Panasonic®

Laser Marking System

Setup and Maintenance Guide

LP-RV Series

EN-EU-LPRV-SM-7

2025.04 | https://industry.panasonic.eu

Preface

Thank you for purchasing this product.

Read this manual carefully to make full use of the product and to ensure its safe and proper operation.

The English version of this document are the original instructions. All other languages are translations that are based on the original documentation. This product has been strictly checked and tested prior to packaging. However, make sure that the product has not been damaged during transportation and operates properly before using it. If the product was damaged or does not operate as specified in this manual, contact our service center or sales office.

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Important symbols

One or more of the following symbols may be used in this documentation.

The following symbols are used to indicate the type of hazard.

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

Notice

Indicates a property damage message.

The following symbols are used to indicate the type of instructions to be observed.



Indicates an operating procedure which must not be performed.



Indicates an operating procedure which must be followed to operate the unit safely.

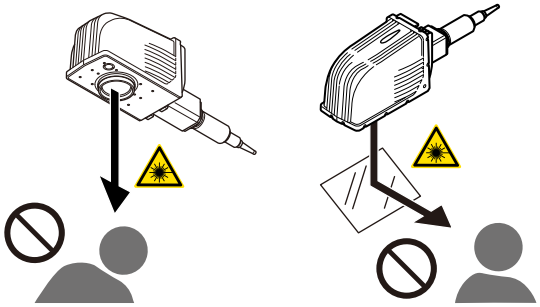
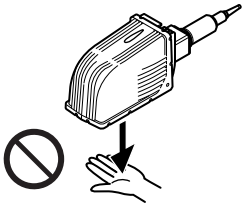


Indicates an operating procedure which must be performed carefully.

General safety precautions

Always follow these important safety precautions!

This product falls into laser class 4 according to IEC 60825-1 "Safety of laser products". By definition, class 4 laser devices are "laser products for which intrabeam viewing and skin exposure is hazardous and for which the viewing of diffuse reflections may be hazardous. These lasers also often represent a fire hazard". Laser class 4 devices require a safety system compliant with ISO 13849-1 and ISO 11553-1. To protect the operator from being exposed to a laser beam, be sure to follow the instructions in this manual and observe the safety regulations of your country.

⚠ DANGER	
	Never look at the direct laser beam, neither directly nor through a lens or any other optical components. Laser radiation into the eye causes blindness or serious damage to the eye. A specularly reflected laser beam is also dangerous. 
	Never expose your skin, clothing or any other flammable object to the laser radiation. Your skin will be severely burned and there is a risk of fire. 

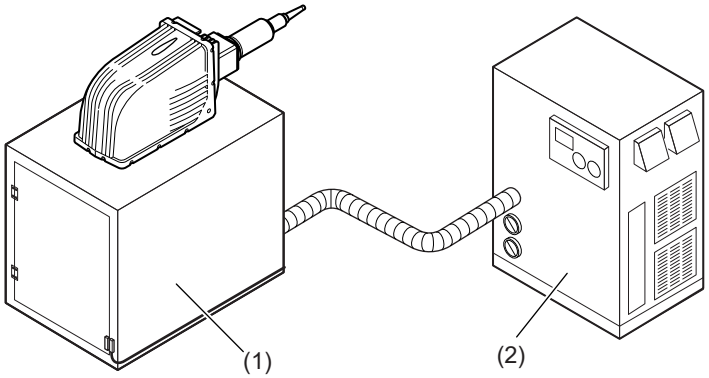
⚠ WARNING	
	Do not use this product near flammable gas or objects (organic solvents such as thinner or gasoline), in a dusty place or anywhere where fire is strictly prohibited. There is a risk of fire.
	Do not install this product in wet places except for water-resistant parts. Never conduct wiring or maintenance work with wet hands or when the product surface is wet. Otherwise, there is a risk of an electrical shock or malfunction.
	Do not open or disassemble this product. Otherwise, there is a risk of exposure to laser radiation or of electrical shock.

⚠ WARNING	
	Do not insert hands or objects in the gaps of the cooling air inlet or outlet. This may result in injuries, electrical shock, or failure of this product.
	Wear laser protective goggles against laser radiation within the laser controlled area. Never look into the direct or specularly reflected laser beam even when you are wearing the protective goggles. The protective goggles are designed to protect your eyes from diffuse reflection only. 
	Build a protective enclosure with proper reflectance, durability and thermal resistance to enclose the laser radiation range without leakage. All objects exposed to laser radiation, e. g. a workpiece stand or an object to stop laser radiation, must be contained within the protective enclosure. Make sure the objects are made of flame-resistant and low-reflectance material. Do not use objects made of resin or wood, or objects with a specular surface.
	Construct an interlock system, e.g. to stop laser radiation when the access panel of the protective enclosure is opened.
	After you turn off the power supply of this product, the laser safety officer must remove the key and keep it.
	Be sure to connect the laser head, oscillator unit, and controller of the laser marking system using combinations from the same product series. If incompatible devices are connected to the laser head or oscillator unit, there is a risk of exposure to laser radiation or failure.
	Read all safety instructions and manuals thoroughly, and do not operate, install and connect this product with any other methods except the instructions provided in the manuals. Otherwise the safety protection and functions provided by the device may be affected and may cause injury, electrical shock or exposure to the laser beam.
	Turn off the power of this product before you conduct wiring, connection, or maintenance work. Wiring and maintenance should be done by an expert engineer or a qualified electrician. Otherwise, there is a risk of an electrical shock or fire.
	When connecting the power supply, be sure to ground this product properly. Otherwise, there is a risk of malfunction and electrical shock in case of a failure or leakage current.
	Make sure that the fiber cable is not put under mechanical stress or squeezed during installation. Do not install this product into systems that impose excessive load on the fiber cable such as head movement units. If the fiber cable is damaged, there is a risk of exposure to laser radiation.
	Perform regular maintenance (cleaning, parts replacement) on this product. Do not use this product if it is visibly soiled with dust or dirt. Otherwise, there is a risk of an electrical shock or fire.

⚠ WARNING

Remove the dust and gas with a dust collector or fume exhauster. Depending on the material of the workpiece, dust or gas, which can be harmful for the human body and this product, may be generated.

Make sure the suction nozzle of the dust collector or fume exhauster is made of flame-resistant and low-reflectance material. Do not place the suction nozzle in the laser beam path.



(1) Protective enclosure
(2) Dust collector or fume exhauster

When using an assist gas for laser processing, take safety measures to protect operators from exposure, ignition, toxic effects, excess or lack of oxygen.

To carry this product, wear non-slip gloves and safety shoes. Hold the product with both hands. Do not carry this product by holding the fiber unit, cables or connectors. In case the unit falls down, it may cause injury.

Do not hold this product by the sharp edges of metal parts or by protrusions and corners.

Carry the controller of this product series with two persons. Lifting or carrying the product without assistance can cause muscle strain or back injury.

Install this product in a stable place without vibration and shock. In case the unit falls down, it may cause injury.

⚠ CAUTION

Do not touch the surface of the laser head during and right after operation. It becomes hot and may cause burn injuries.

General property damage messages

Operating environment

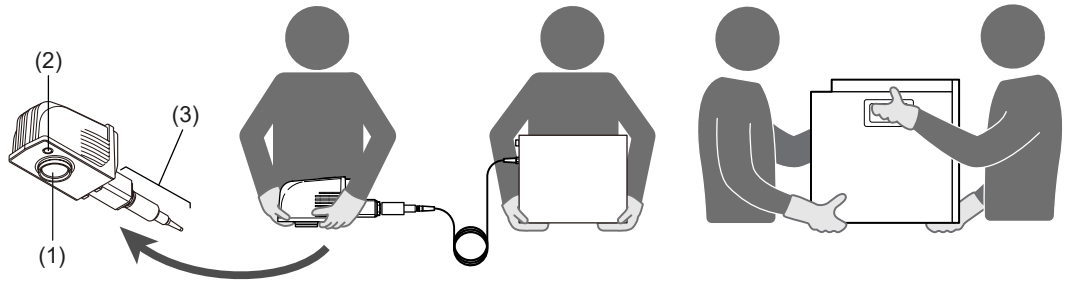
- Do not use the product in a place with frequent vibrations or shocks. Moreover, please do not drop this product. It may affect the precision and optical components inside, which could influence the performance or result in a failure.
- Do not use the system outdoors.
- This product uses an air cooling system as the laser cooling method. Make sure the air flow is not blocked and provide sufficient space around the device. Avoid placing heat sources near the product.
- Be sure to use the product within the ambient temperature and humidity defined in the specifications.
- Keep the laser emission port free of water, oil, fingerprints, dust, or dirt to ensure reliable marking performance and prevent a failure. If necessary, use a dry soft cloth to clean the laser emission port.
- Replace the air filter on a periodic basis. A dirty air filter hinders the air flow and may cause malfunction of the laser marking system.
- Remove dust, fume or particles generated during the marking process by placing the suction nozzle of a dust collector or fume exhauster as near as possible to the workpiece. In case dust or fumes adhere to the laser emission port, such as oily fume, construct an air flow system with compressed air to remove all contaminations reliably. Any contamination on the laser emission port may cause failure or decrease the laser marking or processing quality.
- Depending on the data setting, the internal temperature of the product may rise, which may cause failure. Take measures such as reducing laser power and scan speed.

  Examples:
  - Applications that require repetitive marking or processing of short lines at high speed.
  - Applications where the laser radiates continuously for extended periods with high laser power setting.

Installation

- To carry this product, wear non-slip gloves and safety shoes. Hold the product with both hands. Do not carry this product by holding the fiber unit, cables or connectors.
- Do not touch the laser emission port on the bottom of the laser head because this may have negative effects on the marking quality.
- The laser head and the oscillator unit are connected with a fiber cable. Carry these units with two person to avoid strain on the fiber cable.
- Carry the controller with two persons.

- Carry the laser head (left), the oscillator unit (middle), and the controller (right) as shown in the figure below.



(1) Laser emission port
(2) Pointer emission port
(3) Fiber unit

- Do not install this product into systems that impose excessive load on the laser head or fiber cable such as head movement units. If the fiber cable is damaged or if cables are disconnected, this may cause malfunction.
- Be careful neither to impose excessive force on the cable nor to bend it during the installation.
- Ensure the bend radius of the cable is not less than the minimum allowed value, and handle it with great care.
- Do not hit the device with a tool such as a hammer at the installation. Do not use excessive force while tightening the screws (nuts). It may cause a failure.
- Do not insert objects into the exhaust port of the unit.
- Use anti-reflection coating (ex. black paint for metal) for an external shutter or a protective enclosure in the path of the laser beam. Otherwise, the components inside the laser head may be damaged.
- If any other devices such as a sensor or a camera are installed near the laser marking position, make sure that these devices are not damaged by the direct or indirect laser beam.

Wiring

- Verify that the cables are wired correctly before powering on.
- Use the cables supplied with this product or the specified optional cables.
- Use an AC power cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used.
- Check the voltage fluctuations of the power supply. Make sure the power supply does not exceed the operating voltage.
- If a surge occurs in the power supplied, connect a surge absorber to the source of the surge.
- Make sure to take measures against surge before connecting any inductive load such as a DC relay.
- The output terminals have no short-circuit protection; therefore, do not connect the power supply or load directly.

- Make sure to ground the frame ground terminal (F.G.) of this product.
- Make sure the housing of the controller, of the oscillator unit, and of the laser head are at the same electric potential.
- Cables should not be used in the same raceway or routed in parallel to any component that generates high voltage, i.e. wires, power lines, large switching surge, etc. There is a risk of malfunction caused by induction.
- The USB cable should not be routed in parallel with the AC power cable or a motor power cable.
- Make the wiring as short as possible to prevent malfunction by noise.

Operation

- Do not turn off the power supply while the system starts ("PLEASE WAIT" is displayed).
- Wait at least 5 seconds before restarting the system after termination.
- Functional characters, i.e. current date and time, expiry date and time, lot date and time, are marked based on the system clock in the laser marking system. Faulty internal components, an exhausted battery, the ambient temperature or humidity may cause a deviation of the system clock. Always check the time of the system clock to ensure proper operation.
- Check the marking quality and ensure the laser marking system is working properly before starting full operation. Changing parameters could lead to unintended results.

Others

Be sure to delete all data when disposing of your laser marking system. Retained data might result in illegal read out and leaking of information by a third-party with malicious intent.

Network security

Implementing measures to protect your network is crucial to keep your network and its traffic secured.

As you will use this product connected to a network, your attention is called to the following security risks.

- Leakage or theft of information through this product
- Use of this product for illegal operations by persons with malicious intent
- Interference with or stoppage of this unit by persons with malicious intent

It is your responsibility to take precautions such as those described below to protect yourself against the above network security risks.

- Use this product in a secure network by using protection tools such as a firewall.
- If this product is connected to a network that includes PCs, make sure that the system is not infected by computer viruses or other malicious entities (using a regularly updated antivirus program, anti-spyware program, etc.).
- Use this product in an environment that has LAN, VPN (virtual private network) or leased line network.
- Use this product in an environment where only limited people concerned can enter.
- Use this product and connected devices such as a PC and tablet securing safety.
- Do not install this product in locations where the product or the cables can be destroyed or damaged by persons with malicious intent.

Note that incorrect setting of the connection to the existing LAN might cause malfunction in the devices on the network. Consult your network administrator before connecting.

Applicable standards

All models of this product comply with the following standards. This product does not comply with standards of countries which are not listed.

When you export the product by itself or integrated into a machine or device, check the regulations and standards of the importing country or region.



Laser class 4 devices require a safety system compliant with ISO 13849-1 and ISO 11553-1. For details, refer to the “Safety Instructions Manual”.

- **EN Standards (CE Marking)**

  2014/30/EU: "EMC Directive" (EN 55011, EN 61000-6-2)

  2006/42/EC "Machinery Directive" for partly completed machinery (EN ISO 11553-1, EN 60204-1)

  2011/65/EU as amended by (EU)2015/863 "RoHS Directive" (EN IEC 63000)

  (EU) 2023/1542 "Battery Regulation"

  Technical specifications: EN 55032, EN 60825-1

  Authorized representative in the EU: Panasonic Marketing Europe GmbH, Panasonic Testing Centre, Winsbergring 15, 22525 Hamburg, Germany

  The printed copy of the EU “Declaration of incorporation of partly completed machinery” is included in the package of this product.

- **EN Standards (UKCA Marking)**

  2016 No. 1091 "Electromagnetic Compatibility Regulations 2016" (EN 55011, EN 61000-6-2)

  2008 No. 1597 "Supply of Machinery (Safety) Regulations 2008" for partly completed machinery (EN ISO 11553-1, EN 60204-1)

  2012 No. 3032 "Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012" (EN IEC 63000)

  Technical specifications: EN 55032, EN 60825-1

  UK address: Panasonic UK, a branch of Panasonic Marketing Europe GmbH, Maxis 2, Western Road, Bracknell, Berkshire, RG12 1RT

  The printed copy of the UK “Declaration of incorporation of partly completed machinery” is included in the package of this product.

- **FDA (Food and Drug Administration, US regulations)**

  21 CFR1040.10 and 1040.11 (except for conformance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56 dated May 8, 2019)

- **JIS (Japanese Industrial Standards)**

  JIS C 6802

- **GB (Chinese National Standard)**

  GB 7247.1-2012 (IDT IEC 60825-1: 2007)

- **KC mark (Korea Certification)**

Implementing safety measures for laser products

This product falls into laser class 4 according to IEC 60825-1.

Laser class 4 refers to “laser products for which intrabeam viewing and skin exposure is hazardous and for which the viewing of diffuse reflections may be hazardous. These lasers also often represent a fire hazard”. To protect the operator from being exposed to a laser beam, be sure to follow the instructions in the “Safety Instructions Manual” and observe the safety regulations of your country.

Removal and disposal of dust or gas

Depending on the material of the workpiece to be marked, dust or gas, which can be harmful for the human body and this product, may be generated. Remove the dust, fume and/or gas which may be generated during the laser processing with an appropriate dust collector or fume exhauster.

Remove and dispose the dust and gas in accordance with the laws and regulations in your country.

Disposal of the laser marking system

Dispose of the laser marking system in accordance with the regional regulations for industrial waste disposal.

For details refer to Disposal of the laser marking system (page 218).

Use of the product in the European region

This product is designed as a component that is incorporated into the customers’ machinery and systems, and this product conforms to 2006/42/EC "Machinery Directive" for partly completed machinery. Therefore, when this product is incorporated into a system and is exported to or used in the European region as a final system, the system designer or the end-customer should take the following measures and verify that the whole system conforms to the Machinery Directive.

- Install the product to the system by following the requirements for accessibility and maintenance of EN 60204-1.
- Provide the power to the laser marker from the power supply terminals of the system.

About this manual

This document is intended for system designers, system administrators and laser safety officers.

Target audience

Laser safety officer

In some countries, you may be required to appoint a laser safety officer to ensure safe operation of laser devices. This person must be competent to evaluate laser hazards and to put effective protective measures in place. For details on the duties and responsibilities of the laser safety officer, refer to the “Safety Instructions Manual”.

System designer

A person who designs a system that incorporates this product must be fully familiar with the knowledge and precautions related to system design and laser safety. They must understand the knowledge and precautions related to laser and machine safety and implement the necessary protective measures.

System administrator

A person who is authorized to operate and manage the system that incorporates this product and who is familiar with operation, troubleshooting, and maintenance procedures for lasers and machines. This person must be fully familiar with the knowledge and precautions related to laser and machine safety and implement protective measures to ensure the safe operation of this product.

Manual overview

This document provides information for use under the assumption that our company's products are integrated and operated within a system. Both the system designer and system administrator are responsible for considering the safety of the overall system during the design and operation phases.

Life cycle stage	Description	Relevant chapters
General	General safety precautions	This document: See sections "General safety precautions" and "Applicable standards". Separate document: “Safety Instructions Manual”.
Transportation	Precautions for handling the product during transport	Installation (page 43)
Assembling and installation	Precautions for product installation and wiring	Installation (page 43) External control via I/O signals (page 103)

Life cycle stage	Description	Relevant chapters
Setup and operation	Covers startup, shutdown, operation modes, and external device control	This document: Operation methods (page 72) External control via I/O signals (page 103) External control via communication commands (page 159) Separate document: “Serial Communication Command Guide” “Laser Marker NAVI smart Operation Manual”
Cleaning and maintenance	Covers daily cleaning and maintenance tasks, including part replacements.	Maintenance (page 194)
Troubleshooting	Remedies for startup or operation problems	Troubleshooting (page 219)
Disposal	Precautions for product disposal	Disposal of the laser marking system (page 218)

Models covered by this manual

Multiple models may be described collectively. Therefore, illustrations and screenshots may slightly vary, depending on the model. Different settings or technical data, however, are specified in the text.

Model	Collective name
LP-RV200P	LP-RV series

Available documentation

The following documents are included on the CD-ROM Laser Marker Smart Utility.

You need Adobe Acrobat Reader of Adobe Inc. to read the PDF version of the manuals.

“Laser Safety Guide”

- Intended audience: All users
- This manual describes the safety measures required before you start to operate the laser marking system.

“Setup and Maintenance Guide”

- Intended audience: System integrators and persons responsible for installing the laser marking system.
- This manual describes the items which are necessary for the installation and maintenance of the laser marking system.
  - Specifications and dimensions
  - Installation and connection methods
  - Input and output specifications, descriptions of input and output signals, including timing charts
  - Maintenance information

“Laser Marker NAVI smart Operation Manual”

- Intended audience: Operators performing the actual marking procedure.
- This document describes how to operate the laser marking system using the PC configuration software Laser Marker NAVI smart.

“Serial Communication Command Guide”

- Intended audience: Machine builders and system integrators
- This manual describes the communication commands for the external control of the laser marking system via RS-232C, Ethernet, or optional network unit (EtherNet/IP or PROFINET).

“Serial Communication Command Guide: LP-400/V compatible mode”

- Intended audience: Machine builders and system integrators
- This manual describes communication commands compatible with the LP-400/LP-V series.

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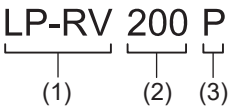
1 Product overview

1.1 Model number

Besides the series name, the model number includes information about the technical features of the laser marking system.

FAYb laser marking systems of the LP-RV series have the following model.

Model	Marking field	Output class	Oscillation method
LP-RF200P	90mm × 90mm	20W	Pulsed



(1) Series name
"LP-RV" refers to a fiber laser marking system.

(2) Output class/marking field
200: 20W, 90mm × 90mm

(3) Laser operation mode
P: Pulsed

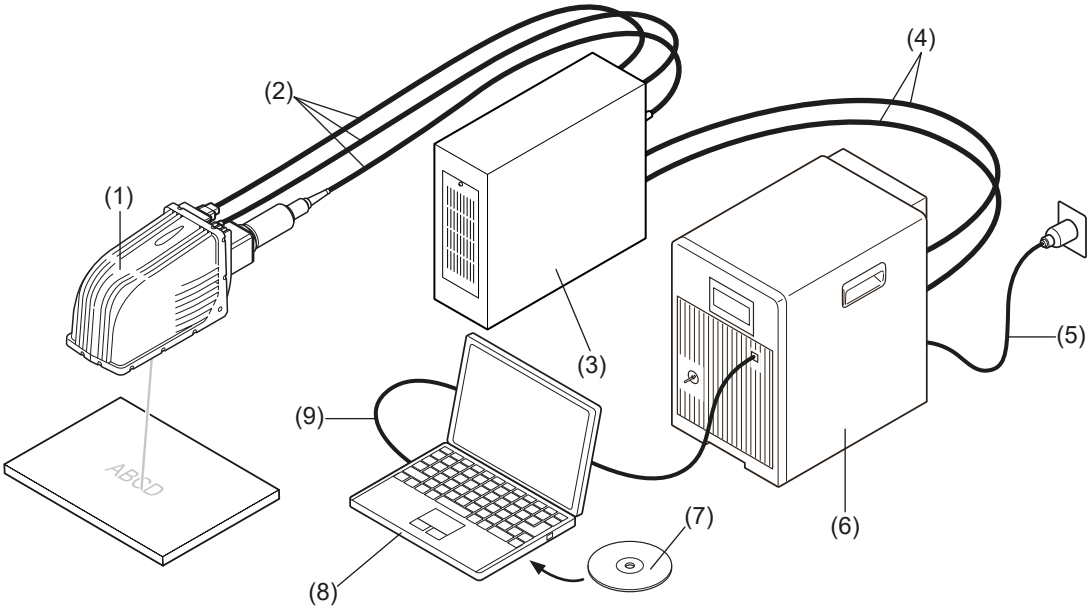
Related topics

Specifications (page 29)

1.2 Product configuration

1.2.1 Basic configuration

The main components of a laser marking system include the laser head, the oscillator unit, the controller, and a PC.



(1) Laser head

The laser head emits the laser beam. Inside are the optical components and the galvano scanner.

(2) Unit power cable, signal cable, and fiber cable

These cables connect the laser head and the oscillator unit. The fiber cable transmits the laser from the oscillator unit to the laser head.

(3) Oscillator unit

The oscillator unit generates the laser beam.

(4) Unit power cable and signal cable

These cables connect the oscillator unit and the controller.

(5) AC power cable (not included, can be ordered separately)

Use an AC power cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used.

(6) Controller

The controller generates the marking data. It provides the main power supply of the laser marking system and interfaces for external devices.

(7) Laser Marker Smart Utility
The CD-ROM contains the Laser Marker NAVI smart software, additional software tools, and PDF manuals.

(8) PC (not included)
Install the configuration software Laser Marker NAVI smart on a PC. The software is required to configure the laser marking system and create the marking data (online or offline). You can also use the software to control and to monitor the marking process (online).

(9) USB cable
Connect the USB cable to the controller and a PC on which the configuration software Laser Marker NAVI smart is installed.

1.2.2 Optional items

Optional items for this product are sold separately.

To purchase an item or if you need further information, please contact our service center or one of our sales offices.

Optional item	Product no.
AC power cable, 250V, CE certified (Europe) The cable plug complies with the standards set by VDE, DEMKO, NEMKO, FIMKO, SEMKO, OVE, KEMA, CEBEC.	LP-ACA12
AC power cable, 250V, PSE certified (Japan)	LP-ACA11
Protection glass of the laser emission port	LP-ACV60
Air filter (10 pieces for controller)	LP-AFT81
Air filter (10 pieces for oscillator unit)	LP-AFT82
Controller fan (2 pieces)	LP-AFA20
Unit power cable, 2m	LP-ACP20-2
Unit power cable, 5m	LP-ACP20-5
Signal cable, 2m	LP-ACS10-2
Signal cable, 5m	LP-ACS10-5
Set of connector cover and gasket	LP-ACC10
INTERLOCK contactor	LP-AEC10
Battery	AFPX-BATT (CR-2450)
Network unit for EtherNet/IP	LP-ANW10
Network unit for PROFINET	LP-ANW11

Notice

Use an AC power cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used.

If you need an AC power cable, 250V, CCC certified, which is recommended for China, please contact our service center or one of our sales offices.

Some optional items may not be sold due to regulations in each country or region. For detailed information, contact our service center or one of our sales offices.

1.2.3 Product package

Before using this product, make sure all items on the packing list are included in the package.

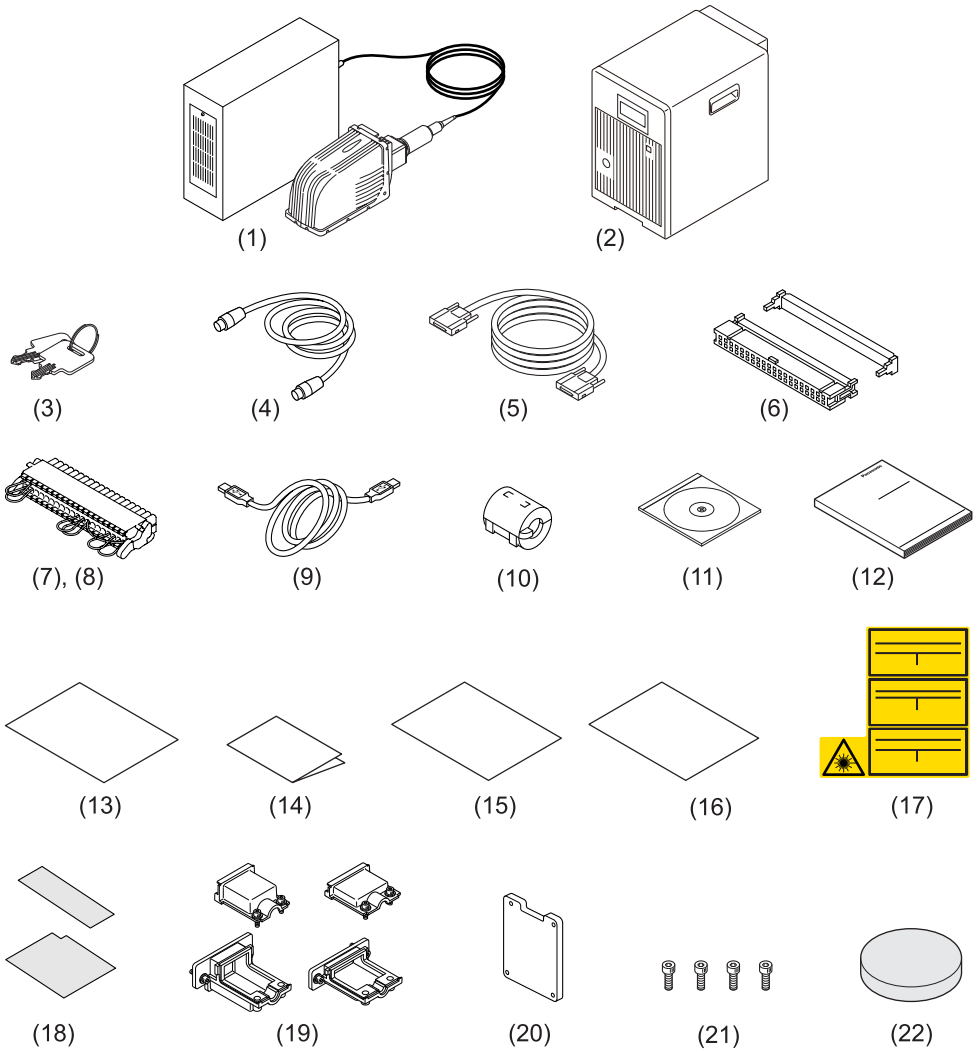
This product is delivered in a set of laser head, oscillator unit and controller packed in one box.

If any item is missing in the package, contact our service center or one of our sales offices.

Notice

Be sure to keep the packing materials. Since this product is a precision machinery, you should reuse the packing materials to prevent damages during transportation.

The packing list includes the following items:



(1) 1 × Laser head, 1 × Oscillator unit

(2) 1 × Controller

(3) 2 × System key

(4) 2 × Unit power cable

(5) 2 × Signal cable

(6) 1 × I/O connector

(7) 1 × I/O terminal block

(8) 7 × Jumper wire

(9) 1 × USB cable (2m)

(10) 3 × Ferrite core for LAN cable, I/O lines to TERMINAL connector and I/O connector

(11) 1 × CD-ROM Laser Marker Smart Utility

(12) 1 × “Laser Safety Guide”

(13) 1 × “Cautions for Handling”/“Infos about PDF Manuals”

(14) 1 × “General safety and compliance information”

(15) 1 × Copy of the EU “Declaration of incorporation of partly completed machinery”

(16) 1 × Copy of the UK “Declaration of incorporation of partly completed machinery”

(17) 1 × Warning label/Explanatory label

(18) 4 × Air filter (2 pieces each for oscillator unit and for controller)

(19) 2 × Connector cover (1 set each for unit power cable and signal cable)

(20) 1 × Scanner cover

(21) 4 × M5 screw (for scanner cover)

(22) 1 × Protection cap of the laser emission port (for transportation)

The AC power cable is not included in the product package. Use one of the specified optional cables or a comparable cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used.

Related topics

Cables (page 34)

1.2.3.1 CD-ROM contents

The included CD-ROM contains the Laser Marker NAVI smart software, additional software tools, and PDF manuals.

- PC software

  Laser Marker NAVI smart
  Logo Data Editing
  Font Maker

- PDF manuals

  Language versions not included on the CD-ROM can be downloaded from local Panasonic Web sites.

  “Laser Safety Guide”
  “Setup and Maintenance Guide”
  “Serial Communication Command Guide”
  “Serial Communication Command Guide: LP-400/V compatible mode”
  “Laser Marker NAVI smart Operation Manual”
  “Logo Data Editing Software Operation Manual”
  “Font Maker Operation Manual”

- Fonts

  Fonts for alphanumeric characters and symbols: ORG1, ORG2, ORG3, ORG4, ORG5, ORG1S, ORG2S, ORG3S, OCR1, ORG3-L1, DINLIKE1-L1

Fonts for Japanese characters: JIS1, JIS2
Fonts for simplified Chinese characters: GB2312-1, GB2312-2
User-defined font: USER1
2D code pattern font: 2DCODE

Note

ExportVEC, a plug-in software for Adobe Illustrator, is not included on the CD-ROM. If you want to convert .ai or .eps files to the graphic file format .vec used in laser marking systems, download the file “export_vec.zip” from the following Web site: https://industry.panasonic.com/global/en/downloads/?tab=software

To find the appropriate software, go to “Download” > “Software” and enter the series name of your laser marking system (e.g. LP-RV) in the “Part No.” field.

1.3 Specifications

The laser marking system has the following characteristics and technical specifications.

Specifications apply to the LP-RV200P model.

Optical specifications	
Scanning system	Galvano scanner
Marking field (X, Y)	90mm (±0.5mm) × 90mm (±0.5mm)
Work distance (base position)	190mm (±0.5mm)
Scan speed[1) 2)]	Max. 12000mm/s
Line speed[1)]	Max. 240m/min
Character height/width[1)]	0.1mm to 90mm (unit: 0.001mm)

1) The values shown here indicate the configurable range. Depending on your application, other marking settings, and the material of the workpiece, the optimal settings for maintaining marking or processing quality may vary.
2) Due to other settings, the actual movement of the laser beam may not be able to keep up with the scan speed and an error may occur. In this case, reduce the scan speed. (Example: applications where short lines are repeatedly marked or processed at high speeds)

Laser specifications	
Laser type	Yb: fiber laser, λ=1064nm, laser class 4
Output class	20W
Average output at processing point	17W (±5%) Average output at the time of delivery and a laser power setting of 100, a pulse duration of 4ns, and a pulse cycle of 1.6μs.

Laser specifications	
Oscillation method	Pulsed
Pulse duration	1ns, 4ns, 8ns, 16ns, 30ns, 120ns, 200ns (switchable)
Pulse cycle[1)]	0.5µs to 500µs
Guide laser and pointer	Red semiconductor laser, λ=655nm, laser class 2, max. output: 1mW
Beam stop	Laser head equipped with 1 shutter

1) The setting range of the pulse cycle varies depending on the setting of the pulse duration.

Pulse duration	Setting range	Pulse duration	Setting range
1ns	0.5µs to 5.0µs	30ns	1.2µs to 111.1µs
4ns	0.5µs to 16.6µs	50ns	1.7µs to 166.6µs
8ns	0.5µs to 33.3µs	120ns	3.0µs to 333.3µs
16ns	0.7µs to 62.5µs	200ns	5.0µs to 500.0µs

Other specifications	
Workpiece positioning	Stationary or moving workpiece
Number of marking files	Max. 10000
Number of objects per file	Max. 2000
Marking data	Characters, TrueType, bar codes, 2D codes, graphic files, points and shapes[1)]
Character arrangement	Straight line, arc, proportional, justify
I/O interfaces	TERMINAL connector (40 pins), I/O connector (40 pins)
Communication interfaces	EIA-RS-232C, Ethernet, EtherNet/IP, PROFINET For EtherNet/IP and PROFINET, the optional network unit must be installed on the controller.
Available software	Laser Marker NAVI smart, Logo Data Editing, ExportVEC, Font Maker
Operating system	Windows 11 Pro (64 bit), Windows 10 Pro (32 or 64 bit)
Laser Marker NAVI smart	Connection methods: USB, Ethernet User interface languages: English, German, Chinese (simplified), Chinese (traditional), Korean, Japanese
System start-up time	Approx. 10s
Laser pumping time	Approx. 1s
Operating voltage	180V AC to 264V AC (including a fluctuation range of ±10%)
Frequency	50/60Hz (switches automatically)
Power consumption (Current consumption)	≤310VA (≤2.1A) The typical inrush current at system start-up is 60A (220V AC) for max. 10ms.
Grounding method	Direct earth (laser head, oscillator unit, controller)
Overvoltage category	II

Other specifications	
Laser cooling method	Laser head: natural air cooling, oscillator unit and controller: forced air cooling
Fiber cable	Length: 2.0m (±0.2m) Minimum bend radius: 80mm
Installation direction	Laser head: in all directions, oscillator unit: vertically or horizontally, controller: vertically
Weight	Laser head: approx. 8kg, oscillator unit: approx. 13kg, controller: approx. 28kg
Battery (mounted in product)	1 Manganese dioxide lithium primary battery, product no. AFPX-BATT (CR-2450), weight: approx. 7g

1) Characters: Upper- and lowercase alphanumeric characters, Latin-1 characters, symbols, up to 50 user-defined characters, Japanese characters (katakana, hiragana, kanji JIS1 and JIS2), simplified Chinese characters (GB 2312-1 and GB 2312-2)
TrueType: TrueType fonts stored on the PC on which Laser Marker NAVI smart is installed can be used. Right-to-left scripts (e.g. Arabic or Hebrew) and scripts with ligatures (e.g. Indian) are not supported.
Bar codes: CODE39, CODE128 (GS1-128), ITF, NW-7, EAN/UPC/JAN, GS1 DataBar Limited, GS1 DataBar Stacked, GS1 DataBar Limited CC-A, GS1 DataBar Stacked CC-A
2D codes: QR Code, Micro QR Code, iQR Code, Data Matrix, GS1 DataMatrix, PDF417
Graphic files: VEC, DXF, BMP, HPGL, JPEG, AI, EPS. VEC is the graphic file type supported by the laser marking system. AI and EPS graphics have to be converted into the VEC format with the dedicated software ExportVEC.
Points and shapes: Point radiation, line, circle, arc

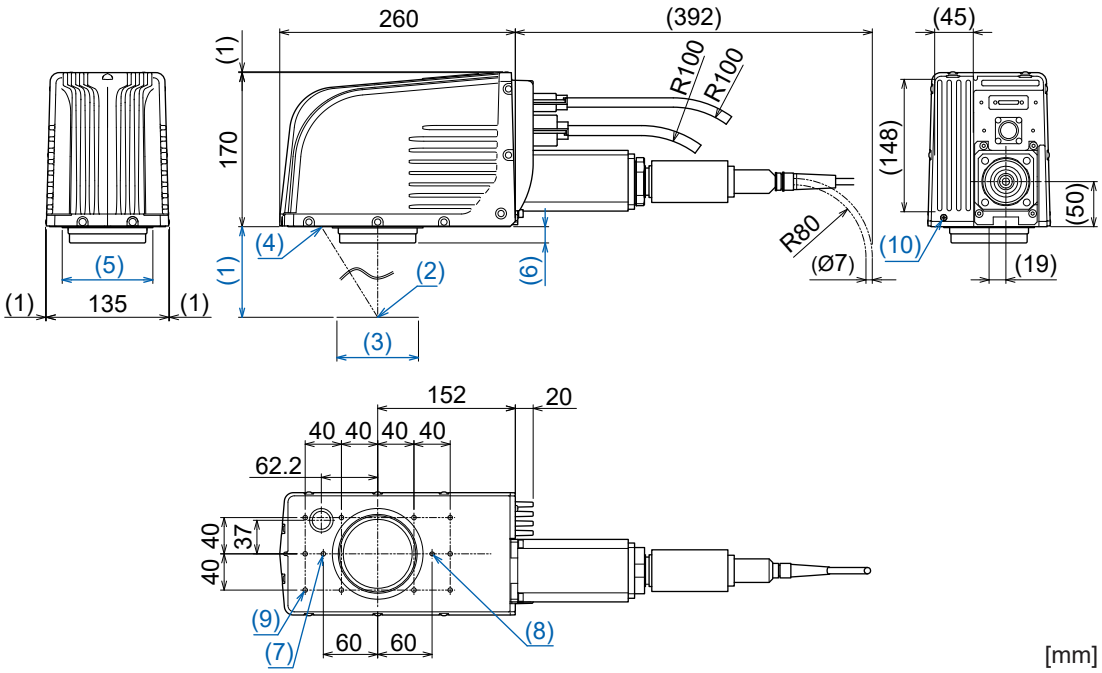
Operating environment	
Operating temperature[1)]	Laser head, oscillator unit, controller: 0°C to +36°C (laser power ≥46), 0°C to +40°C (laser power <46)[2)]
Operating humidity[1)]	35% to 85% RH
Storage temperature[1)]	-10°C to +60°C
Area of use	Indoor use only, at a max. altitude of 1000m
Degree of protection (laser head only)	IP64 (only if fiber unit, laser emission protection glass, cables, and connector covers are installed properly)
Pollution degree	2

1) No condensation or freezing: If there is a difference between storage temperature and operating temperature, make sure to have the product get used to the operating temperature gradually prior to use to prevent dew condensation.
2) If the laser power is corrected, e.g. by an offset value, the allowed operating temperature is based on the corrected value.

1.4 Dimensions

1.4.1 Laser head

Refer to the technical drawing and legend for dimensions.



[mm]

(1) Work distance (base position): 190mm

(2) Center of the marking field

(3) Marking field (X/Y): 90mm × 90mm

(4) Pointer emission port: Ø26mm (aperture diameter: Ø20mm)

(5) Laser emission port: Ø100mm (outer diameter)

(6) Laser emission port height: 20mm

(7) Positioning pin hole: Ø4mm +0.01mm/-0mm, depth 5mm

(8) Positioning pin hole: elongated hole Ø4mm +0.01mm/-0mm × 5, depth 5mm

(9) Fixing screw hole (10 holes): M6 screw, depth 6mm
Use 6 screws or more to fix the laser head.

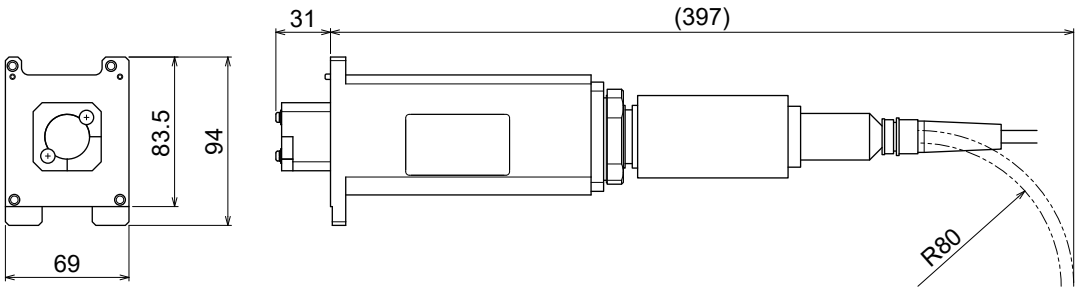
(10) Frame ground terminal: M4 screw, screw hole depth 5mm

Related topics

Laser head installation method (page 47)

1.4.2 Fiber unit

The drawing shows the dimensions when the fiber unit is detached from the laser head.



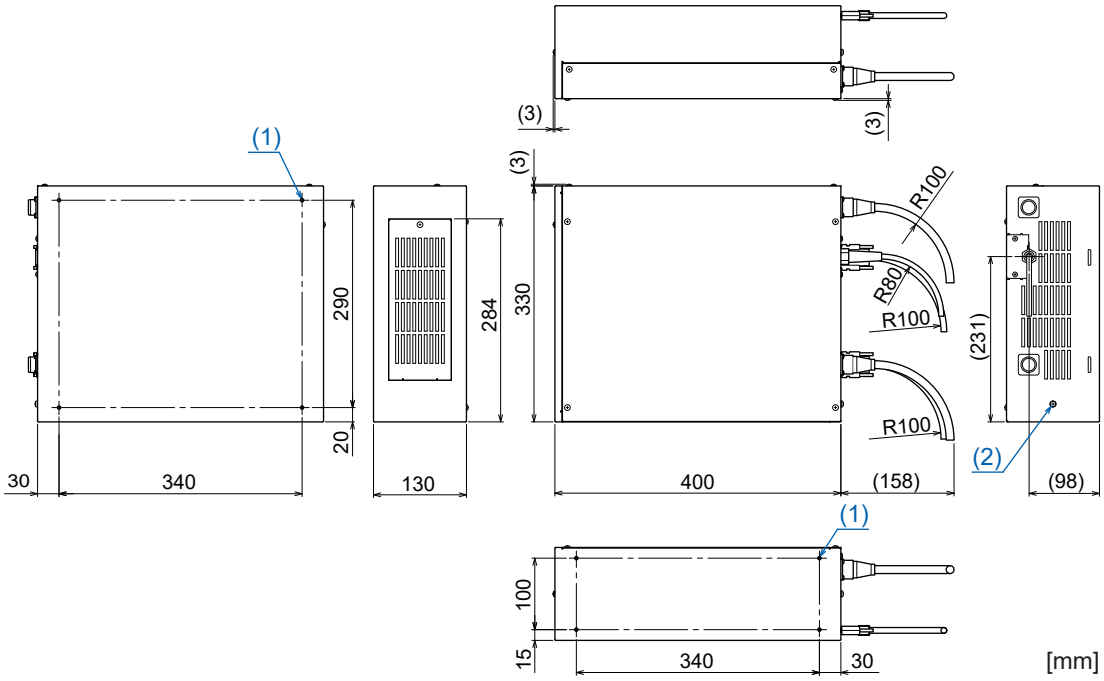
[mm]

Related topics

Detachment of the fiber unit (page 52)

1.4.3 Oscillator unit

Refer to the technical drawing and legend for dimensions.



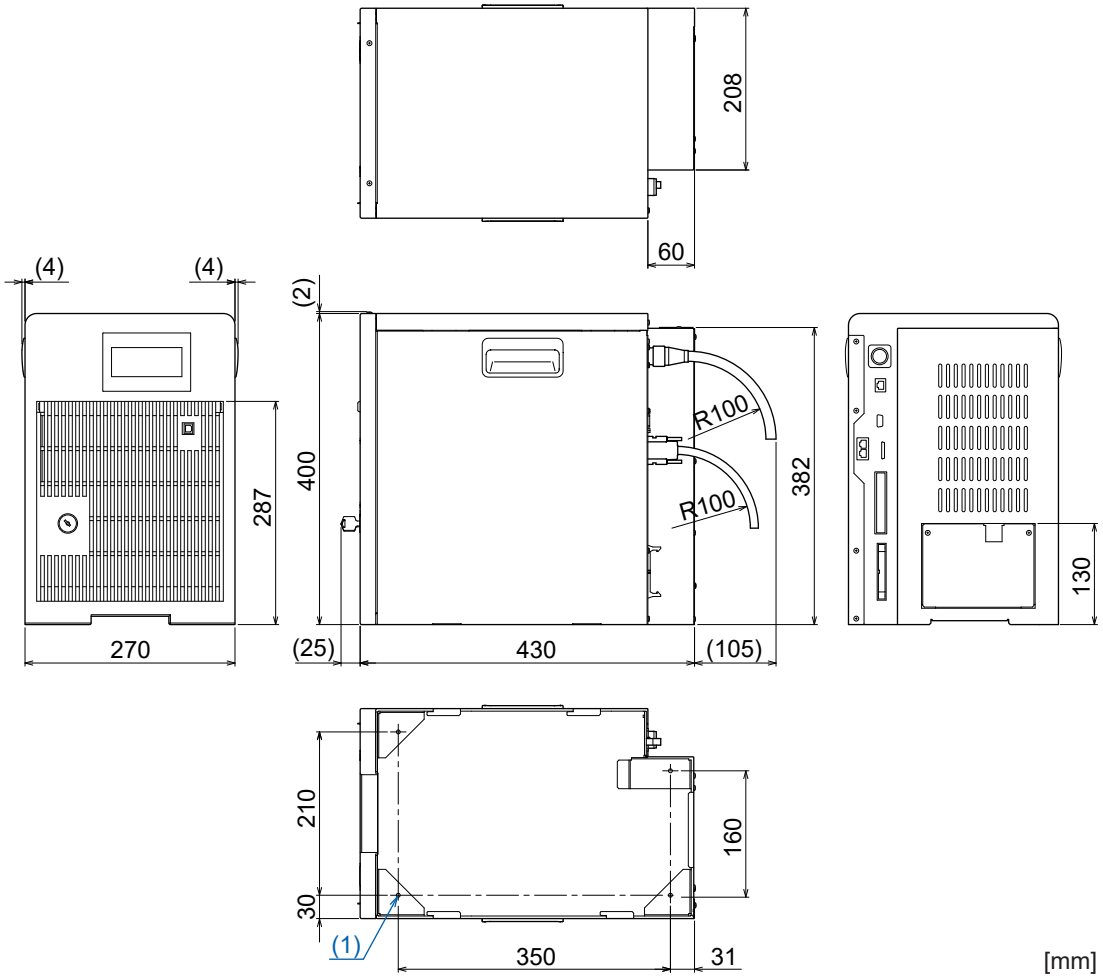
[mm]

(1) Fixing screw hole (4 holes each on the bottom and left side viewed from front): M5 screw, depth 6mm

(2) Frame ground terminal: M4 screw, screw hole depth 5mm

1.4.4 Controller

Refer to the technical drawing and legend for dimensions.



(1) Fixing screw hole (4 holes): M5 screw, depth 10mm

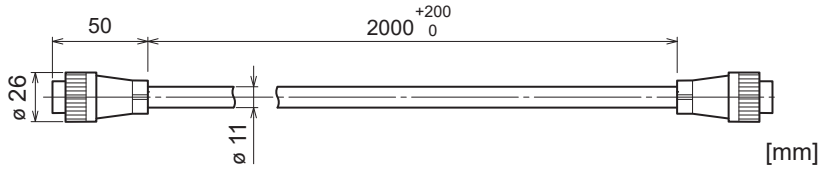
1.4.5 Cables

Refer to the technical drawing and legend for dimensions.

Two identical 2m signal cables and two identical 2m unit power cables are included in the product package. Additional 5m cables can be purchased from our sales offices.

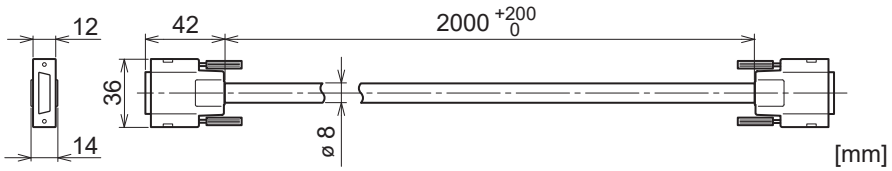
Unit power cable

Minimum bend radius: 100mm



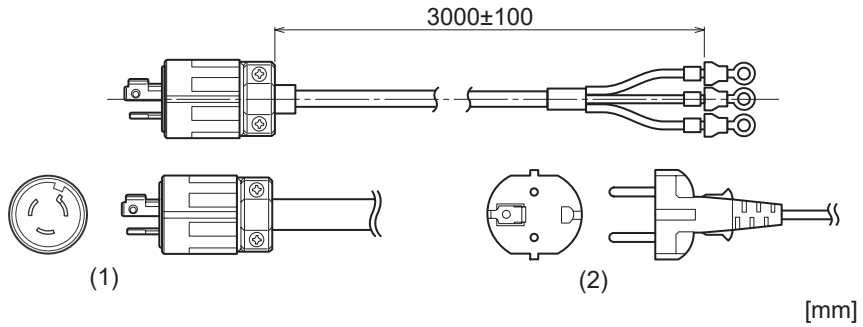
Signal cable

Minimum bend radius: 100mm



AC power cable (optional item)

The AC power cable is not included in the product package. Use one of the specified optional cables or a comparable cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used.



(1) LP-ACA11: 250V, NEMA L6-15P, PSE certified (Japan)
Minimum bend radius: 70mm

(2) LP-ACA12: 250V, CEE Public 7-7, CE certified (Europe)
Minimum bend radius: 50mm
The cable plug complies with the standards set by VDE, DEMKO, NEMKO, FIMKO, SEMKO, OVE, KEMA, CEBEC.

Notice

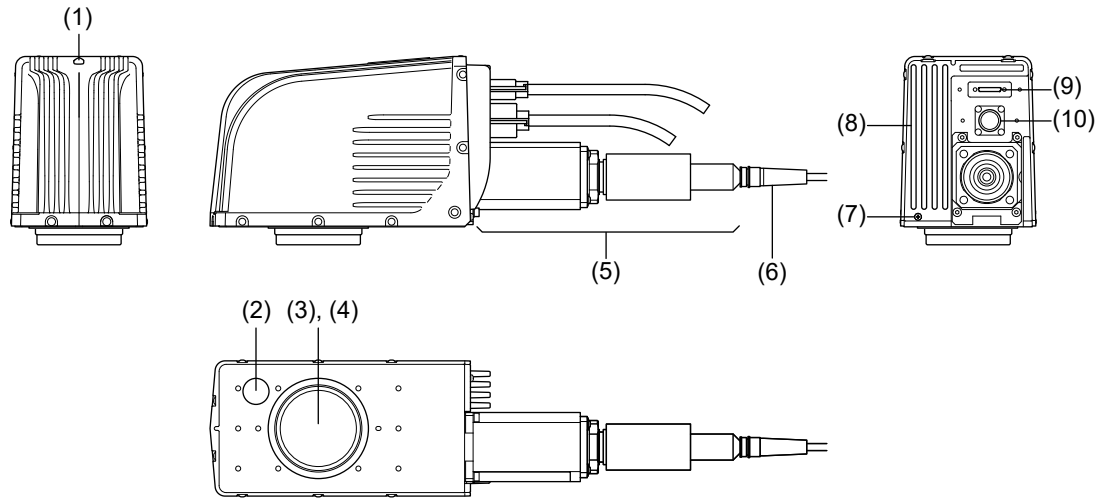
Be sure to connect the protective conductor of the AC power cable to ground permanently.

If you need an AC power cable, 250V, CCC certified (China), contact our service center or one of our sales offices.

1.5 Parts and functions

1.5.1 Laser head

The laser head emits the laser beam. Inside are the optical components and the galvano scanner.



(1) Laser head LED display
(2) Pointer emission port
(3) Laser emission port
(4) Protection glass of the laser emission port
(5) Fiber unit
(6) Fiber cable
(7) Frame ground terminal (F.G.)
(8) Heat sink
(9) SIGNAL connector
(10) POWER connector

The **laser head LED display (1)** indicates the status of laser radiation.

Color	LED status	Status of laser radiation
Orange	On	Laser emission in progress
Green	On	Shutter open/Laser pumping completed
Green	Flashes	Shutter open/Laser pumping in progress
White	On	Shutter closed/Laser pumping completed
White	Flashes	Shutter closed/Laser pumping in progress
	Off	Laser in non-pumped status

⚠ WARNING

If the laser head LED display is placed out of sight of operators, install an external signal lamp that is clearly visible.

From the **pointer emission port (2)**, a red laser beam is emitted diagonally when using the guide laser function to check the work distance. Make sure that the pointer emission port is not obstructed when installing the laser head. For details refer to Checking the marking position (page 50).

Always attach the **protection glass (4)** to protect the laser emission port from dirt or damage. Remove the plastic cap before operation.

The **fiber cable (6)** transmits the laser from the oscillator unit to the laser head. The fiber cable is permanently connected to the **fiber unit (5)**. The fiber unit can be detached from the laser head. For details refer to Detachment of the fiber unit (page 52).

Be sure to connect the **frame ground terminal (7)** to ground permanently.

Connect a signal cable to the **SIGNAL connector (9)** for communication between the laser head and the oscillator unit. The signal cables from laser head to oscillator and from oscillator to controller are identical. Connect a unit power cable to the **POWER connector (10)** to supply power to the laser head via the oscillator unit. The unit power cables from laser head to oscillator and from oscillator to controller are identical. For details refer to Connection of the laser head, oscillator unit, and controller (page 58).

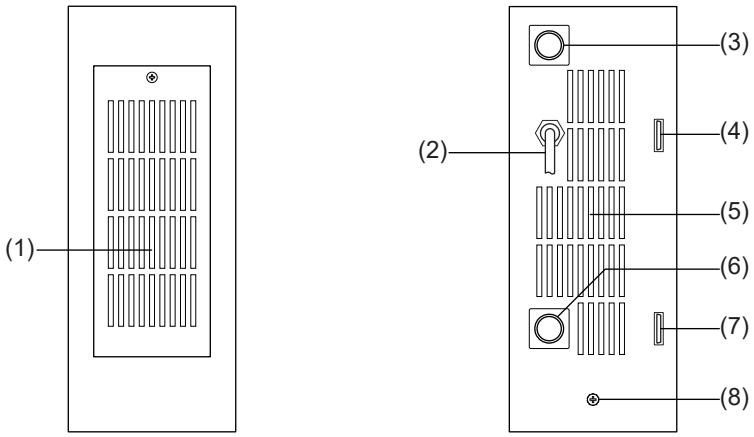
Notice

To ensure that the laser head meets the requirements of IP64, attach the included connector covers to the signal cable and to the unit power cable.
For details refer to Install the connector covers (page 60).

1.5.2 Oscillator unit

The oscillator unit generates the laser beam.

Front view (left) and rear view (right)



(1) Cooling air inlet
(2) Fiber cable
(3) POWER connector (for laser head)
(4) SIGNAL connector (for laser head)
(5) Cooling air outlet
(6) POWER connector (for controller)
(7) SIGNAL connector (for controller)
(8) Frame ground terminal (F.G.)

A filter is installed in the **cooling air inlet (1)** of the oscillator unit.

The **fiber cable (2)** transmits the laser from the oscillator unit to the laser head. The fiber unit is permanently connected to the oscillator unit.

Connect one signal cable to the upper **SIGNAL connector (4)** for communication between the laser head and the oscillator unit. Connect another signal cable to the lower **SIGNAL connector (7)** for communication between the oscillator unit and the controller. The signal cables from laser head to oscillator and from oscillator to controller are identical.

Connect one unit power cable to the upper **POWER connector (3)** to supply power to the laser head. Connect another unit power cable to the lower **POWER connector (6)** to supply power to the oscillator unit via the controller. The unit power cables from laser head to oscillator and from oscillator to controller are identical.

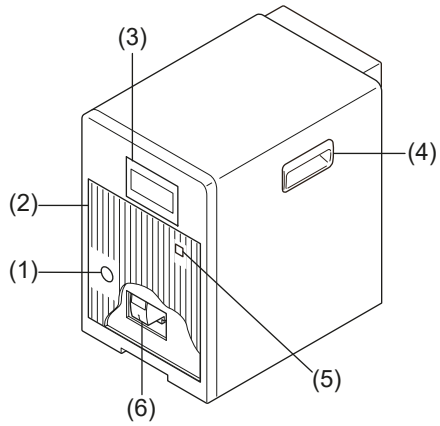
For details refer to Connection of the laser head, oscillator unit, and controller (page 58).

Be sure to connect the **frame ground terminal (8)** to ground permanently.

1.5.3 Controller

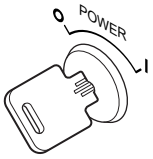
The controller generates the marking data. It provides the main power supply of the laser marking system and interfaces for external devices.

Front view



(1) Key switch (POWER)
(2) Cooling air inlet
(3) Controller LED display
(4) Handle
(5) USB type B interface
(6) Circuit protector

Turn the **key switch (1)** from 0 to I to start the system. To terminate the system, turn the switch from I to 0 and remove the key.



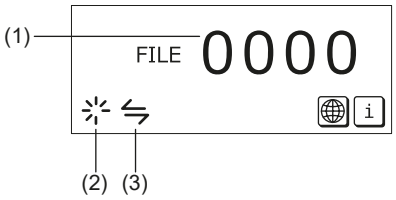
The laser safety officer is responsible for the key. Wait at least 5 seconds before restarting the system after termination. Do not turn off the power supply while the system starts ("PLEASE WAIT" is displayed).

A filter is installed in the **cooling air inlet (2)** of the controller.

The backlight color of the **controller LED display (3)** indicates the status of the laser marking system. The following colors are the default colors.

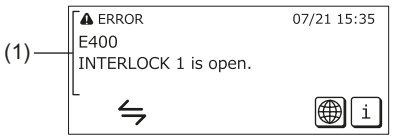
White: Normal operation
Red: There is an alarm
Pink: There is a warning

Normal operation display:



(1) File number
(2) Laser pumping
(3) Remote mode (operation by external device)

Alarm and warning display:



(1) Error code and error message

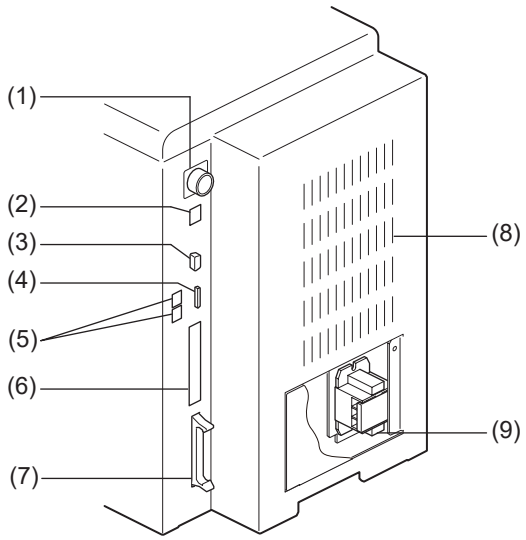
For details about the controller LED display refer to Using the touch-sensitive controller display (page 76) and Specify settings for the controller display (page 77).

Use the **handle (4)** and support the bottom with the other hand to lift the controller. Carry the controller with two persons. For details refer to Controller installation (page 57)

Use the **USB type B interface (5)** to connect a PC with the Laser Marker NAVI smart software via USB cable.

In the event of an overcurrent, the **circuit protector (6)** inside the front cover turns off to cut off the current. For details refer to Restore the circuit protector (page 65).

Rear view



(1) POWER connector
(2) Ethernet interface LAN
(3) RS-232C interface
(4) SIGNAL connector
(5) Interface for EtherNet/IP or PROFINET
(6) TERMINAL connector
(7) I/O connector
(8) Cooling air outlet
(9) AC power supply terminals AC INPUT

Connect a unit power cable to the **POWER connector (1)** to supply power to the oscillator unit. The unit power cables from laser head to oscillator and from oscillator to controller are identical. For details refer to Connection of the laser head, oscillator unit, and controller (page 58).

Use the **Ethernet interface LAN (2)** to connect one of the following devices via Ethernet: PC with the Laser Marker NAVI smart software, PLC or PC for control by communication commands, special external devices, e.g. image processing devices.

Use the **RS-232C interface (3)** to connect one of the following devices: PLC or PC for control by communication commands, code reader for modifying the marking data on the basis of captured code commands.

Connect a signal cable to the **SIGNAL connector (4)** for communication between the controller and the oscillator unit. The signal cables from laser head to oscillator and from oscillator to controller are identical. For details refer to Connection of the laser head, oscillator unit, and controller (page 58).

The **interface for EtherNet/IP or PROFINET (5)** is a 2-port switch that can be used to control the laser marking system by an external device such as a PLC. Use a LAN cable to connect the external device. The interface is only available if the corresponding network unit has been attached to the controller. For details, please refer to the “EtherNet/IP Communication Guide” or “PROFINET Communication Guide”.

Use the **TERMINAL connector (6)** for external control of the laser marking system via I/O signals. Attach the provided I/O terminal block. For details refer to Pin assignment of the TERMINAL connector (page 105).

Use the **I/O connector (7)** for external control of the laser marking system via I/O signals. For details refer to Pin assignment of the I/O connector (page 116).

Use the AC power cable to connect the following power supply to the **AC power supply terminals AC INPUT (9)**: 180V AC to 264V AC (including a fluctuation range of ±10%), 50/60Hz (voltage and frequency are switched automatically). The AC power cable is not included in the product package. Use one of the specified optional cables or a comparable cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used. For details refer to Cables (page 34).

Notice

Be sure to connect the protective conductor of the AC power cable to ground permanently.
For details refer to Connect the power supply and earth (page 63).

2 Installation

2.1 Installation environment

To prevent failure or malfunctions, the operating environment must comply with the specifications of the laser marking system.

Operating environment	
Operating temperature[1)]	Laser head, oscillator unit, controller: 0°C to +36°C (laser power ≥46), 0°C to +40°C (laser power <46)[2)]
Operating humidity[1)]	35% to 85% RH
Storage temperature[1)]	-10°C to +60°C
Area of use	Indoor use only, at a max. altitude of 1000m
Degree of protection (laser head only)	IP64 (only if fiber unit, laser emission protection glass, cables, and connector covers are installed properly)
Pollution degree	2

1) No condensation or freezing: If there is a difference between storage temperature and operating temperature, make sure to have the product get used to the operating temperature gradually prior to use to prevent dew condensation.

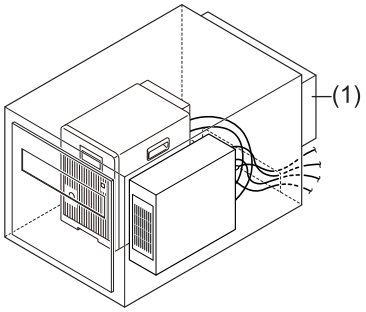
2) If the laser power is corrected, e.g. by an offset value, the allowed operating temperature is based on the corrected value.

Notice

- Do not install the laser marking system at a place where vibrations and shocks can be directly transmitted to it. In any environment where effects of vibration are concerned, take measures against vibration on the product, e.g. fitting rubber feet.
- Do not use the laser marking system in a place where there is an oil mist or dust. Take measures to prevent dust from entering the laser marking system, e.g. by using a protective enclosure.

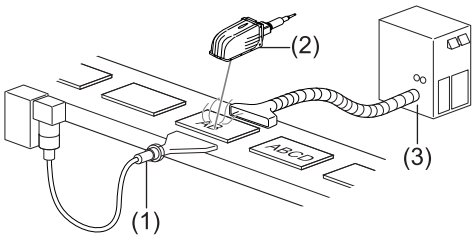
Notice

- If the oscillator unit and the controller are installed in a protective enclosure, a panel cooling unit or heat exchanger is recommended to ensure proper cooling of the oscillator unit and the controller.



(1) Panel cooling unit or heat exchanger

- Remove dust, fume or particles generated during the marking process by placing the suction nozzle of a dust collector or fume exhauster as near as possible to the workpiece. In case dust or fumes adhere to the laser emission port, such as oily fume, construct an air flow system with compressed air to remove all contaminations reliably. Any contamination on the laser emission port may cause failure or decrease the laser marking or processing quality.



(1) Compressed air
(2) Laser head
(3) Dust collector or fume exhauster

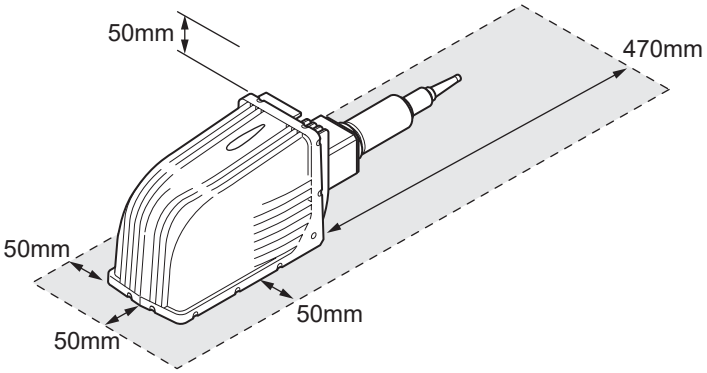
2.2 Installation space

Provide sufficient space around the laser marking system to assure proper air cooling.

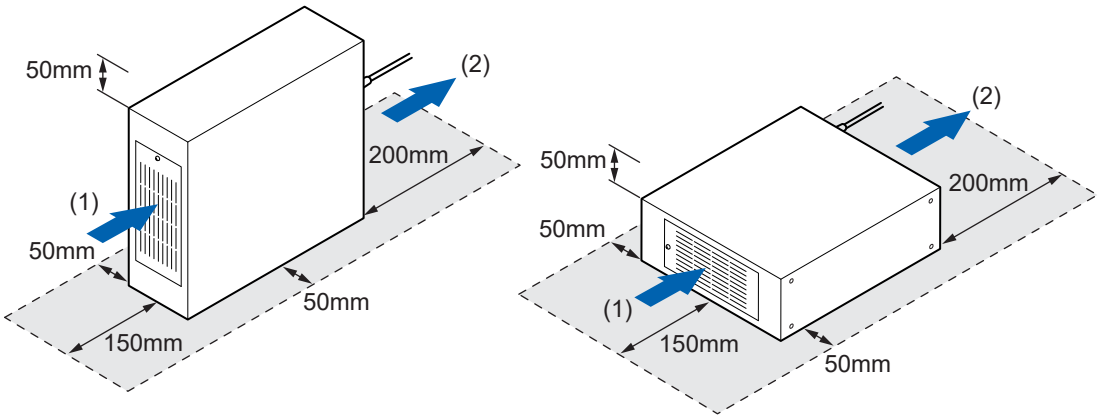
Notice

- To maintain the air-cooling performance of the laser marking system, install the laser head, oscillator unit, and controller in a well-ventilated place.
- Installation near a heat source may increase the operating temperature above the acceptable range, which may cause malfunction of the product.

Laser head

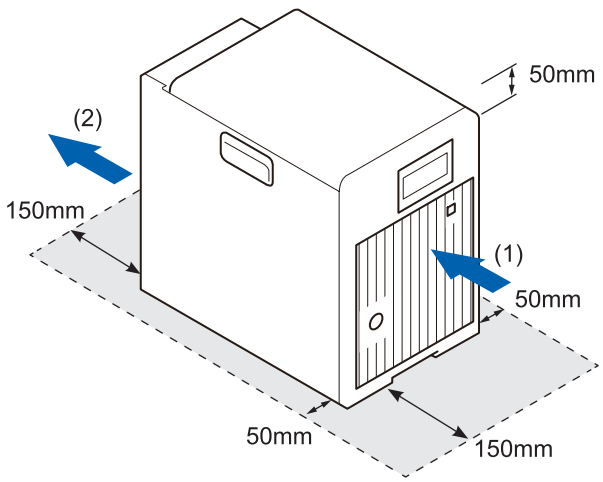


Oscillator unit



(1) Intake air
(2) Exhaust air

Controller



(1) Intake air
(2) Exhaust air

2.3 Laser head installation

Failure to observe the following precautions when installing the laser head can result in serious or moderate injury.

⚠ WARNING

- Make sure the power is turned off before installation. Otherwise, there is a risk of an electrical shock.
- Install the product so that the laser beam path is not at eye level.
- Build a protective enclosure with proper reflectance, durability and thermal resistance to enclose the laser radiation range without leakage.

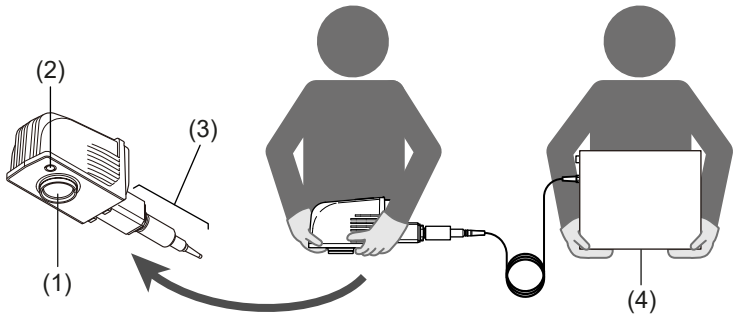
Carrying the laser head

To carry this product, wear non-slip gloves. Hold the product with both hands. Do not carry this product by holding the fiber unit, cables or connectors.

Do not touch the laser emission port on the bottom of the laser head because this may have negative effects on the marking quality.

The laser head and the oscillator unit are connected with a fiber cable. Carry these units with two person to avoid strain on the fiber cable.

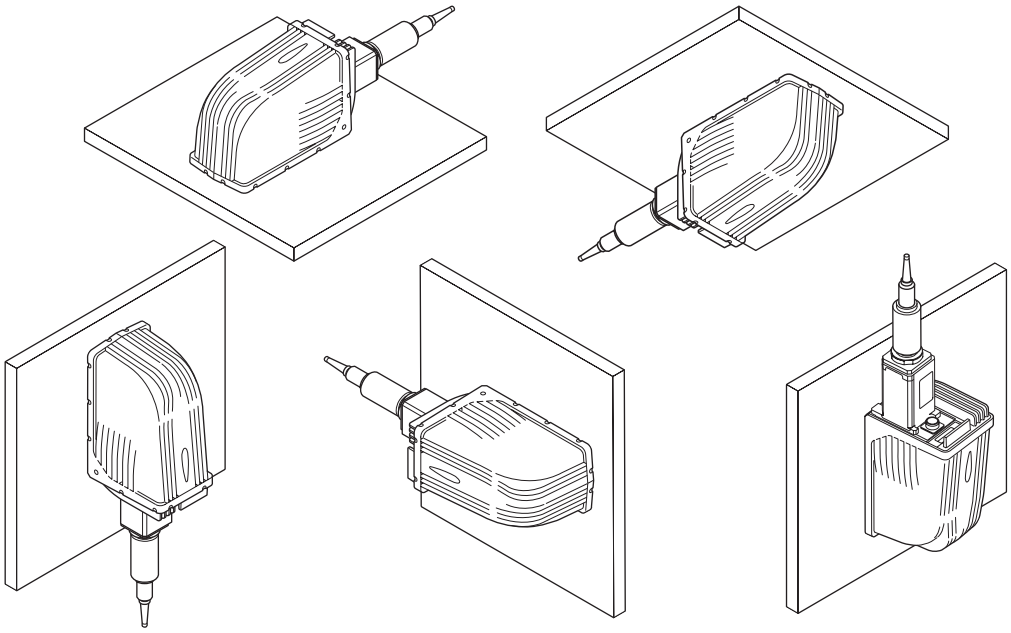
Carry the laser head as shown in the figure below.



(1) Laser emission port
(2) Pointer emission port
(3) Fiber unit
(4) Oscillator unit

2.3.1 Laser head installation directions

The laser head can be installed in all directions (up, down, left, and right).



Notice

- Do not move the laser head during operation.
- If the laser head is installed with the lens side up, clean the lens surface regularly so that it is not covered by the marking dust.
- Be sure to fix the bottom surface of the laser head (the laser emission port side).

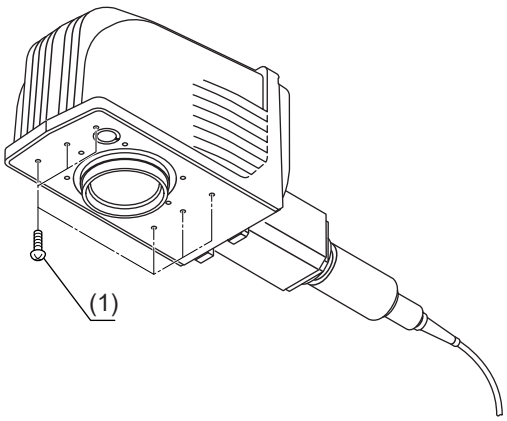
Related topics

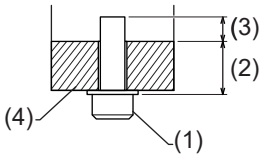
Laser head installation method (page 47)

2.3.2 Laser head installation method

To install the laser head, you must fix the bottom surface (laser emission port side) to a custom-made mounting plate.

Use a mounting plate with a thickness of 10mm to 20mm and made of aluminum or other material with a radiation performance equivalent to that of aluminum.





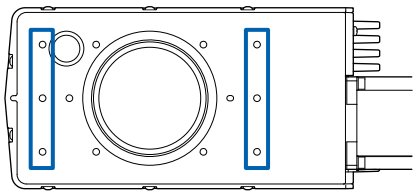
(1) M6 screw at 6 positions or more, tightening torque: 3.0Nm

(2) Thickness of washer and mounting plate

(3) Insert length: 5mm to 6mm

(4) Mounting plate

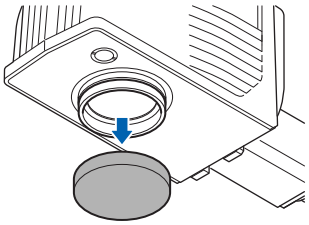
When installing the head, use at least six of the ten M6 screw holes on the bottom. As shown in the example, use a combination of screw holes that will secure the head evenly on all sides.



Bottom side of the laser head

Notice

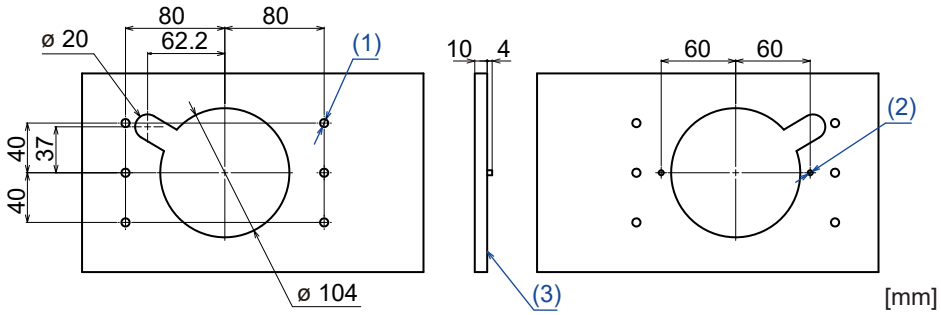
- Do not insert any screws exceeding the specified length. Otherwise, the product may not function properly.
- Be careful not to damage the lens after you have removed the protection cap on the laser emission port.



Mounting plate example

In the following example, the mounting plate has a thickness of 10mm. As the pointer emits the beam towards the center of the marking field, it is recommended to connect the two holes for the emission port of the marking laser and the emission port of the pointer so that the pointer's beam path does not interfere with the plate.

Change the position of the fixing holes depending on the screw holes you want to use.



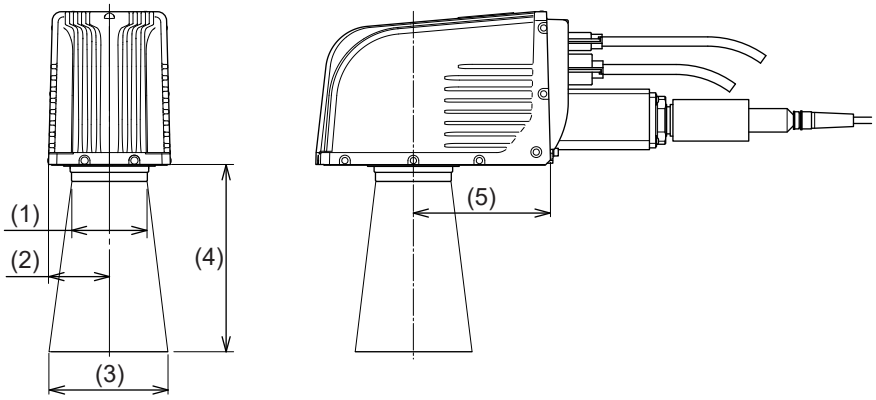
(1) Fixing hole (6 holes): ∅6.6mm through hole

(2) Positioning pin (2 pins): ∅4mm stainless steel; height 4mm

(3) Side facing the bottom of the laser head

2.3.3 Work distance and center of the marking field

The work distance is the distance from the bottom surface of the laser head to the center of the marking field on the workpiece surface.



(1) Diameter of laser emission port: 87mm

(2) Distance to the center of the marking field: 67.5mm

(3) Marking field (X, Y): 90mm × 90mm

(4) Work distance (Z): 190mm

(5) Distance to the center of the marking field: 152mm

Notice

- Do not place anything between the laser emission port and the workpiece during laser emission.
- Use anti-reflection coating (ex. black paint for metal) for an external shutter or a protective enclosure in the path of the laser beam. Otherwise, the components inside the laser head may be damaged.
- If any other devices such as a sensor or a camera are installed near the laser marking position, make sure that these devices are not damaged by the direct or indirect laser beam.

2.3.4 Checking the marking position

The marking position can be checked with the red laser beam of the guide laser.

2.3.4.1 Guide laser

Use the guide laser to display the marking field, marking image, masked objects, or work distance.

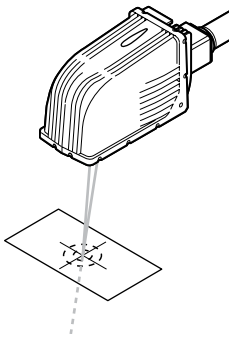
Notice

- The guide laser function is used for reference only. To obtain the most appropriate marking quality, fine adjust the work distance and the position of the workpiece after performing a test marking.
- When the fiber unit is removed and re-installed, the lasing position might be misaligned relative to the guide laser radiation position. To align the lasing position, calibrate the marking field as described in the “Laser Marker NAVI smart Operation Manual”.

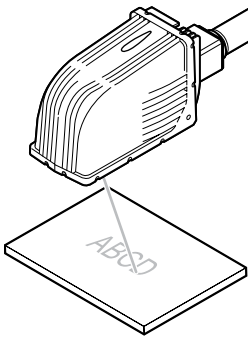
The guide laser is a red laser beam to simulate the marking process or to indicate the marking field and work distance. Use the Laser Marker NAVI smart configuration software to select a display mode.

Select one of the following settings for “Guide laser display”:

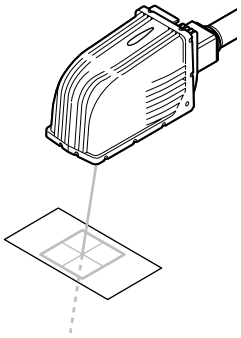
- “Work distance”: Select this mode to adjust the work distance. The guide laser displays the dot of the pointer and the crosshairs. Adjust the distance so that the dot of the pointer overlaps with the center of the crosshairs.



- “Marking image”: The guide laser displays the marking data in the file. Objects are not displayed if they are set to “OFF” under “Marking ON/OFF”.



- “Marking field”: The guide laser displays the marking field frame and center lines. The pointer indicates the center of the marking field.



- “Masked objects”: The guide laser displays marking objects with the following settings:
  - “OFF” is set for “Marking ON/OFF”.
  - “Guide laser display” is selected.

For more instructions on how to use the guide laser functions, refer to “Laser Marker NAVI smart Operation Manual”.

2.3.5 Tips for achieving consistent marking quality

Due to the characteristics of the laser marking system, the laser power, the focus (working distance) and marking status can fluctuate depending on the ambient temperature or operating conditions.

To achieving reliable results, consider the following measures:

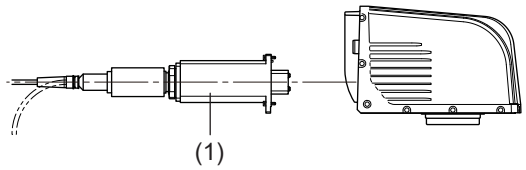
- Before engaging in full-scale operation, it is essential to perform test marking to confirm that there is flexibility in the marking settings and that the marking performance remains stable.
- Take necessary measures for air conditioning, ventilation, and waste heat management to minimize fluctuations in ambient temperature.
- If you are moving the laser marking system to an area with a different ambient temperature, allow it to acclimate to the new ambient temperature before use.

The following are some examples of changing ambient temperatures or changing environments that can affect marking results.

- When the laser marking system is installed immediately after transport
- When the laser marking system is started for the first time or when it is started at the beginning of the day
- After an extended period of inactivity (e.g. after a long holiday)
- Temperature changes between seasons or from day to night
- When the product configuration is changed
- Extreme fluctuations in the operation time of the laser marking system
- When the temperature of the laser marking system is low

2.3.6 Detachment of the fiber unit

The fiber unit, which is attached to the laser head at delivery, can be removed temporarily during installation.



(1) Fiber unit

⚠ WARNING

Turn off the power supply and disconnect the AC power cable before you remove or install the fiber unit. Otherwise, there is a risk of exposure to laser radiation or of electrical shock.

Notice

- The fiber unit cannot be disconnected from the oscillator unit. Trying to remove it forcibly may cause malfunction.
- We recommend that you connect a laser head, oscillator unit, and controller which have identical serial numbers.
- To ensure that the laser head meets the requirements of IP64, make sure that the fiber unit is mounted properly. Read this section thoroughly to avoid incorrect removal and installation.
- When the fiber unit is removed and re-installed, the actual marking position may be misaligned relative to the marking field indicated by the guide laser. For details on how to calibrate the marking field, refer to the “Laser Marker NAVI smart Operation Manual”.
- Avoid oil mist, dust, and dirt when removing or installing the fiber unit.

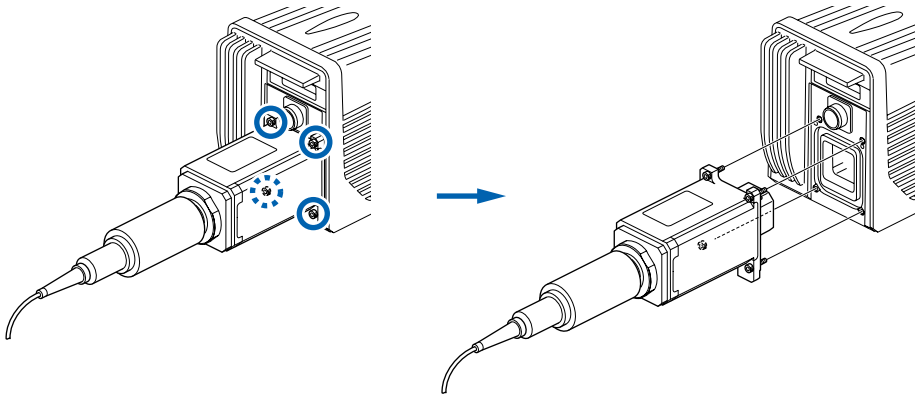
You need the following items:

- Hex key (ball point, M5, L=150mm)
- Scanner cover (included accessory)
- M5 screws (included accessories)
- Clean plastic bag to protect the fiber unit
- O-ring for fiber unit (optional accessory)
- Air duster to clean the optical components

2.3.6.1 Remove the fiber unit

The fiber unit can be disconnected from the laser head.

1. Use a ball point hex key to loosen the 4 fixing screws on the fiber unit and carefully remove the unit from the head.



Notice

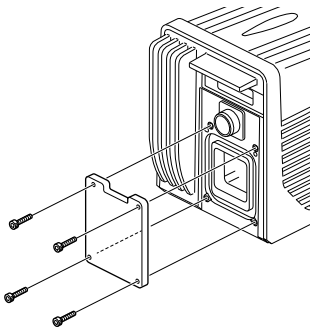
- Only remove the four fixing screws; removing any other screws may cause malfunction.
- Insert the ball point hex key as straight as possible to avoid breaking the screw head.

2. Put a clean plastic bag over the fiber unit as a protection.

Notice

Make sure that the lens is not contaminated by fingerprints or dust. Any contamination of the lens may cause failure or decrease the laser marking quality.

3. Use a hex key to install the scanner cover with 4 screws.
   Tightening torque: 0.7Nm to 1.3Nm



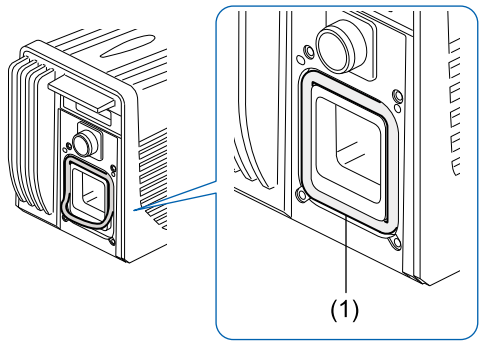
Notice

- Always attach the scanner cover when the fiber unit is detached from the scanner unit.
- The scanner cover should only be used temporarily because it is not water resistant.

2.3.6.2 Re-install the fiber unit

When re-installing the fiber unit make sure the fiber cable is not twisted and the optical components are not contaminated.

1. Remove the scanner cover and keep it for the next use.
   Make sure that the o-ring (1) is attached to the joint part of the fiber unit properly.



Notice

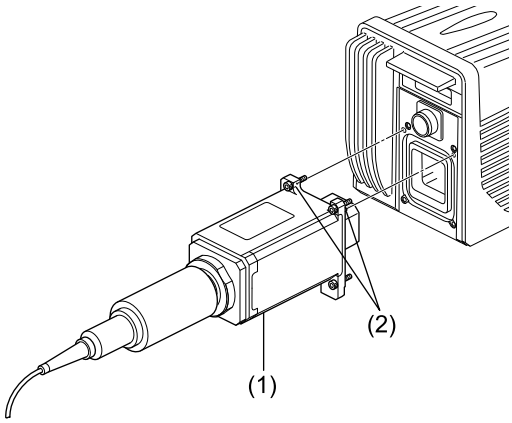
If there are signs of deterioration or damage in the o-ring, replace it. For replacement, order product no. LP-ACC10 (set of connector cover and gasket).

2. Make sure that the fiber cable is not twisted.

Notice

A twisted fiber cable may cause a power decrease or other malfunction.

3. If a plastic bag or other protection cover is attached to the fiber unit, remove it.
4. Align the fiber unit to the head by using the positioning pin.

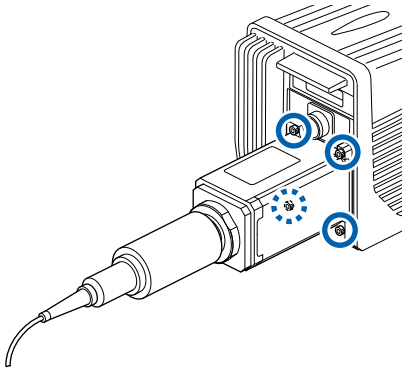


(1) Fiber unit
(2) Positioning pin

Notice

Make sure that the optical components of the fiber unit are not contaminated by any foreign matter such as fingerprints, dust, grease, or oil. Blow away any contamination using an air duster for optical components.

5. Loosely tighten the screws, then tighten them further in a crisscross pattern with a tightening torque of 1.5Nm.



Notice

- Handle the fiber unit with care. Any shocks may cause malfunction.
- Insert the ball point hex key as straight as possible to avoid breaking the screw head.
- If the o-ring is deformed by forcibly inserting the screws, the IP64 requirements cannot be met. Use a torque wrench or similar tool to avoid overtightening the screws.

6. Check the lasing position.
   If there is a gap between the marking field indicated by the guide laser and the actual lasing position, calibrate the marking field. For details on how to calibrate the marking field, refer to the “Laser Marker NAVI smart Operation Manual”.

2.4 Oscillator unit installation

The oscillator unit may be installed in vertical or horizontal direction.

⚠ WARNING

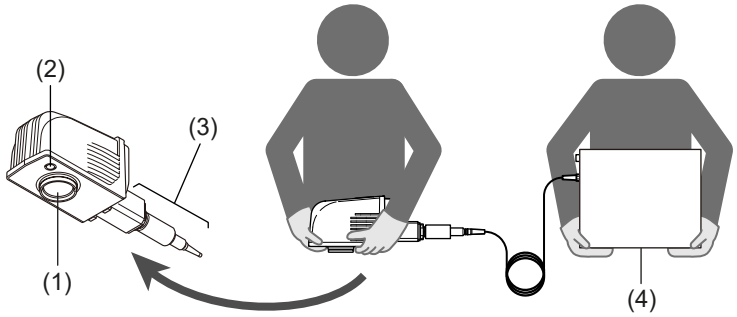
Make sure the power is turned off before installation. Otherwise, there is a risk of an electrical shock.

Carrying the oscillator unit

To carry this product, wear non-slip gloves and safety shoes. Hold the product with both hands. Do not carry this product by holding the fiber unit, cables or connectors.

The laser head and the oscillator unit are connected with a fiber cable. Carry these units with two person to avoid strain on the fiber cable.

Carry the laser head (left) and the oscillator unit (right) as shown in the figure below.

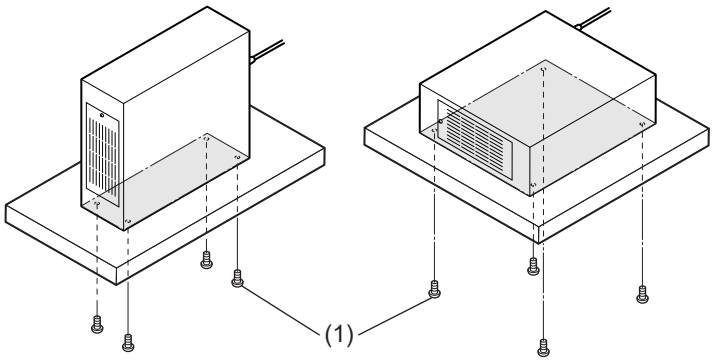


(1) Laser emission port
(2) Pointer emission port
(3) Fiber unit
(4) Oscillator unit

Installation method

The oscillator unit can be installed vertically or horizontally. For horizontal installation, ensure that the left side of the oscillator unit (when viewed from the front) is at the bottom, as shown in the figure below.

For details on the location of the fixing screw holes, refer to Oscillator unit (page 33).



(1) M5 screw, 4 positions, tightening torque: 2.0Nm, insert length: 4mm to 6mm

Notice

- Do not insert any screws exceeding the specified length. Otherwise, the product may not function properly.
- Do not install the laser marking system at a place where vibrations and shocks can be directly transmitted to it. In any environment where effects of vibration are concerned, take measures against vibration on the product, e.g. fitting rubber feet.
- Do not install the oscillator unit in a direction other than described above.

2.5 Controller installation

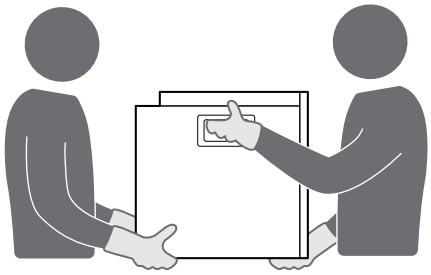
Failure to observe the following precautions when installing the controller can result in serious or moderate injury.

⚠ WARNING

- Make sure the power is turned off before installation. Otherwise, there is a risk of an electrical shock.
- Carry the controller of this product series with two persons. Lifting or carrying the product without assistance can cause muscle strain or back injury.
- To carry this product, wear non-slip gloves and safety shoes. Hold the product with both hands. Do not carry this product by holding the cables and connectors. In case the unit falls down, it may cause injury.

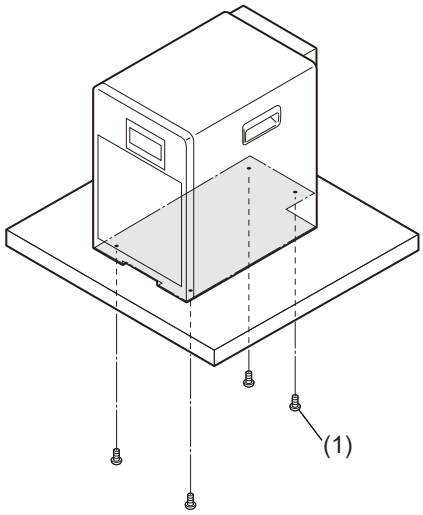
Carrying the controller

Carry the controller as shown in the figure below.



Installation method

- The controller must be installed vertically.
- For details on the location of the fixing screw holes, refer to Controller (page 34).



(1) M5 screw, 4 positions, tightening torque: 2.0Nm, insert length: 5mm to 10mm

Notice

- Do not insert any screws exceeding the specified length. Otherwise, the product may not function properly.
- Do not install the laser marking system at a place where vibrations and shocks can be directly transmitted to it. In any environment where effects of vibration are concerned, take measures against vibration on the product, e.g. fitting rubber feet.
- Do not install the controller horizontally.

2.6 Hardware connection

2.6.1 Connection of the laser head, oscillator unit, and controller

The laser marking system is shipped with four cables which must be connected to the laser head, the oscillator unit, and the controller, two for signal transmission and two for power supply to the oscillator unit and laser head.

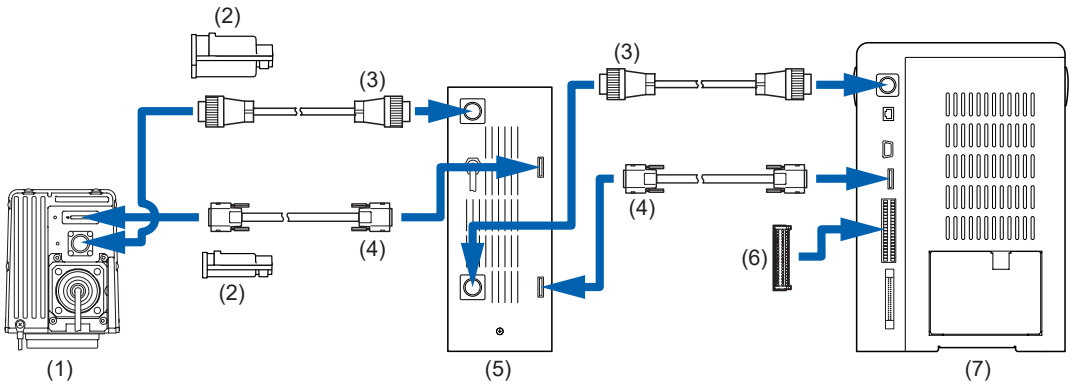
⚠ WARNING

- Make sure that the power is turned off before you connect the AC power supply terminals. Otherwise, there is a risk of an electrical shock.
- Be sure to connect the laser head, oscillator unit, and controller of the laser marking system using combinations from the same product series. If incompatible devices are connected to the laser head or oscillator unit, there is a risk of exposure to laser radiation or failure.

Notice

- We recommend that you connect a laser head, oscillator unit, and controller which have identical serial numbers.
- Use the cables supplied with this product or the specified optional cables.
- Insert the connectors all the way without tilting them.
- Be careful not to crush or put stress on the cables.
- Make sure the minimum bend radius of each cable is observed, and take care not to apply excessive force on the cables.
- To ensure that the laser head meets the requirements of IP64, install the included connector covers.

Connect the cables and the I/O terminal block to the connectors on the rear of the laser head (left), oscillator unit (middle), and controller (right):



(1) Laser head
(2) Connector cover
(3) Unit power cable (POWER connector)
(4) Signal cable (SIGNAL connector)
(5) Oscillator unit
(6) I/O terminal block (TERMINAL connector)
(7) Controller

The laser head and the oscillator unit are connected with a fiber cable (2m).

Two identical 2m signal cables and two identical 2m unit power cables are included in the product package. 5m cables (unit power cable, signal cable) for the oscillator unit to controller connection are available as an option. If you want to buy a cable or if you need further information, contact our service center or one of our sales offices.

When shipped, some terminals of the I/O terminal block are connected by jumper wires. Do not remove these wires unless you want to connect external devices. If any of these terminals are not connected, laser radiation is disabled. For information on the factory settings, refer to Factory setting of the jumper wires (page 128).

LASER STOP IN (X10)	–	OUT COM. 1 (X12)
LASER STOP IN (X11)	–	OUT COM. 1 (X12)
INTERLOCK 1(+) (X16)	–	INTERLOCK 1(-) (X17)
INTERLOCK 2(+) (X18)	–	INTERLOCK 2(-) (X19)
REMOTE INTERLOCK (X20)	–	OUT COM. 1 (X12)

IN COM. 1 (X2)	–	Power supply
OUT COM. 1 (Y2)	–	Power supply

Connect the common terminals IN COM. 1 (X2) and OUT COM. 1 (Y2) to the internal or external power supply of the inputs and outputs.

Related topics

Wiring of the common terminals (page 129)

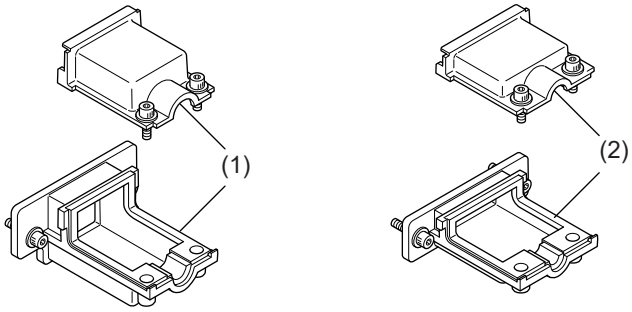
2.6.1.1 Install the connector covers

To ensure that the laser head meets the requirements of IP64, attach the included connector covers to the signal cable and to the unit power cable.

Notice

If there are signs of deterioration or damage in the gaskets of the connector covers, replace the connector covers. For replacement, order product number LP-ACC10 (set of connector cover and gasket).

Make sure that the product package contains the following parts of the connector covers:

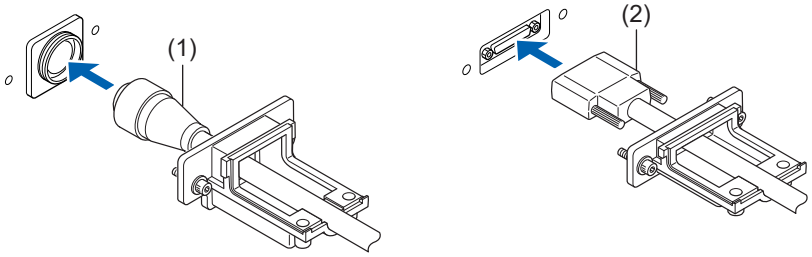


(1) Bottom and top parts of connector cover for unit power cable
(2) Bottom and top parts of connector cover for signal cable

Connect the unit power cable to the POWER connector and the signal cable to the SIGNAL connector on the rear of the laser head. Connect the unit power cable first and attach the connector cover. Then connect the signal cable.

To tighten the screws, use an M4 hex key and a tightening torque of 0.5Nm.

1.



(1) Unit power cable
(2) Signal cable

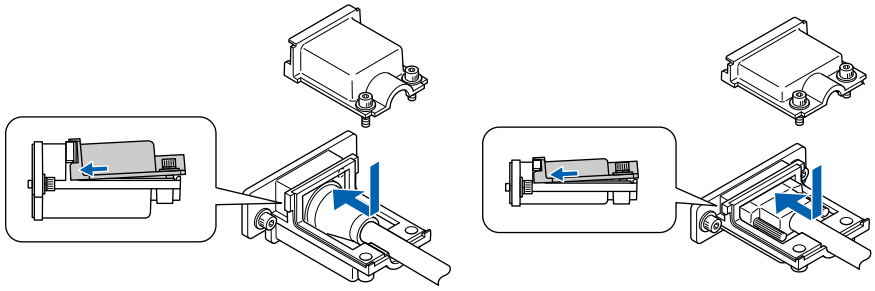
2.



3.



4.



5.

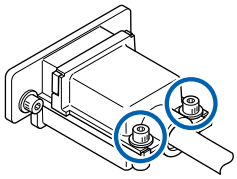


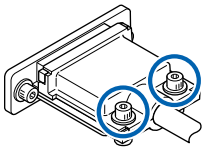
2.6.1.2 Disconnect the unit power or signal cable

To disconnect the unit power cable or the signal cable, you must first remove the connector covers.

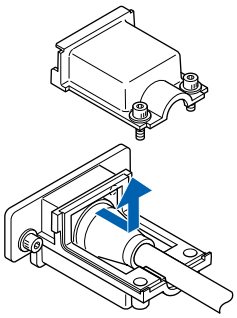
When loosening the screws, do not remove the screws and washers from the case. Use an M4 hex key.

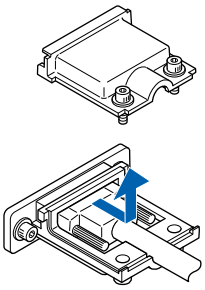
1.



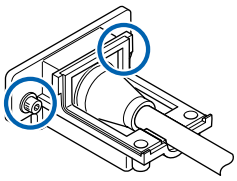


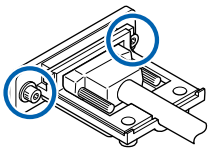
2.



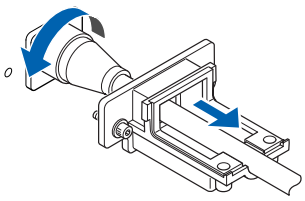


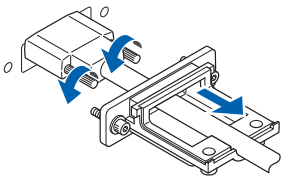
3.





4.





2.6.2 Connect the power supply and earth

Before you connect the power supply, be sure to ground the product properly to protect operators and devices in case of a failure.

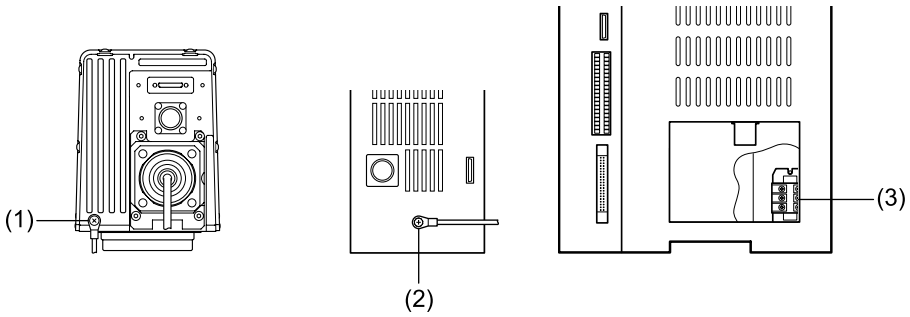
⚠ WARNING

- When connecting the power supply, be sure to ground this product properly. Otherwise, there is a risk of malfunction and electrical shock in case of a failure or leakage current.
- Make sure that the power is turned off before you connect the AC power supply terminals. Otherwise, there is a risk of an electrical shock.

Notice

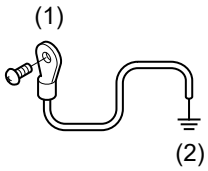
- Before connecting the power supply, connect the frame ground terminal permanently to earth.
- The frame ground terminal must be negatively grounded.
- Make sure the housing of the controller, of the oscillator unit, and of the laser head are at the same electric potential.
- The earth terminal of the AC power supply cable must be permanently grounded.
- Install all cables as far away as possible from noise-generating sources such as power lines, high-voltage equipment, and machines generating large switching surges. If noise occurs in the power line, use a noise cut-off transformer.

The AC power cable is not included in the product package. Use one of the specified optional cables or a comparable cable with a rated output capacity that matches the operating voltage specification of this product and complies with the regulations and standards of the country or region in which it is used.



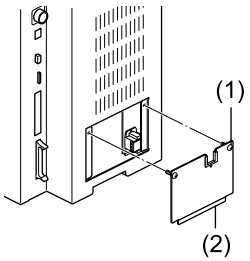
(1) Frame ground terminal (on laser head)
(2) Frame ground terminal (on oscillator unit)
(3) AC power supply terminals (on controller)

1. Connect the frame ground terminals of the laser head and of the oscillator unit to earth.
   Screw size: M4
   Tightening torque: 1.0Nm



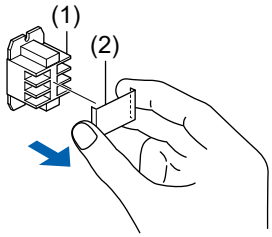
(1) Frame ground terminal
(2) Earth

2. Loosen the two M3 screws of the AC power supply terminal cover on the rear of the controller and remove it.



(1) Screw
(2) Terminal cover

3. Remove the resin cover of the terminals.

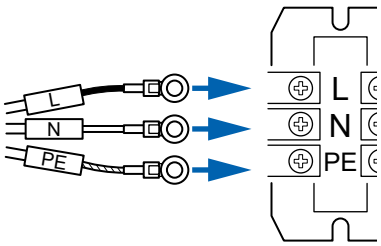


(1) Terminal
(2) Resin cover

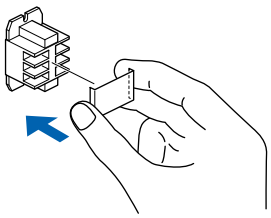
4. Connect the AC power supply cables labeled "L" (black), "N" (white) and "PE" (yellow/green) to the corresponding terminals.

   Screw size: M4

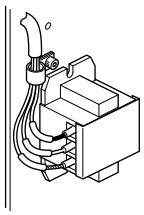
   Tightening torque: 1.2Nm



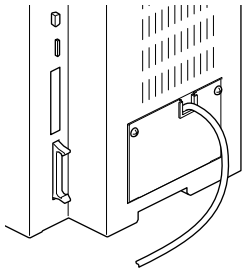
5. Reattach the resin cover.



6. Fix the AC power cable with the clamp.
   Screw size: M4 hex screw
   Tightening torque: 1.0Nm



7. Pass the AC power cable through the cable hole and fix the cover with two screws.
   Screw size: M3
   Tightening torque: 0.5Nm



8. Make sure all cables and connectors other than the AC power cable are connected. Then connect the AC power cable to the AC power supply.
   Operating voltage: 180V AC to 264V AC (including a fluctuation range of ±10%)

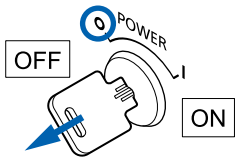
Related topics

Cables (page 34)

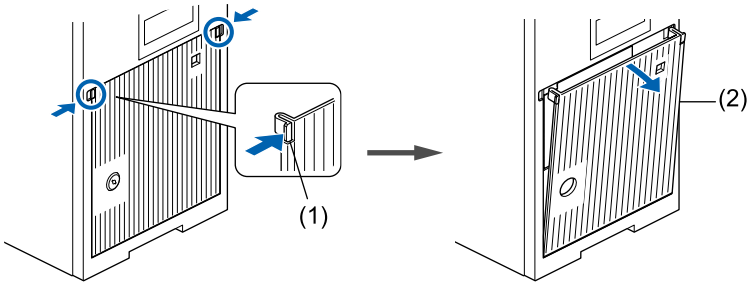
2.6.3 Restore the circuit protector

The controller is fitted with a circuit protector that switches off the laser marking system in the event of an overcurrent. After eliminating the cause of the overcurrent, you need to restore the circuit protector.

1. Eliminate the cause of the overcurrent.
2. Turn off the key switch of the controller and disconnect the AC power cable.

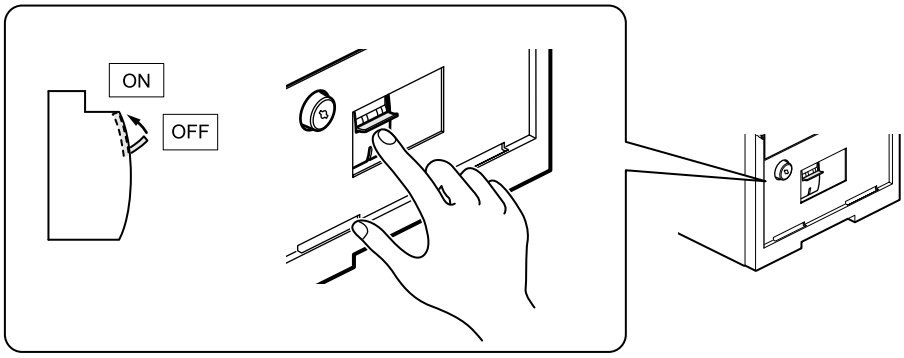


3. To open the front cover of the controller, press the latches on the top and pull the cover forward.



(1) Latch
(2) Cover

4. Turn on the switch of the circuit protector.



5. Attach the front cover of the controller.
   Insert the lower part of the cover into the controller and gently push the upper part until it clicks into place.
6. Connect the AC power cable, turn on the key switch, and confirm that the laser marking system starts properly.

2.6.4 Connection with PC configuration software

This product is configured and operated with the PC configuration software Laser Marker NAVI smart.

Laser Marker NAVI smart is included in the supplied CD-ROM Laser Marker Smart Utility. For details about the installation of Laser Marker NAVI smart, refer to the “Laser Marker NAVI smart Operation Manual”.

The PC and the laser marking system can be connected via USB or Ethernet.

Install the software in the environment described below.

System requirements	
Operating system	Microsoft Windows 11 Pro (64 bit), Microsoft Windows 10 Pro (32 bit, 64 bit)[1)]
Free disk space	Min. 512MB

System requirements	
CD-ROM drive	To install the software on a PC without CD-ROM drive, copy all CD-ROM data to the PC before installation. Use an external storage media such as a USB flash drive to copy the data.
USB interface	USB 2.0 or 3.0 (connection of all PCs cannot be guaranteed)
LAN (for Ethernet)	10BASE-T or 100BASE-TX
PC memory	Min. 2GB
CPU	Equivalent to or higher than Intel Core i3
Screen resolution (recommended)	1366 × 768 pixels
Display size	Min. 10.6"
Peripherals	Mouse or other pointing device, keyboard or other input device

1) Operating system versions that are no longer supported by Microsoft are excluded.
Follow Microsoft's recommendation for the CPU type, memory capacity, hard disk space, and display function required to operate the operating system.
Laser Marker Smart Utility can be installed in English, German, simplified Chinese, or Japanese. The language of the operation system should correspond to the installation language. If the language of the operating system is not supported by Laser Marker NAVI smart, install the software in English.

Notice

- Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.
- Do not disconnect the USB or LAN cable while the laser marking system is online.
- When grounding the F.G. of the PC, make sure it is at the same electric potential as the controller.

Note

- When the PC enters sleep mode, the online connection to the laser marking system is disabled. In remote or RUN mode, the PC is disconnected, but the operation mode is maintained. To prevent disconnection, disable the sleep mode setting on the PC.
- One PC can be connected with multiple laser marking systems. However, you can only establish one online connection at a time. The laser marking system which is connected is displayed in the “Connection” dialog together with the online mode icon. To configure and to control more than one laser marking system, you must switch the connected device in the software.
- If your version of Laser Marker NAVI smart does not support the connected laser marker model, some functions and operations cannot be set or executed online.

Related topics

Establish a USB connection between PC and laser marking system (page 68)

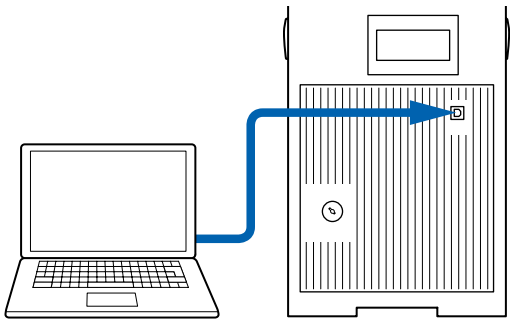
Establish an Ethernet connection between PC and laser marking system (page 68)

2.6.4.1 Establish a USB connection between PC and laser marking system

Laser Marker NAVI smart must be installed on your PC.

You can connect more than one laser marking system to a PC, e.g. using a USB hub.

1. Connect the laser marking system and the PC with a USB cable.
   Connect the USB cable to the USB type B interface on the controller.



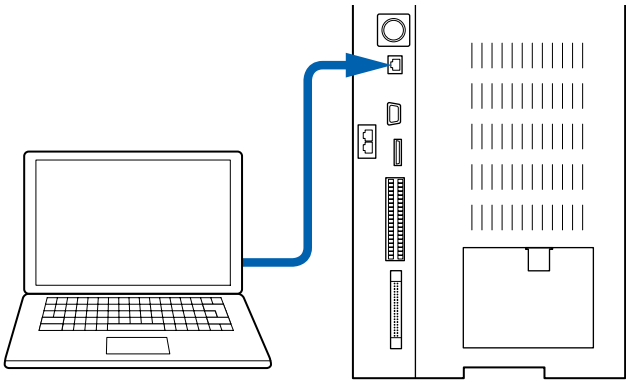
2. Start the laser marking system.
3. Start Laser Marker NAVI smart.
4. On the “Startup” screen, select “Online” to open the “Connection” dialog.
   Any laser marking system that is ready for an online connection is displayed in the list.
   If the desired laser marking system is not in the list, select “Search laser marker”.
5. Select the laser marking system that you want to connect.
6. Select “Connect” to establish the connection.
   When the online connection is established, the “Marking settings” screen appears.

2.6.4.2 Establish an Ethernet connection between PC and laser marking system

Before you can make an Ethernet connection, you must make the appropriate communication settings in Laser Marker NAVI smart. Connect the PC via USB to make these settings.

- Ethernet communication should be performed in a secure network environment.
- Using a hub or a router, you can connect multiple devices simultaneously to the Ethernet interface, such as a PC for configuration, a PLC for command control, and a code reader to check the marking results.

1. Connect the PC and the laser marking system with a LAN cable. Use the Ethernet interface labeled “LAN” on the rear of the controller.
   The interfaces of the optional network unit (EtherNet/IP or PROFINET) cannot be used to operate Laser Marker NAVI smart.



2. Start the laser marking system.
3. Start Laser Marker NAVI smart.
4. On the “Startup” screen, select “Online” to open the “Connection” dialog.
   Any laser marking system that is ready for an online connection is displayed in the list. If the desired laser marking system with an Ethernet connection is not listed, you can find it using any of the following methods:
   - To display all available laser marking systems, enable “Including Ethernet connections” and select “Search laser marker”.
     If you want to change the default setting so that the check box is always activated in this dialog, go to “Startup” > “Preferences” > “General settings”, and select the check box “Enable "Including Ethernet connections" by default”.
   - To find a laser marking system with specific IP address settings, select “Search by IP address”. In the dialog, enter the “IP address” and the “Port number” identical to those specified in “System settings” > “Communication” for the “IP address” and “Port for PC configuration software”, and select “OK”.
5. Check that an Ethernet connection appears in the list.
6. Select the laser marking system that you want to connect.
7. Select “Connect” to establish the connection.
   When the online connection is established, the “Marking settings” screen appears.

Related topics

Specify Ethernet communication settings (page 98)

Connect multiple devices to the Ethernet interface (page 164)

Connect a LAN cable with ferrite core (page 164)

Ethernet interface (page 163)

General Ethernet specifications (page 165)

2.7 Construction of an interlock system

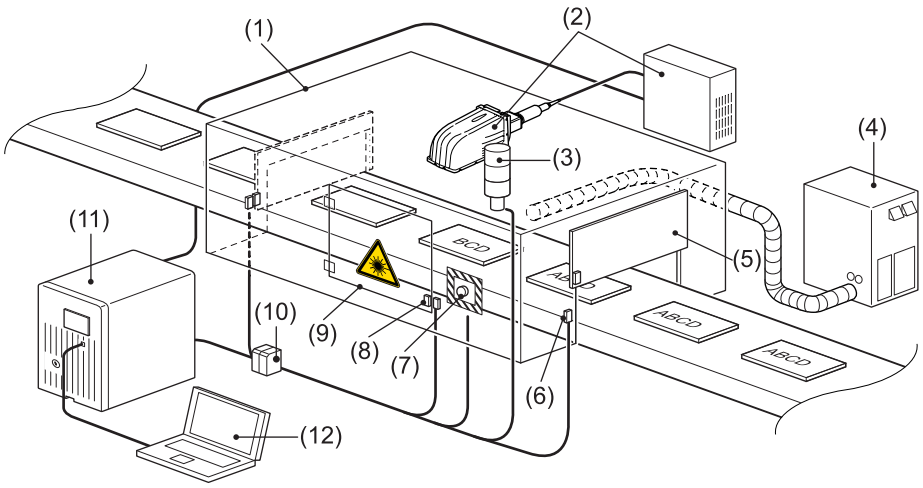
To operate this product, construct a protective enclosure with an interlock system to avoid that human beings and surrounding objects are exposed to laser radiation.

By using interlock input 1 and 2 or the two laser stop inputs together with a safety relay unit, you can design a dual-channel safety system.

Notice

The interlock inputs are connected to the operating coils of contactors inside the controller. Therefore, connect only non-voltage contacts, such as relays or switches, to the interlock inputs. Do not connect any voltage contacts, such as transistors (semiconductors).

Installation example with protective enclosure and interlock system:



(1) Protective enclosure
(2) Laser head and oscillator unit
(3) Laser emission signal lamp
(4) Dust collector or fume exhauster
(5) Laser shield plate
(6) Safety switch for laser shield plate
(7) Emergency stop button
(8) Safety switch for access panel
(9) Access panel
(10) Safety relay unit or safety PLC
(11) Controller
(12) PC for configuration or monitoring

Installation notes

Connect the safety devices (5) to (9) via a safety relay unit or the relay outputs of a safety PLC (10) to the safety inputs of this product.

To interrupt laser radiation or turn off laser pumping when the laser shield plate (5) is open for loading or unloading the workpieces, use the interlock or laser stop inputs.

To turn off laser pumping when the emergency stop button (7) is pressed or the safety switch for monitoring the access panel (8) or the access panel (9) itself is opened, connect the safety devices to the interlock inputs.

Connect the laser emission signal lamp (3) to output terminals such as the alarm output (Y15), the laser pumping output (Y20), or the laser radiation output (No. 40).

Place the suction nozzle of the dust collector or fume exhauster (4) as close as possible to the marking position.

3 Operation methods

3.1 Overview

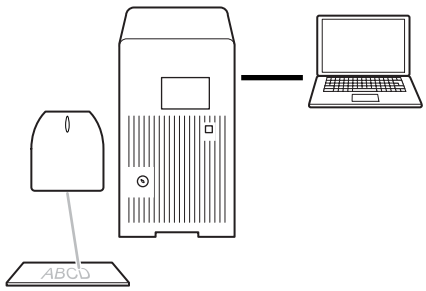
The laser marking system can be controlled by PC configuration software or by external devices.

Control by PC configuration software

Establish an online connection between Laser Marker NAVI smart on your PC and the laser marking system. You can control operations such as laser pumping or marking with the software. Use one of the following methods to radiate the laser:

- Test marking

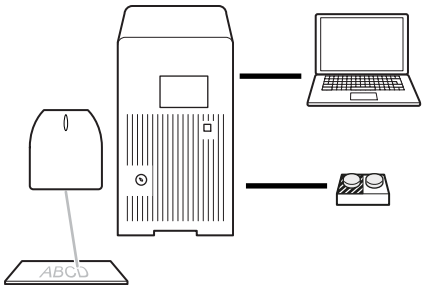
  In test marking mode, start the marking by manually triggering the laser radiation in Laser Marker NAVI smart. Perform the test marking process to test the marking settings during installation or when you want to radiate the laser during maintenance work.



Controlling the laser marking system using Laser Marker NAVI smart

- RUN mode

  In RUN mode, either a signal from Laser Marker NAVI smart or from an external device starts the laser radiation. The external device can be a switch, or a sensor connected to the I/O terminal. When you turn on RUN mode, the laser marking system enters the marking trigger ready status. Use this mode for semi-automatic marking processes. Use RUN mode to configure the laser marking system without external control devices, such as a PLC.



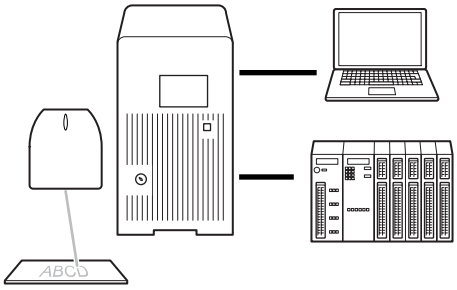
Controlling the laser marking system using Laser Marker NAVI smart or a switch

You can edit marking data with Laser Marker NAVI smart even when it is not connected to the laser marking system (offline).

For details on Laser Marker NAVI smart, refer to the “Laser Marker NAVI smart Operation Manual”.

Control by external devices (remote mode)

In remote mode, fully automatic control of the laser marking system is possible. By connecting a control device (e.g. a PLC) to the laser marking system, I/O signals or communication commands can control operations such as laser pumping and marking.



Controlling the laser marking system using an external control device, such as a PLC

The following control methods are available and can be combined:

- I/O control
- Command control (RS-232C/Ethernet)
- Linking of imagecheckers (Ethernet)
- Linking of code readers (RS-232C)
- Control by industrial network (EtherNet/IP or PROFINET)

Note

- With on-the-fly marking, imagecheckers and code readers cannot be linked.
- Check the marking quality and ensure the laser marking system is working properly before starting full operation. Changing parameters could lead to unintended results.

Related topics

Perform test marking (page 89)

Perform marking in RUN mode (page 90)

Operation by external devices (remote mode) (page 91)

3.2 System start-up and termination

3.2.1 Start the laser marking system

To start the laser marking system, use the key switch of the controller or of an external system if the laser marking system is controlled by an external device.

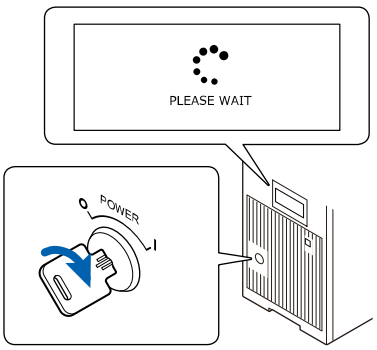
⚠ WARNING

According to IEC/FDA/JIS standards, laser products shall incorporate a key-actuated master control. The laser marking system is basically started by the key switch located on the front of the controller. However, when the laser marking system is operated as part of a larger system, the key switch is permanently in ON position and the power is supplied. In this case, you have to make sure that the external system which controls the laser marking system is equipped with a key-actuated master control.

Note

- Do not turn off the power supply while the system starts ("PLEASE WAIT" is displayed).
- Wait at least 5 seconds before restarting the system after termination.

1. Make sure the laser head, oscillator unit, controller and interfaces are properly connected.
2. Turn the key switch on the front of the controller from 0 to I.



On the controller display, the message "PLEASE WAIT" appears (the backlight color is white).

System start-up completes approximately after 10 seconds. The controller display shows the file number.



In case the file number is not displayed after 10 seconds or if "**00FF" is displayed, please contact our service center or sales offices.

Related topics

Hardware connection (page 58)

Connection with PC configuration software (page 66)

3.2.2 Start the PC configuration software

The software is required to configure the laser marking system and create the marking data (online or offline). You can also use the software to control and to monitor the marking process (online).

Laser Marker NAVI smart must be installed on your PC.

Depending on your Windows operating system version, do any of the following.

– In Windows 10, open the start menu and select “Panasonic Industry Laser” > “Laser Marker NAVI smart”.

– In Windows 11, open the start menu and select “All apps” > “Panasonic Industry Laser” > “Laser Marker NAVI smart”.

Laser Marker NAVI smart starts and displays the “Startup” screen.

For details about the installation of Laser Marker NAVI smart, refer to the “Laser Marker NAVI smart Operation Manual”.

Related topics

Connection with PC configuration software (page 66)

3.2.3 Terminate the laser marking system

To terminate the laser marking system, turn off laser pumping and disconnect the online connection before you turn the key switch. If you have edited the marking file, make sure to save your changes before turning off the power supply.

Note

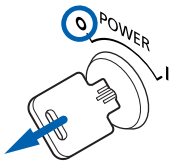
- Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.
- Wait at least 5 seconds before restarting the system after termination.

1. Turn off laser pumping.
   Control by PC configuration software: In Laser Marker NAVI smart, select the “Laser pumping” tool and confirm with “Yes”.

   Control by external devices (remote mode): Use the laser pumping input LASER SUPPLY IN (X6) or the Laser pumping (**LSR**) command.
2. Save marking files as needed.
   Any unsaved data will be lost when the power is turned off.
3. Disconnect the online connection with the laser marking system.
4. To exit Laser Marker NAVI smart, select “Exit” from the menu on “Startup” screen.
   Or select “X” in the upper right corner of the screen.
5. Turn the key switch on the front of the controller from I to 0.

6. Remove the key.
   The laser safety officer is responsible for the key.

Related topics

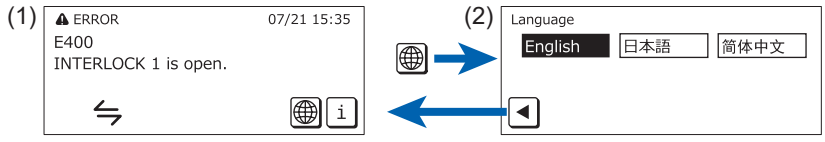
Disconnect an online connection (page 85)

3.2.4 Using the touch-sensitive controller display

Tap the icons in the touch area of the controller display to change the display language or show the system clock and model information.

Touch screen icons

Change the display language:



(1) Alarm/warning status
(2) Language selection

The alarm/warning status (1) displays the date and time of occurrence of the error (month/day, hour:minute), the error code number, and the error message.

In the language selection (2), you can choose between English, Japanese, and Simplified Chinese.

Show the system clock or model information:



(1) Normal operation
(2) System clock display
(3) Model information display

The system clock display (2) displays the clock information in the format year/month/day and hour:minute. The system clock can be adjusted in the “System settings”.

The model information (3) includes the following information:

- Model
- Serial number (C: controller, H: laser head, O: oscillator unit)
- Version (C: controller, H: laser head, O: oscillator unit)
- Optional network unit with network type (EtherNet/IP or PROFINET), IP address, and version. If the network unit is not installed "-----" or "None" is displayed.

Related topics

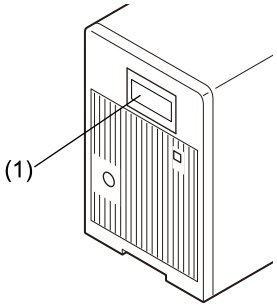
Specify settings for the controller display (page 77)

Controller (page 39)

3.2.5 Specify settings for the controller display

Specify the controller LED display settings, including the backlight color and the display language.

You can specify different colors that indicate normal operation, alarm or warning output.



(1) Controller display

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Operation/information”.

3. Under “Controller display”, specify the following settings:
   - “Color for normal operation” (initial setting: “White”): Specify a color to indicate that the laser marking system is in normal operation.
   - “Color for warning” (initial setting: “Pink”): Specify a color to indicate that a warning is output.
   - “Color for alarm” (initial setting: “Red”): Specify a color to indicate that an alarm is output.

     When an alarm occurs and the displayed error code is in the range from E001 to E199, the display color is always red, regardless of the setting.
   - For “Display language”, set one of the following languages.
     – Japanese
     – English (initial setting)
     – Simplified Chinese
4. Select “Apply to laser marking system” in the ribbon to save the settings.
   The new settings will be updated in the laser marking system.

3.3 Operation by PC configuration software

You can configure the laser marking system with Laser Marker NAVI smart, either in online or in offline mode.

3.3.1 Online and offline mode

The PC configuration software Laser Marker NAVI smart is in online mode if your PC and the laser marking system are connected via USB or Ethernet. In offline mode, there is no connection between the devices.

An online connection between your PC and the laser marking system is required to configure the laser marking system and to save the marking data to the laser marking system. In online mode, you can use the PC to control operations such as laser pumping or marking.

In offline mode, you can create and edit marking files (including backup files) saved on local or network drives.

The status icon of the “Connection” tool indicates an online or offline connection.



(1) (2)

(1) Online mode icon
(2) Offline mode icon

Notice

Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.
Do not disconnect the USB or LAN cable while the laser marking system is online.

Note

- When the PC enters sleep mode, the online connection to the laser marking system is disabled. In remote or RUN mode, the PC is disconnected, but the operation mode is maintained. To prevent disconnection, disable the sleep mode setting on the PC.
- One PC can be connected with multiple laser marking systems. However, you can only establish one online connection at a time. The laser marking system which is connected is displayed in the “Connection” dialog together with the online mode icon. To configure and to control more than one laser marking system, you must switch the connected device in the software.
- If your version of Laser Marker NAVI smart does not support the connected laser marker model, some functions and operations cannot be set or executed online.

Related topics

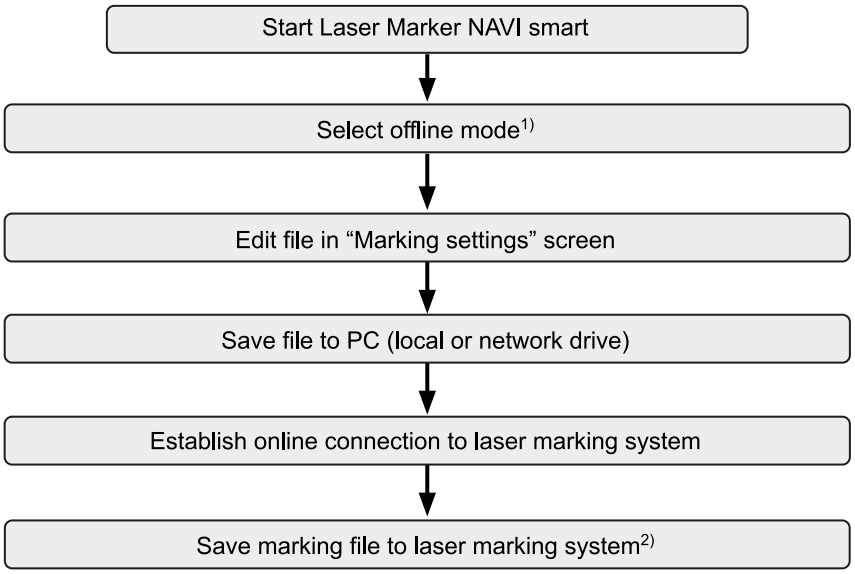
Establish a USB connection between PC and laser marking system (page 68)

Establish an Ethernet connection between PC and laser marking system (page 68)

Disconnect an online connection (page 85)

3.3.1.1 Flow chart for offline editing

Offline editing lets you work on your marking file offline and save it locally or on a network drive. You can then transfer it to the laser marking system after you have established an online connection.

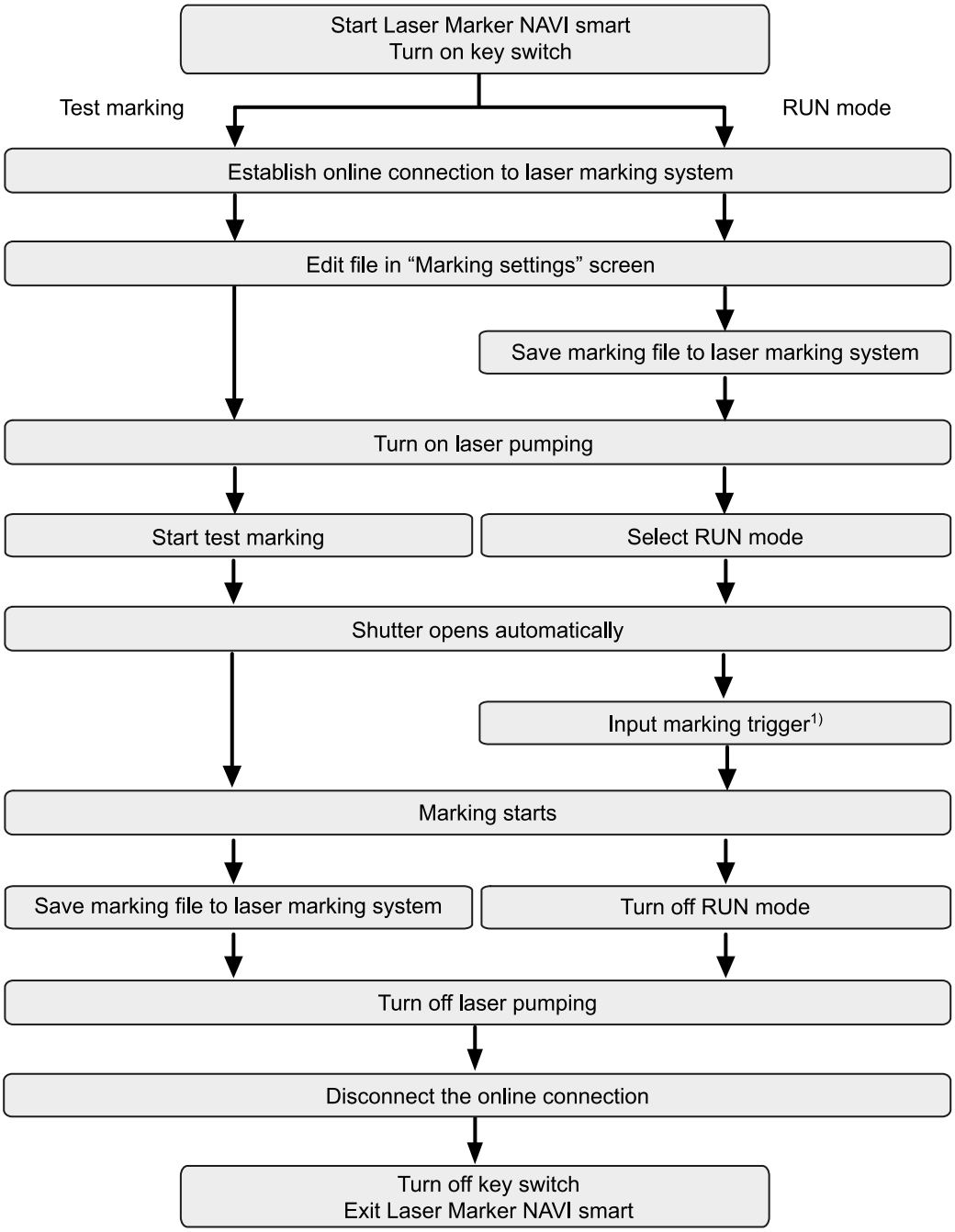


1) To create a new marking file, select “New...” > “Marking file (.lzs)” or “Marking file (.lms)” and select the model of your laser marking system. Or select “Open” to edit an existing file.

2) In the “Marking settings” screen, select “Open” > “From PC” and then a file number, or go to “Data management” > “Marking files”, select a file number and then “Add” in the ribbon.

3.3.1.2 Flow chart for online editing and marking

You can also work on your marking file online with the laser marking system and test mark directly. Or, save the file to the laser marking system and start marking by entering a trigger.



1) Use the signal input TRIGGER IN of the I/O terminal block or the “Start marking” button of Laser Marker NAVI smart to input the marking trigger signal.

3.3.2 Screen types

Laser Marker NAVI smart has different screen modes, depending on the settings and operation contents.

Availability of the screens

The availability of screens depends on the application mode and the user role (administrator or restricted user).

Online mode:

- If remote mode is off and you are logged in as “Administrator”, the following screens are available:
  “Startup”, “Marking settings”, “Monitor”, “Maintenance”, “Data management”, “System settings”
- If remote mode is off and you are logged in as “Restricted user”, the following screens are available:
  “Startup”, “Marking settings”, “Monitor”, “Maintenance”
- If remote mode or RUN mode is on, the following screens are available:
  “Startup”, “Monitor”

Offline mode:

- If you edit a backup file, the following screens are available:
  “Startup”, “Marking settings”, “Maintenance”, “Data management”, “System settings”
- If you edit a marking file, the following screens are available:
  “Startup”, “Marking settings”

“Startup” screen

When you launch Laser Marker NAVI smart, the “Startup” screen appears.

You can do the following:

- Establish an online connection with a laser marking system.
- Disconnect a laser marking system.
- Open an existing marking file (offline mode).
- Create a new marking file (offline mode).
- Open backup files (offline mode).
- Change the user interface language.
- Customize user interface elements.
- Open help topics.
- View the software version.

- Exit the software.

“Marking settings” screen

In this screen, you can create and edit marking data such as character, graphic, and bar code objects and save them in a file.

You can do the following:

- Create new marking data.
- Edit a marking or backup file that is saved on a local or network drive (offline mode).
- Edit a marking file that is saved on the laser marking system (online mode).
- Execute test marking (online mode).

“Monitor” screen

In this screen, you can monitor the operation status of the laser marking system during remote mode or RUN mode.

You can do the following:

- Check the marking image.
- Check the marking settings (only enabled parameters are displayed).
- Check the ON or OFF status of I/O terminals.
- Check data for on-the-fly marking.

“Maintenance” screen

This screen is used for the maintenance of the laser marking system.

You can do the following:

- Check the operating data.
- Check the error log.
- Check the communication command history.
- Start laser radiation to measure the laser power (commercial power meter required).
- Simulate output operation.

“Data management” screen

This screen lists all files that are currently saved on the laser marking system, including marking files, graphic files, and font files.

You can do the following:

- Add or delete a marking file, graphic file, or font file.
- Copy a backup file from the laser marking system.
- Save a backup file or restore it to the laser marking system.

- Change the name of a marking file.

“System settings” screen

In this screen, you set the system properties of the laser marking system. If changes are required, make the settings before operation.

You can do the following:

- View information about the laser marking system.
- Change the date and time of the system clock.
- Make settings for communication with external devices.
- Specify input and output settings.
- Make settings for laser power correction and marking position offset.
- Calibrate the marking field.
- Set the administrator password.

Related topics

Set or disable a password (page 87)

3.3.3 Establish an online connection

Laser Marker NAVI smart must be installed on your PC.

1. Connect the laser marking system and the PC with a USB cable.
2. Start the laser marking system.
3. Start Laser Marker NAVI smart.
4. On the “Startup” screen, select “Online” to open the “Connection” dialog.
   Any laser marking system that is ready for an online connection is displayed in the list.
   If the desired laser marking system is not in the list, select “Search laser marker”.
5. Select the laser marking system that you want to connect.
6. Select “Connect” to establish the connection.
   When the online connection is established, the “Marking settings” screen appears.

Notice

- Do not disconnect the USB or LAN cable while the laser marking system is online.
- Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

Note

- When the PC enters sleep mode, the online connection to the laser marking system is disabled. In remote or RUN mode, the PC is disconnected, but the operation mode is maintained. To prevent disconnection, disable the sleep mode setting on the PC.
- If your version of Laser Marker NAVI smart does not support the connected laser marker model, some functions and operations cannot be set or executed online.

Related topics

Establish a USB connection between PC and laser marking system (page 68)

Establish an Ethernet connection between PC and laser marking system (page 68)

3.3.4 Disconnect an online connection

You can disconnect an online connection between the laser marking system and a PC on the “Startup” screen or alternatively with the “Connection” tool.

Disconnect the laser marking system on the “Startup” screen:

- Go to the “Startup” screen and select “Online”.
- In the “Connection” dialog, select “Disconnect”.
  The online connection with the laser marking system is now disconnected.

Disconnect the laser marking system with the “Connection” tool:

- Select the “Connection” tool in the ribbon.
- In the “Connection” dialog, select “Disconnect”.
  The online connection with the laser marking system is now disconnected.

3.3.5 User selection and password settings

You can set different user roles and assign a password to the administrator role.

3.3.5.1 User selection

You can select between two user roles “Restricted user” or “Administrator”. In offline mode, you cannot select a user.

“Restricted user”

The access to screens and settings is restricted. The following screens are available if remote mode is off: “Startup”, “Marking settings”, “Monitor”, “Maintenance”.

The parameters in the “Marking settings” screen that a “Restricted user” is allowed to edit, can be configured in “System settings” > “Access permissions”. You must be logged in as “Administrator” to configure these settings.

“Administrator”

As “Administrator” you have access to all screens and settings. The following screens are available if remote mode is off: “Startup”, “Marking settings”, “Monitor”, “Maintenance”, “Data management”, “System settings”.

User selection

A password was not set for the “Administrator” role:

- When you establish an online connection between your PC and laser marking system, the default user role is set to “Administrator”.

A password was set for the “Administrator” role:

- When you establish an online connection between your PC and laser marking system, the “User selection” dialog appears.
- Select “Restricted user” or “Administrator”.
- If you select “Administrator”, enter the password and select “OK”.
- A password is not required if you select “Restricted user”.

Switch the user

- To switch the user from “Restricted user” to “Administrator”, select the user icon.



User icon

- The “User selection” dialog appears.
- Select “Administrator”, enter the password if it was set and select “OK”.
- The user icon changes to indicate the “Administrator” role.



User icon for “Administrator”

Related topics

Set or disable a password (page 87)

Availability of the screens (page 82)

3.3.5.2 Configure permissions for restricted users

For the “Restricted user” profile, you can add or remove a permission to edit a parameter on the “Marking settings” screen. You can also specify which marking file settings are displayed on the “Monitor” screen.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Access permissions”.
3. You can configure the parameters that are shown in the “Permissions” column.
   Add or remove a permission to edit parameters with the “Restricted user” profile:
   - Select the check box in the “Restricted user” column, to add the permission for editing the parameter on the “Marking settings” screen.
   - To remove the permission, deselect the check box.

   Customize the “Monitor” screen:
   - If you select a check box in the “Monitor” column, the selected parameter is displayed on the “Monitor” screen.
   - Deselect the check box if you do not want to show the parameter on the “Monitor” screen.
4. Select “Apply to laser marking system” in the ribbon to save the settings.
   The new settings will be updated in the laser marking system.

Related topics

User selection (page 85)

3.3.5.3 Set or disable a password

You can set a password in the “System settings” screen. The password is required when you switch from “Restricted user” to “Administrator”.

In offline mode, you cannot select a user.

Notice

The password protection of this configuration software is designed for the purpose to prevent incorrect configuration or unintended operation. You cannot use this password for security purposes.

1. Start the Laser Marker NAVI smart software.
2. Establish an online connection between your PC and the laser marking system.
3. Go to the “System settings” screen and select “Access permissions”.
4. Select “Change” next to “Password for administrator” to specify a password.

5. In the dialog, select “Enable password protection”. If you do not use the password protection, deselect the check box.
6. Enter a password, verify it and select “OK”.
7. Select “Apply to laser marking system” in the ribbon to save the settings.
   The new settings will be updated in the laser marking system.

Related topics

Delete a forgotten password (page 88)

3.3.5.4 Delete a forgotten password

To restrict access to certain screens and settings, a password can be set for the “Administrator” role. In case you cannot remember the password, the file ClearPassword.exe must be executed to remove the password.

Do not delete the password while the laser marking system is in remote mode.

1. Make sure the laser marking system is not in remote mode.
2. Exit Laser Marker NAVI smart.
3. Execute ClearPassword.exe.
   The file is located on the Laser Marker NAVI smart CD-ROM under \Tools \ClearPassword.exe.
4. Select “Clear the password”.
5. Select “OK”.
   During the execution of ClearPassword.exe, a connection between the laser marking system and the PC is not required.
6. Start Laser Marker NAVI smart.
7. Establish an online connection between your PC and the laser marking system.
   This deletes the password and clears the password protection of the connected laser marking system.
8. Exit Laser Marker NAVI smart.
9. Execute ClearPassword.exe again.
10. Deselect “Clear the password”.
11. Select “OK”.
    Pay attention that “Clear the password” in the dialog is not selected. Otherwise, the new password will be deleted again when you establish an online connection even without executing ClearPassword.exe.

Related topics

Set or disable a password (page 87)

3.3.6 Test marking and RUN mode

Marking with the PC configuration software can be performed in test marking mode or in RUN mode.

3.3.6.1 Perform test marking

In test marking mode, start the marking by manually triggering the laser radiation in Laser Marker NAVI smart. Perform the test marking process to test the marking settings during installation or when you want to radiate the laser during maintenance work.

- The counter value is not updated during test marking.
- If “Trigger mode” is set to “Continuous trigger”, the setting value of “Minimum number of scans” is used for the test marking.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Marking settings” screen.
3. To open a marking file, select “Open” > “From laser marking system” or “From PC”.
4. You can edit marking objects and specify the marking settings.
   In the “Laser settings” tab, specify settings such as “Laser power” and “Scan speed [mm/s]”.
5. Select “Save” > “To laser marking system” to save the file to the laser marking system.
6. Select the “Laser pumping” tool.
7. Select “Yes” to start laser pumping.
   After a few seconds, laser pumping is completed and the status icon of the “Laser pumping” tool changes.
8. Select “Test marking” to open the “Test marking/guide laser” dialog.

   “Test marking” tool
9. In the dialog, specify new values for the laser settings.

⚠ WARNING

Take appropriate protective measures during laser radiation such as wearing laser protective goggles or using a protective enclosure.

10. Select “Start marking” to trigger the laser radiation.
    A confirmation dialog appears.

11. Select “Yes” to start laser radiation. The shutter opens automatically and marking starts.
    During a marking process, you can select “Stop marking” to terminate the test marking.

3.3.6.2 Perform marking in RUN mode

In RUN mode, either a signal from Laser Marker NAVI smart or from an external device starts the laser radiation.

- The external device can be a switch, or a sensor connected to the I/O terminal. When you turn on RUN mode, the laser marking system enters the marking trigger ready status. Use this mode for semi-automatic marking processes.
- You cannot edit the marking data in RUN mode.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Marking settings” or “Monitor” screen.
3. This step is only possible in the “Marking settings” screen:
   a. To open a marking file, select “Open” > “From laser marking system” or “From PC”.
   b. You can edit marking objects and specify the marking settings.
   c. Select “Save” > “To laser marking system” to save the file to the laser marking system.
4. Select the “Laser pumping” tool.
5. Select “Yes” to start laser pumping.
   After a few seconds, laser pumping is completed and the status icon of the “Laser pumping” tool changes.
6. Select the “Operation” tool.



“Operation” tool icon

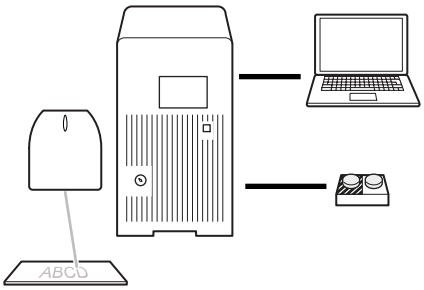
7. In the dialog, select “RUN ON”.
   Select “Yes” to confirm.
   When shifting to RUN mode while editing in the “Marking settings” screen, a file saving confirmation message appears. After saving the file, the screen shifts to the “Monitor” view.
   The icon of the “Operation” tool changes to indicate that the laser marking system is in RUN mode.



Icon indicates that RUN mode is on

The laser marking system changes to the marking trigger ready status.

8. Input the marking trigger signal.
   The signal input TRIGGER IN of the TERMINAL connector and the “Start marking” button of Laser Marker NAVI smart can both be used to input the marking trigger signal.



Controlling the laser marking system using a switch

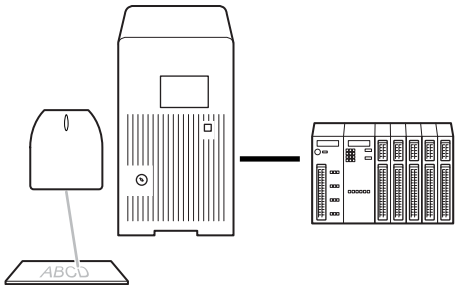
3.4 Operation by external devices (remote mode)

3.4.1 Control methods

External devices can control the laser marking system by I/O signals, by communication commands, or a combination of both.

I/O control (remote mode)

To control the laser marking system by I/O signals, connect the external device (e.g. a PLC) to the I/O connectors on the rear of the controller.

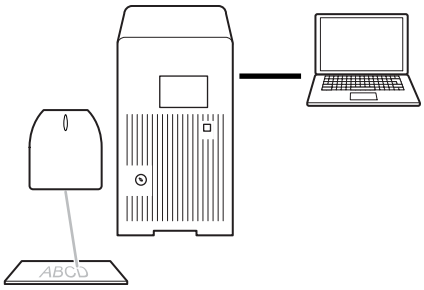


The system must be in RUN mode to receive the marking trigger signal and setting changes from the configuration software.

If the optional network unit is mounted on the controller, you can use EtherNet/IP or PROFINET to control the laser marking system. For detailed information, refer to the “PROFINET Communication Guide” or to the “EtherNet/IP Communication Guide”.

Command control (remote mode)

To control the laser marking system by communication commands, connect the external device via RS-232C or Ethernet. To use this function, you need to make all settings in the configuration software in advance.



I/O control and command control can be combined.

If the optional network unit is mounted on the controller, you can send commands via EtherNet/IP or PROFINET. For detailed information, refer to the “PROFINET Communication Guide” or to the “EtherNet/IP Communication Guide”.

Linking of image processing devices (remote mode or RUN mode)

Connect a specific imagechecker (via Ethernet) or a commercial code reader (via RS-232C) to control the laser marking system.

Related topics

Perform marking in RUN mode (page 90)

External control via I/O signals (page 103)

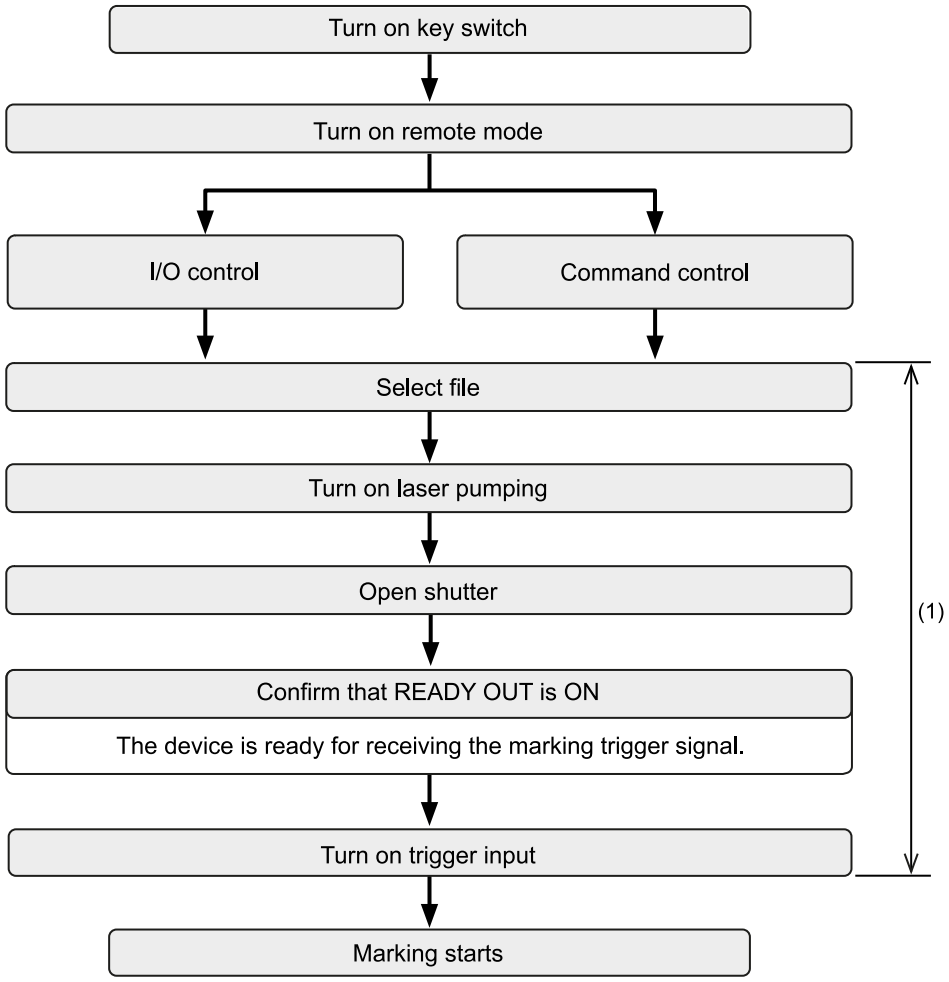
External control via communication commands (page 159)

Linking of image processing devices (page 169)

3.4.2 Flow chart for external control

The basic operation procedure for control by external devices is very similar for I/O control, command control, or a combination of both.

To use this function, you need to make all settings in the configuration software in advance.



(1) Control by I/O signals or by communication commands

Related topics

Configuring the operation by external devices (page 93)

Remote mode (page 99)

3.4.3 Configuring the operation by external devices

To control the laser marking system by external devices, certain settings must be made in advance in the Laser Marker NAVI smart configuration software.

- Select the switching method for remote mode (page 99)
- Specify the control method (page 94)

For I/O control:

- Specify input and output settings (page 94)

For command control:

- Make communication settings for command control via RS-232C (page 97) or via Ethernet (page 98)
- Specify the command format (page 95)

3.4.3.1 Specify control methods

Specify whether you want to control laser pumping, shutter operation, and guide laser display by I/O signals or by communication commands.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Operation/information”.
3. Select the control method (“I/O” or “Communication commands”) for laser pumping, shutter control, and guide laser control.
   The initial setting is “I/O”.
   To use the Laser radiation for measurement (**SPT**) command, you must select “Communication commands” for “Shutter operation control”.
   Select “I/O” to control the remote mode via optional network unit (EtherNet/IP or PROFINET).
4. To use the command format of the LP-400/LP-V series, select “Compatible mode”.
   In LP-400 compatibility mode, the command format of the older model will be used. The settings for "Start code", "Include response in command", "Response code", and "Encoding for non-ASCII characters" will be ignored.
   For details, refer to the “Serial Communication Command Guide: LP-400/V compatible mode”.
5. Select “Apply to laser marking system” in the ribbon.
6. Disconnect the online connection with the laser marking system.
7. Turn off the power of the laser marking system, wait five seconds and then restart the system.

   Notice

   Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

   The new settings will be updated in the laser marking system.

3.4.3.2 Specify input and output settings

If you use I/O signals for control, you can change the one-shot pulse duration, configure the output of warnings at invalid trigger signals, and make terminal assignments.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Inputs/outputs”.

3. Specify any of the following parameters:
   - “One-shot pulse duration [ms]” (initial setting: 40ms):

     Change the ON-time for one-shot outputs, e.g. PROCESSING END OUT (Y11).

     One-shot output terminals:
     - PROCESSING END OUT (Y11)
     - PROCESSING FAIL OUT (Y12)
     - SET OK OUT (28)
     - CHECK OK OUT (34)
     - CHECK NG OUT (35)
   - “Warning at invalid trigger signal” (initial setting: “Enabled”):

     Select “Disabled” to deactivate the warning that is output when invalid marking trigger signals are detected while the trigger processing output PROCESSING OUT (Y10) is ON.

     If “Enabled” is selected, the warning E750 is output. The warning is automatically cleared after 3s.
   - “TARGET DETECTION IN (X7)” (initial setting: “Disabled”):

     Enable this input if you use a sensor to check that the workpiece is in the marking position during the lasing process.
   - “Assignment of counter end outputs”:

     Change the counter numbers for the counter end outputs A to D (I/O terminal No. 30 to 33). The initial settings for counter end outputs A to D are counter number 0 to 3, respectively.

   These settings also apply if you use the optional network unit (EtherNet/IP or PROFINET).
4. Select “Apply to laser marking system” in the ribbon.
5. Disconnect the online connection with the laser marking system.
6. Turn off the power of the laser marking system, wait five seconds and then restart the system.

   Notice

   Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

   The new settings will be updated in the laser marking system.

3.4.3.3 Specify the command format

For command control, you can customize the command format, the encoding for non-ASCII characters, and the input method for control codes in 2D codes.

For details about command control, refer to the “Serial Communication Command Guide”.

For the configuration of the optional network unit (EtherNet/IP or PROFINET), refer to the “PROFINET Communication Guide” or to the “EtherNet/IP Communication Guide”.

To use the command format of the LP-400/LP-V series, select “Compatible mode”. In this case, the LP-400/LP-V settings for start code, response code, and encoding for non-ASCII characters will be applied, regardless of any other settings. For details, refer to the “Serial Communication Command Guide: LP-400/V compatible mode”.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Communication”.
3. Make the following settings in the “Command format (standard mode)” category:
   - “Start code”: “STX” (initial setting) or “None”

     If you use the optional network unit (EtherNet/IP or PROFINET) for command control, the start code is not required, regardless of this setting.
   - “Include command in response”: “ON” (initial setting) or “OFF”

     If you use the optional network unit (EtherNet/IP or PROFINET) for command control, the command is included in the response data, regardless of this setting.
   - Response code: Any single-byte ASCII code from 01_h to $7F_h$. The initial settings are:
     – “Positive response code”: A
     – “Negative response code”: E
     – “Read request response code”: A

     To set another response code, select “Change”. In the dialog, select a response code and select “OK”.
   - For “Encoding for non-ASCII characters”, select “Shift JIS” (initial setting), “GB 2312” or “Latin-1”.

     This setting is required for European special characters, Japanese and Chinese characters which cannot be specified by ASCII codes. Select “Shift JIS” for Japanese characters and “GB 2312” for simplified Chinese. If you use European special characters such as À or Ä, select “Latin-1”.
   - To enter control codes in bar code or 2D code character strings via communication commands or optional network unit (EtherNet/IP or PROFINET), specify the settings for “Input method for control codes”.

     This setting is also applied to the data of the read request response.

     This setting only applies to the control codes in bar code/2D code strings, but not to general control codes used in the message such as STX or CR.
     – Select “Open settings”.
     – In the dialog, select “Input EOT/FS/GS/RS/US directly using ASCII code” or “Input all ASCII control codes using alternative code” (initial setting).
     – “Input FNC1 using ASCII GS” (initial setting): If you select “Input all ASCII control codes using alternative code”, select this option to use the ASCII control code to input the separator “FNC1”. If the check box is not selected, use the alternative code.
     – Select “OK”. The dialog closes.
4. Select “Apply to laser marking system” in the ribbon.

5. Disconnect the online connection with the laser marking system.
6. Turn off the power of the laser marking system, wait five seconds and then restart the system.

   Notice

   Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

   The new settings will be updated in the laser marking system.

3.4.3.4 Specify RS-232C communication settings

If you are using the RS-232C interface, align the RS-232C communication settings with the external device.

- Use the RS-232C interface to control the laser marking system by communication commands or to connect a code reader.
- For RS-232C, the "Flow control" setting of the communication port on the external device must be "None".
- For details about command control, refer to the “Serial Communication Command Guide”.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Communication”.
3. Specify the following RS-232C communication settings:
   - “RS-232C usage”:

     Select “Communication commands” to control the laser marking system by communication commands.

     Select “Code reader” if you connect a code reader.
   - “Baud rate [bit/s]”: Select the baud rate.

     Initial setting: 9600
   - “Data length [bit]”: 8 (fixed)
   - “Parity”: “None” (initial setting), “Even” or “Odd”
   - “Stop bits [bit]”: “1” (initial setting) or “2”
   - “Check sum”: “OFF” (initial setting) or “ON”

     The checksum is used to detect an error in data communication.
   - “End code”: “CR” (initial setting) or “CR+LF”

     The end code identifies the end of a message.
4. Select “Apply to laser marking system” in the ribbon.
5. Disconnect the online connection with the laser marking system.

6. Turn off the power of the laser marking system, wait five seconds and then restart the system.

   Notice

   Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

   The new settings will be updated in the laser marking system.

Related topics

Operation by external devices (remote mode) (page 91)

Linking of image processing devices (page 169)

3.4.3.5 Specify Ethernet communication settings

To establish an Ethernet connection, make the network settings in Laser Marker NAVI smart according to the requirements of your network environment.

- Using a hub or a router, you can connect multiple devices simultaneously to the Ethernet interface, such as a PC for configuration, a PLC for command control, and a code reader to check the marking results.
- Ethernet communication should be performed in a secure network environment.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Communication”.
3. Set the Ethernet communication settings according to your network environment.
   Even if the values for the IP address and the subnet mask are within the configurable range, they may be invalid because of their combination.
   - “IP address”: 1.0.0.0–223.255.255.255 (do not use 127 for the first octet)
     Initial setting: 192.168.1.5
     Enter an IP address, which is not already used by the laser marking system or by the PC.
   - “Subnet mask”: 128.0.0.0–255.255.255.254
     Initial setting: 255.255.255.0
   - “Default gateway”: 1.0.0.0–223.255.255.255 (do not use 127 for the first octet)
     Initial setting: 0.0.0.0 (unspecified)
   - “Port for PC configuration software”: 1025–65534 (do not use 9090)
     Initial setting: 9093
   - “Port for communication commands”: 1025–65534 (do not use 9090)
     Initial setting: 9094
     Set different port numbers for “Port for PC configuration software” and “Port for communication commands”.

- “MAC address”: Displays the MAC address.

4. Select “Apply to laser marking system” in the ribbon.
5. Disconnect the online connection with the laser marking system.
6. Turn off the power of the laser marking system, wait five seconds and then restart the system.

Notice

Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

The new settings will be updated in the laser marking system.

Related topics

Establish an Ethernet connection between PC and laser marking system (page 68)

Connect multiple devices to the Ethernet interface (page 164)

Ethernet interface (page 163)

General Ethernet specifications (page 165)

Connect a LAN cable with ferrite core (page 164)

3.4.4 Remote mode

There are different methods to turn on remote mode. The desired method must be pre-set in Laser Marker NAVI smart.

You can choose from the following methods to switch remote on and off:

- By configuration software (page 99)
- Automatically at power-on (page 100)
- By external devices (page 101)

3.4.4.1 Switch remote mode on and off by configuration software

Unless you changed the initial setting, the laser marking system can be switched to remote mode in Laser Marker NAVI smart.

Make sure that “Configuration software” (initial setting) is selected for “Remote mode switching method” in the “System settings” screen of Laser Marker NAVI smart. If “I/O” is selected for “Remote mode switching method”, you cannot switch remote mode on and off by configuration software.

1. Establish an online connection between your PC and the laser marking system.

2. Select the “Operation” tool.



“Operation” tool icon

3. In the dialog, select “Remote ON”.
   Select “Yes” to confirm.
   When shifting to remote mode while editing in the “Marking settings” screen, a file saving confirmation message appears. After saving the file, the screen shifts to the “Monitor” view.
   The icon of the “Operation” tool changes to indicate that the laser marking system is in remote mode.



Icon indicates that remote mode is on

4. To deactivate remote mode, select the “Operation” tool and “Remote/RUN OFF”.

3.4.4.2 Automatically switch to remote mode at power-on

In the “System settings” screen, you can specify that the laser marking system will automatically start in remote mode when you turn on the key switch.

⚠ WARNING

In case of an emergency stop or an interlock, re-pumping of the laser marking system will be necessary. For safety reasons, construct a laser re-pumping system which must be operated by hand.

- To use this function, you need to make all settings in the configuration software in advance.
- If the laser marking system starts in remote mode, you cannot switch remote mode on and off by external devices.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Operation/information”.
3. For “Remote mode switching method”, select “Configuration software”.
4. For “Remote mode at power-on”, select “ON”.
5. Select “Apply to laser marking system” in the ribbon.
6. Disconnect the online connection with the laser marking system.

7. Turn off the power of the laser marking system, wait five seconds and then restart the system.

   Notice

   Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

   The laser marking system will automatically start in remote mode.

3.4.4.3 Switch remote mode on and off by external devices

In the “System settings” screen, you can specify that an external device, for instance a PLC, can switch the laser marking system to remote mode by inputting a signal at the TERMINAL connector.

⚠ WARNING

In case of an emergency stop or an interlock, re-pumping of the laser marking system will be necessary. For safety reasons, construct a laser re-pumping system which must be operated by hand.

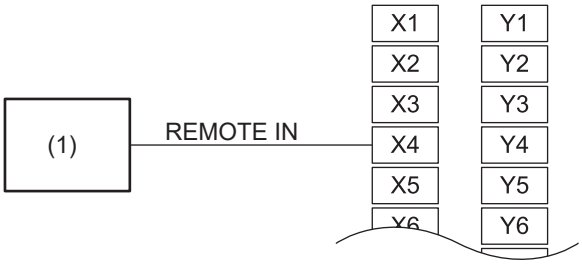
- To use this function, you need to make all settings in the configuration software in advance.
- If “I/O” is selected for “Remote mode switching method”, you cannot switch remote mode on and off by configuration software.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Operation/information”.
3. For “Remote mode switching method”, select “I/O”.
4. Select “Apply to laser marking system” in the ribbon.
5. Disconnect the online connection with the laser marking system.
6. Turn off the power of the laser marking system, wait five seconds and then restart the system.

   Notice

   Do not turn off the power supply during an online connection with your PC. Otherwise a data loss or system failure may occur.

   The laser marking system can now be switched to remote mode by turning ON the remote mode input X4 of the TERMINAL connector.



(1) PLC output

4 External control via I/O signals

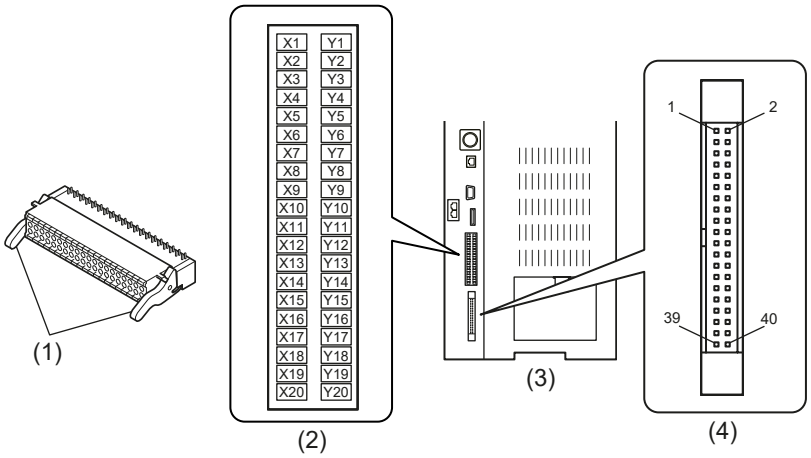
4.1 Functional overview

To control the laser marking system by I/O signals, connect the external device (e.g. a PLC) to the I/O connectors on the rear of the controller.

The connector labeled TERMINAL is used to control basic functions of the laser marking system, such as starting laser pumping, starting the marking process, or alarm output. The connector labeled I/O can be used for data configuration (e.g. selecting a file number) and status monitoring of various functions.

I/O connectors on the controller

You need to make all system settings for I/O control in the configuration software in advance. For details, refer to Configuring the operation by external devices (page 93).



(1) I/O terminal block with locking hooks
The I/O terminal block is attached to the TERMINAL connector. It can be removed by pushing down the locking hooks.

(2) Connector labeled TERMINAL

(3) Rear of the controller

(4) Connector labeled I/O
Use this connector together with the supplied flat cable connector.

Connector product numbers

Connector	Type	Model	Manufacturer
TERMINAL connector on controller	Special connector	15EDGRHCM-THR-3.5-40P-1	Degson Electronics Co., Ltd
Removable I/O terminal block for TERMINAL connector	Special connector	15EDGKNHG-3.5-40P-14-00A (accessory)	Degson Electronics Co., Ltd
I/O connector on controller	MIL connector, 40-pin, male	XG4A-4034	OMRON Corporation
Flat cable connector for I/O connector	MIL connector, 40-pin, female	XG4M-4030-T (accessory)	OMRON Corporation

Precautions

Be sure to observe the precautions described below when wiring the I/O connectors.

⚠ WARNING

Turn off the power of this product before you conduct wiring, connection, or maintenance work. Wiring and maintenance should be done by an expert engineer or a qualified electrician. Otherwise, there is a risk of an electrical shock or fire.

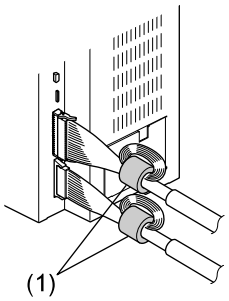
Notice

- The I/O connectors support both NPN and PNP transistor outputs. However, you cannot mix NPN and PNP circuits on the same product.
- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. 1 (X2) and OUT COM.1 (Y2, X12). Starting the laser marking system with these terminals short-circuited will cause the laser marking system to malfunction.
- The voltage applied to the outputs and the current flowing through the output terminals must not exceed the specified maximum values. Exceeding the max. load voltage and the max. load current at a terminal will cause the laser marking system to malfunction.

Connection of the signal lines

Use the ferrite cores included in the product package. If the diameter of the ferrite core is too large, wind the wires around the core as shown in the figure.

Rear of the controller



(1) Ferrite cores

4.2 Pin assignment of the TERMINAL connector

4.2.1 Overview

The connector labeled TERMINAL is used to control basic functions of the laser marking system, such as starting laser pumping, starting the marking process, or alarm output.

When shipped, some terminals of the I/O terminal block are connected by jumper wires. Do not remove these wires unless you want to connect external devices. If any of these terminals are not connected, laser radiation is disabled.

Inputs and outputs of the TERMINAL connector:

X1	24V OUT	Y1	0V OUT
X2	IN COM.1	Y2	OUT COM. 1
X3	0V OUT	Y3	24V OUT
X4	REMOTE IN	Y4	REMOTE OUT
X5	TRIGGER IN	Y5	READY OUT
X6	LASER SUPPLY IN	Y6	LASER STANDBY OUT
X7	TARGET DETECTION IN	Y7	SYSTEM STANDBY OUT
X8	SHUTTER IN	Y8	SHUTTER CLOSE 1 OUT
X9	SHUTTER ENABLE IN	Y9	SHUTTER CLOSE 2 OUT
X10	LASER STOP IN	Y10	PROCESSING OUT
X11	LASER STOP IN	Y11	PROCESSING END OUT
X12	OUT COM. 1	Y12	PROCESSING FAIL OUT
X13	ENCODER A IN	Y13	RESERVED
X14	ENCODER B IN	Y14	WARNING OUT
X15	ALARM RESET IN	Y15	ALARM OUT
X16	INTERLOCK 1 (+)	Y16	INTERLOCK 1 MONITOR
X17	INTERLOCK 1 (-)	Y17	INTERLOCK 1 MONITOR COM.
X18	INTERLOCK 2 (+)	Y18	INTERLOCK 2 MONITOR
X19	INTERLOCK 2 (-)	Y19	INTERLOCK 2 MONITOR COM.
X20	REMOTE INTERLOCK IN	Y20	LASER SUPPLY OUT

Note

- The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.
- If the laser marking system is controlled by a device such as a PLC, which supplies power to the TERMINAL connector, do not connect anything to the internal power supply terminals 24V OUT (X1, Y3) or 0V OUT (X3, Y1). If a jumper wire is installed, remove it.
- Do not connect anything to system reserved terminals.

Related topics

Factory setting of the jumper wires (page 128)

Wiring (page 128)

4.2.2 Input signals

The TERMINAL connector can receive signals from safety devices to control laser pumping, shutter opening, and the marking process.

Because NPN and PNP transistors function in opposite ways, "ON" and "OFF" refer to the ON or OFF status of the terminals and not to the voltage level (high or low) of the signal.

X1 24V OUT: Internal power supply 24V

Use the internal power supply terminals to operate the laser marking system independently.

X1 and Y3 are connected internally.

Max. load current: 300mA

Notice

- Use X3 or Y1 as the 0V contact of the internal 24V power supply (X1 or Y3). Do not mix internal and external power supply.
- Do not connect anything to this terminal if an external power supply is used.
- If you use the internal power supply of the TERMINAL connector, make sure that the total load (external device and consumption current for I/O control) does not exceed 300mA.

X2 IN COM. 1: Input common 1

This is the common terminal for all inputs of the TERMINAL connector.

The common terminal must be connected to the positive pole of the power supply for NPN circuits or to the negative pole for PNP circuits.

For details, refer to Wiring of the common terminals (page 129).

X3 0V OUT: Internal power supply 0V

Use the internal power supply terminals to operate the laser marking system independently.

Y1 and X3 are connected internally.

Notice

- Use X3 or Y1 as the 0V contact of the internal 24V power supply (X1 or Y3). Do not mix internal and external power supply.
- Do not connect anything to this terminal if an external power supply is used.

X4 REMOTE IN: Remote mode input

While this input is ON, the laser marking system operates in remote mode. In remote mode, the laser marking system can be controlled by I/O signals or communication commands.

To control the laser marking system in remote mode, you must make the appropriate settings in the “System settings” screen of Laser Marker NAVI smart.

For details, refer to Remote mode (page 99).

X5 TRIGGER IN: Marking trigger input

Marking (laser radiation) starts with the rising edge of the signal. To input a trigger signal, the marking trigger ready output READY OUT (Y5) must be ON.

The behavior of the TRIGGER IN signal varies depending on the “Trigger mode” settings.

For marking static objects:

- “Single trigger” (default setting): One lasing process is executed with every rising edge of the TRIGGER IN signal.
- “Continuous trigger”: The lasing process is repeated while TRIGGER IN is ON.

For on-the-fly marking:

- “Single trigger” (default setting): One lasing process is executed with every rising edge of the TRIGGER IN signal.
- “Marking at regular intervals”: Marking processes are executed at regular intervals while TRIGGER IN is ON.
- “Multiple triggers”: Max. 16 trigger signals are accepted in advance while PROCESSING OUT (Y10) is ON.

You can set the trigger mode with Laser Marker NAVI smart. For static objects, go to “File settings” and set the mode for each marking file. For on-the-fly marking, go to “On-the-fly settings for all files” to set the mode for all marking files.

When a trigger delay is set in the marking file, laser radiation starts after the set time.

When on-the-fly marking is set, the lasing process starts when TRIGGER IN was accepted and the workpiece comes to the preset marking position.

When linking image processing devices, a series of operations (operation of the connected devices, laser radiation, processing in the laser marking system) is started at the rising edge of the signal. For details, refer to Linking of image processing devices (page 169).

X6 LASER SUPPLY IN: Laser pumping input

While this input is ON, the laser is pumped to enable radiation.

Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.

Before you can use the laser pumping input, select “I/O” for “Laser pumping control” in the “System settings” screen of Laser Marker NAVI smart.

X7 TARGET DETECTION IN: Target detection input

Connect a sensor to check that the workpiece is in the marking position during the lasing process.

Depending on the status of TARGET DETECTION IN, the check OK output CHECK OK OUT (34) or the check NG output CHECK NG OUT (35) of the I/O connector turns on after trigger processing (lasing). CHECK OK OUT turns on if TARGET DETECTION IN is ON for more than 1ms during lasing. If the input does not turn on, CHECK NG OUT turns on. The check OK/NG outputs turn on for the set one-shot pulse duration.

To use the target detection input, you must enable “TARGET DETECTION IN (X7)” in the “System settings” screen.

The target detection input cannot be used when linking image processing devices to the laser marking system.

X8 SHUTTER IN: Shutter open input

When this input turns on, the shutter inside the laser head opens.

To enable this terminal, the shutter open enable input SHUTTER ENABLE IN (X9) must be ON.

There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals.

To use this terminal, select “I/O” for “Shutter operation control” in the “System settings” screen of Laser Marker NAVI smart.

X9 SHUTTER ENABLE IN: Shutter open enable input

While this input is ON, the shutter can be controlled by the shutter open input SHUTTER IN (X8). To control the shutter via SHUTTER IN only, short-circuit SHUTTER ENABLE IN (X9) and OUT COM. 1 (X12 or Y2).

⚠ WARNING

Do not use the shutter open input SHUTTER IN (X8) and the shutter open enable input SHUTTER ENABLE IN (X9) as an emergency stop or interlock. Turning these inputs off during laser radiation will not close the shutter until the marking process is completed.

X10 LASER STOP IN: Laser stop input
X11 LASER STOP IN: Laser stop input

Use the laser stop inputs to stop or interrupt laser radiation temporarily.

If one of the two laser stop inputs is disconnected (OPEN), laser radiation is interrupted.

Terminal connection	Operation
LASER STOP IN–OUT COM1: OPEN	Laser is radiating: • Laser pumping turns off • Shutter closes Laser is not radiating, shutter is open: • Laser pumping remains active • Shutter closes

For safety-related stop functions, safeguards must be connected via non-voltage contacts, such as relays or switches, and not via voltage contacts, such as transistors (semiconductors).

To turn off laser pumping physically, use the interlock inputs (X16–X19).

For details, refer to Behavior of the safety functions under fault condition (page 114).

X12 OUT COM. 1: Output common 1

This is one of two common terminals for all outputs of the TERMINAL connector.

X12 and Y2 are connected internally.

The common terminal must be connected to the negative pole of the external power supply for NPN circuits or to the positive pole for PNP circuits.

X13 ENCODER A IN: Encoder A input
X14 ENCODER B IN: Encoder B input

Input the signals from an encoder or two sensors which detect the line speed for on-the-fly marking.

When using an encoder, input phase A to ENCODER A IN (X13) and phase B to ENCODER B IN (X14).

Make sure the encoder frequency does not exceed 100kHz per phase.

When only one phase of the encoder is used, connect the encoder signal to ENCODER A IN (X13) and connect ENCODER B IN (X14) to IN COM.1 (X2).

When using two sensors for measuring the line speed, connect the first sensor in moving direction to ENCODER A IN (X13) and the second sensor to ENCODER B IN (X14).

X15 ALARM RESET IN: Alarm reset input

Use this input to clear the alarm status of the system.

Eliminate the cause of the alarm before turning this input on.

The alarm reset input clears the following errors: E400–E499, E500–E599.

Alarms caused by hardware problems or system errors can only be cleared by restarting the laser marking system.

X16 INTERLOCK 1 (+): Positive interlock input 1
X17 INTERLOCK 1 (-): Negative interlock input 1
X18 INTERLOCK 2 (+): Positive interlock input 2
X19 INTERLOCK 2 (-): Negative interlock input 2

Connect safeguards, e.g. a safety switch of an access panel or an emergency stop button, to the interlock inputs.

When the connection between INTERLOCK (+) and INTERLOCK (-) is opened, the shutter is closed and laser pumping is turned off physically:

Terminal connection	Operation
X16–X17 or X18–X19: OPEN	• Laser pumping turns off • Shutter closes

For details, refer to Behavior of the safety functions under fault condition (page 114).

To enable laser radiation, connect INTERLOCK (+) and INTERLOCK (-) with non-voltage contacts, such as relays or switches.

Using both INTERLOCK 1 and INTERLOCK 2 with a safety relay unit, a safety system with a double interlock circuit can be constructed.

At the factory, X16–X17 and X18–X19 are connected by jumper wires.

For details, refer to Construction of an interlock system (page 70) and Connecting safety devices (page 131).

Notice

The interlock inputs are connected to the operating coils of contactors inside the controller. Therefore, connect only non-voltage contacts, such as relays or switches, to the interlock inputs. Do not connect any voltage contacts, such as transistors (semiconductors).

X20 REMOTE INTERLOCK IN: Remote interlock input

Use this terminal to stop laser radiation or interrupt laser radiation temporarily.

If REMOTE INTERLOCK IN (X20) and OUT COM. 1 (X12) are not connected (OPEN), the shutter is closed and laser pumping is turned off.

This terminal can be used as the remote interlock connector that is required by IEC 60825-1.

To turn off laser pumping physically, use the interlock inputs (X16–X19).

4.2.3 Output signals

The TERMINAL connector outputs status and alarm signals.

Because NPN and PNP transistors function in opposite ways, "ON" and "OFF" refer to the ON or OFF status of the terminals and not to the voltage level (high or low) of the signal.

Y1 0V OUT: Internal power supply 0V

Use the internal power supply terminals to operate the laser marking system independently.
Y1 and X3 are connected internally.

Notice

- Use X3 or Y1 as the 0V contact of the internal 24V power supply (X1 or Y3). Do not mix internal and external power supply.
- Do not connect anything to this terminal if an external power supply is used.

Y2 OUT COM. 1: Output common 1

This is one of two common terminals for all outputs of the TERMINAL connector.
X12 and Y2 are connected internally.
The common terminal must be connected to the negative pole of the external power supply for NPN circuits or to the positive pole for PNP circuits.
For details, refer to Wiring of the common terminals (page 129).

Y3 24V OUT: Internal power supply 24V

Use the internal power supply terminals to operate the laser marking system independently.
X1 and Y3 are connected internally.
Max. load current: 300mA

Notice

- Use X3 or Y1 as the 0V contact of the internal 24V power supply (X1 or Y3). Do not mix internal and external power supply.
- Do not connect anything to this terminal if an external power supply is used.
- If you use the internal power supply of the TERMINAL connector, make sure that the total load (external device and consumption current for I/O control) does not exceed 300mA.

Y4 REMOTE OUT: Remote mode output

This output is ON while the laser marking system is in remote mode.
Make sure REMOTE OUT is ON before you start control by I/O signals or by communication commands.

Y5 READY OUT: Marking ready output

This output is ON when the marking trigger input TRIGGER IN (X5) is in the marking ready state (laser radiation is possible).

READY OUT turns on if the following conditions are met:

- No error occurred (except for E700–E799)
- No trigger processing is performed

  This does not apply if “Multiple triggers” is set for on-the-fly marking.
- Laser pumping has completed
- The shutter is open
- File switching by number has completed
- A record number for the register function or external offset function has been input and SET IN (2) has been turned on
- An **SIN** command has been sent for character input
- An **SEO** command has been sent to set the marking offset or the laser power
- An **MKM** command has turned off command reception mode

Y6 LASER STANDBY OUT: Laser pumping completion output

This output turns on when laser pumping is completed. The output is ON until the laser pumping turns off.

Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.

Y7 SYSTEM STANDBY OUT: System standby output

This output turns on when system start-up after power-on is completed. The output is ON until the power is turned off.

The output turns on ≈10s after the key switch has been turned on.

Y8 SHUTTER CLOSE 1 OUT: Shutter closed output 1
Y9 SHUTTER CLOSE 2 OUT: Shutter closed output 2

The shutter outputs are ON when the shutter is closed.

Two sensors mounted inside the laser head detect and output the shutter status at SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT, respectively.

The two shutter outputs are turned on by the same operation with a small margin of error.

There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals.

To confirm the shutter open status, use SHUTTER OPEN OUT (39) on the I/O connector.

Y10 PROCESSING OUT: Trigger processing output

When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT).

The output is ON for the set one-shot pulse duration or for the trigger processing time, whichever is longer. Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

When on-the-fly marking with multiple triggers is set, PROCESSING OUT remains ON until all trigger processing operation has completed.

When linking image processing devices, the trigger processing time includes the internal processing time for the linked devices.

Y11 PROCESSING END OUT: Trigger processing completed output

This output turns on when trigger processing (e.g. laser radiation) is completed. You can use this output to confirm marking completion.

The output is ON for the set one-shot pulse duration. Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Y12 PROCESSING FAIL OUT: Trigger processing abnormal end output

This output turns on when trigger processing (e.g. laser radiation) did not complete normally due to an alarm or a warning.

The output is ON for the set one-shot pulse duration. Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Notice

The trigger processing completed output PROCESSING END OUT (Y11) and the trigger processing abnormal end output PROCESSING FAIL OUT (Y12) indicate that the marking process has ended. They do not indicate a good or bad marking quality.

Y13 RESERVED: System reserved

Do not connect anything.

Y14 WARNING OUT: Warning output

This output turns off if there is a warning.

For a list of errors, refer to Troubleshooting (page 219).

Y15 ALARM OUT: Alarm output

This output turns off if there is an alarm.

If there is an alarm, the laser pumping output turns off.

For a list of errors, refer to Troubleshooting (page 219).

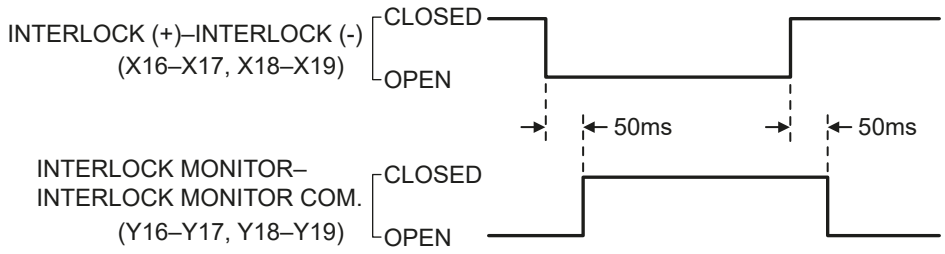
Y16 INTERLOCK 1 MONITOR: Interlock monitor output 1
Y17 INTERLOCK 1 MONITOR COM.: Interlock monitor common 1
Y18 INTERLOCK 2 MONITOR: Interlock monitor output 2
Y19 INTERLOCK 2 MONITOR COM.: Interlock monitor common 2

Interlock monitor output 1 checks the status of interlock input 1 (X16-X17). Interlock monitor output 2 checks the status of interlock input 2 (X18–X19).

For details, refer to Interlock terminals (page 126).

INTERLOCK input status	INTERLOCK monitor output status
X16–X17: OPEN	Y16–Y17: CLOSED
X16–X17: CLOSED (short-circuited)	Y16–Y17: OPEN
X18–X19: OPEN	Y18–Y19: CLOSED
X18–X19: CLOSED (short-circuited)	Y18–Y19: OPEN

There is a delay of ≈50ms between the switching of the interlock inputs and the interlock monitor outputs.



Y20 LASER SUPPLY OUT: Laser pumping output

This output is ON while LASER SUPPLY IN (X6) is ON, including the preparation time for laser pumping.

Connect an external signal lamp or other indicator to show the on/off state of this output terminal.

Use LASER STANDBY OUT (Y6) to confirm the completion of laser pumping.

4.2.4 Behavior of the safety functions under fault condition

The safety functions have different effects on the operation of the laser marking system and require individual release methods.

If one of the interlock inputs (X16–X17 and X18–X19) or the remote interlock input (X20) is opened, the laser is powered off and the shutter is closed, regardless of whether the laser is radiating or not. For the laser stop inputs (X10 and X11), the behavior of the laser marking system depends on whether the laser is radiating or not.

Safety function	Operation	Release method
INTERLOCK 1 (X16–X17): OPEN or INTERLOCK 2 (X18–X19): OPEN	• Laser pumping turns off • Shutter closes • Alarm is activated (E400, E401)[1)]	Close the interlock input and reset the alarm.
LASER STOP IN (X10, X11): OPEN	Laser is radiating: • Laser pumping turns off • Shutter closes • Alarm is activated (E402)	Close the laser stop input and reset the alarm.
	Laser is not radiating, shutter is open: • Laser pumping remains active • Shutter closes • Warning is activated (E600)	Close the laser stop input.
REMOTE INTERLOCK IN (X20): OPEN	• Laser pumping turns off • Shutter closes • Alarm is activated (E405, E503)[1)]	Close the remote interlock input and reset the alarm.

1) There is no alarm when the laser marking system is operated by PC configuration software and the shutter is closed (no laser radiation).

Note

You can configure the alarm behavior in remote mode for the interlock outputs under “System settings” > “Operation/information” > “INTERLOCK alarm detection”. Instead of the initial setting “Activate always under remote mode”, you can select “Deactivate while shutter closed”.

4.3 Pin assignment of the I/O connector

4.3.1 Overview

The connector labeled I/O can be used for data configuration (e.g. selecting a file number) and status monitoring of various functions.

Inputs and outputs of the I/O connector:

1	IN COM. 2	2	SET IN
3	D0 IN	4	D1 IN
5	D2 IN	6	D3 IN
7	D4 IN	8	D5 IN
9	D6 IN	10	D7 IN
11	D8 IN	12	D9 IN
13	D10 IN	14	D11 IN
15	D12 IN	16	D13 IN
17	D14 IN	18	D15 IN
19	SELECT 0 IN	20	SELECT 1 IN
21	SELECT 2 IN	22	TIME HOLD IN
23	GUIDE IN	24	TIMING IN
25	RESERVED	26	RESERVED
27	OUT COM. 2	28	SET OK OUT
29	DATE GAP OUT	30	COUNT END A OUT
31	COUNT END B OUT	32	COUNT END C OUT
33	COUNT END D OUT	34	CHECK OK OUT
35	CHECK NG OUT	36	TIMING WAIT OUT
37	SCRIPTING OUT	38	DATA WAIT OUT
39	SHUTTER OPEN OUT	40	LASING OUT

Note

- The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.
- Do not connect anything to system reserved terminals.

4.3.2 Input signals

The I/O connector can receive signals from external devices to configure the marking data.

Because NPN and PNP transistors function in opposite ways, "ON" and "OFF" refer to the ON or OFF status of the terminals and not to the voltage level (high or low) of the signal.

1 IN COM. 2: Input common 2

This is the common terminal for all inputs of the I/O connector.

The common terminal must be connected to the positive pole of the power supply for NPN circuits or to the negative pole for PNP circuits.

The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.

For details, refer to Wiring of the common terminals (page 129).

2 SET IN: Set input

A signal at the set input activates the settings specified with the selection inputs SELECT 0 IN (19) to SELECT 2 IN (21) and the number inputs D0 IN (3) to D15 IN (18).

Make sure the state of the selection inputs and the number inputs is not changed when the set input turns on. The operation is executed at the rising edge of the signal.

A SET IN signal is required for the following input functions:

- Specify a file number
- Specify a step value for up or down counters
- Specify a counter number for reset
- Specify a record number for the register function or the external offset function

3 to 18 D0 IN to D15 IN: Number inputs

Use the number inputs to specify a value for the function set with the selection inputs SELECT 0 IN (19) to SELECT 2 IN (21).

Make sure the state of the selection inputs and the number inputs is not changed when the set input turns on.

The following numbers can be set:

- File number
- Step value for up counter
- Step value for down counter
- Counter number for reset
- Record number for register and external offset function

Specify a file number:

1. Set the file number function with the selection inputs:

SELECT 0 IN: OFF	SELECT 1 IN: OFF	SELECT 2 IN: OFF

2. Specify the number of the marking file (0–9999) using the number inputs and turn on SET IN (2).

   The number of the marking file is input as a binary number. ON and OFF indicate the binary numbers “1” and “0”. D0 IN represents the least significant bit.

   Example: Specify file number 618.

   The number 618 corresponds to the binary number 0000 0010 0110 1010 of the 16-bit binary system. Set the number inputs as in the table below.

D15	D14	D13	D12	D11	D10	**D9**	D8	D7	**D6**	**D5**	D4	**D3**	D2	**D1**	D0
0	0	0	0	0	0	**1**	0	0	**1**	**1**	0	**1**	0	**1**	0
OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF	OFF	**ON**	**ON**	OFF	**ON**	OFF	**ON**	OFF

Specify a step value for up or down counters:

1. Set the step value function with the selection inputs:

Step value for up counter	SELECT 0 IN: OFF	**SELECT 1 IN: ON**	SELECT 2 IN: OFF
Step value for down counter	**SELECT 0 IN: ON**	**SELECT 1 IN: ON**	SELECT 2 IN: OFF

2. Specify the counter number.

   Use D0 IN to D7 IN to specify the counter number. Counter numbers 0–3 are assigned to D0 to D3. The global counter numbers 16–19 are assigned to D4 IN to D7 IN.

   If two or more counter numbers are specified, the step value is changed for all of them.

   Example: Specify counter number 3.

   To set the counter number, set D3 IN to ON.

D7	D6	D5	D4	**D3**	D2	D1	D0
19	18	17	16	**3**	2	1	0
OFF	OFF	OFF	OFF	**ON**	OFF	OFF	OFF

3. Specify the step value and turn on SET IN (2).

   Use D8 IN to D15 IN to specify the step value. The step value is input as a binary number. ON and OFF indicate the binary numbers “1” and “0”. D8 IN represents the least significant bit.

   Example: Specify a step value of 2.

   A step value of 2 corresponds to the binary number 0000 0010 of the 8-bit binary system. Set the number inputs as in the table below.

D15	D14	D13	D12	D11	D10	**D9**	D8
0	0	0	0	0	0	**1**	0
OFF	OFF	OFF	OFF	OFF	OFF	**ON**	OFF

Specify a counter number for reset:

1. Set the counter reset function with the selection inputs:

SELECT 0 IN: OFF	SELECT 1 IN: OFF	**SELECT 2 IN: ON**

2. Specify the counter number and turn on SET IN (2).

   Use D0 IN to D015 to specify the counter number: counter 0–3: D0 IN–D3 IN, counter 4–7: D8 IN–D11 IN, counter 16–19: D4 IN–D7 IN, counter 20–23: D12 IN–D15 IN.

   Example: Reset counter numbers 0–3.

   To reset the counter numbers, turn D0 IN to D3 IN ON.

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	**D3**	**D2**	**D1**	**D0**
23	22	21	20	7	6	5	4	19	18	17	16	**3**	**2**	**1**	**0**
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**

Specify a record number for the register function or the external offset function:

The character strings and offset values must be configured in advance and assigned to the record numbers that correspond to the inputs D0 IN to D15 IN. For details, refer to the “Laser Marker NAVI smart Operation Manual”.

1. Set the register and external offset function with the selection inputs:

SELECT 0 IN: ON	SELECT 1 IN: OFF	SELECT 2 IN: OFF

2. Specify the record number and turn on SET IN (2).

   Use D0 IN to D15 IN to specify the record number.

   The record number is input as a binary number at the number inputs D0 IN to D15 IN. ON and OFF indicate the binary numbers “1” and “0”. The input which represents the least significant bit varies depending on the input method and register used.

   Assignment of record numbers to number inputs:

Input method		Number inputs	Record numbers
4-bit registers	Register 0	D0 IN–D3 IN	0–15
	Register 1	D4 IN–D7 IN	
	Register 2	D8 IN–D11 IN	
	Register 3	D12 IN–D15 IN	
8-bit registers	Register 0	D0 IN–D7 IN	0–255
	Register 1	D8 IN–D15 IN	
4-bit external offset		D0 IN–D3 IN	0–15
8-bit external offset		D0 IN–D7 IN	0–255
10-bit external offset		D0 IN–D9 IN	0–1023

   Example: Specify record number 15 for input methods using D0 IN as the least significant bit.

   15 corresponds to the 8-bit binary number 0000 1111. Set the number inputs as in the table below.

D7	D6	D5	D4	**D3**	**D2**	**D1**	**D0**
0	0	0	0	**1**	**1**	**1**	**1**
OFF	OFF	OFF	OFF	**ON**	**ON**	**ON**	**ON**

   If you use the register function and the external offset function in the same marking file, the assigned record numbers will be valid for both functions.

19 **SELECT 0 IN:** Selection input 0
20 **SELECT 1 IN:** Selection input 1
21 **SELECT 2 IN:** Selection input 2

Use the selection inputs to set a function or a guide laser mode. Use D0 IN to D15 IN to specify a value for the function.

Each function or mode is represented by a unique combination of ON and OFF for SELECT 0 IN to SELECT 2 IN.

The following functions can be set:

File number	SELECT 0 IN: OFF	SELECT 1 IN: OFF	SELECT 2 IN: OFF
Step value for up counter	SELECT 0 IN: OFF	**SELECT 1 IN: ON**	SELECT 2 IN: OFF
Step value for down counter	**SELECT 0 IN: ON**	**SELECT 1 IN: ON**	SELECT 2 IN: OFF

Counter number for reset	SELECT 0 IN: OFF	SELECT 1 IN: OFF	**SELECT 2 IN: ON**
Record number for register and external offset function	**SELECT 0 IN: ON**	SELECT 1 IN: OFF	SELECT 2 IN: OFF

Make sure the state of the selection inputs and the number inputs is not changed when the set input turns on.

The following guide laser modes can be set:

Work distance	SELECT 0 IN: OFF	SELECT 1 IN: OFF	SELECT 2 IN: OFF
Marking image	**SELECT 0 IN: ON**	SELECT 1 IN: OFF	SELECT 2 IN: OFF
Marking field	SELECT 0 IN: OFF	**SELECT 1 IN: ON**	SELECT 2 IN: OFF
Masked objects	**SELECT 0 IN: ON**	**SELECT 1 IN: ON**	SELECT 2 IN: OFF

Do not change the state of the selection inputs while GUIDE IN (23) is ON.

22 TIME HOLD IN: Time/date hold input

When this input turns on, the marking data for the functional characters for date/time and lot are retained. This setting applies to the current and the expiry date and time set as functional characters, lot functions based on the date and time, and counter reset at date change.

The time/date hold input can be used even when remote mode is turned off.

If TIME HOLD IN turns on when the power of the laser marking system turns on, the start-up time of the system is retained.

The input is disabled when “System settings” > “Operation/information” > “Time hold control” > “Activate until fixed time” is configured in the system settings of Laser Marker NAVI smart.

23 GUIDE IN: Guide laser trigger input

When the guide laser trigger input is ON, the guide laser is emitted (for max. 1min).

Before you can use the guide laser trigger input, set a guide laser mode with the selection inputs and select “I/O” for “Guide laser display control” in the “System settings” screen of Laser Marker NAVI smart.

Turn this input on with the shutter closed.

Do not change the state of the selection inputs while GUIDE IN (23) is ON.

24 TIMING IN: Timing input

Application: Linking of image processing devices.

Turn this input on to trigger operations of the laser marking system and the imagechecker or code reader separately.

The operation is executed at the rising edge of the signal.

This input must turn on within 60s after the timing standby output TIMING WAIT OUT (36) turned on.

Before you can use the timing input, select “ON” for “TIMING IN signal input” under “File settings” in Laser Marker NAVI smart.

For details, refer to Linking of image processing devices (page 169).

25, 26 RESERVED: System reserved

Do not connect anything.

4.3.3 Output signals

Output signals at the I/O connector indicate the status of various functions, e.g. the counter function or the file number setting function.

Because NPN and PNP transistors function in opposite ways, "ON" and "OFF" refer to the ON or OFF status of the terminals and not to the voltage level (high or low) of the signal.

27 OUT COM. 2: Output common 2

This is the common terminal for all outputs of the I/O connector.

The common terminal must be connected to the negative pole of the external power supply for NPN circuits or to the positive pole for PNP circuits.

The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.

For details, refer to Wiring of the common terminals (page 129).

28 SET OK OUT: Setting completion output

This output turns on when the processing of the set input SET IN (2) is completed, e.g. after setting a file number or a counter reset using the number inputs.

The setting completion output responds to the set input. To verify that the laser marking system is ready for marking, check that the marking ready output READY OUT (Y5) is ON.

The output is ON for the set one-shot pulse duration. Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

29 DATE GAP OUT: Date gap output

This output turns on when the date of the system clock changes (passes midnight) while the time/date hold input TIME HOLD IN (22) is ON to indicate that the laser marking system is marking a date different from the date of the system clock.

The time hold function can be activated either by turning on the TIME HOLD IN (22) input of the I/O connector or by configuring the setting “System settings” > “Operation/information” > “Time hold control” > “Activate until fixed time”.

30 COUNT END A OUT: Counter end output A
31 COUNT END B OUT: Counter end output B
32 COUNT END C OUT: Counter end output C
33 COUNT END D OUT: Counter end output D

A counter end output turns on when the end value of the specified counter number has been marked. The initial settings for counter end outputs A to D are counter number 0 to 3, respectively.

The counter end output remains ON with the shutter open until the next marking trigger signal is input. When you close the shutter, the output turns off.

Assign the counter numbers to the counter end outputs in the “System settings” screen of Laser Marker NAVI smart.

The counter value is not updated during test marking.

The counter restarts at the starting value once it reaches the end value.

The counter end output turns off when “Count individually” is selected under “Step & repeat” in Laser Marker NAVI smart.

The counter end output can be used for marking data that contains functional characters for counters.

34 CHECK OK OUT: Check OK output

35 CHECK NG OUT: Check NG output

Application: Linking of image processing devices and target detection.

Linking of image processing devices: The outputs indicate the inspection results supplied by connected devices, e.g. a camera or a code reader. When the check result is positive, CHECK OK OUT (34) turns on. When the check result is negative, CHECK NG OUT (35) turns on.

Target detection: The outputs indicate whether the workpiece is in the marking position during the lasing process. When TARGET DETECTION IN (X7) turns on for more than 1ms during lasing, CHECK OK OUT (34) turns on. When it does not turn on, CHECK NG OUT (35) turns on.

These are one-shot outputs. Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

36 TIMING WAIT OUT: Timing standby output

Application: Linking of image processing devices.

This output turns on when the laser marking system enters the timing standby mode after image processing operations are completed.

TIMING WAIT OUT must be ON before TIMING IN (24) is turned on.

37 SCRIPTING OUT: Scripting output

Application: Linking of image processing devices.

When the marking trigger input TRIGGER IN (X5) turns on, the scripting output turns on. It remains ON until the operation of the connected devices and the processing in the laser marking system is finished. SCRIPTING OUT turns off during laser radiation.

38 DATA WAIT OUT: Data wait output

This output must be ON before you can input data with the following functions:

- Character input by **SIN** command
- Marking offset or laser power input by **SEO** command
- Record number input (with SET IN) for the register function or external offset function

After the data has been input, this output turns off and READY OUT (Y5) turns on.

39 SHUTTER OPEN OUT: Shutter open output

This output is ON when the shutter is open.

There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals.

To monitor the shutter operation for the safe operation of the laser marking system, use SHUTTER CLOSE 1 OUT (Y8) and SHUTTER CLOSE 2 OUT (Y9).

The output timing of SHUTTER OPEN OUT, SHUTTER CLOSE 1 OUT (Y8), and SHUTTER CLOSE 2 OUT (Y9) has a margin of error.

40 LASING OUT: Laser radiation output

This output is on during the lasing process.

If the lasing time is shorter than the set one-shot pulse duration, the laser radiation output is ON as long as the one-shot output is ON. Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Use PROCESSING END OUT (Y11) and PROCESSING FAIL OUT (Y12) to confirm marking completion.

4.4 I/O ratings and circuit diagrams

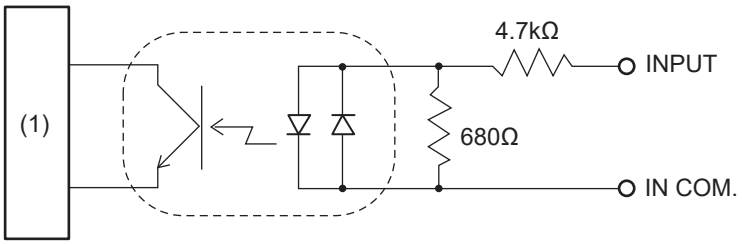
4.4.1 Inputs

The input ratings and circuit diagrams apply to both, TERMINAL connector and I/O connector.

Note that the specifications and circuit diagrams for the interlock input terminals (X16, X17, X18, X19) are different from those shown here. For details, refer to Interlock terminals (page 126).

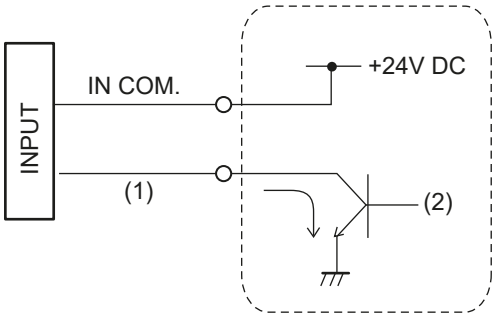
Item	Description
Input type	Bidirectional optocoupler (insulated)
Input ON voltage	Voltage difference between input and input common: ≥19V
Input OFF voltage	Voltage difference between input and input common: ≤3V or open
Rated input voltage	+24V DC ±10%

The ON status of an input is based on the ON status of the optocoupler.



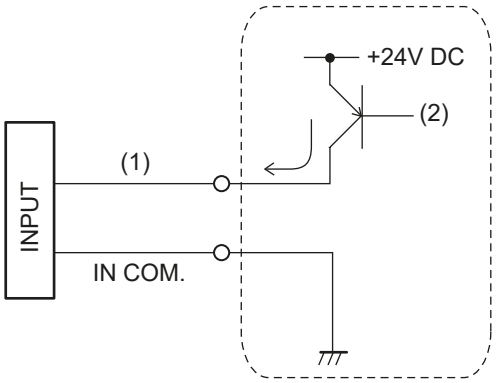
(1) Internal circuit

NPN sample circuit:



(1) Any input
(2) NPN open-collector output

PNP sample circuit:



(1) Any input
(2) PNP open-collector output

Notice

- The I/O connectors support both NPN and PNP transistor outputs. However, you cannot mix NPN and PNP circuits on the same product.
- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. 1 (X2) and OUT COM.1 (Y2, X12). Starting the laser marking system with these terminals short-circuited will cause the laser marking system to malfunction.

Note

- The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.
- DC 2-wire sensors cannot be connected.

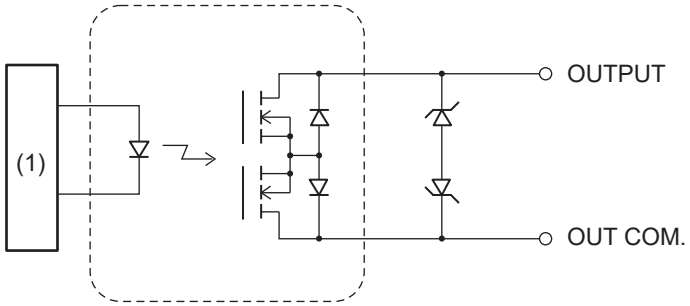
4.4.2 Outputs

The output ratings and circuit diagrams apply to both, TERMINAL connector and I/O connector.

Note that the specifications and circuit diagrams for the interlock monitor terminals (Y16, Y17, Y18, Y19) are different from those shown here. For details, refer to Interlock terminals (page 126).

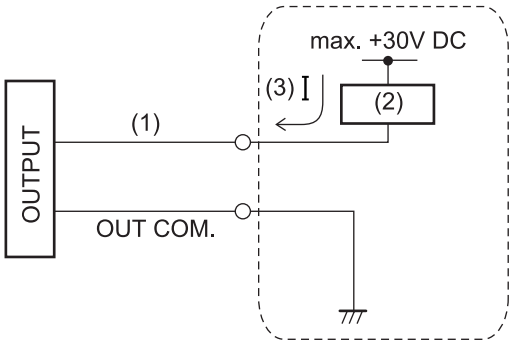
Output ratings	TERMINAL	I/O
Output type	NPN/PNP optocoupler (insulated)	
Short-circuit protection	—	
Max. load current	50mA	20mA
Max. load voltage	+30V DC	
Residual voltage	≤2.0V DC	

The ON status of an output is based on the ON status of the optocoupler.

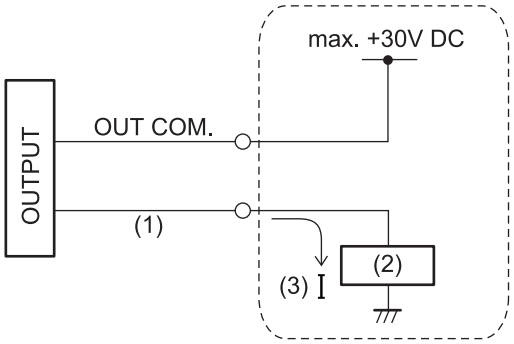


(1) Internal circuit

NPN sample circuit:



PNP sample circuit:



(1) Any output
(2) Load
(3) Max. load current (TERMINAL: 50mA, I/O: 20mA)

Notice

- The I/O connectors support both NPN and PNP transistor outputs. However, you cannot mix NPN and PNP circuits on the same product.
- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. 1 (X2) and OUT COM.1 (Y2, X12). Starting the laser marking system with these terminals short-circuited will cause the laser marking system to malfunction.
- The voltage applied to the outputs and the current flowing through the output terminals must not exceed the specified maximum values. Exceeding the max. load voltage and the max. load current at a terminal will cause the laser marking system to malfunction.

Note

The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.

4.4.3 Interlock terminals

The TERMINAL connector has four interlock inputs and four interlock monitor outputs.

Interlock inputs:

INTERLOCK 1 (+) (X16)

INTERLOCK 1 (-) (X17)

INTERLOCK 2 (+) (X18)

INTERLOCK 2 (-) (X19)

Interlock monitor outputs:

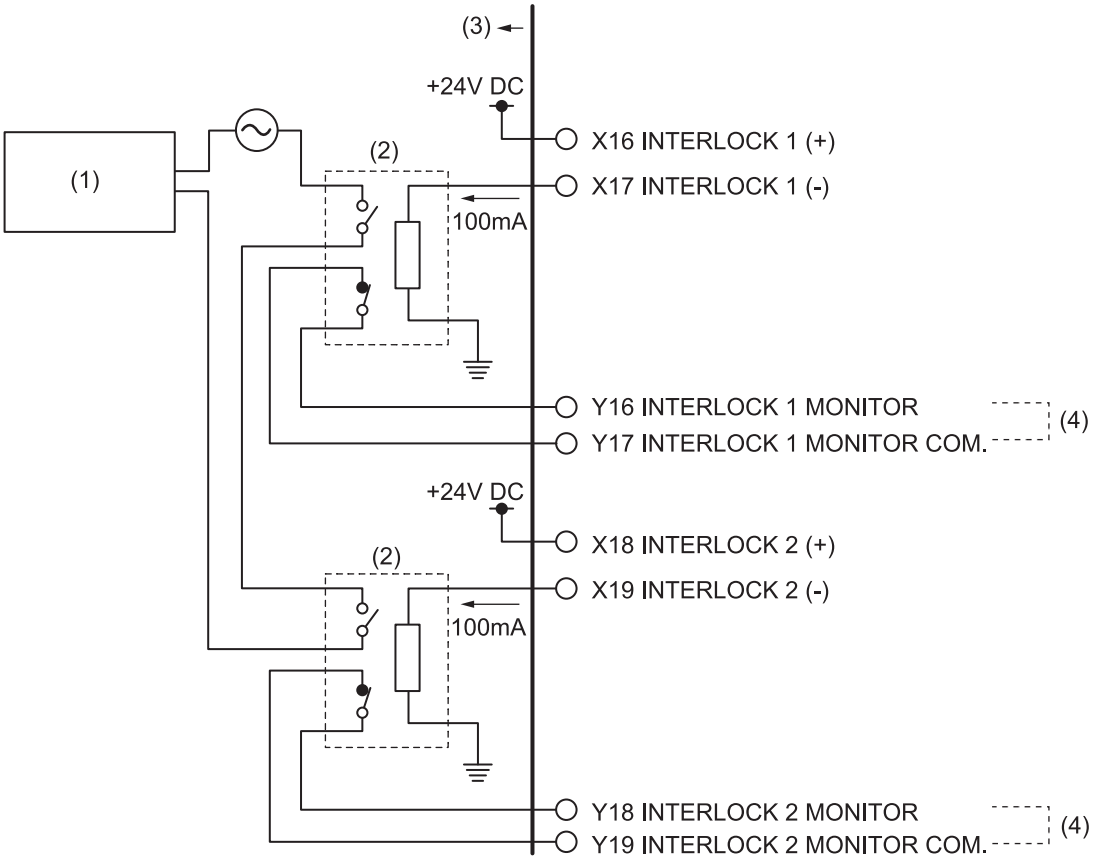
INTERLOCK 1 MONITOR (Y16)

INTERLOCK 1 MONITOR COM. (Y17)

INTERLOCK 2 MONITOR (Y18)

INTERLOCK 2 MONITOR COM. (Y19)

The positive interlock inputs INTERLOCK 1 (+) (X16) and INTERLOCK 2 (+) (X18) are connected internally to their own power supply of +24V DC. This power supply is independent from the internal 24V power supply (X1 or Y3) of the TERMINAL connector.



(1) Power supply of the laser oscillator
(2) INTERLOCK contactor
(3) Internal circuit of the laser marking system
(4) Contact capacity: +24V DC 1A

Notice

The interlock inputs are connected to the operating coils of contactors inside the controller. Therefore, connect only non-voltage contacts, such as relays or switches, to the interlock inputs. Do not connect any voltage contacts, such as transistors (semiconductors).

Related topics

Connecting safety devices (page 131)

4.5 Wiring

When you connect external devices to the TERMINAL connector and to the I/O connector, the power supply of the I/O terminals and the correct use of the jumper wires require special attention.

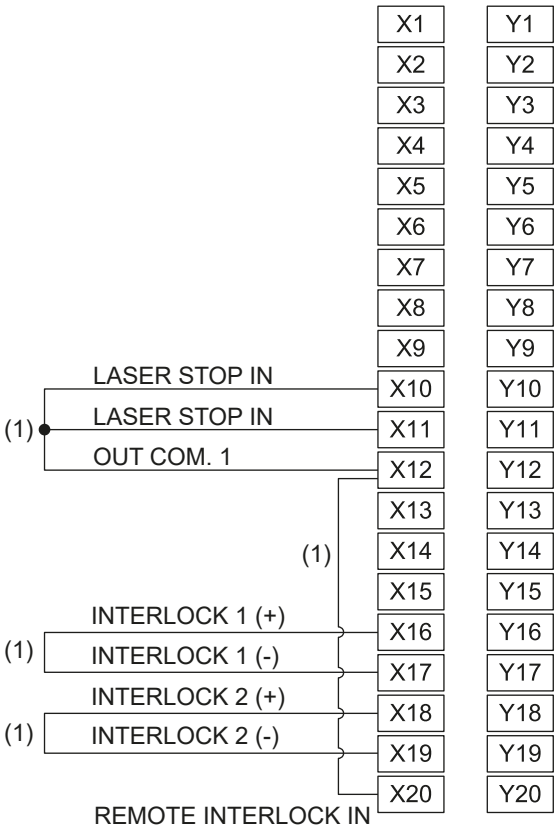
⚠ WARNING

Turn off the power of this product before you conduct wiring, connection, or maintenance work. Wiring and maintenance should be done by an expert engineer or a qualified electrician. Otherwise, there is a risk of an electrical shock or fire.

4.5.1 Factory setting of the jumper wires

At the factory, the following terminals are connected by jumper wires. Remove these wires when you want to connect an external device.

I/O terminal block:



1. Short-circuited

Notice

Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. 1 (X2) and OUT COM.1 (Y2, X12). Starting the laser marking system with these terminals short-circuited will cause the laser marking system to malfunction.

To enable laser radiation, connect IN COM. 1 (X2) and OUT COM. 1 (Y2) to the internal or external power supply.

The following terminals of the TERMINAL connector are connected internally:

X1–Y3: 24V OUT
X3–Y1: 0V OUT
Y2–X12: OUT COM. 1

Related topics

Wiring of the common terminals (page 129)

4.5.2 Wiring of the common terminals

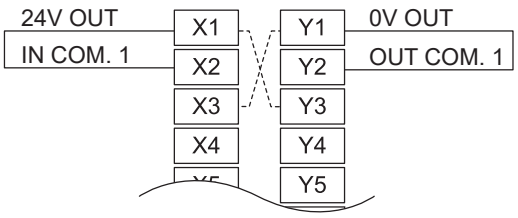
Connect the common terminals IN COM. 1 (X2) and OUT COM. 1 (Y2) to the internal or external power supply of the inputs and outputs. On the I/O connector, use IN COM. 2 and OUT COM. 2 respectively.

Notice

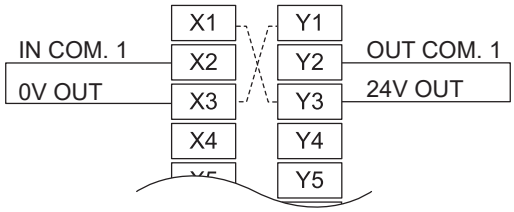
- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. 1 (X2) and OUT COM.1 (Y2, X12). Starting the laser marking system with these terminals short-circuited will cause the laser marking system to malfunction.
- Do not mix internal and external power supply.
- The I/O connectors support both NPN and PNP transistor outputs. However, you cannot mix NPN and PNP circuits on the same product.
- If you use the internal power supply of the TERMINAL connector, make sure that the total load (external device and consumption current for I/O control) does not exceed 300mA.
- If the laser marking system is controlled by a device such as a PLC, which supplies power to the TERMINAL connector, do not connect anything to the internal power supply terminals 24V OUT (X1, Y3) or 0V OUT (X3, Y1). If a jumper wire is installed, remove it.

Internal power supply

NPN:



PNP:

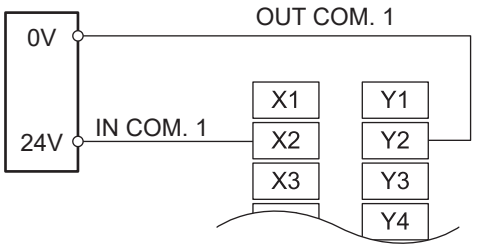


Dotted lines indicate internal connections.

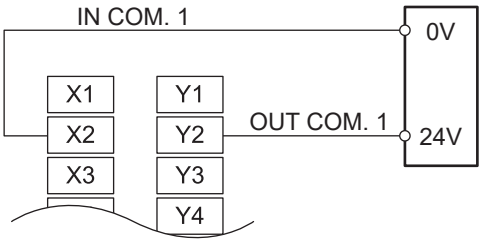
When connecting the internal power supply to IN COM. 1 and OUT COM. 1, use the jumper wires included in the product package.

External power supply

NPN:



PNP:



Note

The common terminals of the connectors TERMINAL and I/O connector are independent of each other and must be connected to the power supply separately.

4.5.3 Connecting a sensor

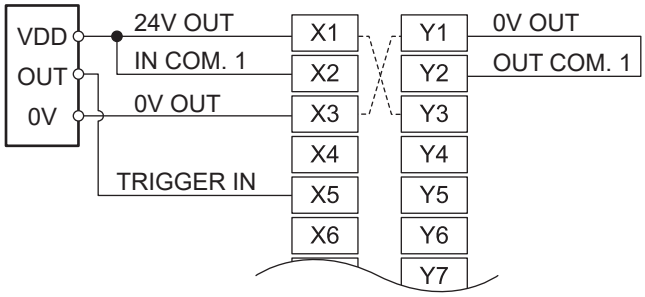
In this example, a sensor is used to input the marking trigger.

The sensor is operated by the internal power supply provided at the TERMINAL connector.

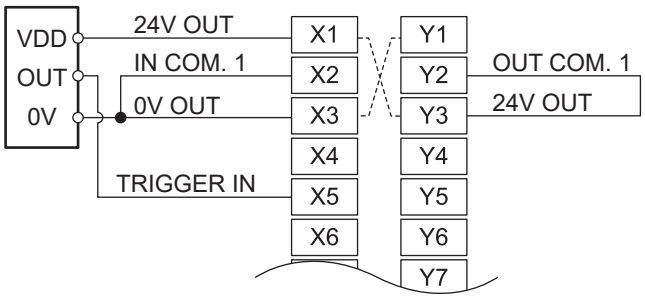
Depending on the connection method (NPN or PNP), the input common must be connected to either the positive pole (24V OUT) or the negative pole (0V OUT) of the internal power supply.

Dotted lines indicate internal connections.

NPN:



PNP:



4.5.4 Connecting safety devices

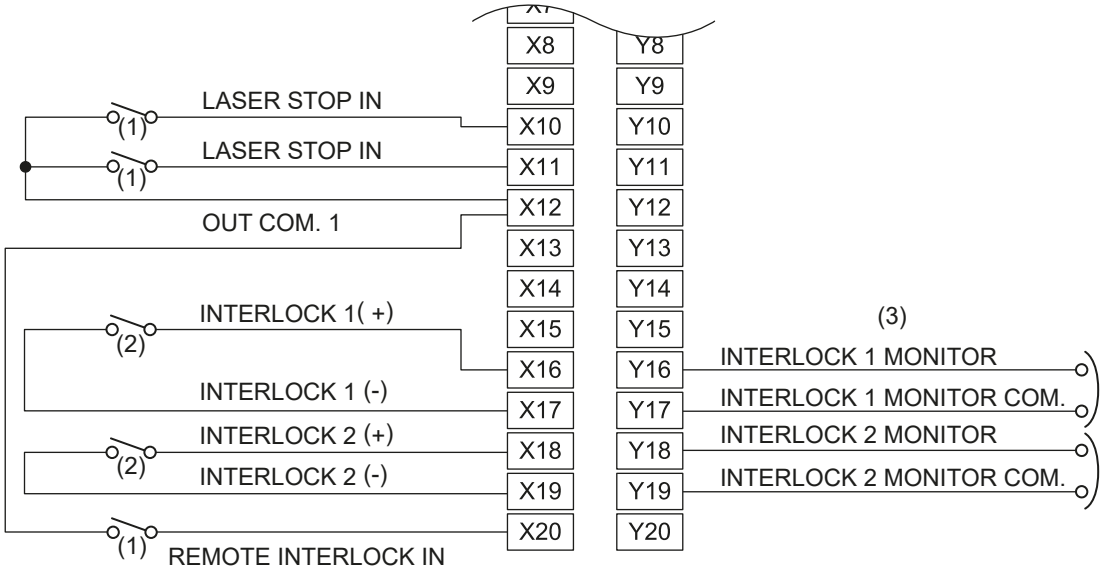
The TERMINAL connector is equipped with terminals to connect safeguards, such as a safety switch of an access panel or an emergency stop button. If any of the terminals is not connected (OPEN), the safety function is activated and laser radiation is interrupted.

To operate the laser marking system, the following terminals must be connected (CLOSED):

LASER STOP IN (X10)–OUT COM. 1 (X12)
LASER STOP IN (X11)–OUT COM. 1 (X12)
INTERLOCK 1 (+) (X16)–INTERLOCK 1 (-) (X17)
INTERLOCK 2 (+) (X18)–INTERLOCK 2 (-) (X19)
REMOTE INTERLOCK (X20)–OUT COM. 1 (X12)

In this example, a laser stop switch is connected between LASER STOP IN (X10) and OUT COM.1 (X12) and between REMOTE INTERLOCK IN (X20) and OUT COM.1 (X12).

Non-voltage contacts, such as the output relays of safety doors or emergency stop buttons are connected between INTERLOCK 1 (+) and INTERLOCK 1 (-) and between INTERLOCK 2 (+) and INTERLOCK 2 (-).



(1) Laser stop switch
(2) Emergency stop button (normally open)
(3) Interlock monitor outputs 1 and 2 connected to PLC

Related topics

Interlock terminals (page 126)

Behavior of the safety functions under fault condition (page 114)

4.5.5 Check the status of I/O terminals

You can use the I/O monitor in Laser Marker NAVI smart to check the operation (ON or OFF status) of all terminals of the I/O connectors.

1. Establish an online connection between your PC and the laser marking system.
2. Select “I/O monitor” in the ribbon to open the I/O monitor.
   The status (“ON”/“OFF”) of the I/O terminals on the laser marking system is displayed in the dialog.
   - The status (“ON”/“OFF”) of the I/O monitor is updated every 500ms.
   - There is a deviation between the actual input or output time and the time “ON” or “OFF” is displayed on the screen.
3. To close the “I/O monitor” dialog, select “Close” or “X”.

4.5.6 Perform output simulation

Use the output simulation function to check the operation of external devices connected to the laser marking system by manually changing the status of an output.

You can also use the output simulation to check the operation of external devices connected to the laser marking system via optional network unit (EtherNet/IP or PROFINET).

When you use the output simulation, you cannot perform other operations or make any settings in Laser Marker NAVI smart.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Maintenance” screen and select “Output simulation” in the ribbon.
3. In the dialog, do any of the following:
   - Select “OFF” next to the output signal that you want to simulate. The status of the output signal changes to “ON”.
   - Select “Reset” to terminate the output simulation and reset the status of the output signals to the actual settings.
   - To close the “Output simulation” dialog and terminate the simulation, select “Close” or “X”.

4.6 Timing charts of I/O signals

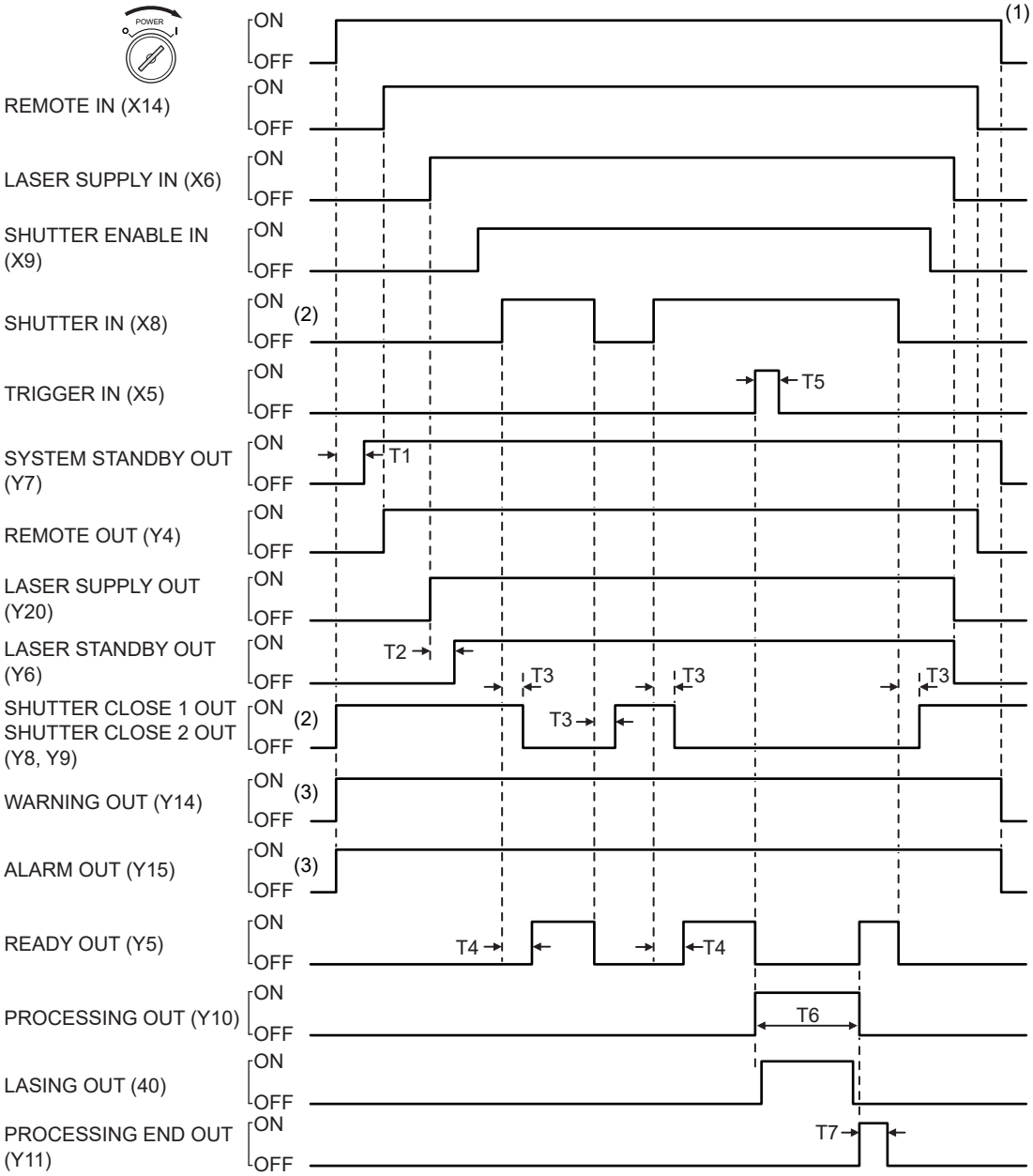
The timing charts show typical signal sequences when controlling the laser marking system by I/O signals.

Because NPN and PNP transistors function in opposite ways, "ON" and "OFF" refer to the ON or OFF status of the terminals and not to the voltage level (high or low) of the signal.

There may be a very small delay of a few milliseconds between signal input and operation of the corresponding output.

4.6.1 From start-up to marking

After turning on the laser marking system, you can control it entirely with a sequence of input signals from an external device.



(1) Turn off the key switch when laser pumping is turned off or when the shutter is closed.

(2) ON = open, OFF = closed

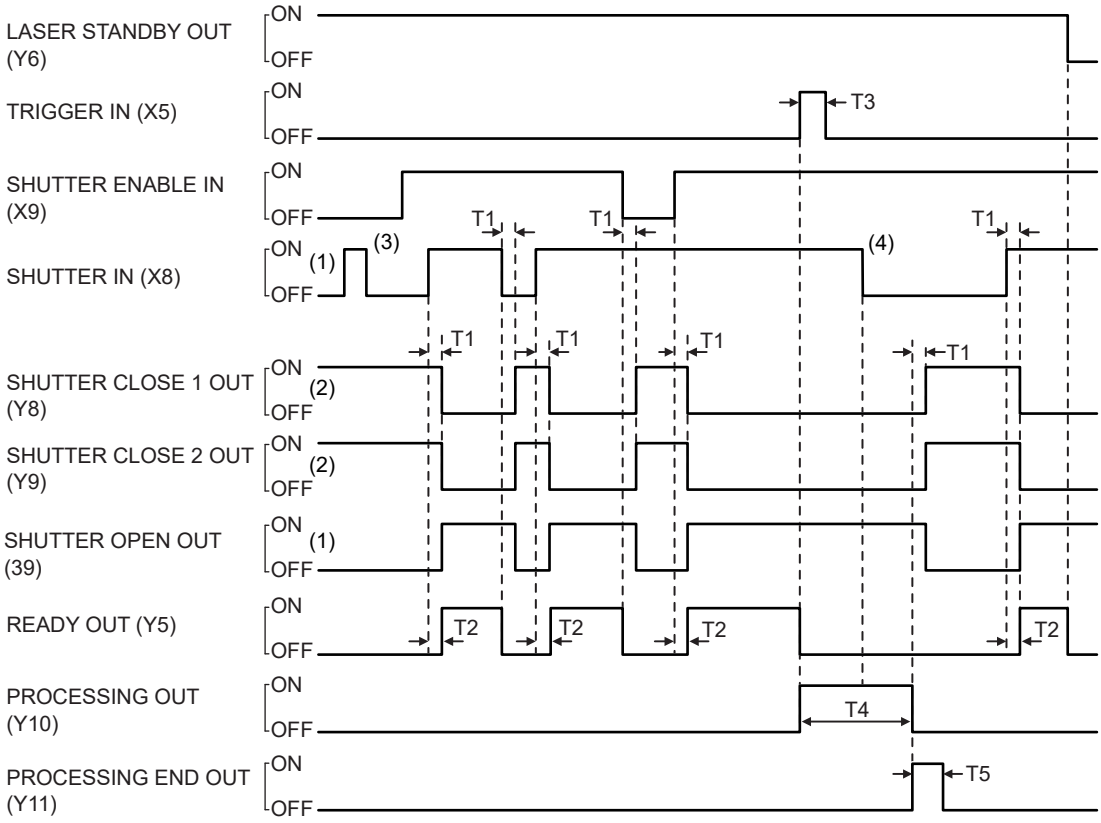
(3) ON = normal, OFF = error

T1	≈10s	System starting time. Before you switch to remote mode, make sure SYSTEM STANDBY OUT (Y7) is ON.
T2	≈1s	Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.

T3	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T4	—	Total setup time to start trigger processing. When laser pumping is completed, this is the time for shutter opening (T3) and marking data generation (depends on data quantity). Otherwise, T4 can also be the laser pumping time, whichever is longer.
T5	≥2ms	Keep the ON status for 2ms or more.
T6	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT). When linking image processing devices, the trigger processing time includes the internal processing time for the linked devices.
T7	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

4.6.2 Shutter operation

The shutter outputs are ON when the shutter is closed.



(1) ON = open, OFF = closed

(2) ON = closed, OFF = open

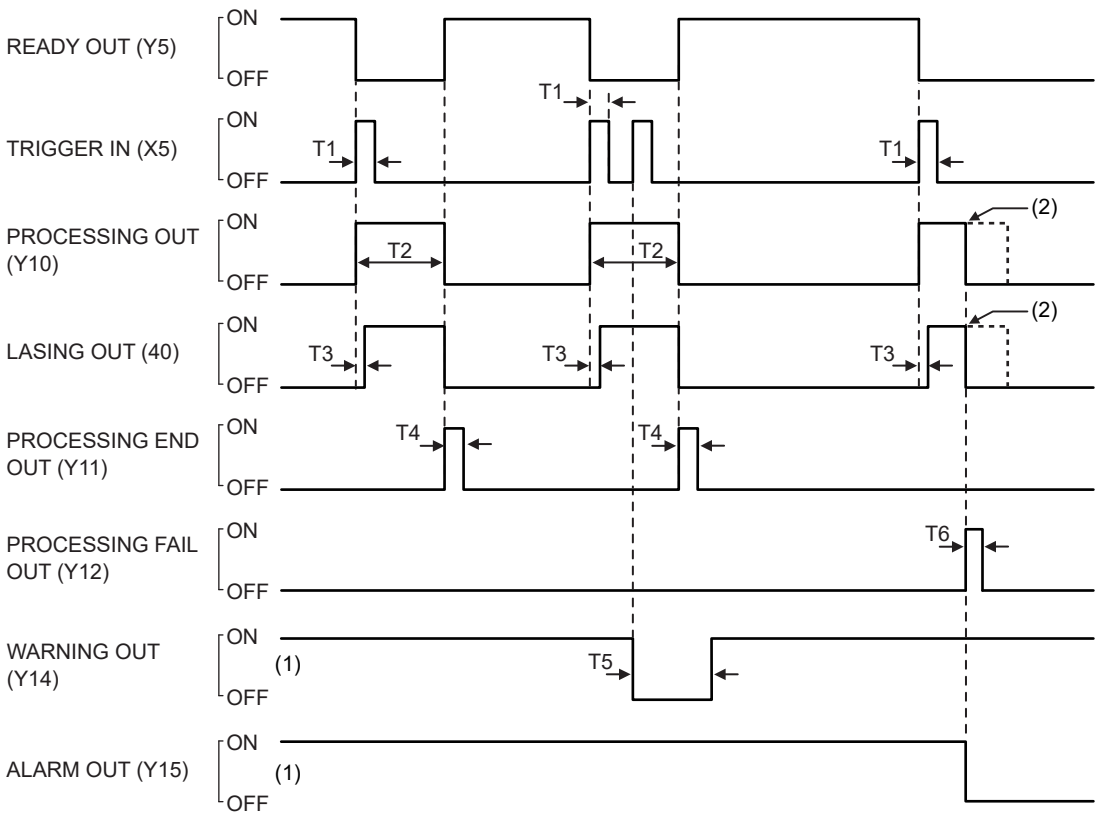
(3) SHUTTER IN turns on, but the shutter only opens when SHUTTER ENABLE IN is ON.

(4) SHUTTER IN turns off, but the shutter only closes when PROCESSING OUT is OFF.

T1	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T2	—	Total time for shutter opening (T1) and marking data generation (depends on data quantity).
T3	≥2ms	Keep the ON status for 2ms or more.
T4	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT). When linking image processing devices, the trigger processing time includes the internal processing time for the linked devices.
T5	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

4.6.3 Marking trigger input: single trigger (static objects)

In single trigger mode, one marking process is executed with the rising edge of the marking trigger signal at TRIGGER IN (X5).



(1) ON = normal, OFF = error

(2) Marking interruption

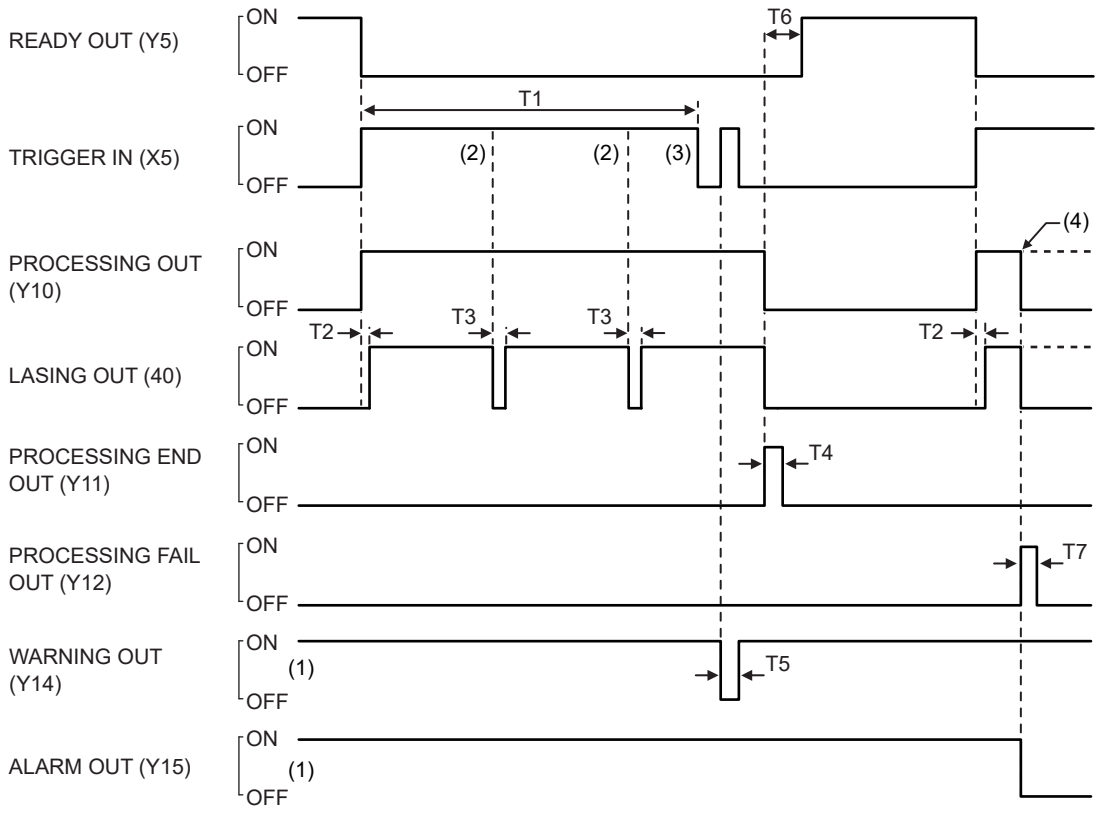
T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT). When linking image processing devices, the trigger processing time includes the internal processing time for the linked devices.
T3	0–9999ms	If a trigger delay time is set in the selected file, trigger processing (the lasing process) starts after the delay time.
T4	2–510ms	This output signal indicates that trigger processing has been completed normally. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T5	≈3s	A warning is output if an invalid marking trigger was input during trigger processing. You can permanently deactivate this warning in the software settings. The output is ON for the set one-shot pulse duration.
T6	2–510ms	If trigger processing was stopped by an alarm or a warning, the trigger processing abnormal end output PROCESSING FAIL OUT (Y12) turns on for the set one-shot pulse duration. In this case, the trigger processing completed output PROCESSING END OUT (Y11) does not turn on.

4.6.4 Marking trigger input: continuous trigger

In continuous trigger mode, the lasing process is repeated while the marking trigger input TRIGGER IN (X5) is ON.

Depending on the setting for “Allow to stop halfway”, the lasing process stops immediately when TRIGGER IN (X5) turns off or continuous until the lasing process is finished.

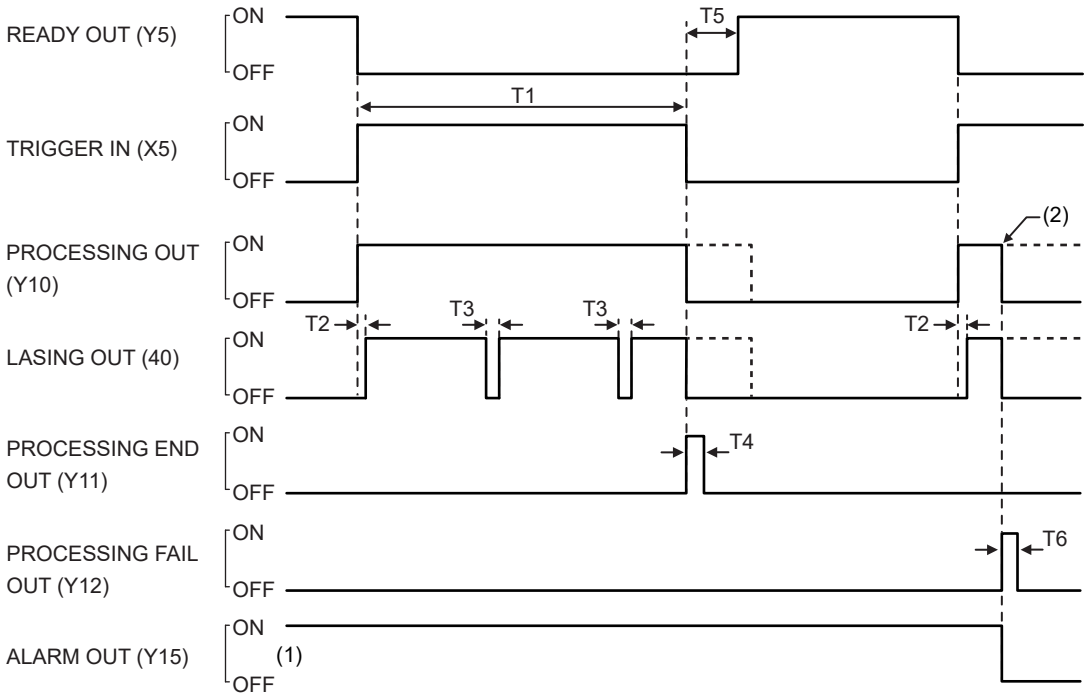
“Allow to stop halfway” deactivated (default setting)



(1) ON = normal, OFF = error
(2) If TRIGGER IN remains ON, the lasing process starts again.
(3) If TRIGGER IN turns off, the current lasing process continues until it is finished.
(4) Marking interruption

T1 ≥2ms	Keep the ON status for the entire duration of the repeated lasing processes.
T2 0–9999ms	If a trigger delay time is set in the selected file, trigger processing (the lasing process) starts after the delay time.
T3 0–60s	If a scan interval is set, the next lasing process starts after the specified time.
T4 2–510ms	This output signal indicates that trigger processing has been completed normally. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T5 ≈3s	A warning is output if an invalid marking trigger was input during trigger processing. You can permanently deactivate this warning in the software settings. The output is ON for the set one-shot pulse duration.
T6 —	Time for generating the next marking data (depends on data quantity).
T7 2–510ms	If trigger processing was stopped by an alarm or a warning, the trigger processing abnormal end output PROCESSING FAIL OUT (Y12) turns on for the set one-shot pulse duration. In this case, the trigger processing completed output PROCESSING END OUT (Y11) does not turn on.

“Allow to stop halfway” activated



(1) ON = normal, OFF = error

(2) Marking interruption

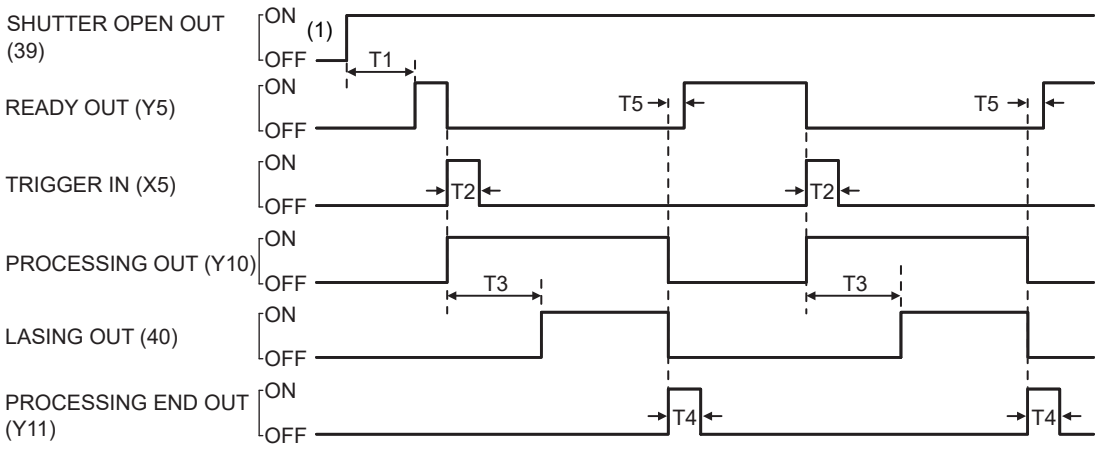
T1	≥2ms	Keep the ON status for the entire duration of the repeated lasing processes.
T2	0–9999ms	If a trigger delay time is set in the selected file, trigger processing (the lasing process) starts after the delay time.
T3	0–60s	If a scan interval is set, the next lasing process starts after the specified time.
T4	2–510ms	This output signal indicates that trigger processing has been completed normally. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value. When the marking process stops halfway because TRIGGER IN (X5) turns off, this is treated as a normal completion of the operation.
T5	—	Time for generating the next marking data (depends on data quantity).
T6	2–510ms	If trigger processing was stopped by an alarm or a warning, the trigger processing abnormal end output PROCESSING FAIL OUT (Y12) turns on for the set one-shot pulse duration. In this case, the trigger processing completed output PROCESSING END OUT (Y11) does not turn on.

Note

- The warning E630 is output if TRIGGER IN turns off before the minimum number of scans is reached.
- The warning E631 is output and the lasing process stops if the TRIGGER IN signal remains on even after the maximum number of scans is reached.

4.6.5 On-the-fly marking: single trigger

Use the single trigger mode to input the marking trigger for every marking process. The lasing process starts when the workpiece comes to the preset marking position. The next trigger can be accepted after the current lasing process is finished.



(1) ON = open, OFF = closed

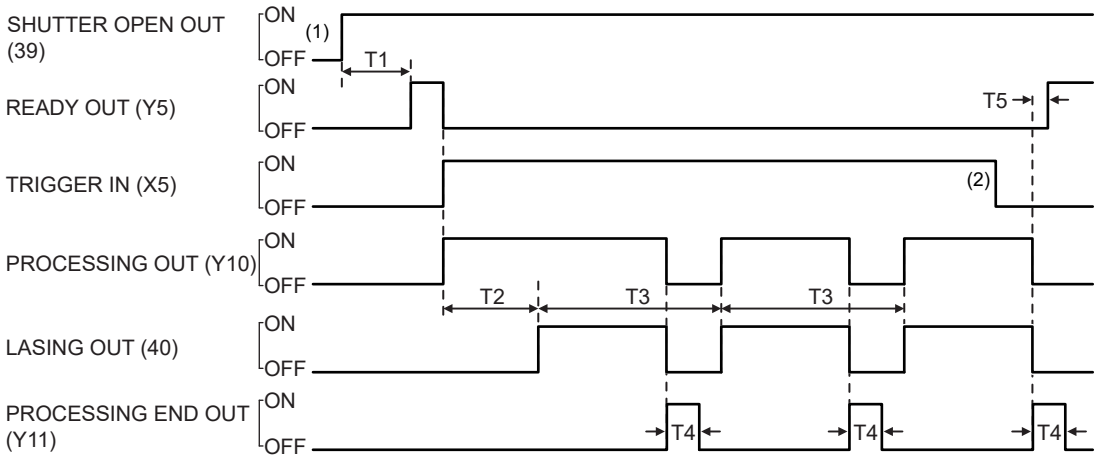
T1	—	Time for generating the next marking data (depends on data quantity).
T2	≥2ms	Keep the ON status for 2ms or more.
T3	—	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T4	2–510ms	This output signal indicates that trigger processing has been completed normally. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T5	—	If data generation finishes within the processing time, READY OUT (Y5) turns on after max. 1ms. Otherwise, this is the remaining time needed for data generation.

Note

If the counter is reset at date change during on-the-fly marking in single trigger mode, the marking trigger ready status momentarily turns off, and the next marking process cannot be executed due to warning E751.

4.6.6 On-the-fly marking: marking at regular intervals

If “Marking at regular intervals” is set, the marking process is repeated at regular intervals.



(1) ON = open, OFF = closed

(2) If TRIGGER IN turns off during trigger processing, on-the-fly marking at regular intervals is terminated after the current process has been completed.

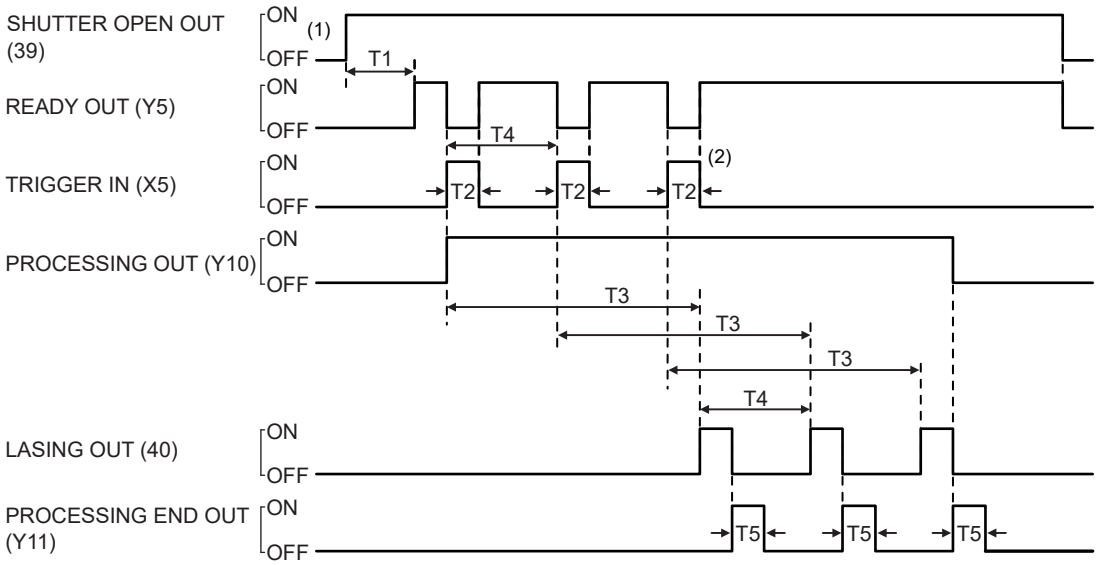
T1	—	Time for generating the next marking data (depends on data quantity).
T2	—	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T3	—	Time needed to cover the specified workpiece spacing [mm].
T4	2–510ms	This output signal indicates that trigger processing has been completed normally. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T5	—	If data generation finishes within the processing time, READY OUT (Y5) turns on after max. 1ms. Otherwise, this is the remaining time needed for data generation.

Note

If the counter is reset during on-the-fly marking, the next marking process cannot be executed due to warning E751.

4.6.7 On-the-fly marking: multiple triggers

In multiple trigger mode, multiple triggers are accepted in advance.



(1) ON = open, OFF = closed

(2) A maximum of 16 triggers can be accepted while the trigger processing output PROCESSING OUT (Y10) is ON.

T1	—	Time for generating the next marking data (depends on data quantity).
T2	≥2ms	Keep the ON status for 2ms or more.
T3	—	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T4	—	The trigger input interval must be sufficient to allow for the lasing process and the generation of the next marking data. Otherwise, warning E618 is output and subsequent marking processes will be canceled.
T5	2–510ms	This output signal indicates that trigger processing has been completed normally. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

Note

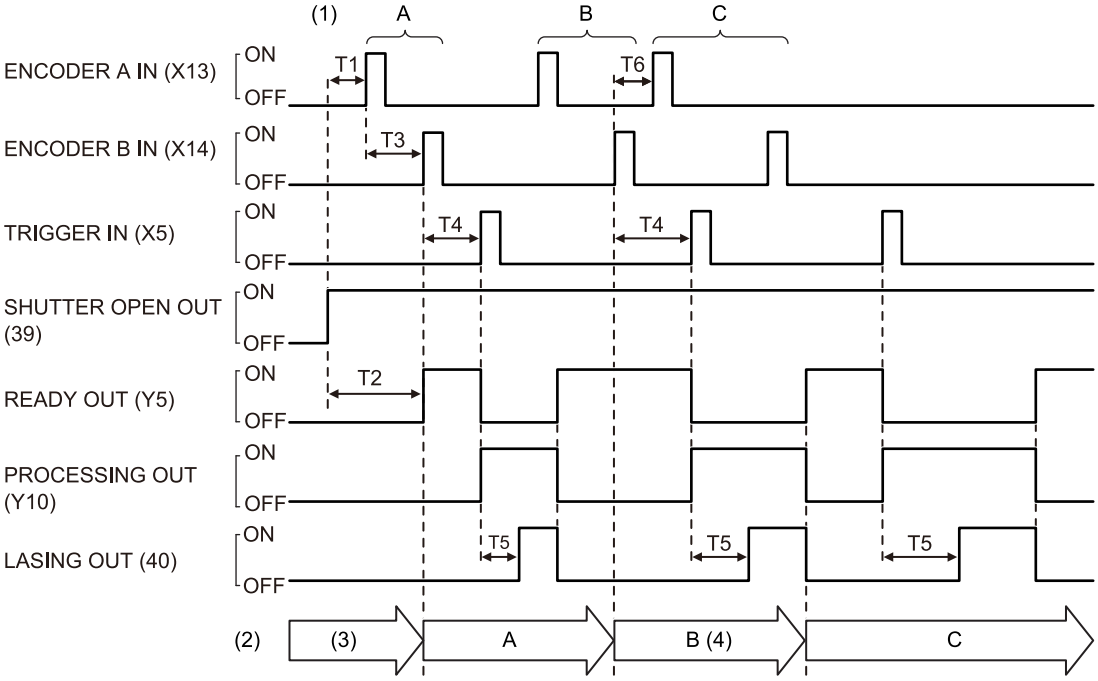
If the counter is reset during on-the-fly marking, the next marking process cannot be executed due to warning E751.

If any of the following operations are performed during the processing of multiple triggers, on-the-fly marking is terminated after finishing the current process, and subsequent triggers will be canceled:

- Closing the shutter
- Sending an **MKM** command to turn on command reception mode
- Changing the file
- Changing the marking characters by a code reader

4.6.8 On-the-fly marking: 2 sensors input

The line speed is calculated based on the input signals from two sensors. The trigger mode is set to “Single trigger”.



(1) Line speed A, B, and C
(2) Applied line speed A, B, and C
(3) Undefined line speed – If TRIGGER IN turns on during this time, warning E607 is output.
(4) If ENCODER B IN turns on during trigger processing, the line speed is updated after trigger processing.

T1	≥0ms	Turn on ENCODER A IN (X13) when the shutter is open.
T2	—	Time for generating the next marking data (depends on data quantity).
T3	≤10s	If ENCODER B IN (X14) does not turn on within 10s from turning on ENCODER A IN (X13), timeout warning E607 is output when TRIGGER IN (X5) turns on.

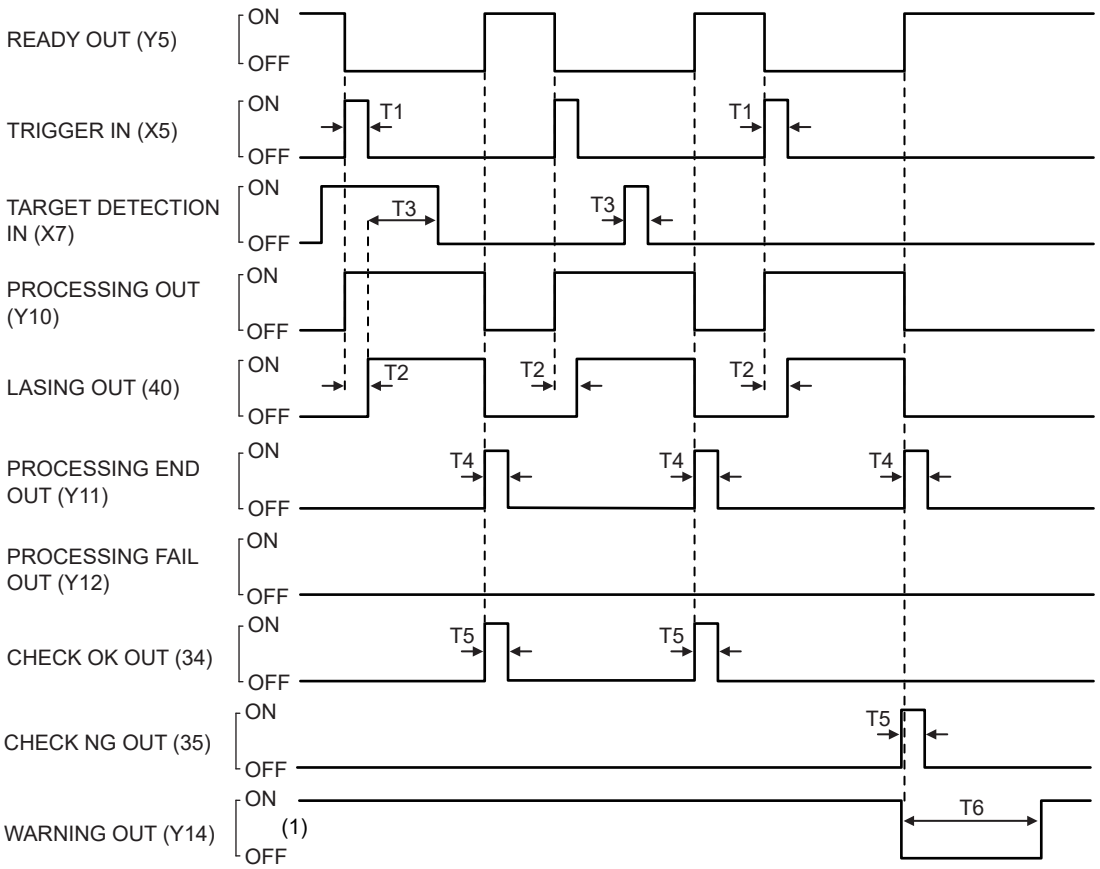
T4 1–10s	If TRIGGER IN (X5) does not turn on within the set timeout period from turning on ENCODER B IN (X14), warning E607 is output. The timeout setting is optional.
T5 —	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T5 ≥0ms	ENCODER A IN (X13) can be accepted for the next marking after ENCODER B IN (X14) was turned on.

Note

Place the sensors and the trigger detecting position as close as possible to each other to reduce the difference between the detected line speed and the actual line speed at the marking position.

4.6.9 Target detection

Connect a sensor to the target detection input to check that the workpiece is in the marking position during the lasing process.



(1) ON = normal, OFF = error

T1 ≥2ms	Keep the ON status for 2ms or more.
T2 0–9999ms	If a trigger delay time is set in the selected file, trigger processing (the lasing process) starts after the delay time.

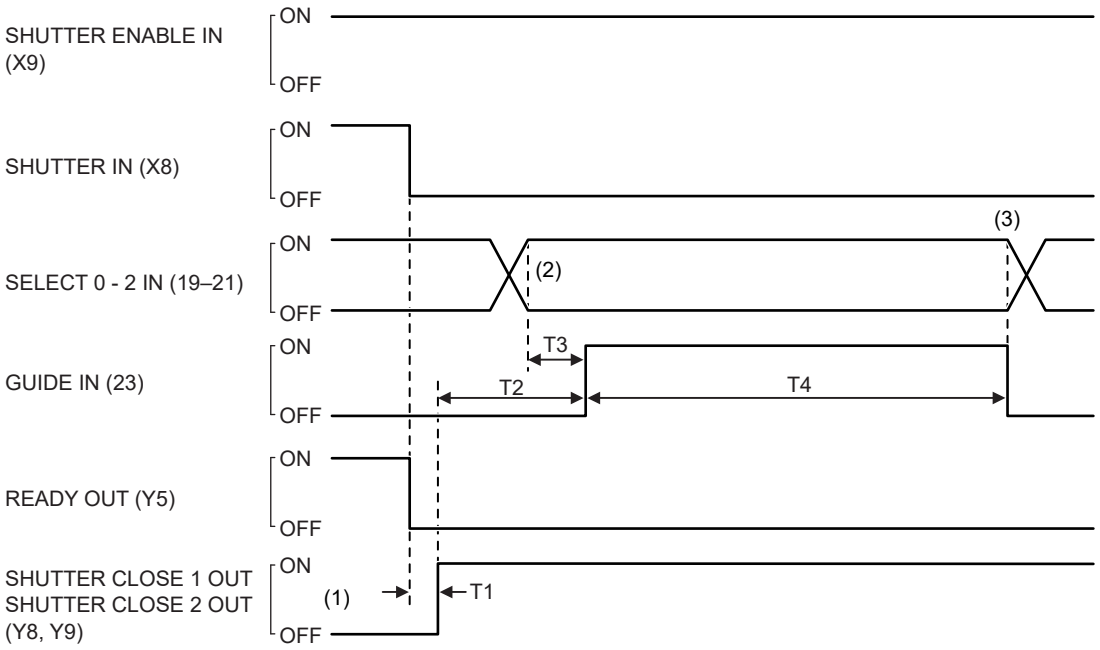
T3	≥1ms	When TARGET DETECTION IN (X7) turns on for more than 1ms while LASING OUT (40) is ON, target detection is judged successful.
T4	2–510ms	This output signal indicates that trigger processing has been completed normally. PROCESSING END OUT (Y11) turns on even when the workpiece could not be detected. The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T5	2–510ms	Depending on the status of TARGET DETECTION IN, the check OK output CHECK OK OUT (34) or the check NG output CHECK NG OUT (35) of the I/O connector turns on after trigger processing (lasing). CHECK OK OUT turns on if TARGET DETECTION IN is ON for more than 1ms during lasing. If the input does not turn on, CHECK NG OUT turns on. The outputs are ON for the set one-shot pulse duration.
T6	≈3s	If TARGET DETECTION IN (X7) does not turn on during lasing, warning E752 is output for 3s.

Note

To use the target detection input, you must enable “TARGET DETECTION IN (X7)” in the “System settings” screen.

4.6.10 Guide laser operation

Before you turn on the guide laser trigger input, a guide laser mode must be specified and the shutter must be closed.



(1) ON = closed, OFF = open

(2) Set the guide laser mode with the selection inputs SELECT 0 IN to SELECT 2 IN:

Work distance	SELECT 0 IN: OFF	SELECT 1 IN: OFF	SELECT 2 IN: OFF
Marking image	**SELECT 0 IN: ON**	SELECT 1 IN: OFF	SELECT 2 IN: OFF
Marking field	SELECT 0 IN: OFF	**SELECT 1 IN: ON**	SELECT 2 IN: OFF
Masked objects	**SELECT 0 IN: ON**	**SELECT 1 IN: ON**	SELECT 2 IN: OFF

(3) Do not change the state of the selection inputs while GUIDE IN (23) is ON.

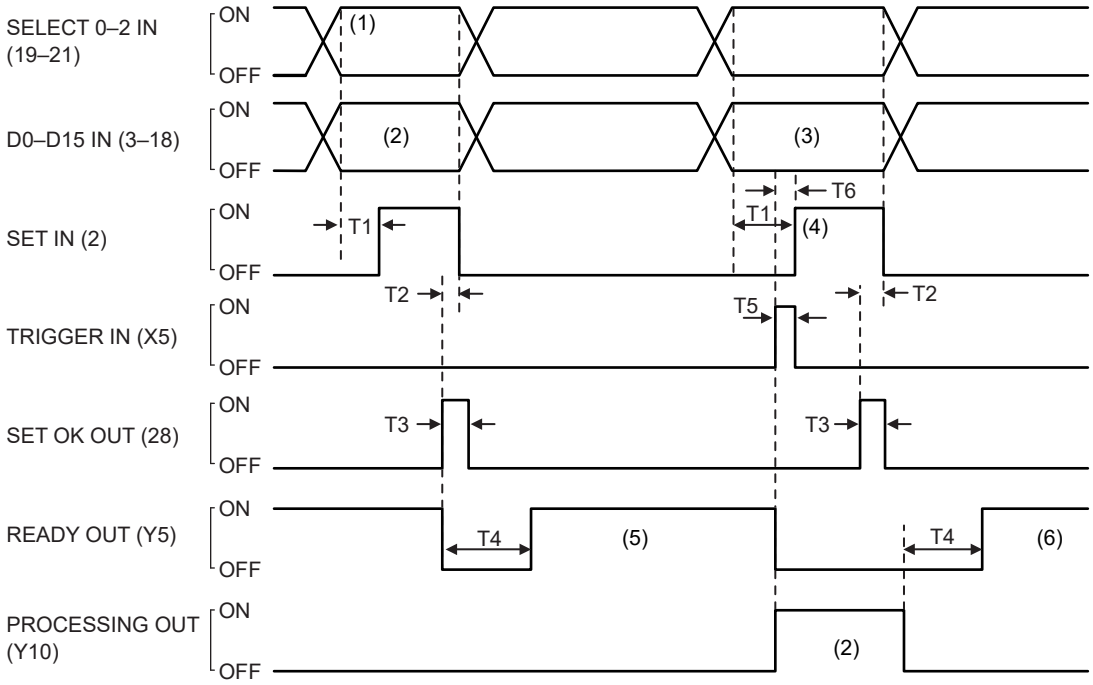
T1	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T2	≥0ms	Turn on GUIDE IN (23) with the shutter closed.
T3	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN, wait for at least 0.5ms to turn on GUIDE IN (23).
T4	≤60s	The guide laser stops automatically after 1min.

Note

- To use a guide laser in remote mode while any of the interlock inputs is open, go to “System settings” > “Operation/information” > “INTERLOCK alarm detection” and select “Deactivate while shutter closed”.
- If command control has been set for guide laser control in Laser Marker NAVI smart, the guide laser cannot be triggered by I/O signals.
- Do not execute any other operation during guide laser emission.

4.6.11 Switching of file numbers

To switch the file number, set the file number function with the selection inputs and specify the number of the marking file with the number inputs.



(1) Set the file number function with the selection inputs:

SELECT 0 IN: OFF	SELECT 1 IN: OFF	SELECT 2 IN: OFF

(2) File number A

(3) File number B

(4) You can input the next file number and turn on SET IN (2) during trigger processing. In this case, the file number changes after trigger processing is completed.

(5) File number A ready for marking

(6) File number B ready for marking

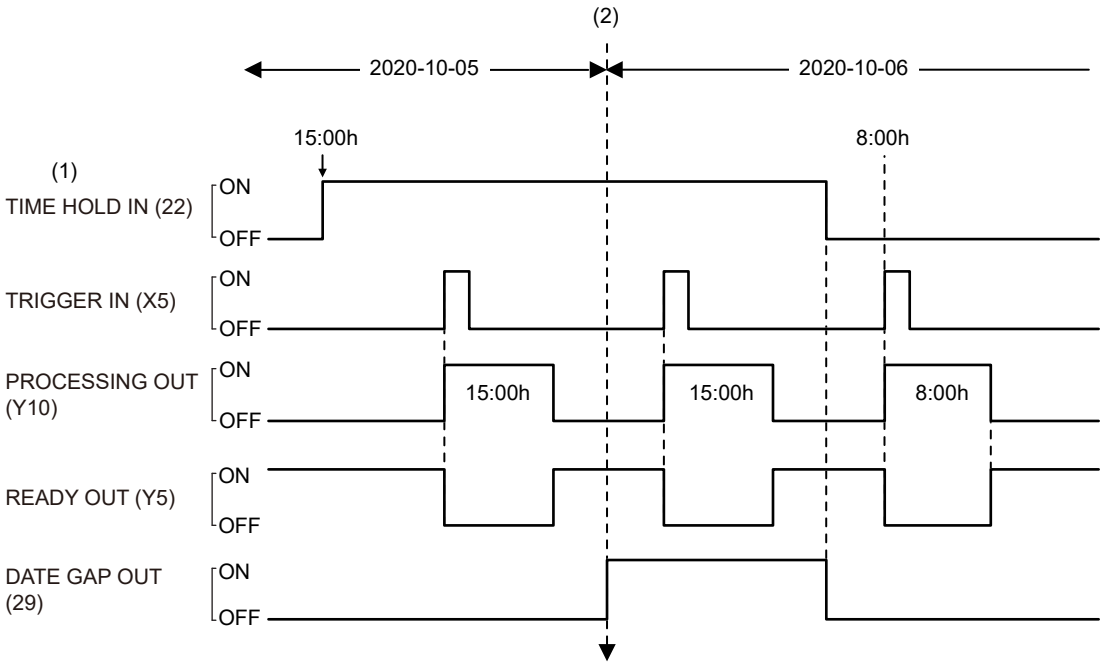
T1	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN and D0 IN to D15 IN, wait for at least 0.5ms to turn on SET IN (2).
T2	≥0ms	Keep the state of the input until SET OK OUT (28) turns on.
T3	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

T4	—	When laser pumping is completed and the shutter open, this is the time for generating the next marking data (depends on data quantity). If laser pumping is not completed and the shutter is closed, this can also be the time for laser pumping, whichever is longer.
T5	≥2ms	Keep the ON status for 2ms or more.
T6	≥0ms	To input the next file number during trigger processing, turn on SET IN (2) after PROCESSING OUT (Y10) turns on.

4.6.12 Holding of time and date

When you turn on the time/date hold input, the retained current time and date are marked until the input is turned off.

The date gap output turns on if the date changes because midnight is passed.



(1) The time hold function can be activated either by turning on the TIME HOLD IN (22) input of the I/O connector or by configuring the setting “System settings” > “Operation/information” > “Time hold control” > “Activate until fixed time”. If you select “Activate until fixed time”, the previous day’s date will be marked from 0:00:00 AM until the time specified with “Deactivate time hold at”.

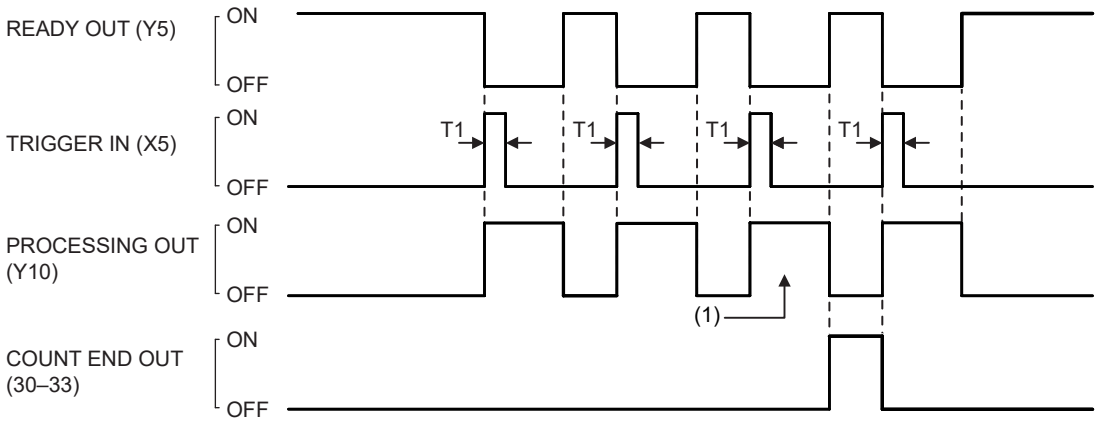
(2) When the date changes, the retained time and date are marked until TIME HOLD IN turns off.

Note

- The date gap output is available even when “Time hold control” > “Activate until fixed time” is configured in the system settings of Laser Marker NAVI smart.
- The time/date hold input can be used even when remote mode is turned off.
- If TIME HOLD IN turns on when the power of the laser marking system turns on, the start-up time of the system is retained.
- If TIME HOLD IN turns on, the time will be retained regardless of the file number, remote mode status, or error status.
- If you turn TIME HOLD IN on and off continuously, make sure the OFF time is at least 2s.

4.6.13 Monitoring of the counter end value

If you have assigned the counter numbers to counter end outputs in Laser Marker NAVI smart, the associated counter end output turns on when the end value has been marked.



(1) Marking of the counter end value

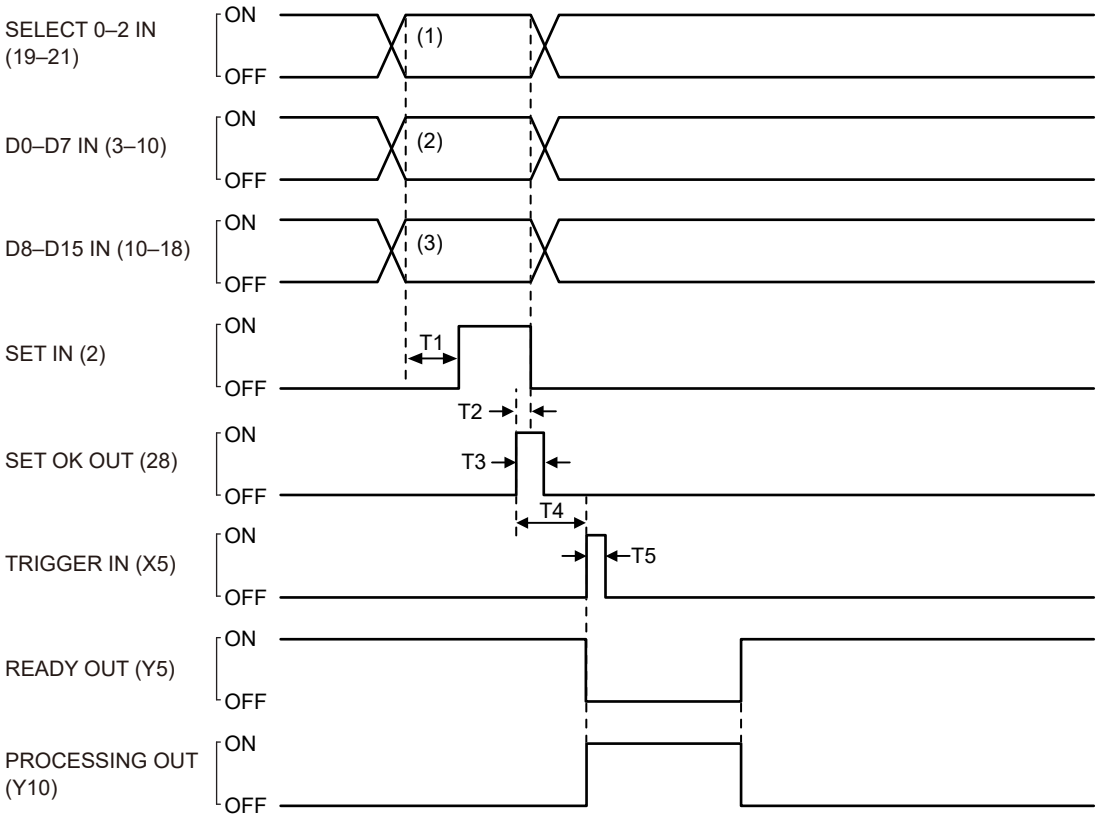
T1	≥2ms	Keep the ON status for 2ms or more.

Note

- Assign the counter numbers to the counter end outputs in the “System settings” screen of Laser Marker NAVI smart.
- The counter end output remains ON with the shutter open until the next marking trigger signal is input. When you close the shutter, the output turns off.
- The counter end output turns off when “Count individually” is selected under “Step & repeat” in Laser Marker NAVI smart.

4.6.14 Setting of the step value for up and down counters

Set the step value function with the selection inputs and specify the counter number and step value with the number inputs.



(1) Set the step value function with the selection inputs:

Step value for up counter	SELECT 0 IN: OFF	**SELECT 1 IN: ON**	SELECT 2 IN: OFF
Step value for down counter	**SELECT 0 IN: ON**	**SELECT 1 IN: ON**	SELECT 2 IN: OFF

(2) Use D0 IN to D7 IN to specify the counter number.

(3) Use D8 IN to D15 IN to specify the step value. For details, refer to Input signals (page 116).

T1	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN and D0 IN to D15 IN, wait for at least 0.5ms to turn on SET IN (2).
T2	≥0ms	Keep the state of the input until SET OK OUT (28) turns on.
T3	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T4	≥0ms	Turn on TRIGGER IN (X5) after SET OK OUT (28) turns on.
T5	≥2ms	Keep the ON status for 2ms or more.

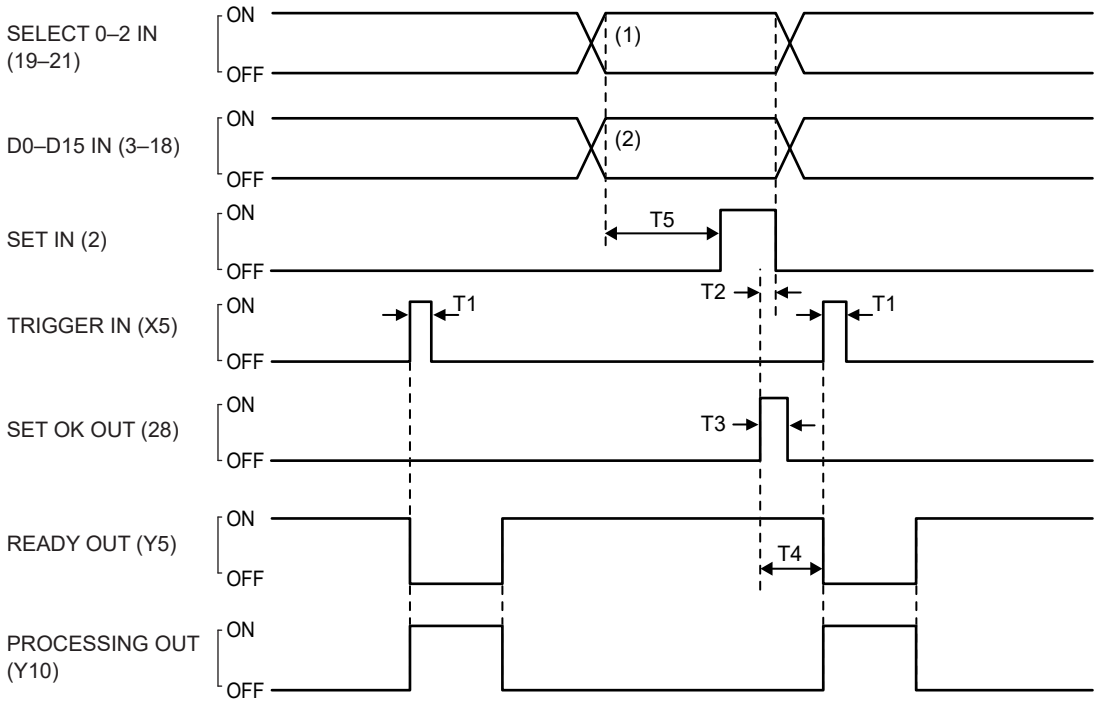
Note

- To specify the next counter number and step value during trigger processing, turn on SET IN (2) as soon as PROCESSING OUT (Y10) is ON.
- If the step value is input during on-the-fly marking, READY OUT (Y5) turns off momentarily, and the next marking process cannot be executed due to warning E751.

4.6.15 Counter reset

To reset a counter to its starting value, set the counter reset function with the selection inputs and specify the counter number with the number inputs.

When you turn on the set input SET IN (2), the counter is reset. Before you turn on the marking trigger input TRIGGER IN (X5), make sure the setting completion output SET OK OUT (28) has turned on.



(1) Set the counter reset function with the selection inputs:

SELECT 0 IN: OFF	SELECT 1 IN: OFF	**SELECT 2 IN: ON**

(2) Use D0 IN to D15 IN to specify the counter number. For details, refer to Input signals (page 116).

T1	≥2ms	Keep the ON status for 2ms or more.
T2	≥0ms	Keep the state of the input until SET OK OUT (28) turns on.
T3	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

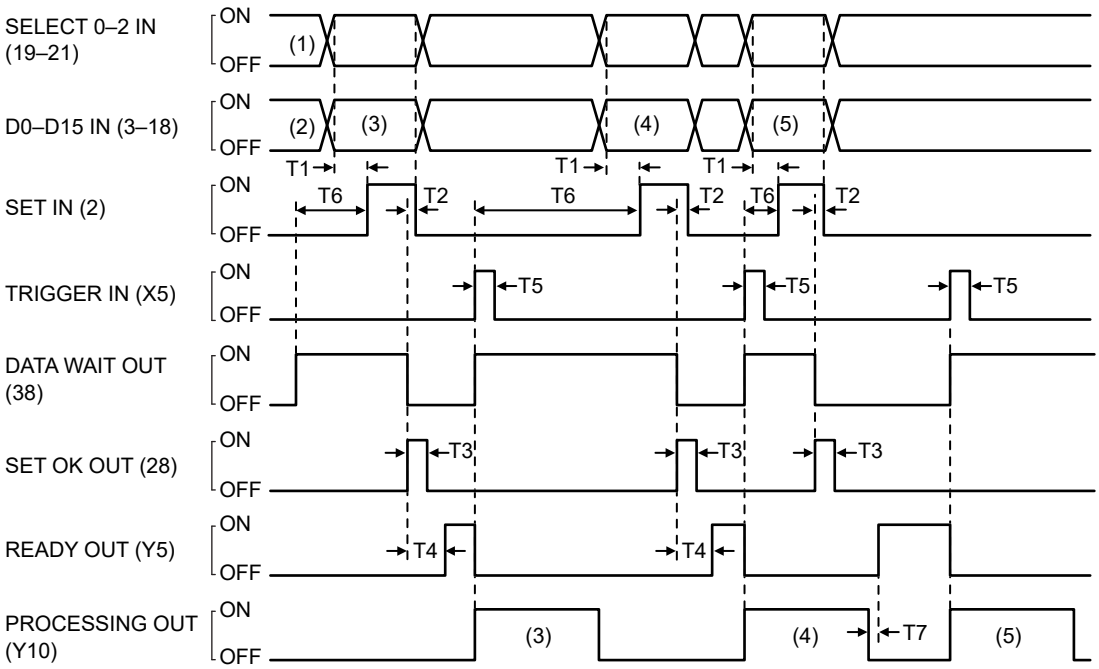
T4	≥0ms	Turn on TRIGGER IN (X5) after SET OK OUT (28) turns on.
T5	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN and D0 IN to D15 IN, wait for at least 0.5ms to turn on SET IN (2).

Note

If the counter is reset at date change during on-the-fly marking in single trigger mode, the marking trigger ready status momentarily turns off, and the next marking process cannot be executed due to warning E751.

4.6.16 Setting of record numbers for registers and external offset

To specify a record number for the register function or the external offset function, use the selection inputs to set the function and specify the record number with the number inputs.



(1) Set the register and external offset function with the selection inputs:

SELECT 0 IN: ON	SELECT 1 IN: OFF	SELECT 2 IN: OFF

(2) Use D0 IN to D15 IN to specify the record number. For details, refer to Input signals (page 116).

(3) Data A

(4) Data B

(5) Data C

T1	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN and D0 IN to D15 IN, wait for at least 0.5ms to turn on SET IN (2).
T2	≥0ms	Keep the state of the input until SET OK OUT (28) turns on.
T3	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

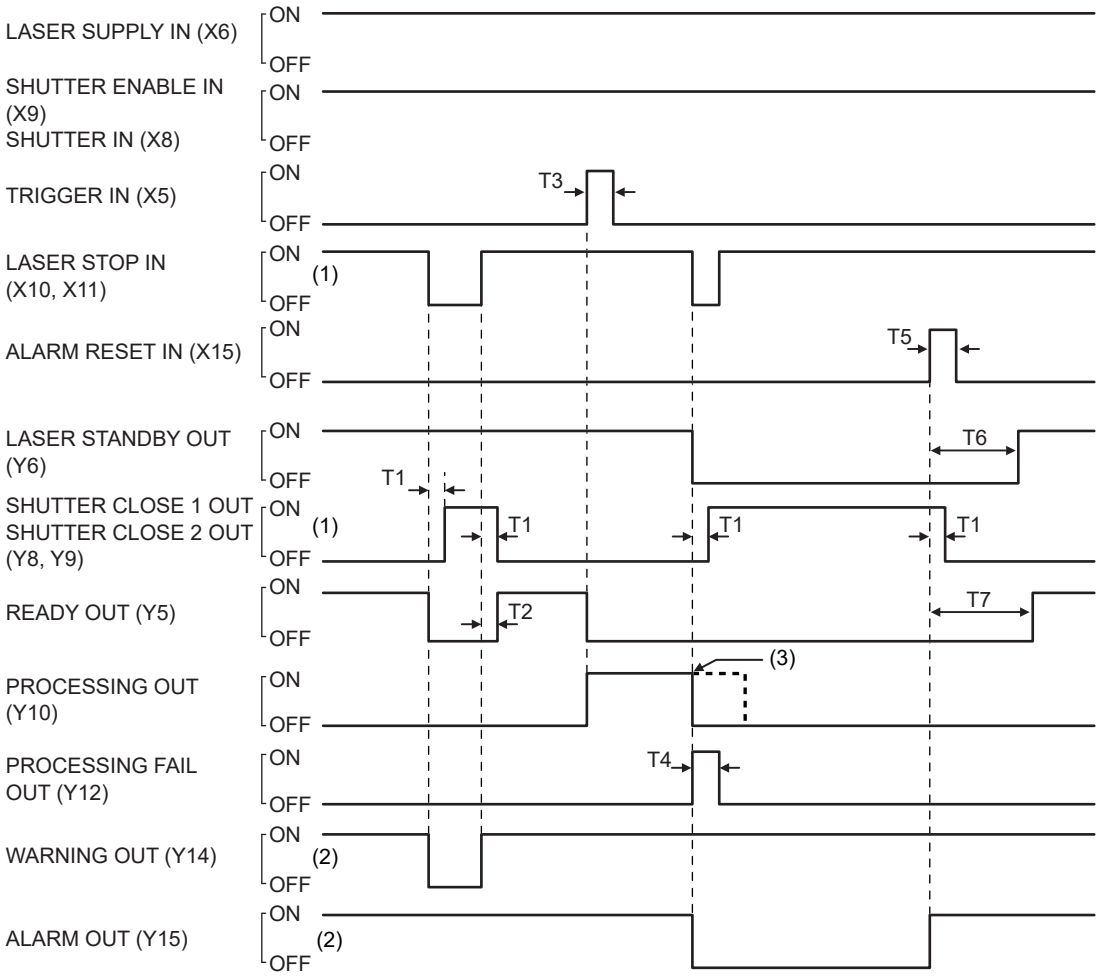
T4	—	Time for generating the next marking data (depends on data quantity).
T5	≥2ms	Keep the ON status for 2ms or more.
T6	≥0ms	Turn on SET IN (2) after DATA WAIT OUT (38) turns on.
T7	—	If data generation finishes within the processing time, READY OUT (Y5) turns on after max. 1ms. Otherwise, this is the remaining time needed for data generation.

Note

- SET IN (2) can be turned on when laser pumping is completed and the shutter opens.
- For the register function and the external offset function, the marking trigger ready output READY OUT (Y5) does not turn on until the record number is input and SET IN (2) is ON.
- Turn on the number inputs and SET IN (2) for every marking trigger, even if the marking data are not changed.
- Close the shutter to reset a record number that was set with SET IN (2).
- READY OUT (Y5) turns on even if no data are specified in the “Registered characters” dialog.

4.6.17 Laser stop input

If one of the two laser stop input is opened and the laser is not radiating, the shutter is closed and laser pumping remains active. If it is opened when the laser is radiating, laser pumping turns off and the shutter is closed.



(1) ON = closed, OFF = open
(2) ON = normal, OFF = error
(3) Marking interruption

T1	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T2	—	Total time for shutter opening and marking data generation (depends on data quantity).
T3	≥2ms	Keep the ON status for 2ms or more.
T4	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.
T5	≥100ms	Keep the ON status for 100ms or more.

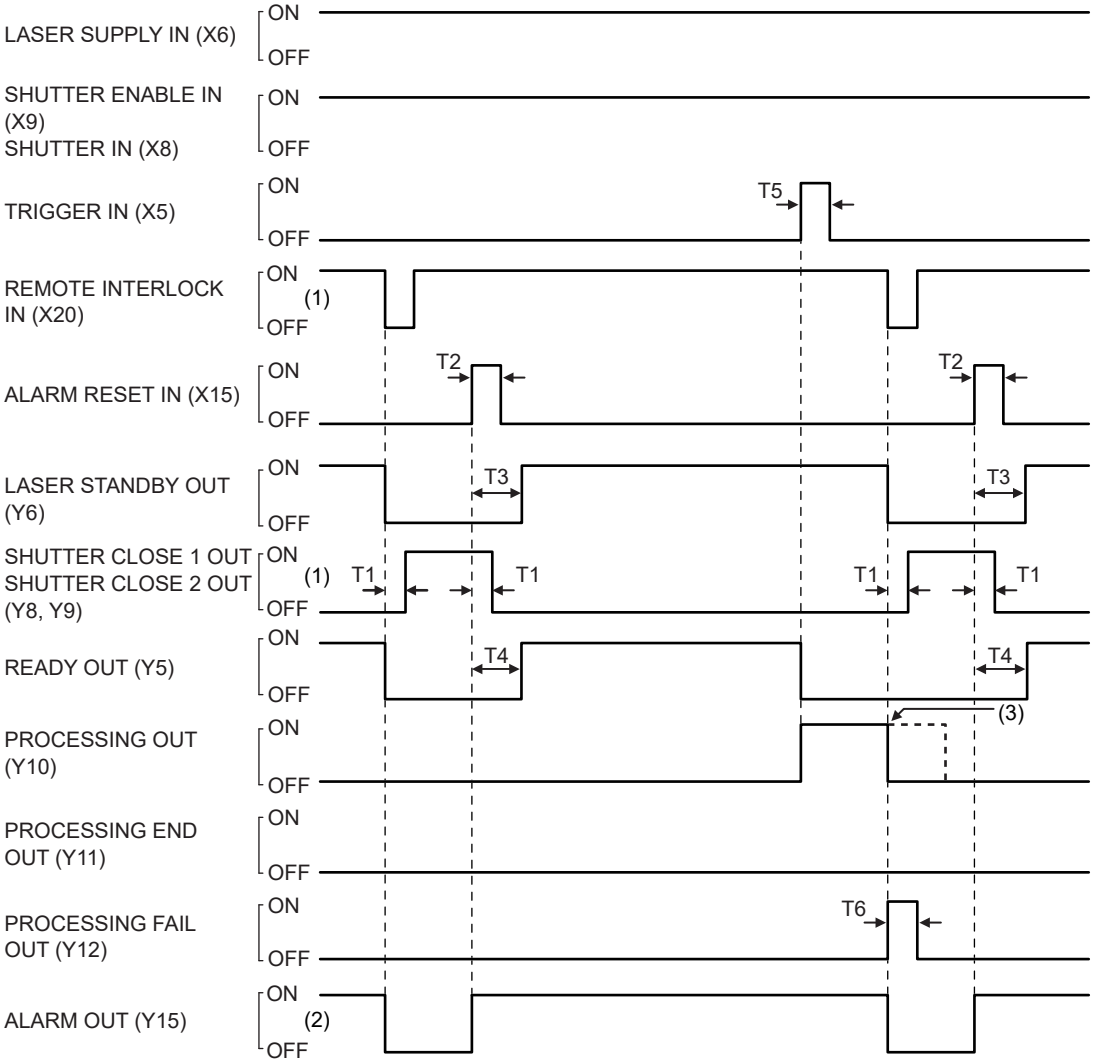
T6	≈1–2s	Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.
T7	—	Total time for shutter opening and marking data generation, or time for laser pumping, whichever is longer.

Related topics

Behavior of the safety functions under fault condition (page 114)

4.6.18 Remote interlock input

If the remote interlock input is opened, laser pumping turns off and the shutter is closed, regardless of whether or not the laser is radiating.



(1) ON = closed, OFF = open
(2) ON = normal, OFF = error
(3) Marking interruption

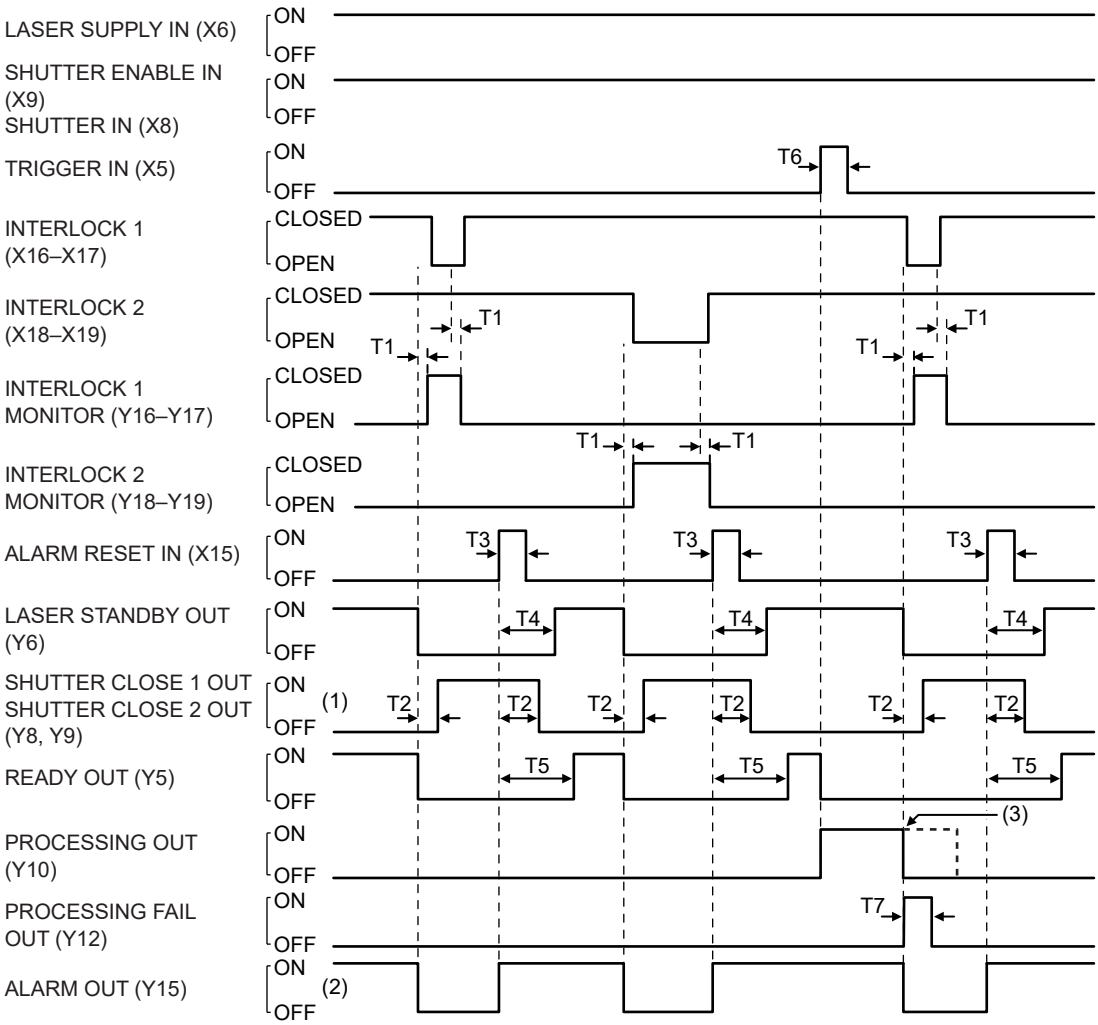
T1	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T2	≥100ms	Keep the ON status for 100ms or more.
T3	≈1–2s	Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.
T4	—	Total time for shutter opening and marking data generation, or time for laser pumping, whichever is longer.
T5	≥2ms	Keep the ON status for 2ms or more.
T6	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

Related topics

Behavior of the safety functions under fault condition (page 114)

4.6.19 Interlock function

If interlock input 1 or interlock input 2 is opened, laser pumping turns off and the shutter closes, regardless of whether or not the laser is radiating.



(1) ON = closed, OFF = open

(2) ON = normal, OFF = error

(3) Marking interruption

T1	≈50ms	There is a delay of ≈50ms between the switching of the interlock inputs and the interlock monitor outputs.
T2	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T3	≥100ms	Keep the ON status for 100ms or more.
T4	≈1–2s	Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.
T5	—	Total time for shutter opening and marking data generation, or time for laser pumping, whichever is longer.

T6	≥2ms	Keep the ON status for 2ms or more.
T7	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

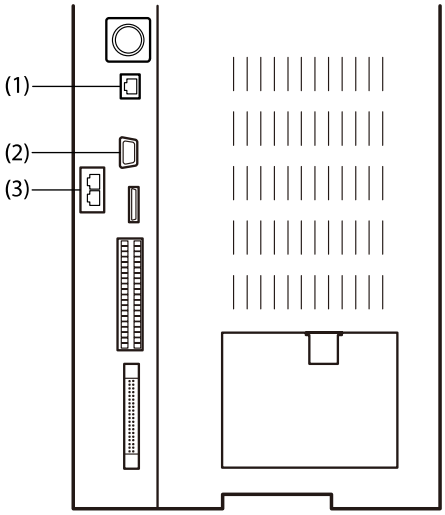
Related topics

Behavior of the safety functions under fault condition (page 114)

5 External control via communication commands

5.1 Serial communication interfaces

The serial communication interfaces are located on the controller.



(1) Ethernet interface

Using a hub or a router, you can connect multiple devices simultaneously to the Ethernet interface, such as a PC for configuration, a PLC for command control, and a code reader to check the marking results.

(2) RS-232C interface

To use the RS-232C interface, specify the usage “Communication commands” or “Code reader” in the “System settings” screen in advance

(3) EtherNet/IP or PROFINET interface

The EtherNet/IP or PROFINET interface is only available when the optional network unit is installed on the controller. Connect a LAN cable to this 2-port switch to control the laser marking system with a control device (e.g. a PLC) in an industrial network. For details, refer to the “EtherNet/IP Communication Guide” or “PROFINET Communication Guide”.

Related topics

RS-232C connection (page 160)

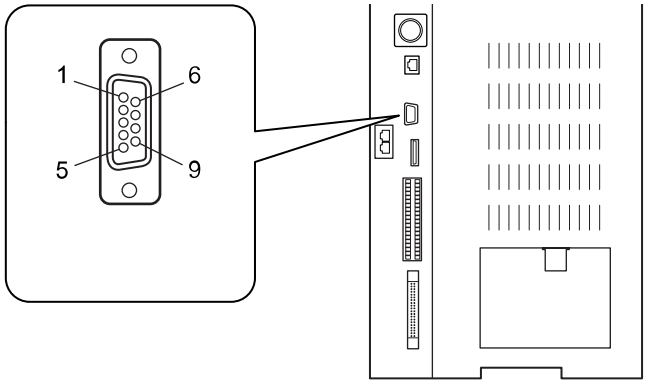
Ethernet connection (page 163)

5.2 RS-232C connection

5.2.1 RS-232C interface

Use the RS-232C interface on the rear of the controller to connect an external device.

To use the RS-232C interface, specify the usage “Communication commands” or “Code reader” in the “System settings” screen in advance.



RS-232C interface (female) on the controller of the laser marking system

Connector	Type	Model	Manufacturer
Connector on controller	9-pin Sub-D, female Screw type: 4-40 UNC, female	—	—
Recommended for external devices	9-pin Sub-D, male Screw type: 4-40 UNC, male	Connector: XM3A-0921 Connector cover: XM2S-0913	OMRON Corporation

Pin assignment of the RS-232C connector:

Pin	Name	Description
2	TxD (SD)	Transmit data: Connect RxD (RD) of the external device
3	RxD (RD)	Receive data: Connect TxD (SD) of the external device
5	GND (SG)	Ground (connected to frame ground): Connect GND (SG) of the external device

Notice

Connect the ground wire of an external control device and that of the laser marking system to the same point. A potential difference between the GND terminals of different products will cause product failure.

Note

- Do not connect any other lines than RxD (RD), TxD (SD), and GND.
- The GND pin of the RS-232C connector is common to the body of the laser marking system.

Related topics

RS-232C wiring (page 161)

5.2.2 RS-232C wiring

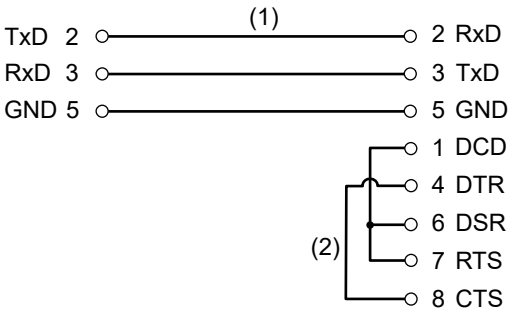
The laser marking system only uses the three lines TxD, RxD, and GND.

To connect a PC, use a commercial RS-232C straight cable with a 9-pin Sub-D male connector on the side of the laser marking system.

Other devices may require a cross cable or an additional loopback. Refer to the manufacturer's documentation for details.

Do not connect any other lines than RxD (RD), TxD (SD), and GND.

RS-232C connection between laser marking system (left) and external device with loopback (right):



(1) Straight cable
(2) Loopback (example)

Related topics

RS-232C interface (page 160)

Specify RS-232C communication settings (page 97)

5.2.3 RS-232C specifications for command control

Command control via RS-232C requires certain communication settings. While some settings are fixed, others have an initial setting which must be changed in the configuration software, depending on the external device.

Item	Description
Synchronization method	Start-stop synchronous system
Communication type	Full-duplex
Baud rate [bit/s]	1200/2400/4800/9600/19200/38400/ 57600/115200 (Initial setting: 9600)
Data length [bit]	8 (fixed)
Parity	None/Even/Odd (Initial setting: None)
Stop bits [bit]	1/2 (Initial setting: 1)
Flow control	None
Checksum	OFF/ON (Initial setting: OFF)
End code	CR/CR+LF (Initial setting: CR)
Start code	ON (STX)/OFF (Initial setting: ON)
Include response in command	ON/OFF (Initial setting: ON)
Response code	Any single-byte ASCII code from 01_h to $7F_h$. The initial settings are: Positive response code: A Negative response code: E Read request response code: A
Character code	ASCII code
Encoding for non-ASCII characters	Shift JIS/GB 2312/Latin-1 (Initial setting: Shift JIS)
Reception timeout	10s

For details about command control, refer to the “Serial Communication Command Guide”.

In LP-400 compatibility mode, the command format of the older model will be used. The settings for "Start code", "Include response in command", "Response code", and "Encoding for non-ASCII characters" will be ignored. For details, refer to the “Serial Communication Command Guide: LP-400/V compatible mode”.

Related topics

Specify the command format (page 95)

Specify RS-232C communication settings (page 97)

5.3 Ethernet connection

5.3.1 Ethernet interface

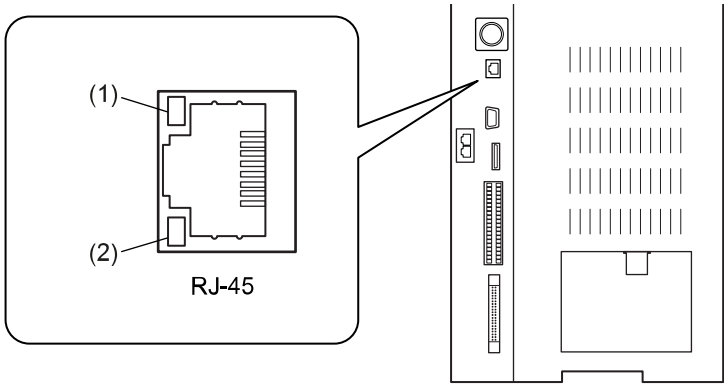
Use the Ethernet interface on the rear of the controller to connect a PC or other external devices.

The Ethernet interface of this product can be used with both straight cables and crossover cables.

The maximum permitted cable length by the Ethernet standards is 100m. A length of max. 10m is recommended to avoid failures or breakdowns due to noise.

Using a hub or a router, you can connect multiple devices simultaneously to the Ethernet interface, such as a PC for configuration, a PLC for command control, and a code reader to check the marking results.

The laser marking system is equipped with an 8-pole RJ-45 connector which is AUTO-MDIX compatible.



(1) Orange LED
(2) Green LED

The LEDs indicate the operation status:

Color	LED status	Operation status
Orange	On	The baud rate is 100Mbit/s.
Green	On	Connected
Green	Flashes	Communication in progress

Related topics

Connect a LAN cable with ferrite core (page 164)

Connect multiple devices to the Ethernet interface (page 164)

Ethernet specifications for command control (page 166)

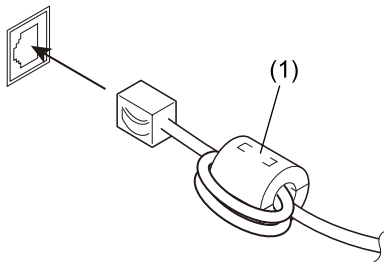
Specify Ethernet communication settings (page 98)

Establish an Ethernet connection between PC and laser marking system (page 68)

5.3.2 Connect a LAN cable with ferrite core

When you connect a LAN cable to the Ethernet interface, attach the included ferrite core on the controller side of the LAN cable.

1. Attach the ferrite core to the LAN cable as close as possible to the Ethernet interface on the controller side.
   Turn the LAN cable three times around the ferrite core as shown in the figure.



   (1) Ferrite core for LAN cable

2. Connect the LAN cable to the Ethernet interface on the rear of the controller.

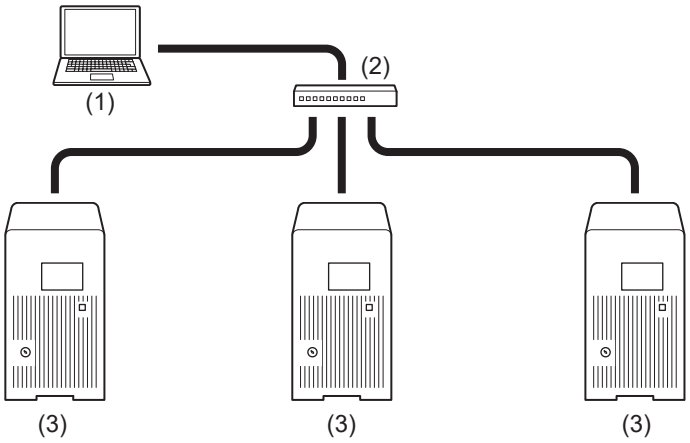
5.3.3 Connect multiple devices to the Ethernet interface

Using a hub or a router, you can connect multiple devices simultaneously to the Ethernet interface, such as a PC for configuration, a PLC for command control, and a code reader to check the marking results. Or, multiple laser marking systems can be connected to one external device.

Use a hub (or a router) that supports 100BASE-TX/10BASE-T and a cable of category 5 or higher for the connection.

Ethernet communication should be performed in a secure network environment.

Three laser marking systems connected to a PC using a hub (or router):



(1) External device (PC)
(2) Hub (or router)
(3) Controller A, B, C

1. Connect a hub (or a router) between the Ethernet interface of the laser marking system and of the external device.
   When connecting the laser marking system directly to the external device, no hub is necessary.
2. Make the Ethernet settings in Laser Marker NAVI smart for each laser marking system connected.
   When assigning IP addresses make sure they do not overlap. Example:

Item	PC	Controller A	Controller B	Controller C
IP address	192.168.1.10	192.168.1.5	192.168.1.6	192.168.1.7
Subnet mask	255.255.255.0			
Default gateway	None			
Port for communication commands	—	9094		

5.3.4 General Ethernet specifications

The Ethernet interface on the controller supports 10MBit/s and 100MBit/s transmissions. Be sure to change the default settings for IP addresses and port numbers to match your network environment.

Item	Description
Protocol	TCP/IP
Applicable standards	IEEE802.3 (10BASE-T)/IEEE802.3u (100BASE-TX)
Communication cable	Category 5 or higher
Hub (or router)	10BASE-T/100BASE-TX

Item	Description
IP address	1.0.0.0–223.255.255.255 (do not use 127 for the first octet) Initial setting: 192.168.1.5
Subnet mask	128.0.0.0–255.255.255.254 Initial setting: 255.255.255.0
Default gateway	1.0.0.0–223.255.255.255 (do not use 127 for the first octet) Initial setting: Unspecified (0.0.0.0)
Port for PC configuration software	1025–65534 (do not use 9090) Initial setting: 9093
Port for communication commands	1025–65534 (do not use 9090) Initial setting: 9094

Note

- Ethernet communication should be performed in a secure network environment.
- Even if the values for the IP address and the subnet mask are within the configurable range, they may be invalid because of their combination.

Related topics

Establish an Ethernet connection between PC and laser marking system (page 68)

Configuring the operation by external devices (page 93)

5.3.5 Ethernet specifications for command control

Command control via Ethernet requires a certain command format. While some settings are fixed, others have an initial setting which can be changed in the PC configuration software.

Item	Description
Start code	ON (STX)/OFF (Initial setting: ON)
Include response in command	ON/OFF (Initial setting: ON)
Response code	Any single-byte ASCII code from 01_h to $7F_h$. The initial settings are: Positive response code: A Negative response code: E Read request response code: A
Character code	ASCII code
Encoding for non-ASCII characters	Shift JIS/GB 2312/Latin-1 (Initial setting: Shift JIS)
Checksum	OFF

Item	Description
End code	CR
Reception timeout	10s

For details about command control, refer to the “Serial Communication Command Guide”.

In LP-400 compatibility mode, the command format of the older model will be used. The settings for "Start code", "Include response in command", "Response code", and "Encoding for non-ASCII characters" will be ignored. For details, refer to the “Serial Communication Command Guide: LP-400/V compatible mode”.

Related topics

Specify the command format (page 95)

5.4 Check the communication command history

The transmitted and received communication commands are displayed in the “Command history” tab.

- When you edit a backup file in offline mode, the communication command history at the time of backup is displayed.
- A maximum of 100 commands are displayed.
- If a code reader is connected to the RS-232C interface, the data transmitted and received between the code reader and the laser marking system are not recorded in the command history.
- If a transmitted message cannot be recognized as a command (for example due to an incorrect start or end code), it is not recorded in the command history.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Maintenance” screen and select “Command history”.
3. The communication commands are listed in a table.
   - The table has the following columns:
     – “Date/time”: Displays the date and time of a transmitted or received command in the format YYYY-MM-DD hh:mm:ss.fff.
     – “Interface”: Displays the interface used for command control: RS-232C, Ethernet, PROFINET, EtherNet/IP
       PROFINET and EtherNet/IP are available if the optional network unit is installed in the controller.
     – “PLC ↔ LM”: Arrows show the communication direction.
       → indicates that the laser marking system received the command from an external device, for instance a PLC.

← indicates that the laser marking system transmitted the command to an external device.

  - “File No.”: Displays the file number that is selected for command transmission or reception.
  - “Command messages”: Displays the command messages transmitted and received by the laser marking system. The recordable data length is up to 64 bytes. Unrecorded data are displayed in parentheses, for example (...70 byte).

- “Display format”: Select “Text” or “Hexadecimal” to change the display format of the command messages.
  - “Text”: The command messages are displayed in text form. Non-ASCII characters are displayed according to the setting made for “Encoding for non-ASCII characters” in “System settings” > “Communication”. Square brackets are used for control codes such as start and end code, for example [STX].
  - “Hexadecimal”: The command messages are displayed in hexadecimal format. Each byte of the message is separated by a space.
- To export the entries of the command history as a TSV file, select “Save as TSV”.
- Select “Delete all” and confirm with “Yes” to delete all entries of the command history. To delete the command history, log in as administrator.

  This function is not available when backup files are edited in offline mode.

6 Linking of image processing devices

6.1 Position correction and validation using an imagechecker

The laser marking system is capable of direct data processing with specific image processing devices to perform position correction and validation of the marking result.

Use a compatible image processing device to perform the following functions:

- Marking position correction

  The laser marking system adjusts the marking position based on the data from the imagechecker's camera.

- Marking validation

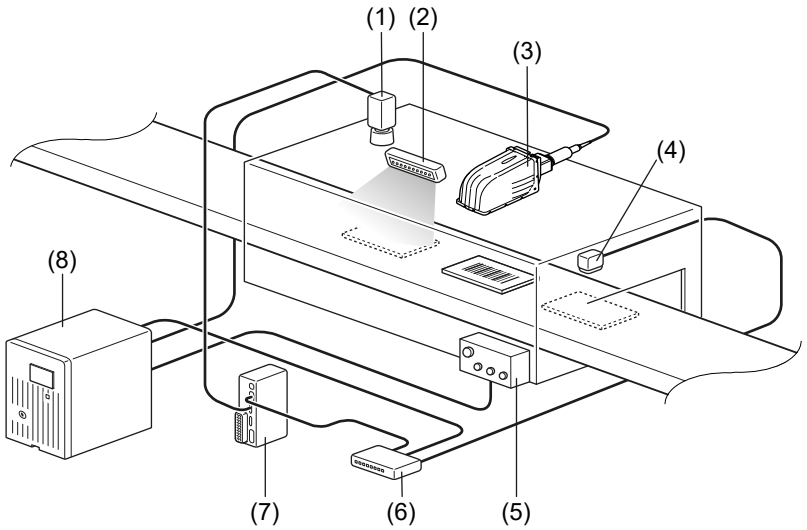
  After marking, the imagechecker's camera reads the marking result, checks it against the marking data and transfers the validation result to the laser marking system. The imagechecker can validate bar codes and 2D codes, characters, and images.

Compatible image processing devices

Function	Device	Manufacturer
Marking position correction	PV230/PV200	Panasonic Industry Co., Ltd.
Code checking	PV230	
	LP-ABR11, LP-ABR12	
	DataMan series (Ethernet type)	Cognex Corporation
Character checking	PV230	Panasonic Industry Co., Ltd.
Image checking	PV230/PV200	

6.1.1 Example of a system using an imagechecker

The entire sequence of operations from workpiece detection to the correction of the marking position to marking and validation can be combined in one system.



(1) Imagechecker camera
(2) Illumination
(3) Laser head
(4) Code reader
(5) Inspection result display
(6) Hub (for Ethernet connections)
(7) Controller of the imagechecker
(8) Controller of the laser marking system

To construct the system, connect an imagechecker and a code reader to the laser marking system via Ethernet.

The **imagechecker** detects the workpiece position and transmits the position to the laser marking system.

The **laser marking system** corrects the marking position, performs marking, and transmits the marked code to the code reader.

The **code reader** reads the marked code, checks the contents against the string transmitted by the laser marking system, and transmits the inspection result to the laser marking system.

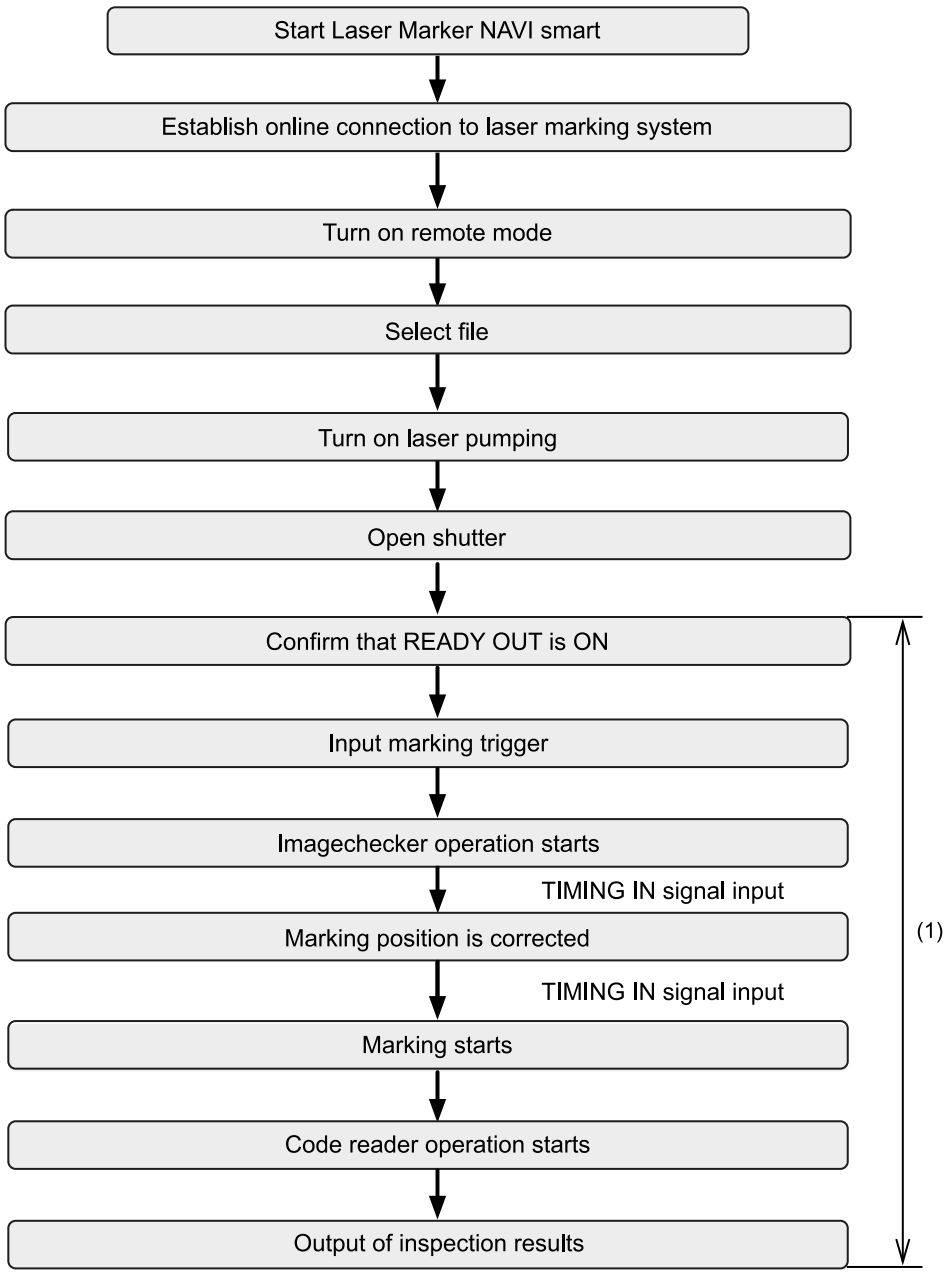
Depending on the inspection result, the **laser marking system** outputs an OK or NG result.

6.1.2 Basic operation procedure

The flow chart illustrates the process of correcting the position, marking, and verifying the marking result.

Flow chart for position correction and code checking

Make the communication settings in the laser marking system and the imagechecker and the marking file settings for image checking in advance.



(1) Repeat these steps.

The input of the marking trigger signal starts a sequence of operations:

- The imagechecker captures the image, executes the checker, and transmits the marking position to the laser marking system.
- The laser marking system corrects the marking position, performs marking, and transmits the marking data to the code reader. (To trigger laser radiation separately, use the TIMING IN input.)
- The code reader reads the marking result, checks it against the marking data, and transmits the inspection result to the laser marking system. (To trigger code reading separately, use the TIMING IN input.)
- The laser marking system outputs the inspection result (OK/NG) via I/O connector.

Note

- Marking position correction and code checking using an image processing device are only possible in remote mode.
- The following functions are not available if you use the link function with imagecheckers:
  - On-the-fly-marking
  - TARGET DETECTION IN (X7) input of TERMINAL connector
  - “Continuous trigger” under “Marking settings” > “File settings” > “Trigger mode”

6.1.3 Device connection

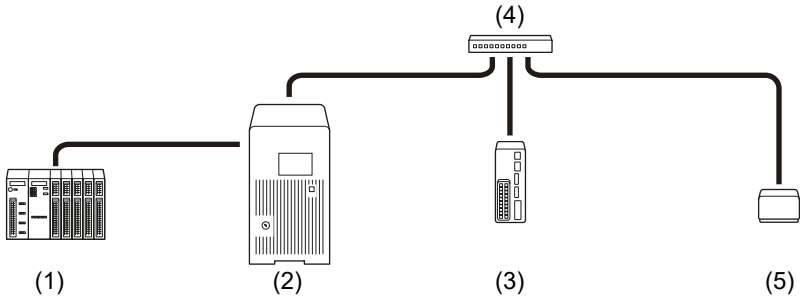
Image processing devices can be connected to the laser marking system via Ethernet. Make sure you do not assign duplicate IP addresses or port numbers.

Notice

Do not install the camera in the laser radiation range and take measures to protect the camera against the reflected laser beam, e.g. by installing a shutter in front of the camera lens. Otherwise, the imagechecker may be damaged.

Use the Ethernet interface on the rear of the laser marking system controller to connect the image processing devices.

The laser marking system can be connected with one device each for marking position correction and code checking.



(1) PLC for I/O control
(2) Laser marking system
(3) PV230 for marking position correction
(4) Hub
(5) DataMan for code reading

For one-to-one connections between the laser marking system and an image processing device, no hub is required.

The Ethernet interface of this product can be used with both straight cables and crossover cables.

IP addresses and port numbers

Set addresses individually to prevent duplicate IP addresses in the network.

When connecting a DataMan code reader, make sure the “Port (command transmission)” setting in Laser Marker NAVI smart matches the Telnet port setting on the code reader.

Example:

Item	Laser marking system	PV230	DataMan
IP address	192.168.1.4	192.168.1.5	192.168.1.10
Subnet mask	255.255.255.0		
Default gateway	192.168.1.1		
Port	—	Fixed	23 (Telnet)

When connecting a PV230 or PV200, the port numbers for the result output (8601) and command transmission (8604) are fixed.

Related topics

Ethernet interface (page 163)

6.1.4 Make communication settings in the laser marking system

When linking the laser marking system with an imagechecker, you need to specify the settings for the imagechecker connection.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Linked device”.
3. Enter the communication settings according to the required functions.
   “Image checking before marking”:
   - “Model”: PV230/PV200 can be used for marking position correction.
   - “IP address”: Set an IP address for the connected imagechecker.
     0.0.0.0–223.255.255.255 (do not use 127 for the first octet)
     Initial setting: 0.0.0.0
   - “Port (result output)”: 8601 (fixed)
   - “Port (command transmission)”: 8604 (fixed)

   “Image checking after marking”:
   - “Model”: PV230, PV200, DataMan or LP-ABR11/LP-ABR12 can be used for checking the marking result. (Only LP-RF and LP-RV can be connected to LP-ABR11/LP-ABR12.)
   - “IP address”: Set an IP address for the connected imagechecker.
     0.0.0.0–223.255.255.255 (do not use 127 for the first octet)
     Initial setting: 0.0.0.0
   - For PV230/PV200:
     “Port (result output)”: 8601 (fixed)
   - “Port (command transmission)”:
     – PV230/PV200: 8604 (fixed)
     – DataMan: 1–65535
       Initial setting: 23
     – LP-ABR11/LP-ABR12: 1–65535
       Initial setting: 27110
4. Select “Apply to laser marking system” in the ribbon to save the settings.
5. Disconnect the online connection with the laser marking system.
6. Turn off the power of the laser marking system, wait five seconds and then restart the system.
   The new settings will be updated in the laser marking system.

6.1.5 Configure the marking file

When linking the laser marking system with an imagechecker, you can specify parameters for marking position correction or checking the marking result.

- Establish an online connection between your PC and the laser marking system.
- Go to the “Marking settings” screen and select “File settings”.

Specify any of the following parameters:

- “Image checking before marking” / “Image checking after marking”:
  To use the link function with imagecheckers and display the settings, select “ON”. Select “OFF” to disable the function.
- “Model”:
  Select the used imagechecker model.
  “Image checking before marking”: PV230/PV200 can be used for marking position correction (fixed).
  “Image checking after marking”: PV230/PV200, DataMan or LP-ABR11/LP-ABR12 can be used for checking the marking result. (Only LP-RF and LP-RV can be connected to LP-ABR11/LP-ABR12.)
- “Type No. set on PV”:
  Specify this parameter if PV230/PV200 is set for “Model” under “Image checking after marking”.
  Enter the same type number (0–255) as specified on PV230/PV200. If there is no matching type number on the imagechecker, the function cannot be performed.
  If PV230/PV200 is set for “Model” under “Image checking before marking”, specify the type number by an external control device such as a PLC.
- “Response timeout [s]”:
  Set the time until the response is returned from the imagechecker.
  If the imagechecker does not respond within the set time, the warning E625 is output.
- “TIMING IN signal input”:
  If required, select “Enabled” to activate the timing input.
  Use the TIMING IN input if you need to trigger operations of the laser marking system and the imagechecker or code reader separately. This is necessary, for instance, when the camera's or the code reader's field of view is distant from the marking position.
- “Application”:
  Select the desired application. Depending on the linked imagechecker, the application is fixed.
  “Image checking before marking”: “Marking position correction” (fixed)
  “Image checking after marking”: “Code checking (PV230)”, “Character checking (PV230)”, “Image capturing and inspection”
  – DataMan, LP-ABR11/LP-ABR12: Under “Image checking after marking”, “Code checking” is set for “Application”.

  - PV200: Under “Image checking after marking”, you must select “Image capturing and inspection” for “Application”.
  - PV230: Under “Image checking after marking”, you can set “Code checking (PV230)”, “Character checking (PV230)” or “Image capturing and inspection”. If you set “Code checking (PV230)” for “Application”, you can specify that the human readable text is checked at the same time as the code symbol.

- “Object No. to check”:
  Enter the same object number as specified in “Object settings” for the marking object (bar code, 2D code or character object).
  This parameter is available if “Code checking (PV230)” or “Character checking (PV230)” is set for “Application” under “Image checking after marking”. Specify the object number of the target object that should be checked.

If PV230/PV200 is set for “Model”, the following parameters are available:

- “CDR checker No. set on PV”:
  Enter the same number as specified on PV230 (“Checker No.” for code reader).
  The parameter is available if “Code checking (PV230)” is set for “Application” under “Image checking after marking”.
- “Check human readable text”:
  Set “ON” to check the code symbol and the human readable text of a bar code or 2D code object at the same time.
  The parameter is available if “Code checking (PV230)” is set for “Application” under “Image checking after marking”.
- “OCR checker No. set on PV”:
  Enter the same number as specified on PV230 (“Checker No.” for optical character recognition).
  The parameter is available if “Code checking (PV230)” or “Character checking (PV230)” is set for “Application” under “Image checking after marking”.
  If “Application” > “Code checking (PV230)” is set: To check the code symbol and the human readable text at the same time, specify “CDR checker No. set on PV” for the code symbol and “OCR checker No. set on PV” for the human readable text.
- “Check human readable text of composite code 2D part”:
  Set “ON” to check the human readable text of the composite code's 2D part.
  The parameter is available if “Code checking (PV230)” is set for “Application” and “Check human readable text” is set to “ON”.
- “OCR checker No. set on PV (2D)”:
  Enter the same number as specified on PV230 (“Checker No.” for optical character recognition).
  The parameter is available if “Check human readable text of composite code 2D part” is set to “ON”.
- To save your marking file on the laser marking system, select “Save” > “To laser marking system”.

Related topics

Make communication settings in the laser marking system (page 174)

Using the TIMING IN signal (page 177)

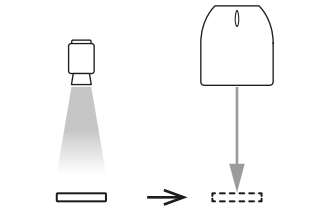
6.1.6 Using the TIMING IN signal

When linking the laser marking system with image processing devices, a series of operations can be started by a single trigger. Depending on your processes, you may need to trigger certain operations separately.

With TIMING IN signal

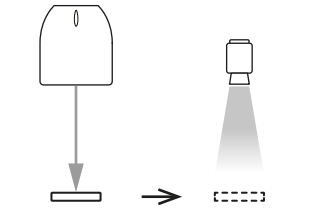
Use the timing input TIMING IN (24) of the I/O connector to trigger operations separately, for example when the camera's or the code reader's field of view is distant from the marking position.

Marking position correction:



The marking trigger starts workpiece detection (initial operation). When TIMING IN turns on, marking starts.

Marking validation:



The marking trigger starts marking (initial operation). When TIMING IN turns on, code reading starts.

The timing input must turn on 60s after completion of the initial operation.

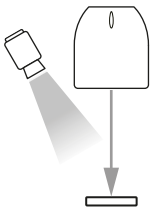
The TIMING IN signal can only be input via the I/O connector. It cannot be input with a communication command.

You must enable “TIMING IN signal input” in the “File settings”.

Without TIMING IN signal

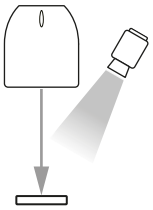
No TIMING IN signal is required when all marking and image processing operations can be triggered by the marking trigger signal, for example when the field of view of the image checking device and the marking position are identical.

Marking position correction:



The marking trigger starts workpiece detection, and then marking begins.

Marking validation:



The marking trigger starts marking, and code checking starts after completion.

Related topics

Position correction and marking (with timing input) (page 183)

6.1.7 Make settings in the imagechecker

In the imagechecker, you must specify the communication and system settings, as well as the parameters for position correction and verification of the marking result.

6.1.7.1 Communication and system settings on PV230/PV200

To connect a laser marking system with a PV230 or PV200 imagechecker, make the communication and system settings in the imagechecker software.

For details, refer to the instruction manuals of PV230 and PV200.

Communication settings on PV230/PV200

Item	Ethernet specifications
Protocol	General communication (TCP/IP)
Port number (fixed)	“Result output”: 8601
	“Command transmission”: 8604
IP address	Initial setting: 192.168.1.5 Make sure the IP address for the laser marking system does not overlap with IP addresses of other external devices.

System settings on PV230/PV200

- Go to “ENVIRONMENT” > “Input/Output” and select “General Output”.
- Make the following Ethernet settings for the “General Com.” protocol:
  “Output”: “Yes”

“Operation”: “Sync.”

“Date/Time”: “No”

“Scan Count”: “No”

“Total Judge”: “Yes”

“Judge”: “No”[1)]

“Num. Calc.”: “Yes”/“No”[1)] (for position correction: “Yes”, otherwise: “No”)

“Optical Character Recognition”: “No”[1)]

“Code Reader”: “No”[1)]

“BCC”: “No”

“No. of Digits”: “7”

“Decimal Digit”: “3”

“Unused digit”: “Fill with 0”

“Error Output”: “No”[1)]

1) If you also use the “PLC Com.” protocol with the Ethernet port, you can change this setting according to your PLC configuration.

Note

If the total judgement result is "1", CHECK OK OUT (34) of the I/O connector turns on. If the result is "0", CHECK NG OUT (35) turns on.

6.1.7.2 Configure position correction on PV230/PV200

Configure the position correction in the imagechecker software.

Calibration:

Calibration is required to convert the inspection results from pixels to x-/y-coordinates (mm). After calibration, make sure that CCW is the positive (+) theta direction in the imagechecker.

1. Go to “TYPE” > “Type Setting” > “Camera” > “Calibration” and set “Calibration” to “Available” and “Method” to “Base X points”.
2. Mark the calibration marks with the laser marking system, and register their coordinates (mm) to the global coordinates of the imagechecker.

Position adjustment:

3. Go to “INSPECTION” > “Position Adj.” or “INSPECTION” > “Checker”.
4. For “Checker”, select “Smart edge (Line)”, “Smart matching”, or any other checker that includes the angle value.
5. Go to “INSPECTION” > “Num. Calcu”.
6. In the “Expression” table, set the coordinates you want to send to the laser marking system in the order x, y, and theta. Under “Output”, set “Yes” for each coordinate.
   The rotation center of the imagechecker corresponds to the center of the marking field (x- and y-movement must be set to 0mm in the file settings).

The imagechecker's correction values for theta, x-, and y-position are added respectively to the rotation movement, x-, and y-movement in the file settings of the laser marking system

7. Go to “INSPECTION” > “Judgement” and set “JDC (External)” for “Type”.
8. In the “Expression” table, set the judgement result for the checker.
9. Select “Set” to go to the “Condition” settings.
10. Set “JDC” for “Condition” and the checker number for “Total Judge”.

6.1.7.3 Configure code checking on PV230

Configure the code checking in the imagechecker software.

1. Go to “INSPECTION” > “Checker”, select “Code Reader” for “Checker Type” and specify the checker number.
   Input the same number as for “CDR checker No. set on PV” in the “File settings” of Laser Marker NAVI smart.
   If you want to check the human readable text together with the code symbol, select “Optical Character Recognition” for “Checker Type” and specify the checker number. Input the same number as for “OCR checker No. set on PV” in the “File settings”. For details, refer to Configure character checking on PV230 (page 181).
2. In the “Code Reader” checker, select “Area Setting” and specify an arbitrary testing area.
3. Select “Inspection Condition” and set the code type used in your marking file.
   Set the other inspection conditions to enable stable reading of the codes.
4. Select “Judgement Limits” and set “Yes” for “String Judgement”.
   No input is required for “Judgement Characters” because the marking data is automatically input by the laser marking system.
   Make sure the marking data does not contain any characters not supported by the PV230.
5. Go to “INSPECTION” > “Judgement” and set “JDC (External)” for “Type”.
6. In the “Expression” table, set the judgement result for the checker(s).
7. Select “Set” to go to the “Condition” settings.
8. Set “JDC” for “Condition” and the checker number for “Total Judge”.
   When linking a PV230, the total judgement output is required.
   If you check both, code symbols and human readable text, set the OK judgement for the condition that the results of both checkers are OK.

6.1.7.4 Configure character checking on PV230

Configure the character checking in the imagechecker software.

1. Go to “INSPECTION” > “Checker”, select “Optical Character Recognition” for “Checker Type” and specify the checker number.
   Input the same number as for “CDR checker No. set on PV” in the “File settings” of Laser Marker NAVI smart.
2. In the “Optical Character Recognition” checker, select “Area Setting” and specify an arbitrary testing area.
3. Select “ Judgement Limits 1” and set “Character String” for “Judgement Type”.
   Set the other inspection conditions to enable stable reading of the character strings.
   No input is required for “Judgement Characters” because the marking data is automatically input by the laser marking system.
   When linking a PV230 and a laser marking system, character strings can be crossed-checked with the marking data, but the number of the characters and the character size are not validated.
   To use the character recognition function, create the dictionary of the PV230 in advance.
   Make sure the marking data does not contain any characters not supported by the PV230.
   Up to 80 characters can be checked with one checker.
4. Go to “INSPECTION” > “Judgement” and set “JDC (External)” for “Type”.
5. In the “Expression” table, set the judgement result for the checker.
6. Select “Set” to go to the “Condition” settings.
   Set “JDC” for “Condition” and the checker number for “Total Judge”.
   When linking a PV230, the total judgement output is required.

6.1.7.5 Configure image checking on PV230/PV200

Configure the image checking settings in the imagechecker software.

1. Go to “INSPECTION” > “Checker” and set the desired checkers.
2. Go to “INSPECTION” > “Judgement” and set “JDC (External)” for “Type”.
3. In the “Expression” table, set the judgement result for the checker(s).
4. Select “Set” to go to the “Condition” settings.
5. Set “JDC” for “Condition” and the checker number for “Total Judge”.
   When linking a PV230/PV200, the total judgement output is required.
   If you do not use the checkers, select numerical calculation and set "1", so that the total judgement result is always "1".

6.1.8 Settings on the LP-ABR code reader

If an LP-ABR11 or LP-ABR12 code reader is used for code or image checking, make the communication and code reading settings using the Configurator LP-ABR software.

- Select “LAN” or “RS-232C/LAN”.
- Set the same IP address and data port number as specified under “Image checking after marking” in the “System settings” of Laser Marker NAVI smart.
- Set the subnet mask and default gateway according to the network environment. Usually the code reader and the laser marking system are used in the same network.

For details, refer to the LP-ABR and Configurator LP-ABR instruction manuals.

Note

Do not start the Configurator LP-ABR software while the laser marking system and the LP-ABR code reader are connected.

6.1.9 Settings on the DataMan code reader

If a DataMan code reader is used for code or image checking, make the communication and code reading settings on the code reader.

- Select the TCP/IP protocol.
- Set the IP address and the Telnet Port number according to the network environment.
- Set the code type, etc. to read the code to be marked by the laser marking system.

  Ensure that no code other than the code to be read is in the shooting range of the DataMan. Otherwise, code reading is not performed properly.

  If the code type is UPC-E (6-digit UPC code), deselect “Expand” and select “Delete Leading Zero” in the UPC/EAN properties of the DataMan.

For details, refer to the DataMan instruction manual.

6.1.10 Timing charts of I/O signals

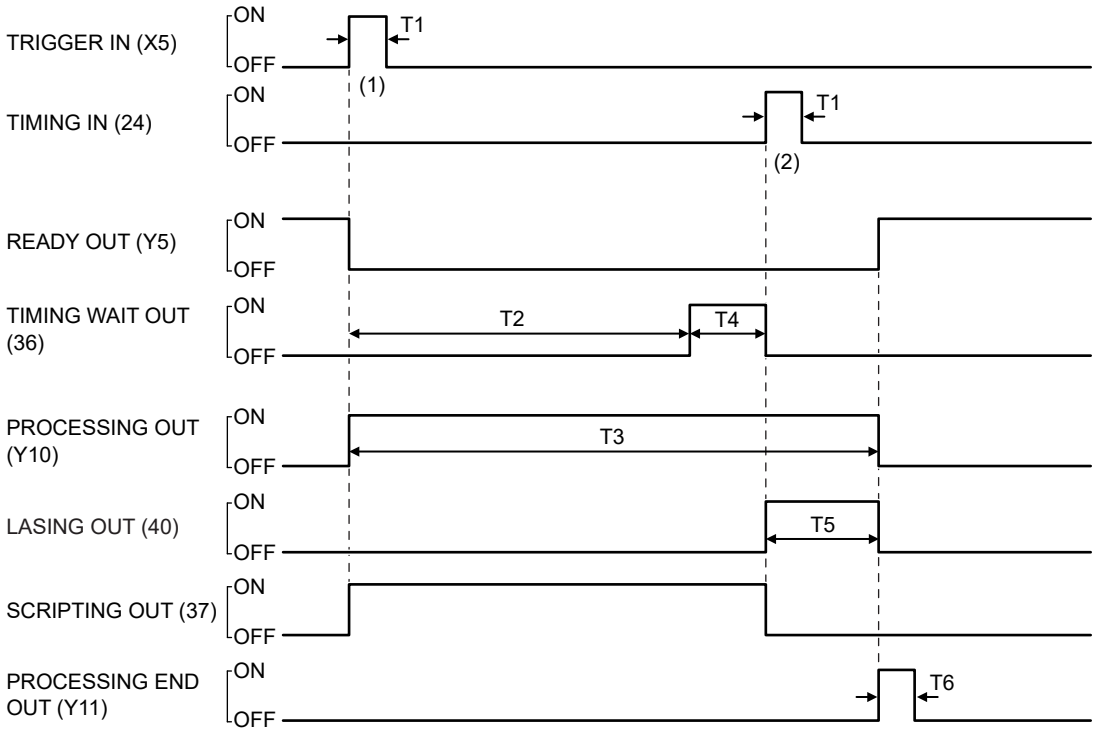
The timing charts show typical signal sequences when controlling the laser marking system by I/O signals.

Because NPN and PNP transistors function in opposite ways, "ON" and "OFF" refer to the ON or OFF status of the terminals and not to the voltage level (high or low) of the signal.

There may be a very small delay of a few milliseconds between signal input and operation of the corresponding output.

6.1.10.1 Position correction and marking (with timing input)

In this example, the marking process is delayed after the trigger input is turned on to account for the time required for workpiece detection by the imagechecker and position correction by the laser marking system.



(1) Workpiece detection starts
(2) Marking starts

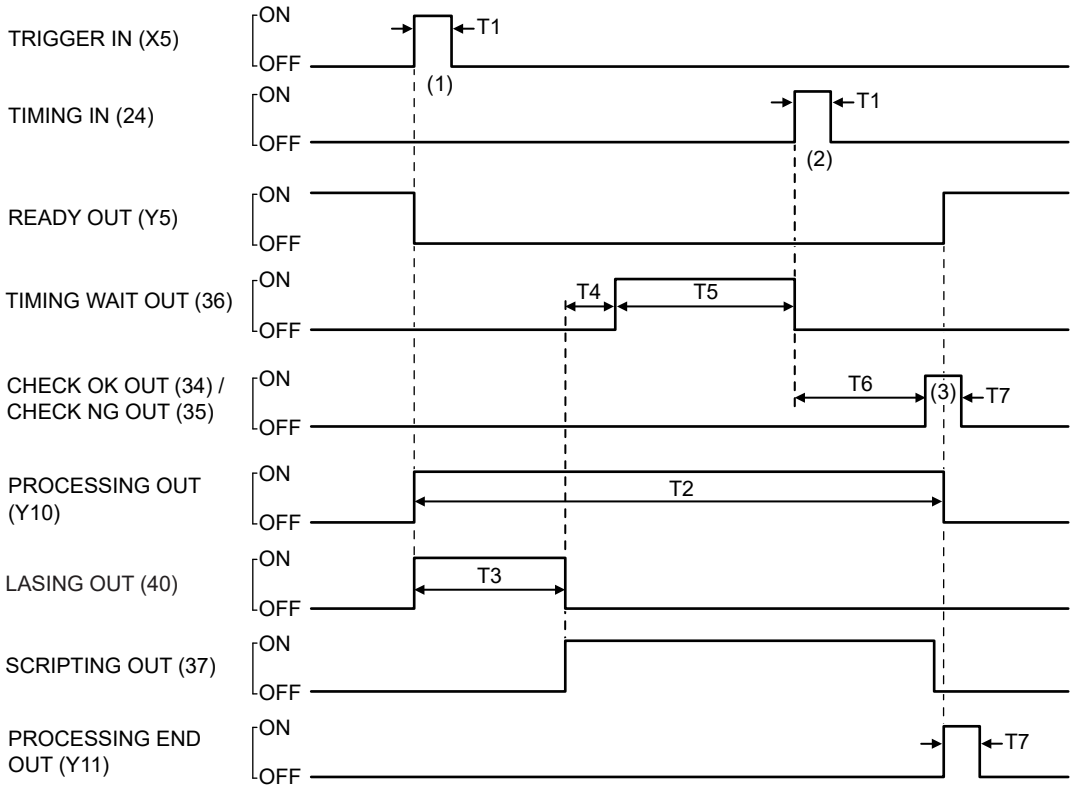
T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	Marking preparation time • Workpiece detection (imagechecker) • Marking position correction (laser marking system)
T3	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT) and includes the internal processing time for the linked devices.
T4	≤60s	Turn on the timing input TIMING IN (24) within 60s after the timing standby output TIMING WAIT OUT (36) has turned ON. Otherwise, an error occurs and trigger processing is terminated.
T5	—	The laser radiation time varies depending on the marking image.
T6	2–510ms	Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Related topics

Using the TIMING IN signal (page 177)

6.1.10.2 Code marking and checking (with timing input)

A TIMING IN signal starts code checking after completion of the marking process.



(1) Marking starts

(2) Code checking starts

(3) The check OK output (CHECK OK OUT) or the check NG output (CHECK NG OUT) turns on before the trigger processing output (PROCESSING OUT) turns off.

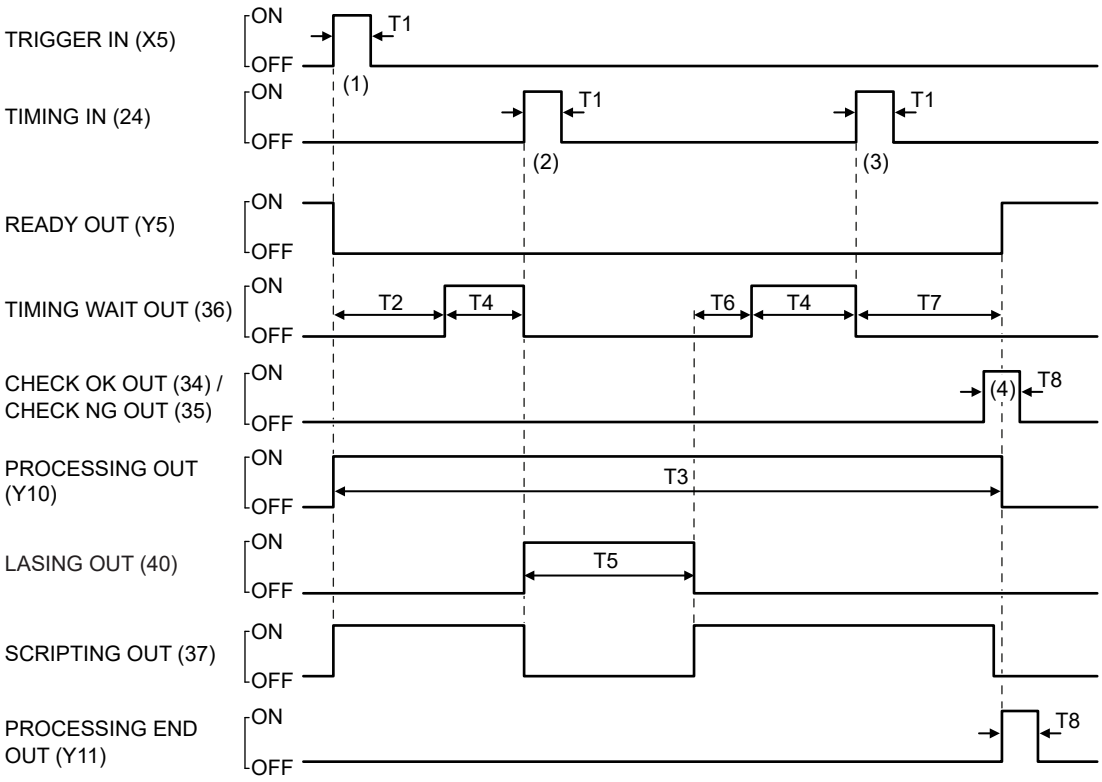
T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT) and includes the internal processing time for the linked devices.
T3	—	The laser radiation time varies depending on the marking image.
T4	—	Marking preparation time: Transfer of the marking data from the laser marking system to the code reader
T5	≤60s	Turn on the timing input TIMING IN (24) within 60s after the timing standby output TIMING WAIT OUT (36) has turned ON. Otherwise, an error occurs and trigger processing is terminated.
T6	—	Result processing time: • Code reading (code reader) • Transfer of the inspection result to the laser marking system
T7	2–510ms	Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Related topics

Using the TIMING IN signal (page 177)

6.1.10.3 Position correction, code marking and checking (with timing input)

One TIMING IN signal is used to delay the marking process to account for the time required for workpiece detection and position correction. Another TIMING IN signal starts code checking.



(1) Workpiece detection starts
(2) Marking starts
(3) Code checking starts
(4) The check OK output (CHECK OK OUT) or the check NG output (CHECK NG OUT) turns on before the trigger processing output (PROCESSING OUT) turns off.

T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	Marking preparation time: • Workpiece detection (imagechecker) • Marking position correction (laser marking system)
T3	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT) and includes the internal processing time for the linked devices.

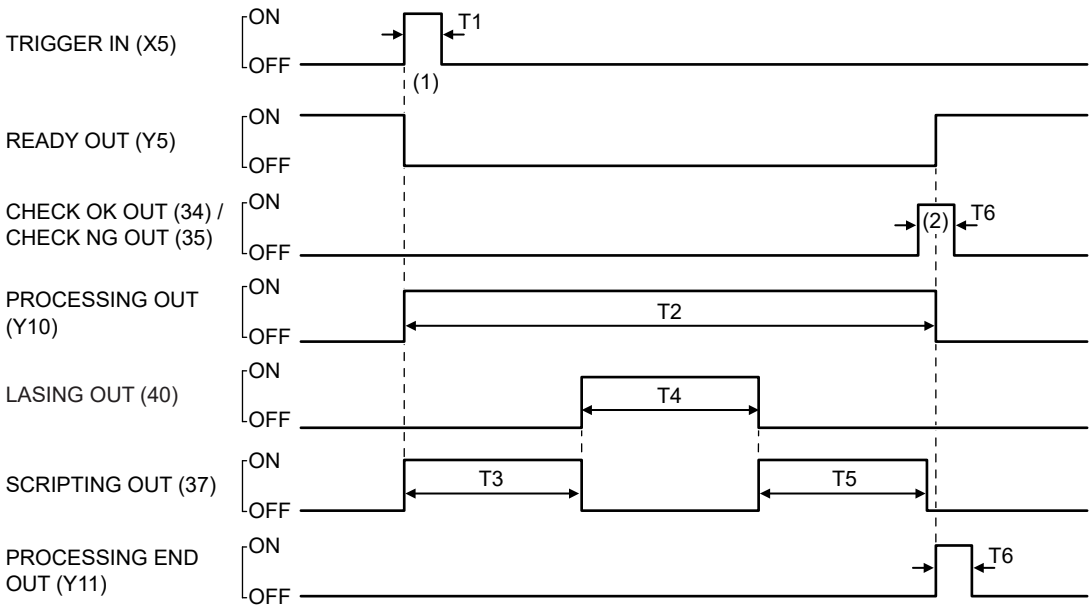
T4	≤60s	Turn on the timing input TIMING IN (24) within 60s after the timing standby output TIMING WAIT OUT (36) has turned ON. Otherwise, an error occurs and trigger processing is terminated.
T5	—	The laser radiation time varies depending on the marking image.
T6	—	Result processing time: • Transfer of the marking data from the laser marking system to the code reader
T7	—	Result processing time: • Code reading (code reader) • Transfer of the inspection result to the laser marking system
T8	2–510ms	Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Related topics

Using the TIMING IN signal (page 177)

6.1.10.4 Position correction, code marking and checking (without timing input)

Without TIMING IN signal, all position correction and validation operations are performed automatically.



(1) A series of operations starts

(2) The check OK output (CHECK OK OUT) or the check NG output (CHECK NG OUT) turns on before the trigger processing output (PROCESSING OUT) turns off.

T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It is almost equivalent to the trigger delay time plus laser radiation time (LASING OUT) and includes the internal processing time for the linked devices.
T3	—	Marking preparation time: • Workpiece detection (imagechecker) • Marking position correction (laser marking system)
T4	—	The laser radiation time varies depending on the marking image.
T5	—	Result processing time: • Code reading (Code reader) • Transfer of the inspection result to the laser marking system
T6	2–510ms	Set the duration in the “System settings”. The setting range is 2–510ms with a small error margin (initial setting: 40ms).

Related topics

Using the TIMING IN signal (page 177)

6.2 File switching and data modification using a code reader

A code reader that is connected to the laser marking system can change the marking file or the marking data, based on the data read.

Use a code reader to perform the following functions:

- File switching

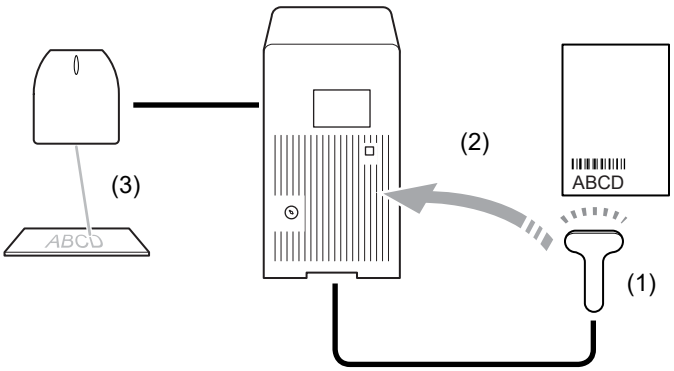
  A commercial code reader reads code that specifies a marking file and transfers it to the laser marking system. Based on this data, the marking file is changed.

- Data modification

  A commercial code reader reads the code for marking characters and transfers the data to the specified object number in the laser marking system, thus changing the marking data. The character data of bar codes or 2D codes can also be changed.

6.2.1 Example of a system using a code reader

Based on the code read, the laser marking system changes the marking file or the marking data and then starts the lasing process.



(1) Commercial code reader
(2) Data transfer to laser marking system
(3) Lasing starts

Any bar code or 2D code generated from alphanumeric characters and symbols in the range of ASCII codes 20_h–$7E_h$ can be read and transferred to the laser marking system.

It is also possible to extract only a part of the code and transfer it to the laser marking system. For details, refer to Make settings in the laser marking system (page 192).

File switching and data modification by code reader cannot be performed at the same time.

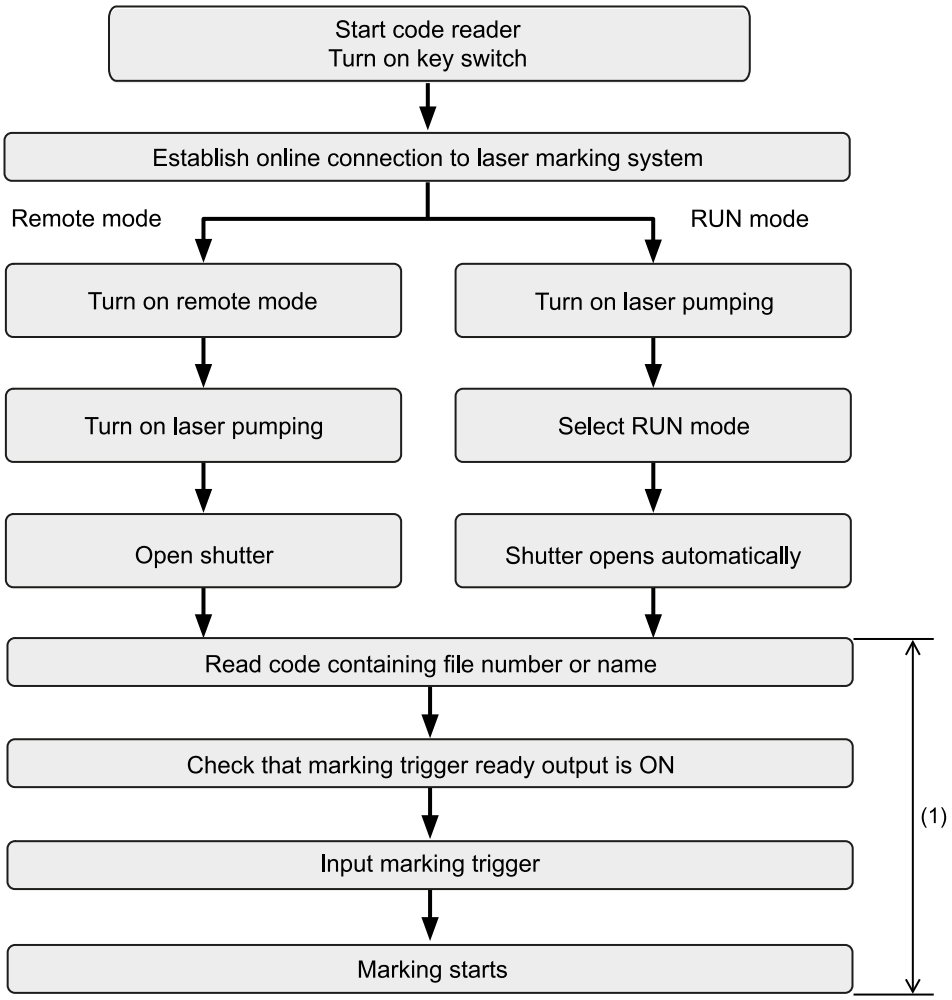
Transfer of marking information using code readers is possible in remote mode and in RUN mode.

6.2.2 Basic operation procedure

The flow charts illustrate the procedures for changing the marking file or the marking data with a code reader.

Flow chart for file switching

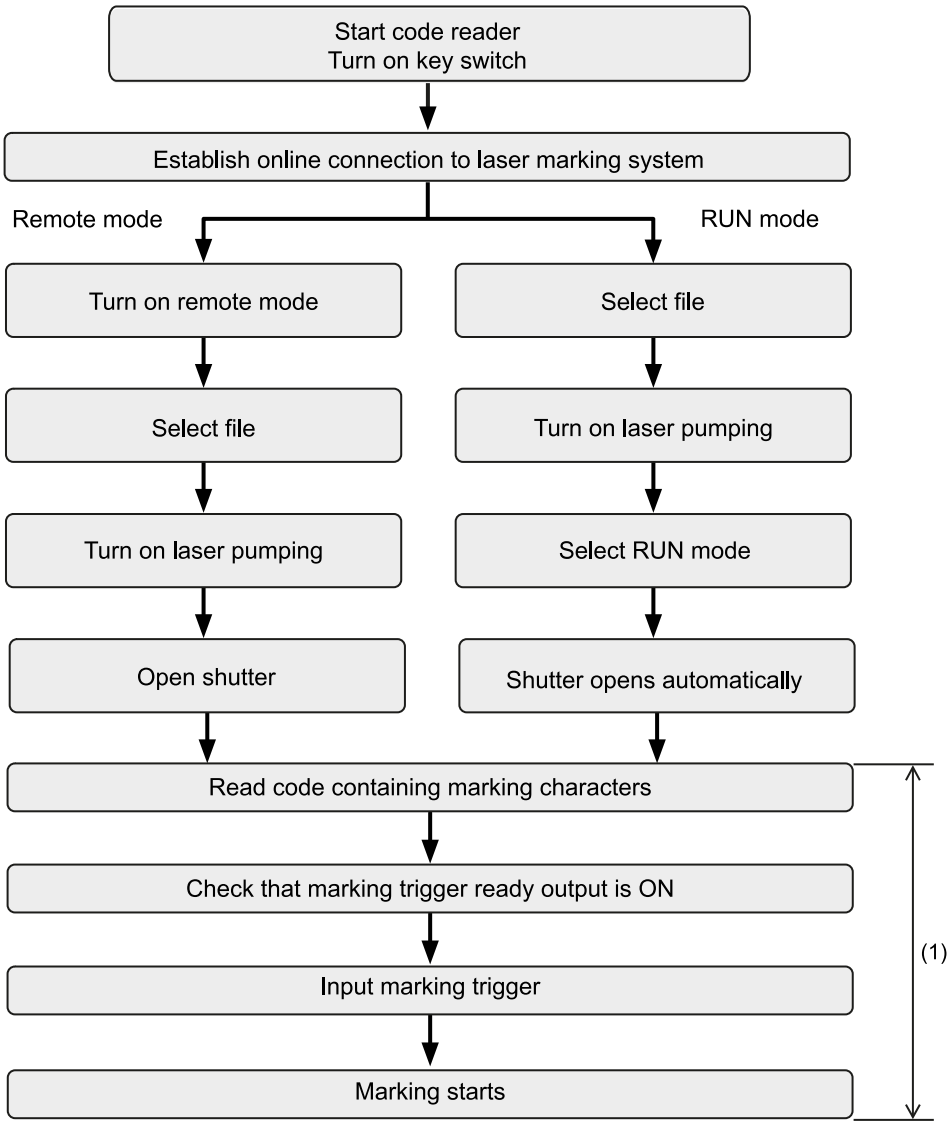
Check the communication settings in the laser marking system and in the code reader in advance.



(1) Repeat these steps.

Flow chart for data modification

Check the communication settings in the laser marking system and in the code reader and specify the target object number of the transferred data in advance.

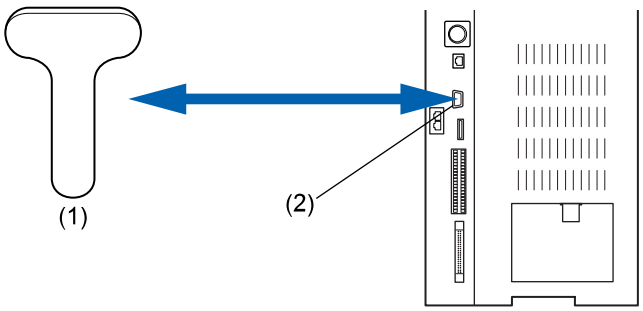


(1) Repeat these steps.

6.2.3 Code reader connection

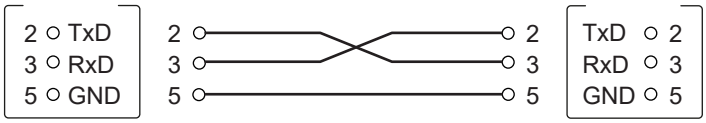
You can connect a code reader via the RS-232C interface to control the laser marking system.

Any commercial code reader with an RS-232C interface can be connected to the laser marking system. Use a cross cable to connect the code reader to the RS-232C interface on the rear of the controller.



(1) Code reader with RS-232C interface (9-pin Sub-D female)
(2) RS-232C interface on laser marking system (9-pin Sub-D female)

Example



Do not connect any other lines than RxD (RD), TxD (SD), and GND.
Cross cable with two RS-232C connectors, 9-pin Sub-D male, left: laser marking system, right: code reader

Communication settings

This product can be connected with a code reader that can be operated with the RS-232C communication settings described.

- Synchronization method: Start-stop synchronous system
- Communication type: Full-duplex
- Baud rate [bit/s]: 1200/2400/4800/9600/19200/38400/ 57600/115200 (Initial setting: 9600)
- Data length [bit]: 8 (fixed)
- Parity: None/Even/Odd (Initial setting: None)
- Stop bits [bit]: 1/2 (Initial setting: 1)
- Flow control: None
- Checksum: None
- End code: CR
- Start code: None
- Reception timeout: 10s

Notice

- Successful communication with all code readers cannot be guaranteed. Check the performance and operation before use.
- If you connect a code reader to the RS-232C interface, control by communication commands via RS-232C is disabled.
- Code reader control is enabled only when the laser marking system is in remote or RUN mode.

Related topics

RS-232C connection (page 160)

6.2.4 Supported codes

If certain conditions are fulfilled, any bar code or 2D code can be read by the code reader.

- Any bar code or 2D code generated from alphanumeric characters and symbols in the range of ASCII codes 20_h–$7E_h$ can be read and transferred to the laser marking system.
- Double-byte characters and control characters are not supported.
- To use the character "%", you must replace it by "%%" in the code.
- If the code contains any non-supported characters, the data cannot be transferred to the laser marking system regardless of the settings for data extraction.

For a list of ASCII codes, refer to the “Serial Communication Command Guide”.

6.2.5 Make settings in the laser marking system

When linking the laser marking system with a code reader, you need to specify the settings for the code reader functions.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “Communication”.
3. Specify the following RS232C communication settings:
   - “RS-232C usage”: “Code reader”
   - For “Baud rate [bit/s]”, “Parity”, “Stop bits [bit]” select the settings that match your code reader's settings.
   - There is no start code or checksum, and the end code is CR.
4. Go to the “System settings” screen and select “Linked device”.
5. Under “Code reader”, make settings according to the required functions.
   - “Control function”:

     Select “File switching by name”, “File switching by number”, or “Character transmission”.
   - “Data extraction”:

     Set to “ON” to extract and transfer only a part of the code read. If “OFF” is selected, all characters of the code string are transmitted.

     The data extraction function cannot be used for code strings with variable-length data.
   - “Extraction start position [byte]”:

Specify the start position for the code extraction.

Setting range: 1–299 bytes

- “Extraction length [byte]”:

  Specify the data length for code extraction.

  Setting range for “Character transmission” and “File switching by name”: 1–299 bytes

  Setting range for “File switching by number”: 4 bytes (fixed)

  Example: Read code characters ABCDE and transfer BCD to the laser marking system as follows: “Extraction start position [byte]”: 2, “Extraction length [byte]”: 3.

  – Count one single byte character as one byte.

  – The extraction position setting applies to all data captured when using this function.

  – If the code to be captured is shorter than the string to extract, the code is not captured.

  – Make sure the checksum setting is “OFF”. Otherwise the checksum is transferred to the laser marking system as marking data.

  – The end code is not part of the extracted string.

- “Target object number”:

  Enter the object number if “Character transmission” is set for “Control function”. The character data read will be transferred to the object number specified here.

  Setting range: 0–1999

  You can specify object numbers of character objects and of bar code or 2D code objects.

6. Select “Apply to laser marking system” in the ribbon to save the settings.

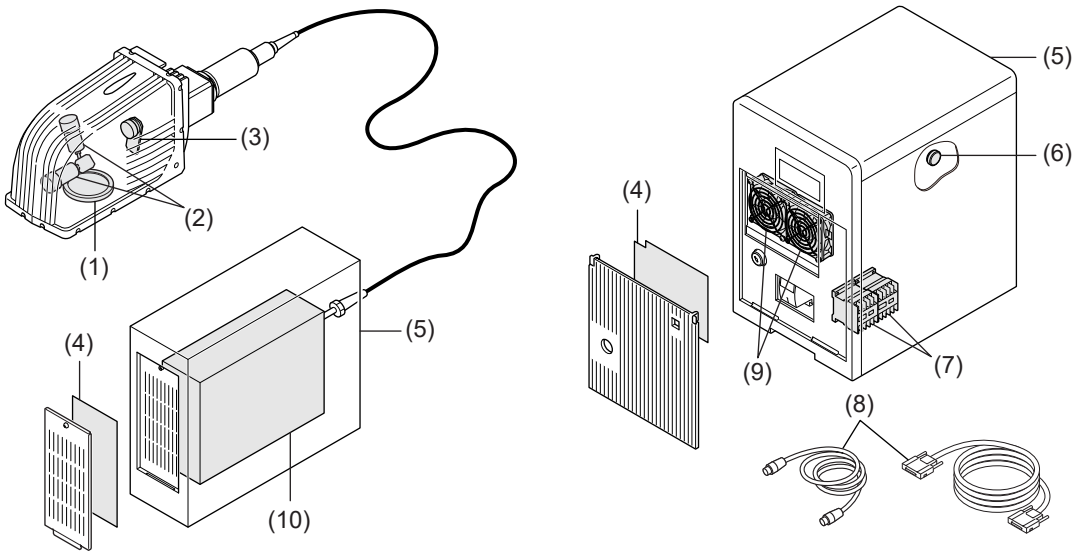
7 Maintenance

7.1 Maintenance parts

The maintenance of the laser marking system involves regular cleaning or replacement of worn or nonfunctional parts depending on the operating environment and the operation duration.

To purchase replacement parts or to request maintenance service, please contact our service center or one of our sales offices. Some optional items may not be sold due to regulations in each country or region. For detailed information, contact our service center or one of our sales offices.

Refer to the following drawing to identify which parts require regular maintenance.



No.	Part name	Maintenance measures	Cause for replacement
(1)	Protection glass of laser emission port	Cleaning	Contamination
(2)	Galvano scanner	—	Aging[1)]
(3)	Shutter	—	Aging[1)]
(4)	Air filter	Cleaning	Contamination
(5)	Cooling air outlet	Cleaning	Contamination
(6)	Battery	—	Aging
(7)	INTERLOCK contactor	—	Aging
(8)	Cables	—	Damage

No.	Part name	Maintenance measures	Cause for replacement
(9)	Controller fan	Cleaning	Contamination
(10)	Laser oscillator	Inspection of laser power	Aging[1)]

1) Replacement by service center only

7.2 Description of maintenance parts

Observe these warnings before cleaning or replacing any parts of the laser marking system.

⚠ WARNING

- Turn off the power of the laser marking system and disconnect the AC power cable before starting the maintenance work. Otherwise, there is a risk of exposure to laser radiation or of electrical shock.
- Do not insert hands or objects in the gaps of the cooling air inlet or outlet. This may result in injuries, electrical shock, or failure of this product.

Notice

Use only specified replacement parts. Otherwise, failure may result.

7.2.1 Protection glass of laser emission port

A protection glass is attached to the laser emission port of the laser head and must be replaced if it becomes contaminated.

An f-theta lens is mounted at the laser emission port of the laser head. The f-theta lens condenses the laser which is emitted from the oscillator.

The protection glass protects the lens from dirt or damage. On the lens and the protection glass surface, an anti-reflection coating is applied in order to maintain appropriate transmittance. Do not remove the protection glass during operation.

The surface of the protection glass may become contaminated by dust generated during the marking process. Do not use the laser marking system with a contaminated laser emission port because the lens might burn in. If the lens surface is scratched or the coating is peeled off, the marking quality can be affected.

If any damage to the laser emission port (f-theta lens) is observed when the protective glass is removed, please contact our service center or one of our sales offices. Replacement must be done by our service center.

Related topics

Clean the laser emission port (page 196)

Replace the protection glass (page 197)

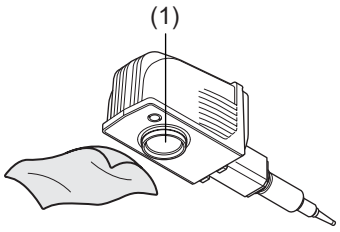
7.2.1.1 Clean the laser emission port

For a consistent marking quality, clean the protection glass of the laser emission port regularly.

⚠ WARNING

Do not use a flammable air duster. If it is ignited by the laser beam, there is a risk of fire.

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Clean the protection glass of the laser emission port (1) with an air blower, and wipe it lightly with a soft cloth.
   If the protection glass is very dirty, use a soft cloth and ethanol.



Notice

Do not exert pressure when wiping the protection glass of the laser emission port or touch it with a sharp or pointed object. The laser marking system may become faulty.

Related topics

Protection glass of laser emission port (page 195)

Replace the protection glass (page 197)

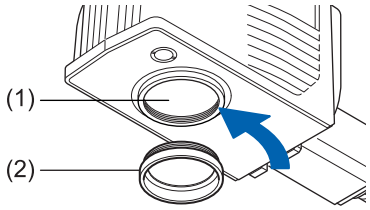
7.2.1.2 Replace the protection glass

The protection glass of the laser emission port must be replaced if it is damaged or contaminations cannot be removed by cleaning.

Replacement parts:

Part name	Product no.	Remarks
Protection glass of the laser emission port	LP-ACV60	5 o-rings are included

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Turn the protection glass (2) counterclockwise to remove it from the laser emission port (1).



Notice

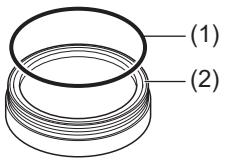
- Be careful not to touch the lens and protection glass when removing or installing the protection glass.
- To loosen a stuck protection glass, use a commercial strap wrench. Avoid to scratch the lens when using a strap wrench.
- When the protection glass is detached from the laser emission port, make sure that the o-ring does not remain in the scanner unit.

3. Make sure that the new protection glass is not contaminated by foreign matter such as fingerprints, dust, grease, or oil. Blow away any contamination using an air duster for optical components.

⚠ WARNING

Do not use a flammable air duster. If it is ignited by the laser beam, there is a risk of fire.

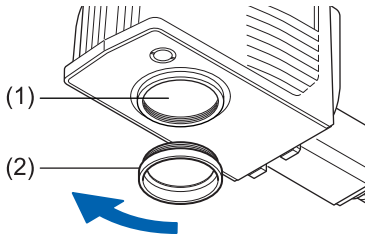
4. Install a new o-ring (1) in the groove (2) inside the protection glass.



Notice

- The o-ring cannot be reused. When you replace the protection glass, change the o-ring as well. Spare o-rings are provided together with the replacement protection glass.
- Do not twist the o-ring when fitting it in the groove inside the protection glass.
- In order to maintain the sealing function of the o-ring, follow some basic storage recommendations.
  - Protect o-rings from direct sunlight and high humidity.
  - Store o-rings in a clean, dust-free environment. O-rings must not come into contact with organic solvents.
  - Store o-rings so that they are free from tension and compression to prevent deformation. Never hang o-rings.

5. Place the new protection glass (2) on the laser emission port (1) and turn it clockwise until you feel a resistance. Then tighten it further by 10mm–20mm.



Make sure that the protection glass is tightened properly to ensure that the laser head meets the requirements of IP64.

Notice

- Be careful not to touch the lens and protection glass when removing or installing the protection glass.
- Tighten the protection glass slowly and evenly.
- If it is difficult to tighten the protection glass by hand, use a commercial strap wrench. Avoid to scratch the lens when using a strap wrench.
- Do not operate the laser marking system without the protection glass installed on the laser emission port.

Related topics

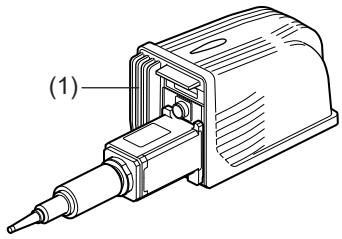
Protection glass of laser emission port (page 195)

Clean the laser emission port (page 196)

7.2.2 Clean the laser head

Clean the laser head on a regular basis.

A heat sink on the rear of the laser head provides a natural cooling effect. If the laser head is soiled with dust or oil, the cooling effect may be reduced.



(1) Heat sink

Clean a contaminated laser head immediately.
A usage under severe operating conditions may require a daily cleaning.

Notice

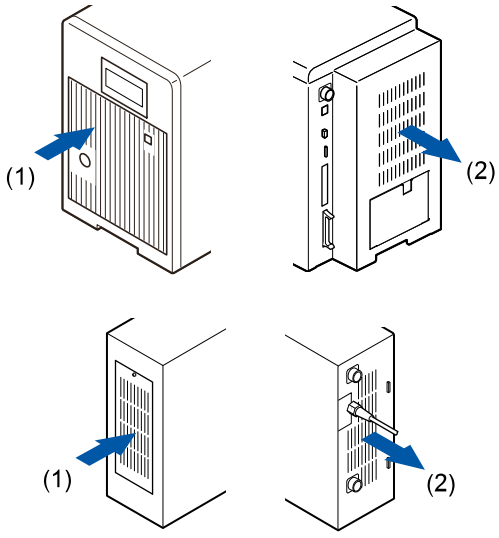
Do not use alcohol to clean the laser head LED display as this may cause damage.

7.2.3 Clean the cooling air inlet and outlet

Clean the cooling air inlet and outlet on a regular basis.

The oscillator unit and the controller is equipped with a cooling air inlet and outlet. If the cooling air inlet or outlet is soiled with dust, the cooling effect may be reduced. This may cause a degrade in marking performance or failure of the laser marking system.

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Use a vacuum cleaner to remove the dust.
   Cooling air inlet and outlet of controller (top) and oscillator unit (bottom):



(1) Cooling air inlet
(2) Cooling air outlet

Notice

Do not blow air in the direction of the cooling air inlet or outlet. Make sure that dust does not get into the laser marking system. Otherwise, failure may result.

3. Wipe the cooling air inlet and outlet with a dry soft cloth.
   If the cooling air inlet or outlet is very dirty, wipe it lightly with a soft cloth moistened with a neutral detergent. Remove excess detergent with a soft cloth moistened with water.

   Notice

   Make sure that water does not enter into the laser marking system.

7.2.4 Replace the air filters

The cooling air inlets of the oscillator unit and the controller have one air filter each.

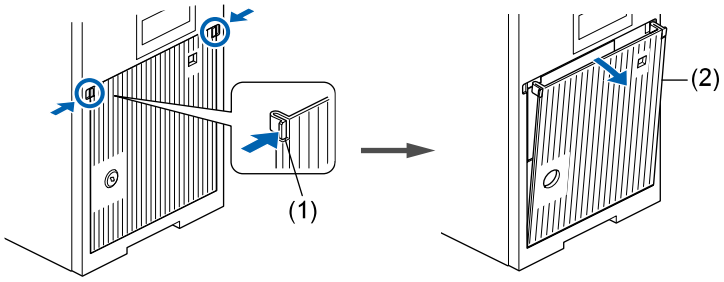
Replace the air filters on a periodic basis. A dirty air filter hinders the air flow and may cause malfunction of the laser marking system.

The air filters must be replaced if they are contaminated or damaged.

Replacement parts:

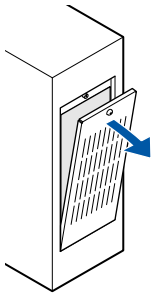
Part name	Product no.	Remarks
Air filter	LP-AFT81	10 pieces for controller
	LP-AFT82	10 pieces for oscillator unit

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. To open the front cover of the controller, press the latches on the top and pull the cover forward.



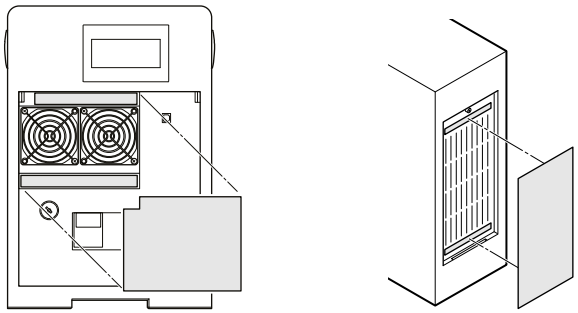
(1) Latch
(2) Cover

Loosen the M3 screw on the front of the oscillator unit and remove the front cover.



3. If the cover is contaminated, remove the dust with a vacuum cleaner or a dry cloth.

4. Remove the filter from the controller and oscillator unit.



Controller (left), oscillator unit (right)

5. If the cooling air inlet of the oscillator unit is contaminated, remove the dust with a vacuum cleaner or a dry cloth.

Notice

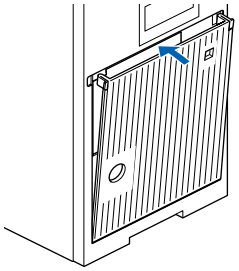
Do not blow air in the direction of the cooling air inlet or outlet. Make sure that dust does not get into the laser marking system. Otherwise, failure may result.

6. Attach the new filters.

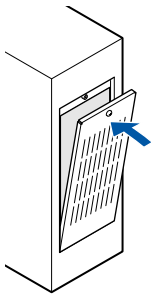
Notice

- The air filter of this product is not washable. If it is contaminated, it must be replaced by a new one.
- Do not operate the laser marking system without the filters. This may cause a product failure.

7. Attach the front cover of the controller.
   Insert the lower part of the cover into the controller and gently push the upper part until it clicks into place.



8. Attach the front cover of the oscillator unit.
   Insert the lower part of the cover into the oscillator unit and fix the screw.
   Screw size: M3
   Tightening torque: 0.5Nm



7.2.5 Fans

The two fans of the controller must be cleaned or replaced regularly.

These fans are installed on the controller to cool the internal circuits. Oil or dust adhering to the fans may reduce the air-flow rate or even stop their rotation.

The two controller fans are placed at the cooling air inlet and rotate continuously while the laser marking system is turned on. When the cooling performance decreases, the temperature in the electric circuits will rise, which may cause an error or stoppage of the laser marking system.

A temperature rise in the housing also has a negative effect on other internal parts and may cause a deterioration in marking quality or failure of the equipment.

Replacement may be required under the following circumstances:

- The fan does not rotate, or the rotating speed is low.
- There is a contamination on the fan that cannot be removed by cleaning.
- Abnormal noise is generated from the fan.

Replacement parts:

Part name	Product no.	Remarks
Controller fan	LP-AFA20	2 pieces Fan for cooling air inlet

Note

The fans mounted inside the oscillator unit must be maintained by our service center. Please contact our service center or one of our sales offices.

Related topics

Clean or replace the controller fans (page 202)

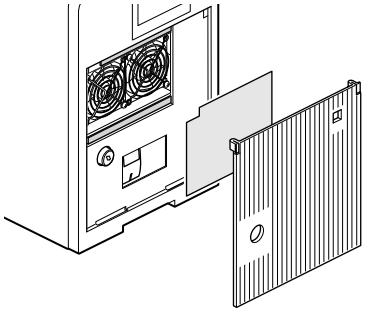
7.2.5.1 Clean or replace the controller fans

Clean the controller fans as regularly and as frequently as the operating environment demands.

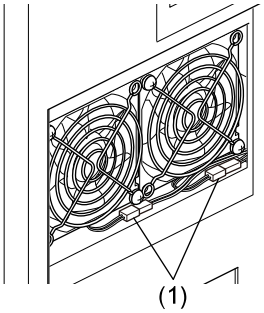
A usage under severe operating conditions may require a daily cleaning. If the fans are defective, replace them immediately.

1. Turn off the key switch of the controller and disconnect the AC power cable.

2. Press on the latches on the top of the front cover and pull it open. Remove the air filter. For details refer to Replace the air filters (page 200).

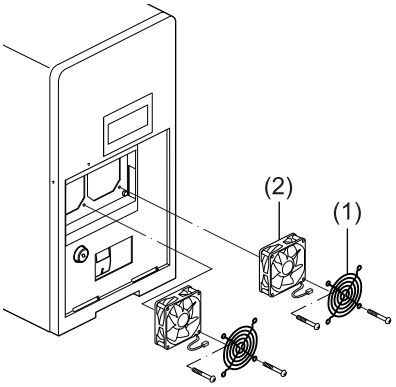


3. Remove the connectors of both fans.



(1) Connectors

4. Loosen the screws of the fans, and remove the fan guards (1) and the fans (2).

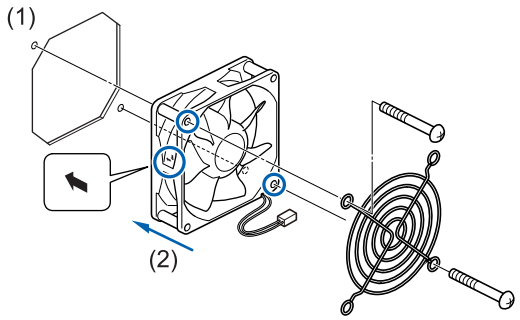


5. Remove dust and dirt from the fans with an air blower (if replacement is not required).

Notice

Do not rinse the fans. Otherwise the electronical parts may be damaged.

6. Install the fans and the fan guards as shown in the figure.
Make sure that the air flow matches the intake direction as indicated by the arrow on the fan.

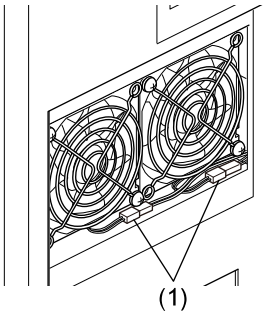


(1) Laser marking system
(2) Air flow direction

Notice

- If you install a fan in the wrong direction, this may cause failure of the product.
- Be careful not to let the cables get caught between the fan and the fan guard.

7. Place the fan cables on the bottom side of the fans.
8. Fasten the screws (M4, depth 30mm, 2 screws per fan) from the top of the fan guard.
   Tightening torque: 1.0Nm
9. Attach the connectors (1) of both fans.



10. Insert the air filter and attach the front cover of the controller.
    For details refer to Replace the air filters (page 200).
11. If you have replaced the fans, reset the operating data in Laser Marker NAVI smart.
    - Go to the “Maintenance” screen and select “Operating data”.
    - Select “Reset” for “Controller fan operating time [h]” and confirm with “Yes” to reset the value.

Related topics

Fans (page 202)

7.2.6 Laser oscillator

The laser oscillator must be replaced after a certain period of time.

Replacement of laser oscillator

A fiber laser oscillator is installed in the oscillator unit. The fiber cable transmits the laser from the oscillator unit to the laser head. The laser beam emitted from the laser head is steered and focused to mark or process the target material.

Laser characteristics such as the laser power will deteriorate over time due to aging of the oscillator. Symptoms such as non-uniform marking intensity, chipped characters, and inconsistent processing quality may occur.

Also, as the cooling efficiency of the oscillator decreases due to the operating environment, electronic parts in the oscillator may become defective and unable to radiate the laser.

Replacement may be required under the following circumstances:

- Deterioration in quality of marking and processing is observed (streaking, reduced marking density, chipped characters, incomplete processing).
- Setting a larger value for the laser power does not improve the quality of marking and processing.
- The laser power measured with a commercial power meter has decreased by 20%, compared to the delivery state.
- The total laser radiation time exceeds 30000 hours. (The replacement interval may differ depending on the operating environment and marking settings.)
- An error occurred in the laser oscillator.

Replacement must be done by our service center. Please contact our service center or one of our sales offices.

Check the laser radiation time

You can check the laser radiation time in Laser Marker NAVI smart.

Go to the “Maintenance” screen and select “Operating data”. Check the value displayed for “Laser radiation time [h]”.

Related topics

Inspect the laser power (page 206)

7.2.6.1 Inspect the laser power

Inspect the laser power regularly in order to maintain consistent marking quality. A usage under severe operating conditions may require a daily inspection.

Use a commercial laser power meter to measure the laser power.

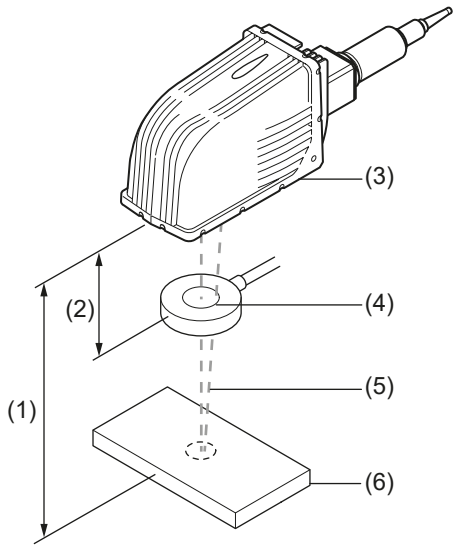
Notice

- Use a calibrated laser power meter.
- The detector of the laser power meter should have a damage threshold (maximum average power density) of more than 10kW/cm^2. The size of the detector should be more than Ø10mm.
- High or low temperatures can result in different measurement values. Measure the power with a normal temperature (20–30°C is recommended).
- Make sure there is no contamination in the laser emission port. If the laser emission port is contaminated or damaged, the measurement results may be faulty.

1. Install the laser power meter. Place the detector of the laser power meter directly beneath the center of the laser emission port. Position it at a distance of one-third to one-half of the specified work distance:

   LP-RV200P: approx. 90mm

   This is the recommended value for a damage threshold of 10kW/cm^2.



(1) Work distance (base position)
(2) Installation distance for detector
(3) Laser head
(4) Detector of laser power meter
(5) Laser beam
(6) Workpiece

Notice

Do not install the detector at the focal point (base position). This may cause destruction of the laser power meter.

2. Establish an online connection between your PC and the laser marking system.
3. Go to the “Maintenance” screen and select the “Laser pumping” tool.
   Select “Yes” to start laser pumping. After a few seconds, laser pumping is completed and the status icon of the “Laser pumping” tool changes.





4. Select “Laser radiation for measurement” in the ribbon.
5. In the dialog, enter the desired laser power and other laser settings.
   The settings specified for the inspection of laser power are saved in the laser marking system.
   The laser power changes depending on the settings for pulse duration and pulse cycle. If you select “Optimal setting”, the software automatically sets the optimal values for “Pulse duration [ns]” and “Pulse cycle [µs]”.
6. Use the guide laser to check the position of the detector.
   - Select “Guide laser ON”.
   - Set the detector so that the crosshairs of the guide laser radiates on the center of the detector.
   - Select “Guide laser OFF”.
7. Select “Laser radiation”.

⚠ WARNING

- Wear laser protective goggles against laser radiation within the laser controlled area.
- During radiation, the laser power is concentrated onto one point. Long radiation periods may cause fire and damage to the workpiece.

8. Select “Yes” to start laser radiation.
   For stable measurement results, it is recommended to obtain the average laser power value by measuring the laser power after about 30s from the start of laser radiation for 10–30s.
9. Select “Stop” to stop laser radiation.
   The laser radiation for measurement automatically stops after about one minute if you do not select “Stop”.
10. Check the measurement results of the power meter.
    If the measurement value is lower than the specified laser power, change the value for “Laser power correction [%]” under “System offset” in the “System settings” screen.
    Setting range of “Laser power correction [%]”: 50–200
    The laser power correction does not change the maximum laser power [W] value. The correction value is applied to the “Laser power” parameter under “Laser settings”.

Notice

If the measurement value is more than 20% below the specified laser power, the laser oscillator needs maintenance. Contact our service center or sales offices.

7.2.7 Galvano scanner

The galvano scanner must be replaced after a certain period of time.

The galvano scanner steers the laser beam with two mirrors along the x and y coordinates of the marking data. Each galvano mirror is mounted onto the rotation axis of a motor.

Uneven wear may occur on the bearing inside the galvano scanner depending upon marking frequency and marking conditions. As the marking is performed by fine angle adjustments, uneven wear may cause skewness or misalignment of the marking result.

Replacement may be required under the following circumstances:

- Deterioration in quality of marking and processing is observed (streaking, reduced marking density, chipped characters, incomplete processing).
- An error occurred in the galvano scanner.
- The galvano scanner has been used for almost five years. The replacement interval may differ depending on the operating environment and marking settings.

Replacement must be done by our service center. Please contact our service center or one of our sales offices.

7.2.8 Shutter

The shutter must be replaced after a certain number of shutter cycles.

The shutter is opened and closed by a rotary solenoid which shuts off the path of the laser beam. When the rotation torque of the rotary solenoid declines, the shutter speed is decreased or the shutter may not work. In this case, a shutter error occurs and the marking cannot be performed.

Replacement may be required under the following circumstances:

- The total number of shutter cycles exceeds two million.
- An error occurred in the shutter.

Replacement must be done by our service center. Please contact our service center or one of our sales offices.

Check the number of shutter operations

You can check the number of shutter operations in Laser Marker NAVI smart.

Go to the “Maintenance” screen and select “Operating data”. Check the value displayed for “Number of shutter cycles”.

7.2.9 INTERLOCK contactor

The INTERLOCK contactor must be replaced after a certain period of time.

The interlock inputs of the TERMINAL connector are connected to the operating coils of contactors inside the controller. If any of the interlock inputs is opened, the safety function is activated and the laser radiation is disabled.

The INTERLOCK contactor deteriorates over time due to aging. This can cause the laser not to be powered off correctly if any of the interlock inputs is opened. Use the interlock monitor outputs to monitor a contact malfunction.

Replacement may be required under the following circumstances:

- The number of open/close operations of the INTERLOCK contactor has exceeded one million (B10d = 1000000 times).
- The INTERLOCK MONITOR output status (Y16–Y17, Y18–Y19) does not correspond to the INTERLOCK input status (X16–X17, X18–X19).
- The error E400 or E401 (interlock input open) persists even if the interlock terminals are connected properly.

Replacement parts:

Part name	Product no.	Remarks
INTERLOCK contactor	LP-AEC10	Model no. SK09L-E01 (Manufacturer: Fuji Electric FA Components & Systems Co., Ltd.) Mechanical lifetime: 10 million times Electrical lifetime: 1 million times

Check the number of switching cycles

You can check the number of switching cycles of the INTERLOCK contactor in Laser Marker NAVI smart.

Go to the “Maintenance” screen and select “Operating data”. Check the value displayed for “Number of switching cycles of INTERLOCK contactors”.

Related topics

Replace the INTERLOCK contactor (page 210)

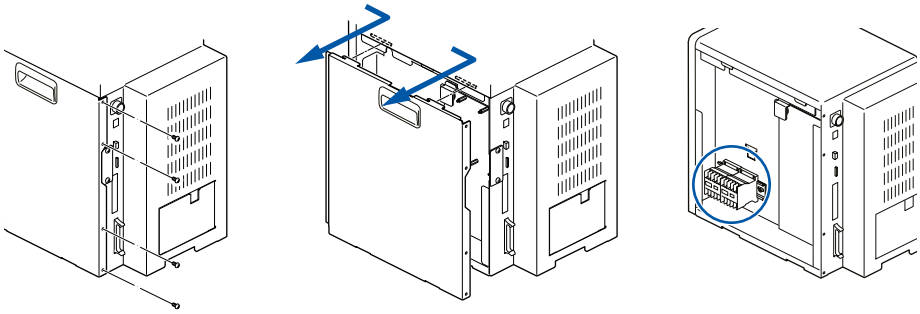
7.2.9.1 Replace the INTERLOCK contactor

Be sure to use the specified type of INTERLOCK contactor.

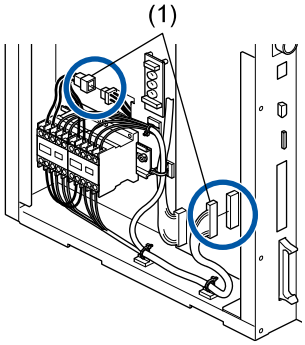
Notice

- Discharge the static electricity for example by touching grounded metal objects before starting the maintenance work. Otherwise, electrical components inside the controller may be damaged.
- Do not touch any other components on the circuit board.

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Loosen the screws on the rear of the controller. Then slide the side panel backwards and remove it.



3. Remove the two connectors (1) of the INTERLOCK contactor.



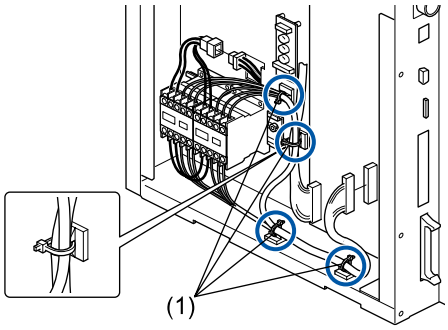
4. Cut the cable ties (max. 4) that secure the cables of the INTERLOCK contactor with a diagonal cutter for plastic.
   The number of cable ties may differ depending on the production date of the controller.

⚠ WARNING

Wear protective goggles when cutting the cable ties to prevent your eyes from injuries caused by flying plastic particles.

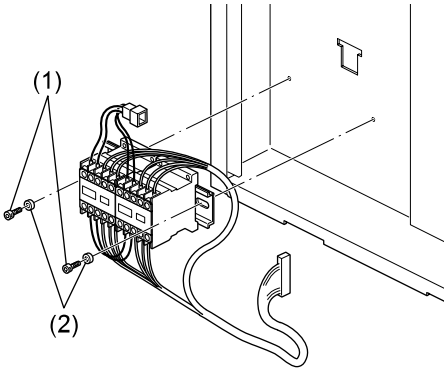
Notice

Be careful not cut or damage the cables when you cut the cable ties.



(1) Cable tie

5. Loosen the bolts of the INTERLOCK contactor with a hex key (M4) and remove the contactor from the controller.



(1) Bolt
(2) Washer

6. Install a new INTERLOCK contactor.
   Insert the bolts with washers into the mounting holes of the INTERLOCK contactor and controller. Fasten the bolts with a hex key (M4).
   Tightening torque: 1.0Nm

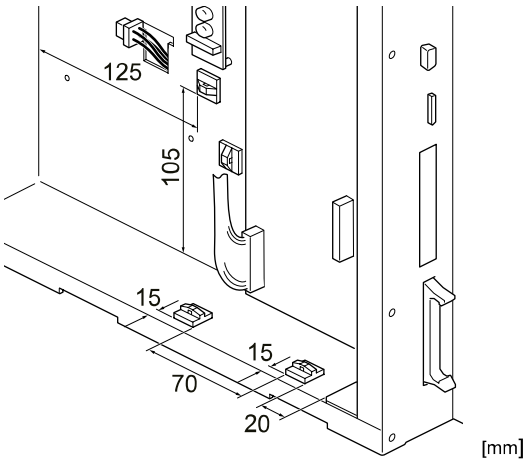
   Notice

   Be careful not to let the cables get caught between the INTERLOCK contactor and the controller.

7. Make sure that the 4 cable tie mounts are in the controller as shown in the figure or fix the cable tie mounts delivered with the INTERLOCK contactor.

   Notice

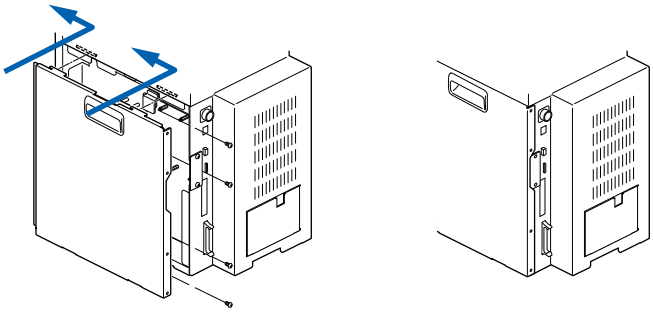
   - Make sure to align the cable tie mounts in the same direction as indicated in the figure.
   - Use only the cable ties and cable tie mounts provided with the new INTERLOCK contactor to avoid a product failure.



8. Connect the two connectors of the INTERLOCK contactor to the controller.
9. Put the cable ties through the holes of the cable tie mounts and secure the cables of the INTERLOCK contactor.
10. Fit the side panel in the top and bottom recesses of the controller. Slide the panel to the front and fix the M3 screws.
    Tightening torque: 0.5Nm

    Notice

    Be careful not to let the cables get caught between the controller's housing and the panel.



11. After you have replaced the INTERLOCK contactor, reset the operating data in Laser Marker NAVI smart.
    - Go to the “Maintenance” screen and select “Operating data”.
    - Select “Reset” for “Number of switching cycles of INTERLOCK contactors” and confirm with “Yes” to reset the value.

Related topics

INTERLOCK contactor (page 209)

7.2.10 Battery

When the battery is low due to aging, the date and time of the clock may not be updated when the laser marking system is turned off.

A lithium battery is located inside the controller to operate the system clock of the laser marking system. Functional characters as the current date and time, expiry date and time, and lot date and time are marked based on the time of this clock.

If you start the laser marking system with a low battery, there may be a system clock alarm, and you must correct the date and time in the “System settings” screen. There will be an alarm every time the laser marking system is started until the battery is replaced.

Replacement may be required under the following circumstances:

- There is a system clock alarm.
- Ten years have passed since delivery.

Replacement parts:

Part name	Product no.	Remarks
Manganese dioxide lithium primary battery, coin-type, with special connector	AFPX-BATT (CR-2450)	Manufacturer: Panasonic Industry Co., Ltd.

Related topics

Remove or replace the battery (page 213)

7.2.10.1 Remove or replace the battery

Be sure to use the specified type of battery.

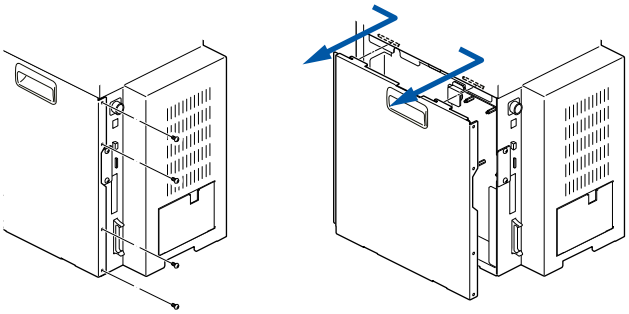
Notice

- Discharge the static electricity for example by touching grounded metal objects before starting the maintenance work. Otherwise, electrical components inside the controller may be damaged.
- Do not touch any other components on the circuit board.
- Be careful not to pinch any cables during battery installation.

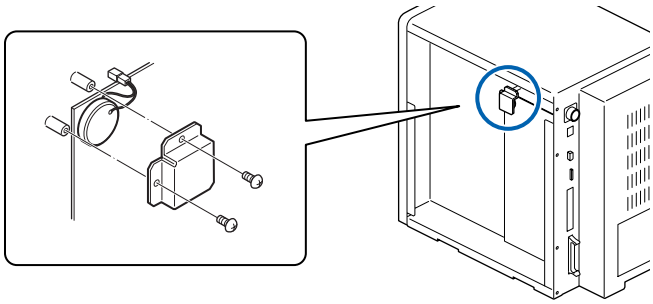
Note

Dispose of batteries according to local regulations. For the correct method of disposal, contact your local municipality, waste disposal services, or the point of sale where you purchased the batteries.

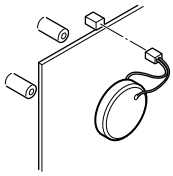
1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Loosen the screws on the rear of the controller. Then slide the side panel backwards and remove it.



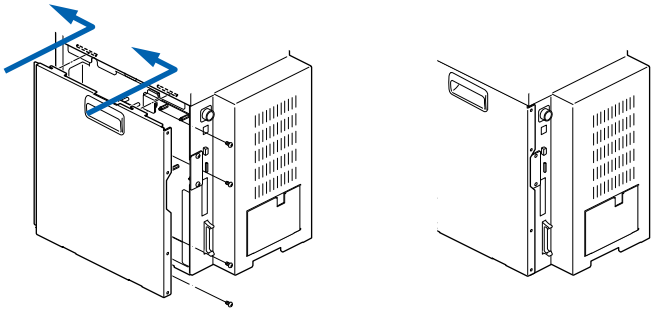
3. Loosen the screws on the battery cover and remove it.



4. Disconnect the battery and remove it.
5. Connect the new battery.



6. Attach the battery cover and fix the screws.
   Tightening torque: 0.5Nm
7. Fit the side panel in the top and bottom recesses of the controller. Slide the panel to the front and fix the M3 screws.
   Tightening torque: 0.5Nm



8. Establish an online connection between your PC and the laser marking system.
9. Set the date and time in the laser marking system.
   - Go to the “System settings” screen and select “Operation/information”.
   - Select “Change” next to “System clock”.

- Select the date and enter the time in the text box. Select “Apply”.
- Select “Apply to laser marking system” in the ribbon.
  The new settings will be updated in the laser marking system.

Note

There may be a system clock alarm the first time you start the laser marking system after battery replacement. To clear the alarm, correct the date and time and confirm the error dialog.

Related topics

Battery (page 213)

Disposal of the laser marking system (page 218)

7.2.11 Cables

If the unit power cable or the signal cable is damaged, for instance due to severe operating conditions, it must be replaced.

To purchase replacement parts or to request maintenance service, please contact our service center or one of our sales offices.

Part name	Product no.	Length
Unit power cable	LP-ACP20-2	2m
	LP-ACP20-5	5m
Signal cable	LP-ACS10-2	2m
	LP-ACS10-5	5m

Notice

To ensure that the laser head meets the requirements of IP64, install the attached connector covers to the cables.

Related topics

Connection of the laser head, oscillator unit, and controller (page 58)

Install the connector covers (page 60)

7.3 Backup the data

Create and keep periodic backups in case you need to replace the laser marking system for repair or maintenance.

A backup file contains the data from the laser marking system.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Data management” screen.
3. Select “Backup”.

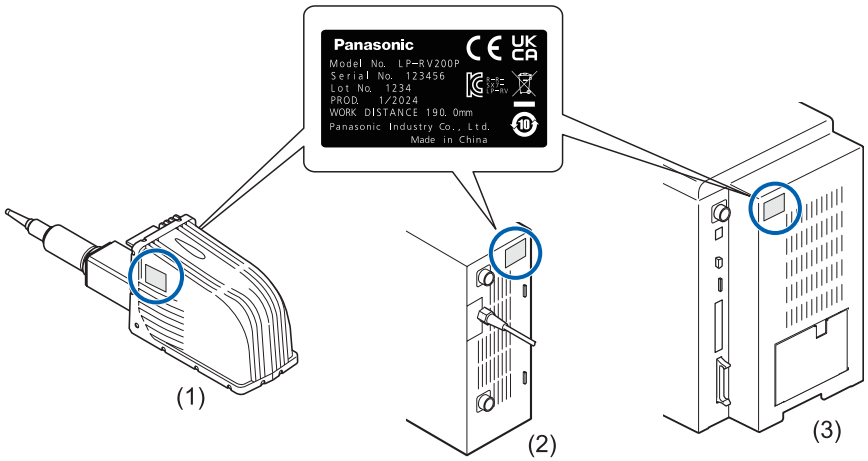
   “Backup” icon
4. Select a storage location for the backup file and select “Save”.
5. If desired, enter comments about the backup file (max. 300 characters) in the “Backup comment” dialog.
   You can refer to the comments when restoring the backup file.
6. Select “OK”.
   The file is saved as a backup file (.lzb or .lmb) to your local or network drive.

7.4 Find the serial number

To request maintenance or repair from our service center, you need to provide the serial number of your laser marking system.

The serial number is the same for laser head, oscillator unit and controller and can be found on any of these devices.

The location of the serial number is indicated in the following figure.



(1) Laser head
(2) Oscillator unit
(3) Controller

If you do not have access to the laser head, oscillator unit, or controller, you can find the serial number in Laser Marker NAVI smart.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “System settings” screen and select “System information” in the ribbon.
   The serial number for the laser head, oscillator unit and controller is displayed in the dialog.

8 Disposal of the laser marking system

To properly dispose of the laser marking system in accordance with local regulations, contact an industrial waste disposal company. Never dispose of the product with regular trash.

When disposing of waste electrical equipment or batteries, follow the regulations of your local authorities.

Notice

- Be sure to delete all data when disposing of your laser marking system. Retained data might result in illegal read out and leaking of information by a third-party with malicious intent.

Symbol explanation

Only for the European Union and countries with recycling systems



This symbol on the products, packaging, and/or accompanying documents means that used electrical and electronic products and batteries must not be mixed with general household waste.
For proper treatment, recovery and recycling of old products and batteries, please take them to designated collection points in accordance with your national laws or regional regulations. Correct disposal will help conserve valuable resources and prevent potential negative effects on human health and the environment. For more information about collection and recycling, please contact your local municipality. Incorrect disposal of this waste may result in penalties, in accordance with national legislation.



This symbol on the battery may be used in conjunction with a chemical symbol.

Related topics

Remove or replace the battery (page 213)

9 Troubleshooting

9.1 List of common problems

If any operation error occurs, check the following items before contacting our service center or sales offices.

Start-up

Power supply is not turned on or system does not start (page 220)

Laser pumping

Laser pumping does not start (page 221)
Laser pumping does not start in remote mode (page 222)

Connection with Laser Marker NAVI smart

Laser marking system not available in the “Connection” dialog (page 222)
Online connection is disconnected (page 223)
Ethernet connection cannot be established (page 223)

Lasing process

Marking cannot be done. (The laser emission indicator blinks but marking is not performed on the workpiece.) (page 224)
Marking is not performed in RUN/REMOTE mode. (The laser emission indicator does not light.) (page 225)
Unintended laser radiation occurs (page 225)
Marking position is not correct (page 226)

Marking quality

Marking result is totally or partially faded (page 226)
Edge of the marking field is faded or chipped (page 228)
Marked characters are partially chipped (page 228)
Marking result of filling lines in drawings or characters is uneven (page 229)
Filling lines in drawings, bar codes or 2D codes are deformed (straight lines are marked wavy) (page 229)
Marking result is uneven, characters are deformed (page 229)
Marking line runs over the intended start or end points (page 230)
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Camera image not displayed (page 243)
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Touch panel console or monitor shows an empty screen (page 244)
Mouse does not respond (page 245)
USB flash drive cannot be recognized (page 245)

9.2 Start-up

When the system does not start, check the power cable, position of the key switch, or condition of the fuse or circuit protector.

Power supply is not turned on or system does not start

Cause:

The power cable is not connected.

Remedy:

Connect the power supply cable.

Cause:

The key switch is not turned on.

Remedy:

Turn the key switch on the front of the controller from 0 to I.

Cause:

Power is not supplied.

Remedy:

Check the power supply.

Cause:

The circuit protector is off.

Remedy:

Turn on the circuit protector. For details, refer to the “Setup and Maintenance Guide”.

9.3 Laser pumping

If laser pumping does not start, check the terminal connections, the state of the “Stop laser” button, or the control method.

Laser pumping does not start

Cause:

One of the following connections between terminals is open.

INTERLOCK 1(+) (X16) and INTERLOCK 1(-) (X17)
INTERLOCK 2(+) (X18) and INTERLOCK 2(-) (X19)
REMOTE INTERLOCK IN (X20) and OUT COM. 1

Remedy:

- Check the connection of all terminals on the TERMINAL connector.
- If the safeguard connected to the laser stop or interlock input was opened or actuated, restore the original status.

Cause:

The “Stop laser” button in the configuration software was selected.

Remedy:

- Solve the safety problem. Then select “Reset” in the error dialog in Laser Marker NAVI smart to finish the laser stop status.
- LP-RH, LP-ZV: When using the touch panel console or monitor:

  Solve the safety problem. Then select “Reset” in the error dialog on the screen to finish the laser stop status.

Cause:

Power is not supplied to the common terminal of the I/O TERMINAL connector.

Remedy:

Connect the internal or external power supply to IN COM. 1 (X2) and OUT COM.1 (Y2) on the I/O TERMINAL connector.

Laser pumping does not start in remote mode

Cause:

Signals from the external device cannot be transmitted.

Remedy:

Refer to External control (page 234).

Cause:

The setting for “Laser pumping control” does not match the actual control method.

Remedy:

- Check if the setting for “Laser pumping control” (“I/O” or “Communication commands”) in the “Operation/information” window of the “System settings” screen is correct.
- A change of this setting will take effect only after restarting the laser marking system.

9.4 Connection with Laser Marker NAVI smart

If a connection to the laser marking system is not possible, check the condition of your PC and the communication settings.

Laser marking system not available in the “Connection” dialog

Cause:

The laser marking system has not been started.

Remedy:

Refer to Start-up (page 220).

Cause:

PC and laser marking system are not connected.

Remedy:

Connect PC and laser marking system with a USB cable or a LAN cable.

Cause:

The USB driver is not installed properly.

Remedy:

Install the USB driver for every laser marking system you wish to connect. For details, refer to the “Laser Marker NAVI smart Operation Manual”.

Online connection is disconnected

Cause:

The PC is in sleep mode or in hibernate mode.

Remedy:

Deactivate the sleep mode settings of the PC to prevent a disconnection.

Cause:

A CPU-intensive application caused the disconnection.

Remedy:

Terminate the CPU-intensive application to maintain the online connection.

Ethernet connection cannot be established

Cause:

The Ethernet settings are incorrect.

Remedy:

Establish a USB connection, and enter the correct settings in the “System settings”. Then, restart the laser marking system.

Cause:

Ethernet connections are not included in the search settings.

Remedy:

In the “Connection” dialog, activate the “Including Ethernet connections” check box.

Cause:

The LAN cable is connected to the wrong port (EtherNet/IP, PROFINET, or INFO LAN).

Remedy:

Connect the cable to the port marked “LAN” on the rear of the controller.

9.5 Lasing process

Invalid laser settings, an incorrect workpiece position, or obstacles in the laser beam path may be responsible for lasing problems.

Marking cannot be done. (The laser emission indicator blinks but marking is not performed on the workpiece.)

Cause:

There is an obstacle in the laser beam path.

Remedy:

- Remove the obstacle between the laser emission port at the laser head and the workpiece.
- LP-RF, LP-RV: Remove the protection cap of the laser emission port.

Cause:

The distance to the workpiece is not appropriate.

Remedy:

Adjust the distance between the bottom surface of the laser marking system and the surface of the workpiece.

Cause:

LP-ZV: When you use the autofocus function:
The workpiece displacement does not match the actual distance.

Remedy:

- Check if the values set for “Workpiece displacement at 4mA [mm]” and “Workpiece displacement at 20mA [mm]” in the “System settings” screen are correct.
- Check if the trigger of the displacement sensor is input after a stable measurement result (analog current output of the sensor) was obtained.
- Check if the sensor's detection area and the marking surface are identical.

Cause:

LP-ZV: The set z-position does not match the height of the actual workpiece.

Remedy:

Set the z-position according to the workpiece height.

Cause:

The workpiece is not in place.

Remedy:

- Check the marking position using the guide laser.
- Connect a sensor to TARGET DETECTION IN (X7) of the TERMINAL connector to check the presence of the workpiece during laser radiation.

Cause:

The laser power is not sufficient.

Remedy:

- Increase the laser power (including correction factor).
- Decrease the scan speed (including correction factor).

Cause:

The laser type (wavelength, laser power, etc.) is not appropriate for the target material.

Remedy:

Laser wavelength and laser power determine which target materials are suitable for laser marking.

LP-RH: not suitable for metal materials

LP-RF, LP-RV, LP-ZV: not suitable for transparent materials

Marking is not performed in RUN/REMOTE mode. (The laser emission indicator does not light.)

Cause:

In RUN mode: RUN mode is not active or the marking trigger signal is not input.

Remedy:

Turn on RUN mode, and then input the marking trigger signal, either from an external device connected to TRIGGER IN (X5) of the TERMINAL connector or from Laser Marker NAVI smart.

Cause:

The marking trigger signal is not input at TRIGGER IN (X5).

Remedy:

- Check the connections to external devices for faulty or loose contacts.
- Make sure that in each marking cycle, the TRIGGER IN (X5) signal is a one-shot signal of more than 2ms.

Cause:

The marking trigger input is ON while the marking trigger ready output is OFF.

Remedy:

Refer to External control (page 234).

Unintended laser radiation occurs

Cause:

Fumes cause malfunction of the photoelectric sensor which triggers the marking process.

Remedy:

Install a dust collector to eliminate fumes (smoke) generated during the marking and make sure the dust is properly collected.

Marking position is not correct

Cause:

- The laser head direction set in the PC configuration software does not correspond to the actual installation direction.
- A system offset was specified in the “System settings”.

Remedy:

Check the laser head direction and system offset values specified in the “System settings”.

9.6 Marking quality

When you are not satisfied with the marking result, check the position and environment of the workpiece, the condition of the laser system, or the laser settings.

Marking result is totally or partially faded

Cause:

The laser emission port is not clean.

Remedy:

- Clean the laser emission port by following the instructions in the “Setup and Maintenance Guide”.
- LP-RF, LP-RV, LP-ZV: If contaminants persist, replace the protection glass of the laser emission port.

Cause:

Fumes created during the marking hinder the laser beam.

Remedy:

Install a dust collector to eliminate fumes (smoke) generated during the marking and make sure the dust is properly collected.

Cause:

The distance to the workpiece is not appropriate.

Remedy:

Adjust the distance between the bottom surface of the laser head and the marking surface of the workpiece.

Cause:

LP-ZV: The set z-position does not match the height of the actual workpiece.

Remedy:

Set the z-position according to the workpiece height.

Cause:

LP-ZV: When you use the autofocus function:

The workpiece displacement does not match the actual distance.

Remedy:

- Check if the values set for “Workpiece displacement at 4mA [mm]” and “Workpiece displacement at 20mA [mm]” in the “System settings” screen are correct.
- Check if the trigger of the displacement sensor is input after a stable measurement result (analog current output of the sensor) was obtained.
- Check if the sensor's detection area and the marking surface are identical.
- Check the sensor's installation status. If there are vibrations that impact the displacement sensor, take measures to prevent vibrations.
- Check if the output signal of the displacement sensor is affected by noise. Take measures to protect the sensor against noise.

Cause:

LP-ZV: The setting option specified for “Uniform spot mode” is not suitable for your marking layout.

Remedy:

Specify a setting option for “Uniform spot mode” to adapt it to the work distance. If you change this setting, marking quality may also change. Adjust the laser power according to the selected uniform spot mode.

Cause:

The marking surface of the workpiece is inclined.

Remedy:

Make sure the bottom surface of the laser head and the marking surface of the workpiece are parallel to each other.

Cause:

The workpieces have varying properties for thickness, surface condition (roughness, gloss level, etc.), and material (incl. chemical composition).

Remedy:

Adjust the marking settings and work distance for each workpiece.

Cause:

The workpiece feeder is unstable.

Remedy:

Adjust the workpiece feeder so that the position of the workpiece will be stable.

Cause:

The performance of the laser oscillator deteriorated due to aging.

Remedy:

- Increase the laser power.
- Decrease the scan speed.
- If the initial marking quality cannot be reached even if the laser power is set to the maximum value, the laser oscillator must be replaced. Contact our service center or sales offices.

Cause:

The laser power or power density is insufficient.

Remedy:

- Increase the laser power (including correction factor).
- Decrease the scan speed (including correction factor).
- LP-ZV206P and LP-ZV506P are not suitable for engraving on metal.

Cause:

LP-RV, LP-ZV200P, LP-ZV205P, LP-ZV206P: The setting value of the pulse duration is incorrect.

Remedy:

Adjust the pulse duration according to the material of the workpiece. For plastic, 4ns or 8ns is a common setting. For metal, 16ns or 30ns are often used. For shallow marking on metal, 120ns or 200ns are often selected.

Edge of the marking field is faded or chipped

Cause:

A decrease of the power density at the edge of the marking field may affect the marking quality.

Remedy:

- LP-RH: Activate “Power optimization by marking position” in the “System settings”.
- LP-RF, LP-RV, LP-ZV: Enable laser power correction for the marking objects at the edge of the marking field.
- LP-ZV: Set “Uniform spot mode”.

Marked characters are partially chipped

Cause:

There is an obstacle in the laser beam path.

Remedy:

Remove the obstacle between the laser emission port at the laser head and the workpiece.

Cause:

The laser emission port is not clean.

Remedy:

- Clean the laser emission port by following the instructions in the “Setup and Maintenance Guide”.
- LP-RF, LP-RV, LP-ZV: If contaminants persist, replace the protection glass of the laser emission port.

Marking result of filling lines in drawings or characters is uneven

Cause:

LP-ZV: The speed is too high when the filling lines are drawn and the z-axis adjustment module cannot follow up with the height change.

Remedy:

- Decrease the scan speed.
- Change the marking order or the marking direction of the filling lines.

Filling lines in drawings, bar codes or 2D codes are deformed (straight lines are marked wavy)

Cause:

The workpiece is moving during the marking process.

Remedy:

Take measures to prevent vibration.

Cause:

The marking settings are not appropriate for the drawing pattern of the filling lines.

Remedy:

- Change the scan speed.
- Adjust the value for “Waiting time” in “Laser settings”.

Marking result is uneven, characters are deformed

Cause:

The laser head is not fixed properly.

Remedy:

- Fix the laser head with the specified torque.
- Improve the strength of the stand on which the laser head is installed.

Cause:

There are continuous vibrations coming from surrounding equipment, such as motors and presses.

Remedy:

Take measures to prevent vibration.

Cause:

There are irregular vibrations coming from surrounding equipment, such as air cylinders and forklifts.

Remedy:

Take measures to prevent vibration.

Cause:

The starting and/or stopping of the workpiece feeder does not match the marking process.

Remedy:

- The marking process is disturbed at the beginning: The marking trigger signal is input before the workpiece has fully stopped or the equipment continues to vibrate after the workpiece has stopped. Use a delay timer, for example, to input the trigger signal only after no more vibrations occur.
- The marking process is disturbed at the end: The workpiece starts moving before the marking process is completed. Delay the start time of the workpiece feeder or increase the scan speed so that the marking process is finished before the workpiece starts moving.

Cause:

Surrounding equipment produces noise.

Remedy:

- Securely ground the frame ground (FG) of the laser marking system or the surrounding equipment.
- Insulate the power and signal lines from each other if they have been routed in parallel.
- Shield the signal line.
- Insulate the power supply of the laser marking system from other equipment.
- Use a noise cut-off transformer to absorb noises from the power supply.

Marking line runs over the intended start or end points

Cause:

The fine adjustment parameters in the laser settings do not match the other settings.

Remedy:

Adjust the laser settings such as start point, end point, or waiting time.

Small characters are not readable

Cause:

The settings or the fonts are inadequate for the character size.

Remedy:

- Use the ORG2 or ORG5 font for small size characters.
- Adjust the laser power or the scan speed.

Marking result is dotted

Cause:

LP-RH: The settings for laser frequency and scan speed are inadequate.

Remedy:

Decrease the scan speed or increase the laser frequency.

Cause:

LP-RF, LP-RV, LP-ZV: The settings for laser pulse cycle and scan speed are inadequate.

Remedy:

Decrease the scan speed or the laser pulse cycle.

9.7 On-the-fly marking

Most problems with on-the-fly marking can be resolved by adjusting the trigger signals, the workpiece position, or the line speed.

Marking is sometimes skipped (E750)

Cause:

The marking trigger signal is entered before the current marking process is finished.

Remedy:

- Select multiple trigger mode if you want to input trigger signals during trigger processing.
- Place the trigger sensor closer to the laser marking system.
- Reduce the marking time by increasing the scan speed, for example.
- Reduce the feeder speed.
- Increase the marking interval (interval between the objects on the feeder).

Start lines of characters are distorted or partially incomplete

Cause:

The timing of the lasing process does not match the line speed.

Remedy:

- Increase the value for overrun correction.
- Check the settings for the lasing start boundary and trigger detecting position.
- Deselect the check box “Align the trigger detecting position with the lasing start boundary” in “System settings” > “Advanced system settings”.

Characters are distorted or character spacing is unstable

Cause:

The set moving direction is wrong.

Remedy:

- Adjust the moving direction to match the operation of the laser marking system.
- Check the setting of the laser head direction in the system settings.

Cause:

The speed changes at a conveyor junction.

Remedy:

If conveyors are coupled, avoid marking near conveyor junctions.

Cause:

The actual speed and the preset speed for feeding workpieces are different due to slippage of workpieces.

Remedy:

Remove the cause of workpiece slippage.

Cause:

Positional misalignment is likely to occur due to meandering motion of the conveyor.

Remedy:

Make sure that the position of the workpiece is stable.

Cause:

The moving speed of the conveyor is not stable.

Remedy:

- Check the conveyor and remove the cause of the speed change.
- Use an encoder to feedback speed changes and to stabilize the speed.

Cause:

A fixed line speed was set, which does not match the actual line speed.

Remedy:

Adjust the setting value of the line speed by checking the marking quality.

- When the character spacing is too wide, increase the value.
- When the character spacing is too narrow, decrease the value.

Cause:

The line speed is controlled by an encoder and could not be measured correctly.

Remedy:

- Make sure that the encoder operates properly.
- Make sure that the setting value of the encoder resolution is correct.
  - When using A phase only:
    Encoder resolution = Number of pulses/mm × 2.
  - When using A and B phases:
    Encoder resolution = Number of pulses/mm × 4.
- When only one phase of the encoder is used, connect the encoder signal to ENCODER A IN (X13) and connect ENCODER B IN (X14) to IN COM.1 (X2).

Cause:

The line speed fed back to an encoder is not consistent with the actual line speed during the marking process.

Remedy:

- Place the encoder closer to the trigger sensor.
- Adjust the setting value of the encoder resolution by checking the marking quality.
  - When the character spacing is too wide, increase the value.
  - When the character spacing is too narrow, decrease the value.
- In some cases, the influence of line speed fluctuations may be reduced by lowering the encoder resolution. However, a minimum encoder resolution of 25pulses/mm is recommended.

Cause:

The line speed, which is controlled by two sensors, could not be measured correctly.

Remedy:

- Adjust the setting value for “Distance line speed sensors [mm]”.
- Make sure the sensors operate properly.

Cause:

The line speed control measured with two sensors is not consistent with the actual line speed during the marking process.

Remedy:

- Place the trigger sensor closer to the line speed measuring sensor to reduce the difference between the speed at the point of measurement and the point of marking.
- Adjust the setting value for “Distance line speed sensors [mm]” by checking the marking quality.
  - When the character spacing is too wide, increase the value.
  - When the character spacing is too narrow, decrease the value.

9.8 External control

If the laser marking system is controlled by I/O signals or communication commands, check the connections, communications settings, and signal sequences.

Communication with the external device does not start

Cause:

The laser marking system is not in remote mode.

Remedy:

- Switch the laser marking system to remote mode. For details, refer to the “Setup and Maintenance Guide”.
- Check the setting for “Remote mode switching method” (“I/O” or “Configuration software”) in the “System settings” of Laser Marker NAVI smart. Make sure the setting matches your actual control method.
- If you have changed the setting for “Remote mode switching method” in the “System settings”, restart the laser marking system.

Cause:

The connection to external devices is inadequate.

Remedy:

- Check the connections to external devices for faulty or loose contacts.
- Check the wiring using a continuity tester or the like.
- For RS-232C connections, check the wiring of the external device including the loopback.

Cause:

The communication settings are incorrect.

Remedy:

- Align the communication settings with the external device.
- If you have changed any of the communication settings (Ethernet, EtherNet/IP, PROFINET or RS-232C) in the “System settings”, restart the laser marking system.
- For DHCP of EtherNet/IP connections, check the connection status of your DHCP server.
- For RS-232C connections, disable flow control on the external device.

Cause:

The communication settings were overwritten by a backup file.

Remedy:

Check the communication settings. For Ethernet and EtherNet/IP connections, check the IP address and other Ethernet settings. When you restore a backup file, the communication settings are overwritten by the backup data.

Cause:

Surrounding equipment produces noise.

Remedy:

- Securely ground the frame ground (FG) of the laser marking system or the surrounding equipment.
- Insulate the power and signal lines from each other if they have been routed in parallel.
- Shield the signal line.
- Insulate the power supply of the laser marking system from other equipment.
- Use a noise cut-off transformer to absorb noises from the power supply.

I/O control fails

Cause:

The settings in the “System settings” are incorrect.

Remedy:

- Make sure that the control method is set to “I/O” in “System settings” > “Operation/ information”.
- Check the I/O settings in “System settings” > “Inputs/outputs”.
- For EtherNet/IP or PROFINET connections, check the settings for “Control method of input signals” in “System settings” > “Communication”.

If you have changed any of the above settings, restart the laser marking system.

Command control fails

Cause:

Communication commands are not received from the external device.

Remedy:

- Check the commands in “Maintenance” > “Command history”.
- Use a commercially available line monitor or protocol analyzer to check if the external device sends data.

Cause:

The start code is incorrect.

Remedy:

- Check if the setting for “Start code” specified in the “System settings” matches the start code in the data from the external device.
- If you use EtherNet/IP or PROFINET, make sure that the command data do not contain the start code.

Cause:

The end code is incorrect.

Remedy:

- For RS-232C and Ethernet connections, make sure the data from the external device contain an end code.
- For RS-232C connections, check if the setting for “End code” specified in the “System settings” matches the end code in the data from the external device.
- If you use EtherNet/IP or PROFINET, make sure that the command data do not contain the end code.

Cause:

The “Compatible mode” setting is wrong.

Remedy:

- To use the command format of the LP-400/LP-V or LP-M/LP-S/LP-Z series, select “LP-400/V compatible” or “LP-M/S/Z compatible” for “Compatible mode” in the “System settings” of Laser Marker NAVI smart.
- To use the standard command format, set “OFF” for “Compatible mode” or switch the command mode with the Command mode (**RSM**) command.
- The LP-M/S/Z compatible command mode cannot be used for LP-RF, LP-RH, and LP-RV.
- For EtherNet/IP or PROFINET connections, set “OFF” for “Compatible mode”. LP-400/V and LP-M/S/Z compatible command modes are not supported for EtherNet/IP and PROFINET connections.

Marking trigger ready output does not turn on

Cause:

An error occurred.

Remedy:

Check the error code and cancel the alarm or warning.

Cause:

The marking trigger signal is being processed.

Remedy:

- Do not input the marking trigger signal until READY OUT (Y5) is ON.
- When multiple trigger mode is selected for on-the-fly marking , a maximum of 16 trigger signals can be transmitted during trigger processing.

Cause:

Laser pumping is turned off.

Remedy:

Turn on laser pumping. If laser pumping is not possible, refer to Laser pumping (page 221).

Cause:

The shutter is closed.

Remedy:

- Open the shutter.
- Check the setting for “Shutter operation control” (“I/O” or “Communication commands”) in the “System settings” of “Laser Marker NAVI smart”. Make sure the setting matches your current control method.
- A change of this setting will take effect only after restarting the laser marking system.

Cause:

File switching has not completed.

Remedy:

During file switching, the marking trigger ready output READY OUT (Y5) is OFF until the marking data are generated. The time varies depending on the quantity of data to be marked. Do not input the marking trigger signal until READY OUT (Y5) is ON.

Cause:

External character input was activated, but the required marking data are not input from the external device.

Remedy:

- If the register function (registered characters), the external offset function, or character entry by **SIN** command is used, the marking data must be input in every marking cycle.
- Before you input the marking data, make sure the DATA WAIT OUT (38) output of the I/O connector is ON.

Cause:

Reception mode was turned on during command control.

Remedy:

Turn off reception mode with the Reception mode (**MKM**) command.

Cause:

The counter was reset during on-the-fly marking.

Remedy:

When the counter is reset during on-the-fly marking, READY OUT (Y5) temporarily turns off and the trigger signal cannot be transmitted. Check the timing of the counter reset.

Cause:

LP-ZV: The autofocus function with the external displacement sensor was activated in Laser Marker NAVI smart, but there is no input from the sensor.

Remedy:

- Check the connection and status of the external displacement sensor.
- Before the sensor provides an input to the laser marking system, make sure the DATA WAIT OUT (38) output of the I/O connector is ON.
- If you do not use the external displacement sensor, change the setting for “Autofocus” in “File settings”.

A negative response is returned

Cause:

The control method is set to “I/O” in the “System settings”.

Remedy:

- To control laser pumping, the shutter, or the guide laser by communication commands, select “Communication commands” for the corresponding operation. A change of this setting will take effect only after restarting the laser marking system. The setting is required for the following commands:

  Laser pumping (**LSR**)
  Shutter control (**SHT**)
  Guide laser (**GID**)

- The **SPT** command (laser radiation for measurement), **TST** command (test marking, LP-RH, LP-ZV) and **PWM** command (power check, LP-ZV500P, LP-ZV505P, LP-ZV506P) are available only if “Shutter operation control” is set to “Communication commands”.

Cause:

Reception mode is OFF.

Remedy:

The setting request of most commands can only be transmitted if reception mode is ON. Turn on reception mode with the Reception mode (**MKM**) command. The following commands do not require the reception mode:

File switching by number (**FNO**)
File switching by name (**FNN**)
Shutter control (**SHT**)
Reception mode (**MKM**)
Laser pumping (**LSR**)
Counter reset (**CTR**)
Marking trigger (**MRK**)
Character entry per trigger (**SIN**)
Marking offset and laser power correction per trigger (**SEO**)

For LP-400/V and LP-M/S/Z compatible mode, different commands apply. For details, refer to the “Serial Communication Command Guide: LP-400/V compatible mode” or “Serial Communication Command Guide: LP-M/S/Z compatible mode”.

Cause:

There is an alarm or a warning.

Remedy:

- If there is an alarm, only these commands can be transmitted:

  Status check (**STS**)
  I/O monitor (**IOM**)
  Operating data (**RTD**)
  Error history (**ERH**)
  Alarm reset (**ARS**)
  Error number (**ENO**)
  Command mode (**RSM**)

- If there is a warning, only these commands can be transmitted:

  Status check (**STS**)
  I/O monitor (**IOM**)
  Operating data (**RTD**)
  Error history (**ERH**)
  Alarm reset (**ARS**)
  Error number (**ENO**)
  Command mode (**RSM**)
  Shutter control (**SHT**); close request and status request only
  Reception mode (**MKM**); read request only

  For LP-400/V and LP-M/S/Z compatible mode, different commands apply. For details, refer to the “Serial Communication Command Guide: LP-400/V compatible mode” or “Serial Communication Command Guide: LP-M/S/Z compatible mode”.

Cause:

Two or more commands are transmitted at the same time.

Remedy:

When you send a command, always confirm the response from the laser marking system before sending the next command.

Cause:

The “Compatible mode” setting is wrong.

Remedy:

- To use the command format of the LP-400/LP-V or LP-M/LP-S/LP-Z series, select “LP-400/V compatible” or “LP-M/S/Z compatible” for “Compatible mode” in the “System settings” of Laser Marker NAVI smart.
- To use the standard command format, set “OFF” for “Compatible mode” or switch the command mode with the Command mode (**RSM**) command.
- The LP-M/S/Z compatible command mode cannot be used for LP-RF, LP-RH, and LP-RV.

Cause:

- The character code used in the commands is incorrect.
- Unsupported characters are used in the readout strings.

Remedy:

- “Shift JIS”, “GB 2312” and “Latin-1” cannot be used together.
- Check the setting for “Encoding for non-ASCII characters” in the “System settings”.
- Check if characters in the readout strings can be encoded with ASCII code or the character code specified in “Encoding for non-ASCII characters”.
- When LP-400/V or LP-M/S/Z compatible mode is set, only ASCII code and Shift JIS are available.

9.9 Linking of image processing devices

Common problems include the connection of the imagechecker or code reader, the workpiece position, or the inspection conditions.

Linking of an imagechecker and/or a code reader fails

Cause:

The connection with the imagechecker or code reader is inadequate.

Remedy:

Check the connections to external devices for faulty or loose contacts. For details, refer to the “Setup and Maintenance Guide”.

Cause:

The communication settings are incorrect.

Remedy:

Check the communication settings. A change of this setting will take effect only after restarting the laser marking system.

Cause:

The LAN cable is connected to the wrong port (EtherNet/IP, PROFINET, or INFO LAN).

Remedy:

Connect the cable to the port marked “LAN” on the rear of the controller.

Position correction fails

Cause:

The imagechecker coordinates differ from the marking position of the laser marking system.

Remedy:

Set the calibration of the imagechecker and align the coordinate origin of the imagechecker with the marking field's center point of the laser marking system.

Cause:

Imagechecker settings are inadequate.

Remedy:

Check the following PV230/PV200 settings:

- Ethernet setting: “General Com.” (general communication) is set for “Protocol”
- Calibration
- Settings for position correction
- Expression of the numerical calculation

Cause:

The setting order in the expression table of PV230/ PV200 is inadequate.

Remedy:

Make appropriate adjustments to the setting order in the expression table of PV230/ PV200. The numerical calculation results should be output to the laser marking system in the following order: X, Y, and theta.

Code or character reading results are NG

Cause:

The inspection conditions of the imagechecker are incorrect.

Remedy:

Set appropriate inspection conditions according to the marked code type or character settings.

Cause:

Other codes or characters than the marked bar code, 2D code or characters are read.

Remedy:

Do not capture codes or characters other than marked codes or characters in the field of view of the imagechecker.

Cause:

When PV230 is used: The settings for total judgement of PV230 are incorrect.

Remedy:

- For code checking, check the settings for the code reader checker of PV230.
- For character checking, check the settings for the OCR checker of PV230.
- Make sure the expression of the numeric calculation in the total judgement is correct.

Cause:

When PV230 is used: No settings were made in the character dictionary of PV230.

Remedy:

To use the character recognition function, set the dictionary of PV230 for each marking character beforehand.

Cause:

An image of fumes (smoke) in the field of view was taken.

Remedy:

Install a dust collector to eliminate fumes (smoke) generated during the marking and make sure the dust is properly collected.

Marking result is uneven, characters are deformed

Cause:

When TIMING IN (24) on the I/O connector is used, the starting and/or stopping of the workpiece feeder does not match the marking process.

Remedy:

- At the beginning of the marking process, make sure the timing input TIMING IN (24) turns ON only after the workpiece has completely stopped.
- At the end of the marking process, make sure workpieces are moved only after the timing standby output TIMING WAIT OUT (36) has turned ON.

9.10 Built-in camera (LP-ZV)

If the camera is not working properly, check the connection of the camera to the PC, the camera settings, and the workpiece position.

Camera image not displayed

Cause:

The camera is not connected to your PC.

Remedy:

Connect the USB port on the rear of the laser head to your PC with a USB cable.

Cause:

If a USB hub is being used, the power supply of the hub is insufficient.

Remedy:

- Connect your PC to the laser head without using a USB hub.
- When you use a USB hub, use a product with an external power supply (self-powered USB hub).

Workpiece not displayed properly

Cause:

For metallic or other glossy surfaces, the camera lighting and the camera settings are inadequate.

Remedy:

- Change the brightness of the camera lighting.
- Turn off “Auto-exposure” and adjust the values for “Gain” and “Exposure time”.

Cause:

The workpiece position is inadequate for the lighting direction.

Remedy:

- Change the workpiece position.
- For metallic or other glossy surfaces, change the angle of the workpiece.
- Change the brightness of the camera lighting.
- Turn off “Auto-exposure” and adjust the values for “Gain” and “Exposure time”.

Workpiece size in marking image editor is incorrect

Cause:

The setting of “Z-movement of camera [mm]” is inadequate.

Remedy:

Measure the work distance and enter the value of the difference from the base position. Enter a positive value to reduce the work distance and a negative value to increase the work distance.

9.11 Operation by touch panel console or monitor (LP-RH, LP-ZV)

If you connect a touch panel console or a monitor, a mouse, or a USB flash drive to the laser marking system, a few requirements must be met.

Touch panel console or monitor shows an empty screen

Cause:

The laser marking system has not been started.

Remedy:

Start-up the laser marking system with the touch panel console or monitor connected.

Cause:

Incorrect connection of the touch panel console or monitor.

Remedy:

- When you use the touch panel console: Connect the cable of the touch panel console to the CONSOLE connector on the front of the controller.
- When you use a monitor: Connect the cable of the monitor to the VGA connector on the rear of the controller. This product can only be connected to a monitor with a VGA connector.

Cause:

The expansion board is not installed or incorrectly installed in the controller.

Remedy:

- When you use the touch panel console or a monitor, you need to install the optional expansion board LP-AEB10 in the controller of the laser marking system.
- Make sure that the cables inside the controller are connected correctly to the expansion board.

Cause:

An online connection between Laser Marker NAVI smart and the laser marking system is established.

Remedy:

You cannot operate the touch panel console or a monitor during an online connection between Laser Marker NAVI smart and the laser marking system.

Cause:

When you use a monitor: The monitor is not turned on.

Remedy:

Check the power supply of the monitor.

Mouse does not respond

Cause:

The mouse is connected to a USB hub.

Remedy:

Connect the USB mouse directly to the controller of the laser marking system without using a USB hub.

Cause:

The mouse type is not supported by the laser marking system.

Remedy:

Use a Human Interface Device (HID) class USB mouse.

USB flash drive cannot be recognized

Cause:

The USB flash drive type is not supported by the laser marking system.

Remedy:

You cannot use the USB flash drive with security functions.

Cause:

The file system selected when formatting the USB flash drive is not appropriate.

Remedy:

Use a USB flash drive formatted with FAT32 or exFAT.

Cause:

The connector of the USB flash drive is not clean.

Remedy:

Clean the connector of the USB flash drive.

Cause:

The USB flash drive is connected to a USB hub.

Remedy:

Connect the USB flash drive directly to the controller of the laser marking system without using a USB hub.

Cause:

The expansion board is not installed in the controller.

Remedy:

The USB flash drive can be used only together with the touch panel console or a monitor. For this, you need to install the optional expansion board LP-AEB10 in the controller of the laser marking system.

Version error appears on the touch panel console or monitor

Cause:

Incorrect firmware version combination of controller and expansion board.

Remedy:

Update the firmware of your laser marking system. Download the software package Laser Marker Firmware Updater from the following Web site:
https://industry.panasonic.com/global/en/downloads/?tab=software
To find the appropriate software, go to “Download” > “Software” and enter the series name of your laser marking system (e.g. LP-ZV) in the “Part No.” field.

9.12 Reset an alarm message (E001–E599)

An alarm is output when a safety function is activated or if there is a hardware or system error.

When an alarm occurs, laser pumping is turned off and laser radiation is stopped if marking is in process.

There are different methods to reset an alarm, depending on the type of error.

If the error persists after restarting the laser marking system, contact our service center or sales offices.

- Remove the cause of the alarm and confirm the operation logic of the safeguards.
- E001–E399: These errors are caused by hardware or system errors. Restart the laser marking system to clear the alarm.
- For error codes E400–E599, reset the alarm by one of the following methods:
  - Confirm the error message in Laser Marker NAVI smart to reset the error.
  - Turn on the alarm reset input ALARM RESET IN (X15) on the TERMINAL connector.
  - Send an Alarm reset (**ARS**) command.

- If a counter is used, check the counter value in the marking file before resuming the marking process.

Related topics

Alarm messages (E001–E599) (page 247)

Warning messages (E600–E799) (page 258)

Reset a warning message (E600–799) (page 257)

9.13 Alarm messages (E001–E599)

Error codes in the range from E001 to E599 indicate an alarm.

E001–E038	Cause: A system error occurred. Remedy: Check the connection of cables and signal lines, and restart the laser marking system.
E039	Cause: • Incorrect model combination. • The signal cable or unit power cable is not connected correctly. Remedy: • LP-RF, LP-RH: Make sure to connect a laser head and controller which have the allowed combination of model numbers. • LP-RV, LP-ZV: Make sure to connect a laser head, controller and oscillator unit which have the allowed combination of model numbers. Connect the oscillator unit correctly to the laser head and controller. • Check the connection of cables and signal lines, and restart the laser marking system.
E040–E043	Cause: • Communication between the laser head and the controller is not possible due to a system error. • The signal cable or unit power cable is not connected correctly. Remedy: • Check the connection of cables and signal lines, and restart the laser marking system. • Replace the cable.

E044	Cause: • Incorrect model combination. • The signal cable or unit power cable is not connected correctly. Remedy: • LP-RF, LP-RH: Make sure to connect a laser head and controller which have the allowed combination of model numbers. • LP-RV, LP-ZV: Make sure to connect a laser head, controller and oscillator unit which have the allowed combination of model numbers. Connect the oscillator unit correctly to the laser head and controller. • Check the connection of cables and signal lines, and restart the laser marking system.
E059	Cause: A network error occurred. Remedy: Make sure the optional network unit is installed correctly.
E045–E058, E060–E099, E101–E138	Cause: A system error occurred. Remedy: Check the connection of cables and signal lines, and restart the laser marking system.
E139	Cause: • Incorrect model combination. • The signal cable or unit power cable is not connected correctly. Remedy: • LP-RF, LP-RH: Make sure to connect a laser head and controller which have the allowed combination of model numbers. • LP-RV, LP-ZV: Make sure to connect a laser head, controller and oscillator unit which have the allowed combination of model numbers. Connect the oscillator unit correctly to the laser head and controller. • Check the connection of cables and signal lines, and restart the laser marking system.
E140–E143	Cause: • Communication between the laser head and the controller is not possible due to a system error. • The signal cable or unit power cable is not connected correctly. Remedy: • Check the connection of cables and signal lines, and restart the laser marking system. • Replace the cable.

E144

Cause:

- Incorrect model combination.
- The signal cable or unit power cable is not connected correctly.

Remedy:

- LP-RF, LP-RH: Make sure to connect a laser head and controller which have the allowed combination of model numbers.
- LP-RV, LP-ZV: Make sure to connect a laser head, controller and oscillator unit which have the allowed combination of model numbers. Connect the oscillator unit correctly to the laser head and controller.
- Check the connection of cables and signal lines, and restart the laser marking system.

E145–E158

Cause:

A system error occurred.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E159

Cause:

A network error occurred.

Remedy:

Make sure the optional network unit is installed correctly.

E160–E199

Cause:

A system error occurred.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E205–E207

Cause:

- An error occurred in the shutter.
- The signal cable or unit power cable is not connected correctly.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E208–E214

Cause:

A system error occurred.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E216–E217

Cause:

An error occurred in the controller fan.

Remedy:

- Clean the cooling air inlet and outlet, and the fan located at the cooling air area of the controller. For details, refer to the “Setup and Maintenance Guide”.
- Replace the air filter.
- Replace the fan.

Applies to LP-RH, LP-ZV only.

E218–E219

Cause:

A system error occurred.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E220

Cause:

The head housing is open.

Remedy:

Contact our service center or sales offices.

E221–E222

Cause:

- Communication between the laser head and the controller is not possible due to a system error.
- The signal cable or unit power cable is not connected correctly.

Remedy:

- Check the connection of cables and signal lines, and restart the laser marking system.
- Replace the cable.

E223–E224

Cause:

A system error occurred.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E225

Cause:

The fiber unit is detached.

Remedy:

Install the fiber unit properly. For details, refer to the “Setup and Maintenance Guide”.

Applies to LP-RF, LP-RV, LP-ZV only.

E226–E229	Cause: An error occurred in the head fan. Remedy: • Clean the cooling air inlet and outlet located at the cooling air area of the laser head. For details, refer to the “Setup and Maintenance Guide”. • Replace the air filter. Applies to LP-RH only.
E231-E236	Cause: A network error occurred. Remedy: Make sure the optional network unit is installed correctly.
E237	Cause: An expansion board error occurred. Remedy: Make sure the optional expansion board is installed correctly. Applies to LP-RH, LP-ZV only.
E240–E243	Cause: • Communication between the laser head and the controller is not possible due to a system error. • The signal cable or unit power cable is not connected correctly. Remedy: • Check the connection of cables and signal lines, and restart the laser marking system. • Replace the cable.
E245–E248	Cause: A system error occurred. Remedy: Check the connection of cables and signal lines, and restart the laser marking system.
E250–E255, E260–E261	Cause: • An error occurred in the laser oscillator. • A power supply voltage error was detected in the laser oscillator. • The signal cable or unit power cable is not connected correctly. Remedy: • Check the power supply. • Check if the AC power line is affected by noise. • Check the connection of cables and signal lines, and restart the laser marking system.

E262

Cause:

The laser oscillator stopped because the permissible temperature was exceeded.

Remedy:

- Make sure the operating temperature of the laser marking system does not exceed the permissible range.
- Make sure the fan operates properly.
- Clean the cooling air inlet and outlet, and the fan located at the cooling air area of the laser marking system.
- If the air filter is contaminated, replace it.
- If the problem persists, contact our service center or sales offices.

Applies to LP-RF, LP-RV, LP-ZV only.

E263

Cause:

Unintended laser radiation was detected.

Remedy:

Contact our service center or sales offices.

Applies to LP-RF, LP-RV, LP-ZV only.

E264–E265

Cause:

- An error occurred in the laser oscillator.
- A power supply voltage error was detected in the laser oscillator.
- The signal cable or unit power cable is not connected correctly.

Remedy:

- Check the power supply.
- Check if the AC power line is affected by noise.
- Check the connection of cables and signal lines, and restart the laser marking system.

E266

Cause:

An error occurred in the power monitor.

Remedy:

Contact our service center or sales offices.

Applies to LP-ZV only.

E270, E273

Cause:

- An error occurred in the galvano scanner.
- The signal cable or unit power cable is not connected correctly.

Remedy:

- Check the power supply.
- Check if the AC power line is affected by noise.
- Check the connection of cables and signal lines, and restart the laser marking system.

E280, E283

Cause:

- An error occurred in the galvano scanner.
- The signal cable or unit power cable is not connected correctly.

Remedy:

- Check the power supply.
- Check if the AC power line is affected by noise.
- Check the connection of cables and signal lines, and restart the laser marking system.

E292

Cause:

An error occurred in the z-axis adjustment module.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

Applies to LP-ZV only.

E300–E380

Cause:

A system error occurred.

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E400

Cause:

Interlock input 1 is open.

Remedy:

- Connect the INTERLOCK 1 inputs on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the interlock terminals.
- Check the operation logic of the connected device.
- If you want to deactivate this alarm when the shutter is closed, set “Deactivate while shutter closed” in “System settings” > “Operation/information” > “INTERLOCK alarm detection”.
- If the error persists even if the interlock terminals are connected properly, replace the INTERLOCK contactor. For details, refer to the “Setup and Maintenance Guide”.

E401

Cause:

Interlock input 2 is open.

Remedy:

- Connect the INTERLOCK 2 inputs on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the interlock terminals.
- Check the operation logic of the connected device.
- If you want to deactivate this alarm when the shutter is closed, set “Deactivate while shutter closed” in “System settings” > “Operation/information” > “INTERLOCK alarm detection”.
- If the error persists even if the interlock terminals are connected properly, replace the INTERLOCK contactor. For details, refer to the “Setup and Maintenance Guide”.

E402

Cause:

The laser stop input is open.

Remedy:

- Connect the LASER STOP IN inputs on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the LASER STOP IN inputs.
- Check the operation logic of the connected device.
- Connect the internal or external power supply to IN COM. 1 (X2) and OUT COM.1 (Y2) on the I/O TERMINAL connector.

E404

Cause:

The “Stop laser” button in the configuration software was selected.

Remedy:

- Solve the safety problem. Then select “Reset” in the error dialog in Laser Marker NAVI smart to finish the laser stop status.
- LP-RH, LP-ZV: When using the touch panel console or monitor:

  Solve the safety problem. Then select “Reset” in the error dialog on the screen to finish the laser stop status.

E405

Cause:

The remote interlock input is open.

Remedy:

- Connect the REMOTE INTERLOCK IN input on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the REMOTE INTERLOCK IN input.
- Check the operation logic of the connected device.
- If you want to deactivate this alarm when the shutter is closed, set “Deactivate while shutter closed” in “System settings” > “Operation/information” > “INTERLOCK alarm detection”.
- Connect the internal or external power supply to IN COM. 1 (X2) and OUT COM.1 (Y2) on the I/O TERMINAL connector.

E410

Cause:

Laser pumping was turned off during the marking process.

Remedy:

- Start the marking process after laser pumping has completed.
- Check the operation logic of laser pumping and trigger input.
- Check the connection of the external devices to the I/O terminals or the communication port.
- Make sure the switch or the sensor connected to TRIGGER IN (X5) of the I/O TERMINAL connector operates without chattering.

E411

Cause:

The marking trigger signal was entered while laser pumping was off.

Remedy:

- Start the marking process after laser pumping has completed.
- Check the operation logic of laser pumping and trigger input.
- Check the connection of the external devices to the I/O terminals or the communication port.
- Make sure the switch or the sensor connected to TRIGGER IN (X5) of the I/O TERMINAL connector operates without chattering.

E450–E453

Cause:

- The date and time of the system clock may not be correct.
- LP-RF, LP-RV: The battery of the system clock in the controller is exhausted.
- An error occurred in the system clock.

Remedy:

- Check the system clock and set it in the “System settings” screen.
- LP-RF, LP-RV: Replace the battery. For details, refer to the “Setup and Maintenance Guide”.
- Before replacing the battery, you can reset this error to set the system clock every time after starting the laser marking system.

E500

Cause:

The marking trigger signal was entered while laser pumping was off.

Remedy:

- Start the marking process after laser pumping has completed.
- Check the operation logic of laser pumping and trigger input.
- Check the connection of the external devices to the I/O terminals or the communication port.
- Make sure the switch or the sensor connected to TRIGGER IN (X5) of the I/O TERMINAL connector operates without chattering.

E501

Cause:

The laser stop input is open.

Remedy:

- Connect the LASER STOP IN inputs on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the LASER STOP IN inputs.
- Check the operation logic of the connected device.
- Connect the internal or external power supply to IN COM. 1 (X2) and OUT COM.1 (Y2) on the I/O TERMINAL connector.

E502

Cause:

The “Stop laser” button in the configuration software was selected.

Remedy:

- Solve the safety problem. Then select “Reset” in the error dialog in Laser Marker NAVI smart to finish the laser stop status.
- LP-RH, LP-ZV: When using the touch panel console or monitor:

  Solve the safety problem. Then select “Reset” in the error dialog on the screen to finish the laser stop status.

E503

Cause:

The remote interlock input is open.

Remedy:

- Connect the REMOTE INTERLOCK IN input on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the REMOTE INTERLOCK IN input.
- Check the operation logic of the connected device.
- If you want to deactivate this alarm when the shutter is closed, set “Deactivate while shutter closed” in “System settings” > “Operation/information” > “INTERLOCK alarm detection”.
- Connect the internal or external power supply to IN COM. 1 (X2) and OUT COM.1 (Y2) on the I/O TERMINAL connector.

E505–E509

Cause:

A safety function (e.g. interlock or laser stop) was activated during marking trigger preparation (data transfer to the laser head).

Remedy:

- Reset the alarm if laser radiation was stopped by a laser stop signal, an interlock signal or the “Stop laser” button in “Laser Marker NAVI smart”.
- Check if the signal lines are affected by noise.

E520–E522

Cause:

The marking file or system data were not saved normally when the laser marking system was turned off. The data of the selected file cannot be read.

Remedy:

- Save the file again in the laser marking system, overwriting the corresponding file number.
- Do not turn off the laser marking system while saving the settings.

E530–E532, E541

Cause:

The marking file or system data were not saved normally when the laser marking system was turned off. The data of the selected file cannot be read.

Remedy:

- Restore the previously saved backup file.
- Do not turn off the laser marking system while saving the settings.

E550–E560

Cause:

A safety function (e.g. interlock or laser stop) was activated during marking trigger preparation (data transfer to the laser head).

Remedy:

- Reset the alarm if laser radiation was stopped by a laser stop signal, an interlock signal or the “Stop laser” button in “Laser Marker NAVI smart”.
- Check if the signal lines are affected by noise.

E570

Cause:

The marking file or system data were not saved normally when the laser marking system was turned off. The data of the selected file cannot be read.

Remedy:

- Save the file again in the laser marking system, overwriting the corresponding file number.
- Do not turn off the laser marking system while saving the settings.

E571

Cause:

The marking file or system data were not saved normally when the laser marking system was turned off. The data of the selected file cannot be read.

Remedy:

- Restore the previously saved backup file.
- Do not turn off the laser marking system while saving the settings.

E572

Cause:

A safety function (e.g. interlock or laser stop) was activated during marking trigger preparation (data transfer to the laser head).

Remedy:

- Reset the alarm if laser radiation was stopped by a laser stop signal, an interlock signal or the “Stop laser” button in “Laser Marker NAVI smart”.
- Check if the signal lines are affected by noise.

Related topics

Warning messages (E600–E799) (page 258)

Reset an alarm message (E001–E599) (page 246)

9.14 Reset a warning message (E600–799)

A warning is output if settings are wrong or if the operating conditions for laser radiation are not met.

While a warning for E600–E699 is displayed, the marking process cannot be started.

There are different methods to reset a warning, depending on the type of error.

If the error persists after restarting the laser marking system, contact our service center or sales offices.

- Remove the cause of the warning or correct the setting.
- Close the shutter or input the alarm reset signal by I/O or **ARS** command.
  The following warnings do not require a reset:
  - E600: This warning occurs if LASER STOP IN and OUT COM. 1 on the TERMINAL connector are not connected. It is automatically cleared when the terminals are connected.
  - E712–E717: The warning is automatically cleared when the cause of the error is eliminated.
  - E750–E783: These warnings are automatically cleared after 3s.
- If a counter is used, check the counter value in the marking file before resuming the marking process.
- Before restarting the marking process, make sure the warning output WARNING OUT (Y14) is ON, and then open the shutter.

Related topics

Warning messages (E600–E799) (page 258)

Alarm messages (E001–E599) (page 247)

Reset an alarm message (E001–E599) (page 246)

9.15 Warning messages (E600–E799)

Error codes in the range from E600 to E799 indicate a warning.

E600

Cause:

The laser stop input is open.

Remedy:

- Connect the LASER STOP IN inputs on the I/O TERMINAL connector.
- Check the status of the safeguards connected to the LASER STOP IN inputs.
- Check the operation logic of the connected device.

E601

Cause:

The specified file contains no marking data.

Remedy:

Add the marking data and overwrite the file.

E603

Cause:

No data is available for laser radiation.

Remedy:

It is not possible to input a marking trigger signal if the marking file does not contain valid marking data. Turn on the marking for at least one marking object and select a laser power correction other than 0%.

E604

Cause:

No data are available for guide laser radiation.

Remedy:

To show masked objects with the guide laser, enable guide laser display in the object settings.

E605, E606

Cause:

- The combination of the version of Laser Marker NAVI smart and the model or version of the laser marking system is not supported.
- The function set with Laser Marker NAVI smart cannot be used with this model of the laser marking system.

Remedy:

Use the right version of Laser Marker NAVI smart with the laser marking system model in use.

E607

Cause:

The sensor signals are invalid. The line speed cannot be detected.

Remedy:

- Make sure the first sensor in moving direction is connected to ENCODER A IN (X13) and the second sensor is connected to ENCODER B IN (X14) of the TERMINAL connector.
- Turn on ENCODER B IN (X14) within 10s from the signal input at ENCODER A IN (X13).
- Input the signal at TRIGGER IN (X5) after turning on ENCODER B IN (X14) within the set timeout period.

E608

Cause:

The counter value may not be updated because the laser marking system was turned off during the marking process.

Remedy:

- Check the current value of the counter.
- Do not turn off the laser marking system during the marking.

E609

Cause:

The marking data could not be saved correctly because the laser marking system was turned off during saving.

Remedy:

- Check the file and the setting values.
- Overwrite the file.
- Do not turn off the laser marking system while saving a file.

E610–E613

Cause:

The marking data are out of range.

Remedy:

- Check the marking image display and adjust position and size of the marking data.
- Adjust the values for “X-axis offset [mm]” and “Y-axis offset [mm]” in “System settings” > “System offset”. The system offset values are not reflected in the marking image editor.
- If you calibrate the marking field in “System settings” > “Marking field calibration”, change the setting values.

E614–E615

Cause:

The z-position of the marking data is outside the marking area.

Remedy:

- Adjust the value for z-movement in the object group settings.
- Adjust the value for z-movement in the file settings.
- Adjust the value for “Z-axis offset [mm]” in “System settings” > “System offset”.
- When you use the autofocus function, check if the detected workpiece displacement value is correct.

Applies to LP-ZV only.

E616

Cause:

The signals from the encoder are invalid. The line speed cannot be detected.

Remedy:

- Check the signal transmission from the encoder to ENCODER A IN (X13) and ENCODER B IN (X14) of the TERMINAL connector.
- If either phase A or B of the encoder is used, connect the encoder to ENCODER A IN (X13) and connect ENCODER B IN (X14) to IN COM. 1 (X2).
- Make sure the encoder frequency does not exceed 100kHz per phase.
- Ensure that you enter the marking trigger signal only if there is an input signal from the encoder.

E617

Cause:

The marking speed cannot follow the line speed.

Remedy:

- Decrease the line speed.
- Specify an upstream position (positive value) for the lasing start boundary.
- Reduce the marking time by increasing the scan speed, reducing the space between characters, reducing the character size, etc.

E618

Cause:

The workpiece spacing is too small.

Remedy:

- For marking at regular intervals, increase the workpiece spacing.
- For multiple trigger mode, increase the time between trigger signals.
- Decrease the line speed.
- Increase the distance from the lasing start boundary to the trigger detecting position.
- For multiple trigger mode, make sure the switch or the sensor connected to TRIGGER IN (X5) of the TERMINAL connector operates without chattering.
- Reduce the marking time by increasing the scan speed, reducing the space between characters, reducing the character size, reducing the ON-time for one-shot outputs, etc.

E619

Cause:

On-the-fly marking is not possible with the set trigger detecting position or lasing start boundary.

Remedy:

- Increase the distance from the lasing start boundary to the trigger detecting position.
- Check the setting of the workpiece reference boundary.

E620–E621

Cause:

The processing in the laser marking system could not be completed. Marking trigger processing terminated abnormally. (Applies to the linking of image processing devices.)

Remedy:

Check the connection of cables and signal lines, and restart the laser marking system.

E622

Cause:

The TIMING IN signal was not input in time. Marking trigger processing terminated abnormally. (Applies to the linking of image processing devices.)

Remedy:

- The signal at the TIMING IN (24) terminal has to be received within 60s after the timing standby output TIMING WAIT OUT (36) is turned ON.
- Check the connection of the TIMING IN (24) terminal on the I/O connector.
- Check the connection with the external device.
- Check the operation logic of the connected device.

E623

Cause:

The TIMING IN (24) signal was input while TIMING WAIT OUT (36) was OFF. (Applies to the linking of image processing devices.)

Remedy:

- The signal at the TIMING IN (24) terminal has to be received within 60s after the timing standby output TIMING WAIT OUT (36) is turned ON.
- Check the connection of the TIMING IN (24) terminal on the I/O connector.
- Check the connection with the external device.
- Check the operation logic of the connected device.

E624

Cause:

A communication error occurred. Marking trigger processing terminated abnormally. (Applies to the linking of image processing devices.)

Remedy:

- Check the Ethernet connection between the laser marking system and the external devices.
- Check the status of the laser marking system and the connected external devices.
- Check the IP address, port number and connecting status of the laser marking system and imagechecker.
- Check if the imagechecker type is set correctly in the “System settings” and in “Marking settings” > “File settings” of Laser Marker NAVI smart.

E625

Cause:

No response is returned from the imagechecker. Marking trigger processing terminated abnormally. (Applies to the linking of image processing devices.)

Remedy:

- Check the connecting status between the laser marking system and the imagechecker.
- Check if the reading process of the imagechecker was successful.
- If you use PV230/PV200, set the total judgement.

E626

Cause:

The settings on the laser marking system and imagechecker do not match. Marking trigger processing terminated abnormally. (Applies to the linking of image processing devices.)

Remedy:

- Check the settings for application, type number, and checker number on the laser marking system and imagechecker.
- Check the Ethernet settings for PV230/PV200 and for the laser marking system. For PV230/PV200, “Protocol” is set to “General Com.” (general communication) in the Ethernet setting table. The general communication protocol is used for the communication with the laser marking system.

E627

Cause:

Code or character checking failed because no bar code, 2D code or character settings are available. (Applies to the linking of image processing devices.)

Remedy:

- Check if the number set for “Object No. to check” in the file settings is the same as the object number you set in the bar code, 2D code or character object settings.
- For code checking, make sure the code type and the settings of the bar code or 2D code object match the code reader configuration.
- For character checking, check if the character type and number of characters in the marking data are supported by the imagechecker.

E628

Cause:

Code reading failed. (Applies to the linking of image processing devices.)

Remedy:

- Check the status of the external devices.
- Improve the marking quality of the code.
- For file switching or character transmission by code reader, check the following:
  - Make sure there are no invalid characters in the code data.
  - If the data extraction function is used, make sure the set number of characters to be extracted is available in the bar code data.
  - If the data extraction function is not used, a maximum of 299 characters can be transmitted.

E629

Cause:

File switching by code reader failed. (Applies to the linking of image processing devices.)

Remedy:

- Make sure the file name in the code data exactly matches the name of the marking file in the laser marking system.
- To switch the marking file by number, always specify a 4-digit value in the code data.
- If the specified marking file does not contain any marking data, make the desired settings and overwrite the file in the laser marking system.

E630

Cause:

TRIGGER IN (X5) turned off before the minimum number of scans was reached.

Remedy:

- Check the on/off control of the TRIGGER IN (X5) terminal on the TERMINAL connector.
- If the TRIGGER IN (X5) terminal turns on and off properly, change the number of minimum scans in the file settings.

E631

Cause:

The lasing process stopped because the maximum number of scans was reached.

Remedy:

- Check the on/off control of the TRIGGER IN terminal on the TERMINAL connector.
- If TRIGGER IN turns on and off properly, change the number of maximum scans in the file settings.

E650

Cause:

The marking data are out of range.

Remedy:

- Check the marking image display and adjust position and size of the marking data.
- Adjust the values for “X-axis offset [mm]” and “Y-axis offset [mm]” in “System settings” > “System offset”. The system offset values are not reflected in the marking image editor.
- If you calibrate the marking field in “System settings” > “Marking field calibration”, change the setting values.

E651

Cause:

The z-position of the marking data is outside the marking area.

Remedy:

- Adjust the value for z-movement in the object group settings.
- Adjust the value for z-movement in the file settings.
- Adjust the value for “Z-axis offset [mm]” in “System settings” > “System offset”.
- When you use the autofocus function, check if the detected workpiece displacement value is correct.

Applies to LP-ZV only.

E652

Cause:

The font file cannot be read.

Remedy:

- Add the font file again in the “Data management” screen.
- Check the font file format.

E653

Cause:

The graphic file cannot be read.

Remedy:

- Add the graphic file again in the “Data management” screen.
- Check the graphic file format.

E654

Cause:

No font file is available at the specified font number.

Remedy:

- Add the font file in the “Data management” screen.
- Specify the correct font number in the character settings.

E655

Cause:

The font file exceeds the memory capacity for font files of the laser marking system.

Remedy:

- Reduce the number of characters in the font file.
- Delete unnecessary font files.

E656

Cause:

The specified graphic file is not available.

Remedy:

- Add the graphic file in the “Data management” screen.
- If you prefer to ignore this warning, when using communication commands to create a marking file without a graphic file (0 byte is specified for graphic file name), deselect the check box “Warning if no graphic file is specified” in “System settings” > “Operation/information” > “Advanced system settings”.

E657

Cause:

The selected font is not available for the specified characters.

Remedy:

- Change the characters, or add the required font file.
- To use Japanese or Simplified Chinese characters, set East Asian characters in the file settings.

E658

Cause:

The marking object contains too many characters.

Remedy:

- Reduce the number of characters.
- Distribute the characters over several objects.

E659

Cause:

The selected font does not support bold marking.

Remedy:

- The ORG4 font cannot be used for bold marking.
- Use the Font Maker software to create the required font.

E660

Cause:

Bold marking is not possible due to the set combination of bold line width, character height and character width.

Remedy:

- Set the line width of the bold character to a half or below of the character height and width.
- When marking a bold character, the ratio between character height and width should be 1/10 to 10.

E661

Cause:

The marking data exceed the memory capacity of the marking file.

Remedy:

- Reduce the number of characters and segments in the graphic data.
- Reduce the number of characters and start/end points of the graphic data.
- Reduce the number of step & repeat markings.
- Split long segments into shorter segments.

E662

Cause:

The number of step & repeat markings exceeds the limit.

Remedy:

- Reduce the number of steps in your step & repeat object (max. 10000).

E664

Cause:

Two or more external input functions which may not be combined are set in one file. The following combinations are not allowed:

- Character entry by **SIN** command/Register function (registered characters switching via I/O connector)
- Character entry by **SIN** command/Marking offset via I/O signal
- Register function (registered characters switching via I/O connector)/Marking offset by **SEO** command
- Linking of image processing devices/Trigger mode “Continuous trigger”
- Linking of image processing devices/TARGET DETECTION IN (X7) input of TERMINAL connector
- LP-ZV:

  Autofocus function/Trigger mode “Continuous trigger”
- LP-ZV:

  3D marking/Marking offset via I/O signal
- LP-ZV:

  Bar code or 2D code objects/3D marking of the shapes “Vertical cone” or “Sphere”
- LP-ZV:

  Bar code or 2D code objects/3D marking of the shapes “Cylinder” or “Horizontal cone” with “Data mapping” set to “Projection”

Remedy:

Delete any one of these functions from the file.

E665

Cause:

The marking data include characters that cannot be converted into 2D code.

Remedy:

- Use characters which can be converted into 2D code.
- For QR Code, change the mode setting. For Data Matrix, change the character type setting. For PDF417, change the compaction mode setting.

E666

Cause:

- The 2D code cannot be generated with the specified settings.
- The number of characters exceeds the upper limit of the selected 2D code.

Remedy:

Check the code settings and the number of characters.

E667

Cause:

The filling pattern specified for the 2D code is not available in the 2D code font (font number: 2D).

Remedy:

- Change the filling pattern.
- Add the required font data in the “Data management” screen.

E668

Cause:

The marking data include characters that cannot be converted into bar code.

Remedy:

Use characters which can be converted into bar code.

E669

Cause:

- The bar code cannot be generated with the current settings.
- The number of characters exceeds the upper limit of the selected bar code.

Remedy:

Check the code settings and the number of characters.

E670

Cause:

The set narrow element or module width for bar codes is too small.

Remedy:

Specify a value which is larger than the value set for the calculation value of the line width in the object group settings.

E671

Cause:

Bar code inversion was selected, but inversion of the quiet zone is incorrect.

Remedy:

Correct the value for “Quiet/narrow ratio”.

E672

Cause:

The settings for “Separator height to module width ratio” or “Lower bar code height to module width ratio” are too small.

Remedy:

- Specify a value which is larger than the value set for the calculation value of the line width in the object group settings.
- If you want to remove the separator, set 0 for “Separator height to module width ratio”.

E673

Cause:

The bar code cannot be generated due to an invalid number of characters for EAN/UPC/JAN or GS1 DataBar code.

Remedy:

Enter the prescribed number of characters for the selected code.

E674

Cause:

A string containing “%” is not properly set.

Remedy:

- If functional characters such as a counter or date/time are input, delete and re-enter the characters after “%”.
- To mark the character “%”, enter “%%”.
- To mark the character “+” or "/" after a counter, enter “%+” or “%/”.

E678

Cause:

The character number specified by the **SIN** command has not been set in Laser Marker NAVI smart.

Remedy:

Specify the same character number in Laser Marker NAVI smart and in the **SIN** command.

E680

Cause:

The following functions are not available in RUN mode:

“Functional characters” > “External control” > “Registered characters (via I/O connector)”

“Functional characters” > “External control” > “Characters specified by SIN command”

“Function settings” > “External offset” (Marking offset via I/O signal or by **SEO** command)

“Function settings” > “Counter” > “Reset at date change”

Remedy:

- To execute the marking in RUN mode, delete these functions from the marking data.
- The laser marking system must be in remote mode to use these functions.

E682

Cause:

The following functions are not available with on-the-fly marking:

“File settings” > “Image checking before marking”, “Image checking after marking”

“Object group” > “Overwriting interval [s]”

2D code: “Object settings” > “Module marking order” > “Skip one”, “Skip two” (LP-ZV: If “LP-M/S/Z compatible” is set in the “System settings” screen: “File settings” > “ 2D code skip marking”)

LP-ZV: “Object group” > “Defocusing [mm]”

For marking at regular intervals and multiple trigger mode, the following functions are also not available:

“Functional characters” > “External control” > “Registered characters (via I/O connector)”

“Functional characters” > “External control” > “Characters specified by SIN command”

“Function settings” > “External offset” (Marking offset via I/O signal or by **SEO** command)

“Function settings” > “Counter” > “Reset at date change”

LP-ZV: “File settings” > “Autofocus” > “ON”

Remedy:

- To perform on-the-fly marking, delete these functions from the marking data.
- Some functions are available with on-the-fly marking in single trigger mode.

E686

Cause:

The following functions are not available when “Seamless loop” is selected in the laser settings:

Multiple objects

Objects consisting of unclosed lines

Point radiation

“Step & repeat” function

Remedy:

- Deactivate “Seamless loop” in the laser settings.
- If you want to radiate the laser continuously without break, create a closed line by setting the start and end points to the same position.

E687

Cause:

- The width or height of the graphic exceeds 999.999mm.
- The graphic parameters are not set because “Adjustment of size and filling” in the graphic object settings is set to “OFF” and “Graphic presets” for the selected DXF file is set to “OFF (recommended)”.

Remedy:

- Reduce the graphic size.
- If “Graphic presets” is set to “OFF (recommended)”, set “ON” for “Adjustment of size and filling” in the graphic object settings and specify the graphic parameters.

E688

Cause:

The workpiece displacement exceeds the permissible range.

Remedy:

- Check if the workpiece is in the proper position when displacement is measured.
- Specify limit values with “Upper limit of work displacement [mm]” and “Lower limit of work displacement [mm]” in “File settings” to avoid this error.
- When you use the autofocus function: Check if the sensor's detection area and the marking surface are identical.

Applies to LP-ZV only.

E689

Cause:

Unable to detect the workpiece displacement.

Remedy:

When you use the autofocus function:

- Check if the displacement sensor can detect the height without problem.
- Check if the displacement sensor operates without error.
- Check if the trigger of the displacement sensor is input when the workpiece is in the correct position.

Applies to LP-ZV only.

E690

Cause:

The marking data is at an invalid position.

Remedy:

Check the 3D settings and move the marking data on the 3D model to the position where the marking can be performed.

Applies to LP-ZV only.

E691

Cause:

The 3D model contains an invalid setting.

Remedy:

- Assign all object groups in the marking file to the 3D model.
- If the shape of the 3D model is a vertical cone, check if the values of “Top diameter [mm]” and “Bottom diameter [mm]” are set correctly.

Applies to LP-ZV only.

E692

Cause:

There are marking data outside of the marking field.

Remedy:

- LP-ZV: When you use the 3D marking, check the 3D settings.
- Adjust the position (LP-ZV: X/Y/Z, LP-RH: X/Y) and size of the marking data located outside of the marking field.
- LP-ZV: When you use the autofocus function, check the workpiece displacement value.
- When you use external input functions to specify the marking position or marking data, e.g. external offset function including **SEO** command or character entry by **SIN** command, make sure that the marking data are in the marking field.

Applies to LP-RH, LP-ZV only.

E699

Cause:

Some settings are incorrect.

Remedy:

- Save the file again in the laser marking system, overwriting the corresponding file number.
- If the problem persists, save a backup file and contact our service center or sales offices.

E712

Cause:

The power supply voltage exceeds the permissible range.

Remedy:

Check the power supply voltage and correct it.

Applies to LP-RH, LP-ZV only.

E716–E717

Cause:

The rotation speed of the controller fan is decreasing.

Remedy:

- Clean the cooling air inlet and outlet, and the fan located at the cooling air area of the controller.
- If the air filter is contaminated, replace it.
- If the fan is not working correctly, replace it.

Applies to LP-RH, LP-ZV only.

E720

Cause:

The counter value may not be updated because the laser marking system was turned off during the marking process.

Remedy:

- Check the current value of the counter.
- Do not turn off the laser marking system during the marking.

E721

Cause:

The marking data could not be saved correctly because the laser marking system was turned off during saving.

Remedy:

- Check the file and the setting values.
- Overwrite the file.
- Do not turn off the laser marking system while saving a file.

E726–E729

Cause:

The rotation speed of the head fan is decreasing.

Remedy:

- Clean the cooling air inlet and outlet located at the cooling air area of the laser head.
- If the air filter is contaminated, replace it.

Applies to LP-RH only.

E750

Cause:

The trigger signal is invalid. The trigger signal was input during trigger processing.

Remedy:

- To input a trigger signal, the marking trigger ready output READY OUT (Y5) must be ON.
- Do not input the trigger signal while the trigger processing output PROCESSING OUT (Y10) is ON.
- Make sure the switch or the sensor connected to TRIGGER IN (X5) of the I/O TERMINAL connector operates without chattering.
- Check the connection of the external devices to the I/O terminals or the communication port.

E751

Cause:

The trigger signal is invalid. The marking trigger input is ON while the marking trigger ready output is OFF.

Remedy:

- To input a trigger signal, the marking trigger ready output READY OUT (Y5) must be ON.
- Do not input the trigger signal while the trigger processing output PROCESSING OUT (Y10) is ON.
- Make sure the switch or the sensor connected to TRIGGER IN (X5) of the I/O TERMINAL connector operates without chattering.
- Check the connection of the external devices to the I/O terminals or the communication port.

E752

Cause:

TARGET DETECTION IN (X7) did not turn on during the lasing process.

Remedy:

- Check the marking results before and after the error occurs.
- Check the connection and control of the workpiece detection sensor.
- Check the installation position of the sensor and make sure it is ON for more than 1ms during the lasing process.
- When you do not use this function, disable TARGET DETECTION IN (X7) in the “System settings”.

E760

Cause:

- The setting of a number input of the I/O connector failed.
- The set input turned ON more than once before the setting completion output turned ON.

Remedy:

- Keep the set input SET IN (2) ON until the setting completion output SET OK OUT (28) turns ON.
- To set the number input again, close the shutter and reset the previous data.
- Check the connections to external devices for faulty or loose contacts.
- Check the operation logic of the connected device.

E770

Cause:

Unable to communicate with Laser Marker NAVI smart because there is no connection between the laser marking system and the PC.

Remedy:

- Check the status of the Ethernet or USB connection.
- Save the files onto your local PC folder, and overwrite and save them on the laser marking system after the online connection was established.

E775

Cause:

Unable to transmit the response data of the Marking end verification (**MST**) command.

Remedy:

- When the marking interval is too short for the transmission of the **MST** command, the command cannot be used. In this case, confirm the completion of the marking process by I/O signals.
- Check the operation logic of the external control.

E780

Cause:

The unit serial numbers are mismatched.

Remedy:

- LP-RH: It is recommended to use a laser head and a controller with the same serial number.
- LP-RF, LP-RV, LP-ZV: Connect a laser head, controller and oscillator unit with the same serial number. If the serial numbers of the units do not match, the laser marking system may not maintain performance during marking.

E781

Cause:

- The laser head and the controller do not match.
- The signal cable or unit power cable is not connected correctly.

Remedy:

- We recommend that you connect a laser head and a controller with the correct combination of models. If the models of the units differ, the laser head model applies.

  LP-ZV: Be sure to connect a laser head, controller, and oscillator unit with the correct combination of models. If the models of the units do not match, the laser marking system may not maintain marking performance.
- Check the connection of cables and signal lines, and restart the laser marking system.

E782

Cause:

The GSD file version is incorrect.

Remedy:

To use PROFINET, download the GSD file (XML file) that corresponds to the controller version of your laser marking system and the network unit LP-ANW11, and then apply it to the products. If the GSD file version is wrong, settings from the PLC cannot be imported correctly by the laser marking system.

E783

Cause:

The version of the optional expansion board is incorrect.

Remedy:

Update the firmware of your laser marking system. Download the software package Laser Marker Firmware Updater from the following Web site:

https://industry.panasonic.com/global/en/downloads/?tab=software

To find the appropriate software, go to “Download” > “Software” and enter the series name of your laser marking system (e.g. LP-ZV) in the “Part No.” field.

Applies to LP-RH, LP-ZV only.

Related topics

Alarm messages (E001–E599) (page 247)

Reset a warning message (E600–799) (page 257)

10 Record of changes

EN-EU-LPRV-SM-7, 2025.04

European edition based on ME-LPRV-SM-7 2024.9

- Updated the sections "General safety precautions", "General property damage messages", "Applicable standards", "Optional items", "Product package", "Cables", "Oscillator unit installation", "Controller installation", "Establish an Ethernet connection between PC and laser marking system", "Start the PC configuration software", "Holding of date and time", "Inspect the laser power", "Troubleshooting"
- Added sections "About this manual", "Tips for achieving consistent marking quality"
- Updated the supported operating system in section "Specifications"
- Updated the drawings in sections "Installation space", "On-the-fly marking: 2 sensors input", "Interlock terminals", "Connect a LAN cable with ferrite core", "Find the serial number"
- Inserted flow charts for offline editing, online editing and marking, position correction and code checking, file switching, data modification
- Summarized the sections on screen types in one topic
- Updated descriptions of the TIME HOLD IN (22) and DATE GAP OUT (29) inputs of the I/O connector
- Optimized the layout of tables throughout the manual
- Improved the overall manual structure by rearranging topics

EN-EU-LPRV-SM-4, 2021.08

First European edition (based on ME-LPRV-SM-4 2021.6)

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