 0.00 0.00 Acceleration [u/s²] 0.00 0.00 Corque [Nm] 0.00 0.00 FB Error: SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError:	I mile	-Software e	rror reaction -				🔾 Quadratic (smooth)
Max. distance [u]: 0 Dynamic limits ID: Velocity [u/s]: Acceleration [u/s²] Deceleration [u/s²]: 10 100 8388608 100 8388608 10000 Inline Status: SMC_AXIS_STATE.power_off Continuity [u/s] 0.00 0.00 Acceleration [u/s²] 0.00 0.00 Acceleration [u/s²] 0.00 0.00 Continuity [u/s] 0.00 0.00 Acceleration [u/s²] 0.00 0.00 Forgue [Nm] 0.00 0.00 FB Error: SMC_ERROR.SMC_NO_ERROR UDriveInterfaceError:				Deceleration [u/s	2]:	8388608	Identification	
Velocity [u/s]: Acceleration [u/s²] Deceleration [u/s²] Jerk [u/s³]: deactivated 10 100 8388608 10000 Lag limit [u]: 1.0 Inline			,	Max. distance [u]		0		0
Velocity [u/s]: Acceleration [u/s²] Deceleration [u/s²] Jerk [u/s³]: deactivated 10 100 8388608 10000 Lag limit [u]: 1.0 Inline variable set value actual value Status: SMC_AXIS_STATE.power_off Communication: operational (100) Velocity [u/s] 0.00 0.00 Communication: operational (100) Errors Axis Error: 0 [16#00000000] FB Error: SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError:	Dynamic limits						Position lag su	pervision
Inline set value actual value Position [u] 0.00 0.00 /clocity [u/s] 0.00 0.00 Acceleration [u/s ²] 0.00 -0.12 Forque [Nm] 0.00 0.00 Image: Status: SMC_AXIS_STATE.power_off Communication: operational (100) Errors Axis Error: 0 [16#00000000] FB Error: SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError:		Acceleration	n [u/s²] Dec	eleration [u/s²]	Jerk	[u/s³]:		\sim
variable set value actual value Position [u] 0.00 0.00 /elocity [u/s] 0.00 0.00 /coceleration [u/s*] 0.00 -0.12 /forque [Nm] 0.00 0.00 ///> 0.00 0.00 ///> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 0.00 //> 0.00 <	10	100	838	8608	100	00	Lag limit [u]:	1.0
SMC_ERROR.SMC_NO_ERROR uiDriveInterfaceError:	Position [u] /elocity [u/s] wcceleration [u/s²]	0.00 0.00 0.00	0.0 0.0 -0.1	0 Communicat 2 Errors 0 Axis Error:	tion: c	perational (100)	.power_oπ	
uiDriveInterfaceError:				FB Error:				
				SMC_ERRC	R.SM	C_NO_ERROR		
				uiDriveInte	erface	Error:		
-				0				
strDriveInterfaceError:				strDriveIn	erfac	eError:		

(4) "Online" - "State"

This indicates one of the axis states in the following figure.



(5) "Online" - "Communication"

This indicates one of the following communication states.

Stopped
Variable initialized
Basic communication initialized
Drive initialized
Drive synchronization on standby
Initialization done
Operational
Re-initialized
Error
Unknown

■ (6) "Online" - "Error"

• FB error

The oldest error that occurred on the axis,"SMC_ReadFBError", is displayed. "SMC_ReadFBError"function block.

• uiDriveInterfaceError / strDriveInterfaceError This is an internal error in the GM1 series.

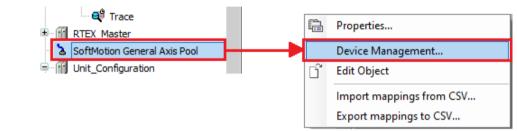
9.1.4 Adding and Setting up Free Encoder and Virtual Drive

This section explains how to add device objects for free encoders and virtual drives to a project and set them up.

For example, use the following procedure to add a device object for a virtual drive to a project and set it up.

¹ 2 Procedure

1. Right-click the [SoftMotion General Axis Pool] object in the navigator pane and then select "Device Management" from the context-sensitive menu that is displayed.



Device Management \times Device:RTEX Master Product ^ Mac ID Name Byte mode number -RTEX A6N 0 • -2 3 • 4 • 5 • Device:SoftMotion Drive No. Name Product number 2 3 4 5 ок Cancel

The "Device Management" dialog box will be displayed.

 Double-click the first row in the "Device: SoftMotion drive" table. The "Select Device" dialog box will be displayed.

Name	Vendor	Ven	dor <all vendors=""></all>			
 <i>B</i> - 56Meton drives						

3. Select a device object for the virtual drives.

ing for a fulltext search	Vendor	Vendor	<all vendors=""></all>	Version	Description	
SoftMotion drives						
SM_Drive_Virtual	3S - Smart	Software So	utions GmbH	4.0.0.0	SoftMotion virtual drive	

4. Click the [Select Device] button.

The selected device object of the virtual drive will be added.

	Name	Product number	Byte mode	í
0	RTEX_A6N_0 (SM3_Drive_RTEX_A6N_0)	RTEX_A6N	16Byte 💌]
1	-	-	-	
2	-	-	-	
3	-	-	-	
4	-	-	-	
5	-	-	-	
No.	Name	Product numbe	r	- 1
No. 1	Name SM_Drive_Virtual	Product numbe SM_Drive_Virtua		Í
				Î
1	SM_Drive_Virtual	SM_Drive_Virtua		
1 2	SM_Drive_Virtual -	SM_Drive_Virtua -		
1 2 3	SM_Drive_Virtual - -	SM_Drive_Virtua - -		

5. Click the [OK] button.

The selected device object of the virtual drive will be added to the navigator pane.



6. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to the virtual drive.

Seneral	Axis type and limits				Velocity ramp type	
SM_Drive_Virtual: Parameters	Virtual mode	Software limits	Negative [u]:	0.0	 Trapezoid Sin² 	
Commissioning	Finite		Positive [u]:	1000.0	Quadratic	
SM_Drive_Virtual: I/O Mapping		Software error read	tion Deceleration [u/s	2]: 0	Quadratic (smooth	1)
SM_Drive_Virtual: IEC Objects			Max. distance [u]	0	ID: 1	
Status	-Dynamic limits Velocity [u/s]:	Acceleration [u/s²]	Deceleration [u/s²]	Jerk [u/s³]:		
Information	30	1000	1000	10000]	

i Info.

• To remove a device object that has been added, select the device object in the navigator pane and press the "Delete" key.

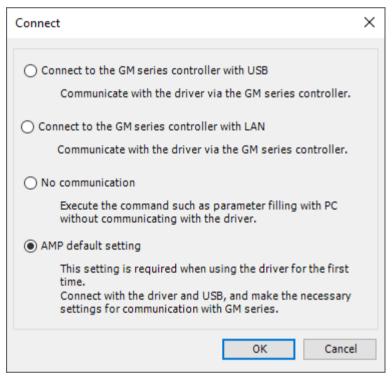
9.2 Initial Setup for Servo Amplifiers

In this section, initialize the servo amplifier.

¹² Procedure

- 1. Please refer to "15.3.1 Connecting the Servo Amplifier and PC" to connect
- 2. Start PANATERM Lite for GM.

The "Connect" dialog box will be displayed.



3. Select "AMP default setting" and click [OK].

The "Model confirmation" dialog box will be displayed.

Model confirmation				>
Driver's software version	Types of driver	Types of motor	AMP Production Sequence Number	Motor Production Sequence Number
Ver.3.2	MADHT1105BA1	MSMD5AZG1A	15120001	15100038
				OK Cancel

 Check the software version of the servo amplifier for which settings are to be changed and then click [OK].

The "Parameter change" dialog box will be displayed. Please refer to the following for parameter change. RTEX: "9.2.1 RTEX parameter settings for servo amplifier" EtherCAT: "9.2.2 EtherCAT parameter settings for servo amplifier"

P	Parameter change X				
	writing to	AMP EEF	PROM.		
ſ	-				
	Class	No	Parameter Name	Setup Range	Value
	00	11	Output pulse counts per one motor rev	1 - 2097152	2500
	00	15	Absolute encoder setup	0 - 4	1
	07	20	RTEX communication cycle setup	-1 - 12	3
	07	21	RTEX command updating cycle setup	1 - 2	2
	07	22	RTEX function extended setup 1	-32768 - 32767	1
	07	25	RTEX speed unit setup	0 - 1	1
[Set A/B p	hase out;	put counts per motor revolution.		^
					~
				ОК	Cancel

5. Click the [OK] button.

The "Setting Complete" dialog box will be displayed.

Click the [OK] button.
 The main panel will be displayed. Start the servo amplifier.

9.2.1 RTEX parameter settings for servo amplifier

Class	No	Parameter Name	Setup Range	Value
00	11	Output pulse counts per one motor rev	1 - 2097152	250
00	15	Absolute encoder setup	0 - 4	
07	20	RTEX communication cycle setup	-1 - 12	
07	21	RTEX command updating cycle setup	1 - 2	
07	22	RTEX function extended setup 1	-32768 - 32767	
07	25	RTEX speed unit setup	0 - 1	
et A/B p	hase out	put counts per motor revolution.		

If you are using the following settings, please change them according to your operating environment.

- "Absolute encoder setup"
- "Output pulse counts per one motor rev..."
- "RTEX communication cycle setup"
- "RTEX command updating cycle setup"

9.2.2 EtherCAT parameter settings for servo amplifier

Pa	rameter	change				×
w	riting to	AMP EEP	PROM.			
	Class	No	Parameter Name	Setup Range		Value
	07	40	Station alias setting(higher)		0 - 255	1
	07	41	Station alias selection		0 - 2	1
s	ets the u	upper 8 bi	its of the Station alias.			~
						× .
					ОК	Cancel
						.::

If Pr7.41 is set to 0, the setting of the rotary switch on the front panel of the servo amplifier and the setting of Pr7.40 will be set as Station alias.

Station alias		
High-order 8 bits	Low-order 8 bits	
3740H setting	Rotary switch setting	

If Pr7.41 is set to 1, the value of the SII area (0004h) will be set as Station alias.

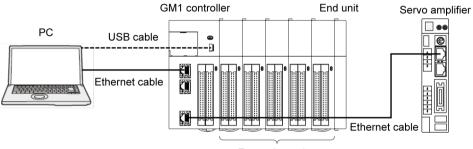
The value of the SII area (0004h) can be set using the EtherCAT slave device object of GM Programmer.

9.3 Preparation for Operation

9.3.1 Checking Wiring

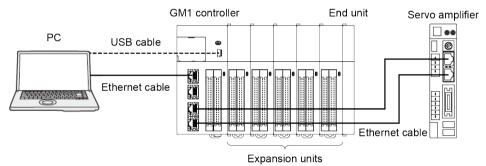
Firstly, check whether the GM1 Controller, expansion units, servo amplifier, and PC are connected correctly.

Example) EtherCAT connection:



Expansion units

Example) RTEX connection:



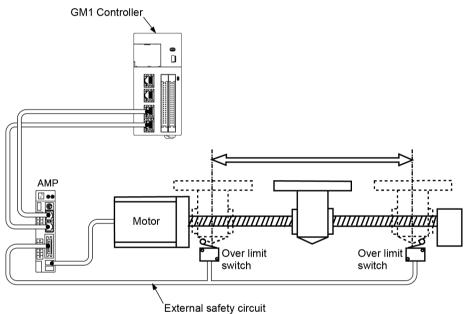
9.3.2 Checking Safety Circuit Design

Safety Circuit Design

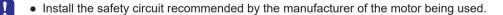
Example of a safety circuit

Be sure to create a safety circuit when using this product.



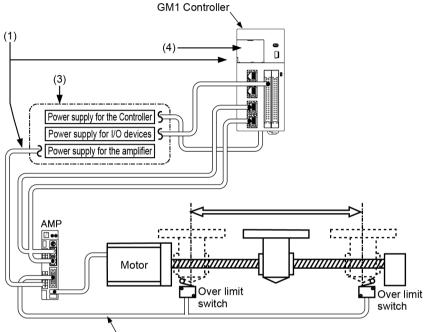


- Install over limit switches as shown above.
- Connect them to the CW and CCW over-travel inhibit inputs of the parallel I/O connector of the servo amplifier. For the GM1 Controller, connect them to the limit input (+) and limit input (-) through the network.



Items to Check during Wiring

System configuration example



(2) External safety circuit

(1) Checking connections of each device

Check to make sure that each device has been connected as indicated by the design.

(2) Checking the installation of the external safety circuit

Check to make sure the safety circuit (wiring and installation of over limit switch) based on the external circuit has been installed properly.

(3) Checking the settings for power ON sequence

Make sure that settings have been entered so that power supplies will be turned according.

(4) Checking the GM1 Controller mode selector switch

Set the GM1 Controller to the STOP mode. Setting it in the RUN mode can cause inadvertent operation.

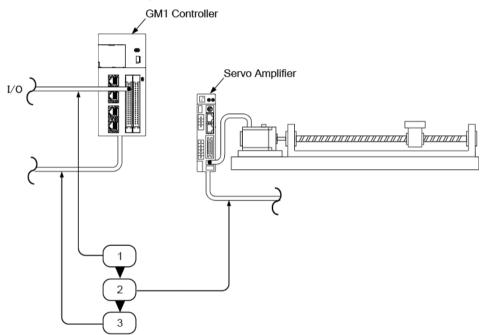
Power ON Operation

When turning ON the power supply to the system incorporating the GM1 Controller, turn ON the power supply in the following order.

 Consider the nature and statuses of any external devices connected to the system, and take sufficient care so that turning ON the power supply will not initiate unexpected movements.

¹² Procedure

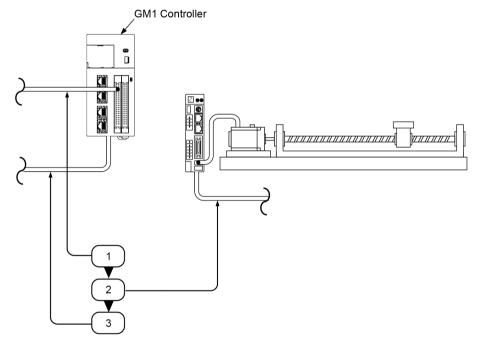
- 1. Turn ON the power supplies to the I/O devices connected to the GM1 Controller.
- 2. Turn ON the power supply to the servo amplifier.
- 3. Turn ON the power supply to the GM1 Controller.



Power OFF Operation

¹² Procedure

- 1. Check to make sure the rotation of the motor has stopped, and then turn OFF the power supply to the GM1 Controller.
- 2. Turn OFF the power supply to the servo amplifier.
- 3. Turn OFF the power supplies to the I/O devices connected to the GM1 Controller.



9.3.3 Operation Mode Switching

Switching to the RUN mode

There are the following two methods.

- Press the operation button (►) on the GM Programmer while the STOP LED is lit.
- Set the RUN/STOP switch on the GM1 Controller to RUN.

f Info.

• The switch cannot be set to the RUN mode if an error that does not allow to continue operation has occurred or if an exceptional situation has occurred.

Switching to the STOP mode

There are the following two methods.

- Press the stop button (=) on the GM Programmer while the RUN LED is lit.
- Set the RUN/STOP switch on the GM1 Controller to STOP.

9.3.4 Operation Check

Checking the Network

After turning ON the power supplies, check if the operation monitor LEDs of the GM1 Controller are in the following states.

- STATUS: Lit
- LINK: Lit



- If the "STATUS" LED is flashing, the network is not established.
- If the "LINK" LED is not lit, the "RX" (reception side) of the GM1 Controller and "TX" (transmission side) of the servo amplifier are not electrically connected normally.

Checking Input Signals

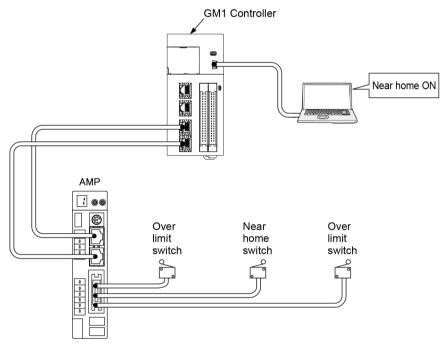
Check the input of the over limit switch for the safety circuit connected to the servo amplifier and the input of the near home (DOG) switch.

Check whether signal inputs are properly loaded into the GM1 Controller, with each switch operated forcibly.

The input state of each switch can be checked on the monitor screen of the MINAS Series Setup Support Software "PANATERM Lite for GM".

1 Info.

• If the operating direction of the motor is opposite to the position of the limits (+) and (-) after the installation of the over limit switch, check the physical connection of the limit switch.



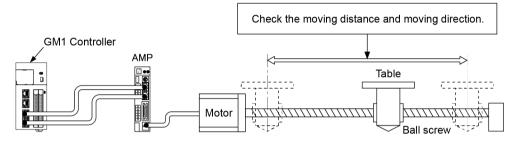
Checking Rotating and Moving Directions and Moving Distance

Check whether the rotating and moving directions of the motor and the moving distance are correct. The operations can be easily confirmed using the commissioning function of the GM Programmer without user programs.

Using the commissioning function

On the GM Programmer, select Project>Online Setting Mode.

Open the "Commissioning" screen for each axis to use the commissioning function.



Checking the rotation direction

Set the rotation direction on the servo amplifier. Check the rotation direction by executing inching operation on the Commissioning screen.

• Checking the moving distance

Set the moving distance on the servo amplifier.

Next, set the scale on the "Scaling / Mapping" screen for each axis on the GM Programmer. Check the moving distance by executing inching operation on the Commissioning screen.

i Info.

For details on inching operation on the Commissioning screen, refer to "11.2 Conducting Commissioning for Servo Amplifiers".

9.4 Operation up to running

This section explains how to run and stop the motor.

9.4.1 Servo ON or OFF

To turn ON or OFF the servo motor, use the "MC_Power" function block.

Explanation of function block

• For input "Axis", specify the axis corresponding to the servo motor. Example) In the case of SM3_Driver_EtherCAT_A6B_0, substitute "SM3_Driver_EtherCAT_A6B_0" for "Axis" of MC_Power.

EtherCAT_Master_SoftMotion
 MADHT1105BA1
 Mager SM3_Driver_EtherCAT_A6B_0

• When inputs "Enable", "bRegulatorOn", and "bDriveStart" are set to TRUE, the servo turns ON.

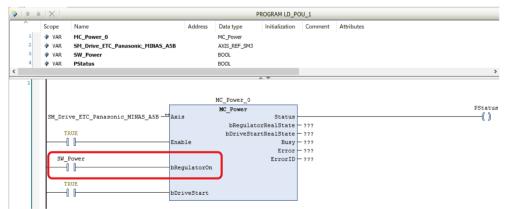
When input "bRegulatorOn" is set to FALSE, the servo turns OFF.

Program examples

The following are LD program and ST program examples that execute the "MC_Power" function block.

Setting variable "SW_Power" to TRUE turns ON the servo and setting it to FALSE turns OFF the servo.

LD program



ST program

Declaration section

```
PROGRAM ST_POU
VAR
MC_Power_0: MC_Power;
SW_power : BOOL := FALSE;
```

```
PStatus : BOOL := FALSE;
END_VAR
```

Implementation section

```
MC_Power_0(
```

```
Axis := Axisl ,
Enable := TRUE ,
bRegulatorOn := SW_power ,
bDriveStart := TRUE ,
Status => PStatus ,
bRegulatorRealState => ,
bDriveStartRealState => ,
Busy => ,
Error => ,
ErrorID =>
);
```

i Info.

• When executing "MC_Power", confirm in advance that communication has been established. The communication state can be checked using the "SMC_CheckAxisCommunication" function block.

9.4.2 Commissioning

Commissioning can be conducted using GM Programmer. To conduct commissioning, the GM1 controller must be connected in online setting mode. After switching to Online Configuration Mode, please refer to the following. EtherCAT:"10.2 Conducting Commissioning for Servo Amplifiers" RTEX:"11.2 Conducting Commissioning for Servo Amplifiers"

Online Config Mode

When the online config mode is selected, the servo amplifiers are set to be connected to the GM1 Controller.

When using the online config mode, perform the setting as described in "7.3 Communication Setting" in advance.

¹² Procedure

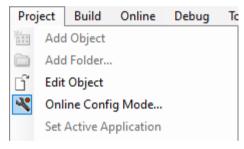
 From the menu bar, select Project>Online Config Mode. A confirmation message will be displayed, asking whether to remove all applications.

GM Prog	rammer	\times
?	Application configuration mode! All applications on PLC will be erased! Do you want to continue?	
	<u>Y</u> es <u>N</u> o	

2. Click [Yes].

All applications will be removed from the GM1 controller, and the GM1 controller and servo amplifiers will be connected in online config mode.

While online config mode is in progress, "Online Config Mode" in the menu bar remains selected.



i Info.

• To cancel the online config mode, select **Project>Online Config Mode** from the menu bar again.

9.5 Single-axis Operation

This section explains single-axis operations using function blocks.

9.5.1 Overview of Single-axis Operation

In single-axis operation, it supports Home Return,Switching the Control Mode,Stop and JOG / Inching.

Single-axis Operation type	Overview	Reference
Ssevo ON	Turn Servo ON and make it ready for operation.	"9.4.1 Servo ON or OFF"
Home Return	Home return of the axis can be performed.	RTEX: "11.3 Home Return" EtherCAT: "10.3 Home Return"
Switching the Control Mode	Switching between position, control, and torque control can be performed.	"9.5.2 Switching the Control Mode"
Stop	Decelerates the axis to a stop.	GM1 Series Reference Manual
JOG / Inching	JOG: Moves forward or reverse at a constant speed. Inching: The axis moves forward or reverse by a specified relative distance.	(Instruction).

9.5.2 Switching the Control Mode

Supports position control, velocity control, and torque control as control modes. Switching the Control Mode can be used while switching control according to the purpose. The control mode can be switched by "SMC_SetControllerMode" of the function block.

Control Mode and Corresponding Function Blocks

Control mode	Val ue	Name	Description	Corresponding Function Blocks
SMC_torque	1	Torque control mode	Torque control is performed at the specified torque.	PMC_SetTorque, SMC_SetTorque
SMC_velocity	2	Velocity control mode	Controls the motor to move at a specified speed.	MC_MoveVelocity, MC_VelocityProfile, MC_AccelerationProfile
SMC_position	3	Position control mode (Default value)	Controls the motor to move at a specified position or distance.	MC_MoveAbsolute, MC_MoveRelative, MC_MoveAdditive, MC_MoveSuperImposed,MC_Po sitionProfile, SMC_MoveContinuousAbsolute, SMC_MoveContinuousRelative, MC_MoveVelocity, MC_VelocityProfile, MC_AccelerationProfile



• For details, refer to the GM1 Series Reference Manual (Instruction).

9.6 Synchronous Control

9.6.1 Overview of Synchronous Control

Synchronous control supports synchronous gear control, synchronous cam control, and CNC control.

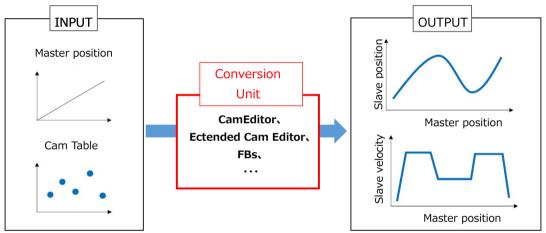
Synchronous control method	Overview	Reference
Synchronous gear control	Enables gear position control.	GM1 Series Reference Manual (Instructions Edition)
Synchronous cam control	Enables synchronous cam control of the axes using a cam table created by a tool or a cam profile created by POU.	"9.7 Cam synchronous Control"
CNC control	Enables motor control by converting G-code into executable form and computing command data from the CNC program to the motor at every control cycle.	"9.8 CNC Control"

9.7 Cam synchronous Control

9.7.1 Overview of Cam Control and How to Use It

This section describes an overview of cam control and how to use cam control with GM Programmer.

Cam control is control used to synchronize the master axis and slave axis in accordance with information (a cam profile) in which the position, velocity, and acceleration of the slave axis are defined based on the phase of the master axis (positional information). In the cam profile, information about the position and velocity of the slave axis is created from a cam table, in which representative points are defined, and the phase of the master axis (positional information) through a converter.



At the converter, conversion is performed largely through the following three steps to output information on slave position from information on master position.

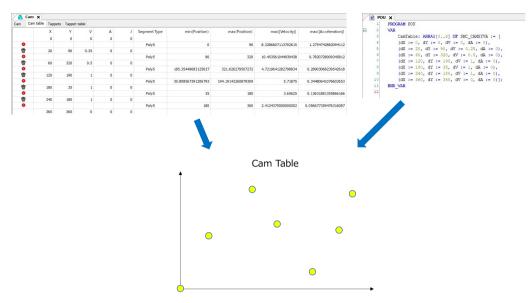
1₂ Procedure

1. Create a cam table

Create a cam table to define representative points that are elements of a cam profile (waveform information).

Configure representative points into which an operation section are divided and specify how these representative points are connected to each other to create a cam table. With GM Programmer, you can create it by the following three types of methods.

- Cam editor
- Expansion cam editor
- Programming in POU

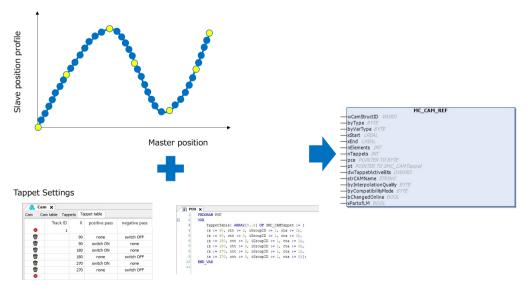


2. Convert the cam table into executable format

Read the created cam table and convert it into executable format.

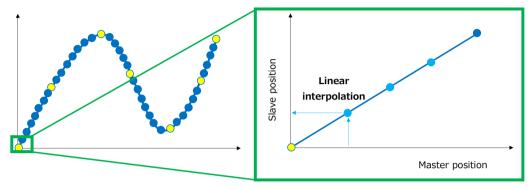
First, convert the cam table into profile data in which each section between the adjacent representative points is divided by information on the master position. Next, create a structure MC_CAM_REF that includes tappet settings in addition to the profile data about position. The tappet settings are a list of data (tappet table) about points that are to be switched ON or OFF in response to the master and slave positions. The data about points includes ON/OFF operation settings aside from the positional information.

Cam tables created by the Cam editor are automatically converted into profile data and MC_CAM_REF.



 Calculate axis command position from the profile data Read the profile data about position from the created MC_CAM_REF and compute a slave position to calculate a command position. The command position is derived from information about the master position by linearly interpolating data between the divided points of the slave axis position profile. Cam synchronous control is performed by causing the slave axis to move according to the command position.

To calculate a command position with GM Programmer, you must do programming using function blocks in POU.



1 Info.

- For the procedure for creating MC_CAM_REF using the Cam editor, refer to "Creating MC_CAM_REF by Cam Editor".
- For the procedure for creating MC_CAM_REF using the Expansion cam editor, refer to "Creating MC_CAM_REF by Ectended Cam Editor".
- Function blocks used in cam control are not just for interpolation calculation but also for acquisition of tappet switching action, axis parameter calculation, and other purposes. For details, refer to the GM1 Series Reference Manual (Instruction Edition).

9.7.2 Creating Cam Data

Creating MC_CAM_REF by Cam Editor

This section explains how to add a cam object and how to create MC_CAM_REF.

¹₂ Procedure

1. Right-click the "Application" object in the navigation pane and then select Add Object>Cam Table from the context-sensitive menu that is displayed.

The "Add cam table" dialog box will be displayed.

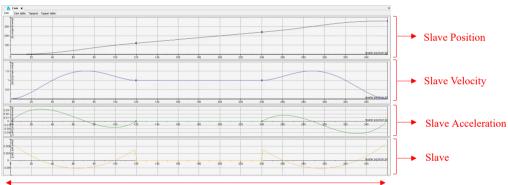
🖻 🔘 Application			
GVL 🛱 Paste			
	Object 🔸	8	Cam table
	Folder	8	CNC program
🗏 🁑 Task C	1		CNC settings
	e application from device	¢.	DUT
			External File
2.User		۵	Global Variable List
3.System		⊶0	Interface
🚭 Trace		T	Persistent Variables
EtherCAT_Master_SoftMotio		æ	POU
Unit_Configuration		æ	POU for implicit checks
LANPort1		A	Recipe Manager
LANPort2		•••	Symbol Configuration
		@ ₿	Trace

Enter a cam table name and then click the [Add] button.
 The name specified here will be used for an entry in a function block.

Add Cam table		×
🙆 Cam table		
Name:		
Cam		
	Add	Cancel

3. When the cam object is added, the "Cam" tab appears. Change the default path setting if necessary.

The "Cam" tab displays the following four items one by one in a vertical direction: position, velocity, acceleration, and jerk of a slave (vertical axis) relative to the master position (horizontal axis). The "Cam Table" tab displays numerical values that represent the graphs displayed in the "Cam" tab.



"Cam" tab



🙆 Ca	x ma									
Cam C	Cam table Tappe	ts Tappet ta	ble							
	X	Y	V	Α	J	Segment Type	min(Position)	max(Position)	max([Velocity])	max(Acceleration)
	0	0	0	0	0					
0						Poly5	0	120	1.512000000000007	0.03283528294141416
1	120	120	1	0	0					
•						Poly5	120	240	1	
1	240	240	1	0	0					
•						Poly5	240	360	1.512	0.03283528294141414
	360	360	0	0	0					

You can change the maximum and minimum values on the master axis and slave axis in the cam table. Right-click the "Cam" object in the navigator pane and then select

"Properties" from the context-sensitive menu that is displayed. In the Properties window, click the "Cam" tab and change the values.

ommon Cam Buile	d Access Contro	ol	
Dimensions Master start posit	ion:0	Master end position:	360
Slave start positio	on: 0	Slave end position:	360
Period Smooth trans	ition	Slave period:	360
Continuity requirer	ments Velocity	Acceleration	Jerk
Compile format			
 polynomial () one dimensio two dimensio 	nal point array	Elements:	256 ~

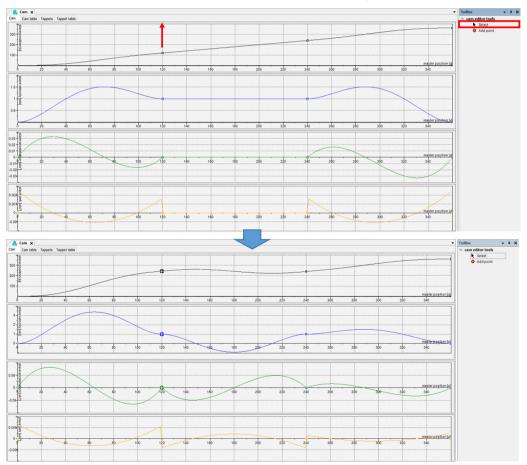
Item		Corresponding variables in MC_CAM_REF	Description
Dimensions	Master start/end position	xStart/xEnd	Defines scale values on the cam horizontal axis (master axis). A cam table can be created only within this range.
	Slave start / end position	-	Defines scale values on the cam vertical axis (slave axis). Slave position points on the Cam editor can be set only within this range.
			However, this does not apply to maximum and minimum values between position points.
Period	Smooth transition	-	Enabled: When a path is edited, the path is automatically adjusted such that the position, velocity, and acceleration values of the slave axis are continuous for the specified "Slave period" value. Details will be described later in step 4.
	Period	-	Specifies a period for the slave position. The specified value is reflected when the smooth transition setting is enabled.
Continuity requiremen ts	Position, Velocity, Acceleration, Jerk	-	Continuity of parameters for which the check box is selected (whether data before and after the representative point is continuous) is checked during build.
Compile format ^{(Note} 1)	Polynomial (XYVA)	byType = 3	A cam table is made up of master position, slave position, slave velocity, and slave axis acceleration items.
	one dimensional point array	byType = 1	A cam table is made up of only a slave position item. (master position is

Item		Corresponding variables in MC_CAM_REF	Description
			divided into equal intervals by the number of elements.)
	two dimensional point array	byType = 2	A cam table is made up of master position and slave position items.
	Elements	-	This can be used for one dimensional and two dimensional point arrays. Specifies the number of elements that make up the array.

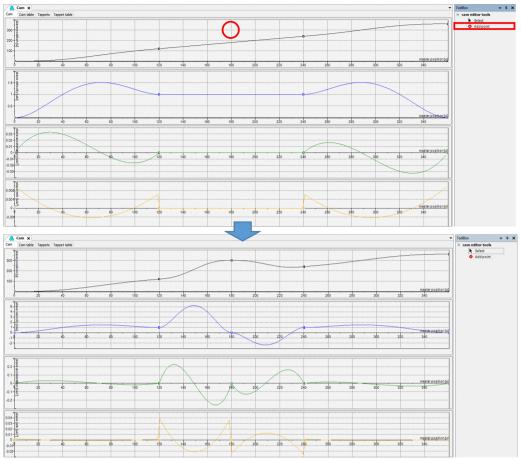
(Note 1) For details, refer to the GM1 Series Reference Manual (Instruction Edition).

4. To change the path on the "Cam" tab, use Toolbox.

To change the path by using a point already set, select "Select" in Toolbox and drag the point you want to change. Points can move only upward or downward. To delete a point, select the point with the "Select" tool and then press the "Del" key.



If you want change another part other than existing points, you must add a point to the path. Select "Add point" in Toolbox and then select a place on the path to which you want to add the point. The added point can be handled in the same way as points set by default.



To edit the path on the "Cam table" tab, directly enter values. Entered values will also be reflected in graphs in the "Cam" tab.

am Ca	am table Tappet	s Tappet ta	ble							
	Х	Y	v	Α	J	Segment Type	min(Position)	max(Position)	max(Velocity)	max(Acceleration)
	0	0	0	0	0					
•						Poly5	0	120	1.512000000000007	0.032835282941414162
1	120	120	1	0	0					
•						Poly5	120	240	1	0
1	240	240	1	0	0					
0						Poly5	240	360	1.512	0.032835282941414141
	360	360	0	0	0					
-	m x	(
-	m X am table Tappet	s Tappet ta	ble							
-	hereiter	s Tappet ta Y	ble V	A	J	Segment Type	min(Position)	max(Position)	max(Velocity)	max(Acceleration
-	am table Tappet			A 0	L D	Segment Type	min(Position)	max(Position)	max([Velocity])	max(Acceleration
am Ca	am table Tappet	Y	V			Segment Type Poly5	min(Position)	max(Position) 100	max(Velocity) 1.2358124999999995	max(Acceleration 0.0250145812094299
am Ca	am table Tappet	Y	V					100		
am Ca	am table Tappet	Y 0 100	V 0	0	0					0.0250145812094299
am Ca	am table Tappet	Y O	V 0	0	0	Poly5 Poly5	0	100 240	1.23581249999999995	0.0250145812094299
am Ca	am table Tappet	Y 0 100	V 0	0	0	Poly5	0	100	1.2358124999999995	0.0250145812094299

To add a point, click the 0 mark at a place where you want to add it. To delete the point, click the 0 mark. Note that after a change is made, segment types are automatically revised to ensure continuity.

\land Can	n x									
am Ca	m table Tappet	Tappet ta	ble							
	х	Y	V	Α	J	Segment Type	min(Position)	max(Position)	max(Velocity)	max(Acceleration)
	0	0	0	0	0					
0						Poly5	0	120	1.512000000000007	0.032835282941414162
Ŵ	120	120	1	0	0					
0						Poly5	120	240	1	0
1	240	240	1	0	0					
•						Poly5	240	360	1.512	0.032835282941414141
		200	(a)							
🚴 Cai	360 m ×	360	0	0	0		-			
-				0	0					
-	m x			0 A	J	Segment Type	min(Position)	max(Position)	max([Velocity])	max(Acceleration
-	m 🗙 am table Tappe	ts Tappet t	able			Segment Type	min(Position)	max(Position)	max([Velocity])	max(Acceleration
	m X am table Tappe X	ts Tappet t Y	able V	A	J	Segment Type Poly5	min(Position)	max(Position) 60	max([Velocity]) 1.6687407407407407402	max(Acceleration
am Ca	m X am table Tappe X	ts Tappet t Y	able V	A	J				4 74	.,
am Ca	m X am table Tappe X 0	ts Tappet t Y 0	able V 0	A 0	J				4 74	0.0806584362139917
am Ca	m X am table Tappe X 0	ts Tappet t Y 0	able V 0	A 0	J	Poly5	0	60	1.6687407407407402	0.0806584362139917
am Ca	m X am table Tappe X 0 60	ts Tappet t Y 0 60	able V 0	A 0	J 0 0	Poly5	0	60	1.6687407407407402	

Item	Description
X	Sets the position of the master axis.
Y	Sets the position of the slave axis.
V	Sets the velocity of the slave axis.
A	Sets the acceleration of the slave axis.
J	Sets the jerk of the slave axis.
Segment type	Sets an interpolation format for the path between the points.
	 Poly5: Interpolates data by a fifth degree polynomial. This enables smooth connection in position and velocity.
	• Line: linearly interpolates slave position. The slave velocity gets constant.
min(Position)	Minimum slave position between the points is calculated.
max(Position)	Maximum slave position between the points is calculated.
max(Velocity)	Maximum slave velocity (absolute value) between the points is calculated.
max(Acceleration)	Maximum slave axis acceleration (absolute value) between the points is calculated.



- When a path is edited, the position, velocity, acceleration, and jerk are each changed accordingly irrespective of the edited parameter.
- Editable parameters differ depending on the segment type. Editable parameters are as shown in the following table.

	Segment type					
	Poly5	Line				
Х	Editable					
Y	Editable					
V	Editable Not editable					
A	Editable	Not editable				
J	Not editable					
min(Position)	Automatic computation					
max(Position)	Automatic computation					
max(Velocity)	Automatic computation					
max(Acceleration)	Automatic computation					

• Smooth transition setting

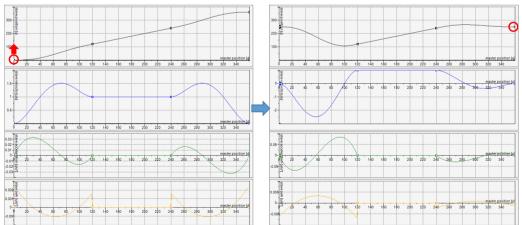
When a cam table is edited with the "Smooth transition" setting enabled, the position, velocity, and acceleration values are each automatically changed such that the slave axis parameters are continuous at the start and end points of the path. Whether the slave axis parameters at the start and end positions of the master axis match is checked to determine continuity.

The "Slave period" setting is set to a period for the slave position. The position of the slave axis returns to 0 when the position reaches the "Slave period" setting. In other words, the position of the slave axis is offset by a constant times the "Slave period" setting in some cases.

The following is an example in which the position settings (0, 0) are changed to (0, 250).

Smooth transition = Enabled, Slave period = 360

When the point is moved from the positions (0, 0) to (0, 250) on the "Cam" tab, the path changes accordingly such that the slave position represents the same value at the start and end points on the Cam table (master position). At this time, the (X, Y) values on the "Cam table" tab are also updated to (360, 250).

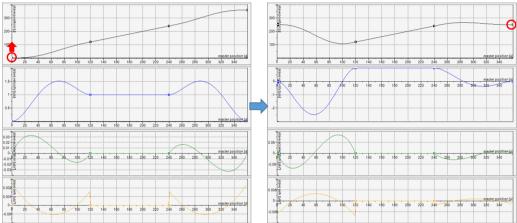


When the positions (X, Y) = (0, 0) are changed to input values (0, 250) on the "Cam table" tab, values (X, Y) = (360, 360) are changed to (360, 250) to update the slave position.



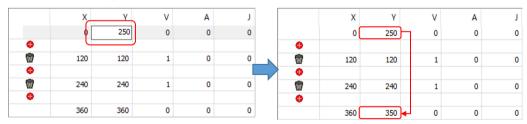
Smooth transition = Enabled, Slave period = 100

When the point is moved from the positions (0, 0) to (0, 250) on the "Cam" tab, in the same way as the case in which the Slave period is set to 360, the path and values on the "Cam table" tab are updated such that the slave position is continuous at the start and end points on the Cam table. The updated values (X, Y) = (360, 250).



On the "Cam "tab, the slave position changes accordingly so as to represent the same value. However, on the "Cam table" tab, the slave position does not necessarily represent the same value but may differ by a constant times the "Slave period" setting.

When the positions (X, Y) = (0, 0) are changed to input values (0, 250) on the "Cam table" tab, values (X, Y) = (360, 360) are updated to (360, 350) such that the slave position is continuous. Since the Slave period is set to 100 in this case, the slave position represents $350 = 250 + 100 (= 100 \times 1 \text{ cycle of the Slave period})$. In other words, the slave position is considered to be moved ahead by one Slave period to a point of 250 and is determined to be continuous despite the different values.



5. To change tappets on the "Tappets" tab, use Toolbox.

Select "Add tappet" in Toolbox and then select a place to which you want to add a tappet with a track ID. The tappet is added to the place at which you click the mouse. If you add a tappet to a track ID with which no tappet is present, a new track ID is created.

The tappet position and switch operation can be changed using "Select" in Toolbox. To delete a tappet, select the tappet you want to delete with the "Select" tool and then press the "Del" key.

🙆 Cam 🗙 🔛											-	ToolBox	- ÷ ×
Cam Cam table Ta	ppets Tappet table											😑 cam editor tools	
+							-	-			master position [u]	Select	
0	30	60	90	120	150	180	210	240	270	300	330 360	🗙 Add tappet	
1 0						()							
Tr.	ack ID					J	-						
🔏 Cam 🗙											-	ToolBox	• 4 ×
Cam X	ppets Tappet table										•	ToolBox a cam editor tools	* 9 X
	ppets Tappet table										master position (u)		* 9 ×
Cam Cam table Ta	ppets Tappet table	60	90	120	150	180	210	240	270	300		😑 cam editor tools	
Cam Cam table Ta		60	90	1 120	150	180	210	40 240	270	300	master position [u]	cam editor tools Select	
Cam Cam table Ta		60	90	120	4 150	180	210	240	270	300	master position [u]	cam editor tools Select	

In the same way as paths, settings for tappets can be configured by entering numerical values, for example, through use of "Tappet table".

💫 Cam 🗙											
Cam (Cam table Ta	ppets	Tappet table								
•	Track ID	X	positive pass	negative pass							

Item	Description
Track ID	Sets an ID of the tappet path.
	All tappets of a shared track ID refer to the same tappet switching (a variable of the BOOL type). Up to 99 track IDs can be set within a range of 1 to 99.
X	Sets the position of the tappet.
	Up to three tappets can be specified for a shared point X irrespective of track ID. If four or more tappets are specified, an error occurs during cam synchronous control.
Positive pass	Sets action of the tappet performed when the axis passes through the position of the tappet in positive direction.
Negative pass	Sets action of the tappet performed when the axis passes through the position of the tappet in negative direction.

The following table shows tappet switch varieties. On the "Tappets" tab, you can switch the attribute of a tappet between ON and OFF by clicking the arrow part of the tappet symbol you want to switch.

Positive pass	Negative pass	Symbol
No action	No action	\times
Switch to ON	No action	Ζ
Switch to OFF	No action	\mathbf{X}
No action	Switch to ON	X
No action	Switch to OFF	Ζ
Switch to ON	Switch to ON	X

9.7 Cam synchronous Control

Positive pass	Negative pass	Symbol
Switch to ON	Switch to OFF	Z
Switch to OFF	Switch to ON	\mathbf{X}
Switch to OFF	Switch to OFF	X
Invert	No action	X
No action	Invert	X
Switch to ON	Invert	X
Invert	Switch to ON	X
Invert	Switch to OFF	X
Switch to OFF	Invert	X
Invert	Invert	X



• Up to 300 tappets can be used.

Creating MC_CAM_REF by Ectended Cam Editor

This section explains how to add a cam object and how to create MC_CAM_REF.

¹² Procedure

 Right-click the "Application" object in the navigation pane and then select Add Object>Ectended Cam Table from the context-sensitive menu that is displayed. The "Add cam table" dialog box will be displayed.

ß	Paste		
***	Add Object	8	Cam table
0	Add Folder	8	CNC program
OŞ	Login		CNC settings
	Delete application from device	4	DUT
	Chief opp	-	Extended Cam table
			External File
		2	Global Variable List
		~	Interface
2		T	Persistent Variables
ť		Ð	POU
t		æ	POU for implicit checks
		A	Recipe Manager
		••	Symbol Configuration
			Text List
		a\$	Trace
		-	Visualization
			Visualization Manager

Enter a cam table name and then click the [Add] button.
 The name specified here will be used for an entry in a function block.

Add Extended Cam table	×
Extended Cam table	
Name:	
Cam_1	
Add	Cancel

3. When the cam object is added, the "Cam" tab appears. Change the default path setting if necessary.

The "Cam" tab consists of a graph area and a table area.

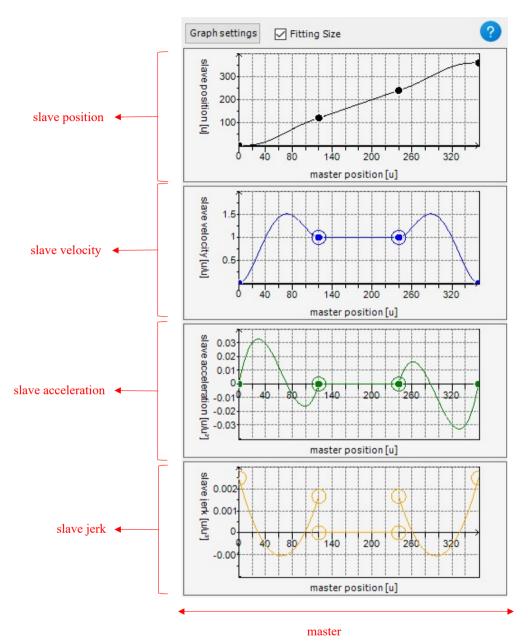
tappets profile														
Graph settings 🛛 Fitting Size graph area ?		table area												
		. i												
day soo	No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end	min(Position)	max(Position)	max([Velocity])	max(Acceleration)
Ē 100	1	Poly5	120	120	0	1	0	0		0.0016	0		1.5120000000	0.03283528294141
0 40 80 140 200 260 320	2	Line	240	240	1	1	0	0	0	0	120	240	1	0
master position [u]	3	Poly5	360	360	1	0	0	0	0.0016	0.0025	240	360	1.512	0.03283528294141
master position [u]														
master position [u]														
master position [u]														
1														

In the graph area, the following four items are displayed one by one in a vertical direction: position, velocity, acceleration, and jerk of a slave (vertical axis) relative to the master position (horizontal axis).

The [Graph setting] button is used to set the interval between graduations for the master position and also the maximum and minimum values of the slave graduations.

When the [Automatic adjustment] check box is enabled, the graph area size is automatically adjusted to match the window size.

Press the [?] button, and a dialog box that explains nodes will be displayed.



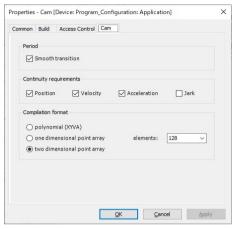
In the table area, numerical values that corresponds with graphs in the graph area are displayed.

	🔜 💼 💮												
No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end	min(Position)	max(Position)	max(Velocity)	max(Acceleration)
		0	0										
1	Poly5	120	120	0	1	0	0	0.0025	0.0016	0	120	1.5120000000	0.03283528294141
2	Line	240	240	1	1	0	0	0	0	120	240	1	(
3	Poly5	360	360	1	0	0	0	0.0016	0.0025	240	360	1.512	0.03283528294141

4. [Cam Table Property Setting]

Right-click the "Cam" object and then select "Properties" from the context-sensitive menu that is displayed.

In the Properties window, click the "Cam" tab and change the values.



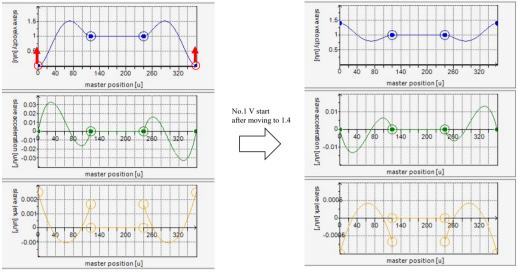
Item		Corresponding variables in MC_CAM_REF	Description				
Transition	Smooth transition	- Enabled: When a path is edited, the automatically adjusted such that the and acceleration values of the slave start position and end position of the axis are continuous.					
Continuous condition check	Position, velocity, acceleration, and jerk	-	Continuity of parameters for which the check box is selected (whether data before and after the representative point is continuous) is checked during build.				
Compile format ^(Note 1)	Polynomial (XYVA)	byType = 3	A cam table is made up of master position, slave position, slave velocity, and slave axis acceleration items. This compile format can be selected only for the segment type that can be expressed in polynomial form. Details will be described later in Section 12.3.				
	One dimensional point array	byType = 1	A cam table is made up of only a slave position item. (master position is divided into equal intervals by the number of elements.)				
	Two dimensional point array	byType = 2	A cam table is made up of master position and slave position items.				
	Elements	-	This can be used for one dimensional and two dimensional point arrays. Specifies the number of elements that make up the array.				

(Note 1) For details, refer to the GM1 Series Reference Manual (Instruction Edition).

Smooth transition setting

When a cam graph or table is edited with the "Smooth transition" setting enabled, the path is automatically adjusted such that the velocity and acceleration values of the slave axis at the start position and end position of the master axis are continuous. Whether the slave axis parameters at the start and end positions of the master axis match is checked to determine continuity.

The following is an example in which (master axis position, slave axis velocity) settings are changed from (0, 0) to (0, 1.4). In the graph for the slave axis velocity, when the node (master axis position, slave axis velocity) is moved from (0, 0) to (0, 1.4), the path changes accordingly such that the slave velocity represents the same value at the start and end points of the master axis position. At this time, the values in the table area are also updated in conjunction with the graphs.



In the table area, if the start point Vstart is changed from 0 to 1.4, the end point Vend is also updated from 0 to 1.4.

No.	Segment Type	X end	Y end	V start	Vend	A start	A end
		0	0				
1	Poly5	120	120	1.4	1	0	0
2	Line	240	240	1	1	0	0
3	Poly5	360	360	1	1.4	0	0

5. Moving Node on a Graph

The node can be moved by operating the mouse. It cannot be moved beyond ±999,999.

Node	Characteristic	Operation Of Dragging Nodes	<shift>key + Operation Of Dragging Nodes</shift>
Movable Node	The value of the slave axis can be changed	Drag Down	The value of the master axis can be changed. Only the slave axis position graph can be dragged left and right, but the result of the change is also reflected in the velocity, acceleration, and jerk of the slave axis.
) Fixed Node	The value of the axis cannot be changed	Can't move up or down	Drag Right
Mixed Node	Has the Characteristic of an active node on one side and a fixed node on the other side	Drag Down(Separation)	

6. Addition or Deletion of Segments in the Table Area

Segments can be added to or deleted through operations in the table area.

Select a row and then click the button at the top of the table area or select an item from the menu displayed when the row is right-clicked.

"Delete" can be executed simultaneously on multiple rows.

The settings are enabled when "Floating Trapezoid" is selected as a segment type. For details, refer to ""Floating Trapezoid"".

Button

Insert	Up Inse	rt Down Delete S	letting		
	No.	Segment Type	X end	Y end	V start
			0	0	
	1	Poly5	120	120	1.4
	2	Line	240	240	1
	3	Poly5	360	360	1

Right-click menu

No.	Segment Type	X end	Y end	V start
		0	0	
1	Poly5	1		
2	Line	2	Insert U	р
3	Poly5	3	Insert D	lown
-			Delete	

The newly added segment is in an unconfirmed state right after the addition as shown in the figure below.

Entry to items other than "Segment type", "Xend", and "Yend" is prohibited.

	No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
			0	0						
	1	Poly5	120	120	0	1	0	0	0.0025	0.0016
Indeterminate segment	2									
	3	Line	240	240	1	1	0	0	0	0
	4	Poly5	360	360	1	0	0	0	0.0016	0.0025

Once you enter values in "Segment type", "Xend", and "Yend" for the unconfirmed segment, the segment becomes a confirmed state and the entry prohibited state is cleared.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Poly5	120	120	0	1	0	0	0.0025	0.0016
2	Poly3	200	200	1	1	0	0	0	0
3	Line	240	240	1	1	0	0	0	0
4	Poly5	360	360	1	0	0	0	0.0016	0.0025

7. Editing segments

To edit a segment, enter numerical values in the table cells with white background and then press the <Enter> key.

i Info.

- The range of numerical values that can be entered is between -999,999 and 999,999.
- When the segment is edited, the graph area is updated in conjunction with the edited contents.
- The following table shows a list of segment editing and display items.

Column name	Description
Segment type	Specify the curve type of each segment. Curve types will be described later in Section "9.7.3 Types and Setting of Cam Curves".
Xend	Indicates the master axis position at the end point of a segment. The start point of the next adjacent segment is at the same master axis position.
Yend	Indicates the slave axis position at the end point of a segment. The start point of the next adjacent segment is at the same slave axis position.
Vstart	Indicates the slave axis velocity at the start point of a segment.
Vend	Indicates the slave axis velocity at the end point of a segment.
Astart	Indicates the slave axis acceleration at the start point of a segment.
Aend	Indicates the slave axis acceleration at the end point of a segment.
Jstart	Indicates the slave axis jerk at the start point of a segment.
Jend	Indicates the slave axis jerk at the end point of a segment.
max(Position)	The maximum value of the slave axis position in the segment is displayed.
min(Position)	The minimum value of the slave axis position in the segment is displayed.
max(Velocity)	The maximum value in absolute value of the slave axis velocity in the segment is displayed.

Column name	Description
max(Acceleration)	The maximum value of the slave axis acceleration in the segment is displayed.

Items that can be entered vary depending on the segment type.

Details will be described later in Section "9.7.3 Types and Setting of Cam Curves".

Fine font numerical values indicate values calculated automatically and bold font numerical values indicate values manually entered.

If the borders between adjacent segments are both movable nodes, the numerical value entered in one movable node is also reflected on the other node.

If the borders between adjacent segments are mixed nodes (one is movable node and the other is fixed node), the numerical value entered in the movable node is not reflected on the fixed node.

No.	Segment Type	X end	Y end	V start	Vend	A start	A end	J start	J end
		0	0			N	ot linke	d	
1	Poly5	120	120	linke	d update	0		the second se	0.1516
2	Poly3	200	200	1	1	0	0	0	C
3	Line	240	240	1	1	0	0	0	C
4	Poly5	360	360	1	0	0	0	0.0016	0.0025

Select a bold numerical value, press the <Delete> key, and then press the <Enter> key to confirm the deletion.

The change made to the node is reset. In the reset cell, an automatically calculated numerical value is displayed in fine font.

Note that Xend and Yend are not automatically calculated. Therefore, set them correctly.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Poly5	120	120	0	1	0	2	0.0525	0.1516
2	Poly3	200	200	1	1	0	0	0	0
3	Line	240	240	1	1	0	0	0	0
4	Poly5	360	360	1	0	0	0	0.0016	0.0025



No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Poly5	120	120	0	0	0	2	0.0541	0.1541
2	Poly3	200	200	0	1	0.05	-0.025	-0.000	-0.000
3	Line	240	240	1	1	0	0	0	0
4	Poly5	360	360	1	0	0	0	0.0016	0.0025

8. Tappet Settings

Since operations of the "Tappet" tab are the same as for the Cam editor, refer to ""Creating MC_CAM_REF by Cam Editor"".

With the Cam editor, tappet and tappet table are displayed under separate tabs. With the Ectended Cam editor, they are displayed on the same tab.

File Import/Export Function

The file import/export function can be selected from the menu bar. When using the Cam editor, select the menu from the "Cam" menu, and when using the Ectended Cam editor, select it from the "Ectended Cam" menu.

Ex	tended <u>C</u> am
	Read Cam Data from ASCII Table
	Write Cam Data into ASCII Table
	Read Cam Online File
	Write Cam <u>O</u> nline File
	Display generated Code

A cam table or a tappet table created by the Cam editor or Ectended Cam editor can be saved and reused by exporting (writing) and importing (reading) files.

On the cam menu, you can use the following items.

Item	Description
Reading cam data from ASCII table	Reads cam data from a text file saved in ASCII table format to create a cam table. The number of cam tables is the number of arrays saved in ASCII table format.
Writing cam data to ASCII table	Saves cam data to a text file in ASCII table format. The maximum number of arrays that can be saved is 100,000. Details will be described later. Information on tappets is not saved.
Reading cam online file	Reads cam data and tappet data from a cam file saved in binary format to create a cam table and a tappet table. A waveform condition that was saved is restored. Cam files created by SMC_WriteCAM cannot be read.
Writing cam online file	Saves cam data and tappet data at the present to a cam file in binary format. Details will be described later. Any saved cam file cannot be read by SMC_ReadCAM.
Showing generated code	This function can be used to display MC_CAM_REF program code created by the Cam editor. The code can be reused in POUs or others by copying & pasting.

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ASCII table format file

An ASCII table format file can be used to read or write master position (X) and slave position (Y) values of a cam table created by the Cam editor. The number of stored points that can be specified is 100,000 or less, and X, Y values of a cam table that are divided by the number of stored points at equal intervals relative to the master position are saved. When an ASCII table format file is read, a cam table is created with the number of points specified when the file was saved.

Velocity, segment type, tappet table, and property settings are not saved. Thus, even when an ASCII table format file is read, a cam table that was written cannot be perfectly reproduced. Note that with an increase in the number of stored points, Cam editor operation speed gets slower despite improved accuracy with which the waveform is reproduced from a read file.

The extension of saved files is .txt. An example of a saved ASCII table format file is shown below.

0;	0		
		2.8346456692913384;	0.0092022399826652158
		5.6692913385826769;	0.07123944761839393

• Cam online file

A cam online file can be used to read or write cam tables, tappet tables, and information on each profile. By reading a cam online file, a cam table and a tappet table that were saved can be reproduced. To save a cam online file, the file can contain up to 100 cam tables (100 segments). For more than 100 cam tables (100 segments), the system does not operate properly.

Cam online files saved by the Cam editor will have extension of ".cam" and cam online files saved by Ectended Cam editor will have extension of ".gmcam". Be careful that cam online files generated by the Cam editor or Ectended Cam editor are different as shown below.

If you edit the saved Cam online file using a text editor or similar software, it may no longer be correctly loaded by the GM Programmer.

	(*.cam)	(*.gmcam)		
Cam editor	R/W (Possible to read or write.)	- (Not possible to read or write.)		
Ectended Cam editor	R (Possible to read only.)	R/W (Possible to read or write.)		
Information to be saved	 Input information of the "Cam table" tab (Note that the segment type is not saved.) Input information of the "Tappet table" tab * Input information of the "Properties" dialog box is not saved. 	 Input information of the "Cam" tab Input information of the "Tappet" tab Input information of the "Cam" tab on the "Properties" dialog box Input information of the "Profile definitions" tab 		

9.7.3 Types and Setting of Cam Curves

The following table shows the types of cam curves (segment types) that connect a specified section.

Segment type	Characteristics				
Line Linear	The slave velocity stays constant. Used to set a constant velocity section.				
Poly3 Cubic polynomial	Used to smoothly connect to adjacent velocity curves.				
Poly5 Quintic polynomial	Used to smoothly connect to adjacent velocity or acceleration curves.				
Spline 4-3-4 beginning seg. Spline 4-3-4 (Start segment)	Used to create a free curve that is continuously interpolated with splines for the position, velocity, or acceleration.				
Spline 4-3-4 Spline 4-3-4 (Middle segment)					
Spline 4-3-4 end seg. Spline 4-3-4 (End segment)					
Floating Trapezoid Floating trapezoid	Used to lower the maximum value of the speed or acceleration within the curve while smoothly connecting to adjacent velocity or acceleration curves.				
Rotary Knife A Rotary Knife A	Used to create a cam curve of the rotary knife whose blade edge draws an arc.				

The following table shows a summary of applicable items for each segment type.

Segment type	Applic able only to the expan sion cam	Specifiable slave axis parameter					Compile format		
		Yend	Vstart	Vend	Astart	Aend	Type= 1	Type= 2	Type= 3
Line Linear	-	0	-	-	-	-	0	0	0
Poly3 Cubic polynomial	0	0	0	0	-	-	0	0	0
Poly5 Quintic polynomial	-	0	0	0	0	0	0	0	0
Spline 4-3-4 beginning seg. Spline 4-3-4 (Start segment)	0	0	0	-	0	-	0	0	0
Spline 4-3-4 Spline 4-3-4 (Middle segment)	0	0	-	-	-	-	0	0	0
Spline 4-3-4 end seg. Spline 4-3-4 (End segment)	0	0	-	0	-	0	0	0	0
Floating Trapezoid Floating trapezoid	0	0	0	0	0	0	0	0	-

Segment type	Applic	Specifiable slave axis parameter					Compile format		
o to e s	able only to the expan sion cam	Yend	Vstart	Vend	Astart	Aend	Type= 1	Type= 2	Type= 3
Rotary Knife A ^(Note 1) Rotary Knife A	0	0	-	-	-	-	0	0	-

(Note 1) It cannot be connected to other segments. It can be used only as a single segment.

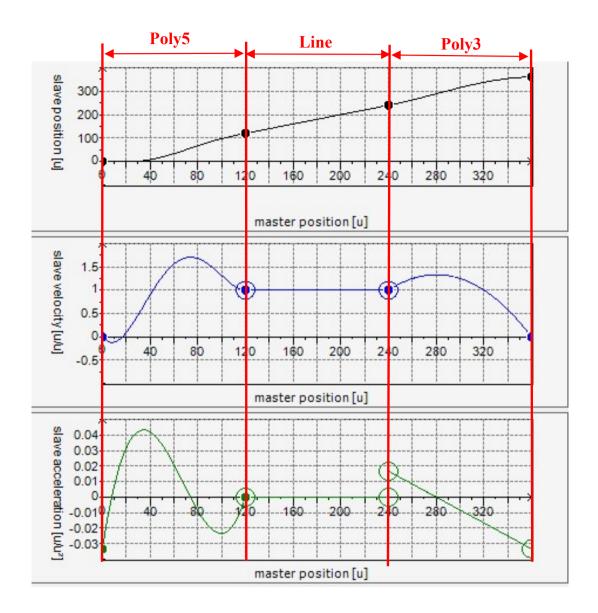
Line, Poly3, Poly5

A cam curve is generated by a single polynomial.

- Line is a first degree polynomial and keeps the velocity of the slave axis constant. Used to set a constant velocity section.
- Poly3 is a cubic polynomial and can be used to specify the velocity at both ends. Used to smoothly connect to adjacent velocity curves.
- Poly5 is a quintic polynomial and can be used to specify the velocity and acceleration at both ends. Used to smoothly connect to adjacent velocity or acceleration curves.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Poly5	120	120	0	1	-0.0333	0	0.005	0.0025
2	Line	240	240	1	1	0	0	0	0
3	Poly3	360	360	1	0	0.01666	-0.033	-0.000	-0.000

9.7 Cam synchronous Control



Spline 4-3-4

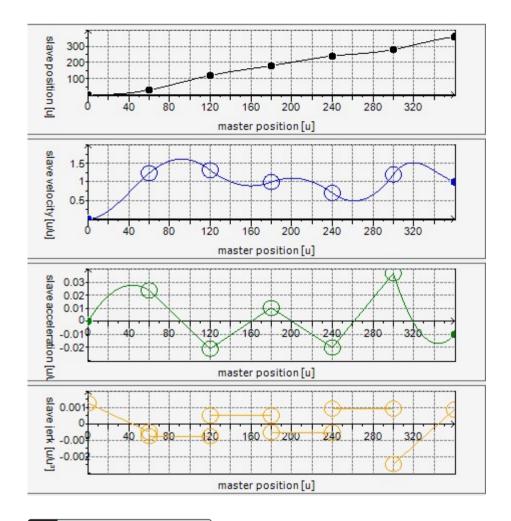
Used to create a free curve that is continuously interpolated with splines for the position, velocity, or acceleration.

The curve is created by connecting multiple middle segments between the start segment and the end segment.

Since a continuous curve for the velocity or acceleration can be obtained without specifying the velocity or acceleration values, free curves can be created more easily than when connecting multiple Poly5 or Poly3 segments.

Since it is possible to specify the velocity or acceleration for the starting point of the start segment and the ending point of the end segment, you can smoothly connect to other curves.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Spline 4-3-4 begi	60	30	0	1.2366	0	0.0236	0.0012	-0.000
2	Spline 4-3-4	120	120	1.2366	1.3169	0.02366	-0.020	-0.000	-0.000
3	Spline 4-3-4	180	180	1.3169	0.9954	-0.0209	0.0102	0.0005	0.0005
4	Spline 4-3-4	240	240	0.9954	0.7011	0.01026	-0.020	-0.000	-0.000
5	Spline 4-3-4	300	280	0.7011	1.1997	-0.0200	0.0366	0.0009	0.0009
6	Spline 4-3-4 end	360	360	1.1997	1	0.03669	-0.01	-0.002	0.0008



¹² Procedure

1. If you select "Spline 4-3-4" on the dropdown list for the segment type, one start segment and one end segment are automatically generated.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Spline 4-3-4 begi								
2	Spline 4-3-4 end								

2. Enter the Xend and Yend values for the start segment and the end segment to make the segments in the defined state.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
6		0	0						
1	Spline 4-3-4 begi	120	120	0	2	0	0	0.0008	-0.000
2	Spline 4-3-4 end	360	360	2	0	0	0	-0.000	0.0002

3. If you add a new segment between the start segment and end segment, a middle segment is generated.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Spline 4-3-4 begi	120	120	0	2	0	0	0.0008	-0.000
2	Spline 4-3-4								
3	Spline 4-3-4 end	360	360	2	0	0	0	-0.000	0.0002

4. Enter the Xend and Yend values for the middle segment to make the segment in the defined state.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
in Ti		0	0						
1	Spline 4-3-4 begi	120	120	0	1.5	0	-0.025	0.0010	-0.001
2	Spline 4-3-4	240	240	1.5	1.5	-0.025	0.025	0.0004	0.0004
3	Spline 4-3-4 end	360	360	1.5	0	0.025	0	-0.001	0.0010

5. In the same procedure, you can increase middle segments.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	Jend
()		0	0						
1	Spline 4-3-4 begi	120	120	0	1.4248	0	-0.028	0.0010	-0.001
2	Spline 4-3-4	180	180	1.4248	1.0130	-0.0287	0.0150	0.0007	0.0007
3	Spline 4-3-4	240	240	1.0130	0.5228	0.01503	-0.031	-0.000	-0.000
4	Spline 4-3-4	300	280	0.5228	1.8954	-0.0313	0.0771	0.0018	0.0018
5	Spline 4-3-4 end	360	360	1.8954	0	0.07712	0	-0.008	0.0057

6. The following table shows behaviors when a segment is deleted or when the segment type is changed.

Target	Deletion of segment	Change of segment type
Start segment	The start segment is deleted and the adjacent middle segment becomes a new start segment.	The change is reflected and the adjacent middle segment becomes a new start segment.
Middle segment	The selected middle segment is deleted.	Not applicable
End segment	The end segment is deleted and the adjacent middle segment becomes a new end segment.	The change is reflected and the adjacent middle segment becomes a new end segment.

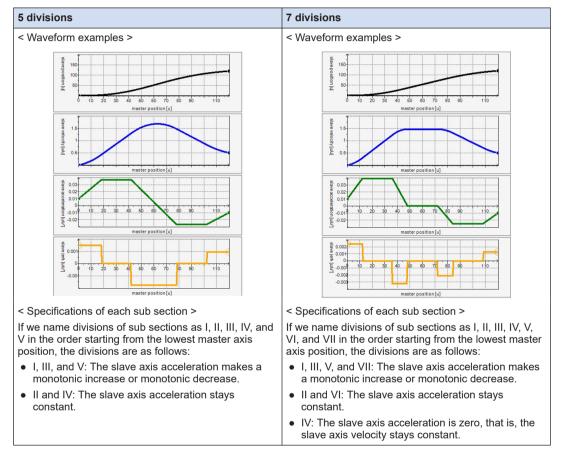
Floating Trapezoid

You can specify the velocity and acceleration at both ends. In addition, you can provide a sub section where the velocity is constant or acceleration is constant within the curve.

Used to lower the maximum value of the speed or acceleration within the curve while smoothly connecting to adjacent velocity or acceleration curves.

Set the number of divisions (5 divisions/7 divisions) of sub sections or the length using the Set button at the top of the table area.

The specifications and waveform examples of the sub sections with 5 divisions and 7 divisions are shown below.

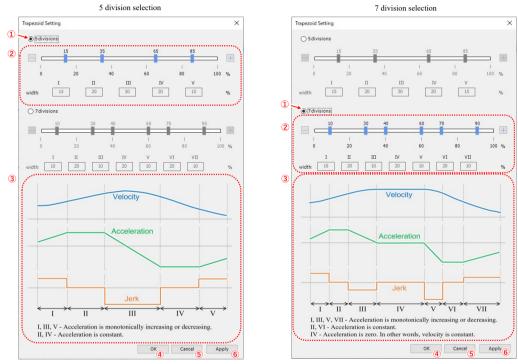


¹² Procedure

1. Specify "Floating Trapezoid" on the dropdown list for the segment type. When the "Floating Trapezoid" row is selected, the Set button at the top of the table area becomes active.

*	=)							
No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Poly5	120	120	0	1	0	0	0.0025	0.0016
2	Floating Trapezoid	240	240	1	1	0	0	3.1329	3.1329
3	Poly5	360	360	1	0	0	0	0.0016	0.0025

2. Click the Set button, and the "Trapezoid Setting" dialog box will be displayed. Set the number of divisions of sub sections and the length of each sub section. In conjunction with the operation of the dialog box, the cam curve in the graph area is updated.



Dialog item	Description
① Division setting (radio button)	Select how many sub sections to create by dividing one segment. It is possible to select either 5 divisions or 7 divisions.
② Split setting	Adjust the length of the sub section according to either one of the following operations.
	Drag the slider.
	 Enter a numerical value in the "Width" field.
	The length of the sub section is displayed in a numerical value in the "Width" field.
	Left-click the slider, and the "Width" fields for the two sub sections divided by the slider will become active to allow you to input numerical values.
③ Schematic diagram	A schematic diagram that shows shape specifications of the sub section is displayed. The diagram switches between 5 divisions and 7 divisions as selected.

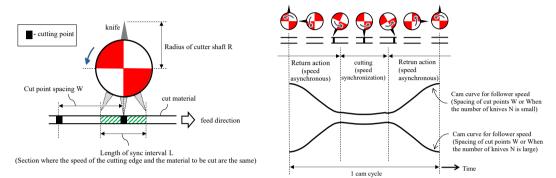
9.7 Cam synchronous Control

Dialog item	Description
④ "OK" button	Saves the settings and then closes the dialog box.
⑤ "Cancel" button	Closes the dialog box without saving the settings.
6 "Apply" button	Saves the settings.

Creating Rotary Knife A

Used for cam operation where a rotary knife cuts the material moved in one direction.

A cam curve is generated so that the blade edge velocity becomes the same as the cut material velocity in the vicinity of the cutting point. The master axis position is at a position in the feed direction of the cut material and the slave axis position corresponds to the rotation angle of the rotary knife. The interval between one cutting and the next corresponds to one cycle of the cam curve.



At the midpoint of the cam curve, the blade edge reaches the bottom dead center (a position where the blade cuts the material at the right angle). At the start point and end point of the cam curve, the blade edge is farthest from the bottom dead center.

2 Procedure

1. On the "Profile Definition" tab, enter the mechanical dimension parameters of the rotary knife to edit the waveform.

oject	Value	Unit	SettingValue	Conte	
Number of Knives	1		1 to 10	Set th	e number of knives. The angle between each knife must be equal.
Radius of cutter axis	30.0	mm	1 to 500	Set th	e rotary cutter axis radius for from the view of its knife tips.
ength of synchronization	10.0	mm	(0.001"W < L < 0.8"W) &		e length of synchronous section. The knife and cut material have same velocity in the synchronous se
Width between cut points	100.0	mm	1 to 10000	Set th	e width between cut points.
N /					
Start Point of Synchronous Speed	Point of chronous Speed Feed =	Cutting Point		itting peed Sync)	Return Motion (Speed Async) Cutter axis speed pro Cutter axis speed pro
Start Point of Synchronous Speed	I Point of schronous Speed Feed =	W			(Speed Async) (Speed Sync) (Speed Async) Cutter axis speed pro (when W or N is small
Start Point of Synchronous Speed	J Point of chronous Speed Feed = er	W			(Speed Async) (Speed Sync) (Speed Async) Cutter axis speed pro (when W or N is sma Cutter axis speed pro (when W or N is large
Start Point of Synchronous Speed	J Point of chronous Speed	W			(Speed Async) (Speed Sync) (Speed Async) Cutter axis speed pro (when W or N is large

Rotary Knife A setting parameters (mechanical dimension parameters of the rotary knife)

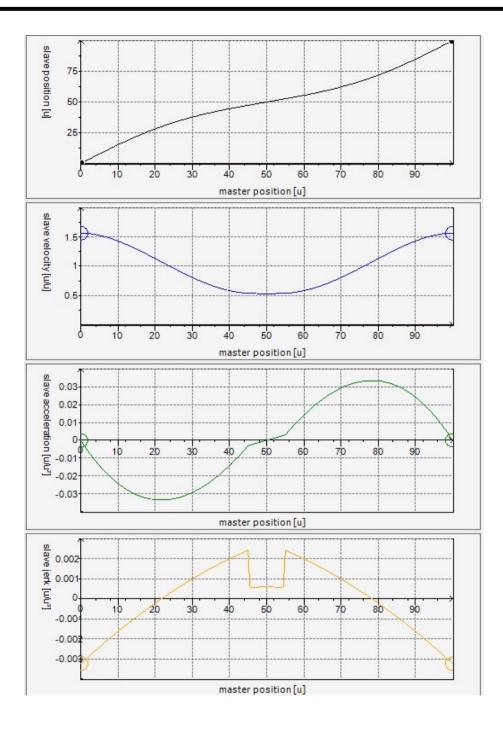
Setting item	Unit	Setting range	Description
N: Number of knives	-	1 to 10	Set the number of knives. The angle between knives must be equal.
R: Radius of the cutter shaft	mm	1 to 500	Set the cutter shaft radius viewed from the knife tip.
L: Length of the synchronous section	mm	(0.001*W < L < 0.8*W) && (L < 1.6*R)	Specify the length of the synchronous section. The knife velocity becomes equal to that of the cut material in this synchronous section.
W: Interval between cut points	mm	1 to 10000	Set the interval between two cut points.

When the entered parameter value is outside the set range, [!] is displayed next to the corresponding parameter. At this time, the parameter is not reflected internally, so enter a correct value.

2. Select "Rotary Knife A" on the dropdown list for the segment type.

An entire cam curve is generated as a single segment. It cannot be combined with other segments.

No.	Segment Type	X end	Y end	V start	V end	A start	A end	J start	J end
		0	0						
1	Rotary knife A	100	100	1.5657	1.5657	0	-5.105	-0.0032	-0.003



9.7.4 Cam Control (POU Programming)

With the GM1 controller, through use of function blocks, you can perform cam synchronous control of the axes using cam objects.

¹² Procedure

- Execute MC_CamTableSelect to specify the master axis, the slave axis, and a cam table (MC_CAM_REF) that is converted into executable format.
- When MC_CamIn is executed, the slave axis moves in response to the master position in accordance with the cam profile and gets synchronized.
- **3.** To release the cam synchronization, execute MC_CamOut.
- 4. Moreover, using auxiliary function blocks for cam synchronous control, you can monitor tappet information, check minimum/ maximum values of the slave velocity and acceleration from the cam profile before operation, and read or write cam data.

1 Info.

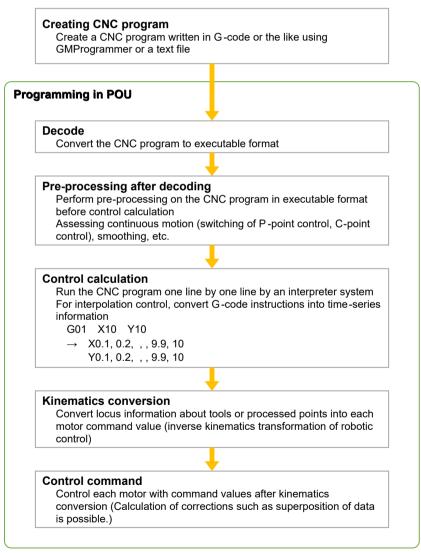
• For details on each function block, refer to the GM1 Series Reference Manual (Instruction Edition).

9.8 CNC Control

9.8.1 Overview of CNC Control and How to Use It

You must execute the following series of processes to perform CNC control with the GM1 controller.

- Create a CNC program written in G-code using the CNC editor or other tools.
- Decode the CNC program to executable format.
- Compute command data from the decoded CNC program at every cycle of motor control to control the motor.

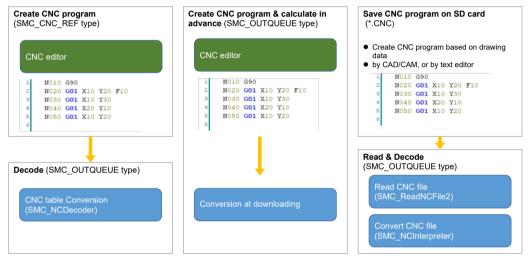


¹² Procedure

1. Create a CNC program and decode it

A CNC program (SMC_OUTQUEUE type) written in executable format is necessary to program CNC control using GM Programmer. The CNC program in executable format can be created by any of the following three methods.

- After creating a CNC program (SMC_CNC_REF type) using the CNC editor, decoding the CNC program to that of the SMC_OUTQUEUE type by SMC_NCDecoder.
- Creating a CNC program (SMC_OUTQUEUE type) using the CNC editor. The created CNC program is converted into executable format when it is downloaded.
- Reading a CNC file (*.CNC), which is created by a text editor or CAD/CAM, via a SD card using SMC_ReadNCFile2 and decoding the CNC file to that of the SMC_OUTQUEUE type by SMC_NCInterpreter.



It is necessary to set a compile mode according to the method of CNC program creation. For details on how to create a CNC program using the CNC editor and set a compile mode for the CNC program, refer to "9.8.2 Creating a CNC Program".

2. Programming CNC control in POU

Program a series of the processes from decoding of the CNC program and motor control in POU.

For details about programming CNC control in POU, function blocks, and G-code, refer to the *GM1 Series Reference Manual (Instruction Edition)*.

9.8.2 Creating a CNC Program

You can create a CNC program by writing it with GM Programmer or on a text editor. The description below explains a method using GM Programmer.

Right-click the "Application" object in the navigator pane and then selectAdd Object>CNC program from the context-sensitive menu that is displayed.

GVL	t	Paste		
Library Manager	*	Add Object 🔸	8	Cam table
MC_PRG (PRG)		Add Folder	Ø	CNC program
Task Configuration	OŞ	Login		CNC settings
□·· 🗀 1.Motion □· 🍪 MotionTas		Delete application from device	**	DUT
	G			External File
🗀 2.User				Global Variable List
🛁 3.System			~	Interface

When"CNC program"is selected, the following window is displayed. Specify settings and click[Add].

Add CNC program X			
CNC program			
Name:			
CNC_Sample			
Implementation: Din66025	\sim		
Compile mode: SMC_CNC_REF	\sim		
Add Ca	ncel		

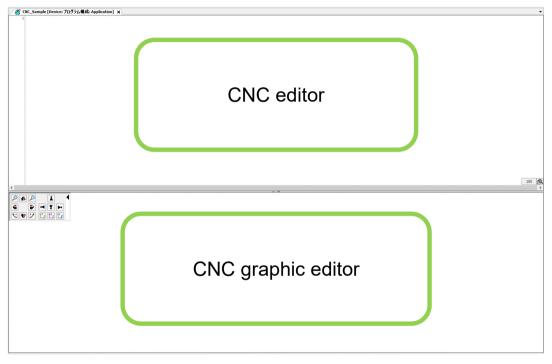
For CNC programs, three compile modes are available. You can select one at the time of creating a table.

Setting item Description		Description
Name	Name Settings Specify a name for a CNC program to be created.	
		Your program will be written in text format. Be sure to use this setting.
mentat ion	Table	Do not use.

Setting item		Description
	SMC_CNC_REF	Normally, use this setting.
Compi le mode	SMC_OUTQUEUE	The movement speed improves due to the prior calculation method, but pre- processing cannot be performed, CNC program settings cannot be changed, and CNC programs cannot be joined together.
	File	CNC programs are generated as external reference files. Even files created by external text editors can similarly work.

When Add is clicked, CNC settings and a CNC program are created in the Device tree. The CNC program is displayed as the name registered earlier (CNC_Sample).

The CNC editor and CNC graphic editor are displayed in the right pane of the GM Programmer screen.



CNC editor

Write a CNC program.

For details on the method of writing, refer to the *GM1 Series Reference Manual (Instruction Edition)*.

CNC graphic editor

The movement loci coded in the CNC editor are graphically displayed in real time. You can also rotate the display and change the scale.

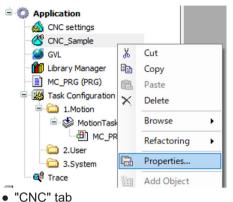
It is possible to make a change to the loci in the CNC graphic editor, but it should be noted that the change will also be reflected in the code in the CNC editor.

If variables are used in CNC programs, the CNC graphic editor cannot be displayed.

"CNC program" - "Properties"

In the Properties window for the CNC program, you can change the compile mode and configure parameter settings.

In the Device tree of GM Programmer, right-click**Application>CNC program>Properties**in this order.



2002						
Impleme	entation:		Din66025		~	
Compile	mode:		SMC_CNC_R	SMC_CNC_REF		
File nam	e:		\$ObjectName	e\$.cnc		
Queue s	ize [elements]:		100		0	
Default	t values					
Velocit	ty (F) [u/s]:		0.000		•	
Accele	ration (E+) [u/s ¹	9:	100.000		•	
Decele	ration (E-) [u/s ²]:	100.000		•	
Defaul	t values for fast (forward (G	0)			
Velocit	ty (FF) [u/s]:		0.000		•	
Accele	ration (EF+) [u/s	a]:	0.000		-	
	ration (EF-) [u/s				•	
3D-Mode	• 🗆					
	alues of variable	ts:				
Start p	osition					
X:	0.00000	\$	P:	0.00000	•	
Y:	0.00000	\$	Q:	0.00000	-	
Z:	0.00000	\$	U:	0.00000	-	
A:	0.00000	\$	V:	0.00000	-	
в:	0.00000	-	W:	0.00000	-	
C:	0.00000	•	A6:	0.00000	•	
Ap	plication-wide C	NCsetting	gs are stored in	n the "CNC setting	s'object	

Setting	item	Description		
Imple Din66025		Your program will be written in text format. Be sure to use this setting.		
ion	Table	Do not use.		
	SMC_CNC_REF	Normally, use this setting.		
Compi le mode	SMC_OUTQUEUE	The movement speed improves due to the prior calculation method, but pre- processing cannot be performed, CNC program settings cannot be changed, and CNC programs cannot be joined together.		
	File	CNC programs are generated as external reference files. Even files created by external text editors can similarly work.		
File nan	ne	If the Compile mode is set to File, the name of the external reference file must be entered.		
Queue size		This is the number of CNC program elements managed under SMC_OUTQUEUE at runtime. (Recommended number: 10 to 30)		
Default values		Specify default values of the velocity, acceleration, and deceleration for interpolation operation. Unless velocity, acceleration, and deceleration are specified using G-code, interpolation control will be performed using these default values.		
Default values for fast forward (G0)		Specify default values of the velocity, acceleration, and deceleration for interpolation operation with G0. Unless velocity, acceleration, and deceleration are specified with G0, interpolation control will be performed using these default values.		
3D-Mode		XY 2-axis interpolation control is set by default. To execute XYZ 3-axis interpolation control without G16 to G19 plane specification, make this setting enabled. If the program is executed with an external file, the argument in the function block FB (SMC_ReadNCFile2) serves as the similar setting.		
Start position				For the SMC_OUTQUEUE type, specify the coordinates from which interpolation control is to be started.

"CNC settings" - Setting window

In the "CNC settings" object added concurrently with the CNC program, you can configure path processing settings for CNC programs created under the SMC_OUTQUEUE type.

• "Path preprocessors" tab

th preprocessors Preinterpolation Table editor		
Available function blocks	Active function block instances	
SMC_Anododo SMC_LinterConductor SMC_LinterConductor SMC_Display Conductor SMC_Display Conductor SMC_Display Conductor SMC_Society Co	SMC_Checkvelootes	

• "Preinterpolation" tab

🔥 CNC settings [Device: Pr	ogram_Configuration: A	pplication] x	
Path preprocessors Preinterpolat	ion Table editor		
Ovcle time [µs]:	20000	¢.	
Velocity mode:	Trapezoid	~	
Maximum jerk [u/s*]:	4000	•	

• "Table editor" tab

th preprocessors Preinterpolation Table editor	
able columns	
∑ Nr	~
Type .	
Mode .	~
☑ Dest.X	~
Dest.Y	
Dest.Z	
Dest.A	
Dest.8	
Dest.C	
Dest.P	
Dest.Q	
Dest.U	
Dest.V	
Dest.W	
Velocity [u/s]	
Acceleration [u/s ²]	
Deceleration [u/s ²]	
Tool radius D [u]	
Center point	
Start tangent	
Dest tangent	
S-profile	
H functions	
2 Orientation	
Radius [u]	
Apex [deg]	
Plane normal Pitch [deg]	
□ Ratio]0,1] ✓ M value	
M param 1 (K)	
M param 1 (K)	
ToolCorr	
SmoothPath	
RoundPath	
AvoidLoop	

Setting item		Description	
Tab name	Settings	Description	
		For SMC_OUTQUEUE type programs, pre-processing is required to be defined here in advance.	
Path preprocessors	-	Even for SMC_CNC_REF type programs or external files, results of pre-processing can be displayed and checked in the CNC graphic editor.	
Preinterpolation	Cycle time	Specify time for MotionTask.	
	Velocity mode	Specify an acceleration/deceleration profile. The setting can be changed by the argument in SMC_Interpolator when the program is executed.	
	Maximum jerk	Specify the maximum jerk value for interpolation control operation. The setting can be changed by the argument in SMC_Interpolator when the program is executed.	
Table editor	-	This tab is used to perform CNC in table format. Do not use.	

CNC menu

When the CNC program editing window is opened, the menu bar displays the "CNC" menu, and you can configure settings for the following items.

ig <u>T</u> ool	_	Help CM	-
8 <u>6</u> M	해 해 개	🛱 🌆 🗖	
		ſ	Show Interpolation Points
🥂 CN	C_Sample [De	vice: Pr	Step Suppression
1	N000 G91		Show <u>G</u> rid
2	N010 G01	X10 Y1 🗸	Show End points
3	N020 G01	•	Scroll <u>P</u> ath View
4	N030 G01	X20 Y0	<u>M</u> ove Program
			Scale Program
			<u>R</u> otate Program
			Reverse Direction
		10	Renumber C <u>N</u> C Program
			Write Program to ASCII File
			Load Program from ASCII File
			Import from DXF <u>F</u> ile
			<u>A</u> nalyze Dynamics
			CNC Info
			Set <u>V</u> ariables

Setting items	Overview	
Show preprocessed Path	Select to show or hide the path with preprocessing in the CNC graphic editor.	
Show Interpolation Points	Select to show or hide interpolation points in the CNC graphic editor.	
Step Suppression	Select to activate or deactivate the step suppression.	
Show Grid	Select to show or hide the grid in the CNC graphic editor.	
Show End Points	Select to show or hide end points in the CNC graphic editor.	
Scroll Path View	If this is activated, the view of the path on a line selected in the CNC editor is automatically scrolled and zoomed such that the path is visible in the CNC graphic editor window.	
Move Program	This opens the translation vector dialog box where you can enter movement amounts for the axes. This moves the CNC program along the axes by specified amounts.	
Scale Program	This opens the scale program dialog box where you can enter a scaling factor and select a target axis. This scales up or down the CNC program by the specified scaling factor along the selected axis.	
Rotate Program	This opens the rotation parameters dialog box where you can enter an angle of rotation and a rotation factor for each axis. This causes the CNC program to rotate about each axis by the specified angle of rotation × rotation factor.	
Reverse Direction	This sets the path elements of the CNC program in reverse order.	
Renumber CNC Program	This refreshes the numbering of program lines in the CNC program. The numbers start at 0 and are incremented by 10.	
Write Program to ASCII File	This opens the dialog box for saving a file. This causes the CNC program to be saved as an ASCII file.	
Load Program from ASCII File	This opens the dialog box for selecting a file. This loads CNC program data from the selected ASCII file.	

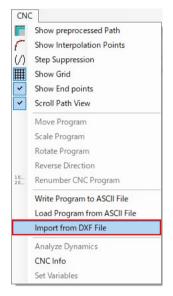
Setting items	Overview	
Import from DXF File	This opens the "Import DXF File" dialog box. Import data from the DXF file saved with a CAD tool.	
	For details, refer to "9.8.3 Import DXF File Function".	
Analyze Dynamics	A dynamical analysis of the CNC program allows you to preliminarily check how each axis moves.	
	For details, refer to "9.8.4 Dynamical Analysis for CNC Program".	
CNC Info	Do not use.	
Set Variables	Do not use.	

9.8.3 Import DXF File Function

You can import DXF files created with CAD tools so that CAD drawings can be represented in the CNC program. The following explains how to import a DXF file.

¹² Procedure

1. From the CNC menu, select "Import from DXF File".



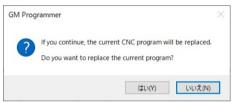
2. Select a DXF file to display the "Import DXF File" dialog box.

🐣 Import DXF file		×	
Layers:	Preview:	View: 🔯 🖾	
 □-0_ (2 elements) □-1_ (1 elements) □-1_ (8 elements) □-0_ (8 elements) 			
Maximum gap size:	0.00100		
T I () ()		Import Cancel	

The contents of the "Import DXF File" dialog box are as follows.

Item	Description
Layout	All layers are listed.
	Checked layers will be imported.
Preview	A preview of the drawing to be imported is displayed.
Display	Select the plane to be displayed in the "Preview".
Maximum gap size	Set the correction value for the distance (gap) between two elements. The gap will be corrected according to the set correction value and converted to the CNC program.
	Details will be described later.
	Use in the default value.

After the settings are configured, click the [Import] button.
 A confirmation dialog box will be displayed, asking if you want to execute the import.



4. Click the [Yes] button.

Import will be executed and the data in the DXF file will be converted to the CNC program. At this time, the CNC program before import will be overwritten.

f Info.

• The import function determines the G-codes to represent elements based on the DXF file data saved by the CAD tool.

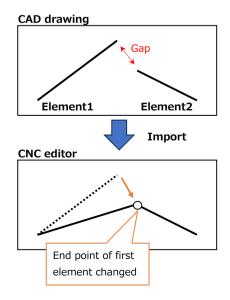
For example, if the DXF file contains an element that represents a straight line such as "LINE", G01 will be used. If the file contains an element that represents a circle or arc such as "CIRCLE" or "ARC", G02/G03 will be used.

- For a connection between two elements, the import result will vary depending on the set value of "Maximum gap size".
 - CAD drawing Gap Element1 Element2 Import CNC editor G00 is used between two elements
 - If the gap is greater than the "Maximum gap size"

The two elements will be connected by G00.

• If the gap is smaller than the "Maximum gap size"

The end point of the first element will be changed to the start point of the second element.



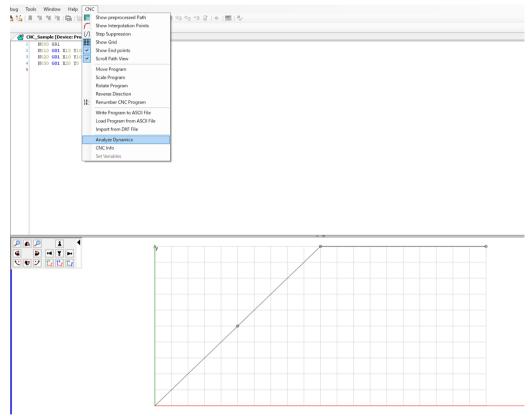
- Elements will be converted to the CNC program in order from the nearest element to the current position. However, figures with a single element (lines, circles, etc.) will be converted to the CNC program in priority over figures enclosed with multiple elements (squares, rounded rectangles, etc.).
- If there is a line element at the origin in the CAD, "G00" will be added to the first line, which does not affect the operation, however.
- If the "Maximum gap size" is greater than the length of the elements, the data will not be converted correctly to a CNC program.
- Do not import CNC objects for which the following items are set in the "CNC" tab of the Properties window. The data will not be imported correctly.
 - "Default values"
 - · "Default values for fast forward"
 - "3D-Mode"

9.8.4 Dynamical Analysis for CNC Program

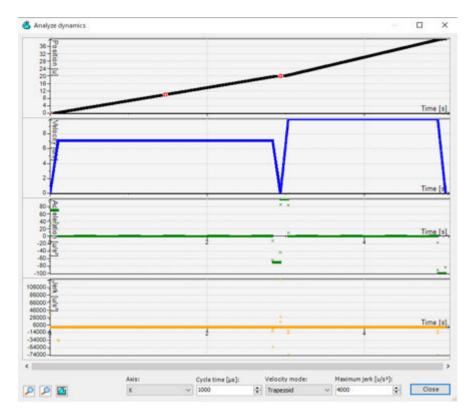
Preliminarily checking motion trace

A dynamical analysis of the created CNC program allows you to preliminarily check an expected motion curve of each axis.

1. In the CNC program editing window, from the menu bar, select CNC>Analyze Dynamics.



2. The "Dynamical Analysis" window will be displayed. Specify appropriate settings in the "Axis", "Cycle time", "Velocity mode", and "Maximum jerk" fields.





- If variables are used in CNC programs, the "Dynamical Analysis" window cannot be displayed.
- If starting coordinates are specified or CNC programs are joined or repeated in POU, actual movements will differ from the results of dynamical analysis.

9.9 Motion Function Errors

9.9.1 Overview of Motion Function Errors

Motion function errors can be classified as below.

Function block (FB) errors

These errors occur when motion function blocks are executed. They are defined as SMC_ERROR in CODESYS.

Errors can be classified as below.

• Errors resulting in errorstop

In CODESYS, if an error that is judged to be operation non-continuable occurs, the axis state will be set to "errorstop" and control for the relevant axes will stop.

In a function block that is being executed, the "CommandAborted" flag is set to TRUE, causing the function block to terminate.

The "errorstop" state is released by executing the MC_Reset function block.

• Errors not resulting in errorstop

In CODESYS, if an error that is judged to be operation continuable (an error that can be cleared by re-executing the function block, such as a parameter error to the function block) occurs, the "Error" flag of the function block will be set to TRUE and an error code will be set in ErrorID. The error is cleared by setting the "Execute" flag in the function block to FALSE, enabling the function block to be re-executed.

DriveInterfaceError

Errors that occur in SM3_Drive_RTEX_Panasonic are output as DriveInterfaceError. DriveInterfaceError is an internal error.

Amplifier alarm

Alarms and warnings occur in servo amplifiers.

9.9.2 Error Check Method

Online monitor in the axis setting window

Example) SM3_Drive_RTEX_A6N "General" tab

Status:	SMC_AXIS_STATE.power_off
Communication	operational (100)
Errors Axis Error: 0 [16#0000000	00]
FB Error: SMC_ERROR.SI	MC_NO_ERROR
uiDriveInterrac	eerror:
0	
strDriveInterfa	iceError:

The oldest error is displayed in the "FB error" field. This is the same error result as that output by the MC_ReadFBError function block.

* Some FB errors are not displayed (SMC_RP_REQUESTING_ERROR, etc.).

Device log

ommunication Settings	O warning(e)	2 arror(c) E 0 exception	(s) 1 334 information(s) 1 0 debug message(s) <all components=""></all>	 Logger <default logger=""></default> 	• 🕹 🖻 🖥 🕻		
ommunication Settings	-		(a) Shinking and a substances age (b) Call components >	Cogger Cheradiciogger >			
ate and Time and Settings	Offline loggi	Offline logging UTC time					
	Severity	Time Stamp	Description	Component			
pplications	0	19.11.2020 14:25:37.697	FBError Drive=0: 5C Modulo period invalid (<= 0 or > half bus bandwidth) SoftMotion			
29	•	19.11.2020 12:00:12.918	FBError Drive=0: 5C Modulo period invalid (<= 0 or > half bus bandwidth) SoftMotion			
sers and Groups							
ccess Rights							
C Shell							
C Parameters							
ask Deployment							
atus							
formation							

All errors that occurred in the past are displayed. This is regardless of whether "errorstop" occurred.

* Some FB errors are not displayed (SMC_RP_REQUESTING_ERROR, etc.).

Return value to function block	When an FB error occurs, the "Error" flag is set to TRUE and the error ID of SMC_ERROR is output to ErrorID.		
MC_ReadFBError	FB errors that occurred are displayed, regardless of "errorstop". Some FB errors are not displayed (SMC_RP_REQUESTING_ERROR, etc.).		
Amplifier alarm	Whether alarms occurred	RTEX_ReadAmpState	
	Alarm information acquisition	RTEX_ReadAmpAlarm	

Errors that can be output to programs

9.9.3 Clearing Errors

When errorstop occurs	Execute MC_Reset.		
When an error returns to a function block	Execute the same function block with the "Execute" flag set to FALSE.		
When an amplifier alarm occurs	RTEX	Execute RTEX_ClearAmpAlarm. * This applies to only errors that can be cleared. For errors that cannot be cleared, perform a warm reset or cold reset.	
	EtherCAT	Execute SMC3_ReinitDrive	

(MEMO)

10 EtherCAT Function

10.1 EtherCAT Axis Settings	10-2
10.1.1 Setting up the EtherCAT master	
10.1.2 EtherCAT Slave Settings	
10.1.3 Adding and Setting up Servo Amplifiers	
10.1.4 Setting an Address for Each Servo Amplifier	10-19
10.2 Conducting Commissioning for Servo Amplifiers	10-20
10.3 Home Return	10-22
10.4 Functional limitations 10.4.1 Restrictions on the Combination of the GM1 Controller and Servo	10-23
Amplifiers	10-23
10.4.2 Restrictions on Servo Amplifier Parameters	10-24

10.1 EtherCAT Axis Settings

10.1.1 Setting up the EtherCAT master

Set a control cycle for the GM1 Controller.

1₂ Procedure

1. Double-click the MotionTask object in the navigator pane.



The "MotionTask" editor will open in the main pane.

2. Set a control cycle.

Task type:	MotionTask				
Priority (33):	3				* *
Type () Cyclic	✓ Interval(<u>I</u>):	1ms	~ [
Watchdog					
Enable					
Time(<u>T</u>):					\Rightarrow \sim
Sensitivity(S):					* *
POU) X Remove Call(<u>R</u>)		Comment		/n(<u>D</u>)
		_ ,		• • ••••••	· · ·
POU	y X nemove can(<u>r</u> y			• • • • • • • • • • • • • • • • • • • •	
	y X nemove can(<u>x</u>)				
POU	y X nemove can(<u>x</u>)				
POU					

EtherCAT_Master_SoftMotion

Overview

The EtherCAT master must be configured as described below.

This section explains various tabs and settings of EtherCAT_Master_SoftMotion editor.

Devices 🗸 🗸 🗸	
EtherCAT_Master_SoftMotion	EtherCAT master setting
🖻 🛗 MADHT1105BA1	
SM_Drive_ETC_Panasonic_MINAS_A5B	
Set EtherCAT Master parameters on the General window	

Set EtherCAT Master parameters on the General window.

General	Autoconfig Master/Slaves	Ether CAT.
Sync Unit Assignment	EtherCAT NIC Setting	
EtherCAT IEC Objects	Destination address (MAC) FF-FF-FF-FF-FF-FF	adcast Enable redundancy
Status		
Information		
	■ Distributed Clock	
	Cycle time 1000 🜩 µs	
	Sync offset 20 🔶 %	
	Sync window monitoring	
	Sync window 1 🜲 µs	

List of parameters

Name		Description	
Automatic Master / Slave Configuration		When this parameter is enabled, it automatically performs configuration of the master and slave.	
		When this parameter is disabled, all configuration settings for the master and slave must be made manually. Since configuration settings require expertise, it is recommended to set to automatic settings.	
EtherCAT NIC Setting	Storage location address (MAC)	Specifies the destination address.	
	Broadcast	When this setting is enabled, a broadcast address (FF-FF-FF- FF-FF) is set in the storage location address (destination).	
		When this setting is disabled, set a multicast address in the storage location address (destination).	
Distributed Clock	Cycle Time	Sets the EtherCAT communication cycle. The MotionTask cycle is set.	
	Synchronous Offset	Sets the delay time between the DC reference time of the EtherCAT slave and the EtherCAT task (PLC's cycle start time).	

Name		Description
	Synchronous Window Monitoring	When this setting is enabled, it monitors slave synchronization.
	Synchronous Window	Sets the synchronous window monitoring time When all slave's synchronizations occur within the set time, xSyncInWindow (loDrvEtherCAT) turns to TRUE.
Options	Use LRW instead of LWR / LRD.	When this setting is enabled, the LRW command (read/write) is used. When this setting is disabled, the LRD command (read) and LWR command (write) are used as separate commands.
	Enable message for every task.	When this setting is enabled, the PDO mapped variables are updated at the point of use of the POU. When this setting is disabled, the PDO mapped variables are updated by a MotionTask.
	Autostart slave.	When a communication breakdown occurs, automatically the master attempts to restart the slave immediately.
Master Configuration		It can be set only when Automatic Master / Slave Configuration is disabled.
	Image In Address	Sets the first logical address of the first slave used for PDO input data.
	Image Out Address	Sets the first logical address of the first slave used for PDO output data.

Sync Unit Assignment

In Sync Unit Assignment, multiple slaves can be grouped together and managed as a Sync Unit.

For example, one slave within a Sync Unit becomes unknown, the rest of the slaves in the Sync Unit are displayed as unknown. Since other Sync Units not affected remain operable, the unknown group can be promptly corrected using the device diagnostics.

EtherCAT_Master_Soft	Motion X	
General	Device name Sync Unit	Selects the Sync Unit group. (Default value: "Default")
Sync Unit Assignment	MADHT1105BA1 default MADHT1105BA1 1 default	The Sync Unit group can be added by clicking the Add button at the bottom of the list.
EtherCAT IEC Objects		
Status		mes of slaves inserted In ter SoftMotion in the Device tree.
Information		
	Add Sync Unit	× Delete
	Sync Unit	
	···· default	Deletes the selected Sync Unit.
		The Sync Unit to be deleted with slaves assigned as a group is reassigned to the default group.
		nter a Sync Unit name in the text field and click the Add button to create a new one.

Status tab

Diagnostic messages of the EtherCAT_Master_SoftMotion device are displayed. They can be checked with the program using the "GetStatistics" method of "IoDevEtherCAT".

eneral	EtherCAT :	n/a	
nc Unit Assignment	Last Diagnostic Message		Acknowledge
herCAT IEC Objects	Statistics		
	SendFrameCount		
atus	FramesPerSecond		
	LostFrameCount		
ormation	TxErrorCount		
	RxErrorCount		
	EtherCAT_Master :	n/a	

Item	Description			
SendFrameCount	The number of EtherCAT send frames is displayed.			
FramesPerSecond	The number of send frames per second is displayed.			
LostFrameCount ^(Note 1)	The number of frame losses is displayed.			
TxErrorCount	The number of send errors is counted.			
RxErrorCount	The number of receive errors is counted.			

(Note 1) Check the following when the number of frame losses is other than 0.

- Influence of noise
- Connection status with slaves
- Program load

10.1.2 EtherCAT Slave Settings

EtherCAT Slave Settings

Overview

The EtherCAT slave must be configured as described below. The description below explains how to set the servo amplifier (A5B: MADHT1105BA1) manufactured by Panasonic.

Set EtherCAT slave parameters on the General window. In the Sync Unit cycle, the cycle set in MotionTask is set.

	Address		Additional		
Process Data	Auto Inc address	0	Enable e	xpert settings	Ether CAT.
	EtherCAT address	1001	Optional		
Startup Parameters	▲ Distributed Clock				
EtherCAT I/O Mapping	Select DC	FreeRUN		~	
EtherCAT IEC Objects	Enable	1000 Sync u	nit cycle (µs)		
Status	Sync0:				
Information	Enable Sync 0 Sync unit cycle			Curla Hana (un	
Information			0	Cycle time (µs Shift time (µs)	
	OUser-defined		•	Shirt time (µs))
	Sync1: Enable Sync 1				
	Sync unit cycle	\sim	* *	Cycle time (µs	0
	O User-defined		•	Shift time (µs)	
	O osci denned		-	chine chine (po)	
	Identification				
	 Disabled 			_	
	Configured station a	alias (ADO 0x0012)	Value	1	001 🖨
	 Explicit device ident 	Easting (ADO (contact)			
	 Data Word (2 Bytes))	ADO (hex)	1	6#134 🌲

List of parameters

Name		Description			
Address		It can be set only when "Automatic Master / Slave Configuration" is disabled in EtherCAT master setting.			
	AutoInc address	Sets a tentative address used before the master assign an EtherCAT address to the slave.			
	EtherCAT address	Sets an EtherCAT address to the slave.			
Add	Enable expert settings	When this setting is enabled, expert setting can be made. Since expert settings are not required for standard applications, it is recommended to disable the settings.			

10.1 EtherCAT Axis Settings

Name		Description			
	Option	When this setting is enabled, the slave is defined as an option. As a result, an error message is not generated even when a device is not found in the bus system. When this setting is enabled, assign a unique ID in the setting for the identification section.			
		Requirements for use			
		 The "Automatic Master / Slave Configuration".parameter on the "General" tab of EtherCAT_Master_SoftMotion editor is enabled. 			
		 The EtherCAT slave supports this function. 			
Distributed Clock	DC selection	Sets the synchronization method between the master and the slave.			
		Example:			
		• FreeRUN: Non-synchronize with master's cycle time.			
		• DC Sync0: Based on the time of the 1st axis, synchronize time information of other slaves.			
Identification	Disable	Slave identification is not checked.			
	Configured station alias value	Sets the address stored in the slave device EEPROM.			
	Explicit device identification	Sets a device identification number for hardware such as a DIP switch of the slave device.			
	Data word (2 bytes)	A 2-byte identification number is saved. (MINAS: Not supported)			

Process data

PDO (Process Data Object) is data that is updated between the master and the slave for every EtherCAT communication cycle. The configuration of the PDO varies depending on the slave. Select an appropriate one for each axis control method. The selected PDO mapping is reflected on the "EtherCAT I/O mapping" and can be used in the program.

MADHT1105BA1 X						
General	Select the Output			Select the Inputs		
General	Name	Туре	Index	Name	Туре	Inde
Process Data	▼ 16#1600 Receive PDO mapping 1	type	muex	6#1A00 Transmit PDO mapping		inde
	Controlword	UINT	16#6040:00	Error code	UINT	16#603F:0
Startup Parameters	Modes of operation	SINT	16#6060:00	Statusword	UINT	16#6041:0
	Targetposition	DINT	16#607A:00	Modes of operation display	SINT	16#6061:0
EtherCAT I/O Mapping	Touch probe function	UINT	16#60B8:00	Position actual value	DINT	16#6064:0
	16#1601 Receive PDO mapping 2	0.101	200000000	Touch probe status	UINT	16#6089:0
therCAT IEC Objects	Controlword	UINT	16#6040:00	Touch probe post pos value	DINT	16#60B4:0
Status	Modes of operation	SINT	16#6060:00	Following error actual value	DINT	16#60E4:0
	Target torgue	INT	16#6071:00	Digitalinputs	UDINT	16#60FD:0
Information	Target position	DINT	16#607A:00	16#1A01 Transmit PDO mapping		201 001 010
	Max motor speed	UDINT	16#6080:00	Error code	UINT	16#603F:0
	Touch probe function	UINT	16#60B8:00	Statusword	UINT	16#6041:0
	Target velocity	DINT	16#60FF:00	Modes of operation display	SINT	16#6061:0
	16#1602 Receive PDO mapping 3			Position actual value	DINT	16#6064:0
	Controlword	UINT	16#6040:00	Velocity actual value	DINT	16#606C:0
	Modes of operation	SINT	16#6060:00	Torgue actual value	INT	16#6077:0
	Max torque	UINT	16#6072:00	Touch probe status	UINT	16#60B9:0
	Targetposition	DINT	16#607A:00	Touch probe pos1 pos value	DINT	16#60BA:0
	Touch probe function	UINT	16#60B8:00	Digitalinputs	UDINT	16#60FD:0
	Target velocity	DINT	16#60FF:00	16#1A02 Transmit PDO mapping		
	16#1603 Receive PDO mapping 4			Error code	UINT	16#603F:0
	Controlword	UINT	16#6040:00	Statusword	UINT	16#6041:0
	Modes of operation	SINT	16#6060:00	Modes of operation display	SINT	16#6061:0
	Target torgue	INT	16#6071:00	Position actual value	DINT	16#6064:0
	Maxtorgue	UINT	16#6072:00	Velocity actual value	DINT	16#606C:0
	Targetposition	DINT	16#607A:00	Torque actual value	INT	16#6077:0
	Max motor speed	UDINT	16#6080:00	Touch probe status	UINT	16#60B9:0
	Touch probe function	UINT	16#60B8:00	Touch probe pos1 pos value	DINT	16#60BA:0
	Target velocity	DINT	16#60FF:00	Digitalinputs	UDINT	16#60FD:0
				16#1A03 Transmit PDO mapping		
				Error code	UINT	16#603F:0
				Statusword	UINT	16#6041:0
				Modes of operation display	SINT	16#6061:0
				Position actual value	DINT	16#6064:0
				Velocity actual value	DINT	16#606C:0
				Torque actual value	INT	16#6077:0
				Touch probe status	UINT	16#60B9:0
				Touch probe pos1 pos value	DINT	16#60BA:0
				Digitalinputs	UDINT	16#60FD:0

Startup parameter

Using the SDO (Service Data Object), slave parameters can be set at the start of RUN.

1. Click "Add".

eneral	🕂 Add	🕂 Add 🗹 Edit 🗙 Delete 🕆 Move Up 🗣 Move Down							
ocess Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment
artup Parameters									
herCAT I/O Mapping									
herCAT IEC Objects									
atus									
formation									

- Enter object information to be changed.
 The following explanation is provided for an example where "Acceleration time setting" is changed.
 - Name: Any name
 - Index 16#: 3312
 - Sub-index 16#: 0
 - Bit length: 16
 - Value: 100

dex:S	Name	Flags	Туре	Default			
Vame	Ad	celeration tin	ne setup				
Name Index: 16		celeration tin	ne setup	Bit length	16		OK

3. Click the [OK] button.

s	elect Item fi	rom Objec	t Directory					
	Index:S	Name	Flags	Туре	Default			
	Name	A	cceleration tim	ne setup				
	Index: 16	5# 33	312	-	Bit length	16	* *	ОК
	SubIndex	: 16# 0		-	Value	100	* *	Cancel
			🗌 Byt	e array				

The data will be displayed as follows.

	🕂 Add 🗹 Edit 🗙 Delete 🏦 Move Up 🐥 Move Down											
	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment			
]	1	16#3312:16#00	Acceleration time setup	100	16			0				

Online

When set to online, the status of the ESM (EtherCAT State Machine) can be changed and displayed, firmware files can be written or read, and configuration information can be written or read to EEPROM.

- Requirements for use
 - "Enable expert settings" on the "General" tab is enabled.
 - You are already logged in to the controller.

Note

• Writing a wrong file or incorrect configuration information may cause the slave to operate in an abnormal manner. Be careful when using the online mode.

CoE online tab

Set values can be written or read from the ESI file or the object dictionary of the slave device.

- Requirements for use
 - "Enable expert settings" on the "General" tab is enabled.

• You are already logged in to the controller.

General	Read Objects	Auto update Offline from ESI file Online from device				
Expert Process Data	Index:Subindex	Name	Flags	Туре	Value	
	16#1000:16#00	Device type	RO	UDINT	131474	
Process Data	16#1001:16#00	Error register	RO	USINT	0	
	16#1008:16#00	Manufacturer device name	RO	STRING	'MADHT1105BA1	
Startup Parameters	16#1009:16#00	Manufacturer hardware version	RO	STRING	'V1.00 '	
Online	16#100A:16#00	Manufacturer software version	RO	STRING	'V1.00 '	
Unline	± 16#1010:16#00	Store parameters	RO	USINT	1	
CoE Online	■ 16#1018:16#00	Identity object	RO	USINT	4	
coe onine	■ 16#10F3:16#00	Diagnosis history	RO	USINT	19	
DiagHistory	± 16#1600:16#00	Receive PDO mapping 1	RW	USINT	4	
		Receive PDO mapping 2	RW	USINT	7	
EtherCAT I/O Mapping	16#1602:16#00	Receive PDO mapping 3	RW	USINT	6	
	16#1603:16#00	Receive PDO mapping 4	RW	USINT	8	
EtherCAT IEC Objects	± 16#1A00:16#00	Transmit PDO mapping 1	RW	USINT	8	
	■ 16#1A01:16#00	Transmit PDO mapping 2	RW	USINT	9	
Status	■ 16#1A02:16#00	Transmit PDO mapping 3	RW	USINT	9	
	■ 16#1A03:16#00	Transmit PDO mapping 4	RW	USINT	9	
Information	■ 16#1C00:16#00	Sync manager communication type	RO	USINT	4	
	■ 16#1C12:16#00	Sync manager channel 2	RW	USINT	1	
	■ 16#1C13:16#00	Sync manager channel 3	RW	USINT	1	
	■ 16#1C32:16#00	Sync manager 2 synchronization	RO	USINT	32	
	■ 16#1C33:16#00	Sync manager 3 synchronization	RO	USINT	32	
	16#3000:16#00	For manufacturer's use	RW	INT	0	
	16#3001:16#00	Control mode setup	RW	INT	0	
	16#3002:16#00	Real-time auto-gain tuning setup	RW	INT	0	
	16#3003:16#00	Real-time auto-tuning machine stiffness setup	RW	INT	25	
	16#3004:16#00	Inertia ratio	RW	INT	13	
	16#3008:16#00	For manufacturer's use	RW	DINT	0	
	16#3009:16#00	For manufacturer's use	RW	DINT	1	

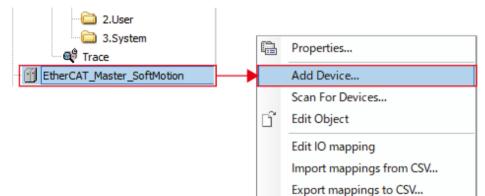
10.1.3 Adding and Setting up Servo Amplifiers

This section explains how to add device objects for servo amplifiers to a project and set them up.

The description below explains how to add device objects for A5B servo amplifiers to a project and how to set them up.

¹² Procedure

1. Right-click the EtherCAT_Master_SoftMotion object in the navigator pane and then select **Device addition** from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

🔟 Add Device				-		Х
Device: EtherCAT_Master_SoftMotion						
String for a fulltext search	Vendor	<all vendors=""></all>				\sim
Name			Vendor			^
🖃 🖬 Fieldbuses						
🖻 நூர் EtherCAT						
Broth Slave						
😟 🚞 Panasonic Corporation, App	liances Compa	ny - AC Servo Driver				
😟 🔤 Panasonic Electric Works SU	NX Co.,Ltd.					
🖲 📄 Panasonic Industrial Devices	s SUNX Co.,Ltd	i.				
MADLN01BE_SoftMotion			Panasonic Corporati	1.1		
MADLN0 1BL_SoftMotion			Panasonic Corporati	1.1		
MADLN05BE_SoftMotion			Panasonic Corporati	1.1		
MADLN05BL_SoftMotion	_		Panasonic Corporati	ion, Autor		nd Y
Group by category Display all versions	(for evperts o	nly) Display outdat	ed versions			
	(ioi experts o		.cu versions			_
Name:						
Device Installation					Canc	el

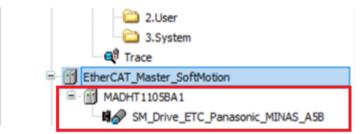
2. Select a device object for the servo amplifier.

The selected device object of the servo amplifier will be added.

Add Device			_		×
Device: EtherCAT_Master_SoftMotion					
String for a fulltext search	Vendor	<all vendors=""></all>			\sim
Name		Vendor			^
🖃 👚 🛐 Fieldbuses					
🖻 - Brat EtherCAT					
Brot Slave					
🖹 🚞 Panasonic Corporation, Applia	nces Compa	ny - AC Servo Driver			
		Panasonic Cor	poration, Appli	iances Com	npi
MADHT1105B91_SM		Panasonic Cor	poration, Appli	iances Con	npi
MADHT1105BA1_SM		Panasonic Cor	poration, Appl	iances Con	1pi
MADHT1105BL1_SM		Panasonic Cor	poration, Appli	iances Con	1pi
MADHT1107B01_SM		Panasonic Cor	poration, Appli	iances Com	1pi
		Panasonic Cor	poration, Appli	iances Com	ipi 🗸 🗌
<				:	>
Group by category Display all versions (f	or experts o	nly) Display outdated versions			
Name: MADHT1105BA1					
L					
Device Installation		Add	Device	Cano	el

3. Click the [Add Device] button.

The selected device object of the servo amplifier will be added to the navigator pane.



Click the [Cancel] button to close the "Select Device" dialog box.

4. Double-click the added object. The setting pane will be displayed in the main pane.

General	Address		Additional	
Process Data	AutoInc address EtherCAT address	0	Enable expert settings	Ether CAT
tartup Parameters	Distributed Clock			
therCAT I/O Mapping				
therCAT IEC Objects				
Status				
Information				
	L			

1 Info.

- To remove a device object that has been added, select the device object in the navigation pane and press the <Delete> key.
- 5. Enable the "Enable expert setting" item.

General	Address	Additional	EtherCAT
Expert Process Data	AutoInc address 0 + EtherCAT address 1001 +	Enable experts	ettings Ether CAI .
Process Data	Distributed Clock		
Startup Parameters	> Startup Checking	Timeouts	
EtherCAT I/O Mapping	DC Cyclic Unit Control: Assign to Local	μC	
EtherCAT IEC Objects	D Watchdog		
tatus	 Disabled 		
nformation	Configured station alias (ADO 0x0012)	Value	1001
	O Explicit device identification (ADO 0x0134)		
	🔿 Data Word (2 Bytes)	ADO (hex)	16#0

6. Set "Station alias".

Depending on the setting of Pr7.41 as the initial setup for the servo amplifier, the method for setting "Station alias" is different.

• When Pr.7.41 is set to 0

Select the "Configured station alias" option and enter the setting of the rotary switch on the front panel of the servo amplifier and the setting of Pr7.40 into the input field.

Example) Set value of the rotary switch on the front panel of the servo amplifier: 8, set value of Pr7.40: 1

The higher 8 bits are 1 and lower 8 bits are 8. Therefore, input 264 in the input field.

Station alias			
Higher 8 bits	Lower 8 bits		
Set value of 3740h	Set value of the rotary switch		
MADHT1105BA1 🗙]		
General	Address	Additional	Ether CAT.
Expert Process Data	AutoIncaddress 0 EtherCAT address 1001	Image: Second	EulerCAI.
Process Data	Distributed Clock		
Startup Parameters	> Startup Checking	> Timeouts	
EtherCAT I/O Mapping	DC Cyclic Unit Control: As	sign to Local µC	
EtherCAT IEC Objects	Vatchdog		
Status	○ Disabled		
Information	Configured station alias (AD	0 0x0012) Value 24	54
	O Explicit device identification	(ADO 0x0134)	
	O Data Word (2 Bytes)	ADO (hex)	5#12

• When Pr.7.41 is set to 1 Select the "Disable" option.

The numerical value displayed in "EtherCAT address" is set as the station alias value.

MADHT1105BA1 X				
General	Address		Additional	
Expert Process Data	AutoInc address EtherCAT address	0	Enable expert settings	Ether CAT.
Process Data	Distributed Clock			
Startup Parameters	> Startup Checking -		Dimeouts	
EtherCAT I/O Mapping	DC Cyclic Unit Contro	ol: Assign to Local µ	с	
EtherCAT IEC Objects	Vatchdog Identification			
Status	Disabled			
Information	Configured station ali	as (ADO 0x0012)	Value	1001
	C Explicit device identifi	cation (ADO 0x0134)		
	O Data Word (2 Bytes)		ADO (hex)	16#0

f Info.

• You can also set any desired value after logging in by selecting the configured station alias value.

Enter any desired value in the input field and click the [Write to EEPROM] button.

Configured station	alias (ADO 0x0012)	Value	2	÷
Write to EEprom		Actual address		

When you log in again after restarting the servo amplifier, the value entered in the input field is set as the station alias value.

Select the configured station alias value and log in for the first time, and the device name of the servo amplifier in the navigation pane will be grayed out due to a mismatch of the station alias value.

=- 😔 🎁 EtherCAT_Master_SoftMotion - MADHT11058A1 ▲ M _____ SM __Drive_ETC_Panasonic_MINAS_A58

10.1.4 Setting an Address for Each Servo Amplifier

The following are the address setting methods prescribed by EtherCAT.

- Reading the Value of Rotary Switch
- Reading the Value of SII Area

Reading the Value of Rotary Switch

Addresses are set using the value of the rotary switch on each servo amplifier.

This setting method is explained using MINAS-A5B as an example.

By setting the Pr7.41 parameter to 0, the value of the rotary switch on the front panel can be used as an address.

In this case, the value of the rotary switch and the value of Pr7.40 are combined and used as an address.

Station alias					
High-order 8 bits	Low-order 8 bits				
3740H setting	Rotary switch setting				

Reading the Value of SII Area

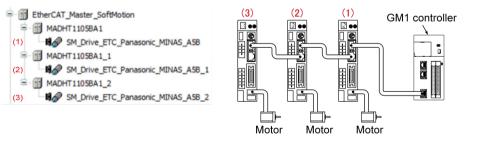
Addresses are set using the value of the SII area (0004h) in each servo amplifier.

This setting method is explained using MINAS-A5B as an example.

By setting the Pr7.41 parameter to 1, the value of the SII area (0004h) can be used as an address.

The value of the SII area (0004h) can be set using the EtherCAT slave device object of GM Programmer.

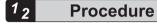
The following figure illustrates the correlation between the settings in GM Programmer and the wiring of each servo amplifier when addresses are set using the value of the SII area.



10.2 Conducting Commissioning for Servo Amplifiers

While in online config mode, you can conduct commissioning for servo amplifiers. There is no need to create a program for commissioning.

The following is an example of commissioning using the A5B-series servo amplifiers.



- **1**. Double-click the servo amplifier object in the navigator pane.
 - EtherCAT_Master_SoftMotion
 - MADHT1105BA1

SM_Drive_ETC_Panasonic_MINAS_A58

The "EtherCAT Axis Setting" dialog box will be displayed.

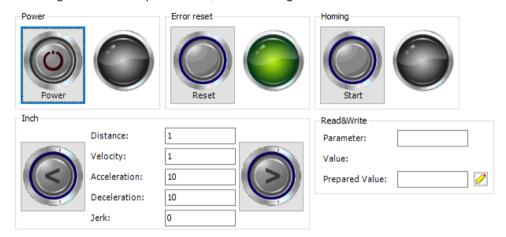
 Click the "Commissioning" tab. The Commissioning pane will be displayed.

		(1)			(2)
R SM_Drive_ETC_Panasonic_M	INAS_A5B 🗙				
General	Online				
		set value	actual value	Status:	SMC_AXIS_STATE.power_off
Scaling/Mapping	Position [u]	0.00	0.00	Communication	operational (100)
	Velocity [u/s] Acceleration [u/s ²]	0.00	0.00 -0.95	Errors	•
Commissioning	Torque [Nm]	0.00	0.00	Axis Error:	
SM_Drive_ETC_Panasonic_MINAS_	roideo (riiii)	0.00	0.00	0 [16#000000	00]
A5B: I/O Mapping				FB Error:	
SM_Drive_ETC_Panasonic_MINAS_ A5B: IEC Objects					SMC_NO_ERROR
Status				uiDriveInterfa	ceError:
Status				0	
Information				strDriveInterf	aceError:
	Power		Error reset		Homing
	Power	0	Reset		Sart
	Inch				Read&Write
	Di	istance:	1		Parameter:
	V	elocity:	1		Value:
		cceleration:	10		
					Prepared Value:
		eceleration:	10		
	Je	erk:	0		
				T	
				(3)	

No.	Group	Description
(1)	Status	Displays the running status of the servo amplifiers during commissioning.
(2)	Error	Displays errors that occurred during commissioning. Allows the user to clear errors.

No.	Group	Description	
(3)	Operation	Allows the user to set commissioning parameters. Allows the user to execute commissioning.	

 Click an appropriate button in the Operation group to start commissioning. Clicking an icon starts the corresponding commissioning. To change home return parameters, use the "Program" tab.



- 4. For the servo amplifier status during commissioning, check the "Status" and "Error" groups.
 - **4-1** To clear errors that are displayed, click the [Reset] button in the "Operation" group. Clicking the [Reset] button clears all errors.
- From the menu bar, select Project>Online Config Mode.
 Online config mode will be canceled and commissioning will be terminated.

This completes commissioning for servo amplifiers.

f Info.

- Even if communication with the servo amplifier is disrupted during "Inching" or "Home Return" operation, the servo amplifier will continue commissioning operation.
- If online config mode is canceled, commissioning will be terminated. To cancel the online config mode, select **Project>Online Config Mode** from the menu bar again.

10.3 Home Return

Home return is an operation that returns the motor to its home position. Home return can be achieved by executing the "MC_Home" function block.

1 Info.

- Home Return, refer to the Manuals of each manufacturer.
- MC_Home, refer to the GM1 Series Reference Manual (Instruction).

10.4 Functional limitations

10.4.1 Restrictions on the Combination of the GM1 Controller and Servo Amplifiers

As for the combination of the GM1 Controller and each MINAS series, confirm the following restrictions.

Combination of the GM1 Controller and servo amplifiers

Connectable servo amplifier		Description
A5B	A6B	Description
•	•	A5B and A6B can be connected to the same network.



• When using servo amplifiers in combination with the GM1 Controller, use the ones with the latest software version.

Setting ranges of movement amount and speed

The input range of the movement amount or speed specified in the GM1 Controller may differ from the upper and lower setting limits of the servo amplifier.



- The respective control cycles of the motion tasks supported by the GM1 controller and servo amplifiers are shown below.
 - GM1 Controller: 500 µs to 4 ms (control cycle)
 - Servo amplifier A5B: 500 µs to 4 ms (control cycle)
 - Servo amplifier A6B: 500 µs to 4 ms (control cycle)

10.4.2 Restrictions on Servo Amplifier Parameters

Some parameters of servo amplifiers affect the operation of the GM1 Controller. Use the following parameter.

No.	Name	Settings	Factory default setting
Pr5.04	Over-travel inhibit input setup	 Use setting value "1". (Recommended) Specifies the behavior of the over-travel inhibit input (POT, NOT). POT works as positive direction travel inhibit, and NOT works as negative direction travel inhibit. When POT is input in the positive direction operation, or NOT is input in the negative direction operation, the operation stops according to the following. Other than torque control mode Follow the Quick stop deceleration ^(Note 2)set value of the servo amplifier. Torque control mode Follow Torque slope^(Note 2). 	1(Note 1)

(Note 1) We recommend that the set value not be changed due to the characteristics of the GM1 and MINAS.

(Note 2) This is a parameter of the servo amplifier. Refer to the manual of the servo amplifier and set an appropriate value.

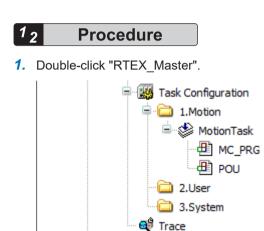
11 RTEX Function

11.1 Setting up the RTEX axis11.1.1 Setting up the RTEX master	11-2 11-2
11.1.2 Adding and Setting up Servo Amplifiers	
11.1.3 Setting an Address for Each Servo Amplifier	11-6
11.2 Conducting Commissioning for Servo Amplifiers	11-7
11.3 Home Return	
11.3.1 Types of home return	11-11
11.3.2 DOG method 1 [Edge detection of near home switch + Home	
position (Z phase) based on front edge]	
11.3.3 DOG method 2 (Edge detection of near home switch)	11-14
11.3.4 DOG method 3 [Edge detection of near home switch + Home	
position (Z phase) based on rear edge]	
11.3.5 Limit method 1 [Edge detection of limit switch + Home position (
phase) based on front edge]	
11.3.6 Limit method 2 (Edge detection of limit switch)	11-17
11.3.7 Home position method [Edge detection of home position (Z	44 47
phase)]	11-17
11.3.8 Stop-on-contact method 1	11-18
11.3.9 Stop-on-contact method 2 [Stop-on-contact detection + Home	44 40
position (Z phase) based on front edge]	
11.3.10 Data set method	
11.3.11 High-speed home return	
11.3.12 Settings and operations of home return	
11.4 Functional limitations	11-21
11.4.1 Restrictions on the Combination of the GM1 Controller and Serv	0
Amplifiers	11-21
11.4.2 Restrictions on Servo Amplifier Parameters	11-21

11.1 Setting up the RTEX axis

11.1.1 Setting up the RTEX master

Set the communication / control cycle for RTEX.



The RTEX_Master editor will open.

RTEX_Master X		•
RTEX parameters RTEX IEC Objects	Communication/Control Cycle: 0.5ms/1.0ms V	
Status	Please set Control Cycle that is shorter than Interval of UserTask and SystemTask.	
Information		
٢		>

2. Set the communication / control cycle.

RTEX_Master X	
RTEX parameters	Communication/Control Cycle: 0.5ms/1.0ms
RTEX IEC Objects	
Status	Please set Control Cycle that is shorter than Interval of UserTask and SystemTask.
Information	
٢	>

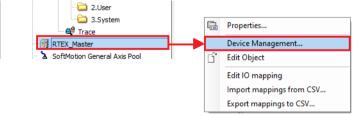
11.1.2 Adding and Setting up Servo Amplifiers

Add device objects for servo amplifiers to a project and set them up.

The description below explains how to add device objects for A6N servo amplifiers to a project and how to set them up.



1. Right-click the [RTEX_Master] object in the navigator pane and then select "Device Management" from the context-sensitive menu that is displayed.



The "Device Management" dialog box will be displayed.

Mac ID	Name	Product number	Byte mode	I
0	-		•	
1	-	-	-	
2	-	-	-	
3	-	-	-	
4	-	-	-	
5	-	-	-	
Device:Soft	Motion Drive			
Device:Soft	Motion Drive Name	Product number	er	
		Product numbr	er	
No.	Name		er	
No. 1	Name -	•	er	
No. 1 2	Name -	•	er	
No. 1 2 3	Name	-	er	

- 2. Double-click the MAC ID row in the "Device: RTEX_Master" table.
 - **1** Info.
 - For the MAC ID, double-click the same No. as the No. set using the address switch of the servo amplifier.

"Select Device" dialog box will be displayed.

tring for a fulltext search Name	Vendor	Vendor	<all th="" vend<=""><th>ors> Description</th><th></th><th></th></all>	ors> Description		
RTEX Series	Panasonic Industry Co. Panasonic Industry Co.		1.6.1.0 1.6.1.0	Panasonic_RTEX: Device Panasonic_RTEX: Device		

Select a device object for the servo amplifier.
 The selected device object for the servo amplifier will be added.

tring to	or a fulltext search		Vendor	<all th="" vend<=""><th>ors></th><th></th><th></th></all>	ors>		
Name		Vendor		Version	Description		
∃ ∭	RTEX Series						
	RTEX_A5N	Panasonic Industry C	o., Ltd.	1.6.1.0	Panasonic_RTEX: Device		
	RTEX_A6N	Panasonic Industry Co	o., Ltd.	1.6.1.0	Panasonic_RTEX: Device		
					Display outdated versions		

4. Click the [Select Device] button.

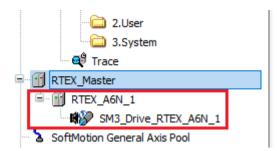
Mac ID	Name	Product number	Byte mode	2
)	RTEX_A6N_0 (SM3_Drive_RTEX_A6N_0)	RTEX_A6N	16Byte	-
L	-	-		•
2	-	-		•
3	-	-		•
1	-	-		•
5)evice:Softi	- Motion Drive	-		•
		- Product num		•
evice:Soft	Motion Drive			•
)evice:Softi No. 1	Motion Drive			•
)evice:SoftI No. 1	Motion Drive Name -	Product num		-
evice:Soft) No.	Motion Drive Name	Product num - -		-
Device:Softi No. 1 2 3	Motion Drive Name	Product num - - -		-

i Info.

- Match the "bite mode" to the byte mode setting of the servo amplifier.
- A servo amplifier set to 16 bytes in "byte mode" is counted as 1 block, and a servo amplifier set to 32 bytes is counted as 2 blocks. You can add devices up to a total of 32 blocks.

5. Click the [OK] button.

The selected device object of the servo amplifier will be added to the navigator pane.



6. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to servo amplifier A6N.

⊮ SM3_Drive_RTEX_A6N_1 X		•
General Scaling/Mapping Commissioning	Axis type and limits Velocity ramp type Virtual mode Activated Negative [u]: 0.0 Modulo Positive [u]: 1000.0 Quadratic	
Home Return Settings SM3_Drive_RTEX_Panasonic: IEC Objects	Software error reaction O Quadratic (smooth) Deceleration [u/s²]: 0 Max. distance [u]: 0	
Status	Dynamic limits Position lag supervision Velocity [u/s]: Acceleration [u/s²] Deceleration [u/s²] Jerk [u/s²]: deactivated	
Information	Velocity [u]s] Acceleration [u]ss] Deceleration [u]ss] Deceleration [u]ss] 10 100 100 10000 Lag limit [u]: 1.0	
<		>



• To remove a device object that has been added, select the device object in the navigator pane and press the "Delete" key.

11.1.3 Setting an Address for Each Servo Amplifier

Set the MAC ID using the address switch of the servo amplifier. The order of connections on the network is not related to the MAC ID.



• For details on how to set station numbers for servo amplifiers, refer to the instruction manual of each servo amplifier.

11.2 Conducting Commissioning for Servo Amplifiers

While in the online config mode, you can conduct commissioning for servo amplifiers. There is no need to create a program for commissioning.

The following is an example of commissioning using the A6N-series servo amplifiers.



1. Double-click the servo amplifier object in the navigator pane.

```
RTEX_Master
```

The "RTEX Axis Setting" dialog box will be displayed.

 Click the "Commissioning" tab. The Commissioning screen will be displayed.

11.2 Conducting Commissioning for Servo Amplifiers

*The operation of home return method follows the parameters set on the "Home return setting" tab.

Item	Set Value	Actual Value
Position [u]	0.00	0.00
Velocity [u/s]	0.00	0.00
Acceleration [u/s²]	0.00	0.00
Torque [%]	-	0.00

Off	
Communica	tion Status:
initialization	of base communication (10)

Error <u>C</u> lear All Cl	ear
Error Type	Error Content
Axis error	No error
Driver error	No error
RTEX error	
+ FBError	No error

Group	Description	
Drive	Allows the user to set commissioning parameters. Allows the user to execute commissioning.	
Status	Displays the running status of the servo amplifiers during commissioning.	
Error	Displays errors that occurred during commissioning. Allows the user to clear errors.	

 Click an appropriate button in the Operation group to start commissioning. Clicking an icon starts the corresponding commissioning procedure. To change home return parameters, use the "Home Return Settings" tab.

<u>S</u> top	Deceleration(T):	
	Deceneration(1).	
	10	[u/s²]
<u>D</u> istance:	1	[u]
<u>V</u> elocity:	1	[u/s]
Acceleration:	10	[u/s²]
Dcc <u>e</u> leration:	10	[u/s²]
<u>]</u> erk:	0	[u/s³]
	 Dcc <u>e</u> leration:	Dcc <u>e</u> leration: 10

- **4.** For the servo amplifier and RTEX statuses during commissioning, check the "Status" and "Error" groups.
 - **4-1** To erase errors that are displayed, click the [Clear] button or [All Clear] button in the "Error" group.
 - Pressing the [Clear] button will erase axis errors, drive errors, RTEX errors, and FB errors [0].
 - Pressing the [All Clear] button will erase axis errors, drive errors, RTEX errors, and FB errors [0] to [5].

Item	Set Value	Actual Value	Servo ON/OFF:
Position [u]	0.00	0.00	Off
Velocity [u/s]	0.00	0.00	Communication Status:
Acceleration [u/s²]	0.00	0.00	initialization of base communication (10)
Torque [%]	-	0.00	

rror <u>C</u> lear All	Clea <u>r</u>
Error Type	Error Content
Axis error	No error
Driver error	No error
RTEX error	
+ FBError	No error

If the display of FB errors is collapsed, the number of FB errors will be displayed as "0" in the "Error Content" column.

5. From the menu bar, select **Project>Online Config Mode**.

If online config mode is canceled, commissioning will be terminated.

This completes commissioning for servo amplifiers.

i Info.

- If you display another window during commissioning, "Stop" will be executed.
- Even if communication with the servo amplifier is disrupted during "Inching" or "Home Return" operation, the servo amplifier will continue commissioning operation.
- If online config mode is canceled, commissioning will be terminated. To cancel the online config mode, select **Project>Online Config Mode** from the menu bar again.

11.3 Home Return

Home return is an operation that returns the motor to its home position.

The GM1 controller supports various home return methods.

Home return can be achieved by setting a desired method in GM Programmer and then executing function block "PMC_Home".

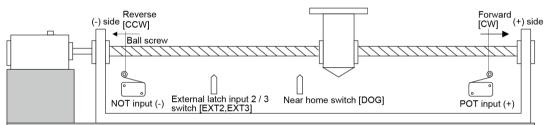
11.3.1 Types of home return

Home return is a function that moves the axis to the preset reference position (home position) and set the coordinates of the position to 0.

If an incremental encoder is used for the servomotor, the home return methods shown in the table below can be selected.



• The GM1 controller also supports home return using an absolute encoder. When implementing home return using an absolute encoder, use MINAS V1.24 or later.



Settings and operations of home return	Behavior overview
DOG method 1	After the rising edge (front edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position. ^(Note 1)
DOG method 2	The rising edge of the near home switch (DOG) is detected and the motor stops. The stopping position is set as the home position.
DOG method 3	After the falling edge (rear edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) in the home return direction is detected and the motor stops. The stopping position is set as the home position. ^(Note 1)
Limit method 1	After the rising edge of the limit switch on the opposite side of the home return direction is detected, the rotation of the motor is reversed. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position. ^(Note 1)
Limit method 2	The rising edge of the limit switch in the home return direction is detected and the motor stops. The stopping position is set as the home position.
Home return method	The axis moves from the current value toward the direction of home return. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position. ^(Note 1)

Settings and operations of home return	Behavior overview
Stop-on-contact method 1	The axis is stopped by a mechanical stopping mechanism such as a stopper. Then, when the torque value exceeding the specified value continues for a certain period of time, the motor stops. The stopping position is set as the home position.
Stop-on-contact method 2	After the axis is stopped by a mechanical stopping mechanism such as a stopper, the rotation of the motor is reversed. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position. (Note 1)
Data set method	The current value is set as the home position.
High-speed home return method	The axis moves to point 0, which is the commanded position.

(Note 1) For E2, external latch input 2 (EXT2) is used instead of the home position (Phase Z). For E3, external latch input 3 (EXT3) is used instead of the home position (Phase Z).

11.3.2 DOG method 1 [Edge detection of near home switch + Home position (Z phase) based on front edge]

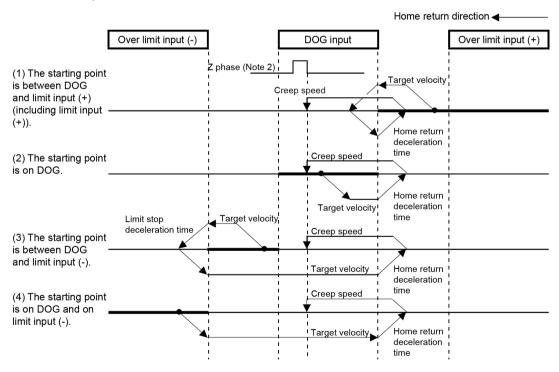
After the rising edge (front edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.

The reference home position can be selected from the three types shown in the following table.

Туре	Reference home position
DOG method 1	Edge detection of near home switch + Home position (Z phase) based on front edge
DOG method 1 (E2)	Edge detection of near home switch + External latch input 2 (EXT2) based on front edge
DOG method 1 (E3)	Edge detection of near home switch + External latch input 3 (EXT3) based on front edge

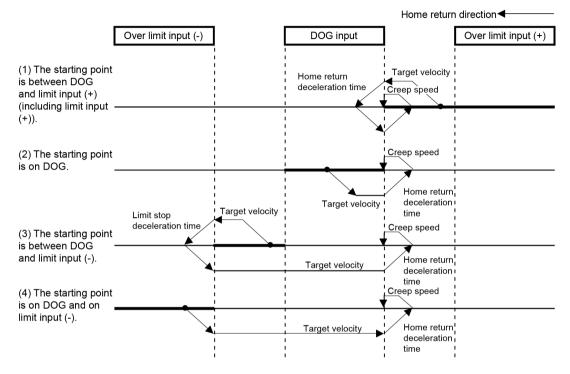
(Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a near home switch (DOG) will be started.

(Note 2) The reference home position differs according to the selected home return type. (Z-phase, EXT2, EXT3)



11.3.3 DOG method 2 (Edge detection of near home switch)

The rising edge of the near home switch (DOG) is detected and the motor stops. The stopping position is set as the home position.



11.3.4 DOG method 3 [Edge detection of near home switch + Home position (Z phase) based on rear edge]

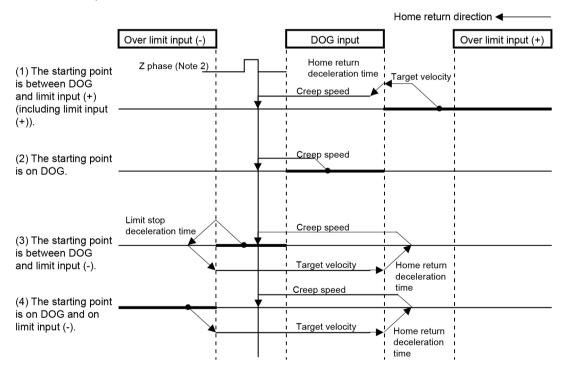
After the falling edge (rear edge) of the near home switch (DOG) is detected, the rising edge of the first home position (Z phase) in the home return direction is detected and the motor stops. The stopping position is set as the home position.

The reference home position can be selected from the three types shown in the following table.

Туре	Reference home position
DOG method 3	Edge detection of near home switch + Home position (Z phase) based on rear edge
DOG method 3 (E2)	Edge detection of near home switch + External latch input 2 (EXT2) based on rear edge
DOG method 3 (E3)	Edge detection of near home switch + External latch input 3 (EXT3) based on rear edge

(Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a near home switch (DOG) will be started.

⁽Note 2) The reference home position differs according to the selected home return type. (Z-phase, EXT2, EXT3)



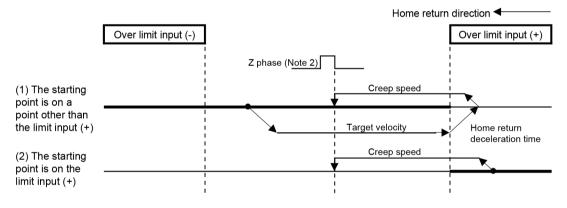
11.3.5 Limit method 1 [Edge detection of limit switch + Home position (Z phase) based on front edge]

After the rising edge of the limit switch on the opposite side of the home return direction is detected, the rotation of the motor is reversed. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position. The reference home position can be selected from the three types shown in the following table.

Туре	Reference home position	
Limit method 1	Edge detection of limit switch + Home position (Z phase) based on front edge	
Limit method 1 (E2)	Edge detection of limit switch + External latch input 2 (EXT2) based on front edge	
Limit method 1 (E3)	Edge detection of limit switch + External latch input 3 (EXT3) based on front edge	

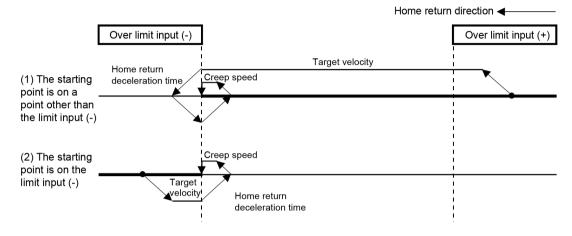
(Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a limit switch will be started.

⁽Note 2) The reference home position differs according to the selected home return type. (Z-phase, EXT2, EXT3)



11.3.6 Limit method 2 (Edge detection of limit switch)

The rising edge of the limit switch in the home return direction is detected and the motor stops. The stopping position is set as the home position.



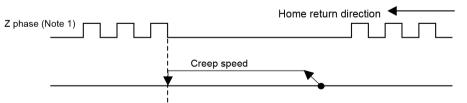
11.3.7 Home position method [Edge detection of home position (Z phase)]

The axis moves from the current value toward the direction of home return. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.

The reference home position can be selected from the three types shown in the following table.

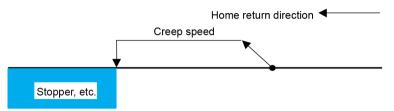
Туре	Reference home position
Z-phase method 1	Edge detection of home position (Z phase)
EXT2 method	Edge detection of external latch input 2 (EXT2)
EXT3 method	Edge detection of external latch input 3 (EXT3)

(Note 1) The reference home position differs according to the selected home return type. (Z-phase, EXT2, EXT3)



11.3.8 Stop-on-contact method 1

The axis is stopped by a mechanical stopping mechanism such as a stopper. Then, when the torque value exceeding the specified value continues for a certain period of time, the motor stops. The stopping position is set as the home position.



11.3.9 Stop-on-contact method 2 [Stop-on-contact detection + Home position (Z phase) based on front edge]

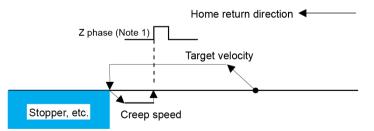
After the axis is stopped by a mechanical stopping mechanism such as a stopper, the rotation of the motor is reversed. Then, the rising edge of the first home position (Z phase) is detected and the motor stops. The stopping position is set as the home position.

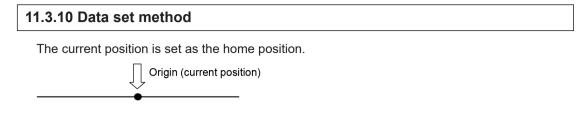
The reference home position can be selected from the three types shown in the following table.

Туре	Reference home position
Stop-on-contact method 2	Stop-on-contact detection + Home position (Z phase) based on front edge
Stop-on-contact method 2 (E2)	Stop-on-contact detection + External latch input 2 (EXT2) based on front edge
Stop-on-contact method 2 (E3)	Stop-on-contact detection + External latch input 3 (EXT3) based on front edge

⁽Note 1) If the home position (Z phase) is ON at the time of startup, it will not be regarded as a home position (Z phase). Searches for a limit switch will be started.

(Note 2) The reference home position differs according to the selected home return type. (Z-phase, EXT2, EXT3)

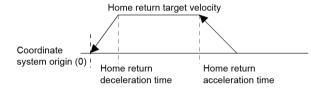




11.3.11 High-speed home return

Executing high-speed home return enables the axis to move to the home position (position 0) of the coordinate system for the absolute encoder.

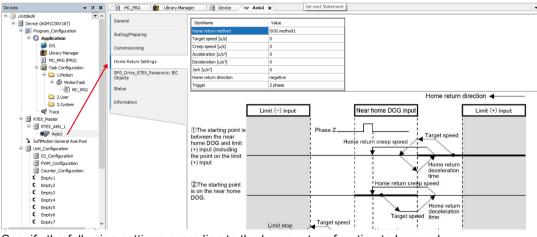
The behavior is similar to that of positioning. After home return is complete, the deviation counter is not cleared.



11.3.12 Settings and operations of home return

Settings in GM Programmer

To use the home return function, specify various settings in "Home Return Settings" in axis settings.



Specify the following settings according to the home return function to be used.

GM Programmer	Value / Type	Default
Home return method	0: DOG1	0: DOG1
	1: DOG2	
	2: DOG3	

GM Programmer	Value / Type	Default
	3: Limit method 1	
	4: Limit method 2	
	5: Home return method	
	6: Stop-on-contact method 1	
	7: Stop-on-contact method 2	
	8: Data setting method	
	10: High-speed home return method	
Target speed	0 or more / LREAL	0
Creep speed	0 or more / LREAL	0
Acceleration	0 or more / LREAL	0
Deceleration	0 or more / LREAL	0
Jerk	0 or more / LREAL	0
Home return direction	1: positive	-1: negative
	-1: negative	
Trigger	17: Z phase	17: Z phase
	26: EXT2	
	28: EXT3	
Contact time	TIME	0
Torque threshold	0 or more / LREAL	0

Home return is performed by executing PMC_Home in POU. For details, refer to *GM1 Series Reference Manual (Instruction Edition)*.

f Info.

- To stop an error that occurs in FB processing within PMC_HOME, set error stop conditions in "Software error reaction" on the "General" tab on the "RTEX Axis Setting" dialog box.
- The deceleration to be applied when stopping an error that occurs in FB processing within PMC_Home can be set in "Software error reaction""General"on the tab on the axis setting (example: SM3_Drive_RTEX_A6N) screen.

For the software error reaction, refer to "General Settings".

11.4 Functional limitations

11.4.1 Restrictions on the Combination of the GM1 Controller and Servo Amplifiers

As for the combination of the GM1 Controller and each MINAS series, confirm the following restrictions.

Combination of the GM1 Controller and servo amplifiers

Connectable servo	amplifier	Description
A5N A6N		Description
•	•	A5N and A6N can be connected to the same network.



• When using servo amplifiers in combination with the GM1 Controller, use the ones with the latest software version.

Setting ranges of movement amount and speed

The input range of the movement amount or speed specified in the GM1 Controller may differ from the upper and lower setting limits of the servo amplifier.



- The communication cycle and command update cycle supported by the GM1 controller and servo amplifiers are as follows.
 - RTEX-compatible GM1 Controller: Communication cycle: 500 μs to 2 ms, Command update cycle: 500 μs to 4ms
 - Servo amplifier A5N: Communication cycle: 500 μs to 1 ms, Command update cycle: 500 μs to 1 ms
 - Servo amplifier A6N: Communication cycle: 500 μs to 2 ms, Command update cycle: 500 μs to 4 ms

11.4.2 Restrictions on Servo Amplifier Parameters

Some parameters on the servo amplifier side affect the behaviors of the RTEX-compatible GM1 controller. Use the following parameter.

No.	Name	Description	Standard factory default setting
Pr5.04	Over-travel inhibit input setup	Use setting value "1 (Disable the over-travel inhibit input)". (Mandatory)	1(Note 1)(Note 3)
Pr7.22	RTEX function extended setup 1	With a setting of 0 (16-byte mode), the maximum connection is 32 axes. With setting 1 (32-byte mode), the maximum number of connections is 16 axes.	O ^(Note 2)

11.4 Functional limitations

No.	Name	Description	Standard factory default setting			
		(Default setting value: 0)				
		Use setting value "18". (Mandatory) This parameter sets each function in bits.				
		bit 0: Allow parameter values to be written via RTEX communication 0: Allow, 1: Disallow				
		bit 1: Set a sub-number for alarm code 0: Fixed at 0, 1: Enable sub-number				
		bit 2: Set RTEX status response conditions when "Over-travel inhibit input setup" is disabled (Pr5.04 = 1) 0: Enable status, 1: Fixed at 0				
		bit 3: Set RTEX status bit assignment for POT and NOT 0: POT corresponds to bit 1 and NOT corresponds to bit 0, 1: NOT corresponds to bit 1 and POT corresponds to bit 0				
		0: POT corresponds to bit 1 and NOT corresponds to bit 0, 1: NOT corresponds to bit 1 and POT corresponds to bit 0 bit 4: Set display mode for "COM" LED 0: Mode 1, 1: Mode 2				
		bit 5: Set non-cyclic command start mode 0: When a change from base command occurs 1: When command code or command argument changes				
Pr7.23	RTEX function extended setup 2	ed setup bit 6: Set RTEX status logic for POT and NOT				
	L	0: Do not reverse, 1: Reverse bit 7: Set RTEX status logic for PSL and NSL 0: Do not reverse, 1: Reverse				
		bit 8: Select RTEX status from In_Progress / AC_OFF 0: In_Progress, 1: AC_OFF (It is linked to the setting in bit 15.)				
		bit 9: Select whether to return a command error when a command for motion toward the direction of over-travel prohibition is received after deceleration stop is executed by "Over-travel inhibit input setup"				
		0: Do not return a command error 1: Return a command error				
		(Bit 10 to bit 13 are not used.) Fix to "0".				
		bit 14: Set position deviation [command unit] output 0: Internal commanded position (after filtering) [command unit] - Actual position [command unit]				
		1: Internal commanded position (before filtering) [command unit] - Actual position [command unit]				
		Bit 15: Select extended RTEX status from In_Progress / AC_OFF / Pr7.112 settings				
		0: Follow the setting of Pr7.23 bit 8 (In Progress / AC OFF)				

No.			Standard factory default setting
		1: Follow the setting of Pr7.112.	
Pr7.25	RTEX speed unit setup	Use setting value "1 (command unit/s)". (Mandatory)	O ^(Note 2)

(Note 1) We recommend that the set value should not be changed judging from the characteristics of the GM1 and MINAS.

(Note 2) Do not change the set value. If the set value is changed, the GM1 Controller will make an error stop.

(Note 3) The stop operation when POT/NOT is detected needs to be executed by the GM1 program. Use RTEX_ReadNot and RTEX_ReadPot to obtain the POT/NOT status of the amplifier and use MC_Stop for forcible stop.

For details, refer to the GM1 Series Reference Manual (Instruction Edition).

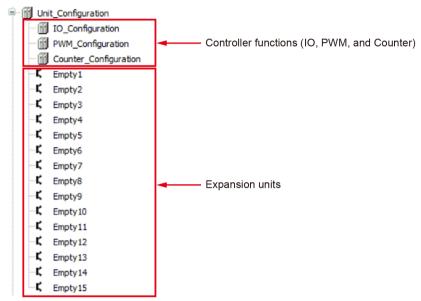
(MEMO)

12 Unit Function

12.1 Overview of Unit Control	12-2
12.2 Setting up the GM1 units	
12.2.1 IO Parameters for Unit Control	
12.2.2 I/O Mapping for Unit Control	
12.2.3 General-purpose I/O	
12.2.4 PWM Output	
12.2.5 High-speed Counter Function	
12.3 Expansion unit settings	
12.3.1 Adding Expansion Units	
12.3.2 Settings of I/O Unit	
12.3.3 Analog I/O Unit	
12.3.4 Pulse Output Unit	
12.3.5 Serial Communication Unit	

12.1 Overview of Unit Control

Unit control provides control for the controller functions (I/O, PWM, and counter) and expansion units.



12.2 Setting up the GM1 units

This section explains how to set up general-purpose I/O, PWM output, and high-speed counter for the GM1 Controller.

The object of each unit is shown below.

Unit_Configuration
IO_Configuration
FORM_Configuration
FORM_CONFIGURA

f Info.

- For details on general-purpose I/O, refer to "12.2.3 General-purpose I/O".
- For details on PMW output, refer to "12.2.4 PWM Output".
- For details on the high-speed counter function, refer to "12.2.5 High-speed Counter Function".

For example, use the following procedure to set up a high-speed counter.

¹² Procedure

 In the navigator pane, double-click the [Counter_Configuration] object. The high-speed counter setting window will be displayed.

Counter I/O Mapping Status	- Ch0		Parameter	Value
Information	Comparison match leading edge reset Comparison function External output function Capture function Cont function Comparison match leading edge reset Comparison match leading edge reset Comparison match realing edge reset Comparison function External output function Capture function			
	Copy(<u>C</u>) F To assign a variable to an address, please set it from the	Paste(<u>A)</u> "I/O mapping"	tab.	

 Set up parameters for the high-speed counter. Select the category of a channel to be set up in the "Category Selection" section and enter values in the "Parameter Settings" section.

Counter parameter	Find	Find Filter Show all					
Counter I/O Mapping	Variable	Mapping	Channel	Address	Туре	Unit	Description
ounter 1/0 Mapping			InputArea	%ID8			Input area
itatus	😟 - 🍫		OutputArea	%QD11			Output area
ormation							
tion							
			Reset Ma	oping			
	🁋 = Create new var	iable 🎲 = Ma	ap to existing va	riable			

3. Select the "Counter I/O Mapping" tab and set the correspondence (mapping) between the channel and variable in the mapping setting pane.

Click the "Variable" column corresponding to the channel to be used by the program and enter a variable name.

Clicking the mark in the "Mapping" column allows you to change the type of mapping.

ounter parameter	Find		Filter Show all				- de Ac	ld FB for IO Channel	→ Go
ounter I/O Mapping	Variable	Mapping	Channel	Address	Туре	Unit	Description		
			InputArea	%ID8			Input area		
tatus	ii - * ∳		OutputArea	%QD11			Output area		
nformation									
omation									
			Reset Ma	pping					
	🍫 = Create new vari	able 😘 = Mi	ap to existing va	riable					
	- Create new van	abie 🧳 – Mi	ap to existing va	nabre					

i Info.

• You can copy the parameter set in a channel. To do so, select a channel (CH0 or CH1) in the "Category Selection" column and click the [Copy] button. Next, select another channel and click the [Paste] button.

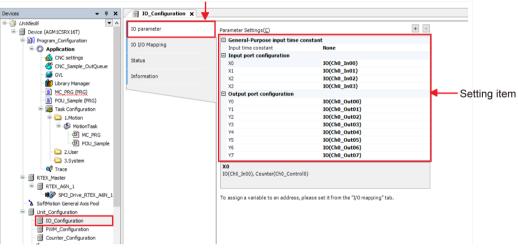
12.2.1 IO Parameters for Unit Control

The parameter window is used to set up parameters for the controller functions (I/O, PWM, and counter) and each expansion unit.

This section explains parameter settings, using IO_Configuration as an example.

In the navigator pane, double-click the "IO_Configuration" object. The "IO_Configuration" pane will be displayed.

In the "IO_Configuration" pane, click the "IO Parameters" tab. The parameter settings sub-pane will be displayed. Change the settings according to your need.



Select the IO Parameters tab

12.2.2 I/O Mapping for Unit Control

The I/O mapping window is used to allocate variables to I/O mapping for the controller functions (I/O, PWM, and counter) and each expansion unit.

This section explains I/O mapping, using IO_Configuration as an example.

Click the "I/O Mapping" tab in the Device pane. The I/O mapping pane will be displayed.

Register variables directly from the variable or I/O mapping window declared in the Application object.

IO parameter	Find		Filter Show al	I			 Add FB for I 	
IO I/O Mapping	Variable	Mapping	Channel	Address	Туре	Unit	Description	
	□ -*		InputArea	%IW8			Input area	
Status	😑 - 🧤		Ch0_In	%IW8	WORD		Ch0_In	
			Ch0_In00	%IX16.0	BOOL		Ch0_In00	
Information	*>		Ch0_In01	%IX16.1	BOOL		Ch0_In01	
	*		Ch0_In02	%IX16.2	BOOL		Ch0_In02	
	* >		Ch0_In03	%IX16.3	BOOL		Ch0_In03	
	*		Ch0_In04	%IX16.4	BOOL		Ch0_In04	
			Ch0_In05	%IX16.5	BOOL		Ch0_In05	
	* ø		Ch0_In06	%IX16.6	BOOL		Ch0_In06	
	*>		Ch0_In07	%IX16.7	BOOL		Ch0_In07	
			Ch0_In08	%IX17.0	BOOL		Ch0_In08	
	¥ø		Ch0_In09	%IX17.1	BOOL		Ch0_In09	
			Ch0_In10	%IX17.2	BOOL		Ch0_In10	
	¥ø		Ch0_In11	%IX17.3	BOOL		Ch0_In11	
			Ch0_In12	%IX17.4	BOOL		Ch0_In12	
	¥ø		Ch0_In13 %IX17.5 BOOL Ch0_In13					
	¥ø		Ch0_In14	%IX17.6	BOOL		Ch0_In14	Allocate variables
	¥ø		Ch0_In15	%IX17.7	BOOL		Ch0_In15	
	<u> </u>		OutputArea	%QW6			Output area	
	🖻 * ø		Ch0_Out	%QW6	WORD		Ch0_Out	
	* *		Ch0_Out00	%QX12.0	BOOL		Ch0_Out00	
	* ø		Ch0_Out01	%QX12.1	BOOL		Ch0_Out01	
	* @		Ch0_Out02	%QX12.2	BOOL		Ch0_Out02	
	* @		Ch0_Out03	%QX12.3	BOOL		Ch0_Out03	
	* @		Ch0_Out04	%QX12.4	BOOL		Ch0_Out04	
	* *		Ch0_Out05	%QX12.5	BOOL		Ch0_Out05	
	*		Ch0_Out06	%QX12.6	BOOL		Ch0_Out06	
	* ø		Ch0_Out07	%QX12.7	BOOL		Ch0_Out07	
	*		Ch0_Out08	%QX13.0	BOOL		Ch0_Out08	
	* ø		Ch0_Out09	%QX13.1	BOOL		Ch0_Out09	
	*		Ch0_Out10	%QX13.2	BOOL		Ch0_Out10	
	* ø		Ch0_Out11	%QX13.3	BOOL		Ch0_Out11	
	*		Ch0_Out12	%QX13.4	BOOL		Ch0_Out12	
	* ø		Ch0_Out13	%QX13.5	BOOL		Ch0_Out13	
	*		Ch0_Out14	%QX13.6	BOOL		Ch0_Out14	
			Ch0 Out15	%QX13.7	BOOL		Ch0 Out15	

Select the I/O Mapping tab

12.2.3 General-purpose I/O

Overview of General-purpose I/O Function

The general-purpose I/O function allows use of up to 16 input points and 16 output points. * However, the general-purpose I/O function shares some ports with the high-speed counter function and PWM output function. Therefore, use IO parameter settings to select functions to be used.

Specification overview

Item	Specifications	Remarks
Number of input ports	Max. 16 points	X0 to X3 are shared with the counter function. Use IO parameter settings to select functions to be used.
Number of output ports	Max. 16 points	Y0 to Y3 are shared with the counter function and Y4 to Y7 are shared with the PWM output function. Use IO parameter settings to select functions to be used.
Input port number	X0 to X15	
Output port number	Y0 to Y15	

Setting Parameters with GM Programmer



Procedure

 In the navigator pane, double-click the "IO_Configuration" object. The general-purpose IO setting pane will be displayed.

Untitled6	IO parameter	Parameter Settings(C)		+ -
Program_Configuration		General-Purpose in	put time constant	
G Application	IO I/O Mapping	Input time constant	None	
CNC settings		Input port configuration	ation	
CNC_Sample_OutQueue	Status	X0	IO(Ch0_In00)	
Gro_sample_outgaede		X1	IO(Ch0_In01)	
ibrary Manager	Information	X2	IO(Ch0_In02)	
		X3	IO(Ch0_In03)	
MC_PRG (PRG)		Output port configu		
POU_Sample (PRG)		YO	IO(Ch0_Out00)	
and Task Configuration		Y1	IO(Ch0_Out01)	
💷 🧰 1.Motion		Y2	IO(Ch0_Out02)	
🖻 🕸 MotionTask		Y3	IO(Ch0_Out03)	
MC_PRG		Y4	IO(Ch0_Out04)	
POU_Sample		Y5 Y6	IO(Ch0_Out05)	
- 🗀 2.User		Y6 Y7	IO(Ch0_Out06) IO(Ch0_Out07)	
3.System		17	10(Cli0_0007)	
🚭 Trace		xo		
RTEX_Master		IO(Ch0_In00), Counter(C	h0_Control0)	
RTEX_A6N_1				
SM3_Drive_RTEX_A6N_1				
SoftMotion General Axis Pool		To assign a variable to an	address, please set it from the "I/O mapping" tab	•
_				
IO_Configuration				
PWM_Configuration				
Counter_Configuration				

2. Set up general-purpose IO parameters.

Select an IO parameter to be changed and then select a desired item from the drop-down list.

0 parameter	Parameter Settings(C)		+
	General-Purpose input time	constant	
0 I/O Mapping	Input time constant	None	
	Input port configuration		
tatus	X0	IO(Ch0_In00)	`
	X1	IO(Ch0_In00)	
information	X2	Counter(Ch0_Control0)	
	X3	10(CII0_1105)	
	Output port configuration		
	YO	IO(Ch0_Out00)	
	Y1	IO(Ch0_Out01)	
	Y2	IO(Ch0_Out02)	
	Y3	IO(Ch0_Out03)	
	¥4	IO(Ch0_Out04)	
	Y5	IO(Ch0_Out05)	
	Y6	IO(Ch0_Out06)	
	Y7	IO(Ch0_Out07)	
	xo		
	IO(Ch0_In00), Counter(Ch0_Cont	rol0)	

3. Select the "I/O Mapping" tab and set the correspondence (mapping) between the channel and variable in the mapping setting pane.

Click the "Variable" column corresponding to the channel to be used by the program and enter a variable name.

Clicking the mark in the "Mapping" column allows you to change the type of mapping.

0 parameter	Find		Filter Show all	I			🕶 🖶 Add
IO I/O Mapping	Variable	Mapping	Channel	Address	Туре	Unit	Description
to yo happing	=- * >		InputArea	%IW8			Input area
Status	<u>ii</u> - *p		Ch0_In	%IW8	WORD		Ch0_In
	😑 - 🍫		OutputArea	%QW6			Output area
Information	😑 - 🍫		Ch0_Out	%QW6	WORD		Ch0_Out
	iVar0	🍫	Ch0_Out00	%QX12.0	BOOL		Ch0_Out00
	* *		Ch0_Out01	%QX12.1	BOOL		Ch0_Out01
	🍫		Ch0_Out02	%QX12.2	BOOL		Ch0_Out02
	···· *•		Ch0_Out03	%QX12.3	BOOL		Ch0_Out03
	* ø		Ch0_Out04	%QX12.4	BOOL		Ch0_Out04



• You can copy the variable name set in the Channel column.

Select a channel (CH0 or CH1) in the "Category Selection" column, right-click, and then select [Copy] from the context-sensitive menu that is displayed. Next, select another channel, right-click, and then select [Paste] from the context-sensitive menu that is displayed.

Setting Items of IO_Configuration Parameters

■ IO parameters

Setting item	Setting item	Settings	Default value	Description
General-purpose input time constant	Input time constant	None 0.1 ms 0.5 ms 1 ms 5 ms 10 ms 20 ms 70 ms	None	Input time constant
Input function setting	X0	IO(Ch0_In00) Counter(Ch0_Control0)	IO(Ch0_In00)	Select X0
	X1	IO(Ch0_In01) Counter(Ch0_Control1)	IO(Ch0_In01)	Select X1
	X2	IO(Ch0_In02) Counter(Ch1_Control0)	IO(Ch0_In02)	Select X2
	Х3	IO(Ch0_In03) Counter(Ch1_Control1)	IO(Ch0_In03)	Select X3
Output function setting	Y0	IO(Ch0_Out00) Counter(Ch0_ExternalOutp ut0)	IO(Ch0_Out00)	Select Y0
	Y1	IO(Ch0_Out01) Counter(Ch0_ExternalOutp ut1)	IO(Ch0_Out01)	Select Y1
	Y2	IO(Ch0_Out02) Counter(Ch1_ExternalOutp ut0)	IO(Ch0_Out02)	Select Y2
	Y3	IO(Ch0_Out03) Counter(Ch1_ExternalOutp ut1)	IO(Ch0_Out03)	Select Y3
	Y4	IO(Ch0_Out04) PWM(Ch0_PWM_Output)	IO(Ch0_Out04)	Select Y4
	Y5	IO(Ch0_Out05) PWM(Ch1_PWM_Output)	IO(Ch0_Out05)	Select Y5
	Y6	IO(Ch0_Out06) PWM(Ch2_PWM_Output)	IO(Ch0_Out06)	Select Y6
	Y7	IO(Ch0_Out07) PWM(Ch3_PWM_Output)	IO(Ch0_Out07)	Select Y07

I/O Mapping for General-purpose I/O

Channel	Туре	Description	Remarks
Ch0_In	WORD	Ch0_In	
Ch0_Out	WORD	Ch0_Out	

Ch0_In

Channel	Туре	Description	Remarks
Ch0_In00	BOOL	Ch0_In00	
Ch0_In01	BOOL	Ch0_In01	
Ch0_In02	BOOL	Ch0_In02	
Ch0_In03	BOOL	Ch0_In03	
Ch0_In04	BOOL	Ch0_In04	
Ch0_In05	BOOL	Ch0_In05	
Ch0_In06	BOOL	Ch0_In06	
Ch0_In07	BOOL	Ch0_In07	
Ch0_In08	BOOL	Ch0_In08	
Ch0_In09	BOOL	Ch0_In09	
Ch0_In10	BOOL	Ch0_In10	
Ch0_In11	BOOL	Ch0_In11	
Ch0_In12	BOOL	Ch0_In12	
Ch0_In13	BOOL	Ch0_In13	
Ch0_In14	BOOL	Ch0_In14	
Ch0_In15	BOOL	Ch0_ln15	

Ch0_Out

Channel	Туре	Description	Remarks
Ch0_Out00	BOOL	Ch0_Out00	
Ch0_Out01	BOOL	Ch0_Out01	
Ch0_Out02	BOOL	Ch0_Out02	
Ch0_Out03	BOOL	Ch0_Out03	
Ch0_Out04	BOOL	Ch0_Out04	
Ch0_Out05	BOOL	Ch0_Out05	
Ch0_Out06	BOOL	Ch0_Out06	
Ch0_Out07	BOOL	Ch0_Out07	
Ch0_Out08	BOOL	Ch0_Out08	
Ch0_Out09	BOOL	Ch0_Out09	
Ch0_Out10	BOOL	Ch0_Out10	
Ch0_Out11	BOOL	Ch0_Out11	

Channel	Туре	Description	Remarks
Ch0_Out12	BOOL	Ch0_Out12	
Ch0_Out13	BOOL	Ch0_Out13	
Ch0_Out14	BOOL	Ch0_Out14	
Ch0_Out15	BOOL	Ch0_Out15	

12.2.4 PWM Output

Overview of PWM Output

The PWM output function enables up to 100 kHz of PWM output to be obtained within a range of 0% to 100%.

Outline of specifications

Item	Specifications	Remarks
Number of output channels	Max. 4 channels	
Output port number	Y4 to Y7	
Output frequency	1 Hz to100 kHz (Settable by 1 Hz) ^(Note 1)	
Output duty ratio	0% to 100% (Settable by 0.1%)	
Control input	Enable request or start request	

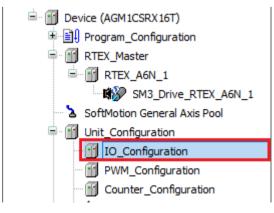
(Note 1) This specification applies when push-pull is set and output current is 0.1 A. It varies according to loads.

Setting Output Ports with GM Programmer

You can set output ports for PWM output via **IO_Configuration>Edit Object** in GM Programmer.

¹² Procedure

1. From "Device view" in the navigator pane, double-click "IO_Configuration".



2. Click the "IO parameter" tab.

IO_Configuration X				
IO parameter	Parameter Settings(<u>C</u>)			
IO I/O Mapping	 			
Status	Output port configuration			
Information				

3. If necessary, change Y4 to Y7 in "Output port configuration" to PWM(Ch0_PWM_Output) to PWM(Ch3_PWM_Output), respectively.

General-Purpose input	ut time constant
Input port configurat	ion
Output port configuration	ation
YO	IO(Ch0_Out00)
Y1	IO(Ch0_Out01)
Y2	IO(Ch0_Out02)
Y3	IO(Ch0_Out03)
Y4	PWM(Ch0_PWM_Output)
Y5	PWM(Ch1_PWM_Output)
Y6	PWM(Ch2_PWM_Output)
Y7	PWM(Ch3_PWM_Output)

_

I/O Mapping for PWM Output

The high-speed counter function is controlled by user programs.

InputArea (input area)

Channel	Туре	Description	Remarks
PwmStatusRegister	WORD	Input area	-

PwmStatusRegister (PWM status register)

Channel	Туре	Description	Remarks
Ch*_PwmStatus	BOOL	Ch* PWM output status	Indicates the PWM output state. FALSE: OFF TRUE: ON

OutputArea (output area)

Channel	Туре	Description	Remarks
PwmRequestRegist er	WORD	PWM request register	-
Ch*_FrequestValue	UDINT	Ch* frequency set value	Unit: Hz (0 to 100,000 Hz)
Ch* DutyValue	UINT	Ch* duty ratio set value	Unit: 0.1% (0 to 100.0%)

PwmRequestRegister (PWM request register)

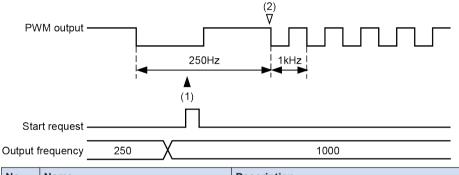
Channel	Туре	Description	Remarks
Ch*_PwmStartRequ est	BOOL	Ch* start request	PWM output is started at the rising edge.
Ch*_PwmEnableRe quest	BOOL	Ch* enable request	FALSE: Disables PWM output TRUE: Enables PWM output

Data Update Timing (Output Frequency)

The data update timing for output frequency during PWM output is descried below.

Data update at the rising edge of start request bit

In this mode, the frequency value to be changed is written to the frequency set value and updated with data at the point in time when the start request bit is switched from OFF to ON. The frequency value changed in this timing is reflected at the falling edge of the pulse that is being output.



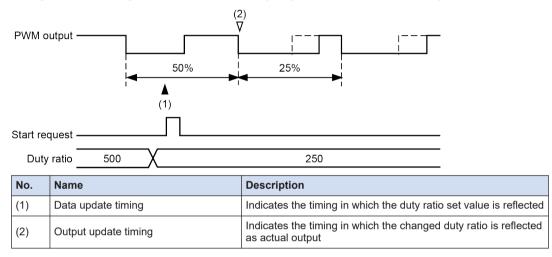
No.	Name	Description
(1)	Data update timing	Indicates the timing in which the frequency set value is reflected
(2)	Output update timing	Indicates the timing in which the changed frequency is reflected as actual output

Data Update Timing (Duty Ratio)

The data update timing for duty ratios during PWM output is descried below.

Data update at the rising edge of start request bit

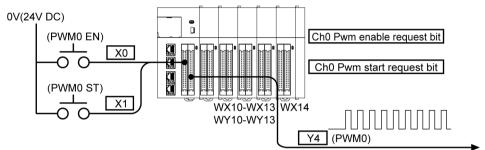
In this mode, the duty ratio to be changed is written to the duty ratio set value and updated with data at the point in time when the start request bit is switched from OFF to ON. The duty ratio changed in this timing is reflected at the falling edge of the pulse that is being output.



PWM Output Setting Example

Overview

PWM output is performed. It is controlled by the switch input (X0 or X1) connected to the GM1 controller. If the start request bit is turned ON when the enable request bit is ON, PWM output will be started.



Settings in GM Programmer

For example, to set PWM output for Y4, use the procedure in "Setting Output Ports with GM Programmer" to configure settings as shown below.

IO parameter	Parameter Settings(<u>C</u>)	+
	General-Purpose in	put time constant
IO I/O Mapping	Input port configuration	ation
	X0	IO(Ch0_In00)
Status	X1	IO(Ch0_In01)
	X2	IO(Ch0_In02)
Information	X3	IO(Ch0_In03)
	Output port configu	ration
	YO	IO(Ch0_Out00)
	Y1	IO(Ch0_Out01)
	Y2	IO(Ch0_Out02)
	Y3	IO(Ch0_Out03)
	Y4	PWM(Ch0_PWM_Output)
	Y5	IO(Ch0_Out05)
	Y6	IO(Ch0_Out06)
	Y7	IO(Ch0_Out07)

Next, perform I/O mapping for variables created in POU.

1. From "Device view" in the navigator pane, double-click "PWM_Configuration".

🖻 🔟 Device (AGM1CSRX16T)
🗉 🗐 Program_Configuration
🖻 🔟 RTEX_Master
- TEX_A6N_1
SM3_Drive_RTEX_A6N_1
🗠 🍐 SoftMotion General Axis Pool
🗐 🔟 Unit_Configuration
IO_Configuration
PWM_Configuration
Counter_Configuration

The "PWM_Configuration" window will be displayed.

PWM_Configuration 🗙		
PWM I/O Mapping	Find	Filter
Status	Variable	
Information	±	

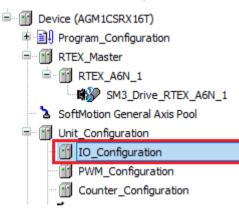
2. In the "PWM_Configuration" window, click the "PWM I/O Mapping" tab.

/ 🛉 PWI	M_Configuration X		
PWM I/O	Mapping	Find	Filter
Status		Variable ⊞	
Informati	ion		

3. In this example, variables with the same name as the channel name are mapped to the channels required for PWM Ch0 (the name of sample POU is created as "PWM").

/ariable	Mapping	Channel	Address	Туре	Unit	Description
₽		InputArea	%IW10			Input area
🖮 🐐		PwmStatusRegister	%IW10	WORD		PwmStatusRegister
Application.PWM.Ch0_PWMstate	~	Ch0_PwmStatus	%IX20.0	BOOL		Ch0 Pwm status
¥ø		Ch1_PwmStatus	%IX20.1	BOOL		Ch1 Pwm status
···· 🍫		Ch2_PwmStatus	%IX20.2	BOOL		Ch2 Pwm status
		Ch3_PwmStatus	%IX20.3	BOOL		Ch3 Pwm status
*		OutputArea	%QD4			Output area
🛱 🍢		PwmRequestRegister	%QW8	WORD		Pwm request register
Application.PWM.Ch0_PWMStartRequest	~	Ch0_PwmStartRequest	%QX16.0	BOOL		Ch0 Pwm start request
*		Ch1_PwmStartRequest	%QX16.1	BOOL		Ch1 Pwm start request
🍫		Ch2_PwmStartRequest	%QX16.2	BOOL		Ch2 Pwm start request
🍫		Ch3_PwmStartRequest	%QX16.3	BOOL		Ch3 Pwm start request
Application.PWM.Ch0_PWMEnableRequest	~	Ch0_PwmEnableRequest	%QX16.4	BOOL		Ch0 Pwm enable request
50		Ch1_PwmEnableRequest	%QX16.5	BOOL		Ch1 Pwm enable request
🍫		Ch2_PwmEnableRequest	%QX16.6	BOOL		Ch2 Pwm enable request
*		Ch3_PwmEnableRequest	%QX16.7	BOOL		Ch3 Pwm enable request
🐶 Application.PWM.Ch0_FrequestValue	~	Ch0_FrequencyValue	%QD5	UDINT		Ch0 frequency set
*		Ch1_FrequencyValue	%QD6	UDINT		Ch1 frequency set
···· * @		Ch2_FrequencyValue	%QD7	UDINT		Ch2 frequency set
🍫		Ch3_FrequencyValue	%QD8	UDINT		Ch3 frequency set
Application.PWM.Ch0_DutyValue		Ch0_DutyValue	%QW18	UINT		Ch0 duty set
*		Ch1_DutyValue	%QW19	UINT		Ch1 duty set
🍫		Ch2_DutyValue	%QW20	UINT		Ch2 duty set
		Ch3_DutyValue	%QW21	UINT		Ch3 duty set

4. From Device view in the navigator pane, double-click "IO_Configuration".



The "IO_Configuration" window will be displayed.

IO parameter	Find	Filter Show all			
IO I/O Mapping	Variable	Mapping	Channel	Address	Туре
to yo happing	📮 🐌		InputArea	%IW8	
Status	🚊 - 🍫		Ch0_In	%IW8	WORD
	Application.PWM.IO_X0	~⊘	Ch0_In00	%IX16.0	BOOL
Information	Application.PWM.IO_X0	~	Ch0_In01	%IX16.1	BOOL
			Ch0_In02	%IX16.2	BOOL
			Ch0_In03	%IX16.3	BOOL
			Ch0 In04	%IX16.4	BOOL

5. Click the "IO I/O Mapping" tab.

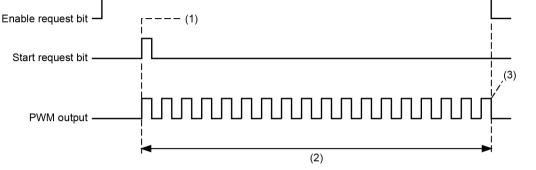
IO parameter	Find	Filter She	Filter Show all			
IO I/O Mapping	Variable	Mapping	Channel	Address	Туре	
io i o Happing	📮 · 🍫		InputArea	%IW8		
Status	🚔 🍫		Ch0_In	%IW8	WORD	
	Application.PWM.IO_X0	~	Ch0_In00	%IX16.0	BOOL	
Information	Application.PWM.IO_X0	~	Ch0_In01	%IX16.1	BOOL	
	* ø		Ch0_In02	%IX16.2	BOOL	
	*•		Ch0_In03	%IX16.3	BOOL	
	**		Ch0_In04	%IX16.4	BOOL	

6. Variables will be mapped.

10_Configuration X								
IO parameter	Find	Filter She	Filter Show all					
IO I/O Mapping	Variable	Mapping	Channel		Туре			
	📮 - 🍫		InputArea					
Status	🖻 🍫		Ch0_In	%IW8	WORD			
	Application.PWM.IO_X0	~ @	Ch0_In00	%IX16.0	BOOL			
Information	🏘 Application.PWM.IO_X0	~∕	Ch0_In01	%IX16.1	BOOL			
	¥ø		Ch0_In02	%IX16.2	BOOL			
			Ch0_In03	%IX16.3	BOOL			
	*		Ch0_In04	%IX16.4	BOOL			

Timing chart

If the rising edge of the start request bit is detected when the enable request bit is ON, Y4 will start PWM output. When the enable request bit is set to OFF, PWM output stops.



No.	Description
(1)	If the rising edge of the start request bit is detected when the enable request bit is ON, PWM output will be started.
(2)	PWM output is performed with a duty ratio of 50% and at a frequency of 100 Hz.
(3)	When the enable request bit turns OFF, PWM output stops.

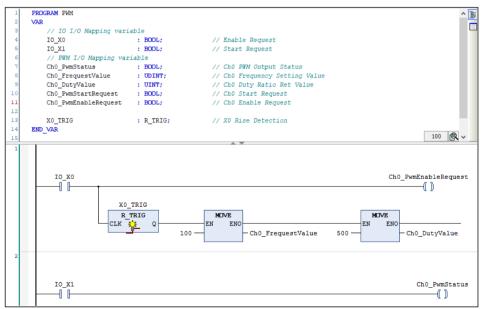
Sample program

The following are LD program and ST program examples for sample POU (PWM). The state of X0 is output to the Ch0 Enable Request bit.

Ch0 frequency and Ch0 duty ratio are set at the rising edge of X0.

The state of X1 is output to the Ch0 Start Request bit.

LD program



ST program

1	PROGRAM PWM		
2	VAR		
3	// IO I/O Mapping vari	able	
4	IO_X0	: BOOL;	; // Enable Request
5	IO_X1	: BOOL;	.; // Start Request
6	// PWM I/O Mapping var	iable	
7	Ch0_PwmStatus	: BOOL;	.; // Ch0 PWM Output Status
8	Ch0_FrequestValue	: UDIN	<pre>NT; // Ch0 Frequency Setting Value</pre>
9	Ch0_DutyValue	: UINT;	; // Ch0 Duty Ratio Ret Value
10	Ch0_PwmStartRequest	: BOOL;	.; // Ch0 Start Request
11	Ch0_PwmEnableRequest	: BOOL;	.; // Ch0 Enable Request
12			
13	X0_TRIG	: R_TRI	RIG; // X0 Rise Detection
14	END_VAR		
15			
1	Ch0_PwmEnableRequest := I0	X0;	// Output X0 status to Ch0 enable request
2			
3	X0_TRIG(CLK:=I0_X0);		
4	IF X0_TRIG.Q = TRUE THEN		// X0 rise detection
5	Ch0_FrequestValue := 1	00;	// Set frequency to 100HZ
6	Ch0_DutyValue := 500;		// Duty ratio set to 50%
7	END_IF		
8			
9	Ch0_PwmStartRequest := I0_	X1;	// Output X1 status to Ch0 start request

12.2.5 High-speed Counter Function

Overview of High-speed Counter Function

- Two 4-MHz, signed 32-bit high-speed counters are provided
- High-speed counting of input signals is available for up to the maximum frequency 4 MHz (or 16 MHz for 2-phase input 4 multiple). Two-phase input (phase differential input), individual input, or direction identification input can be selected according to the input device such as encoders or sensors.

■ 24 VDC, 12 VDC, and 5 VDC inputs and line driver input are supported

• The count input circuit supports both open collector output and line driver output (differential output: equivalent to AM26LS31).

Ring counter or linear counter can be selected

• Both the ring counter and linear counter are supported. Both types can use the Z-phase of an encoder as count reset timing.

Internal clock counting is possible

• Internal clocks can be selected as count input signals. High-accuracy time measurements can be made with a maximum resolution of 0.25 μ s. Selectable internal clocks are 0.25 μ s (4 MHz), 1 μ s (1 MHz), 10 μ s (100 kHz), and 100 μ s (10 kHz).

Capture function and sampling capture function are provided

- It is possible to store the count value at the moment of the occurrence of a trigger assigned to a capture flag. Count values can be checked, independently of I/O refresh.
- The capture function executes capturing at the rising and falling edges of a capture flag. The sampling capture function executes capturing at every sampling time according to the input of a capture flag.

Various counter operations can be selected

- 1. Enable count operation
- 2. Reset count operation
- 3. Preset count operation
- 4. Enable reset count operation
- 5. Enable preset count operation

Band comparison function and target value match comparison function are provided

- The band comparison function allows up to 16 pairs of upper and lower limits to be set for each counter. Up to 16 comparison match flags can be turned ON or OFF for each comparison condition.
- The target value match comparison function allows up to16 target values to be set for each counter. Target values can be set or reset individually according to the direction of counting (incrementation or decrementation) when the count value reaches the target value or when

up to 16 comparison match flags for each comparison condition match their respective target values.

- For each counter, up to two comparison match flags and external output signals can be linked with each counter.
- ON hold time setting (for band comparison function only)
- The ON state of external output signals is retained for the set time (1 to 1,000 ms).

Input time constant (noise filter)

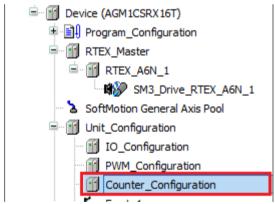
• Input time constants can be set as input signals (A-phase, B-phase, and Z-phase) and control signals for each counter.

Setting Parameters with GM Programmer

You can set parameters for the high-speed counter via Couter_Configuration in GM Programmer.

¹² Procedure

1. From "Device view" in the navigator pane, double-click "Counter_Configuration".



The "Counter Configuration" setting window will be displayed.

Counter_Configuration X	
Counter parameter	Category Selection(<u>T</u>)
Counter I/O Mapping	⊡ Ch0 ⊟ Count function
Status	Comparison match leading edge reset Comparison match trailing edge reset
Information	Comparison function External output function
	Capture function

2. In the "Counter_Configuration" window, click the "Counter parameter" tab.

Counter_Configuration X						
Counter parameter	Category Selection(\underline{T})					
Counter I/O Mapping	□·· Ch0					
Status	Comparison match leading edge reset Comparison match trailing edge reset					
Information	Comparison function External output function Capture function					

3. Set up parameters of each function for each counter.

Counter function

Category Selection(<u>T</u>)	+ - Parameter Setting (<u>R</u>)	
⊡. Ch0	Parameter	Value
Count function	Counter type	Linear counter
Comparison match trailing edge reset	Enable/Disable overflow/underflow	Disable
···· Comparison function	Counter upper limit	2,147,483,647
External output function	Counter lower limit	-2,147,483,648
	Specify count direction	Count in normal direction
Count function	Select count input	Count signal
Comparison match leading edge reset	Count method	2-phase input 1 multiple
Comparison function	Input Z signal function setting	Not used
External output function	Control 0 signal function setting	Not used
····· Capture function	Control 1 signal function setting	Not used
	Default value	0
	Input A signal/Input B signal input time constant	2.0us(100kHz)
	Input Z signal input time constant	2.0us(100kHz)
	Control signal input time constant	2.0ms

Comparison match leading edge reset / Comparison match trailing edge reset

Category Selection(<u>T</u>)	+ -	Parameter Setting (<u>R</u>)	
⊡- Ch0		Parameter	Value
- Count function - Comparison match leading edge reset	Comparison match 0 flag	Notreset	
Comparison match trailing edge reset		Comparison match 1 flag	Notreset
Comparison function		Comparison match 2 flag	Notreset
External output function Capture function		Comparison match 3 flag	Notreset
=-Ch1		Comparison match 4 flag	Notreset
Count function		Comparison match 5 flag	Notreset
Comparison match leading edge reset Comparison match trailing edge reset		Comparison match 6 flag	Notreset
Comparison match training edge reset		Comparison match 7 flag	Notreset
External output function		Comparison match 8 flag	Notreset
Capture function		Comparison match 9 flag	Notreset
		Comparison match 10 flag	Notreset
		Comparison match 11 flag	Notreset
		Comparison match 12 flag	Notreset
		Comparison match 13 flag	Notreset
		Comparison match 14 flag	Notreset
		Comparison match 15 flag	Notreset

Comparison function (band comparison)

Category Selection(I)	+ -	Parameter Setting (<u>R</u>)	
⊡. Ch0	^	Parameter	Value
Count function Comparison match leading edge reset		Select comparison function	Band comparison
Comparison match trailing edge reset		Select comparison input	Count value
Comparison function		Set number of comparison data	16
Comparison data 0			

Comparison function (band comparison) comparison data

Category Selection(T)	+ -	Parameter Setting (<u>R</u>)	
⊡- Ch0	^	Parameter	Value
Count function Comparison match leading edge reset		Lower limit	0
Comparison match trailing edge reset		Upper Limit	0
Comparison function Comparison data 0 Set pattern G- Comparison data 1			

Set patterns for comparison function (band comparison) comparison data

Category Selection(\underline{T})	+ -	Parameter Setting (<u>R</u>)	
⊡Ch0	^	Parameter	Value
Count function Comparison match leading edge reset		Comparison match 0 flag	OFF
Comparison match leading edge reset		Comparison match 1 flag	OFF
Comparison function		Comparison match 2 flag	OFF
- Comparison data 0 - Set pattern		Comparison match 3 flag	OFF
		Comparison match 4 flag	OFF
Comparison data 2		Comparison match 5 flag	OFF
Comparison data 3		Comparison match 6 flag	OFF
Comparison data 4		Comparison match 7 flag	OFF
€- Comparison data 5 ⊕- Comparison data 6		Comparison match 8 flag	OFF
		Comparison match 9 flag	OFF
⊕ Comparison data 9		Comparison match 10 flag	OFF
		Comparison match 11 flag	OFF
Comparison data 11		Comparison match 12 flag	OFF
		Comparison match 13 flag	OFF
⊡ Comparison data 13			
⊕ Comparison data 14		Comparison match 14 flag	OFF
Comparison data 15		Comparison match 15 flag	OFF
 External output function 			

Comparison function (target value match comparison)

Category Selection(T)	+ -	Parameter Setting (<u>R</u>)	
⊡. Ch0	^	Parameter	Value
Count function Comparison match leading edge reset		Select comparison function	Target value match comparison $$
Comparison match trailing edge reset		Select comparison input	Count value
Comparison function		Set number of comparison data	16
⊕ Comparison data 0			

Comparison function (target value match comparison) comparison data

Category Selection(\underline{T})	+ -	Parameter Setting (<u>R</u>)	
⊡ Ch0	^	Parameter	Value
		Target Value	0
Comparison match trailing edge reset			
Comparison function Comparison data 0			

Set/reset patterns for comparison function (target value match comparison) comparison data

Category Selection(<u>T</u>)	+ -	Parameter Setting (<u>R</u>)	
- Ch0	^	Parameter	Value
 Count function Comparison match leading edge reset 		Comparison match 0 flag	No change
Comparison match trailing edge reset		Comparison match 1 flag	No change
Comparison function		Comparison match 2 flag	No change
Comparison data 0 Addition set pattern		Comparison match 3 flag	No change
- Addition reset pattern		Comparison match 4 flag	No change
Subtraction set pattern		Comparison match 5 flag	No change
Subtraction reset pattern		Comparison match 6 flag	No change
Comparison data 1		Comparison match 7 flag	No change
		Comparison match 8 flag	No change
Comparison data 4		Comparison match 9 flag	No change
Comparison data 5		Comparison match 10 flag	No change
Comparison data 6			
Comparison data 7 ⊕ Comparison data 8		Comparison match 11 flag	No change
Comparison data 9		Comparison match 12 flag	No change
Comparison data 3		Comparison match 13 flag	No change
Comparison data 10		Comparison match 14 flag	No change
Comparison data 12		Comparison match 15 flag	No change
Comparison data 13		companion match 15 hag	no charge

External output function

Category Selection(T)	+ -	Parameter Setting (<u>R</u>)	
⊡ Ch0		Parameter	Value
Count function Comparison match leading edge reset		External output 0 signal setting	Not output
Comparison match trailing edge reset - Comparison function External output function - Capture function		External output 0 signal ON hold delay	0
		External output 1 signal setting	Not output
		External output 1 signal ON hold delay	0
Captare random			

Capture function

Category Selection(T)	+ •	Parameter Setting (<u>R</u>)	
⊡- Ch0		Parameter	Value
Count function Comparison match leading edge reset Comparison match trailing edge reset Comparison function		Capture 0 setting	Not use capture 0 function
		Capture 1 setting	Not use capture 1 function
		Capture function operation setting	Continuous operation
External output function		Sampling time	1

f Info.

• You can copy the parameter set in a counter. To do so, select a channel (Ch0 or Ch1) in the "Category Selection" column and click the [Copy] button.

Next, select another counter and click the [Paste] button.

• For details on each parameter, refer to "Counter Parameter Setting Items".

Counter Parameter Setting Items

Count function (Settable for each counter)

Setting item	Settings	Default value
Counter type	Linear counter / Ring counter	Linear counter
Enable/Disable overflow/ underflow	Disable / Enable	Disable
Counter upper limit	-2,147,483,647 to 2,147,483,647	2,147,483,647

Setting item	Settings	Default value	
Counter lower limit	-2,147,483,648 to 2,147,483,646	-2,147,483,648	
Specify count direction	Count in normal direction / Count in reverse direction	Count in normal direction	
	Count signal	_	
	Internal clock 0.25 µs (4 MHz)		
Select count input	Internal clock 1.00 µs (1 MHz)	Count signal	
	Internal clock 10 µs (100 kHz)		
	Internal clock 100 μs (10 kHz)		
Count method	2-phase input 1 multiple / 2-phase input 2 multiple / 2- phase input 4 multiple / Individual input 1 multiple / Individual input 2 multiple / Direction detection input 1 multiple / Direction detection input 2 multiple	2-phase input 1 multiple	
	Not used		
	Reset operation at rising edge		
	Reset operation at falling edge		
	Positive logic reset operation		
Input Z signal function setting	Negative logic reset operation	Not used	
	Preset operation at rising edge		
	Preset operation at falling edge		
	Positive logic preset operation		
	Negative logic preset operation		
	Not used	Not used	
	Positive logic enable operation		
Control 0 signal function setting	Negative logic enable operation		
	Positive logic enable operation, reset operation at rising edge		
	Negative logic enable operation and reset operation at falling edge		
	Positive logic enable operation and preset operation at rising edge		
	Negative logic enable operation and preset operation at falling edge		
Control 1 signal function setting	Not used		
	Positive logic enable operation	Not used	
	Negative logic enable operation		
Default value	Overwrites the count value with the default value when the power is turned ON	0	
Input A signal/Input B signal input time constant	No input time constant / 0.1 μs (2 MHz) / 0.2 μs (1 MHz) / 0.5 μs (500 kHz) / 1.0 μs (250 kHz) / 2.0 μs (100 kHz) / 10.0 μs (10 kHz)		
Input Z signal input time No input time constant / 0.1 μs (2 MHz) / 0.2 μs (⁷ MHz) / 0.5 μs (500 kHz) / 1.0 μs (250 kHz) / 2.0 μ (100 kHz) / 10.0 μs (10 kHz)		- 2.0 μs (100 kHz)	
Control signal input time constant	No input time constant / 2 μs / 5 μs / 10 μs / 20 μs / 50 μs / 100 μs / 500 μs / 1.0 ms / 2.0 ms / 5.0 ms / 10.0 ms	2.0 ms	

(Note 1) The control 0 signal and control 1 signal cannot be assigned to the capture function if they are assigned to the enable operation.

Setting item	Settings	Default value
Comparison match leading edge reset / Comparison match trailing edge reset	Selects a comparison match flag that resets the count value at the rising edge or falling edge. Not reset / Reset	Not reset

Comparison function (Settable for each counter)

Setting item	Settings	Default value
Select comparison function	Not use / Band comparison / Target value match comparison	Not use
Select comparison input	Count value	Count value
Set number of comparison data	Sets the number of data items to be compared Setting range: 1 to 16	16

If you select "Band comparison" or "Target value match comparison" for "Select comparison function", set parameters for each comparison data item.

Setting item	Settings	Default value
Comparison data 0 to Comparison data 15 (for band comparison)	Specifies the lower and upper limits for each comparison data (^{Note 1)} Setting range: -2,147,483,648 to 2,147,483,647	0
	Specifies the state of the comparison match flag when the current value falls within the specified band ON / OFF	OFF
Comparison data 0 to Comparison data 15 (for target value match comparison)	Specifies target values for each comparison data Setting range: -2,147,483,648 to 2,147,483,647	0
	Comparison match flags to be set or reset can be selected for each status (incrementation or decrementation) of comparison data that has reached the target value. • Addition set pattern: Set / No change • Addition reset pattern: Reset / No change • Subtraction set pattern: Set / No change • Subtraction reset pattern: Reset / No change	No change

(Note 1) Lower and upper limits can be set within the range between the lower and upper limits for the counter. For linear counters, set each limit so that the lower limit is less than the upper limit. For ring counters, lower and upper limits can be set in any range.

External output function (Settable for each counter)

Setting item	Settings	Default value
External output 0 signal setting	Not output / Output	Not output
External output 0 signal ON hold time	Setting range: 0 to 1,000 (ms)	0 ms
External output 1 signal setting	Not output / Output	Not output
External output 1 signal ON hold delay	Setting range: 0 to 1,000 (ms)	0 ms

(Note 1) "ON hold time" is enabled only when the band comparison function is used.

Capture function (Settable for each counter)

Setting item	Settings	Default value	
	Not use capture 0 function		
	Capture function at rising edge of control 0 signal		
	Capture function at falling edge of control 0 signal		
	Capture function at rising edge of control 1 signal		
	Capture function at falling edge of control 1 signal		
Capture 0 setting	Control 0 signal positive logic sampling capture function	Not use capture 0	
	Control 0 signal negative logic sampling capture function	function	
	Control 1 signal positive logic sampling capture function		
	Control 1 signal negative logic sampling capture function		
	Output relay (Y relay) sampling capture function		
	Not use capture 1 function		
	Capture function at rising edge of control 0 signal		
Capture 1 setting	Capture function at falling edge of control 0 signal	Not use capture 1	
	Capture function at rising edge of control 1 signal	Idilotion	
	Capture function at falling edge of control 1 signal		
Capture function operation setting	One operation / Continuous operation	Continuous operation	
Sampling time (ms)	1 to 65,535	1	

(Note 1) If any value related to the sampling capture function is selected for "Capture 0 setting", "Capture 1 setting" will be disabled.

I/O Mapping for High-speed Counter Output

The high-speed counter function is controlled by user programs.

InputArea (input area)

Channel	Туре	Description	Remarks
Ch*_StatusRegister	WORD	Ch* status register	-
Ch*_ComparisonMat chRegister	WORD	Ch* comparison match flag	-
Ch*_CountValue	DINT	Ch* count value	-
Ch*_Capture0Value	DINT	Ch* capture 0 value	-
Ch*_Capture1Value	DINT	Ch* capture 1 value	-
Ch*_CaptureDifferen ceValue	DINT	Ch* capture differential value	Stores the value (Capture 1 value - Capture 0 value)

■ Ch*_StatusRegister (Ch* status register)

Channel	Туре	Description	Remarks
Ch*_OperationRead yStatus	BOOL	Ch* operation ready status	Indicates whether the count function is ready to run. 0: Getting ready, 1: Ready
CH*_CountEnableSt atus	BOOL	Ch* count enable status	Indicates whether count operation is in progress. 0: Stopped, 1: Operation in progress
Ch*_CountDirection Status	BOOL	Ch* count direction status	Indicates the direction of counting. 0: Reverse rotation (decrementation direction), 1: Forward rotation (incrementation direction)
Ch*_Capture0Status	BOOL	Ch* capture 0 status	Indicates that the count value is stored as capture 0 value at the rising edge or falling edge of the control signal, whichever is enabled.
Ch*_Capture1Status	BOOL	Ch* capture 1 status	Indicates that the count value is stored as capture 1 value at the rising edge or falling edge of the control signal, whichever is enabled.
Ch*_ExternalOutput 0Status	BOOL	Ch* external output 0 status	Indicates the output status of external output 0 signal. 0: Output OFF, 1: Output ON
Ch*_ExternalOutput 1Status	BOOL	Ch* external output 1 status	Indicates the output status of external output 1 signal. 0: Output OFF, 1: Output ON
Ch*_InputAStatus	BOOL	Ch* input A status	Indicates the input status of input A signal. 0: Output OFF, 1: Output ON
Ch*_InputBStatus	BOOL	Ch* input B status	Indicates the input status of input B signal. 0: Output OFF, 1: Output ON
Ch*_InputZStatus	BOOL	Ch* input Z status	Indicates the input status of input Z signal. 0: Output OFF, 1: Output ON
Ch*_Control0Status	BOOL	Ch* control 0 status	Indicates the input status of control 0 signal. 0: Output OFF, 1: Output ON
Ch*_Control1Status	BOOL	Ch* control 1 status	Indicates the input status of control 1 signal. 0: Output OFF, 1: Output ON

■ Ch*_ComparisonMatchRegister (Ch* comparison match flag)

Channel	Туре	Description	Remarks
Ch*_ComparisonMat ch0Status to Ch*_ComparisonMat ch15Status	BOOL	Ch* comparison match 0 flag to Ch* comparison match 15 flag	Outputs the result of the band comparison function or target value match function. 0: Unmatched, 1: Matched

OutputArea (output area)

Channel	Туре	Description	Remarks
Ch*_RequestRegist er	WORD	Ch* request register	-
Ch*_TemporaryPres etValue	DINT	Ch* temporary preset value	Stores the value to replace the preset value. -2,147,483,648 to 2,147,483,647
Ch*_TemporaryCurr entValue	DINT	Ch* temporary current value	Stores the value to replace the count value. -2,147,483,648 to 2,147,483,647

Ch*_RequestRegister (Ch* request register)

Channel	Туре	Description	Validity condition	Remarks
Ch*_OperationRead yRequest	BOOL	Ch* operation ready request	Level	Specifies whether to enable operation preparation for the count function.
				0: Disable, 1: Enable
Ch*_CountEnableRe	BOOL	Ch* count enable request	Level	Specifies whether to enable count operation.
44001		Toquoor		0: Disable, 1: Enable
Ch* DepatDequest	BOOL	Ch* reset request	ON odro	Specifies whether to reset the count value.
Ch*_ResetRequest	BOOL	Ch* reset request	ON edge	0: Do not reset
				1: Reset
Ch*_PresetRequest	BOOL	Ch* preset request	ON edge	Specifies whether to change the count value to a preset value.
				0: Do not change, 1: Change
				Capture function:
Ch* ResetEnableRe	Re BOOL			Specifies whether to enable reset count operation for the input Z signal or comparison match flag.
quest		Ch* reset enable request	Level	0: Disable, 1: Enable
				Sampling capture function
				Specifies whether to enable reset count operation.
				0: Disable, 1: Enable
Ch*_CurrentValueC hangeRequest	BOOL	Ch* current value change request	ON edge	Specifies whether to change the count value to a temporarily current value.
				0: Do not change, 1: Change
Ch*_PresetValueCh angeRequest	BOOL	Ch* preset value change request	ON edge	Specifies whether to change the preset value to a temporarily preset value.
				0: Do not change, 1: Change
				Capture function:
Ch*_CaptureEnable Request	BOOL	Ch* capture enable request ^(Note 1)	Level	Specifies whether to enable the capture function.
				0: Disable, 1: Enable

Channel	Туре	Description	Validity condition	Remarks
				Sampling capture function Used as a capture flag.
Ch*_ExternalOutput 0ForcedONRequest	BOOL	Ch* external output 0 forced ON request	Level	Relay to forcibly turn on the external output 0 signal
Ch*_ExternalOutput 0ForcedOFFReques t	BOOL	Ch* external output 0 forced OFF request	Level	Relay to forcibly turn off the external output 0 signal
Ch*_ExternalOutput 1ForcedONRequest	BOOL	Ch* external output 1 forced ON request	Level	Relay to forcibly turn on the external output 1 signal
Ch*_ExternalOutput 1ForcedOFFReques t	BOOL	Ch* external output 1 forced OFF request	Level	Relay to forcibly turn off the external output 1 signal
Ch*_ErrorClearRequ est	BOOL	Ch* error clearing request	ON edge	Specifies whether to clear the error. 0: Do not clear, 1: Clear

(Note 1) The behavior of the "Ch* capture enable request" bit differs according to the function to be used.

Operation Ready Request

Operation ready request program

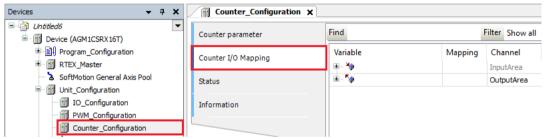
To enable the settings of the high-speed counter function, you must configure parameter settings with GM Programmer and issue an operation ready request.

Ensure that the following operation ready request is issued before the high-speed counter is used.

Example: A program to request preparation for CH0 operation of the high-speed counter function

First, perform I/O mapping for variables created in POU.

From "Device view" in the navigator pane, double-click "Counter_Configuration" and select the "Counter I/O Mapping" tab.



In this example, variables are mapped to the channel used for high-speed counter Ch0 (the name of sample POU is created as "Counter").

Variable	Mapping	Channel	Addres	s Typ	e	Unit	Descrip	otion
₽- *		InputArea	%ID8				Input are	ea
÷*		Ch0_StatusRegister	%IW16	WO	RD		Ch0 Stat	us register
Application.Counter.bCh0_OperationReadyStatus	~ >	Ch0_OperationReadyStatus	%IX32.0	BOO	L		Ch0 Ope	ration ready status
		Ch0_CountEnableStatus %IX32.1		BOO	L		Ch0 Count enable status	
Variable	Mapping	Channel		Addres	; Tj	ype	Unit	Description
		InputArea		%ID8				Input area
<u> </u>		OutputArea		%QD11				Output area
🛱 - 🍢		Ch0_RequestRegister		%QW22	W	ORD		Ch0 Request register
Application.Counter.bCh0_OperationReadyRequest	۴	Ch0_OperationReadyRequest		%QX11.0	BC	DOL		Ch0 Operation ready request
		Ch0_CountEnableRequest		%QX44.	BC	DOL		Ch0 Count enable request

The following are LD program and ST program examples for sample POU (Counter). When the "OperationReadyRequest" flag is set to TRUE, operation preparation is started.

LD program

1	PROGRAM Counter	
2	VAR	
3	// Local variables	
4		// Operation preparation request
5		// Stop preparing for operation
e	// Counter I/O Mapping variable	// stop preparing for operation
7		// Ch0 Ready to operate status
8		// Ch0 Operation preparation request
9	// FunctionBlock instance	// Cho operation preparation request
10		// Operation preparation start detection
11		// Operation ready stop detection
12		// Operation ready stop detection
12	END_VAR	100 🔍 🗸
1		
2	Operation preparation stop processing ScopTrig bCounterReady F TRIG Operation preparation request processing StartTrig bCounterReady R TRIG CLK 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	bCounterStop () bCh0_OperationReadyRequest ()
3	bCh0_OperationReadyRequest	ogram upon completion of operation preparation)

ST program

	1	PROGRAM Counter				
8	2	VAR				
	з	// Local variables				
	4	bCounterReady	: BOOL := FALSE;	// Operation preparation request		
	5	bCounterStop	: BOOL := FALSE;	<pre>// Stop preparing for operation</pre>		
	e	<pre>// Counter I/O Mapping vari</pre>	able			
	7	bCh0_OperationReadyStatus	: BOOL;	// Ch0 Ready to operate status		
	8	bCh0_OperationReadyRequest	: BOOL;	// Ch0 Operation preparation request		
	9	<pre>// FunctionBlock instance</pre>				
	10	StartTrig	: R_TRIG;	<pre>// Operation preparation start detection</pre>		
	11	StopTrig	: F_TRIG;	<pre>// Operation ready stop detection</pre>		
	12	END_VAR				
		// Annahise annahise atom				
	1	// Operation preparation stop p	rocessing			
	-	<pre>StopTrig(CLK:=bCounterReady);</pre>				
	3	bCounterStop := StopTrig.Q;				
	4	// <u>Description</u>				
		// Operation preparation reques				
	6	<pre>StartTrig(CLK:=bCounterReady)</pre>				
	8	<pre>bunu_operationReadyRequest := (</pre>	Startirig.Q UR bCh	<pre>O_OperationReadyRequest) AND NOT(bCounterStop);</pre>		
	8	(/ Deedee be amounts				
	-	// Ready to operate				
	10	<pre>IF bCh0_OperationReadyStatus =</pre>	IRUE THEN			
Ξ	11 12	(Arbitrary program upon completion of operation preparation)				
	12		completion of	operation preparation)		
	14	END IF				
	14	DRD_II				

Downloading IO parameters

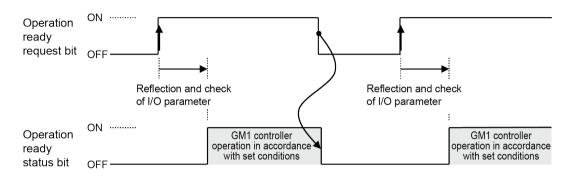
The IO parameters of the high-speed counter function are downloaded to the GM1 controller together with user programs.

When an operation ready request is issued in RUN mode and the operation ready status bit turns ON, each function of the high-speed counter function is enabled.

Behaviors when operation ready request program is executed

When the operation ready request program is executed and each behavior set in the GM1 controller becomes executable, the operation ready status bit turns ON.

Behaviors of operation ready request bit



(Note 1) Ensure that the operation ready request bit remains ON when the high-speed counter is used.



• If the default value or preset value is out of range, the operation ready status bit will not turn ON.

Count Function

Setup procedure

- 1. From "Device view" in the navigator pane, double-click"Couter_Configuration".
- 2. Click the "Counter parameter" tab.
- 3. For each channel, select the count function and set up each parameter.

i Info.

• For details on how to set up parameters, refer to "Setting Parameters with GM Programmer".

Counter upper limit and Counter lower limit

Set the upper limit and lower limit values for each counter.

Counter upper limit: Any value between -2,147,483,647 and 2,147,483,647 can be set (Default value: 2,147,483,647)

Counter lower limit: Any value between -2,147,483,648 and 2,147,483,646 can be set (Default value: -2,147,483,648)

Specify count direction

Set the rotational direction of count input.

Count in normal direction: Counts in the direction stated in the manual

Count in reverse direction: Counts in the direction reverse to the one stated in the manual

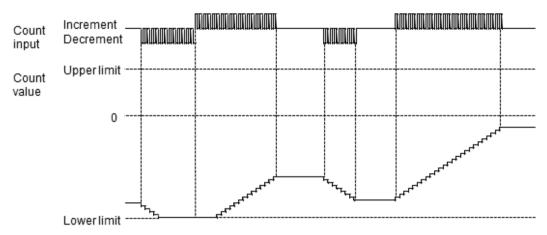
Counter type

The counter behavior differs according to the type of the counter as below.

Difference in behavior between counter types

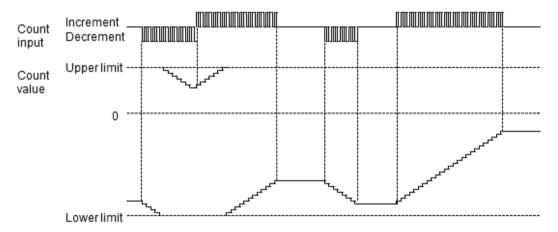
Item	Linear counter	Ring counter
Behavior image	Lower limit Upper limit Count value Underflow Increment Overflow	Upper limit Lower limit Increment





Behavior example of ring counter

- If the count is decremented from the lower limit, the counter will roll over the count and continue a decremental count from the upper limit.
- If the count is incremented from the upper limit, the counter will roll over the count and continue an incremental count from the lower limit.



Enable / Displable overflow/underflow (for linear counters only)

Set the counter behavior to be performed when the count value reaches the specified upper limit or lower limit.

Disable: Continues counting within the countable range for the system (-2,147,483,648 to 2,147,483,647) even if the specified upper limit or lower limit is reached.

Select count input

- To import input signals from external devices, select "Count input".
- To measure the frequencies of external input signals or time based on the internal clock, select "Internal clock".
- For internal clocks, you can select from 0.25 μs (4 MHz), 1.00 μs (1 MHz), 10 μs (100 kHz), and 100 μs (10 kHz).

Count method

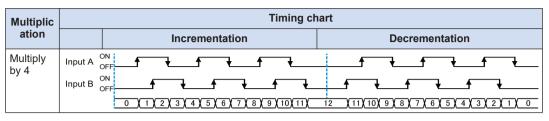
- You can select from the three types shown in the table below according to the input device to be connected.
- The count behavior changes according to the settings of a multiplication factor, as described on the following pages.

Count method

Method	Connection	Count			
2-phase (Phase differen ce)	High-speed counter unit Phase A pulse input encoder Phase B pulse input Phase Z input (reset input)	For 2-phase input, the input A signal and input B signal of each counter are connected to phase A and phase B, respectively, in the encoder. The count direction depends on the phase difference between phases A and B. When phase A is ahead of phase B by 90 degrees in terms of the electrical angle, the count value is incremented. When phase A is behind phase B by 90 degrees in terms of the electrical angle, the count value is decremented.			
Individu al	High-speed counter unit High-speed counter unit Incremental encoder or pulse generator Increment pulse input Decrement pulse input	For individual input, the counter is incremented when the level of the input A signal rises or falls, and decremented when the level of the input B signal rises or falls.			
Directio n	High-speed counter unit	For direction detection input, the count signal is connected to the input A signal. The count direction is controlled by the direction signal level of the input B signal.			
detectio n	SensorO Input B	When the input B signal is OFF, the counter is incremented when the level of the input A signal rises or falls. When the input B signal is ON, the counter is decremented.			

Count operation of 2-phase input (Phase difference input)

Multiplic	Timing chart					
ation		Incrementation	Decrementation			
Multiply by 1	Input A					
Multiply by 2	Input A	ON DFF OFF 0 (1) (2) 3) (4) 5)				



Count operation of individual input

Multiplic		Timing ch	hart		
ation		Incrementation	Decrementation		
Multiply by 1	Input A ON OFF Input B ON OFF				
Multiply by 2	Input A OFF				

Count operation of direction detection input

Multiplic	Timing chart						
ation		Incrementation Decrementation					
Multiply by 1	Input A						
		0 (1) 2 (3) 2 (1) 0					
Multiply by 2	Input A						

Input time constant

Input time constants can be set for input signals (phases A, B, and Z) and control signals.

Input signal name	Settings
Input A signal, input B signal	No input time constant / 0.1 μs (2 MHz) / 0.2 μs (1 MHz) / 0.5 μs (500 kHz) / 1.0 μs
(The same time constant for both signals)	(250 kHz) / 2.0 μs (100 kHz) / 10.0 μs (10 kHz)
Input Z signal	No input time constant / 0.1 μs (2 MHz) / 0.2 μs (1 MHz) / 0.5 μs (500 kHz) / 1.0 μs (250 kHz) / 2.0 μs (100 kHz) / 10.0 μs (10 kHz)
Control signal	No input time constant / 2 µs / 5 µs / 10 µs / 20 µs / 50 µs / 100 µs / 500 µs / 1.0 ms / 2.0 ms / 5.0 ms / 10.0 ms

Types of count operation

Enable count operation

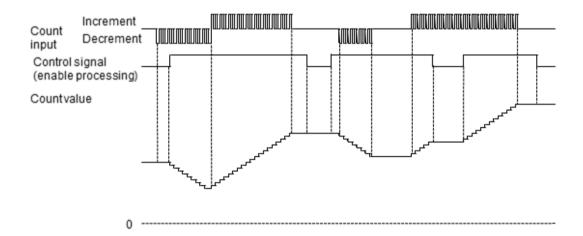
- Enable count operation is used by allocating the enable function to the control flag. Count operation is performed while the control flag is enabled.
- Enable count operation can be set using the methods shown in the following table.

Types of control flag (enable processing)

O'run al	Setting method using the Counter_Configuration parameters		Enable condition		
Signal			ON OFF-		
Count enable request bit	- (No need to set)	٠			
Control 0 signal	Setting the enable operation conditions by setting up the control 0 signal function	•	•		
Control 1 signal Setting the enable operation conditions by setting up the control 1 signal function		•	•		

(Note 1) If you set the control 0 signal or control 1 signal as the enable operation condition, do not use the count enable request bit.

Count enable operation example



Reset count operation

- Reset count operation is used by allocating the reset function to the control flag.
- The count value is reset to 0 according to the change (rising, falling, positive logic, or negative logic) of the control flag.
- Reset count operation can be set using the methods shown in the following table.

Types of control flag (reset processing)

Olam al	Setting method using the Counter_Configuration parameters	Reset condition			
Signal		ON - ·		ON -	ON OFF-
Reset request bit	- (No need to set)	٠			
Input Z signal	Setting the reset operation conditions by setting up the input Z signal function	•	•	•	•
Comparison match status bit	Setting the "Comparison match rising edge reset" or "Comparison match falling edge reset" function to "Reset"	•	•		

(Note 1) If you set the control 0 signal or control 1 signal as the enable operation condition, the count enable request bit will be disabled.



• To use the input Z signal and comparison match flag as reset signals, turn ON the reset enable request bit through user programs.

Preset count operation

- Preset count operation is used by allocating the preset function to the control flag.
- Preset count operation rewrites the count value as the preset value according to the change (rising, falling, positive logic, or negative logic) of the control flag.
- Preset count operation can also be used to start counter operation from the preset value.
- Preset count operation can be set using the methods shown in the following table.

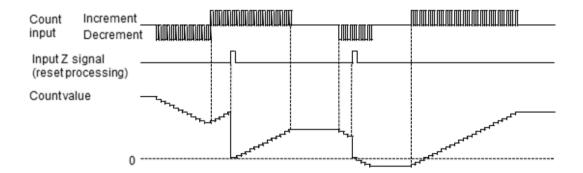
Types of control flag (preset processing)

O	Setting method using the Counter_Configuration parameters	Preset condition			
Signal		ON - ·	ON	ON -	ON OFF-
Preset request bit	- (No need to set)	•			
Input Z signal	Setting the preset operation conditions by setting up the input Z signal function	•	•	•	•

f Info.

• To set a preset value, you must use a user program to set a temporary preset value and turn ON the preset value change request bit.

Reset (preset) count operation example



Enable reset count operation

- Enable reset count operation is used by allocating the enable function and reset function to the control flag.
- The count value is reset to zero when the counter becomes enabled due to the change of the control flag (enable reset processing).

Types of control flag (enable reset processing)

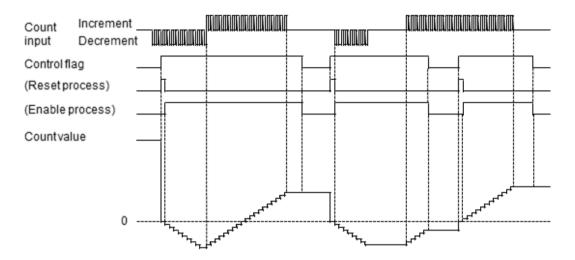
O'mu al	Setting method using the Counter_Configuration parameters	Reset condition		Enable condition	
Signal				ON -	ON OFF -
Control 0 signal	Setting the following conditions by setting up the control 0 signal function				
	Positive logic enable operation and reset operation at rising edge	•	•	•	•
	Negative logic enable operation and reset operation at falling edge				

Enable preset count operation

- Enable preset count operation is used by allocating the enable function and preset function to the control flag.
- The count value is set as a preset value when the counter becomes enabled due to the change of the control flag (enable preset processing).

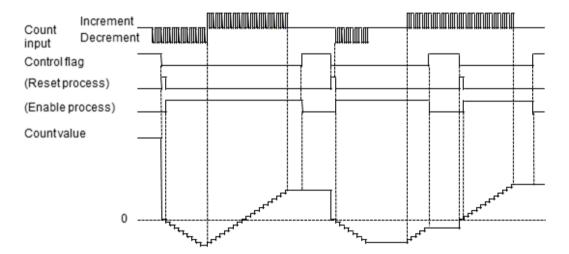
Types of control flag (enable preset processing)

Olar al	Setting method using the	Preset c	ondition	Enable condition		
Signal	Counter_Configuration parameters	ON - ·		ON -	ON OFF-	
Control 0 signal	Setting the following conditions by setting up the control 0 signal function					
	Positive logic enable operation and preset operation at rising edge	•	•	•	•	
	Negative logic enable operation and preset operation at falling edge					



Positive logic enable operation and reset (preset) operation at rising edge

Negative logic enable operation and reset (preset) operation at falling edge



Reading the count value or changing the current count value or preset value

• To read and write channel data, variables are mapped to channels in the same way as in"Operation Ready Request". In this example, variables are mapped to channels used for reading the count value of Counter Ch0 and changing the current count value and preset value.

Variable	Mapping	Channel	Address	Туре	Unit	Description
		InputArea	%ID8			Input area
1 - Y		Ch0_StatusRegister	%IW16	WORD		Ch0 Status register
1 ··· *		Ch0_ComparisonMatchRegister	%IW17	WORD		Ch0 Comparison match register
Application.Counter2.dCh0_CountValue	~	Ch0_CountValue	%ID-10	DINT		Ch0 Count value
Application.Counter3.dCh0_Capture0Value	~)	Ch0_Capture0Value	%ID11	DINT		Ch0 Capture 0 value

iable	Mapping	Channel	Address	Туре	Unit	Description
🍫		InputArea	%ID8			Input area
à- ¶¢		OutputArea	%QD11			Output area
🛱 - 🍫		Ch0_RequestRegister	%QW22	WORD		Ch0 Request register
Application.Counter.bCh0_OperationReadRequest	۰	Ch0_OperationReadyRequest	%QX44.0	BOOL		Ch0 Operation ready request
2475 * *		Ch0_CountEnableRequest	%QX44.1	BOOL		Ch0 Count enable request
*		Ch0_ResetRequest	%QX44.2	BOOL		Ch0 Reset request
		Ch0_PresetRequest	%QX44.3	BOOL		Ch0 Preset request
		Ch0_ResetEnableRequest	%QX44.4	BOOL		Ch0 Reset enable request
Application.Counter2.bCh0_CurrentValueChangeReque	st 🛯 🖗	Ch0_CurrentValueChangeRequest	%QX11.5	BOOL		Ch0 Current value change request
Application.Counter2.bCh0_PresetValueChangeReques	t 🗇	Ch0_PresetValueChangeRequest	%QX11.6	BOOL		Ch0 Preset value change request
		Ch0_CaptureEnableRequest	%QX44.7	BOOL		Ch0 Capture eneble request
**		Ch0_ExternalOutput0ForcedONRequest	%QX45.1	BOOL		Ch0 External output 0 forced ON request
···· **		Ch0_ExternalOutput0ForcedOFFRequest	%QX45.2	BOOL		Ch0 External output 0 forced OFF request
		Ch0_ExternalOutput1ForcedONRequest	%QX45.3	BOOL		Ch0 External output 1 forced ON request
		Ch0_ExternalOutput1ForcedOFFRequest	%QX45.4	BOOL		Ch0 External output 1 forced OFF request
		Ch0_ErrorClearRequest	%QX45.7	BOOL		Ch0 Error dear request
Application.Counter2.diCh0_TemporaryPresetValue	*	Ch0_TemporaryPresetValue	%QD12	DINT		Ch0 Temporary preset value
Application.Counter2.diCh0_TemporaryCurrentValue	~ >	Ch0_TemporaryCurrentValue	%QD13	DINT		Ch0 Temporary current value

- The following are LD program and ST program examples for sample POU (Counter2).
 - In this example, count values are read for each scan.
 - When the current value change start bit is set to TRUE, the current value of Ch0 is set to 1000000.
 - When the start preset bit is set to TRUE, the preset value of Ch0 is set to 500000.

LD program

1	PROGRAM Counter2			^ ⁻
2	VAR			Le contra de la contra de
3	diCountValue	: DINT:	// Ch0 Count read value	4
4	diCh0 CountValue	: DINT:	// Ch0 Count value	
5	=			
6	bCurrentChange	: BOOL := FALSE:	// Current value change start	
7			// Ch0 temporary current value (I/O mapping variable)	
8	bCh0 CurrentValueChangeRequest		<pre>// Ch0 current value change request (I/O mapping variable)</pre>	
9	CurrentChangeTrig		// Current value change rise detection	
10	currencenangerray		// current varue change rise detection	
11	bPreset	: BOOL := FALSE:	// Start preset	
12	diCh0 TemporaryPresetValue		// Ch0 temporary preset value (I/O mapping variable)	
13	bCh0_PresetValueChangeRequest		// Ch0 preset value change request (I/O mapping variable)	
14	PresetTrig		// Preset rise detection	
15	END VAR	. R_IRIG,	// Fieset fise detection	
16	END_VAR			100 🔍 🗸
2		iCountValue		
	Current value change process CurrentChange CLK		EN ENO diCh0_TemporaryCurrentValue	bCh0_CurrentValueChangeRequest
3	Preset value change processing PresetTrig bPreset RTRIG CLK 20-	500000	0 - diCh0_TemporaryPresetValue	bCh0_PresetValueChangeRequest

ST program

1	PROGRAM Counter2							
2	VAR							
3	diCountValue	: DINT;	// Ch0 Count read value					
4	diCh0_CountValue	: DINT;	// Ch0 Count value					
5								
6	bCurrentChange	: BOOL := FALSE;	// Current value change start					
7	diCh0_TemporaryCurrentValue	: DINT;	// Ch0 temporary current value (I/O mapping variable)					
8	bCh0_CurrentValueChangeRequest	: BOOL;	// Ch0 current value change request (I/O mapping variable)					
9	CurrentChangeTrig	: R_TRIG;	// Current value change rise detection					
10		-						
11	bPreset	: BOOL := FALSE;	// Start preset					
12	diCh0_TemporaryPresetValue	: DINT;	// Ch0 temporary preset value (I/O mapping variable)					
13	bCh0_PresetValueChangeRequest	: BOOL;	// Ch0 preset value change request (I/O mapping variable)					
14	PresetTrig	: R_TRIG;	// Preset rise detection					
15	END VAR							
16								
1	// Count value read processing							
2	diCountValue := diCh0_CountValue;							
3								
4	<pre>// Current value change process</pre>							
5	CurrentChangeTrig(CLK:=bCurrentCha	nge);						
6	<pre>IF CurrentChangeTrig.Q = TRUE THEN</pre>							
7	diCh0_TemporaryCurrentValue :=	1000000;						
8	END_IF							
9	bCh0_CurrentValueChangeRequest := C	urrentChangeTrig.Q;						
10								
11	// Preset value change processing							
12	PresetTrig(CLK:=bPreset);							
13	IF PresetTrig.Q = TRUE THEN							
14	diCh0_TemporaryPresetValue := 5	00000;						
15	END IF							
16	bCh0_PresetValueChangeRequest := Pr	esetTrig.Q;						

Count value when the power is turned on

• When the power is turned on, the count value is "0".

Changing the current count value

- The current count value can be changed to any value as necessary.
- Set a value in the temporary current value channel and turn ON the current value change request bit.

f Info.

• Count values cannot be written directly to the count value channel (Ch*_CountValue).

Changing the preset value

- The preset value can be changed to any value as necessary.
- Set a value in the temporary preset value channel and turn ON the preset value change request bit.



• Preset values that are set cannot be read by programs.

Comparison Function

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter parameter" tab.
- 3. For each counter, select the comparison function and set up each parameter.

1 Info.

• For details on how to set up parameters, refer to "Setting Parameters with GM Programmer".

Types of comparison function

This function compares the current value of the high-speed counter with a preset target value and, when these values match, it reflects the value in the comparison match flag.

- There are target value match comparison and band comparison.
- A total of 16 comparison data items can be set.
- Comparison results can be output externally.
- Comparison methods can be selected for each counter.

Item	Specifications
Set number of comparison data	Up to 16 data items for each counter (Comparison data 0 to comparison data 15)
Comparison match flag	Up to 16 flags for each counter (Comparison match 0 flag to comparison match 15 flag) Behaviors of 16 comparison match flags can be set for a single comparison data item.
Select comparison	Target value match comparison Sets or resets the comparison match flag when the elapsed value matches the target value.
function	Band comparison Turns ON or OFF the comparison match flag when the elapsed value falls within the range between the lower and upper limits that are set.
External output function	Up to two flags for each counter Comparison match 0 flag or comparison match 1 flag can be allocated to external output.
	ON hold time can be set only when the band comparison function is used. ON hold time: 0 to 1,000 ms

Comparison match function specifications

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- Only the comparison match 0 flag or comparison match 1 flag can be set as the external output function.
- By default, the external output 0 and external output 1 signals are set to "Not output". When necessary, change the setting in the Counter_Configuration parameter window.
- There is no need to arrange comparison data items in ascending or descending order.

■ Target value match comparison and band comparison

The main differences are as below.

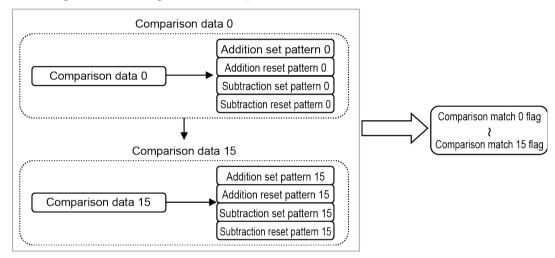
Main differences in characteristics

Item	Target value match comparison	Band comparison
Setting of comparison value data	Comparison value data is specified as a target value.	Comparison value data is specified as a band (lower and upper limits).
	One of the following four options is specified as the comparison match flag behavior to be performed when the target value is reached.	
	"Addition set pattern": Sets the flag when the current value and comparison value match at the time of incrementation	
Setting for comparison value data match	"Addition reset pattern": Resets the flag when the current value and comparison value match at the time of incrementation	ON or OFF is specified as the behavior of the comparison match flag when the current value falls within the specified band.
	"Subtraction set pattern": Sets the flag when the current value and comparison value match at the time of decrementation	
	"Subtraction reset pattern": Resets the flag when the current value and comparison value match at the time of decrementation	
Behavior when comparison value data matches	The behavior that is performed when the current value matches the same comparison value data may differ between incremental count and decremental count, depending on the settings.	The behavior that is performed when the current value matches the same comparison value data is the same for incremental count and decremental count.
External output signal ON hold time	Cannot be set	ON hold time: 0 to 1,000 ms

Parameter settings for target value match comparison

Parameter setting procedure

- Click Counter parameter>Counter (Ch0 or Ch1)>Comparison function, change the "Select comparison function" parameter to "Target value match comparison", and execute "Set number of comparison data".
- 2. Click Counter parameter>Counter (Ch0 or Ch1)>Comparison function>Comparison data and specify target values for each comparison data item.
- Select "Addition set pattern", "Addition reset pattern", "Subtraction set pattern", and "Subtraction reset pattern" separately and set ""No change", "Set output", or "Reset output"" for each comparison match flag.



4. Configure these settings for each comparison data item.



- Settings can be configured individually according to the count direction (incremental or decremental direction) at the time of comparison data match.
- A total of 16 comparison match flags can be set separately for "Addition set pattern", "Addition reset pattern", "Subtraction set pattern", and "Subtraction reset pattern".
- For details on how to set up parameters, refer to "Setting Parameters with GM Programmer".

Setting example for target value match function

Output setting example

Compariso n data	Target value	Output setting	Compariso n match 0 flag	Compariso n match 1 flag	Compariso n match 2 flag	Compariso n match 3 flag
		Addition set pattern		0		
0	+500	Addition reset pattern	0			
0	+500	Subtraction set pattern				
		Subtraction reset pattern		0	0	0
		Addition set pattern			0	
1	+1,250	Addition reset pattern		0		0
1	+1,250	Subtraction set pattern				
		Subtraction reset pattern				
		Addition set pattern				0
2	.0.500	Addition reset pattern				
2	+2,500	Subtraction set pattern		0		0
		Subtraction reset pattern				
		Addition set pattern		0		
2	12 750	Addition reset pattern			0	
3	+3,750	Subtraction set pattern				
		Subtraction reset pattern				0
		Addition set pattern				
4	. 5 000	Addition reset pattern				0
4	+5,000	Subtraction set pattern			0	0
		Subtraction reset pattern	0	0		
		Addition set pattern			0	
5	.0.050	Addition reset pattern				
5	+6,250	Subtraction set pattern				
		Subtraction reset pattern				0
		Addition set pattern	0			0
G	17 500	Addition reset pattern		0		
6	+7,500	Subtraction set pattern	0	0		
		Subtraction reset pattern				
		Addition set pattern				
7	+0 750	Addition reset pattern			0	
	+8,750	Subtraction set pattern				0
		Subtraction reset pattern				

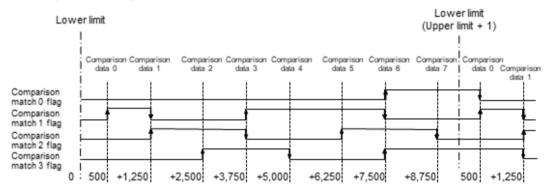
1 Info.

- The behavior of the comparison match flag that is performed when the count value reaches the target value can be changed separately for incrementation and decrementation.
- If the contents of comparison data 0 to 15 are duplicated and reset conditions are different, comparison data is prioritized in the following order.

(High) 0 > 1 > 2 > 3 > 4 > 5 > 6 > 7 > 8 > 9 > 10 > 11 > 12 > 13 > 14 > 15 (Low)

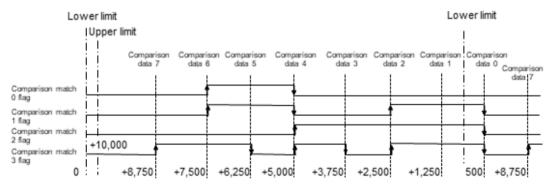
Behavior of comparison match flag during incremental count

When the current value matches the comparison data, the comparison match flag behaves according to the setting of "Addition set pattern" or "Addition reset pattern".



Behavior of comparison match flag during decrementation count

When the current value matches the comparison data, the comparison match flag behaves according to the setting of "Subtraction set pattern" or "Subtraction reset pattern".



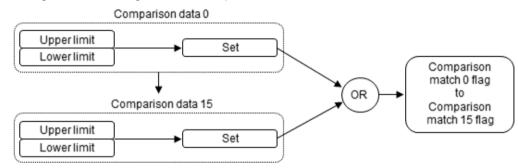
f Info.

• For ring counters, comparison data can be set in an area including the lower and upper limits where count values are rolled over.

Parameter settings for band comparison

Parameter setting procedure

- 1. Click **Counter parameter>Counter (Ch0 or Ch1)>Comparison function**, change the "Select comparison function" parameter to "Band comparison", and execute "Set number of comparison data".
- 2. Click Counter parameters>Counter (Ch0 or Ch1)>Comparison function>Comparison data and specify upper and lower limits for each comparison data item.
- 3. Set whether to turn ON or OFF the comparison match flag when the count value exists in the zone (between the upper and lower limits).
- 4. Configure these settings for each comparison data item.



f Info.

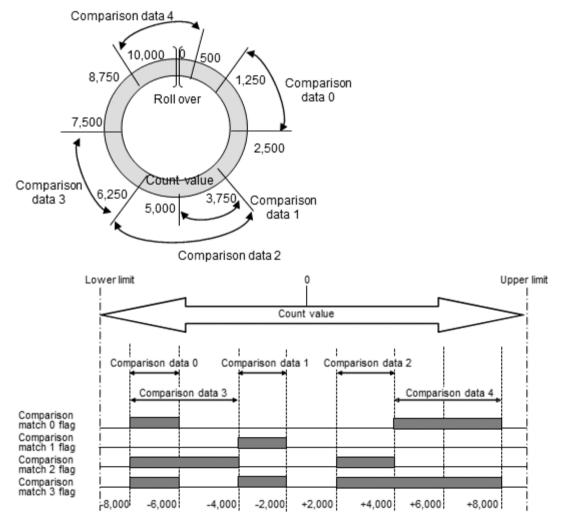
- A total of 16 comparison match flags can be set separately for each comparison data item.
- Multiple comparison data items can be set for the same band.
- For details on how to set up parameters, refer to "Setting Parameters with GM Programmer".

Setting example for band comparison

Output setting example

Compa	Band compa	arison value	Output	Compariso	Compariso	Compariso	Compariso
rison data	Lower limit	Upper limit	setting	n match 0 flag	n match 1 flag	n match 2 flag	n match 3 flag
0	+1,250	2,500	Set	ON	OFF	OFF	OFF
1	+3,750	+5,000	Set	OFF	ON	OFF	ON
2	+3,750	+7,500	Set	OFF	OFF	OFF	ON
3	+6,250	+7,500	Set	ON	ON	ON	ON
4	+8,750	+500	Set	OFF	OFF	ON	OFF

Behavior of comparison match flag during band comparison



f Info.

• For ring counters, comparison data can be set in an area including the lower and upper limits where count values are rolled over.

Parameter settings for external output function

- The comparison match 0 flag and comparison match 1 flag can be output externally using parameter settings.
- The Counter_Configuration parameter window is used to allocate the comparison match 0 flag and comparison match 1 flag to the external output function.

f Info.

• For details on how to set up parameters, refer to "Setting Parameters with GM Programmer".

External Output Function

Overview of external output function

The comparison match 0 flag and comparison match 1 flag can be output externally using parameter settings.

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter parameter" tab.
- 3. For each counter, select "External output function "and set up each parameter.

Counter_Configuration parameter setting example

Category Selection(\underline{T})	+ -	Parameter Setting (<u>R</u>)	
⊡. Ch0		Parameter	Value
Count function Comparison match leading edge reset		External output 0 signal setting	Output ~
Comparison match trailing edge reset		External output 0 signal ON hold delay	0
Comparison function		External output 1 signal setting	Not output
External output function Capture function		External output 1 signal ON hold delay	0
⊡ Ch1			
Count function			

ON hold time (for band comparison only)

When the band comparison function is used, ON hold time can be set as an output signal.

Differences in behavior between settings

ON hold time	Timing chart for comparison match flag and external output signal
0	Comparison ON match 0 flag (input contact) OFF ON External output 0 signal OFF
1 to 1,000 ms	Comparison match 0 flag (input contact) OFF External output 0 signal OFF ON hold time ON hold time ON hold time

Forced output function

• If the Ch* external output 0* forced ON / OFF request bit is used, the external output 0 signal and external output 1 signal can be turned ON or OFF through user programs.

• The forced output function can be used to check wiring and for other purposes.

Capture Function

Setup procedure

- 1. From "Device view" in the navigator pane, double-click "Counter_Configuration".
- 2. Click the "Counter parameter" tab.
- 3. For each counter, select "Capture function" and set up each parameter.

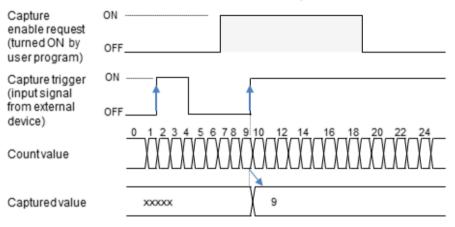
f Info.

• For details on how to set up parameters, refer to "Setting Parameters with GM Programmer".

Types of capture function

Capture function

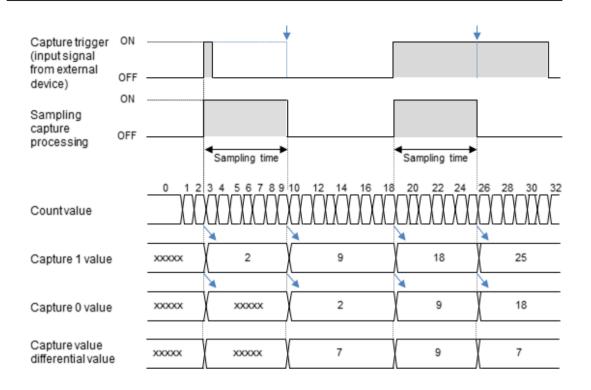
• The count value at the point in time when the input signal from an external device changes is stored in the capture 0 value or capture 1 value register.



Sampling capture function

- The count value when the specified sampling time elapses after the input signal from an external device changes is stored in the capture 0 value and capture 1 value registers.
- The count value equivalent to the sampling time can be monitored by reading the capture differential value.

12.2 Setting up the GM1 units



Comparison between capture function and sampling capture function

Available conditions differ between the functions.

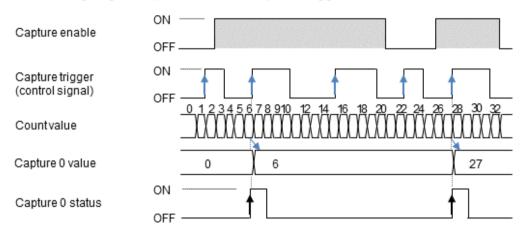
Comparison between both functions

Item		Capture function	Sampling capture function		
Number of poi	ints that can be	Max. 2 points	Max. 1 point		
Number of points that can be used		The capture function cannot be used when the sampling capture function is used.			
		Capture 0 value: 1 register (2 words)	Capture 0 value: 1 register (2 words)		
		Capture 1 value: 1 register (2 words)	Capture 1 value: 1 register (2 words)		
Registers use	d	These registers can be used individually.	These registers are used simultaneously.		
		Capture differential value: 1 register (2	words)		
		The capture function is enabled while the capture enable request bit is ON.	Always enabled		
		The Counter_Configuration parameter window is used to allocate capture flags.			
	Control 0 signal	Used as a trigger for capture 0 or capture 1.	Used as a trigger for the sampling capture function		
	Control 1 signal	Used as a trigger for capture 0 or capture 1.	Not use		
Capture flags		Activated when either of the following conditions is met.	Activated when either of the following		
		At rising edge of control 0 / 1signal	conditions is met.		
	Validity condition	At falling edge of control 0 / 1signal	Control 0 signal (positive logic)		
		By allocating one of the control	Control 0 signal (negative logic)		
		signals to the same capture number, the capture function can be allocated as the rising or falling edge of the signal.	Capture enable request bit (positive logic)		
Clearing the c	apture * status bit	The capture * status bit is cleared auto	matically each time I/O refresh occurs.		

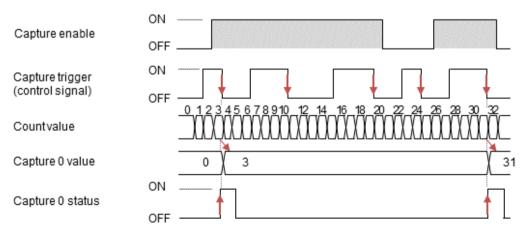
One operation

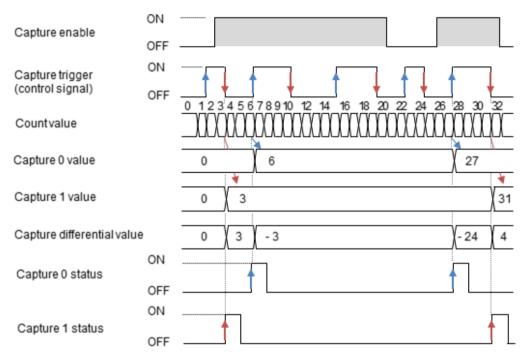
- When the capture enable request bit enables the capture function, capture is executed when the first capture flag becomes enabled.
- The behaviors differ according to the validity condition (rising edge or falling edge) of the capture flag to be enabled, as below.

When "rising edge" is specified as the capture trigger condition



When "falling edge" is specified as the capture trigger condition





When "rising edge" and "falling edge" of the same signal are specified as the capture trigger conditions

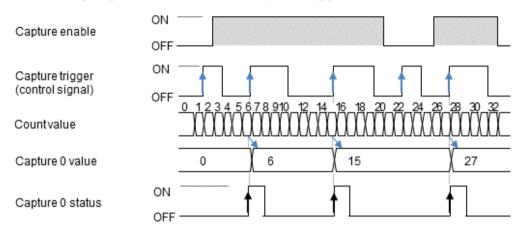


• The sign of the capture differential value changes according to the sequence of the capture enable request bit and capture flag.

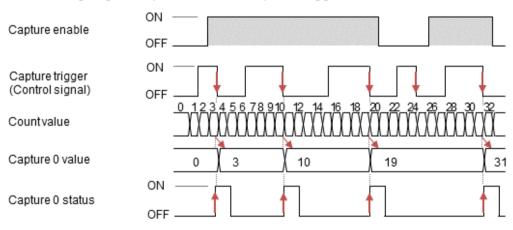
Continuous operation

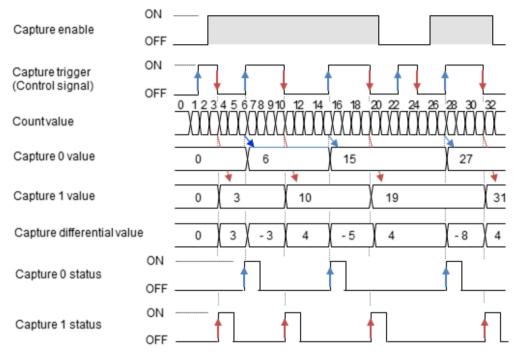
- When the capture enable request bit enables the capture function, capture is executed every time a capture flag becomes enabled.
- The behaviors differ according to the validity condition (rising edge or falling edge) of the capture flag to be enabled, as below.

When "rising edge" is specified as the capture trigger condition



When "falling edge" is specified as the capture trigger condition





When "rising edge" and "falling edge" of the same signal are specified as the capture trigger conditions

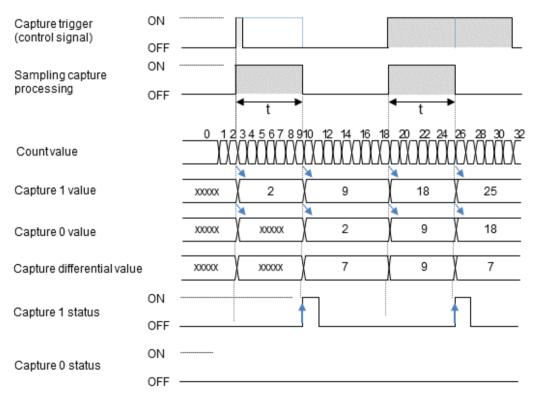


- The sign of the capture differential value changes according to the sequence of the capture enable request bit and capture flag.
- For continuous operation, capture 0 value, capture 1 value, and capture differential value are overwritten each time a capture operation is completed.

Sampling capture function (one operation)

- When the specified sampling time elapses after the capture flag turns ON or OFF, the count value is stored in the capture 0 value and capture 1 value registers and the differential value is stored in the capture differential value register.
- The sampling capture function is always executable when the control 0 signal is allocated to the sampling capture function.
- The trigger condition that starts sampling capture can be selected from control 0 signal (positive logic), control 1 signal (negative logic), and capture enable request bit (positive logic).
- For one operation, the capture 1 status bit is activated. Note that the capture 0 status bit is not activated.

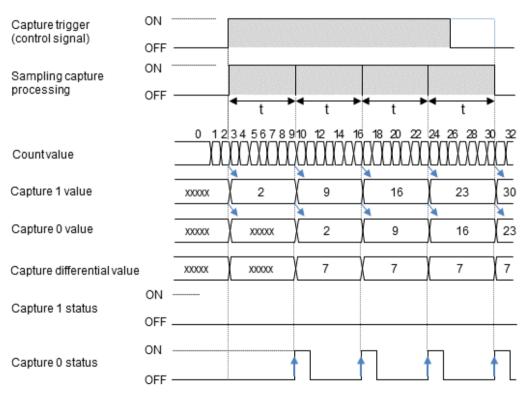
Timing chart



Sampling capture function (continuous operation)

- Each time the specified sampling time elapses after the capture flag turns ON or OFF, successively, the count value is stored in the capture 0 value and capture 1 value registers and the differential value is stored in the capture differential value register.
- The sampling capture function is always executable when the control 0 signal is allocated to the sampling capture function.
- The trigger condition that starts sampling capture can be selected from control 0 signal (positive logic), control 0 signal (negative logic), and capture enable request bit (positive logic).
- For continuous operation, the capture 0 status bit is activated. Note that the capture 1 status bit is not activated.

Timing chart



Reading captured data

Areas where captured data is stored

- The latest captured data is stored in the capture 0 value and capture 1 value registers.
- Captured data is stored as signed 32-bit data (-2,147,483,648 to 2,147,483,647).

Sample program

To read and write channel data, variables are mapped to channels in the same way as in "12.6.5 Operation Ready Request". In this example, variables are mapped to the channel used for reading captured data for Counter Ch0 (the name of sample POU is created as "Counter3").

able	Mapping	Channel	Address	Туре	Unit	Description
*		InputArea	%ID8			Input area
🛱 - 🏘		Ch0_StatusRegister	%IW16	WORD		Ch0 Status register
Application.Counter.bCh0_OperationReadRequest	~ @	Ch0_OperationReadyStatus	%IX32.0	BOOL		Ch0 Operation ready status
🍬		Ch0_CountEnableStatus	%IX32.1	BOOL		Ch0 Count enable status
* *		Ch0_CountDirectionStatus	%IX32.2	BOOL		Ch0 Count direction status
Application.Counter3.bCh0_Capture0Status	~>	Ch0_Capture0Status	%IX32.4	BOOL		Ch0 Capture 0 status
		Ch0_Capture 1Status	%IX32.5	BOOL		Ch0 Capture 1 status
🍫		Ch0_ExternalOutput0Status	%IX32.6	BOOL		Ch0 External output 0 status
		Ch0_ExternalOutput1Status	%IX32.7	BOOL		Ch0 External output 1 status
🍫		Ch0_InputAStatus	%IX33.0	BOOL		Ch0 Input A status
🍫		Ch0_InputBStatus	%IX33.1	BOOL		Ch0 Input B status
🐐		Ch0_InputZStatus	%IX33.2	BOOL		Ch0 Input Z status
🍫		Ch0_Control0Status	%IX33.3	BOOL		Ch0 Control 0 status
		Ch0_Control1Status	%IX33.4	BOOL		Ch0 Control 1 status
a		Ch0_ComparisonMatchRegister	%IW17	WORD		Ch0 Comparison match register
Application.Counter2.dCh0_CountValue	~	Ch0_CountValue	%ID 10	DINT		Ch0 Count value
Application.Counter3.dCh0_Capture0Value	~	Ch0_Capture0Value	%ID11	DINT		Ch0 Capture 0 value
- ×p		Ch0 Capture 1Value	%ID12	DINT		Ch0 Capture 1 value

LD program

1	PROGRAM Counter3
2	VAR
3	// Local variables
4	diCaptureValue : DINT; // Capture value read variable
5	<pre>// Counter I/O mapping variables</pre>
6	bCh0_Capture0Status : BOOL; // Ch0 capture0 status
7	diCh0_Capture0Value : DINT; // Ch0 capture0 value
8	END_VAR
9	
1	Capture 0 status is ON and read the capture value bCh0_Capture0Status diCh0_Capture0Value bCh0_Capture0Value MCVE EN EN EN CaptureValue

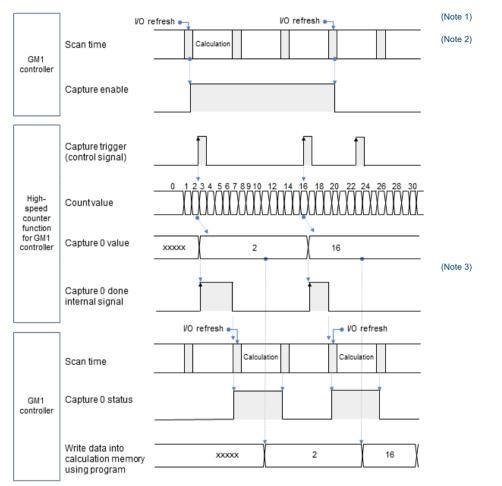
ST program

```
1
    PROGRAM Counter3
2
    VAR
3
       // Local variables
                                   // Capture value read variable
4
       diCaptureValue : DINT;
5)
       // Counter I/O mapping variables
6
       bCh0_Capture0Status : BOOL; // Ch0 capture0 status
7
       diCh0_Capture0Value : DINT; // Ch0 capture0 value
8
    END VAR
                                                                A 🔻
1
    // Capture 0 status is ON and read the capture value
2
    IF bCh0_Capture0Status = TRUE THEN
3
       diCaptureValue := diCh0 Capture0Value;
    END IF
4
```

Behaviors and read operations of capture * status bits

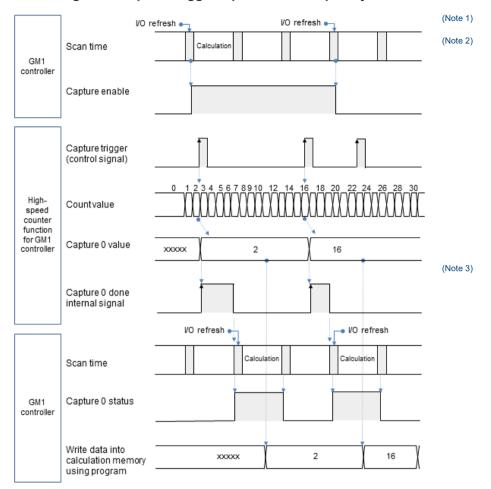
Basic behaviors

- When capture is completed, it is reflected in the capture * status bit for each I/O refresh.
- For the capture function, the capture * status bit is reset when the capture enable request bit turns ON.



(Note 1) The capture enable request bit is turned ON by a user program.

- (Note 2) Each time a capture flag turns ON, a capture operation is performed asynchronously with user program execution. The capture completion internal flag used by the system is reset each time an I/O refresh is performed.
- (Note 3) Capture * status bits are reflected each time an I/O refresh is performed. Capture * status bits are used to read capture 0 value, capture 1 value, and capture differential value as arbitrary variables through user programs. These values are read at the time of relevant calculation processing.



Processing when capture trigger input occurs frequently

- (Note 1) The capture enable request bit is turned ON by a user program.
- (Note 2) Each time a capture flag turns ON, a capture operation is performed asynchronously with user program execution. The capture completion internal flag used by the system is reset each time an I/O refresh is performed.
- (Note 3) Capture * status bits are reflected each time an I/O refresh is performed. If multiple capture operations are performed continuously, the capture 0 completion status bit or capture 1 completion status bit will remain ON.



• If control signals used as capture triggers are input frequently, the capture 0 completion status bit or capture 1 completion status bit will remain ON. Take care when reading multiple captured data items.

Unit Error

Overflow and underflow errors with the counter unit are operation stop errors.

To continue the operating status when an error occurs, change the value of PLC parameter "A unit error occurred" to "Continue operation".

1₂ Procedure

- 1. From "Device view" in the navigator pane, double-click the "Device" object.
- 2. Click the "PLC Parameters" tab in the Device window.
- 3. Change the value of "A unit error occurred" to "Continue operation".

Communication Settings	Category Selection(I)	+ Parameter Setting (R)		
Date and Time and Settings Applications	- PLC - A unit error occurred	Parameter A unit error occurred	Value Stop operation	
Log Users and Groups Access Rights	- Project management setting			
PLC Setting PLC Parameter				
PLC Shell Fask Deployment Status				
Information				

12.3 Expansion unit settings

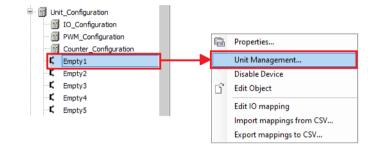
12.3.1 Adding Expansion Units

This section explains how to add device objects for expansion units to a project and set them up.

For example, use the following procedure to add a digital input unit (product number: AGM1X64D2) to Empty1.

¹² Procedure

1. Right-click the [Empty1] object in the navigator pane and then select "Unit Management" from the context-sensitive menu that is displayed.



The "Unit Management" dialog box will be displayed.

No.	Name	Product number	UP()	U)
1	Empty	Empty	DOWN	(/mà
2	Empty	Empty	DOWN	
3	Empty	Empty	DELET	
4	Empty	Empty		
5	Empty	Empty		
6	Empty	Empty		
7	Empty	Empty		
8	Empty	Empty		
9	Empty	Empty		
10	Empty	Empty		
11	Empty	Empty		
12	Empty	Empty		
13	Empty	Empty		
14	Empty	Empty		
15	Empty	Empty		

 Double-click the first row in the "Device: Unit_Configuration" table. The "Select Device" dialog box will be displayed.

ung lor	a fulltext search	Vend	<all th="" ve<=""><th>endors></th><th>~</th></all>	endors>	~
Name		Vendor	Version	Description	^
3 🗊 I	O Units				
-(AGM1AD8	Panasonic Corporation	1.0.0.0	Analog-Input 8 channels	
(AGM1DA4	Panasonic Corporation	1.0.0.0	Analog-Output 4 channels	
- (AGM1PG04L	Panasonic Corporation	1.0.0.0	Line driver Pulse output 4 channels	
	AGM1PG04T	Panasonic Corporation	1.0.0.0	Transistor Pulse output 4 channels	
	AGM1X64D2	Panasonic Corporation	1.0.0.0	24V-DC Input 64points,MIL-connector	
	AGM1XY64D2P	Panasonic Corporation	1.0.0.0	24V-DC Input 32points, Transistor output source (PN	P) 32
-(AGM1XY64D2T	Panasonic Corporation	1.0.0.0	24V-DC Input 32points, Transistor output sink(NPN)	32po
(AGM1Y64P	Panasonic Corporation	1.0.0.0	Transistor output source(PNP) 64points,MIL-connec	tor
(AGM1Y64T	Panasonic Corporation	1.0.0.0	Transistor output sink(NPN) 64points,MIL-connector	~
C I					>

3. Select a device object for the expansion unit to be added.

String	g for a	fulltext search		Vendo	r	<all th="" ve<=""><th>ndors></th><th></th><th>`</th></all>	ndors>		`
Nar	me		Vendor		Ve	rsion	Description		1
B (🗊 IO	Units							
		AGM1AD8	Panasonic Corpora	ation	1.0	0.0.0	Analog-Input 8 channels		
		AGM1DA4	Panasonic Corpora	ation	1.0	0.0.0	Analog-Output 4 channels		
	- 11	AGM1PG04L	Panasonic Corpora	ation	1.0	0.0.0	Line driver Pulse output 4 channels		
	<u> </u>	AGM1PG04T	Panasonic Corpora	ation	1.0	0.0.0	Transistor Pulse output 4 channels		
	- 1	AGM1X64D2	Panasonic Corpora	ation	1.0	0.0.0	24V-DC Input 64points,MIL-connector		
		AGM1XY64D2P	Panasonic Corpora	ation	1.0	0.0.0	24V-DC Input 32points, Transistor output source(PI	NP) 32	2
	- 11	AGM1XY64D2T	Panasonic Corpora	ation	1.0	0.0.0	24V-DC Input 32points, Transistor output sink(NPN)) 32po	i
	- 11	AGM1Y64P	Panasonic Corpora	ation	1.0	0.0.0	Transistor output source(PNP) 64points,MIL-conne	ctor	
	···· 👔	AGM1Y64T	Panasonic Corpora	ation	1.0	0.0.0	Transistor output sink(NPN) 64points,MIL-connecto		`
<								>	_
∠ Gi	roup by	y category D	isplay all versions (fo	or expert	ts or	nly)	Display outdated versions		
lame	. Slot	t1 64IN							

4. Click the [Select Device] button.

The selected device object of the expansion unit will be added.

evice:	UnitConfiguration			
No.	Name	Product number	UP(<u>U</u>	
1	Slot1_64IN	AGM1X64D2	DOWN(D)
2	Empty	Empty		_
3	Empty	Empty	DELETE	:(<u>S</u>)
4	Empty	Empty		
5	Empty	Empty		
6	Empty	Empty		
7	Empty	Empty		
8	Empty	Empty		
9	Empty	Empty		
10	Empty	Empty		
11	Empty	Empty		
12	Empty	Empty		
13	Empty	Empty		
14	Empty	Empty		
15	Empty	Empty		

5. Click the [OK] button.

The selected device object of the expansion unit will be added to the navigator pane.

🖃 👚 🔟 Uni	Unit_Configuration					
11	IO_Configuration					
> f	PWM_Configuration					
	Counter_Configuration					
	Slot1_64IN (AGM1X64D2)					
Ľ	Empty2					
- K	Empty3					
- K	Empty4					
- K	Empty5					

6. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to the expansion unit.

Slot1_64IN X	
64IN parameter	
64IN I/O Mapping	Input Time Constant(I): None
Status	To assign a variable to an address, please set it from the "1/0 mapping" tab.
Information	
L	



• To remove the device object of an expansion unit that has been added, select the expansion unit to be removed in the "Unit Management" dialog box and press the "Delete" key or click the [Delete] button.

12.3.2 Settings of I/O Unit

Expansion I/O units are classified into 64-point input, 64-point output, and 32-point I/O units. This section explains 32-point I/O units as an example.

Setting Parameters with GM Programmer

Devices – 🕈 🗙	Slot1_32IN_320UT X	
Unit_Configuration	32IN_32OUT parameter	Input Time Constant(]): None
PWM_Configuration	32IN_32OUT I/O Mapping	
Slot1_32IN_32OUT (AGM1XY64D2	Status	To assign a variable to an address, please set it from the "I/O mapping" tab.
K Empty2	Information	
Empty4		
Empty5		
Empty6		
Empty7		
Empty8		
Empty9		
Empty 10		
Empty11		
Empty12		
K Empty13 ~		

Parameter Settings

Parameter

Setting item	Settings	Default value	Description
Input time constant	None	None	Input time constant
	0.1 ms		
	0.5 ms		
	1 ms		
	5 ms		
	10 ms		
	20 ms		
	70 ms		

Accuracy of time constant

There is an error in the time constant to be set, so please check in advance before selecting the setting value. The precision of each time constant is shown in the table below.

Set value	Accuracy				
	Min.	Max.			
No time constant setting	-	-			
0.1ms	0.1ms	0.2ms			
0.5ms	0.3ms	0.7ms			
1ms	0.7ms	1.3ms			
5ms	3.0ms	5.2ms			
10ms	6.0ms	10.4ms			
20ms	12.1ms	20.7ms			
70ms	48.6ms	82.8ms			

I/O Mapping for I/O Unit

Channel	Туре	Description	Remarks
Ch0_In	WORD	Ch0_In	
Ch1_In	WORD	Ch1_In	
Ch0_Out	WORD	Ch0_Out	
Ch1_Out	WORD	Ch1_Out	

Ch*_In

* represents 0 or 1.

Channel	Туре	Description	Remarks
Ch*_In00	BOOL	Ch*_In00	
Ch*_In01	BOOL	Ch*_In01	

12.3 Expansion unit settings

Channel	Туре	Description	Remarks
Ch*_In02	BOOL	Ch*_In02	
Ch*_In03	BOOL	Ch*_In03	
Ch*_In04	BOOL	Ch*_In04	
Ch*_In05	BOOL	Ch*_In05	
Ch*_In06	BOOL	Ch*_In06	
Ch*_In07	BOOL	Ch*_In07	
Ch*_In08	BOOL	Ch*_In08	
Ch*_In09	BOOL	Ch*_In09	
Ch*_In10	BOOL	Ch*_In10	
Ch*_In11	BOOL	Ch*_In11	
Ch*_In12	BOOL	Ch*_In12	
Ch*_In13	BOOL	Ch*_In13	
Ch*_In14	BOOL	Ch*_In14	
Ch*_In15	BOOL	Ch*_In15	

Ch*_Out

* represents 0 or 1.

Channel	Туре	Description	Remarks
Ch*_Out00	BOOL	Ch*_Out00	
Ch*_Out01	BOOL	Ch*_Out01	
Ch*_Out02	BOOL	Ch*_Out02	
Ch*_Out03	BOOL	Ch*_Out03	
Ch*_Out04	BOOL	Ch*_Out04	
Ch*_Out05	BOOL	Ch*_Out05	
Ch*_Out06	BOOL	Ch*_Out06	
Ch*_Out07	BOOL	Ch*_Out07	
Ch*_Out08	BOOL	Ch*_Out08	
Ch*_Out09	BOOL	Ch*_Out09	
Ch*_Out10	BOOL	Ch*_Out10	
Ch*_Out11	BOOL	Ch*_Out11	
Ch*_Out12	BOOL	Ch*_Out12	
Ch*_Out13	BOOL	Ch*_Out13	
Ch*_Out14	BOOL	Ch*_Out14	
Ch*_Out15	BOOL	Ch*_Out15	

12.3.3 Analog I/O Unit

The analog I/O unit receives various analog values (i.e., voltage, current, and temperature values) from laser analog sensors and pressure sensors and converts them internally into digital values.



• For details, refer to the GM1 Series Reference Manual (Analog I/O Unit Edition).

12.3.4 Pulse Output Unit

The pulse output unit can be combined with a stepping motor or servo motor to achieve position control.

A	Info.	
	inno.	

• For details, refer to the GM1 Series Reference Manual (Pulse Output Unit Edition).

12.3.5 Serial Communication Unit

The serial communication unit communicates with display units, etc. via serial communication (RS-232C, RS-422, or RS-485).



• For details, refer to the GM1 Series Reference Manual (Serial Communication Unit Edition).

(MEMO)

13 Communication Function

 13.1 Overview of Communication Function 13.1.1 Adding a Protocol to Be Used for the LAN Port 13.1.2 Adding Serial Communication Devices	13-3 13-8
13.2 General-purpose Communication13.2.1 General-purpose Communication (Ethernet)13.2.2 General-purpose Communication (Serial)	13-11
 13.3 MODBUS	13-13 13-13 13-18 13-21
 13.4 EtherNet/IP 13.4.1 What is EtherNet/IP? 13.4.2 Cyclic Communication Function 13.4.3 EtherNet/IP Scanner Function 13.4.4 Setting up the EtherNet/IP Scanner Function 13.4.5 EtherNet/IP Scanner Operation 13.4.6 EtherNet/IP Adapter Function 13.4.7 Setting up the EtherNet/IP Adapter Function 13.4.8 EtherNet/IP Adapter Operation 	13-33 13-33 13-33 13-34 13-41 13-44 13-44
13.5 Communicating with Display Units 13.5.1 Symbol Configuration	
 13.6 OPC UA Server 13.6.1 What is OPC UA?	13-55 13-55 13-56
 13.7 FTP Server Function	13-58 13-58 13-59 13-60
13.8 MQTT Client 13.8.1 What is MQTT? 13.8.2 MQTT Client Specifications	13-63

13.10 NTP client	13.9 DNS client 13.9.1 What is DNS?	
13.10.1 What is NTP?		

13.1 Overview of Communication Function

The GM1 controller allows general-purpose communication and various protocols with external devices via COM and LAN ports.

The following table shows the functions supported by each port.

Port	Supported protocol	Maximum number of connections
COM port	General-purpose communication	1 port
	MODBUS-RTU(Master/Slave)	
	General-purpose communication	
	Communication with the display (CodesysV3)	16 connections in total
LAN port 1/ port 2	OPC UA (Server)	2 connections in total
	FTP (Server)	3 connections in total
	MQTT Client	3 connections in total
	MODBUS-TCP(Master/Slave)	port 1 : 16 connections in total
LAN port2	EtherNet/IP(Scanner/Adapter)	port 2 : 32 connections in total

fi Info.

• The IP address of the LAN port and FTP server setting can be changed using the "PLC Parameters" tab in the Device setting window.

For details, refer to "4.3 Setting up the GM1 Controller" and "13.7.3 List of Setting Items" .

• LAN port 2 has a limit on the total number of MODBUS-TCP and EtherNet / IP connections.

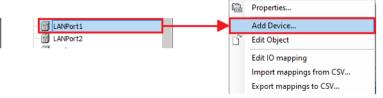
13.1.1 Adding a Protocol to Be Used for the LAN Port

This section explains how to add an object of the protocol to be used for the LAN port to a project and set it up.

For example, use the following procedure to add an object of Modbus TCP to LANPort1 and set it up.

¹² Procedure

1. Right-click the [LANPort1] object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

Add Device		×
Device: LANPort1		
Name		
🖃 🖬 Fieldbuses		
🖮 📲 Modbus		
Modbus TCP Master		
ModbusTCP Slave Device		
Name:		
	Add Device	Cancel

2. Select device "Modbus TCP Master".

Add Device	×
Device: LANPort1	
Name Fieldbuses Nodbus	
Modbus TCP Master	
Name: Modbus_TCP_Master	
Add Device Cancel	

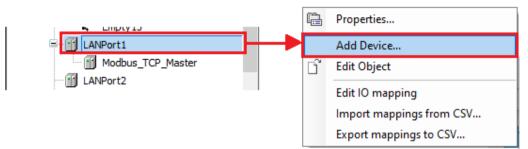
3. Click the [Add Device] button.

Object [Modbus_TCP_Master] will be added to the navigator pane.

🖹 🔐 🖬 LA	NPort1
(Modbus_TCP_Master
👘 LA	NPort2

Then, add object [ModbusTCP_Slave_Device] below object [Modbus_TCP_Master].

4. Right-click the [LANPort1] object and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

Add Device	×
Device: LANPort1	
Name Fieldbuses Modbus Modbus TCP Master Modbus TCP Slave Device	
Name:	
Add [Device Cancel

5. Select device "Modbus TCP Slave Device".

🚹 Add D	levice			×
Device:	LANPort1			
	ieldbuses Modbus Modbus TCP Master Modbus TCP Master Modbus TCP Slave Device]		
Name:	NodbusTCP_Slave_Device			
			Add Device	Cancel

6. Click the [Add Device] button.

The [ModbusTCP_Slave_Device] object will be added.

LANPort1	
Modbus_TCP_Master	
ModbusTCP_Slave_Device	
LANPort2	~

7. Double-click the added object.

The setting pane will be displayed in the main pane. Specify settings related to Modbus TCP.

ModbusTCP_Slave_Device	×			
General	Configured Parameters			
Modbus TCP Slave Device I/O Mapping	Watchdog Slave port	500 ÷	(ms)	
Modbus TCP Slave Device IEC Objects	Unit ID]	
Modbus TCP Slave Device Parameters	Holding registers	10		
Information	Input registers	10 🗘	(%QW)	
Status				
	Data Model			
	StartAddresses			
	Coils Discrete inputs	0		
	Holding register	0		
	Input register	0		
	Holding- and input re	gister data areas over	ay	

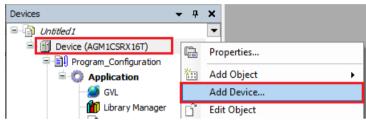
1 Info.

• To remove a device that has been added, select the device in the navigator pane and press the "Delete" key.

13.1.2 Adding Serial Communication Devices



1. Right-click the "Device" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



The "Add Device" dialog box will be displayed.

II Add Device	×
Device: Device	
Name	
🖹 📖 Modbus Serial Port	
Modbus COM	
Name:	
Add Device	e Cancel

2. Select "Modbus COM".

I Add Device	×
Device: Device	
Name G-∰ Fieldbuses G-■M Modbus G-■M Modbus Serial Port U ∰ Modbus COM	
Name: Modbus_COM Add Device Cano	el

3. Click the [Add Device] button.

The selected "Modbus_COM" object will be added to the navigator pane.



4. Right-click the "Modbus_COM" object and then select "Add Device" from the context-sensitive menu that is displayed.

Empty15		
LANPort1	Ж	Cut
LANPort2	B	Сору
	e	Paste
	\times	Delete
	ħ	Properties
		Add Device
	D,	Edit Object

The "Add Device" dialog box will be displayed.

Add Device	×
Device: Modbus_COM	
Name	
🖃 🔟 Fieldbuses	
🖻 - 🗰 Modbus	
Hodbus Serial Device	
🗄 - 📖 Modbus Serial Master	
Name:	
-	,
	Add Device Cancel

5. Select "Modbus_Serial_Device".

dd Device		×
Device: Modbus_COM		
Name - 10 Fieldbuses Modbus		
Modbus Serial Device Modbus Serial Device Modbus Serial Device		
Name: Modbus_Serial_Device		
C	Add Device	Cancel

6. Click the [Add Device] button.

The selected "Modbus_Serial_Device" will be added to the navigator pane.



For details on how to set up, refer to "13.3 MODBUS".

13.1.3 List of Devices

Check the following list for devices that can be added.

Addition source	Added device
Device	Modbus COM
RTEX_Master	RTEX_A5N
	RTEX_A6N
EtherCAT_Master_SoftMotion	Various EtherCAT slaves can be selected.
SoftMotion General Axis Pool	SM_FreeEncoder
	SM_Drive_Virtual
Unit_Configuration	AGM1X64D2
or Empty1 to Empty15	AGM1Y64T
	AGM1Y64P
	AGM1XY64D2T
	AGM1XY64D2P
	AGM1AD8
	AGM1DA4
	AGM1PG04T
	AGM1PG04L
	AGM1NSCS2
	AGM1NSCM2
	AGM1NSCS1M1
LAN Port1	Modbus TCP Master
	ModbusTCP Slave Drive
LAN Port2	Modbus TCP Master
	ModbusTCP Slave Drive
	EtherNet/IP Scanner
	EtherNet/IP Adapter
Modbus TCP Master	Modbus TCP Slave
EtherNet/IP Scanner	Remote adapter for each device can be selected
EtherNet/IP Adapter	EtherNet/IP Module
Modbus COM	Modbus Serial Device
	Modbus Master, COM Port
Modbus Master, COM Port	Modbus Slave COM Port

13.2 General-purpose Communication

13.2.1 General-purpose Communication (Ethernet)

This section explains how to use the CAA_NetBaseServices, in the following order.

1₂ Procedure

1. Double-click "Library Manager" in the Navigator window



2. Check that the following CAA_NetBaseServices library is registered in Library_Manager.

1	🞁 Library Manager 🗙				
🛃 Add	🗄 Add Library 🗙 Delete Library 🛛 🚰 Properties 🗃 Details 🛛 🛤 Placeholders 🛛 🎁 Library Repository 🕕 Icon legend				
Name		Namespace	Effective version		
Ŧ 🕑	3SLicense = 3SLicense, 3.5.14.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE	3.5.14.0		
🗉	BreakpointLogging = Breakpoint Logging Functions, 3.5.5.0 (3S - Smart Software Solutions GmbH)	BPLog	3.5.5.0		
_ 🖻	CAA File = CAA File, 3.5.15.0 (CAA Technical Workgroup)	FILE	3.5.15.0		
ا 🗉	CAA NetBaseSrv = CAA Net Base Services, 3.5.15.0 (CAA Technical Workgroup)	NBS	3.5.15.0		
۰ 🗉	CAA SerialCom = CAA SerialCom, 3.5.15.0 (CAA Technical Workgroup)	COM	3.5.15.0		
🖻 📲	IoDrvEthernet = IoDrvEthernet, 3.5.15.0 (3S - Smart Software Solutions GmbH)	IoDrvEthernet	3.5.15.0		
•	IoDrvRTEX = IoDrvRTEX, 0.6.8.2 (Panasonic Corporation)	IoDrvRTEX	0.6.8.2		

For reference programs, please refer to the GM1 Series Reference Manual (Instruction)...

13.2.2 General-purpose Communication (Serial)

This section explains how to use the CAA SerialCom, in the following order.



1. Double-click "Library Manager" in the Navigator window



2. Check that the following CAA SerialCom library is registered in Library_Manager.

/ 🎁 Library Manager 🗙 Add Library 🗙 Delete Library 🖙 Properties 🗃 Details 🖃 Placeholders 🎁 Library Repository 🕕 Icon Iegend			
Name	Namespace	Effective version	
🗆 🕑 3SLicense = 3SLicense, 3.5.14.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE	3.5.14.0	
BreakpointLogging = Breakpoint Logging Functions, 3.5.5.0 (3S - Smart Software Solutions GmbH)	BPLog	3.5.5.0	
CAA File = CAA File, 3.5.15.0 (CAA Technical Workgroup)	FILE	3.5.15.0	
CAA NetBaseSrv = CAA Net Base Services, 3.5.15.0 (CAA Technical Workgroup)	NBS	3.5.15.0	
CAA SerialCom = CAA SerialCom, 3.5.15.0 (CAA Technical Workgroup)	COM	3.5.15.0	
- 📒 IoDrvEthernet = IoDrvEthernet, 3.5.15.0 (3S - Smart Software Solutions GmbH)	IoDrvEthernet	3.5.15.0	
IoDrvRTEX = IoDrvRTEX, 0.6.8.2 (Panasonic Corporation)	IoDrvRTEX	0.6.8.2	

For reference programs, please refer to the GM1 Series Reference Manual (Instruction)...

13.3 MODBUS

13.3.1 What is Modbus TCP?

The GM1 controller can communicate with HMI and controllers via the Modbus protocol. Master communication or slave communication can be performed by adding a master or slave device for Modbus to the project file.

13.3.2 Modbus-TCP Master Communication

The Modbus-TCP master function can be used to send commands to slave devices in the following two ways.

- 1) When device object settings are used
- Transmission method based on slave initialization
- Transmission method
 - Cyclic
 - · Rising edge
 - Application (ModbusChannel function block)
- 2) When device object settings are not used
- A method by which a user program (ModbusRequest function block) generates and sends commands

f Info.

• For details on how to use ModbusRequest, refer to the *GM1 Series Reference Manual* (*Instruction*).

The method in 1) is explained below.

¹² Procedure

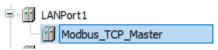
1. Right-click the "LANPort1" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

Device: LANPort1 Name	
⊟ 👔 Fieldbuses	
🖹 - Kills Modbus	
Modbus TCP Master	
ModbusTCP Slave Device	
lame:	

 Select "Modbus TCP Master" under "Modbus" and click the [Add Device] button. "Modbus_TCP_Master" will be added to the "LANPort1" object.

Example: When master communication is performed via LAN port1



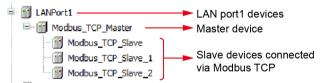
 Right-click the "Modbus_TCP_Master" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

Add Device	×
Device: Modbus_TCP_Master	
Name I Fieldbuses I Modbus I Modbus TCP Slave Modbus TCP Slave	
Name:	
Add Device Cancel	

 Select "Modbus TCP Slave" under "Modbus TCP Slave" and click the [Add Device] button. "Modbus_TCP_Slave" will be added to the "Modbus_TCP_Master" object.

Example: When master communication is performed via LAN port1



5. Open the device (AGM1CSR16T1) of the GM1 controller, select the "PLC' Parameters" tab, and set the IP address of LAN port1.

Log IP Address STRING '192.168 Subnet Mask STRING '255.255.2	Network setting LAN port1 network settings
Applications • Ø Network setting • Ø LAN port1 • Ø IP Address STRING • 192.168 Log Log • Ø Subnet Mask STRING '125.255.2	LAN port1 network settings
Applications IP Address STRING '192.168 Log Image: Subnet Mask STRING '255.255.2	
Log IP Address STRING '192.168 Subnet Mask STRING '255.255.2	68.1.5' '192.168.1.5' Specify the ip address for LAN port1.
Log	
	.255.0' '255.255.255.0' Specify the subnet mask for LAN port1.
V Delaut Gateway STRING 152.100	68.1.1 '192.168.1.1' Specify the default gateway for LAN port1.
Users and Groups 🖹 🖉 LAN port2	LAN port2 network settings
P Address STRING '192.168	68.2.5' '192.168.2.5' Specify the ip address for LAN port2.
Access Rights 🛛 🖉 🖉 Subnet Mask 🛛 STRING 255.255.2	.255.0' '255.255.255.0' Specify the subnet mask for LAN port2.
Default Gateway STRING '0.0	1.0.0.0' '0.0.0.0' Specify the default gateway for LAN port2.

 Double-click "Modbus_TCP_Slave" in the navigator pane. "Modbus_TCP_Slave" object is displayed. Select the "General" tab and set appropriate values for each item.

Modbus_TCP_Slave X			
General	Modbus-TCP		
Modbus Slave Channel	Slave IP address	192 . 168 . 0 . 1	MODBUS
Modbus Slave Init	Response timeout (ms)	1000	
ModbusTCPSlave Parameters	Port	502	
ModbusTCPSlave IEC Objects			
Status			
Information			

Item	Description
Slave IP address	Specifies the IP address of the slave device.
Response timeout [ms]	Waiting time for response from slave * The response timeout value for the master device is overwritten.
Port	Slave port No. (TCP/IP). Port 502 is the default of Modbus.

1 Info.

• If the slave device requires the Unit-ID setting, change it from the "ModbusTCPSlave Parameters" tab.

General	Parameter	Туре	Value	Default Value	Unit	Description
	🐡 < NewChannelConfig	BOOL	true	true		Use the new Channel-Config format
Modbus Slave Channel	🖤 < Unit-ID	USINT	16#FF	16#FF		Unit-ID of the Device
Modbus Slave Init	ResponseTimeout	DWORD	1000	1000		Maximum time for a Slave to respond in m
	IPAddress	ARRAY[03] OF BYTE	[192, 168, 0, 1]	[192, 168, 0, 1]		Configure IP Address of TCP SLave.
ModbusTCPSlave Parameters	🗝 < Port	UINT	502	502		Port where the slave is listening
noobus ter sind er diameters	ConfigVersion	UDINT	16#03050800	16#03050800		

7. Select the "Modbus Slave Channel" tab.

Modbus_TCP_Slave X									
General	Name	Access Type	Trigger	READ Offset	Length	Error Handling	WRITE Offset	Length	Comment
Modbus Slave Channel									
Modbus Slave Init									
ModbusTCPSlave Parameters									
ModbusTCPSlave IEC Objects									
Status									
Information									
[Move Up	Mov	e Down			Add Ch	annel	Delete	Edit

8. Click the [Add Channel] button.

The "Modbus Channel" dialog box will be displayed.

Enter information for channels to be used. Up to 100 channels can be set.

/lodbusChannel		2
Channel		
Name	Channel 0	
Access type	Read Holding Registers (Function Code 3) $\qquad \qquad \lor$	
Trigger	Cyclic \checkmark Cycle time (ms) 100	
Comment		
READ Register		
Offset	0x0000 ~	
Length	1	
Error handling	Keep last Value \vee	
WRITE Register		
Offset	0x0000 ~	
Length	1	
	<u>O</u> K <u>C</u> ancel	

Access type:

Select an access type (function code) and change the value of the READ or WRITE register parameter according to the selected access type.

Function code	Access type	Description
1	Read Coils	Reads from coils
2	Read Discrete Inputs	Reads from discrete inputs
3	Read Holding Registers	Reads from holding registers
4	Read Input Registers	Reads from input registers
5	Write Single Coil	Writes to single coil
6	Write Single Register	Writes to single register
15	Write Multiple Coils	Writes to multiple coils
16	Write Multiple Registers	Writes to multiple registers
23	Read / Write Multiple Registers	Reads from or writes to multiple registers

Trigger:

Select conditions for command transmission.

Access type	Description			
Cyclic	Commands are sent periodically.			
	Enter a transmission interval in the Cycle time field.			

Access type	Description
Rising edge	Commands are sent at the rising edge of a Boolean trigger variable. The trigger variable area is defined in the I/O Mapping tab.
Application	Commands are sent using the ModbusChannel function block in a user program.

READ register settings

Item	Description
Offset	Specifies the starting address from which read operation is to be started.
Length	Specifies the number of registers to be read from. The value of the parameter depends on the function code.
Error handling	Defines data that identifies communication errors. "Keep last value": Holds the last value that is read "Set to ZERO": Sets 0

WRITE register settings

Item	Description
Offset	Specifies the starting address from which write operation is to be started. For SP15, do not specify offset "65535".
Length	Specifies the number of registers to be written to. The value of the parameter depends on the function code.

This completes the device object settings for the method for sending commands based on slave initialization and the method for sending commands based on channel settings.

13.3.3 Modbus-TCP Slave Communication

This section explains how to use the Modbus-TCP slave function. The slave function is used by setting up the device object.

¹² Procedure

1. Right-click the "LANPort1" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

Device: LANPort1 Name		 	
E- I Fieldbuses			
🖻 – Killi Modbus			
Modbus TCP Master			
Modbus TCP Master			
ModbusTCP Slave Device			
ModbusTCP Slave Device	2		
ame: ModbusTCP_Slave_Device			

 Select "ModbusTCP Slave Device" under "ModbusTCP Slave Device" and click the [Add Device] button.

The "ModbusTCP_Slave_Device" object will be added to the "LANPort1" object.



 Double-click "ModbusTCP_Slave_Device" in the navigator pane. The "LANPort1" object will be displayed.

Select the "General" tab and set appropriate values for each item.

ModbusTCP_Slave_Device	¢	
General	Configured Parameters	
Modbus TCP Slave Device I/O Mapping	Watchdog Slave port	500 ★ (ms) 502 ★
Modbus TCP Slave Device IEC Objects	Unit ID	
Modbus TCP Slave Device Parameters	Holding registers	10 (%IW) Writeable
Information	Input registers	10 🔷 (%QW)
Status		
	Data Model	
	StartAddresses	
	Coils 0	
	Discrete inputs 0	
	Holding register 0	× v
	Input register 0	× v
	Holding- and input register	r data areas overlay

Item	Description
Watchdog	If no valid command is received from the master during the preset time period, the holding register (%IW) will be set to zero. Settable value: 500 to 200000
Slave port	Port number used by the slave (local unit) Settable value: 1 to 65535
Unit ID	A station number is set. Settable value: 1 to 247
Holding registers (%IW)	The number of holding registers is set. Buffer size of holding register: 1 to 4096
Input registers (%QW)	The number of input registers is set. Buffer size of input register: 1 to 4096

4. Select the "Modbus TCP Slave Device I/O Mapping" tab.

You can allocate variables to holding registers and input registers.

eneral	Find		Filter Show all		- 🕂 Add FB for IO Channel 👌		
Modbus TCP Slave Device I/O Mapping	Variable	Mapping	Channel Inputs	Address %IW32	Type ARRAY [09] OF WORD	Unit	Description Modbus Holding Registers
Modbus TCP Slave Device IEC Objects	.		Outputs	%QW28	ARRAY [09] OF WORD		Modbus Input Registers
Modbus TCP Slave Device Parameters							
Information							
Status							

Function code	Access type	Register			
		When the check box is not selected ^(Note 1)	When the check box is selected ^(Note 1)		
1	Read Coils	Holding register	Input register		
2	Read Discrete Inputs	Input register	Input register		
3	Read Holding Registers	Holding register	Input register		
4	Read Input Registers	Input register	Input register		
5	Write Single Coil	Holding register	Holding register		
6	Write Single Register	Holding register	Holding register		
15	Write Multiple Coils	Holding register	Holding register		
16	Write Multiple Registers	Holding register	Holding register		
23	Read / Write Multiple Registers	Holding register (Read/ Write)	Input register (Read) Holding register (Write)		

Registers correspond to each access type (function code)

(Note 1) The register to be used is changed according to whether the "Holding register data area overlay and input register data area overlay" check box is selected.

13.3.4 Modbus-RTU Master Communication

The Modbus-RTU master function can be used to send commands to slave devices in the following two ways.

1) When device object channel settings are used

- Transmission method based on slave initialization
- Transmission method based on channel settings
 - Cyclic
 - · Rising edge
 - Application (ModbusChannel function block)
- 2) When device object channel settings are not used (Note 1)
- A method by which a user program (ModbusRequest function block) generates and sends commands

(Note 1) Device object registration is required.

The method in 1) is explained below.

¹² Procedure

1. Right-click the "Device" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

dd Device	×
Device: Device	
Name	
E- 1 Fieldbuses	
😑 - 📖 Modbus	
Modbus Serial Port	
Modbus COM	
Name: Modbus_COM	
Name: houses_com	
	Add Device Cancel

 Select "Modbus COM" under "Modbus Serial Port" and click the [Add Device] button. The "Modbus_COM" object will be added to the "Device" object.

🗊	LANPort1	
	LANPort2	
	Modbus_COM	

3. Right-click the "Modbus_COM" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

🚹 Ado	d Device	×
Device	:: Modbus_COM	
	e Fieldbuses IIII Modbus Fieldbuss Serial Device Fieldbuss Serial Device Fieldbuss Serial Device Fieldbuss Serial Master Fieldbuss Master, COM Port	
Name:	Modbus_Master_COM_Port	
	Add Device Cance	;I

4. Select "Modbus Master, COM Port" under "Modbus Serial Master" and click the [Add Device] button.

The "Modbus_Master_COM_Port" object will be added below the "Modbus_COM" object.

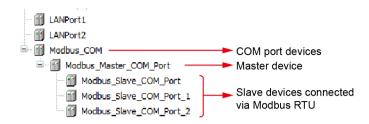


 Right-click the "Modbus_Master_COM_Port" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed. The "Add Device" dialog box will be displayed.

Add Device		×
Device: Modbus_Master_COM_Port		
Name		
🖃 🗊 Fieldbuses		
🖻 - 🛤 Modbus		
🖻 📖 Modbus Serial Slave		
Modbus Slave, COM Port		
Name: Modbus_Slave_COM_Port		
	Add Device	Cancel

6. Select "Modbus Slave, COM Port" under "Modbus Serial Slave" and click the [Add Device] button.

The "Modbus_Slave_COM_Port" object will be added below the "Modbus_Master_COM_Port" object.



Double-click "Modbus_COM" in the navigator pane.
 "Modbus_COM" object will be displayed.
 Select the "General" tab and set appropriate values for each item.

General	Serial Port Configuratio	n
Status	COM port	1
	Baud rate	9600 ~
information	Parity	EVEN 🗸
	Data bits	8
	Stop bits	1

Item	Description				
COM port	Settable value: 1 to 99 The COM port of the GM1 controller is fixed at 1.				
Baud rate	Can be selected from 9600, 19200, 38400, 57600, and 115200				
Parity	Can be selected from EVEN, ODD, and NONE				
Data bits	Data bit length between start bit and stop bit Settable value: 7 bits and 8 bits (Settable: 0 to 255) The default value of Modbus is 8 bits.				
Stop bit	Settable value: 1 bit and 2 bits The default value of Modbus is 1 bit.				

 Double-click "Modbus Master, COM Port" in the navigator pane. The "Modbus_Master_COM_Port" object will be displayed. Select the "General" tab and set appropriate values for each item.

Modbus_Master_COM_Port	x		
General	Modbus-RTU/ASCII		MODBUS
ModbusGenericSerialMaster I/O Mapping	Transmission mode		MUDDU3
ModbusGenericSerialMaster IEC	Response timeout (ms)	1000	
Objects	Time between frames (ms)	10	
Status	Auto-restart communicat	ion	
Information			

Item	Description
Transmission mode	RTU: Binary transmission ASCII: ASCII code transmission (Not supported)
Response timeout [ms] [065535]	Waiting time for response from slave * If a response timeout period is set in the slave device, the settings in the slave device will take effect.

Item	Description
Time between frames [ms] [065535]	Time period during which master transmission is paused from when the last response is received until the next command is sent.
Auto-restart	When the check box is selected: After a communication error occurs, the communication status is automatically checked. When the communication is restored, reconnection is performed.
communication	When the check box is not selected: After a communication error occurs, reconnection is not performed.

"ModbusGenericSerialMaster I/O Mapping" tab: Select a bus cycle task that performs Modbus communication.

Modbus_Master_COM_Port	×		
General	Bus Cycle Options Bus cycle task	Use parent bus cycle setting	~
ModbusGenericSerialMaster I/O Mapping	bus cycle task	ose parent bus cycle setting	
ModbusGenericSerialMaster IEC Objects			
Status			
Information			

 Double-click "Modbus Slave, COM Port" in the navigator pane. The "Modbus_Slave_COM_Port" object will be displayed. Select the "General" tab and set appropriate values for each item.

Modbus_Slave_COM_Port	×			
General	Modbus-RTU/ASCI	[MODBUS	
Modbus Slave Channel	Slave address [1247] 1	MUDDU3	
Modbus Slave Init	Response timeo	out[ms] 1000		
ModbusGenericSerialSlave IEC Objects				
Status				
Information				
ltem	1	Description		
Slave address [1	247]	Specifies the addre	ss (station number) of t	he slave device.
Response timeout	t (ms)	Waiting time for res	ponse from slave	
[265535]		* The response tim	eout value for the maste	er device is overwritt

10. Select the "Modbus Slave Channel" tab.

eneral	Name	Access Type	Trigger	READ Offset	Length	Error Handling	WRITE Offset	Length	Comment
odbus Slave Channel									
odbus Slave Init									
odbusGenericSerialSlave IEC ojects									
atus									
formation									

11. Click the [Add Channel] button.

The "Modbus Channel" dialog box will be displayed.

Enter information for channels to be used. Up to 100 channels can be set.

/lodbusChannel		
Channel		
Name	Channel 0	
Access type	Read Holding Registers (Function Code 3) $\qquad \qquad \lor$	
Trigger	Cyclic V Cycle time (ms) 100	
Comment		
READ Register		
Offset	0x0000 ~	
Length	1	
Error handling	Keep last Value 🗸 🗸	
WRITE Register		
Offset	0x0000 ~	
Length	1	
	OK Cancel	

Access type :

Select an access type (function code) and change the value of the READ or WRITE register parameter according to the selected access type.

Function code	Access type	Description
1	Read Coils	Reads from coils
2	Read Discrete Inputs	Reads from discrete inputs
3	Read Holding Registers	Reads from holding registers
4	Read Input Registers	Reads from input registers
5	Write Single Coil	Writes to single coil

Function code	Access type	Description
6	Write Single Register	Writes to single register
15	Write Multiple Coils	Writes to multiple coils
16	Write Multiple Registers	Writes to multiple registers
23	Read/Write Multiple Registers	Reads from or writes to multiple registers

Trigger :

Select conditions for command transmission.

Access type	Description
Cyclic	Commands are sent periodically. Enter a transmission interval in the Cycle time field.
Rising edge	Commands are sent at the rising edge of a Boolean trigger variable. The trigger variable area is defined in the I/O Mapping tab.
Application	Commands are sent using the ModbusChannel function block in a user program.

READ register settings

Item	Description
Offset	Specifies the starting address from which read operation is to be started. For SP15, do not specify offset "65535".
Length	Specifies the number of registers to be read from. The value of the parameter depends on the function code.
Error handling	Defines data that identifies communication errors. "Keep last value": Holds the last value that is read "Set to ZERO": Sets 0

WRITE register settings

Item	Description
Offset	Specifies the starting address from which write operation is to be started.
Length	Specifies the number of registers to be written to. The value of the parameter depends on the function code.

12. Select the "Initialize Modbus Slave" tab.

Slave devices can be initialized.

Slave initialization is executed once when a slave is activated at the time of startup or RUN mode.Click the [New] button and enter information for channels to be used. Up to 20 commands can be added for each device.

Modbus_Slave_COM_Port 🗙								•
General	Line	Access Type	WRITE Offset	Default Value	Length	Comment		
Modbus Slave Channel								
Modbus Slave Init								
ModbusGenericSerialSlave IEC Objects								
Status								
Information								
	Mo	ove Up	Move Down			New	Delete	Edit

List of access types (function codes)

Code	Access type	Description
5	Write Single Coil	Writes to single coil
6	Write Single Register	Writes to single register
15	Write Multiple Coils	Writes to multiple coils
16	Write Multiple Registers	Writes to multiple registers

13. Select the "ModbusGenericSerialSlave I/O Mapping" tab.

Read areas, write areas, and trigger variable areas are defined according to the channel information created in Step 10. Allocate variables as necessary.

General	Find		Filter Show a	I		- 🕂 Ac	dd FB for IO Channel
Modbus Slave Channel	Variable	Mapping	Channel Channel 0	Address %IW42	Type ARRAY [00] OF WORD	Unit	Description Read Holding Registers
Modbus Slave Init							
ModbusGenericSerialSlave I/O Mapping							
ModbusGenericSerialSlave IEC Objects							
Status							
Information							

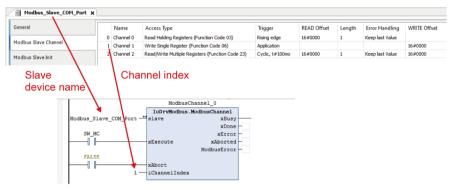
Update settings for I/O variables

Re	set Mapping Always update variables Use parent device setting \checkmark			
🍫 = Create new variable 🌍 = M	1ap to existing variable			
Item	Description			
Use parent device settings	Updates I/O variables according to the parent device settings			
Enable 1 (Bus cycle task if not used by any tasks)	Updates I/O variables in the bus cycle if not used by any other task			
Enable 2 (Always use bus cycle task)	Updates all I/O variables in each cycle of the bus cycle task			

This completes the device object settings for the method for sending commands based on slave initialization and the method for sending commands based on channel settings.

The following is an example of creating an LD program that sends commands when a trigger is set as an "application" in channel settings.

The ModbusChannel function block is used for command transmission. The slave device added to the navigator pane is specified in the slave operand, and the index of the channel that has been added to the "Modbus Slave Channel" tab and that is used to send commands is specified in the iChannelIndex command.



13.3.5 Modbus-RTU Slave Communication

This section explains how to use the Modbus-RTU slave function. The slave function is used by setting up the device object.

¹² Procedure

 Right-click the "Device" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.
 The "Add Device" dialog box will be displayed.

Add Device X

Device: Device

Name

Fieldbuses

Fieldbuses
Fieldbuses

Fieldbuses

Fieldbuses

Fieldbuses

Fieldbuses

Fieldbuses

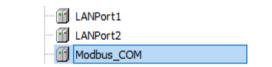
Fieldbuses

Fieldbuses

Fieldbuses

Fieldb

2. Select "Modbus COM" under "Modbus Serial Port" and click the [Add Device] button. The "Modbus_COM" object will be added to the "Device" object.



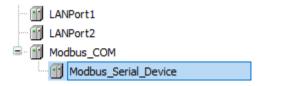
3. Right-click the "Modbus_COM" object in the navigator pane and then select Add Device from the context-sensitive menu that is displayed.

The "Add Device" dialog box will be displayed.

I Add Device	×
Device: Modbus_COM	
Name 	
Init Modbus	
Modbus Serial Device Modbus Serial Master Modbus Serial Master Modbus Master, COM Port	
Name: Modbus_Serial_Device	
	Add Device Cancel

4. Select "Modbus Serial Device" under "Modbus Serial Device" and click the [Add Device] button.

The "Modbus_Serial_Device" object will be added below the "Modbus COM" object.



 Double-click "Modbus_COM" in the navigator pane. The "Modbus_COM" object will be displayed. Select the "General" tab and set appropriate values for each item.

Modbus_COM X			
General Status Information	Serial Port Configuration COM port Baud rate 9600 Parity EVEN Data bits 8 Stop bits		
Item	Description		
COM port	Settable value: 1 to 99 The COM port of the GM1 controller is fixed at 1.		
Baud rate	Can be selected from 9600, 19200, 38400, 57600, and 115200		
Parity	Can be selected from EVEN, ODD, and NONE		
Data bits	Data bit length between start bit and stop bit Settable value: 7 bits and 8 bits (Settable: 0 to 255) The default value of Modbus is 8 bits.		
Stop bit	Settable value: 1 bit and 2 bits The default value of Modbus is 1 bit.		

 Double-click "Modbus_Serial_Device" in the navigator pane. The "Modbus_Serial_Device" object will be displayed. Select the "General" tab and set appropriate values for each item.

Modbus_Serial_Device X		
General	Unit ID	1
Modbus Serial Device I/O Mapping	Watchdog	500
Modbus Serial Device IEC Objects	Holding registers (%IW)	10 😴 (%IW) 🗌 Writeable
Information	Input registers (%QW)	10 🔷 (%QW)
Status		
	Startaddresses	
	Coils	0
	Discrete inputs:	0
	Holding register	0
	Input Register	0

Item	Description
Watchdog	If no valid command is received from the master during the preset time period, the holding register (%IW) will be set to zero. Settable value: 500 to 200000
Unit ID	A station number is set. Settable value: 1 to 247
Holding registers (%IW)	The number of holding registers is set. Buffer size of holding register: 1 to 500
Input registers (%QW)	The number of input registers is set. Buffer size of input register: 1 to 500

7. Select the "Modbus Serial Device I/O Mapping" tab.

You can allocate variables to holding registers and input registers.

General	Find		Filter Show	all		•	Add FB for IO Channel
Modbus Serial Device I/O Mapping Modbus Serial Device IEC Objects	Variable 	Mapping	Channel Inputs Outputs	Address %IW42 %QW38	Type ARRAY [09] OF WORD ARRAY [09] OF WORD	Unit	Description Modbus holding registers Modbus input registers
Information							
Status							
		Res	et Mapping	Always u	pdatevariables Use parer	t device s	etting
	🍾 = Create new variable		et Mapping ap to existing		pdatevariables Use parer	t device s	etting

Registers correspond to each access type (function code)

Function code	Access type	Description
1	Read Coils	Holding register
2	Read Discrete Inputs	Input register
3	Read Holding Registers	Holding register

Function code	Access type	Description
4	Read Input Registers	Input register
5	Write Single Coil	Holding register
6	Write Single Register	Holding register
15	Write Multiple Coils	Holding register
16	Write Multiple Registers	Holding register
23	Read/Write Multiple Registers	Holding register (Read/Write)

13.4 EtherNet/IP

13.4.1 What is EtherNet/IP?

EtherNet/IP (Ethernet Industrial Protocol) is an industrial multi-vendor real-time Ethernet system that executes a communication protocol for controlling the Common Industrial Protocol (CIP) in the application layer implemented over standard Ethernet.

For details on CIP, refer to ODVA documentation.

13.4.2 Cyclic Communication Function

After the scanner device connects to an adapter device and a connection is established, the cyclic communication function allows them to send data mutually at the requested packet interval (RPI).

- Scanner device: Controllers such as PLC
- Adapter device: Robot controllers, encoders, I/O devices, etc.

The EtherNet/IP function of the GM1 controller consists of the scanner function and adapter function.

Supplementary note: About GM1 controllers used as adapter devices

- Adapter devices are classified into the following two types: Adapter devices connected under the control of the GM1 controller used as a scanner device and adapter devices that are the GM1 controller itself. To avoid confusion, the following two different terms are used in this manual.
 - · Local adapter

Adapter device that is the GM1 controller itself

· Remote adapter

Adapter device connected to the GM1 controller used as a scanner

13.4.3 EtherNet/IP Scanner Function

The EtherNet/IP scanner function allows the GM1 controller to communicate with EtherNet/IP adapter devices.

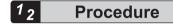
Communication settings for an adapter device to be connected can be configured by loading the EDS file of the adapter device. Multiple adapter devices can be connected to a scanner device.

13.4.4 Setting up the EtherNet/IP Scanner Function

This section explains how to set up the EtherNet/IP scanner function.

Adding devices

Add an EtherNet/IP scanner device and remote adapter device to the Device tree, as described below.



1. Add an EtherNet/IP scanner device.

1-1 Right-click the "LANPort2" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.

🗉 🔟 LANPort1		
LANPort2	æ	Descetion
🖻 💮 Modbus_COM		Properties
Modbus_Serial_Device		Add Device
	đ	Edit Object
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV

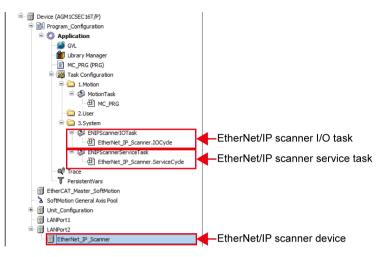
The "Add Device" dialog box will be displayed.

1-2 Select "EtherNet_IP_Scanner" and click the [Add Device] button.

Name	Vendor	Versi	on Description		
E fieldbuses					
🖹 🔶 EtherNet/IP					
EtherNet/IP Local A					
EtherNet/IP Scanne					
EtherNet/IP Sca	anner 3S - Smart Software S	Solutions GmbH 3.5.1	.21 EtherNet/IP Scann	er -	
🗄 - 💷 Modbus					
Group by category 🗌 Display	all versions (for experts only)) Display outdated vers	ons		

Image of added device and tasks

After an EtherNet/IP scanner device has been added, a device and tasks are added to the Device tree, as shown below.



- 2. Add a remote adapter device.
 - **2-1** Right-click the "EtherNet/IP scanner device" object added in "Step 1" and select "Add Device" from the context-sensitive menu that is displayed.

LANPort2		
EtherNet_IP_Scanner Modbus COM	Ж	Cut
Modbus Serial Device	8	Сору
<u> </u>	ril.	Paste
	\times	Delete
	æ	Properties
		Add Device
		Disable Device
	ß	Edit Object
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV

The "Add Device" dialog box will be displayed.

2-2 Select a remote adapter device to be added and click the [Add Device] button.

tring for a fulltext search	Vendor	<all vendors=""></all>		
Name	1	/endor	Version	Description
= 1 Fieldbuses				
🖹 👄 EtherNet/IP				
😑 👄 EtherNet/IP Remote Adapter				
AGM1CSEC16	F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
AGM1CSRX16	F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
FPOH CONTROL UNIT AFPOR	HC32E F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
FP7CPU UNIT AFP7CPS31E	F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
FP7CPU UNIT AFP7CPS31E5	S F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
FP7CPU UNIT AFP7CPS41E	F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
FP7CPU UNIT AFP7CPS41ES	S F	anasonic Industry Co., Ltd.	Major Revision=16#1, Minor Revision = 16#1	EtherNet/IP Target imported from
Generic EtherNet/IP device	3	IS - Smart Software Solutions GmbH	3.5.15.0	EtherNet/IP Target for a generic I
		only) Display outdated version		
		IN THE LEVEL		

A new remote adapter device can also be added by selecting an EDS file. Click the [Install Device] button and select a desired EDS file.

Device tree after devices are added



Setting up an EtherNet/IP scanner device

Set up an EtherNet/IP scanner device as below.

¹² Procedure

- 1. Double-click "EtherNet_IP_Scanner" in the navigator pane.
- In the "General" tab, select the "Auto-reestablish connections" check box. When the check box is not selected: The device is stopped in the event of a communication error.

When the check box is selected: The device is reconnected automatically in the event of a communication error.

EtherNet_IP_Scanner X		
General	Options	
EtherNet/IP Scanner Parameters	Auto-reestablish connections	EtherNet/IP [®]
EtherNet/IP Scanner I/O Mapping		
EtherNet/IP Scanner IEC Objects		
Status		
Information		

Setting up a remote adapter device

Set up a remote adapter device, as below.

Setting items for remote adapter devices differ according to the EDS file. The following procedure is explained, using Panasonic "AFP7CPS31E" as an example.

1₂ Procedure

- 1. Double-click "FP7CPU_UNIT_AFP7CPS31E" in the navigator pane.
- 2. In the "General" tab, set an IP address and items to be checked at the time of connection.

General		Address Settings	
onnectio	ns	(1) IP address 192 . 168 . 0 . 2	EtherNet/IP [®]
semblie	s		
r-Defi	ned Parameters (2	2) Electronic Keying Keying Options	
erNet/	P Parameters	O Compatibility check	
rNet/	P IEC Objects	 Strict identity check 	
		Check device type 12	
tatus		Check vendor ID 216	
formati	in	Check product code 1	
		Check major revision 1	
		Check minor revision 1	
		Restore Default Values	
			-
	IP address		
	Set the IP add	lress of the adapter device.	
	Electronic Key	/ing	
	Select items to	o be checked at the time of connection	l.
	 Compatibili 	ity check	
	•	er device executes its own compatibilit	y check.
	•	e, the user can select only the "Check	
	 Strict identi 		
	The user s	pecifies check items individually.	

3. Set a connection point.

3-1 In the "Connection" tab, click the [Add Connection] button.

Connection Name RPI (ms) O>T Size (Bytes) T>O Size (Bytes) Proxy Config Size (Bytes) Target Config	ze (Bytes) Co
ser-Defined Parameters therNet/IP Parameters therNet/IP IEC Objects tatus formation	
herNet/IP Parameters herNet/IP IEC Objects atus formation	
herNet/IP IEC Objects atus formation	
atus formation	
formation	
<	
Add Connection Delete Connection Edit Connection	
Configuration Data	
Raw data values 🗹 Show Parameter Groups	<u>D</u> efaults
Parameters Value Unit Data Type Minimum Maximum Default Help String	

The "New Connection" window will be displayed.

3-2 Set up parameters required for connection.

Generic connection (free	y configurable)			
Predefined connection (B	DS file)			C
oice of Connection				
Connection Name	O>T Size (Bytes)	T>O Size (Bytes)	Proxy Config Size (Bytes)	Target C
· Input Only (Tag type)	0	2		
Input Only (ID type)	0	2		
				>
neral Parameters				
Connection Path 20 0	4 24 01 2C FE 2D 00 64 00			
Trigger type Cyd	ic	RPI (ms)	50 🜲	
		iti i (iiii)	••	
transport type Inpu		-	les les	
ingeneration	it only	Timeout mu	ltiplier 4 \vee	
anner to Target (Output)	it only	Timeout mu Target to Sca		
anner to Target (Output)		Target to Sca	nner (Input)	
anner to Target (Output) 0>T size (bytes)	0		nner (Input)	
anner to Target (Output)	0	Target to Sca	nner (Input)	
anner to Target (Output) 0>T size (bytes)	0	Target to Sca	nner (Input)	
anner to Target (Output) D>T size (bytes) Proxy config size (bytes) Target config size (bytes)	0 0) 0	Target to Sca T>0 size	(bytes) 2	
anner to Target (Output) D>T size (bytes) Proxy config size (bytes) Target config size (bytes)	0	Target to Sca	nner (Input) (bytes) 2	~
anner to Target (Output) 0>T size (bytes) Proxy config size (bytes) Target config size (bytes Connection type	0 0) 0	Target to Sca T>0 size	nner (Input) (bytes) 2 type Multicast	~
anner to Target (Output) O>T size (bytes) Proxy config size (bytes) Target config size (bytes) Connection type Pr Connection Priority S	0 0 0 0 0 0 0 0 0 0 0 0 0 0	Target to Sca T>O size Connection	nner (Input) (bytes) 2 type Multicast priority Scheduled	~
anner to Target (Output) D>T size (bytes) Proxy config size (bytes) Target config size (bytes) Connection type P Connection Priority S Fixed/Variable Fi	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Target to Sca T>0 size Connection	nner (Input) (bytes) 2 type Multicast priority Scheduled ble Fixed	~

- This section displays the connection points that are supported by the adapter device according to the EDS file.
 Select a connection point to be used.
 Example: Select "Input Only (ID type)".
- (2) The parameters in the "General parameters" section differ according to the selected connection point.

Example: Set "RPI" to 10 (ms) and "T \rightarrow O size" to 16 (bytes).

1 Info.

- For tag connection, uppercase English letters cannot be used for tag names.
- 4. In the "Assemblies" tab, set up a data configuration.

If "T \rightarrow O size" in the "General parameters" section is set to 16 bytes, the default data configuration will be as shown below.

eral	Connections						
nections	Connection Name	O>T Size (Bytes)	T>O Size (Bytes)	Proxy Config Size	(Bytes) T	arget Config Size	(Bytes)
emblies	1. Input Only (ID type)	0	16				
Implies							
r-Defined Parameters							
	Output Assembly "Output" (C)>T)		Input Assembly "Input			
erNet/IP Parameters	🕂 Add 🔀 Delete 🛛 🕆 M	love Up 🕀 Move Dow	n	🕂 Add 🔀 Delete	1 Move U	p 🕀 Move Dow	1
nerNet/IP I/O Mapping	Name Data Type B	it Length Help String	1	Name	Data Type	Bit Length	Help String
				Input_Param0	BYTE	8	
erNet/IP IEC Objects				Input_Param1	BYTE	8	
				Input_Param2	BYTE	8	
itus				···· Input_Param3	BYTE	8	
ormation				Input_Param4	BYTE	8	
ormation				Input_Param5	BYTE	8	
				Input_Param6	BYTE	8	
				Input_Param7	BYTE	8	
				Input_Param8	BYTE	8	
				Input_Param9	BYTE BYTE	8	
				Input_Param10	BYTE	8	
				Input_Param11	BYTE	8	
				···· Input_Param13	BYTE	8	
				···· Input_Param14	BYTE	8	
				Input_Param15	BYTE	8	

To change the data structure, click a relevant data type and select a desired data type. In the following example, the BYTE type (16-byte data structure) is changed to the WORD type (4-word data structure) and the DWORD type (2-word data structure).

Name	Data Type	Bit Length	Help String				
Input_Param0	BYTE ~	8					
Input_Param1	LREAL	8		- Input Assembly "In	put" (T>0)		
Input_Param2	REAL LWORD	8					
Input_Param3	DWORD	8		🕂 Add 🔀 Delei	te 🕼 Move Up	Move Down	n
Input_Param4	WORD ULINT	8		Name	Data Type	Bit Length	Help String
Input_Param5	LINT	8				-	ricip string
Input_Param6	UDINT DINT	8		Input_Param0	WORD	16	
Input_Param7	USINT	8		Input_Param1	WORD	16	
Input_Param8	SINT	8		Input Param2	WORD	16	
Input_Param9	INT	8		Input Param3		16	
Input_Param10	BYTE	8					
Input_Param11	BYTE	8		···· Input_Param4	DWORD	32	
Input_Param12	BYTE	8		Input_Param5	DWORD	32	
Input_Param13	BYTE	8					
Input_Param14	BYTE	8					
Input_Param15	BYTE	8					

- 5. In the "EtherNet/IP I/O Mapping" tab, map data to variables in the application POU, as below.
 - **5-1** In the POU, create variables to which data is to be mapped.



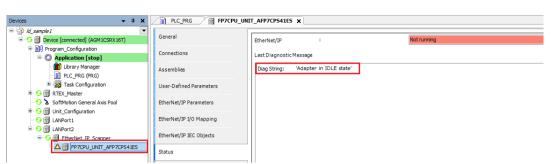
5-2 Map I/O data to each variable that has been created.

General	Find	F	ilter Show	all		- 🕂 Ac	ld FB for	O Channel
Connections	Vari	able	Mapp	ing Channel	Address	Туре	Unit	Description
connections	8-(🤰 Input Only (ID type)						
Assemblies		Application.PLC_RPG.wToData[1]	~	Input_Param0	%IW32	WORD		
		Application.PLC_RPG.wToData[2]	~	Input_Param1	%IW33	WORD		
User-Defined Parameters		Application.PLC_RPG.wToData[3]	~	Input_Param2	%IW34	WORD		
		Application.PLC_RPG.wToData[4]	~	Input_Param3	%IW35	WORD		
EtherNet/IP Parameters		Application.PLC_RPG.dwToDat[1]	2	Input_Param4	%ID18	DWORD		
		Application.PLC_RPG.dwToData[2]	2	Input_Param5	%ID19	DWORD		
EtherNet/IP I/O Mapping		*		Input_Param6	%IB80	BYTE		
		🇤		Input Param7	%IB81	BYTE		

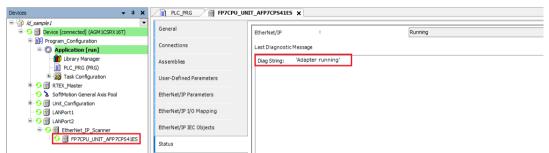
13.4.5 EtherNet/IP Scanner Operation

When a project in which EtherNet/IP scanner settings have been configured is downloaded to the GM1 controller and then an adapter is connected, cyclic communication is started, regardless of whether the GM1 controller is set to RUN or STOP mode.

When the GM1 controller is set to STOP mode, the remote adapter is placed in "Adapter in IDLE state" and displayed as \triangle in the Device tree.



When the GM1 controller is set to RUN mode, the remote adapter is placed in "Adapter running" and displayed as O in the Device tree.



To perform a status check or reset using a program, use I/O of the remote adapter device. The following is an example of adapter operation using device I/O.

Declaration section

```
PROGRAM PLC_PRG
VAR
        eState :
        IoDrvEtherNetIP.AdapterState;// Remote adapter status
        xDiagnosticAvailable : BOOL; // TRUE if there is diagnostic information
        sDiagString : STRING; // Diagnostic string
        xAcknowledge : BOOL := FALSE; // Approve diagnostic information
        xReset : BOOL := FALSE; // Remote adapter reset
END VAR
```

Implementation section

```
eState := FP7CPU_UNIT_AFP7CPS41ES.eState;
xDiagnosticAvailable := FP7CPU_UNIT_AFP7CPS41ES.xDiagnosticAvailable;
sDiagString := FP7CPU_UNIT_AFP7CPS41ES.sDiagString;
FP7CPU_UNIT_AFP7CPS41ES.xAcknowledge := xAcknowledge;
FP7CPU_UNIT_AFP7CPS41ES.xReset := xReset;
```

The current state of the remote adapter is stored in eState.

Exampl When line is connected RUNNING e normally: ENCAPSULATION_CONFIG When line is disconnected:

If an error occurs, xDiagnosticAvailable will be set to TRUE and a message will be found in sDiagString.

If xAcknowledge is set to TRUE, xDiagnosticAvailable will return to FALSE.

If xReset is set to TRUE, the line will be closed temporarily and then reconnected. (To reset all remote adapters simultaneously, use xReaset of the EtherNet/IP scanner device.)

13.4.6 EtherNet/IP Adapter Function

The EtherNet/IP adapter function allows the GM1 controller to communicate with EtherNet/IP scanner devices.

13.4.7 Setting up the EtherNet/IP Adapter Function

This section explains how to set up the EtherNet/IP adapter function.

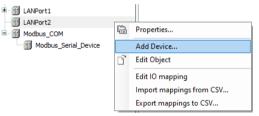
Adding devices

Add a local adapter device and module device to the Device tree, as described below.

¹² Procedure

Add a local adapter device.
 A local adapter device serves as a connection point to which the scanner device connects.

1-1 Right-click the "LANPort2" object in the navigator pane and then select "Add Device" from the context-sensitive menu that is displayed.



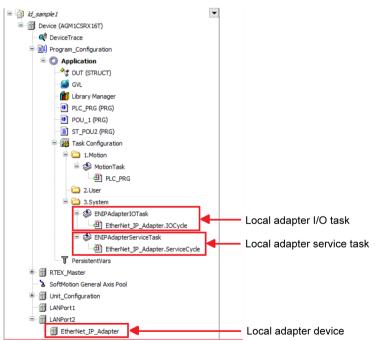
The "Add Device" dialog box will be displayed.

1-2 Select "EtherNet_IP_Adapter" and click the [Add Device] button.

String for a fulltext search	Vendor	<all vendors=""></all>	Version	Description		_
Name =- ∰ Fieldbuses =- ← EtherNet/IP =- ← EtherNet/IP Local Adap			version	Description		
EtherNet/IP Adapt	er 35 - Smart So	ftware Solutions GmbH	3.5.15.21	A device that works as an EtherNet/IP Adapter.		

Image of added device and tasks

After a local adapter device has been added, a device and tasks are added to the Device tree, as shown below.



2. Add a module device.

A module device defines data to be transferred via cyclic communication.

2-1 Right-click the "Local adapter device" object added in "Step 1" and select "Add Device" from the context-sensitive menu that is displayed.

LANPort2		
EtherNet_IP_Adapter	*	Cut
Modbus_COM	8	Сору
	æ	Paste
	\times	Delete
	æ	Properties
		Add Device
		Disable Device
	ß	Edit Object
		Edit IO mapping
		Import mappings from CSV
		Export mappings to CSV

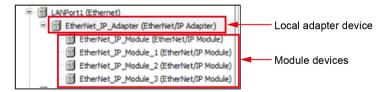
The "Add Device" dialog box will be displayed.

2-2 Select the "EtherNet/IP Module" object to be added and click the [Add Device] button.

Add Device						-		×
Device: EtherNet_IP_Adapter								
String for a fulltext search	Vendor	<all vendors=""></all>						~
Name	Vendor		Version	Description				
Fieldbuses								
EtherNet/IP								
EtherNet/IP Module	3S - Smart Softw	are Solutions GmbH	3.5.14.1	A device that works as an EtherNet/IP Module.				
Group by category Display all ver	rsions (for experts o	inly) 🔄 Display out	dated versions					
ame: EtherNet_IP_Module								_
					Add Devi	ce	Can	cel

Image of added devices

Multiple module devices can be added within a local adapter device. The following is an example of four module devices added to a local adapter device.



Settings of local adapter device

Check the settings of the local adapter device.

¹² Procedure

- 1. Double-click "EtherNet_IP_Adapter" in the navigator pane.
- 2. In the "General" tab, check the settings of the local adapter device.

EtherNet_IP_Adapter X			
General	EDS File		
EtherNet/IP Adapter Parameters	Vendor name	Panasonic Industry Co., Ltd.	
EtherNet/IP Adapter I/O Mapping	Vendor ID	216	
	Product name	AGM1CSRX16	
EtherNet/IP Adapter IEC Objects	Product code	5	(1)
Status	Majorrevision	1	
Information	Minorrevision	1	
	Install to Device	e Repository Export EDS File	(2)

(1) The settings of the local adapter device are shown below. However, the settings cannot be changed.

Vendor name: Panasonic Industry Co., Ltd. Vendor ID: 216 Product name: AGM1CSRX16 Product code: 5 Major revision: 1 Minor revision: 1

For the following items, the settings cannot be changed.

- Install to Device Repository The remote adapter device specified here is registered as a device in CODESYS.
 Export EDS File
 - The EDS file specified here is output.
 - For scanner device settings, use the EDS file provided by Panasonic ("panasonicgm1csrx16_0005_0101.eds").

(2)

Setting up a module device

Set up a module device, as below.

1₂ Procedure

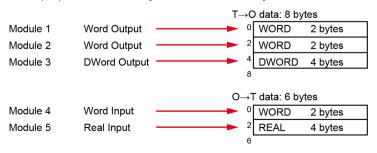
- 1. Double-click "EtherNet_IP_Module" in the navigator pane.
- 2. In the "General" tab, set module information.

P	EtherNet_IP_Module X				
	General	Module Information			
	EtherNet/IP Module Parameters (1)	Module	Word Output Module	~	EtherNet/IP
	EtherNet/IP Module I/O Mapping (2)	Vendor name	Panasonic Industry Co., Ltd.		
	EtherNet/IP Module IEC Objects	Vendor ID	216		
	Status	Product name	Word Output Module		
		Product code	109		
	Information	Majorrevision	1		
ľ		Minorrevision	1		

2-1 (1) Select a desired module type from the following 10 types.

Module type	Size	Direction
Byte Input	1 byte	O→T
Byte Output	1 byte	T→O
Word Input	1 word (2 bytes)	O→T
Word Output	1 word (2 bytes)	T→O
DWord Input	1 double-word (4 bytes)	O→T
DWord Output	1 double-word (4 bytes)	T→O
Real Input	1 single-precision real number (4 bytes)	O→T
Real Output	1 single-precision real number (4 bytes)	T→O
Big Input	505 bytes	O→T
Big Output	509 bytes	T→O

By generating multiple module devices and setting module types, data structure can be created within cyclic data.



Example) T \rightarrow O data: 8 bytes, O \rightarrow T data: 6 bytes

Note

- The maximum data length within a single connection point is as follows:
 O→T data: 505 bytes
 T→O data: 509 bytes
- **2-2** There is no need to set all items in (2), as values cannot be entered.
- **3.** In the "EtherNet/IP Module I/O Mapping" tab, map data to variables in the application POU, as below.
 - **3-1** In the POU, create variables to which data is to be mapped.

ff 8	therNet_IP_Adapter	ľ	Device	PLC_PRG	×
1	PROGRAM PLC_PRG				
2	VAR				
3	TO_Data1	÷	WORD ;		
- 4	TO_Data2	÷	WORD;		
5	TO_Data3	÷	DWORD ;		
6	OT_Data1	÷	WORD ;		
7	END_VAR				

3-2 Map I/O data to each variable that has been created. Double-click the section indicated by (1) and select a variable to which I/O data is to be mapped.

4	PLC_RPG ItherNet_I	P_	Module X									•
	General	F	ind	Filter	Show	w all			• + 4	Add FB for IO Cha	annel	Ŧ
	EtherNet/IP Module Parameters (1)		Variable ∄– ^K ∲ Application.PLC_RPG.To_Data1	Mapp ~		Channel Output Data	Address %QW34	Type WORD	Unit	Description		
	EtherNet/IP Module I/O Mapping											
	EtherNet/IP Module IEC Objects											

13.4.8 EtherNet/IP Adapter Operation

When a project in which EtherNet/IP adapter settings have been configured is downloaded to the GM1 controller and then RUN mode is invoked, the adapter device responds to a ForwordOpen packet from the scanner device and cyclic communication is started.

The following shows the respective states of the local adapter device and module devices during normal operation.

Devices 🗸 🗸 🗙		EtherNet_IP_Module_1	EtherNet_IP_Adapter 🗙
□ d_sample1	-		
🖹 😏 👔 Device [connected] (AGM1CSRX16T)		General	EtherNet/IP Adapter : Running
Program_Configuration			
Application [run]		EtherNet/IP Adapter Parameters	Last Diagnostic Message
🖲 😏 📺 RTEX_Master		EtherNet/IP Adapter I/O Mapping	Diag String: 'TEST'
- 😔 🍐 SoftMotion General Axis Pool			
🗉 🧐 Unit_Configuration		EtherNet/IP Adapter IEC Objects	
- 😔 🕤 LANPort1			
E 😳 📆 LANPort2		Status	
EtherNet_IP_Adapter			
EtherNet_IP_Module		Information	
- 😌 🔟 EtherNet_IP_Module_1			
EtherNet_IP_Module_2			
EtherNet_IP_Module_3			

The local adapter device and module devices are displayed with "O" symbol in the Device tree and the status of the local adapter device is displayed as "Adapter running".

The local adapter device can be connected from multiple scanner devices.



 ExclusiveOwner connection (using O→T data) is allowed for only one scanner device. This is to prevent the same variable from being overwritten with input data from multiple scanner devices.

13.5 Communicating with Display Units

Variables that communicate with the display can be set in the GM Programmer's symbol configuration.

When code generation is executed in the set project, the symbol definition XML file (.xml) is generated in the same folder as the project file (.project), so you can import it into the display and share the variable definition.

13.5.1 Symbol Configuration

This section describes the symbol configuration function.

With this function, a symbol configuration object can be added and used.

You can set variables communicating with the display unit as well as variables open to the OPC UA server.

Creating symbol configuration object

 Right-click the[Application]object in the navigation pane and selectAdd Object>Symbol Configurationfrom the context-sensitive menu that is displayed.

The "Add Symbol Configuration" dialog box will be displayed.

Add Symbol Configuration	×
Create a remote access symbol configuration.	
Name	
Symbol Configuration	
Include comments in XML	
Support OPC UA features	
Add library placeholder in Device Application (recommended, but may trigger download)	
Client Side Data Layout	
Compatibility Layout	
Optimized Layout	
Add Cancel	
Add Cancel	

2. Enter a name, select check boxes for necessary items, and click the[Add]button. A symbol configuration object will be added under the[Application]object.

List of setting items

Item		Description
Include comments in XML		Includes comments on variables in an XML file when the symbol configuration is exported to the XML file.
Support OPC UA features		Enables the symbol configuration OPC UA Server function.
Client Side Data Layout		Specifies a method for generating a client side data layout.
	Compatibility Layout	Generates a data layout compatible with older version. Do not use this setting because of possible trouble occurrence.
	Optimized Layout	Use this setting.

Editing symbol configuration

1. Double-click the[Symbol Configuration]object in the navigator pane. The setting pane will be displayed in the main pane.

■ シンテホルコンフィクレーション.projet* - GM Programmer _ □ ×							
File Edit View Project Build Online Debug Tools Window Help							
19 🛎 🖬 🚳 🗠 🗠 🐰 🖻 🗈 🗙 🐴 🎼	● ● ● ● ● ● × ▲ ● ● × ● ● ● ● ● ● ● ● ●						
Devices - 7 ×	Symbol Configuration 🗙 🎑 GVL					•	
■ ③ シンボルコンフィグレーション	View • 🖽 Build 🛛 🖓 Settings • Tools •						
Device (AGM1CSRX16T) Program_Configuration	There are 1 configured variables which are not re	eferenced by the IEC code	Reading and writing to them may not have t	the desired effect(s). Remove			
Application	Changed symbol configuration will be transferred wi	ith the next download or o	nline change				
GVL	Symbols Acce	ess Rights Maximal	Attribute Type	Members Comment			
Library Manager	E- Constants						
MC_PRG (PRG)	- CompilerVersion	*	VERSION	the compiler version as defined in the build options (not OEP	4 Customized Vers	lion!)	
Symbol Configuration	RuntimeVersion	*	VERSION	the runtime version number as defined by the device description	ation.		
S Conguration	⊜-IV ∎ GVL	s s					
B S MotionTask	- ♥ ♦ AAA - ♥ ♥ BBB		BOOL				
MC_PRG	B- Io Config_Globals	* *	2001				
- 🗀 2.User	ANPort1	S	IoDrvEthernet.IoDrvEthernet				
3.System	- ANPort2	S	IoDrvEthernet.IoDrvEthernet				
- Iff RTEX Master	- 🔄 🛊 nIoConfigTaskMapCount	*	DINT				
SoftMotion General Axis Pool	PIOConfigTaskMap	*	POINTER TO IoConfigTaskMap	p			
*- ff Unit Configuration							
LANPort1							
- m LANPort2							
Modbus_COM							
	1						
	_						
POUs 👷 Devices	<					>	
Messages - Total 0 error(s), 0 warning(s), 0 message							
				Last build: 😋 0 💿 0 Precompile 🧹 🦓 Project user:	(nobody)		

Press[Build]to display the declared variables list in the window.

In the setting pane, the symbols (variables) table and menu bar for editing are displayed.

• Symbols table

4						
Symbols	Access Rights	Maximal	Attribute	Туре	Members	Comment
🖃 📄 Constants						
- 📄 🛷 CompilerVersion		* ø		VERSION		the compiler version as defined in the build options (not OEM Customized Version!)
OmpilerVersion OmpilerVersion		* ø		VERSION		the runtime version number as defined by the device description.
GVL						
		*		BOOL		
- ♥ ■ GVL - ♥ ∲ AAA - ♥ ∲ BBB		*		INT		
🖻 🔄 📑 IoConfig_Globals						
- 🗐 🤣 LANPort1		*		IoDrvEthernet.IoDrvEthernet		
- ANPort2		*		IoDrvEthernet.IoDrvEthernet		
- 📄 🔌 nIoConfigTaskMapCount		*		DINT		
pIoConfigTaskMap		N		POINTER TO IoConfigTaskMap		

The symbols table shows the following components:

Item name	Description	
Symbols	Displays a list of variables.	
	If the check boxes are selected, values can be read or written from display units and OPC UA devices.	

Item name	Description
Access Rights	If a symbol in the[Access Rights]column is clicked, the right of access to the symbol can be changed.
	Access right icons
	Nead only
	≫ Write only
	Nead / Write
	With these rights, functions, function blocks, methods, and programs can be accessed.
Maximal	Maximum access rights.
Attribute	For symbols set by Attribute 'symbol' pragma, set access rights are displayed.
Туре	Displays the data type of the symbol.
Members	A elision mark button is displayed only for structure-type symbols.
	By clicking the elision mark button, you can set the access right member by member in the structure.
	Note: This selection is applied to all instances of this data type for which the symbol is exported.
	Note: If members in the structure cannot be selected, an asterisk is displayed at the member check box, indicating that all the members that can be read or written will be exported.
Comment	Displays a description of the symbol.

• Menu bar

📉 View 🔹 🛗 Build 🛛 🛗 Settings 👻 Tools 👻

The menu bar displays the following menus:

Item na	ne	Description
View		When the following items used in the symbol configuration are clicked, symbol display is filtered.
	Project, not yet configured	Symbols that are not added to the symbol configuration but are provided in projects.
	Library, not yet configured	Symbols that are not added to the symbol configuration but are provided in libraries.
	Symbols exported on attribute	Symbols set by Attribute 'symbol' pragma.
Build		This item is used to compile a project. Note: Build needs to be executed to display variables in the symbol table.
Setting	Support OPC UA features	Enables the symbol configuration OPC UA function.
S	Include comments in XML	Includes comments on variables in an XML file when the symbol configuration is exported to the XML file.
	Include node flags in XML	Includes namespace node flags in an XML file when the symbol configuration is exported to the XML file.

Item na	ame	Description
	Include comments and attributes	About comments and attributes, you can set details of the symbol configuration and contents required to be included in the XML file.
		XML symbol file contents can be configured to include"namespace node flag","comment", and"attribute".
		Do not use this setting for symbol table contents because the OPC UA function does not support it.
	Configure sync with IEC task	You can set a function with which to access variables in sync with an IEC task.
		Do not use.
	Compatibility Layout	Generates a data layout compatible with older version.
		Do not use this setting because of possible trouble occurrence.
	Optimized Layout	Generates a data layout independent of the internal layout.
		Use this setting.
	Use empty namespace by default	Do not use.
	Enable direct I/O access	Do not use.
	Enable symbol set	Enables symbol set configuration.
		In the "Symbol Permissions" tab of the device editor, set the device users who have access to the configured symbol set.
Tools	Save XML schema file	Saves a symbol file in XSD format to use it in external programs.

13.6 OPC UA Server

13.6.1 What is OPC UA?

OPC Unified Architecture (OPC UA) is an interoperability standard for the secure and reliable exchange of data in the industrial automation field and other industries.

Abstracting PLC specific protocols (such as Modbus) into a standardized interface, OPC UA is platform-independent and ensures the seamless flow of information among many devices.

As a result, users with HMI (display unit) or SCADA systems can build systems that interface with and seamlessly interact with devices via OPC.

13.6.2 OPC UA Server Settings

¹² Procedure

- 1. With reference to section "13.5.1 Symbol Configuration", select variables to be opened.
- 2. Select the "Support OPC UA features" check box to enable the server function.
- **3.** After downloading the project to the GM1 controller, turn the controller OFF and then ON to get the OPC UA Server function enabled.

Note

- Variables that are opened are used in common with settings used for communication with the display unit.
- Please use the number of items that can be monitored at one time within the range of "13.6.3 OPC UA Server Specifications".

13.6.3 OPC UA Server Specifications

OPC UA server specifications with the GM1 controller are described below:

Item	Details
Available ports	Both LAN ports 1 and 2
Supported Profiles	Micro Embed Device Server Profile
Server URL	Port 1: opc.tcp://192.168.1.5:4840 (default) Port 2: opc.tcp://192.168.2.5:4840 (default) * IP addresses depend on settings
Maximum number of sessions	2
Number of all monitored items on server	1000 Monitoring interval: Minimum 300 ms Client notification interval: Minimum 500 ms
Variable types not permitted to be opened to server	 Real number (LREAL: permitted, REAL: not permitted) Character string (WSTRING: permitted, STRING: not permitted) Time (only DATE_AND_TIME(DT): permitted, others: not permitted) Constant (const), Interface, Properties Union, Pointer
Limit on the number of variable name characters	Up to 255 charactersHalf-width characters (alphanumeric characters, symbols)
Security settings	 Security mode: None: Neither signature nor encryption required Sign: Only signature required Sing & Encrypt: Both signature and encryption required Security policy: Basic256 Sha256
Certificates	 Classified as below (Each 32 units can be registered) Own Certificates: own certificates Trusted Certificates: certificates that are trusted UnTrusted Certificates: certificates that are not trusted Quarantined Certificates: certificates that are quarantined
User authentication	 Username&Password (user name and password) Anonymous (anonymous user) * Do not use anonymous user from a security perspective

13.6.4 Security Settings

You can set security settings for secure communication with the OPC UA server

¹² Procedure

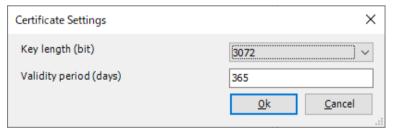
- 1. Perform a network scan and connect to the GM1 controller.
- 2. Click the display security screen of menu bar View>Security Screen.
- 3. Click the 🙋 button to display the certificate information in the device.

Devices	Φ	Information	Ľ.ª	Information	Issued for	Issued by	Valid from	Valid until	Thumbprint	
	-	Device	\times							
	_	Own Certificates	463							
		Trusted Certificates	ED .							
		Untrusted Certificates								
		Quarantined Certificates	(1)							
			- W							

4. Select "Device" to display the certificate status.

Devices	Φ	Information	23	Information	Issued for	Issued by	Valid from	Valid until
	忉	E Device	\times	OPC UA Server (not available)				
		Own Certificates	483	Encrypted Application (not available)				
		Trusted Certificates	<u> </u>	Encrypted Communication	AGM1CSEC16	AGM1CSEC16	2022/04/20 21:13:47	2022/05/20 21:13:47 (2
		Untrusted Certificates		Web Server (not available)				
		Quarantined Certificates	54					
			~#·					

- 5. Select "OPC UA Server" and click the 💷 button on the certificate icon.
- **6.** The screen for setting the length and validity period of the certificate key will be displayed. Set it and click the "OK" button.



7. Once the OPC UA server certificate has been created, it becomes active.

Devices	Φ	Information	$[\tilde{E}_{\mu}^{\dagger}]$	Information	Issued for	Issued by	Valid from	Valid until
	-	😑 🕤 Device	×	💱 OPC UA Server	OPCUAServe	OPCUAServer@	2022/04/23 2:28:08	2023/04/23 2:28:08 (>
		Own Certificates	4673	Encrypted Application (not available)				
		Trusted Certificates	1	Encrypted Communication	AGM1CSEC16	AGM1CSEC16	2022/04/20 21:13:47	2022/05/20 21:13:47 (2
		Untrusted Certificates	a	Web Server (not available)				
		Quarantined Certificates	香香					
			(- <u>A</u>)					

13.7 FTP Server Function

13.7.1 Overview of FTP Server Function

The FTP server function allows the FTP client to read files from the SD card mounted on the GM1 controller and write files into the SD card.

13.7.2 Setup Procedure

¹² Procedure

- 1. Double-click the [Device] object in the navigator pane to display the Device setting window.
- 2. Click the "PLC parameters" tab in the Device setting window.
- 3. Click "FTP server settings" in the "Category selection".
- 4. When the "Use FTP server" setting is changed to "Valid" in "Parameter settings", the settings in items take effect. For the contents of setting items, refer to "13.7.3 List of Setting Items".

Communication Settings	Category Selection(1)	+ -	Parameter Setting (R)		
Date and Time and Settings	- PLC		Parameter	Value	
oute and time and bettings	- A unit error occurred - Network setting		Use FTP server	Invalid	
Applications	- Network setting		FTP server disconnect time	300	
Log	Project management setting		Username		
LUY			Password		
Users and Groups			Use SSL/TLS communication	Invalid	
Access Rights			Permit connection without encryption	Invalid	
Access Rights					
PLC Setting					
PLC Parameter					
PLC Parameter					
PLC Shell					
Task Deployment					
Status					
Information					



- The FTP server function is supported by the unit firmware Ver. 1.3 or later.
- Up to three FTP clients can be connected at the same time.

13.7.3 List of Setting Items

List of setting Items (FTP server)

Setting item	Default	Description
Use FTP server	Not use	Select whether to use the FTP server function.
FTP server disconnection time	300	Setting unit: 1 (second) Setting range: 300 to 4,294,967,295 Enter an inactive communication monitoring time for FTP connection.
		When the time for which the FTP server is in an inactive communication state has exceeded the specified time, the server is automatically disconnected.
User name	-	Enter a user name for logging in to the FTP server.
		Number of characters: 4 to 32
		Allowed characters: lowercase and uppercase alphabetic characters, numerals, and an underscore (_)
Password	_	Enter a password for logging in to the FTP server.
		Number of characters: 8 to 32
		Allowed characters: lowercase and uppercase alphabetic characters, numerals, and symbols (space (SP), !, #, \$, %, &, (,), *, +, -, ., /, :, ;, <, =, >, ?, @, [,], ^, _, {, , }, ~)
		Combine three different types out of lowercase and uppercase alphabetic characters, numerals, and symbols.
Use SSL/TLS communication	Not use	Set whether to use SSL/TLS communication (Explicit mode) under encrypted connection.
		Only SSL/TLS version TLS1.2 can be used.
Permit connection without encryption	Not permit	Select whether to allow communication even under insecure state by configuring settings without encryption or to allow only secure communication using the SSL/TLS (encryption).
		This item is operative only when "Use SSL/TLS communication" is set to "Valid".
		If set to "Valid", match the SSL/TLS (encryption) communication setting on the FTP client side to the setting on this side.

f Info.

• If you forget your password, you cannot log in to the GM1 controller. In this case, execute device reset from the GM1 controller.

(For details, refer to the "8.8.3 Executing Device Reset from GM1 Controller")

• The root directory of the FTP server is the root directory of the SD card on the GM1 Controller.

13.7.4 FTP Server Standards

The FTP server provides FTPS functions according to the following SSL/TLS specifications.

Item	Description
Protocol	TLS1.2
Cipher suite	Available cipher suites differ depending on the cipher system of the certificate used. "When RSA certificate is used" • TLS_ECDHE_RSA_WITH_AES_128_GCM_SHA256 • TLS_RSA_WITH_AES_128_GCM_SHA256 • TLS_ECDHE_RSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_RSA_WITH_AES_256_CBC_SHA • TLS_RSA_WITH_AES_256_CBC_SHA256 • TLS_RSA_WITH_AES_128_CBC_SHA256 • TLS_RSA_WITH_AES_256_CBC_SHA "When ECDSA certificate is used" • TLS_ECDHE_ECDSA_WITH_AES_128_GCM_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_128_CBC_SHA256 • TLS_ECDHE_ECDSA_WITH_AES_256_CBC_SHA * The suites are listed in order of precedence. * Key length: ECDHE/ECDSA = 256bit, RSA = 2048bit * The RSA certificate is built in by default.
Server certificate	The server certificate is a default certificate, which is used when the user certificate is not set, or is a user certificate, which is used when the user certificate is set. Default certificate: A 2048-bit self-signed RSA certificate that is set by factory default. User certificate: A certificate set by the user. * This can be set as either a RSA certificate or ECDSA certificate.
Connection method	Explicit connection. * Implicit connection is not supported.

i Info.

- For the method of writing a user certificate, refer to "13.7.5 SSL/TLS Certificate Settings".
- A desired certificate / secret key can be set for use in the SSL/TLS communication. * When this is not set, the default certificate is used.
- Do not perform the following operations while the operation mode is in RUN mode. Please change to STOP mode and execute.
 - Insert the SD card with "Use FTP server" enabled.
 - Registering and deleting certificates with "13.7.5 SSL/TLS Certificate Settings".

13.7.5 SSL/TLS Certificate Settings

Set this when using an SSL/TLS certificate / secret key prepared by the user for the SSL/TLS communication of the FTP server function.

* When this is not set, the default self-signed certificate / secret key is used.

Perform the procedure in "7.3 Communication Setting" in advance to connect GM Programmer to the GM1 controller.

¹² Procedure

 From the menu bar, select Online>SSL/TLS Certificate Management. The "SSL/TLS Certificate Management" screen is displayed.

SSL/TLS Certificate Ma	nagement		×
Action type	Register	○ <u>D</u> elete	
<u>C</u> ertificate file			Reference(<u>1</u>)
Private <u>k</u> ey file			Reference(2)
			Execute Cancel

- Select "Register" under "Operation type". Select "Delete" to delete the certificate and follow the following step 5.
- 3. Press the [Refer (1)] button and select a certificate file.

Certificate designation file

Item	Description
Extension	pem, cer, crt
File format	ASN.1 (Base64)
Data size	8,192 bytes or less

 Press the [Refer (2)] button and select the secret key file that corresponds to the certificate selected in step 3.

Secret key designation file

Item	Description
Extension	pem, key
File format	ASN.1 (Base64)
Data size	8,192 bytes or less

5. Press the [Execute] button.

The designated certificate / secret key is transferred to the GM1 controller and an attempt is made to restart the FTP server. When the FTP server is successfully restarted, the

transferred certificate / secret key is reflected. The same reflection timing applies when the certificate is deleted.



• Checking user certificate storage status

The storage status of the user certificate can be checked by the SYS_GetFTPCertState function. For details, refer to the *GM1 Series Reference Manual (Instruction Edition)*.

• The user certificate is not transferred when a project is downloaded.

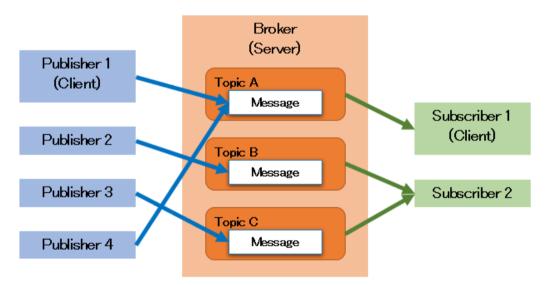
13.8 MQTT Client

13.8.1 What is MQTT?

MQTT stands for Message Queuing Telemetry Transport. It is a simple and lightweight publish/ subscribe messaging protocol.

This protocol allows asynchronous many-to-many communication by a mechanism called "topic" designed to identify messages. Messages are sent and received through an intermediary called a broker server, and thus MQTT enables a device to communicate with another device on the opposite side without being conscious of the opposite device. In addition, since the intermediary is responsible for most of message management, the number of connected client devices can be readily increased. Another feature is that client devices can be freely connected to and disconnected from the broker server. Generally, the amount of information necessary for exchange is small, and this helps to reduce the burden on CPUs and power consumption.

Because of these features, MQTT is widely adopted for IoT applications and is a protocol effective in a system for control among a large number of devices, as well as data logging, traceability, and other communication with a host system.



13.8.2 MQTT Client Specifications

MQTT client specifications with the GM1 controller are described below.

• MQTT Client Specifications

Item	Details
Usable port	LAN ports 1, 2
MQTT protocol version	Version 3.1.1 Version 5.0
Data size	Max. 6000 bytes per packet (payload part Max. 4096 Bytes) (Note 1)
Торіс	Topic name : Max.1024 characters Topic level : Max.10
Communication constraints	Max. 20 publishes/subscribes per connection Max. 3 connections
Supported QoS	 QoS0 (publish at most once) QoS1 (publish at least once) QoS2 (publish exactly once)

(Note 1) This applies to the MQTT protocol packet size out of the total packet.

• List of supported functions

Туре	Function	Overview	MQTT Version		
				5.0	
Connect ion	KeepAlive	Specifies an interval during which connection closing is judged	0	0	
	Will Message	Specifies a message that is sent when connection is closed	0	0	
	Will Retain	Specifies if the Will Message is to be retained	0	0	
	Will QoS	Specifies the QoS level for the Will Message	0	0	
	Clean Session	Specifies a session used for connection with the broker server	0	0	
	User authentication	Connection using a user name and password	0	0	
	Client ID	Specifies a client identifier	0	0	
	Ping Interval	Specifies an interval at which a ping request (existance check) is sent	0	0	
	TLS connection	Connection encrypted by TLS	×	×	
	WebSocket connection	Connection using WebSocket	×	×	
	Reason Code	An output value of the detailed result of an operation	×	0	
	Session Expiry Interval	Specifies how long to retain the session after a disconnect	×	0	
	Enhanced authentication	Using other forms of authentication	×	×	

Туре	Function	Overview	MQTT Version		
			3.1.1	5.0	
	Request Problem Information	Specifies the way an operation result is received	×	0	
	Request Response Information	Requests the server to return Response Information (runs on request/response format)	×	×	
	Receive Maximum	Specifies the number of messages that the client can process concurrently	×	0	
	Topic Alias Maximum	Specifies the number of Topic Aliases that the client can receive	×	×	
	Maximum Packet Size	Specifies a Maximum Packet Size value	×	0	
	Payload Format Indicator	Specifies a format for the Will Message	×	0	
	Message Expiry Interval	Specifies an interval for the expiry of the message	×	0	
	Content Type	Specifies a type of the content of the Will Message	×	×	
	Response Topic	The topic name for a response message (runs on request/response format)	×	0	
	Correlation Data	Specifies correlation data (runs on request/response format)	×	0	
	Will Delay Interval	Specifies a delay that occurs before the Will Message is sent	×	0	
	User Property	User-defined properties	×	0	
Publish	Re Delivery	Specifies the re-delivery flag (DUP Flag)	0	0	
	Retain	Specifies a message store setting	0	0	
	Payload Format Indicator	Specifies a format for the message	×	0	
	Message Expiry Interval	Specifies an interval for the expiry of the message	×	0	
	Content Type	Specifies a type of the content of the message	×	×	
	Response Topic	The topic name for a response message (runs on request/response format)	×	0	
	Correlation Data	Specifies correlation data (runs on request/response format)	×	0	
	Subscription ID	The identifier of the subscription (for the broker)	×	×	
	Topic Alias	Specifies a Topic Alias value	×	0	
	User Property	User-defined properties	×	0	
Subscri be	Subscription ID	Specifies the identifier of the subscription	×	0	
DE	Correlation Data	Reception of correlation data (runs on request/response format)	×	0	
	No Local Option	The setting of reception of messages from the same client	×	0	
	Retain As Published	The setting of the Retain flag in a forwarded message	×	×	

13.8 MQTT Client

Туре	Function	Overview	MQTT Version	
			3.1.1	5.0
	RetainHandling	Setting of whether or not to receive retained messages at the time of subscribing	×	0
	User Property	User-defined properties	×	0

13.9 DNS client

13.9.1 What is DNS?

DNS stands for the Domain Name System and refers to a system that manages a mapping between the name of a domain or a host on the network and its IP address. A DNS server has information about mappings between domain names and IP addresses. In response to a query containing a "host name" as a key from a DNS client, the DNS server sends back a corresponding "IP address".

The GM1 controller can obtain an IP address corresponding to a domain name from a DNS server through an FB of a DNS client.

13.10 NTP client

13.10.1 What is NTP?

NTP stands for the Network Time Protocol and is a communication protocol used to synchronize time between systems in a server/client model. A mechanism for time synchronization operates by allowing an NTP client to send a query about time to a NTP server and obtain a response. Handled time information is defined as the number of seconds that have elapsed since 00:00:00 UTC on January 1 in 1970, and the NTP mechanism allows the synchronization of time in units of milliseconds.

The GM1 controller supports the Simple Network Time Protocol (SNTP), a simplified version of NTP. The GM1 controller can obtain time information from an SNTP server through an FB of SNTP client communication.

14 Management Function

14.1 Security Function	14-3 14-16
 14.2 Interface Function	14-26 14-29 14-31
14.3 SD Card Access Function14.3.1 Overview of SD Card Access Function	14-37
14.4 External File Functions14.4.1 Setting up an External File Object	
 14.5 Recipe Manager Functions 14.5.1 Setting the Recipe Manager 14.5.2 Setting the Recipe Definition 14.5.3 Recipe Operation Using the GM Programmer 14.5.4 Recipe operation using instructions in the POU 14.5.5 Saving and restoring persistent variables 	14-41 14-44 14-46 14-49
 14.6 Project Management Function	14-56 14-58 14-59
14.7 SD card log storage function14.7.1 What is SD card log storage function?14.7.2 How to save logs in SD card	14-61
14.8 Firmware Version Upgrade Function14.8.1 Checking Unit Configuration14.8.2 Unit Version Upgrade	14-63
 14.9 Servo Amplifier / Motor Operation Function (PANATERM Lite for GM) 14.9.1 Starting PANATERM Lite for GM 	

Stop

14.1 Security Function

GM Programmer is equipped with a security function that can implement user management (project user management and device user management) and encrypt project files. This section explains security-related functions such as user management and project encryption, and the procedures for operating each security function.

- Each user ID and their corresponding password must be different character strings.
- Password strength must be sufficiently high. Do not use any passwords that can be easily guessed.
- Accounts must be managed properly and must not be shared unnecessarily.
- Use this controller in a secure network environment.
- Use encryption functions properly to protect information assets.
- Use the device user management function to perform authentication protection for the controller during operation.
- After logging in with the initial password, be sure to change the password.
 - Implement password management to prevent passwords from being forgotten. If the password is forgotten, device reset must be performed on the controller.
 - Implement password management to prevent passwords from being leaked to third parties.

Item	Description	Reference page
User management	Allows execution permissions for operations (such as executing menu commands and adding, editing, and deleting objects) to be assigned to each group in which users are registered.	"P.14-3"
	User management also enables logins to be permitted by assigning permission for login to the device to each user and entering passwords.	
Encryption / signature	Provides password-based encryption for project files and encrypts connections between the GM1 controller and the PC.	"P.14-16"
Write-protection	Provides write-protection for project files and prevents project files from being modified unintentionally by mistake.	"P.14-24"

14.1.1 User Management

Project user management allows execution permissions for operations (such as executing menu commands and adding, editing, and deleting objects) to be assigned to each group in which users are registered. Logon must be performed by a user of a privileged group.

Device user management also enables logins to be permitted by assigning permission for login to the device to each user and entering passwords.

Project User Management

When a new project is created, Owner users, Owner group, and Everyone group are already registered.

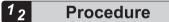
Owner users belong to Owner group and can execute all operations.

All users including Owner users are automatically registered in Everyone group.

Group	User	Remarks
Owner	Owner	Users can execute all operations. For Owner users, the password field is left blank.
Everyone	Owner	All users are registered automatically.

Creating a New User and Group

In the following example, a group (group name: GroupA) and a user belonging to the group (user name: Fred) are newly created and privileges are set so that users belonging to GroupA can access POU object "POU_1".



1. From the menu bar, select **Project >Project Settings**.

The "Project Settings" dialog box will be displayed.

Compile options Compiler warnings Page Setup	SFC Flags Build				
Security	Use Varia	able	Declare	Description	^
SoftMotion	SFCI	nit	\checkmark	All steps and actions are reset. T	
Static Analysis Light	SFCF	leset	\checkmark	All steps and actions are reset. T	
Users and Groups	SFCE	rror	\checkmark	Gets 'TRUE', if a time check failed	
Cocro una croapo	SFCE	nableLimit	\checkmark	Enable time check on steps	
	SFCE	rrorStep	\checkmark	Contains the name of the step th	
	SFCE	rrorPOU	\checkmark	Contains the name of the POU th	
	SFCC	JuitError	\checkmark	Execution is stopped. SFCError is	
	SFCF	ause	\checkmark	Execution is stopped. SFCError is	
	SFC1	rans	\checkmark	Gets 'TRUE', if a transition switch	
	SFC0	CurrentStep	\checkmark	Contains the name of the active :	
	SFCT	īp	\checkmark	Switches the next transition on a	v
	<			>	
	Apply to A	I			

2. In the "Project Settings" dialog box, select the "Users and Groups" category.

The "Users and Groups" setting pane will be displayed.

Project Settings	Users and Groups		×
Compiler warnings Page Setup Security SFC SoftMotion	Users Groups Settings Name Full name B-S Owner	Description	
Static Analysis Light Static Analysis Light Users and Groups	Export/Import	Add	Edt <u>R</u> enove
			OK Cancel

3. Click the [Add] button.

The "Add User" dialog box will be displayed.

Add User	>
<u>A</u> ccount properties Logon name	
<u>F</u> ull name	
<u>D</u> escription	
Old password	
<u>P</u> assword	
Confir <u>m</u> password	
Acti <u>v</u> e	
Memberships	
Owner	
This user is also memb	er of the 'Everyone' group.
	OK Cancel

Enter information for a new user to be added.
 Enter information about a new user (Fred) to be added.

Account properties	Fred	
	Fred	
Evil anna		
<u>F</u> ull name	Fred	
<u>D</u> escription	TestUser	
Old password		
<u>P</u> assword	*****	
Confir <u>m</u> password	*****	
Acti <u>v</u> e	\checkmark	
Memberships		
This user is also memb	er of the 'Everyone' group.	

5. Click the [OK] button.

The "Logon" dialog box will be displayed. To add a new user, you must log in as an Owner user.

6. In the "User name" field, enter "Owner".

The default password for "Owner" is not set in the Password field. The "Password" field must be left blank.

Logon			×
P		this action, you must logon as a user which is e following groups:]
	Please enter your us	ser name and password	
	<u>U</u> ser name	Owner	
	Pass <u>w</u> ord		
	8	OK Cancel	

7. Click the [OK] button.

Login by the Owner user will be completed and new user "Fred" will be added to the "Users" tab pane.

Project Settings					×
Compile options Compiler warnings	Users and Gr Users Groups Se				
Security	Name	Full name	Description		
 SoftMotion Static Analysis Light 	🗄 🤮 Fred	Fred	TestUser		
Se Users and Groups		7			
	Export/Import		<u>A</u> dd	<u>E</u> dit	<u>R</u> emove
				OK	Cancel

The name ("Owner") of the user who logged on is displayed in the status field.

Last build: 😮 0 🕐 0 🛛 Precompile 🧹	C.	Project user: Owner
------------------------------------	----	---------------------

- Select the "Groups" tab and click the [Add] button. The "Add Group" dialog box will be displayed.
- 9. Enter information for a new group to be added.

Enter information about a new group (GroupA) to be added. In the "Members" section, specify a member that belongs to the group. Select the new user added in step "Step 4".

Ad	ld Group		Х
	<u>G</u> roup Properties <u>N</u> ame <u>D</u> escription	GroupA TestGroup	
	Members		
		OK Cancel	

10. Click the [OK] button.

The new group (GroupA) will be added to the "Groups" tab pane. User "Fred" is registered in GroupA as a member

Project Settings		×
Compile options Compiler warnings Page Setup Cosecurity SrC SoftMotion SoftMotion SoftMotion Users and Groups	Users and Groups Users Groups Settings Name Description Settings Services Services Settings Description Settings Description Settings Settings Description Settings S	
	Egport/Import Add Edit Remove	

11. Click the [OK] button.

The "Project Settings" dialog box will be closed.

This completes the procedure for registering user "Fred" in group "GroupA". After the procedure is complete, the following groups and users exist in the project.

Group	User	Remarks
Owner	Owner	Group whose users can execute all operations
Everyone	Owner, Fred	Group in which all users are registered automatically
GroupA	Fred	Newly added group



• User and group information can be exported in XML format. Click the [Export/Import] button in the "Users and Groups" setting pane and select the "Export users and groups" menu item ". users" files can be exported.

By selecting the "Import User and Group" menu item, you can import ".users" files.

Setting Operation Privileges

In the following example, privileges are set so that users belonging to GroupA can display a POU object (object name: POU_1).

Before performing the following procedure, add a POU object (object name: POU_1) to the project.



1. From the menu bar, select Project>User Management>Permissions.

The "Permissions" dialog box will be displayed.

Permissions	×
Actions # Commands # Object types # Project objects	Permissions + Grant = Deny X Clear Everyone GroupA
* Disers, groups and permissions	Key to the symbols: For this group, permission for the selected actions is
Export/Import	Close

 In the "Action" pane, select the operation to be permitted. Select Project Object>View>Device>Program Configuration>Application>POU_1.

Permissions	×
 A Modify Modify Remove Percent LANPort1 Application Back on Figure 300 Application Application	Permissions Image: Second Se
Export/Import	Close

3. In the "Permissions" pane, set privileges to be assigned.

Select "Everyone" and click — Deny . "Reject" will be set. Select "GroupA" and click — Grant . "Approve" will be set. This enables only the users of group "GroupA" to display the object.

Permissions	
🕂 Grant 💻 Deny 💥 Clear	
- Everyone	
🕂 GroupA	

If the "Logon" dialog box is displayed, enter "Owner" in the "User name" field and leave the "Password" field blank before performing a logon.

Logon			×
P		this action, you must logon as a user which is e following groups:	_
	Owner		
	Please enter your u	ser name and password	_
	<u>P</u> roject/Library	Project: Untitled3	
	<u>U</u> ser name	Owner	
	Pass <u>w</u> ord		
	8	OK Cancel	

4. Click the [Close] button.

The "Permissions" dialog box will be closed.

Permissions	×
Actions ⊛ Commands	Permissions ♣ Grant = Deny 💥 Clear
Command Construction Construction Construction Project objects Construction Project objects Construction Project objects Construction Project objects Construction Project objects Construction Construction Project objects Construction	Key to the symbols: For this group, permission for the selected actions is
Please note: Members of the group 'Owner' are granted all permissions.	
Export/Import	Close

Info.
Settings of operation privileges can be exported in XML format. In the "Permissions" dialog box, click the [Export/Import] button and then select the "Export All Permissions" menu item or "Export selected permissions" menu item ". .perms" files can be exported.

By selecting the "Import Permission" menu item, you can import ".perms" files.

Performing Operation with Privileges Set

In the following example, an object (POU object: POU_1) is displayed.

Before performing the following procedure, check the status field to see that there is no user who is currently logged on the project.

If there are any users who are currently logged on the project, execute logoff by selecting **Project>User Management>User Logoff**.

Last build: 👩 0 😗 0 Precompile 🧹 🛛 🥵 Project user: (nobody))
---	---

12	Procedure
----	-----------

 Double-click the POU_1 object in the navigator pane. The "Logon" dialog box will be displayed with object display operations restricted.

Logon			×
P		this action, you must logon as a user which is e following groups:	
	Please enter your us	ser name and password Project: Untitled3	
			4
	<u>U</u> ser name		4
	Pass <u>w</u> ord		
	¥	OK Cancel	

2. Enter appropriate values in the "User name" field and "Password" field, and click the [OK] button.

Enter the user name and password of the user added in "Creating a New User and Group". Logon will be completed and the POU_1 object will be displayed.

The user name of the user who logged on is displayed on the status field.



Device User Management

Device user management registers device users and allows only the authorized device users to log in to the device.

A user with user name "Administrator" and password "Administrator" is registered as a device user beforehand.

When you log in as an Administrator user for the first time, you must set any password.

¹² Procedure

 Connect the PC where GM Programmer is installed and the GM1 controller. For details, refer to "7.5 Connecting to the GM1 Controller".

Double-click the [Device] object in the navigator pane.

= ()	San	nole 1	-	1
ė	1	Device (AGM1CSRX16T)		
	-	Program_Configuration		1

The Device setting window will be displayed.

Device X		
Communication Settings	Scan Network Gateway - Device -	
Date and Time and Settings		
Applications	I↓ I	
Log		
Users and Groups	Gateway	
Access Rights	Gateway-1	[0347.A064] (active) Device Name:
PLC Shell	localhost	AGM1CSRX16T Device Address:
PLC Parameters	Port: 1217	Device Address: 0347.A064
Task Deployment		Target ID: 16A9 0001
Status		Target Type: 4102
Information		Target Vendor: Panasonic Corporation
Inormation		Target Version:
		1.0.0.0

 Click the "Users and Groups" tab. The "Users and Groups" pane will be displayed.

Communication Settings	💠 😹 📄 Device user: Anonymous		
Date and Time and Settings	To get started, either connect to a device to upload its configuration or load a configuration from disc.		
Applications		⊘ Add	
Log		♥ Import	
Users and Groups	-	🖉 Edit	
Access Rights	-	Delete	
PLC Shell			
PLC Parameters	Groups		
Task Deployment		AddImport	
Status		📝 Edit	
Information		O Delete	

3. Click the [2] icon (Synchronization). A confirmation dialog box will be displayed.

GM Prog	rammer	×
?	Currently, the user management is not activated on the device. Would you like to activate it now? Please note: When activating the user management you will be asked to login as 'Administrator' using the default password. Then you will be asked to enter a new password.	
	<u>Y</u> es <u>N</u> o	

4. Click the [Yes] button.

The "Device User Logon" dialog box will be displayed.

Enter "user name" and "password".
 Enter Administrator in the "User name" field and Administrator in the "Password" field.

Device	User Logon		Х
\swarrow		not authorized to perform this operation on the device. Please enter the nan f an user account which has got the sufficient rights.	ne
	Device Name	Device (AGM1CSRX16T)	
	DeviceAddress		
	<u>U</u> ser Name	Administrator	
	<u>P</u> assword	•••••	
	Operation: Object:	View "Device"	
		OK Cancel	

6. Click the [OK] button.

The "Password expired, please enter a new one" dialog box will be displayed.

7. Enter any password.

To set a password for the Administrator user, enter any password. If you forget your password, you cannot log in to the device.

Password expired, please en	ter a new one!			×
<u>N</u> ame	Administrator			
<u>P</u> assword	•••••			
Confirm password	•••••			
Passwordstrength	Better	✓ Hidepassword		
	Password can be char	iged by user		
	Password must be cha	anged at first login		
			<u>0</u> K	<u>C</u> ancel

8. Click the [OK] button.

The password will be set for the Administrator user and you will be logged in as an Administrator user.

Communication Settings	📀 🖙 🔚 Device user: Administrator	
Date and Time and Settings	Synchronized mode: All changes are immediately downloaded to the device.	
Applications	🗷 🔮 Administrator	Add Import
Users and Groups Access Rights		Edit Delete
PLC Shell	Groups	
PLC Parameters	R-SS Administrator	 Add
Fask Deployment	Beveloper Beveloper Beveloper	 Import
Status	🕫 😫 Service	Z Edit
Information		Delete

9. From the menu that is displayed, select **Online>Login**. You can log in to the device as an Administrator user account.

_					
Device user: Administrator	Last build: 😮 0 🕐 0	Precompile 🧹	ില	STOP	

i Info.

- To log off logged-in users, from the menu bar, select **Online>Security>Logoff Current Device** User.
- You can add or remove device users or change their passwords by using the "Users and Groups" pane.

To add device users:	٥	Ad	ld	
To remove device use	ers:	۰.	Delete	
			-1	Edit

To change device user passwords: device user passwords:

Device X		
Communication Settings	🔕 🗁 🖶 Device user: Administrator	
Date and Time and Settings	Synchronized mode: All changes are immediately downloaded to the device.	
Applications	* S Administrator	⊙ Add
Log		✿ Import
Users and Groups		 Edit Delete
Access Rights		
PLC Shell		

• Users registered by project user management can be imported as device users. Clicking the

• Import... button displays the "Import Users" dialog box. Select a user to be imported and click the [OK] button. In this case, passwords managed by project user management will not be imported. In the "Users and Groups" pane, click the [Edit] button and set a password for the user that has been imported.

• Device user management information can be exported.

In the "Users and Groups" pane, click the [11] icon (Export to Disk).

XML format files (".dum" files) can be saved.

To import ".dum" files that have been exported, click the [22] icon (Import from Disk).

- Device user management information can be initialized by resetting the device.
- If you forget your password, you cannot log in to the GM1 controller. In this case, reset the GM1 controller. For details on how to reset the GM1 controller, refer to the *GM1 Series User's Manual (Hardware)*.

14.1.2 Encryption

This section explains how to encrypt project files.

Encrypting Project Files

Project files can be encrypted using passwords. If a password is set, the password must be entered when a project file is opened.



- From the menu bar, select Project>Project Settings. The "Project Settings" dialog box will be displayed.
- 2. In the "Project Settings" dialog box, select the "Security" category. The "Security" pane will be displayed.

Project Settings		×
Project Settings Compile options Compiler warnings Page Setup Security SFC SoftMotion § Static Analysis Light Users and Groups	Security Enable Project File Encryption(E) Your project file is not protected from unauthorized access and data manipulation. It is highly recommended that you enable the security feature.	×
	OK Cancel	

3. Select the "Enable Project File Encryption" check box, select the Password option, and then enter a password.

Project Settings		×
Compile options	Security	
 Compiler warnings Page Setup 	Enable Project File Encryption(E)	
Security SFC SoftMotion Static Analysis Light	If this option is activated, a dongle is used to encrypt the content of the currently opened project file. The user must plug a dongle whenever the project is loaded, even if it is loaded as library reference.	
Susers and Groups	If you forget the encryption password, your project file will be lost! It is not possible to restore the file contents in this case!	
	New password(P): ••••••• Confirm new password(C): •••••••	
	OK Cancel	

4. Click the [OK] button.

The specified password will be set for project files.

This completes the password setting procedure.

When an attempt is made to open a project file, a window is displayed, asking the user to enter a password. In this situation, enter the specified password.

Encrypting the Communication Path: Encrypting Communications Using the Certificate Possessed by the GM1 Controller

Communications between GM Programmer and the GM1 controller can be encrypted using certificates.

This section explains how to encrypt communications by using the certificate possessed by the GM1 controller as a trusted certificate.



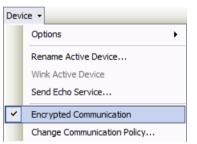
1. Double-click the [Device] object in the navigator pane.

=-: - []	Sample 1	^
Ė	Device (AGM1CSRX16T)	
	Program_Configuration	

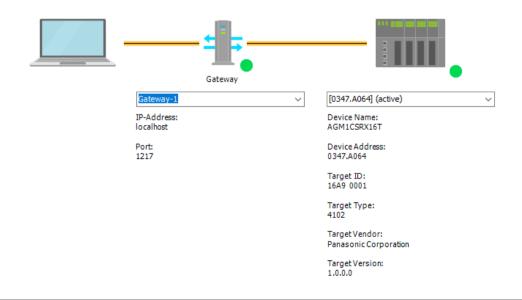
The Device setting window will be displayed. Open the "Communication Settings" tab.

Communication Settings	Scan Network Gateway -	Device 🔹	
Date and Time and Settings		_	
Applications		<u>+</u>	
Log			
Users and Groups		Gateway	[0347.A064] (active)
Access Rights		IP-Address:	Device Name:
PLC Shell		localhost Port:	AGM1CSRX16T Device Address:
PLC Parameters		1217	0347.A064
Task Deployment			Target ID: 16A9 0001
Status			Target Type: 4102
Information			Target Vendor: Panasonic Corporation
			Target Version: 1.0.0.0

2. In the Device menu, select "Encrypted Communication".



If "Encrypted Communication" is selected, the connection lines between the integrated development environment, gateway, and controller will be displayed in yellow.



3. Click the Network Scan menu.

The "Select Device" dialog box will be displayed.

elect Device		
elect the network path to the controller:		
🖃 💏 🖕 Gateway-1 (scanning)	Device Name:	Scan Network
GM1CSRX16T [0347.A064]	Gateway-1	Wink
	Driver: TCP/IP	
	IP-Address: localhost	
	Port: 1217	
	<u>_</u>	<u>C</u> ancel

4. Select the connected GM1 controller and click the [OK] button.

A message window will be displayed, indicating that the certificate of the GM1 controller is not certified with a trusted signature for encrypted communication.

5. If the [OK] button is clicked, communications can be encrypted by installing the certificate indicated by the message in local store "Controller Certificates" on the PC to use it as a trusted certificate.

You can check the registered controller certificate in certmgr.msc in the C:\Windows \System32 folder.

certmgr - [Certificates - Current U	Jser\Controller Certificates\Certificate	s]				-		×
<u>File</u> Action <u>V</u> iew <u>H</u> elp								
🗢 🄿 🙍 📷 🗈 🛛 🗟 🖌	? 🖬							
Certificates - Current User Personal Tusted Root Certification Aut Enterprise Trust Enterprise Trust Intermediate Certification Aut Active Directory User Object Intrusted Certificates Intrusted Certificates Intrusted Reople Intrusted Reople Intrusted People Intrusted People Intermediate Root Reople Intermediate Root Root Reople Intermediate Root Root Root Root Root Root Root Ro	Issued To	Issued By AGM1CSRX16T	Expiration Date 2020/10/18	Intended Purposes Server Authenticati	Friendly Name Encrypted Commu	Status	Certificate	Tem
Controller Certificates Certificates Certificates Controller Certificates Smart Card Trusted Roots Controller Certificates store contains 1	٢							>

When the certificate of the GM1 controller is used as a trusted certificate, the validity period of the certificate is 30 days.

1 Info.

• If the certificate has already expired, the message window shown in step 4 above will be displayed, indicating that the certificate has expired.

By clicking the [OK] button, you can extend the validity period of the certificate.

Encrypting the Communication Path: Encrypting Communications Using a Created Certificate

Communications between GM Programmer and the GM1 controller can be encrypted using certificates.

This section explains how to create a trusted certificate for the GM1 controller and encrypt communications using the created certificate.

2 Procedure

1. Open the device editor and select the "PLC Shell" tab.

Device X
Communication Settings
Date and Time and Settings
Applications
Log
Users and Groups
Access Rights
PLC Shell
PLC Parameters
Task Deployment
Status

 Enter the "cert-getapplist" command in the input field. All certificates that are used will be displayed.

cert-geta	pplist							
Nr.	ComponentName Thumbprint	CommonName		CertAvailable	DateNotBefore		DateNotAft	
0	CmpWebServer	buildroot	FALSE					
1	CmpSecureChannel e8e28f5bc7517f2885bd5d52	AGM1CSRX16T1_Test 7e052ff96fbf7d853	TRUE	2019	9-4-7T0:8:2.0	2019-5-7T0:8:2.0		
2	СтрАрр	AGM1CSRX16T1_Test		FALSE	-			

 Enter the "cert-genselfsigned 1" command in the input field. Create a certificate for ComponentName "CmpSecureChannel".

cert-genselfsigned l Generate selfsigned certificate with given index (l). Check logger to see when finished.

4. Open the "Log" tab of the device editor and click the [Update Information] button. Check whether a certificate has been created.

M Device X						
Communication Settings	! 0 warning(s)	Serror(s) E 0 exception(s	238 information(s) 0 debug message(s) <all components=""></all>	Logger <defau< th=""><th>it logger></th><th>• 📀 🖻</th></defau<>	it logger>	• 📀 🖻
Date and Time and Settings	Offline logg	ing 🔲 UTC time				
	Severity	Time Stamp	Description		Component	
Applications	0	24.11.2020 12:34:39.165	[2] SelfSigned cert created, subject='commonName=buildroot'		CmpOpenSSL	
Log	0	24.11.2020 12:34:20.067	 SelfSigned cert created, subject='commonName=AGM1CSRX16T unstructuredNational CommonName=AGM1CSRX16T 	ame=Vendor: Panaso	CmpOpenSSL	
Log	0	24.11.2020 12:33:55.229	[0] SelfSigned cert created, subject='commonName=AGM1CSRX16T unstructuredNa	ame=Vendor: Panaso	CmpOpenSSL	

5. In the device editor, open the "PLC Shell" tab and enter the "cert-getapplist" command in the input field.

Check whether a certificate has been created for ComponentName "CmpSecureChannel".

cert-	getapplist						
Nr.	ComponentName Thumbprint	CommonName		CertAvailable	DateNotBefore	DateNotAfter	
0	CmpWebServer CmpSecureChannel	buildroot AGM1CSRX16T1_Test	FALSE TRUE		I-7T0:43:37.0		
2	e8e78074837da953e41 CmpApp	b94b82d8ae6bcf0bc9bad AGM1CSRX16T1_Test		FALSE			

6. Open the device editor and select the "Communication Settings" tab.

Device X			•
Communication Settings	Scan Network Gateway 👻	Device 🕶	
Date and Time and Settings		_	
Applications	_	<u>+</u>	
Log		"	
Users and Groups		Gateway	[0347.A064] (active)
Access Rights		IP-Address: localhost	Device Name: AGMICSRV16T
PLC Shell		Port:	Device Address:
PLC Parameters		1217	0347.A064 Target ID:
Task Deployment			16A9 0001
Status			Target Type: 4102
Information			Target Vendor: Panasonic Corporation
			Target Version: 1.0.0.0

7. In the Device menu, select "Encrypted Communication".

Device 🔻		
	Opt	tions •
	Rer	name Active Device
	Win	k Active Device
	Sen	nd Echo Service
~	Enc	rypted Communication
	Cha	ange Communication Policy

If "Encrypted Communication" is selected, the connection lines between the integrated development environment, gateway, and controller will be displayed in yellow.

Gateway			
Gateway-1	\sim	[0347.A064] (active)	\sim
IP-Address: localhost		Device Name: AGM1CSRX16T	
Port: 1217		Device Address: 0347.A064	
		Target ID: 16A9 0001	
		Target Type: 4102	
		Target Vendor: Panasonic Corporation	
		Target Version: 1.0.0.0	

8. Click the Network Scan menu.

The "Select Device" dialog box will be displayed.

Select Device	×
Select the network path to the controller:	
Select the network path to the controller:	Device Name: Scan Network Gateway-1 Wink Driver: TCP/IP IP-Address: localhost localhost Port: 1217 1217
	<u>OK</u>

9. Select the connected GM1 controller and click the [OK] button.

A message window will be displayed, indicating that the certificate of the GM1 controller is not certified with a trusted signature for encrypted communication.

GM Prog	rammer	×
?	The certificate of device 'AGM1CSRX16T' has expired. Thumbprint [3B641E13413CD2DD4FACA84B99E81062F33D0DD9] SERIALNUMBER=000A35000001, OID.1.2.840.113549.1.9.2=Device: AGM1CSRX16T, OID.1.2.840.113549.1.9.2=Vendor: Panasonic Corporation, CN=AGM1CSRX16T Do you want to continue nevertheless or cancel connecting to the device?	
	OK Cancel	

 If the [OK] button is clicked, communications can be encrypted by installing the certificate indicated by the message in local store "Controller Certificates" on the PC to use it as a trusted certificate.

You can check the registered controller certificate in certmgr.msc in the C:\Windows \System32 folder.

🖀 certmgr - [Certificates - Current User\Controller Certificates\Certificates]						-		×
<u>File</u> <u>Action</u> <u>View</u> <u>H</u> elp								
🗢 🔿 🙍 📆 📋 🙆 🛃								
Certificates - Current User Personal Trusted Root Certification Aut Certificated Root Certification Aut Certificates Trusted Publishers Trusted Publishers Trusted Perople Certificates Certificates Cerificates Certificates	Issued To	Issued By AGM1CSRX16T	Expiration Date 2020/10/18	Intended Purposes Server Authenticati	Friendly Name Encrypted Commu	Status	Certificate	Tem
Smart Card Irusted Roots Controller Certificates store contains 1	<							>

When the created certificate is used as a trusted certificate, the validity period of the certificate is 360 days.

14.1.3 Write-protection

This section explains how to implement write-protection for project files to prevent project files from being modified unintentionally by mistake.

Opening Files in Read-only Mode

Open a project file in read-only mode.

When selecting a project file to be opened, select the "Open in Read-only Mode" check box.

File <u>n</u> ame:	Sample1 project 🗸 🗸]	Open
Files of <u>type</u> :	Project files(* project)		Cancel
	🗹 Open as read-only		

If a file is opened in read-only mode, it cannot be saved.

To save a project file, select "Project file cannot be saved. Click for options" on the menu bar and select an appropriate menu item that is displayed.

Project file cannot be saved. Click for options...

Save the project under a different file name on disk...

Leave the read-only mode.

Item	Description		
Save the project under a different file name on disk	Allows the user to rename and save the project file as a writable file.		
Leave the read-only mode	Leaves the project file open in read-only mode.		

Setting the "Released" Flag

Set a "released" flag in project information in a project file.

If a "released" flag is set in a project file, changes made in the file cannot be saved.

From the menu bar, select **Project Project Information**, and open the "Summary" tab window and then select the "Released" check box.

Project Information	×	
Summary File		
<u>C</u> ompany:		
<u>T</u> itle:		
<u>V</u> ersion:	✓ <u>R</u> eleased	
Library Categories:		
De <u>f</u> ault namespace:		
<u>A</u> uthor:		
Description:	^	
	~	
The fields in bold lett	ers are used to identify a library.	
Automatically generate	'Library Information' POUs	
Automatically generate	'Project Information' POUs	
	OK Cancel	

To save a project file in which the "Released" flag is set, select "Project file cannot be saved. Click for options" on the menu bar and select a menu item that is displayed.

۵	Project file cannot be saved. Click for options	
	Unset the "Released" flag in the Project Information.	

14.2 Interface Function

The interface object defines common methods and properties that are used between different function blocks in the same way.

The interface object is one of the means of implementing object-oriented programming. The interface object contains only method and property declarations but does not contain implementation.

14.2.1 Setting up an Interface Object

This section explains how to add an interface object.



 Right-click the "Application" object in the navigator pane and then select Add Object>Interface from the context-sensitive menu that is displayed. The "Add Interface" dialog box will be displayed.

Add Interface	×
↔ Create a new interface	
Name	
Inheritance	
Extends	
Add Cancel	

Enter a name and click the [Add] button.
 An interface object will be added.
 If the "Extends" check box is selected, the interface entered in the input field can be inherited and extended.

□ 🗐 Program_Configuration								
🖹 🔘 Application								
🧭 GVL								
⊶ ITF								
🗂 📶 Library Manager								
MC_PRG (PRG)								
🖃 🎆 Task Configuration								
🖹 🗀 1.Motion								
🖃 🍪 MotionTask								
MC_PRG								
··· 🗀 2.User								
3.System								
🚭 Trace								

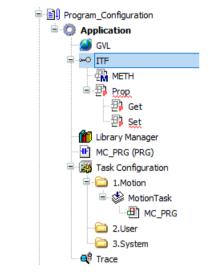
 Right-click the "ITF" object added to the navigator pane and then select Add Object>Interface property or method from the context-sensitive menu that is displayed. The "Add Interface property" dialog box or "Add Interface method" dialog box will be displayed.

Add Interface property		×	Add Int	erface method		×
🕀 Create a new pro	perty		Ð	Create a new method		
<u>N</u> ame Prop		~	<u>N</u> ame METH			~
Return type			<u>R</u> eturn	type		
	Add	Cancel			Add	Cancel
					1	

* For interface properties, the data type of return values must be entered.

4. Enter a name and click the [Add] button.

For interface properties, be sure to enter a value in the "Return type" field. "Prop" or "METH" object will be added under the "ITF" object.



5. The added "METH" and "Prop" objects are used to define methods and properties, respectively.

This completes the procedure for creating an interface object.

14.2.2 Implementing in New Function Block

This section explains how to implement an interface in a new function block to be created.

1₂ Procedure

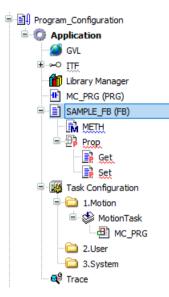
 Right-click the "Application" object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed.

The "Add POU" dialog box will be displayed.

Add POU ×
Create a new POU (Program Organization Unit)
<u>N</u> ame
SAMPLE_FB
Туре
○ <u>P</u> rogram
Function <u>b</u> lock
Extends
⊡ Implements ITF
Final Ab <u>s</u> tract
<u>A</u> ccess specifier
~
Method implementation language
Structured Text (ST) 🗸 🗸
○ <u>F</u> unction
<u>R</u> eturn type
Implementation <u>l</u> anguage
Structured Text (ST) V
Add Cancel

2. Enter a name. In the Type section, select the Function block option, select the "Implements" check box, and enter an interface to be implemented. Click the [Add] button.

A function block with the interface implemented will be added under the "Application" object.



3. Open the respective editors for the added "METH" and "Prop" objects, and implement internal processing for the methods and properties.



• If methods and properties are added under the "interface" object later, they will not be automatically added to the function block with the interface implemented. Therefore, if they need to be added, perform the procedure starting from "Step 3" 3 in "14.2.3 Implementing in Existing Function Block".

14.2.3 Implementing in Existing Function Block

This section explains how to implement an interface in an existing function block.

1₂ Procedure

1. Open the editor of the existing function block from the navigator pane.

Character string format



Table format

SAMPLE_FB X								•	
۵ 🔇	$ * \times $		_			FUNCTION_E	LOCK SAMPLE_FB		N
^	Scope	Name	Address	Data type	Initialization	Comment	Attributes		

2. For character string format, add "IMPLEMENTS <interface name>" to the declaration header section. For table format, open the "Edit Declaration Header" dialog box, enter an interface name in the "IMPLEMENTS" field, and click the [OK] button.

Character string format

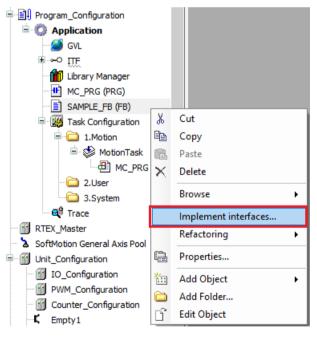


Table format

Edit Decla	ration Header		×
Declarat	tion		
FUNCTI	ON_BLOCK ~	SAMPLE_FB	
	EXTENDS		
	IMPLEMENTS	ΠF	
Commer			>
	outes	Il references on rename.	ancel

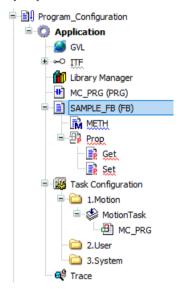
3. Right-click the existing function block in the navigator pane and select "Implement Interfaces" from the context-sensitive menu that is displayed.

The "Select implementation language" dialog box will be displayed.



Select Implementation Language	×
Method and property implementation language	
Structured Text (ST)	\sim
ОК	Cancel

4. Select a desired programming language and click the [OK] button. The method and property objects will be added under the function block object.



5. Open the respective editors for the added "METH" and "Prop" objects, and implement internal processing for the methods and properties.

Note

• If methods and properties are added under the "interface" object later, they will not be automatically added to the function block with the interface implemented. Therefore, if they need to be added, perform the procedure starting from Step "Step 3".

f Info.

• When methods and properties are implemented, warning messages are automatically implemented. Therefore, when compilation is executed, the following warning messages are displayed.

Messages - Total 5 error(s), 5 warning(s), 0 message(s)					•
Precompile	 S error(s) S warning(s) 🚺	0 message(s) 🛛 🗙 🕷		
Description			Project	Object	Position
C0373: Add method implementation			Untitled8	METH [Device: Progr	Line 1 (Ded)
C0373: Add property implementation			Untitled8	Set [Device: Progra	
C0373: Add property implementation			Untitled8	Set [Device: Progra	
C0373: Add property implementation			Untitled8	Get [Device: Progra	
C0373: Add property implementation			Untitled8	Prop [Device: Progr	Line 1

These warning messages do not indicate any problems. However, to prevent particular warning messages from being displayed, from the menu bar, select **Project>Project Settings** and then clear the check boxes of the target warning messages in the Compiler Warnings pane.

roject Settings			
Compile options	Compiler warnings		
Compiler warnings			
🗐 Page Setup	Warnings		^
3 Security	C0354: Comparison of one enumeration type () with a	~	
SFC	C0355: A single bit cannot be referenced. A reference t	~	
SoftMotion	C0357: POU '' has been marked as obsolete:	~	
Static Analysis Light	C0370: Instance '' is called more than once.	~	
Users and Groups	C0371: Access to VAR_IN_OUT '' declared in '' from	~	
	C0373: User defined warning generated by warning pra	~	
	C0388: Consider declaring VAR_IN_OUT string variable '	~	
	C0389: VAR_IN_OUT parameter '' of '' needs variab	~	
	C0394: Compatibility warning: FB_Exit is now called in	~	
	C0404: The used compilerversion is deprecated. Please	~	
	C0406: Implicit check function call of not possible, be	~	
	C0410: COMPATIBILITY WARNING: A write Access to a	~	
	C0421: Use keyword EXTENDS for inheritance of interfa	~	_
	C0422: Variable '' has a granularity of but is locate	~	_
	C0426: At least one statement is expected	~	-
			~
	OK		Cancel
	- OK		Cancel

14.2.4 Extending the Interface

Existing interfaces can be inherited and extended.

This section explains how to extend existing interface "ITFBase" and create new interface "ITFExtend".

In this example, when interface "ITFBase" exists, create a new interface as below.

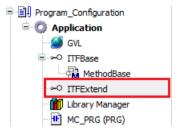


 Right-click the "Application" object in the navigator pane and then select Add Object>Interface from the context-sensitive menu that is displayed. The "Add Interface" dialog box will be displayed.

Add Interface			×
⊶O Create a	a new interface		
Name			
ITFExtend			
Inheritance			
<u> </u>	ITFBase		
		Add	Cancel

2. In the "Add Interface" dialog box, select the "Extends" check box and enter an interface to be inherited.

Interface "ITFExtend" will be created.



- Right-click the "ITFExtend" object added to the navigator pane and then select Add Object>Interface property or method from the context-sensitive menu that is displayed in order to add a property or method for the "ITFExtend" object.
- Right-click the "Application" object in the navigator pane and then select Add Object>POU from the context-sensitive menu that is displayed. The "Add POU" dialog box will be displayed.

Add POU	×
Create a new POU (Program Organization Unit)	
<u>N</u> ame	
SAMPLE_FB	
Type	
○ <u>P</u> rogram	
Function <u>b</u> lock	
Extends	
☑ Implements ITFExtend	
Final Ab <u>s</u> tract	
Access specifier	
~	
Method implementation language	
Structured Text (ST) 🗸 🗸	
O <u>F</u> unction	
Return type	
Implementation <u>l</u> anguage	
Structured Text (ST)	1
Add Cancel	

5. Enter a name. In the Type section, select the Function block option, select the "Implement" check box, and enter "ITFExtend". Click the [Add] button.

A function block with properties and methods for both interfaces "ITFExtend" and "ITFBase" will be added under the "Application" object.

14.3 SD Card Access Function

14.3.1 Overview of SD Card Access Function

The GM1 controller allows directories and files to be written to and read from the SD card via the CAA File library.

Preparation for SD card access

- 1. Before starting operation using the CAA File library, always use the following function of the Panasonic_GM_System library to check whether the SD card can be accessed.
 - a) SYS_GetSDAccessRdy: Reads the mount state of the SD card

TRUE: SD card is accessible. An SD card has been inserted.

FALSE: SD card is inaccessible. No SD card has been inserted.

- 2. Considering situations such as removal of the SD card during operation, use the following function to check whether the SD card cover is open or closed.
 - a) SYS_GetSDCoverState: Reads the open / closed state of the SD card slot cover TRUE: The SD card slot cover is closed.

FALSE: The SD card slot cover is open.

When the SD card slot cover is open, the SD card can be removed safely by stopping processing such as writing or reading directories or files using the CAA File library.

MC_PRG X					
Device.Application.MC_PRG					
Expression	Туре	Value	Prepared value	Address	Comment
bMount	BOOL	FALSE			
Ø bCover	BOOL	TRUE			
<pre>1 bMount FALSE :=SYS_GetSDAccessRdy();</pre>					
2 bCover TRUE :=SYS_GetSDCoverState(); RETURN					

14.3.2 File Manipulations Using the CAA File Library

This section explains how to use the CAA File, in the following order.



1. Double-click "Library Manager" in the Navigator window



2. Check that the following CAA File library is registered in Library_Manager.

👔 Library Manager 🗙				
🗄 Add Library 🗙 Delete Library 🛛 😁 Properties 👼 Details 🛛 💷 Placeholders 🎁 Library Repository 🕕 Icon legend				
Name	Namespace	Effective version		
🕮 🗠 🕑 3SLicense = 3SLicense, 3.5.14.0 (3S - Smart Software Solutions GmbH)	_3S_LICENSE	3.5.14.0		
🖗 📒 BreakpointLogging = Breakpoint Logging Functions, 3.5.5.0 (3S - Smart Software Solutions GmbH)	BPLog	3.5.5.0		
🖲 📒 CAA File = CAA File, 3.5. 15.0 (CAA Technical Workgroup)	FILE	3.5.15.0		
🗄 📙 CAA NetBaseSrv = CAA Net Base Services, 3.5.15.0 (CAA Technical Workgroup)	NBS	3.5.15.0		
CAA SerialCom = CAA SerialCom, 3.5.15.0 (CAA Technical Workgroup)	COM	3.5.15.0		
🕮 📙 IoDrvEthernet = IoDrvEthernet, 3.5.15.0 (3S - Smart Software Solutions GmbH)	IoDrvEthernet	3.5.15.0		
IoDrvRTEX = IoDrvRTEX, 0.6.8.2 (Panasonic Corporation)	IoDrvRTEX	0.6.8.2		

For reference programs, please refer to the GM1 Series Reference Manual (Instruction)...

14.4 External File Functions

The external file object allows text files, image files, and other files to be saved in the project.

14.4.1 Setting up an External File Object

This section explains how to add an external file object.



Procedure

 Right-click the "Application" object in the navigator pane and then select Add Object>External File from the context-sensitive menu that is displayed. The "Add External File" dialog box will be displayed.

Add External File X
Create a reference to an external file
<u>F</u> ile path
Name
External File
What do you want to do with the external file?
Remember the link Remember the link and embed into project Embed into project
When the external file changes, then
<u>r</u> eload the file automatically
◎ prompt whether to reload the file ○ do nothing
Display File Properties
Add Cancel

2. In the File path field, specify a file to be registered. In the Name field, enter the name of the file.

In the "What do you want to do with the external file?" section, select an appropriate option as the method for registering the external file in the project.

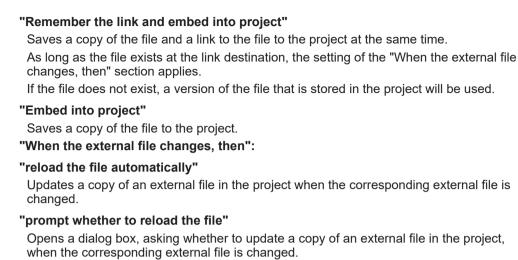
If you select the "Remenber the link and embed into project" option in the "What do you want to do with the external file?" section, select an appropriate option in the "When the external file changes, then" section to specify settings for update processing to be performed when the external file is changed.

"What do you want to do with the external file?":

"Remember the link"

Stores only the path to the file in the project.

If the file does not exist at the link destination, it cannot be used in the project.



GM Prog	rammer	×
?	'C:\Work\01-work\21-GM1\80-Sample\sample26\Sample.txt' This file has been modified outside of GM Programmer. Do you want to reload it?	
	Yes <u>N</u> o	

"do nothing"

Does not update a copy of an external file in the project even if the corresponding external file is changed.

3. Click the [Add] button.

The external file will be added under the "Application" object.

f Info.

• When the added external file is opened in GM Programmer, a copy of the file is temporarily created in the following folder:

C:\Users\<user name>\AppData\Local\Temp

• Files added as "external file" objects cannot be accessed from programs such as POU.

14.5 Recipe Manager Functions

With the Recipe Manager, you can add recipes and alos switch and control the recipe data.

14.5.1 Setting the Recipe Manager

This section explains how to add and set Recipe Manager objects.



 Right-click the "Application" object in the navigation pane and select Add Object >Recipe Manager from the context-sensitive menu that is displayed.

The "Add Recipe Manager" dialog box will be displayed.

Add Recipe Manager	×
Create a Recipe Manager	
Name	
RecipeManager	
	Add Cancel

2. Click the [Add] button.

 The Recipe Manager setting window will be displayed. The default settings can be used as is. You can also make settings if necessary.
 ■Strage

It is displayed when you select **Recipe Manager >Storage** tab.

ge General			
Storage type	xtual		~
File path			
File extension .tx	trecipe		
Separator			
) Tab	 Semicolon 	O Comma	
) Space	• :=	01	
Available Columns © Type © Name © Comment © Minimal Value © Maximal Value	>>><<	Selected Columns	
Save as Default		Up	Down

Setting items		Overview
	Textual	The recipe file is written in text format.
Storage type	Binary	The recipe file is written in binary format. Please do not use this setting.
File path		Set the path where you want to save the recipe file. The path that can be specified is under the root directory of the SD card. Examples Recipe\ ^(Note 1)
File extension		Specify the extension of the recipe file. Possible to set a desired name with up to 10 characters.
Separator	Tab/Semicolon/ Comma/Space/ ":=" / " "	Specify the delimiter within the recipe file. If you do not set the same settings as when saving, it will not be loaded correctly. Ex. Description in the recipe file when ": =" is selected AAA:=1 (Variable := Current Value) BBB:=12 (Variable := Current Value)
Available Columns	Variable Current Value Type Name	It is a list of information that can be described in the recipe file. The information registered in this list is not saved in the recipe file.
Selected digits ^(Note 2) (Note 3) (Note 4)	Comment Minimal Value Maximal Value	Specifies the information and the order in which it is stored in the recipe file. It will not be loaded correctly unless the settings are the same as when saving. The "Current Value" is always registered.
Save as Defalt		Please do not use this.

(Note 1) Enter backslash "\" at end of folder.

(Note 2) "Selected Columns" must need "Variable" and "Current Value".

(Note 3) When loading a recipe from the Recipe Manager menu, all items written to the recipe file in the "Selected Columns" setting are loaded into the recipe definition. (Note 4) When using "Minimal Value" and "Maximal Value", be sure to register both in the "Selected Columns".

∎General

It is displayed when you select **Recipe Manager >General** tab.

For details, refer to the GM1 Series Reference Manual Instruction Edition.

Storage	General	
Recip	pe Management in the PLC	
Sav	ve Recipe	
	Save recipe changes to recipe files automatically	
Loa	ad Recipe	
۲	Load only by exact match of variable list	
0	Load matching variables by variablename	
Write R	Recipe	
• Lim	it the variable to min/max when recipe value is out of the range	
	not write to a variable when the recipe value is out of the min/max range	
Read R	Recipe	
Che	eck recipe for changes	

Setting items		Overview	
Recipe Management in the PLC		"Save Recipe" setting, "Load Recipe" setting, and instructions by POU are possible.	
Save Recipe	Save recipe changes to recipe files automatically	Each recipe set in the recipe definition is automatically saved in the recipe file when you log in to the GM1.	
Load Recipe	Load only by exact match of variable list	The recipe value is loaded only if the recipe file contains all the variables in the variable list of the recipe definition and they are listed in the same order as the "Selected Columns".	
	Liad matching variables by variablename	Only variables with the same name in the recipe file and the recipe definition will be loaded with the recipe value.	
Write Recipe	Limit the variable to min/max when recipe value is out of range	When writing the recipe value to the "Current Value", if the value is outside the range of "Minimal Value" / "Maximal Value", the minimal value or maximal value is written.	
	Do not write to a variable when the recipe value is out of the min/max range	When writing the recipe value to the "Current Value", if the value is outside the range of the "Minimal Value" / "Maximal Value", the value is not written and the "Current Value" is retained.	
Read Recipe	Check recipe for changes	A file check is performed when the ReadAndSaveRecipe method is called. It also enables the	

Setting items	Overview
	RecipeManCommands.prvCompareRecipe method. ^(Note 5)

(Note 1) For details, refer to the GM1 Series Reference Manual (Instruction).

14.5.2 Setting the Recipe Definition

¹² Procedure

 Right-click the "Recipe Manager" object and in the navigation pane and select Add Object>Recipe Definition from the context-sensitive menu that is displayed. The "Add Recipe Definition" dialog box will be displayed.

Add Recipe Definition		×
Create a new Recipe De	efinition	
Name		
Recipes		
	Add C	ancel

- **2.** Enter a recipe definition name and click the [Add] button. Possible to set a desired name with up to 35 characters.
- **3.** Move the cursor to below the variable, enter a variable name you want to add to the recipe definition.

🔍 SettingData 🗙							
Variable		Туре	Name	Comment	Minimal Value	Maximal Value	Current Value
GVL.stSettingData							

If you enter an array or structure, a list of developed variables is automatically registered.

However, since it takes time for the development if the number of elements is large, implement this only after saving the project in advance.

Variable	Туре	Name	Comment	Minimal Value	Maximal Value	Current Value
GVL.stSettingData.int_val[0]	INT					
GVL.stSettingData.int_val[1]	INT					
GVL.stSettingData.int_val[2]	INT					
GVL.stSettingData.int_val[3]	INT					
GVL.stSettingData.int_val[4]	INT					
GVL.stSettingData.int_val[5]	INT					
GVL.stSettingData.int_val[6]	INT					
GVL.stSettingData.int_val[7]	INT					
GVL.stSettingData.int_val[8]	INT					
GVL.stSettingData.int_val[9]	INT					
GVL.stSettingData.real_val[0]	REAL					
GVL.stSettingData.real_val[1]	REAL					
GVL.stSettingData.real_val[2]	REAL					
GVL.stSettingData.real_val[3]	REAL					
GVL.stSettingData.real_val[4]	REAL					
GVL.stSettingData.real_val[5]	REAL					
GVL.stSettingData.real_val[6]	REAL					
GVL.stSettingData.real_val[7]	REAL					
GVL.stSettingData.real_val[8]	REAL					
GVL.stSettingData.real_val[9]	REAL					

Setting items	Overview
Variable	The variable names registered in the recipe definition are displayed. To add a new variable, double-click the blank field at the bottom and specify the name of the variable you want to register. You can enter variables using the Input Assistant from the [] button.
Туре	The variable type name is displayed. It is automatically entered when the variable is registered.
Name	You can write the name of each variable separately from "Variable".
Comment	You can optionally include additional information about the variable.
Minimal Value / Maximal Value	Specify the minimum and maximum values used in "14.5.1 Setting the Recipe Manager".
	When using, be sure to set all variables for possible variables. If there is an unconfigured variable, it will not function correctly.
Current Value	The current variable value is displayed.

14.5.3 Recipe Operation Using the GM Programmer

1₂ Procedure

- **1.** After setting the recipe definition in "14.5.2 Setting the Recipe Definition", log in to the GM1 unit and download the settings.
- 2. In the login state, the current value of the variable registered is displayed in the current value.
- 3. In the login state, move the cursor to the recipe definition and select "Add New Recipe". The "New Recipe" dialog box will be displayed.

Variable	Туре	Name	Comn	nent	Minimal Value	Maximal Value	Current Value	data
GVL.stSettingData.int_val[0]	INT						0	
GVL.stSettingData.int_val[1]	INT	U	<u></u>				0	
GVL.stSettingData.int_val[2]	INT	*	Cut				0	
GVL.stSettingData.int_val[3]	INT		Сору				0	
GVL.stSettingData.int_val[4]	INT	12	Paste				0	
GVL.stSettingData.int_val[5]	INT	×	Delete		0			
GVL.stSettingData.int_val[6]	INT		Colored All		_	0		
GVL.stSettingData.int_val[7]	INT		Select All				0	
GVL.stSettingData.int_val[8]	INT	100	New Breakpoir	nt			0	
GVL.stSettingData.int_val[9]	INT		Toggle Breakp	oint			0	
GVL.stSettingData.real_val[0]	REAL					_	0	
GVL.stSettingData.real_val[1]	REAL	*1	Run to Cursor				0	
GVL.stSettingData.real_val[2]	REAL	\$	Set Next State	ment			0	
GVL.stSettingData.real_val[3]	REAL		Unforce All Values of 'Device.Application'				0	
GVL.stSettingData.real_val[4]	REAL		Display Mode				0	
GVL.stSettingData.real_val[5]	REAL		Display Mode		0			
GVL.stSettingData.real_val[6]	REAL	+>	Insert Variable		0			
GVL.stSettingData.real_val[7]	REAL	-12	Add Child Add Sibling				0	
GVL.stSettingData.real_val[8]	REAL						0	
GVL.stSettingData.real_val[9]	REAL		,			0		
		C.	Update Structu	ured Variabl	es			
		2	Add a New Re	cipe				
		2	Remove Recip	e				
		e7	Load Recipe					
		×.	Save Recipe					
		ر ه ا	Read Recipe					
		50 E	Read and Save	e Recipe				
		79	Write Recipe					
		£10	Load and Writ	e Recipe				
		3	Upload Recipe	- from David				

4. Enter a name for the new recipe and select [OK] to add the recipe as show in the above figure.

Possible to set a desired name with up to 35 characters.

Rev Recipe		×
Name	data	
Copy from existing	<create empty=""></create>	~
	ОК	Cancel

- 🔍 SettingData 🗙 Variable Name Comment Minimal Value Maximal Value Current Value data Туре GVL.stSettingData.int_val[0] INT X Cut GVL.stSettingData.int_val[1] INT 🗈 Сору GVL.stSettingData.int_val[2] INT 🚯 Paste GVL.stSettingData.int_val[3] INT GVL.stSettingData.int_val[4] × Delete INT GVL.stSettingData.int_val[5] INT Select All GVL.stSettingData.int_val[6] INT GVL.stSettingData.int_val[7] INT 10 New Breakpoint... GVL.stSettingData.int_val[8] INT Toggle Breakpoint GVL.stSettingData.int_val[9] INT →∃ Run to Cursor GVL.stSettingData.real_val[0] REAL Set Next Statement GVL.stSettingData.real_val[1] REAL GVL.stSettingData.real_val[2] REAL Unforce All Values of 'Device.Application' GVL.stSettingData.real_val[3] REAL Display Mode GVL.stSettingData.real_val[4] REAL . GVL.stSettingData.real_val[5] REAL to Insert Variable GVL.stSettingData.real_val[6] REAL the Add Child GVL.stSettingData.real_val[7] REAL 46 Add Sibling GVL.stSettingData.real_val[8] REAL 🍫 Update Structured Variables GVL.stSettingData.real_val[9] REAL 0 2 Add a New Recipe Remove Recipe 🛃 Load Recipe... 💕 🛛 Save Recipe... 🆘 Read Recipe Read and Save Recipe ... write Recipe Load and Write Recipe... Recipes from Device
- 5. Move the cursor to the added recipe and right-click to switch and control the recipe data.



• The following operations can be performed using the GM Programmer. Items that can be operated are different depending on whether the mode is offline or online. GM Programmer

Item	Offlin e	Onlin e	Function
Insert Variable	0	0	Inerts a new variable in the recipe definition.
Add Child	0		You can add a child array that can be used in the structured view and that has not been registered in the recipe definition.
Add Sibling	0		You can add a brother array that can be used in the structured view and that has not been registered in the recipe definition.
Update Structured variable	0	0	If there are any items that are not registered in structure, they are reflected on the variable list.
Add a New Recipe	0	0	Adds a new recipe to the recipe definition.
Remove Recipe	0	0	Deletes the selected recipe.
Load Recipe	0	0	Loads the recipe file in the operating PC and write to the selected recipe.
Save Recipe ^(Note 1)	0	0	Saves the selected recipe in the operating PC as a recipe file.
Read Recipe		0	Reads the current value to the recipe data.
Read and Save Recipe		0	Reads the current value to the recipe (within the tool) and saves the recipe file in the operating PC.
Write Recipe		0	Writes the current value to the recipe data.

Item	Offlin e	Onlin e	Function
Load and Write Recipe		0	Loads data from the recipe file to the recipe (within the tool) and write it in the current value.
Upload Recipes from device		0	Reads the recipe within the controller device and reflects it on the recipe within the tool.
Display mode (Decimal/ Hexadecimal)		0	-

(Note 1) This function cannot be used because REAL data of 7 or more digits and LREAL data of 16 or more digits may not be saved correctly.

Switch to list view/structured view

Variable	Туре	Name	Comment	Minimal Value	Maximal Value	Current Value
□ GVL						
stSettingData						
int_val						
int_val[0]	INT					
int_val[1]	INT					
int_val[2]	INT					
int_val[3]	INT					
int_val[4]	INT					
int_val[5]	INT					
int_val[6]	INT					
int_val[7]	INT					
int_val[8]	INT					
int_val[9]	INT					
real_val						
real_val[0]	REAL					
real_val[1]	REAL					
real_val[2]	REAL					
real_val[3]	REAL					
real_val[4]	REAL					
real_val[5]	REAL					
real_val[6]	REAL					
real_val[7]	REAL					
real_val[8]	REAL					
real_val[9]	REAL					

• When you update the structure or global variable list registered in the recipe definition, you can use the "Update Structured Variables" function to update the variable list in the recipe definition.

The following describes how to update a recipe definition when you declare a new variable for a global variable.

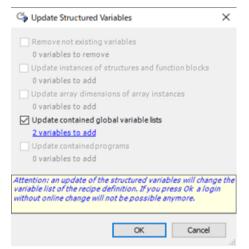
* The same operation is performed when the structure is changed or the variable deleted from the declaration is deleted from the recipe definition.

1. Add add_variables to the global variable.

```
{attribute 'qualified_only'}
VAR_GLOBAL
variables : ARRAY [0..4] OF INT;
add_variables : ARRAY [0..1] OF LREAL;
END VAR
```

2. From the Recipe Definition menu, select "Update Structured Variables" and a window appears.

Items are displayed in black only if there is a variable that can be added or removed.



3. Select "2 variables to add" to see the list of variables that will be added to the recipe definition in the update.

All variables in the list are subject to the update and cannot be selected individually.

Variables to add	×
GVL.add_variables[0] GVL.add_variables[1]	
0	

4. Variables are automatically added to the recipe definition by pressing [OK].

Variable	Туре	Name	Comment	Minimal Value	Maximal Value	Current Value
GVL.variables[0]	INT					
GVL.variables[1]	INT					
GVL.variables[2]	INT					
GVL.variables[3]	INT					
GVL.variables[4]	INT					
GVL.add_variables[0]	LREAL					
GVL.add_variables[1]	LREAL					

14.5.4 Recipe operation using instructions in the POU

It is also possible to operate a recipe from the recipe method described in the POU without operating the Recipe Manager.For details of each method, refer to the GM1 Series Reference Manual (Instruction Edition).

Recipe Manager recommended settings

The following are the recommended settings for the Recipe Manager when using instructions in the POU to perform recipe operations.

For details on the effect of changing and executing the settings, refer to the Instructions section.

torage type 🛛 💽	
_	
File path	ecipe
ieparator	
) Тар	O Semicolon O Comma
) Space	ا := ٢
Available Columns Type Name Comment Minimal Value Maximal Value	Selected Columns Variable Current Value <
Save as Default	Up Down
Recipe M Save Re	anagement in the PLC
Recipe M Save Re	anagement in the PLC cipe recipe changes to recipe files automatically
Recipe M Save Re Save Re Save	anagement in the PLC cipe recipe changes to recipe files automatically cipe
Recipe M Save Re Save Re Save	anagement in the PLC cipe recipe changes to recipe files automatically
Recipe M Save Re Save Save Load Re O Load	anagement in the PLC cipe recipe changes to recipe files automatically cipe
Recipe M Save Re Save Re Save Load Re Load Load	anagement in the PLC ecipe recipe changes to recipe files automatically cipe d only by exact match of variable list d matching variables by variablename
Recipe M Save Re Save Re Save Load Re O Load Nrite Recip	anagement in the PLC ecipe recipe changes to recipe files automatically cipe d only by exact match of variable list d matching variables by variablename
Recipe M Save Re Save Re Save Load Re Load Re Load Load	anagement in the PLC ecipe recipe changes to recipe files automatically cipe d only by exact match of variable list d matching variables by variablename
Recipe M Save Re Save Re Save Load Re Load Re Load Load Vrite Recip	anagement in the PLC ecipe recipe changes to recipe files automatically cipe d only by exact match of variable list d matching variables by variablename e e variable to min/max when recipe value is out of the range
Recipe M Save Re Save Re Save Load Re Load Re Load Nrite Recip	anagement in the PLC ecipe recipe changes to recipe files automatically cipe d only by exact match of variable list d matching variables by variablename
Recipe M Save Re Save Re Save Load Re Load Re Load Nrite Recip	anagement in the PLC ecipe recipe changes to recipe files automatically cipe d only by exact match of variable list d matching variables by variablename e e variable to min/max when recipe value is out of the range write to a variable when the recipe value is out of the min/max range

Recipe command description example Example 1 Create a new recipe.

Declaration section

```
PROGRAM sample
VAR
    //FB Instance
    RecipeManCommands_0 : RecipeManCommands;
    //Varable
```

```
ERR : BOOL;//ErrorFlag
iRecipeCnt : INT;//Number of recipe
GetRcpNames: DWORD;//Return Value of GetRecipeNames
CreateRcp : DWORD;//Return Value of CreateRecipe
RECIPE_DATA_DEF : STRING := 'Recipes';//Name of Recipe Difinition
RECIPE_NAME : STRING := 'RcpOl';//New Recipe Name
RecipeNames : ARRAY[0..9] OF STRING;//List of getting Recipe
i : INT := 0;//FOR loop counter
iSequence : INT;//SquenceNo.
END_VAR
```

Implement section

```
CASE Process OF
    1:
        //Get the number of recipe files in the SD card
        iRecipeCnt := RecipeManCommands 0.GetRecipeCount(RECIPE DATA DEF);
        iSequence := 2;
    2:
        //Get the recipe name if there are recipe files
        IF iRecipeCnt <> 0 THEN
            GetRcpNames:=RecipeManCommands 0.GetRecipeNames(
            RECIPE DATA DEF, ADR(RecipeNames), iRecipeCnt, 0);
            iSequence := 3;
        ELSE
            iSequence := 4;
        END IF
    3:
        //Check if the recipe name is the same as the existing recipe
        FOR i := 0 TO 9 DO
            IF RecipeNames[i] = RECIPE NAME THEN
               ERR := TRUE;
               RETURN;
            END IF
        END FOR
        iSequence := 4;
    4:
        //Create the new recipe
        IF NOT ERR THEN
            CreateRcp := RecipeManCommands 0.CreateRecipe(
            RECIPE DATA DEF, RECIPE NAME);
            iSequence := 0;
        END IF
END CASE
```

Example 2 Read the recipe value from the recipe file and write it in the "Current Value" **Declaration section**

```
PROGRAM sample
VAR
//FB Instance
RecipeManCommands_0 : RecipeManCommands;
```

/	//Varable	
E	IRR :	: BOOL;//ErrorFlag
i	RecipeCnt	: INT;//Number of recipe
G	GetRcpNames	: DWORD;//Return Value of GetRecipeNames
L	loadFromAndWtRcp	: DWORD;//Return Value of LoadFromAndWriteRecipe
R	RECIPE_DATA_DEF	: STRING := 'Recipes';//Name of Recipe Difinitio
n		
R	RECIPE_NAME	: STRING := 'Rcp01';//Reading Recipe Name
	RECIPE_FILENAME	: STRING;//Reading Recipe file Name
	EXTENTION	: STRING := '.txtrecipe';//Extention
R	RecipeNames	: ARRAY[09] OF STRING;//List of getting Recipe
i	-	: INT := 0;//FOR loop counter
i	Sequence	: INT;//SquenceNo.
END_V	AR	

Implement section

```
CASE Process OF
   1:
        //Get the number of recipe files in the SD card
        iRecipeCnt := RecipeManCommands 0.GetRecipeCount(RECIPE DATA DEF);
        iSequence := 2;
    2:
        //Get the recipe name if there are recipe files
        IF iRecipeCnt <> 0 THEN
            GetRcpNames:=RecipeManCommands 0.GetRecipeNames(
            RECIPE DATA DEF, ADR(RecipeNames), iRecipeCnt, 0);
            iSequence := 3;
        ELSE
           ERR := TRUE;
        END IF
    3:
        //Check if the recipe name is the same as the existing recipe
        FOR i := 0 TO 9 DO
            IF RecipeNames[i] = RECIPE NAME THEN
               iSequence := 4;
                EXIT;
            END IF
        END FOR
        IF iSequence = 3 THEN
           ERR := TRUE;
        END IF
    4:
        //Read the recipe file and Write the recipe value to current variabl
e value.
       RECIPE FILENAME := CONCAT(CONCAT(RECIPE NAME, '.'),
        RECIPE DATA DEF), EXTENTION);
        IF NOT ERR THEN
            LoadFromAndWtRcp := RecipeManCommands 0.LoadFromAndWriteRecipe(
             RECIPE DATA DEF, RECIPE NAME, RECIPE FILENAME);
        END IF
        iSequence := 0;
```

END_CASE

14.5.5 Saving and restoring persistent variables

You can save and restore data by automatically creating recipe definitions and recipes from persistent variable lists. If you update a variable that has been registered as a persistent variable, the data held by the persistent variable will be cleared when you download it.

¹² Procedure

- **1.** After setting the recipe definition in "14.5.2 Setting the Recipe Definition", log in to the GM1 unit and download the settings.
- 2. While logged in, place the cursor on a variable in the persistent variable list, right-click, and select [Save Current Value to Recipe] from the menu that appears.

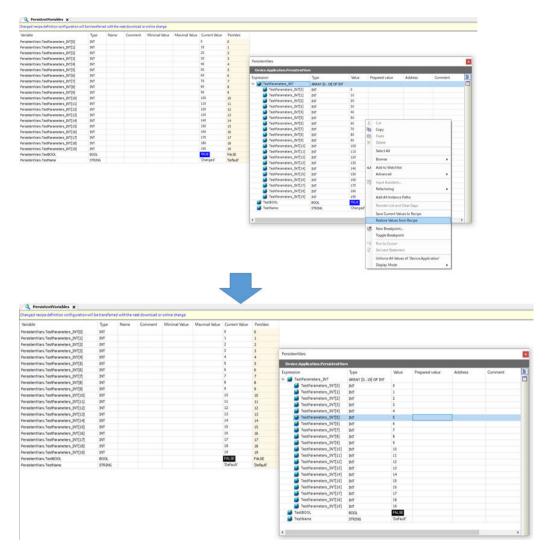
Expression	Туре	Value	Prepared v	alue	Address	Comment		
🗏 🍯 TestParameters_INT	ARRAY [019] OF INT							
TestParameters_INT[0]	INT	0						
TestParameters_INT[1]	INT	1						
TestParameters_INT[2]	INT	2			211			
TestParameters_INT[3]	INT	3	1.92		lut			
TestParameters_INT[4]	INT	4		9 0	Сору			
TestParameters_INT[5]	INT	5	1	B P	aste			
TestParameters_INT[6]	INT	6	>	0.0	elete			
TestParameters_INT[7]	INT	7		1	1			
TestParameters_INT[8]	INT	8		5	elect All			
TestParameters_INT[9]	INT	9		8	rowse			
TestParameters_INT[10]	INT	10			dd to Watchlist			
TestParameters_INT[11]	INT	11	6	20110				
TestParameters_INT[12]	INT	12		A	dvanced			
TestParameters_INT[13]	INT	13	10	3 h	Refactoring Add All Instance Paths Reorder List and Clear Gaps			
TestParameters_INT[14]	INT	14		54 L				
TestParameters_INT[15]	INT	15						
TestParameters_INT[16]	INT	16		A				
TestParameters_INT[17]	INT	17		R				
TestParameters_INT[18]	INT	18						
TestParameters_INT[19]	INT	19		S	ave Current Values t	o Recipe		
TestBOOL	BOOL	FALSE		Restore Values from Recipe		Recipe		
🎒 TestName	STRING	'Default'	1		lew Breakpoint			
			9					
					oggle Breakpoint			
			*	II F	un to Cursor			
			3	5 5	et next Statement			
				Unforce All Values of 'Device.Ap		'Device.Application'		
					isplay Mode	20160-013020-0540/01/07/02/02		

3. Recipe Definition PersistentVariables is created and all variables in the persistent variable list are set.

Also, the recipe "PersVars" is created from the current values.

Changed recipe definition configuration will be transferred with the next download or online change							
Variable	Type	Name	Comment	Minimal Value	Maximal Value	Current Value	PersVars
PersistentVars.TestParameters_JNT[0]	INT					0	0
PersistentVars.TestParameters_INT[1]	INT					1	1
PersistentVars.TestParameters_INT[2]	INT					2	2
PersistentVars.TestParameters_INT[3]	INT					3	3
PersistentVars.TestParameters_INT[4]	INT					4	4
PersistentVars.TestParameters_INT[5]	INT					5	5
PersistentVars.TestParameters_INT[6]	INT					6	6
PersistentVars.TestParameters_INT[7]	INT					7	7
PersistentVars.TestParameters_INT[8]	INT					8	8
PersistentVars.TestParameters_INT[9]	INT					9	9
PersistentVars.TestParameters_INT[10]	INT					10	10
PersistentVars.TestParameters_INT[11]	INT					11	11
PersistentVars.TestParameters_INT[12]	INT					12	12
PersistentVars.TestParameters_INT[13]	INT					13	13
PersistentVars.TestParameters_INT[14]	INT					14	14
PersistentVars.TestParameters_INT[15]	INT					15	15
PersistentVars.TestParameters_INT[16]	INT					16	16
PersistentVars.TestParameters_INT[17]	INT					17	17
PersistentVars.TestParameters_JNT[18]	INT					18	18
PersistentVars.TestParameters_INT[19]	INT					19	19
PersistentVars.TestBOOL	BOOL					FALSE	FALSE
PersistentVars.TestName	STRING					'Default'	'Default'

4. If you place the cursor on a variable in the Persistent Variables list, right-click, and select [Restore Values from Recipe] from the menu that appears, the values currently set for Recipe PersVars are reflected in the Persistent Variables list.



1 Info.

• When the recipe definition "PersistentVariables" was created, it was not downloaded into the GM1 itself.

To use the Recipe Manager function block or to automatically create a recipe file on the SD card, log out, log back in to the GM1 unit, and download the project.

• The function to restore values from a recipe is not limited to the persistent variable list, but covers all set values of the recipe "PersVars".

An error occurs if there is no recipe "PersVars" in the recipe definition "PersistentVariables".

14.6 Project Management Function

14.6.1 What is Project Management Function?

The backup and restore functions for data of each type in the GM1 controller are called project management functions.

Backup function

This is a function used to collectively save data of every type in the GM1 controller to an SD memory card. File data to be saved is called a backup file. This function can be executed by any of two methods: operation by the controller and a function block in a program.

Restore function

This is a function used to transfer a backup file in an SD memory card to the GM1 controller. Data of every type in the GM1 controller will be replaced by a backup file. This function can be executed by any of two methods: operation by the controller and a function block in a program.

Backup file and restoration configuration file

When the backup function is performed, a backup file and a restoration configuration file are created in a predetermined directory on the SD memory card. These files have roles as shown below.

File name	Description	Backup	Restore
Backup file AUTOEXEC.GM1	Data of every type in the GM1 controller is stored in this file.	Creation	Reference
Restoration configuration file AUTOEXEC.INI	This file is used to specify data subject to restoration. This is text data and thus is editable.	Creation	Reference

Each type of settings data subject to backup and restoration

Target data	Backup	Restore
Source file	0	0
External file	0	Selectable ^(Note 1)
Bootstrap application	0	0
RETAIN variable	0	Selectable ^(Note 1)
Network setting	0	Selectable ^(Note 1)
Time zone	0	Selectable ^(Note 1)
Account (device user)	0	0
Certificates	×	×

(Note 1) Whether or not to specify it for a target of restoration can be selected.

Method for writing specifications in restoration configuration file

The restoration configuration file is a text file used to specify each type of settings data for a target of restoration when data is restored. The following is an example of specifications written in a restoration configuration file.

```
[AUTOEXEC_OPTION]
Application_File=yes
External_File=no
Retain_File=no
Network_File=no
Timezone File=no
```

Method for specifying each type of settings data

Writing	Description
Application_File	Source file, bootstrap application, and account (device user)
External_File	External file
Retain_File	RETAIN variable
Network_File	Network setting
Timezone_File	Time zone

Method for specifying data for a target of restoration.

Writing	Description
yes	Specify it for a target of restoration
no	Not specify it for a target of restoration



- Application_File cannot be excluded from the target of restoration. If it is excluded from the target of restoration, an error occurs.
- In writing, do not use spaces around the equals "=" sign. If there is any single- or double-width space around the equals "=" sign, the type of data is regarded as (no), being excluded from the target of restoration.

14.6.2 Backup (Operation by the controller)

This is a function used to collectively save every type of settings data in the GM1 controller to an SD memory card by operating the controller.

To enable this function, open the PLC parameter screen and change project backup of project management setting from "Invalid" \rightarrow "Valid". (Refer to "4.3 Setting up the GM1 Controller" for PLC parameter screens)

¹² Procedure

- 1. Set the mode switch to STOP.
- 2. Turn OFF the power to the GM1 controller.
- 3. Create "AUTO" folder in the root directory of the SD card and empty the folder.
- 4. Open the cover and insert the SD card into the slot.
- 5. With the cover left open, turn ON the power to the GM1 controller.
- 6. When the backup process starts, the STOP lamp starts flashing.
- **7.** When the process is completed normally, the STOP lamp is lit and the ERROR is unlit. If an error occurs, the STOP lamp goes off and the ERROR lamp blinks.
- **8.** Close the cover, set the mode switch to RUN, and turn the controller OFF and then ON, so that the controller returns to the original state.

f Info.

- If there is no "AUTO" empty folder, the bag-up process will not start.
- After the backup process is completed, "AUTOEXEC.GM1" project data and the "AUTOEXEC.INI" configuration file are created in the "AUTO" folder.
- If the "AUTOEXEC.INI" configuration file is already contained in the "AUTO" folder at the time of starting the backup process, the configuration file will remain unchanged.

14.6.3 Restore (Operation by the controller)

This is a function used to transfer a backup file in an SD memory card to the GM1 Controller by operating the controller.

To enable this function, open the PLC parameter screen, select project management setting, and change the project backup and project restore setting from "Invalid" \rightarrow "Valid". (Refer to "4.3 Setting up the GM1 Controller" for PLC parameter screens)

¹² Procedure

- 1. Set the mode switch to STOP.
- 2. Turn OFF the power to the GM1 controller.
- **3.** Confirm that the project data "AUTOEXEC.GM1" and the setting file "AUTOEXEC.INI" generated by the backup process are contained in the "AUTO" folder in the SD card.
- **4.** To edit targets to be restored, configure settings by editing the "AUTOEXEC.INI" configuration file.
- 5. Open the cover and insert the SD card into the slot.
- 6. With the cover left open, turn ON the power to the GM1 controller.
- 7. When the restore process starts, the STOP lamp will start blinking.
- **8.** When the process is completed normally, the STOP lamp is lit and the ERROR is unlit. If an error occurs, the STOP lamp goes off and the ERROR lamp blinks.
- **9.** Close the cover, set the mode switch to RUN, and turn the controller OFF and then ON, so that the controller switches to the restored project.

f Info.

• Application_File in the "AUTOEXEC.INI" restoration configuration file cannot be excluded from the target of restoration. If it is excluded from the target of restoration, an error occurs.

14.6.4 Backup and Restoration (Function Blocks)

You can back up or restore data from a program using function blocks. In combination with the FTP server function, a maintenance function can be implemented by remotely upgrading versions and regularly backing up data. The function block types are as shown below.

Item	Description
SYS_PRJBackup	This function block is used to collectively save every type of settings data in the GM1 controller to an SD memory card.
SYS_PRJRestore	This function block is used to transfer a backup file in an SD memory card to the GM1 Controller.
SYS_GetPRJRestoreResult	This function block is used to check results of execution of SYS_PRJRestore.

i Info.

• For details on the function blocks, refer to to the Instruction Edition.

14.7 SD card log storage function

14.7.1 What is SD card log storage function?

This is a function used to save logs ("8.9.1 Checking Logs") in the GM1 controller to an SD memory card. Logs are saved with operation by the controller. Logs are also saved when the GM1 controller is turned OFF.

■ Log file and configuration file

A log file is saved based on the log configuration file for the function to save logs in SD card. These files have roles as shown below.

File name	Description
Log file GM1_DeviceLog.log	Logs in the GM1 controller are stored in CSV format. The maximum file size is 30 MB.
Log backup file GM1_DeviceLog_0.log	When the number of log files exceeds the limit, the contents of the log files are saved as log backup files.
Log configuration file DEVLOGEXEC.INI	Log storage configuration file This is text data and thus is editable.

Log configuration file

To save logs, you must save the log configuration file in an SD memory card.

In the log configuration file, specify whether to enable or disable the log storage function and the type of logs to be saved.

The following is an example of specifications written in a log configuration file.

```
[DEVLOGEXEC_OPTION]
Save_LogFile=yes
Error Only=yes
```

Method for specifying each type of data

Writing	Description
Save_LogFile	If yes, the log storage function is enabled.
Error_Only	If yes, ERROR/EXCEPTION (exception error) only are saved. In other cases, INFO (information)/WARNING /ERROR/EXCEPTION (exception error) are saved.



- Make sure that there is no space before and after "=".
- The types of Error_Only specified in the log configuration file also apply to the log types displayed in GM Programmer.

For details on logs, refer to "8.9.1 Checking Logs".

14.7.2 How to save logs in SD card

This is a function to save logs in the GM1 controller to an SD memory card by directly operating the controller.

To enable this function, enable the setting in the log configuration file.

¹² Procedure

- 1. Turn OFF the power to the GM1 controller.
- 2. Create a "DEVLOG" folder in the root directory of the SD memory card and save the "DEVLOGEXEC.INI" file.
- **3.** Open the cover and insert the SD memory card.
- 4. Turn ON the power of the controller.
- 5. The controller restarts, and the logs are saved in the SD memory card.
- 6. Confirm that the LED of the SD is turned off.
- Remove the SD memory card and close the cover. When the process is completed successfully, the log file "GM1_DeviceLog.log" is stored in the "DEVLOG" folder of the SD memory card.



- If there is no log configuration file, the log storage function is disabled.
- If you change the log configuration file, you need to restart the controller.
- The operation sequence for switching the log storage setting of the controller is as follows.

Sequence of log storage setting	Controll er	Log configuration file	Remarks
(1) Log storage setting before starting controller	Setting A	Not depend on the setting.	
(2) Log storage setting immediately after starting controller	Setting A	Setting B	The controller starts up with the previous log storage setting until the restart is completed.
(3) Log storage setting when the controller is restarted	Setting B	Setting B	If you change the log configuration file again when restarting, the controller starts up again.
(4) Log storage setting after startup of controller is completed	Setting B	Not depend on the setting.	After startup is completed, the setting of the controller is fixed (the settings in the log configuration file are not referenced).

- When Setting A = Setting B, the restart in (3) does not occur.
- Cases after firmware upgrade ("14.8 Firmware Version Upgrade Function") is completed are included in (3). When the version upgrade is completed, the setting is disabled. However, if the log configuration file is enabled, the controller starts up again.

14.8 Firmware Version Upgrade Function

14.8.1 Checking Unit Configuration

You can check the product numbers and current firmware versions of the GM1 controller and expansion units connected to the controller.

¹² Procedure

- From the menu bar, select Online>Unit configuration confirmation.
 The "Select Device" dialog box appears to show a GM1 controller that you can connect.
- 2. "Unit configuration confirmation" The "Unit configuration confirmation" dialog box appears and displays the product numbers and current versions of the GM1 controller and expansion units connected to the controller.
- **3.** Click the [OK] button.

The "Unit configuration confirmation" dialog box will be closed.

Unit configuration confirmation			\times
Please check the version.			
Unit Name	Product Number	Current Version	
Device(AGM1CSEC16)	AGM1CSEC16T/P	1.2.0.0	
Slot1_32IN_32OUT	AGM1XY64D2T	1.0.0.0	
		ок	
		OK	



• The configuration of units can also be confirmed by selecting "Basic Operations" on the start page and Unit "Configuration Confirmation".

14.8.2 Unit Version Upgrade

You can upgrade the firmware versions of the GM1 controller and expansion units connected to the controller. The versions of the expansion units as well as the GM1 controller can be upgraded by batch.

¹₂ Procedure

- From the menu bar, select Online>Unit Version Upgrade. The "Select Device" dialog box appears to show a GM1 controller that you can connect.
- 2. Select Device of the GM1 controller and click the [OK] button.
- 3. "Unit Version Upgrade" The "Unit Version Upgrade" dialog box appears and displays current firmware versions in the Current Version column.

Latest versions are displayed by default in the Update Version column.

Unit Version Upgrade					
Path for version upgrade file:					
C:\Program Files (x86)\Panas	C:\Program Files (x86)\Panasonic Corporation\GM Programmer\Verup Select Path				
Unit Name	Product Number	Current Version	Update Version		
Device(AGM1CSEC16)	AGM1CSEC16T/P	1.2.0.0	1.3.0.0		
Slot1_32IN_32OUT	AGM1XY64D2T	1.0.0.0	No change		
			OK Cancel		

- 4. Select the version in the Update Version column. To change to a version other than the latest version, select the desired version. If the version is not to be upgraded, select "Not change".
- 5. Set the RUN/STOP switch on the GM1 Controller to STOP.
- 6. Click the [OK] button.

A confirmation dialog box will be displayed. Proceed with version upgrading by following the prompts in the dialog box.

After the version upgrading is completed, the "Version Upgrade Result" dialog box appears and displays upgrade results.

Check that every result is "Success" in the Result column.

Unit Name	Product Number	Result
Device(AGM1CSEC16)	AGM1CSEC16T/P	Success

7. Click the [Complete] button.

Restart of the GM1 controller will start automatically. When the restart ends, the version upgrading is completed.



- When the firmware version of the GM1 controller is upgraded, Reset Origin is executed.
- The designation of the path for the version upgrade file can be changed. Click the "Select Path" button and specify a folder where the version upgrade file (.hex) is saved.
- The versions of units can also be upgraded by selecting Basic Operations on the start page and Unit Version Upgrade.

14.9 Servo Amplifier / Motor Operation Function (PANATERM Lite for GM)

You can start PANATERM Lite for GM, which allows you to check the settings of servo amplifiers, the operating states of servo amplifiers and motors, and the error status of servo amplifiers via the GM1 controller.

For details, refer to "15 Overview of PANATERM Lite for GM".

14.9.1 Starting PANATERM Lite for GM

This section explains how to start PANATERM Lite for GM from GM Programmer.

¹² Procedure

1. From the menu bar, select **Tools>PANATERM Lite for GM**. PANATERM Lite for GM will be started.

Tools Window Help

 Tools
 Window
 Help

 PANATERM Lite for GM...
 PANATERM Lite for GM...

15 Overview of PANATERM Lite for GM

15.1 System Requirements 15.1.1 Operating Environment of PANATERM Lite for GM	.15-3 15-3
15.2 Installation and Uninstallation15.2.1 Installing PANATERM Lite for GM15.2.2 Uninstalling PANATERM Lite for GM	15-4
15.3 Connecting with servo amplifier	15-5
15.4 Basic Operations 15.4.1 How to Start 15.4.2 How to Exit	15-6
15.5 Component Names 15.5.1 Menu Bar 15.5.2 Toolbar 15.5.3 Navigation Pane 15.5.4 Main Pane 15.5.5 Status Field	15-12 15-13 15-13 15-14
15.6 Window Operations15.6.1 Moving the Pane Location15.6.2 Switching the Tab of the Main Pane	15-15
15.7 Connection settings Servo Amplifier to the GM1 Controller 15.7.1 Selecting the Device to Connect	
 15.8 Parameter Window	15-26 15-28 15-29 15-31 15-32
 15.9 Object Window. 15.9.1 Configuration of Object Window	15-36 15-39
15.10 Monitor Window15.10.1 Configuration of Monitor Window15.10.2 Checking the Monitor Window	15-42

15.11 Alarm Window15.11.1 Configuration of Alarm Window15.11.2 Checking Alarms	15-45
15.12 Other Functions15.12.1 Language Setting Function15.12.2 Version Display Function	15-50
15.13 Troubleshooting 15.13.1 Troubleshooting for Servo Amplifiers and Motors	

15.1 System Requirements

15.1.1 Operating Environment of PANATERM Lite for GM

Programming software

Product name	Applicable language
PANATERM Lite for GM	Japanese / English / Chinese

(Note 1) When GM Programmer is installed, MINAS setup support software "PANATERM Lite for GM" is installed at the same time.

Software operating environment

Item	Description
OS	Microsoft(R) Windows(R) 10: 32bit / 64bit
PC	 PC with the following software installed: Microsoft.NET Framework 4.6.1 or later Microsoft Visual C++ 2010 SP1 Redistributable Package (x86) Microsoft Visual C++ 2010 SP1 Redistributable Package (x64) Microsoft Visual C++ 2013 Redistributable Package (x86) Microsoft Visual C++ 2013 Redistributable Package (x64) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x86) Microsoft Visual C++ 2015 Update 3 Redistributable Package (x64)
HDD	At least 4 GB of free space
Memory	At least 8 GB
Communication port	LAN port (for Ethernet connection) USB 2.0 port (for USB connection)

15.2 Installation and Uninstallation

15.2.1 Installing PANATERM Lite for GM

When GM Programmer is installed, PANATERM Lite for GM is also installed at the same time.

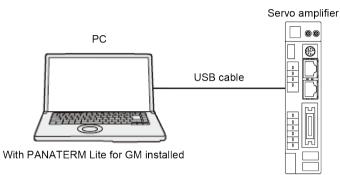
15.2.2 Uninstalling PANATERM Lite for GM

When GM Programmer is uninstalled, PANATERM Lite for GM is also uninstalled at the same time.

15.3 Connecting with servo amplifier

15.3.1 Connecting the Servo Amplifier and PC

Use a USB cable to connect the servo amplifier and a PC on which PANTERM Lite for GM has been installed.

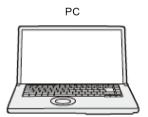


f Info.

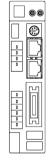
• When the GM Programmer is installed, the USB driver is also installed at the same time.

15.3.2 Disconnecting the Servo Amplifier from the PC

Disconnect the USB cable connecting the PC and the servo amplifier.



Servo amplifier



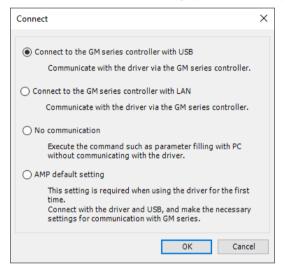
15.4 Basic Operations

This section explains how to start and exit PANATERM Lite for GM.

15.4.1 How to Start

- ¹₂ Procedure
- 1. Click the [Start] button in the Windows task bar and select **Panasonic** Corporation>PANATERM Lite for GM.
- **2.** The "Connect" dialog box will be displayed.

Select a communication setting option and click [OK].



3. The "Series Setting" dialog box will be displayed.

Series setting	×
MINAS-A5B MINAS-A5N MINAS-A6B MINAS-A6N	
	OK Cancel

Note

When the "Selection of Aircraft Types" dialog box is displayed, select a model and click the "OK" button.

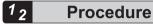
MINAS-A6BSelection of Aircraft Types	-		\times
MINAS-A6BE standard MINAS-A6BF standard			
	ОК	Cance	ا: :.:

4. PANATERM Lite for GM will be started.

PANATERM		-	×
<u>F</u> ile <u>V</u> iew <u>T</u> ools <u>H</u> elp			
🏂 💱 🐷 🖾 🗔 📖 -			
Axes 👻 👎	×		
ID: - MINAS-A68F			
	•		

15.4.2 How to Exit

• Note that all information will be lost if you close the program without saving settings, collected data, or other information.



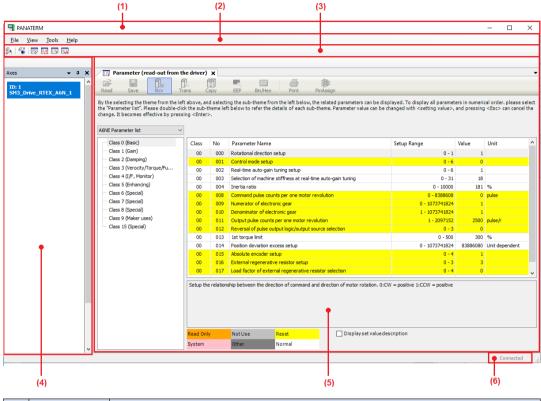
1. From the menu bar, select File>Exit. PANATERM Lite for GM will be closed.



• You can also close PANATERM Lite for GM by clicking the [x] button on the title bar.

15.5 Component Names

This section explains the components and displays of PANATERM Lite for GM.



No.	Name	Description
(1)	Title bar	The title bar displays the project file name, [minimize] button, [maximize] button, and [close] button.
(2)	Menu bar	The menu bar displays the menu commands for each purpose in list format.
(3)	Toolbar	The toolbar displays each command as an icon.
(4)	Navigator pane	This pane displays a list of axes.
(5)	Main pane	This pane displays the Parameter window, Monitor window, Alarm window, and other windows. The window can be switched by selecting a desired tab.
(6)	Status field	This field displays the status of connection to the GM1 controller.

15.5.1 Menu Bar

The menu bar displays the following menus:

<u>File View Tools H</u>elp

File

Item	Function
Settings	Used to set up an amplifier with the amplifier connected or with a model selected. Select Model: Select an amplifier to be connected.
	Connect Amplifier: Select either the connection via PC or the direct connection for connecting the GM1 controller and the amplifier order to set up an amplifier.
Exit	Closes PANATERM Lite for GM

View

Item	Function	
Axes	Displays a list of axes	
Parameter	Displays the Parameter window	
Monitor	Displays the Monitor window	
Alarm	Displays the Alarm window	

Tools

Item	Function
English	Switches the display language of GM Programmer to English
日本語	Switches the display language of GM Programmer to Japanese
中文(簡体)旧版	Switches the display language of GM Programmer to Chinese

Help

Item	Function
About	Displays version information
PANATERM Lite for GM Help	Displays the manual

15.5.2 Toolbar

The toolbar displays the following icons:



Name	Icon	Function
Select the drive series	34	Sets up an amplifier with the amplifier unconnected
Opens the connrct dialog	Ø3	Select either the connection via PC or the direct connection for connecting the GM1 controller and the amplifier order to set up an amplifier.
Opens the Axis view		Displays a list of axes
Opens the Alarm view		Displays the Alarm view
Opens the Parameter view	E	Displays the Parameter view
Opens the Monitor view	255	Displays the Monitor view

15.5.3 Navigation Pane

The navigation pane displays the following tree:



No.	Name	Icon	Function
(1)	Auto Hide		Always shows the navigation pane.
		ц	Minimizes and hides the navigation pane.
	Close	×	Closes the navigation pane.
(2)	Axes		Displays a list of axes downloaded to the GM1 controller

15.5.4 Main Pane

The main pane displays the following sub-panes:

-theme left						
Copy and selection -theme left	EEP Bin/Hex Print PinAssign ng the sub-theme from the left below, the related parameters can be d					
-theme left						
		By the selecting the theme from the left above, and selecting the sub-theme from the left below, the related parameters can be displayed. To display all parameters in numerical order. please select the "Parameter list". Please double-click the sub-theme left below to refer the details of each sub-theme. Parameter value can be changed with < setting value>, and pressing <esc> can cancel the change. It becomes effective by pressing <enter>.</enter></esc>				
No	Parameter Name	Setup Range	Value	Unit		
	Rotational direction set in		1			
			-			
			-			
			-			
004	Inertia ratio			%		
008	Command pulse counts per one motor revolution	0 - 8388608	3	pulse		
009	· · · · ·					
010	-	1 - 1073741824				
011	-			pulse/r		
012						
013		0 - 500	500	%		
014	Position deviation excess setup	0 - 1073741824	100000	Unit dependent		
015	Absolute encoder setup	0 - 4	1			
016	External regenerative resistor setup	0 - 3	3			
017	Load factor of external regenerative resistor selection	0 - 4	0			
018	For manufacturer's use	0-1	0			
t	000 001 002 003 004 008 009 010 011 012 013 014 015 016 017 018	000 Rotational direction setup 001 Control mode setup 002 Real-time auto-gain tuning setup 003 Selection of machine stiffness at real-time auto-gain tuning 004 Inertia ratio 008 Command pulse counts per one motor revolution 009 Numerator of electronic gear 011 Output pulse counts per one motor revolution 012 Reversal of pulse output logic/output source selection 013 1st torque limit 014 Position deviation excess setup 015 Absolute encoder setup 016 External regenerative resistor selection 017 Load factor of external regenerative resistor selection 018 For manufacturer's use	000 Rotational direction setup 0-1 001 Control mode setup 0-6 002 Real-time auto-gain tuning setup 0-6 003 Selection of machine stiffness at real-time auto-gain tuning 0-31 004 Incertia ratio 0 008 Command pulse counts per one motor revolution 0-8388608 009 Numerator of electronic gear 0-1073741824 010 Denominator of electronic gear 1-1073741824 011 Outp pulse counts per one motor revolution 1-2097152 102 Reversal of pulse output logic/output source selection 0-3 013 1st torque limit 0-500 014 Position deviation excess setup 0-4 015 Absolute encoder setup 0-3 016 External regenerative resistor selection 0-3 017 Load factor of external regenerative resistor selection 0-4	000 Rotational direction setup 0 - 1 1 001 Control mode setup 0 - 6 0 002 Real-time auto-gain tuning setup 0 - 6 1 003 Selection of machine stiffness at real-time auto-gain tuning 0 - 31 11 004 Inertia ratio 0 - 10000 250 008 Command pulse counts per one motor revolution 0 - 8388608 33 009 Numerator of electronic gear 0 - 1073741824 11 010 Denominator of electronic gear 1 - 1073741824 11 0110 Denominator of electronic gear 0 - 3 0 0121 Reversal of pulse output logic/output source selection 0 - 3 0 013 1st torque limit 0 - 500 500 011 015 Absolute encoder setup 0 - 1073741824 100000 015 External regenerative resistor setup 0 - 4 11 016 External regenerative resistor setup 0 - 3 33 017 Load factor of external regenerative resistor selection 0 - 4		

No.	Name	
(1)	Toolbar	In each window, the toolbar displays commands as icons.
(2)	Main view	The main view displays the Parameter window, Alarm window, Monitor window, and other windows.

15.5.5 Status Field

The status field displays the current communication status.

Display	Description
	Indicates that there is no communication with the GM1 controller.
Connected	Indicates that there are communications with the GM1 controller.

15.6 Window Operations

This section explains common window operations for PANATERM Lite for GM.

15.6.1 Moving the Pane Location

You can freely change the layout of each pane of PANATERM Lite for GM.

Example: Moving the navigator pane from the left edge to the right edge of the window

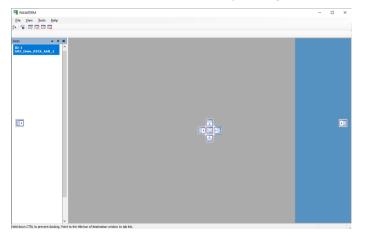
¹² Procedure

1. Click the title bar of the navigator pane and then drag it to the main pane.

The navigator pane will stay in a floating state and arrows indicating movable directions will be displayed.



2. Drag the navigator pane in the direction in which you want to move it. The relocation destination will be displayed in light blue.



3. Release the left mouse button.

The navigator pane will be docked into the existing pane and the relocation will be completed.



15.6.2 Switching the Tab of the Main Pane

You can switch the tab of the main pane.

12	Procedure

 Press the <Ctrl> key + <Tab> key simultaneously. The window for switching the tab of the main pane will be displayed.

🖪 Alarm	
Active Views	Active Editors
Axes	Alarm Parameter (read-out from the driver)

- 2. While holding down the <Ctrl> key, press the <Tab> key until the desired tab is selected.
- Release the <Ctrl> key. The window corresponding to the selected tab will be displayed.

15.7 Connection settings Servo Amplifier to the GM1 Controller

This section explains how to set up MINAS series servo amplifiers connected to the GM1 Controller.

For other devices, refer to their instruction manuals when setting up them.

The PC communicates with the servo amplifier connected to the GM1 Controller.

Connect the PC and GM1 Controller with an Ethernet cable or USB cable. With the GM1 Controller and servo amplifier connected with a Cat5e shielded cable, set up the servo amplifier.

• Perform this setup work only after the connection between the GM1 Controller and the servo amplifier has been established.

15.7.1 Selecting the Device to Connect

After you start PANATERM Lite for GM or when you select **File>Settings>Connect Amplifier**, a dialog box for selecting the device to be connected will be displayed.

Connect	×
Connect to the GM series controller with USB	
Communicate with the driver via the GM series controller.	
\bigcirc Connect to the GM series controller with LAN	
Communicate with the driver via the GM series controller.	
O No communication	
Execute the command such as parameter filling with PC without communicating with the driver.	
○ AMP default setting	
This setting is required when using the driver for the first time. Connect with the driver and USB, and make the necessary settings for communication with GM series.	
OK Cancel	1

The following options will be displayed.

- Connect to the GM series controller with USB
- Connect to the GM series controller with LAN
- No communication
- AMP default setting

The following section describes operations when each option is selected.

When you use the servo amplifier for the first time after it was purchased, you must establish a communication between the GM1 Controller and the servo amplifier. Connect the PC and the servo amplifier with a USB cable and execute "Configure amplifier communication settings".

Then, with the servo amplifier and GM1 Controller connected, set up the servo amplifier.

1

If Connected with USB Cables

If connected with USB cables, use the following procedure.



 Start PANATERM Lite for GM. The "Connect" dialog box will be displayed.

Connect	×
Connect to the GM series controller with USB	
Communicate with the driver via the GM series controller.	
○ Connect to the GM series controller with LAN	
Communicate with the driver via the GM series controller.	
○ No communication	
Execute the command such as parameter filling with PC without communicating with the driver.	
○ AMP default setting	
This setting is required when using the driver for the first time. Connect with the driver and USB, and make the necessary settings for communication with GM series.	
OK Cance	

2. Select "Connect to the GM series controller with USB" and click the [OK] button. The "Add USB Port" dialog box will be displayed.

Add USB Port	×
USB Port	
Device:	Panasonic GM USB-COM
Port:	СОМЗ
Communication	timeout settings
Timeout period	d(s): 10
	OK Cancel

Change the timeout period and click the [OK] button.
 A message window will be displayed, asking whether to add a USB port and restart the Gateway.



4. Click the [OK] button.

The "Select Device" dialog box will be displayed.

Select Device		×
Select the network path to the controller:		
Gateway-1	Device Name: Gateway-1	Scan Network
		<u>W</u> ink
	Driver: TCP/IP	
	IP-Address: localhost	
	Port: 1217	
	<u>o</u> k	<u>C</u> ancel

5. Click the [Search Network] button, select the GM1 Controller, and click the [OK] button. The main pane will be displayed.

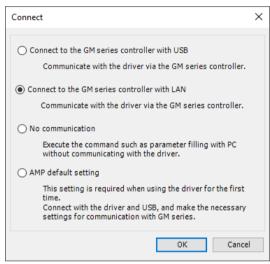
PANATERM				
Axes	R PANATERM	-	-	×
Axes • # X D: 1001 SH_Drive_ETC_Panasonic	<u>F</u> ile <u>V</u> iew <u>T</u> ools <u>H</u> elp			
ID: 1001 SHI_Drive_ETC_Panasonic	3x 🐔 🐷 🖪 🗔 📖			
ID: 1001 SHI_Drive_ETC_Panasonic				
ID: 1001 SH_Drive_ETC_Panasonic	Axes 👻 🕂 🗙			
	ID: 1001			
	•			

If Connected with Ethernet Cables

If connected with Ethernet cables, use the following procedure.



 Start PANATERM Lite for GM. The "Connect" dialog box will be displayed.



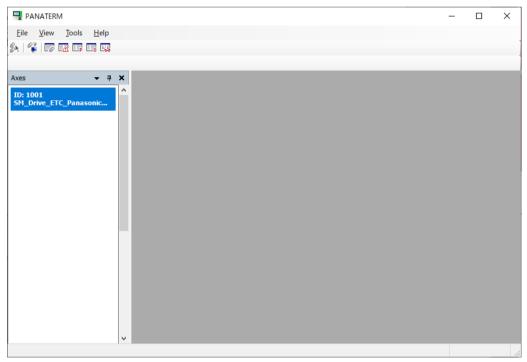
 Select "Connect to the GM series controller with LAN" and click the [OK] button. The "Communication timeout settings" dialog box will be displayed.

Communication timeout settings X				
Communication timeo	ut settings –			
Timeout period(s):				
	ОК	Cancel		

3. Change the timeout period and click the [OK] button. The "Select Device" dialog box will be displayed.

Gateway-1	Device Name: Gateway-1	Scan Network
	Driver:	<u>W</u> ink
	TCP/IP	
	IP-Address:	
	localhost	
	Port: 1217	
]	

4. Click the [Search Network] button, select the GM1 Controller, and click the [OK] button. The main pane will be displayed.



Editing Settings without Connecting to the GM1 Controller

You can freely edit parameters and other data saved in files without connecting to the GM1 Controller. The edited contents are not written to the servo amplifier.



1. Start PANATERM Lite for GM.

The "Connect" dialog box will be displayed.

Connect	×
Connect to the GM series controller with USB	
Communicate with the driver via the GM series controller.	
○ Connect to the GM series controller with LAN	
Communicate with the driver via the GM series controller.	
No communication	
Execute the command such as parameter filling with PC without communicating with the driver.	
○ AMP default setting	
This setting is required when using the driver for the first time. Connect with the driver and USB, and make the necessary	
settings for communication with GM series.	
OK Cance	I

2. Select "No communication" and click the [OK] button. The "Select Series" dialog box will be displayed.

Series setting		\times
MINAS-A5N MINAS-A6N		
	OK Cance	1

3. Select a servo amplifier to be connected and click the [OK] button. The main pane will be displayed.

Note

When the "Selection of Aircraft Types" dialog box is displayed, select a model and click the "OK" button.

MINAS-A6NSelection of Aircraft Types	_		×
MINAS-A6NE standard MINAS-A6NF standard			
	ОК	Cano	cel

Configure amplifier communication settings

For details on the connection method using the amplifier's communication settings, refer to the following.

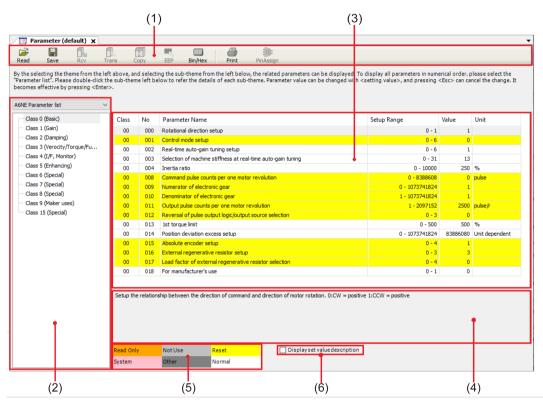
RTEX: "9.2.1 RTEX parameter settings for servo amplifier"

EtherCAT: "9.2.2 EtherCAT parameter settings for servo amplifier"

15.8 Parameter Window

The Parameter window allows the user to check and rewrite the values of servo amplifier parameters, save them to parameter files, and perform parameter-related operations.

15.8.1 Configuration of Parameters Window



No.	Name	Function		
		The toolbar consists of basic operation commands related to parameters, such as save and read.		
		lcon	Name	Function
	Toolbar	🗃 Read	Read	Reads parameters from file ".prm5"
(1)			Save	Writes parameters to file ".prm5"
		Rcv	Rcv	Receives parameters from the servo amplifier.
		Trans	Trans	Transmits parameters to the servo amplifier.

No.	Name	Function							
		Icon	Name		Function				
		Сору Сору			Copies the parameters of a servo amplifier to servo amplifiers for other axes.				
		EEP	EEP		Writes parameters to EEPROM of the servo amplifier.				
		Bin/Hex	Bin / Hex		Inputs the selected settings in binary or hexadecimal format.				
		Print Print			Prints parameters.				
		PinAssign	Pin assigr setting	ment Sets I/O pin assignment.					
			After a theme is selected, if a parameter category is selected from a sub- theme, related parameters will be displayed in the parameter setting area.						
	Theme selection pane	Position co	ontrol		Theme				
		Initially(Position)							
(2)		Position mode selection Position command input							
(2)		Electronic gear rati							
		Gain tuning (Position)							
		···· Real Time Auto Tuni							
		Adaptive filter (Posit							
		For details on each parameter, refer to the instruction manual and other technical references for the servo amplifier.							
		Allows the	user to set	or edit para	ameters.				
		Name		Function					
		Class		Displays p	parameter categories				
		No.		Displays p	parameter numbers				
		Paramete	r Name		parameter names				
		Setup Rar	nge		he maximum and minimum allowable parameter settings				
(3)	Parameter setting area	For parameters set value, combo box box, press a ▼ butto a value us edit the va value, pre original va			parameter values. Values can be changed. neters provided with a ▼ button beside the a desired value can be selected from the box. After selecting a value from the combo is the <enter> key. For parameters without on beside the set value, either directly enter sing <numerical> keys or click "▲" "▼" to alue by increasing or decreasing it. To set a less the <enter> key. To return a value to its alue, press the <esc> key.</esc></enter></numerical></enter>				
		Unit		Displays t	ne unit of parameter settings.				

No.	Name	Function
(4)	Text display area	Displays a description related to the selected parameter.
(5)	Parameter attribute description area	Displays a description of parameter attributes. The background color of each parameter in the parameter setting area represents an attribute.
(6)	"Display-set value description" check box	Selecting the check box displays combo boxes and decimal points in the "Value" column of the parameter setting area. To display parameter set values in an easy-to-understand manner, select the check box.

15.8.2 Setting Parameters



1. From the menu bar on the main pane, select **Display>Parameter**. Alternatively, on the toolbar, click the "Open the Parameter view" icon.

PANATERM
File View Tools Help
3x 🗣 57 🗉 🖪 📖
Axes Opens the Parameter view (Alt+1) ID: - MINAS-AGNE
The "Coloction of normator to be read" dialog box will be di

The "Selection of parameter to be read" dialog box will be displayed.

Selection of parameter to be read	×
O Road out from the driver	
 Read-out from the driver 	
Read from file	
○ Read default	
01	Cancel

□ Read-out from the driver

Communicates with the connected servo amplifier and reads the parameter settings from the servo amplifier. If this mode is selected, parameter values will be reflected in the servo amplifier as soon as they are changed.

□ Read from file

Read the parameter file (".prm5") that was edited previously. If communication is performed with the servo amplifier, parameter values will be reflected in the servo amplifier as soon as they are changed.

Read default

Reads the standard default settings of the servo amplifier that were saved during installation. If communication is performed with the servo amplifier, parameter values will be reflected in the servo amplifier as soon as they are changed.

2. Select one of the three options above and click the [OK] button.

The Parameter window will be displayed.

🗃 Read	Save	Boy	Trans	CODY	FEP	Bin/Hex	Print	PinAssian				
the selec arameter l	ting the ther	ne from the double-clic	e left abov k the sub-	e, and sel	ecting the sul	o-theme from	n the left belo	w, the related parameters ca	n be displayed. To o be changed with <s< th=""><th>lisplay all parameters in num etting value>, and pressing</th><th>erical order. p <esc> can ca</esc></th><th>blease select the ncel the change. I</th></s<>	lisplay all parameters in num etting value>, and pressing	erical order. p <esc> can ca</esc>	blease select the ncel the change. I
NE Param	ieter list		\sim									
Class 0	(Basic)		Cla	ss No	Parame	ter Name				Setup Range	Value	Unit
Class 1	(Gain)		C	0 0	00 Rotation	al direction s	etup			0 - 1	1	
Class 2	(Damping)		C	0 0	01 Control	node setup				0-6	0	
Class 3	(Verocity/To	rque/Fu	0	0 0	02 Real-tim	e auto-gain t	uning setup			0 - 6	1	
	(I/F, Monitor)	C	0 00	03 Selection	ofmachine	stiffness at rea	al-time auto-gain tuning		0 - 31	13	
	(Enhancing)		0	0 0	04 Inertia r	atio				0 - 10000	250	%
	(Special)		C	0 0	08 Comman	d pulse coun	its per one mot	or revolution		0 - 8388608	0	pulse
Class 7	(Special)		C	0 0	09 Numerat	or of electro	nic gear			0 - 1073741824	1	
	(Special)		C	0 0	10 Denomin	ator of elect	ronic gear			1 - 1073741824	1	
	(Maker uses))	C	0 0	11 Output p	ulse counts	per one motor	revolution		1 - 2097152	2500	pulse/r
Class 1	5 (Special)		C	0 0	12 Reversa	l of pulse out	tput logic/outpu	ut source selection		0 - 3	0	
			0	0 0	13 1st torq	ue limit				0 - 500	500	%
			0	0 0	14 Position	deviation ex	cess setup			0 - 1073741824	83886080	Unit dependent
			C	0 0	15 Absolute	encoder set	tup			0 - 4	1	
			C	0 0	16 External	regenerativ	e resistor setup	o		0 - 3	3	
			C	0 0	17 Load fac	tor of extern	nal regenerativ	e resistor selection		0 - 4	0	
			0	0 0	18 For man	ufacturer's u	se			0-1	0	
				10 0: 10 0: 10 0:	16 External 17 Load fac 18 For man	regenerative tor of extern ufacturer's u	e resistor setup nal regenerativ se		ion. 0:CW = positive	0 - 3 0 - 4 0 - 1	3	
				Only	NotUse		Reset	Diselsuset	valuedescription			
			Read	only	NotUse		Reset		valueuescription			
			Syste		Other		Normal					

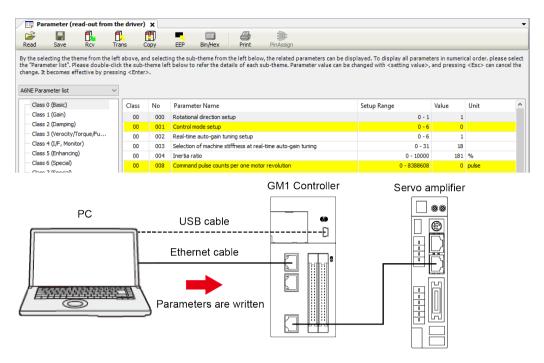
- 3. After changing the parameter settings, click the [EEP] button to write the parameter settings to the EEPROM of the servo amplifier.
- 4. Click the [x] button on the Parameter window to close the Parameter window.

15.8.3 Writing Parameters to Servo Amplifier

By connecting the PC and a servo amplifier, the parameters set with PANATERM Lite for GM can be written directly to the servo amplifier.



 Click "Trans" on the toolbar. The parameters will be sent from PANATERM Lite for GM to the servo amplifier.





• If you have changed parameters on a yellow background, click "EEP" on the toolbar to restart the servo amplifier.

15.8.4 Copying Parameters

Copies the parameters of a servo amplifier to servo amplifiers for other axes. It is not possible to copy between different series.



 Click the "Copy" icon on the toolbar. The Copy Parameter window will be displayed.

Copy Parameter	Х
Source Axis:	Destination Axes:
☐ ID: 0, SM3_Drive_RTEX_A6N_0 ☐ ID: 1, SM3_Drive_RTEX_A6N_1	D: 0, SM3_Drive_RTEX_A6N_0 D: 1, SM3_Drive_RTEX_A6N_1
	이옷 Cancel

- 2. In the "Copy source" area, select an axis from which parameters are to be copied.
- **3.** In the "Copy destination" area, select an axis to which parameters are to be copied.

Copy Parameter		\times
Source Axis:	Destination Axes:	
ID: 0, SM3_Drive_RTEX_A6N_0 ID: 1, SM3_Drive_RTEX_A6N_1	DID: 0, SM3_Drive_RTEX_A6N_0	
	OK Cancel	

4. Click the [OK] button.

- 5. The Parameter window for the copy destination axis will be displayed.
- Click the "Trans" icon on the toolbar. The parameters will be written to the servo amplifier.
- Click the [EEP] icon on the toolbar. The parameters will be written to the EEPROM of the servo amplifier.

15.8.5 Switching the Input Format of Parameter Values

Selected parameter values can be entered in binary or hexadecimal format.



 Click the "Bin / Hex" icon on the toolbar. The Binary / Hexadecimal Input window will be displayed.

📑 Param	neter (read from the	file) 🗙 🔄																	
	Save Rcv	Trans	Сору	EEP	Bin/Hex	Print	PinAssig	n											
	ng the theme from the ft below to refer the d																	eter list". P	leas
)-tneme ien	rt below to refer the d	etalls of each	i sub-ther	me. Paramet	ter value car	n be change	d with < setti	ng value>, a	and pressir	ig <esc></esc>	can cance	the cha	nge. It be	comes er	ective by pres	ising <enter></enter>			
NF Paramet	ter list	~																	
NE Paramet		~																	
Class 0 (B	Basic)	Class	No	Paramet	er Name										Setup Ran	ge	Val	alue	Ur
	Basic)	Class 00	No 000		ter Name al direction se	etup									Setup Ran	ge 0 ·		alue 1	U
Class 0 (B	Basic) Gain)	00	000	Rotationa	al direction se	tup									Setup Ran	0 -	1	1	U
Class 0 (B Class 1 (G Class 2 (D	Basic) Gain)	00	000	Rotationa Control m	al direction se node setup										Setup Ran	- 0 - 0 -	1 6	alue 1 0	U
Class 0 (B Class 1 (G Class 2 (D Class 3 (V	Basic) Gain) Damping)	00	000	Rotationa Control m Real-time	al direction se node setup auto-gain tu	uning setup	eal-time auto-								Setup Ran	0 -	1 6 6	1	U

To enter parameter values in hexadecimal format, enter a value and then press the <Enter>
 key. To enter parameter values in binary format, click the button corresponding to each bit
 to switch between "0" and "1".

Binary/Hexadecimal Input			×
Rotational direction setup			
Decimal	10000	Hexadecimal	2710
Binary input			
31 30 29 28	27 26 25 24	23 22 21 20	19 18 17 16
15 14 13 12	11 10 9 8	7 6 5 4	3 2 1 0
0 0 1 0	0 1 1 1	0 0 0 1	0 0 0 0
			OK Cancel

Note: If the input exceeds the parameter range, "!" mark is displayed on the right side of the hexadecimal display section. Move the mouse cursor over the "!" mark to display the input range.

Binary/Hexadecimal Input		×	
Rotational direction setup Decimal 10 Binary input	Hexadecimal	A O The given value is out of range (Value = 10, Min =	0, Max = 1).

3. After the above input operation is complete, click the [OK] button.

15.8.6 Setting I/O Pin Assignment

I/O pin assignment can be set.

The assignment can be set for the input and output related parameter "Class 4 (I/F, monitor)".



Procedure

 Click the "Pin assignment " icon on the toolbar. The pin assignment setting input window will be displayed.

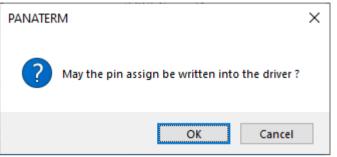
Pin-No.	Position/Full-closed control	Velocity control	Torque control
05(SI1)	SI-MON5_ConnectA	SI-MON5_ConnectA	SI-MON5_ConnectA
07(SI2)	POT_ConnectB	POT_ConnectB	POT_ConnectB
08(SI3)	NOT_ConnectB	NOT_ConnectB	NOT_ConnectB
09(SI4)	SI-MON1_ConnectA	SI-MON1_ConnectA	SI-MON1_ConnectA
10(SI5)	HOME_ConnectA	HOME_ConnectA	HOME_ConnectA
11(SI6)	EXT2_ConnectA	EXT2_ConnectA	EXT2_ConnectA
12(SI7)	EXT3_ConnectA	EXT3_ConnectA	EXT3_ConnectA
13(SI8)	SI-MON4_ConnectA	SI-MON4_ConnectA	SI-MON4_ConnectA
utput			
Pin-No.	Position/Full-closed control	Velocity control	Torque control
01/02(SO1)	BRK-OFF	BRK-OFF	BRK-OFF
25/26(SO2)	EX-OUT1	EX-OUT1	EX-OUT1
	ALM	ALM	ALM

2. Double-click the row of the pin number to be set. The function selection window will be displayed.

Input function select			>	
Position/Full-closed con	trol	⊖ B-Connect		
Velocity control	A-Connect	O B-Connect		
Torque control	A-Connect	⊖ B-Connect		
Position/Full-closed	Velocity control	Torque control	^	
Invalid	Invalid	Invalid		
POT	POT	POT		
NOT	NOT	NOT		
EX-SON	EX-SON	EX-SON		
-	-	-		
-	-	-		
-	-	-		
-	-	-		
-	-	-		
			· ·	
		OK Cance		

- **3.** Select a function to be assigned to the pin for each control mode and a contact method (only when an input function is selected).
- In the function selection window, click the [OK] button.
 The display will be returned to the pin assignment setting input window.
- 5. Click the [OK] button.

A confirmation window will be displayed, asking whether to write to the servo amplifier.



Click the [OK] button to write the parameter settings to the EEPROM of the servo amplifier. Click the [Cancel] button to close the window without writing the parameter settings to the EEPROM of the servo amplifier.

Note: Pin assignment settings do not take effect until the servo amplifier is restarted.

15.9 Object Window

Troubleshooting can be performed more easily by displaying and editing the list of objects on the amplifier side without using a host device.

1 Info.

- Object Window is for EtherCAT connection only.
- Some objects affect the behaviors of servo amplifiers or motors. Therefore, before changing the objects, carefully read the instruction manual and other technical references for the servo amplifier and pay careful attention when changing them.

15.9.1 Configuration of Object Window

😨 Object (default) 🗙										
🖻 🖬 🚯	6 60	- H	Disolay Mode: Hex							
Read Save Rov	Trans Copy	EEP	Print							_
nen EtherCAT communication sta	te(ESM) is Operationa	l, changed sett	ing values can be sent to the servo amplitier.							
oject value can be changed by se MINAS:ASB series, object other	t the <value> and pre than the 3000h group</value>	ess <enter> or can be enable</enter>	leave the selected row. Editing a object value can be d if you reset the control power after writing to the E	e canceled by pressing <es< th=""><th>ю.</th><th></th><th></th><th></th><th></th><th></th></es<>	ю.					
The second second second	chair che booon groop	can be enable	s in your esser the control points when when when	LINOIN .						
Close TreeView	PDS Conditio	n -	ESM Condition -							
All object	Main Index	Sub Index	Object Name	Data Type	Attributes	Min	Max	Value	Unit	
🗏 - 1000h	1000h	00h	Device type	U32	RO	00000000h	FFFFFFFh	00020192h		
≝ 3000h	1001h	00h	Error register	U8	RO	00h	FFh	00h		
8 4000h	1008h		Manufacturer device name	VS	RO			MADLT158F		
6000h	1009h	00h	Manufacturer hardware version	VS	RO			V1.00		
	100Ah	00h	Manufacturer software version	VS	RO			V1.00		
	1010h	00h	Number of entries	U8	RO	00h	FFh	01h		
	10 10h	01h	Save all parameters	U32	RO	00000000h	FFFFFFFFh	0000000 1h		
	1018h		Number of entries	UB	RO	00h	FFh	04h		
	1018h	01h	Vendor ID	U32	RO	00000000h	FFFFFFFh	0000066Fh		
	1018h	02h	Product code	U32	RO	00000000h	FFFFFFFh	613C0005h		
	1018h		Revision number	U32	RO	00000000h	FFFFFFFh	00010000h		
	1018h		Serial number	U32	RO	0000000h	FFFFFFFh	0000000h		
	10F3h		Number of entries	U8	RO	00h	FFh	13h		
	10F3h		Maximum messages	U8	RO	00h	FFh	OEh		
	10F3h		Newest message	U8	RO	00h	FFh	00h		
	10F3h		Newest advnowledged message	U8	RO	00h	FFh	00h		
	10F3h		New messages available	BOOL	RO	Oh	1h	Oh		
	10F3h		Flags	U16	RW	0000h	FFFFh	0027h		
	10F3h		Diagnosis message 1	OS	RO			00000000h		
	10F3h		Diagnosis message 1	OS	RO			0000000h		
	10F3h		Diagnosis message 1	OS	RO			00000000h		
	10F3h		Diagnosis message 1	OS	RO			00000000h		
	10F3h		Diagnosis message 2	OS	RO			00000000h		
	10F3h		Diagnosis message 2	OS	RO			00000000h		
	10F3h 10F3h		Diagnosis message 2 Diagnosis message 2	OS	RO			00000000h		
	10F3h 10F3h		Diagnosis message 2 Diagnosis message 3	OS	RO			00000000h		
	10F3h		Diagnosis message 3 Diagnosis message 3	OS	RO			00000000h		
↑	10F3h		Diagnosis message 3	OS	RO			00000000h		
	10F3h		Diagnosis message 3	OS	RO			00000000h		
					RU			00000000		

No.	Name	Function						
		The toolbar and read.	consists of bas	sic operation commands related to objects, such as save				
		Icon	Name	Function				
(1)	Toolbar	Pread	Read	Reads objects from the file ".obj5".				
		F Save	Save	Writes objects to the file ".obj5".				

No.	Name	Function					
		Rcv	Rcv	Receives objects from the servo amplifier.			
		9		Transmits objects to the servo amplifier.			
		Trans	Trans	If you turn OFF the power supply to the servo amplifier without writing to EEPROM, the object will be reverted back to the value before the change was made.			
		Copy	Сору	Copies the objects of a servo amplifier to servo amplifiers for other axes.			
				Writes objects to EEPROM of the servo amplifier.			
			EEP	Do not turn OFF the power supply to the servo amplifier and the PC while data is being written to EEPROM.			
		EEP		If the power supply is cut off while data is being written, the data content is not warranted.			
		erint	Print	Prints objects.			
				Changes the numerical display of the object being displayed.			
		Hex •	Display	Hex: Displayed in hexadecimal number and "h" is placed at the end of the number.			
			mode	Dec: Displayed in decimal number and a sign is set. Bin: Displayed in binary number and "b" is placed at the end of the number. The values in the Min-Max column			
				are displayed in hexadecimal number.			
		PDS Condi	tion				
				n on the servo amplifier side.			
	Condition	It varies dep	ending on the	object value of 6041h-00h.			
(2)	monitor	ESM Condi	tion				
		Displays the amplifier sid		indicates whether the object can be rewritten on the servo			
		Rewriting is	possible when	"Operational" is displayed.			
		When a nod object settin		rom the object tree, related objects are displayed in the			
		Operate Close TreeView or Open TreeView to hide or display the object tree.					
	Objects		bject" to displa				
(3)	Object tree	When a par displayed.	ent node is sel	ected, all child node objects under the selected node are			
		When a chil	d node is seled	cted, objects of the selected node are displayed.			
			of each object, or the servo ar	refer to the instruction manual and other technical nplifier.			

No.	Name	Function					
		B- All object	Parent node				
		- 1000h - 1000h - 1600h - 1600h - 1400h - 100h - 100h	Child node				
		- 3000h - 3100h - 3200h - 3300h - 3400h - 3500h - 3500h - 3500h - 3500h - 3000h - 4000h					
		Allows the u	iser to edit and set an object.				
		Name	Function				
		Main Index	Displays the Main Index of an object.				
		Main Index	Displays the Sub Index of an object.				
		Object Name	Displays the name of an object.				
(4)	Object setting field	Data Type	Displays the data type of an object. 18: Integer 8 type 116: Integer 16 type 132: Integer 32 type U8: Unsigned 8 type U16: Unsigned 16 type U32: Unsigned 32 type Bool: Boolean type OS: Octet String type VS: Visible String type				
		Attributes	Displays the attributes of an object. RO: Read-only attribute, exclusively for reading. RW: Read/write attribute, possible to read or write.				
		Min	Displays the setting range of an object.				
		Мах	The setting range is not displayed for an object whose Data Type is "OS" or "VS".				
			Displays the value of an object. The value can be changed if the object attribute is "RW" and the set value is a numerical value. Note that there are input restrictions for each Display mode setting. The				
			following values can be input.				
		Value	Hex: 0 to 9, A to F (After editing, ""h"" is automatically placed at the end of the number.)				
			Dec: 0 to 9 and minus sign "-"				
			Bin: 0 and 1 (""b"" is automatically placed at the end of the number.) After changing the value, press the <enter> key or click the [Trans] button.</enter>				
			To return a value to its original value press the <esc> key.</esc>				
		Unit	Displays the unit of an object set value.				

15.9.2 Setting Objects

¹² Procedure

1. From the menu bar on the main pane, select **View>Object**. Alternatively, on the toolbar, click the "Open the Object view" icon.

R PANATERM
File View Tools Help
3x 🗣 🗊 📼 🖪 🖪 🛤
Open the Object view (Alt+2)
Axes 🗸 🗸 🗸
ID: - MINAS-A6BE

The "Selection of objects to be read" dialog box will be displayed.

Selection of objects to be read	×
 Read-out from the driver Read from file Read default 	
OK Cancel	

□ Read-out from the amplifier.

Communicates with the connected servo amplifier and reads objects set in the servo amplifier.

If this mode is selected, object values will be reflected in the servo amplifier as soon as they are changed.

□ Read from file

Reads the parameter file ("obj5") that was edited previously. If communication is performed with the servo amplifier, object values will be reflected in the servo amplifier as soon as they are changed.

Read default

Reads the standard default settings of the servo amplifier that were saved during installation.

If communication is performed with the servo amplifier, object values will be reflected in the servo amplifier as soon as they are changed.

 Select one of the three options above for reading the object settings and click the [OK] button.

🗔 Object (default) 🗙											
Read Save Rcv	Trans Copy	EEP	Display Mode: Hex	•							
ject value can be changed b	y set the <value> and pr</value>	ess <enter> o can be enable</enter>	driver and changing the setting value r leave the selected row. Editing a o ed if you reset the control power after ESM Conditio	object value can be cancel by press ter writig the EEPROM.	<esc>.</esc>						
All object				··· []							_
÷ All object ⊕ - 1000h	Main Index	Sub Index	Object Name		Data Type	Attributes	Min	Max	Value	Unit	
■- 1000h	1000h		Device type		U32	256	0000000h	FFFFFFFh	00020192h		
- 4000h	100 1h		Error register		U8	256	00h	FFh	00h		
4000h	1008h		Manufacturer device name		VS	256			MADHT1505801		
60001	1009h		Manufacturer hardware version		VS	256			V1.00		
	100Ah		Manufacturer software version		VS	256			V1.00		
	1010h		Number of entries		U8	256	00h	FFh	01h		
	1010h		Save all parameters		U32	0	0000000h	FFFFFFFh	00000000h		
	1018h		Number of entries		UB	4352	00h	FFh	04h		
	1018h		Vendor ID		U32	4352	00000000h	FFFFFFFh	0000066Fh		
	1018h		n Product code		U32	4352	00000000h	FFFFFFFh	51505001h		
	1018h		n Revision number		U32	4352	00000000h	FFFFFFFh	00010000h		
	1018h		Serial number		U32	4352	00000000h	FFFFFFFh	0000000h		
	10F3h		Number of entries		U8	256	00h	FFh	13h		
	10F3h		Maximum messages		U8	256	00h	FFh	0Eh		
	10F3h		Newest message		UB	256	00h	FFh	00h		
	10F3h		Newest acknowledged message		U8	0	00h	FFh	00h		
	10F3h		New messages available		BOOL	256	0h	1h	0h		
	10F3h		Flags		U16	0	0000h	FFFFh	0007h		
	10F3h		n Diagnosis message 1		OS	256			0000000h		
	10F3h		Diagnosis message 1		OS	256			00000000h		
	10F3h		Diagnosis message 1		OS	256			00000000h		
	10F3h		n Diagnosis message 1		OS	256			0000000h		
	10F3h		n Diagnosis message 2		OS	256			0000000h		
	10F3h		n Diagnosis message 2		OS	256			0000000h		
	10F3h		n Diagnosis message 2		OS	256			0000000h		
	10F3h	07	n Diagnosis message 2		OS	256			0000000h		
	10F3h	08	Diagnosis message 3		OS	256			0000000h		
	10F3h	08	Diagnosis message 3		OS	256			0000000h		
	10F3h	09	Diagnosis message 3		OS	256			0000000h		

The Object window will be displayed.

- **3.** After changing the object settings, click the [EEP] button to write the object settings to the EEPROM of the servo amplifier.
- 4. Click the [×] button on the Object window to close the Object window.

15.9.3 Writing Objects to Servo Amplifier

By connecting the PC and a servo amplifier, the objects set with PANATERM Lite for GM can be written directly to the servo amplifier.



 Click [Trans] on the toolbar. The objects will be sent from PANATERM Lite for GM to the servo amplifier.

ad Save Rcv	Trans	Сору	EEP	Print Di	isplay Mode: Hex	•				
SM state is not Init then, yo ect value can be changed b MINAS-A5B series, object of Close TreeView	y set the <value> her than the 3000</value>	> and pre	ss <enter> or an be enabled</enter>	leave the select	ted row. Editing a obje	ct value can be cancel by privritig the EEPROM.	ess <esc>.</esc>			
All object	Main I	ndex	Sub Index	Object Name			Data Type	Attributes	Min	Max
i 1000h		1000h		Device type			U32	256	00000000h	FFFFF
1000h		100 1h		Error register			UB	256	00h	
1600h		1008h		Manufacturer d	levice name		VS	256	0011	
1A00h		1009h			hardware version		VS	256		
1C00h		1005h		00h Manufacturer software version				256		
9000h		1010h		Number of entr			VS U8	256	00h	
3000h		1010h		Save all parame			U32	0	00000000h	FFFFF
3100h		1018h		Number of entr			U8	4352	00b	
3200h		1018h		Vendor ID	105		U32	4352	00000000h	FFFFF
3300h		1018h		Product code			U32	4352	00000000h	FFFF
3400h		1018h		Revision numbe	~		U32	4352	00000000h	FFFF
3500h		1018h		Serial number			U32	4352	00000000h	FFFF
3600h		10F3h			rier		UB	256	000000000	
3700h		10F3h		Maximum mess			UB	256	00h	
3800h		10F3h			2		UB	256	00h	
4000h		10F3h		-	ye wledged message		UB	250	00h	
		104,20	Uan	newest acknow	weugeu message		08	0	uun	

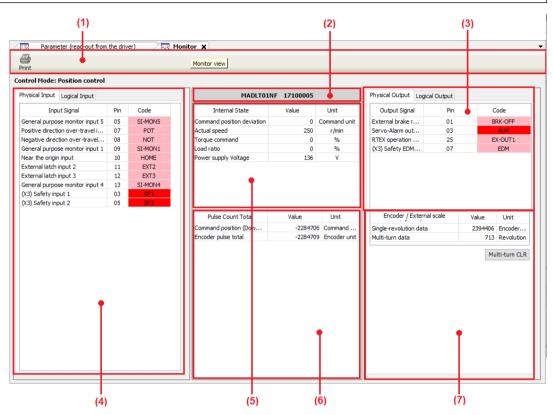
2. Click the [EEP] button to write the objects to the EEPROM of the servo amplifier.

ad	Save	Rev	Trans	Copy	EEP	Print Uis	play Mode: Hex	•				
ject vali	ue can be cl	hanged by se object other	et the <\	/alue> and pri	can be enabled	reave me allecte		ject value can be cancel b writig the EEPROM.	y press <esc>.</esc>			
All obj	ject			Main Index	Sub Index	Object Name			Data Type	Attributes	Min	Max '
₽ -10	000h			1000h	00h	Device type			U32	256	00000000h	FFFFF
	1000h			100 1h		Error register			UB	256	00h	
	1600h			1008h	00h	Manufacturer de	vice name		VS	256		
	1A00h			1009h	00h	Manufacturer ha	ardware version		VS	256		
	1C00h			100Ah	00h	Manufacturer so	ftware version		VS	256		
= 3	000h			1010h	00h	Number of entrie	es		U8	256	00h	
	3000h			1010h	01h	Save all paramet	ters		U32	0	0000000h	FFFFFI
	3100h			1018h	00h	Number of entrie	es		U8	4352	00h	
	3200h			1018h	01h	Vendor ID			U32	4352	00000000h	FFFFFI
	3300h			1018h	02h	Product code			U32	4352	00000000h	FFFFFI
	3400h			1018h	03h	Revision number			U32	4352	00000000h	FFFFFI
	3500h			1018h	04h	Serial number			U32	4352	00000000h	FFFFFI
	3600h			10F3h	00h	Number of entrie	es		U8	256	00h	
	3700h			10F3h	01h	Maximum messa	ges		U8	256	00h	
	3800h			10F3h	02h	Newest message	2		U8	256	00h	
- 4	000h			10F3h	03h	Newest acknowle	edged message		U8	0	00h	
6	000h			1050			4.1.1		20.01	000		

15.10 Monitor Window

The Monitor window displays the operating states of servo amplifiers and motors, I/O signals, internal statuses, and other information and also allows the user to check them.

15.10.1 Configuration of Monitor Window



NO.	Name	Description						
		The toolbar consists of basic operation commands related to paramete						
(1)	Toolbar	lcon	Name	Function				
		Print	Print	Prints the contents of the Monitor window.				
(2)	Amplifier model name and serial number	Displays the model	name and serial n	umber of the servo amplifier.				
		Displays the status "Physical Output" a		nal. The tab can be switched between ".				
(3)	Output signal status monitor	Physical Output – Displays the status of output signals from the servo amplifier.						
		Red: Indicates that	output transistor is	ON				
		Pink: Indicates that output transistor is OFF						

NO.	Name	Description				
		Logical Output – Disp Red: Indicates that sig Pink: Indicates that sig				
(4)	Input signal status monitor	Displays the status of input signals. The tab can be switched between "Physical Input" and "Logical Input". Physical Input – Displays the status of input signals to the servo amplifier. Red: Indicates that COM- is connected Pink: Indicates that signal status is open Logical Input – Displays the status of signals within the servo amplifier. Red: Indicates that signal status is active Pink: Indicates that signal status is inactive				
			status of the servo amplifier.			
		Name	Function			
		Commanded position deviation	Displays the position deviation of a command unit.			
(5)	Internal status monitor	Actual speed	Displays the monitor speed			
		Torque command	Displays the torque command.			
		Load factor	Displays the ratio relative to the rated load. Adjust the operation pattern so that 100% is not exceeded.			
		Power supply voltage value	Displays the voltage (voltage between the P and N terminals) of power supply to the servo amplifier.			
(6)	Pulse sum monitor	Displays the sum of c amplifier.	ommand and encoder pulses received by the servo			
		Displays encoder info	rmation.			
		Single-turn data	Displays an absolute position when the motor makes no more than a single turn.			
(7)	Encoder information monitor	Multi-turn data	Displays how many turns the motor made after "Clear" operation.			
		"0" and clears all enco Note: Before using "C	urn" resets the multi-turn data stored in the encoder to oder errors. lear Multi-turn", check the precautions on use. To clear hay need to restart the servo amplifier.			

(Note 1) Because Ethernet communication is used to transfer data between the servo amplifier and PC, there is a difference or delay between the value displayed on the screen and the actual value of the servo amplifier.

- (Note 2) When the polarity is "+", symbol "+" is not displayed.
- (Note 3) The monitor function is not a measuring instrument. Use the values displayed in the Monitor window as a guide.
- (Note 4) If the servo amplifier outputs "Error 40.0 Error protection from absolute system failure" or "Error 42.0 Error protection from absolute overspeed", execute "Clear Multi-turn". Unless the absolute encoder is reset, the alarm cannot be cleared.

15.10.2 Checking the Monitor Window



1. From the menu bar on the main pane, select **Display>Monitor**. Alternatively, on the toolbar, click the "Open the Monitor view" icon.

PANATERM	
File View Tools Help	
3x 🗳 🗊 🖬 🖪 🔣	
Axes	s the Monitor view (Alt+3)
ID: 1 SH3_Drive_RTEX_A6N	

The Monitor window will be displayed.

hysical Input Logical Input			MADLT01N	F 17100005		Physical Output Logica	l Output	
Input Signal	Pin	Code	Internal State	Value	Unit	Output Signal	Pin C	ode
General purpose monitor input 5	05	SI-MON5	Command position deviation	0	Command unit	External brake r	01 B	RK-OFF
Positive direction over-travel i	07	POT	Actual speed	0	r/min	Servo-Alarm out	03	ALM
Negative direction over-travel	08	NOT	Torgue command	0	%	RTEX operation	25 E	X-OUT1
General purpose monitor input 1	09	SI-MON1	Load ratio	0	%	(X3) Safety EDM	07	EDM
Vear the origin input	10	HOME	Power supply Voltage	137	v			
External latch input 2	11	EXT2	,					
External latch input 3	12	EXT3						
General purpose monitor input 4	13	SI-MON4						
X3) Safety input 1	03	SF 1						
(X3) Safety input 2	05	SF2						
			Pulse Count Total	Value	Unit	Encoder / External	scale Value	Unit
			Command position (Dow	-228468	Command	Single-revolution data	2394434	Encoder
			Encoder pulse total	-2284679	Encoder unit	Multi-turn data	713	Revolution
							Mu	ulti-turn CLR

2. Check each item.

Check the input signal state, output signal state, and the internal status of the servo amplifier.

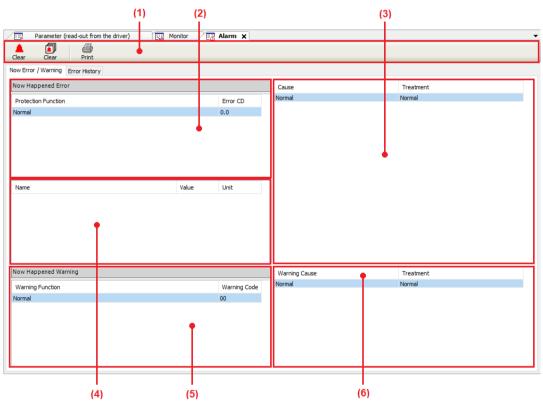
3. Click the [x] button on the Monitor window. The Monitor window will be closed.

15.11 Alarm Window

If the front panel of the servo amplifier is blinking, such as when the motor is not working, you can check the alarm status.Please note that the alarm cannot be cleared.

15.11.1 Configuration of Alarm Window

Display of the current errors and warnings (only during communication with servo amplifier)



Display of error histories

	(7)		(8)
Alarm X				
Lear Clear Print				
ow Error / Warning Error History				
Hist Protection Function		Error CD	Cause	Treatment
1 Command error protection		27.4	Position command variation (value after	Check whether the position command was
2 RTEX communication timeout error protection		84.0	electronic gear) exceeds the specified valu	
3 RTEX communication timeout error protection		84.0		control (CP). Check electronic gear ratio.
4 RTEX communication timeout error protection		84.0		Check whether Update Counter is changed in
5 RTEX communication timeout error protection		84.0		the correct period.
6 RTEX communication timeout error protection		84.0	11 · · · · · · · · · · · · · · · · · ·	In case of changes from servo-off to
7 Command error protection	-	27.4		servo-on, check whether the position command was initialized by the actual position
8 RTEX communication timeout error protection	84.0		when Servo Active is 0.	
9 RTEX communication timeout error protection		84.0		Check whether parameter settings related to
10 RTEX communication timeout error protection		84.0		the communication cycle or the command
11 RTEX communication timeout error protection		84.0		update cycle are consistent with the specifications of the host controller.
12 RTEX communication timeout error protection		84.0		apecine addita of the nost condition.
13 RTEX communication timeout error protection		84.0		
14 RTEX communication timeout error protection		84.0		
Name	Value	Unit /	×	
Control mode	0	-		
Motor speed	90	r/min		
Position control speed	3	r/min		
Velocity control command	90	r/min		
Torque control	-1.0	%		
Position deviation command	149157	Command unit		
Motor position	251509057	Encoder unit		
Hybrid deviation	0	Command unit		
Input port (Logical signal)	2013265933	-		
Output port (Logical signal)	266249	-		
Analog input	0	AD value		
Maker uses	0	-		
Maker uses	0	-		
Over-load ratio	1.4	%		

(9)

No.	Name	Description		
		lcon	Name	Function
(1)	Toolbar	Clear	Clear	Allows the user to clear the current alarm history. If you click this button after eliminating the cause of the alarm, the current alarm will be cleared and normal operation will be performed. However, you cannot clear any alarms that cannot be cleared by alarm clear input signals of servo amplifiers. In such a case, turn off the servo amplifier, eliminate the cause of the alarm, and then turn the power on again.
		Clear	Clear	Allows the user to clear error histories.
		e Print	Print	Prints error-related information.
(2)	Current error display area	occurring.	d on the top of the	es of all errors that are currently list is the alarm displayed on the front

No.	Name	Description
(3)	Error cause / treatment display area	Displays the cause and treatment of the selected error.
(4)	Motor internal status display area	Displays the motor internal status in the event of an alarm.
(5)	Current warning display area	Displays the warning numbers and names of all warnings that are currently occurring.
(6)	Warning cause / treatment display area	Displays the cause and treatment of the selected warning.
(7)	Error history display area	Displays the order of error histories, alarm numbers, and error names.
(8)	Error cause / treatment display area	Displays the cause and treatment of the selected error.
(9)	Motor internal status display area	Displays the motor internal status in the event of an alarm.

(Note 1) Some alarms cause tripping as errors but are not recorded in error histories. For alarms that are not recorded in error histories, refer to the instruction manual of the servo amplifier.

(Note 2) Up to 14 error histories are stored. When more than 14 errors occur, error histories are erased in chronological order (the oldest error history is erased first).

(Note 3) Up to three histories of motor internal status in the event of an alarm are stored. If an alarm occurs immediately after the power is turned on, motor internal status may not be captured normally.

15.11.2 Checking Alarms



1. From the menu bar on the main pane, select **Display>Alarm**. On the toolbar of the main pane, click the "Open the Alarm view" icon.



The Alarm window will be displayed.

K Alarm X							
^ ▲	Print						
	History						
Now Happened Error				Cause	Treatment		
Protection Function			Error CD	Normal	Normal		
Normal			0.0				
Name		Value	Unit				
Now Happened Warning				Warning Cause	Treatment		
Warning Function			Warning Code	Normal	Normal		
Normal			00				
	Cer Cer Now Happened Error Now Happened Error Protection Normal Name Name Now Happened Warning Warning Function				Car Car Print Print Print Print Print Print Cause Protecton Function Protecton Function Protecton Function Normal D.0 Normal Norma	Cauce Treatment Mormal Normal Normal	Case Print P

- Check for any errors that are currently occurring. Click the current "Now Error / Warning" tab and check for any errors that are currently occurring.
- 3. Check for any errors that occurred in the past.

Click the "Error History" tab and check for any errors that occurred in the past.

4. Click the [×] button on the Alarm window. The Alarm window will be closed.

15.12 Other Functions

15.12.1 Language Setting Function

This function allows the user to set the display language of PANATERM Lite for GM. The default setting is the same language as the one set in GM Programmer.

¹² Procedure

 Select a language from the menu bar tool. The language set in PANATERM Lite for GM will be switched.



• The display language setting of PANATERM Lite for GM is linked with that of the GM Programmer.

15.12.2 Version Display Function

This function allows the user to check the version, license, and other information for PANATERM Lite for GM.

1₂ Procedure

1. From the menu bar, select Help>Version Info.

Information(1.1.0.109)	×
PANATERM Lite for GM V1.1	
Version Info(V) License Info(L) Close(C)	

2. Click a desired button at the bottom of the window.

Button	Description
Version Info	Displays information about the plug-ins that have been applied and the operating system of the PC that is used.
License Info	Displays license information for the software used by PANATERM Lite for GM.

15.13 Troubleshooting

15.13.1 Troubleshooting for Servo Amplifiers and Motors

This section explains how to resolve problems.

I Cannot Set up

Symptom	Action method
I cannot set up	• Refer to the chapter related to the system configuration that you need, and check that the PC in which you install the software satisfies the necessary conditions. In particular, note that all the necessary service packs for the operating system must have been applied.
	• The installer may have been damaged due to download failure. Clear the browser cache and then download again.

I Cannot Communicate

Symptom	Solution
After PANATERM Lite for GM is started,	 Check that the power to the control circuit of the servo amplifier is turned on. Check the USB communication cable for loose connections or
the servo amplifier is not recognized in the window for connecting to the servo amplifier.	breakage or check whether a correct cable is used.
	• Check whether the USB port on the PC is functioning normally. (Refer to the instruction manual of the PC.)
	Check whether the USB driver is installed correctly.
After PANATERM Lite for GM is started, the GM1 controller is not recognized in the window for connecting to the GM1 controller.	Check that the power to the GM1 controller is turned on.
	• Check the USB communication cable or Ethernet cable for loose connections or breakage or check whether a correct cable is used.
	 Check whether the USB port on the PC is functioning normally. (Refer to the instruction manual of the PC.)
	 Check whether the LAN adapter on the PC is functioning normally. (Refer to the instruction manual of the PC.)
	Check whether the USB driver is installed correctly.
	Check whether Gateway is running.

I Cannot Print

Symptom	Action method
I cannot print	 Check whether the printer is connected correctly. Check that the printer driver is operating normally, by printing a test page, for example.
	 You may be unable to print any comment that consists of too many characters in a single line. Split such a comment into

Symptom	Action method
	multiple lines so that the number of characters per line falls within the printable range.

I Cannot Set up Axes

Symptom	Solution
The number of servo amplifiers connected does not match the number of servo amplifiers checked by performing a search.	 Check whether the axis name (ID) of the servo amplifier connected to the PC is 0, the respective axis names (IDs) of other servo amplifiers are 1 to 15, and there are any duplicate axis names (IDs). Check the communication cable for loose connections or breakage or check whether a correct cable is used.

PANATERM Lite for GM Does Not Behave Normally

Symptom	Solution
PANATERM Lite for GM responds or acts slowly	 Close any windows that are not used. All windows communicate with the servo amplifier in certain cycles even if they are hidden under other windows. If USB devices other than servo amplifiers are connected, reduce USB communication load by pausing their operations or taking some other action.
The window does not open or icons appear garbled	 The PC is running out of memory. Temporarily close PANATERM Lite for GM and other applications that are not used. Alternatively, turn the PC off and then on, and start PANATERM Lite for GM again.
PANATERM Lite for GM does not respond	 Press the <ctrl> key + <alt> key + <delete> key simultaneously to invoke the window for forcibly terminating programs, and terminate PANATERM Lite for GM.</delete></alt></ctrl>
PANATERM Lite for GM suddenly terminates	Start PANATERM Lite for GM again.
PANATERM Lite for GM does not start	• Microsoft .NET Framework Ver. 4.6.1 may have failed to be installed. Refer to the website of Microsoft and install Microsoft .NET Framework Ver. 4.6.1 directly on the PC that you use. After installing Microsoft .NET Framework Ver. 4.6.1, run the PANATERM Lite for GM installer again.

The Parameter Window Does Not Behave Normally

Symptom	Solution
The changed parameter value returns to its original value	 After changing the parameter value, press the <enter> key or click the [Trans] button. If you move to another parameter or make changes in the window without performing either of these operations, any change to the parameter value will be canceled.</enter> When the values read from a file are displayed in the window, changed parameter values are not sent to the servo amplifier. To send changed parameter values to the servo amplifier, click the [Trans] button.

The Monitor Window Does Not Behave Normally

Symptom	Solution
Monitor display does not change	• There is a possibility that communication with the servo amplifier has been disrupted and the PC is in an offline state. Check the connection status of the servo amplifier.

The Alarm Window Does Not Behave Normally

Symptom	Action method
	• If no error has occurred before or error histories have been cleared, error histories are not displayed.
Error histories are not displayed	• Supplementary information about errors is displayed only when the most recent, the second most recent, or the third most recent error history is selected. Select an error history number again.
	• Errors that are not recorded in error histories are not displayed in error histories even if they occur.

Unusual Operation during RTEX Motion Control

Acquiring values on the monitor window and writing or reading on the parameter window cannot be executed simultaneously with the following function blocks.

RTEX_Reset、PMC_Home、PMC_ReadLatchPosition、PMC_StopLatchPosition

Internal State	Value	Unit
Command position deviation	<read data="" failed="" monitor=""></read>	Command unit
Actual speed	<read data="" failed="" monitor=""></read>	Command unit/s
Torque command	<read data="" failed="" monitor=""></read>	%
Load ratio	<read data="" failed="" monitor=""></read>	%
Power supply Voltage	<read data="" failed="" monitor=""></read>	v
Pulse Count Total	Value	Unit
Command position (Downstream of filter)	<read data="" failed="" monitor=""></read>	
	<read data="" failed="" monitor=""></read>	
Encoder pulse total	<reau data="" failed="" monitor=""></reau>	Encoder unit

h <value> and pressing <ecc> c</ecc></value>	eft above,	and sele	cting the sub-theme from the left below, the related parameters can be e. It becomes effective by pressing <enter>.</enter>	displayed. To display all paramet	ers in numerical order, please s	elect the "Param
in cronder, and pressing ceach e	un concer	and chung	crabiconics creative by pressing ventury.			
	_					
iNF Parameter list	~					
Class 0 (Basic)	Class	No	Parameter Name	Setup Range	/alue	Unit
Class 1 (Gain)	00	00	Rotational direction setup	0 - 1	<execute command="" failed.=""></execute>	
Class 2 (Damping)	00	00	Control mode setup	0 - 6	<execute command="" failed.=""></execute>	
Class 3 (Verocity/Torque/Fu	00	00	2 Real-time auto-gain tuning setup	0 - 6	<execute command="" failed.=""></execute>	
Class 4 (I/F, Monitor)	00	00	Selection of machine stiffness at real-time auto-gain tuning	0 - 31	<execute command="" failed.=""></execute>	
Class 5 (Enhancing)	00	00	Inertia ratio	0 - 10000	<execute command="" failed.=""></execute>	%
Class 6 (Special)	00	00	Command pulse counts per one motor revolution	0 - 8388608	<execute command="" failed.=""></execute>	pulse
Class 7 (Special)	00	00	Numerator of electronic gear	0 - 1073741824	<execute command="" failed.=""></execute>	
Class 8 (Special)	00	01	Denominator of electronic gear	1 - 1073741824	<execute command="" failed.=""></execute>	
Class 9 (Maker uses)	00	01	Output pulse counts per one motor revolution	1 - 2097152	<execute command="" failed.=""></execute>	pulse/r
Class 15 (Special)	00	01	2 Reversal of pulse output logic/output source selection	0 - 3	<execute command="" failed.=""></execute>	
	00	01	3 1st torque limit	0 - 500	<execute command="" failed.=""></execute>	%
	00	01	Position deviation excess setup	0 - 1073741824	<execute command="" failed.=""></execute>	Unit dependent
	00	01	Absolute encoder setup	0 - 4	<execute command="" failed.=""></execute>	
	00	01	External regenerative resistor setup	0 - 3	<execute command="" failed.=""></execute>	
	00	01	7 Load factor of external regenerative resistor selection	0 - 4	<execute command="" failed.=""></execute>	
	00	01	B For manufacturer's use	0 - 1	<execute command="" failed.=""></execute>	

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Appendix Warranty / Cautions for Proper Use

Warranty	Арр-2
Cautions for Proper Use	Арр-3

Warranty

Warranty Period

The warranty period of the Product shall be 12 months from the ex-factory date or 18 months from the date of manufacturing unless otherwise specified between both parties.

Warranty Scope

Panasonic warrants the replacement of the defected parts of the Product or repair of them when the defects of the Product occur during the Warranty Period, and when the defects are under Panasonic responsibility. This Warranty only covers the Product itself and does not cover any damage to your company and the third party incurred by the Product, such as damage that is induced by an object machined or produced using the Product or by the defects of the Product. This Warranty shall be exempted in the following cases,

- 1. Defects resulting from misuse and/or repair or modification by the customer.
- 2. Defects resulting from drop of the Product or damage during transportation.
- 3. Defects resulting from improper usage of the Product beyond the Specifications.
- 4. Defects resulting from fire, earthquake, lightening, flood, damage from salt, abnormal voltage or other Act of God, or other disaster.
- 5. Defects resulting from the intrusion of foreign material to the Product, such as water, oil or metallic particles.
- 6. Parts exceeding their standard lifetime specified in this document.
- 7. The machines are not assembled in accordance with the instructions or precautions noted in this specification.
- 8. When the machine does not match the Product assembled in the machine.
- 9. When the machine condition is not caused by Panasonic reasons.
- 10. Defects that Panasonic could not foresee at the time of delivery of the Prodcuct.

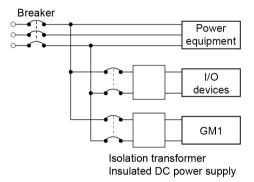
Cautions for Proper Use

Selection of a power supply

- Use a low noise power supply.
- The inherent noise resistance is sufficient for the noise superimposed on the power wires, however, the noise can be attenuated further by using the isolation transformer / insulated power supply.

Isolation of power supply systems

 Wiring to the units, I/O devices, and other power devices should have separate wiring systems.

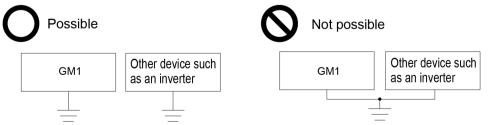


Power supply sequence

 Start the GM1 controller only after I/O devices and power devices are energized. In case of stopping the operation of the GM1 controller, have the I/O devices or power devices turned OFF after the GM1 controller has stopped operating.

Grounding

- The grounding connection should have a resistance of 100 Ω or less.
- The point of grounding should be as close to the GM1 controller as possible. The ground wire should be as short as possible.
- Sharing the ground with another device may have an adverse effect. Therefore, be sure that grounding is dedicated.



Conversely, depending on your environment, grounding may cause a problem. Do not ground the function earth when grounding a plus (+) terminal of the power.

Wiring

- Turn OFF the power supply when carry out wiring or connecting the GM1 controller to expansion units.
- Noise resistance measures such as attaching a noise filter, a surge absorber or a ferrite core may be necessary in some cases, depending on the usage environment.

Installation of an interlock circuit

• When controlling conflicting operations such as the motor rotation in clockwise or counterclockwise direction, provide an interlock circuit external to the GM1 controller.

Installation of an emergency stop circuit

• Provide an emergency stop circuit external to the GM1 controller to turn OFF the power supply of the output device.

Installation environment

Do not use it in the following environments.

- Direct sunlight
- Sudden temperature changes causing condensation.
- Inflammable or corrosive gas.
- Excessive airborne dust, metal particles or saline matter.
- Benzine, paint thinner, alcohol or other organic solvents or strong alkaline solutions such as ammonia or caustic soda.
- Direct vibration, shock or direct drop of water.
- Influence from power transmission lines, high voltage equipment, power cables, power equipment, radio transmitters, or any other equipment that would generate high switching surges. (100 mm or more)

Handling instructions

- Before touching the unit, always touch a grounded piece of metal in order to discharge static electricity.
- Always rid yourself of any static electricity before handling this product.
- Do not connect a unit other than our GM1 series to the side connector on the unit.
- Use copper wires with a temperature rating of 90°C or higher.

Revision History

The manual code is shown at the bottom of the cover page	je.
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Date of issue	Manual code	Revision details
August 2024	WUME-GM1OP-01	1st Edition
		• Integrated the following four manuals.
		User's Manual (Setup Edition) WUME-GM1ETCSU-04
		 User's Manual (Setup Edition) WUME-GM1RTXSU-05
		 User's Manual (Operation Edition) WUME-GM1ETCOP-08
		 User's Manual (Operation Edition) WUME-GM1RTXOP-09
		Added description of serial communication units
		 Added description of CNC control (Import DXF File function)
		Changed description of the velocity
		ramp type sin ² in Axis Extended Setting
		Enable symbol set in Symbol Configuration
		Added the source download function
		Changed description of the instruction help function
May 2025	WUME-GM1OP-02	2nd Edition
		Corrected errors.
		 Correction of description of ST program syntax
		 Correction of description of restrictions on servo amplifier parameters
		Correction of device name of serial communication device
		Addition of description
		How to use MODBUS-TCP master communication
		Device reset procedure from GM1 controller
		Addition of function
		 SD card log storage function

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Please contact

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WUME-GM10P-02