Panasonic®

Laser Marking System

Setup and Maintenance Guide

LP-ZV series

EN-EU-LPZV-SM-6

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.

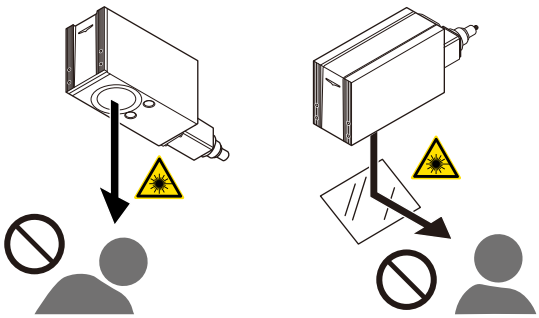
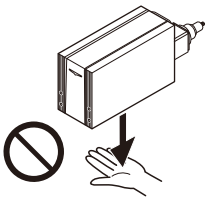


Indicates an operating procedure which must be performed carefully.

General safety precautions

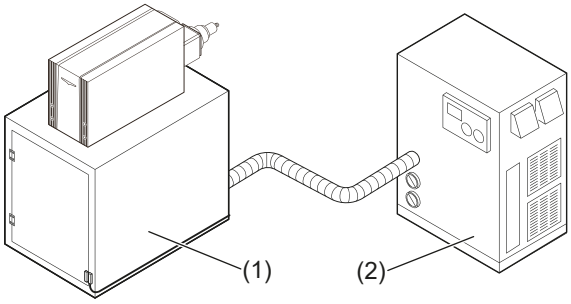
Always follow these important safety precautions!

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

When using the touch panel console, take the following safety precautions.

⚠ WARNING	
🚫	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.

⚠ CAUTION	
🚫	Do not disassemble or modify the product. This could result in excessive heat or smoke.
🚫	Since the touchscreen is made of glass, be careful not to hit it with a hard object or apply excessive force. Do not drop the product from a high place as the glass may break and cause injury.
🚫	Do not press more than one point on the touchscreen at a time. Pressing two or more points may activate an unintended point located in the middle of the input points. This may damage the facility or cause an accident.

General property damage messages

Operating environment

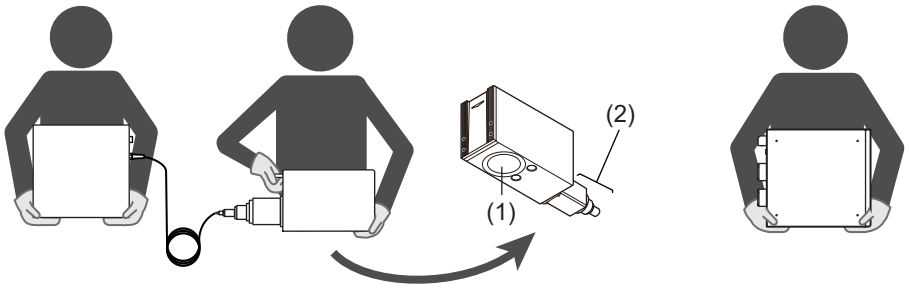
- Do not use the product in a place with frequent vibrations or shocks. Moreover, please do not drop this product. It may affect the precision and optical components inside, which could influence the performance or result in a failure.
- Do not use the system outdoors.
- This product uses an air cooling 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. 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.
- Do not apply excessive force to the laser head, oscillator unit, or the front panel of the controller. When carrying it, avoid holding the front panel, as it may come off.

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



(1) Laser emission port
(2) 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.) and the protective conductor terminal 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 during system startup (MAIN LED flashes).
- 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)

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 251).

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 49)
Assembling and installation	Precautions for product installation and wiring	Installation (page 49) External control via I/O signals (page 122)

Life cycle stage	Description	Relevant chapters
Setup and operation	Covers startup, shutdown, operation modes, and external device control	This document: Operation methods (page 93) External control via I/O signals (page 122) External control via communication commands (page 179) 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 225)
Troubleshooting	Remedies for startup or operation problems	Troubleshooting (page 254)
Disposal	Precautions for product disposal	Disposal of the laser marking system (page 251)

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-ZV200P	LP-ZV series
LP-ZV205P	
LP-ZV206P	
LP-ZV500P	
LP-ZV505P	
LP-ZV506P	

Available documentation

The following documents are included in the ZIP file “laser_marker_smart_utility_v3.zip” which you can download from the Web site.

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.

“Serial Communication Command Guide: LP-M/S/Z compatible mode” (LP-ZV)

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

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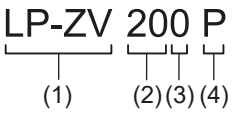
1 Product overview

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-ZV series have the following models.

Model	Marking field	Output class	Oscillation method
LP-ZV200P	125mm × 125mm	20W	Pulsed
LP-ZV205P	220mm × 220mm		
LP-ZV206P	220mm × 220mm		
LP-ZV500P	125mm × 125mm	52W	
LP-ZV505P	220mm × 220mm		
LP-ZV506P	220mm × 220mm		



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

(2) Output class
20: 20W
50: 52W

(3) Marking field
0: 125mm × 125mm
5: 220mm × 220mm
6: 330mm × 330mm

(4) Laser operation mode
P: Pulsed

Related topics

Specifications (page 31)

1.2 Product identification

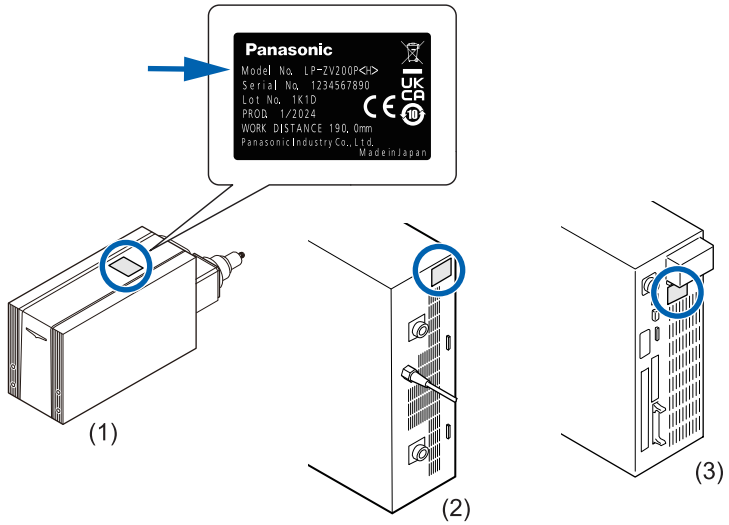
To identify the laser marking system, the model numbers listed in the table below are indicated on the certification and identification labels.

Model	Model No. on laser head	Model No. on oscillator unit	Model No. on controller
LP-ZV200P	LP-ZV200P<H>	LP-ZV20XP<L>	LP-ZV20XP<C>
LP-ZV205P	LP-ZV205P<H>		
LP-ZV206P	LP-ZV206P<H>		
LP-ZV500P	LP-ZV500P<H>	LP-ZV50XP<L>	LP-ZV50XP<C>
LP-ZV505P	LP-ZV505P<H>		
LP-ZV506P	LP-ZV506P<H>		

The labels include the following information:

- Model number
- Serial number
- Lot number
- Production date (month/year)
- Work distance

The location of the labels is shown below.

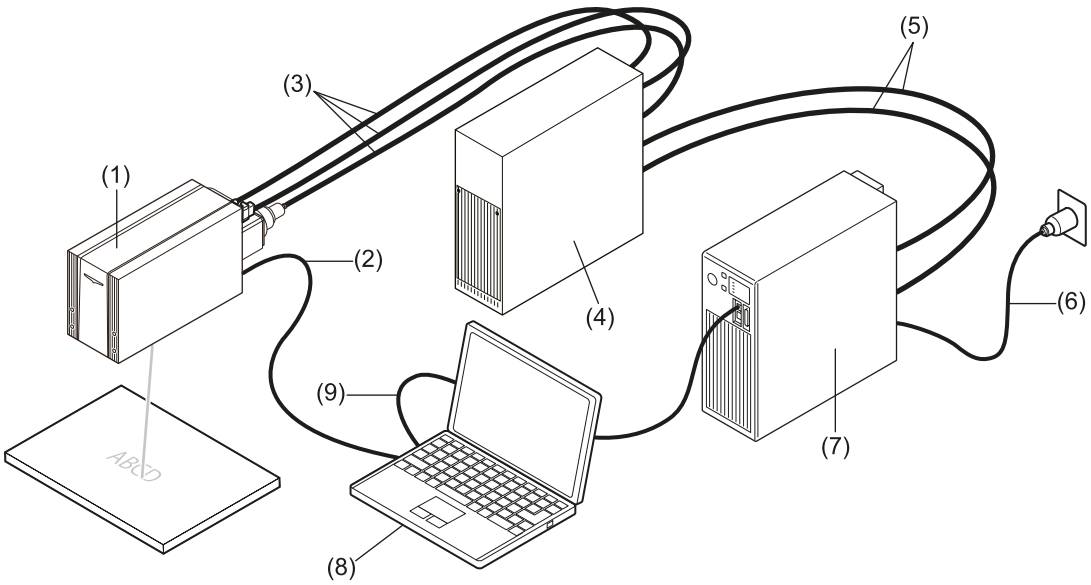


(1) Laser head
(2) Oscillator unit
(3) Controller

1.3 Product configuration

1.3.1 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) USB cable for camera connection
Connect the USB cable to the laser head and to a PC when using the internal camera.

(3) 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.

(4) Oscillator unit
The oscillator unit generates the laser beam.

(5) Unit power cable and signal cable
These cables connect the oscillator unit and the controller.

(6) 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.

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

(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).
Download the configuration software Laser Marker NAVI smart from our Web site. For details, refer to Download Laser Marker Smart Utility (page 30).

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

1.3.2 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, 125V, PSE certified (Japan)	LP-ACA10
AC power cable, 250V, PSE certified (Japan)	LP-ACA11
Protection glass of the laser emission port	LP-ACV80
Air filter, nonwoven fabric (2 pieces for controller and oscillator unit)	LP-AFT90
Air filter, urethane (2 pieces for controller and oscillator unit)	LP-AFT92
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-ACC11
INTERLOCK contactor	LP-AEC10
Network unit for EtherNet/IP	LP-ANW10
Network unit for PROFINET	LP-ANW11

Optional item	Product no.
Touch panel console	LP-ADP50
Expansion board (needed for touch panel console or monitor and displacement sensor)	LP-AEB10

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.

1.3.3 Product package

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

This product is packaged in a box that contains the laser head and the oscillator unit and in a separate box that contains the controller.

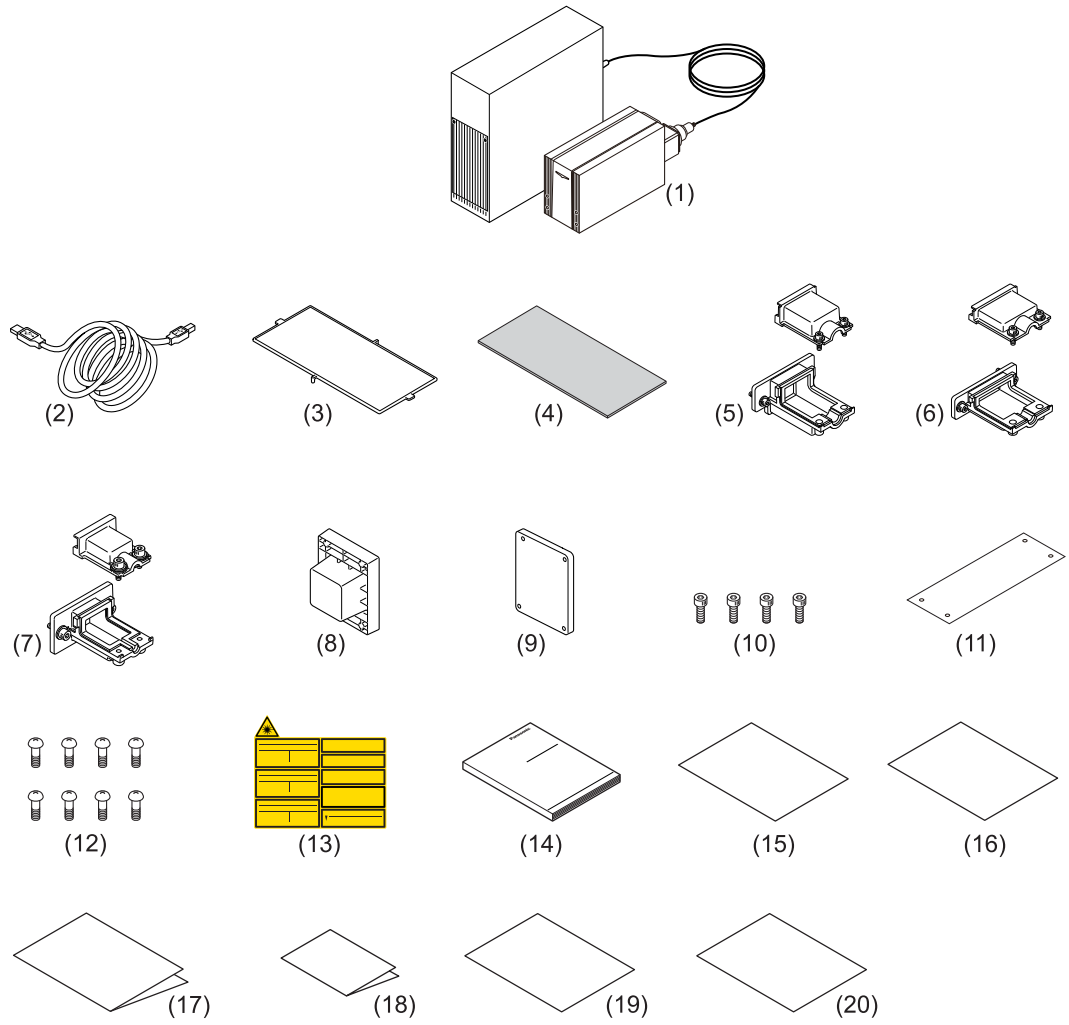
If any item is missing in the package, contact our service center or one of our sales offices.

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.

Laser head and oscillator unit

The packing list includes the following items:



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

(2) 1 × USB cable (4.5m) for camera connection

(3) 2 × Air filter, nonwoven fabric (for oscillator unit and controller), installed at delivery

(4) 2 × Air filter, urethane (for oscillator unit and controller)

(5) 1 × Connector cover (for unit power cable)

(6) 1 × Connector cover (for signal cable)

(7) 1 × Connector cover (for USB cable)

(8) 1 × Fiber unit protection cap

(9) 1 × Scanner cover

(10) 4 × M5 screw (for scanner cover)

(11) 2 × Metal mounting plate

(12) 8 × M5 screw (for metal mounting plate)

(13) 1 × Warning label/Explanatory label/Aperture label

(14) 1 × “Laser Safety Guide”

(15) 1 × “Cautions for Handling”

(16) 1 × “Download information for software and manuals”

(17) 1 × Packing list

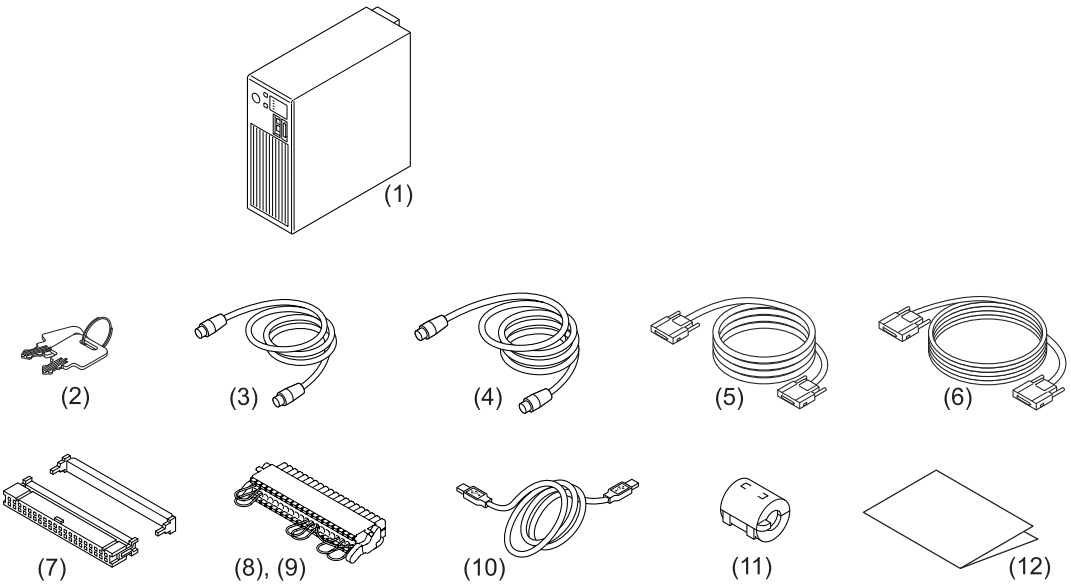
(18) 1 × “General safety and compliance information”

(19) 1 × Copy of the EU “Declaration of incorporation of partly completed machinery”

(20) 1 × Copy of the UK “Declaration of incorporation of partly completed machinery”

Controller

The packing list includes the following items:



(1) 1 × Controller

(2) 2 × System key

(3) 1 × Unit power cable (2m)

(4) 1 × Unit power cable (5m)

(5) 1 × Signal cable (2m)

(6) 1 × Signal cable (5m)

(7) 1 × I/O connector

(8) 1 × I/O terminal block

(9) 7 × Jumper wire

(10) 1 × USB cable (2m)

(11) 3 × Ferrite core for LAN cable, I/O lines to I/O TERMINAL connector and I/O connector

(12) 1 × Packing list

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.

To configure the laser marking system, download the required software and PDF manuals from our Web site.

Related topics

Cables (page 37)

Download Laser Marker Smart Utility (page 30)

1.3.4 Download Laser Marker Smart Utility

Download the software package Laser Marker Smart Utility 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.

The ZIP file contains the Laser Marker NAVI smart software, additional software tools and user manuals in several languages.

- PC software tools

  Laser Marker NAVI smart: 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).

  Logo Data Editing: With this software, you can create and edit graphic data (.vec) for the marking process.

  Font Maker: This exclusive software creates and edits the font data (.fon) used for the marking process.

- PDF manuals

  Language versions not included in the ZIP file 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”
  “Serial Communication Command Guide: LP-M/S/Z compatible mode”
  “Laser Marker NAVI smart Operation Manual”
  “Logo Data Editing Software Operation Manual”

“Font Maker Operation Manual”

Note

ExportVEC, a plug-in software for Adobe Illustrator, is not included in the ZIP file.
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-ZV) in the “Part No.” field.

1.4 Specifications

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

Optical specifications	**LP-ZV200P, LP-ZV500P**	**LP-ZV205P, LP-ZV505P**	**LP-ZV206P, LP-ZV506P**
Scanning system	Galvano scanner		
Marking field (X, Y)	125mm (±0.5mm) × 125mm (±0.5mm)	220mm (±0.5mm) × 220mm (±0.5mm)	330mm (±0.5mm) × 330mm (±0.5mm)
Work distance (base position ± variable length)	190mm ±25mm (±0.5mm)	220mm ±25mm (±0.5mm)	330mm ±25mm (±0.5mm)
Scan speed[1) 2)]	Max. 12000mm/s	Max. 12000mm/s	Max. 8000mm/s
Line speed[1)]	Max. 170m/min	Max. 170m/min	Max. 120m/min
Character height/width[1)]	0.100mm to 125.000mm	0.100mm to 220.000mm	0.100mm to 330.000mm

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	**LP-ZV200P, LP-ZV205P, LP-ZV206P**	**LP-ZV500P, LP-ZV505P, LP-ZV506P**
Laser type	Yb: fiber laser, λ=1064nm, laser class 4	
Output class	20W	52W
Average output at processing point	17W (±5%)[1)]	42W (±5%)[2)]
Oscillation method	Pulsed	

Laser specifications	LP-ZV200P, LP-ZV205P, LP-ZV206P	LP-ZV500P, LP-ZV505P, LP-ZV506P
Pulse duration	1ns, 4ns, 8ns, 16ns, 30ns, 50ns, 120ns, 200ns (switchable)	150ns
Pulse cycle[3)]	0.5µs to 500µs	2µs to 20µs
Guide laser and pointer	Red semiconductor laser, λ=655nm, laser class 2, max. output: 1mW	
Beam stop	Laser head equipped with 1 shutter	

1) Average output at the time of delivery with a laser power setting of 100, a pulse duration of 8ns, and a pulse cycle of 3.3µs.

2) Average output at the time of delivery with a laser power setting of 100 and a pulse cycle of 20µs.

3) 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	LP-ZV200P, LP-ZV205P, LP-ZV206P	LP-ZV500P, LP-ZV505P, LP-ZV506P
Workpiece shape	Plane, step, cylinder, cone, sphere	
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	I/O TERMINAL connector (40 pins), I/O connector (40 pins), displacement sensor connector (available if the expansion board is installed in the controller)	
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 The software is available for download from our Web site.	
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 to 2s	

Other specifications	LP-ZV200P, LP-ZV205P, LP-ZV206P	LP-ZV500P, LP-ZV505P, LP-ZV506P
Operating voltage	90V AC to 132V AC or 180V AC to 264V AC (including a fluctuation range of ±10%)	
Frequency	50/60Hz (switches automatically)	
Power consumption (Current consumption)	At 100V AC: ≤320VA (≤3.6A) At 200V AC: ≤360VA (≤2.0A)	At 100V AC: ≤510VA (≤5.7A) At 200V AC: ≤520VA (≤2.9A)
	The typical inrush current at system start-up is 85A (100V AC) or 170A (200V AC) for max. 10ms.	
Grounding method	Direct earth (laser head, oscillator unit, controller)	
Overvoltage category	II	
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	Length: 5.0m (±0.2m) Minimum bend radius: 80mm
Installation direction	Laser head: in all directions, oscillator unit and controller: vertically or horizontally	
Weight	Laser head: approx. 11kg, oscillator unit: approx. 12kg, controller: approx. 12kg	
Battery (mounted in product)	1 Manganese dioxide lithium primary battery, product no. AFP8801 (BR-2/3A), weight: approx. 13g (weight of battery built into AFP8801)	

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, ITF, NW-7, EAN/UPC, GS1 DataBar (GS1 DataBar Limited, GS1 DataBar Stacked, GS1 DataBar Expanded, etc.), GS1 composite code (GS1 DataBar Limited CC-A, GS1 DataBar Stacked CC-A, GS1-128 CC-A, etc.)
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	LP-ZV200P, LP-ZV205P, LP-ZV206P	LP-ZV500P, LP-ZV505P, LP-ZV506P
Operating temperature[1)]	Laser head, oscillator unit: 0°C to +36°C (laser power ≥46), 0°C to +40°C (laser power <46)[2)]	Laser head, oscillator unit: 0°C to +40°C
	Controller: 0°C to +40°C	
Operating humidity[1)]	35% to 85% RH	

Operating environment	LP-ZV200P, LP-ZV205P, LP-ZV206P	LP-ZV500P, LP-ZV505P, LP-ZV506P
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	

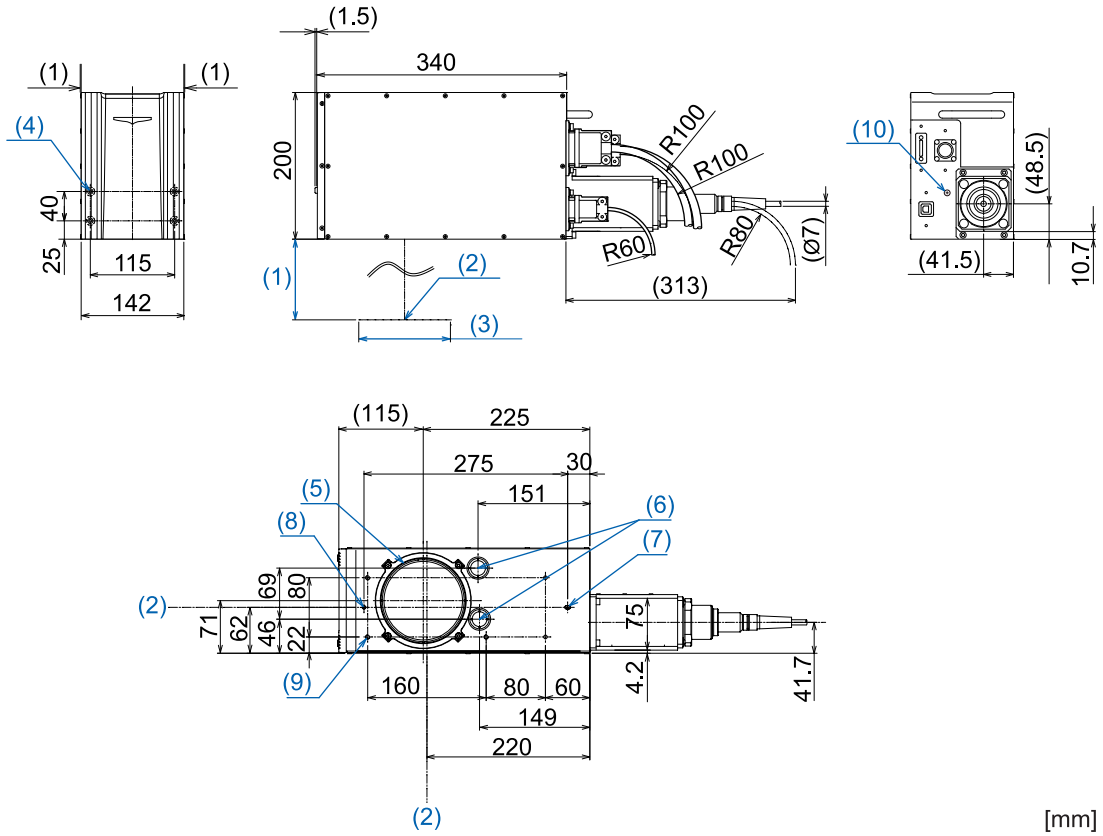
1) No condensation or freezing: If there is a difference between storage temperature and operating temperature, make sure to have the product get used to the operating temperature gradually prior to use to prevent dew condensation.

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

1.5 Dimensions

1.5.1 Laser head

Refer to the technical drawing and legend for dimensions.



[mm]

(1) Work distance (base position ± variable length):
LP-ZV200P, LP-ZV500P: 190mm±25mm
LP-ZV205P, LP-ZV505P: 220mm±25mm
LP-ZV206P, LP-ZV506P: 330mm±25mm

(2) Center of the marking field

(3) Marking field (X/Y):
LP-ZV200P, LP-ZV500P: 125mm × 125mm
LP-ZV205P, LP-ZV505P: 220mm × 220mm
LP-ZV206P, LP-ZV506P: 330mm × 330mm

(4) Fixing screw hole for an external device (4 holes): M5 screw, depth 9mm, load capacity 1000N

(5) Laser emission port: Ø115mm (Projecting part: Ø106mm)

(6) LED lights for camera (2 holes): Ø26mm

(7) Positioning pin hole: elongated hole Ø4mm +0.05mm/-0mm × 7, depth 7mm

(8) Positioning pin hole: Ø4mm +0.012mm/-0mm, depth 7mm

(9) Fixing screw hole (5 holes): M6 screw, depth 6mm

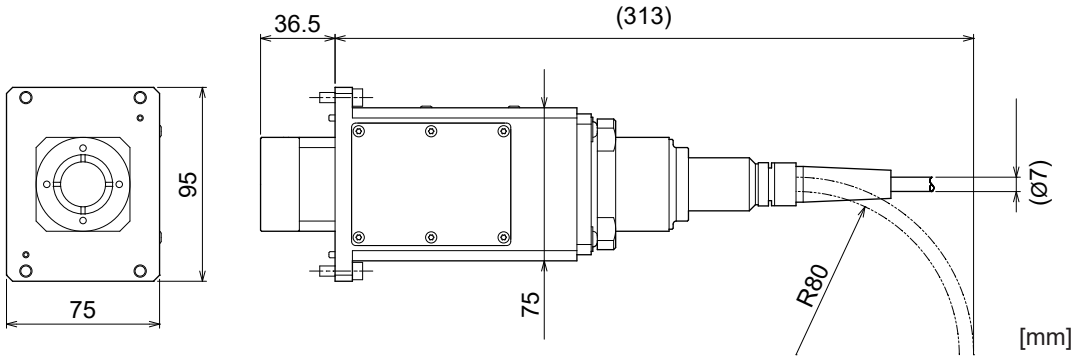
(10) Frame ground terminal: M4 screw, screw hole depth 5mm

Related topics

Laser head installation method (page 54)

1.5.2 Fiber unit

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

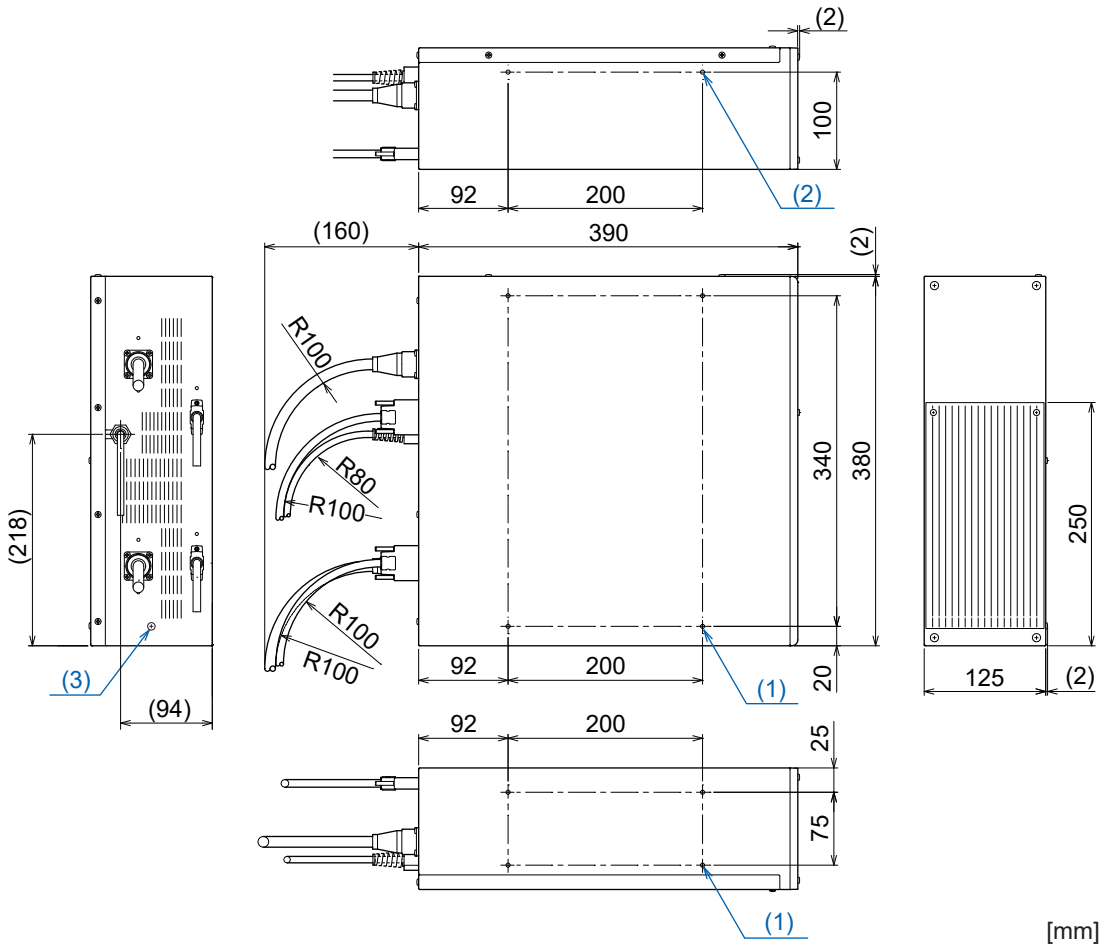


Related topics

Detachment of the fiber unit (page 60)

1.5.3 Oscillator unit

Refer to the technical drawing and legend for dimensions.



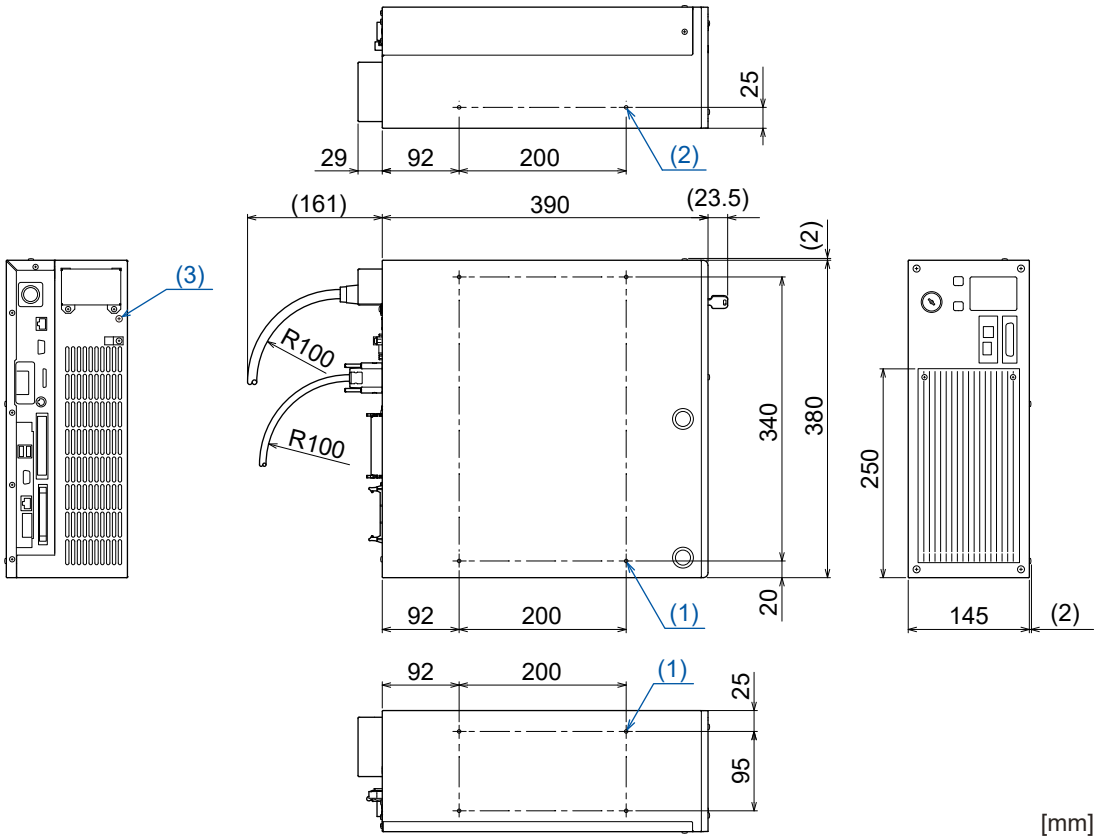
(1) Fixing screw hole (4 holes each on the bottom and left side viewed from front): M5 screw, depth 6mm

(2) Fixing screw hole for metal mounting plate (2 holes): M5 screw, depth 6mm

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

1.5.4 Controller

Refer to the technical drawing and legend for dimensions.



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

(2) Fixing screw hole for metal mounting plate (2 holes): M5 screw, depth 6mm

(3) Protective conductor terminal: M4 screw, screw hole depth 5mm

1.5.5 Cables

Refer to the technical drawing and legend for dimensions.

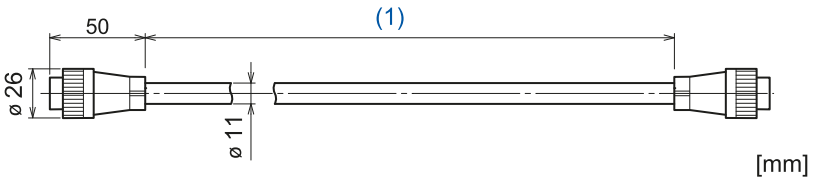
Two signal cables (2m and 5m) and two unit power cables (2m and 5m) are included in the product package.

LP-ZV200P, LP-ZV205P, LP-ZV206P: The length of the fiber cable is 2m. Use the 2m cables to connect the laser head to the oscillator unit and the 5m cables to connect the oscillator unit to the controller.

LP-ZV500P, LP-ZV505P, LP-ZV506P: The length of the fiber cable is 5m. Select the appropriate cables based on the installation situation. Additional 5m cables can be purchased from our sales offices.

Unit power cable

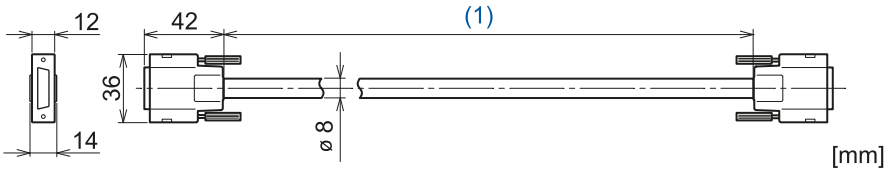
Minimum bend radius: 100mm



(1) 2m length type: 2000 +200/-0
5m length type: 5000 +200/-0

Signal cable

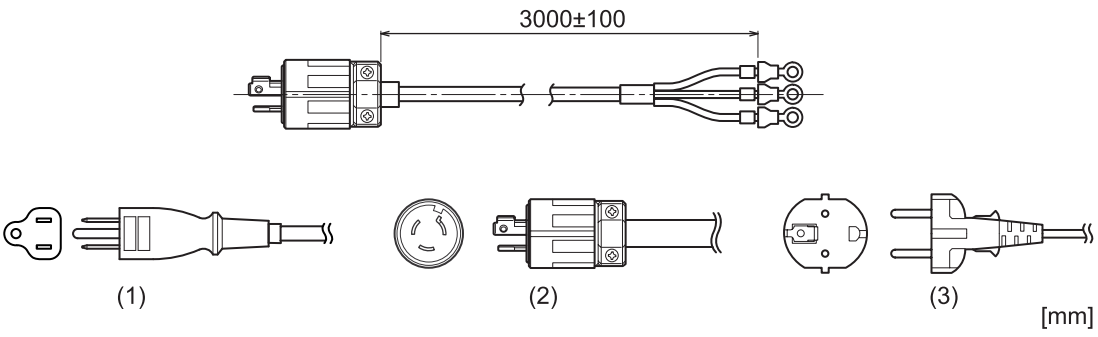
Minimum bend radius: 100mm



(1) 2m length type: 2000 +200/-0
5m length type: 5000 +200/-0

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-ACA10: 125V, NEMA 1-15P, PSE certified (Japan)
Minimum bend radius: 50mm

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

(3) 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.

1.5.6 Touch panel console

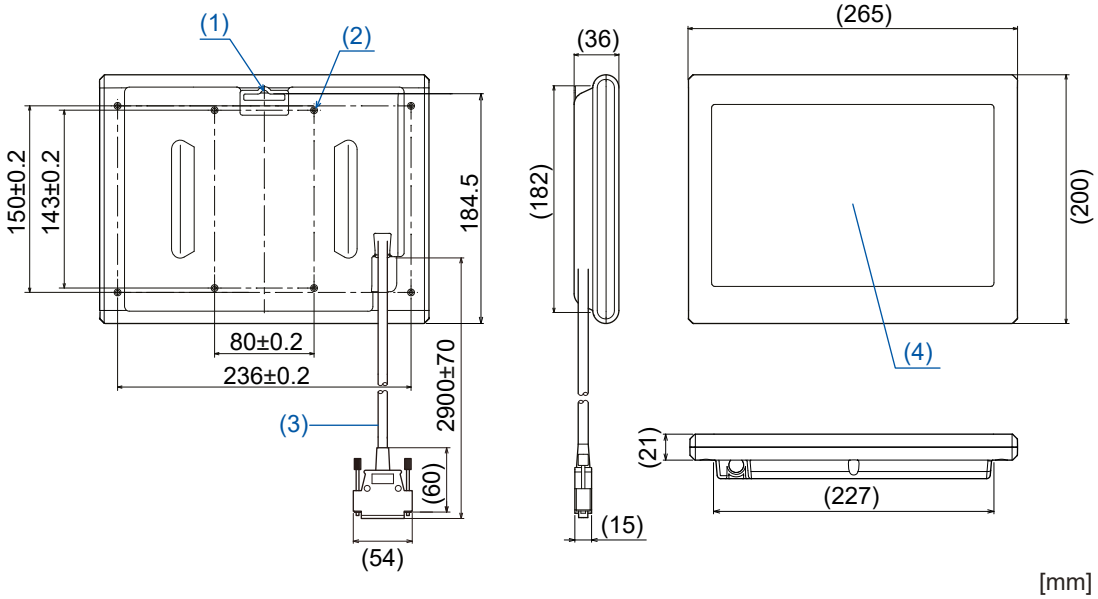
Refer to the technical drawing and legend for dimensions.

The optional touch panel console serves as a monitor during the operation of the laser marking system. To use the touch panel console, the optional expansion board must be installed in the controller.

Specifications of the touch panel console:

Product no.: LP-ADP50

Weight: approx. 1.5kg



[mm]

(1) Hook hole for wall mounting
Dimensions: 33mm × 5mm, radius: 3mm

(2) Fixing screw hole (8 holes)
M4 screw, depth: 5mm, tightening torque: 0.7Nm (±0.1Nm)
Use either the 4 inner holes or the 4 outer holes.

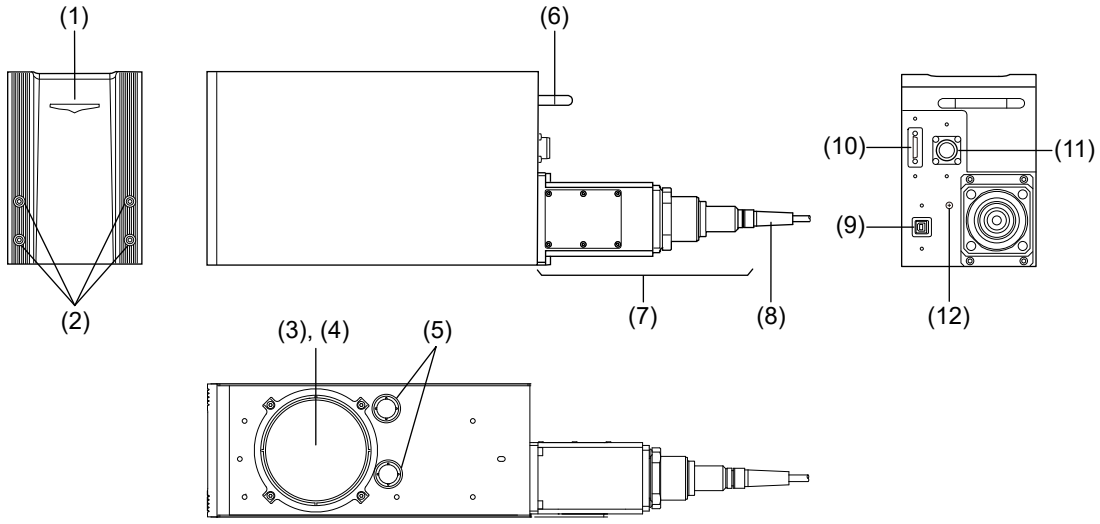
(3) Connection cable
Minimum bend radius: 65mm, diameter: 8.6mm

(4) Touch screen
Size: 216mm × 135mm

1.6 Parts and functions

1.6.1 Laser head

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



(1) Laser head LED display
(2) Fixing screw hole (4 holes)
(3) Laser emission port
(4) Protection glass of the laser emission port
(5) LED lights for camera
(6) Handle
(7) Fiber unit
(8) Fiber cable
(9) USB type B interface for camera
(10) SIGNAL connector
(11) POWER connector
(12) Frame ground terminal (F.G.)

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

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.

Use the **fixing screw holes (2)** (1000N load capacity) to attach an external device such as a camera, lighting, or sensor to the laser head. When using these holes, remove the M5 screws, that are attached to the fixing screw holes at delivery.

Notice

- The installed external device must not obstruct the view of the laser head LED display.
- Be sure to install the device in a location where it will not be damaged by the direct or specularly reflected laser beam.

Always attach the **protection glass (4)** to protect the laser emission port from dirt or damage.

The **LED lights (5)** turn automatically on or off together with the camera. For details refer to Verify the marking position with the camera (page 58). If you plan to use the camera function, make sure that the LED lights are not obstructed when installing the laser head.

To carry the laser head, hold the **handle (6)** with one hand and support the base with the other hand. For details refer to Laser head installation (page 52).

The **fiber cable (8)** transmits the laser from the oscillator unit to the laser head. The fiber cable is permanently connected to the **fiber unit (7)**. The fiber unit can be detached from the laser head. For details refer to Detachment of the fiber unit (page 60).

Remove the cover, that is attached to the **USB type B interface (9)** at delivery. To use the camera function, connect the laser head and your PC with the supplied camera connection cable (USB cable). For details refer to Connect a USB cable for camera display (page 79). Install the configuration software Laser Marker NAVI smart to display the image of the marking field taken by the camera.

Connect a signal cable to the **SIGNAL connector (10)** for communication between the laser head and the oscillator unit. Connect a unit power cable to the **POWER connector (11)** to supply power to the laser head via the oscillator unit. For details refer to Connection of the laser head, oscillator unit, and controller (page 74).

Notice

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

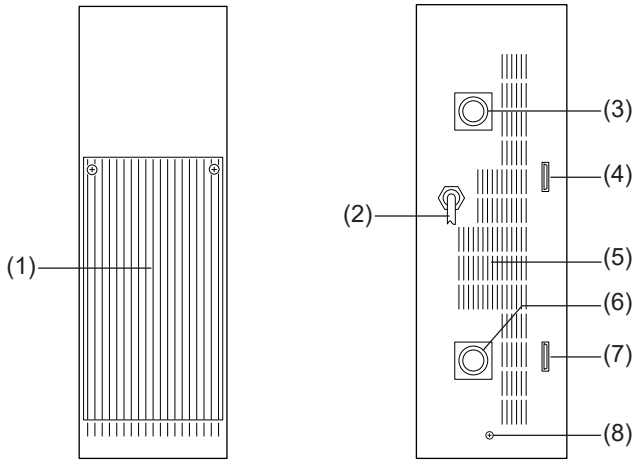
For details refer to Install the connector covers (page 76) and Install the connector cover to the USB cable (page 80).

Be sure to connect the **frame ground terminal (12)** to ground permanently.

1.6.2 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.

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.

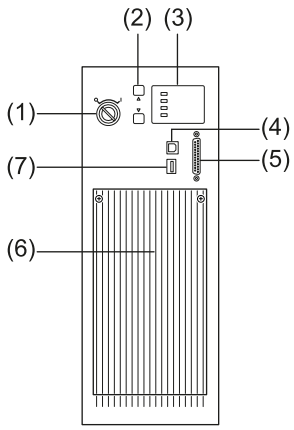
For details refer to Connection of the laser head, oscillator unit, and controller (page 74).

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

1.6.3 Controller

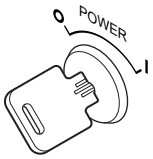
The controller generates the marking data. It provides the main power supply of the laser marking system and interfaces for external devices.

Front view



(1) Key switch (POWER)
(2) Circuit protector
(3) Controller LED display
(4) USB type B interface
(5) Console connector (CONSOLE)
(6) Cooling air inlet
(7) USB type A interface

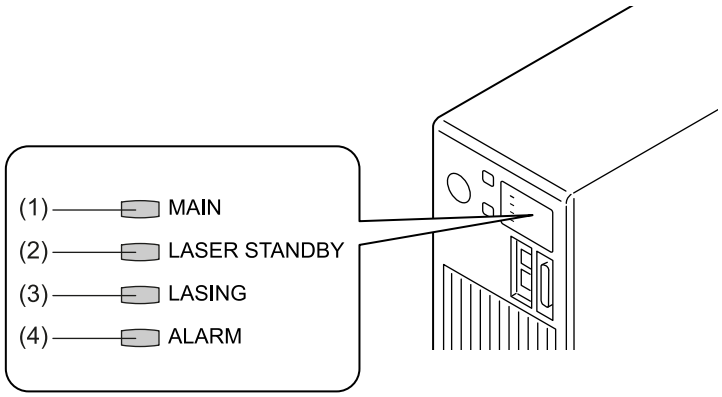
Turn the **key switch (1)** from 0 to I to start the system. To terminate the system, turn the switch from I to 0 and remove the key.



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 (MAIN LED is flashing).

In the event of an overcurrent, one or both **circuit protectors (2)** will trip and cut off the current. For details refer to Restore the circuit protector (page 85).

The operating status of the laser marking system is shown on the **controller LED display (3)**.



(1) MAIN (green)
System start-up completed / Flashes: System start-up in progress

(2) LASER STANDBY (white)
Laser pumping completed / Flashes: Laser pumping in progress

(3) LASING (orange)
Laser emission in progress

(4) ALARM (red)
There is an alarm / Flashes: There is an alarm (system does not start)

Use the **USB type B interface (4)** to connect a PC with the Laser Marker NAVI smart software via USB cable.

The **console connector (5)** is available if the expansion board (optional accessory) is installed in the controller. For details refer to Connect a touch panel console (page 89).

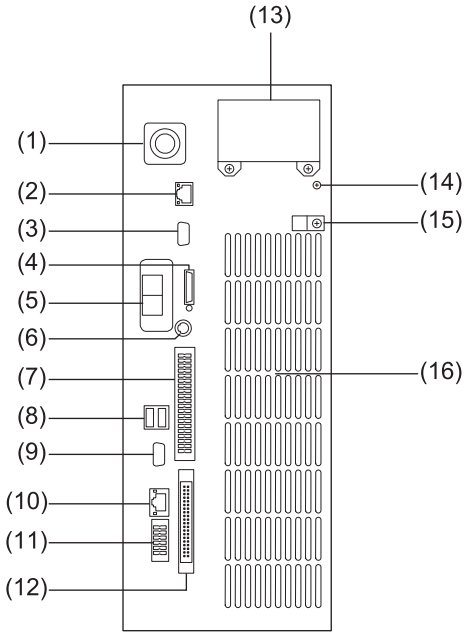
A filter is installed in the **cooling air inlet (6)** of the controller.

Connect a USB flash drive to the **USB type A interface (7)** to save marking data when using the touch panel console or a monitor. When operating the laser marking system with a commercial monitor, you can also connect a USB mouse to this interface. If the optional expansion board is installed in the controller, two additional USB type A interfaces are available on the rear of the controller.

Notice

- Do not connect any device other than a USB flash drive or USB mouse to the USB type A interfaces.
- You cannot use a USB flash drive with security functions. Use a USB flash drive formatted with FAT32 or exFAT.
- USB hubs are not supported.

Rear view



(1) POWER connector
(2) Ethernet interface LAN
(3) RS-232C interface
(4) SIGNAL connector
(5) Interface for EtherNet/IP or PROFINET
(6) Mini DIN connector
(7) I/O TERMINAL connector
(8) 2 USB type A interfaces
(9) VGA connector
(10) Ethernet interface INFO LAN
(11) Displacement sensor connector D-SENSOR
(12) I/O connector
(13) AC power supply terminals AC INPUT
(14) Protective conductor terminal
(15) Clamp
(16) Cooling air outlet

Connect a unit power cable to the **POWER connector (1)** to supply power to the oscillator unit. For details refer to Connection of the laser head, oscillator unit, and controller (page 74).

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. You can connect multiple devices to the Ethernet interface simultaneously using a hub or router.

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. For details refer to Connection of the laser head, oscillator unit, and controller (page 74).

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”.

The **Mini DIN connector (6)** is not used in this product. Do not connect any devices to it.

Use the **I/O TERMINAL connector (7)** 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 I/O TERMINAL connector (page 124).

The two **USB type A interfaces (8)** are only available when the optional expansion board is installed in the controller. Connect a USB flash drive to save marking data when using the touch panel console or a monitor. When operating the laser marking system with a commercial monitor, you can also connect a USB mouse to this interface. There is one more USB type A interface located at the front of the controller.

Notice

- Do not connect any device other than a USB flash drive or USB mouse to the USB type A interfaces.
- You cannot use a USB flash drive with security functions. Use a USB flash drive formatted with FAT32 or exFAT.
- USB hubs are not supported.

To operate the laser marking system with a commercially available monitor, connect it to the **VGA connector (9)**. The VGA connector is only available when the optional expansion board is installed in the controller. For details refer to Connect a monitor and mouse (page 90).

The **Ethernet interface INFO LAN (10)** is not used in this product. Do not connect any devices to it. This interface is only available when the optional expansion board is installed in the controller.

To use the autofocus function connect a displacement sensor to the **connector D-SENSOR (11)**. This connector is only available when the optional expansion board is installed in the controller. For details refer to Displacement sensor connection (page 216).

Use the **I/O connector (12)** for external control of the laser marking system via I/O signals. For details refer to Pin assignment of the I/O CONNECTOR (page 135).

Use an appropriate AC power cable to connect the following power supply to the **AC power supply terminals AC INPUT (13)**: 90V AC to 132V AC or 180V AC to 264V AC (including a fluctuation range of ±10%), 50/60Hz (switches 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 37).

Notice

The earth terminal of the AC power supply cable must be permanently grounded.
For details refer to Connect the power supply and earth (page 82).

Be sure to connect the **protective conductor terminal (14)** to ground permanently.

Use the **clamp (15)** to fix the AC power cable.

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	LP-ZV200P, LP-ZV205P, LP-ZV206P	LP-ZV500P, LP-ZV505P, LP-ZV506P
Operating temperature[1)]	Laser head, oscillator unit: 0°C to +36°C (laser power ≥46), 0°C to +40°C (laser power <46)[2)]	Laser head, oscillator unit: 0°C to +40°C
	Controller: 0°C to +40°C	
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.

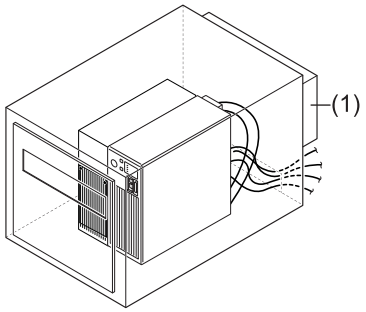
2) If the laser power is corrected. e.g. by an offset value, the allowed operating temperature is based on the corrected value.

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.
- 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.
- 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.

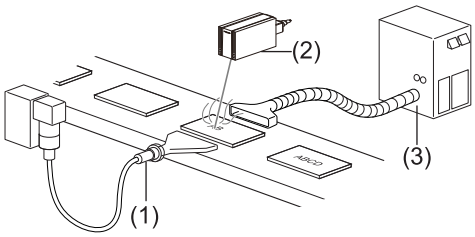
Notice

- 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

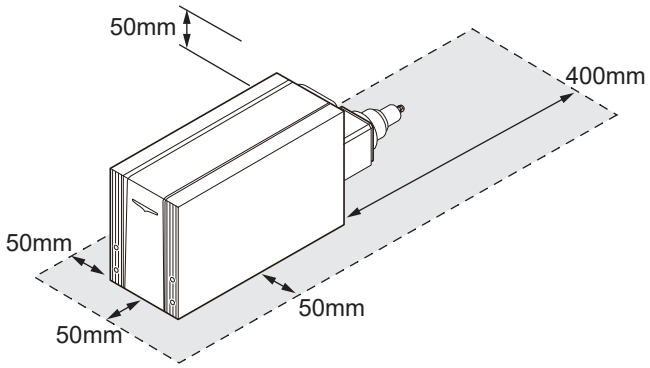
2.2 Installation space

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

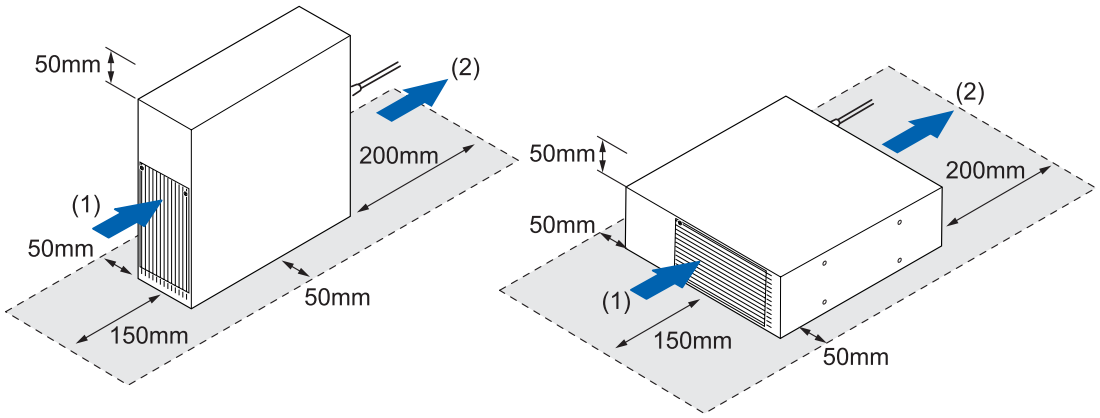
Notice

- 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

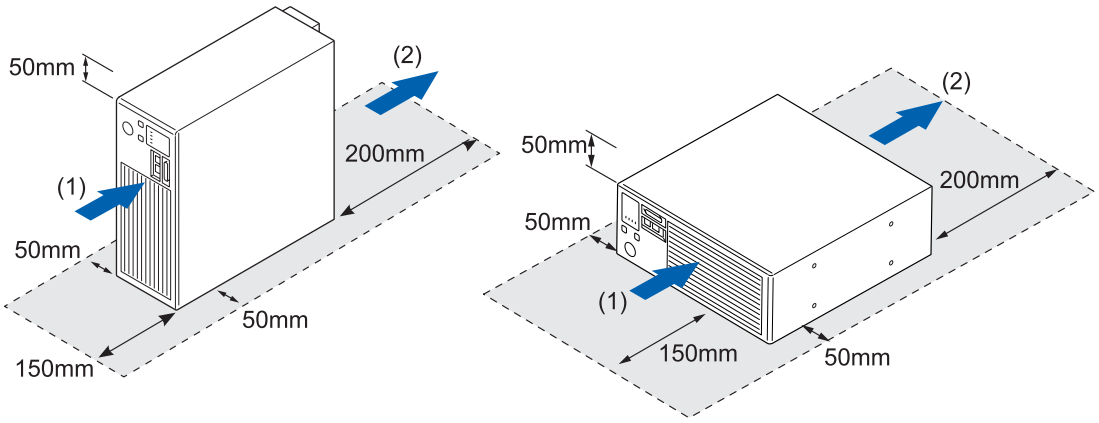


Oscillator unit



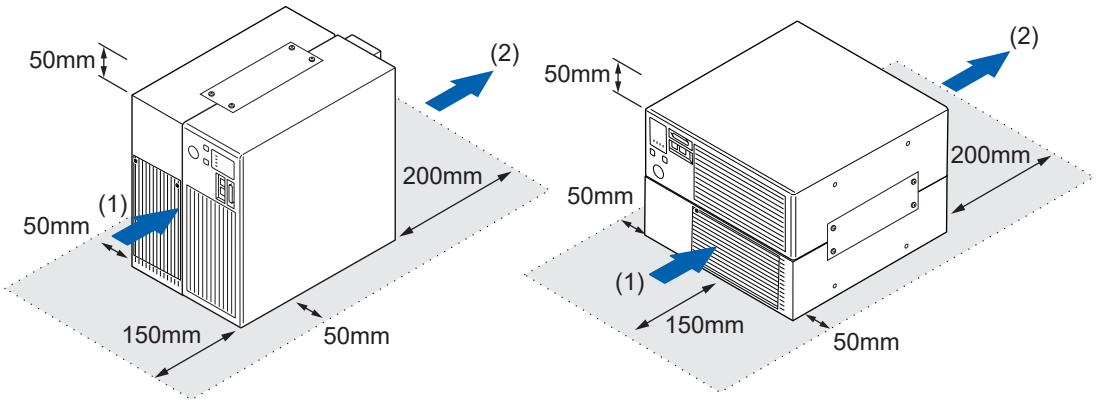
(1) Intake air
(2) Exhaust air

Controller



(1) Intake air
(2) Exhaust air

Oscillator unit and controller installed side by side



(1) Intake air
(2) Exhaust air

Related topics

Installation of oscillator unit and controller side by side (page 67)

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.

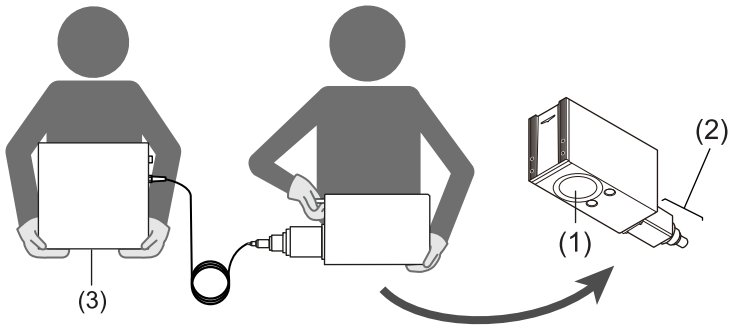
Carrying the laser head

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.

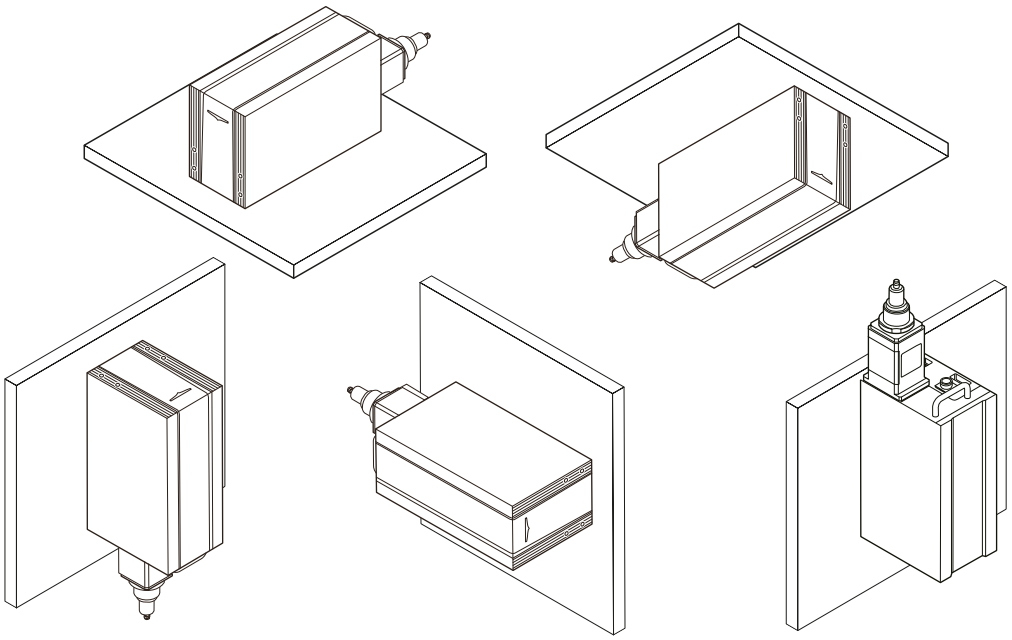
Carry the laser head as shown in the figure below.



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

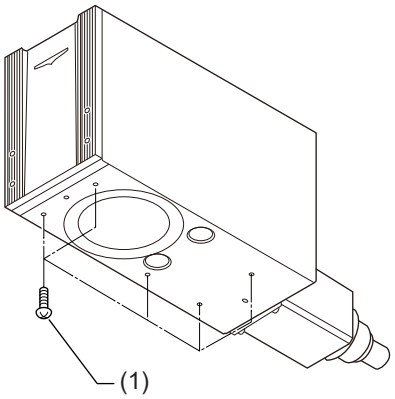
Related topics

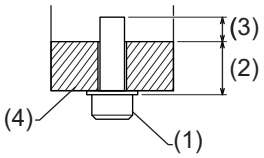
Laser head installation method (page 54)

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.





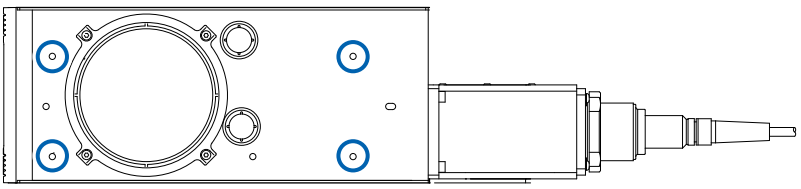
(1) M6 screw, 5 positions, tightening torque: 3.0Nm

(2) Thickness of washer and mounting plate

(3) Insert length: 5mm to 6mm

(4) Mounting plate

If you cannot use the screw hole located near the LED light for the camera, secure the laser head with four screws as shown in the figure below.



Bottom side of the laser head

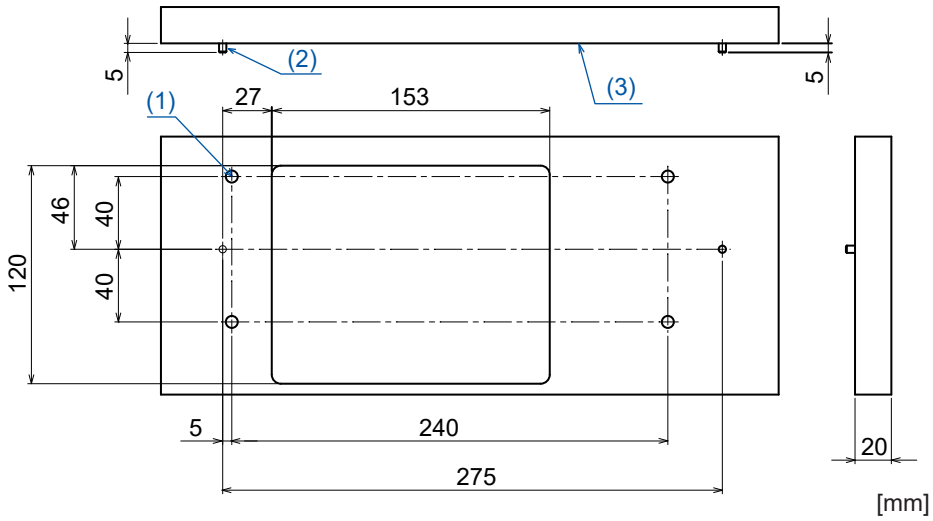
Notice

Do not insert any screws exceeding the specified length. Otherwise, the product may not function properly.

Mounting plate example

In the following example, the mounting plate has a thickness of 20mm. It is recommended to connect the holes for the laser emission port and the camera's LED lights to ensure that the LED lights are not obstructed by the plate.

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



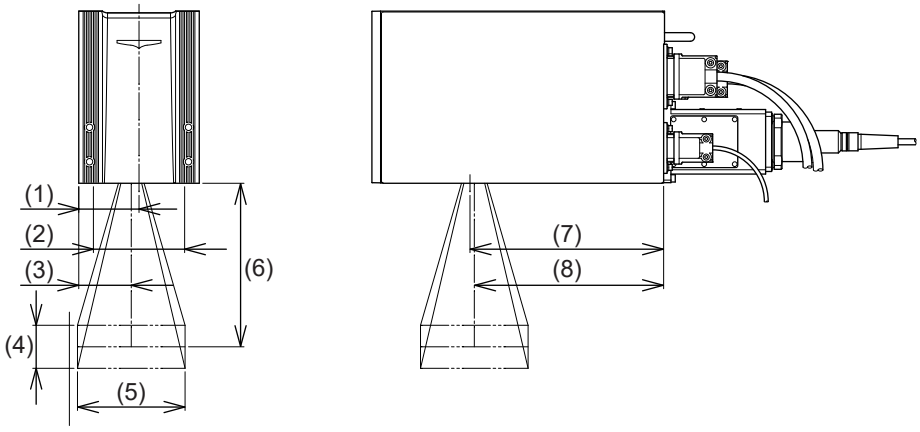
(1) Fixing hole (6 holes): ∅6.6mm through hole

(2) Positioning pin (2 pins): ∅4mm stainless steel; height 5mm

(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) Distance to the center of the laser emission port: 71mm

(2) Diameter of laser emission port: 106mm

(3) Distance to the center of the marking field: 62mm

(4) Setting range of work distance: ±25mm

(5) Marking field (X, Y):
125mm × 125mm (LP-ZV200P, LP-ZV500P)
220mm × 220mm (LP-ZV205P, LP-ZV505P)
330mm × 330mm (LP-ZV206P, LP-ZV506P)

(6) Work distance (base position):
190mm (LP-ZV200P, LP-ZV500P)
220mm (LP-ZV205P, LP-ZV505P)
330mm (LP-ZV206P, LP-ZV506P)

(7) Distance to the center of the laser emission port: 225mm

(8) Distance to the center of the marking field: 220mm

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 or with the image projected by the internal camera in the Laser Marker NAVI smart configuration software.

2.3.4.1 Guide laser

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

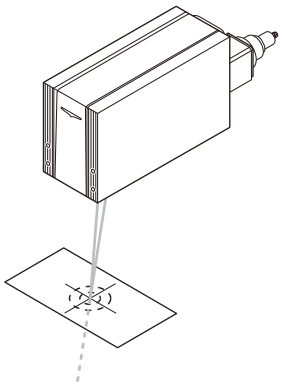
Notice

- 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”.

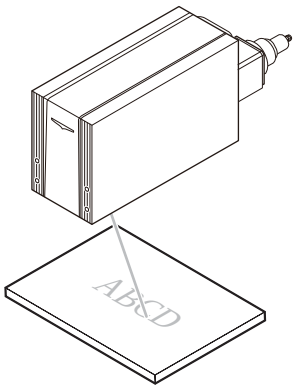
The guide laser is a red laser beam to simulate the marking process or to indicate the marking field and work distance. Use the Laser Marker NAVI smart configuration software to select a display mode.

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

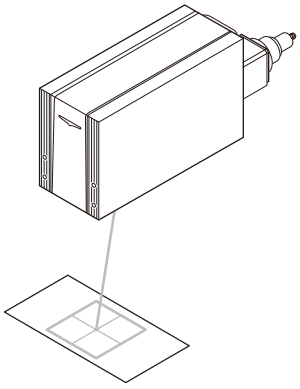
- “Work distance”: Select this mode to adjust the work distance. The guide laser displays the dot of the pointer and the crosshairs. Adjust the distance so that the dot of the pointer overlaps with the center of the crosshairs.



- “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”.

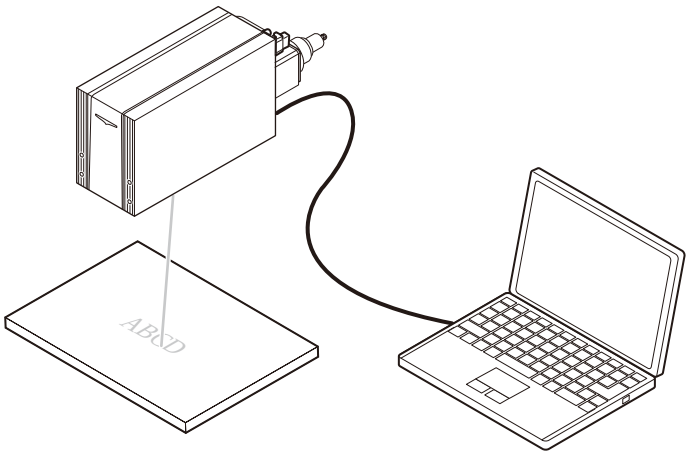
2.3.4.2 Verify the marking position with the camera

Use the built-in camera to check the marking position by superimposing the marking data on the captured image.

When the laser head is connected to a PC with the Laser Marker NAVI smart configuration software installed, the image of the marking field captured by the internal camera can be displayed.

Notice

- Depending on the installation environment, workpiece material, and light reflection, it may not be possible to project the image properly with the internal camera. It is advisable to assess the image quality in advance.
- The colors of the camera image may differ from the actual colors.



1. Connect the laser head of the laser marking system and your PC with the supplied camera connection cable (USB cable).
2. Establish an online connection between your PC and the laser marking system.
3. In the “Marking settings” screen, select the “Camera” tool in the ribbon. The “Camera” dialog is displayed.

   “Camera” tool
4. Select “Camera ON” in the dialog. The image taken by the camera is displayed in the marking image editor.
5. Adjust the camera settings while viewing real-time changes in the marking image editor.
6. To close the dialog, select “Close” or “X”.
7. To switch the camera off, select “Camera” in the ribbon and “Camera OFF” in the dialog. Alternatively, use the camera icon on the right side of the marking image editor to switch the camera on or off.

Related topics

Connect a USB cable for camera display (page 79)

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:

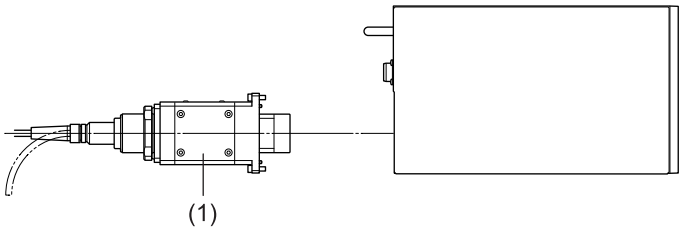
- Before engaging in full-scale operation, it is essential to perform test marking to confirm that there is flexibility in the marking settings and that the marking performance remains stable.
- Take necessary measures for air conditioning, ventilation, and waste heat management to minimize fluctuations 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.
- Be sure to connect a laser head, oscillator unit, and controller that have identical serial numbers. Connecting different combinations may result in a decline in marking performance.
- 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.

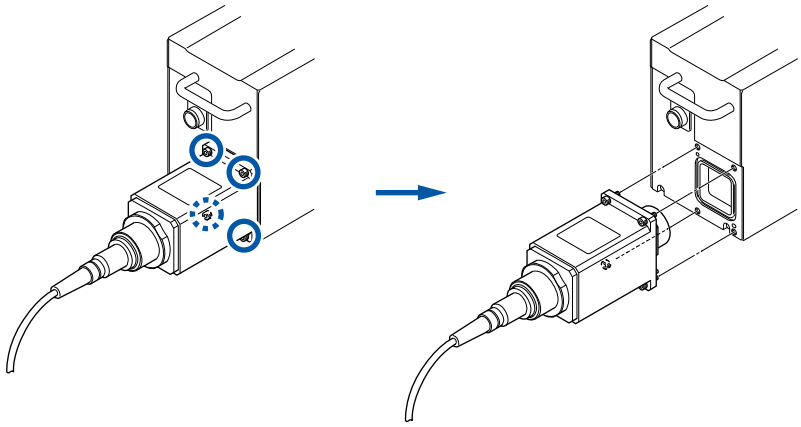
You need the following items:

- Hex key (ball point, M5, L=150mm)
- Scanner cover (included accessory)
- M5 screws (included accessories)
- Fiber unit protection cap (included accessory)
- 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.

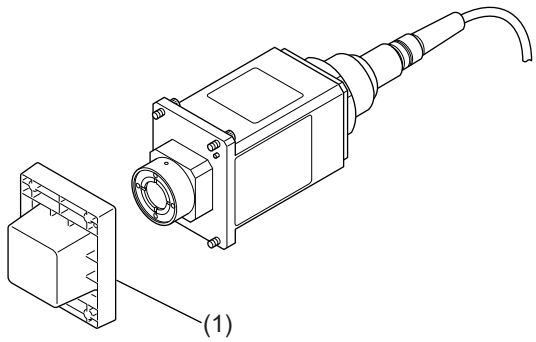
1. Use a ball point hex key to loosen the 4 fixing screws on the fiber unit and carefully remove the unit from the head.



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.

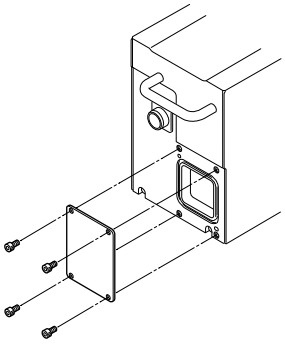
2. Place the included protective cap (1) over the fiber unit.



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



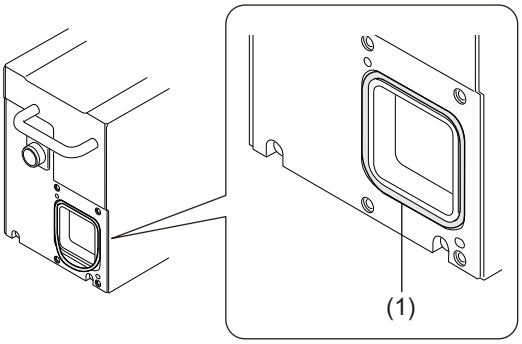
Notice

- 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

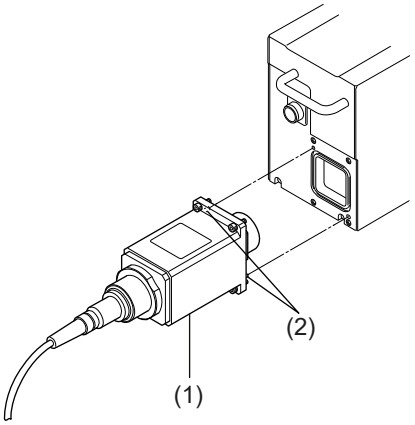
- The o-ring cannot be reused. When you re-install the fiber unit, you must change the o-ring. For replacement, order product no. LP-ACC11 (set of connector cover and gasket).
- In order to maintain the sealing function of the o-ring, follow some basic storage recommendations.
  - Protect o-rings from 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.

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

Notice

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

3. Remove the protective cap from the optical component of the fiber unit.
4. Align the fiber unit to the head by using the positioning pin.

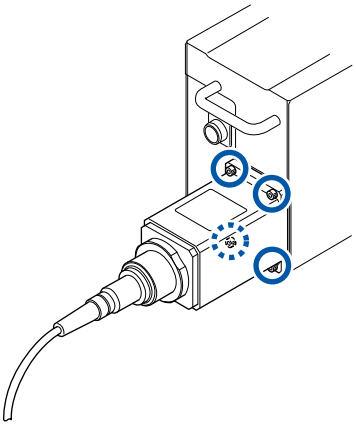


(1) Fiber unit
(2) Positioning pin

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

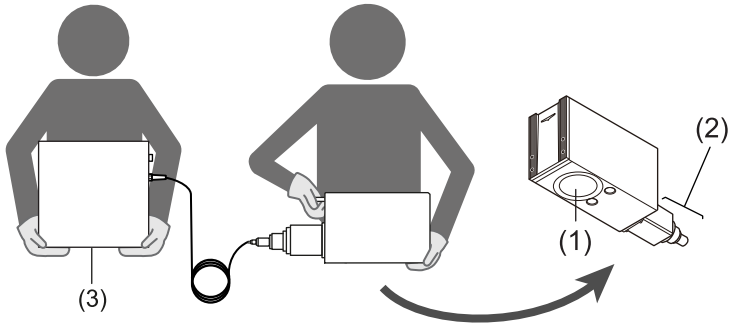
Make sure the power is turned off before installation. Otherwise, there is a risk of an electrical shock.

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

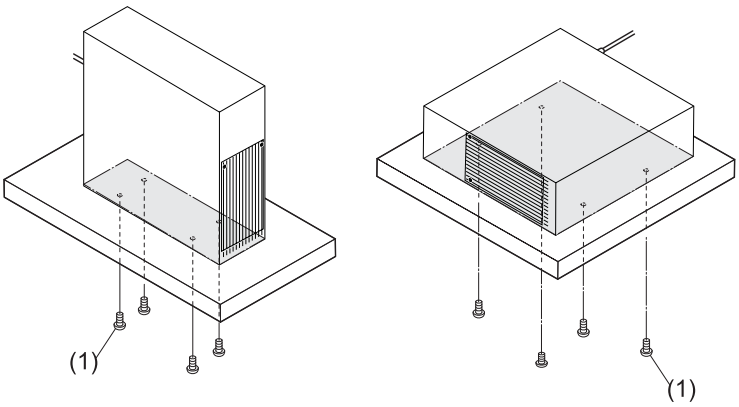


(1) Laser emission port
(2) Fiber unit
(3) Oscillator unit

Installation method

- The oscillator unit can be installed vertically or horizontally.
- To ensure proper vertical installation, verify the production date of your oscillator unit on the label. Refer to Product identification (page 24).

  Make sure to install an oscillator unit and controller manufactured before January 2025 only side by side. An oscillator unit manufactured in February 2025 or later can be installed vertically on its own. Refer to the figure below.
- 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 36).



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

Notice

- An oscillator unit manufactured before January 2025 cannot be installed vertically on its own. It must be installed alongside the controller.
- 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.

Related topics

Installation of oscillator unit and controller side by side (page 67)

2.5 Controller installation

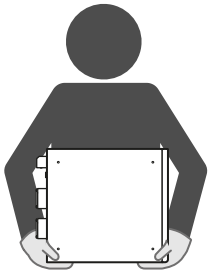
Failure to observe the following precautions when installing the controller can result in serious or moderate injury.

⚠ WARNING

- Make sure the power is turned off before installation. Otherwise, there is a risk of an electrical shock.
- To carry this product, wear non-slip gloves. 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

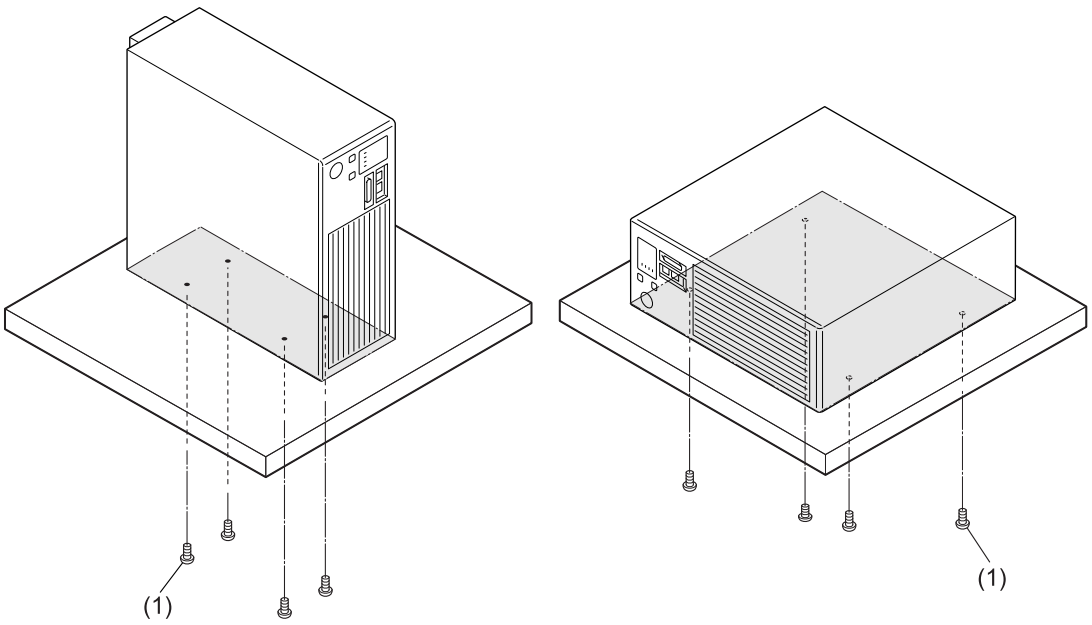
Carry the controller as shown in the figure below.



Installation method

- The controller may be installed vertically or horizontally.
- To ensure proper vertical installation, verify the production date of your controller on the label. Refer to Product identification (page 24).

  Make sure to install an oscillator unit and controller manufactured before January 2025 only side by side. A controller manufactured in February 2025 or later can be installed vertically on its own. Refer to the figure below.
- For horizontal installation, ensure that the key switch is at the bottom.
- For details on the location of the fixing screw holes, refer to Controller (page 37).



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

Notice

- A controller manufactured before January 2025 cannot be installed vertically on its own. It must be installed alongside the oscillator unit.
- 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.

Related topics

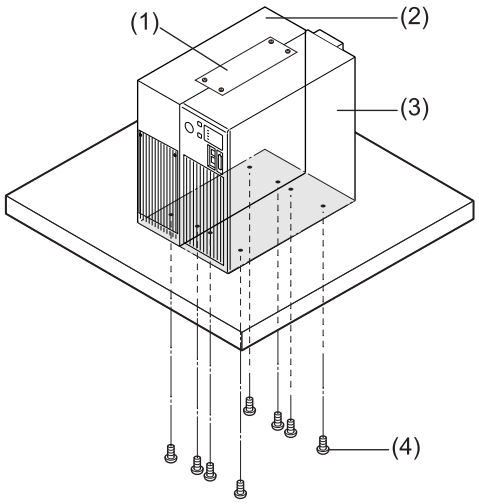
Installation of oscillator unit and controller side by side (page 67)

2.5.1 Installation of oscillator unit and controller side by side

The oscillator unit and the controller can be installed side by side, either vertically or horizontally. For vertical installation, make sure that the oscillator unit is positioned on the left side when viewed from the front. For horizontal installation, ensure that the oscillator unit is located on the lower side.

Vertical installation

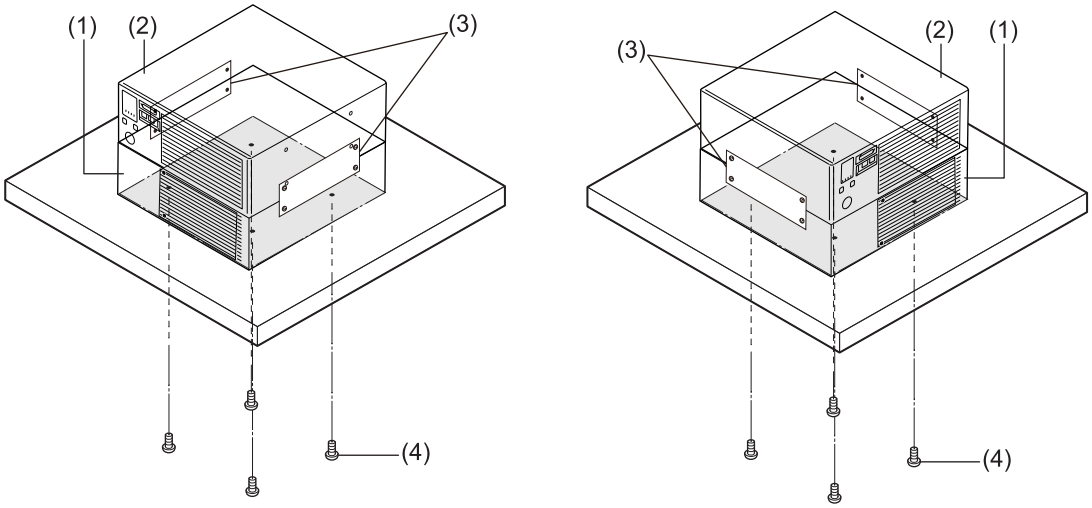
- Make sure to install an oscillator unit and controller manufactured before January 2025 only side by side. They cannot be installed vertically on their own.
- Install the oscillator unit on the left and the controller on the right when viewed from the front.
- Attach the included metal mounting plate to the top of both the oscillator unit and the controller, and tighten the four fixing screws.
- Secure the bottom of the oscillator unit and the controller using four fixing screws for each.



(1) Metal mounting plate
(2) Oscillator unit
(3) Controller
(4) M5 screw, 4 positions, insert length: 4mm to 6mm, tightening torque: 2.0Nm

Horizontal installation

- Install the oscillator unit on the lower side and position the controller on the upper side. Ensure that both the oscillator unit and the controller have their left sides facing down when viewed from the front.
- Attach the oscillator unit and the controller using the provided metal mounting plates on both the left and right sides to prevent the controller from falling. Fasten the metal mounting plates with screws at four locations.
- Secure the bottom of the oscillator unit using four fixing screws.

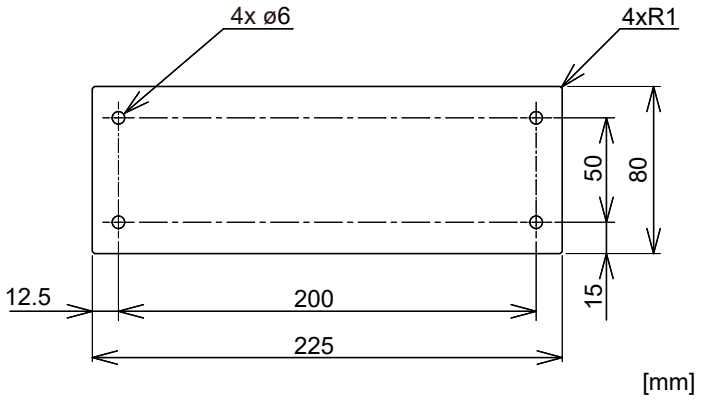


(1) Oscillator unit
(2) Controller
(3) Metal mounting plate
(4) M5 screw, 4 positions, insert length: 4mm to 6mm, tightening torque: 2.0Nm

Metal mounting plates

The metal mounting plates are included in the product package. Use one of these metal mounting plates to install the oscillator unit and the controller vertically, or use two of them for horizontal installation.

The mounting plate has a thickness of 1mm.



Related topics

Controller (page 37)

Oscillator unit (page 36)

Installation space (page 50)

2.5.2 Installation of air filters

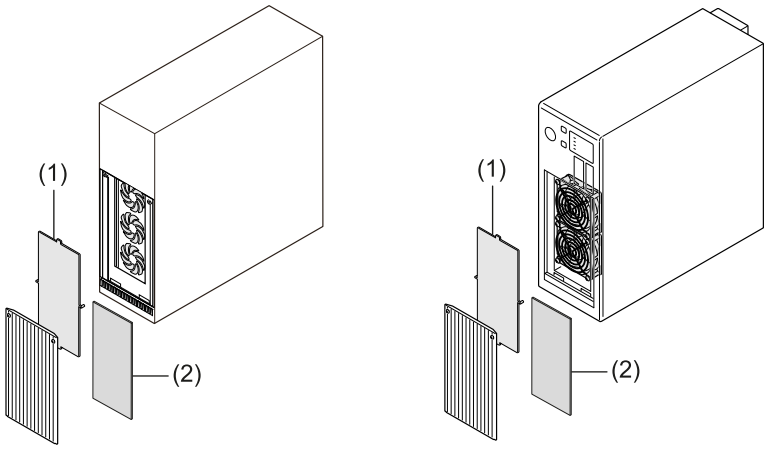
Two nonwoven fabric filters and two urethane filters for the oscillator unit and the controller are included in the product package. The nonwoven fabric filter is pre-installed at the time of delivery.

Notice

- Select and install one air filter, either nonwoven fabric or urethane. Do not stack two filters together.
- If the filter becomes clogged with dirt and can no longer maintain airflow, replace it with a new one.

Select the appropriate air filter based on your workpiece materials. Use the nonwoven fabric filter for metal materials and the urethane filter for resin and other non-metallic materials.

Install an air filter at the cooling air inlet of the oscillator unit (left) and the controller (right). For details refer to Replace the air filters (page 232).



(1) Nonwoven fabric air filter
(2) Urethane air filter

2.6 Expansion board installation

Adding the expansion board to the controller enables the use of additional devices, such as a touch panel console or monitor, and a displacement sensor. The expansion board is also needed to display the marking image on an external device using the **IMC** and **IMG** commands.

The expansion board (product no. LP-AEB10) is not included in the product package. If you would like to purchase one, contact our service center or one of our sales offices.

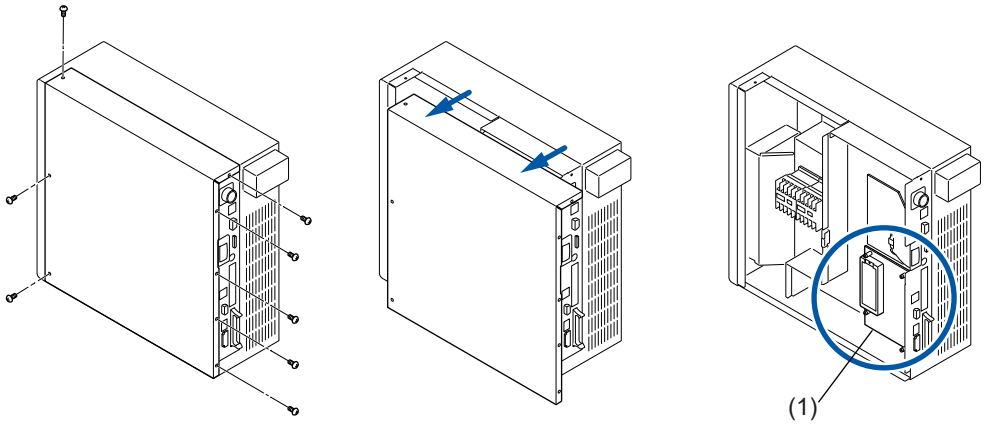
⚠ WARNING

- Turn off the power of the laser marking system and disconnect the AC power cable before installing the expansion board. 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

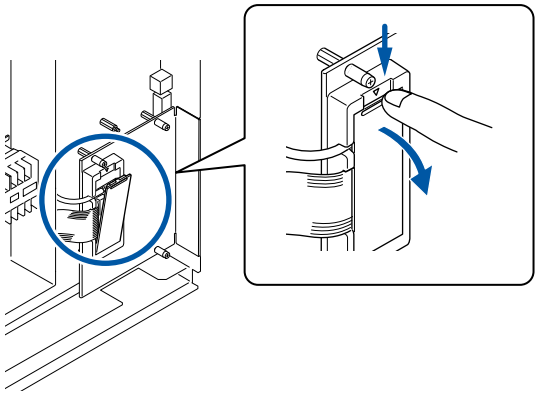
- Discharge the static electricity for example by touching grounded metal objects before starting the installation work. Otherwise, electrical components inside the controller may be damaged.
- Do not touch any other components on the circuit board.

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Loosen the M3 screws located on the rear, side, and top of the controller and remove the side panel.

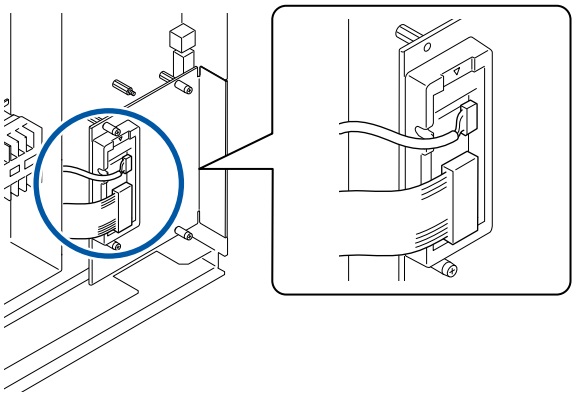


(1) Installation position of the expansion board

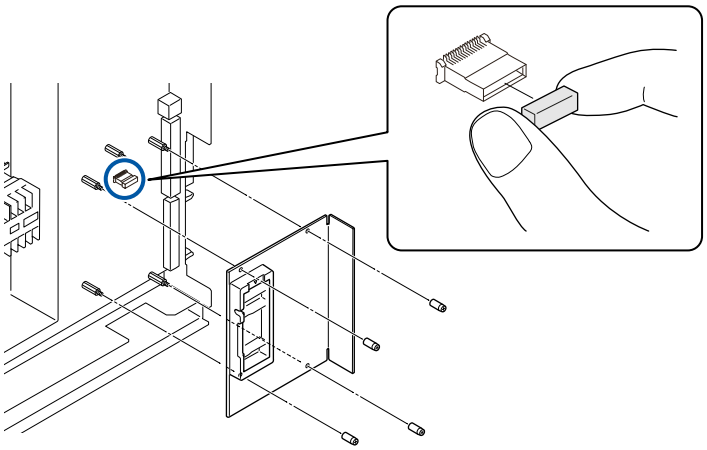
3. To access the installation location of the expansion board, remove the case cover. Press at the designated arrow-marked area and gently pull the cover towards yourself to release it.



4. Disconnect the two different types of cables within the case.

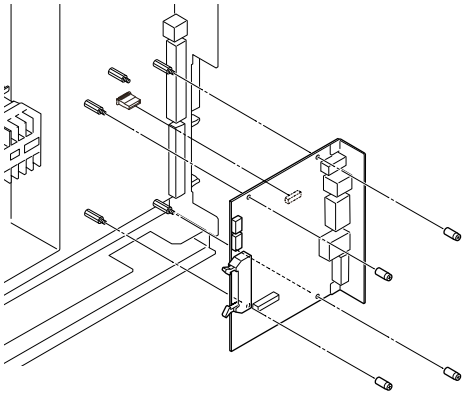


5. Loosen the four M3 screws and remove the circuit board from the controller.
6. Remove the protective cap from the connector located beneath the circuit board that was just removed.

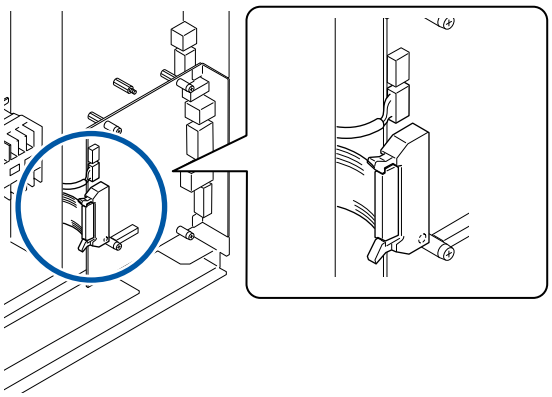


7. Place the expansion board in the position indicated in the figure. Insert the connector on the rear of the expansion board into the corresponding connector on the laser marking system. Tighten the four M3 screws that were previously removed, using the screw holes located at the four corners of the board.

   Tightening torque: 0.5Nm



8. Reconnect the cables that were previously disconnected to the two connectors on the expansion board. Ensure that the connections are not loose. Incorrectly connected cables may prevent you from using the expanded functions.

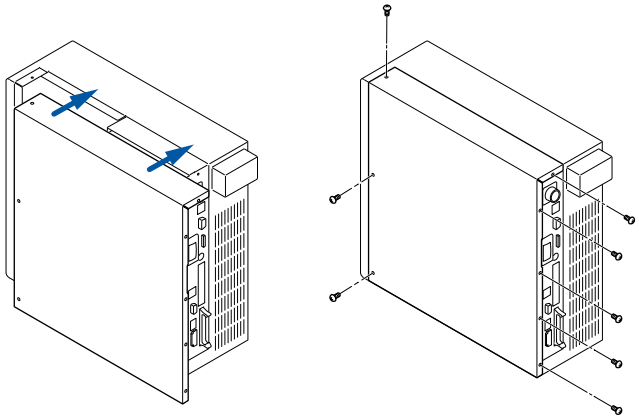


9. Fit the side panel in the top and bottom recesses of the controller. Tighten the M3 screws located on the rear, side, and top of the controller.

   Tightening torque: 0.5Nm

Notice

Be careful not to let the cables get caught between the controller's housing and the panel.



10. Turn the key switch from 0 to I to start the laser marking system.
11. Establish an online connection between your PC and the laser marking system.
12. Go to the “System settings” screen and select “System information” in the ribbon. Make sure that “Optional expansion board” is displayed in the dialog.

Note

If the first and second digits of the controller version number do not match those of the expansion board version number, the warning E783 is output and the use of the product is disabled. To resolve this issue, update the firmware version of the laser marking system.

Example:

Expansion board version	Controller version	Measures
3.1.05	**3.2**.03	Firmware update required
3.2.05	**3.1**.06	Firmware update required
3.2.03	**3.2**.04	–

Related topics

Troubleshooting the “Expansion board version error” dialog (page 74)

2.6.1 Troubleshooting the “Expansion board version error” dialog

If the “Expansion board version error” dialog appears on the touch panel console or monitor, the firmware version of the controller is incompatible with the firmware version of the expansion board.

To resolve this issue, update the firmware version of the laser marking system. Download the software 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.

Note

- Before performing the firmware updates, ensure the expansion board is installed in the controller.
- The firmware of both the controller and expansion board will be updated to the versions specified in the Laser Marker Firmware Updater.

2.7 Hardware connection

2.7.1 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.

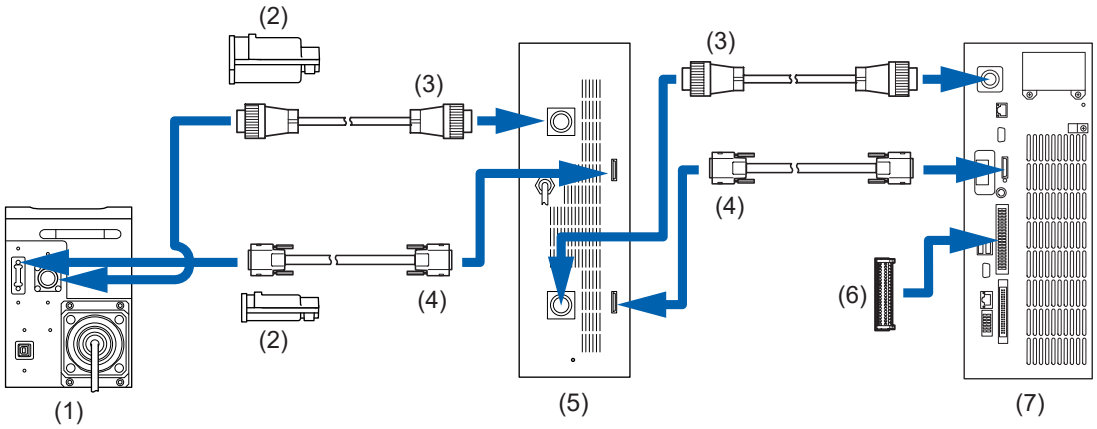
⚠ WARNING

- 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

- Be sure to connect a laser head, oscillator unit, and controller that have identical serial numbers. Connecting different combinations may result in a decline in marking performance.
- 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 (I/O TERMINAL connector)
(7) Controller

Two signal cables (2m and 5m) and two unit power cables (2m and 5m) are included in the product package. The laser head and the oscillator unit are connected with a fiber cable.

LP-ZV200P, LP-ZV205P, LP-ZV206P: The length of the fiber cable is 2m. Use the 2m cables to connect the laser head to the oscillator unit and the 5m cables to connect the oscillator unit to the controller.

LP-ZV500P, LP-ZV505P, LP-ZV506P: The length of the fiber cable is 5m. Select the appropriate cables based on the installation situation. Additional 5m cables can be purchased from our sales offices. 5m cables (unit power cable, signal cable) for the laser head to oscillator and the oscillator 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 147).

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 148)

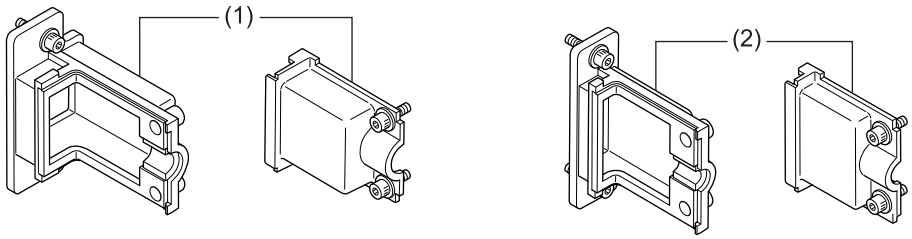
2.7.1.1 Install the connector covers

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

The connector covers cannot be reused. Please use new ones. For replacement, order product number LP-ACC11 (set of connector cover and gasket).

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

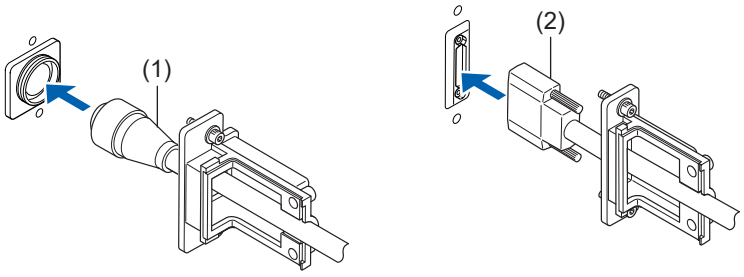


(1) Bottom and top parts of connector cover for unit power cable
(2) Bottom and top parts of connector cover for signal cable

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.

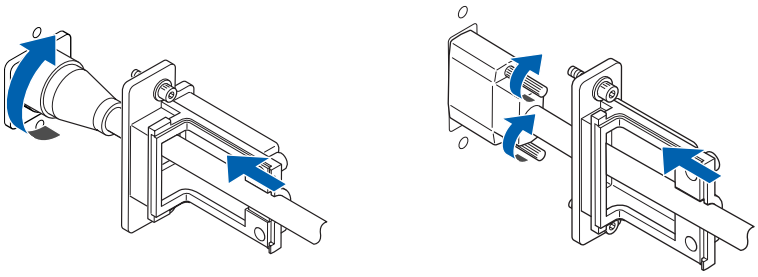
To tighten the screws, use an M4 hex key and a tightening torque of 0.5Nm.

1.

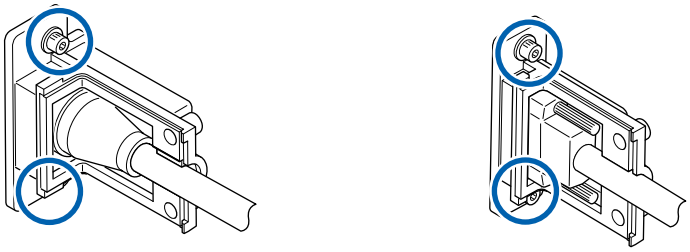


(1) Unit power cable
(2) Signal cable

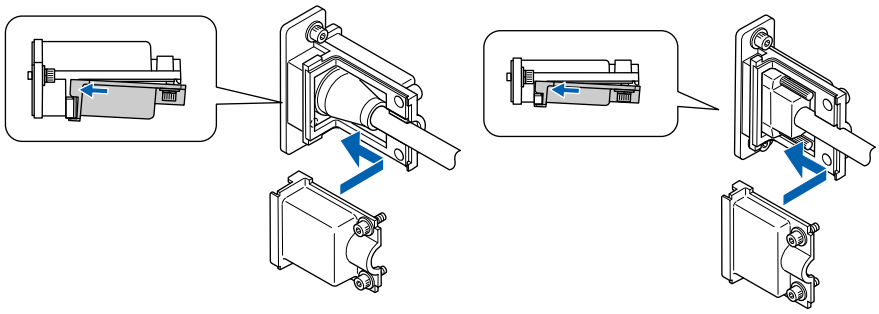
2.



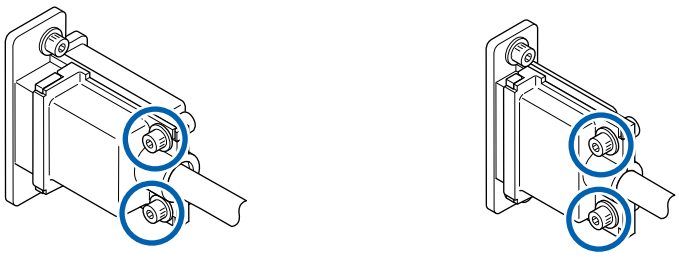
3.



4.



5.

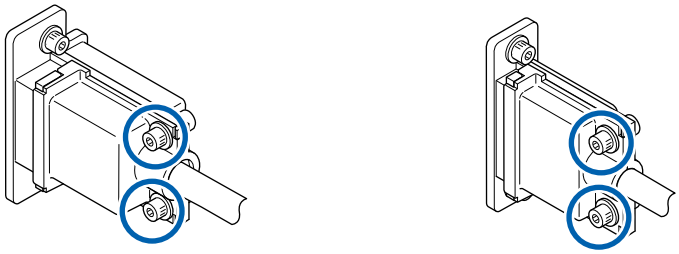


2.7.1.2 Disconnect the unit power or signal cable

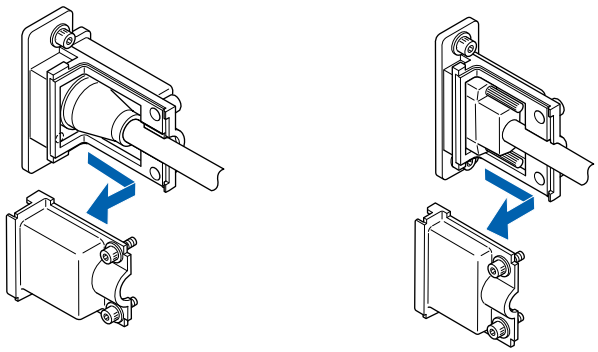
To disconnect the unit power cable or the signal cable, you must first remove the connector covers.

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

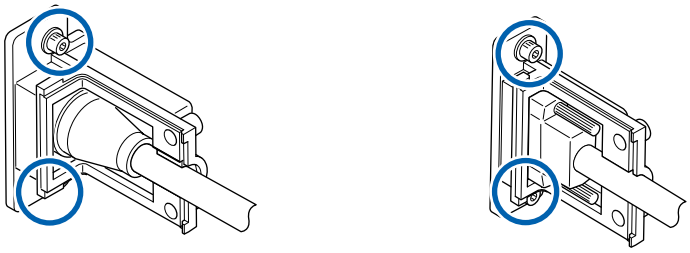
1.



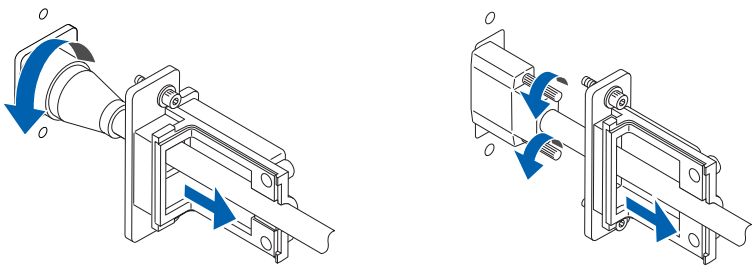
2.



3.



4.



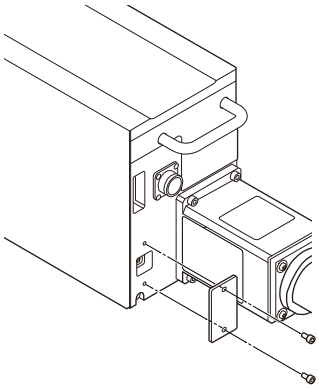
2.7.2 Connect a USB cable for camera display

When the laser head is connected to a PC with the Laser Marker NAVI smart configuration software installed, the image of the marking field captured by the internal camera can be displayed.

Notice

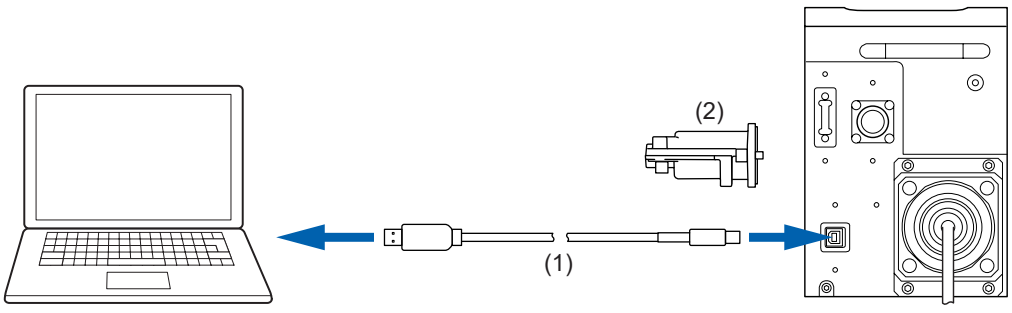
- Use the USB cable included in the package of this product.
- Insert the cable all the way without tilting it.
- Be careful not to crush or put stress on the cable.
- To ensure that the laser head meets the requirements of IP64, install the included connector covers.

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. At the time of delivery, a cover is attached to the USB type B interface located on the rear of the laser head. Use a hex key to loosen the two M4 screws securing the cover, and then remove it.



Keep the cover in place when you are not using the camera function.

3. Connect the USB cable to the USB type B interface and to your PC.



(1) USB cable
(2) Connector cover

4. Install the included connector cover to the USB cable to ensure that the laser head meets the requirements of IP64.

Related topics

Install the connector cover to the USB cable (page 80)

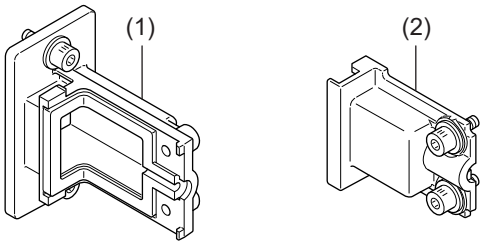
2.7.2.1 Install the connector cover to the USB cable

To ensure that the laser head meets the requirements of IP64, attach the included connector cover to the USB cable.

Notice

The connector covers cannot be reused. Please use new ones. For replacement, order product number LP-ACC11 (set of connector cover and gasket).

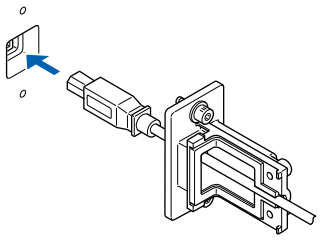
Make sure that the product package contains the following parts of the connector cover:



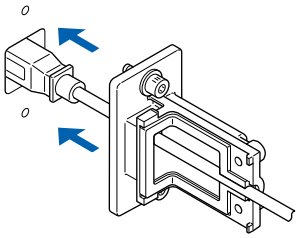
(1) Bottom part of connector cover
(2) Top part of connector cover

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

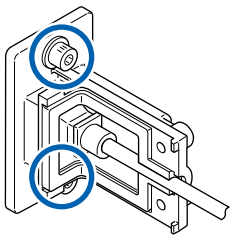
1.



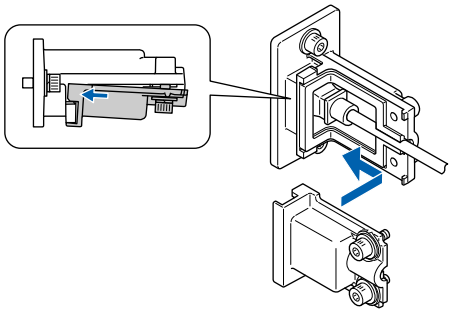
2.



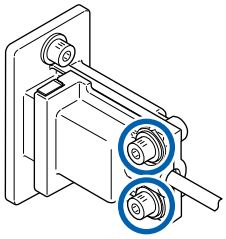
3.



4.



5.

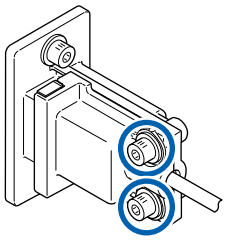


2.7.2.2 Disconnect the USB cable

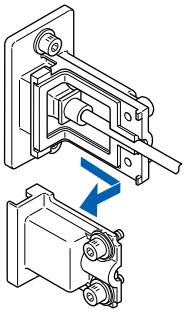
To disconnect the USB cable, you must first remove the connector cover.

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

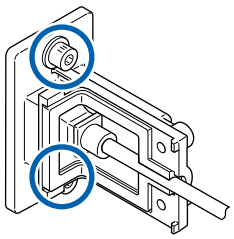
1.



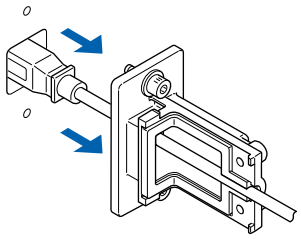
2.



3.



4.



5. If you are not using the USB interface, attach the cover and tighten its two screws with an M4 hex key and a tightening torque of 1.0Nm.

Related topics

Connect a USB cable for camera display (page 79)

2.7.3 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.

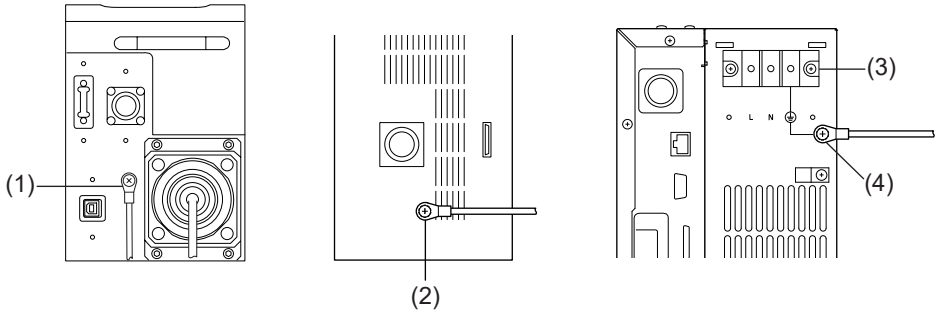
⚠ WARNING

- 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

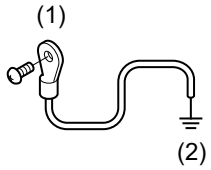
- Before connecting the power supply, connect the protective conductor terminal and the frame ground terminals permanently to earth.
- The frame ground terminal must be negatively grounded.
- Make sure the housing of the controller, of the oscillator unit, and of the laser head are at the same electric 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.



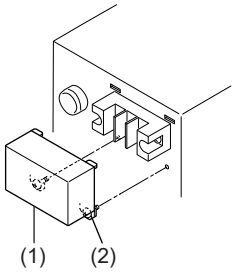
(1) Frame ground terminal (on laser head)
(2) Frame ground terminal (on oscillator unit)
(3) AC power supply terminals (on controller)
(4) Protective conductor terminal (on controller)

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



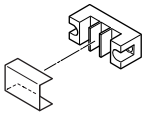
   (1) Protective conductor terminal/Frame ground terminal
   (2) Earth

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

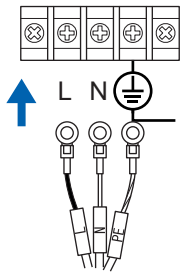


   (1) Terminal cover
   (2) Screw

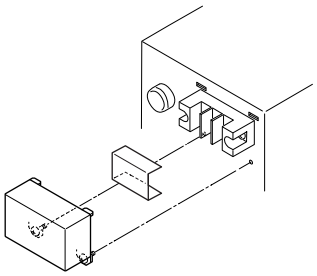
3. Remove the resin cover of the terminals.



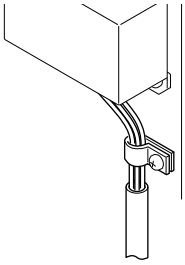
4. Connect the AC power supply cables labeled "L" (black), "N" (white) and "PE" (yellow/green) to the corresponding terminals.
   Screw size: M4
   Tightening torque: 1.8Nm



5. Reattach the resin cover and the terminal cover.
   Screw size: M3
   Tightening torque: 0.5Nm



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



7. 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: 90V AC to 132V AC or 180V AC to 264V AC (including a fluctuation range of ±10%)

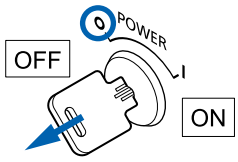
Related topics

Cables (page 37)

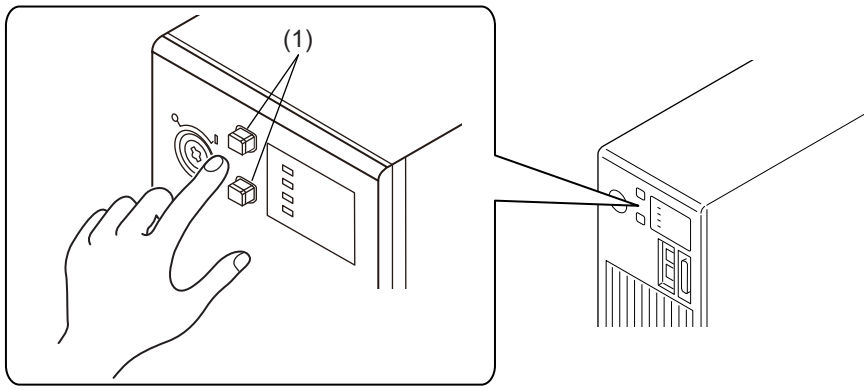
2.7.4 Restore the circuit protector

The controller is equipped with two circuit protectors. In the event of an overcurrent, one or both circuit protectors will trip and cut off the current. 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. Press the push button switch of the circuit protector (1).



4. Connect the AC power cable, turn on the key switch, and confirm that the laser marking system starts properly.

2.7.5 Connection with PC configuration software

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

The software package Laser Marker Smart Utility including Laser Marker NAVI smart, other software tools, and instruction manuals can be downloaded from our Web site. 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
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 87)

Establish an Ethernet connection between PC and laser marking system (page 87)

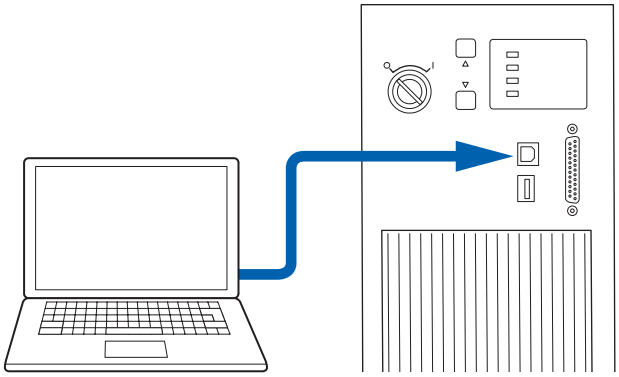
Download Laser Marker Smart Utility (page 30)

2.7.5.1 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.

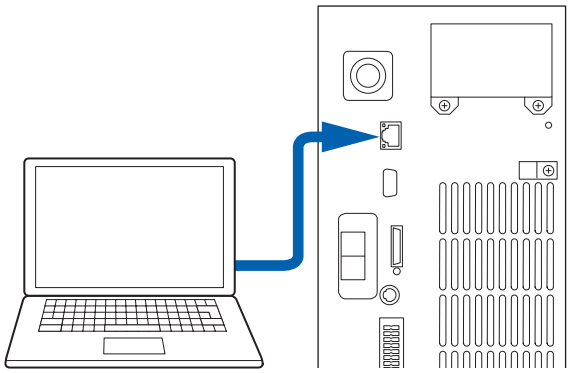
2.7.5.2 Establish an Ethernet connection between PC and laser marking system

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 117)

Connect multiple devices to the Ethernet interface (page 184)

Connect a LAN cable with ferrite core (page 184)

Ethernet interface (page 183)

General Ethernet specifications (page 185)

2.7.6 Connect a touch panel console

Connect a touch panel console to the laser marking system to monitor the marking process or to change settings.

If you would like to purchase the touch panel console (product no. LP-ADP50), please contact our service center or one of our sales offices.

To use the touch panel console, the optional expansion board must be installed in the controller.

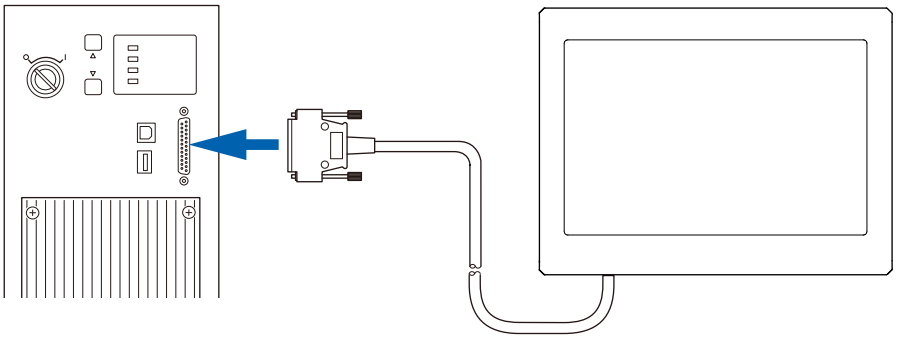
Before operating the laser marking system with the touch panel console, specify all settings in advance. For details, refer to the “Operation Manual for Touch Panel Console / Monitor”.

1. Turn off the key switch of the controller.

   Notice

   Do not connect or disconnect the touch panel console while the laser marking system is powered on.

2. Connect the touch panel console to the console connector on the front of the controller.



If, after turning on the power of the laser marking system, the touch panel console displays nothing, double-check that the cables inside the controller are correctly connected to the expansion board.

Related topics

Expansion board installation (page 70)

2.7.7 Connect a monitor and mouse

Connect a monitor and a mouse to the laser marking system to monitor the marking process or to change settings.

If you want to connect a monitor and mouse, the optional expansion board must be installed in the controller.

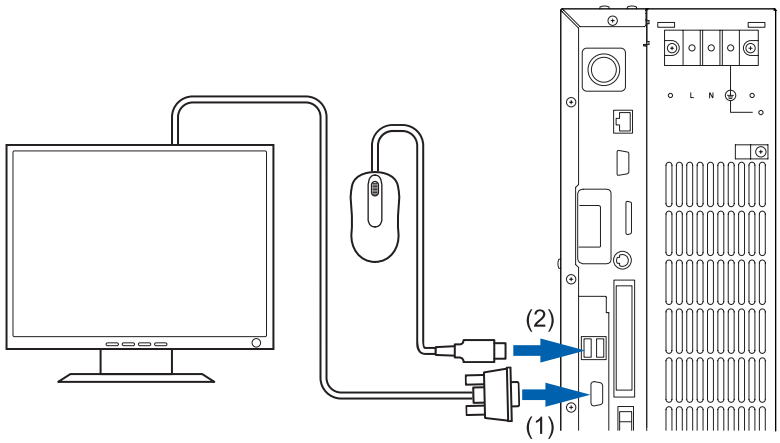
The monitor and mouse must meet the following specifications:

- Screen resolution: 1280 × 1024 or 1440 × 900 pixels
- Monitor interface: VGA connector (15-pin Sub-D)
- Mouse: Human Interface Device (HID) class USB mouse

Notice

- Before operating the laser marking system with a monitor and mouse, perform a preliminary check to ensure correct operation. Please note that compatibility cannot be guaranteed with all types of VGA monitors and USB mice.
- Do not connect or disconnect a monitor and mouse while the power is turned on.
- Connect the USB mouse directly to the controller of the laser marking system without using a USB hub.

1. Turn off the key switch of the controller.
2. Connect the monitor to the VGA connector on the rear of the controller. The USB mouse can be connected to either the rear USB interfaces or the front USB interface of the controller.



(1) VGA connector
(2) USB type A interface

Related topics

Expansion board installation (page 70)

2.8 Construction of an interlock system

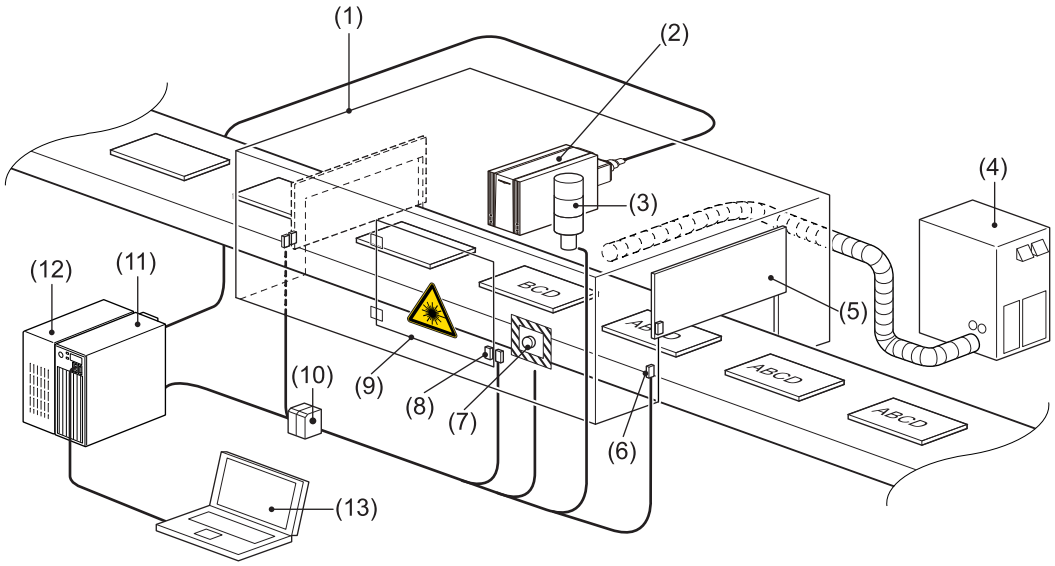
To operate this product, construct a protective enclosure with an interlock system to avoid that human beings and surrounding objects are exposed to laser radiation.

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
(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) Oscillator unit
(13) 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

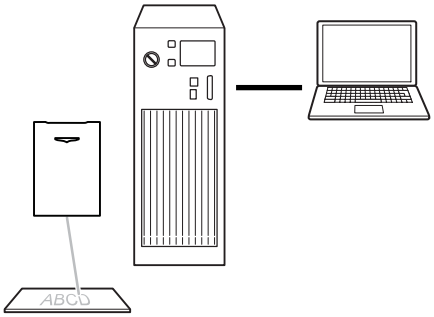
The laser marking system can be controlled by PC configuration software or by external devices.

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

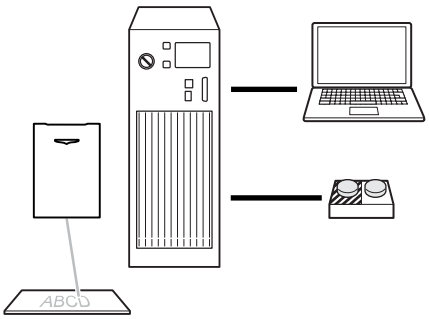
  In test marking mode, start the marking by manually triggering the laser radiation in Laser Marker NAVI smart. Perform the test marking process to test the marking settings during installation or when you want to radiate the laser during maintenance work.



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.



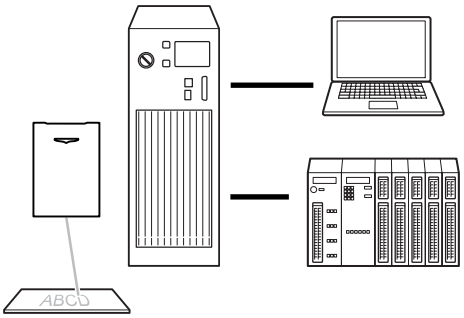
Controlling the laser marking system using Laser Marker NAVI smart or a switch

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.

For information on how to operate the laser marking system with a touch panel console, monitor, or mouse, refer to the “Operation Manual for Touch Panel Console / Monitor”.

Related topics

Perform test marking (page 108)

Perform marking in RUN mode (page 109)

Operation by external devices (remote mode) (page 110)

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.

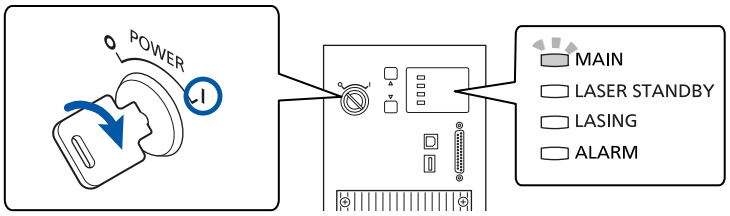
⚠ WARNING

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 during system startup (MAIN LED flashes).
- 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.
   The MAIN LED on the controller LED display is flashing.



System start-up completes approximately after 10 seconds.

If the controller does not start and the ALARM LED flashes, indicating that an online connection between the laser marking system and the configuration software has not been established, please contact our service center or one of our sales offices.

Related topics

Hardware connection (page 74)

Connection with PC configuration software (page 85)

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 85)

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.

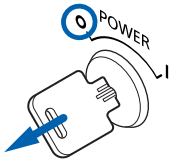
1. Turn off laser pumping.
   Control by PC configuration software: In Laser Marker NAVI smart, select the “Laser pumping” tool and confirm with “Yes”.





   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 104)

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

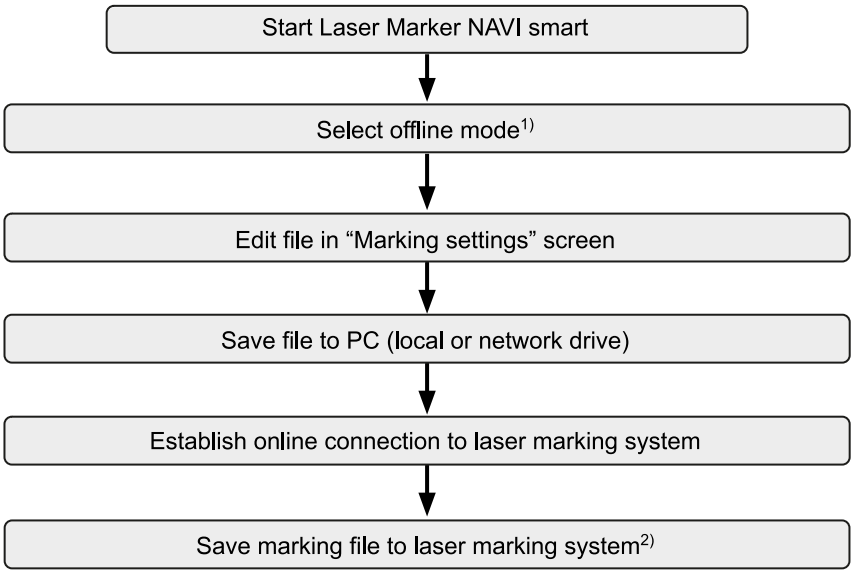
Establish a USB connection between PC and laser marking system (page 87)

Establish an Ethernet connection between PC and laser marking system (page 87)

Disconnect an online connection (page 104)

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.

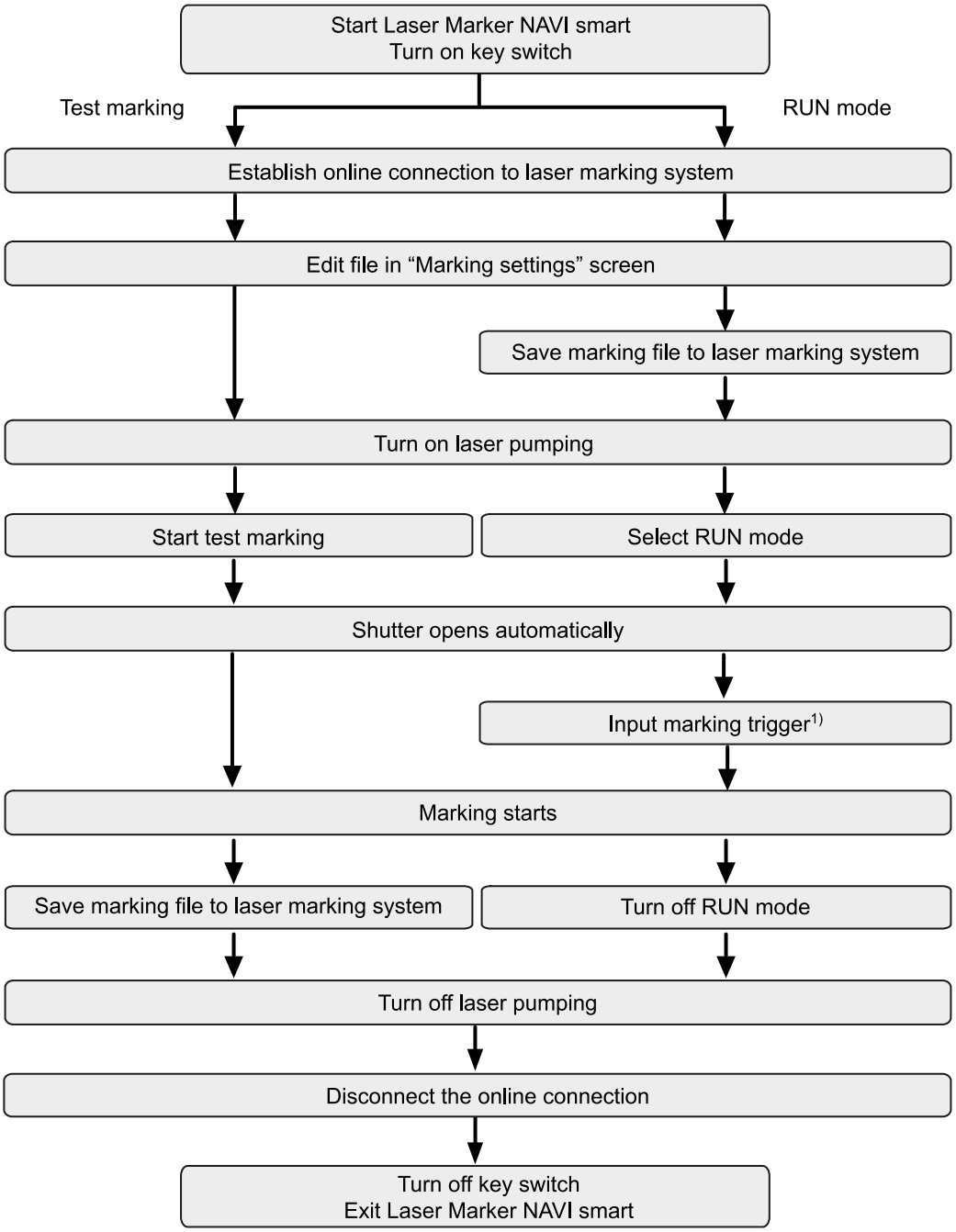


1) To create a new marking file, select “New...” > “Marking file (.lzs)” or “Marking file (.lms)” and select the model of your laser marking system. Or select “Open” to edit an existing file.

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.
- Check the marking energy (LP-ZV500P, LP-ZV505P, LP-ZV506P).

“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.
- Check and correct the laser power using the built-in power monitor (LP-ZV500P, LP-ZV505P, LP-ZV506P).
- 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 106)

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 87)

Establish an Ethernet connection between PC and laser marking system (page 87)

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.

If you use the optional touch panel console or a commercially available monitor, you can only edit the parameters allowed for the “Restricted user”, regardless of the currently set user role.

“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 106)

Availability of the screens (page 101)

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.

If you use the optional touch panel console or a commercially available monitor, you can only edit the parameters allowed for the “Restricted user”, regardless of the currently set user role.

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 104)

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 107)

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 in the “Laser Marker Smart Utility” - “Tools” folder on your PC. If you installed Laser Marker Smart Utility with the default setting, the file would be under:

   C:\Program Files (x86)\Panasonic Industry Laser\Laser Marker Smart Utility\Tools\ClearPassword\ClearPassword.exe

   or

   C:\Program Files\Panasonic Industry Laser\Laser Marker Smart Utility\Tools\ClearPassword\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 106)

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.

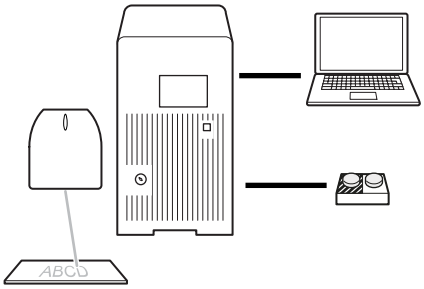
The icon of the “Operation” tool changes to indicate that the laser marking system is in RUN mode.



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

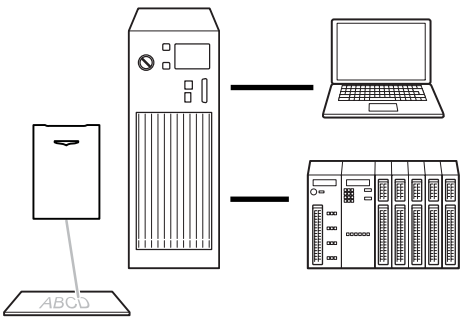
3.4 Operation by external devices (remote mode)

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.

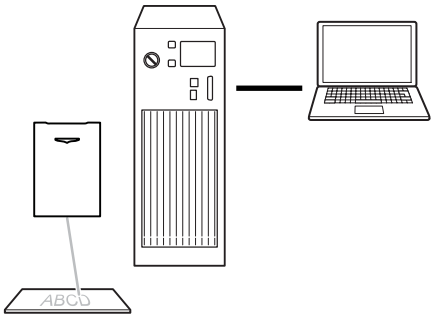


The system must be in RUN mode to receive the marking trigger signal and setting changes from the configuration software.

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 109)

External control via I/O signals (page 122)

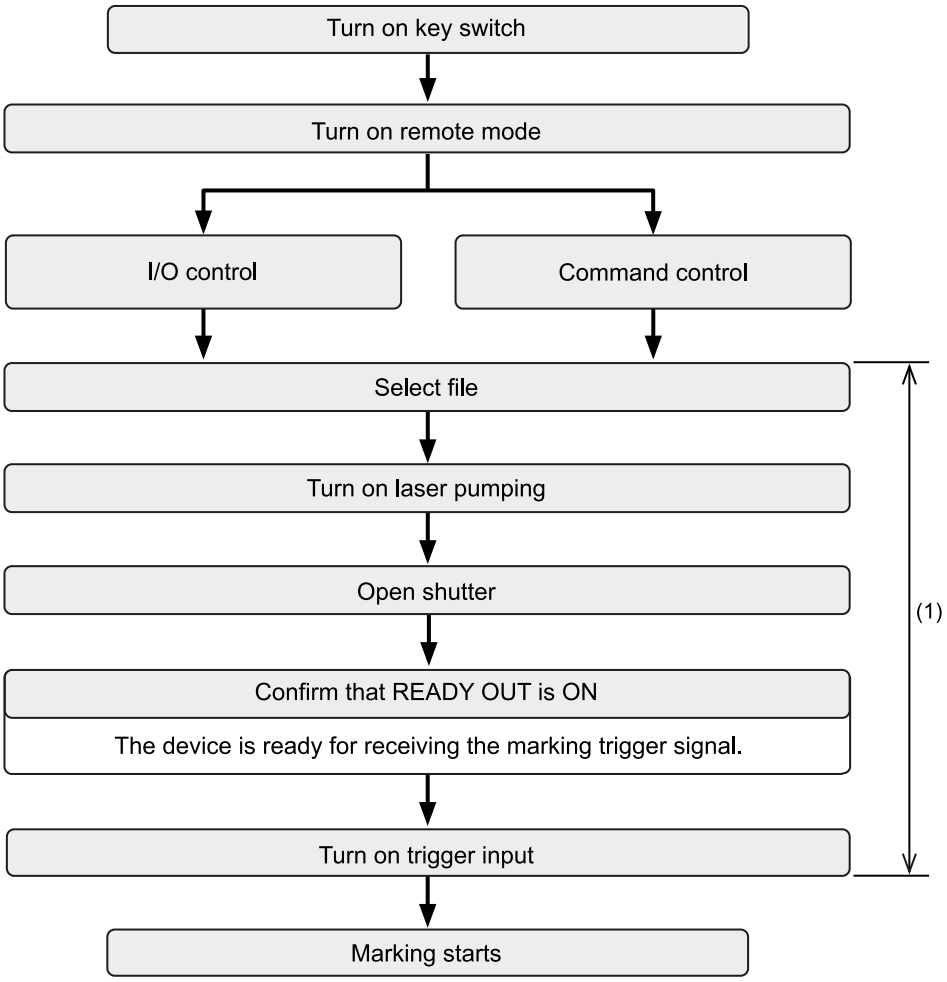
External control via communication commands (page 179)

Linking of image processing devices (page 189)

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 112)

Remote mode (page 118)

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 118)
- Specify the control method (page 113)

For I/O control:

- Specify input and output settings (page 114)

For command control:

- Make communication settings for command control via RS-232C (page 116) or via Ethernet (page 117)
- Specify the command format (page 115)

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 Test marking (**TST**), Power check (**PWM**), and Laser radiation for measurement (**SPT**) commands, 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).
   If “Remote mode switching method” > “Configuration software” is set, you can switch remote mode on and off by configuration software using a PC, a touch panel console or a commercially available monitor. To use the touch panel console or a monitor, the optional expansion board must be installed in the controller.
4. To use the command format of the LP-400/LP-V or LP-M/S/Z series, select “LP-400/V compatible” or “LP-M/S/Z compatible” for “Compatible mode”.
   In LP-400 or LP-M/S/Z 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” or “Serial Communication Command Guide: LP-M/S/Z 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 or LP-M/S/Z series, select “LP-400/V compatible” or “LP-M/S/Z compatible” for “Compatible mode”. In this case, the LP-400/LP-V or LP-M/S/Z 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” or “Serial Communication Command Guide: LP-M/S/Z 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 110)

Linking of image processing devices (page 189)

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 87)

Connect multiple devices to the Ethernet interface (page 184)

Ethernet interface (page 183)

General Ethernet specifications (page 185)

Connect a LAN cable with ferrite core (page 184)

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 119)
- Automatically at power-on (page 119)
- By external devices (page 120)

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.

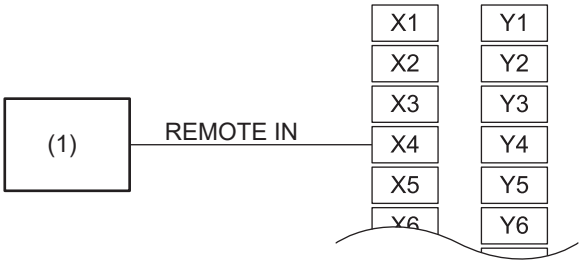
- To use this function, you need to make all settings in the configuration software in advance.
- If “I/O” is selected for “Remote mode switching method”, you cannot switch remote mode on and off by configuration software.

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

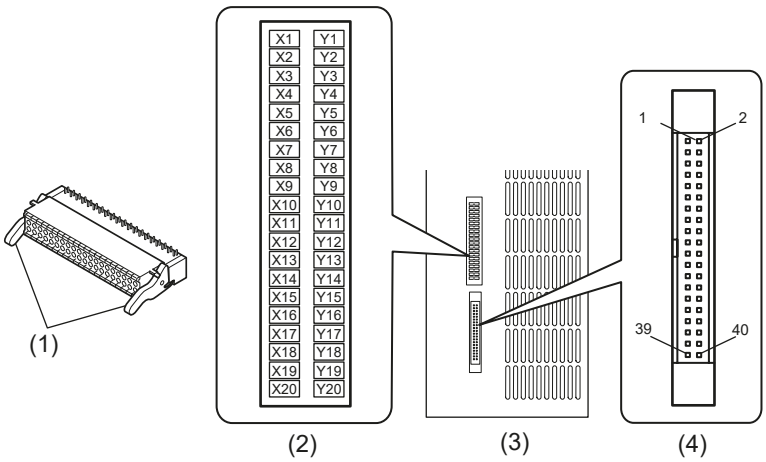
4.1 Functional overview

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 I/O 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 CONNECTOR 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 112).



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

(2) Connector labeled I/O TERMINAL

(3) Rear of the controller

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

Connector product numbers

Connector	Type	Model	Manufacturer
I/O TERMINAL connector on controller	Special connector	15EDGRHCM-THR-3.5-40P-1	Degson Electronics Co., Ltd
Removable I/O terminal block for I/O 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.

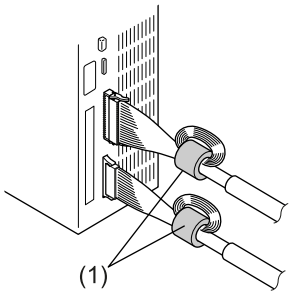
Notice

- 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 I/O TERMINAL connector

4.2.1 Overview

The connector labeled I/O 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 I/O 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	MAINTENANCE OUT
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 I/O 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 I/O 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.

Related topics

Factory setting of the jumper wires (page 147)

Wiring (page 147)

4.2.2 Input signals

The I/O 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 I/O 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 I/O 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 148).

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 118).

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 189).

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 133).

X12 OUT COM. 1: Output common 1

This is one of two common terminals for all outputs of the I/O 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 133).

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 91) and Connecting safety devices (page 150).

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 I/O 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 I/O 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 148).

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 I/O 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
- The autofocus function is used and the workpiece displacement is input by the external displacement sensor
- 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.

During guide laser radiation, SHUTTER CLOSE 1 OUT is ON and SHUTTER CLOSE 2 OUT is OFF.

During the measurement or correction by the power check function, SHUTTER CLOSE 1 OUT is OFF and SHUTTER CLOSE 2 OUT is ON.

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 includes the trigger delay time, marking preparation time, laser radiation time, and processing time after marking is completed.

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 MAINTENANCE OUT: Maintenance output

If “Announcement” is selected on the “Maintenance” screen, this output turns on when the internal parts of the laser marking system have reached the recommended operating time or number of switching cycles.

Y14 WARNING OUT: Warning output

This output turns off if there is a warning.

For a list of errors, refer to Troubleshooting (page 254).

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 254).

Y16 INTERLOCK 1 MONITOR: Interlock monitor output 1

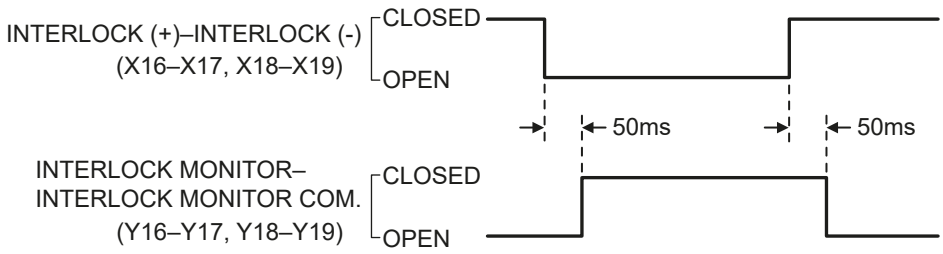
Y17 **INTERLOCK 1 MONITOR COM.:** Interlock monitor common 1
Y18 **INTERLOCK 2 MONITOR:** Interlock monitor output 2
Y19 **INTERLOCK 2 MONITOR COM.:** Interlock monitor common 2

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 145).

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 CONNECTOR 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 I/O 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 I/O 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 148).

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 189).

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 I/O 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 148).

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, target detection, and marking energy limit values.

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.

Marking energy limit values [mJ]: When upper and lower limit values are set in advance, the check result is output when marking is completed. When the marking energy is in the specified range, CHECK OK OUT (34) turns on. If the marking energy is not in the specified range or if the measurement fails due to a marking interruption caused by an error, CHECK NG OUT (35) turns on. When no limit values are set, the output is disabled.

If multiple applications use the check OK and check NG outputs simultaneously, the check OK output turns on when all functions are judged OK.

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
- Input from an external displacement sensor when the autofocus function is used

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

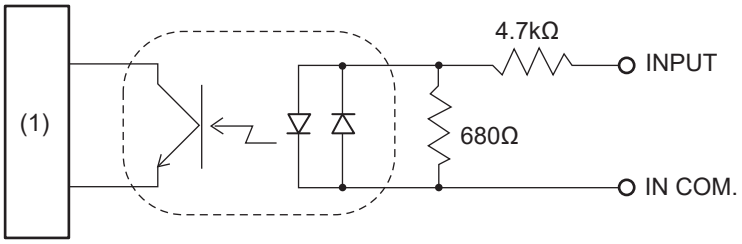
4.4.1 Inputs

The input ratings and circuit diagrams apply to both, I/O 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 145).

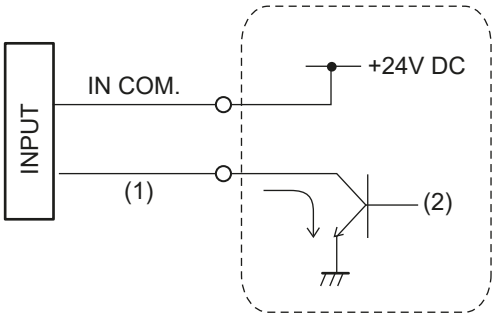
Item	Description
Input type	Bidirectional optocoupler (insulated)
Input ON voltage	Voltage difference between input and input common: ≥19V
Input OFF voltage	Voltage difference between input and input common: ≤3V or open
Rated input voltage	+24V DC ±10%

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



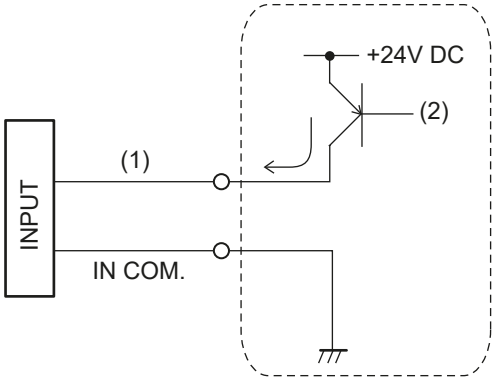
(1) Internal circuit

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 I/O 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.

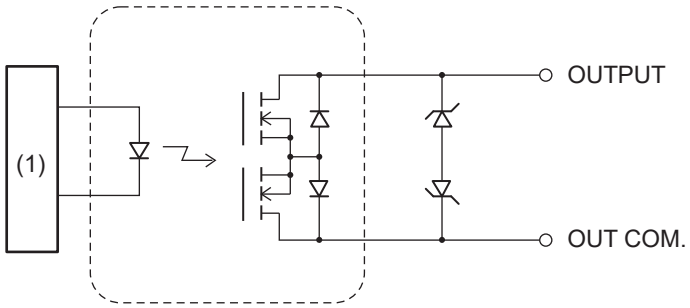
4.4.2 Outputs

The output ratings and circuit diagrams apply to both, I/O 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 145).

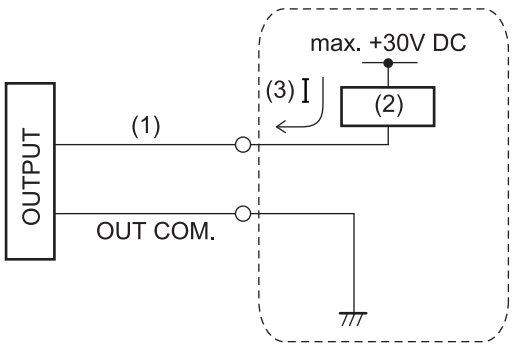
Output ratings	I/O TERMINAL	I/O CONNECTOR
Output type	NPN/PNP optocoupler (insulated)	
Short-circuit protection	—	
Max. load current	50mA	20mA
Max. load voltage	+30V DC	
Residual voltage	≤2.0V DC	

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

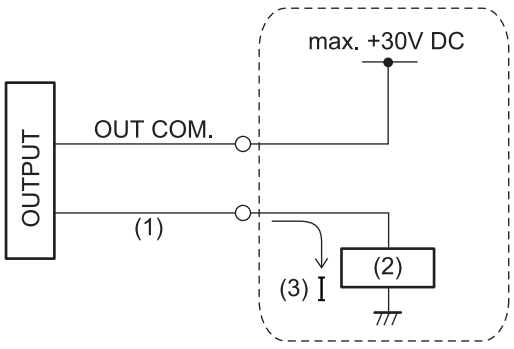


(1) Internal circuit

NPN sample circuit:



PNP sample circuit:



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

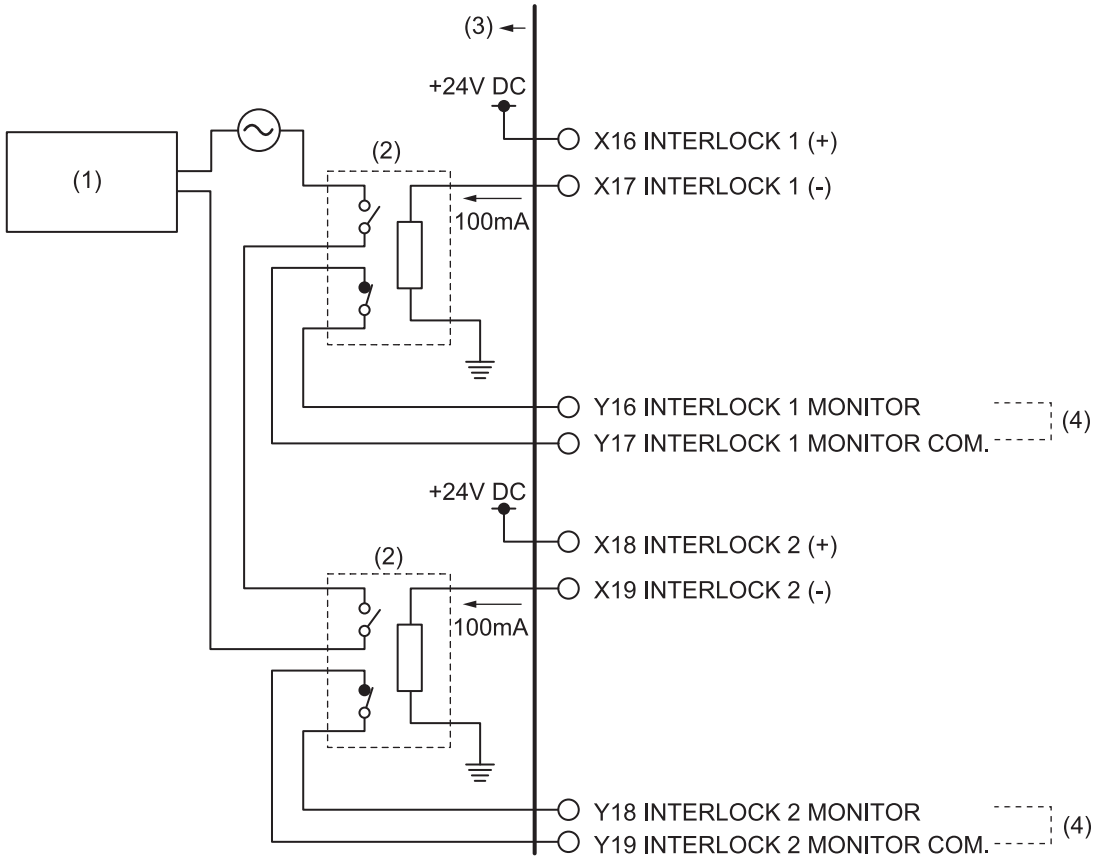
INTERLOCK 1 MONITOR (Y16)

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 I/O 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 150)

4.5 Wiring

When you connect external devices to the I/O 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.

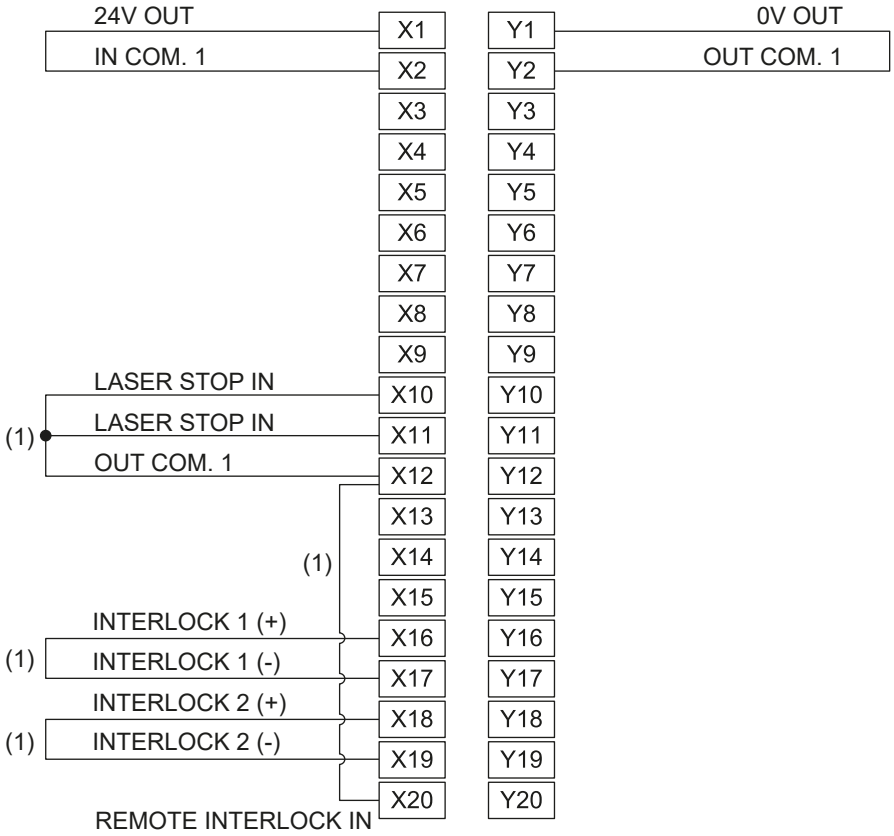
⚠ WARNING

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 I/O 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 148)

4.5.2 Wiring of the common terminals

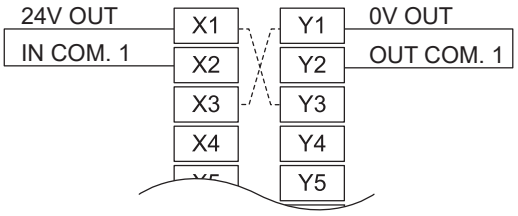
Connect the common terminals IN COM. 1 (X2) and OUT COM. 1 (Y2) to the internal or external power supply of the inputs and outputs. On the I/O CONNECTOR, use IN COM. 2 and OUT COM. 2 respectively.

Notice

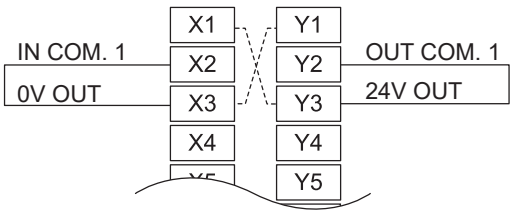
- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. 1 (X2) and OUT COM.1 (Y2, X12). Starting the laser marking system with these terminals short-circuited will cause the laser marking system to malfunction.
- Do not mix internal and external power supply.
-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

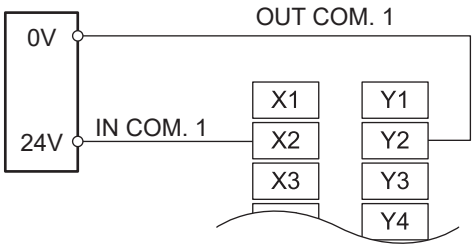


Dotted lines indicate internal connections.

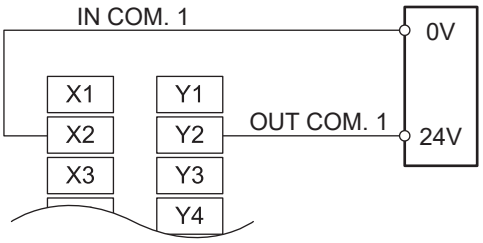
When connecting the internal power supply to IN COM. 1 and OUT COM. 1, use the jumper wires included in the product package.

External power supply

NPN:



PNP:



Note

The common terminals of the connectors I/O 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

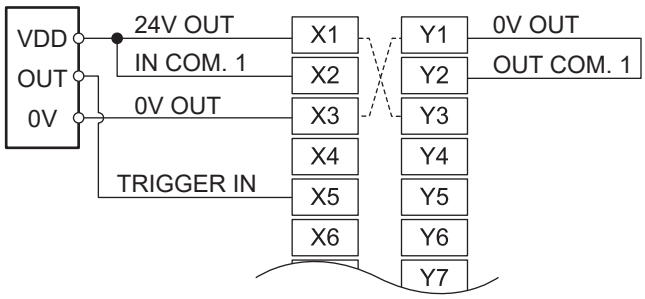
In this example, a sensor is used to input the marking trigger.

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

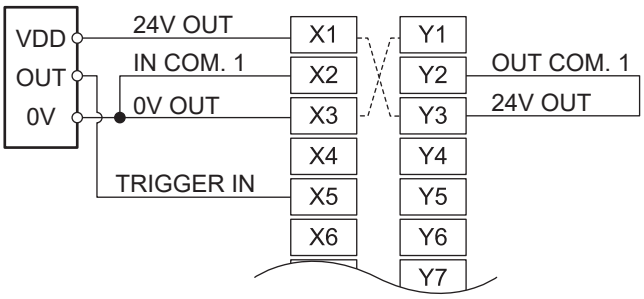
Depending on the connection method (NPN or PNP), the input common must be connected to either the positive pole (24V OUT) or the negative pole (0V OUT) of the internal power supply.

Dotted lines indicate internal connections.

NPN:



PNP:



4.5.4 Connecting safety devices

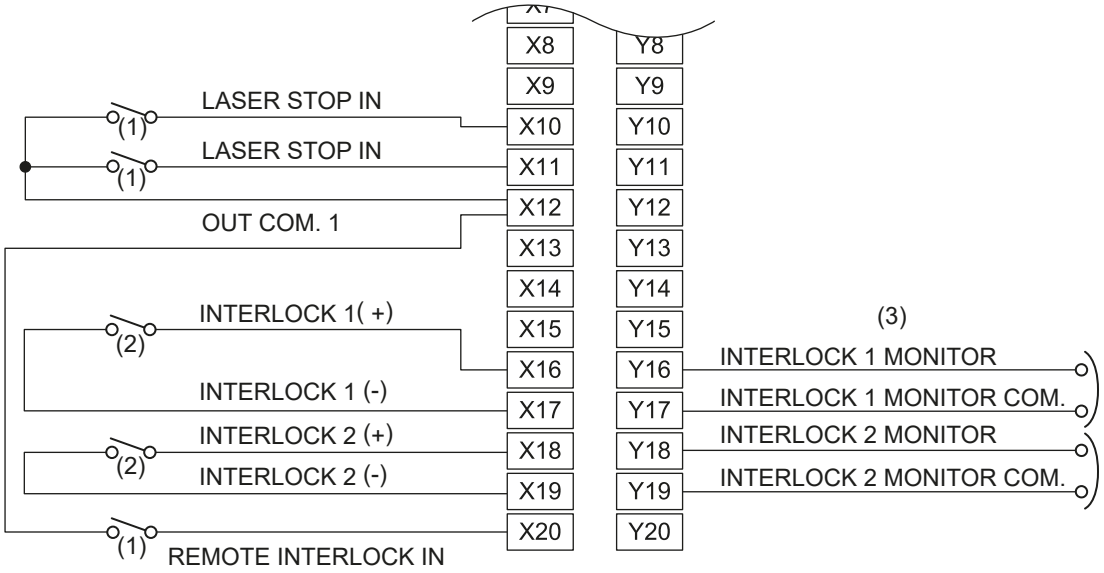
The I/O TERMINAL connector is equipped with terminals to connect safeguards, such as a safety switch of an access panel or an emergency stop button. If any of the terminals is not connected (OPEN), the safety function is activated and laser radiation is interrupted.

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 145)

Behavior of the safety functions under fault condition (page 133)

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

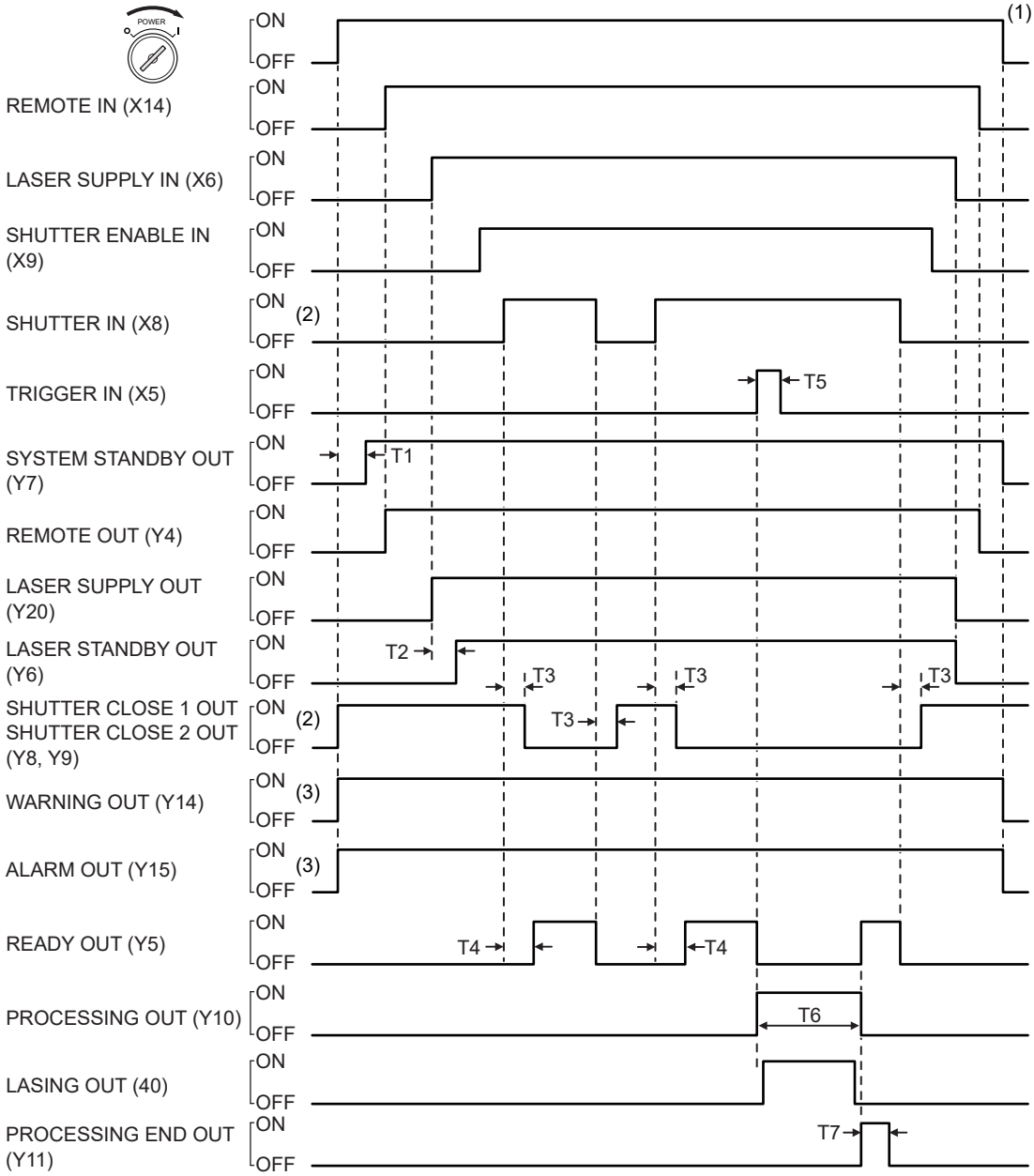
The timing charts show typical signal sequences when controlling the laser marking system by I/O signals.

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

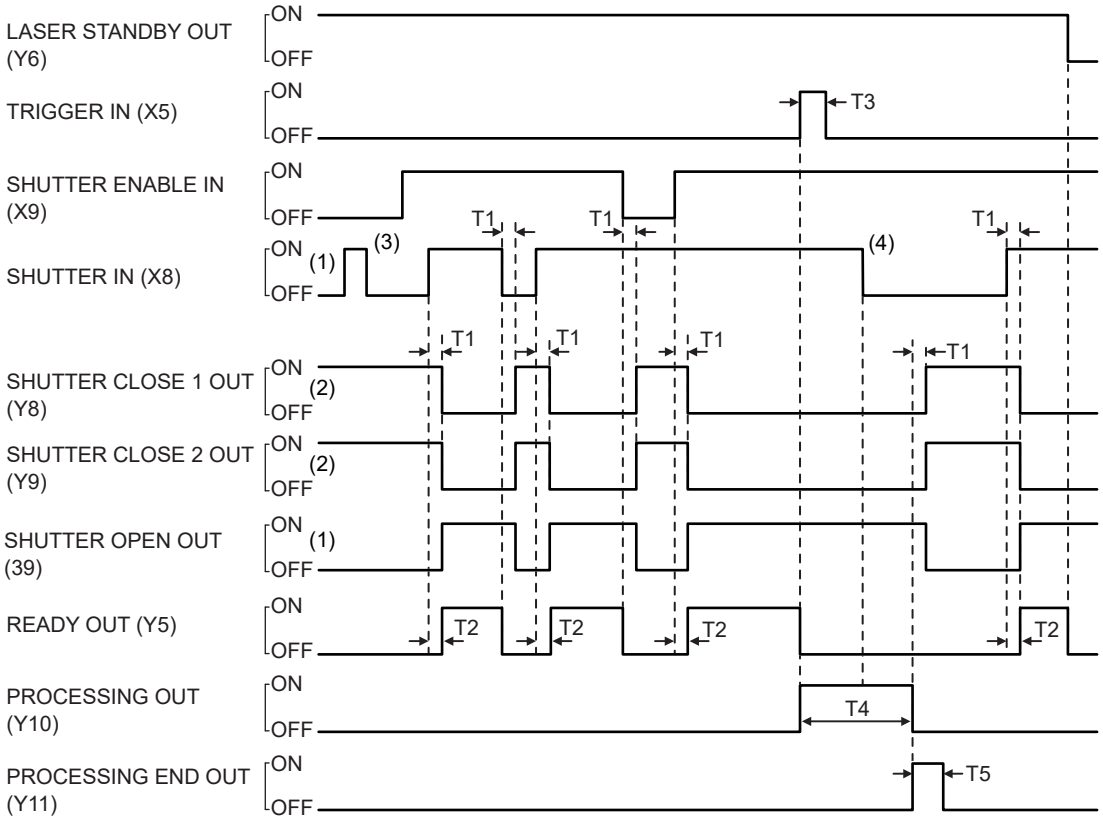
(3) ON = normal, OFF = error

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 includes the trigger delay time, marking preparation time, laser radiation time, and processing time after marking is completed.
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

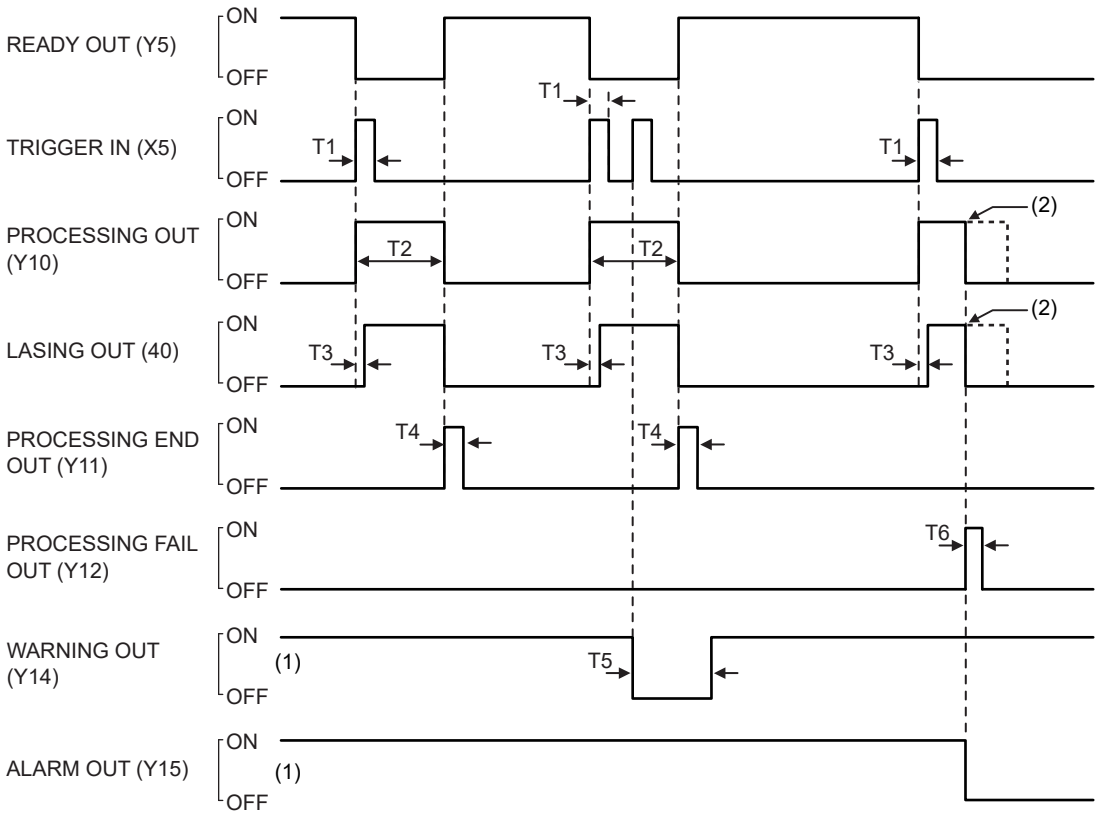
(3) SHUTTER IN turns on, but the shutter only opens when SHUTTER ENABLE IN is ON.

(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 includes the trigger delay time, marking preparation time, laser radiation time, and processing time after marking is completed.
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

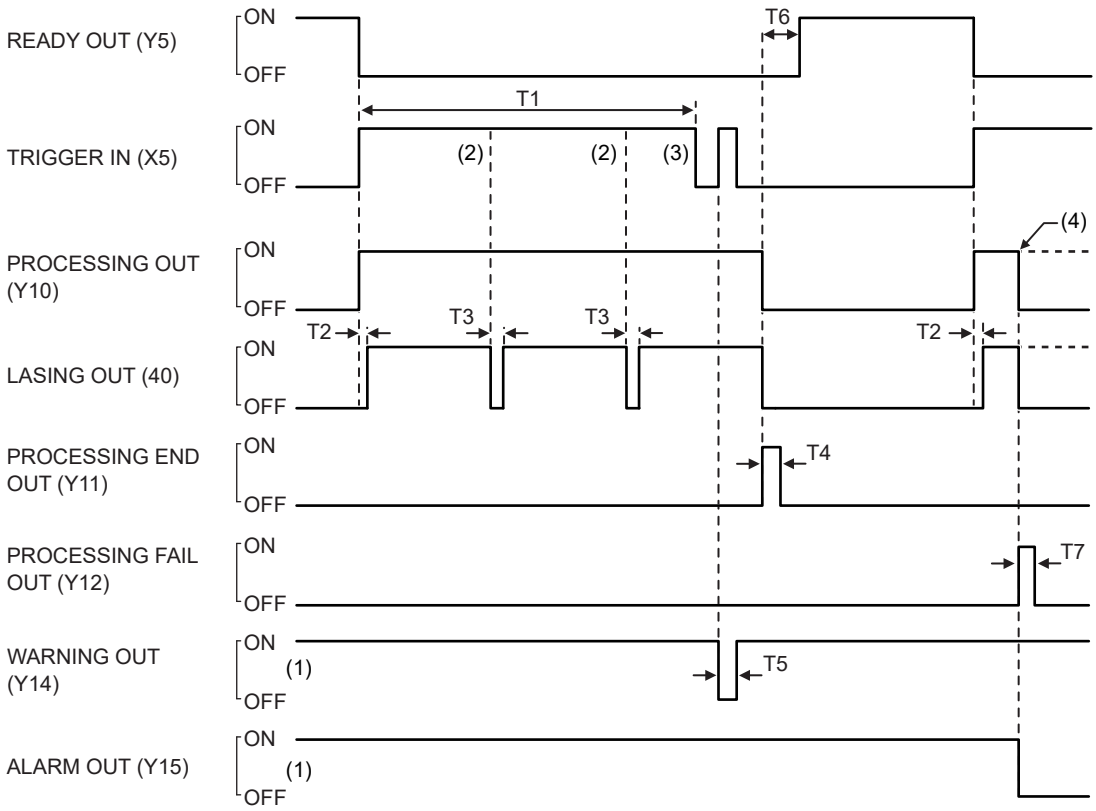
T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It includes the trigger delay time, marking preparation time, laser radiation time, and processing time after marking is completed.
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.

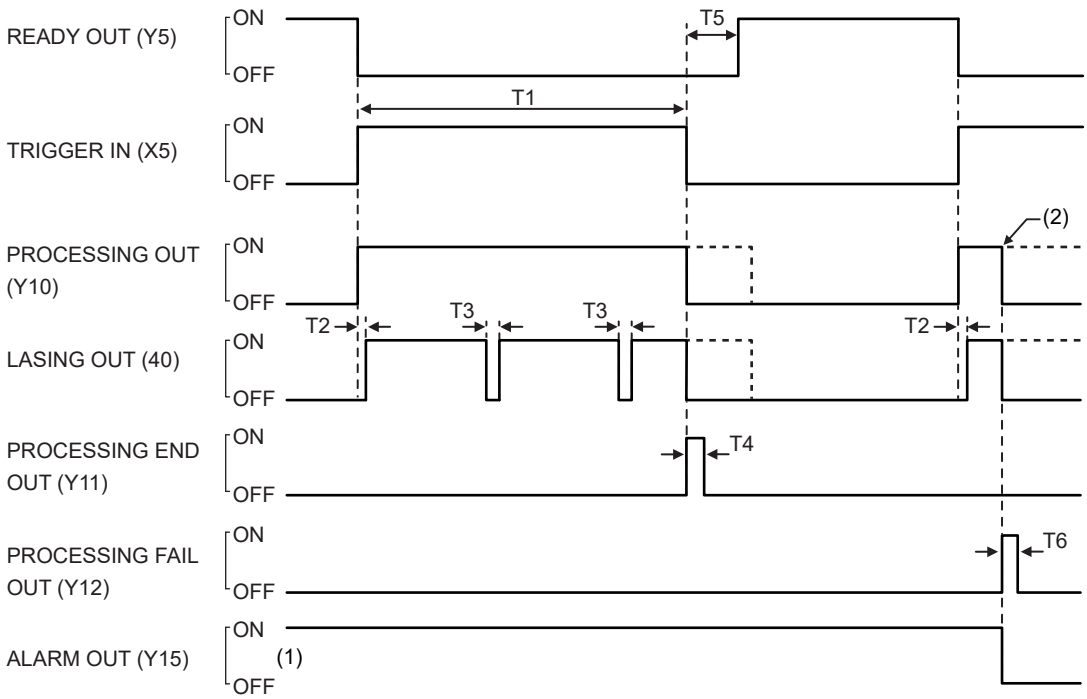
“Allow to stop halfway” deactivated (default setting)



(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

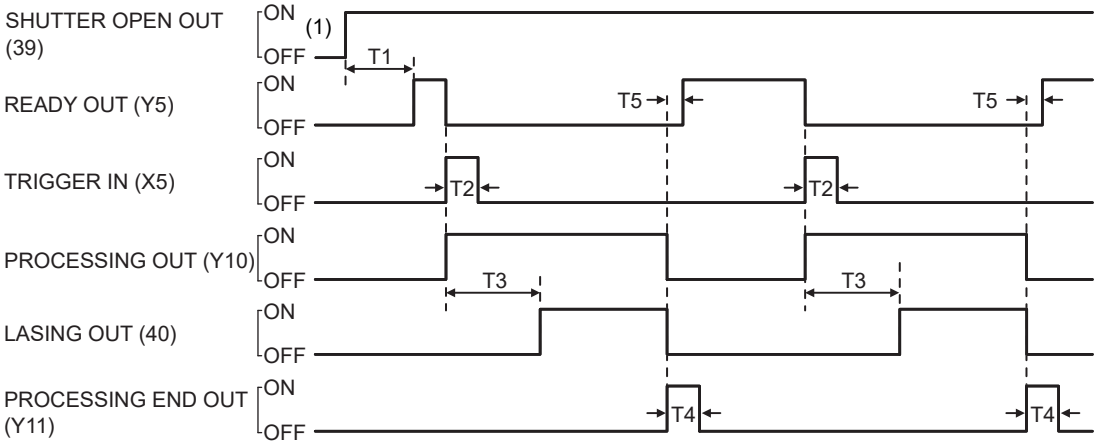
T1	≥2ms	Keep the ON status for the entire duration of the repeated lasing processes.
T2	0–9999ms	If a trigger delay time is set in the selected file, trigger processing (the lasing process) starts after the delay time.
T3	0–60s	If a scan interval is set, the next lasing process starts after the specified 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

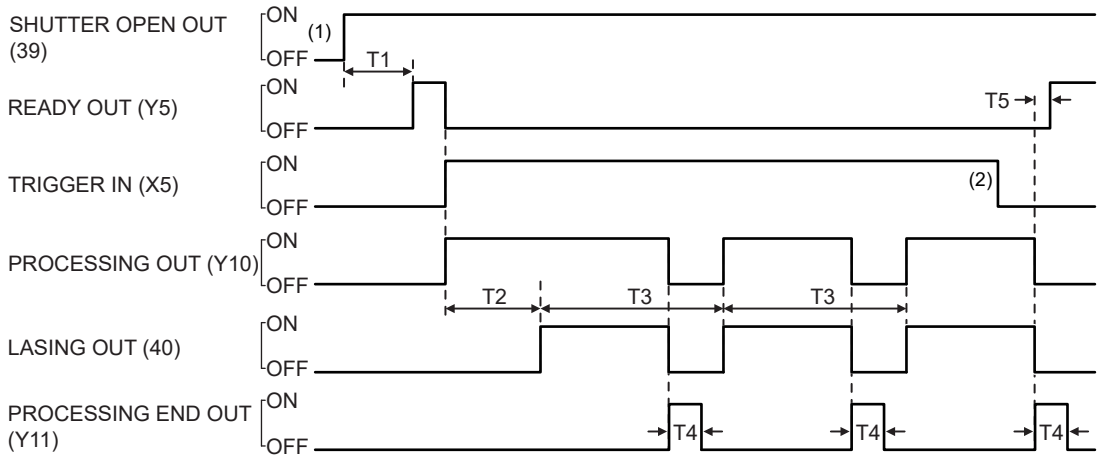
T1	—	Time for generating the next marking data (depends on data quantity).
T2	≥2ms	Keep the ON status for 2ms or more.
T3	—	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T4	2–510ms	This output signal indicates that trigger processing has been completed 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.

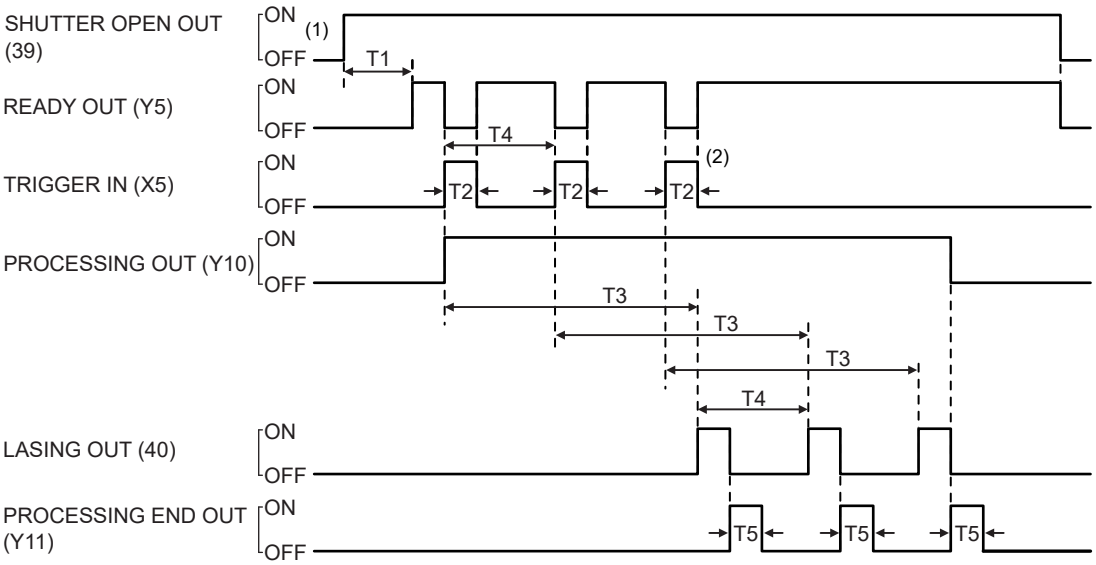
T1	—	Time for generating the next marking data (depends on data quantity).
T2	—	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T3	—	Time needed to cover the specified workpiece spacing [mm].
T4	2–510ms	This output signal indicates that trigger processing 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

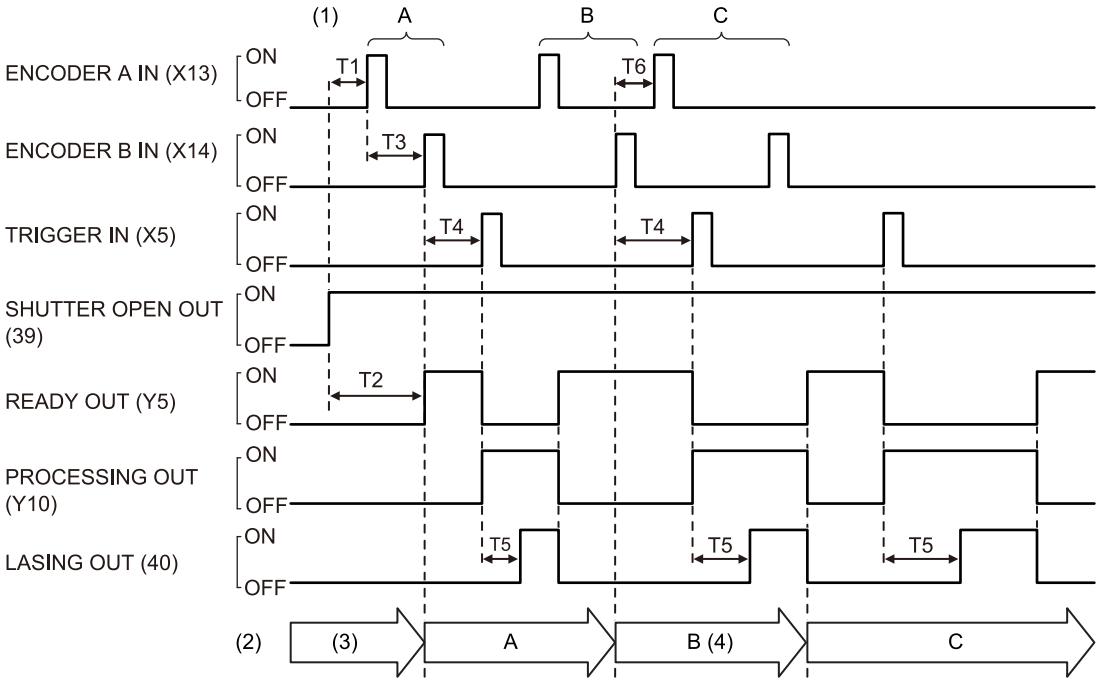
If the counter is reset during on-the-fly marking, the next marking process cannot be executed due to warning E751.

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.

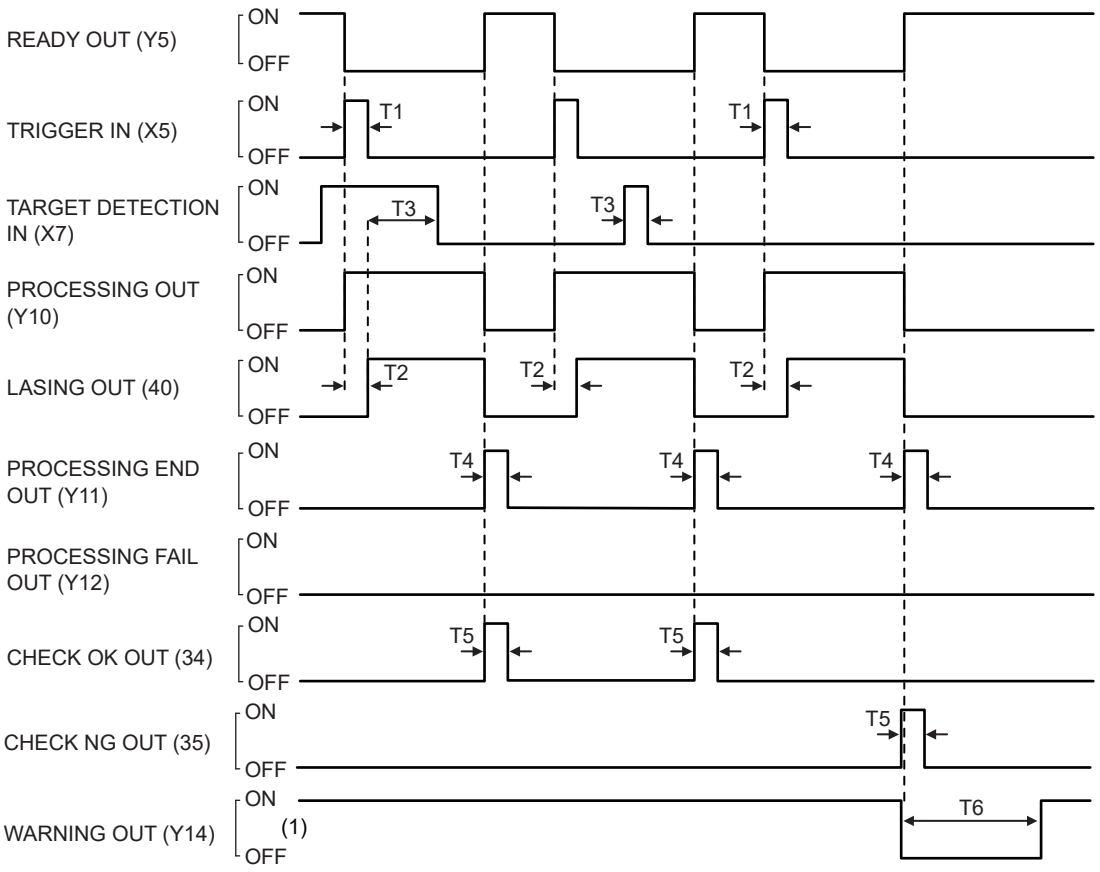
T4	1–10s	If TRIGGER IN (X5) does not turn on within the set timeout period from turning on ENCODER B IN (X14), warning E607 is output. The timeout setting is optional.
T5	—	Time from when TRIGGER IN (X5) turns on until the workpiece comes to the preset marking position.
T5	≥0ms	ENCODER A IN (X13) can 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.

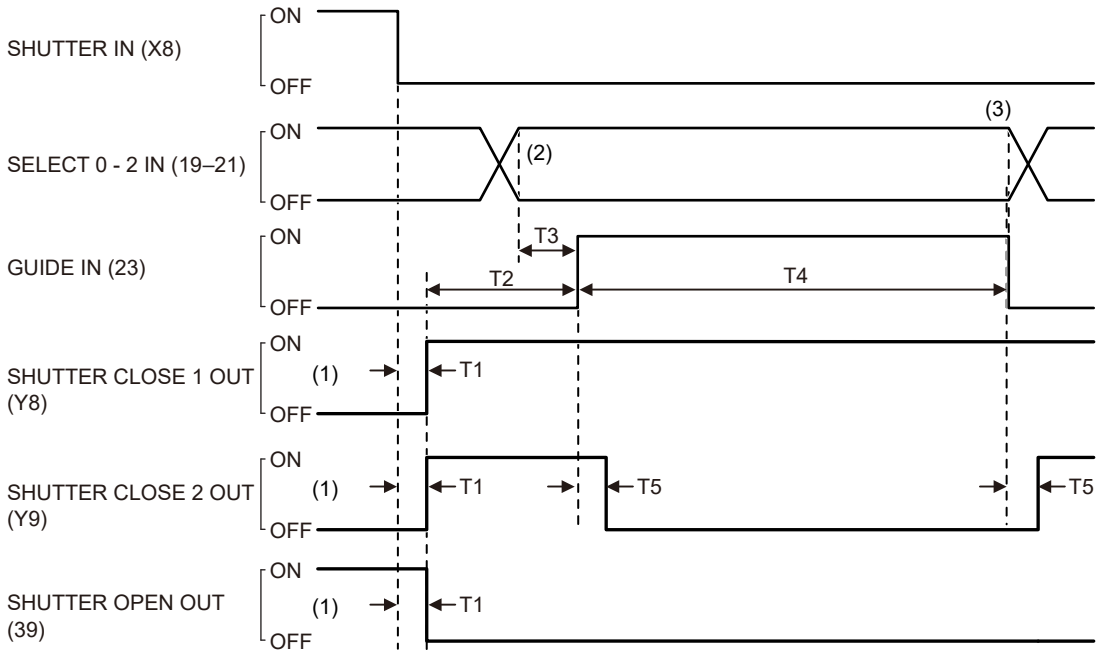
T3	≥1ms	When TARGET DETECTION IN (X7) turns on for more than 1ms while LASING OUT (40) is ON, target detection is judged successful.
T4	2–510ms	This output signal indicates that trigger processing has been completed normally. PROCESSING END OUT (Y11) turns on even when the workpiece could not be detected. 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.

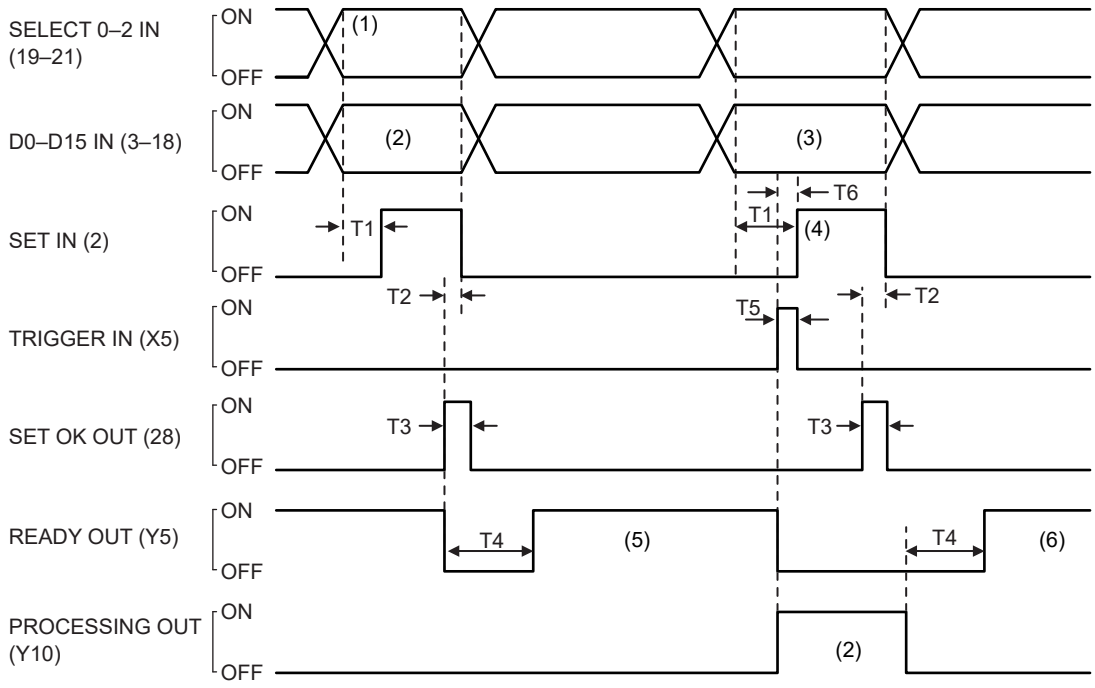
T1	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T2	≥0ms	Turn on GUIDE IN (23) with the shutter closed.
T3	≥0.5ms	After you turned on 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.
T5	≤1s	There is a delay time of ≈200ms to max. 1s from turning on/off GUIDE IN (23) to turning on/off SHUTTER CLOSE 2 OUT (Y9).

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.
- During guide laser radiation, SHUTTER CLOSE 1 OUT is ON and SHUTTER CLOSE 2 OUT is OFF.

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

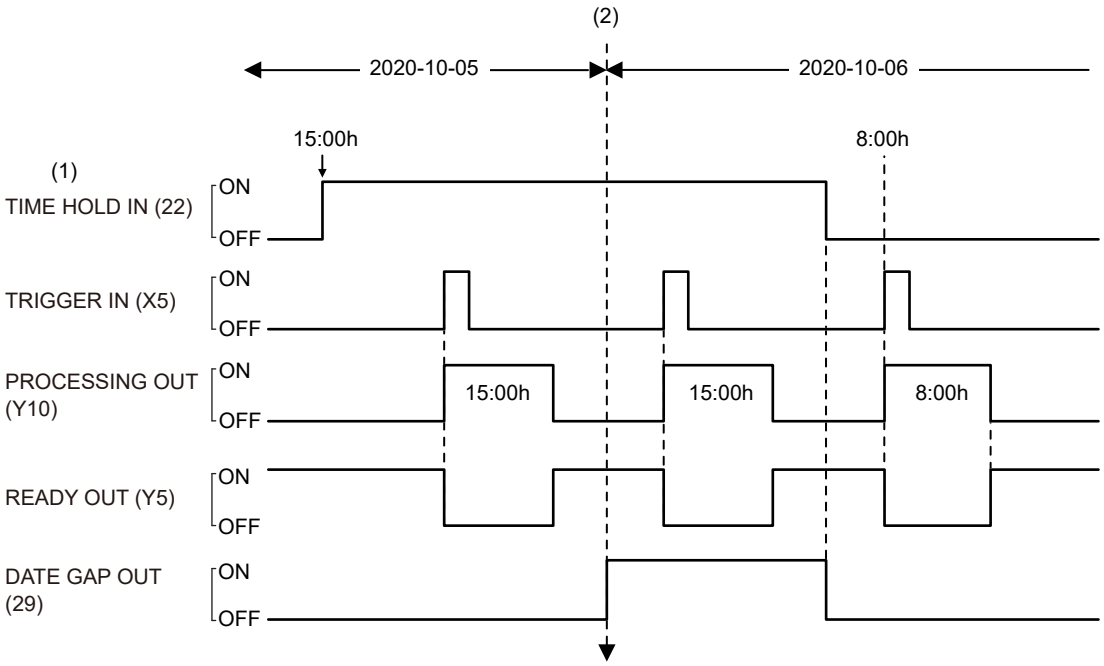
T1	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN and D0 IN to D15 IN, wait for at least 0.5ms to turn on SET IN (2).
T2	≥0ms	Keep the state of the input until SET OK OUT (28) turns on.

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”.

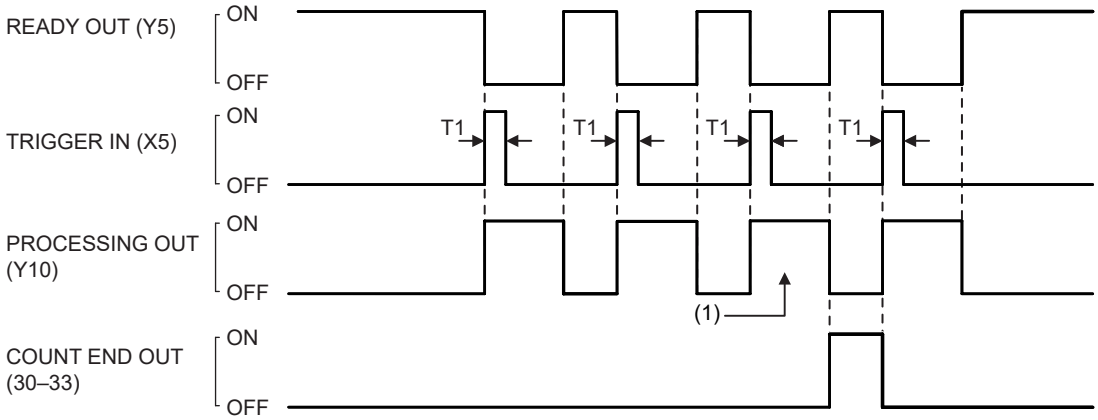
(2) When the date changes, the retained time and date are marked until TIME HOLD IN turns off.

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

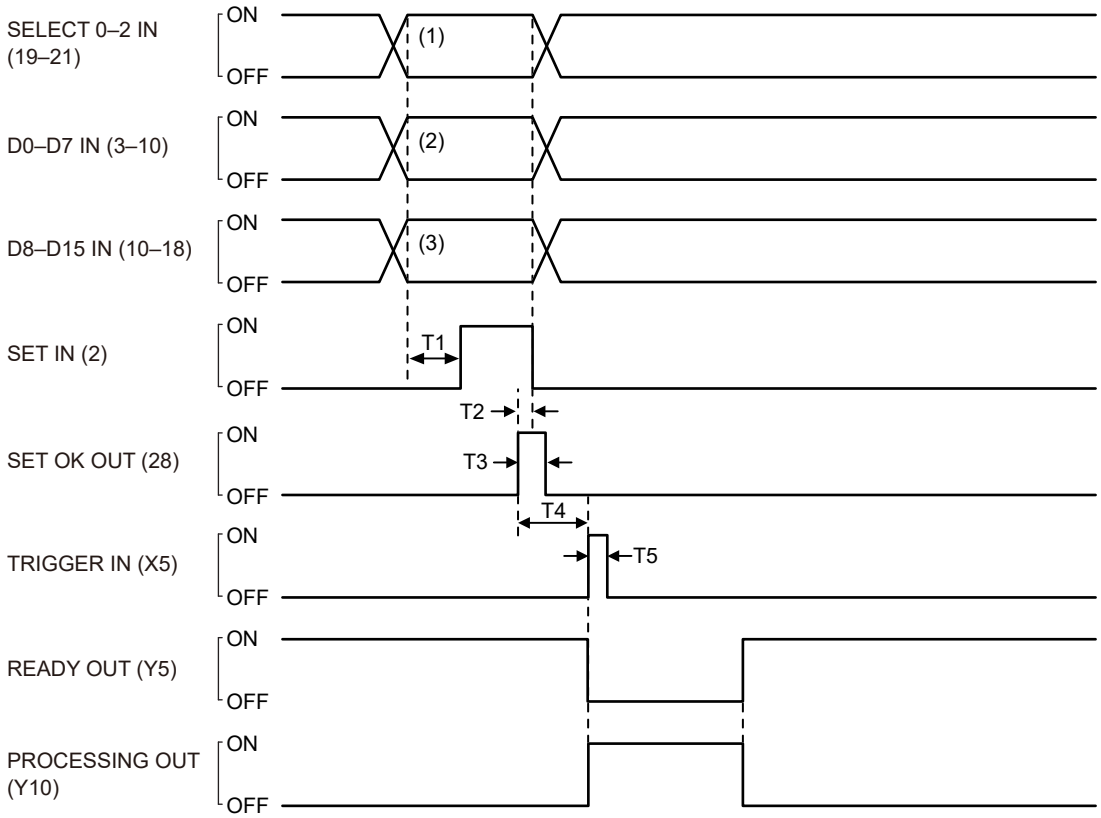
T1	≥2ms	Keep the ON status for 2ms or more.

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 135).

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.

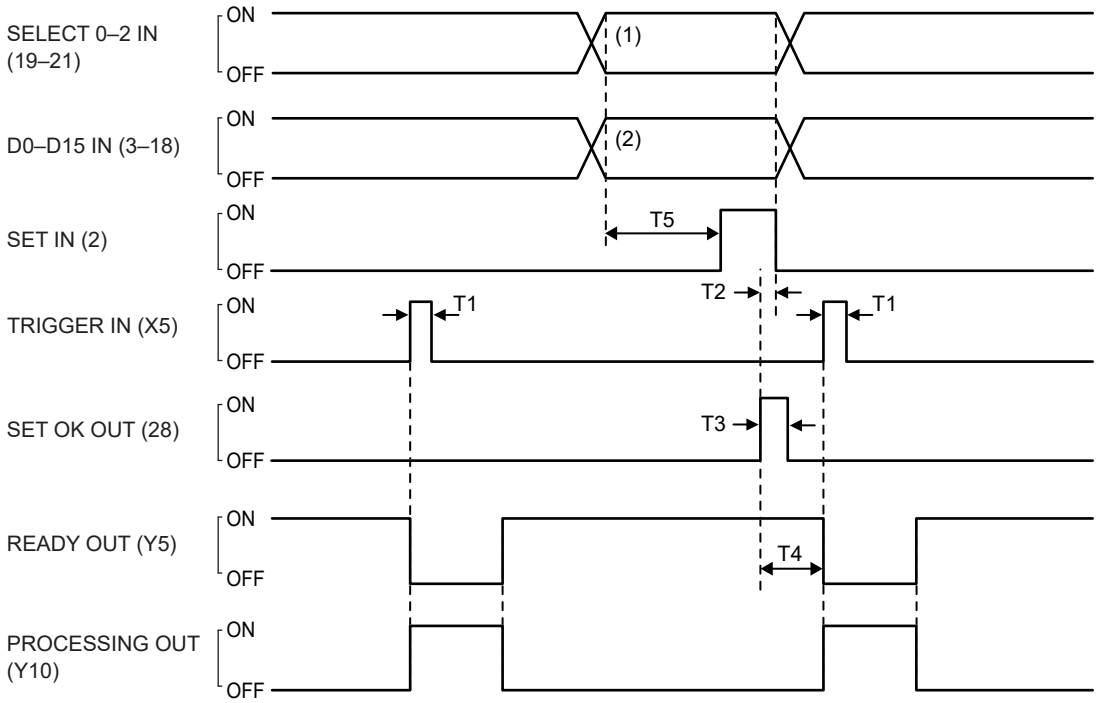
Note

- 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 135).

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.

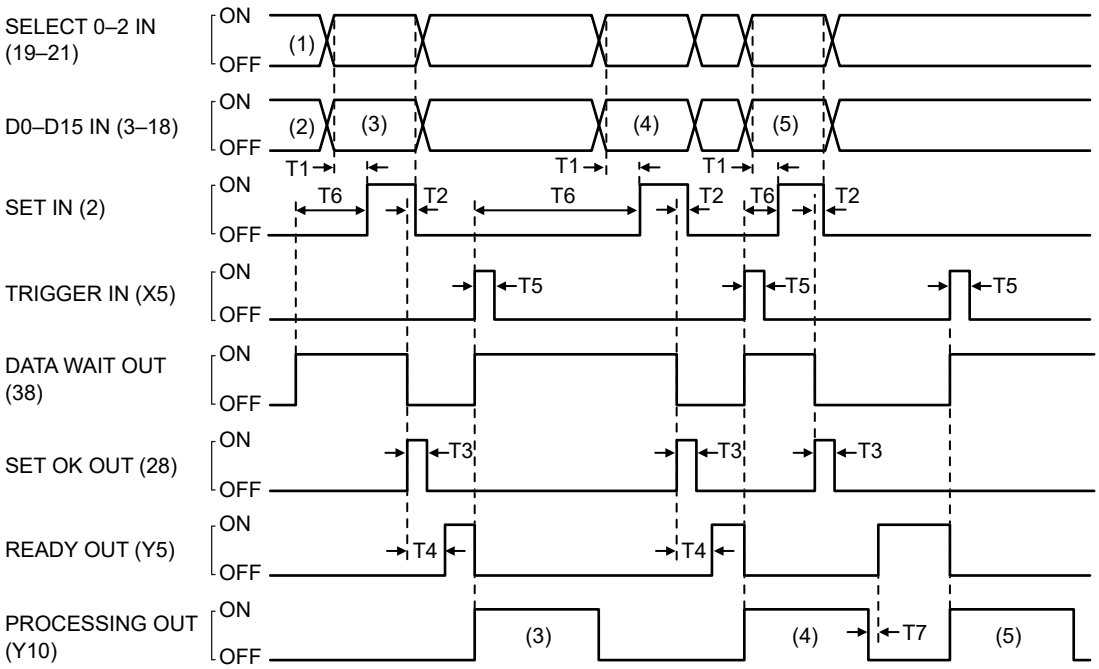
T4	≥0ms	Turn on TRIGGER IN (X5) after SET OK OUT (28) turns on.
T5	≥0.5ms	After you turned on SELECT 0 IN to SELECT 2 IN and D0 IN to D15 IN, wait for at least 0.5ms to turn on SET IN (2).

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 135).

(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.

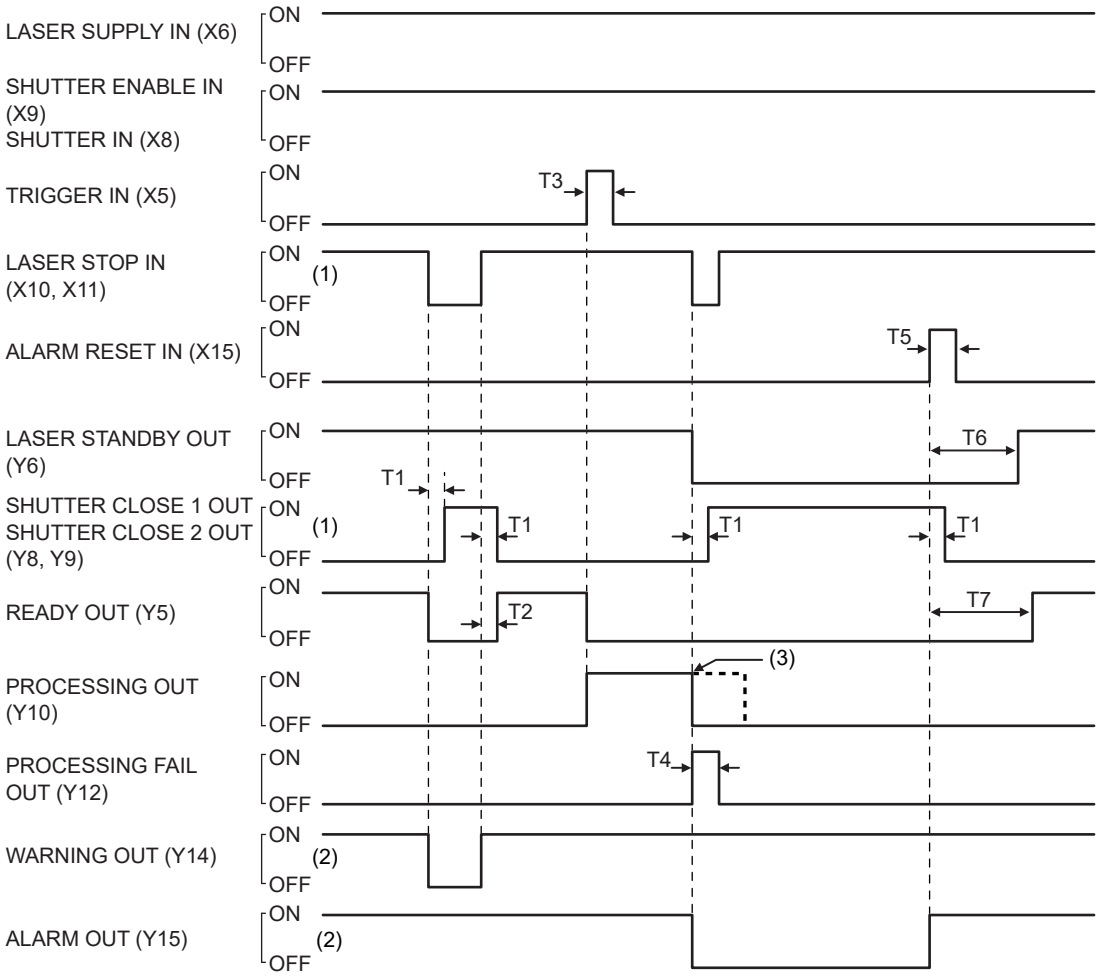
T4	—	Time for generating the next marking data (depends on data quantity).
T5	≥2ms	Keep the ON status for 2ms or more.
T6	≥0ms	Turn on SET IN (2) after DATA WAIT OUT (38) turns on.
T7	—	If data generation finishes within the processing time, READY OUT (Y5) turns on after max. 1ms. Otherwise, this is 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.

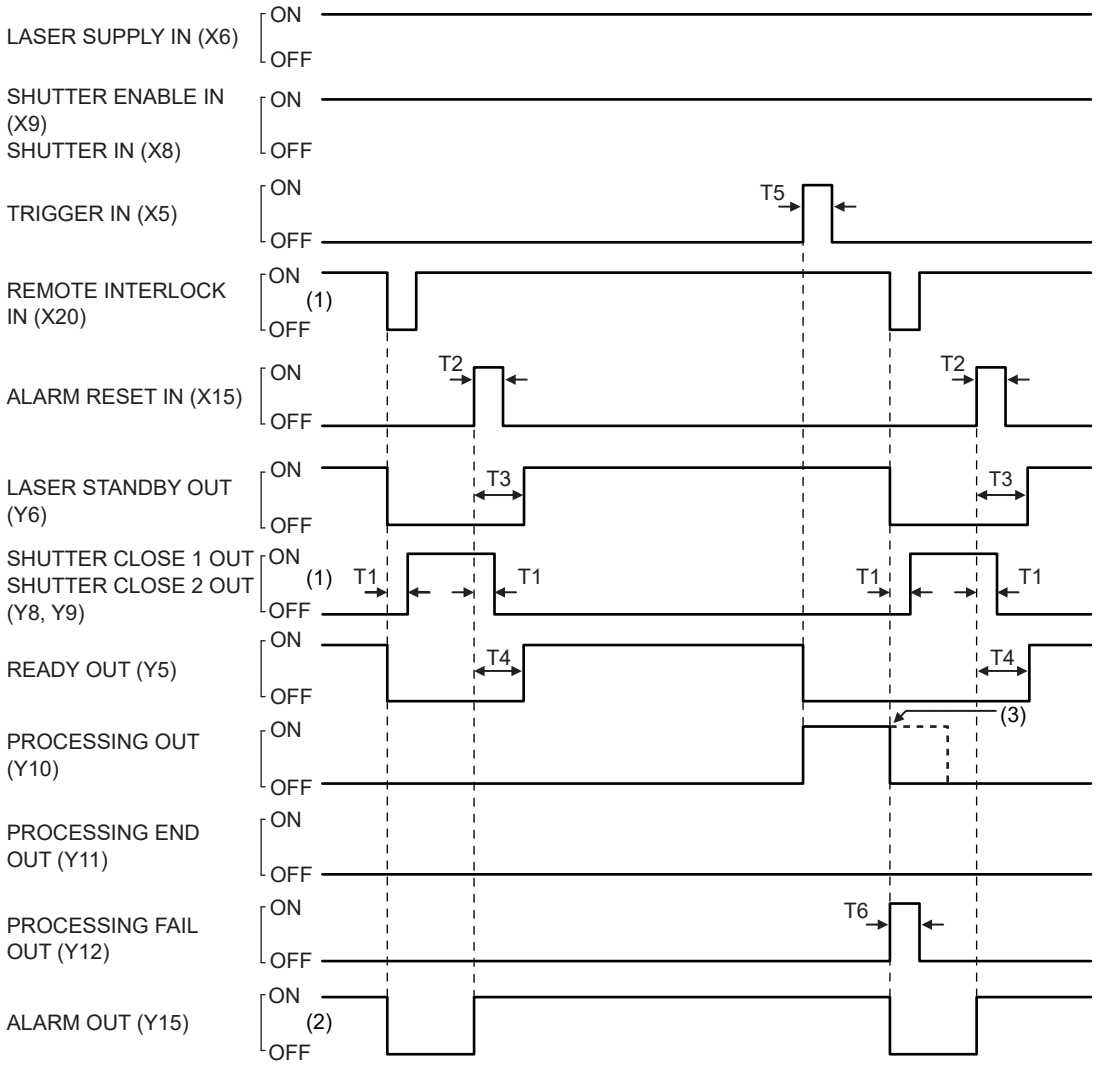
T6	≈1–2s	Laser pumping takes ≈1s from start-up to completion and max. 2s when laser pumping is restarted immediately after it was turned off.
T7	—	Total time for shutter opening and marking data generation, or time for laser pumping, whichever is longer.

Related topics

Behavior of the safety functions under fault condition (page 133)

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

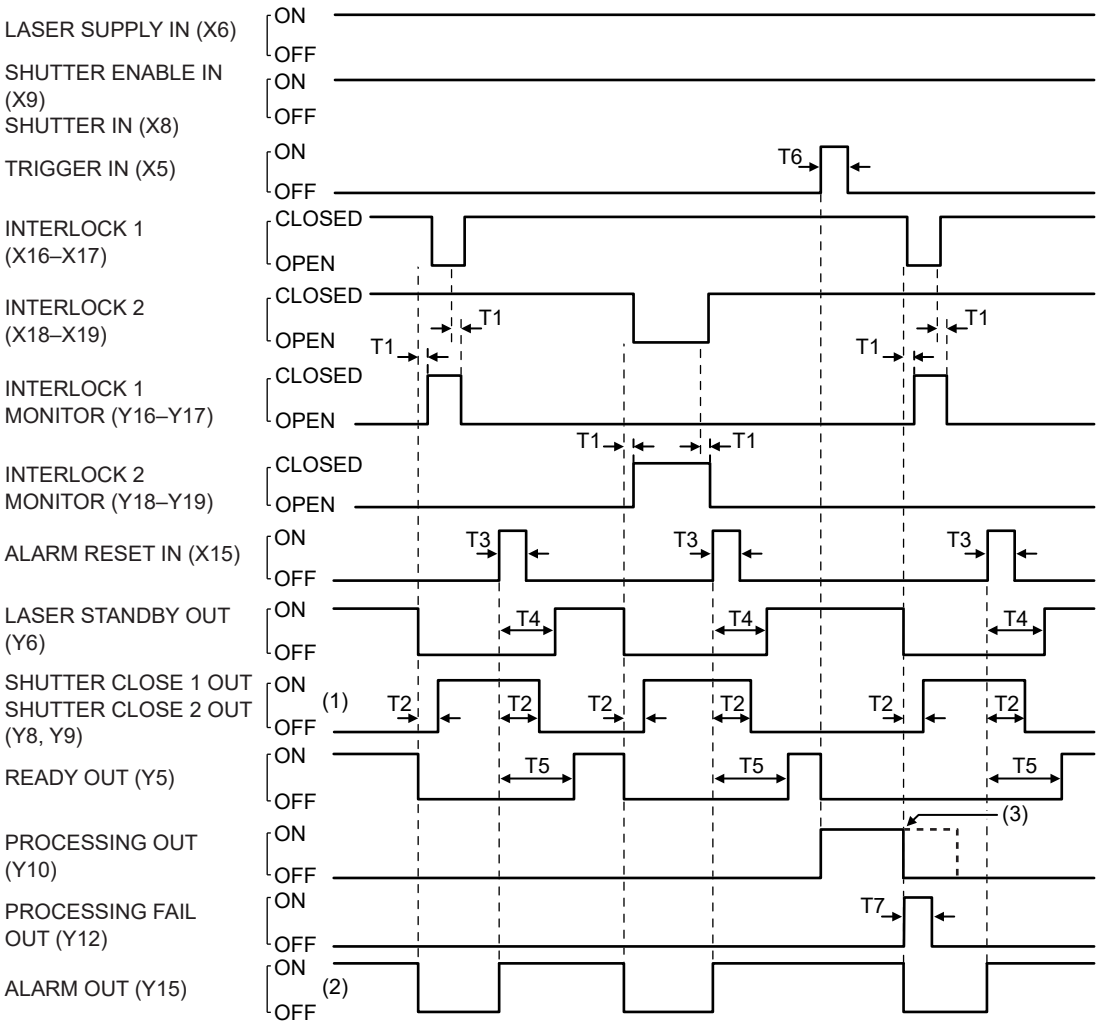
T1	≤1s	There is a delay of ≈200ms to max. 1s between the shutter open input signal (X8) and the shutter closed output signals. The two shutter outputs are turned on by the same operation with a small margin of error.
T2	≥100ms	Keep the ON status for 100ms or more.
T3	≈1–2s	Laser pumping takes ≈1s from 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 133)

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.

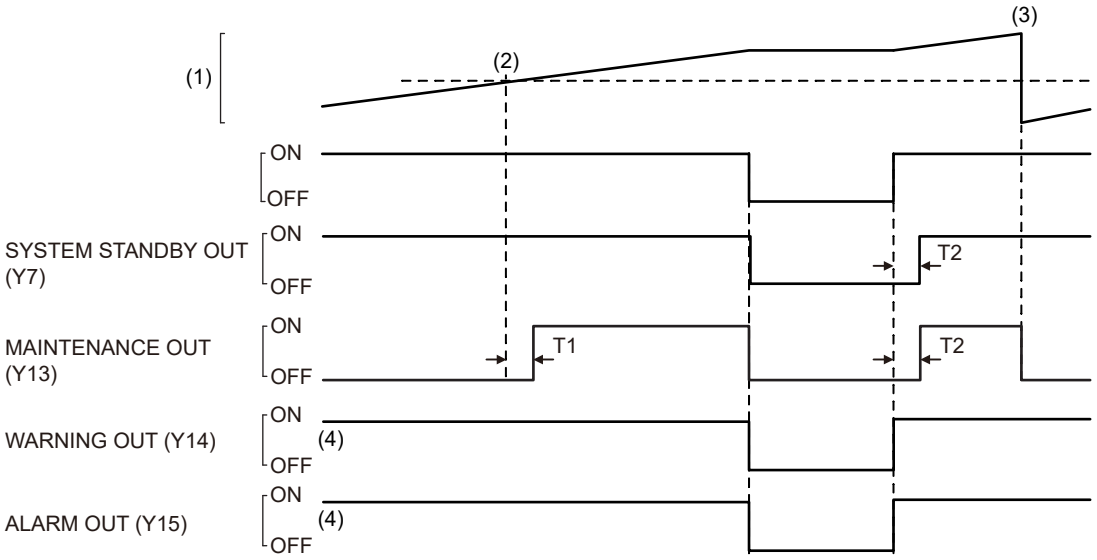
T6	≥2ms	Keep the ON status for 2ms or more.
T7	2–510ms	The output is ON for the set one-shot pulse duration. Set the one-shot pulse duration in the “System settings”. There is a small error margin for the setting value.

Related topics

Behavior of the safety functions under fault condition (page 133)

4.6.20 Maintenance output

The maintenance output turns on if the specified operating time or number of operations have been reached for a maintenance part.



(1) Maintenance criterion (operating time or number of operations)

(2) MAINTENANCE OUT (Y13) turns on when the maintenance criterion is reached.

(3) When the completion of the maintenance is entered in the “Maintenance” screen of Laser Marker NAVI smart, the operating time and the number of operations are reset.

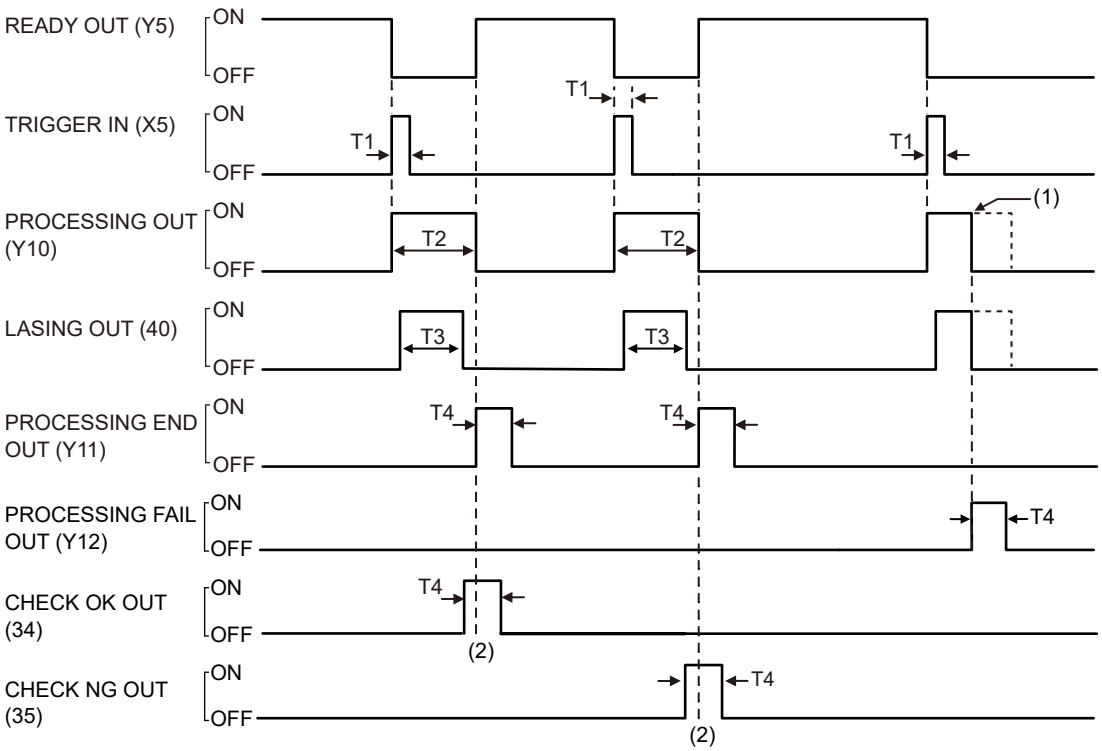
T1	≤1s	There is a delay of max. 1s from when the maintenance criterion is reached to the instant when MAINTENANCE OUT (Y13) turns on.
T2	≤10s	Time from system startup. If a maintenance part has reached the maintenance criterion when the system starts, MAINTENANCE OUT (Y13) turns on simultaneously with SYSTEM STANDBY OUT (Y7).

Note

- The ON/OFF status of MAINTENANCE OUT (Y13) does not affect the status of READY OUT (Y5).
- When the laser radiation time and the number of shutter cycles reach the maintenance time, contact our service center or sales offices to arrange for maintenance and replacement.

4.6.21 Marking energy check

To monitor the marking quality, upper and lower limits of the marking energy can be monitored.



(1) Marking interruption

(2) CHECK OK OUT (34)/CHECK NG OUT (35) turns on before PROCESSING OUT (Y10) turns off.

T1	≥2s	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 includes the trigger delay time, marking preparation time, laser radiation time, and processing time after marking is completed.
T3	—	The laser radiation time varies depending on the marking image.
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.

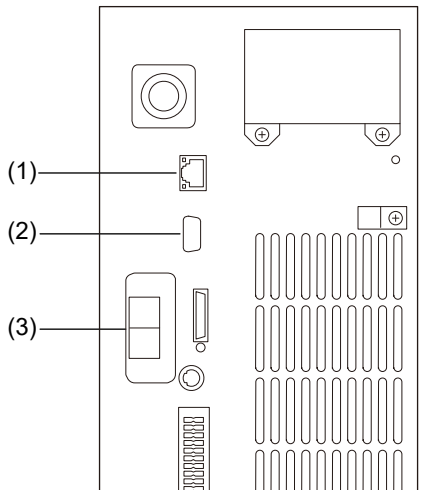
Note

- If the marking is interrupted due to an error, CHECK OK OUT (34)/CHECK NG OUT (35) do not turn on.

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”.

If the optional expansion board is installed to the controller, there is a port labeled "INFO LAN" which is not used in this product. Do not connect anything.

Related topics

RS-232C connection (page 180)

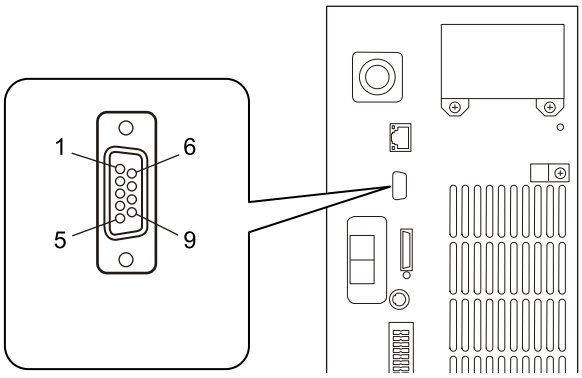
Ethernet connection (page 183)

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 181)

5.2.2 RS-232C wiring

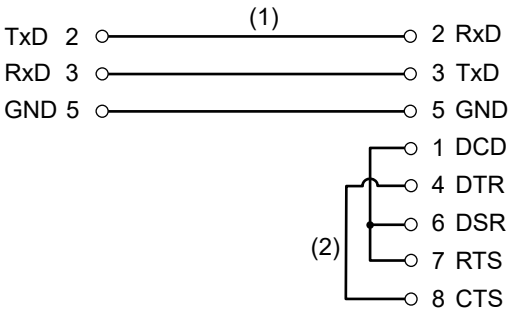
The laser marking system only uses the three lines TxD, RxD, and GND.

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 180)

Specify RS-232C communication settings (page 116)

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 or LP-M/S/Z 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” or “Serial Communication Command Guide: LP-M/S/Z compatible mode”.

Related topics

Specify the command format (page 115)

Specify RS-232C communication settings (page 116)

5.3 Ethernet connection

5.3.1 Ethernet interface

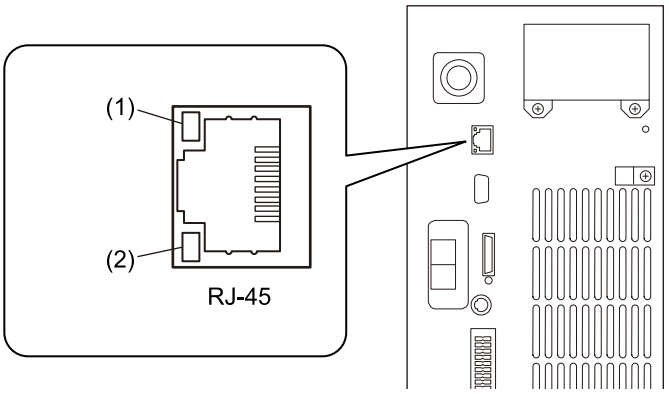
Use the Ethernet interface on the rear of the controller to connect a PC or other external devices.

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 184)

Connect multiple devices to the Ethernet interface (page 184)

Ethernet specifications for command control (page 186)

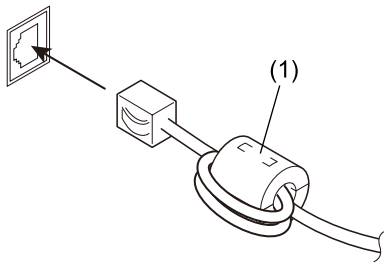
Specify Ethernet communication settings (page 117)

Establish an Ethernet connection between PC and laser marking system (page 87)

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.

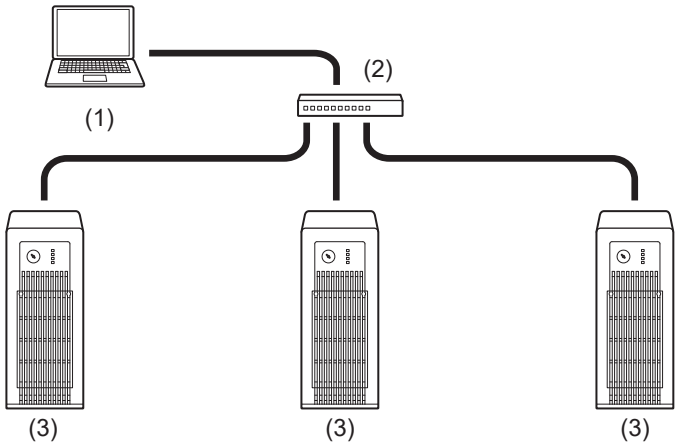
5.3.3 Connect multiple devices to the Ethernet interface

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 87)

Configuring the operation by external devices (page 112)

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 or LP-M/S/Z 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” or “Serial Communication Command Guide: LP-M/S/Z compatible mode”.

Related topics

Specify the command format (page 115)

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

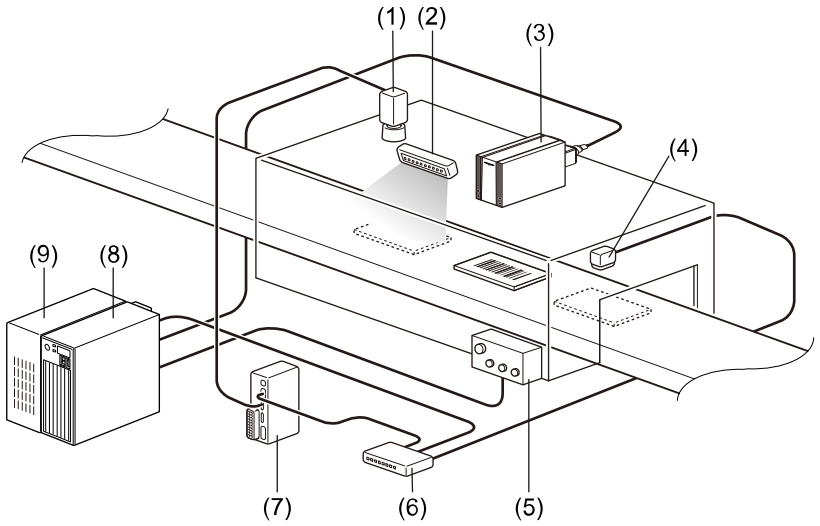
  After marking, the imagechecker's camera reads the marking result, checks it against the marking data and transfers the validation result to the laser marking system. The imagechecker can validate bar codes and 2D codes, characters, and images.

Compatible image processing devices

Function	Device	Manufacturer
Marking position correction	PV230/PV200	Panasonic Industry Co., Ltd.
Code checking	PV230	
	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
(9) Oscillator unit

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.

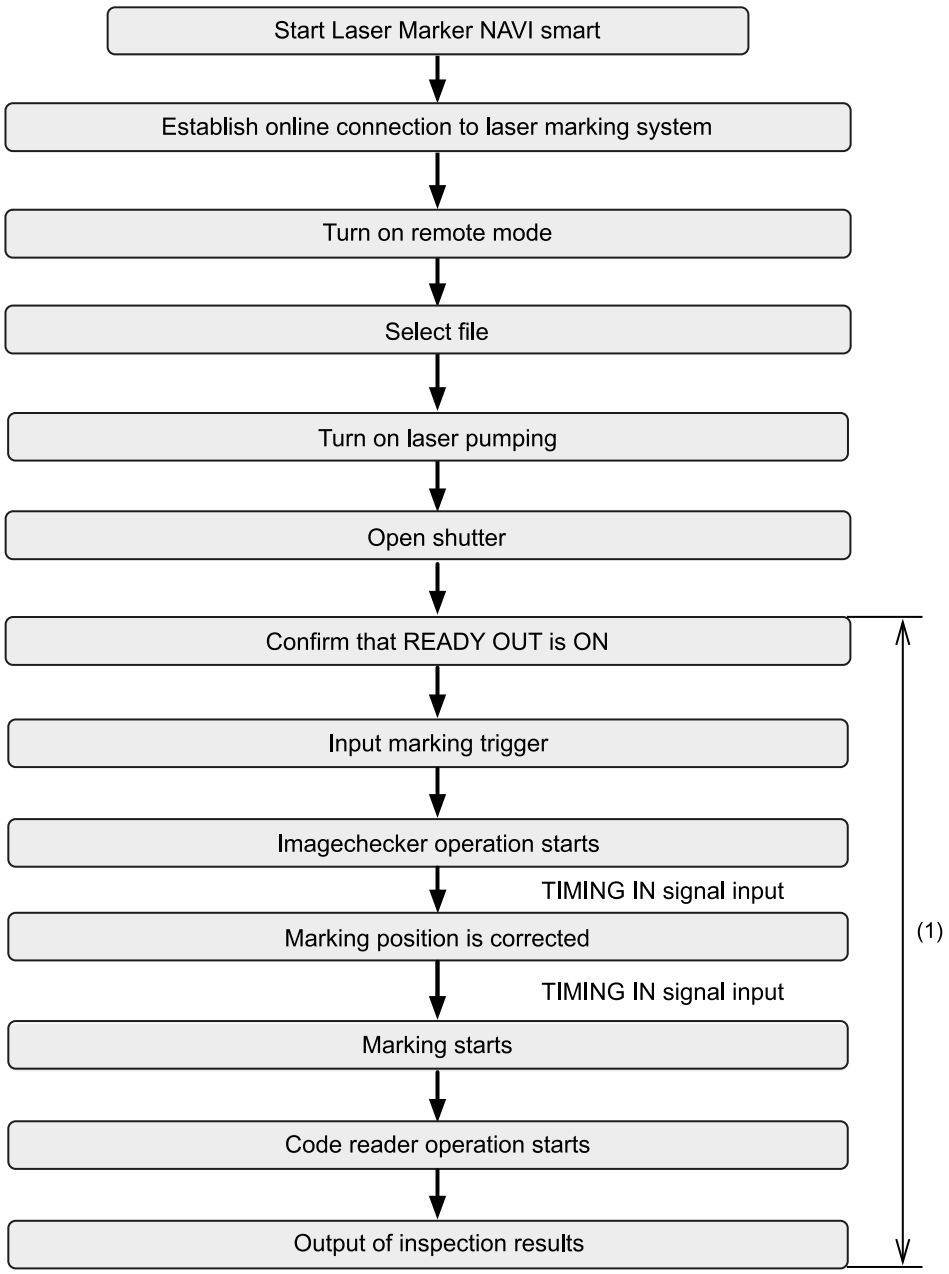
Depending on the inspection result, the **laser marking system** outputs an OK or NG result.

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 I/O TERMINAL connector
  - “Continuous trigger” under “Marking settings” > “File settings” > “Trigger mode”

6.1.3 Device connection

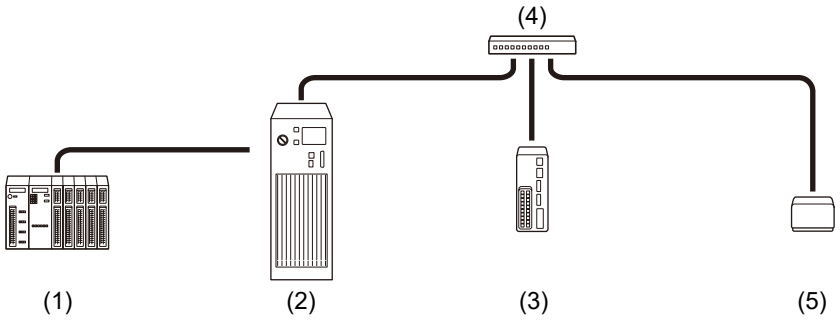
Image processing devices can be connected to the laser marking system via Ethernet. Make sure you do not assign duplicate IP addresses or port numbers.

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 183)

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 194)

Using the TIMING IN signal (page 197)

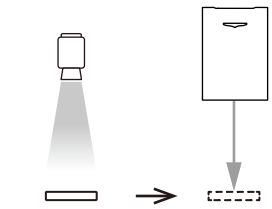
6.1.6 Using the TIMING IN signal

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

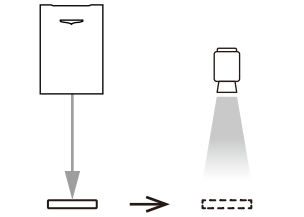
Use the timing input TIMING IN (24) of the I/O connector to trigger operations separately, for example when the camera's or the code reader's field of view is distant from the marking position.

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.

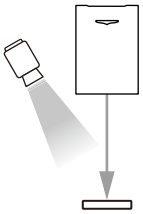
The TIMING IN signal can only be input via the I/O connector. It cannot be input with a communication command.

You must enable “TIMING IN signal input” in the “File settings”.

Without TIMING IN signal

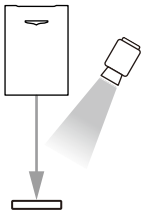
No TIMING IN signal is required when all marking and image processing operations can be triggered by the marking trigger signal, for example when the field of view of the image checking device and the marking position are identical.

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 203)

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 201).
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 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.

6.1.9 Timing charts of I/O signals

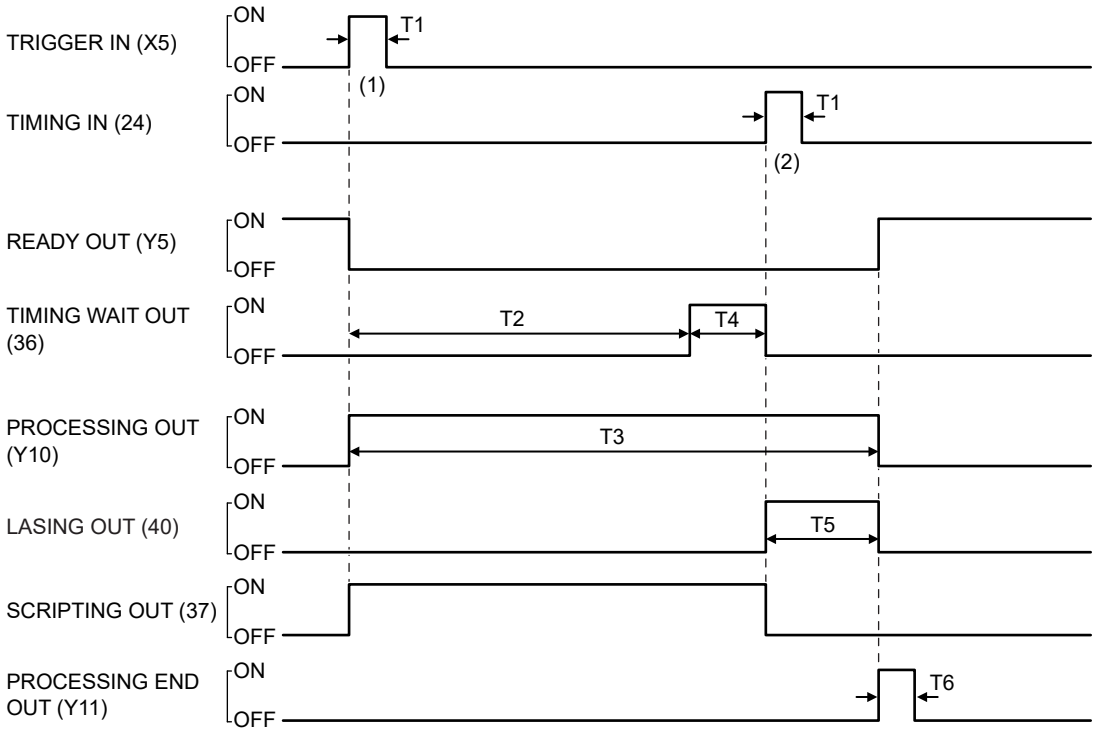
The timing charts show typical signal sequences when controlling the laser marking system by I/O signals.

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.

6.1.9.1 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

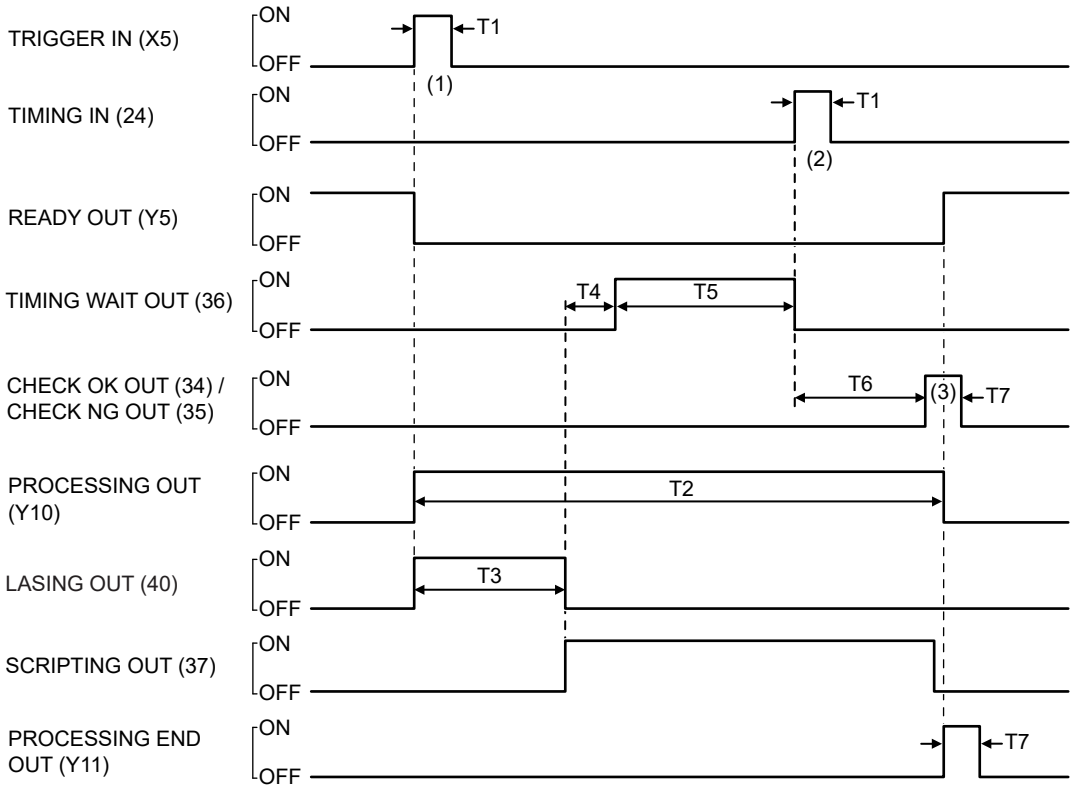
T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	Marking preparation time • Workpiece detection (imagechecker) • Marking position correction (laser marking system)
T3	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It includes the trigger delay time, operation time of the external device, laser radiation time, and internal processing time for 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 197)

6.1.9.2 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.

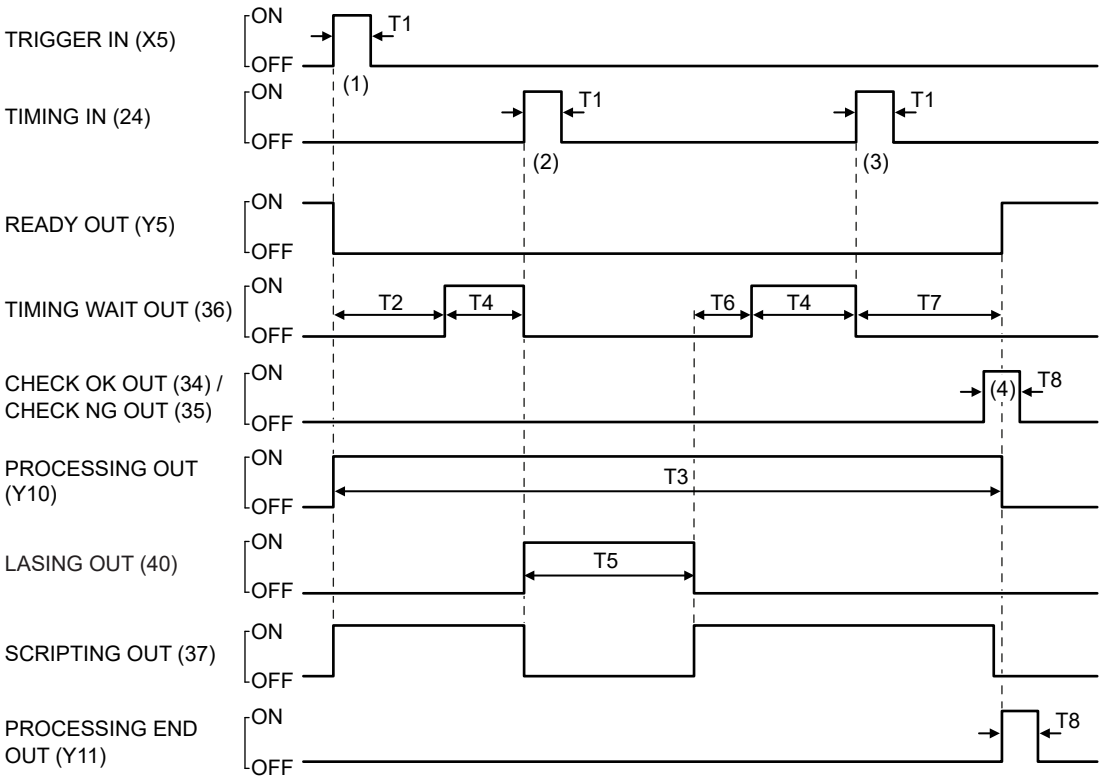
T1	≥2ms	Keep the ON status for 2ms or more.
T2	—	When the marking trigger input TRIGGER IN (X5) turns on, the trigger processing output PROCESSING OUT (Y10) turns on. The ON-time is the trigger processing time. It includes the trigger delay time, operation time of the external device, laser radiation time, and internal processing time for 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 197)

6.1.9.3 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 includes the trigger delay time, operation time of the external device, laser radiation time, and internal processing time for linked devices.

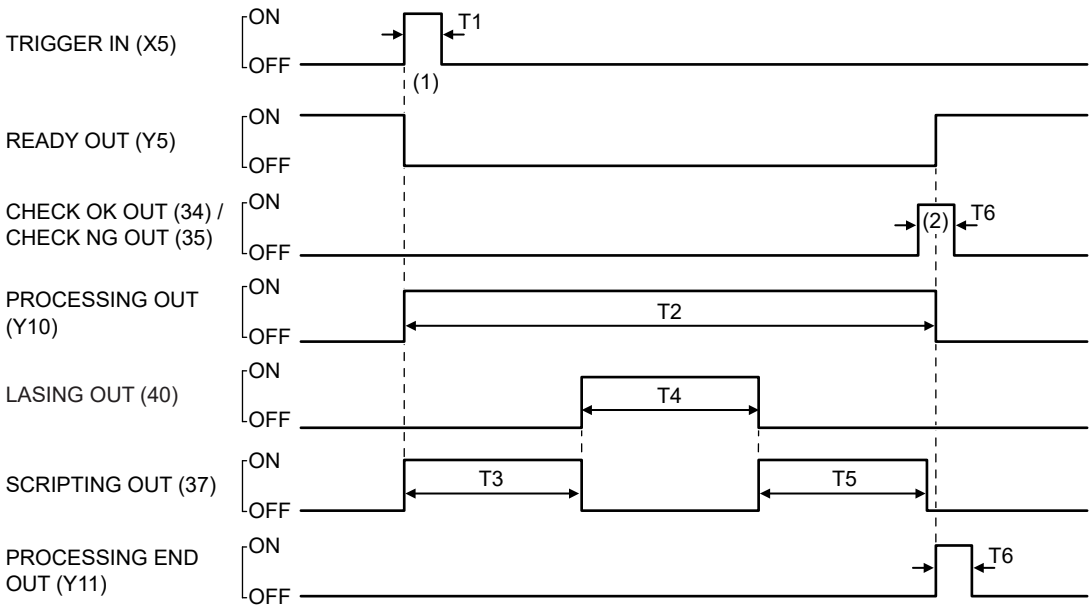
T4	≤60s	Turn on the timing input TIMING IN (24) within 60s after the timing standby output TIMING WAIT OUT (36) has turned ON. Otherwise, an error occurs and trigger processing is terminated.
T5	—	The laser radiation time varies depending on the marking image.
T6	—	Result processing time: • Transfer 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 197)

6.1.9.4 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 includes the trigger delay time, operation time of the external device, laser radiation time, and internal processing time for 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 197)

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

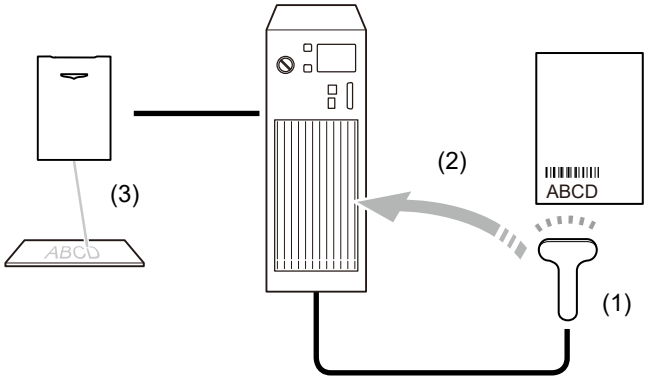
  A commercial code reader reads code that specifies a marking file and transfers it to the laser marking system. Based on this data, the marking file is changed.

- 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 212).

File switching and data modification by code reader cannot be performed at the same time.

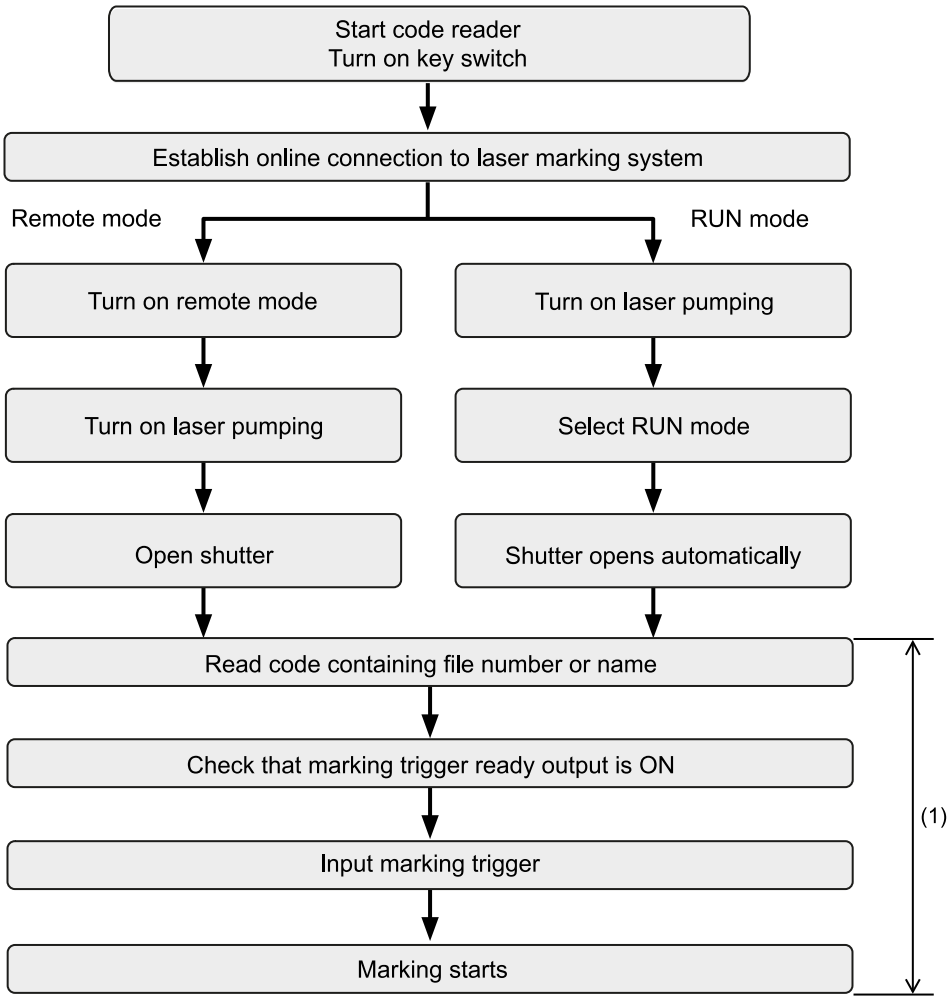
Transfer of marking information using code readers is possible in remote mode and in RUN mode.

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

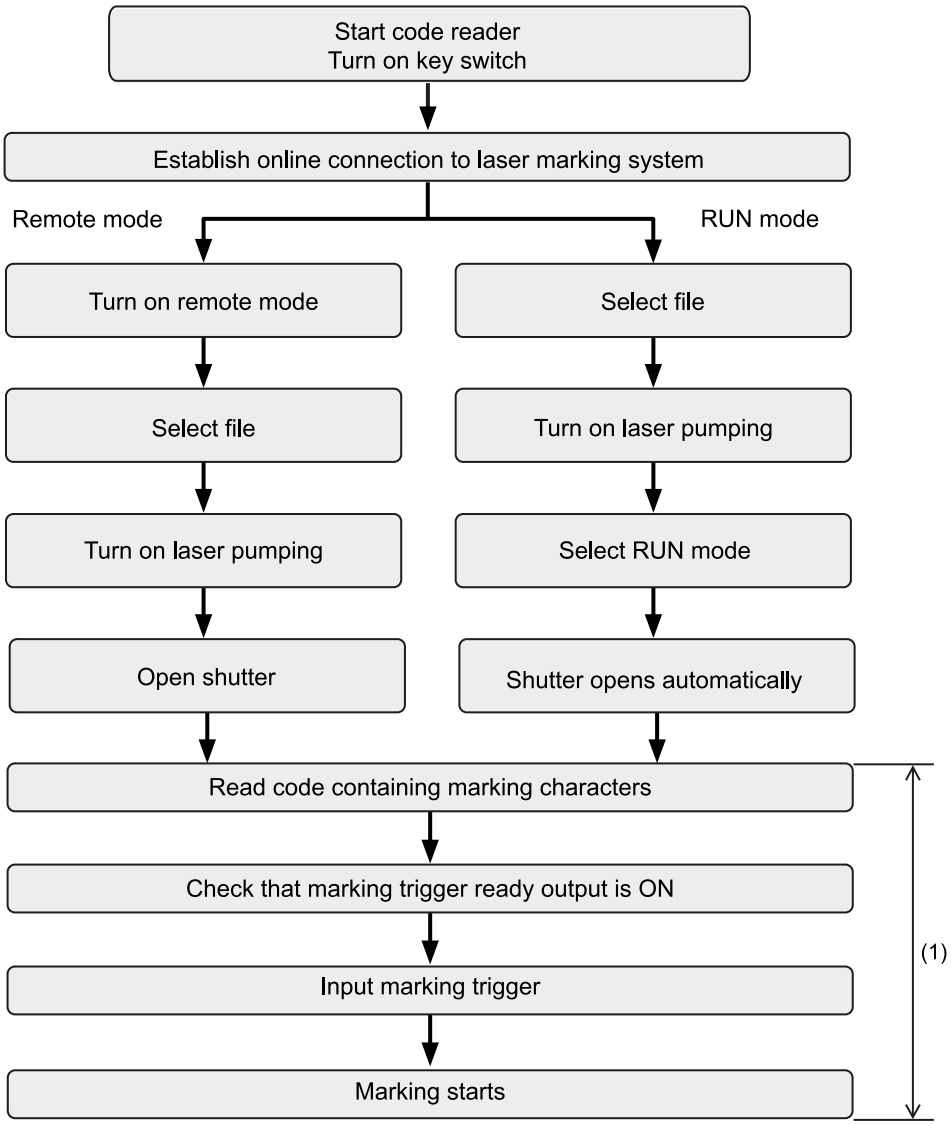
Check the communication settings in the laser marking system and in the code reader in advance.



(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.

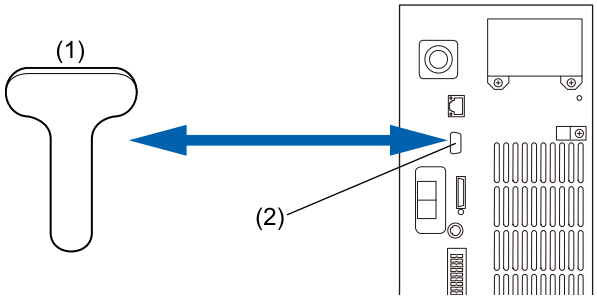


(1) Repeat these steps.

6.2.3 Code reader connection

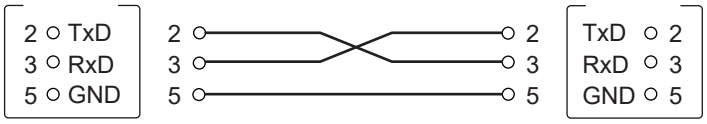
You can connect a code reader via the RS-232C interface to control the laser marking system.

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 180)

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.

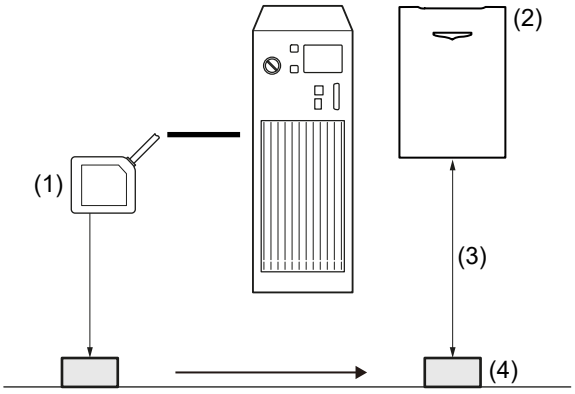
6.3 Autofocus using a displacement sensor

Use the autofocus function if you want to mark workpieces of varying height. An external displacement sensor must be installed and configured.

The autofocus function is available if the optional expansion board is installed in the controller.

When you use the autofocus function, the work distance is adjusted automatically, depending on the height of the workpiece. To obtain the height of the workpiece, the workpiece displacement is measured by the external displacement sensor.

Connect a sensor with analog current output signals (4mA to 20mA) to the laser marking system. The value measured by the sensor is converted into the workpiece displacement and applied to the marking process. The laser marking system must receive the signal from the sensor before the input of the marking trigger signal.



(1) Displacement sensor
(2) Laser head
(3) Work distance
(4) Workpiece

Input and output specifications of the displacement sensor

Item	Description
Input method	Analog current input
Input range	4mA to 20mA
Measurement range of the sensor[1)]	-200mm to +200mm (initial setting: -25mm to +25mm)
Scope of correction	-25mm to +25mm
Input resistance	15Ω

1) Specify the values at which the analog outputs of the displacement sensor are 4mA and 20mA respectively. It is possible to enter values in the range from -200.000mm to 200.000mm in Laser Marker NAVI smart. However, with the laser marking system the work distance value can be adjusted only in the range from -25mm to 25mm.

Related topics

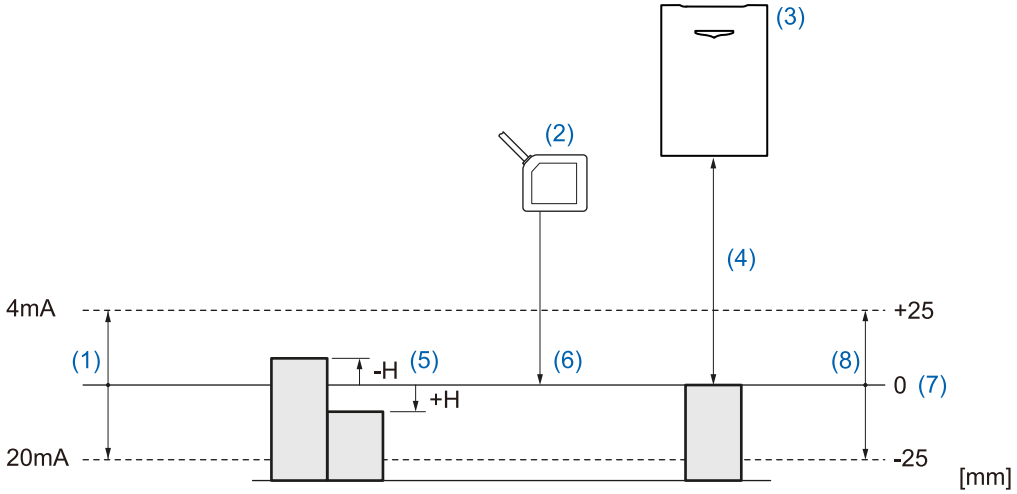
Expansion board installation (page 70)

6.3.1 Displacement sensor input example

The full marking range can only be used if the laser head's base position (z-offset = 0) is identical to the center of the sensor's measurement range.

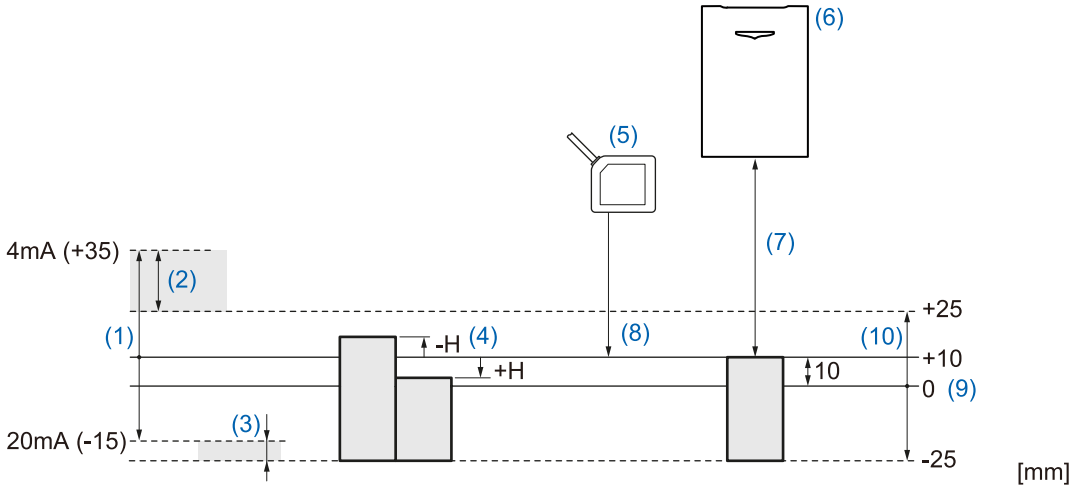
If the base position differs from the center of the measurement range, the marking range is reduced due to the limited correction range from -25mm to +25mm. Warning E651 or E692 occurs if the sum of the preset z-offset and the measured displacement value exceeds the marking range.

Base position identical to measurement center distance:



(1) Input from displacement sensor
(2) Displacement sensor
(3) Laser head
(4) Work distance
(5) Workpiece displacement **H** (measured by an external displacement sensor)
(6) Measurement center distance of the displacement sensor (H = 0)
(7) Base position of the laser head (z-offset = 0)
(8) Correction range of the workpiece displacement

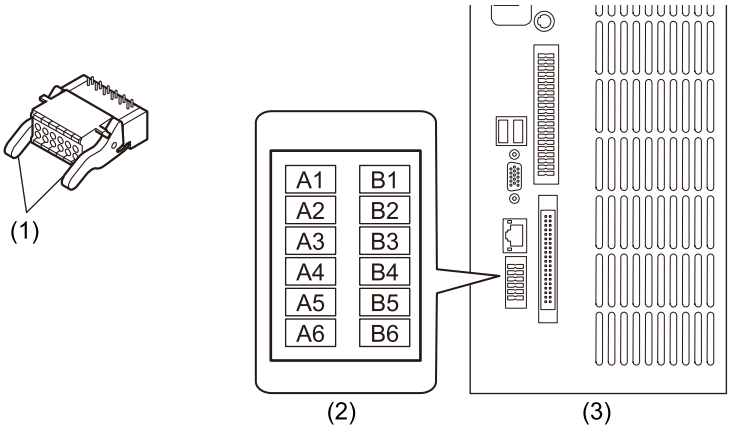
Base position different from measurement center distance:



(1) Input from displacement sensor
(2) Marking is not possible in this range
(3) Outside the measurement range of the sensor
(4) Workpiece displacement **H** (measured by an external displacement sensor)
(5) Displacement sensor
(6) Laser head
(7) Work distance
(8) Measurement center distance of the displacement sensor (H = 0)
(9) Base position of the laser head (z-offset = 0)
(10) Correction range of the workpiece displacement

6.3.2 Displacement sensor connection

To connect the sensor, wire and attach the I/O terminal block of the connector labeled D-SENSOR on the rear of the controller.



(1) I/O terminal block with locking hooks
The I/O terminal block is attached to the D-SENSOR connector. It can be removed by pushing down the locking hooks.
(2) Connector labeled D-SENSOR
(3) Rear of the controller

Connector product numbers

Connector	Type	Model	Manufacturer
Connector on controller	Special connector	15EDGRHCM-THR-3.5-12P-13-100A(H)	Degson Electronics Co., Ltd
Removable I/O terminal block		15EDGKNHG-3.5-12P-1Y-00A(H) (accessory)	

Pin assignment

Terminal No.	Signal	Description
A1	+24V	+24V output for power supply of sensor Connect the sensor's power supply terminal (V_+). The output current must not exceed 500mA.
A2	Alarm	Error signal input from sensor. When the error output of the sensor is connected to this terminal, the laser marking system can check the error status of the sensor. If the sensor trigger is input while the shutter is open and an error occurs in the sensor, the laser marking system can output a warning.
A3	Analog	Sensor input This terminal is used to input the displacement amount. Connect the analog current output of the sensor.
A4	Trig	Displacement sensor trigger input If it remains ON for 500µs or longer, the displacement amount is imported to the laser marking system on the rising edge of the signal. Connect the output of an external device, e.g. a PLC.
A5	N.C.	Do not connect anything.
A6		
B1	GND	Ground Connect the sensor's 0V and analog ground terminals.
B2	Alarm COM.	Common terminal for the error signal input A2
B3	N.C.	Do not connect anything.
B4	Trig COM.	Common terminal for the sensor trigger input A4 Connect the terminal to the power source such as PLC which is used to input the displacement sensor trigger.
B5	N.C.	Do not connect anything.
B6		

Notice

Power to the displacement sensor is supplied from the D-SENSOR connector (A1: +24V and B1: GND) on the controller.

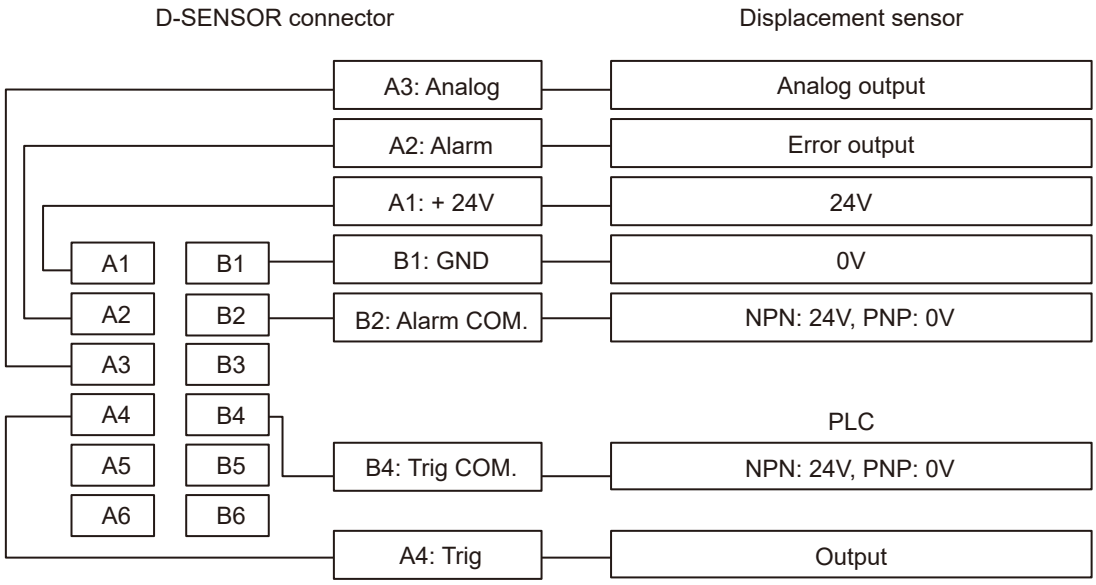
Note

- The displacement sensor inputs Alarm COM. (B2) and Trig. COM. (B4) are not connected to the input commons (IN COM.1 and IN COM.2) of the I/O TERMINAL connector and I/O CONNECTOR.
- The displacement sensor inputs Alarm COM. (B2) and Trig. COM. (B4) are not connected.
- If you do not use the error signal from the displacement sensor, connect as follows.

  NPN: Connect Alarm COM. (B2) of the D-SENSOR connector to the power supply of the displacement sensor and Alarm (A2) to GND.

  PNP: Connect Alarm COM. (B2) of the D-SENSOR connector to GND and Alarm (A2) to the power supply of the displacement sensor.

Connection example



Note

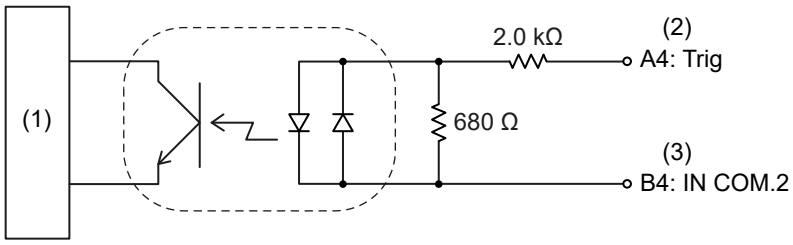
Power to the displacement sensor is supplied from the D-SENSOR connector (A1: +24V and B1: GND) on the controller.

6.3.3 Input ratings and circuit diagrams of the D-SENSOR connector

When connecting the trigger input and the error signal input, note the difference between NPN and PNP.

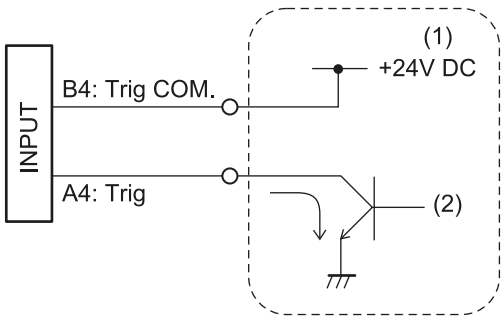
Item	Description
Input type	Bidirectional optocoupler (insulated)
Input ON voltage	Voltage difference between input and input common: ≥19.6V
Input OFF voltage	Voltage difference between input and input common: ≤4V
Rated input voltage	+24V DC ±10%

Input circuit of the sensor trigger input:



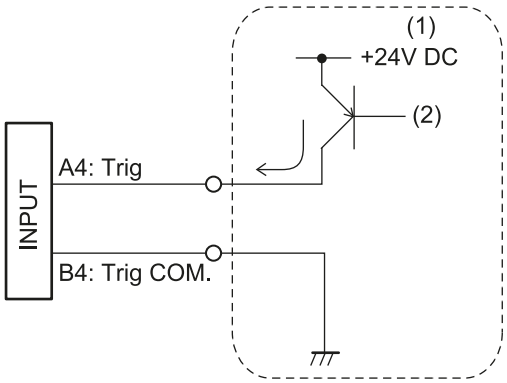
(1) Internal circuit
(2) Sensor trigger input
(3) Input common for sensor trigger input

NPN sample circuit:



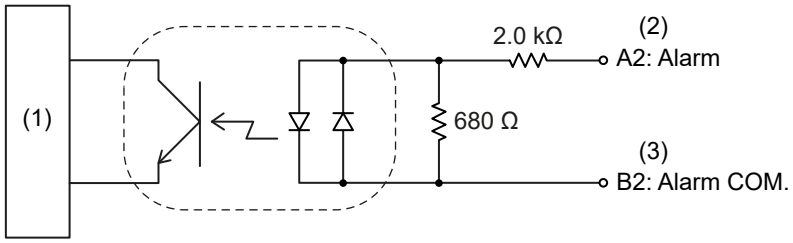
(1) External power supply
(2) NPN open-collector output

PNP sample circuit:



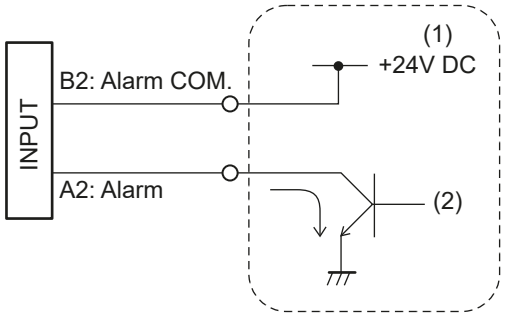
(1) External power supply
(2) PNP open-collector output

Input circuit of error signal input:



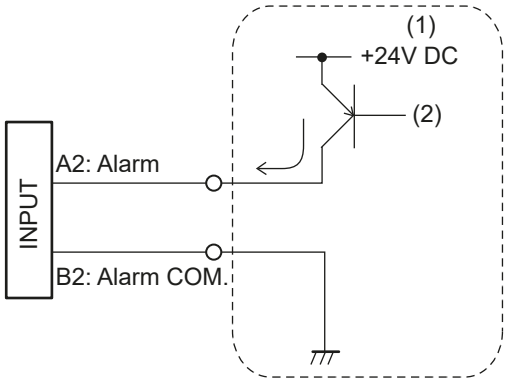
(1) Internal circuit
(2) Error signal input
(3) Common for error signal input

NPN sample circuit:



(1) External power supply
(2) NPN open-collector output

PNP sample circuit:



(1) External power supply
(2) PNP open-collector output

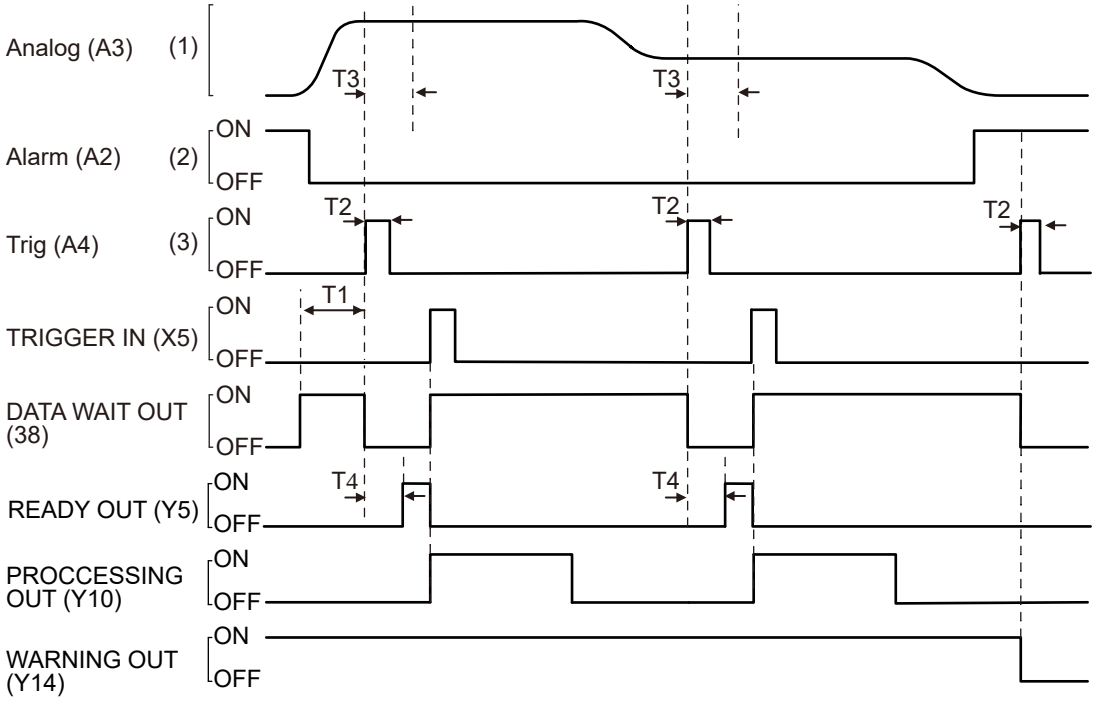
Note

Make the connection so that the error signal from the displacement sensor (B2: Alarm) of the laser marking system turns on when the sensor outputs an error.

6.3.4 Timing chart of displacement sensor input

To obtain a good marking quality, make sure that the analog output of the sensor is stable before you input the displacement sensor trigger.

When using the autofocus function



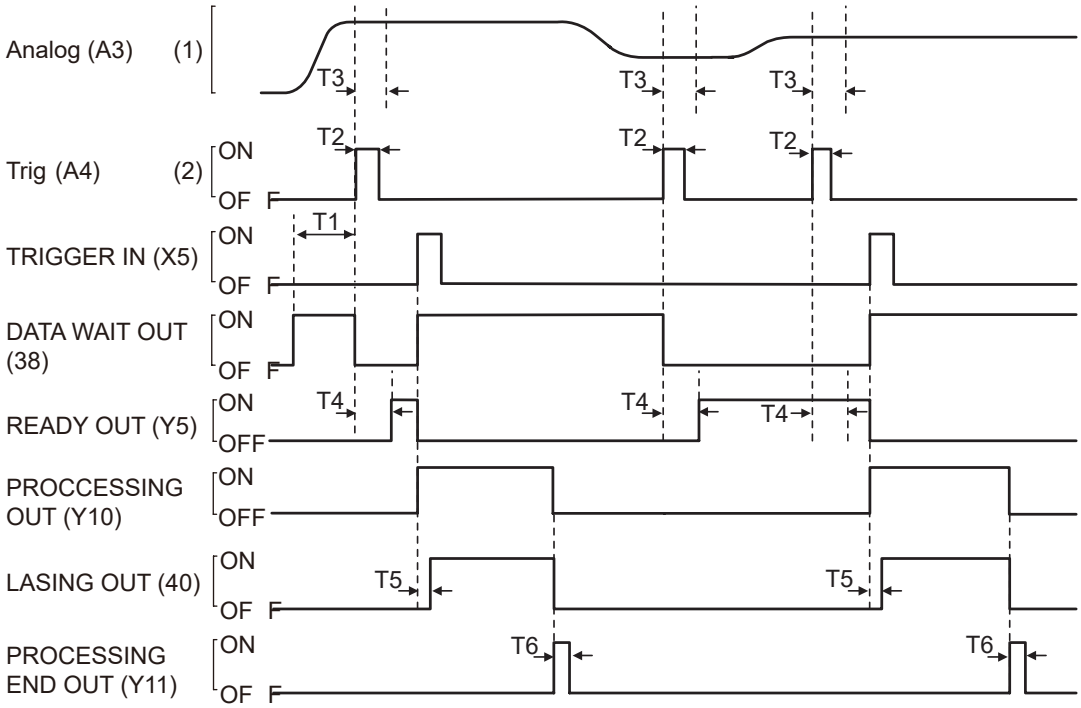
(1) Analog input from sensor
(2) Error signal input from sensor
(3) Sensor trigger input

T1	—	Verify that the sensor's analog output is stable enough before entering the sensor trigger. If the trigger is entered when the output is not stable, it will affect the marking quality.
T2	≥500μs	Keep the ON status for 500μs or longer. Input the sensor trigger when the shutter of the laser marking system is open.
T3	≥10ms	Time required for the value measured by the sensor to be reflected in the laser marking system. Hold the workpiece stationary for 10ms after the sensor trigger is input.
T4	—	Time for creating the marking data. Turn on TRIGGER IN (X5) after the sensor trigger is input and READY OUT (Y5) is turned on.

Note

- Enter the measured value of the displacement sensor each time marking is performed. When the marking is completed, the input value (workpiece displacement) is automatically reset.
- If any of the following operations is performed between inputting the measured value of the displacement sensor and marking, the input value (workpiece displacement) of the sensor is reset and READY OUT (Y5) is turned off.
  - The shutter closes.
  - The marking file is switched.
  - Remote or RUN mode is turned off.
  - Reception mode is turned on by the Reception mode (**MKM**) command.
  - Data modification by a code reader is performed.
- Depending on the emission wavelength of the displacement sensor, the measurement value may not always be stable during guide laser radiation. In this case, stop the guide laser during measurement.
- If the sensor trigger is input when the error signal input is ON, the laser marking system outputs warning E689 and the displacement amount is not imported to the laser marking system.

When using the autofocus function with on-the-fly marking



(1) Analog input from sensor
(2) Sensor trigger input

T1	—	Verify that the sensor's analog output is stable enough before entering the sensor trigger. If the trigger is entered when the output is not stable, it will affect the marking quality.
T2	≥500µs	Keep the ON status for 500µs or longer. Input the sensor trigger when the shutter of the laser marking system is open.
T3	≥10ms	Time required for the value measured by the sensor to be reflected in the laser marking system. Hold the workpiece stationary for 10ms after the sensor trigger is input. If this time is shorter than 10 ms, the value measured by the sensor may not be accurately reflected in the laser marking system.
T4	—	Time for creating the marking data. Turn on TRIGGER IN (X5) after the sensor trigger is input and READY OUT (Y5) is turned on. When a new sensor trigger is input while READY OUT (Y5) is ON, the later entered value will be used for marking only if the time for creating the marking data (T4) has passed by the time the trigger signal is input.
T5	—	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 includes the trigger delay time, marking preparation time, laser radiation time, and processing time after marking is completed.
T6	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

- Enter the measured value of the displacement sensor each time marking is performed. When the marking is completed, the input value (workpiece displacement) is automatically reset.
- If more than one sensor trigger is input before marking, it cannot be determined which sensor trigger will be used for marking. Make sure that the time between the sensor trigger input and the marking trigger input is greater than T4, as shown in the timing chart.

6.3.5 Specify settings for an external displacement sensor

Before you use the autofocus function, specify all settings in Laser Marker NAVI smart in advance.

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. Under “Displacement sensor”, specify the following parameters depending on the specifications and installation conditions of the displacement sensor.
   - “Input method”: “Analog current input” (fixed)

     Displays the type of input signal available on the laser marking system. Displacement sensors with other types of output signals cannot be used.
   - “Workpiece displacement at 4mA [mm]”, “Workpiece displacement at 20mA [mm]”:

Specify the displacement values (z-movement) at which the analog outputs of the sensor are 4mA and 20mA respectively. It is possible to enter values in the range from -200.000mm to 200.000mm. However, with the laser marking system the work distance value can be adjusted only in the range from -25mm to 25mm.

The work distance is adjusted based on the measured workpiece displacement. The workpiece displacement is 0mm if the laser head is installed at base position (LP-ZV200P/LP-ZV500P: 190mm, LP-ZV205P/LP-ZV505P: 220mm, LP-ZV206P/LP-ZV506P: 330mm).

Enter a positive value to reduce the work distance and a negative value to increase the work distance.

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.
   The new settings will be updated in the laser marking system.
7. Establish an online connection between your PC and the laser marking system.
8. Go to the “Marking settings” screen and select “File settings”.
9. For “Autofocus”, select “ON”.
   The displacement sensor input is activated in the marking file.
10. You can set “Upper limit of work displacement [mm]” and “Lower limit of work displacement [mm]” if necessary.

Note

You can check the measured workpiece displacement in remote mode or RUN mode on the “Monitor” screen in the “Real-time data” tab.

For more details and setting examples, refer to the “Laser Marker NAVI smart Operation Manual”.

6.3.6 Perform test marking with the autofocus function

You can check the amount of workpiece displacement caused by the autofocus function by performing a test marking.

1. Select “Test marking” to open the “Test marking/guide laser” dialog.
2. Select the “Measure” button. The value measured by the external sensor is displayed for “Workpiece displacement”.
3. To apply the displayed value to the test marking, measure the value before you start test marking. Without measuring the workpiece displacement, test marking is performed with a workpiece displacement value of 0mm.
   To reset the workpiece displacement value, select “Reset”.
   After reset, “--” is displayed for “Workpiece displacement”.

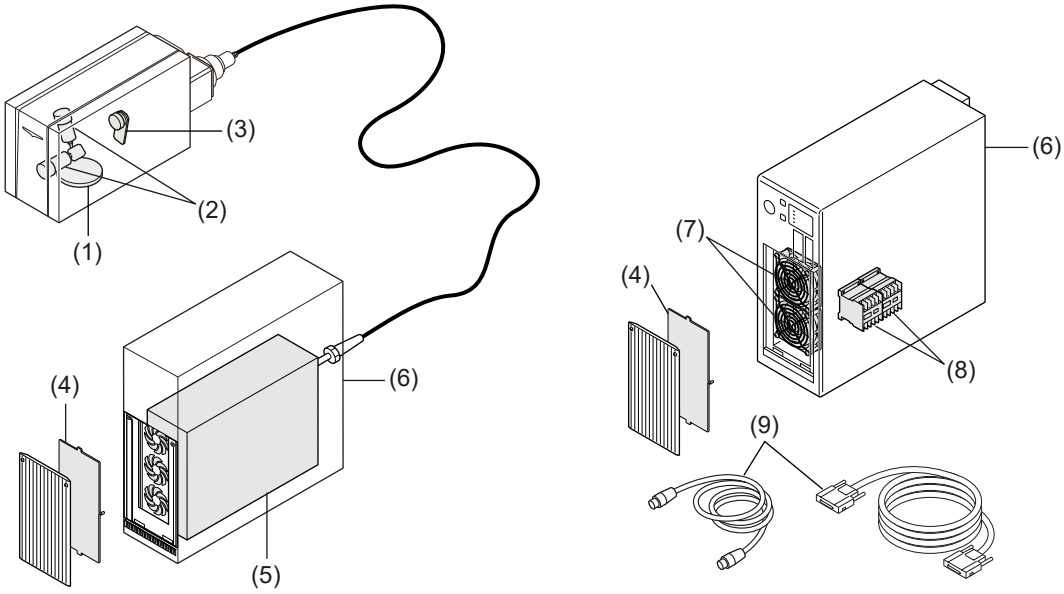
7 Maintenance

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	Replacement	Contamination
(5)	Laser oscillator	Inspection of laser power	Aging[1)]
(6)	Cooling air inlet and outlet	Cleaning	Contamination
(7)	Controller fan	Cleaning	Contamination

No.	Part name	Maintenance measures	Cause for replacement
(8)	INTERLOCK contactor	—	Aging
(9)	Cables	—	Damage

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.

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 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 227)

Replace the protection glass (page 228)

7.2.1.1 Specify settings for the cleaning cycle

You can configure Laser Marker NAVI smart to announce the cleaning time of the laser emission port.

1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Maintenance” screen and select “Operating data”.
3. Under “Announcement for regular maintenance”, select the “Announcement” check box to activate the announcement function.
   The output MAINTENANCE OUT (Y13) of the I/O TERMINAL connector turns on when the maintenance due date is reached. In addition, an exclamation point symbol (!) is displayed on the “Maintenance” screen of Laser Marker NAVI smart.
4. To change the maintenance cycle, select “Change”.
5. In the dialog, specify the maintenance cycle based on the controller operating time (operating time of the laser marking system).
   Initial setting: Maintenance is announced every 300 hours of controller operating time.
6. Select “OK” to close the dialog.
   The time displayed under “Next maintenance” is updated.

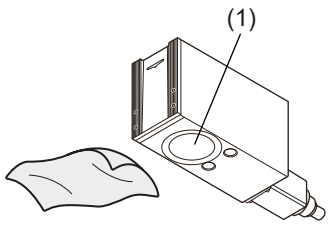
7.2.1.2 Clean the laser emission port

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.

3. In Laser Marker NAVI smart, you can update the maintenance cycle data for the laser emission port.
   Go to the “Maintenance” screen and select “Operating data”. Select “Done” for “Laser emission port glass cleaning”. The date and time of the cleaning will be saved and displayed under “Last maintenance”.

Related topics

Protection glass of laser emission port (page 226)

Replace the protection glass (page 228)

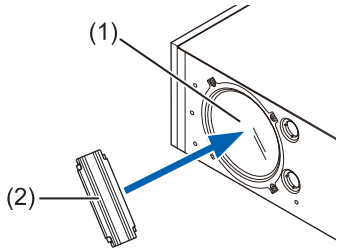
7.2.1.3 Replace the protection glass

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-ACV80	A tool for detaching the protection glass is included.

1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Place the laser head on its side.
3. Insert the detachment tool into the recess in the laser emission port.

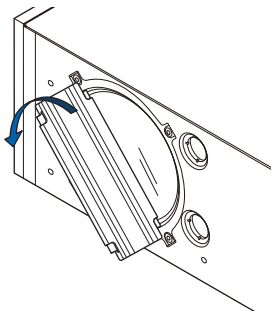


(1) Laser emission port
(2) Detachment tool

4. To remove the protection glass, press and hold the detachment tool while turning it counterclockwise. Carefully catch the protection glass with a soft cloth or similar material.

Notice

- Be careful not to touch the lens and protection glass when removing or installing the protection glass.
- Do not remove the glass positioned behind the protection glass inside the laser head.

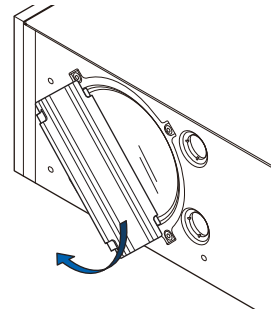


5. Make sure that the new protection glass is not contaminated by foreign matter such as fingerprints, dust, grease, or oil. Blow away any contamination using an air duster for optical components.

⚠ WARNING

Do not use a flammable air duster. If it is ignited by the laser beam, there is a risk of fire.

6. Place the new protection glass on the laser emission port. The protection glass is the same on both sides.
7. Insert the detachment tool into the recess in the laser emission port.
8. To fix the protection glass, press and hold the detachment tool while turning it clockwise.
   Tightening torque: 1.5Nm
   Alternatively, gently turn the detachment tool approximately 4 mm when you first feel resistance.



Make sure that the protection glass is tightened properly to ensure that the laser head meets the requirements of IP64.

Notice

- Do not tighten the protection glass with excessive force as this may cause it to break.
- Be careful not to touch the lens and protection glass when removing or installing the protection glass.
- Do not operate the laser marking system without the protection glass installed on the laser emission port.

Related topics

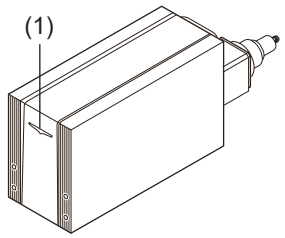
Protection glass of laser emission port (page 226)

Clean the laser emission port (page 227)

7.2.2 Clean the laser head

Clean the laser head on a regular basis.

A natural cooling system is used in the laser head. If the laser head is soiled with dust or oil, the cooling effect may be reduced.



(1) Laser head LED display

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.

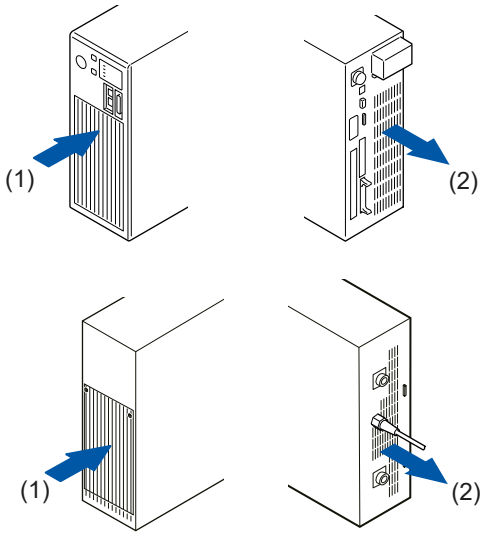
7.2.3 Clean the cooling air inlet and outlet

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 Air filter replacement

The cooling air inlets of the oscillator unit and the controller have one air filter each.

Two nonwoven fabric filters and two urethane filters for the oscillator unit and the controller are included in the product package. The nonwoven fabric filter is pre-installed at the time of delivery. Select the appropriate air filter based on your marking or processing materials. Use the nonwoven fabric filter for metal materials and the urethane filter for resin and other non-metallic materials.

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.

7.2.4.1 Specify settings for the replacement cycle

You can configure Laser Marker NAVI smart to announce the replacement cycle of the air filters.

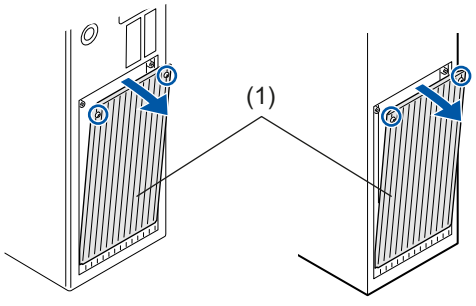
1. Establish an online connection between your PC and the laser marking system.
2. Go to the “Maintenance” screen and select “Operating data”.
3. Under “Announcement for regular maintenance”, select the “Announcement” check box to activate the announcement function.
   The output MAINTENANCE OUT (Y13) of the I/O TERMINAL connector turns on when the maintenance due date is reached. In addition, an exclamation point symbol (!) is displayed on the “Maintenance” screen of Laser Marker NAVI smart.
4. To change the maintenance cycle, select “Change”.
5. In the dialog, specify the maintenance cycle based on the controller operating time (operating time of the laser marking system).
   Initial setting: Maintenance is announced every 300 hours of controller operating time.
6. Select “OK” to close the dialog.
   The time displayed under “Next maintenance” is updated.

7.2.4.2 Replace the air filters

Replacement parts:

Part name	Product no.	Remarks
Air filter, nonwoven fabric	LP-AFT90	2 pieces for controller and oscillator unit
Air filter, urethane	LP-AFT92	2 pieces for controller and oscillator unit

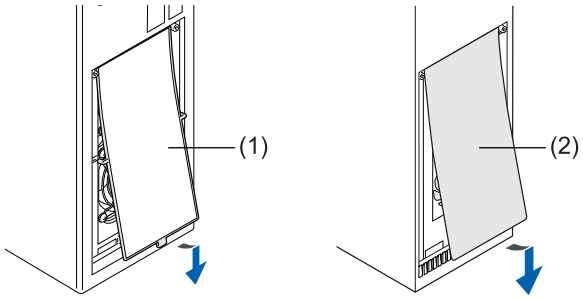
1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Loosen the M3 screw on the front of the controller (left) and the oscillator unit (right) and remove the front cover.



(1) 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.



(1) Nonwoven fabric air filter
(2) Urethane air filter

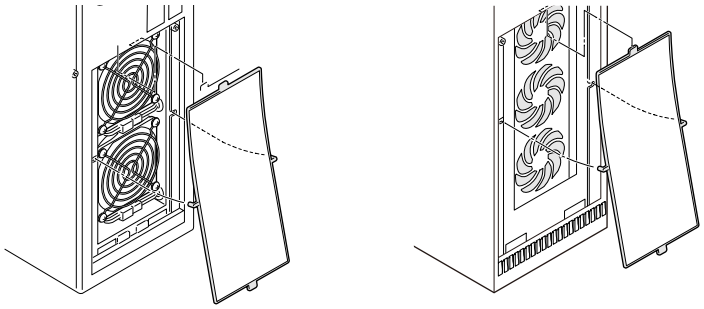
5. If the cooling air inlet is contaminated, remove the dust with a vacuum cleaner or a dry cloth.

Notice

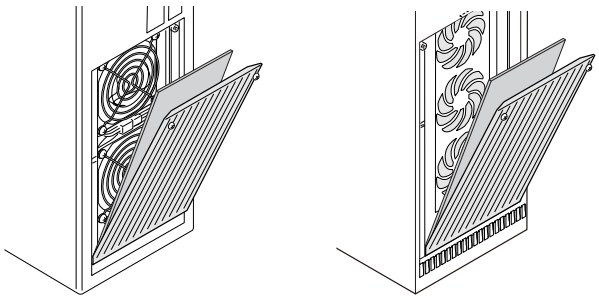
Do not blow air in the direction of the cooling air inlet or outlet. Make sure that dust does not get into the laser marking system. Otherwise, failure may result.

6. Attach the new filters.

Nonwoven fabric air filter: Insert the tabs on the top and on the sides of the filter into the corresponding recesses on the controller (left) and the oscillator unit (right). The nonwoven fabric filter has no specific top or bottom orientation.



Urethane air filter: Insert the lower part of the front cover into the controller (left) and the oscillator unit (right). Then place the new filter on the rear side of the cover. The urethane filter has no designated front, back, top, or bottom orientation.



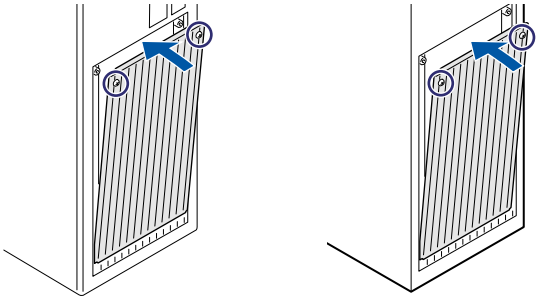
Notice

- The air filter of this product is not washable. If it is contaminated, it must be replaced by a new one.
- Ensure the filter is clean and free of tears before use. For the nonwoven fabric filter, verify that the tabs on the filter frame are intact and not broken.
- Do not operate the laser marking system without the filters. This may cause a product failure.

7. To attach the front cover, insert the lower part of the cover into the controller and the oscillator unit, and fix the two screws.

   Screw size: M3

   Tightening torque: 0.3Nm



Controller (left), oscillator unit (right)

When installing the urethane air filter, check the following:

- Ensure the air filter is not twisted or bent.
- Make sure the air filter fully covers all the fans.
- If the air filter extends beyond the cover, push the top part into the controller and oscillator unit before closing the cover.

8. In Laser Marker NAVI smart, you can update the maintenance cycle data for the air filters.

   Go to the “Maintenance” screen and select “Operating data”. Select “Done” for “Air filter replacement”. The date and time of the air filter replacement will be saved and displayed under “Last maintenance”.

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.
- A warning occurs indicating that the rotation speed of the controller fan is decreasing.

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

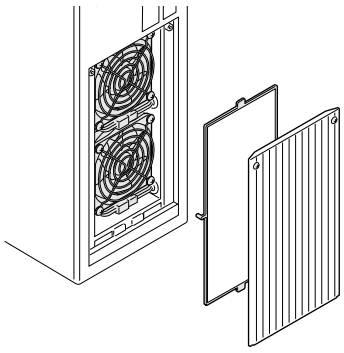
Clean or replace the controller fans (page 235)

7.2.5.1 Clean or replace the controller fans

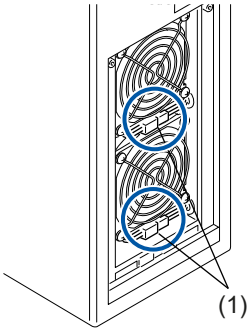
Clean the controller fans as regularly and as frequently as the operating environment demands.

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. Loosen the two M3 screws on the front of the controller. Remove the front cover and the air filter. For details refer to Replace the air filters (page 232).

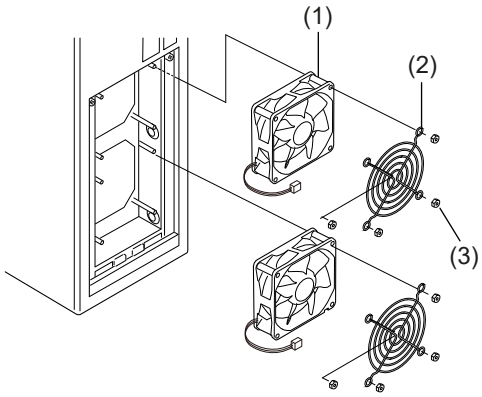


3. Remove the connectors of both fans.



(1) Connectors

4. Loosen the four M4 nuts (3) of each fan, and remove the fan guards (2) and the fans (1).



⚠ WARNING

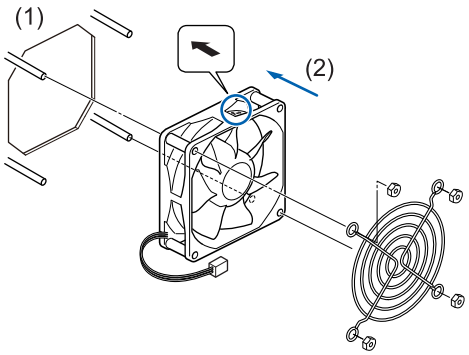
Do not drop the mounting nuts inside the controller. Doing so may short-circuit the internal circuits, leading to accidents or malfunctions.

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.

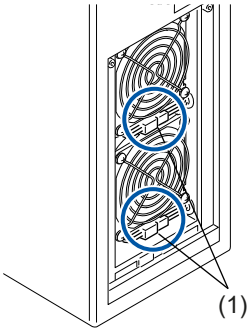


(1) Laser marking system
(2) Air flow direction

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 nuts (M4, 4 nuts per fan) to the screws protruding from the controller.
   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 232).

Notice

Be careful not to pinch any cables when closing the front cover.

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 234)

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.
- “Power compared to delivery state [%]” measured using the power check function is below 80%.
- The total laser radiation time exceeds 30000 hours. (The replacement interval may differ depending on the operating environment and marking settings.)

  In this case, an exclamation mark (!) is displayed on the “Maintenance” screen of Laser Marker NAVI smart, and the output MAINTENANCE OUT (Y13) of the I/O TERMINAL connector turns on.
- 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 238)

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.

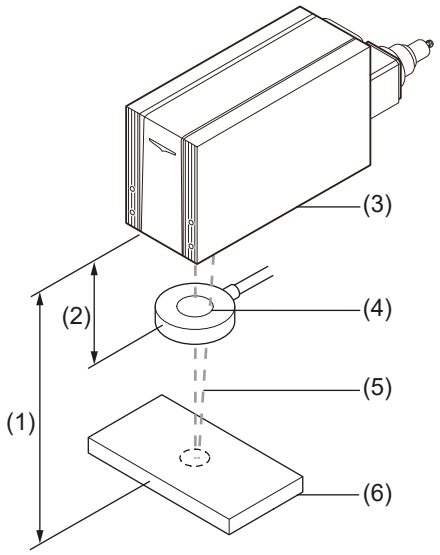
1. Install the laser power meter. Place the detector of the laser power meter directly beneath the center of the laser emission port. Position it at a distance of one-third to one-half of the specified work distance:

   LP-ZV200P, LP-ZV500P: approx. 90mm

   LP-ZV205P, LP-ZV505P: approx. 110mm

   LP-ZV206P, LP-ZV506P: approx. 160mm

   These are the recommended values 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]” (LP-ZV200P, LP-ZV205P, LP-ZV206P) 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.

7.2.6.2 Inspect the laser power with the power check function

Use the built-in power monitor to check and correct the laser power. This function is available for the following models: LP-ZV500P, LP-ZV505P, LP-ZV506P.

Inspect the laser power regularly in order to maintain consistent marking quality. A usage under severe operating conditions may require a daily inspection.

Take note of the following points when using the power check function:

- Use the results measured with the power check function for reference only. To obtain accurate measurements of the laser power, use a commercial power meter.
- After the laser marking system was installed or moved, the measured values may change slightly. Calibrate the built-in power monitor to improve the accuracy when measuring or correcting values with the power check function.
- The built-in power monitor is not a precise measuring instrument. The difference between the specified laser power value and the measured laser power value may increase over time. If this difference interferes with your operation, our service staff will inspect and repair the laser marking system. Contact our service center or sales offices.
- The power check function allows you to measure and correct the laser power using the configuration software Laser Marker NAVI smart. However, this function does not automatically adjust the laser power to maintain a constant laser output power.

⚠ WARNING

When the power check function is used to measure and correct the laser power, the laser radiates without opening the shutter. Even if the shutter remains closed, take appropriate protective measures during laser radiation such as wearing laser protective goggles or using a protective enclosure. Keep flammable materials away from the marking field of your laser marking system.

1. Establish an online connection between your PC and the laser marking system.
2. 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.

3. Select “Power check” in the ribbon.
4. Select the “Measurement” tab and specify the measurement settings. For “Laser settings”, select “Optimal setting” or “User-defined settings”.
   - Select “Optimal setting” to apply the recommended values for laser power (80.0), and pulse cycle.
   - Select “User-defined settings” to specify a value for laser power. For measurement, you must use the laser power setting 80.0 in order to obtain a value

for “Power compared to delivery state [%]”. The laser power correction is only available if the output power was measured with the laser power setting 80.0.

The following functions are only available with a laser power setting of 80.0:

Power check history

Power comparison to delivery state

Power correction after power check

5. Select the “Measure” button.
6. In the confirmation dialog, select “Yes” to start the measurement.
   It takes about 20 seconds to complete the power measurement.
7. The following data is shown under “Measurement results” as soon as the measurement is completed:
   - “Output power [W]”: Displays the measured laser power.
   - “Corrected output power [W]”: If power correction has been performed, the corrected laser power is displayed.
   - “Power compared to delivery state [%]”: This value is displayed only if the measurement has been performed with the laser power setting 80.0. It shows the ratio of the current output power relative to the initial power at the time of delivery. For the calculation, it is assumed that the laser power is 100% at delivery.

Notice

If “Power compared to delivery state [%]” is below 80%, the oscillator unit requires maintenance. Contact our service center or sales offices.

8. If you identify a decline in the laser power after measurement, correct the laser power setting. Select the “Correction” tab.
   The laser power correction is only available if the output power was measured with the laser power setting 80.0.
9. For “Correction method”, select “Auto”.
10. Select “Correct power”. In the confirmation dialog, select “Yes” to perform the correction.
    It takes about 10 seconds to complete the laser power correction.
11. The following data under “Status” is updated as soon as the correction is completed:
    Laser power correction
    Corrected output power
    Valid power setting range
    Date/time of correction

    The laser power correction is a function that internally corrects the setting value of “Laser power” under “Laser settings”. This setting does not change the maximum laser power [W] value.

Related topics

Inspect the laser power (page 238)

Calibrate the built-in power monitor (page 243)

7.2.6.3 Calibrate the built-in power monitor

After the laser marking system was installed or moved, the measured values by the power check function may change slightly. Execute a calibration to improve the accuracy of the built-in power monitor.

This function is available for the following models: LP-ZV500P, LP-ZV505P, LP-ZV506P.

Use a commercial laser power meter to calibrate the power monitor. The power meter must meet the following requirements:

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. Establish an online connection between your PC and the laser marking system.
2. 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.
3. Select “Power check” in the ribbon.
4. Select the “Measurement” tab and select “Calibrate”.
   The “Power monitor calibration” dialog opens.
   - If you have previously performed the calibration, the date and time of the previous calibration would be displayed under “Last calibration date/time” in the format YYYY-MM-DD hh:mm:ss.
   - To exit the dialog without changes, select “Cancel”.
5. Select “Next” to carry out the whole calibration process.
   To calibrate the power monitor, you have to measure the current output power with an external power meter. Make sure that the result is in the range from 31.7 to 32.3W for a laser power setting of 80.
   If you already measured and checked the output power, select “Skip” and move to step 13.
6. Install the laser power meter.
   Place the laser power meter detector vertically down from the center of the laser emission port at one-third to half of the specified work distance.
   LP-ZV500P: approx. 90mm
   LP-ZV505P: approx. 110mm
   LP-ZV506P: approx. 160mm
   These are the recommended values for a damage threshold of 10kW/cm^2.

Notice

Do not install the detector at the focal point (base position). This may cause destruction of the laser power meter.

7. 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 radiate on the center of the detector.
8. Select “Laser radiation” to measure the output power.

⚠ 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.

9. 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.
10. Select “Stop” to stop laser radiation.
    The laser radiation for measurement automatically stops after about one minute if you do not select “Stop”.
11. Enter a value for “Laser power correction” so that the measured value is in the range from 31.7 to 32.3W.
12. Select “Next” to go on with the calibration.
    To exit the dialog without changes, select “Cancel”.
13. Select “Start calibration”.

⚠ WARNING

During power monitor calibration, the laser radiates without opening the shutter. Even if the shutter remains closed, take appropriate protective measures during laser radiation such as wearing laser protective goggles or using a protective enclosure. Keep flammable materials away from the marking field of your laser marking system.

14. Select “Yes” to start calibration.
15. A message is displayed once the power monitor calibration is completed.
    To close the “Power monitor calibration” dialog, select “Close”.

Related topics

Inspect the laser power with the power check function (page 241)

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.

  In this case, an exclamation mark (!) is displayed on the “Maintenance” screen of Laser Marker NAVI smart, and the output MAINTENANCE OUT (Y13) of the I/O TERMINAL connector turns on.
- 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 I/O 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).

  In this case, an exclamation mark (!) is displayed on the “Maintenance” screen of Laser Marker NAVI smart, and the output MAINTENANCE OUT (Y13) of the I/O TERMINAL connector turns on.
- 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 247)

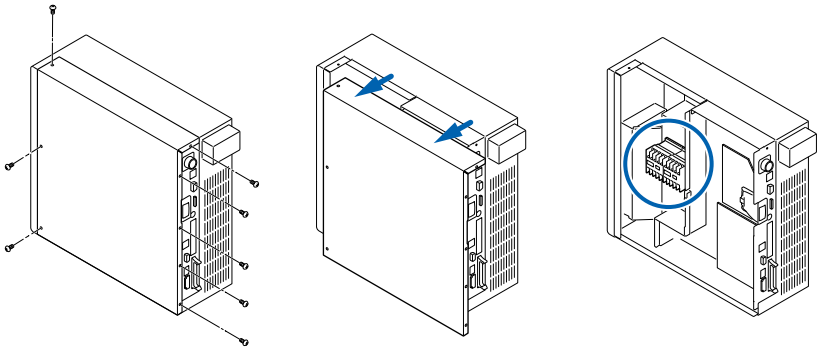
7.2.9.1 Replace the INTERLOCK contactor

Be sure to use the specified type of INTERLOCK contactor.

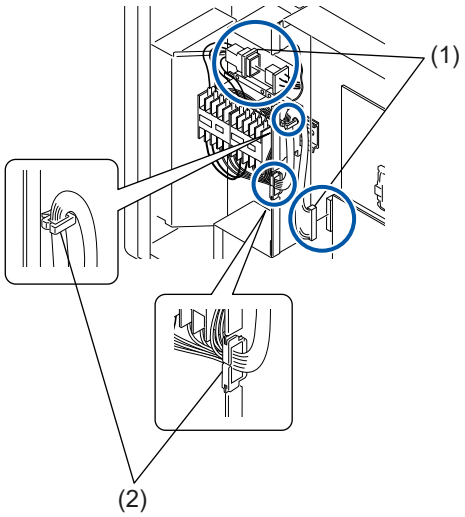
Notice

- 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 M3 screws located on the rear, side, and top of the controller and remove the side panel.

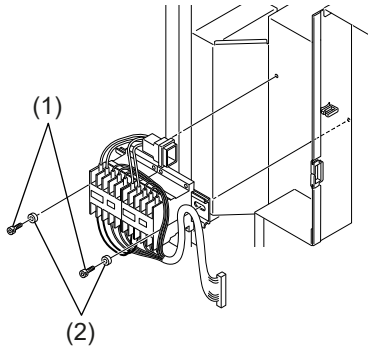


3. Disconnect the two connectors of the INTERLOCK contactor. Then, remove the INTERLOCK contactor's cables from the cable ties.



(1) Connector
(2) Cable tie

4. Loosen the bolts of the INTERLOCK contactor with a hex key (M4) and remove the contactor from the controller.



(1) Bolt
(2) Washer

5. 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

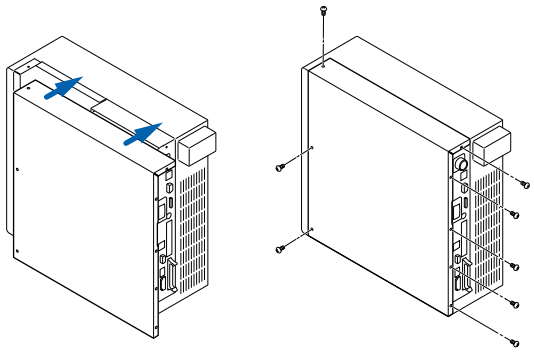
   Notice

   Be careful not to let the cables get caught between the INTERLOCK contactor and the controller.

6. Connect the two connectors of the INTERLOCK contactor to the controller.
7. Attach the cables of the INTERLOCK contactor to the cable ties.
8. Fit the side panel in the top and bottom recesses of the controller. Tighten the M3 screws located on the rear, side, and top of the controller.
   Tightening torque: 0.5Nm

   Notice

   Be careful not to let the cables get caught between the controller's housing and the panel.



9. 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 246)

7.2.10 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 74)

Install the connector covers (page 76)

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”.

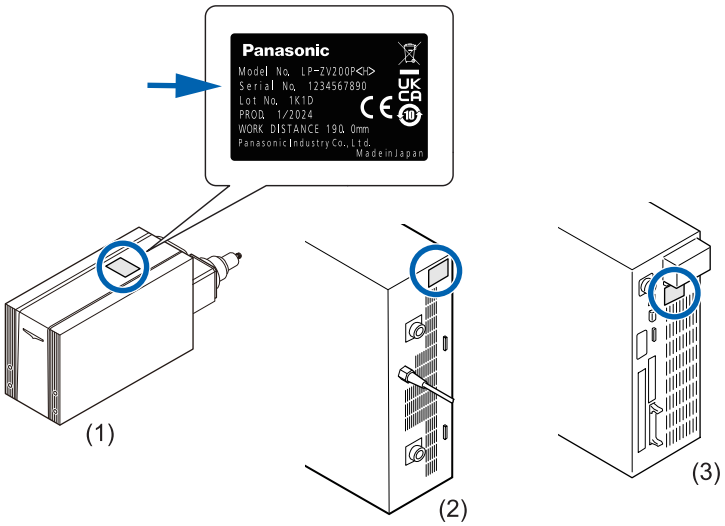
5. If desired, enter comments about the backup file (max. 300 characters) in the “Backup comment” dialog.
   You can refer to the comments when restoring the backup file.
6. Select “OK”.
   The file is saved as a backup file (.lzb or .lmb) to your local or network drive.

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.
- To initialize the data saved in the laser marking system, double-click and execute DeleteUserData.exe located in the installation folder (“Laser Marker Smart Utility” - “Tools”). If you installed Laser Marker Smart Utility with the default setting, the file would be under:

  C:\Program Files (x86)\Panasonic Industry Laser\Laser Marker Smart Utility\Tools\DeleteUserData\DeleteUserData.exe

  or

  C:\Program Files\Panasonic Industry Laser\Laser Marker Smart Utility\Tools\DeleteUserData\DeleteUserData.exe
- If the optional expansion board is installed, ensure that no external storage media, such as USB flash drives, are connected to the USB interfaces on the controller (one on the front and two on the back) before disposal.

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.

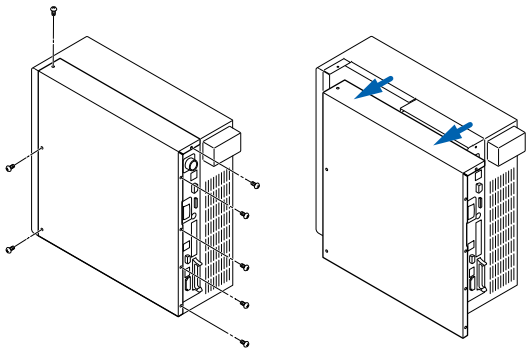
Remove the battery

⚠ WARNING

- This product contains a lithium battery. Lithium batteries and products that use them may pose a risk of explosion if mishandled. To ensure safety, do not expose the battery to heat, disassemble it or dispose of it in a fire.
- Turn off the power of the laser marking system and disconnect the AC power cable before removing the battery. Otherwise, there is a risk of an electrical shock.

A lithium battery is installed in the controller and is used for the system clock. When disposing of the laser marking system in the EU, remove the battery and sort it properly based on the EU Battery Directive (2006/66/EC).

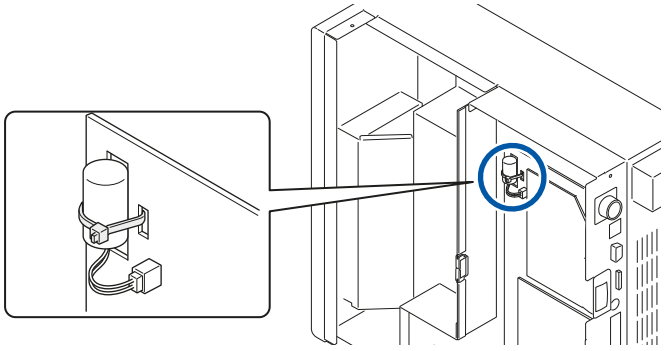
1. Turn off the key switch of the controller and disconnect the AC power cable.
2. Loosen the M3 screws located on the rear, side, and top of the controller and remove the side panel.



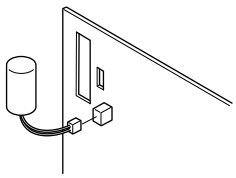
3. Cut the cable tie that secures the battery with a diagonal cutter for plastic.

⚠ WARNING

Wear protective goggles when cutting the cable ties to prevent your eyes from injuries caused by flying plastic particles.



4. Disconnect the connector and remove the battery.



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.

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 255)

Laser pumping

Laser pumping does not start (page 256)
Laser pumping does not start in remote mode (page 257)

Connection with Laser Marker NAVI smart

Laser marking system not available in the “Connection” dialog (page 257)
Online connection is disconnected (page 258)
Ethernet connection cannot be established (page 258)

Lasing process

Marking cannot be done. (The laser emission indicator blinks but marking is not performed on the workpiece.) (page 259)
Marking is not performed in RUN/REMOTE mode. (The laser emission indicator does not light.) (page 260)
Unintended laser radiation occurs (page 260)
Marking position is not correct (page 261)

Marking quality

Marking result is totally or partially faded (page 261)
Edge of the marking field is faded or chipped (page 263)
Marked characters are partially chipped (page 263)
Marking result of filling lines in drawings or characters is uneven (page 264)
Filling lines in drawings, bar codes or 2D codes are deformed (straight lines are marked wavy) (page 264)
Marking result is uneven, characters are deformed (page 264)
Marking line runs over the intended start or end points (page 265)
Small characters are not readable (page 266)
Marking result is dotted (page 266)

On-the-fly marking

Marking is sometimes skipped (E750) (page 266)
Start lines of characters are distorted or partially incomplete (page 267)
Characters are distorted or character spacing is unstable (page 267)

External control

Communication with the external device does not start (page 269)
I/O control fails (page 270)
Command control fails (page 271)
Marking trigger ready output does not turn on (page 272)
A negative response is returned (page 273)

Linking of image processing devices

Linking of an imagechecker and/or a code reader fails (page 275)
Position correction fails (page 276)
Code or character reading results are NG (page 276)
Marking result is uneven, characters are deformed (page 277)

Built-in camera (LP-ZV)

Camera image not displayed (page 278)
Workpiece not displayed properly (page 278)
Workpiece size in marking image editor is incorrect (page 279)

Operation by touch panel console or monitor (LP-RH, LP-ZV)

Touch panel console or monitor shows an empty screen (page 279)
Mouse does not respond (page 280)
USB flash drive cannot be recognized (page 280)

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 269).

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 255).

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 269).

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 256).

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 282)

Warning messages (E600–E799) (page 293)

Reset a warning message (E600–799) (page 292)

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 293)

Reset an alarm message (E001–E599) (page 281)

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 293)

Alarm messages (E001–E599) (page 282)

Reset an alarm message (E001–E599) (page 281)

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 282)

Reset a warning message (E600–799) (page 292)

10 Record of changes

EN-EU-LPZV-SM-6, 2025.04

First European edition (based on ME-LPZV-SM-6 2025.2)

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April 2025