Panasonic

Laser Welding Machine

Serial Communication Command Guide

VL-W1 series

ME-VLW1N-SR-2

2024.4 | industry.panasonic.com/

Preface

Thank you for purchasing our product.
For full use of this product safely and properly, please read this document carefully.
This product has been strictly checked and tested prior to its delivery. However, please make sure that this product operates properly before using it. In case that the product becomes damaged or does not operate as specified in this document, contact the dealer you purchased from or our sales office.

The English version of this document is the original instruction. All other languages are translations that are based on the original documentation.

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2. Contents of this document could be changed without notice.
3. This document must not be partially or totally copied or revised.
4. All efforts have been made to ensure the accuracy of all information in this document. If there are any questions, mistakes, or comments in this document, please notify us.
5. Please remind that we assume no liability for any results arising out of operations regardless of the above clauses.

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Cautions in Handling

ALWAYS FOLLOW THESE IMPORTANT SAFETY PRECAUTIONS!

To reduce the risk of injury, loss of life, electric shock, fire, malfunction, and damage to equipment or property, always observe the following safety precautions.

The following symbols are used to classify and describe the level of hazard, injury, and property damage caused when the denotation is disregarded and improper use is performed.

⚠ DANGER	Denotes a potential hazard that will result in serious injury or death.
⚠ WARNING	Denotes a potential hazard that could result in serious injury or death.
⚠ CAUTION	Denotes a hazard that could result in minor injury.

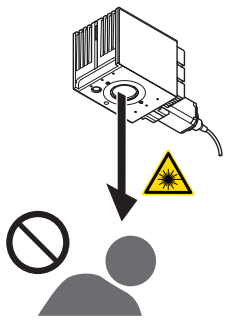
The following symbols are used to classify and describe the type of instructions to be observed.

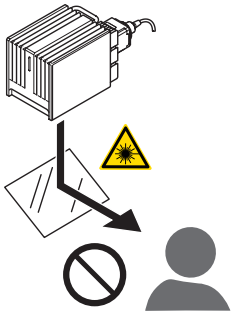
⃠	This symbol is used to alert users to a specific operating procedure that must not be performed.
❗	This symbols is used to alert users to a specific operating procedure that must be followed in order to operate the unit safely.
⚠	This symbols is used to alert users to a specific operating procedure that must be performed carefully.

⚠ DANGER

⃠

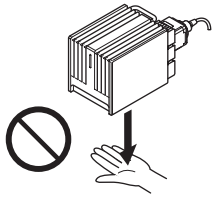
- Never look at laser beam directly, through lens or through any other optical components. Laser beam radiation into the eye causes blindness or serious damage to the eye.
  Not only the direct beam of laser, but also diffused reflected beam is harmful.





⃠

- Never touch laser beam and avoid human skin, clothing and any other flammable object from laser beam exposure directly.
  Burning into deep skin might result and there is a risk of fire.



❗

- Set protective enclosure with proper reflectance, durability and thermal resistance to enclose the laser radiation area without leakage. This laser is highly collimated and the laser energy density is high even at the distance.

⚠WARNING

- Do not use this product anywhere where fire is strictly prohibited, near inflammable gas, objects or organic solvents such as thinner or gasoline, or in dusty place. There is a risk of fire.

- Do not use this product except for water-resistant part in wet place. In addition, never conduct wiring or maintenance work with wet hands or when the product surface is wet. Otherwise, electric shock and/or malfunction may result.

- Never disassemble the product.
  Doing so may cause exposure to the laser beam or electric shock.

- Do not insert hands or objects between the gaps of the exhaust port or intake port. There is a risk of electrical shock or injury.

- Be careful neither to give strong power to the fiber cable nor to nip it for installation. Do not install the product to the systems that give excessive load acts on the fiber cable. If the fiber cable is damaged, laser beam comes out from the cable and it may cause laser exposures.

- Take laser protection measures required to use Class 4 laser products subject to the local laws and regulations of the country or region in which this laser product is used.

- To protect the operators' eyes, make it mandatory to wear goggles against laser beam within the laser controlled area. The protective goggles can momentarily protect the eyes against the scattered beam. Never look at the direct beam or reflected beam even when you are wearing the protective goggles.



- Set a workpiece fixing jig and terminating object of the laser beam with a flame-resistant material which has low reflectivity, in case of the radiation of the direct laser beam. Do not use the resin or specular objects for a workpiece stand and terminating object.

- Construct an interlock systems such as a function to stop laser radiation for the maintenance door of the protective enclosure.

- After power supply of the laser system is turned off, laser safety manager must remove the key and keep it.

- Be sure to connect the head to the exclusive controller. It will cause exposure of laser beam and a failure if it connects with any equipment other than the exclusive controller.

- Read all guides and manuals thoroughly, and do not operate, install and connect the laser system with any other methods except the instructions provided in the manuals. If the product is used in a manner not specified by the instruction, the safety protection and functions provided by the device may be impaired and may cause injury, electrical shock or exposure of laser beam.

- Prior to wiring, cable connecting, and/or maintenance work, ensure that all the power switches are turned off. Otherwise, electrical shock may result.

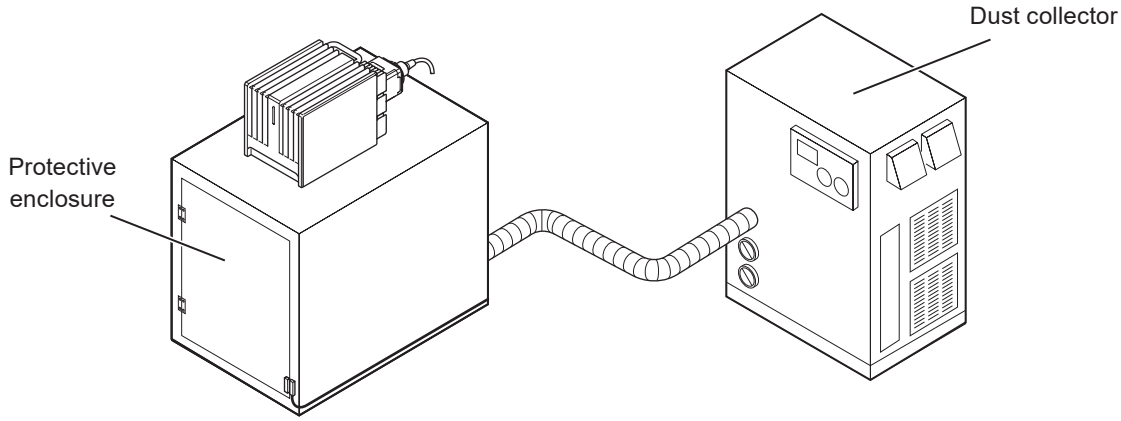
- The wiring and maintenance must be conducted by the electrical engineers or under their supervision. Incorrect work may cause electrical shock.

- Connect ground wire before using. A failure or electrical leakage that occurs when the unit is not properly grounded may result in electric shock.

⚠WARNING

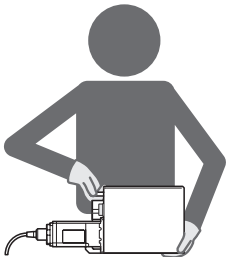
- Perform regular maintenance (cleaning, parts replacement) on this product. Using the product with dust or dirt may cause a fire or electric shock.

- Remove the dust and/or gas which may be generated during the laser radiation with dust collector or exhauster. Use an appropriate dust collector or exhauster for dust or gas generated.
  Depending on the material of the objects, harmful dust and/or gas to the human body and the laser system may be generated.
- For a nozzle of a dust collector or exhauster, use a flame-resistant material which has low reflectivity. Do not place a nozzle in the path of the laser beam.

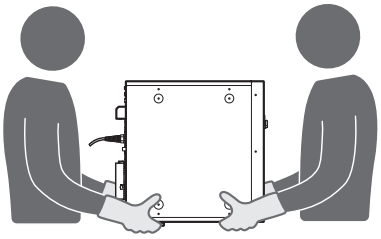


- When using the assist gas for laser processing, take safety precautions to protect operators from exposure, ignition, toxic effect, excess or lack of oxygen.

- To carry this product, wear the non-slip gloves and safety shoes. Hold the product with both hands. Do not hold the cables or connectors at carrying.
- To carry this product, do not hold the cut edges of metal parts, the protrusions or corners of the product body. It may cause injury.
- Carry the controller unit with two persons. Lifting or carrying without assistance may cause of injury.
- Install this product in the stable place without vibration and shock.
- In case it falls down, it may cause injury.



Head



Controller

The following are safety precautions when using the touch panel console.

⚠ WARNING

- Never conduct wiring or maintenance work with wet hands or when the product surface is wet. Otherwise, electric shock and/or malfunction may result.

⚠ CAUTION

- Do not dismantle or remodel the product. It could lead to excessive exothermic heat or smoke generation.
- Since the touch panel is made of glass, care should be taken so that a hard object may not hit it or an excessive force should not be applied. Do not fall the product from a high place because there is a danger of the glass breaking and causing an injury.
- Do not press more than one point on the touch panel at a time. A switch located in the middle of the plural points pressed (that was not meant to be pressed) will be activated. It could lead to a damage to the facility or an accident.

How to Read this Document

■ Symbol description

Notice	• “Notice” denotes any instructions or precautions for using this product. To prevent the damage or malfunction of the product, observe these precautions fully.
Reference	• “Reference” denotes any hints for operation, detail explanations, or references.

■ Target model

This document is subject to the following laser welding machine models.
In this document, this product is called “laser welding machine”.
If the setting contents or specifications vary by models, the target models are specified in the text.
In the text, multiple models may be described collectively, as shown in the table below.
Please remind that the illustration and the screen image may vary with the model.

Target model	Description in the text
VL-W1500-N	VL-W1 Series
VL-W1506-N	
VL-W1A00-N	
VL-W1A06-N	

■ Type of manuals

For this product, the following manuals are prepared. Read each manual and operate this product correctly and safely.
Save the manuals for future use.

Laser Safety Guide

This manual describes the items required for using the laser product correctly and safely. All users shall be required for reading this manual.

Setup/Maintenance Guide

This manual describes the items required for introduction and installation of this product as well as for the maintenance work.

- Product specifications, external dimensions
- Installation and connection method
- Signal details, I/O rating, and timing chart when I/O is used for control
- Maintenance details

Operation Manual

This manual describes the procedure and method to operate this product, and the screen operations to set the laser processing data and conditions.

Serial Communication Command Guide

This manual describes the communication commands to control this product externally using the serial communication (RS-232C). It describes the communication conditions, communication data formats, communication commands, and the control samples.
Mainly the machine builder and system integrator shall be required for reading this manual.

Reference

- The PDF data of each manual is included on an attached CD-ROM “Laser Processing Utility_VL-W1”.
- To read the PDF manual, Adobe Reader of Adobe Systems Incorporated is required.

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1 Preparation of Command Control

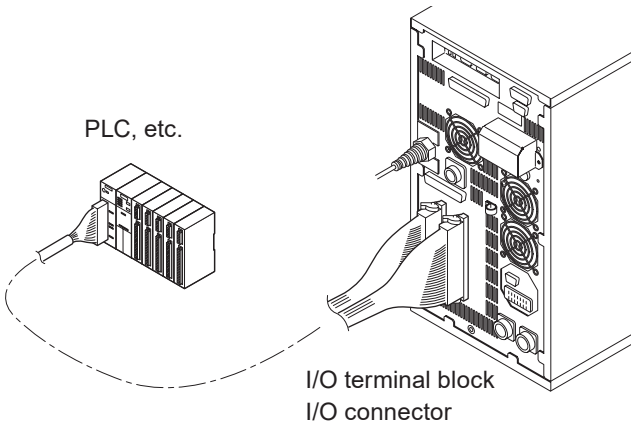
1-1 Operation by External Devices

1-1-1 Operation method using external control device

To control the laser welding machine VL-W1 series with the external control device, the following connecting methods are applicable:

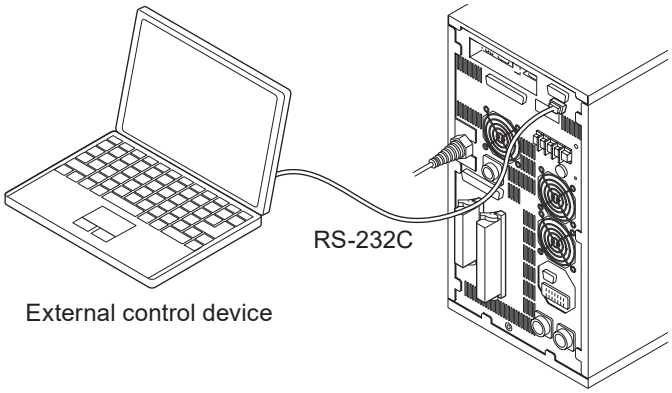
External control using I/O : Remote mode operation

Controls the laser welding machine from external devices such as PLC using various I/O signals loaded into the laser welding machine.
For details, refer to “Setup/Maintenance Guide”.



External control by serial communication commands (RS-232C) : Remote mode operation

Use the RS-232C interface for controlling the laser welding machine from an external device such as PLC using communication commands.

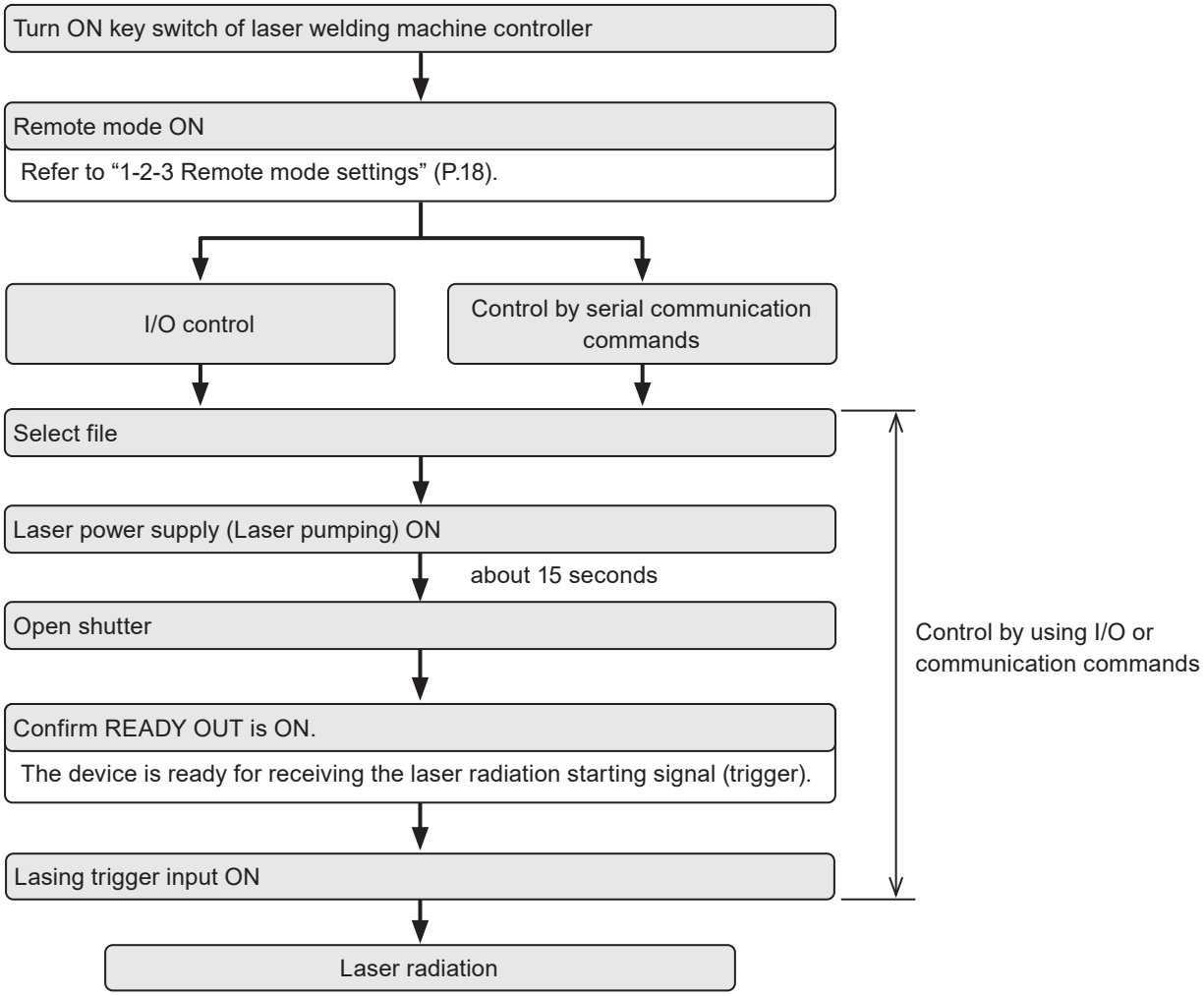


Reference

- It is available to the external control combining I/O, and serial communication commands.
- To input lasing trigger with I/O and configure other settings with a screen operation manually, use Run mode. For details, refer to “Setup/Maintenance Guide”.
- For the communication details to monitor the laser power at lasing, refer to “Setup/Maintenance Guide”.

1-1-2 Operation procedure with external control

■ Operation example when controlling the laser welding machine from external control devices such as PLC



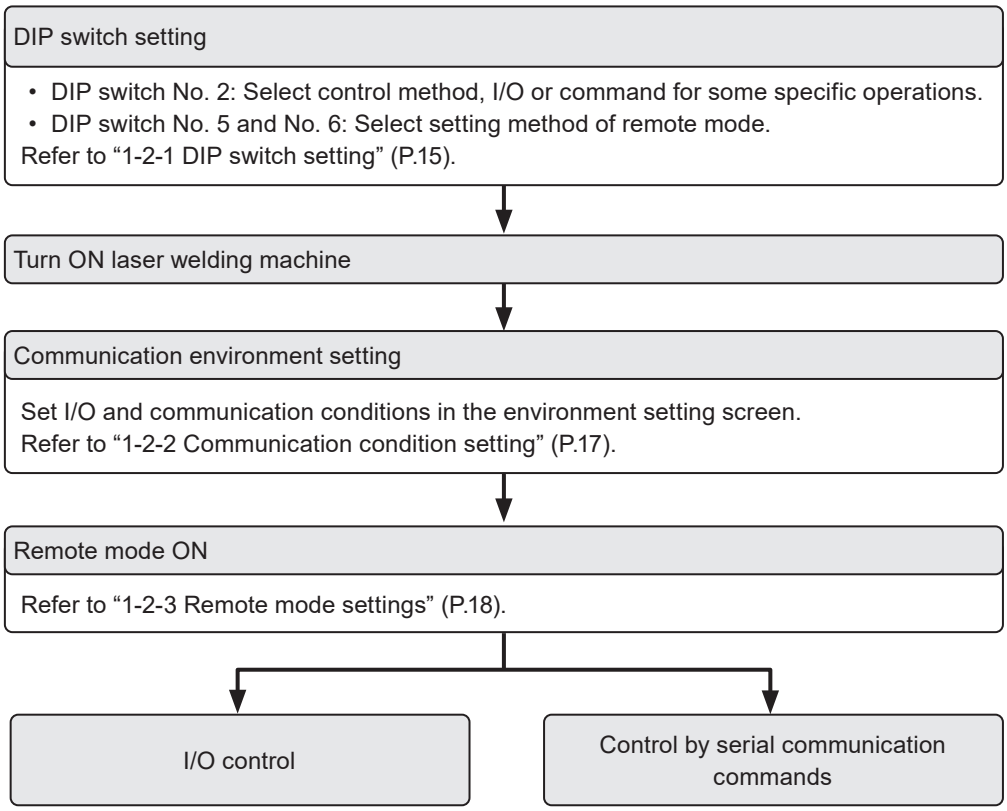
Reference

- It is available to the external control combining I/O, and serial communication commands.
- Configure the environment setting on the I/O communication in advance before using external control. Refer to “1-2 Before External Control” (P.14).

1-2 Before External Control

The following settings are required before the external control by using I/O or communication commands.

■ Setting flow to start external control



1-2-1 DIP switch setting

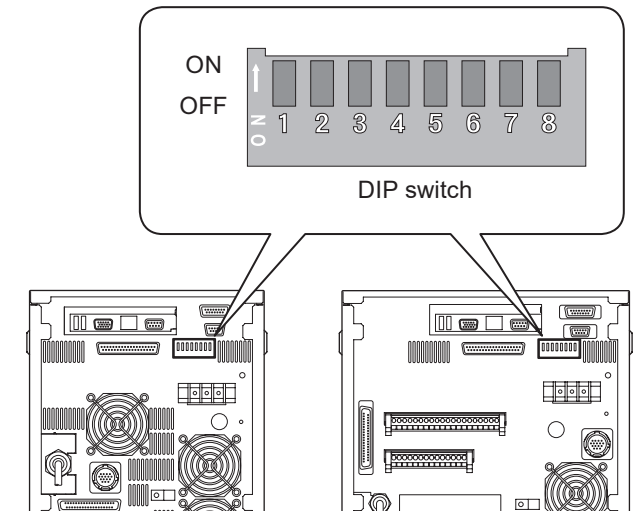
Set the operational options for the external control with the DIP switch equipped on the controller rear side.

Reference

- The initial setting of all DIP switches is OFF.
- Turn OFF the power at DIP switch setting.
- For the details on DIP switch, refer to “Setup/Maintenance Guide”.

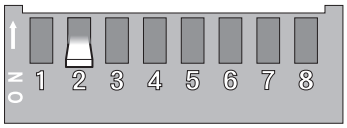
1. Turn OFF the power of laser welding machine.

2. Remove the DIP switch cover on the rear of the controller.



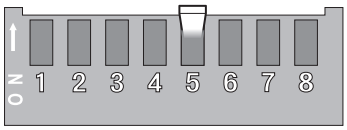
Rear of controller

3. With DIP switch No. 2, select the control method, I/O or command for some specific operations.



DIP switch No. 2	Control method for specific operations
ON	Control by serial communication commands for the following operations • Laser pumping (LSR) • Shutter open/close (SHT) • Guide laser (GID) • Laser radiation for measurement (SPT)
OFF (initial setting)	Control by I/O for the following operations • Laser power supply (Laser pumping) • Shutter open/close • Guide laser radiation

4. With DIP switch No. 5, select the setting method of the remote mode.

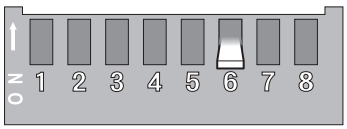


DIP switch No. 5	Setting method of remote mode
ON	Use the input signal of X5 “REMOTE IN” on I/O terminal.
OFF(initial setting)	Use the remote switch on the front of the controller.

Reference

- When DIP switch No. 5 is ON, the remote switch on the controller is not available.

5. When DIP switch No. 5 is OFF, select the remote mode state at powered ON with DIP switch No. 6.



DIP switch No. 6	Remote mode state at powered ON
ON	Starts up with remote mode ON
OFF (initial setting)	Starts up with remote mode OFF

Reference

- When DIP switch No. 5 is ON, keep DIP switch No. 6 OFF.
- When DIP switch No. 6 is ON, “X5: REMOTE IN” signal on I/O terminal is not available.

⚠WARNING

- If the DIP switch No. 5 or No. 6 is set to on, construct a manual resetting system to re-pump the laser when the laser pumping is turned to off due to an emergency stop or an interlock.

6. Install the DIP switch cover to the controller.

Notice

- A plastic cover is installed on the DIP switch. Install this cover always to avoid the dust penetration to the controller.

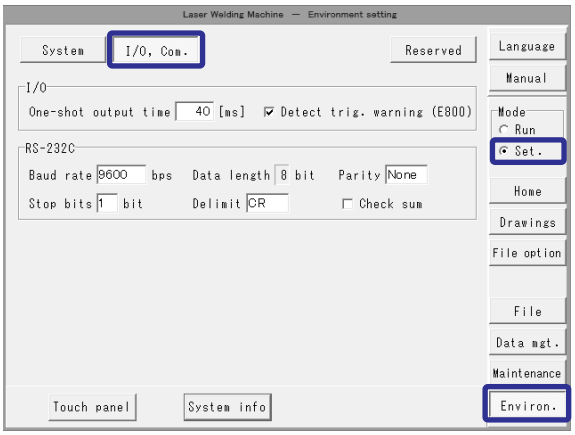
7. Turn ON the power of laser welding machine.

1-2-2 Communication condition setting

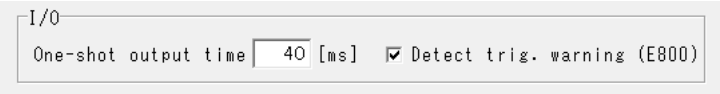
To control the laser welding machine by using I/O or communication commands, configure the following items in advance on the environment setting screen.

1. Select the screen mode to “Set”.

2. Click “Environment” on the right menu and click “I/O, Com.”.



3. To use I/O signals, configure the following output conditions:

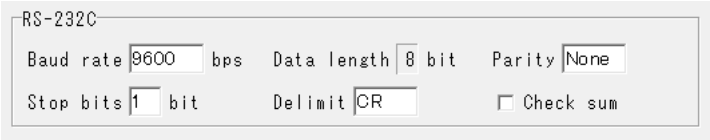


- One-shot output time:
  Sets the output duration for some signals such as LASING END OUT (Y8) and SET OK OUT (No.36).
  Setting range: 20 ms to 510 ms (initial value is 40 ms)

- Detect trigger warning (E800)
  Configure if you will output (ON) or will not output (OFF) the warning for the invalid trigger. With enabling this setting, the warning is output when the trigger that cannot be accepted is input while the shutter is opened. (Initial setting: Enabled)

4. When using serial communication commands, set the RS-232C communication conditions.

Configure the communication conditions of the laser welding machine corresponding to the external control device.



Reference

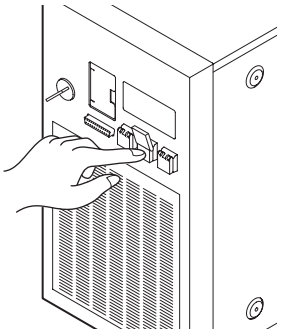
- The laser welding machine can be controlled by I/O and communication commands combined.
- The parameters on the environment setting screen are applied to the laser welding machine directly without saving.
- Specify the “Flow control” to “None” at the communication port settings of the external control device.

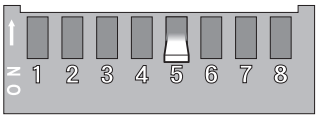
1-2-3 Remote mode settings

To control the laser welding machine externally using I/O or serial communication commands, set the operation mode to the remote mode with one of the following methods.
Select the method to switch to the remote mode by setting the DIP switch on the rear side of the controller.

Use the remote switch on the front of the controller.

Turn ON the remote mode switch on the front of the controller.

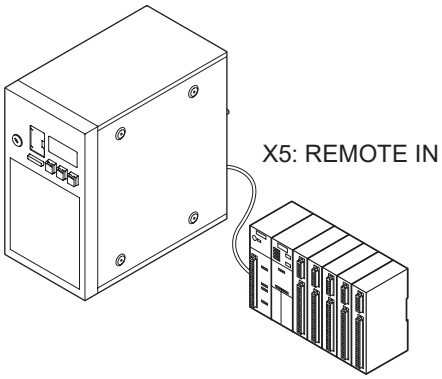


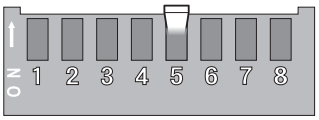


Turn OFF the DIP switch No. 5.
Refer to “1-2-1 DIP switch setting” (P.15).

Use input signal of X5 “REMOTE IN” on I/O terminal.

Turn ON REMOTE IN (X5) of the I/O terminal on the rear of the controller.





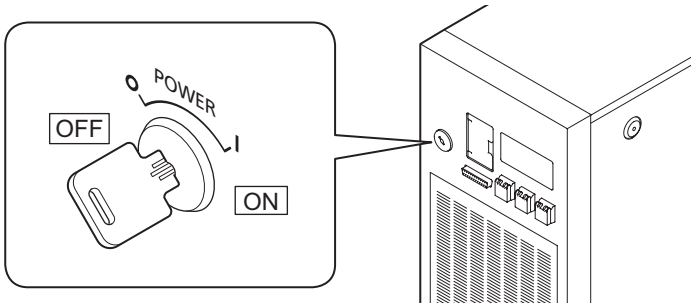
Turn ON the DIP switch No. 5.
Refer to “1-2-1 DIP switch setting” (P.15).

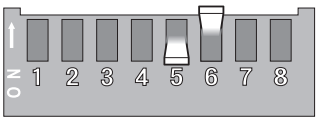
Reference

- When DIP switch No. 5 is ON, the remote switch on the controller is not available.

Start the laser welding machine in the remote mode

The laser welding machine starts up always in the remote mode state. Use the remote mode switch button of the controller for releasing and resetting the remote mode.





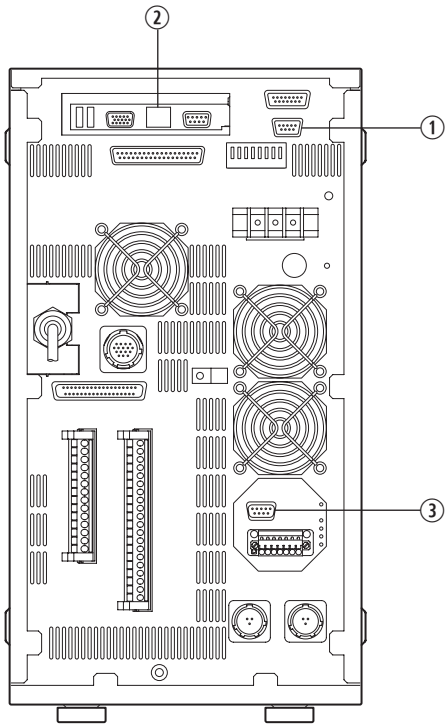
Turn OFF the DIP switch No. 5 and turn ON the DIP switch No. 6.
Refer to “1-2-1 DIP switch setting” (P.15).

Reference

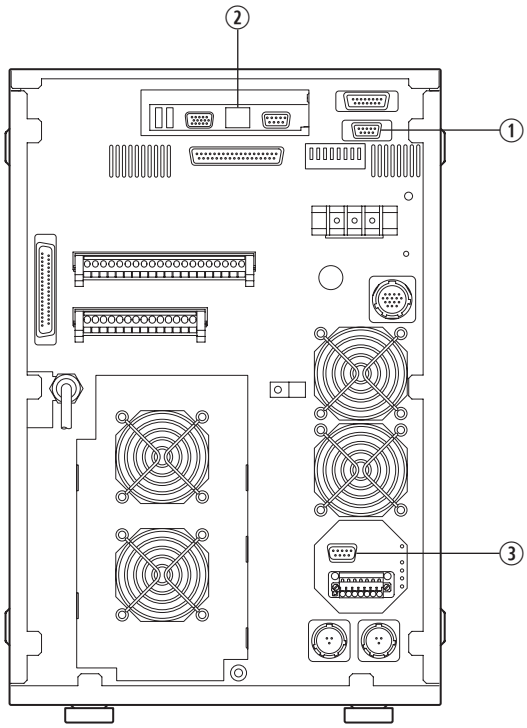
- When DIP switch No. 6 is ON, “X5: REMOTE IN” signal on I/O terminal is not available.
- The remote switch on the controller is available when DIP switch No. 6 is ON.

1-3 Serial Communication Interfaces

This product has the following serial communication interfaces on the rear side of the controller.



VL-W1500-N, VL-W1506-N



VL-W1A00-N, VL-W1A06-N

No.	Item	Description
①	RS-232C port for external control	Interfaces to control the laser welding machine by using serial communication commands.
②	RESERVE	Reserved port
③	RS-232C port for power monitoring	Interface to monitor the laser power at lasing with a serial communication data. For the details of power monitoring, refer to “Setup/Maintenance Guide”.

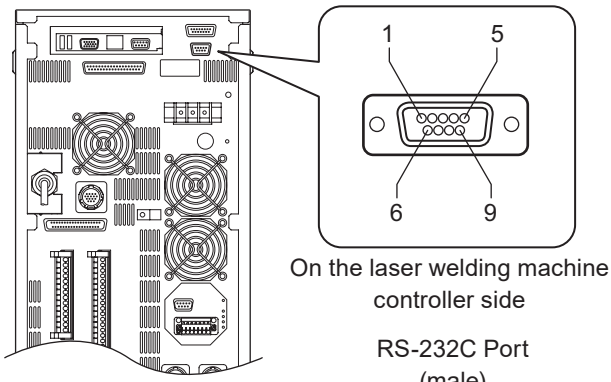
1-4 RS-232C for External Control

Reference

- For the details of RS-232C for power monitoring, refer to “Setup/Maintenance Guide”.

1-4-1 Interface specifications and connection

To execute command communication control with RS-232C, connect the RS-232C port on the rear of the controller to the external control device.



Connector position	Connector specifications	Model	Manufacturer name
On the laser welding machine side	D-sub 9-pin, male Screw type: No.4-40UNC inch screw, female	—	—
User side	D-sub 9-pin, female Screw type: No.4-40UNC inch screw, male	Recommended connector 17JE-13090-02(D1)A	DDK Ltd.
		Recommended connector cover 17JE-09H-1C4-CF or 17JE-09H-1C-CF	

■ Signals of RS-232C connector

Terminal No.	Signal	Description
1	Reserve	Do not connect anything.
2	RxD (RD)	Receiving data: Connect TxD (SD) of the external control device
3	TxD (SD)	Transmission data: Connect RxD (RD) of the external control device
4	Reserve	Do not connect anything.
5	GND (SG)	Signal ground: Connect GND (SG) of the external control device
6	Reserve	Do not connect anything.
7		
8		
9		

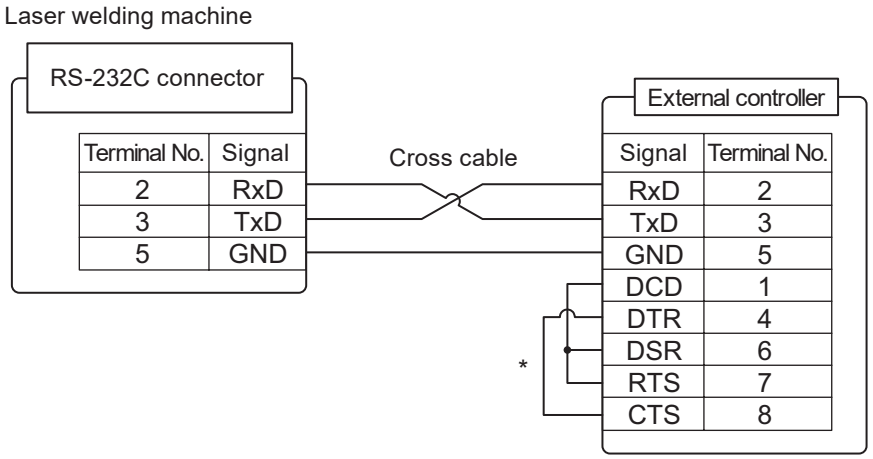
Reference

- To connect RS-232C terminal without using a commercially available RS-232C cable, connect only 3 signals of RxD, TxD and GND and do not use other signals on the laser welding machine side.

■ Connecting to external control devices

- To connect the laser welding machine to the PC for control, use a commercially available RS-232C cross cable.
- In case of connecting to PLC, a type of the cable (straight or cross) differs depending on a manufacturer or a model. Please follow the PLC manual.
- To connect RS-232C terminal without using a commercially available RS-232C cable, connect only 3 signals of RxD, TxD and GND and do not use other signals on the laser welding machine side.
- You may need a signal line connection (loop back line) other than RxD, TxD, or GND on the external control device side depending on the specifications of the external control device. Read the instruction manual of the external control device and connect it appropriately.

Connection example



* The loop back wiring on the external control device side shown in the above figure is just an example. The wiring method varies depending on the specifications of each external control device. Read the instruction manual of the external control device and connect it appropriately.

1-4-2 Communication conditions

Item	RS-232C communication conditions
Synchro system	Start-stop method
Communication	Full-duplex transmission
Baud rate	1200 / 2400 / 4800 / 9600 / 19200 / 38400 bps (initial setting: 9600 bps)
Data length	8-bit fixed
Parity	None / Even / Odd (initial setting: None)
Stop bits	1-bit / 2-bit (initial setting: 1-bit)
Flow control	None
Check sum	OFF / ON (initial setting: OFF)
Delimiter	CR / CR + LF (initial setting: CR)
Start code	• Setting request, Reading request, Reading response: STX • Normal response: ACK • Abnormal response: NAK
Reception timer	Timeout monitoring ON (10 sec.)

Reference

- For the details of the setting method of communication conditions, refer to “1-2-2 Communication condition setting” (P.17).

2 Communication Control Basics

2-1 Communication Data Types

To control this product by communication commands, the external device transmits request data to the laser welding machine.
After the laser welding machine receives request data, it transmits the response data to the external device.

2-1-1 Request data

The request data is sent from the external device to the laser welding machine. The following types are applicable to the request data.

■ Setting request

Request data to modify or create the laser welding machine data or to control the laser welding machine operations.

■ Readout request

Request data to read out the status or setting data of the laser welding machine.

2-1-2 Response data

The response data is sent from the laser welding machine to the external device. The following types are applicable to the response data:

■ Response for normal receiving

Response data transmitted when the setting request data were received normally.
The response data for normal receiving will be transmitted when the laser welding machine processing has been completed for some of the command types.

■ Response for readout

Response data to transmit the readout content for the readout request data.

■ Response for abnormal receiving

Response data to transmit when the request data are not acceptable.

2-2 Communication Sequence

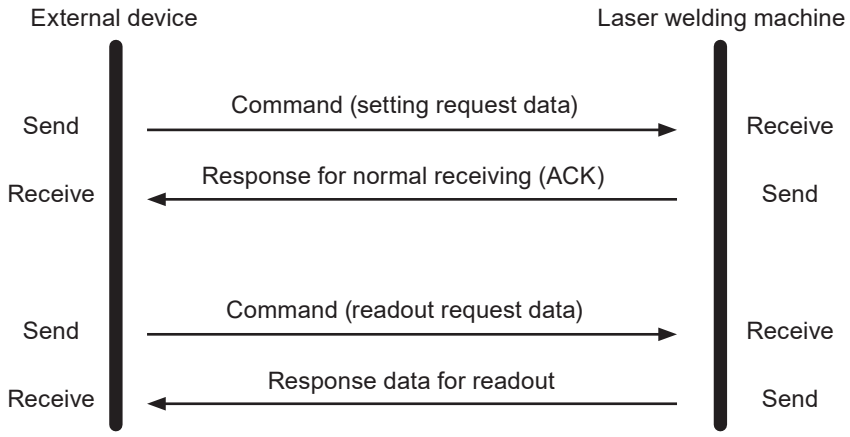
The communication sequence of this product consists of the sequence where the laser welding machine transmits the response data for the (command) data requested from external devices.
As an exception, the laser welding machine transmits the response data automatically if you have set the response permission of the lasing end verification (MST) command.

■ Reception timeout

The time-out duration of this product is set to 10 seconds from receiving the telegraphic message from the head till the end transmitted from the external device.
If a reception timeout occurs, the telegraphic message transmitted will be discarded and the laser welding machine will not transmit the response data.
To resume the communication, transmit the correct telegraphic message once again.

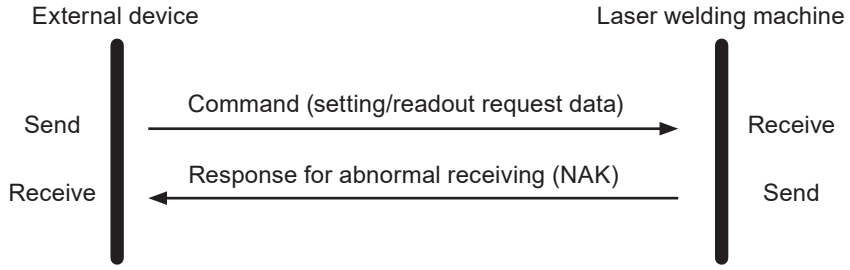
■ Communication sequence of setting/readout request data

When the requested data was received normally from the external device, the laser welding machine transmits response data for normal receiving to the setting request data and transmits readout data to the readout request data.
After sending the command, confirm the response data from the laser welding machine. Do not send the next command before receiving the response.



■ Communication sequence when the request data cannot be accepted

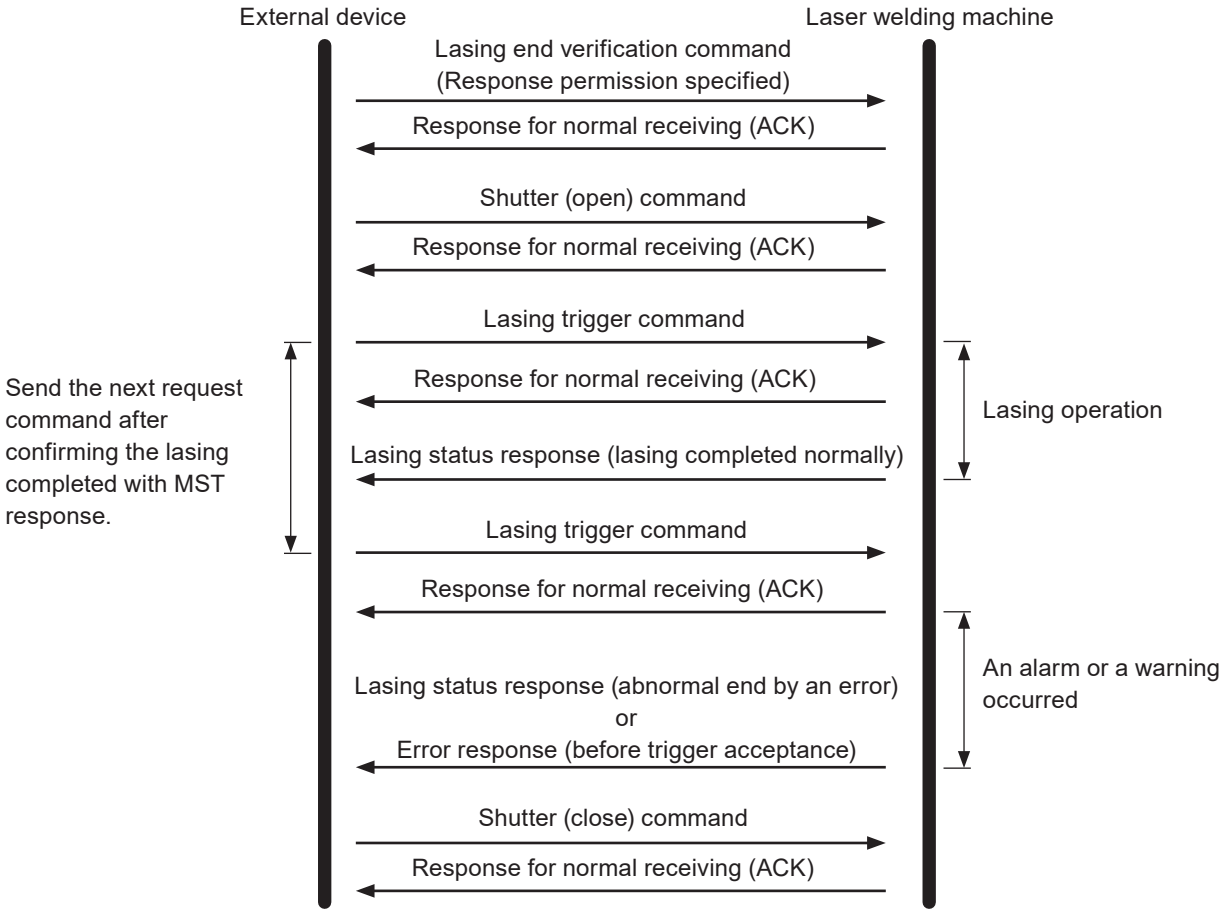
When the request data transmitted from the external device to the laser welding machine are not acceptable, the laser welding machine transmits response data for abnormal receiving.



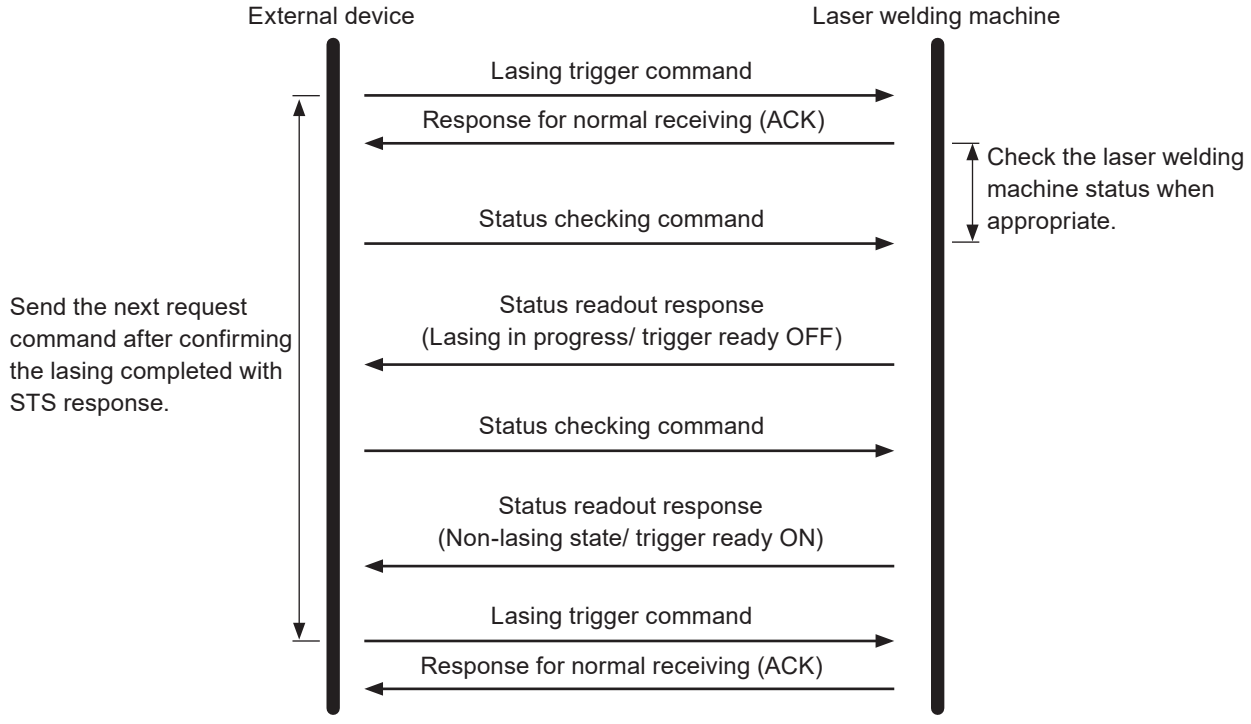
■ Communication sequence when the lasing end verification (MST) command response is enabled

The laser welding machine transmits the response data automatically upon completing the lasing operation with the response permission setting of the lasing end verification (MST) command.
This response data indicate that the lasing operation completed normally or ended abnormally by an error.
For more information on this command, refer to “3-3-9 Lasing end verification: MST” (P.52).

- When the response permission of the lasing end verification (MST) command is set



- When the response permission of the lasing end verification (MST) command is not set



2-3 Communication Data Format

Use the ASCII code basically and the shift JIS code partially for the communication data when controlling the laser welding machine by external device. The characters enclosed with double quotation marks (“ ”) in the description below indicate the ASCII code. In addition, the characters enclosed with [ ] indicate the control codes. When using the shift JIS code, it is described in each case.

Reference

- For the serial communication details to monitor the laser power at lasing, refer to “Setup/Maintenance Guide”.

2-3-1 Data format basics

■ Basic data format

Head End

Start code	Command *1	Sub command *1	Data defined per data and command type	Check sum	Delimiter
1-byte	3-byte	1-byte		2-byte or N/A	1-byte or 2-byte

Item	Description
Start code	A start code is a code to identify the data head. Depending on the data type, the start code is fixed as follows: • Setting request, Readout request, Response for readout: [STX] 02(HEX) • Normal response: [ACK] 06(HEX) • Abnormal response: [NAK] 15(HEX)
Command *1	The alphabetical characters consisting of three characters (3-byte) representing the control contents. For command types and description, refer to “3-1 Command List” (P.40).
Sub command *1	One-byte alphabetic character representing the communication data type. The sub command is fixed to the following alphabetic characters: • Setting request data: “S” • Readout request data: “R” • Response data for readout: “A”
Check sum	Check sum is the value to detect an error during data communication. You can enable or disable the check sum. It is disabled in the initial settings.
Delimiter	Delimiter is a code to identify the end of data. • Select either [CR]: 0D (HEX) or [CR][LF]: 0D0A (HEX).

*1 : Added to Setting request data, Readout request data and Response data for readout only.

Reference

- Set Check sum and Delimiter on the “environment setting” screen. Refer to “1-2-2 Communication condition setting” (P.17).
- There is no separating character among the each terms.
- When using the external device set by 2-byte, [NUL]: 00(HEX) can be used. Add [NUL] before the start code or after the delimiter.

■ How to calculate the check sum

Convert the data from the start code to those before the check sum into the hexadecimal values according to the ASCII code table and add them all together.
When two-byte characters are in the data, convert them into the hexadecimal values according to the shift JIS code.
Check sum is the value calculated by converting the lower one-byte of the total value into two characters in the ASCII code.

Calculation example

- Calculating the check sum of the following setting request data

Start code STX	Command “LPW”	Sub command “S”	Data example: [Laser power] “042.5”	Check sum	Delimiter CR
02	4C 50 57	53	30 34 32 2E 35	34 31	0D (HEX)

- Convert the start code to the end of data into hexadecimal values and add them all together. Include the start code for the addition.
  02 + 4C + 50 + 57 + 53 + 30 + 34 + 32 + 2E + 35 = 241 (HEX)
- “41”, which is the lower one-byte (lower two-digit) characters of 241 (HEX), is converted to 34 31 (HEX) in the two-character ASCII code.

2-3-2 Request data

Request data in the following format will be transmitted when you control the laser welding machine from the external device.

■ Setting request data format

Request data to modify or create the laser welding machine data or to control the laser welding machine operations.
The start code is [STX]: 02(HEX).
The sub command is “S”.

Start code [STX]	Command	Sub command “S”	Variable-length data or fixed-length data	Check sum	Delimiter
1-byte	3-byte	1-byte	The maximum data length is defined per command	2-byte or N/A	1-byte or 2-byte

■ Readout request data format

Request data to read out the status or setting data of the laser welding machine.
The start code is [STX]: 02(HEX).
The sub command is “R”.

Start code [STX]	Command	Sub command “R”	Variable-length data or fixed-length data	Check sum	Delimiter
1-byte	3-byte	1-byte	The maximum data length is defined per command	2-byte or N/A	1-byte or 2-byte

Content of variable-length data/fixed-length data part

The content to specify varies depending on the command.
Numeric values or character strings are converted into the ASCII code and the Shift JIS code for the input.
There is no separating character among the each terms. Input them in a row.
Some items can be omitted for some commands.

Reference

- For details on how to input variable-length data or fixed-length data, refer to “2-3-4 Numeric data input method” (P.30) and “2-3-5 Character data input method” (P.31).

Example of Request Data

- To change file number

Start code STX	Command “FNO”	Sub command “S”	Data example: File No. “2047”	Check sum	Delimiter CR
02	46 4E 4F	53	32 30 34 37	30 35	0D (HEX)

2-3-3 Response data

The laser welding machine transmits response data in the following format for the command transmitted from the external device.

■ Response data format for normal receiving

Response data transmitted when the setting request data (sub command “S”) was received normally.
The response data for normal receiving will be transmitted when the laser welding machine operation has been completed for some of the command types.
The start code is [ACK]: 06(HEX).
The response code is always “00”.

Start code [ACK]	Response code “00”	Check sum	Delimiter
1-byte	2-byte	2-byte or N/A	1-byte or 2-byte

■ Response data format for readout

Response data to transmit the readout content for the readout request data (sub command “R”).
The start code is [STX]: 02(HEX).
The sub command is “A”.

Start code [STX]	Command	Sub command “A”	Variable-length data or fixed-length data	Check sum	Delimiter
1-byte	3-byte	1-byte	The maximum data length is defined per command	2-byte or N/A	1-byte or 2-byte

Content of variable-length data/fixed-length data part

The response content varies depending on the command.
Numeric values or character strings are converted into the ASCII code and the Shift JIS code for the response.
There is no separating character among the each terms.

Example of response data for normal receiving

Start code ACK	Response code “00”	Check sum	Delimiter CR
06	30 30	36 36	0D (HEX)

Example of response data for readout

- Response data for readout to the file number readout request (FNO command)

Start code STX	Command “FNO”	Sub command “A”	Data example: File No. “2047”	Check sum	Delimiter CR
02	46 4E 4F	41	32 30 34 37	46 33	0D (HEX)

■ Response data format for abnormal receiving

Response data to transmit when the request data are not acceptable.
The start code is [NAK]: 15(HEX).
Response code indicates the error cause.

Start code [NAK]	Response code “01”–“99”	Check sum	Delimiter
1-byte	2-byte	2-byte or N/A	1-byte or 2-byte

Reference

- If the laser welding machine transmitted response data for abnormal receiving to the request data, all the contents instructed by the request data will be invalidated.

Response code details

The error cause is displayed in two numerical characters in case of invalid request data format or invalid value specified, or when the laser welding machine cannot accept the request data.

Response code	Error cause
“01”	Incorrect start code.
“02”	Incorrect delimiter.
“03”	Unacceptable command because the internal shutter is open or the MKM command is not set to “command reception permission ON”.
“04”	No applicable command.
“05”	Incorrect check sum.
“06”	Incorrect data length.
“07”	Unacceptable command because the DIP switch No. 2 is OFF and the I/O terminal control is valid.
“08”	Incorrect sub command.
“09”	Invalid variable-length or fixed-length data part. • Incorrect value or unacceptable combination of numbers are in the data part. • Unsupported characters are in the data part.
“10”	Unacceptable command because of an alarm or a warning occurred.
“11”	SEO command is not acceptable. • The internal shutter is closed. • The MKM command is set to “command reception permission ON”. • “Offset by SEO command” is not enabled at file option setting.
“12”	Unable to register data due to a lack of memory capacity.
“14”	Unacceptable command with current trigger mode setting.
“99”	Others

Example of response data for abnormal receiving

Start code NAK	Data example: “06”	Check sum	Delimiter CR
15	30 36	37 42	0D (HEX)

2-3-4 Numeric data input method

■ Input data

Use the ASCII code to input numeric data.
The content and the number of digits (data length) of numeric values vary for each command.

Data type	Input data
Integer part	“0”–“9": 30 (HEX) to 39 (HEX)
Decimal part	
Decimal point	“.”: 2E (HEX)
Sign	“+”: 2B (HEX) “-”: 2D (HEX)

Reference

- For details on the ASCII code, refer to “Character Code Table” (P.108).
- You cannot shorten the numeric data length. It is not allowed to omit “+” and “0” in upper digit.
- For numeric data including a decimal point, the number of digits of the integer part and the decimal part must correspond to the value defined as the specified data length.

Example of numeric data input

- To input “+010.000” (8-byte data length), use ASCII code as follows *:
  2B 30 31 30 2E 30 30 30
- To input “0158” (4-byte data length), use ASCII code as follows *:
  30 31 35 38

* Spaces in the example above are not included in the input data.

2-3-5 Character data input method

■ Applicable commands

To specify a name of the file or drawing data with the following commands, enter character data.

- File selection by file name: FNN
- File name: FNM
- VEC/DXF file: CDF
- Custom shape name: LNM

■ Input data

Use the ASCII code or Shift JIS code to input character data.
Use the ASCII code to input one-byte characters.
Use the Shift JIS code to input two-byte characters.
The ASCII code and Shift JIS code can be mixed.
The following restrictions apply to the input characters depending on the data type to input:

Command	Content to be specified	Restrictions on the input characters
FNN	File name	• Control codes cannot be used. • No line feed is allowed.
FNM	File name	
CDF	VEC/DXF file name	
LNM	Custom shape name	

Reference

- For details on the ASCII code and Shift JIS code, refer to “Character Code Table” (P.108).
- If the VEC/DXF file name contains special characters that cannot be expressed by the ASCII code or Shift JIS code, it may not be set or read out correctly.

Example of character input

- To input “ABCD”
  Input using the ASCII codes*: 41 42 43 44
  Input using the Shift JIS codes*: 8260 8261 8262 8263
- To input “ABCD 株式会社 ”
  Input using the ASCII codes and Shift JIS codes combined*: 41 42 43 44 8A94 8EAE 89EF 8ED0
  Input using the Shift JIS codes*: 8260 8261 8262 8263 8A94 8EAE 89EF 8ED0

* Spaces in the example above are not included in the input data.

2-4 Command Reception Condition

2-4-1 Commands requiring pre-set

The following commands are available only when the DIP switch No. 2 on the rear side of the controller is ON.

- Laser pumping (LSR)
- Shutter open/close (SHT)
- Guide laser (GID)
- Laser radiation for measurement (SPT)

2-4-2 Command reception permission

When transmitting the communication command including an action to update the laser welding machine data, commands are refused in the trigger ready ON status or the shutter open. If “reception mode ON” is set for “command reception permission (MKM command)” before transmitting a command, trigger ready is set to OFF and commands get acceptable. Set “reception mode OFF” for “command reception permission (MKM command)” to set the trigger ready ON before lasing.

Reference

- Commands are acceptable by closing the shutter instead of “command reception permission (MKM command)”. However, it is recommended to use the “command reception permission (MKM command)” when the number of open and close of the shutter is a lot.
- The command reception permission (MKM command) does not include opening/closing operation of the shutter.

■ Commands that do not need the command reception permission (MKM command)

The following commands can be transmitted while the shutter is opened.
(There is no need to set “reception mode ON” for “command reception permission (MKM command)”.)

- Command reception permission (MKM)
- Shutter close request (SHT)
- Laser pumping (LSR)
- Status checking (STS)
- Lasing trigger (for single trigger) (MRK)
- File selection by file No. (FNO)
- File selection by file name (FNN)
- Trigger counter reset (CTR)
- Position and power adjustment per trigger (SEO)
- Guide laser (SPT) : Stop request: Only while the guide laser is irradiated
- Laser radiation for measurement (SPT) : Stop request: Only while the guide laser is irradiated

2-4-3 Commands acceptable only with the shutter closed

For Guide laser and Laser for measurement, send the command to start radiation only when the shutter is closed. Do not start radiation when “reception mode ON” is set for “command reception permission (MKM)”.

- Guide laser (GID): Start request
- Laser radiation for measurement (SPT): Start request

2-4-4 Commands acceptable during alarm/warning occurrence

The laser welding machine accepts only the following commands while an alarm or warning occurs.

■ Alarm

- Status checking (STS)

■ Warning

- Status checking (STS)
- Shutter open/close (SHT): Shutter close request and shutter status readout only
- Command reception permission (MKM): Reception mode ON request and reception permission state readout only

Reference

- For release method of alarm and warning, refer to “Error Indication” (P.102).
- It is not possible to reset the alarm status by the serial communication control.
- To reset the warning status except “E800”, “E811” and “E812”, close the shutter with SHT command or set “reception mode ON” with MKM command, and then clear the warning causes.
- When warning “E800” and “E812” occurs, the laser welding machine can accept the commands same as under the normal status.

2-5 Communication Check

Verify if the communications between the laser welding machine and external control device have been established properly in the following procedure:

1. Turn ON the power of the external control device

2. Turn ON the key switch of laser welding machine.

3. Coordinate the communication conditions between laser welding machine and external control device

Refer to “1-2-2 Communication condition setting” (P.17).

4. Set the laser welding machine to the remote mode

Refer to “1-2-3 Remote mode settings” (P.18).

5. Change the file number of the laser welding machine (transmit the FNO command)

Start code STX	Command “FNO”	Sub command “S”	Data: File No. “2047”	Check sum*1	Delimiter CR
02	46 4E 4F	53	32 30 34 37	30 35	0D (HEX)

The transmission data above is just a sample. Check sum ON/OFF and delimiter content vary depending on the communication environment settings.

*1 : For the command above, calculate the check sum value as follows:
Convert the data from the start code to those before the check sum into the hexadecimal values according to the ASCII code table and add them all together. Check sum is the value calculated by converting the lower two digits of the total value into two characters in the ASCII code.

- 02(HEX) + 46(HEX) + 4E(HEX) + 4F(HEX) + 53(HEX) + 32(HEX) + 30(HEX) + 34(HEX) + 37(HEX) = 205(HEX)
- 30 35 (HEX) is the value converted the lower two digits character (lower one-byte) 05 (HEX) into two characters in the ASCII code

6. Check the response from the laser welding machine

When the connection and communication condition settings are appropriate, the laser welding machine returns response data.

Example of response data for normal communication

Start code ACK	“00”	Check sum	Delimiter
06	30 30	36 36	0D (HEX)

Example of response data for abnormal communication

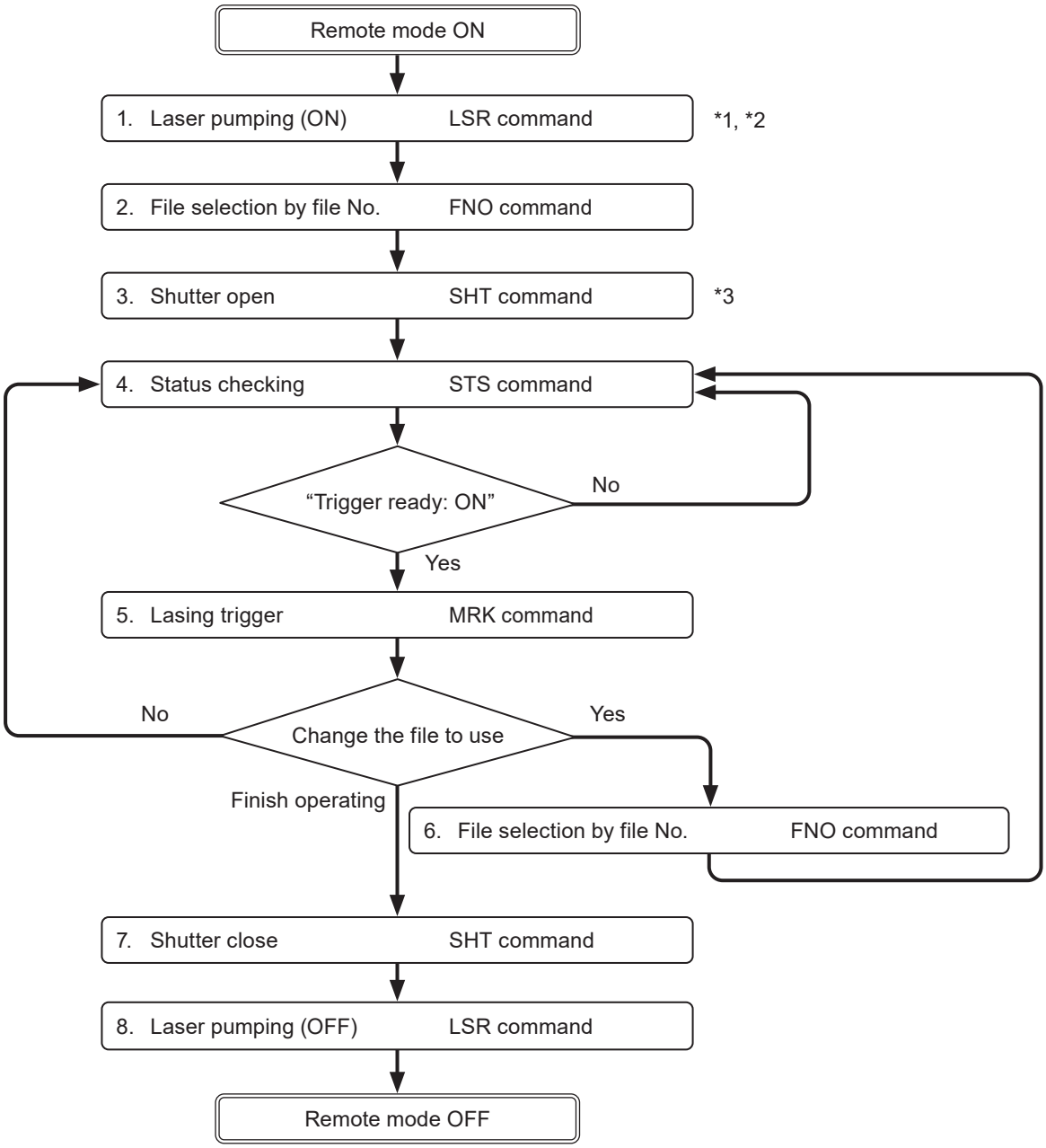
Start code NAK	“06”	Check sum	Delimiter
15	30 36	37 42	0D (HEX)

Reference

- Select either [CR] or [CR][LF] as the delimiter.

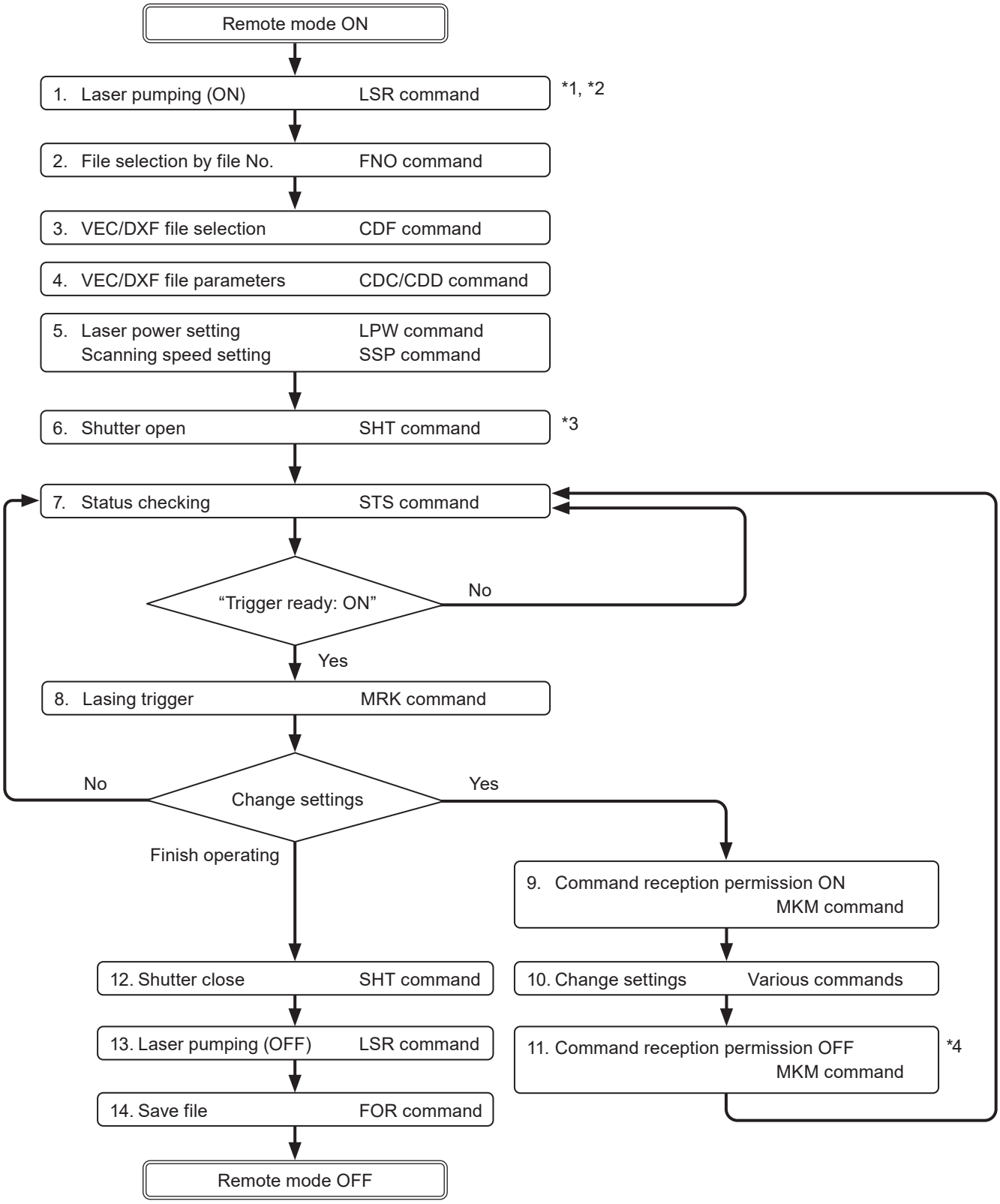
2-6 Control Sample

■ File selecting and lasing



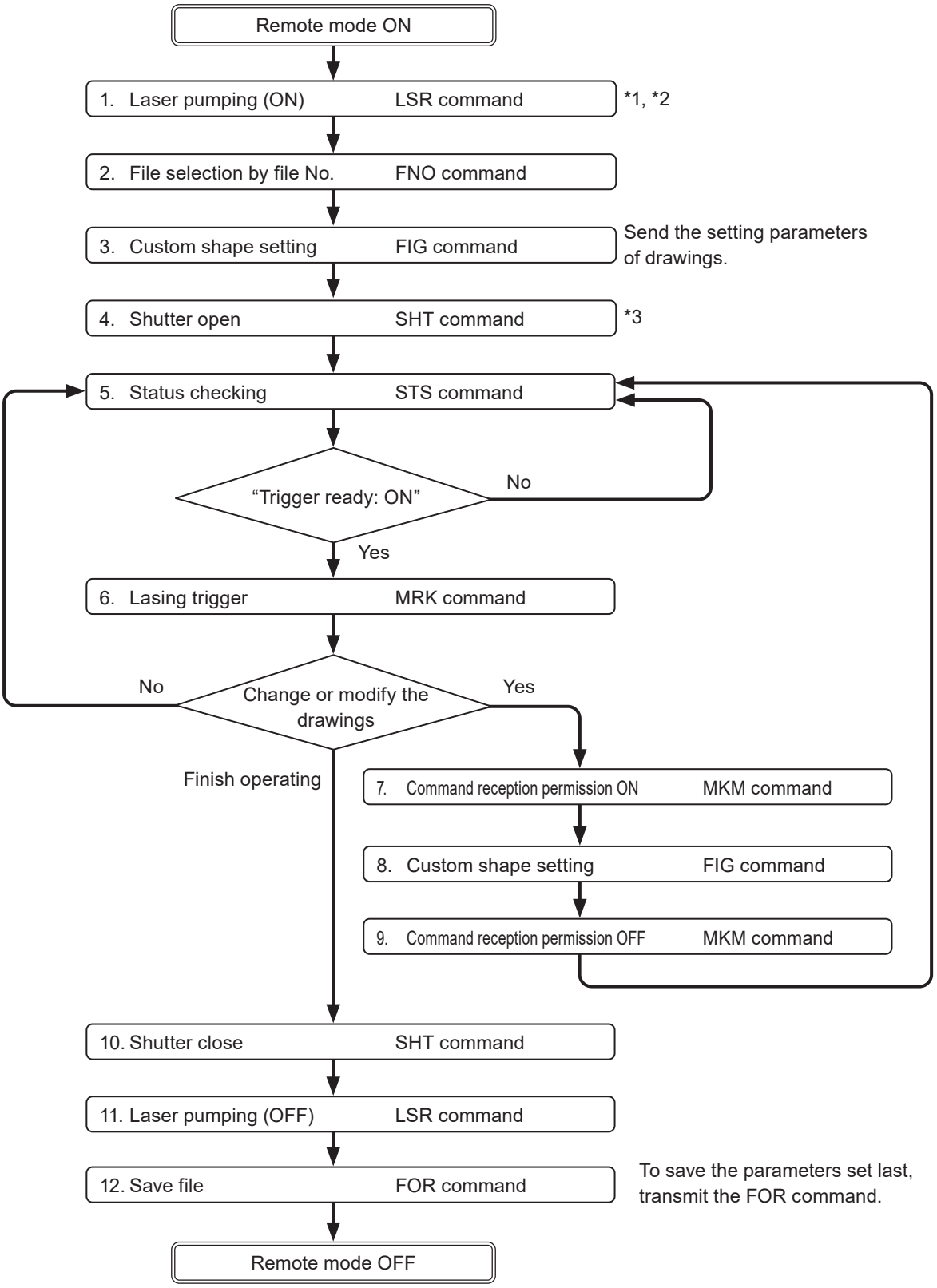
*1 : It takes approximately 15 seconds from receiving the laser pumping ON request to completion of pumping.
*2 : Commands from No. 2 to No. 4 above chart can be sent right after turning on laser pumping (without waiting for the laser pumping completion).
*3 : There is a delay time of around 200ms to max. 1 second from receiving shutter open/close command for the actual shutter open/close operation time.

■ Setting of drawing data (VEC/DXF file) and lasing



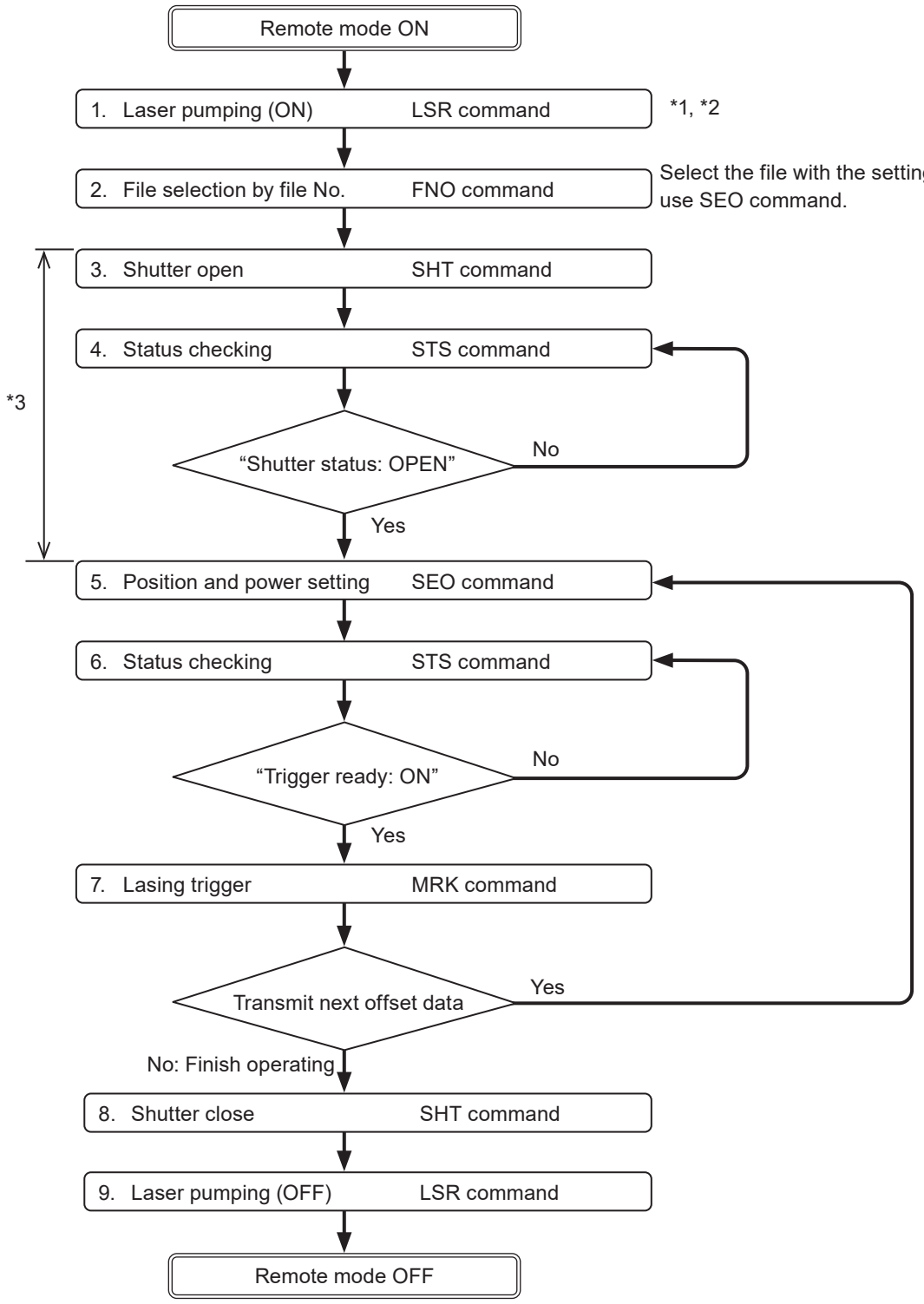
*1 : It takes approximately 15 seconds from receiving the laser pumping ON request to completion of pumping.
*2 : Commands from No. 2 to No. 7 above chart can be sent right after turning on laser pumping (without waiting for the laser pumping completion).
*3 : There is a delay time of around 200ms to max. 1 second from receiving shutter open/close command for the actual shutter open/close operation time.
*4 : After settings, set trigger ready ON by "11 Command reception permission OFF".

■ Setting of drawing data (custom shape) and lasing



*1 : It takes approximately 15 seconds from receiving the laser pumping ON request to completion of pumping.
*2 : Commands from No. 2 to No. 5 above chart can be sent right after turning on laser pumping (without waiting for the laser pumping completion).
*3 : There is a delay time of around 200ms to max. 1 second from receiving shutter open/close command for the actual shutter open/close operation time.

■ Change position or laser power per trigger



*1 : It takes approximately 15 seconds from receiving the laser pumping ON request to completion of pumping.
*2 : Commands from No. 2 to No. 5 above chart can be sent right after turning on laser pumping (without waiting for the laser pumping completion).
*3 : SEO command can be accepted only when the shutter is open. There is a delay time of around 200ms to max. 1 second from receiving shutter open/close command for the actual shutter open/close operation time.

Reference

- Before using SEO command to change position or laser power, enable the setting of "Offset by SEO Command" at file options for each file.
- When the file with the setting to use SEO command is selected, transmit SEO command by every trigger input. Otherwise trigger ready does not turn ON.

3 Data Format for Each Command

3-1 Command List

Reference

- For the communication settings and command to monitor the laser power at lasing, refer to “Setup/Maintenance Guide”.

Type	Name	Code	Functions	Refer
Operation control	Command reception permission	MKM	Controls the reception permission for the settings by communication commands.	(P.44)
	Laser pumping	LSR	Controls the laser power supply (laser pumping) ON/OFF.	(P.45)
	Shutter open/close	SHT	Controls the internal shutter opening/closing.	(P.46)
	Lasing trigger (for single trigger)	MRK	Inputs lasing trigger (laser radiation startup signal) when the trigger mode is set to “single trigger”.	(P.47)
	Trigger mode	TMS	Specifies how you will input TRIGGER IN (lasing start signal) at the remote control mode or run mode.	(P.48)
	Trigger delay	DLY	Sets the delay time from trigger input to starting trigger processing (lasing) operation.	(P.49)
	Guide laser	GID	Controls radiation of red guide laser for scanning position confirmation.	(P.50)
	Status checking	STS	Reads out the laser welding machine status, such as trigger ready status and error occurrence.	(P.51)
	Lasing end verification	MST	Enables automatic response of lasing operation result (e.g. normal end or error occurrence, etc.) at the end of lasing.	(P.52)
File	File selection by file No.	FNO	Selects the file by specifying the file no.	(P.54)
	File selection by file name	FNN	Selects the file by specifying the file name.	(P.55)
	Save file	FOR	Overwrites the file being edited onto the laser welding machine.	(P.56)
	Save file to different No.	FRG	Saves the file being edited to the specified file no. in the laser welding machine.	(P.56)
	File name	FNM	Sets the file name of the selected file no.	(P.57)

Type	Name	Code	Functions	Refer
Drawing data	VEC/DXF file	CDF	Sets a drawing file in VEC or DXF format pre-saved in the laser welding machine as the scanning data.	(P.58)
	VEC file parameters	CDC	Sets the VEC file parameters such as size and position.	(P.59)
	DXF file parameters	CDD	Sets the DXF file parameters such as size and position.	(P.61)
	Custom shape elements	FIG	Creates drawings with line, circle, arc and rectangle by specifying their sizes and positions.	(P.63)
	Custom shape parameters	LAY	Corrects the parameters of the all elements in the specified custom shape no., such as position, laser power and line width.	(P.67)
	Custom shape name	LNM	Sets the name of the custom shape.	(P.69)
	Point radiation parameters	PRD	Sets the position, time and laser power correction ratio of the point radiation.	(P.70)
	Point radiation correction	PRF	Specifies the offset value of the position and laser power to the all points set in the selected point radiation no.	(P.74)
	Lasing on/off by group	LMS	Specifies whether draw the setting data or not at lasing by each group No.	(P.75)
	Data compile mode	CVM	To avoid lasing pause during operation (warning E720), set Data compile mode from Runtime to Precompiled.	(P.76)
Layout/position adjustment	Work distance	WRD	Sets the distance from the mounting surface of the laser welding machine to the lasing object.	(P.77)
	File options	ALC	Adjusts the lasing position and layout for each file.	(P.78)
	Position and power adjustment per trigger	SEO	Specifies the offset value of lasing position and laser power for all data in the file. Send this command per each trigger.	(P.79)
	SEO command setting	OFC	Sets whether you use SEO command or not with the selected file.	(P.81)

Type	Name	Code	Functions	Refer
Laser condition	Laser power	LPW	Sets the laser power for the file.	(P.82)
	Scanning speed	SSP	Sets the scanning speed for the file.	(P.83)
	Laser fine tune	WTC	Fine-tunes lasing quality such as on/off timing of the radiation.	(P.84)
Trigger counter	Trigger counter	CNT	Reads out the trigger count and the error count for the selected file. The trigger count can be changed with this command.	(P.86)
	Trigger counter reset	CTR	Resets the trigger count and the error count for the selected file to “0”.	(P.87)
Maintenance	Laser radiation for measurement	SPT	Controls the radiation of the “laser for measurement” used to measure laser output by a commercially available power meter.	(P.88)
	Laser power warning threshold	PWL	Sets the laser power [W] threshold at lasing to check the measurement results.	(P.89)
	Laser energy warning threshold	MEN	Sets the laser energy [mJ] threshold at lasing to check the measurement results.	(P.90)
Environment	Internal clock	YMD	Sets the date and time of the internal clock of the laser welding machine.	(P.91)
	I/O settings	ENV	Sets the operating conditions of the input/output signals.	(P.92)

3-2 Command Description Details

■ How to read command format

- The command format is defined for setting request data, readout request data, and response data for readout respectively.
- Some commands have unsupported data format. In that case, such data format is not listed.

Start code	GID	S	[Guide laser radiation mode] [Guide laser scanning speed] 6-byte or 1-byte	(Check sum)	Delimiter

- Indicates variable-length or fixed-length data items.
- Data content varies for each command.
- [ ] indicates each data item. The [ ] is not included in the input data.
- If there is more than one item, input them in a row. There is no separating character among the each terms.

■ How to view the data description table

The data description table explains the content of variable-length or fixed-length data items.

- Data length of each item.
- If the data length shows “Max.”, it refers to variable-length data.
- If the command includes data that can be omitted, the data length is written in ( ). For the omitted data, the data set last (the initial value if it was not set) will be maintained.

It indicates the value at the setting/readout.
Characters enclosed in “ ” represent the characters input in the ASCII code.

Name	Data length [byte]	Data content	Remarks
Guide laser radiation mode	1	“0”: Display stop “1”: Working field “2”: Scanning image “3”: Laser off data “4”: Work distance	
Guide laser scanning speed *1	(5)	“00001”–“02000” [mm/s]	When this item is omitted, the data set last will be maintained for the omitted field.
Total data length	6 (1)	Fixed length. • Response for readout / Setting with Guide laser scanning speed: 6-byte • Setting without Guide laser scanning speed: 1-byte	

It is the total data length of the variable-length or fixed-length data part.
If the data length shows “Max.”, it refers to variable-length data.
If there is another variation of the total data length depending on the setting contents, it is written in ( ).

3-3 Operation Control Commands

3-3-1 Command reception permission: MKM

Controls the reception permission (reception mode ON/OFF) for the settings by communication commands.
In the shutter open or trigger ready ON status, set “command reception permission ON” when transmitting the command including an action to update the laser welding machine data.
To resume the trigger ready ON status after command transmission, set “command reception permission OFF”.

■ Setting request data / response data for readout

Start code	MKM	Sub command	[Command reception permission] 1-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	MKM	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Command reception permission	1	“0”: Command reception permission ON “1”: Command reception permission OFF	Setting “command reception permission ON” turns OFF the trigger ready to start receiving commands. Setting “command reception permission OFF” ends the command reception to resume the trigger ready ON status.
Total data length	1	Fixed length.	

Reference

- Refer to “2-4 Command Reception Condition” (P.32) for details on the command reception permission.
- When the command reception status is readout during the shutter closed, the response data indicates the status as “command reception permission ON”.
- Send MKM command with the shutter opened state. When DIP switch No. 2 is ON and the shutter is closed, the shutter opens at the timing of “reception mode OFF” is set.
- MKM command is not acceptable during the guide laser emission or laser radiation for measurement.

■ Data example

Condition: Command reception permission = 0

- Setting

Transmission data	[STX]	MKM	S	0	[CR]

- Readout

Transmission data	[STX]	MKM	R	[CR]

Response data	[STX]	MKM	A	0	[CR]

3-3-2 Laser pumping: LSR

Controls the laser power supply (laser pumping) ON/OFF.

■ Setting request data / response data for readout

Start code	LSR	Sub command	[Laser pumping ON/OFF] 1-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	LSR	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Laser pumping ON/OFF	1	“0”: Laser pumping OFF “1”: Laser pumping ON	
Total data length	1	Fixed length.	

Reference

- The laser pumping control with this command is possible only when the DIP switch No. 2 on the rear side of the controller is turned ON.
- It takes approximately 15 seconds from receiving the laser pumping ON request to completion of pumping.
- The response data for readout indicates the laser pumping command status. To check the laser pumping status, use the status checking (STS) command.
- When turning OFF the laser pumping during laser radiation, an error occurs and this stops the laser radiation.

■ Data example

Condition: Laser pumping ON/OFF = 1

- Setting

Transmission data	[STX]	LSR	S	1	[CR]

- Readout

Transmission data	[STX]	LSR	R	[CR]

Response data	[STX]	LSR	A	1	[CR]

3-3-3 Shutter open/close: SHT

Controls the internal shutter opening/closing.

■ Setting request data / response data for readout

Start code	SHT	Sub command	[Shutter status] 1-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	SHT	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Shutter status	1	“0”: Shutter close “1”: Shutter open	
Total data length	1	Fixed length.	

Reference

- The shutter control with this command is possible only when the DIP switch No. 2 on the rear side of the controller is turned ON.
- When the shutter open request command is transmitted with the shutter already open, the laser welding machine returns the response for abnormal receiving.
- It takes around 200ms to max. 1 second from receiving the shutter open/close request to the completion of the shutter open/close operations.
- If the shutter close command is transmitted during the trigger processing (laser radiation), the internal shutter is closed after the laser radiation is completed.
- It is possible to recover from the warning status by closing the shutter.

■ Data example

Condition: Shutter status = 1

- Setting

Transmission data	[STX]	SHT	S	1	[CR]

- Readout

Transmission data	[STX]	SHT	R	[CR]

Response data	[STX]	SHT	A	1	[CR]

3-3-4 Lasing trigger (for single trigger) : MRK

Inputs lasing trigger (laser radiation startup signal) when the trigger mode is set to “single trigger”.

■ Setting request data

Start code	MRK	S	(Check sum)	Delimiter

Reference

- Laser radiation starts upon receiving this command.
- This command can be accepted when the trigger ready is on. Before sending this command, confirm the trigger ready status by using STS command.
- When the trigger delay time is set in the selected file, trigger processing (lasing) operation starts after the delay time.
- This command can be accepted when the trigger mode is set to “single trigger”. When the trigger mode is set to “continuous trigger”, input the lasing trigger by using TRIGGER IN signal in I/O terminal.

■ Data example

- Setting

Transmission data	[STX]	MRK	S	[CR]

3-3-5 Trigger mode: TMS

Specifies how you will input TRIGGER IN (lasing start signal) at the remote control mode or run mode. According to this setting, the behavior of TRIGGER IN signal in I/O terminal is defined. Trigger mode setting is applied to only the selected file.

■ Setting request data / response data for readout

Start code	TMS	Sub command	[Trigger mode] [Minimum number of scans] [Maximum number of scans] 1-byte or 9-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	TMS	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Trigger mode	1	“0”: Single trigger “1”: Continuous trigger	• When the trigger mode is set to “single trigger”, one lasing operation is executed by each input of TRIGGER IN. • When the trigger mode is set to “continuous trigger”, lasing operation is repeated while TRIGGER IN is on.
Minimum number of scans	(4)	“0001”–“9999” [times]	• Specify these values only when the trigger mode is continuous trigger. When the trigger mode is single trigger, do not input anything. • Minimum number should be less than or equal to maximum number.
Maximum number of scans	(4)		
Total data length	1 (9)	Fixed length. • When the trigger mode is single trigger: 1-byte • When the trigger mode is continuous trigger: 9-byte	

Reference

- Trigger mode setting is applied to only the selected file. When using several files, set the trigger mode for each file.
- The default setting of the trigger mode is “single trigger”.
- When the trigger mode is set to “continuous trigger”, “number of scans” set in file option (by ALC command) is not used.
- MRK command can be used when the trigger mode is set to “single trigger”. When the trigger mode is set to “continuous trigger”, input the lasing trigger by using TRIGGER IN signal in I/O terminal.

■ Data example

Condition: Trigger mode = 1, Minimum number of scans = 8, Maximum number of scans = 10

• Setting

Transmission data	[STX]	TMS	S	100080010	[CR]

• Readout

Transmission data	[STX]	TMS	R	[CR]

Response data	[STX]	TMS	A	100080010	[CR]

3-3-6 Trigger Delay: DLY

Sets the delay time from trigger input to starting trigger processing (lasing) operation. Trigger delay setting is applied to only the selected file.

■ Setting request data / response data for readout

Start code	DLY	Sub command	[Delay time] 6-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	DLY	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Delay time	6	“000000”–“005000” [ms]	
Total data length	6	Fixed length.	

Reference

- Trigger delay setting is applied to only the selected file. When using several files, set the trigger delay for each file.

■ Data example

Condition:
- Setting

Transmission data	[STX]	DLY	S	000075	[CR]

- Readout

Transmission data	[STX]	DLY	R	[CR]

Response data	[STX]	DLY	A	000075	[CR]

3-3-7 Guide laser: GID

Controls radiation of red guide laser for scanning position confirmation.

■ Setting request data

Start code	GID	S	[Guide laser radiation mode] [Guide laser scanning speed] 6-byte or 1-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Guide laser radiation mode	1	“0”: Display stop “1”: Working field “2”: Scanning image “3”: Laser off data “4”: Work distance	• “1” to “4” can be used only when the shutter is closed. • To set guide laser scanning speed without guide laser radiation, set guide laser radiation mode to “0”.
Guide laser scanning speed *1	(5)	“00001”–“02000” [mm/s]	When this item is omitted, the data set last will be maintained for the omitted field.
Total data length	6 (1)	Fixed length. • Setting with Guide laser scanning speed: 6-byte • Setting without Guide laser scanning speed: 1-byte	

*1: This item can be omitted.

Reference

- This command is available only when the DIP switch No. 2 on the rear side of the controller is ON.
- You can start the guide laser radiation only with the internal shutter closed.
- The internal shutter is automatically opened and closed at the time of start and stop of radiation.
- The guide laser stops automatically after about 60 minutes has passed from the startup. At this time the internal shutter is automatically closed.
- Do not execute any other operation including the shutter opening/closing and sending MKM command while the guide laser is emitted.
- The setting of the guide laser scanning speed is common in all files.
- The setting of the guide laser scanning speed is saved in the laser welding machine without overwriting operation.

■ Data example

Condition:
- Setting

Guide laser radiation mode = 1, Guide laser scanning speed = 200

Transmission data	[STX]	GID	S	100200	[CR]

Condition:
- Setting

Stop the guide laser radiation

Transmission data	[STX]	GID	S	0	[CR]

3-3-8 Status checking: STS

Reads out the laser welding machine status, such as trigger ready status and error occurrence.

■ Readout request data

Start code	STS	R	(Check sum)	Delimiter

■ Response data for readout

Start code	STS	A	[Error occurrence] [Laser pumping status] [Command reception permission status] [Trigger ready status] 4-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Error occurrence	1	“0”: No error “1”: Error occurrence	
Laser pumping status	1	“0”: Laser pumping OFF “1”: Laser pumping in progress “2”: Laser pumping completed	
Command reception permission status	1	“0”: Command reception permission ON “1”: Command reception permission OFF	Indicates the command reception permission (MKM command) status. Use this for determination of whether other setting commands can be transmitted. For details, refer to “2-4 Command Reception Condition” (P.32).
Trigger ready status	1	“0”: Trigger ready OFF “1”: Trigger ready ON	Lasing trigger can be input only with the trigger ready ON.
Total data length	4	Fixed length.	

Reference

- “0211” is the response data for status checking with the trigger ready ON.

3-3-9 Lasing end verification: MST

Enables automatic response of lasing operation result (e.g. normal end or error occurrence, etc.) at the end of lasing.
For the communication sequence with this command, refer to “Communication sequence when the lasing end verification (MST) command response is enabled” (P.25).

■ Setting request data / response data for readout

Start code	MST	Sub command	[Response setting] 1-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	MST	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Response setting	1	“0”: Response prohibited “1”: Response permitted	
Total data length	1	Fixed length.	

Reference

- Once the lasing end verification is set to active, they are valid during the remote mode.
- To use the lasing end verification, set the response permission before every shifting to the remote mode. This command setting will be restored to the response prohibited state when the remote mode is turned OFF.

■ Automatic response data with response permitted

The following response data transmit normal end or abnormal end at the end of the trigger processing (lasing) with the lasing end verification response permitted.

Start code	MST	A	[Status] [Laser energy warning] [Laser energy] 14-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Status	4	“0000”: Normal end “E001”–“E999”: Error code (abnormal end)	It returns the error number occurred in case of an abnormal end by an error during lasing trigger processing.
Laser energy warning	1	“0”: Normal (within the warning threshold) “1”: Abnormal (out of the warning threshold) “2”: Not available	• Indicates if the measurement result of the laser energy is in the preset threshold or not. • If the warning threshold is not specified, this response data is always “0”: Normal. • In case the laser energy cannot be measured due to the error occurrence, this response data is “2”: Not available. • In case the warning E812 occurs, this response data is “0”: Normal.
Laser energy	9	“000000000”–“429496729” [mJ]	In case the laser energy cannot be measured due to the error occurrence (except E710 and E812), this response data is “000000000”.
Total data length	14	Fixed length.	

Reference

- Refer to “Error Indication” (P.102) for the error details.
- If an error occurred before lasing, the automatic response data will be transmitted at the time of error occurrence.
- For some system errors, the response data may not be transmitted.
- For the communication settings and command to monitor the laser power at lasing, refer to “Setup/Maintenance Guide”.
- When the trigger mode is set to “Continuous trigger”, the response of the laser energy shows the total energy of the all lasing operation repeated during the period from turning on of TRIGGER IN to turning on of LASING END OUT.

■ Data example

Condition: Response setting = 1

- Setting

Transmission data	[STX]	MST	S	1	[CR]

- Readout

Transmission data	[STX]	MST	R	[CR]

Response data	[STX]	MST	A	1	[CR]

Condition: Status = 0000 (normal end), Laser energy warning = 0, Laser energy = 30000

- Response data with response permitted

Response data	[STX]	MST	A	00000000030000	[CR]

Condition: Status = E710, Laser energy warning = 1, Laser energy = 25000

- Response data with response permitted

Response data	[STX]	MST	A	E7101000025000	[CR]

3-4 File Setting Commands

3-4-1 File selection by file No. : FNO

Selects the file by specifying the file no.

■ Setting request data / response data for readout

Start code	FNO	Sub command	[File No.] 4-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	FNO	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
File No.	4	“0000”–“2047”	Response data for readout returns the file number currently selected.
Total data length	4	Fixed length.	

Reference

- The file change operation turns off the trigger ready momentarily.

■ Data example

Condition: File No. = 10

- Setting

Transmission data	[STX]	FNO	S	0010	[CR]

- Readout

Transmission data	[STX]	FNO	R	[CR]

Response data	[STX]	FNO	A	0010	[CR]

3-4-2 File selection by file name: FNN

Selects the file by specifying the file name.

■ Setting request data

Start code	FNN	S	[File name] Max. 20-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
File name	Max. 20	Variable-length character data: 1 to 20 digits (when specifying all characters in ASCII code) Input Method: ASCII code or Shift JIS code (can be mixed)	• Use the ASCII code to specify one-byte characters. • Use the Shift JIS code to specify two-byte characters.
Total data length	Max. 20	Variable length.	

Reference

- Refer to “2-3-5 Character data input method” (P.31) for details on the character input method and restrictions.
- Specifies a case-sensitive alphabetical file name.
- If the file name contains both the ASCII code (one-byte characters) and Shift JIS code (two-byte characters), specify them exactly as they are in the ASCII code and Shift JIS code.
- When two or more of the same file names exists, the file with smaller no. is selected.
- Use the file name (FNM) command to read out the file name currently selected.
- The file change operation turns off the trigger ready momentarily.
- Unnamed files (0-byte name) cannot be selected with this command.

■ Data example

Condition:
- Setting

File name = ABCD

Transmission data	[STX]	FNN	S	ABCD	[CR]

3-4-3 Save file: FOR

Overwrites the file being edited onto the laser welding machine.

■ Setting request data

Start code	FOR	S	(Check sum)	Delimiter

■ Data example

• Setting	Transmission data	[STX]	FOR	S	[CR]

Reference

- When the setting is changed by the following commands, the modified data is saved in the laser welding machine without saving operation.
  - Trigger counter (CNT)
  - Trigger counter reset (CTR)
  - Internal clock (YMD)
  - I/O settings (ENV)
  - Guide laser scanning speed (GID)

3-4-4 Save file to different No.: FRG

Saves the file being edited to the specified file no. in the laser welding machine.

■ Setting request data

Start code	FRG	S	[File No.] 4-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
File No.	4	“0000”–“2047”	When saving files by this command, the file number selected currently also changes to the specified one.
Total data length	4	Fixed length.	

■ Data example

Condition: File No. = 1234

• Setting	Transmission data	[STX]	FRG	S	1234	[CR]

3-4-5 File name: FNM

Sets the file name of the selected file no.

■ Setting request data / response data for readout

Start code	FNM	Sub command	[File name] Max. 20-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	FNM	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
File name	Max. 20	Variable-length character data: Max. 20 digits (when specifying all characters in ASCII code) Input Method: ASCII code or Shift JIS code (can be mixed)	• Use the ASCII code to specify one-byte characters. • Use the Shift JIS code to specify two-byte characters. • To delete the file name, specify here no data (0-byte).
Total data length	Max. 20	Variable length.	

Reference

- Refer to “2-3-5 Character data input method” (P.31) for details on the character input method and restrictions.
- The characters from 00 (HEX) to 1F (HEX), and 7F (HEX) of the ASCII code cannot be used for file names.

■ Data example

Condition: File name = abcd

- Setting

Transmission data	[STX]	FNM	S	abcd	[CR]

- Readout

Transmission data	[STX]	FNM	R	[CR]

Response data	[STX]	FNM	A	abcd	[CR]

3-5 Drawing Data Setting Commands

3-5-1 VEC/DXF file: CDF

Sets a drawing file in VEC or DXF format pre-saved in the laser welding machine as the scanning data.

■ Setting request data / response data for readout

Start code	CDF	Sub command	[VEC/DXF No.] [VEC/DXF file name]	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	CDF	R	[VEC/DXF No.] 2-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
VEC/DXF No.	2	“00”–“15”	
VEC/DXF file name	Not specified	Variable-length character data: Recommended less than 20 digits in one-byte alphanumeric or 10 digits in two-byte characters excluding the extension (.VEC/.DXF). Input Method: ASCII code or Shift JIS code (can be mixed)	• Specifies the drawing file name set in the selected No. • For DXF file, input the file name with the extension “.DXF”. Ex. ABCD.DXF: “ABCD.DXF” • For VEC file, the extension “.VEC” can be omitted. Ex. ABCD.VEC: “ABCD” or “ABCD.VEC” • Use the ASCII code to specify one-byte characters. • Use the Shift JIS code to specify two-byte characters. • To delete the VEC/DXF data from the file, specify here no data (0-byte).
Total data length	Not specified	Variable length.	

Reference

- Files configurable with this command are the drawing files in VEC and DXF format saved in the laser welding machine.
- VEC/DXF file names with one-byte alphabetical characters are not case-sensitive.
- If the VEC/DXF file name contains both the one-byte characters and two-byte characters, specify them exactly as they are in the ASCII code and the Shift JIS code.
- Refer to “2-3-5 Character data input method” (P.31) for details on the character input method and restrictions.
- If the file is saved without selecting VEC/DXF file, the all setting parameters in the VEC/DXF No. are reset to default.

■ Data example

Condition: VEC/DXF No. = 1, VEC/DXF file name = Abcd.VEC

- Setting

Transmission data	[STX]	CDF	S	01Abcd	[CR]

- Readout

Transmission data	[STX]	CDF	R	01	[CR]

Response data	[STX]	CDF	A	01Abcd.VEC	[CR]

3-5-2 VEC file parameters: CDC

Sets the VEC file parameters such as size and position.

Reference

- VEC is a drawing format converted for the laser welding machine use.
- If the file is saved without selecting VEC/DXF file, the all setting parameters in the VEC/DXF No. are reset to default.

■ Setting request data / response data for readout

Start code	CDC	Sub command	[VEC/DXF No.] [Group No.] [X-scale] [Y-scale] [X-position] [Y-position] [Rotation] [Spiral line] [Spiral line width] [Spiral interval] [End points fitting] [Line power correction] [Curve power correction] [Scanning speed correction] 68-byte or 53-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	CDC	R	[VEC/DXF No.] 2-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
VEC/DXF No.	2	“00”–“15”	
Group No.	2	“00”–“15”	• Group No. specifies the scanning order at lasing. The setting data is scanned from smallest to largest group no. • By using LMS command, it is possible to set lasing ON/OFF for each group.
X-scale	8	“0010.000”–“1000.000” [%]	The correction ratio is calculated using the size of the pre-saved drawing as 100%.
Y-scale	8		
X-position	8	“-999.999”–“+999.999” [mm]	Specifies the origin coordinate of the drawing. The drawing origin is the position specified when converting the drawing data into a VEC file.
Y-position	8		
Rotation	7	“-360.00”–“+360.00” [°]	• The rotation center is the origin of the drawing. • The drawing rotates in CW direction with the negative value and in CCW with the positive value.
Spiral line	1	“0” : Off “1” : On	• The all lines in the selected drawing become spiral form to make thick lines. • When Spiral line setting is “Off”, do not send the data of “Spiral line width”, “Spiral interval” and “End points fitting”.

<table>
<tr><th>Name</th><th>Data length [byte]</th><th>Data content</th><th>Remarks</th></tr>
<tr><td>Spiral line width</td><td>(7)</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.010”–“200.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.010”–“400.000”</td></tr></table></td><td rowspan="2">When Spiral line setting is “Off”, do not send these data.</td></tr>
<tr><td>Spiral interval</td><td>(7)</td></tr>
<tr><td>End points fitting</td><td>(1)</td><td>“0” : Off
“1” : On</td><td>• Enables the auto-adjustment of the Spiral line length according to the attribute of start and end points.
• When Spiral line setting is “Off”, do not send this data.</td></tr>
<tr><td>Line power correction</td><td>3</td><td>“000”–“999” [%]</td><td rowspan="3">• The correction ratio is calculated using the value of laser power and scanning speed currently set as 100%.
• When Line power correction setting is “000”, the whole data of this drawing including the curved lines is not scanned at lasing.</td></tr>
<tr><td>Curve power correction</td><td>3</td><td>“001”–“999” [%]</td></tr>
<tr><td>Scanning speed correction</td><td>3</td><td>“001”–“999” [%]</td></tr>
<tr><td>Total data length</td><td>68
(53)</td><td colspan="2">Fixed length.
• When Spiral line setting is “On” : 68-byte
• When Spiral line setting is “Off” : 53-byte</td></tr>
</table>

■ Data example

Condition: VEC/DXF No. = 1, Group No. = 0, X-scale = 200, Y-scale = 200, X-position = 10, Y-position = -0.5, Rotation = 180, Spiral line = On, Spiral line width = 0.2, Spiral interval = 0.1, End points fitting = On, Line power correction = 120, Curve power correction = 80, Scanning speed correction = 100

• Setting

Transmission data	[STX]	CDC	S	01000200.0000200.000+010.000-000.500 +180.001000.200000.1001120080100	[CR]

• Readout

Transmission data	[STX]	CDC	R	01	[CR]

Response data	[STX]	CDC	A	01000200.0000200.000+010.000-000.500 +180.001000.200000.1001120080100	[CR]

Condition: VEC/DXF No. = 1, Group No. = 0, X-scale = 200, Y-scale = 200, X-position = 10, Y-position = -0.5, Rotation = 180, Spiral line = Off, Line power correction = 120, Curve power correction = 80, Scanning speed correction = 100

• Setting

Transmission data	[STX]	CDC	S	01000200.0000200.000+010.000-000.500 +180.000120080100	[CR]

• Readout

Transmission data	[STX]	CDC	R	01	[CR]

Response data	[STX]	CDC	A	01000200.0000200.000+010.000-000.500 +180.000120080100	[CR]

3-5-3 DXF file parameters: CDD

Sets the DXF file parameters such as size and position.

Reference

- If the file is saved without selecting VEC/DXF file, the all setting parameters in the VEC/DXF No. are reset to default.

■ Setting request data / response data for readout

Start code	CDD	Sub command	[VEC/DXF No.] [Group No.] [Origin] [X-position] [Y-position] [Rotation] [Size specification] [Width] [Height] [Hatch pitch] [Hatch direction] [Line power correction] [Curve power correction] [Scanning speed correction] 60-byte, 53-byte or 46-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	CDD	R	[VEC/DXF No.] 2-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
VEC/DXF No.	2	“00”–“15”	
Group No.	2	“00”–“15”	• Group No. specifies the scanning order at lasing. The setting data is scanned from smallest to largest group no. • By using LMS command, it is possible to set lasing ON/OFF for each group.
Origin	1	“0”: Center “1”: Lower left “2”: Lower right “3”: Upper left “4”: Upper right “5”: Original	Origin of the drawing. X- and Y-position of DXF file are applied to this position.
X-position	8	“-999.999”–“+999.999” [mm]	Specifies the origin coordinate of the drawing.
Y-position	8		
Rotation	7	“-360.00”–“+360.00” [°]	• The rotation center is the origin of the drawing. • The drawing rotates in CW direction with the negative value and in CCW with the positive value.
Size specification	1	“0”: Height and width “1”: Width (fixed aspect ratio) “2”: Height (fixed aspect ratio) “3”: Original	

<table>
<tr><th>Name</th><th>Data length [byte]</th><th>Data content</th><th>Remarks</th></tr>
<tr><td>Width</td><td>(7)</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.100”–“300.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.100”–“600.000”</td></tr></table></td><td>Input only when “0”: Height and width or “1”: Width is selected at “Size specification”.</td></tr>
<tr><td>Height</td><td>(7)</td><td>Input only when “0”: Height and width or “2”: Height is selected at “Size specification”.</td></tr>
<tr><td>Hatch pitch</td><td>7</td><td><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.010”–“200.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.010”–“400.000”</td></tr></table></td><td rowspan="2">These settings are valid with the DXF file created by using hatching or solid function.</td></tr>
<tr><td>Hatch direction</td><td>1</td><td>“0”: Horizontal
“1”: Vertical</td></tr>
<tr><td>Line power correction</td><td>3</td><td>“000”–“999” [%]</td><td rowspan="3">• The correction ratio is calculated using the value of laser power and scanning speed currently set as 100%.
• When Line power correction setting is “000”, the whole data of this drawing including the curved lines is not scanned at lasing.</td></tr>
<tr><td>Curve power correction</td><td>3</td><td>“001”–“999” [%]</td></tr>
<tr><td>Scanning speed correction</td><td>3</td><td>“001”–“999” [%]</td></tr>
<tr><td>Total data length</td><td>60
(53)
(46)</td><td colspan="2">Fixed length.
• When Size specification is “Height and width” : 60-byte
• When Size specification is “Width” or “Height” : 53-byte
• When Size specification is “Original” : 46-byte</td></tr>
</table>

■ Data example

Condition: VEC/DXF No. = 1, Group No. = 0, Origin = 0, X-position = 10, Y-position = -0.5, Rotation = 180, Size specification = 0, Width = 20, Height = 35.5, Hatch pitch = 0.3, Hatch direction = 1, Line power correction = 120, Curve power correction = 80, Scanning speed correction = 100

• Setting

Transmission data	[STX]	CDD	S	01000+010.000-000.500+180.000020.000035.500000.3001120080100	[CR]

• Readout

Transmission data	[STX]	CDD	R	01	[CR]	
Response data	[STX]	CDD	A	01000+010.000-000.500+180.000020.000035.500000.3001120080100	[CR]	

Condition: VEC/DXF No. = 1, Group No. = 0, Origin = 0, X-position = 10, Y-position = -0.5, Rotation = 180, Size specification = 3, Hatch pitch = 0.3, Hatch direction = 1, Line power correction = 120, Curve power correction = 80, Scanning speed correction = 100

• Setting

Transmission data	[STX]	CDD	S	01000+010.000-000.500+180.003000.3001120080100	[CR]

• Readout

Transmission data	[STX]	CDD	R	01	[CR]	
Response data	[STX]	CDD	A	01000+010.000-000.500+180.003000.3001120080100	[CR]	

3-5-4 Custom shape elements: FIG

Creates drawings with line, circle, arc and rectangle by specifying their sizes and positions.

■ Setting request data / response data for readout

Start code	FIG	Sub command	[Custom shape No.] [Element No.] [Shape] [Size, positions and etc. *1]	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout

*1: Setting parameters vary depending on the element type.

■ Readout request data

Start code	FIG	R	[Custom shape No.] [Element No.] 5-byte	(Check sum)	Delimiter

■ Data description

1. Setting of “Line”

Name	Data length [byte]	Data content	Remarks
Custom shape No.	2	“00”–“15”	
Element No.	3	“000”–“031”	Max. 32 elements can be set in one custom shape.
Shape	1	“0”: Straight line	
X-start point	8	Model: VL-W1500-N, VL-W1A00-N → “-100.000”–“+100.000” Model: VL-W1506-N, VL-W1A06-N → “-200.000”–“+200.000”	When all positions are “+000.000”, that element is deleted.
Y-start point	8		
X-end point	8		
Y-end point	8		
Total data length	38	Fixed length.	

2. Setting of “Circle”

<table>
<tr><th>Name</th><th>Data length [byte]</th><th>Data content</th><th>Remarks</th></tr>
<tr><td>Custom shape No.</td><td>2</td><td>“00”–“15”</td><td></td></tr>
<tr><td>Element No.</td><td>3</td><td>“000”–“031”</td><td>Max. 32 elements can be set in one custom shape.</td></tr>
<tr><td>Shape</td><td>1</td><td>“1”: Circle</td><td></td></tr>
<tr><td>X-center</td><td>8</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“-100.000”–“+100.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“-200.000”–“+200.000”</td></tr></table></td><td rowspan="2">Specifies the center position of the circle.</td></tr>
<tr><td>Y-center</td><td>8</td></tr>
<tr><td>Radius</td><td>7</td><td><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.010”–“100.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.010”–“200.000”</td></tr></table></td><td></td></tr>
<tr><td>Start angle</td><td>7</td><td>“-360.00”–“+360.00” [°]</td><td>Specifies the start position of the stroke.</td></tr>
<tr><td>Total data length</td><td>36</td><td colspan="2">Fixed length.</td></tr>
</table>

3. Setting of “Arc”

<table>
<tr><th>Name</th><th>Data length [byte]</th><th>Data content</th><th>Remarks</th></tr>
<tr><td>Custom shape No.</td><td>2</td><td>“00”–“15”</td><td></td></tr>
<tr><td>Element No.</td><td>3</td><td>“000”–“031”</td><td>Max. 32 elements can be set in one custom shape.</td></tr>
<tr><td>Shape</td><td>1</td><td>“2”: Arc</td><td></td></tr>
<tr><td>X-start point</td><td>8</td><td rowspan="4"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“-100.000”–“+100.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“-200.000”–“+200.000”</td></tr></table></td><td rowspan="4">Specifies the start and end position of the curved line.</td></tr>
<tr><td>Y-start point</td><td>8</td></tr>
<tr><td>X-end point</td><td>8</td></tr>
<tr><td>Y-end point</td><td>8</td></tr>
<tr><td>Radius</td><td>7</td><td>“000.010”–“999.999” [mm]</td><td>Specifies the radius for the circular arc.</td></tr>
<tr><td>Direction</td><td>1</td><td>“0”: CCW
“1”: CW</td><td>Specifies the stroke direction of the arc.</td></tr>
<tr><td>Angle</td><td>1</td><td>“0”: Under 180 degree
“1”: Over 180 degree</td><td>Specifies the arc length by selecting the central angle.</td></tr>
<tr><td>Total data length</td><td>47</td><td colspan="2">Fixed length.</td></tr>
</table>

4. Setting of “Rectangle”

<table>
<tr><th>Name</th><th>Data length [byte]</th><th>Data content</th><th>Remarks</th></tr>
<tr><td>Custom shape No.</td><td>2</td><td>“00”–“15”</td><td></td></tr>
<tr><td>Element No.</td><td>3</td><td>“000”–“031”</td><td>Max. 32 elements can be set in one custom shape.</td></tr>
<tr><td>Shape</td><td>1</td><td>“3”: Rectangle</td><td></td></tr>
<tr><td>X-position</td><td>8</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“-100.000”–“+100.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“-200.000”–“+200.000”</td></tr></table></td><td rowspan="2">Specifies the coordinate of the base position.</td></tr>
<tr><td>Y-position</td><td>8</td></tr>
<tr><td>Rotation</td><td>7</td><td>“-360.00”–“+360.00” [°]</td><td>• The rotation center is the origin of the drawing.
• The drawing rotates in CW direction with the negative value and in CCW with the positive value.</td></tr>
<tr><td>Base position</td><td>1</td><td>“0”: Center
“1”: Upper left
“2”: Upper right
“3”: Lower left
“4”: Lower right</td><td>Origin of the rectangle. X- and Y-position are applied to this position.</td></tr>
<tr><td>Width</td><td>7</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.100”–“300.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.100”–“600.000”</td></tr></table></td><td rowspan="2"></td></tr>
<tr><td>Height</td><td>7</td></tr>
<tr><td>Fillet radius</td><td>7</td><td><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.000”–“100.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.000”–“200.000”</td></tr></table></td><td>• To make the corners rounded, input the value here.
• For the rectangle without rounded corners, set “000.000” here.
• For the fillet radius, set smaller value than half of the width or height of the rectangle.</td></tr>
<tr><td>Total data length</td><td>51</td><td colspan="2">Fixed length.</td></tr>
</table>

Reference

- To delete the element of the custom shape, select “Line” for shape and set all positions to “+000.000”.

■ Data example

Condition: Custom shape No. = 0, Element No. = 1, Shape = Rectangle, X-position = 15, Y-position = 20, Rotation = -10, Base position = Lower left, Width = 10, Height = 20, Fillet radius = 1

• Setting

Transmission data	[STX]	FIG	S	000013+015.000+020.000-010.00 3010.000020.000001.000	[CR]

• Readout

Transmission data	[STX]	FIG	R	00001	[CR]

Response data	[STX]	FIG	A	000013+015.000+020.000-010.00 3010.000020.000001.000	[CR]

Condition: To delete the element with Custom shape No. = 0, Element No. = 1

• Setting

Transmission data	[STX]	FIG	S	000010+000.000+000.000+000.000+000.000	[CR]

3-5-5 Custom shape parameters: LAY

Corrects the parameters of the all elements in the specified custom shape no., such as position, laser power and line width.

■ Setting request data / response data for readout

Start code	LAY	Sub command	[Custom shape No.] [Group No.] [X-offset] [Y-offset] [Rotation] [Spiral line] [Spiral line width] [Spiral interval] [End points fitting] [Line power correction] [Curve power correction] [Scanning speed correction] 52-byte or 37-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	LAY	R	[Custom shape No.] 2-byte	(Check sum)	Delimiter

■ Data description

<table>
<tr><th>Name</th><th>Data length [byte]</th><th>Data content</th><th>Remarks</th></tr>
<tr><td>Custom shape No.</td><td>2</td><td>“00”–“15”</td><td></td></tr>
<tr><td>Group No.</td><td>2</td><td>“00”–“15”</td><td>• Group No. specifies the scanning order at lasing. The setting data is scanned from smallest to largest group no.
• By using LMS command, it is possible to set lasing ON/OFF for each group.</td></tr>
<tr><td>X-offset</td><td>8</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“-100.000”–“+100.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“-200.000”–“+200.000”</td></tr></table></td><td rowspan="2">Moves the all elements set in the specified custom shape no. from the currently set position.</td></tr>
<tr><td>Y-offset</td><td>8</td></tr>
<tr><td>Rotation</td><td>7</td><td>“-360.00”–“+360.00” [°]</td><td>The rotation center is the center of the working field.</td></tr>
<tr><td>Spiral line</td><td>1</td><td>“0” : Off
“1” : On</td><td>• The all lines in the selected drawing become spiral form to make thick lines.
• When Spiral line setting is “Off”, do not send the data of “Spiral line width”, “Spiral interval” and “End points fitting”.</td></tr>
<tr><td>Spiral line width</td><td>(7)</td><td rowspan="2"><table><tr><th>Model</th><th>Setting range [mm]</th></tr><tr><td>VL-W1500-N
VL-W1A00-N</td><td>“000.010”–“200.000”</td></tr><tr><td>VL-W1506-N
VL-W1A06-N</td><td>“000.010”–“400.000”</td></tr></table></td><td rowspan="2">When Spiral line setting is “Off”, do not send these data.</td></tr>
<tr><td>Spiral interval</td><td>(7)</td></tr>
</table>

Name	Data length [byte]	Data content	Remarks
End points fitting	(1)	“0” : Off “1” : On	• Enables the auto-adjustment of the Spiral line length according to the attribute of start and end points. • When Spiral line setting is “Off”, do not send this data.
Line power correction	3	“000”–“999” [%]	• The correction ratio is calculated using the value of laser power and scanning speed currently set as 100%. • When Line power correction setting is “000”, the whole data of this drawing including the curved lines is not scanned at lasing.
Curve power correction	3	“001”–“999” [%]	
Scanning speed correction	3	“001”–“999” [%]	
Total data length	52 (37)	Fixed length. • When Spiral line setting is “On” : 52-byte • When Spiral line setting is “Off” : 37-byte	

■ Data example

Condition: Custom shape No. = 1, Group No. = 0, X-offset = 2, Y-offset = -0.5, Rotation = 180,
Spiral line = On, Spiral line width = 0.2, Spiral interval = 0.1, End points fitting = On,
Line power correction = 120, Curve power correction = 80, Scanning speed correction = 100

• Setting

Transmission data	[STX]	LAY	S	0100+002.000-000.500+180.001000.200000.100 1120080100	[CR]

• Readout

Transmission data	[STX]	LAY	R	01	[CR]	
Response data	[STX]	LAY	A	0100+002.000-000.500+180.001000.200000.100 1120080100		[CR]

Condition: Custom shape No. = 1, Group No. = 0, X-offset = 2, Y-offset = -0.5, Rotation = 180,
Spiral line = Off, Line power correction = 120, Curve power correction = 80,
Scanning speed correction = 100

• Setting

Transmission data	[STX]	LAY	S	0100+002.000-000.500+180.00120080100	[CR]

• Readout

Transmission data	[STX]	LAY	R	01	[CR]	
Response data	[STX]	LAY	A	0100+002.000-000.500+180.00120080100		[CR]

3-5-6 Custom shape name: LNM

Sets the name of the custom shape.

■ Setting request data

Start code	LNM	S	[Custom shape No.] [Custom shape name] Max. 22-byte	(Check sum)	Delimiter

■ Readout request data

Start code	LNM	A	[Custom shape No.] 2-byte	(Check sum)	Delimiter

■ Response data for readout

Start code	LNM	A	[Custom shape name] Max. 20-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Custom shape No.	2	“00”–“15”	
Custom shape name	Max. 20	Variable-length character data: Max. 20 digits (when specifying all characters in ASCII code) Input Method: ASCII code or Shift JIS code (can be mixed)	• Use the ASCII code to specify one-byte characters. • Use the Shift JIS code to specify two-byte characters. • To delete the name, specify here no data (0-byte).
Total data length	Max. 22	Variable length.	

Reference

- Refer to “2-3-5 Character data input method” (P.31) for details on the character input method and restrictions.
- The characters from 00 (HEX) to 1F (HEX), and 7F (HEX) of the ASCII code cannot be used for the custom shape names.
- For response data for readout, two-byte characters are read out in the Shift JIS code while one-byte characters in the ASCII code.

■ Data example

Condition: Custom shape No. = 0, Custom shape name = abcd

- Setting

Transmission data	[STX]	LNM	S	00abcd	[CR]

- Readout

Transmission data	[STX]	LNM	R	00	[CR]

Response data	[STX]	LNM	A	abcd	[CR]

3-5-7 Point radiation parameters: PRD

Sets the position, time and laser power correction ratio of the point radiation.
Point radiation is a function lasing at a point of the specified coordinate.

Reference

- The data items of PRD command vary depending on the setting details.

■ Setting request data: When specifying the radiation position

Start code	PRD	S	[Point radiation No.] [Point No.] [Radiation time] [Laser power correction] [X-position] [Y-position] [...] [X-position] [Y-position] 15 + 16n-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Point radiation No.	2	“00”–“15”	
Point No. (First No. for setting)	3	“000”–“049”	• Max. 50 points can be set in one point radiation no. • Specifies the point no. to be set. • When setting two or more points, this no. indicates the first no. to be set.
Radiation time	7	“00000.1”–“99999.9” [ms]	Radiation time and laser power correction settings apply to all points specified in this command.
Laser power correction	3	“000”–“999” [%]	The correction ratio is calculated using the value of laser power currently set as 100%.
X-position	8		• Specifies the position of the selected point no. • When setting the position of only one point, do not send further data.
Y-position	8		
⋮	⋮		• When setting two or more points, specify the position of the following point no. • Max. 50 points of positions can be set.
X-position	(8)		
Y-position	(8)		
Total data length	Min. 31 Max. 815	Variable length within 15 + 16n-byte n=Count of the points to set position • When setting only one point: 31-byte • When setting 50 points: 815-byte	

Model	Setting range [mm]
VL-W1500-N VL-W1A00-N	“-100.000”–“+100.000”
VL-W1506-N VL-W1A06-N	“-200.000”–“+200.000”

■ Data example

Condition: Point radiation No. = 1, Point No. = 5, Radiation time = 2000, Laser power correction = 100, X-position = 25.5, Y-position = -7

• Setting

Transmission data	[STX]	PRD	S	0100502000.0100+025.500-007.000	[CR]

Condition: When setting 4 points:
Point radiation No. = 1, Point No. = 0, Radiation time = 2000, Laser power correction = 100,
X-position = 25.5, Y-position = 7, X-position = 25.5, Y-position = -7,
X-position = -25.5, Y-position = -7, X-position = -25.5, Y-position = 7

• Setting

Transmission data	[STX]	PRD	S	0100002000.0100+025.500+007.000+025.500 -007.000-025.500-007.000-025.500+007.000	[CR]

■ Setting request data : When specifying radiation time and laser power correction ratio for each point

Start code	PRD	S	[Point radiation No.] [Point No.] [Radiation time] [Laser power correction] 15-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Point radiation No.	2	“00”–“15”	
Point No.	3	“000”–“049”	Specifies the radiation time and laser power correction ratio by a point. It is not possible to specify the radiation time and laser power correction ratio for the multiple points at once.
Radiation time	7	“00000.1”–“99999.9” [ms]	
Laser power correction	3	“000”–“999” [%]	The correction ratio is calculated using the value of laser power currently set as 100%.
Total data length	15	Fixed-length data.	

■ Data example

Condition: Point radiation No. = 1, Point No. = 3, Radiation time = 2000, Laser power correction = 100

• Setting

Transmission data	[STX]	PRD	S	0100302000.0100	[CR]

■ Setting request data : When deleting point setting

Start code	PRD	S	[Point radiation No.] [First point No. to delete] [Last point No. to delete] 8-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Point radiation No.	2	“00”–“15”	
First point No. to delete	3	“000”–“049”	• Deletes all points from the specified first point no. to the last point no. • To delete the only one point, specify the same no. to the first and last point no. • Specify the smaller no. to the first point no. than the last point no.
Last point No. to delete	3		
Total data length	8	Fixed-length data.	

■ Data example

Condition: When deleting point setting
Point radiation No. = 1, First point No. to delete = 5, Last point No. to delete = 10

• Setting

Transmission data	[STX]	PRD	S	01005010	[CR]

■ Readout request data

Start code	PRD	R	[Point radiation No.] [Point No.] 5-byte	(Check sum)	Delimiter

■ Response data for readout

Start code	PRD	A	[Point radiation No.] [Point No.] [Radiation time] [Laser power correction] [X-position] [Y-position] 31-byte or 5-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Point radiation No.	2	“00”–“15”	
Point No.	3	“000”–“049”	Reads out the point radiation setting by a point. It is not possible to readout settings for the multiple points at once.
Radiation time *1	(7)	“00000.1”–“99999.9” [ms]	
Laser power correction *1	(3)	“000”–“999” [%]	The correction ratio is calculated using the value of laser power currently set as 100%.
X-position *1	(8)	Model: VL-W1500-N, VL-W1A00-N — Setting range [mm]: “-100.000”–“+100.000” Model: VL-W1506-N, VL-W1A06-N — Setting range [mm]: “-200.000”–“+200.000”	
Y-position *1	(8)		
Total data length	31 (5)	Fixed length. • When the specified point no. has settings : 31-byte • When the specified point no. has no settings : 5-byte	

*1: If there is no setting in the specified point no., these items are not sent in the response data for readout.

■ Data example

Condition: Point radiation No. = 1, Point No. = 0, Radiation time = 2000,
Laser power correction = 100, X-position = 25.5, Y-position = -7

• Readout

Transmission data	[STX]	PRD	R	01000	[CR]

Response data	[STX]	PRD	A	0100002000.0100+025.500-007.000	[CR]

3-5-8 Point radiation correction: PRF

Specifies the offset value of the position and laser power to the all points set in the selected point radiation no.

■ Setting request data / response data for readout

Start code	PRF	Sub command	[Point radiation No.] [Group No.] [X-offset] [Y-offset] [Laser power correction] 23-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	PRF	R	[Point radiation No.] 2-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Point radiation No.	2	“00”–“15”	
Group No.	2	“00”–“15”	• Group No. specifies the scanning order at lasing. The setting data is scanned from smallest to largest group no. • By using LMS command, it is possible to set lasing ON/OFF for each group.
X-offset	8	Model / Setting range [mm] VL-W1500-N, VL-W1A00-N: “-100.000”–“+100.000” VL-W1506-N, VL-W1A06-N: “-200.000”–“+200.000”	Moves the all points set in the selected point radiation no. from currently set position.
Y-offset	8		
Laser power correction	3	“000”–“999” [%]	• The correction ratio is calculated using the value of laser power for each point as 100%. • When laser power correction ratio is set to “000”, all points set in the specified point radiation no. are not scanned at lasing.
Total data length	23	Fixed length.	

■ Data example

Condition: Point radiation No. = 1, Group No. = 2, X-offset = 0, Y-offset = -5.6, Laser power correction = 130

• Setting

Transmission data	[STX]	PRF	S	0102+000.000-005.600130	[CR]

• Readout

Transmission data	[STX]	PRF	R	01	[CR]

Response data	[STX]	PRF	A	0102+000.000-005.600130	[CR]

3-5-9 Lasing ON/OFF by group: LMS

Specifies whether draw the setting data or not at lasing by each group No.
Without this setting, the all data in a file is drawn at lasing. If there is a group that should not be drawn, send this command and set it to lasing off.

Reference

- Group No. is specified by each drawing setting with the command of “CDC: VEC file parameters”, “CDD: DXF file parameters”, “LAY: Custom shape parameters”, or “PRF: Point radiation parameters”.
- If there is a group desired not to be scanned at lasing, send this command every time when the file No. is changed and when remote mode is turned on.
- When the laser welding machine power or the remote mode is turned off, or when the file No. is changed, this setting is cleared and all groups are set to “lasing on”.
- This setting is not saved to the laser welding machine.
- The data in a group set to lasing off is not scanned by guide laser.
- This setting can not be confirmed on the image display.
- Even for the lasing off data, when SEO command is used in that data, send SEO command always before lasing trigger input.

■ Setting request data / response data for readout

Start code	LMS	Sub command	[Lasing ON/OFF for each group] 16-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	LMS	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Group No. 00 Lasing ON/OFF	1	“0” : Lasing OFF “1” : Lasing ON	• Sets lasing on/off for all groups (group No. 0 to No. 15). • Even if there is a group No. not used in a file, send all 16 digits with “0” or “1”.
Group No. 01 Lasing ON/OFF	1		
Group No. 02 Lasing ON/OFF	1		
⋮	⋮		
Group No. 15 Lasing ON/OFF	1		
Total data length	16	Fixed length.	

■ Data example

Condition: Setting for lasing off to the group No. 2 and 3, and no data in group No. 4 to 15.

• Setting

Transmission data	[STX]	LMS	S	1100111111111111 or 1100000000000000	[CR]

• Readout

Transmission data	[STX]	LMS	R	[CR]

Response data	[STX]	LMS	A	1100111111111111 or 1100000000000000	[CR]

3-5-10 Data compile mode: CVM

To avoid lasing pause during operation (warning E720), set Data compile mode from Runtime to Precompiled. Setting of Data compile mode is applied to only the selected file. Specify it at each file.

■ Setting request data / response data for readout

Start code	CVM	Sub command	[Data compile mode] 1-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	CVM	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Data compile mode	1	“0”: Runtime, Enable warning E720 “1”: Runtime, Disable warning E720 “2”: Precompiled	When lasing pause warning (E720) is not occur, use Runtime mode.
Total data length	1	Fixed length.	

Reference

- SEO command is not available when Data compile mode is set to Precompiled.
- The available data capacity (total length of the drawing lines) at Precompiled mode is lower than the capacity at Runtime mode.
- When Precompiled mode is set, the required time for turning on READY OUT is longer than that of Runtime mode.
- Before disabling lasing pause warning E720, make sure that the processing results are not impaired by lasing pause.

■ Data example

Condition: Data compile mode = 2

• Setting

Transmission data	[STX]	CVM	S	2	[CR]

• Readout

Transmission data	[STX]	CVM	R	[CR]

Response data	[STX]	CVM	A	2	[CR]

3-6 Layout/Position Adjustment Commands

3-6-1 Work distance: WRD

Sets the distance from the mounting surface of the laser welding machine to the lasing object.

Reference

- The work distance setting is linked to the indicating work distance by the guide laser.

■ Setting request data / response data for readout

Start code	WRD	Sub command	[Work distance] 5-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	WRD	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Work distance	5	Model: VL-W1500-N, VL-W1A00-N — Setting range [mm]: “300.0”–“330.0” Model: VL-W1506-N, VL-W1A06-N — Setting range [mm]: “670.0”–“700.0”	
Total data length	5	Fixed length.	

■ Data example

Condition: Work distance = 315

- Setting

Transmission data	[STX]	WRD	S	315.0	[CR]

- Readout

Transmission data	[STX]	WRD	R	[CR]

Response data	[STX]	WRD	A	315.0	[CR]

3-6-2 File options: ALC

Adjusts the lasing position and layout for all data in a file.

■ Setting request data / response data for readout

Start code	ALC	Sub command	[X-offset] [Y-offset] [Rotation offset] [Number of scans] [Scanning interval] [Y-axis mirroring] [X-axis mirroring] [Overlap length] 38-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	ALC	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
X-offset	8	Model: VL-W1500-N, VL-W1A00-N — Setting range [mm]: “-100.000”–“+100.000” Model: VL-W1506-N, VL-W1A06-N — Setting range [mm]: “-200.000”–“+200.000”	• Moves the all data set in the file from currently set position. • The rotation center is the center of the working field. • After the rotation offset is applied, X-/Y-offset values are applied.
Y-offset	8		
Rotation offset	7	“-360.00”–“+360.00” [°]	
Number of scans	4	“0001”–“9999” [times]	This setting is applied only when the trigger mode is “single trigger”. When the trigger mode is set to “continuous trigger”, this setting is not used.
Scanning interval	4	“00.0”–“60.0” [Second]	
Y-axis mirroring	1	“0”: Do not invert “1”: Invert	Mirror image along Y-axis
X-axis mirroring	1		Mirror image along X-axis
Overlap length	5	“0.000”–“5.000” [mm]	• This setting is applied to a line which start point and end point are in the same coordinate. • Extends the line length at the start and end points respectively with a half length of the setting overlap length.
Total data length	38	Fixed length.	

■ Data example

Condition: X-offset = 10, Y-offset = -5.5, Rotation offset = 120, Number of scans = 4, Scanning interval = 0, Y-axis mirroring = 0, X-axis mirroring = 1, Overlap length = 0.03

• Setting

Transmission data	[STX]	ALC	S	+010.000-005.500+120.00000400.0010.030	[CR]

• Readout

Transmission data	[STX]	ALC	R	[CR]

Response data	[STX]	ALC	A	+010.000-005.500+120.00000400.0010.030	[CR]

3-6-3 Position and power adjustment per trigger: SEO

Specifies the offset value of lasing position and laser power for all data in the file. Send this command per trigger.

■ Setting request data / response data for readout

Start code	SEO	Sub command	[X-offset] [Y-offset] [Rotation offset] [Laser power correction] 26-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

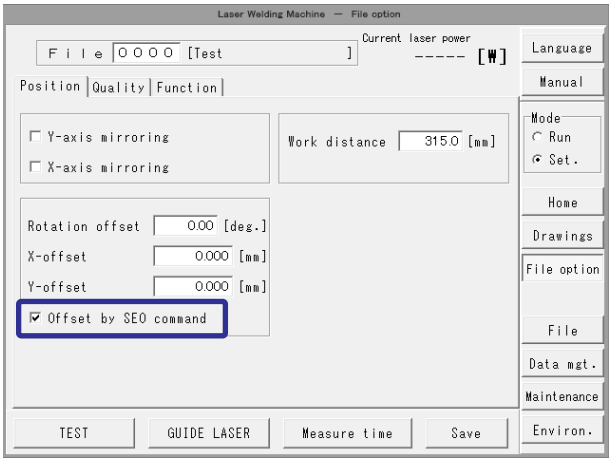
Start code	SEO	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
X-offset	8	Model: VL-W1500-N, VL-W1A00-N — Setting range [mm]: “-100.000”–“+100.000” Model: VL-W1506-N, VL-W1A06-N — Setting range [mm]: “-200.000”–“+200.000”	• Moves the all data set in the file from currently set position. • The rotation center is the center of the working field. • After the rotation offset is applied, X-/Y-offset values are applied.
Y-offset	8		
Rotation offset	7	“-360.00”–“+360.00” [°]	
Laser power correction	3	“000”–“999” [%]	• Corrects the laser power of the all data in the file. • The correction ratio is calculated using the value of laser power currently set as 100%.
Total data length	26	Fixed length.	

Reference

- Before using SEO command to change position or laser power, enable the setting of “Offset by SEO command” at file options for each file.
- When the file with the setting to use SEO command is selected, transmit SEO command by every trigger input. Otherwise trigger ready does not turn ON.
- SEO command is not available when Data compile mode is set to Precompiled.



■ Data example

Condition: X-offset = 10, Y-offset = -5.5, Rotation offset = 120, Laser power correction = -80

• Setting

Transmission data	[STX]	SEO	S	+010.000-005.500+120.00080	[CR]

• Readout

Transmission data	[STX]	SEO	R	[CR]

Response data	[STX]	SEO	A	+010.000-005.500+120.00080	[CR]

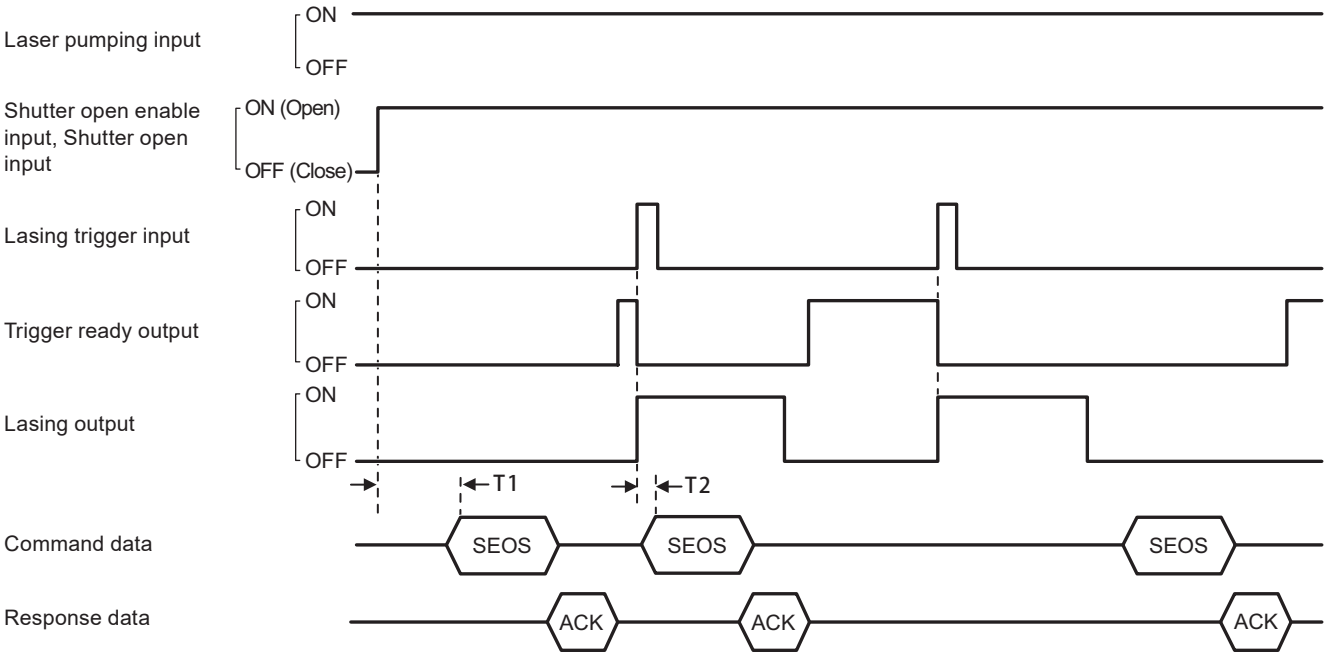
Condition: Sending SEO command without any change of position and power

• Setting

Transmission data	[STX]	SEO	S	+000.000+000.000+000.00100	[CR]

■ Timing chart for SEO command transmission

When the file with the setting to use SEO command is selected



Item	Time	Remarks
T1	1 second or more	SEO command cannot be sent until the shutter opens. The shutter opens approx. 1 second after the shutter open input.
T2	0ms or more	After confirming the lasing output is turned ON, the next SEO command data can be sent.

Reference

- When the file with the setting to use SEO command is selected, transmit SEO command by every trigger input. Otherwise trigger ready does not turn ON.
- SEO command can be accepted only when the shutter is open. The shutter status can be confirmed by using SHUTTER OPEN OUT signal of I/O.
- When “command reception permission ON” is set by MKM command, SEO command can not be accepted.
- To reset the transmitted SEO command data, either close the shutter, or set “command reception permission ON” for MKM command.
- When SEO command will be sent right after file change (FNO/FNN command) or command reception permission OFF (MKM command) setting, set the wait time of 1 second or more after FNO/FNN/MKM command reception.
- When the trigger counter is reset after sending of SEO command, the setting by SEO command is also reset and trigger ready turns OFF. In this case, send SEO command again.

3-6-4 SEO command setting: OFC

Sets whether you use SEO command or not with the selected file. When using SEO command, send it per trigger.

■ Setting request data / response data for readout

Start code	OFC	Sub command	[SEO command setting] 1-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	OFC	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
SEO command setting	1	“0”: Do not use “1”: Use SEO command	SEO command specifies the offset value of lasing position and laser power for all data in the file.
Total data length	1	Fixed length.	

Reference

- Refer to “3-6-3 Position and power adjustment per trigger: SEO” (P.79) for SEO command.
- SEO command is not available when Data compile mode is set to Precompiled.

■ Data example

Condition: SEO command setting = 1

- Setting

Transmission data	[STX]	OFC	S	1	[CR]

- Readout

Transmission data	[STX]	OFC	R	[CR]

Response data	[STX]	OFC	A	1	[CR]

3-7 Laser Condition Setting Commands

3-7-1 Laser power: LPW

Sets the laser power for the file.

■ Setting request data / response data for readout

Start code	LPW	Sub command	[Laser power] 5-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	LPW	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Laser power	5	Model: VL-W1500-N, VL-W1506-N — Setting range [W]: “009.0”–“045.0” Model: VL-W1A00-N, VL-W1A06-N — Setting range [W]: “018.0”–“090.0”	
Total data length	5	Fixed length.	

■ Data example

Condition: Laser power = 40

- Setting

Transmission data	[STX]	LPW	S	040.0	[CR]

- Readout

Transmission data	[STX]	LPW	R	[CR]

Response data	[STX]	LPW	A	040.0	[CR]

Reference

- Though the laser power is set in [W], in some cases there is a difference between the actual output power and the setting value. It is recommended to measure the actual laser power regularly and to adjust the setting value.
- This setting is applied to all data in a file. To change the laser power for some data, set the laser power correction by each drawing data.

3-7-2 Scanning speed: SSP

Sets the scanning speed for the file.

■ Setting request data / response data for readout

Start code	SSP	Sub command	[Scanning speed] 5-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	SSP	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Scanning speed	5	“00001”–“03000” [mm/s]	
Total data length	5	Fixed length.	

■ Data example

Condition: Scanning speed = 500

- Setting

Transmission data	[STX]	SSP	S	00500	[CR]

- Readout

Transmission data	[STX]	SSP	R	[CR]

Response data	[STX]	SSP	A	00500	[CR]

Reference

- This setting is applied to all data in a file. To change the scanning speed for some data, set the scanning speed correction by each drawing data.

3-7-3 Laser fine tune: WTC

Fine-tunes lasing quality such as on/off timing of the radiation.

■ Setting request data / response data for readout

Start code	WTC	Sub command	[Laser starting] [Laser ending] [Edge] [Curve] [Waiting time] [Pre-scan time] [Jump] [Point radiation on wait] [Point radiation off wait] 33-byte, 25-byte or 8-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	WTC	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Laser starting	4	“-100”–“+100”	
Laser ending	4	“-100”–“+100”	
Edge	3	“000”–“100”	With a larger value, lasing time becomes longer.
Curve	3	“000”–“100”	
Waiting time	3	“000”–“100”	
Pre-scan time	5	“00.00”–“10.00” [ms]	
Jump	3	“000”–“100”	
Point radiation on wait *1	(4)	“0.00”–“9.99” [ms]	• These settings are valid for the file with the point radiation. • It is not possible to omit one side of the point radiation on/off wait.
Point radiation off wait *1	(4)	“0.00”–“9.99” [ms]	
Total data length	33 (25) (8)	Fixed length. • When sending all data and response data for readout : 33-byte • When Point radiation on/off wait are omitted : 25-byte • When sending only Point radiation on/off wait : 8-byte	

*1: These items can be omitted. It is also possible to send only them.

Reference

- For the omitted data, the data set last (the initial value if it was not set) will be maintained.

■ Data example

Condition: Laser starting = -5, Laser ending = 10, Edge = 10, Curve = 0, Waiting time = 20,
Pre-scan time = 1, Jump = 0, Point radiation on wait = 0, Point radiation off wait = 0

• Setting

Transmission data	[STX]	WTC	S	-005+01001000002001.000000.000.00 or -005+01001000002001.00000	[CR]

• Readout

Transmission data	[STX]	WTC	R	[CR]	
Response data	[STX]	WTC	A	-005+01001000002001.000000.000.00	[CR]

Condition: When sending only Point radiation on/off wait:
Point radiation on wait = 1.5, Point radiation off wait = 0.5

• Setting

Transmission data	[STX]	WTC	S	1.500.50	[CR]

3-8 Trigger Counter Commands

3-8-1 Trigger counter: CNT

Reads out the trigger count and the error count for the selected file. The trigger count can be changed with this command.

■ Readout request data

Start code	CNT	R	(Check sum)	Delimiter

■ Response data for readout

Start code	CNT	A	[Trigger count] [Error count] 18-byte	(Check sum)	Delimiter

■ Setting request data

Start code	CNT	S	[Trigger count] 9-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Trigger count	9	“000000000”–“999999999”	• Indicates the total number of the received trigger for the selected file. • Trigger count includes the error count. • Trigger count does not include the test lasing operation.
Error count	9		Indicates the number of the abnormal lasing operation from the received trigger with the following reasons. • When the lasing operation is interrupted because of the alarm or warning occurrence. • When the lasing operation done with the laser energy or power out of the setting threshold. (Warning “E710” or “E812” occurrence)
Total data length	18 (9)	Fixed length. • Response data for readout : 18-byte • Setting request data : 9-byte	

■ Data example

Condition: Trigger count = 700, Error count = 3

• Readout

Transmission data	[STX]	CNT	R	[CR]

Response data	[STX]	CNT	A	000000700000000003	[CR]

Condition: Trigger count = 1000

• Setting

Transmission data	[STX]	CNT	S	000001000	[CR]

Reference

- When the trigger count is changed, the error count is reset to “0”.
- The setting changed by this command is saved in the laser welding machine without overwriting to the file.

3-8-2 Trigger counter reset: CTR

Resets the trigger count and the error count for the selected file to “0”.

■ Setting request data

Start code	CTR	S	[Reset counter] 1-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Reset counter	1	“0”: Trigger count and error count “1”: Error count only	It is not possible to reset only the trigger count.
Total data length	1	Fixed length.	

■ Data example

Condition:
- Setting

To reset error count

Transmission data	[STX]	CTR	S	1	[CR]

Reference

- The setting changed by this command is saved in the laser welding machine without overwriting to the file.

3-9 Maintenance Commands

3-9-1 Laser radiation for measurement: SPT

Controls the radiation of the “laser for measurement” used to measure laser output by a commercially available power meter.

■ Setting request data

Start code	SPT	S	[Radiation control] 1-byte	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Radiation control	1	“0”: Stop radiation “1”: Start radiation “2”: Stop radiation temporarily	• The internal shutter is automatically opened and closed at the time of start and stop of radiation. • “Stop radiation temporarily” refers to the status stopping radiation with the shutter opened. Use this state only when restarting radiation in a while. • To restart the radiation after sending “2” (Stop radiation temporarily), send “1” without closing the shutter.
Total data length	1	Fixed length.	

Reference

- This command is available only when the DIP switch No. 2 on the rear side of the controller is ON.
- You can start the laser radiation for measurement only when the laser pumping is completed and the shutter is closed.
- The laser power setting in the selected file is applied to the power for the laser radiation for measurement.
- The laser for measurement is radiated at the center of working field. The X-/Y-offset value in System offset of the environment setting is not applied to the lasing position of this function.
- Do not execute any other operation including the shutter opening/closing and sending MKM command during the laser radiation for measurement.
- Do not control other operation or setting with “Stop radiation temporarily” status. Laser radiation for measurement should be ended with “Stop radiation” status.
- If you want to radiate the laser to the arbitrary points, use “Point radiation” function instead of this function.

■ Data example

Condition:
- Setting

Radiation control = 1

Transmission data	[STX]	SPT	S	1	[CR]

3-9-2 Laser power warning threshold: PWL

Sets the laser power [W] threshold at lasing to check the measurement results.
When the measured value is out of the threshold, warning “E812” is output.

■ Setting request data / response data for readout

Start code	PWL	Sub command	[Upper limit] [Lower limit] 10-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	PWL	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Upper limit	5	“000.0”: No threshold “000.1”–“100.0” [W]	• Set the larger value to the upper limit than the lower limit. • It is possible to specify only one side of the limit value. In this case, set “000.0” to the not specified value.
Lower limit	5		
Total data length	10	Fixed length.	

■ Data example

Condition: Upper limit = 47, Lower limit = 43.5

• Setting

Transmission data	[STX]	PWL	S	047.0043.5	[CR]

• Readout

Transmission data	[STX]	PWL	R	[CR]

Response data	[STX]	PWL	A	047.0043.5	[CR]

Reference

- Set the threshold based on the actual power measured at test lasing.
- Warning “E812” for exceeding laser power threshold is released automatically when the lasing operation ended.

3-9-3 Laser energy warning threshold: MEN

Sets the laser energy [mJ] threshold at lasing to check the measurement results.
When the measured value is out of the threshold, warning “E710” is output.

■ Setting request data / response data for readout

Start code	PWL	Sub command	[Upper limit] [Lower limit] 18-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	PWL	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Upper limit	9	“000000000”: No threshold “000000100”–“999999999” [mJ]	• Set the larger value to the upper limit than the lower limit. • It is possible to specify only one side of the limit value. In this case, set “000000000” to the not specified value.
Lower limit	9		
Total data length	18	Fixed length.	

■ Data example

Condition: Upper limit = 33000, Lower limit = 27000

• Setting

Transmission data	[STX]	MEN	S	000033000000027000	[CR]

• Readout

Transmission data	[STX]	MEN	R	[CR]

Response data	[STX]	MEN	A	000033000000027000	[CR]

Reference

- Set the threshold based on the actual laser energy measured at test lasing.
- When the laser energy warning threshold is set, it is possible to confirm whether the laser energy is in the threshold range or not at each lasing operation with MST command response data.
- To release the warning “E710” for exceeding laser energy threshold, close the shutter.
- Though the laser energy threshold can be set up to 999999999 mJ, the measurable value is up to 429496729 mJ.

3-10 Environment Setting Command

3-10-1 Internal clock: YMD

Sets the date and time of the internal clock of the laser welding machine. Based on this internal clock, the date and time information for the saving data is updated.

■ Setting request data / response data for readout

Start code	YMD	Sub command	[Dominical year] [Month] [Date] [Hour] [Minute] [Second] 14-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	YMD	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
Dominical year	4	“1980”–“2037” [Year]	
Month	2	“01”–“12” [Month]	
Date	2	“01”–“31” [Day]	
Hour	2	“00”–“23” [Hour]	
Minute	2	“00”–“59” [Minute]	
Second	2	“00”–“59” [Second]	
Total data length	14	Fixed length.	

Reference

- The setting changed by this command is saved in the laser welding machine without overwriting to the file.

■ Data example

Condition: Dominical year = 2015, Month = 12, Date = 1, Hour = 18, Minute = 45, Second = 00

- Setting

Transmission data	[STX]	YMD	S	20151201184500	[CR]

- Readout

Transmission data	[STX]	YMD	R	[CR]

Response data	[STX]	YMD	A	20151201184500	[CR]

3-10-2 I/O settings: ENV

Sets the operating conditions of the input/output signals.

■ Setting request data / response data for readout

Start code	ENV	Sub command	[One-shot output time] [Warning for invalid trigger] 4-byte	(Check sum)	Delimiter

Sub command is “S” for the setting request data and “A” for the response data for readout.

■ Readout request data

Start code	ENV	R	(Check sum)	Delimiter

■ Data description

Name	Data length [byte]	Data content	Remarks
One-shot output time	3	“020”–“510” [ms]	Sets the output duration for the following signals. There is a margin of error between the setting value and actual output time. • LASING END OUT (Y8) • SET OK OUT (No. 36)
Warning for invalid trigger	1	“0”: Do not output warning (OFF) “1”: Output warning (ON)	Specify whether Warning E800 is enabled or disabled. Warning E800 indicates that the trigger was not accepted because it was input during the lasing operation. This warning “E800” is output during the one-shot output time.
Total data length	4	Fixed length.	

Reference

- The setting changed by this command is saved in the laser welding machine without overwriting to the file.
- In some case, one-shot output time is also applied to the following outputs.
  - LASING OUT (Y7): In case the lasing time is shorter than the set one-shot output time, the lasing output remains ON until the one-shot output time ends.
  - POWER WARNING OUT (Y11): The minimum output duration of the power warning is the same with the one-shot output time.

■ Data example

Condition: One-shot output time = 60, Warning for invalid trigger = 1

- Setting

Transmission data	[STX]	ENV	S	0601	[CR]

- Readout

Transmission data	[STX]	ENV	R	[CR]

Response data	[STX]	ENV	A	0601	[CR]

Troubleshooting

Troubleshooting

If any operation errors occur, check items below.
When the problems cannot be resolved, please contact our sales office or representatives.

■ Start-up

Troubles	Causes	Measures
• Power supply is not turned on. • The system does not start up.	Power cable is not connected.	Connect the power supply cable.
	Key switch is not turned on.	Turn on the key switch.
	Power is not supplied.	Check the power supply.
	Fuse is blown.	Replace the fuse by following the procedures described in the Setup/Maintenance Guide.

■ Laser pumping (Laser supply)

Troubles	Causes	Measures
Laser pumping does not start.	The interlock terminal is disconnected.	• Check the wiring of INTERLOCK 1 and INTERLOCK 2 respectively. • If the safety equipment such as door and switch connected to the INTERLOCK 1 and 2 is in released status, restore the original condition.
	LASER STOP 2 IN of the I/O terminal is disconnected.	• Check the connection between LASER STOP 2A IN, LASER STOP 2B IN and OUT COM. of the I/O terminal. • If the safety equipment such as door and switch connected to the LASER STOP 2A IN and LASER STOP 2B IN is in released status, restore the original condition.
	Power is not supplied to the common terminal of the I/O terminal.	Connect the internal or external power supply to IN COM. and OUT COM. in the I/O terminal respectively.
Laser pumping does not start in remote mode.	Signals from the external control device are refused.	Refer to “External Control” in Troubleshooting.

	The DIP switch setting is not consistent with the actual control method of laser pumping (laser supply).	• Check if the setting of DIP switch No. 2 and the control method for laser pumping (laser supply) are consistent:
		  • By I/O: OFF
		  • By communication command : ON
		• If the DIP switch setting is changed, restart the laser welding machine.

■ Display/Configuration

Troubles	Causes	Measures
Touch panel console shows nothing.	Laser welding machine has not been started.	See remedial action against “Start-up”.
	Cable of the touch panel is not connected.	Check that the cable is connected to connector [CONSOLE] on front of controller.
	Return harness is not connected.	Connect return harness to [RETURN OUT], [VGA OUT] and [(VGA+RETURN) IN] on the rear of the controller.
Touch panel console does not respond to screen tap.	Return harness is not connected.	Connect return harness to [RETURN OUT], [VGA OUT] and [(VGA+RETURN) IN] on the rear of the controller.
Monitor shows nothing.	Monitor is not turned on.	Check power to monitor.
	Monitor cable is not connected.	Check that monitor cable is securely connected to connector [VGA OUT] on rear of controller.
	The connected monitor is not applicable with the laser welding machine.	Connect a VGA-compatible monitor.
Mouse does not work.	The mouse is connected to the USB hub.	Connect the USB mouse to the laser welding machine controller directly without USB hub.
	The mouse type is not supported by the laser welding machine.	Use the USB mouse with Human interface device (HID) class.
A USB flash drive cannot be recognized.	• A USB flash drive with a security function is used. • The file system selected when formatting the USB flash drive is not appropriate. • The connector of the USB flash drive is dirty. • The laser welding machine was launched with the USB flash drive connected.	• USB flash drives with a security function cannot be used. • Use a USB flash drive formatted with FAT32. • Clean the connector according to the procedure in the instruction manual of your USB flash drive. • Insert the USB flash drive after the activation of the laser welding machine is completed.

■ Lasing operation

Troubles	Causes	Measures
Laser processing cannot be done. (The laser emission indicator blinks but laser processing is not performed on the object.)	Obstacle hinders laser beam.	Remove obstacle between laser emission port of laser welding machine head and object.
	Distance to object is not appropriate.	Adjust distance between bottom surface of laser welding machine head and target surface of object.
	Object is not in place.	Check the lasing position using the guide laser if the object is out of the specified position.
	Laser power is insufficient.	• Increase laser power (including correction factor). • Decrease scanning speed (including correction factor).
Lasing is not performed in RUN/REMOTE Mode. (The laser emission indicator does not light.)	In RUN Mode: The start button for RUN mode is not activate or the lasing trigger is not input.	Start the RUN Mode, and then input a signal to TRIGGER IN on the I/O terminal.
	The lasing trigger signal on the I/O terminal is not input.	Check connections with external equipment for mis-connection, disconnection or contact failure due to any loose connector.
		Confirm that lasing trigger by one-shot signal of more than 10 ms is input per lasing cycle.
	The lasing trigger is entered while the trigger ready is OFF.	Refer to “External Control” in Troubleshooting.
Sometimes laser is emitted unintentionally.	Fumes causes malfunction of photoelectric sensor for lasing trigger signal.	• Install a dust collector to eliminate the fume (smoke) generated during lasing. • Check that dust collector works well.

■ Lasing quality

Troubles	Causes	Measures
There is a decrease in laser processing quality.	Laser emission port is not clean.	Refer to the “Maintenance” in Setup/Maintenance Guide and clean contaminants off the laser emission port. If contaminants persist, replace laser emission port protective glass. Contact our sales office.
	Fumes occurring during lasing hinder laser beam.	• Install dust collector. • Check that dust collector works well.
	Distance to object is not appropriate.	Adjust distance between bottom surface of laser welding machine head and lasing surface of object.
	Lasing surface of object is inclined.	Make adjustment so that bottom surface of laser welding machine head and lasing surface of object are parallel with each other.
	There are variations in properties of objects. • Thickness varies. • Surface roughness varies (including those in gloss). • Material varies (including those in chemical composition).	Adjust the setting parameters and work distance according to respective target objects.
	Object feeder is not stable.	Adjust object feeder so that position of objects become stable.
	Performance of laser oscillator deteriorates due to aging.	• Increase setting value of laser power. • Decrease scanning speed. If it is not possible to get the same laser processing quality as before even with the max. value of the laser power setting, laser oscillator must be replaced. Contact our sales office.
Lasing does not work partially.	Obstacle hinders laser beam.	Remove obstacle between laser emission port of laser welding machine head and object.
	Laser emission port is not clean.	Refer to the “Maintenance” in Setup/Maintenance Guide and clean contaminants off the laser emission port. If contaminants persist, replace laser emission port protective glass. Contact our sales office.
Drawing line runs over the intended start or end points.	The setting in lasing quality parameters does not match the other settings.	Adjustment the lasing quality parameters such as laser starting, laser ending, or wait value in file option menu.

Troubles	Causes	Measures
Lasing position is out of the setting place.	Head lacks fixation strength.	• Fix head with the specified torque. • Improve strength of head mounting.
	Constant vibration from surrounding equipment (motor and press, etc.) influences.	Perform vibration prevention measures.
	There are irregular vibrations coming from surrounding equipment (air cylinder and forklift, etc.). (Lasing position moves at irregular intervals.)	
	Start and/or stop timing of feeder does not match with lasing operation.	Lasing position moves at the beginning: Lasing trigger signal is likely to be input before object is fully stopped or with a vibration remaining. Turn the lasing trigger signal ON after vibrations are completely damped.
		Lasing position moves at the ending: Object is likely to start moving before completion of lasing. Delay start timing of feeder or speed up scanning speed so that lasing is finished before object starts moving.
	The setting work distance does not match the distance to the actual target object.	Set the same value to the work distance with the actual distance from the head mounting surface to the target object.
	There are noises coming from surrounding equipment.	Protect laser welding machine against noises as follows: • Securely ground the frame ground terminal of laser welding machine or surrounding equipment. • Isolate power and signal lines from each other if they have been routed in parallel. • Shield signal line. • Isolate power supply for laser welding machine from other equipment. • Use noise cut transformer to absorb noises from power supply.

■ External control

Troubles	Causes	Measures
Signals from the external device are refused	Laser welding machine is not in remote mode.	Select the remote mode by following the procedure indicated in Setup/Maintenance Guide.
	The connection with external devices is inadequate.	• Check connections with external equipment for mis-connection, disconnection or contact failure due to any loose connector. • Check for continuity using tester or the like.
	There are noises coming from surrounding equipment.	Protect laser welding machine against noises as follows: • Securely ground the frame ground terminal of laser welding machine or surrounding equipment. • Isolate power and signal lines from each other if they have been routed in parallel. • Shield signal line. • Isolate power supply for laser welding machine from other equipment. • Use noise cut transformer to absorb noises from power supply.
Control by serial communication fails	The RS-232C cable is connected to the wrong connector (RETURN OUT).	Connect the RS-232C cable to “RS-232C” connector on the rear of the controller.
	The connection of the communication cable is incorrect.	• Check the connection method described in Setup/ Maintenance Guide for proper wiring. • For RS-232C connection, confirm the wiring of the external device including the loop back connection.
	Communication parameter settings are incorrect.	• Match communication parameter settings to external equipment. • When using RS-232C, specify the “Flow control” to “None” at the communication port settings of the external control device.
	The communication setting was changed at the time of backup file importing.	Check the communication setting. When the backup file is restored, the communication setting is overwritten by the backup data.
	Command data is not received from external equipment.	Using commercially available line monitor or protocol analyzer, check if the external equipment transmits data.
	Communication data format is inadequate.	• Check if start code STX (02: HEX) is placed at beginning of transmitted data. • Check if a delimiter is placed at the end of the transmitted data. • Check if the delimiter is the value specified in the laser welding machine on the environment setting screen.

Troubles	Causes	Measures
Trigger ready does not turn ON	An error occurs.	Check the error code and cancel the alarm or warning.
	Lasing operation is in progress.	Do not input the next lasing trigger until the lasing operation is completed.
	Laser supply is turned OFF.	Turn ON the laser supply. If the laser pumping fails, refer to “Laser pumping” in Troubleshooting.
	Internal shutter is closed.	• Open the internal shutter. • Check if the setting of DIP switch No. 2 and the actual control method for shutter operation (by I/O or communication command) are consistent. • If the DIP switch setting is changed, restart the laser welding machine.
	File switching is not complete.	If the file number is changed, the trigger ready is turned OFF for dozens of ms or seconds to create drawing data. Input lasing trigger signal after making sure that READY output is ON if you changed the file.
	Though the setting of “Offset by SEO Command” is enabled in the file, SEO command is not input from the external control device.	When the file with the setting to use SEO command is selected, transmit SEO command by every trigger input. Input the lasing trigger signal after making sure that the READY output is on, or checking the status of READY using the status checking command (STS).
	For communication command control: “reception mode ON” is set for command reception permission (MKM command).	Set “reception mode OFF” for command reception permission (MKM command). Before inputting the lasing trigger signal, use the status checking command (STS) to make sure that trigger ready is on.
The required time for turning on READY OUT (Y6) after opening the shutter or changing the file is longer.	Data compile mode was set to Precompiled.	If Lasing pause warning (E720) is not occurred with the selected file, change Data compile mode to Runtime in File option menu.

Troubles	Causes	Measures
The sending command is not accepted with NAK response.	The requested operation can be controlled only by I/O with the current DIP switch setting.	To control the following commands with the serial communication, turn ON DIP switch No. 2 and restart the laser welding machine. • Laser pumping (LSR) • Shutter open/close (SHT) • Guide Laser (GID) • Laser radiation for measurement (SPT)
	“Reception mode ON” is not set for command reception permission (MKM command).	The laser welding machine does not accept commands except the following unless it is in the “reception mode ON” status. For command transmission, set “reception mode ON” for “command reception permission (MKM command)”. • File selection by file No. (FNO) • File selection by file name (FNN) • Shutter open/close (SHT) • Command reception permission (MKM) • Laser pumping (LSR) • Trigger counter reset (CTR) • Status checking (STS) • Lasing trigger (MRK) • Position and power adjustment per trigger (SEO)
	Alarm or Warning occurred.	All commands except the following are refused while alarm or warning is active. When alarm occurred: • Status checking (STS) When warning occurred: • Status checking (STS) • Shutter open/close (SHT) (Only for closing request, and readout) • Command reception permission (MKM) (reception mode ON and readout only)
	Two or more command data are transmitted at the same time.	After sending the command, confirm the response data from the laser welding machine. Do not send the next command before receiving the response.

Error Indication

When an error occurs, an error code appears on the front panel of the laser welding machine controller.
Errors are categorized into alarm and warning depending on their details.
This chapter describes the details and measures of errors.

Alarm

Errors that occur when highly emergent safety function is activated or there is any abnormality in laser welding machine are output as alarm.
When an alarm occurs, the laser supply (laser pumping) is turned OFF, and the laser radiation is stopped if during lasing.

■ Release method of alarm

1. Remove a cause of alarm and confirm the safety. (Any alarms due to hardware's problem cannot be released.)
2. For error codes E004, E011, E260, and E700, use any of the following means to input the alarm reset.
   - Press the alarm reset switch on the controller.
   - Turn on ALARM RESET IN (X13) on the I/O terminal.

For the alarms you are unable to reset such as the ones caused by hardware or system error, restart the laser welding machine.

ERROR CODE	Description	Measures *1
E004	LASER STOP 2 IN is disconnected.	• Connect the LASER STOP terminals of the I/O terminal. • Check the status of the safety equipment connected to the LASER STOP terminals. • Confirm operation logic of the connected devices. • Connect the internal or external power supply to IN COM. and OUT COM. in the I/O terminal respectively.
E011	LASER STOP 1 IN is disconnected during lasing operation.	
E021	Fiber unit or head housing is detached.	• Install the fiber unit properly by following the procedures described in the Setup/ Maintenance Guide. • If there is a looseness in the head housing, contact our sales office or representatives.
E205 - E207	Temperature error in galvanometer or driver.	• Check if the ambient temperature of the laser welding machine is not exceeding the range of its specification. • Avoid placing heat sources near the head.
E208 E209	Improper setting combination of scanning speed and drawing data.	Turn off the power and after rebooting the laser welding machine, correct the following settings. • Decrease the drawing lines and coordinate numbers. • Decrease the scanning speed.
E210 - E218 *2	Galvanometer error.	• Check and correct the power status. • Check if the AC power line is effected by noise. • Check the connection of the cables and signal lines, and then restart the laser welding machine.
E220 *2	Internal shutter error.	Check the connection of the cables and signal lines, and then restart the laser welding machine.

ERROR CODE	Description	Measures *1
E233 *2	Laser error. • Failure of laser oscillator is detected. • Fiber cable is broken. • Instantaneous interruption of laser power supply is detected. • Temperature in the laser oscillator exceeds the limit.	• Check and correct the power status. • Check if the AC power line is effected by noise. • Check the connection of the cables and signal lines, and then restart the laser welding machine. • Check if the ambient temperature of the laser welding machine is not exceeding the range of its specification.
E234	Detected unintended-irradiation.	Contact our sales office or representatives.
E240 E241	Temperature error in laser oscillator.	• Check if the ambient temperature of the laser welding machine is not exceeding the range of its specification. • Make sure air-cooling fan operates. • Remove the dust and contamination in the air intake and exhaust port, and clean the filter of the air-cooling part. • When not recovered, contact our sales office or representatives.
E242	Temperature error in head.	• Check if the ambient temperature of the laser welding machine is not exceeding the range of its specification. • Avoid placing heat sources near the head.
E250	Power supply voltage is low.	• Check and correct the power status. • Check if the AC power line is effected by noise from other devices. • Check the connection of the cables and signal lines, and then restart the laser welding machine.
E260	Interlock is disconnected.	• Confirm the connection of the interlock terminals. • Check the status of the safety equipment connected to the interlock terminals. • Confirm operation logic of the connected devices.
E300	Head connection error. Turn the power off and check connection.	Turn off the power and check the followings: • Check the head and controller model. Connect models in the correct combination. • Check the connection of the cables and signal lines, and then restart the laser welding machine. • If the cable is disconnecting, replace it.
E310 *2 E320 *2	Unsupported combination of the head and controller.	
E311 E312 E410	Internal system error occurs in the laser welding machine.	Check the connection of the cables and signal lines, and then restart the laser welding machine.
E411 - E413	Internal process data in the laser welding machine may be corrupted.	Restart the laser welding machine. If it doesn't reboot normally, contact our sales office or representatives.

ERROR CODE	Description	Measures *1
E420 - E443	Internal system error occurs in the laser welding machine.	Check the connection of the cables and signal lines, and then restart the laser welding machine.
E451 - E456	Internal memory error occurs in the laser welding machine.	
E700	Unable to lase as laser pumping is turned OFF.	• Confirm that the laser pumping (laser supply) remains on during lasing operation. • Check wiring of I/O or communication port to the external control devices. • Check the procedures and operation logic of laser pumping (laser supply) control.
E990 - E999	System error.	• Check the connection of the cables and signal lines, and then restart the laser welding machine. • Check if the signal lines are effected by noise.

*1 : If the error persists after restart of the laser welding machine, contact our sales office or representatives.
*2 : The error may occur when the cable between the head and controller is not connected correctly.

Warning

Errors that notify of that the setting data are incorrect or laser radiation conditions are not met are output as warnings. Lasing cannot be started while any warning is active. Laser pumping maintains the state before the warning.

■ Release method of warning

1. Remove a cause of warning. If the setting is incorrect, correct it.
2. In Remote Mode, close the shutter.
   In addition, the following error code warnings are released automatically. Shutter close input is not necessary.
   - E800: After the warning outputs in the duration of the one-shot output time, the warning is released.
   - E811: The warning is only output while the connection between LASER STOP 1A/1B IN (X14, X19) and OUT COM. is opened and the warning is released when it is closed.
   - E812: POWER WARNING OUT (Y11) turns off when the measured laser power exceeds the threshold and it is released after a lapse of the one-shot output time from the lasing operation is finished.
3. To be in ready state for lasing, make sure that WARNING OUT (Y12) is turned on, and then open the internal shutter.

ERROR CODE	Description	Measures *
E251	Internal clock battery is low. Set date and time.	• Check the date and time on the environment setting screen and set it again. After the setting, the warning status is released while laser welding machine power is on. When the power is off, set the date and time again. • To replace the internal battery, contact to our sales office.
E500	Insufficient disk space to save file.	Delete the setting files or VEC/DXF files stored in the laser welding machine on the data management screen.
E502 E503	Cannot read VEC file.	• Import the VEC file again on the data management screen. • Convert the drawing file to VEC format again with Logo data conversion software.
E600	Unset file is selected.	• Input the setting data and save the file. • If you want to use a blank file, save the file without setting data.
E603	No VEC/DXF file.	Import the VEC/DXF file on the data management screen.
E606	There is a data outside of working field.	• Check the working image view on Home screen and adjust the data position and size located outside of the working field. • When there is no data outside of the working field on the working image view, check the X-/Y-offset value of the system offset on the environment setting screen.
E607	Cannot create spiral line in VEC or custom shape drawing.	• If the line length of the custom shape is too small relative to the spiral interval, set the larger value. • Check if there are incorrect data in VEC file. • Convert the drawing file to VEC format again with Logo data conversion software.
E610	Too much coordinate data in file.	• Reduce the number of segments in the drawings. • Reduce the number of start/end points of the drawings.
E612	There is a too long line data to scan.	• Separate the long segment into short data. • Speed up scanning speed.

ERROR CODE	Description	Measures *
E613	Precompiled mode is not available for this drawing data.	• Change Data compile mode to “Runtime” in File option menu. • To use Precompiled mode, speed up scanning speed.
E614	SEO command is not available with Precompiled mode.	• To use SEO command, change Data compile mode to “Runtime” in File option menu. • To use Precompiled mode, disable “Offset by SEO command” in File option menu.
E650	Invalid setting in custom shape elements.	• For arc shape, set the distance between the start point and end point to less than double for radius. • For rectangle shape, set the height or width to more than double for fillet radius.
E651	Invalid line length in custom shape elements.	Set the distance between start point and end point of a line more than 0.01 mm.
E660	Cannot read DXF file.	• Import the DXF file again on the data management screen. • Save the DXF file with DXF-R12J, R13J or R14 format. • Delete the entities which are not supported by laser welding machine in the DXF file. • Reduce the number of layers to 128 or less.
E690	Measurement time over: Over 9999 sec.	• Reduce the number of segments in the drawings and measure the time. • Speed up scanning speed.
E700	Unable to lase as laser pumping is turned OFF.	• Turn ON the laser supply and after the laser pumping has completed, start lasing. • Change timing so that the lasing trigger is input after the laser supply input is turned ON. • Check wiring of I/O or communication port to the external control devices. • Check the procedures and operation logic of laser pumping (laser supply) control.
E710	Laser energy is out of threshold.	• Check the setting value of thresholds. • If there is a decrease in lasing quality, check the output power.
E720	Lasing pause was detected due to data compiling during operation. It might affect the processing results.	• To avoid lasing pause, set Data compile mode to Precompiled in File option menu. • To use Runtime mode, decrease scanning speed. • If the processing results are not impaired by lasing pause, it is possible to use Runtime mode. In such case this warning can be disabled by selecting “Disable warning E720” at Data compile mode setting.
E730	TRIGGER IN turned off before the minimum number of scans was reached.	• Confirm the on/off control of the TRIGGER IN on the I/O terminal. • If TRIGGER IN turns on/off properly, change the setting value of Minimum number of scans in File option menu.
E731	Lasing stopped because the maximum number of scans was reached.	• Confirm the on/off control of the TRIGGER IN on the I/O terminal. • If TRIGGER IN turns on/off properly, change the setting value of Maximum number of scans in File option menu.

ERROR CODE	Description	Measures *
E800	Invalid input of lasing trigger because trigger ready output is off.	• Make sure that the trigger ready output is ON and input to the TRIGGER IN terminal. • Do not input the lasing trigger while the lasing output is ON. • Check for any malfunctions of the switch/sensor connected to the TRIGGER IN on the I/O terminal. • Check wiring of I/O or communication port to the external control devices. • Check the procedures and operation logic of trigger control.
E811	LASER STOP 1 IN on I/O terminal is disconnected.	• Check wiring of LASER STOP 1A/1B IN on the I/O terminal. • Check the status of the safety equipment connected to the LASER STOP terminals. • Confirm operation logic of the connected device.
E812	Laser power is out of threshold.	• Check the setting value of thresholds. • If there is a decrease in lasing quality, check the output power.

* : If the error persists after restart of the laser welding machine, contact our sales office or representatives.

Character Code Table

ASCII Code

Use the ASCII Code shown below for the communication data.
The characters described with [ ] denote control code.

Top / Bottom	00	10	20	30	40	50	60	70
0	[NUL]		(SP)	0	@	P	‘	p
1			!	1	A	Q	a	q
2	[STX]		”	2	B	R	b	r
3			#	3	C	S	c	s
4			$	4	D	T	d	t
5		[NAK]	%	5	E	U	e	u
6	[ACK]		&	6	F	V	f	v
7			’	7	G	W	g	w
8			(	8	H	X	h	x
9			)	9	I	Y	i	y
A	[LF]		*	:	J	Z	j	z
B			+	;	K	[	k	{
C			,	<	L	¥	l	|
D	[CR]		−	=	M	]	m	}
E			.	>	N	^	n	¯
F			/	?	O	_	o	

Reference

- This ASCII Code differs from the ANSI Standard ASCII Code in the symbols denoted by the following codes.
  - 5C (HEX)
  - 60 (HEX)
  - 7E (HEX)
- When using the external device set by 2 byte, NUL00 (HEX) can be used. Please add NUL00 (HEX) before the start code or after delimiter.
- The control codes not listed on the table are not available for the communication data with this product.

Shift-JIS Code

■ Alphanumeric and symbols

	Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Symbols	813F	2120			、	。	,	.	・	:	;	?	!	゛	°	´	`	¨
	814F	2130	^	￣	_	ヽ	ヾ	ゝ	ゞ	〃	仝	々	〆	〇	―	—	-	／
	815F	2140	＼	～	∥		…	‥	‘	’	“	”	（	）	〔	〕	[	]
	816F	2150	{	}	〈	〉	《	》	「	」	『	』	【	】	＋	－	±	×
	8180	2160	÷	＝	≠	＜	＞	≦	≧	∞	∴	♂	♀	°	′	″	℃	¥
	8190	2170	$	¢	£	%	#	&	*	@	§	☆	★	○	●	◎	◇	
	819E	2220		◆	□	■	△	▲	▽	▼	※	〒	→	←	↑	↓	=	
	81AE	2230											∈	∋	⊆	⊇	⊂	⊃
	81BE	2240	∪	∩									∧	∨	¬	⇒	⇔	∀
	81CE	2250	∃												∠	⊥	⌒	∂
	81DE	2260	∇	≡	≒	≪	≫	√	∽	∝	∵	∫	∬					
	81EE	2270			Å	‰	♯	♭	♪	†	‡	¶						
Alphanumeric	824F	2330	0	1	2	3	4	5	6	7	8	9						
	825F	2340		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	826F	2350	P	Q	R	S	T	U	V	W	X	Y	Z					
	8280	2360		a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	8290	2370	p	q	r	s	t	u	v	w	x	y	z					

* JIS code “2121” is a blank character (space).

■ JIS 第一水準文字 / Japanese characters of JIS level-1

JIS X 0208:1997

	Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
平仮名 Hiragana	829E	2420		ぁ	あ	ぃ	い	ぅ	う	ぇ	え	ぉ	お	か	が	き	ぎ	く
	82AE	2430	ぐ	け	げ	こ	ご	さ	ざ	し	じ	す	ず	せ	ぜ	そ	ぞ	た
	82BE	2440	だ	ち	ぢ	っ	つ	づ	て	で	と	ど	な	に	ぬ	ね	の	は
	82CE	2450	ば	ぱ	ひ	び	ぴ	ふ	ぶ	ぷ	へ	べ	ぺ	ほ	ぼ	ぽ	ま	み
	82DE	2460	む	め	も	ゃ	や	ゅ	ゆ	ょ	よ	ら	り	る	れ	ろ	ゎ	わ
	82EE	2470	ゐ	ゑ	を	ん												
片仮名 Katakana	833F	2520		ァ	ア	ィ	イ	ゥ	ウ	ェ	エ	ォ	オ	カ	ガ	キ	ギ	ク
	834F	2530	グ	ケ	ゲ	コ	ゴ	サ	ザ	シ	ジ	ス	ズ	セ	ゼ	ソ	ゾ	タ
	835F	2540	ダ	チ	ヂ	ッ	ツ	ヅ	テ	デ	ト	ド	ナ	ニ	ヌ	ネ	ノ	ハ
	836F	2550	バ	パ	ヒ	ビ	ピ	フ	ブ	プ	ヘ	ベ	ペ	ホ	ボ	ポ	マ	ミ
	8380	2560	ム	メ	モ	ャ	ヤ	ュ	ユ	ョ	ヨ	ラ	リ	ル	レ	ロ	ヮ	ワ
	8390	2570	ヰ	ヱ	ヲ	ン	ヴ	ヵ	ヶ									
ギリシア文字 Greek characters	839E	2620		Α	Β	Γ	Δ	Ε	Ζ	Η	Θ	Ι	Κ	Λ	Μ	Ν	Ξ	Ο
	83AE	2630	Π	Ρ	Σ	Τ	Υ	Φ	Χ	Ψ	Ω							
	83BE	2640		α	β	γ	δ	ε	ζ	η	θ	ι	κ	λ	μ	ν	ξ	ο
	83CE	2650	π	ρ	σ	τ	υ	φ	χ	ψ	ω							
ロシア文字 Russian characters	843F	2720		А	Б	В	Г	Д	Е	Ё	Ж	З	И	Й	К	Л	М	Н
	844F	2730	О	П	Р	С	Т	У	Ф	Х	Ц	Ч	Ш	Щ	Ъ	Ы	Ь	Э
	845F	2740	Ю	Я														
	846F	2750		а	б	в	г	д	е	ё	ж	з	и	й	к	л	м	н
	8480	2760	о	п	р	с	т	у	ф	х	ц	ч	ш	щ	ъ	ы	ь	э
	8490	2770	ю	я														
あ	889E	3020		亜	唖	娃	阿	哀	愛	挨	姶	逢	葵	茜	穐	悪	握	渥
	88AE	3030	旭	葦	芦	鯵	梓	圧	斡	扱	宛	姐	虻	飴	絢	綾	鮎	或
あ / い	88BE	3040	粟	袷	安	庵	按	暗	案	闇	鞍	杏	以	伊	位	依	偉	囲
い	88CE	3050	夷	委	威	尉	惟	意	慰	易	椅	為	畏	異	移	維	緯	胃
	88DE	3060	萎	衣	謂	違	遺	医	井	亥	域	育	郁	磯	一	壱	溢	逸
	88EE	3070	稲	茨	芋	鰯	允	印	咽	員	因	姻	引	飲	淫	胤	蔭	
い / う	893F	3120		院	陰	隠	韻	吋	右	宇	烏	羽	迂	雨	卯	鵜	窺	丑
う	894F	3130	碓	臼	渦	嘘	唄	欝	蔚	鰻	姥	厩	浦	瓜	閏	噂	云	運
う / え	895F	3140	雲	荏	餌	叡	営	嬰	影	映	曳	栄	永	泳	洩	瑛	盈	穎
え	896F	3150	頴	英	衛	詠	鋭	液	疫	益	駅	悦	謁	越	閲	榎	厭	円
	8980	3160	園	堰	奄	宴	延	怨	掩	援	沿	演	炎	焔	煙	燕	猿	縁
え / お	8990	3170	艶	苑	薗	遠	鉛	鴛	塩	於	汚	甥	凹	央	奥	往	応	
お	899E	3220		押	旺	横	欧	殴	王	翁	襖	鴬	鴎	黄	岡	沖	荻	億
お / か	89AE	3230	屋	憶	臆	桶	牡	乙	俺	卸	恩	温	穏	音	下	化	仮	何
か	89BE	3240	伽	価	佳	加	可	嘉	夏	嫁	家	寡	科	暇	果	架	歌	河
	89CE	3250	火	珂	禍	禾	稼	箇	花	苛	茄	荷	華	菓	蝦	課	嘩	貨
	89DE	3260	迦	過	霞	蚊	俄	峨	我	牙	画	臥	芽	蛾	賀	雅	餓	駕
	89EE	3270	介	会	解	回	塊	壊	廻	快	怪	悔	恢	懐	戒	拐	改	
	8A3F	3320		魁	晦	械	海	灰	界	皆	絵	芥	蟹	開	階	貝	凱	劾
	8A4F	3330	外	咳	害	崖	慨	概	涯	碍	蓋	街	該	鎧	骸	浬	馨	蛙
	8A5F	3340	垣	柿	蛎	鈎	劃	嚇	各	廓	拡	撹	格	核	殻	獲	確	穫
	8A6F	3350	覚	角	赫	較	郭	閣	隔	革	学	岳	楽	額	顎	掛	笠	樫
	8A80	3360	橿	梶	鰍	潟	割	喝	恰	括	活	渇	滑	葛	褐	轄	且	鰹
	8A90	3370	叶	椛	樺	鞄	株	兜	竈	蒲	釜	鎌	噛	鴨	栢	茅	萱	
	8A9E	3420		粥	刈	苅	瓦	乾	侃	冠	寒	刊	勘	勧	巻	喚	堪	姦

	Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
か	8AAE	3430	完	官	寛	干	幹	患	感	慣	憾	換	敢	柑	桓	棺	款	歓
	8ABE	3440	汗	漢	澗	潅	環	甘	監	看	竿	管	簡	緩	缶	翰	肝	艦
	8ACE	3450	莞	観	諌	貫	還	鑑	間	閑	関	陥	韓	館	舘	丸	含	岸
か / き	8ADE	3460	巌	玩	癌	眼	岩	翫	贋	雁	頑	顔	願	企	伎	危	喜	器
き	8AEE	3470	基	奇	嬉	寄	岐	希	幾	忌	揮	机	旗	既	期	棋	棄	
	8B3F	3520		機	帰	毅	気	汽	畿	祈	季	稀	紀	徽	規	記	貴	起
	8B4F	3530	軌	輝	飢	騎	鬼	亀	偽	儀	妓	宜	戯	技	擬	欺	犠	疑
	8B5F	3540	祇	義	蟻	誼	議	掬	菊	鞠	吉	吃	喫	桔	橘	詰	砧	杵
	8B6F	3550	黍	却	客	脚	虐	逆	丘	久	仇	休	及	吸	宮	弓	急	救
	8B80	3560	朽	求	汲	泣	灸	球	究	窮	笈	級	糾	給	旧	牛	去	居
	8B90	3570	巨	拒	拠	挙	渠	虚	許	距	鋸	漁	禦	魚	亨	享	京	
	8B9E	3620		供	侠	僑	兇	競	共	凶	協	匡	卿	叫	喬	境	峡	強
	8BAE	3630	彊	怯	恐	恭	挟	教	橋	況	狂	狭	矯	胸	脅	興	蕎	郷
	8BBE	3640	鏡	響	饗	驚	仰	凝	尭	暁	業	局	曲	極	玉	桐	粁	僅
	8BCE	3650	勤	均	巾	錦	斤	欣	欽	琴	禁	禽	筋	緊	芹	菌	衿	襟
き / く	8BDE	3660	謹	近	金	吟	銀	九	倶	句	区	狗	玖	矩	苦	躯	駆	駈
く	8BEE	3670	駒	具	愚	虞	喰	空	偶	寓	遇	隅	串	櫛	釧	屑	屈	
	8C3F	3720		掘	窟	沓	靴	轡	窪	熊	隈	粂	栗	繰	桑	鍬	勲	君
く / け	8C4F	3730	薫	訓	群	軍	郡	卦	袈	祁	係	傾	刑	兄	啓	圭	珪	型
け	8C5F	3740	契	形	径	恵	慶	慧	憩	掲	携	敬	景	桂	渓	畦	稽	系
	8C6F	3750	経	継	繋	罫	茎	荊	蛍	計	詣	警	軽	頚	鶏	芸	迎	鯨
	8C80	3760	劇	戟	撃	激	隙	桁	傑	欠	決	潔	穴	結	血	訣	月	件
	8C90	3770	倹	倦	健	兼	券	剣	喧	圏	堅	嫌	建	憲	懸	拳	捲	
	8C9E	3820		検	権	牽	犬	献	研	硯	絹	県	肩	見	謙	賢	軒	遣
	8CAE	3830	鍵	険	顕	験	鹸	元	原	厳	幻	弦	減	源	玄	現	絃	舷
け / こ	8CBE	3840	言	諺	限	乎	個	古	呼	固	姑	孤	己	庫	弧	戸	故	枯
こ	8CCE	3850	湖	狐	糊	袴	股	胡	菰	虎	誇	跨	鈷	雇	顧	鼓	五	互
	8CDE	3860	伍	午	呉	吾	娯	後	御	悟	梧	檎	瑚	碁	語	誤	護	醐
	8CEE	3870	乞	鯉	交	佼	侯	候	倖	光	公	功	効	勾	厚	口	向	
	8D3F	3920		后	喉	坑	垢	好	孔	孝	宏	工	巧	巷	幸	広	庚	康
	8D4F	3930	弘	恒	慌	抗	拘	控	攻	昂	晃	更	杭	校	梗	構	江	洪
	8D5E	3940	浩	港	溝	甲	皇	硬	稿	糠	紅	紘	絞	綱	耕	考	肯	肱
	8D6F	3950	腔	膏	航	荒	行	衡	講	貢	購	郊	酵	鉱	砿	鋼	閤	降
	8D80	3960	項	香	高	鴻	剛	劫	号	合	壕	拷	濠	豪	轟	麹	克	刻
	8D90	3970	告	国	穀	酷	鵠	黒	獄	漉	腰	甑	忽	惚	骨	狛	込	
	8D9E	3A20		此	頃	今	困	坤	墾	婚	恨	懇	昏	昆	根	梱	混	痕
こ / さ	8DAE	3A30	紺	艮	魂	些	佐	叉	唆	嵯	左	差	査	沙	瑳	砂	詐	鎖
さ	8DBE	3A40	裟	坐	座	挫	債	催	再	最	哉	塞	妻	宰	彩	才	採	栽
	8DCE	3A50	歳	済	災	采	犀	砕	砦	祭	斎	細	菜	裁	載	際	剤	在
	8DDE	3A60	材	罪	財	冴	坂	阪	堺	榊	肴	咲	崎	埼	碕	鷺	作	削
	8DEE	3A70	咋	搾	昨	朔	柵	窄	策	索	錯	桜	鮭	笹	匙	冊	刷	
	8E3F	3B20		察	挿	撮	擦	札	殺	薩	雑	皐	鯖	捌	錆	鮫	皿	晒
	8E4F	3B30	三	傘	参	山	惨	撒	散	桟	燦	珊	産	算	纂	蚕	讃	賛
さ / し	8E5F	3B40	酸	餐	斬	暫	残	仕	仔	伺	使	刺	司	史	嗣	四	士	始
し	8E6F	3B50	姉	姿	子	屍	市	師	志	思	指	支	孜	斯	施	旨	枝	止
	8E80	3B60	死	氏	獅	祉	私	糸	紙	紫	肢	脂	至	視	詞	詩	試	誌
	8E90	3B70	諮	資	賜	雌	飼	歯	事	似	侍	児	字	寺	慈	持	時	
	8E9E	3C20		次	滋	治	爾	璽	痔	磁	示	而	耳	自	蒔	辞	汐	鹿
	8EAE	3C30	式	識	鴫	竺	軸	宍	雫	七	叱	執	失	嫉	室	悉	湿	漆
	8EBE	3C40	疾	質	実	蔀	篠	偲	柴	芝	屡	蕊	縞	舎	写	射	捨	赦

	Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	8ECE	3C50	斜	煮	社	紗	者	謝	車	遮	蛇	邪	借	勺	尺	杓	灼	爵
	8EDE	3C60	酌	釈	錫	若	寂	弱	惹	主	取	守	手	朱	殊	狩	珠	種
	8EEE	3C70	腫	趣	酒	首	儒	受	呪	寿	授	樹	綬	需	囚	収	周	
	8F3F	3D20		宗	就	州	修	愁	拾	洲	秀	秋	終	繍	習	臭	舟	蒐
	8F4F	3D30	衆	襲	讐	蹴	輯	週	酋	酬	集	醜	什	住	充	十	従	戎
	8F5F	3D40	柔	汁	渋	獣	縦	重	銃	叔	夙	宿	淑	祝	縮	粛	塾	熟
	8F6F	3D50	出	術	述	俊	峻	春	瞬	竣	舜	駿	准	循	旬	楯	殉	淳
	8F80	3D60	準	潤	盾	純	巡	遵	醇	順	処	初	所	暑	曙	渚	庶	緒
	8F90	3D70	署	書	薯	藷	諸	助	叙	女	序	徐	恕	鋤	除	傷	償	
し	8F9E	3E20		勝	匠	升	召	哨	商	唱	嘗	奨	妾	娼	宵	将	小	少
	8FAE	3E30	尚	庄	床	廠	彰	承	抄	招	掌	捷	昇	昌	昭	晶	松	梢
	8FBE	3E40	樟	樵	沼	消	渉	湘	焼	焦	照	症	省	硝	礁	祥	称	章
	8FCE	3E50	笑	粧	紹	肖	菖	蒋	蕉	衝	裳	訟	証	詔	詳	象	賞	醤
	8FDE	3E60	鉦	鍾	鐘	障	鞘	上	丈	丞	乗	冗	剰	城	場	壌	嬢	常
	8FEE	3E70	情	擾	条	杖	浄	状	畳	穣	蒸	譲	醸	錠	嘱	埴	飾	
	903F	3F20		拭	植	殖	燭	織	職	色	触	食	蝕	辱	尻	伸	信	侵
	904F	3F30	唇	娠	寝	審	心	慎	振	新	晋	森	榛	浸	深	申	疹	真
	905F	3F40	神	秦	紳	臣	芯	薪	親	診	身	辛	進	針	震	人	仁	刃
し / す	906F	3F50	塵	壬	尋	甚	尽	腎	訊	迅	陣	靭	笥	諏	須	酢	図	厨
す	9080	3F60	逗	吹	垂	帥	推	水	炊	睡	粋	翠	衰	遂	酔	錐	錘	随
	9090	3F70	瑞	髄	崇	嵩	数	枢	趨	雛	据	杉	椙	菅	頗	雀	裾	
す / せ	909E	4020		澄	摺	寸	世	瀬	畝	是	凄	制	勢	姓	征	性	成	政
	90AE	4030	整	星	晴	棲	栖	正	清	牲	生	盛	精	聖	声	製	西	誠
	90BE	4040	誓	請	逝	醒	青	静	斉	税	脆	隻	席	惜	戚	斥	昔	析
	90CE	4050	石	積	籍	績	脊	責	赤	跡	蹟	碩	切	拙	接	摂	折	設
せ	90DE	4060	窃	節	説	雪	絶	舌	蝉	仙	先	千	占	宣	専	尖	川	戦
	90EE	4070	扇	撰	栓	栴	泉	浅	洗	染	潜	煎	煽	旋	穿	箭	線	
	913F	4120		繊	羨	腺	舛	船	薦	詮	賤	践	選	遷	銭	銑	閃	鮮
せ / そ	914F	4130	前	善	漸	然	全	禅	繕	膳	糎	噌	塑	岨	措	曾	曽	楚
	915F	4140	狙	疏	疎	礎	祖	租	粗	素	組	蘇	訴	阻	遡	鼠	僧	創
	916F	4150	双	叢	倉	喪	壮	奏	爽	宋	層	匝	惣	想	捜	掃	挿	掻
そ	9180	4160	操	早	曹	巣	槍	槽	漕	燥	争	痩	相	窓	糟	総	綜	聡
	9190	4170	草	荘	葬	蒼	藻	装	走	送	遭	鎗	霜	騒	像	増	憎	
	919E	4220		臓	蔵	贈	造	促	側	則	即	息	捉	束	測	足	速	俗
そ / た	91AE	4230	属	賊	族	続	卒	袖	其	揃	存	孫	尊	損	村	遜	他	多
	91BE	4240	太	汰	詫	唾	堕	妥	惰	打	柁	舵	楕	陀	駄	騨	体	堆
	91CE	4250	対	耐	岱	帯	待	怠	態	戴	替	泰	滞	胎	腿	苔	袋	貸
た	91DE	4260	退	逮	隊	黛	鯛	代	台	大	第	醍	題	鷹	滝	瀧	卓	啄
	91EE	4270	宅	托	択	拓	沢	濯	琢	託	鐸	濁	諾	茸	凧	蛸	只	
	923F	4320		叩	但	達	辰	奪	脱	巽	竪	辿	棚	谷	狸	鱈	樽	誰
	924F	4330	丹	単	嘆	坦	担	探	旦	歎	淡	湛	炭	短	端	箪	綻	耽
た / ち	925F	4340	胆	蛋	誕	鍛	団	壇	弾	断	暖	檀	段	男	談	値	知	地
	926F	4350	弛	恥	智	池	痴	稚	置	致	蜘	遅	馳	築	畜	竹	筑	蓄
	9280	4360	逐	秩	窒	茶	嫡	着	中	仲	宙	忠	抽	昼	柱	注	虫	衷
ち	9290	4370	註	酎	鋳	駐	樗	瀦	猪	苧	著	貯	丁	兆	凋	喋	寵	
	929E	4420		帖	帳	庁	弔	張	彫	徴	懲	挑	暢	朝	潮	牒	町	眺
	92AE	4430	聴	脹	腸	蝶	調	諜	超	跳	銚	長	頂	鳥	勅	捗	直	朕
ち / つ	92BE	4440	沈	珍	賃	鎮	陳	津	墜	椎	槌	追	鎚	痛	通	塚	栂	掴
つ	92CE	4450	槻	佃	漬	柘	辻	蔦	綴	鍔	椿	潰	坪	壺	嬬	紬	爪	吊
つ / て	92DE	4460	釣	鶴	亭	低	停	偵	剃	貞	呈	堤	定	帝	底	庭	廷	弟

	Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
	92EE	4470	悌	抵	挺	提	梯	汀	碇	禎	程	締	艇	訂	諦	蹄	逓	
て	933F	4520		邸	鄭	釘	鼎	泥	摘	擢	敵	滴	的	笛	適	鏑	溺	哲
	934F	4530	徹	撤	轍	迭	鉄	典	填	天	展	店	添	纏	甜	貼	転	顛
て / と	935F	4540	点	伝	殿	澱	田	電	兎	吐	堵	塗	妬	屠	徒	斗	杜	渡
	936F	4550	登	菟	賭	途	都	鍍	砥	砺	努	度	土	奴	怒	倒	党	冬
	9380	4560	凍	刀	唐	塔	塘	套	宕	島	嶋	悼	投	搭	東	桃	梼	棟
	9390	4570	盗	淘	湯	涛	灯	燈	当	痘	祷	等	答	筒	糖	統	到	
と	939E	4620		董	蕩	藤	討	謄	豆	踏	逃	透	鐙	陶	頭	騰	闘	働
	93AE	4630	動	同	堂	導	憧	撞	洞	瞳	童	胴	萄	道	銅	峠	鴇	匿
	93BE	4640	得	徳	涜	特	督	禿	篤	毒	独	読	栃	橡	凸	突	椴	届
	93CE	4650	鳶	苫	寅	酉	瀞	噸	屯	惇	敦	沌	豚	遁	頓	呑	曇	鈍
な	93DE	4660	奈	那	内	乍	凪	薙	謎	灘	捺	鍋	楢	馴	縄	畷	南	楠
な / に	93EE	4670	軟	難	汝	二	尼	弐	迩	匂	賑	肉	虹	廿	日	乳	入	
に / ぬ / ね	943F	4720		如	尿	韮	任	妊	忍	認	濡	禰	祢	寧	葱	猫	熱	年
ね / の	944F	4730	念	捻	撚	燃	粘	乃	廼	之	埜	嚢	悩	濃	納	能	脳	膿
の / は	945F	4740	農	覗	蚤	巴	把	播	覇	杷	波	派	琶	破	婆	罵	芭	馬
	946F	4750	俳	廃	拝	排	敗	杯	盃	牌	背	肺	輩	配	倍	培	媒	梅
	9480	4760	楳	煤	狽	買	売	賠	陪	這	蝿	秤	矧	萩	伯	剝	博	拍
	9490	4770	柏	泊	白	箔	粕	舶	薄	迫	曝	漠	爆	縛	莫	駁	麦	
は	949E	4820		函	箱	硲	箸	肇	筈	櫨	幡	肌	畑	畠	八	鉢	溌	発
	94AE	4830	醗	髪	伐	罰	抜	筏	閥	鳩	噺	塙	蛤	隼	伴	判	半	反
	94BE	4840	叛	帆	搬	斑	板	氾	汎	版	犯	班	畔	繁	般	藩	販	範
は / ひ	94CE	4850	釆	煩	頒	飯	挽	晩	番	盤	磐	蕃	蛮	匪	卑	否	妃	庇
	94DE	4860	彼	悲	扉	批	披	斐	比	泌	疲	皮	碑	秘	緋	罷	肥	被
	94EE	4870	誹	費	避	非	飛	樋	簸	備	尾	微	枇	毘	琵	眉	美	
ひ	953F	4920		鼻	柊	稗	匹	疋	髭	彦	膝	菱	肘	弼	必	畢	筆	逼
	954F	4930	桧	姫	媛	紐	百	謬	俵	彪	標	氷	漂	瓢	票	表	評	豹
	955F	4940	廟	描	病	秒	苗	錨	鋲	蒜	蛭	鰭	品	彬	斌	浜	瀕	貧
ひ / ふ	956F	4950	賓	頻	敏	瓶	不	付	埠	夫	婦	富	冨	布	府	怖	扶	敷
	9580	4960	斧	普	浮	父	符	腐	膚	芙	譜	負	賦	赴	阜	附	侮	撫
ふ	9590	4970	武	舞	葡	蕪	部	封	楓	風	葺	蕗	伏	副	復	幅	服	
	959E	4A20		福	腹	複	覆	淵	弗	払	沸	仏	物	鮒	分	吻	噴	墳
ふ / へ	95AE	4A30	憤	扮	焚	奮	粉	糞	紛	雰	文	聞	丙	併	兵	塀	幣	平
へ	95BE	4A40	弊	柄	並	蔽	閉	陛	米	頁	僻	壁	癖	碧	別	瞥	蔑	箆
へ / ほ	95CE	4A50	偏	変	片	篇	編	辺	返	遍	便	勉	娩	弁	鞭	保	舗	鋪
	95DE	4A60	圃	捕	歩	甫	補	輔	穂	募	墓	慕	戊	暮	母	簿	菩	倣
	95EE	4A70	俸	包	呆	報	奉	宝	峰	峯	崩	庖	抱	捧	放	方	朋	
	963F	4B20		法	泡	烹	砲	縫	胞	芳	萌	蓬	蜂	褒	訪	豊	邦	鋒
ほ	964F	4B30	飽	鳳	鵬	乏	亡	傍	剖	坊	妨	帽	忘	忙	房	暴	望	某
	965F	4B40	棒	冒	紡	肪	膨	謀	貌	貿	鉾	防	吠	頬	北	僕	卜	墨
	966F	4B50	撲	朴	牧	睦	穆	釦	勃	没	殆	堀	幌	奔	本	翻	凡	盆
	9680	4B60	摩	磨	魔	麻	埋	妹	昧	枚	毎	哩	槙	幕	膜	枕	鮪	柾
ま	9690	4B7O	鱒	桝	亦	俣	又	抹	末	沫	迄	侭	繭	麿	万	慢	満	
ま / み	969E	4C20		漫	蔓	味	未	魅	巳	箕	岬	密	蜜	湊	蓑	稔	脈	妙
み / む / め	96AE	4C30	粍	民	眠	務	夢	無	牟	矛	霧	鵡	椋	婿	娘	冥	名	命
め / も	96BE	4C40	明	盟	迷	銘	鳴	姪	牝	滅	免	棉	綿	緬	面	麺	摸	模
も	96CE	4C50	茂	妄	孟	毛	猛	盲	網	耗	蒙	儲	木	黙	目	杢	勿	餅
も / や	96DE	4C60	尤	戻	籾	貰	問	悶	紋	門	匁	也	冶	夜	爺	耶	野	弥
や / ゆ	96EE	4C70	矢	厄	役	約	薬	訳	躍	靖	柳	薮	鑓	愉	愈	油	癒	
ゆ	973F	4D20		諭	輸	唯	佑	優	勇	友	宥	幽	悠	憂	揖	有	柚	湧

	Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
ゆ / よ	974F	4D30	涌	猶	猷	由	祐	裕	誘	遊	邑	郵	雄	融	夕	予	余	与
よ	975F	4D40	誉	輿	預	傭	幼	妖	容	庸	揚	揺	擁	曜	楊	様	洋	溶
	976F	4D50	熔	用	窯	羊	耀	葉	蓉	要	謡	踊	遥	陽	養	慾	抑	欲
よ / ら	9780	4D60	沃	浴	翌	翼	淀	羅	螺	裸	来	莱	頼	雷	洛	絡	落	酪
ら / り	9790	4D70	乱	卵	嵐	欄	濫	藍	蘭	覧	利	吏	履	李	梨	理	璃	
り	979E	4E20		痢	裏	裡	里	離	陸	律	率	立	葎	掠	略	劉	流	溜
	97AE	4E30	琉	留	硫	粒	隆	竜	龍	侶	慮	旅	虜	了	亮	僚	両	凌
	97BE	4E40	寮	料	梁	涼	猟	療	瞭	稜	糧	良	諒	遼	量	陵	領	力
り / る	97CE	4E50	緑	倫	厘	林	淋	燐	琳	臨	輪	隣	鱗	麟	瑠	塁	涙	累
る / れ	97DE	4E60	類	令	伶	例	冷	励	嶺	怜	玲	礼	苓	鈴	隷	零	霊	麗
れ	97EE	4E70	齢	暦	歴	列	劣	烈	裂	廉	恋	憐	漣	煉	簾	練	聯	
れ / ろ	983F	4F20		蓮	連	錬	呂	魯	櫓	炉	賂	路	露	労	婁	廊	弄	朗
ろ	984F	4F30	楼	榔	浪	漏	牢	狼	篭	老	聾	蝋	郎	六	麓	禄	肋	録
ろ / わ	985F	4F40	論	倭	和	話	歪	賄	脇	惑	枠	鷲	亙	亘	鰐	詫	藁	蕨
わ	986F	4F50	椀	湾	碗	腕												

■ JIS 第二水準文字 / Japanese characters of JIS level-2

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Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
989E	5020		弋	丐	丕	个	丱	丶	丼	丿	乂	乖	乘	亂	亅	豫	事
98AE	5030	舒	弍	于	亞	亟	亠	亢	亰	亳	亶	从	仍	仄	仆	仂	仗
98BE	5040	仞	伃	仟	价	伉	佚	估	佛	佝	佗	佇	佶	侈	侏	侘	佻
98CE	5050	佩	佰	侑	佯	來	侖	儘	俔	俟	俎	俘	俛	俑	俚	俐	俤
98DE	5060	俥	倚	倨	倔	倪	倥	倅	伜	俶	倡	倩	倬	俾	俯	們	倆
98EE	5070	偃	假	會	偕	偐	偈	做	俸	俺	偸	傀	傚	傅	傴	傲	
993F	5120		僉	僊	傳	僂	僖	僞	僥	僭	僣	僮	價	僵	儉	儁	儂
994F	5130	儖	儕	儔	儚	儡	儺	儷	儼	儻	儿	兀	兒	兌	兔	兢	競
995F	5140	兩	兪	兮	冀	冂	冏	册	冉	冏	冑	冓	冕	冖	冤	冠	冢
996F	5150	冩	冪	冫	决	冱	冲	冰	况	冽	凅	凉	凛	几	處	凩	凭
9980	5160	凰	凵	函	刃	刋	刔	刎	刧	刪	刮	刳	刹	剏	剄	剋	剌
9990	5170	剞	剔	剪	剴	剩	剳	剿	剽	劍	劒	劔	劔	劈	劑	辨	
999E	5220		辦	劬	劭	劼	劵	勁	勍	勗	勞	勣	勦	飭	勠	勳	勵
99AE	5230	勸	勹	匆	匈	甸	匍	匐	匏	匕	匚	匣	匯	匱	匳	匸	區
99BE	5240	卆	卅	卋	卉	卍	凖	卞	卩	卮	夘	卻	卷	厂	厖	厠	厦
99CE	5250	厥	厮	厰	厶	參	簒	雙	叟	曼	燮	叮	叨	叭	叺	吁	吽
99DE	5260	呀	听	吭	吼	吮	吶	吩	吝	呎	咏	呵	咎	咳	呱	呷	呰
99EE	5270	咒	呻	咀	呪	咄	咐	咆	哇	唸	咸	啀	咬	哄	哈	咨	
9A3F	5320		咫	哂	咤	咾	哽	哘	哥	哦	唏	唔	哽	哮	哭	哺	哢
9A4F	5330	唹	唯	唧	唾	售	啜	啅	啖	啗	唸	唳	唯	喙	喀	咯	喊
9A5F	5340	喟	啻	啾	喘	喞	單	啼	喃	喩	喇	喨	嗚	嗅	嗟	嗄	嗜
9A6F	5350	嗤	嗔	嘔	嗷	嘖	嗾	嗽	嘛	嗹	噎	噐	營	嘴	嘶	嘲	嘸
9A80	5360	噫	噤	噦	噬	噪	噤	噞	噱	噫	噎	噫	嚊	嚮	嚶	嚴	囂
9A90	5370	囁	囃	囀	囀	囈	囎	囑	囓	口	囘	圀	囿	圄	圉	圈	
9A9E	5420		圈	國	圍	圓	團	圖	嗇	圜	圠	圷	圾	圸	坎	圻	址	坏
9AAE	5430	坩	埀	垈	坡	坿	埖	垓	垠	垳	垤	垪	垉	埃	埒	埔	埒
9ABE	5440	埴	埜	堊	埜	堋	堙	堝	塲	堡	塢	塋	塗	毀	塒	堲	塹
9ACE	5450	墅	墹	墟	墫	墺	壞	墻	墸	墮	壅	壓	壑	壗	壙	壘	壜
9ADE	5460	壡	壤	壟	壯	壺	壹	壻	壺	壽	夂	夊	夐	夛	梦	夥	夬
9AEE	5470	夭	本	夸	夾	奇	奕	奐	奎	奚	奘	奢	奠	奧	奬	奩	
9B3F	5520		奸	妁	妝	佞	佚	妣	妲	姆	姨	姜	妍	姙	姚	娥	娟
9B4F	5530	娑	娜	娉	娚	婀	娙	婉	娵	婢	婪	媚	媼	媾	嫋	嫂	媽
9B5F	5540	媽	嫣	嫗	嫦	嫩	嫖	嫺	嫻	嬌	嬋	嬖	嬲	嬾	嬪	嬶	嬾
9B6F	5550	孃	孅	孀	孑	孕	孚	孛	孥	孩	孰	孳	孵	學	斈	孺	宀
9B80	5560	它	宦	宸	寃	寇	寉	寔	寐	寤	實	寢	寞	寥	寫	寰	寶
9B90	5570	寳	尅	將	專	對	尓	尠	尢	尨	尸	尹	屁	屆	屎	屓	
9B9E	5620		屐	屏	孱	屬	屮	山	岑	屹	崋	岑	岱	崟	岫	岻	岼
9BAE	5630	岶	岑	岼	岵	峇	峙	峩	峽	峺	峭	嶌	峪	崋	崕	崗	嵎
9BBE	5640	嵯	崛	崑	崔	崢	崚	崙	崘	嵌	嵒	嵎	嵋	嵬	嵳	嵷	嶇
9BCE	5650	嶄	嶂	嶢	嶝	嶬	嶮	嶽	嶸	嵺	嶼	嶷	巍	巓	巒	巖	巛
9BDE	5660	巫	已	巵	帋	帚	帙	帑	帛	帶	帷	幄	幃	幀	幎	幗	幔
9BEE	5670	幟	幢	幣	幇	幵	并	幺	麼	广	庠	廁	廂	廈	廐	廏	
9C3F	5720		廖	廣	廝	廚	廛	廢	廡	廨	廩	廬	廱	廳	廰	廴	廸
9C4F	5730	廾	弃	弉	彝	彜	弋	弍	弖	弩	弭	弸	弼	彈	彌	彎	弯
9C5F	5740	彑	彖	彗	彙	彡	彭	彳	彷	徃	徂	彿	徊	很	徑	徇	從
9C6F	5750	徙	徘	徠	徨	徭	徼	忖	忻	忤	忸	忱	忝	悳	忿	怡	恠
9C80	5760	怙	怐	怩	怎	怱	怛	怕	怫	怦	怏	悵	悷	悖	悗	悩	悮

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9C90	5770	協	恒	恍	恣	恃	恤	恂	恬	恫	恙	悁	悍	悧	悩	悴	
9C9E	5820		悄	悛	悖	悗	悃	悚	悋	惡	悸	惠	惓	悴	忰	悽	惆
9CAE	5830	悵	惘	慍	愕	愆	惶	惷	愀	惴	惺	愰	愾	惻	惱	愍	愎
9CBE	5840	慇	慊	慤	愧	慊	愿	愼	愬	愴	愽	慂	慄	慳	慷	慘	慙
9CCE	5850	慚	慫	慴	慯	慥	慱	慟	慝	慓	慵	慮	慼	慙	憬	憔	憚
9CDE	5860	憊	憑	憫	憮	懌	懊	應	懷	懈	懃	懆	憺	懋	罹	懍	懦
9CEE	5870	懣	懶	懺	懴	懿	懽	懼	攝	戀	戈	戉	戍	戌	戔	戛	
9D3F	5920		戞	戡	截	戮	戰	戲	戳	扁	扎	扞	扣	扛	扠	扨	扼
9D4F	5930	抂	抉	找	抒	抓	抖	拔	抃	抔	拗	拑	抻	挲	拿	拆	擔
9D5F	5940	拈	拜	拌	拊	拂	拇	抛	拉	挌	拮	拱	挧	挂	挈	拯	拵
9D6F	5950	捐	挾	捍	搜	捏	掖	掎	掀	掫	捶	掣	掏	掉	掟	掵	捫
9D80	5960	捩	掾	揩	揀	揆	揣	揉	插	揶	揄	搖	搴	搆	搓	搦	搶
9D90	5970	攝	搗	搨	搏	摧	摯	摶	摎	攪	撕	撓	撥	撩	撈	撼	
9D9E	5A20		據	擒	擅	擇	撻	擘	擂	擱	擧	舉	擠	擡	抬	擣	擯
9DAE	5A30	攬	擶	擴	擲	擺	攀	攅	攘	攜	攅	攤	攣	攫	攴	攵	攷
9DBE	5A40	收	攸	畋	效	敖	敕	敍	敘	敞	敝	敲	數	斂	斃	變	斛
9DCE	5A50	斟	斫	斷	旃	旆	旁	旄	旌	旒	旛	旙	无	旡	旱	杲	昊
9DDE	5A60	昃	昇	昉	昵	昶	昴	昜	晏	晄	晉	晁	晞	晝	晤	晧	晨
9DEE	5A70	晟	晢	晰	暃	暈	暎	暉	暄	暘	暝	曁	暹	曉	暾	暼	
9E3F	5B20		曄	暸	曖	曚	曠	昿	曦	曩	曰	曳	曷	朏	朖	朞	朦
9E4F	5B30	朧	霸	朮	朿	朶	杁	朸	杓	杏	杞	杠	杙	杣	杤	枉	杰
9E5F	5B40	杼	枋	枒	枌	枨	枢	枏	枡	枷	柯	枴	柬	枳	柩	枸	柤
9E6F	5B50	柞	柝	柢	柮	枹	柎	柆	柧	檜	栞	框	栩	桀	桍	栲	桎
9E80	5B60	梳	栫	桙	档	桷	桿	梟	梏	梭	梔	條	梛	梃	檮	栜	桴
9E90	5B70	梵	梠	梓	梯	桾	梶	椁	棊	椥	棘	椢	椦	棡	椌	棍	
9E9E	5C20		棔	棧	棕	椶	椒	椄	棗	棣	椥	棹	棠	棯	椨	椪	椚
9EAE	5C30	椀	椥	棆	楹	楷	楜	楸	楫	楔	楾	楮	椹	楴	椽	楙	椰
9EBE	5C40	楡	楞	楝	榁	楪	榲	榮	槐	榿	槁	槓	榼	槎	槧	槊	榑
9ECE	5C50	榻	槃	榠	槞	槫	榠	榜	榕	榴	槍	榻	樂	樛	槿	權	槨
9EDE	5C60	槲	槧	樅	榱	樞	槭	樔	槫	樊	樒	櫁	槾	樣	樓	橄	檜	橲
9EEE	5C70	橸	橲	橇	橢	橙	橦	橈	樸	樢	檐	檍	檠	檄	檢	檣	
9F3F	5D20		檗	蘗	檻	櫃	櫂	檸	檳	檬	櫺	櫟	櫛	櫟	櫪	櫻	欅
9F4F	5D30	欟	蘗	櫺	欒	欖	鬱	欟	欽	歙	盜	欹	飮	歇	歃	歉	歐
9F5F	5D40	歙	歔	歛	歟	歡	歸	歹	歿	殀	殄	殃	殍	殘	殕	殞	殤
9F6F	5D50	殪	殫	殯	殲	殱	殳	殷	殼	毆	毋	毓	毟	毬	毫	毳	毯
9F80	5D60	麾	氈	氓	气	氛	氤	氣	汞	汕	汢	汪	沂	沍	沚	沁	沛
9F90	5D70	汾	汨	汳	沒	沐	泄	泱	泓	沽	泗	泅	泝	沮	沱	沾	
9F9E	5E20		泅	泛	泯	泙	泪	洩	衍	洶	洫	洽	洸	洙	洵	洳	洒
9FAE	5E30	洌	浣	涓	浤	浚	浹	浙	涎	涕	濤	涅	淹	渕	渊	涵	淇
9FBE	5E40	淦	涸	淆	淬	淞	淌	淨	淒	淅	淺	淙	淤	淶	淪	淮	渭
9FCE	5E50	湮	渚	渙	湲	湟	渾	渣	湫	渫	湶	湍	渟	湃	渺	湎	渤
9FDE	5E60	滿	渝	游	溂	溪	溘	滉	溷	滓	溽	溯	滄	溲	滔	滕	溏
9FEE	5E70	溥	滂	溟	潁	漑	灌	滬	滸	滾	漿	滲	漱	滯	漲	滌	
E03F	5F20		漾	漓	滷	澆	潺	潸	澁	澀	潯	潛	濳	潭	澂	潼	潘
E04F	5F30	澎	澑	濂	潦	澳	澣	澡	澤	澹	濆	澪	濟	濕	濬	濔	濘
E05F	5F40	濱	濮	濛	瀉	瀋	濺	瀑	濯	瀏	濾	瀛	瀚	瀦	瀝	瀘	瀟
E06F	5F50	瀰	瀾	瀲	灑	灣	炙	炒	炯	烱	炬	炸	炳	炮	烟	烋	烝
E080	5F60	烙	焉	烽	焜	焙	煥	煕	熙	煦	煢	煌	煖	煬	熏	燻	熄
E090	5F70	熕	熨	熬	燗	熹	熾	燒	燉	燔	燎	燠	燬	燧	燵	燼	
E09E	6020		燹	燿	爍	爐	爛	爨	爭	爬	爰	爲	爻	爼	爿	牀	牆

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E0AE	6030	牋	牘	牴	牾	犂	犁	犇	犒	犖	犢	犧	犹	狃	狆	狄	狎
E0BE	6040	狒	狢	狠	狡	狹	狷	倏	猗	猊	猜	猖	猝	猴	猯	猩	
E0CE	6050	猥	猾	獎	獏	默	獗	獪	獨	獰	獣	獵	獻	獺	珈	玳	珎
E0DE	6060	玻	珀	珥	珮	珞	璢	琅	瑯	琥	珸	琲	琺	瑕	琿	瑟	瑙
E0EE	6070	瑁	瑜	瑩	瑰	瑣	瑪	瑶	瑾	璋	璞	璧	瓊	瓏	瓔	珱	
E13F	6120		瓠	瓣	疋	疐	疇	皹	砡	痾	痼	瘁	甄	皴	皺	皹	甑
E14F	6130	甍	甕	甓	甞	甦	甬	甼	畄	畤	畊	畉	畛	畚	畠	畤	
E15F	6140	畧	畫	畭	畸	當	疆	疇	畴	疊	疊	疂	疔	疚	疝	疥	疣
E16F	6150	痂	疳	痃	疵	疽	疸	疼	疱	痍	痊	痒	痙	痣	痞	痾	痿
E180	6160	痼	痰	痺	痲	痳	痲	瘋	瘍	瘉	瘟	瘧	瘠	瘡	瘢	瘤	瘴
E190	6170	瘰	瘻	癇	癈	癆	癌	癘	癡	癢	癨	癩	癪	癧	癬	癰	
E19E	6220		癲	癶	癸	發	皀	皃	皈	皋	皎	皖	皓	皙	皚	皰	皴
E1AE	6230	皸	皹	皺	盂	盍	盖	盒	盞	盡	盥	盧	盪	蘯	盼	盹	盻
E1BE	6240	眄	眩	眤	眞	眥	眦	眛	眷	眸	睇	睚	睨	睫	睛	睥	睿
E1CE	6250	睾	睹	瞎	瞋	瞑	瞠	瞞	瞰	瞶	瞹	瞿	瞼	瞽	瞻	矇	矍
E1DE	6260	矗	矚	矜	矣	矮	矼	砌	砒	礦	砠	礪	硅	碎	硼	碆	硼
E1EE	6270	碚	碌	碣	碵	碪	磑	磆	磋	磔	碾	碼	磅	磊	磬		
E23F	6320		磧	磚	磽	磴	礫	礒	礙	礑	礜	礫	祀	祠	祇	祟	祚
E24F	6330	祕	祓	祺	祿	禊	禝	禧	齋	禪	禮	禳	禹	禺	秉	秕	秧
E25F	6340	秬	秡	秣	稈	稍	稘	稙	稠	稟	禀	稱	稻	稾	稷	稼	穂
E26F	6350	穉	穡	穢	穩	龝	穰	穹	穿	窈	窗	窕	窘	窖	窩	竈	窰
E280	6360	竅	竅	竄	窿	邃	竇	竊	竚	竡	竚	竝	竡	竢	竦	竭	竰
E290	6370	竸	竭	竰	笂	笏	笊	笆	笳	笘	笙	笞	笵	笨	笶	筐	
E29E	6420		筺	笄	筍	箏	筌	筅	筵	筥	筴	筧	筰	筱	筳	箘	箟
E2AE	6430	箘	箙	箍	箜	箚	箋	箒	箏	筝	箙	箘	箘	箘	箘	箙	篆
E2BE	6440	篝	篩	簔	簔	篦	篥	籠	簀	簇	簑	篳	篷	簗	簍	篶	篋
E2CE	6450	篁	簪	簟	簷	簫	簽	籌	籃	籔	簇	籀	籐	籘	籟	籤	籖
E2DE	6460	籥	籬	粁	粗	粑	粤	粭	粢	粨	粡	粨	粳	粲	粱	粮	粹
E2EE	6470	粽	糀	糅	糘	糘	糯	糜	糢	鬻	糯	糲	糴	糶	糺	紆	
E33F	6520		紂	紜	紕	紊	絅	紘	紮	絏	紿	紵	絆	絳	絖	絎	絲
E34F	6530	絨	絮	絏	絣	經	綉	條	綏	絽	綛	綺	綮	綣	綵	緇	綽
E35F	6540	綫	總	綱	綯	縣	綸	綟	綰	緘	緝	緤	緞	緻	緲	緡	縅
E36F	6550	縊	縣	縡	縒	縱	縟	縉	縋	縢	繆	繦	縻	縵	縹	繃	縷
E380	6560	縲	縺	繧	繝	繖	繞	繙	繚	繹	繪	繩	繼	繻	纃	緕	繽
E390	6570	辮	纈	纈	纉	續	纏	纈	纓	纔	纖	纎	纛	纜	缸	缺	
E39E	6620		罅	罌	罍	罎	罐	网	罕	罔	罘	罟	罠	罨	罩	罸	罰
E3AE	6630	翩	罹	羃	羈	羇	羌	羔	羞	羝	羚	羣	羯	羲	羹	羮	羶
E3BE	6640	羸	譱	翅	翠	翊	翕	翔	翡	翦	翩	翳	翹	飜	耆	耄	耋
E3CE	6650	耒	耘	耙	耜	耡	耨	耿	耻	聊	聆	聒	聘	聚	聟	聢	聯
E3DE	6660	聳	聲	聰	聶	聹	聽	聿	肄	肆	肅	肛	肓	肚	肭	冐	肬
E3EE	6670	胛	胥	胙	胝	胄	胚	胖	脉	胯	胱	脛	脩	脣	脯	腋	
E43F	6720		隋	腆	脾	腓	腑	胼	腱	腮	腥	腦	腴	膃	膈	膊	膀
E44F	6730	膂	膠	膕	膤	膣	腟	膓	膩	膰	膵	膾	膸	膽	臀	臂	膺
E45F	6740	臉	臍	臑	膿	臘	膕	臚	臟	臠	臧	臺	臻	臾	舁	舂	舅
E46F	6750	與	舊	舍	舐	舗	舩	舫	舸	舳	艀	艙	艘	艝	艚	艟	艤
E480	6760	艢	艨	艪	艫	舮	艱	艶	艸	艾	芍	芒	芫	芟	芻	芬	苡
E490	6770	苣	苟	苒	苴	苳	苺	莓	范	荐	荜	荀	茆	茘	茉	苣	
E49E	6820		茵	茴	荅	茲	茱	萄	茹	荐	荅	茯	茫	茗	荔	莅	莚
E4AE	6830	莪	莟	莢	莖	莫	莎	莇	莊	荼	莵	荳	荵	莠	莉	莨	菴
E4BE	6840	萓	菫	菎	萩	萃	萩	萋	菁	菷	萇	菠	菲	萍	萢	萠	莽

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E4CE	6850	萸	蔆	莇	葭	莉	萼	蓼	蒂	葷	葫	蓊	葭	蒂	葩	葆	萬
E4DE	6860	葯	蕤	萵	蓊	蓋	蒹	蒿	蒟	蓙	著	翡	蓧	蓦	蓁	蓆	蓖
E4EE	6870	蒡	蔡	蓿	蓴	蔗	蓼	蔬	蔟	蒂	蔔	蓼	蘇	蘞	蕘	蓴	
E53F	6920		蓴	藥	蓋	蓿	薀	薙	薈	薑	薹	薊	薨	蕭	薔	薛	藪	薇
E54F	6930	薜	蘋	蕾	蘂	藉	薺	藏	薹	藐	藕	藝	藥	藜	藹	蘊	蘇
E55F	6940	蘋	藾	藺	蘆	蘢	蘚	蘰	蘿	虍	乕	虔	號	虧	虱	蚓	蚣
E56F	6950	蚩	蚪	蚋	蚌	蚶	蚯	蛄	蛆	蚰	蛉	蠣	蚫	蛔	蛞	蛩	蛬
E580	6960	蛟	蛛	蛯	蜒	蜆	蜈	蜀	蜃	蛻	蜑	蜉	蜍	蛹	蜊	蜴	蜿
E590	6970	蜷	蜻	蜥	蜩	蜚	蝠	蝟	蝸	蝌	蝎	蝴	蝗	蝨	蝮	蝙	
E59E	6A20		蝓	蝣	蝪	蠅	螢	螟	螂	螯	蟋	螽	蟀	蟐	雖	螯	蟄
E5AE	6A30	螳	蟇	蟆	螻	蟯	蟲	蟠	蠏	蠍	蟾	蟶	蟷	蠑	蠖	蠑	蠖
E5BE	6A40	蠕	蠢	蠡	蠱	蠶	蠹	蠧	蠻	衄	衂	衒	衙	衞	衢	衫	袁
E5CE	6A50	衾	袞	袒	袵	袮	袙	袢	袗	袒	袮	袍	袢	袍	袤	袰	袿
E5DE	6A60	袱	袴	袲	裔	裘	裙	裝	裹	褂	裼	裨	裲	褄	褌	福	
E5EE	6A70	褓	褒	褞	褥	褪	褫	襁	襄	褻	褶	褸	襌	褝	襠	襞	
E63F	6B20		襦	襤	襭	襪	襴	襷	襾	覃	覈	覊	覓	覘	覡	覩	覦
E64F	6B30	覯	覬	覿	覲	覺	覽	覿	覲	觚	觜	觝	解	觴	觸	訃	訖
E65F	6B40	訐	訌	訛	訝	訥	訶	詁	詛	詒	詆	詈	詼	詭	詬	詢	誅
E66F	6B50	誂	誄	誨	誡	誑	誥	誦	誚	誣	諄	諍	諂	諚	諫	諳	諧
E680	6B60	諤	諱	謔	諠	諢	諷	諞	諛	諤	謇	謚	謦	謨	謐	謗	謠
E690	6B70	謳	鞫	謦	謫	謾	謨	譁	譌	譏	譎	證	譖	譜	譚	譫	
E69E	6C20		譟	譬	譯	譴	譽	讀	讌	讎	讒	讓	讖	讙	讚	谺	豁
E6AE	6C30	谿	豈	豌	豎	豐	豕	豢	豬	豸	豺	貂	貉	貅	貊	貍	貎
E6BE	6C40	貔	豼	貘	戝	貭	貪	貽	貲	貳	貳	貶	賈	賁	賤	賣	賚
E6CE	6C50	賽	賺	賻	贄	贅	贇	贊	贏	贍	贐	齎	贓	賍	贔	贖	赧
E6DE	6C60	赭	赱	赳	趁	趙	跂	趾	趺	跏	跚	跖	跌	跛	跋	跪	跫
E6EE	6C70	跟	跣	跼	踈	踉	跿	踝	踞	踐	踟	蹂	踵	踰	踴	蹊	
E73F	6D20		蹇	蹉	蹌	踏	蹈	蹙	蹤	蹠	踪	蹣	蹕	蹶	蹲	蹼	躁
E74F	6D30	躇	躅	躔	躋	躊	躓	躑	躡	躙	躪	躦	躰	躬	躰	體	躱	躾
E75F	6D40	軅	軆	軋	軛	軼	軻	軫	軾	輊	輅	輕	輒	輙	輓	輜	
E76F	6D50	輟	輛	輌	輦	輳	輻	輹	轅	轂	輾	轌	轉	轆	轎	轗	轜
E780	6D60	轣	轢	轤	辜	辟	辣	辭	辯	辷	迚	迥	迢	迪	迯	邇	迴
E790	6D70	逅	迹	迺	逑	逕	逡	逍	逞	逖	逋	逧	逶	逵	達	逝	
E79E	6E20		遏	遐	遑	遒	逎	遉	逾	遖	遘	遞	遨	遯	遶	隨	遲
E7AE	6E30	邂	遽	邁	邀	邊	邉	邏	邨	邯	邱	邵	郢	郤	扈	郛	鄂
E7BE	6E40	鄒	鄙	鄲	鄰	酊	酖	酘	酣	酥	酩	酳	酲	醋	醉	醂	醢
E7CE	6E50	醫	醯	醪	醵	醴	醺	釀	釁	釉	釋	釐	釖	釟	釜	釗	釙
E7DE	6E60	釵	釶	鈞	釿	鈔	鈬	鈕	鈑	鉞	鉗	鉅	鉉	鉤	鉈	銕	鈿
E7EE	6E70	鉋	鉐	銜	銖	銓	銛	鉚	鋏	銹	銷	鍇	鋩	鋺	鍜	鍋	
E83F	6F20		錙	錢	錚	錣	錻	鍜	鍠	鍼	鍮	鍖	鎰	鎬	鎭		
E84F	6F30	鎔	鎹	鏖	鏗	鏨	鏥	鐓	鐔	鐓	鐃	鏆	鏈	鏤	鐚	鐔	鐓	鐃
E85F	6F40	鐇	鐐	鐶	鐫	鐵	鐡	鐺	鑁	鑒	鑄	鑛	鑠	鑢	鑞	鑪	鈩
E86F	6F50	鑰	鑵	鑷	鑽	鑚	鑼	鑾	钁	鑿	門	閇	閊	閔	閖	閘	閙
E880	6F60	閏	閨	閧	閭	閖	閻	閹	閾	闊	濶	闃	闍	闌	闕	闔	闖
E890	6F70	關	闡	闥	闢	阡	阨	阮	阯	陂	陌	陏	陋	陷	陜	陞	
E89E	7020		陝	陟	陦	陲	陬	隍	隘	隕	隗	險	隧	隱	隲	隰	隴
E8AE	7030	隶	隷	隹	雎	雋	雉	雍	襍	雜	霍	雕	雹	霄	霆	霈	霓
E8BE	7040	霎	霑	霏	霖	霙	霤	霪	霰	霹	霽	霾	靄	靆	靈	靂	靉
E8CE	7050	靜	靠	靤	靦	靨	勒	靫	靹	鞅	靼	鞁	靺	鞆	鞄	鞋	鞏
E8DE	7060	靹	鞜	鞨	鞦	鞣	鞳	鞴	韃	韆	韈	韋	韜	韭	齏	韲	竟

Shift-JIS	JIS	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
E8EE	7070	韶	韵	頇	颂	頸	頤	頡	頷	頹	顆	顏	顋	顫	顯	顰	
E93F	7120		顱	顴	飁	風	颯	颱	颶	飄	飉	飆	飩	飫	餃	餉	餒
E94F	7130	餔	餘	餡	餱	餞	餤	餅	餬	餮	餽	餾	饁	饉	饅	饈	饋
E95F	7140	饑	饒	饌	饕	馗	馘	馥	馭	馮	馼	駆	駛	駝	駘	駑	駭
E96F	7150	駮	駱	駲	駸	駿	騁	騏	騅	騈	騙	騫	騒	驅	驂	驀	驃
E980	7160	驟	驕	驍	驛	驗	驟	驢	驥	驤	驩	驫	驪	骭	骰	骼	髀
E990	7170	髏	髑	髓	體	髞	髟	髡	髣	髦	髯	髫	髪	髴	髷	髻	
E99E	7220		鬟	鬆	鬘	鬚	鬟	鬢	鬣	鬥	鬧	鬨	鬩	鬮	鬻	魃	鳧
E9AE	7230	魄	魆	魏	魍	魎	魑	魘	魴	鮓	鮃	鮑	鮖	鮗	鮟	鮠	鮨
E9BE	7240	鮴	鯀	鯊	鮹	鯆	鯏	鯑	鯒	鯣	鯢	鯤	鯔	鯡	鰺	鰙	鰔
E9CE	7250	鰥	鰕	鰔	鰉	鰓	鰌	鰆	鰈	鰒	鰊	鰔	鰛	鰡	鰰	鰲	鰡
E9DE	7260	鰤	鰱	鰲	鰡	鰾	鰧	鰌	鰮	鰳	鰾	鰕	鰲	鴉	鴟	鴈	鴇
E9EE	7270	鴠	鴣	鴪	鴦	鶯	鴭	鴟	鵄	鴕	鴿	鴞	鴿	鴾	鵆	鵈	
EA3F	7320		鵝	鵞	鵚	鵑	鵐	鵙	鵲	鶉	鶇	鶫	鵯	鵺	鶚	鶤	鶩
EA4F	7330	鶲	鷄	鷁	鶻	鶸	鶺	鷁	鷆	鷂	鷙	鷓	鷆	鷏	鷦	鷭	鷯
EA5F	7340	鷽	鸛	鸞	鹵	鹹	鹽	麁	麈	麋	麕	麒	麕	麗	麝	麥	麩
EA6F	7350	麸	麺	麹	黌	黌	黎	黏	黝	黜	點	黝	黠	黙	黨	黯	
EA80	7360	黴	黶	黷	黹	黻	黼	黽	鼇	鼈	皷	鼕	鼬	鼬	鼾	齊	齒
EA90	7370	齔	齣	齟	齠	齡	齦	齧	齬	齪	齷	齲	齶	龕	龜	龠	
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Panasonic Industry Co., Ltd.
1006, Oaza Kadoma, Kadoma-shi, Osaka 571-8506, Japan
https://industry.panasonic.com/

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