Panasonic

Laser Welding Machine

Setup / Maintenance Guide

VL-W1 series

Please read these instructions carefully before using this product, and save this manual for future use.

ME-VLW1N-SM-3

2024.9 | industry.panasonic.com/

Preface

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

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

■ General terms and conditions of this document

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

■ Disclaimer

The applications described in this document are all intended for examples only. The purchase of our products described in this document shall not be regarded as granting of a license to use our products in the described applications. We do NOT warrant that we have obtained some intellectual properties, such as patent rights, with respect to such applications, or that the described application may not infringe any intellectual property rights, such as patent rights, of a third party.

■ Trademark

- Windows is a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.
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- All other product names and companies provided in this document are trademarks or registered trademarks of their respective companies.

Cautions in Handling

ALWAYS FOLLOW THESE IMPORTANT SAFETY PRECAUTIONS!

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

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

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

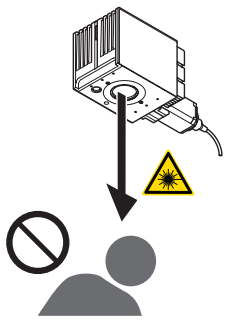
The following symbols are used to classify and describe the type of instructions to be observed.

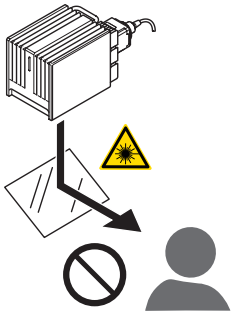
⃠	This symbol is used to alert users to a specific operating procedure that must not be performed.
❗	This symbols is used to alert users to a specific operating procedure that must be followed in order to operate the unit safely.
⚠	This symbols is used to alert users to a specific operating procedure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

⚠ DANGER

⃠

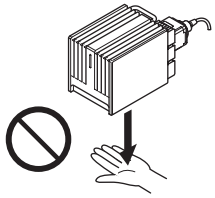
- Never look at laser beam directly, through lens or through any other optical components. Laser beam radiation into the eye causes blindness or serious damage to the eye.
  Not only the direct beam of laser, but also diffused reflected beam is harmful.





⃠

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



❗

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

⚠WARNING

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

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

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

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

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

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

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



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

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

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

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

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

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

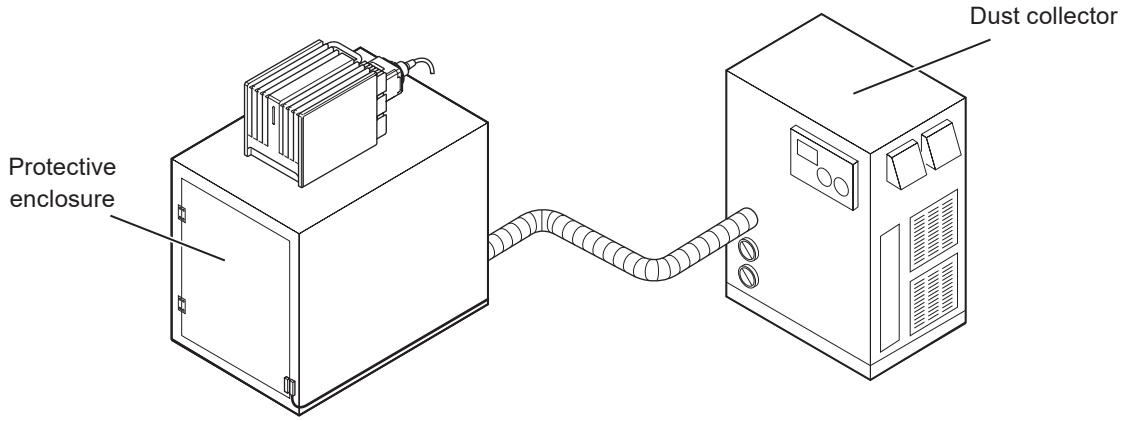
- The wiring and maintenance must be conducted by the electrical engineers or under their supervision. Incorrect work may cause electrical shock.

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

⚠WARNING

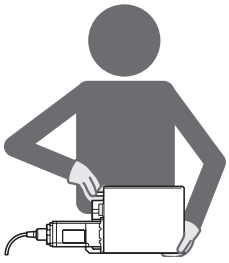
- Perform regular maintenance (cleaning, parts replacement) on this product. Using the product with dust or dirt may cause a fire or electric shock.

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

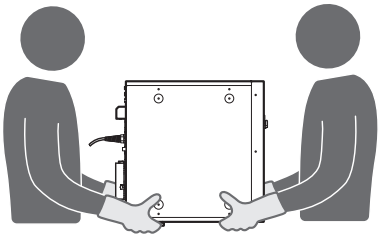


- When using the assist gas for laser processing, take safety precautions to protect operators from exposure, ignition, toxic effect, excess or lack of oxygen.

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



Head



Controller

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

⚠ WARNING

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

⚠ CAUTION

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

For the Proper Use of Product

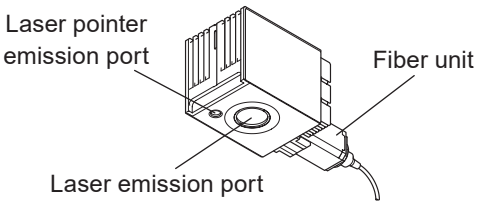
• Be sure to observe the following matters to prevent a failure or a malfunction of this product and to maintain the product performance properly.

■ 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 component and optical component inside, which could impair the performance or result in a failure.
- Do not use the system outdoors.
- This product uses the air cooling system as the laser cooling method. Please install not to bar the flow of air cooling. Avoid placing heat sources near the product.
- Be sure to use the product within the ambient temperature and humidity defined in the specifications.
- Be careful not to have water, oil, fingerprints, dust, or dirt attached to the laser emission port of the head. This could degrade the lasing performance and may result in a failure. If the laser emission port becomes dirty, use a dry soft cloth to clean the port.
- If the air filter becomes dirt, clean the filter without delay. Failure to do so may hinder the air flow, resulting in failure of this product. Make sure to replace the air filter on a periodic basis.
- Ensure that the dust or gas is removed by placing the intake duct of the dust collector or exhauster near the source of dust or gas. Any dust or gas contamination on the laser emission port may cause failure or decrease the laser processing quality. In addition, when the laser beam is blocked by dust or gas, it may cause decrease in laser processing quality.

■ Installation

- Carry and install this product properly with referring to “2 Laser Welding Machine Installation” (P.40).
- Do not hold the fiber unit, cables and connectors at carrying this product.
- Do not touch the laser emission port on the bottom of the head. They may affect the laser processing quality badly.



- Do not move the head unit during the operation. Install the product by following the specified direction and method not to give excessive load acts on the head and cables. Failure to do so may damage the head precision parts or disconnect the cables, resulting in a failure.
- Be careful not to apply excess force to the cable or not to nip the cable at the installation.
- Verify the minimum bend radius of each cable and install them without excess forces being applied.
- 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 foreign objects to the exhaust port of each unit or the gaps between units.
- Use anti-reflection material (ex. black paint for metal) for an external shutter or a protective enclosure in a path of laser beam. It may cause a failure of the components inside the head.
- If any other devices such as a sensor or a camera are installed near the laser welding machine, make sure that these devices are installed in the place where laser beam and its reflected beam do not damage to them.

For the Proper Use of Product



- Be sure to observe the following matters to prevent a failure or a malfunction of this product and to maintain the product performance properly.

■ Wiring

- Verify that the cables are wired correctly before powering on.
- For the connection of this product, use the dedicated cables attached to the product or the specified optional cables.
- For the AC power cable, use a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used.
- Check the voltage fluctuations of the power supply. Do not input the power supply exceeding the rating.
- If a surge occurs in the power supplied, connect a surge absorber to a source of the surge to absorb it.
- Be sure to take measures against surge before connecting any induction load such as DC relay to the load.
- The output has no protection function for short-circuit; therefore, do not connect the power supply or capacitive load directly.
- Make sure to ground the frame ground (F.G.) terminal and the protective conductor terminal of this product.
- Install such that the controller housing and the head housing are at the same electric potential.
- Each connecting cable should not be used in the same raceway or connected in parallel to any device that generates high-tension wires, power lines, large switching surge or the like. There is a risk of malfunction caused by induction.
- USB cable should not be connected in parallel with the AC power cable or the motor power cable.
- Make the wiring as short as possible to prevent a malfunction by the noise.

■ Operation

- Do not power off until the startup has completed since turning on the laser welding machine power.
- To power on the laser welding machine again, wait for 5 seconds or more since turning off the power, then turn it on again.
- Do not remove the USB media nor turn off the power during the data writing and reading operation.

■ Others

- Be sure to delete all registered data when transferring or discarding this product. Retained data might result in illegal read out and leaking of information by a third-party with malicious intent.

Network security

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

(1) Leakage or theft of information through this product

(2) Use of this product for illegal operations by persons with malicious intent

(3) 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, tablet or USB memory stick 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.

■ Order Placement Recommendations and Considerations

The Products and Specifications listed in this document are subject to change (including specifications, manufacturing facility and discontinuing the Products) as occasioned by the improvements of Products. Consequently, when you place orders for these Products, Panasonic Industry asks you to contact one of our customer service representatives and check that the details listed in the document are commensurate with the most up-to-date information.

SAFETY PRECAUTIONS

Panasonic Industry is consistently striving to improve quality and reliability. However, the fact remains that electrical components and devices generally cause failures at a given statistical probability. Furthermore, their durability varies with use environments or use conditions. In this respect, check for actual electrical components and devices under actual conditions before use. Continued usage in a state of degraded condition may cause the deteriorated insulation. Thus, it may result in abnormal heat, smoke or fire. Carry out safety design and periodic maintenance including redundancy design, design for fire spread prevention, and design for malfunction prevention so that no accidents resulting in injury or death, fire accidents, or social damage will be caused as a result of failure of the Products or ending life of the Products.

The Products are designed and manufactured for the industrial indoor environment use. Make sure standards, laws and regulations in case the Products are incorporated to machinery, system, apparatus, and so forth. With regard to the mentioned above, confirm the conformity of the Products by yourself.

Do not use the Products for the application which breakdown or malfunction of Products may cause damage to the body or property.

i) usage intended to protect the body and ensure security of life
ii) application which the performance degradation or quality problems, such as breakdown, of the Products may directly result in damage to the body or property

It is not allowed the use of Products by incorporating into machinery and systems indicated below because the conformity, performance, and quality of Products are not guaranteed under such usage.

i) transport machinery (cars, trains, boats and ships, etc.)
ii) control equipment for transportation
iii) disaster-prevention equipment / security equipment
iv) control equipment for electric power generation
v) nuclear control system
vi) aircraft equipment, aerospace equipment, and submarine repeater
vii) burning appliances
viii) military devices
ix) medical devices (except for general controls)
x) machinery and systems which especially require the high level of reliability and safety

ACCEPTANCE INSPECTION

In connection with the Products you have purchased from us or with the Products delivered to your premises, please perform an acceptance inspection with all due speed and, in connection with the handling of our Products both before and during the acceptance inspection, please give full consideration to the control and preservation of our Products.

WARRANTY PERIOD

Unless otherwise stipulated by both parties, the warranty period of our Products is one year after the purchase by you or after their delivery to the location specified by you.
The consumable items such as battery, relay, filter and other supplemental materials are excluded from the warranty.

SCOPE OF WARRANTY

In the event that Panasonic Industry confirms any failures or defects of the Products by reasons solely attributable to Panasonic Industry during the warranty period, Panasonic Industry shall supply the replacements of the Products, parts or replace and/or repair the defective portion by free of charge at the location where the Products were purchased or delivered to your premises as soon as possible.
However, the following failures and defects are not covered by warranty and we are not responsible for such failures and defects.

(1) When the failure or defect was caused by a specification, standard, handling method, etc. which was specified by you.
(2) When the failure or defect was caused after purchase or delivery to your premises by an alteration in construction, performance, specification, etc. which did not involve us.
(3) When the failure or defect was caused by a phenomenon that could not be predicted by the technology at purchasing or contracted time.
(4) When the use of our Products deviated from the scope of the conditions and environment set forth in the instruction manual and specifications.
(5) When, after our Products were incorporated into your products or equipment for use, damage resulted which could have been avoided if your products or equipment had been equipped with the functions, construction, etc. the provision of which is accepted practice in the industry.
(6) When the failure or defect was caused by a natural disaster or other force majeure.
(7) When the equipment is damaged due to corrosion caused by corrosive gases etc. in the surroundings.

The above terms and conditions shall not cover any induced damages by the failure or defects of the Products, and not cover your production items which are produced or fabricated by using the Products. In any case, our responsibility for compensation is limited to the amount paid for the Products.

SCOPE OF SERVICE

The cost of delivered Products does not include the cost of dispatching an engineer, etc.
In case any such service is needed, contact our sales representative.

Related Regulations and Standards

■ Applicable regulations and standards

This product meets the requirements mandated by the following regulations and standards.
Note that our products do not conform to the regulations and standards of the countries and regions not mentioned in this section. When exporting the product by itself or integrated into machine or device, confirm the regulations and standards of the exporting country or region.

Model	Applicable regulations and standards
VL-W1500-N VL-W1A00-N VL-W1506-N VL-W1A06-N	JIS (Japanese Industrial Standards) • JIS C 6802
	FDA (Food and Drug Administration) Regulations • 21 CFR 1040.10 and 1040.11 (except for conformance with IEC 60825-1 Ed. 3, as described in Laser Notice No. 56 dated May 8, 2019)

	EN Standard (CE Marking) *1
	• 2014/30/EU “EMC Directive”
	  • EN 55011
	  • EN 61000-6-2
	• 2006/42/EC “Machinery Directive” (for partly completed machinery) *2
	  • 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 specification
	  • EN 60825-1
	EN Standard (UKCA Marking) *3
	• 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) *4
	  • 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 specification
	  • EN 60825-1

	GB (Chinese National Standard) • GB 7247.1-2012 (idt IEC 60825-1: 2007)

*1 : Authorized Representative in EU:
Panasonic Marketing Europe GmbH, Panasonic Testing Centre
Winsbergring 15, 22525 Hamburg, Germany

*2 : The printed copy of EU declarations of conformity “EU Declaration of Incorporation of Partly Completed Machinery” is included in the package of this product.

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

*4 : The printed copy of UK declarations of conformity “UK Declaration of Incorporation of Partly Completed Machinery” is included in the package of this product.



- Construct a safety system before using this product as it is a class 4 laser product.
- While constructing the system, check ISO 13849-1 and ISO 11553-1, and take the required safety measures accordingly.
  Please see the “Laser Safety Guide” for details.

■ Implementing safety measures for the laser products

This product falls into Class 4 laser product according to IEC 60825-1 “Safety of Laser Products”.
By definition, class 4 lasers 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.”
To protect the operator from being exposed to a laser beam, be sure to follow the instructions in attached “Laser Safety Guide” and safety regulations in each country or region.

■ Removing and eliminating dust or gas

Depending on the laser radiation objects, noxious dust or gas may generate by the laser radiation, which could harm human body or the environment.
Eliminate dust or gas generated using a dust collector or an exhauster according to the constituent of such dust or gas.
Dispose of the exhaust gas safely and appropriately according to the laws and regulations of the country, region, or area applicable.

■ Attention for the laser welding machine disposal

For disposal of this product, segregate and dispose of it appropriately according to the laws and regulations of the country, region, or area applicable.
Refer to “7-5 Disposal of Laser Welding Machine” (P.154).

■ To use the laser welding machine 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 laser welding machine product is incorporated into the system and it 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 laser welding machine to the system by following the requirements for the accessibility and maintenance of EN 60204-1.
- Provide the power to the laser welding machine from the power supply terminals of the system.

Information for use

■ Target readers

This document is intended for the following readers: “System Designer” and “System Administrator” of the system that uses this product. Also, it is necessary to appoint a “Laser Safety Manager” in order to ensure safety regarding laser.

Classification	Description
Laser Safety Manager	A person who has sufficient knowledge to assess and manages the risk of laser damage and who is responsible for managing and overseeing the laser hazard. The requirements required for the Laser Safety Manager are as follows. (They are described in the Laser Safety Guide.)
System Designer	A person who designs a system that incorporates this product. This person is required to be fully familiar with the knowledge and precautions related to system design and laser safety. The person needs to be fully familiar with the knowledge and precautions related to laser and machine safety and to take necessary protective measures.
System Administrator	A person who has the authority to operate and manage the system that incorporates this product. It refers to a person who is fully familiar with operations, troubleshooting and maintenance procedures of laser and machines. This person is required to be fully familiar with the knowledge and precautions related to the safety of laser and machines and to implement protective measures for the operations by the user.

■ Information for use

This document describes information for use on the assumption that our company products are incorporated and operated in the system. The System Designer and System Administrator must consider the safety of the overall system in designing and operating the system.

Life cycle	Description	Chapters containing main descriptions
Overall	Explains general safety precautions.	Separate volume: Laser Safety Guide This document: Cautions in Handling Related Regulations and Standards
Transportation	Explains precautions in handling the product during transportation.	This document: Chapter 2
Assembling and installation	Explains precautions in installing and wiring the product.	This document: Chapter 2 and Chapter 4
Setup and operation	Explains startup and exit procedures, operation mode, and control methods using external devices.	This document: Chapter 3 - 5 *
Cleaning and maintenance	Explains daily cleaning and items that require maintenance such as parts replacement.	This document: Chapter 7
Troubleshooting	Explains methods of resolving problems that may occur during startup or operation.	This document: Back matter
Disuse	Explains precautions related to product disposal.	This document: Chapter 7

* : Depending on the system configuration, refer also to the operation manual or communication manual of the software.

How to Read this Document

■ Symbol description

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

■ Target model

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

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

■ Type of manuals

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

Laser Safety Guide

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

Setup/Maintenance Guide

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

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

Operation Manual

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

Serial Communication Command Guide

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

Reference

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

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1 Product Overview

1-1 Product Model

Laser welding machine VL-W1 series have the following models.
Some of the specifications vary depending on the model. For details, see “1-4 Specification” (P.24).

Model	Laser output for processing	Working field
VL-W1500-N	45W	200 mm x 200 mm
VL-W1506-N		400 mm x 400 mm
VL-W1A00-N	90W	200 mm x 200 mm
VL-W1A06-N		400 mm x 400 mm

■ Model description

VL-W1 A0 0-N
① ② ③④

① Represents the series name. “VL-W1 series” refers to the fiber laser welding machine.

② Represents the laser output class. The following types are applicable to this product.

50: Laser output for processing 45W
A0: Laser output for processing 90W

③ Represents the working field size. The following types are applicable to this product.

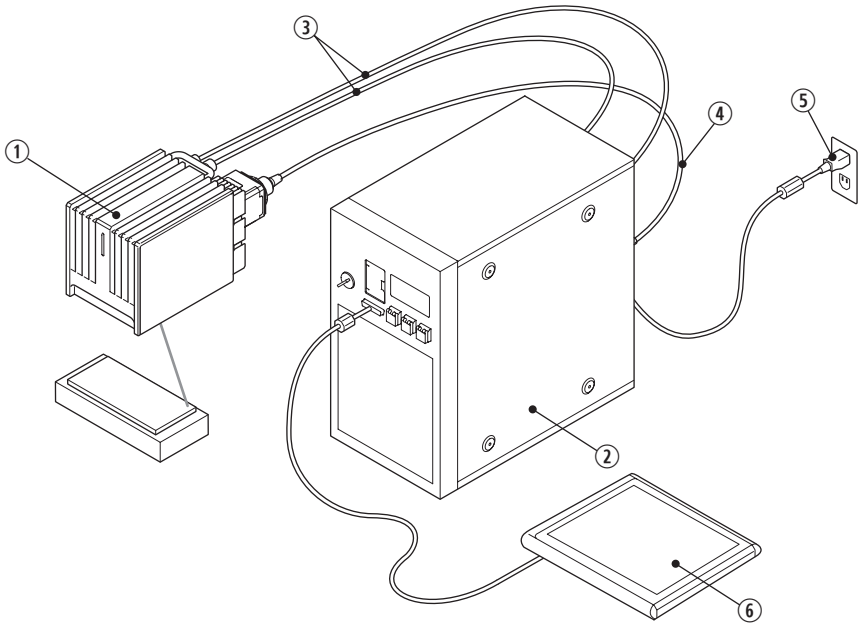
0: Working field 200 mm x 200 mm

6: Working field 400 mm x 400 mm

④ Represents the series name.

1-2 Product Configuration

This product is a laser welding machine which is used to process the materials by lasing.
The laser welding machine VL-W1 series consists mainly of the following units.



No.	Name	Description
①	Head	It is the unit that radiates the laser beam. The optical components and the scanner are loaded inside.
②	Controller	It is the unit that stores the setting data and controls the operation. The main power supply, laser oscillator and connection interface with external devices are loaded.
③	Unit power cable (Attached accessory) Signal cable (Attached accessory)	Cables to connect the head and controller.
④	Fiber cable	Cable to deliver the laser beam from controller to head.
⑤	AC power cable (Optional item)	Cable to supply AC power to the controller. Use the specified optional cable or a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used.
⑥	Touch panel console (Optional item) or Commercially available monitor and mouse (Not included in this product.)	Connect the touch panel console or monitor and mouse to the laser welding machine to set the drawing data and other lasing parameters. This display can be used also as a monitor during the operation.

■ Optional items

The following optional items (sold separately) are available for this product.
To purchase them and for the detailed information, please contact our sales office.

Optional items	Model
AC power cable: Rating 125V AC, PSE certified cable (For Japan)	LP-ACA10
AC power cable: Rating 250V AC, PSE certified cable (For Japan)	LP-ACA11
AC power cable: Rating 250V AC, CE certified cable (For Europe) *1	LP-ACA12
Touch panel console	LP-ADP40 (Discontinued) LP-ADP50
Air filter (for replacement)	LP-AFT50X5
Protection glass of laser emission port (for replacement)	LP-ACV70
Set of gaskets for head (for replacement)	LP-APK10X5

*1 : Rating 250V AC, CE certified cable (For Europe) plug is compliant with the following standards.
VDE,DEMKO,NEMKO,FIMKO,SEMKO,OVE,KEMA,CEBEC.

Notice

- For the AC power cable, use a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used.

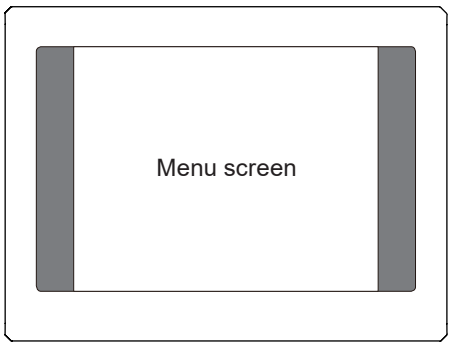
Reference

- Some optional items cannot be sold due to regulations in each country or region. For detailed information, please contact our sales office.
- For the recommended AC power cable for China (rating 250V, CCC certified cable), please contact our sales office.

■ LP-ADP40 and LP-ADP50 compatibility

Item	LP-ADP40 (Discontinued)	LP-ADP50
Screen size	8.4 inch	10.1 inch (wide)
Display resolution	800 × 600 (SVGA)	1280 × 800 (WXGA) *1
Interface	D-sub 25 pin	D-sub 25 pin
Buzzer sound (when touched)	ON	OFF
Mounting torque	0.8 N·m (M4, depth 6mm)	0.7±0.1 N·m (M4, depth 5mm)
Outer dimensions	W: 253mm × H: 197mm × D: 41.5mm	W: 265mm × H: 200mm × D: 36mm
Attached accessory	Wall hook, pen holder	None

*1 : For LP-ADP50, the LCD resolution is 1280×800 (WXGA), so the menu screen is displayed in the center.

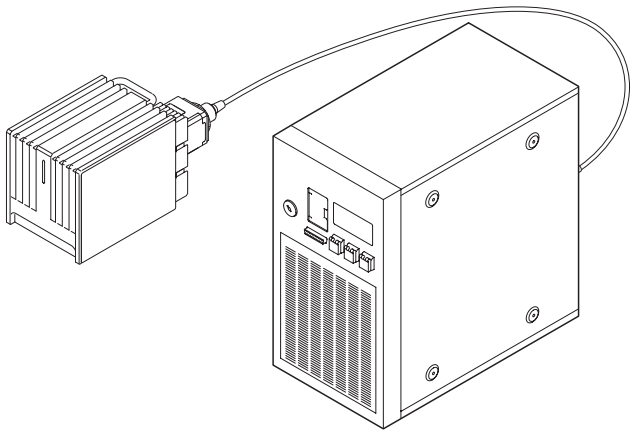


1-3 Package

Before using this product, be sure to check the packed objects as shown below.
This product is delivered in a set of head unit and controller unit packed in one box.
If you find any missing item in the package, please contact the dealer you purchased it or our sales office.

Notice

- Be sure to store the packing material. Since this product is precision machinery, reuse the packing materials to prevent damages during transportation.



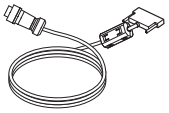
☐ Laser welding machine: Head and controller
1 unit



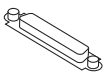
☐ System key
qty.: 2



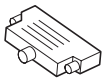
☐ Unit power cable
qty.: 1



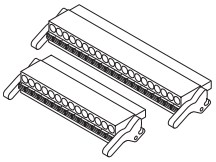
☐ Signal cable
qty.: 1



☐ I/O connector
qty.: 1



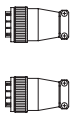
☐ I/O connector cover
qty.: 1



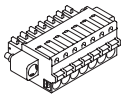
☐ I/O terminal block
20 pins : 1
14 pins : 1



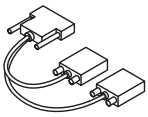
☐ Jumper wire (partly installed to I/O terminal)
qty.: 7



☐ Interlock connector
qty.: 2



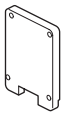
☐ Shutter close output terminal
qty.: 1



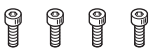
☐ Return harness
qty.: 1



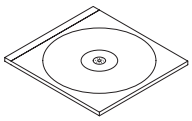
☐ USB cable (2m)
qty.: 1



☐ Scanner unit cover
qty.: 1

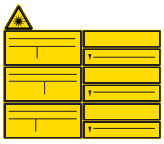


☐ M5 screw (for scanner unit cover)
qty.: 4



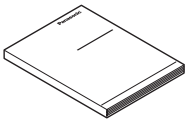
☐ Laser Processing Utility_VL-W1 (CD-ROM) *1

qty.: 1



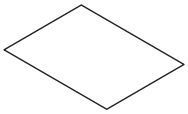
☐ Warning / explanation / aperture label

qty.: 1



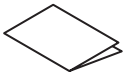
☐ Laser Safety Guide

qty.: 1



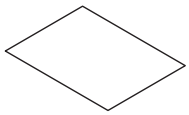
☐ Carrying caution leaflet/information about PDF manuals

qty.: 1



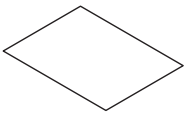
☐ General Information for Safety, Compliance, and Instructions

qty.: 1



☐ Copy of EU Declaration of Incorporation

qty.: 1



☐ Copy of UK Declaration of Incorporation

qty.: 1

*1 : This CD-ROM contains the following data:

PC setting software
Logo Data Conversion Software
Logo Data Editing Software

PDF manuals	Language
Laser Safety Guide	English / Simplified Chinese / Japanese
Setup/Maintenance Guide	
Serial Communication Command Guide	
Operation Manual	
Logo Data Conversion Software Operation Manual	
Logo Data Editing Software Operation Manual	

Reference

- The AC power cable is not included in this product. Use the specified optional cable or a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used. For the optional cables, refer to “1-5-4 Cables” (P.29).

1-4 Specification

■ Optical specifications

Item	Model	
	VL-W1500-N VL-W1A00-N	VL-W1506-N VL-W1A06-N
Condensing lens	Single lens	
Working field (X, Y) [mm] *1	200 × 200	400 × 400
Work distance (Base position ± setting range) [mm]	315 ± 15	685 ± 15
Control range of output beam diameter [mm] *2	ϕ 0.7 to ϕ 2.0	ϕ 1.0 to ϕ 2.0
Radiation exit angle [°]	90 ± 22	

*1 : The working field has approx. +/-1.2mm deviation per product.
*2 : If there are fluctuations in the ambient temperature, the output beam diameter can change around 1% per one degree C.

■ Laser and general specifications

Item		Model	
		VL-W1500-N VL-W1506-N	VL-W1A00-N VL-W1A06-N
Output laser	Laser type	Yb: Fiber laser, Wavelength: 1070nm, Class 4 laser	
	Oscillator average output	50W	100W
	Average output for processing *3	45W ± 5%	90W ± 5%
	Mode of operation	CW oscillation	
Guide laser, laser pointer		Red semiconductor, Wavelength: 655nm, Class 2 laser Max. output: 1mW or less	
Scanning system		Digital galvano scanner	
Scanning speed *4		Max 3000 mm/sec.	
Beam stop		1 Shutter is equipped inside of head	
Work piece status		Stationary object	
No. of setting files		2048 files	
Setting data	Readable data	VEC *5, DXF, HPGL *6, BMP *6, JPEG *6	
	Drawing data	Line, Circle, Arc, Rectangle, Point radiation	
Removable storage media		USB media *7	
I/O port		I/O terminal block, I/O connector, Interlock connector, Shutter close output terminal	
Serial communication interface		EIA-RS-232C (for external control and power data output)	
Attached software		Logo Data Conversion Software, Logo Data Editing Software	
Supported OS *8		Windows® 11 Pro 64bit / Windows® 10 Pro 32bit, 64bit	
Display language		English, German, Japanese, Chinese (Simplified)	
Required time for system startup		Approx. 75 seconds	
Required time for laser pumping		Approx. 15 seconds	

Item		Model	
		VL-W1500-N VL-W1506-N	VL-W1A00-N VL-W1A06-N
Power voltage		90V to 132V AC or 180V to 264V AC (including ± 10% voltage fluctuations) *9 Frequency: 50/60Hz	
Power consumption *10	100V AC	580VA or less	740VA or less
	200V AC	720VA or less	830VA or less
Grounding method		Direct earth for both the head and the controller	
Cooling method	Head	Natural air-cooling	
	Controller	Forced air-cooling	
Operating ambient temperature *11		0°C to +40°C	
Ambient temperature for storage *11		-10°C to +60°C	
Operating ambient humidity *11		35 to 85%RH	
Protection degree of head *12		IP54	
Overvoltage category		Ⅱ	
Pollution degree		2	
Use location		Indoor; at an altitude of 1000 m or below	
Fiber cable length		5 m ± 0.2 m, Minimum bent radius 70 mm	
Installation direction	Head	• Horizontally with the laser emission port facing downward or upward • Vertically with the rear of the head facing upward	
	Controller	Vertically or horizontally	
Weight	Head	Approx. 12kg	
	Controller	Approx. 28kg	Approx. 35kg
Battery (mounted in product)	Type	Graphite fluoride lithium primary battery	
	Model	BR-1 / 2AAC2P	
	Quantity	1 piece	
	Weight	Approx. 9.5g	

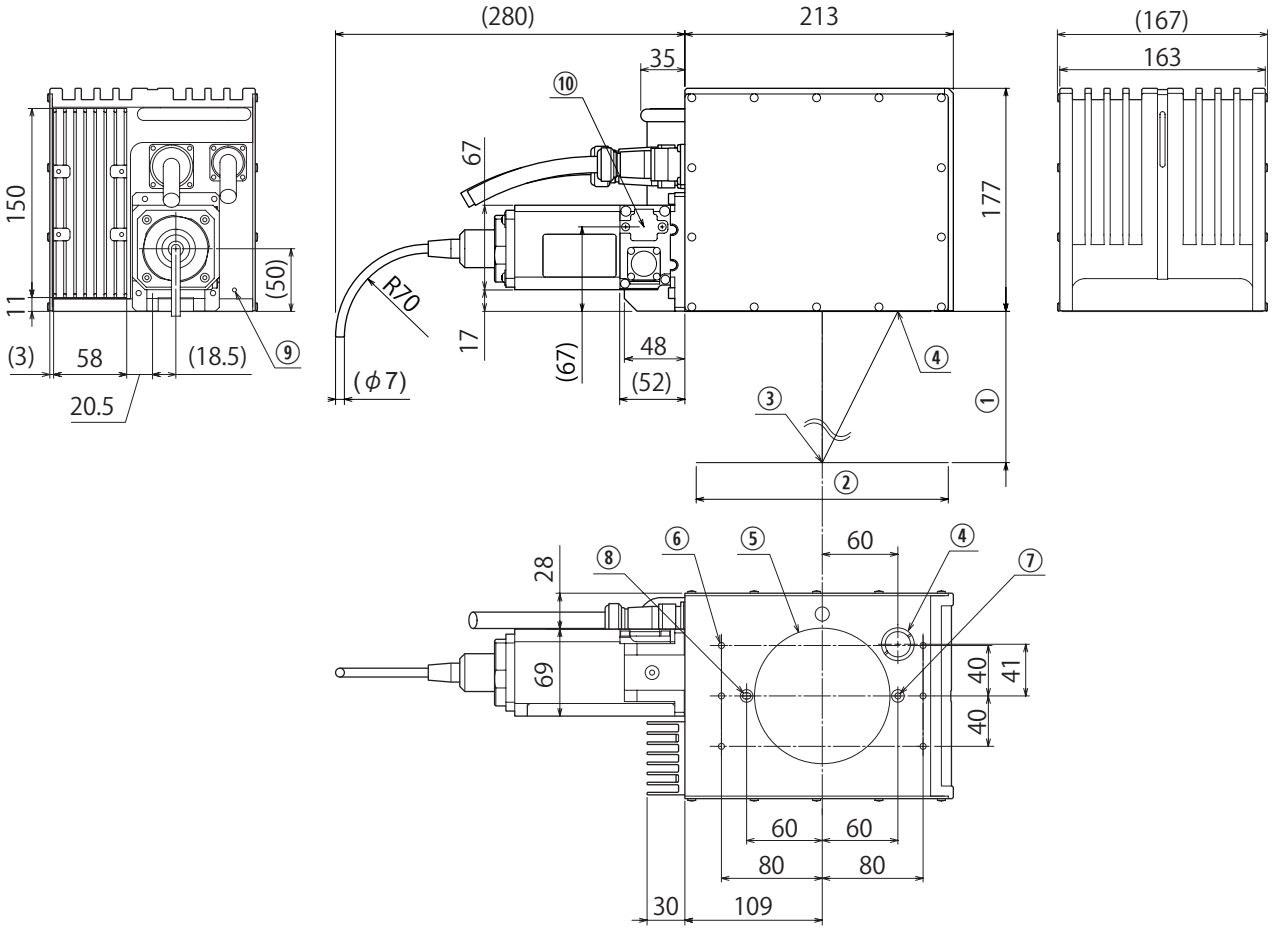
*3 : Average output power from the laser welding machine at delivery time with the maximum laser power setting.
*4 : The value shown here is the configuration range that can be input. The setting values that can keep the quality of laser processing vary depending on the setting details and the target materials.
*5 : VEC is a graphic file format dedicated for the laser welding machine.
*6 : Requires converting to VEC format with the attached “Logo Data Conversion Software”.
*7 : Check the operation before use. Use a USB flash drive formatted with FAT32. USB media with security features cannot be used.
*8 : OS versions of which Microsoft has ended support are excluded.
*9 : The power supply voltage switches automatically.
*10 : The typical value of the inrush current at startup is as follows: (Duration time is 10ms or less.)
At 100V AC: 80A
At 200V AC: 160A
*11 : Common to the controller and the head. No condensation or freezing shall be allowed. If there is a gap between the stored temperature and operating temperature, make sure to have the product get used to the operating ambient temperature gradually prior to use to prevent the dew condensation.
*12 : The controller is non-compliant with the ingress protection rating. The ingress protection characteristics of the head are ensured only when the fiber unit, cables, and the cover of the output beam diameter control are mounted properly.

1-5 Outer Dimensional Drawing

1-5-1 Head

■ VL-W1500-N, VL-W1A00-N, VL-W1506-N, VL-W1A06-N

Unit: mm



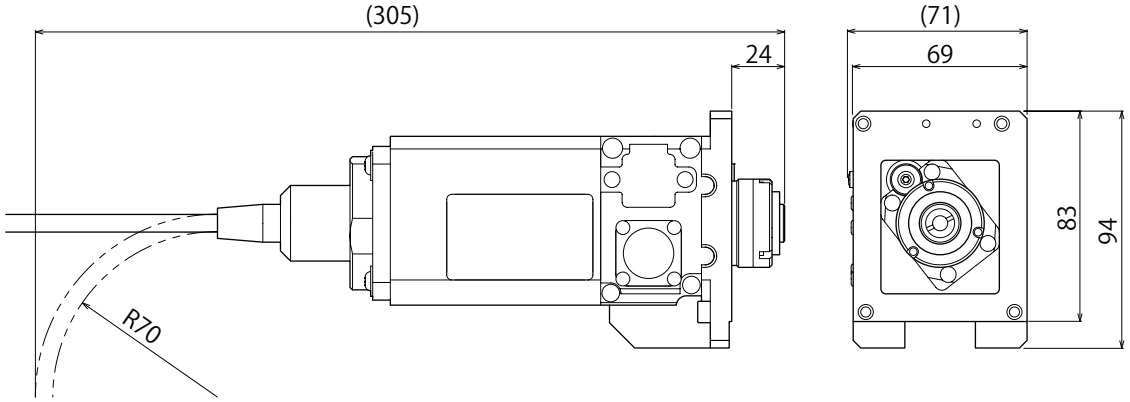
No.	Description
①	Work distance (Base position ± setting range) VL-W1500-N, VL-W1A00-N: 315 mm ± 15 mm / VL-W1506-N, VL-W1A06-N: 685 mm ± 15 mm
②	Working field (X, Y) VL-W1500-N, VL-W1A00-N: 200 mm x 200 mm / VL-W1506-N, VL-W1A06-N: 400 mm x 400 mm
③	Center of working field
④	Laser pointer emission port ϕ 26mm (Emission port diameter: ϕ 20mm, pointed to the center of working field)
⑤	Laser emission port diameter: ϕ 70mm (Lens: ϕ 62mm)
⑥	Head fixing screw hole (six holes): M6 screw, depth 6
⑦	Head positioning pin hole: ϕ 4 $^{+0.03}_{0}$, depth 6
⑧	Head positioning pin hole: Elongated hole ϕ 4 $^{+0.03}_{0}$ × 6, depth 6
⑨	Screw for frame ground: M4 screw, depth 5
⑩	Output beam diameter control dial

Reference

- For details on the head component installation, refer to “2-3-3 Installation method” (P.44).

1-5-2 Fiber unit

When the fiber unit is detached from the head
Unit: mm



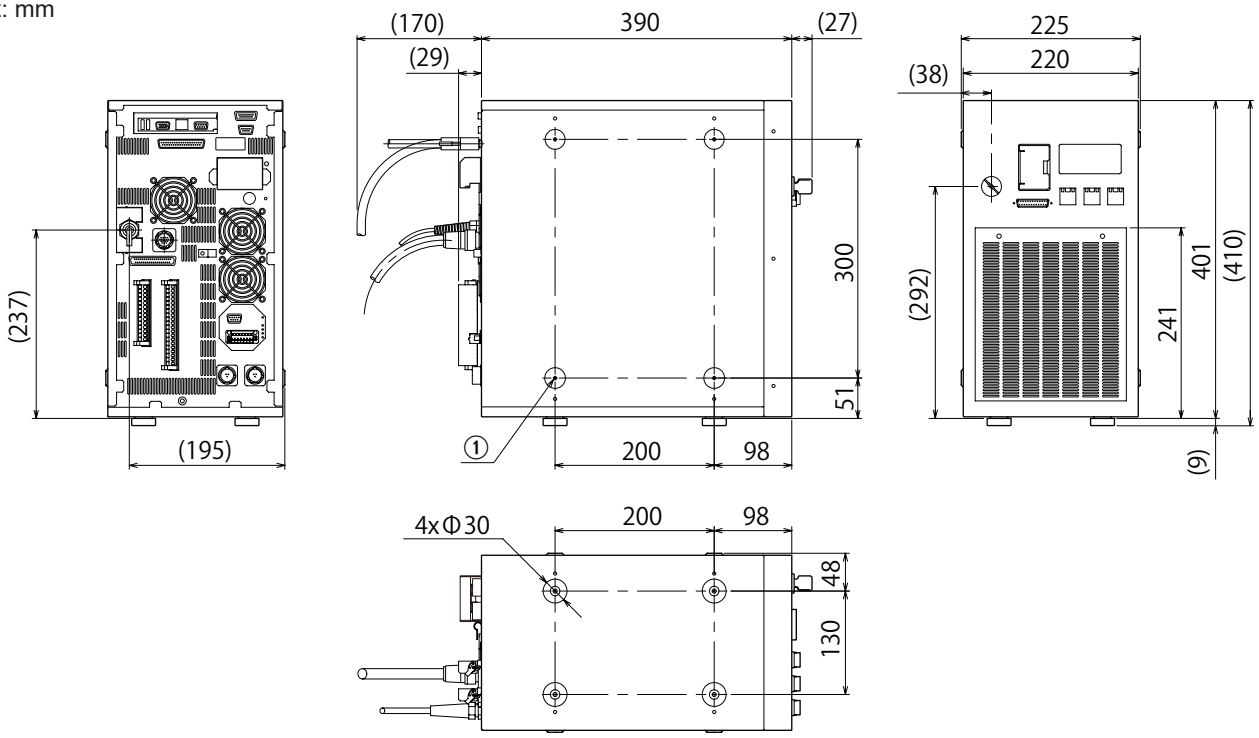
Reference

- For the detaching of the fiber unit, refer to “2-3-6 Detaching / attaching the fiber unit” (P.47).

1-5-3 Controller

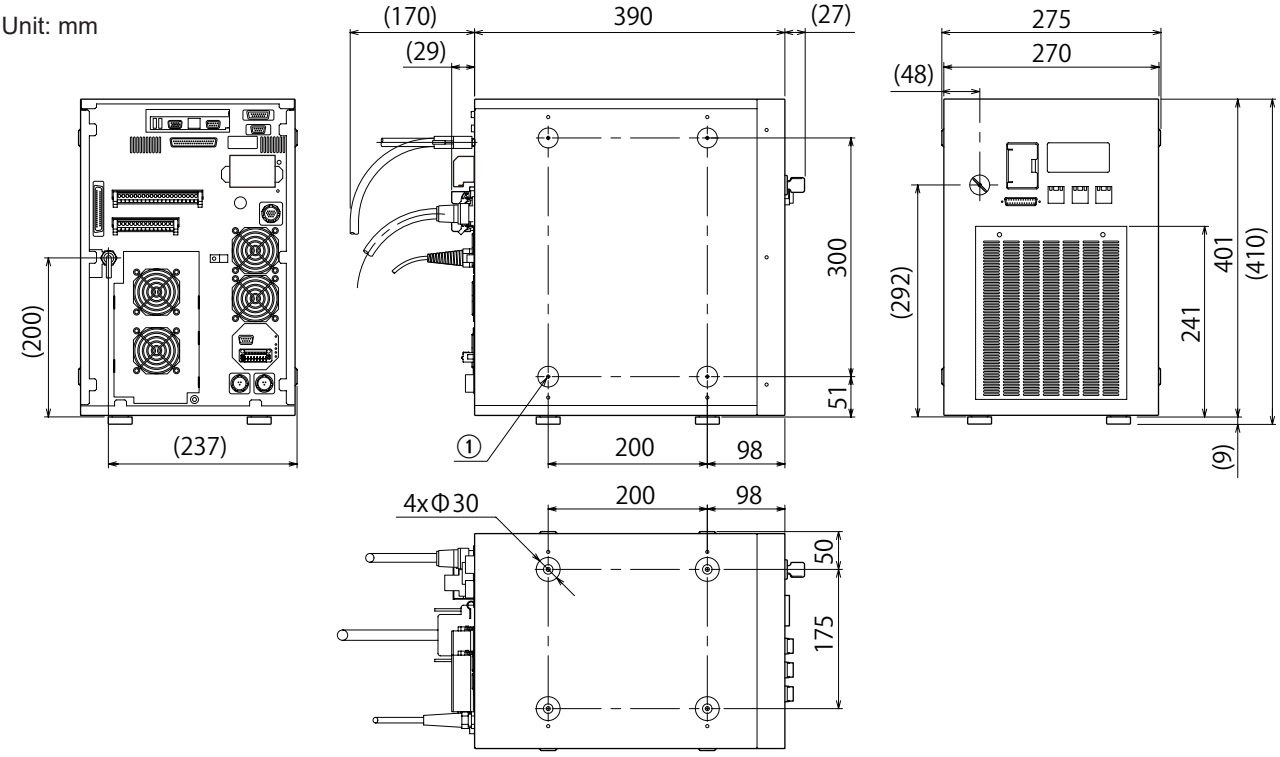
■ VL-W1500-N, VL-W1506-N

Unit: mm



■ VL-W1A00-N, VL-W1A06-N

Unit: mm

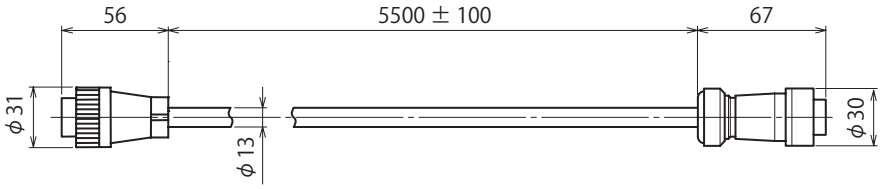


No.	Description
①	Rubber feet installation screw hole (four holes on base and both side surfaces) : M5, depth 6 The rubber feet for controller can be installed on base or both side surfaces.

1-5-4 Cables

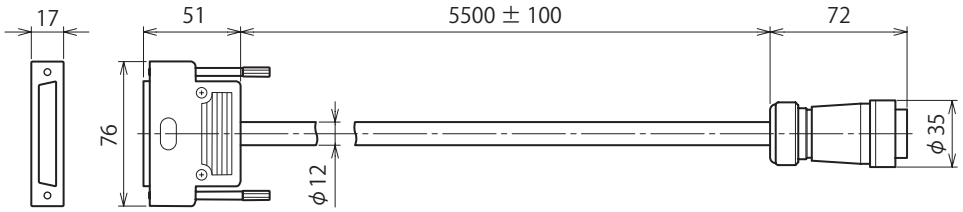
■ Unit power cable

Unit: mm
Minimum bent radius 100mm



■ Signal cable

Unit: mm
Minimum bent radius 100mm



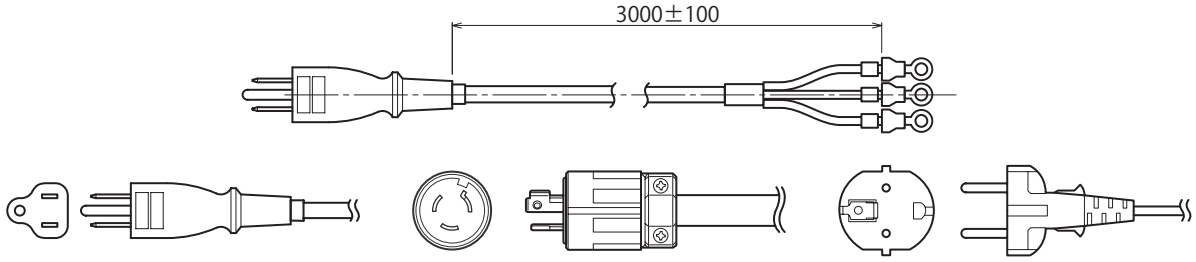
■ AC power cable (Optional item)

The AC power cable is not included in this product. Use the specified optional cable or a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used.

① Rating 125V AC, PSE certified cable (For Japan): LP-ACA10
② Rating 250V AC, PSE certified cable (For Japan): LP-ACA11
③ Rating 250V AC, CE certified cable (For Europe): LP-ACA12

Rating 250V AC, CE certified cable (For Europe) plug is compliant with the following standards.
VDE,DEMKO,NEMKO,FIMKO,SEMKO,OVE,KEMA,CEBEC

Unit: mm
LP-ACA10, LP-ACA12: Minimum bent radius 50mm
LP-ACA11: Minimum bent radius 70mm



① LP-ACA10
NEMA 1-15P

② LP-ACA11
NEMA L6-15P

③ LP-ACA12
CEE Public 7-7

Notice

- Be sure to connect the ground pin of the AC power cable to earth permanently.

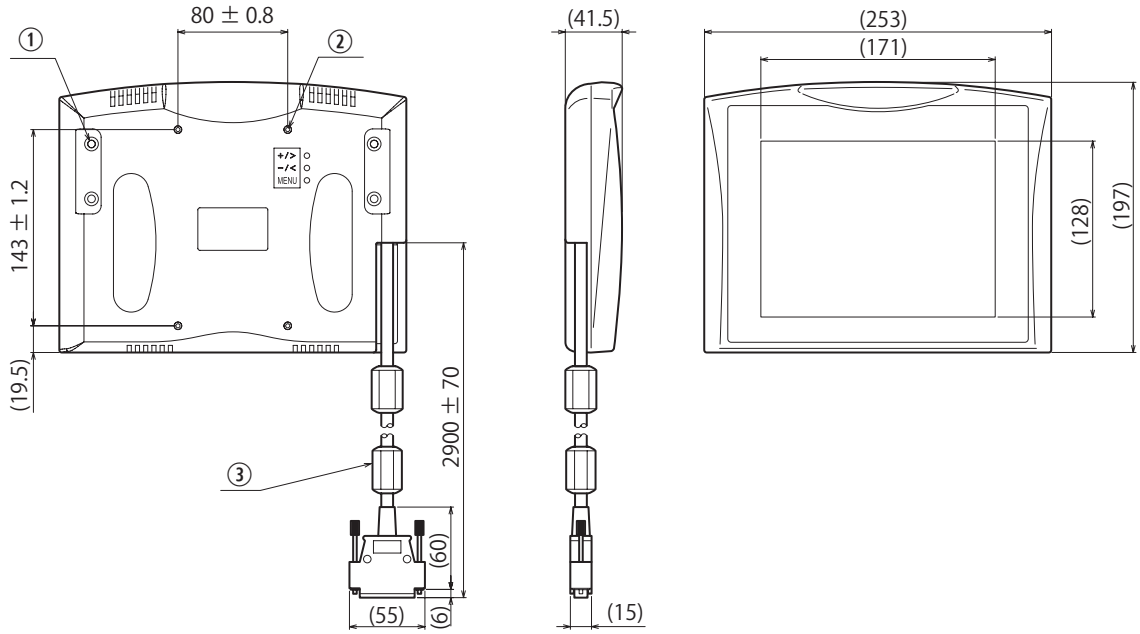
Reference

- For the recommended AC power cable for China (rating 250V, CCC certified cable), please contact our sales office.

1-5-5 Touch panel console

■ LP-ADP40 (Discontinued)

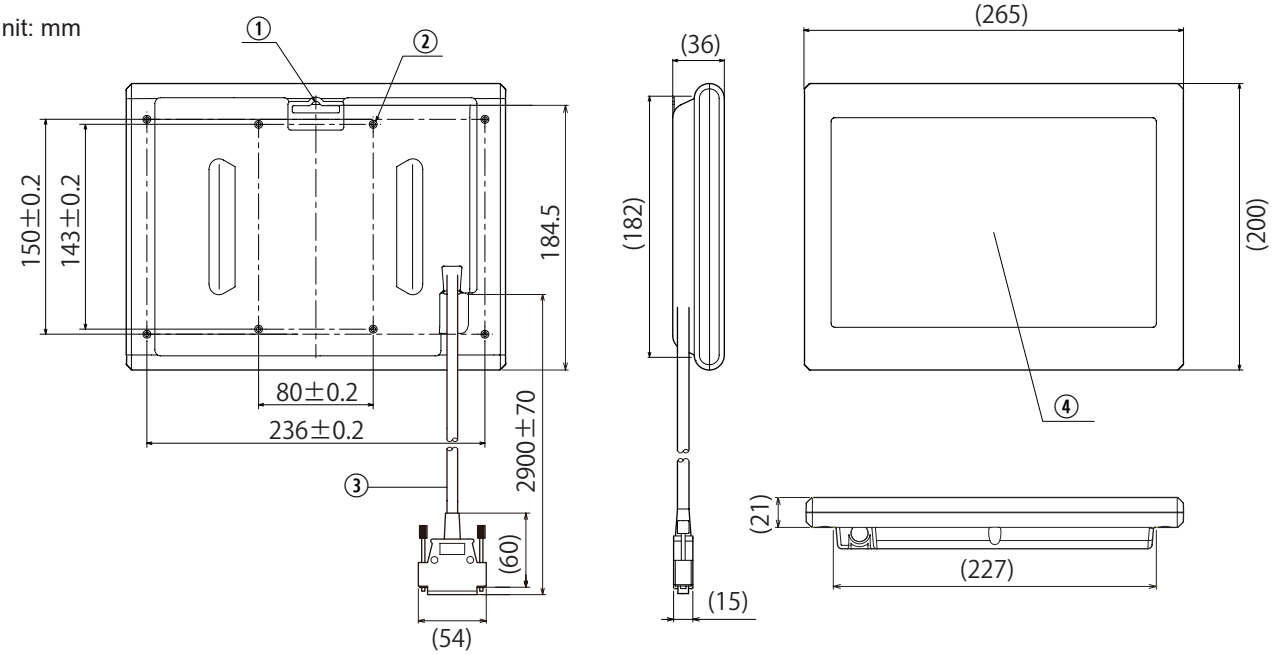
Unit: mm



No.	Description
①	Pen holder attaching nut M4, depth 6 (both left and right sides)
②	Fixing nut (4 positions) M4, depth 6
③	Controller connecting cable

■ LP-ADP50 (Option)

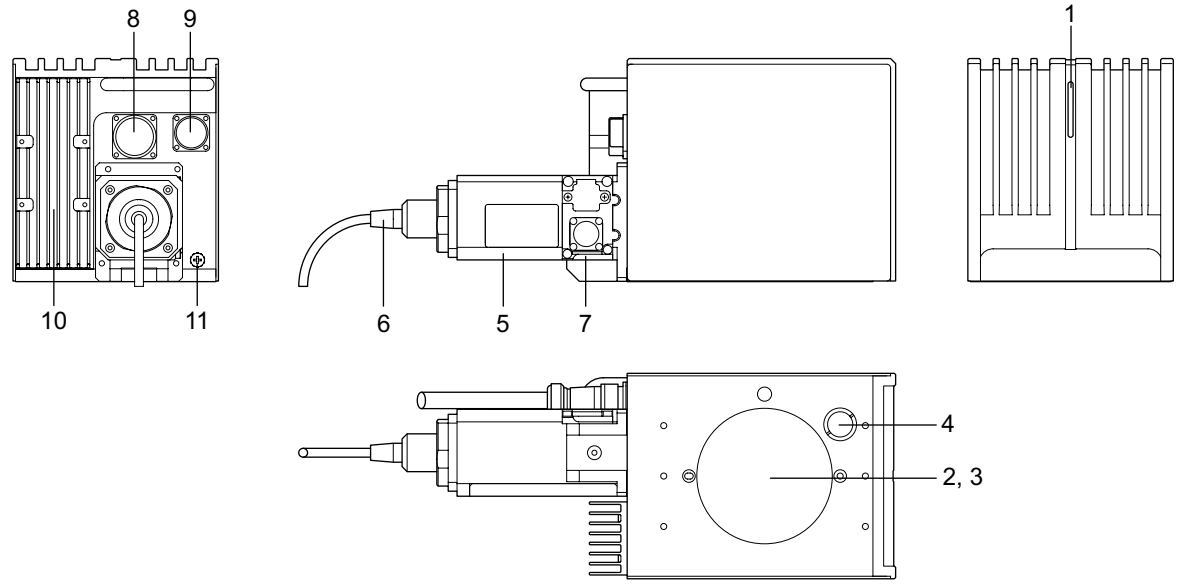
Unit: mm



No.	Description
①	Hook hole for wall hanging: hole size 33 mm × 5 mm, hook part R3 mm
②	Fixing screw hole (8 holes): M4 screw, depth 5, tightening torque: 0.7±0.1N·m You can use either inside 4 holes or outside 4 holes.
③	Connection cable: minimum bending radius 65 mm, cable diameter φ 8.6 mm
④	Touch panel: indicated area 216 mm × 135 mm

1-6 Name of Each Component

1-6-1 Head



1. Laser radiation indicator

   The display that shows the status of laser radiation and the laser welding machine.

Status	Indication
Being in laser emitting	Orange lighted-up
Being in laser pumped state and internal shutter opened	Green lighted-up
Being in laser pumped state and internal shutter closed	White lighted-up
Laser pumping is in progress (uncompleted) and internal shutter opened	Green flashing
Laser pumping is in progress (uncompleted) and internal shutter closed	White flashing
Laser in non-pumped state	Lights off

⚠WARNING

- If the laser emission indicator is placed out of the sight of operators, place the external indicator light or warning lamp on the immediately apparent place on the system.

2. Laser emission port

   The emission port of the laser for processing and the guide laser.

3. Protection glass of laser emission port

   This glass protects laser emission port from dirt or damage.
   Attach this glass always.

4. Laser pointer emission port

   From this port the red laser pointer radiates in oblique direction when indicating the work distance by the guide laser. Refer to “2-3-5 Lasing position check” (P.46).
   When using the work distance indication by the guide laser, do not seal the laser pointer emission port at the installation.

5. Fiber unit

   Connection part for the laser transmission from the controller to the head.
   The fiber unit can be detached from the head.
   Refer to “2-3-6 Detaching / attaching the fiber unit” (P.47).

6. Fiber cable

   Laser transmission cable from the controller to the head. This cable cannot be detached from the fiber unit.

7. Output beam diameter control dial

   This is the mechanical control dial to change the diameter of the output laser beam.
   Refer to “2-3-7 Output beam diameter control” (P.51).

8. Signal connector: SIGNAL

   This is the terminal for communicating between head and controller.
   Connect the attached signal cable.

9. Power connector: POWER

   This is the connector for supplying the power to the head.
   Connect the attached unit power cable.

10. Heat sink

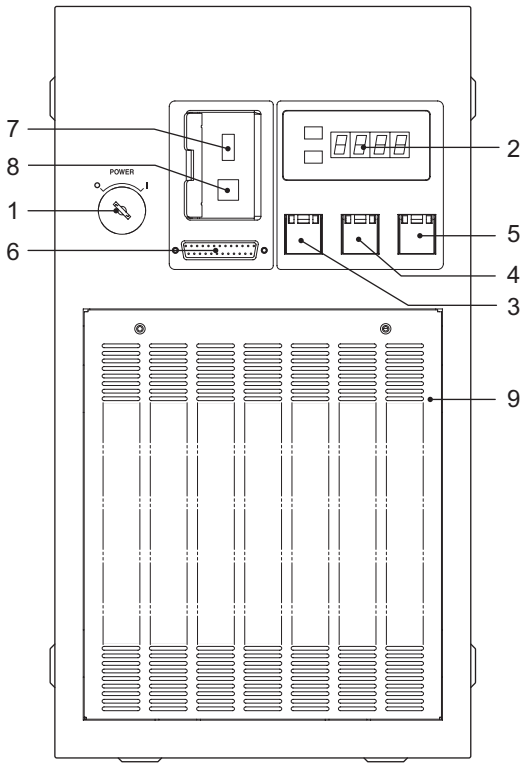
    This is a fin for promoting heat radiation.

11. Frame ground terminal: F.G.

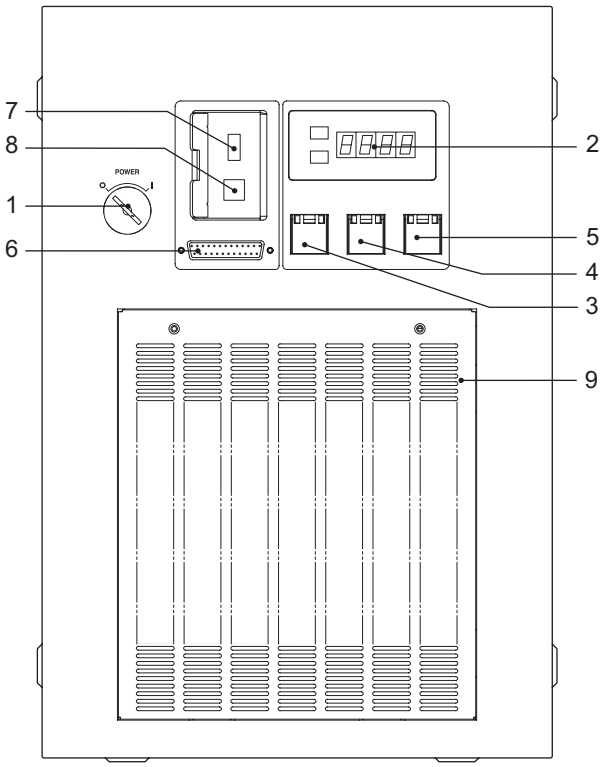
    This is the terminal for ground. Ground this terminal to the earth permanently.

1-6-2 Controller

■ Front

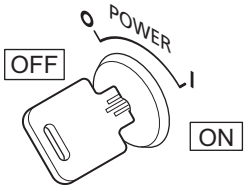


VL-W1500-N, VL-W1506-N



VL-W1A00-N, VL-W1A06-N

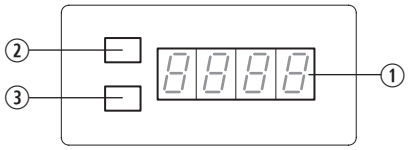
1. Key switch: POWER



The main power switch for the laser welding machine.
Turn ON (|) the key switch to start-up the system, and turn OFF (O) to shut down the system.
Only when the key switch is turned OFF (in O position), the key can be pulled out.
When the laser welding machine is not in use, the key should be in safekeeping by a laser safety manager.
In case of turning ON the power supply after turning OFF, leave the interval five seconds or more between ON and OFF.
Do not turn off the power supply while the system starts (during MAIN indicator is flashing).

2. Controller display panel

The indicator that shows the status of laser radiation and the laser welding machine.



No.	Display name	Status	Indication
①	FILE No. / ERROR CODE	Normal status	Displays the file number selected.
		Alarm or warning status	Displays the error code. Refer to “Error Indication” (P.165).
②	MAIN	System startup state	Green lighted-up
		System starting up (not completed)	Green flashing
③	LASING	Being in laser emitting	Orange lighted-up

3. Laser pumping switch (with white LED): LASER SUPPLY

   This is the switch for starting laser pumping.
   LED flashes (approx. 15sec) in white when the switch is pressed, and it lights up when the laser irradiation becomes enabled.

4. Remote switch (with white LED): REMOTE

   This is the switch for activating communication control and I/O control. This indicator is lighted-up by pressing this switch, and is changed into remote mode.

5. Alarm reset switch (with blue LED): ALARM RESET

   This switch is used to reset the system when an alarm generates. LED lights up in blue when an alarm generates. Release the cause of alarm and press this switch.

6. Console connector: CONSOLE

   This is the connector for the touch panel console (option).

7. USB connector A: USB MEDIA

   This is the terminal for connecting the USB media or USB mouse.
   For registering or saving data in the laser welding machine, connect a commercially available USB. (USB media with security features cannot be used.)
   You can also connect a USB mouse when setting by using a commercially available monitor.
   A USB port is also mounted at the back.

Notice

- Do not connect the USB devices other than a USB media or a USB mouse.

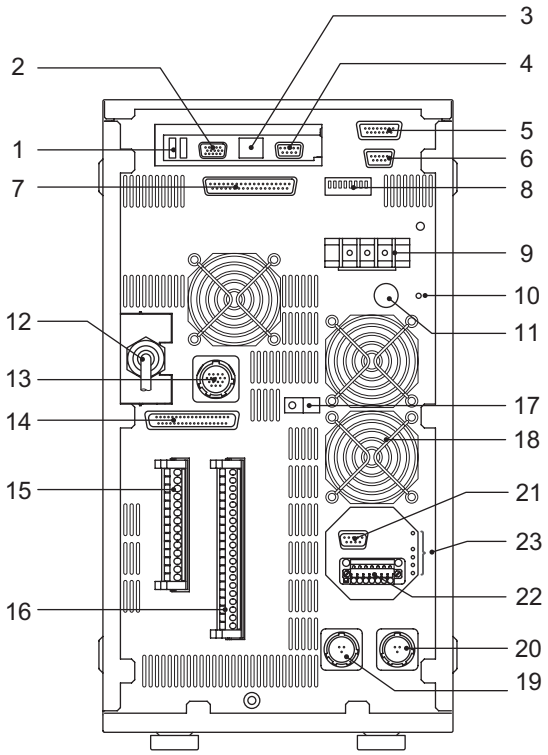
8. USB connector B: PC

   This is the connector for PC.
   When importing the drawing file (.VEC) created by the attached software “Logo Data Editing” to the laser welding machine, connect the PC with the attached USB cable.

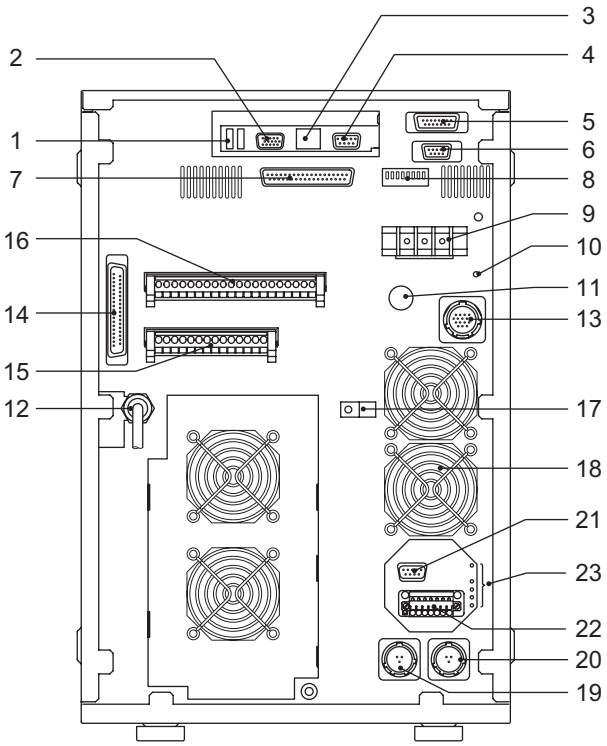
9. Controller air-cooling inlet

   The air inlet for cooling the controller. The air filter is attached.

■ Rear



VL-W1500-N, VL-W1506-N



VL-W1A00-N, VL-W1A06-N

1. USB connector A (2 connectors)
   This is the terminal for connecting the USB media or USB mouse.
   For registering or saving data in the laser welding machine, connect a commercially available USB.
   You can also connect a USB mouse when setting by using a commercially available monitor.
   A USB port is also mounted on the front.

Notice

- Do not connect the USB devices other than a USB media or a USB mouse.

2. VGA connector: VGA OUT
   This is the connector for connecting VGA OUT monitor. When using a separately sold touch panel console, connect the attached return harness.

3. Reserved port
   Do not connect any cable to this port.

4. Return connector: RETURN OUT
5. Console return connector: (VGA+RETURN)IN
   Connectors for connecting the attached return harness for using touch panel console (option).

6. RS-232C connector: RS-232C
   This is the connector for connecting to the external device so as to control the laser welding machine with RS-232C.
   For details, refer to Serial Communication Command Guide.

7. Signal connector: SIGNAL
   This is the terminal for communicating between head and controller. Connect the attached signal cable.

8. DIP switch
   Sets the operational options of the laser welding machine.
   Refer to “1-6-3 DIP switch” (P.38).

Notice

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

9. AC power supply terminal: AC INPUT
   Terminal for connecting AC power supply.
   90V to 132V AC or 180V to 264V AC (including +/-10% voltage fluctuations), 50/60Hz (voltage and frequency are switched automatically)
   Be sure to connect the ground pin of the AC power cable to earth permanently.

Reference

- The AC power cable is not included in this product. Use the specified optional cable or a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used. For the optional cables, refer to “1-5-4 Cables” (P.29).

10. Protective conductor terminal
    This is the terminal for ground. Ground this terminal to the earth permanently.

11. Fuse holder: FUSE 10A
    Rotate and remove holder for replacing the fuse on fusing.
    For details, refer to “7-2-11 Replacement of fuse” (P.151).

12. Fiber cable
    Laser transmission cable from the controller to the head. This cable cannot be detached from the controller.

13. Power connector: POWER
    This is the connector for supplying the power to the head. Connect the attached unit power cable.

14. I/O connector: I/O
    The connector to connect I/O signals used for the external control of the laser welding machine.
    For details, refer to “4-2-2 Signals and details of I/O connector” (P.93).

15. I/O terminal block (Output): OUTPUT
16. I/O terminal block (Input): INPUT
    The terminal block to connect I/O signals used for the external control of the laser welding machine.
    Connect the attached terminal block.
    Refer to “4-2-1 Signals and details of I/O terminal block” (P.86) for details.

17. Clamp
    This is the clamp for fixing the AC power cable.

18. Controller air-cooling fan (outlet)
    The air-cooling fan for the controller.

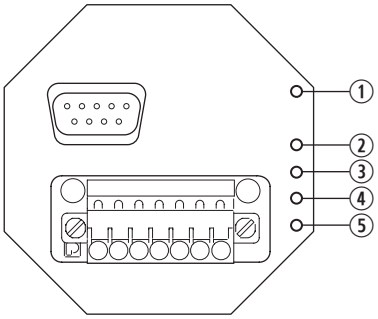
19. Interlock connector: INTERLOCK1
20. Interlock connector: INTERLOCK2
    Use these interlock signals to construct the interlock system to stop laser radiation.
    Using both Interlock 1 , 2 and a safety relay unit, the safety designed system with the double-circuit of the interlock can be constructed.
    Refer to “4-4 Interlock Connector” (P.104).

21. RS-232C connector for power monitoring: POWER DATA (RS-232C)

    Interface to monitor the laser power at lasing with a serial communication data.
    Refer to “6-2 Serial Data Output of Power Data” (P.130).

22. Shutter close output terminal: SHUTTER CLOSE OUT
    - Terminal No. 1 to 3: Output terminals to confirm the shutter closing status. Connect these signals to the external safety control unit to ensure the shutter status of the laser system.
      Refer to “4-5 Shutter Close Output” (P.108).

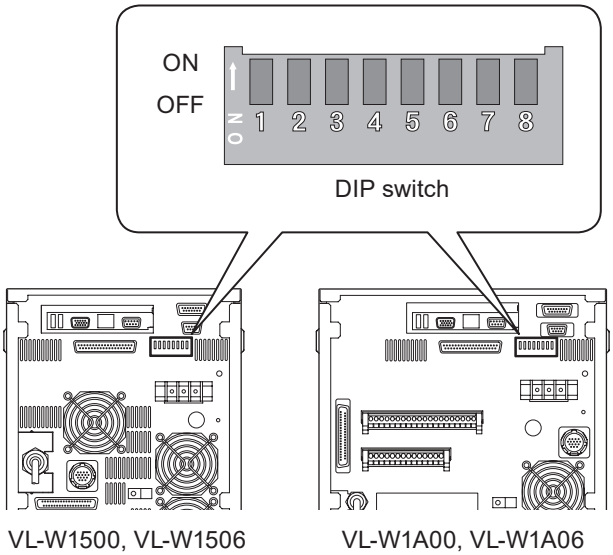
23. LED indicator for power data, shutter and interlock
    Displays the status of the following output or input.
    - Power data output
    - Shutter close output
    - Interlock input



No.	Display name	Description
①	Power data communication: TxD / RxD	When the power data is output with the serial communication data, the LED is lighted-up as follows: • When the laser welding machine has received the command: LED blinks once. • When the laser welding machine has transmitted the data: LED blinks twice.
②	SHUTTER CLOSE 1 OUT	Lighted-up while SHUTTER CLOSE 1 OUT (Shutter close output terminal No.2) is turned ON. Lightening both LEDs of SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT represents the shutter is closed.
③	SHUTTER CLOSE 2 OUT	Lighted-up while SHUTTER CLOSE 2 OUT (Shutter close output terminal No.3) is turned ON. Lightening both LEDs of SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT represents the shutter is closed.
④	INTERLOCK 1 OPEN	Lighted-up while the connection of INTERLOCK 1 IN - INTERLOCK 1 COM. is opened.
⑤	INTERLOCK 2 OPEN	Lighted-up while the connection of INTERLOCK 2 IN - INTERLOCK 2 COM. is opened.

1-6-3 DIP switch

Set the operational options of the laser welding machine with the DIP switch equipped on the controller rear side.

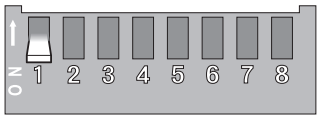
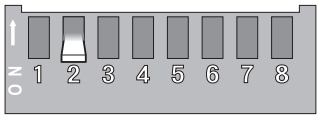
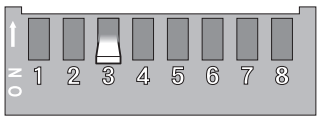
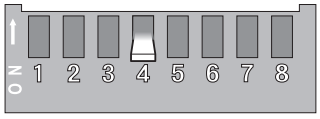
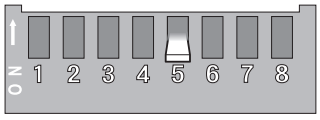


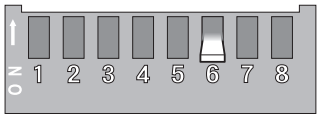
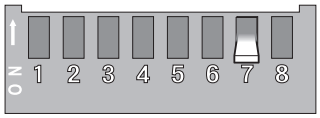
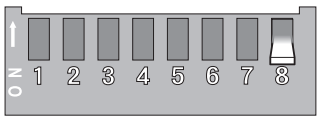
Notice

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

Reference

- The initial setting of all DIP switches is OFF.
- Turn OFF the power at DIP switch setting.

Item	Description
No. 1 	System reservation. Keep OFF state.
No. 2 	Select the control method, I/O or command for some specific operations. **ON**: Control by serial communication commands for the following operations • Laser pumping (LSR) • Shutter open/close (SHT) • Guide laser (GID) • Laser radiation for measurement (SPT) **OFF**: Control by I/O for the following operations • Laser power supply (Laser pumping) • Shutter open/close • Guide laser radiation
No. 3 	Select the ON/OFF of the buzzer sound to notify the alarm or warning occurrence. **ON**: Disables the buzzer sound for alarm or warning state. **OFF**: Enables the buzzer sound for alarm or warning state.
No. 4 	Select the ON/OFF of the password lock to change the screen mode from “Run” to “Setting”. Refer to “When password is forgotten” (P.72). **ON**: Disables the password lock. **OFF**: Enables the password lock.
No. 5 	Select the setting method of the remote mode. **ON**: Use the input signal of X5 “REMOTE IN” on I/O terminal. **OFF**: Use the remote switch on the front of the controller. **Reference** • When DIP switch No. 6 is ON, keep DIP switch No. 5 OFF.

Item	Description
No. 6 	Select the remote mode state at powered ON. ON: Starts up with remote mode ON OFF: Starts up with remote mode OFF Reference • When DIP switch No. 5 is ON, keep DIP switch No. 6 OFF.
⚠WARNING	• If the DIP switch No. 5 or No. 6 are turned on, construct a system for re-pumping the laser manually as safety protection measures after stop of the laser radiation due to an interlock or other safety functions.
No. 7 	System reservation. Keep OFF state.
No. 8 	System reservation. Keep OFF state.

2 Laser Welding Machine Installation

2-1 Installation Environment

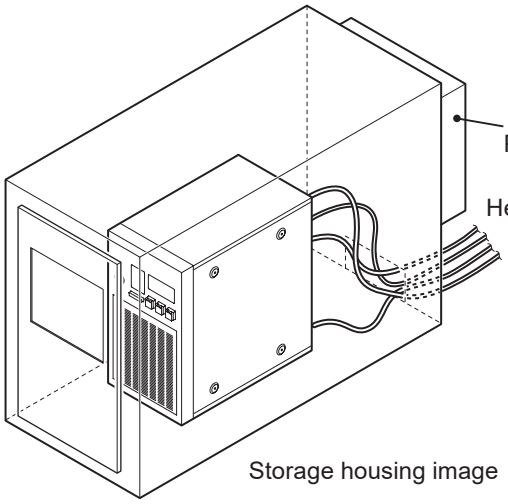
Use this product in the following environments.

Item	VL-W1500-N, VL-W1A00-N, VL-W1506-N, VL-W1A06-N
Operating ambient temperature *1	0°C to +40°C
Operating ambient humidity *1	35 to 85%RH
Ambient temperature for storage *1	-10°C to +60°C *2
Protection degree *3	IP54 (Head)
Pollution degree	2
Use location	Indoor; at an altitude of 1000 m or below

*1 : No condensation or freezing shall be allowed.
*2 : If there is a gap between the stored temperature and operating temperature, make sure to have the product get used to the operating ambient temperature gradually prior to use to prevent the dew condensation.
*3 : The controller is non-compliant with the ingress protection rating. The ingress protection characteristics of the head are ensured only when the fiber unit, cables, and the cover of the output beam diameter control are mounted properly.

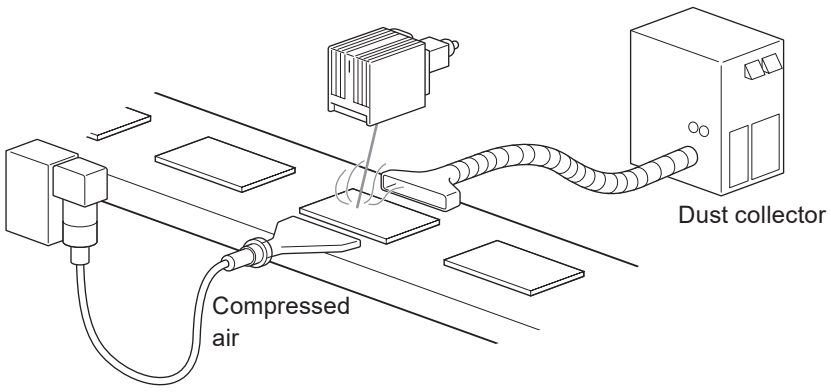
Notice

- Do not install the laser welding machine at a place where vibrations and shocks can be directly transmitted to it.
- Do not use this product at a place with oil mist.
- In case this product is used in a dusty environment, take measures to prevent dust from entering into the controller, e.g. using a storage housing.
- When installing the controller in the storage housing, use a housing equipped with panel cooler or heat exchanger to maintain the air-cooling performance of the laser welding machine according to the ambient temperature.



Storage housing image

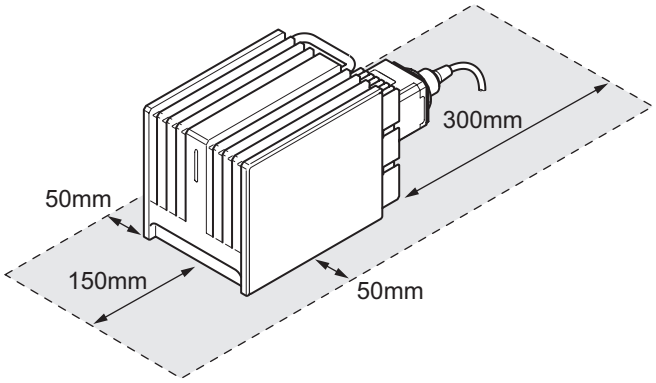
- Remove any dust and smoke from the laser emission port and laser beam path using a dust collector. For effective dust collection, put the suction port of the dust collector near the lasing position. In an environment where dust and smoke that tend to attach to the lens surface, it is recommended to create a compression air flow to ensure thorough dust collection.



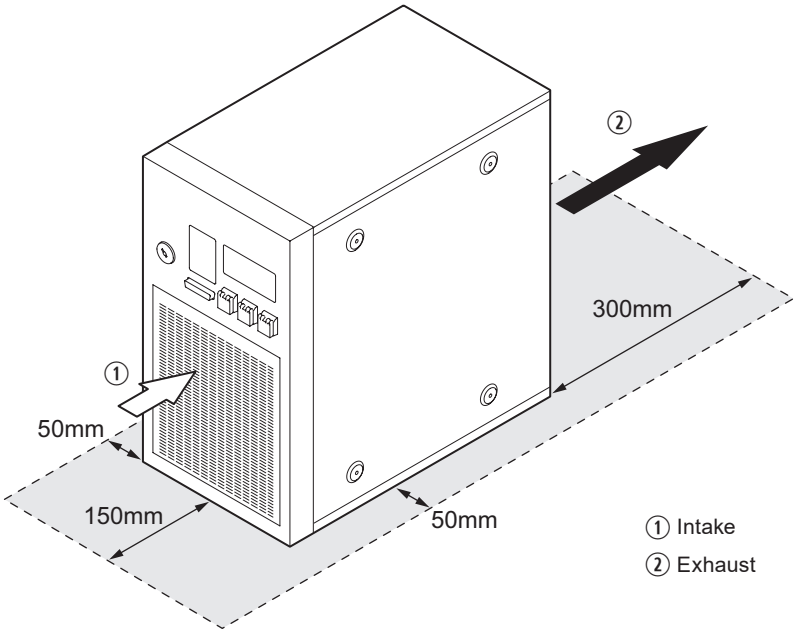
2-2 Installation Space

To keep the appropriate air cooling performance, provide space around the laser welding machine as shown in the following figure.

■ Head



■ Controller



Notice

- To maintain the air-cooling performance of the laser welding machine, install both the head and controller in a well-ventilated place.
- Installing near a heating element could cause the ambient temperature exceeding the specification range, which may cause malfunction of the product.

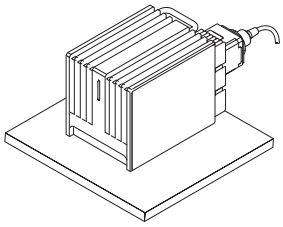
2-3 Head Installation

⚠WARNING

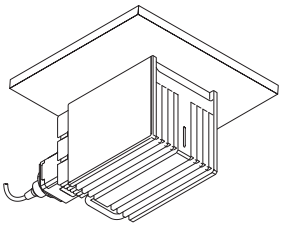
- Make sure that the power is turned OFF at installing. Failure to do so may cause electrical shock.
- Install the product so that the laser beam path does not cross the eye height.
- The laser beam path shall be enclosed with protective enclosure and make sure it is not exposed with direct light or reflected light.

2-3-1 Installation direction

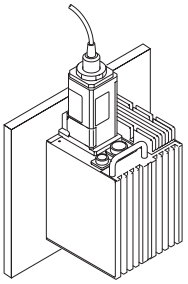
Install the head to the following directions.



Horizontally with the laser emission port facing downward



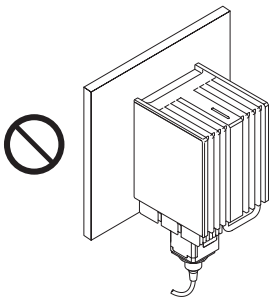
Horizontally with the laser emission port facing upward

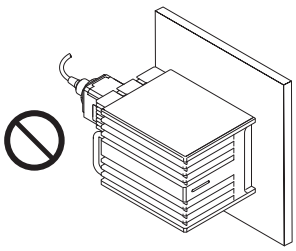


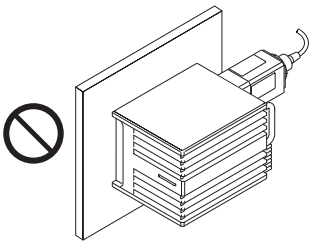
Vertically with the rear of the head facing upward

Notice

- Do not move the head unit during the operation.
- Be sure to fix the bottom surface (the laser emission port side).
- When the head is installed with the laser emission port facing upward, dust may attach to the laser emission port, impairing processing quality and damage the product. Clean the laser emission port periodically according to the head installation conditions and environment.
- Do not install the head with the side surfaces or front surface facing upward. In addition, do not install the head inclined.







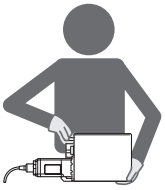
2-3-2 Carrying head part

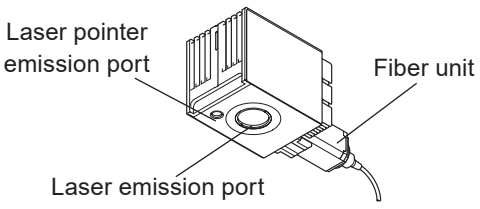
⚠WARNING

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

Notice

- Do not hold the fiber unit, cables and connectors at carrying this product.
- Do not touch the laser emission port on the bottom of the head. They may affect the laser processing quality badly.
- Carry the head as shown in the figure below.





2-3-3 Installation method

- Install the head on a durable and plane parallel plate which is made of aluminum or other material with radiation performance equivalent to that of aluminum.
- For details of installation, refer to “1-5-1 Head” (P.26).
- Fix the head in the following conditions.

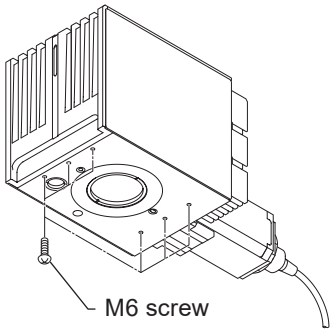
Item	Model
	VL-W1500-N, VL-W1A00-N, VL-W1506-N, VL-W1A06-N
Fixing position	Bottom surface (laser emission port side)
Fixing screw	M6 screws at 6 positions
Material of fixing screw	Stainless steel
Screw insert length	5 mm to 6 mm
Tightening torque	3.0 N·m or below
Recommended base thickness	10 mm to 15 mm

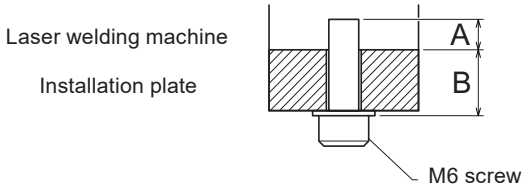
Reference

- To reduce the influence of galvanic corrosion in the screw section, it is recommended to use stainless steel as the material for fixing screws.

Notice

- Do not insert any screw of length exceeding the specification. Otherwise, the failure of the product may be caused.

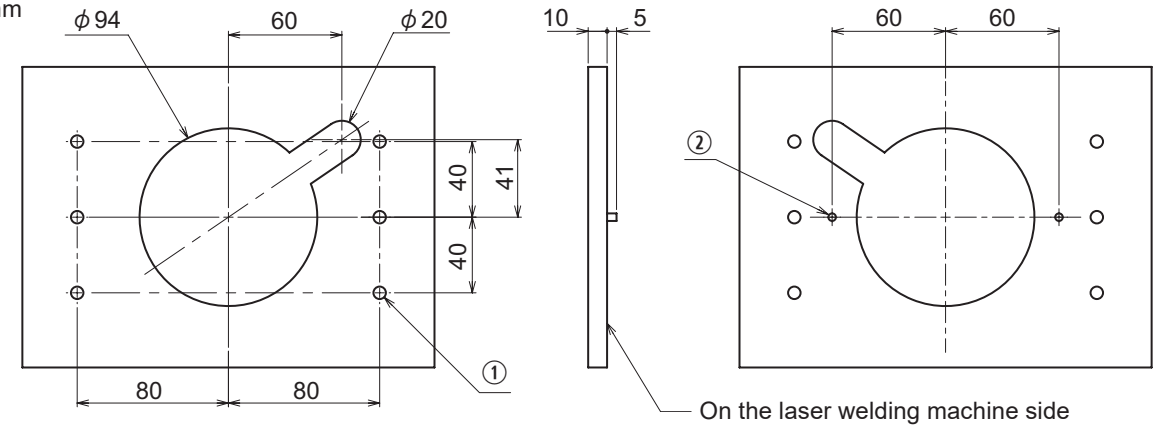




A : Screw insert length 5mm to 6mm
B : Plate thickness + washer thickness

■ Example of head installation base

Example dimensions of plate for the head are indicated below.
For plate thickness of 10 mm
Unit: mm

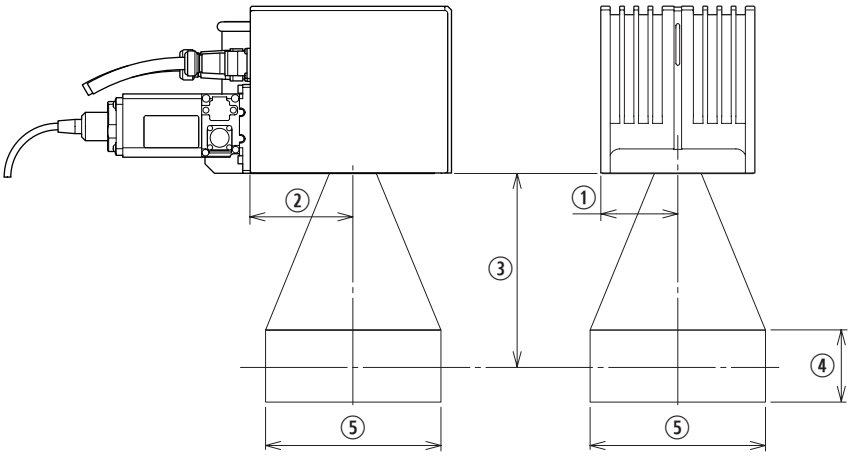


No.	Description
①	Head fixing hole (six holes): ϕ6.6 through hole
②	Head positioning pin (2 pins): ϕ4, SUS pin, height 5

Reference

- As the laser pointer radiate the beam toward the center of the working field, it is recommended to process the laser emission port and laser pointer emission port hole to link them so that the laser pointer’s beam path does not interfere with the plate.

2-3-4 Working field and center position



Specified point	Model			
	VL-W1500-N	VL-W1A00-N	VL-W1506-N	VL-W1A06-N
① Center position of laser emission port	81.5 mm			
② Center position of laser emission port	109 mm			
③ Work distance (base position)	315 mm		685 mm	
④ Work distance (setting range)	± 15 mm			
⑤ Working field (X, Y)	200 mm x 200 mm		400 mm x 400 mm	

Notice

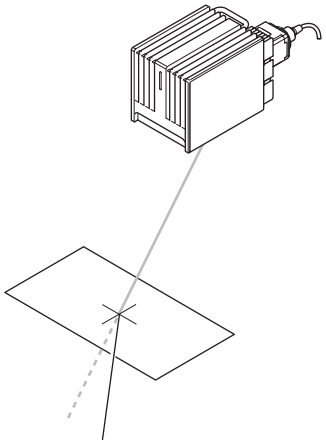
- Do not place anything in the area between the laser emission port and lasing object during the lasing operation.
- Use anti-reflection material (ex. black paint for metal) for an external shutter or a protective enclosure in a path of laser beam. It may cause a failure of the components inside the head.
- If any other devices such as a sensor or a camera are installed near the laser welding machine, make sure that these devices are installed in the place where laser beam and its reflected beam do not damage to them.

2-3-5 Lasing position check

The lasing position can be checked visually by using the red guide laser.
With the guide laser the following data can be indicated.

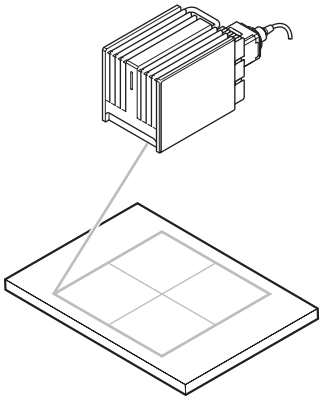
Item	Description
Working field	Displays the working field frame and center lines with the guide laser.
Scanning image	Displays the setting data in the file. The drawing data with laser power correction 0% setting is not displayed.
Masked data (drawings with power 0%)	Displays only VEC/DXF and Custom shape drawings with laser power correction 0% setting.
Work distance	The guide laser shows the rough indication of the work distance (distance from the head base to the processing surface). The red point emitted in oblique and the red cross emitted perpendicularly from the head are displayed. The distance where the laser point is closest to the center of the cross represents the guide of the work distance.

Work distance indication



Where the red point is closest to the center of the cross is the rough indication of the work distance.

Working field indication



Notice

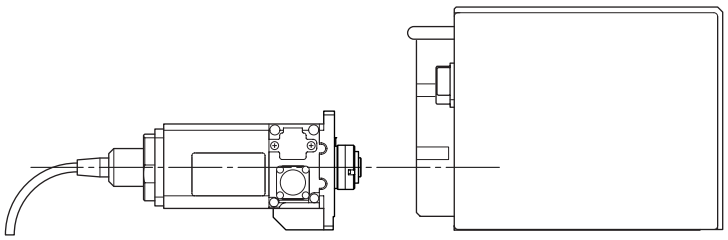
- Use the guide laser only as the guideline. For the appropriate laser processing quality, fine adjust the work distance and setting position of the target object by checking the actual lasing results.
- When the fiber unit is removed and re-installed, the lasing position might be misaligned relative to the guide laser radiation position. To align the lasing position, calibrate the working field with following the procedures described in Operation Manual.

Reference

- For the detail of the guide laser operation, refer to Operation Manual.

2-3-6 Detaching / attaching the fiber unit

The fiber unit of this product can be removed from the head at the installation temporarily.
At the delivery state, the fiber unit is connected to the head.



Fiber unit

Notice

- The fiber cable cannot be removed from the controller side. Trying to disconnect the controller unit from the fiber cable forcibly may cause a failure.
- Make sure that the serial No. of the head and controller are identical before connecting them.
- The ingress protection characteristics of the head are ensured only when the fiber unit is mounted properly. Read this chapter thoroughly for correct removal and installation.
- 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 working field with following the procedures described in Operation Manual.

■ Working conditions

⚠WARNING	• Before the detaching or attaching the fiber unit, turn off the power supply and disconnect the AC power cable. There is a risk of exposure to the laser beam or electrical shock.

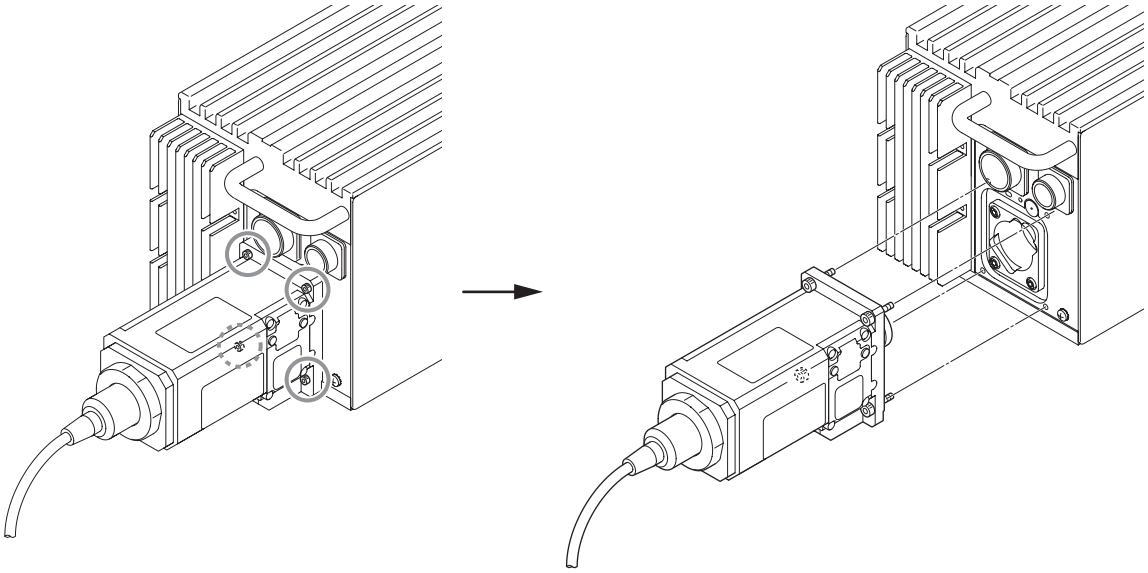
- Avoid oil mist, dust and dirt when removing or installing the fiber unit.

■ Items to be prepared

- Hexagon wrench (ball point, M5, L=150 mm)
- M5 screws (Attached accessories)
- Scanner unit protection cover (Attached accessory)
- Clean plastic bag as a protection cover of the fiber unit
- O-ring for fiber unit (Optional item)
- Air duster for optics

■ Procedure for fiber unit detaching

1. Use a hexagon wrench to loose the 4 locking screws on the fiber unit. Handhold the fiber unit and remove it from the head.



Notice

- Do not remove the screws other than the specified ones. It may cause failure.
- Not to break the screw head, use the end-rounded tightening tool and insert it to the screw head as straight as possible.

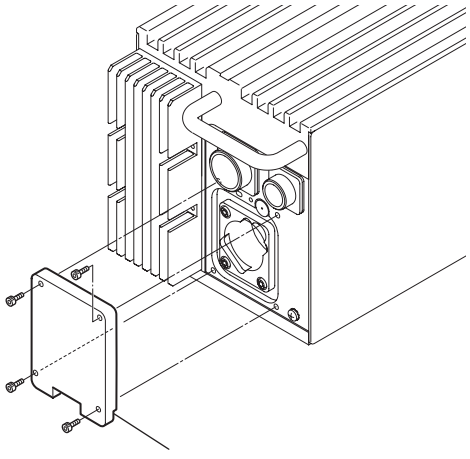
2. Attach a clean plastic bag to the fiber unit as a protection cover.

Notice

- Make sure that no foreign matter such as fingerprint or dust is attached to the lens of the fiber unit. It may cause decrease in laser processing quality or a failure.

3. Install the scanner unit protection cover with 4 screws by using a hexagon wrench.

Tightening torque: 0.7N·m to 1.3N·m



Scanner unit protection cover

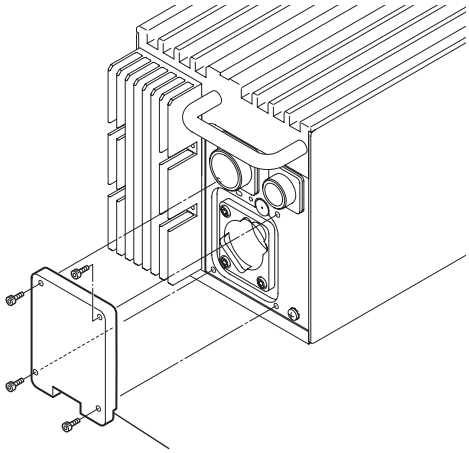
Notice

- Attach the protection cover always when the fiber unit is detached from the scanner unit.
- The protection cover is a temporary item and shows no water resistance.

■ Procedure for fiber unit attaching

1. Remove the scanner unit protection cover.

Keep the scanner unit protection cover for the next use.

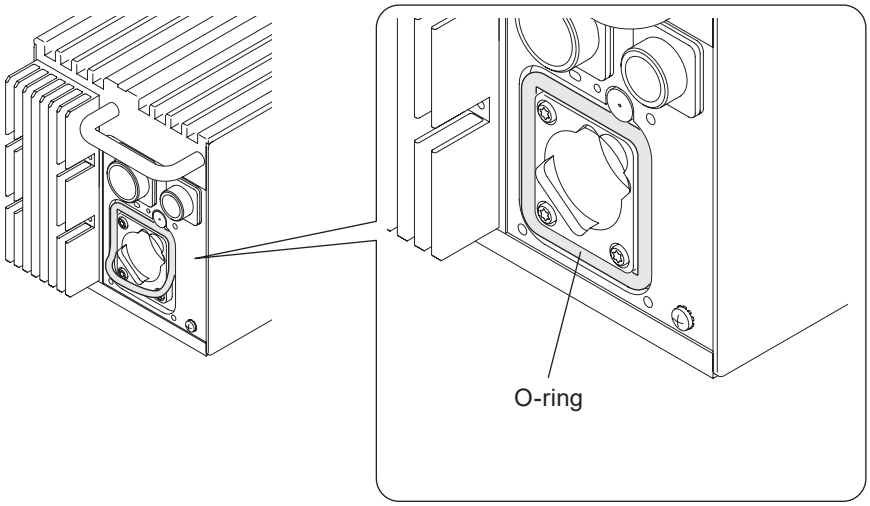


Scanner unit protection cover

Notice

- Make sure that no foreign matter such as fingerprint, dust, grease or oil is attached to the glass inside of the head. If the glass is contaminated, blow dusts with an air duster for optics.

2. Make sure that the O-ring is attached to the joint part of the fiber unit properly.



Notice

- If there are signs of deterioration or damage in the O-ring, replace it. Replacement O-rings (Set of gasket) are available on request. For purchasing them, contact our sales agency.

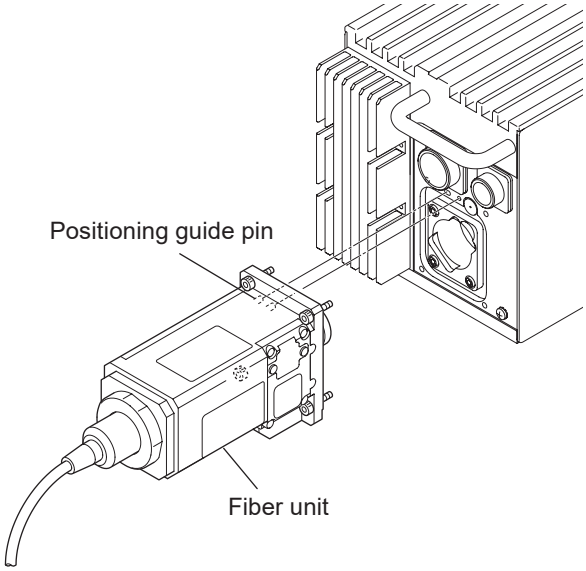
3. Make sure that the fiber cable is not twisted.

If a plastic bag or other protection cover is attached to the fiber unit, remove it.

Notice

- If the fiber cable is twisted, it may cause of a power decrease or a failure.

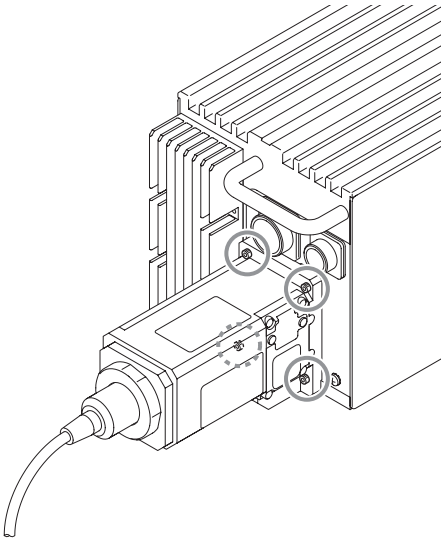
4. Install the fiber unit to the head by using the positioning guide pin.



Notice

- Make sure that no foreign matter such as fingerprint, dust, grease or oil is attached to the optical part of the fiber unit. If it is contaminated, blow dusts with an air duster for optics.

5. After the temporary fitting of the fiber unit by tightening loosely, evenly tighten the screws in a crisscross manner to the specified torque of 1.5 N·m.



Notice

- Use due caution when handling the fiber unit. Giving any shock may cause a failure.
- Not to break the screw head, use the end-rounded tightening tool and insert it to the screw head as straight as possible.
- If the O-ring is deformed by forcibly inserting the screws, the ingress protection characteristics of the head are not ensured. Proportionally tighten the screws with a specified torque using torque wrench or other tools.

6. Confirm the lasing position. If there is a gap between the guide lasing position and the actual lasing position, calibrate the working field.

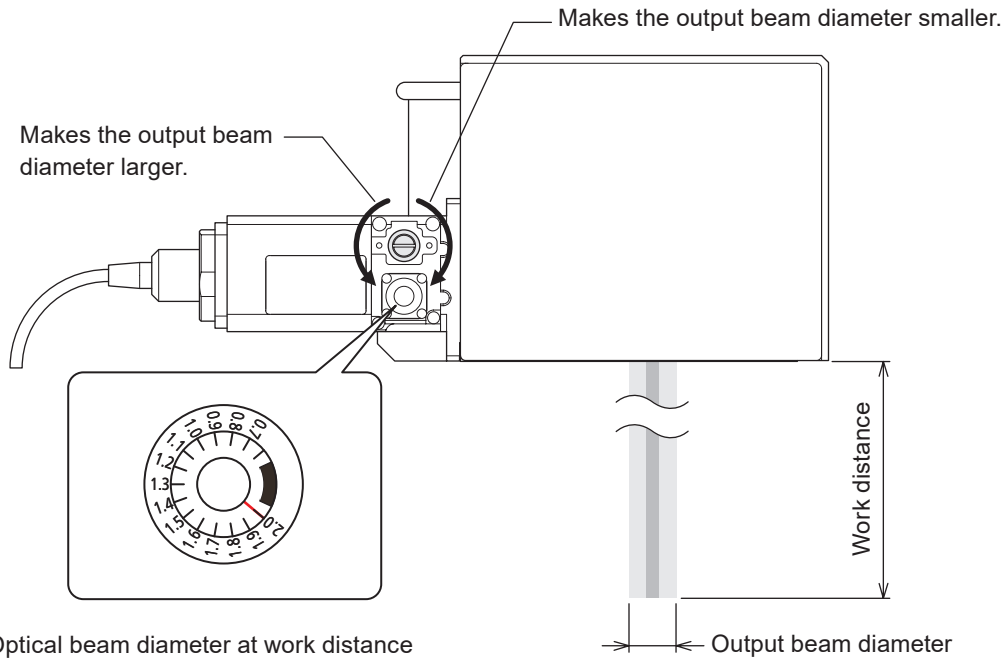
Refer to “Working field calibration” (Maintenance screen) in Operation Manual.

2-3-7 Output beam diameter control

The output beam diameter at the work distance can be changed optically with turning the control dial.
Use this function to adjust the laser processing quality.

Notice

- The output beam diameter may not be the same with the line width at the laser scanning. The line width at the laser scanning may be defined the combination of several factors, such as the output beam diameter, target materials, laser power and scanning speed.
- When the output beam diameter is changed, the laser power density is also changed. After changing of the beam diameter, confirm the laser processing quality and adjust the laser power and scanning speed with test lasing.
- If there are fluctuations in the ambient temperature, the output beam diameter can change around 1% per one degree C. To ensure the stable processing quality, operate the laser welding machine under constant temperature. (recommended operating temperature: 20°C ± 5°C)
- Always close the cover after adjusting the output beam diameter. The beam diameter might be changed if the cover is not closed. The ingress protection characteristics of the head are ensured only when the fiber unit, cables, and the cover of the output beam diameter control are mounted properly.

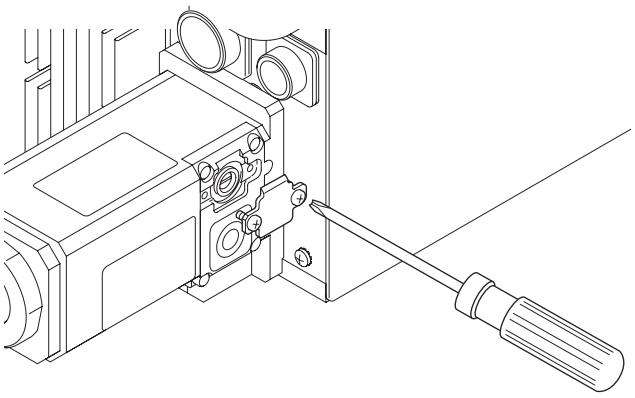


Optical beam diameter at work distance

Model	VL-W1500-N, VL-W1A00-N	VL-W1506-N, VL-W1A06-N
Setting range	ϕ0.7 mm to ϕ2.0 mm	ϕ0.1 mm to ϕ2.0 mm
Default setting	ϕ1.3 mm	ϕ1.3 mm

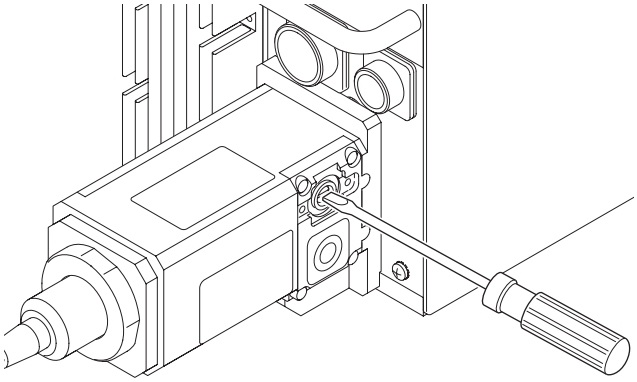
1. Use a Phillips screwdriver to remove the cover on the control dial.

Keep the cover for next use.



2. Adjust the control dial with a flat-blade screwdriver.

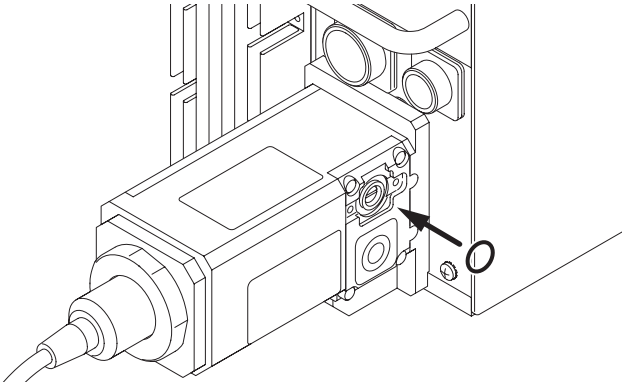
The red pin indicates the diameter of the output beam.



Notice

- Do not turn the screw beyond the scale markings with an extra force. It may cause the product failure.

3. Make sure that the O-ring is attached to the joint part of the cover properly.

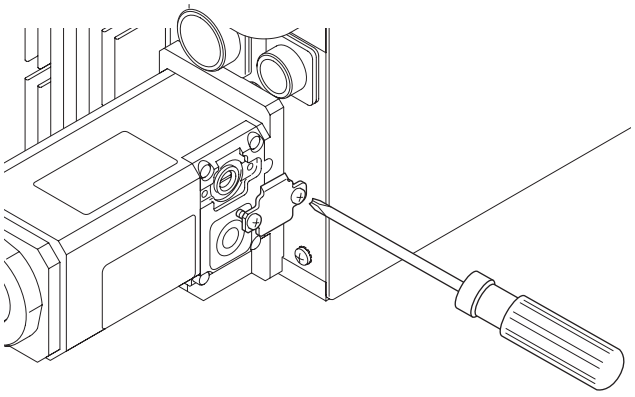


Notice

- If there are signs of deterioration or damage in the O-ring, replace it. Replacement O-rings (Set of gasket) are available on request. For purchasing them, contact our sales agency.

4. Reinstall the cover to the control dial.

Tightening torque for the cover should be 0.3 N·m or less.



5. Confirm the laser processing quality with the actual target object and fine tune the output beam diameter, laser power and scanning speed.

Reference

- Use the ruler of the control dial as an adjustment guide. Repeat the adjustment and test lasing to set the appropriate output beam diameter.

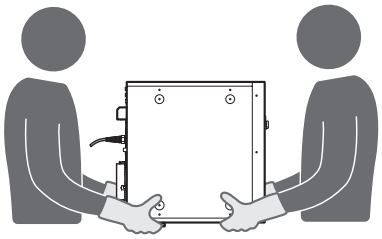
2-4 Controller Installation

⚠WARNING

- Make sure that the power is turned OFF at installing. Failure to do so may cause electrical shock.
- Carry the controller unit with two persons. Lifting or carrying without assistance may cause of injury.
- To carry this product, wear the non-slip gloves and safety shoes.
- In case it falls down, it may cause injury.

■ Carrying the controller

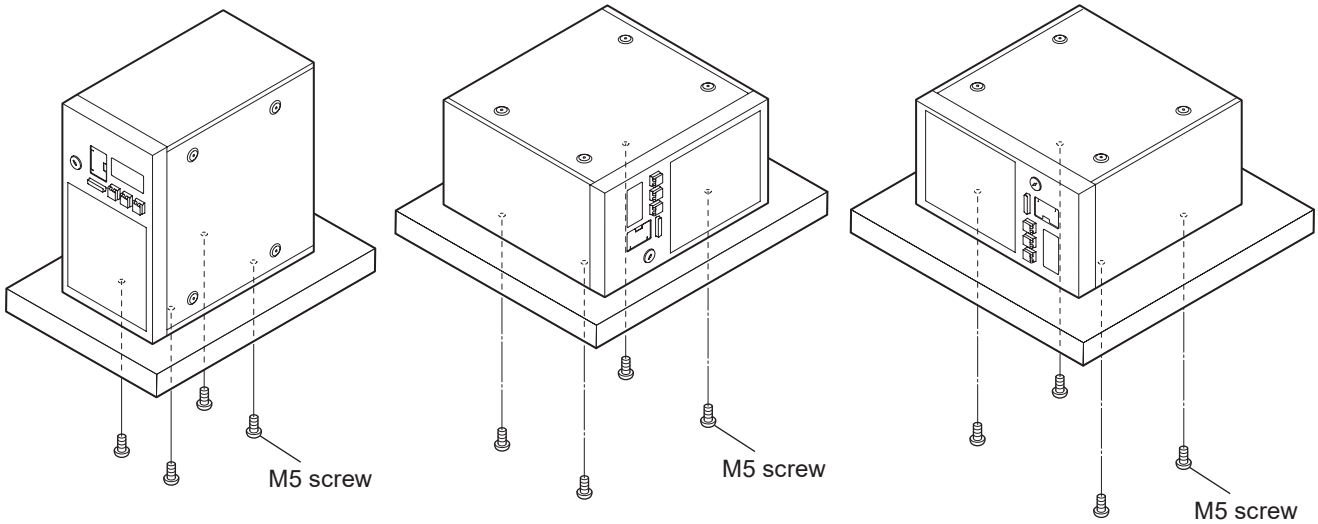
To carry the controller, hold the bottom of the unit with both hands.
Do not hold the fiber unit, cables or connectors at carrying this product.



■ Installation method

- The controller may be installed vertically or horizontally.
- The rubber feet are attached to the bottom of the controller on shipping. Remove the rubber feet in case of fixing the bottom of the controller directly to the installation place.
- The rubber feet can be mounted either on left or right side face. The attaching location of the controller is symmetrical for the face.
- For details of installation, refer to “1-5-3 Controller” (P.28).
- Fix the controller in the following conditions.

Fixing surface	Fixing screw	Screw insert length	Tightening torque
Bottom	M5 screws at 4 positions	4 mm to 6 mm	2.0 N·m or below
Side (both left and right side)			



Notice

- Do not insert any screw of length exceeding the specification. Otherwise, the failure of the product may be caused.
- Do not install the laser welding machine at a place where vibrations and shocks can be directly transmitted to it. In any environment where effects of vibration are concerned, take measures against vibration on the product, e.g. fitting rubber feet.

2-5 Connecting Laser Welding Machine

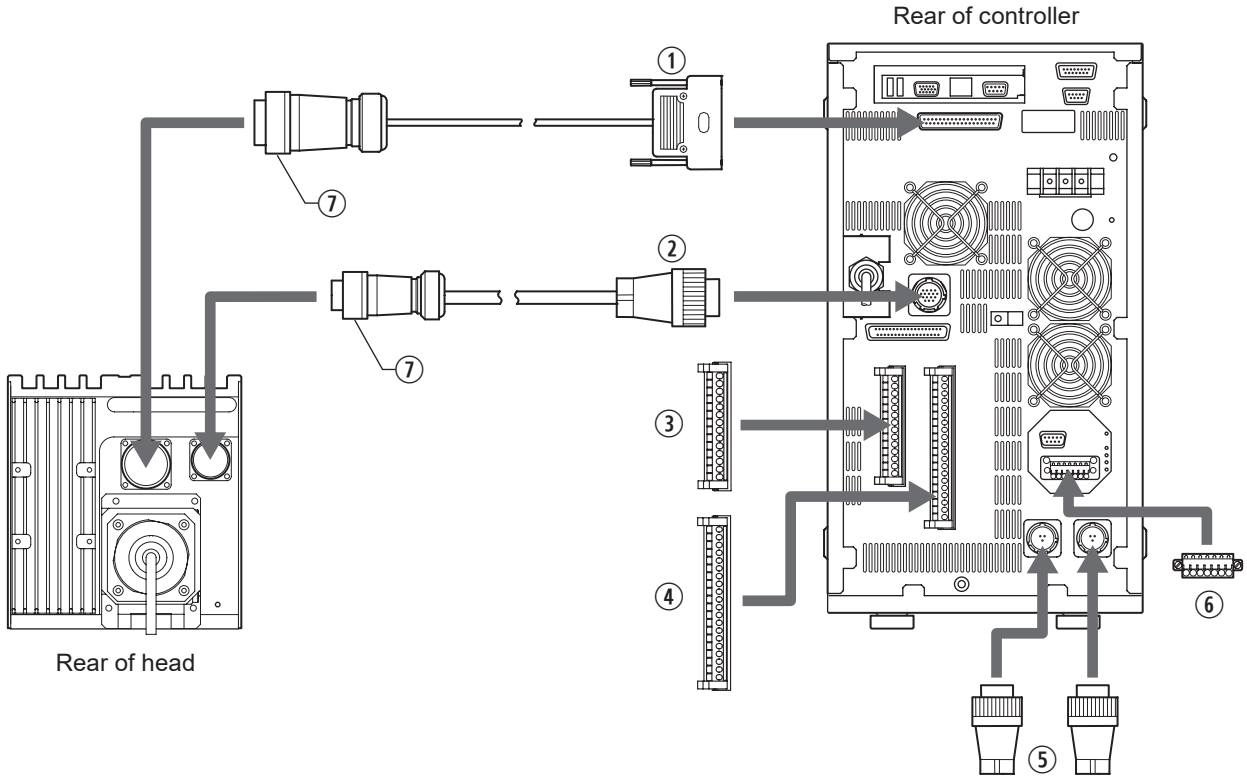
⚠WARNING	• Be sure to turn the power off before you conduct wiring or connection. Failure to do so may cause electrical shock. • Be sure to connect the head to the exclusive controller. It will cause exposure of laser beam and a failure if it connects with any equipment other than the exclusive controller.

2-5-1 Connection of head, controller and I/O terminal block

Notice

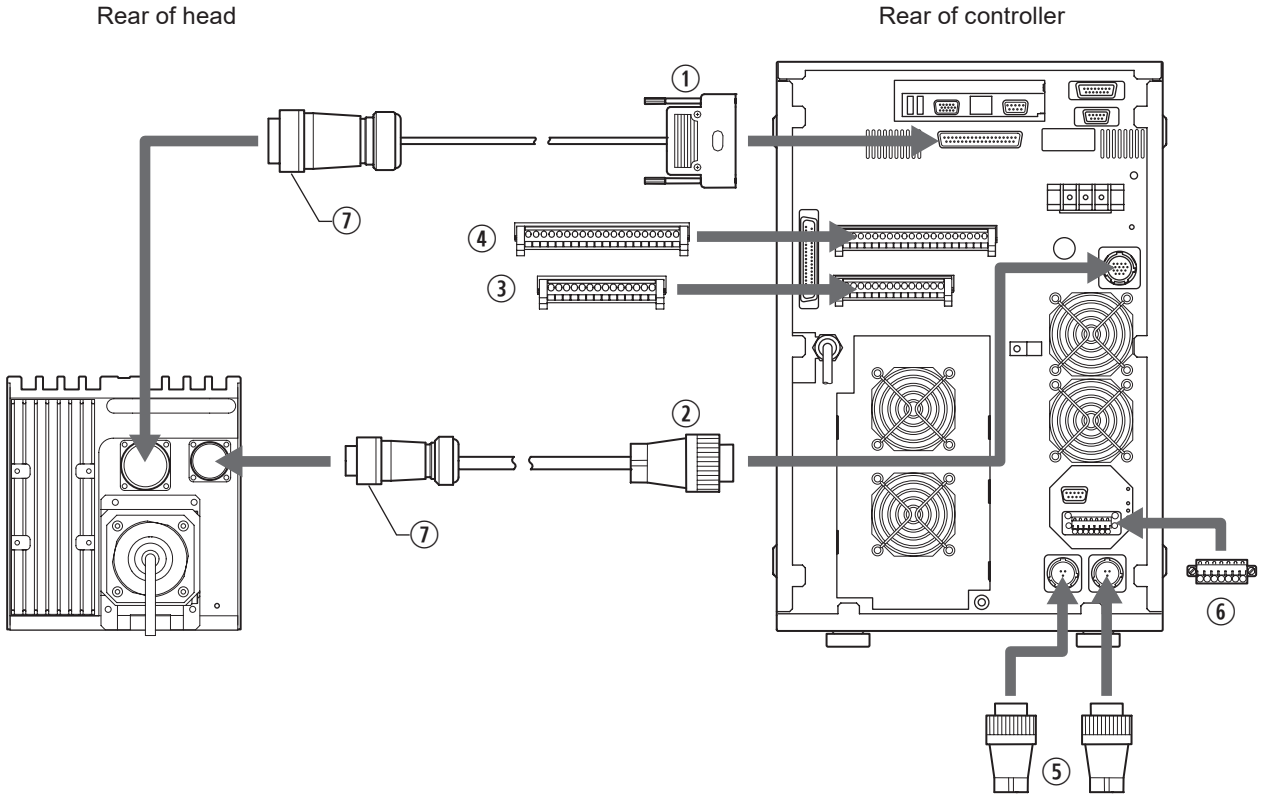
- Connect the head and controller combined for the same serial number.
- For the connection of this product, use the dedicated cables attached to the product or the specified optional cables.
- Insert the cable all the way in a straight line. Tilting and inserting the cable may cause a failure.
- Be careful not to apply excess force to the cable or not to nip the cable at the installation.
- Verify the minimum bend radius of each cable and install them without excess forces being applied.
- A gasket is incorporated in the joint of each cable, which keeps the protection structure. The head protection structure is ensured only when each cable is properly inserted all the way and each gasket is crushed.

■ VL-W1500-N, VL-W1506-N



No.	Description
①	Signal cable
②	Unit power cable
③	I/O terminal block (14 pin): Output *1
④	I/O terminal block (20 pin): Input *1
⑤	Interlock connector
⑥	Power data/Shutter close output terminal (If these signals are needed)
⑦	Lock ring: After inserting the connector, turn the lock ring to fix it.

■ VL-W1A00-N, VL-W1A06-N



No.	Description
①	Signal cable
②	Unit power cable
③	I/O terminal block (14 pin): Output *1
④	I/O terminal block (20 pin): Input *1
⑤	Interlock connector
⑥	Power data/Shutter close output terminal (If these signals are needed)
⑦	Lock Ring: After inserting the connector, turn the lock ring to fix it.

*1 : To allow the lasing, connect some terminals properly. Refer to “4-3 Connecting I/O Terminal Block” (P.99).

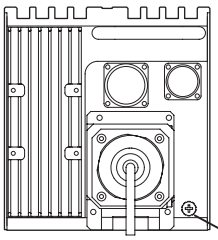
2-5-2 Power connection and earth (Grounding)

When connecting the power supply, be sure to perform earth (grounding) properly. Failure to do so may cause electrical shock in case of a failure or electrical leakage. Further, it may cause malfunction of the device.
The power supply terminal, protective conductor terminal and frame ground terminal are located as indicated below.

Reference

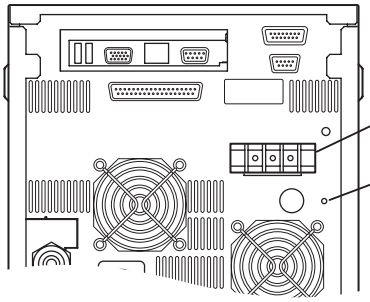
- The AC power cable is not included in this product. Use the specified optional cable or a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used. For the optional cables, refer to “1-5-4 Cables” (P.29).

Rear of head



Frame ground terminal (F.G.)

Rear of controller



⚠WARNING

- Perform the connection of the power terminal with power-off state. Failure to do so may cause electrical shock.

1. Connect the protective conductor terminal and the frame ground terminal to the grounding part.

Screw size: M4

Tightening torque: 1.0N·m

Protective conductor terminal / Frame ground terminal

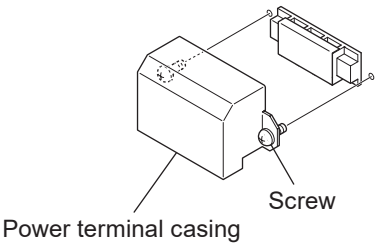


Notice

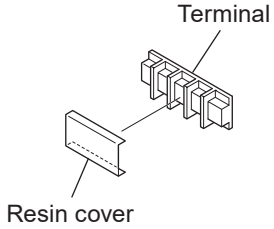
- Before connecting the power supply, connect the protective conductor terminal and the frame ground terminal permanently to the grounding part.
- Install such that the controller housing and the head housing are at the same electric potential.

2. Loosen two M3 screws of the power terminal casing and remove it.

Rear of controller



3. Remove the resin cover on the terminal.

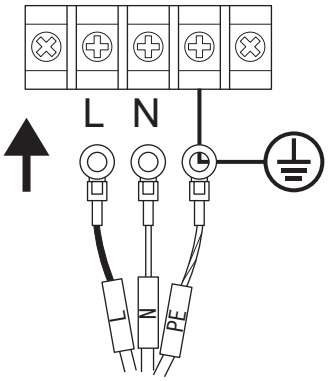


4. Connect the three wires to the terminals.

The signs of “L (black)”, “N (white)” and “PE (yellow/green)” show in the cables. Connect each cable to the appropriate terminal.

Screw size: M4

Tightening torque: 1.2N·m to 1.8N·m



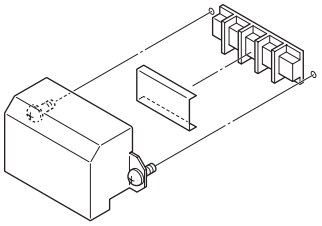
Notice

- For the AC power cable, use a cable with the enough rating capacity to fulfil the power voltage specification of this product, which is compliant with the regulations and standards in the country or region where it is used.

5. Attach the resin cover to the terminal and screw the terminal casing.

Screw size: M3

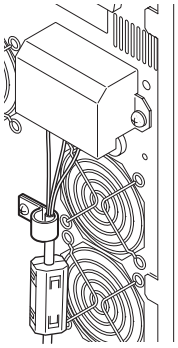
Tightening torque: 0.5N·m



6. Fix the AC power cable with the clamp.

Screw size: M4

Tightening torque: 1.0N·m



Notice

- Locate the AC power cable beside the fan. Locating it in front of the fan may impair the air-cooling performance, leading to the device failure.

7. Make sure that the cables and connectors other than the power supply are connected and then connect the AC power cable to the AC power supply.

Power voltage: 90V to 132V AC or 180V to 264V AC (including ± 10% voltage fluctuations; automatic switching)

Notice

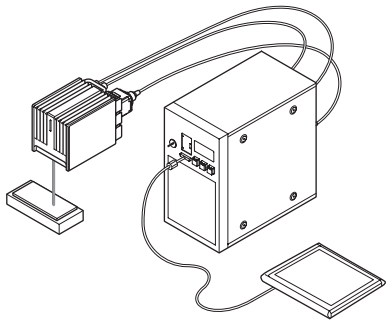
- Be sure to connect the ground pin of the AC power cable to earth permanently.
- Set each connecting cable away from the device that generates high voltage, power line, and large switching surge as far as possible. If there may be any noise effect on the power supply, use the noise cut-off transformer.

2-5-3 Connection of display device

The setting data for the laser processing is configured with the display operation connected to the controller.
The following display devices can be connected to the laser welding machine.

① Touch panel console (Optional item)

Connect the touch panel console supplied as an optional item to the controller.
The drawing data and other lasing parameters are set by the touch operation.
Refer to “Connection of touch panel console” (P.59).



Touch panel console

Notice

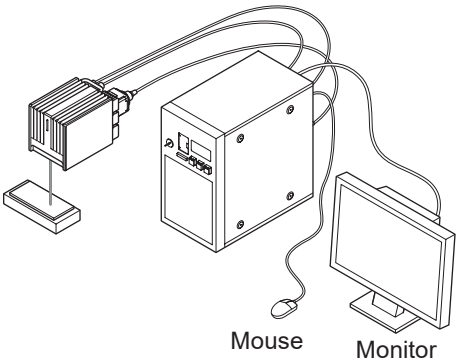
- Turn OFF the power of laser welding machine when connecting or disconnecting the touch panel console.

Reference

- To purchase the touch panel console and for the detailed information, please contact our sales office.

② Monitor and mouse (Commercially available items)

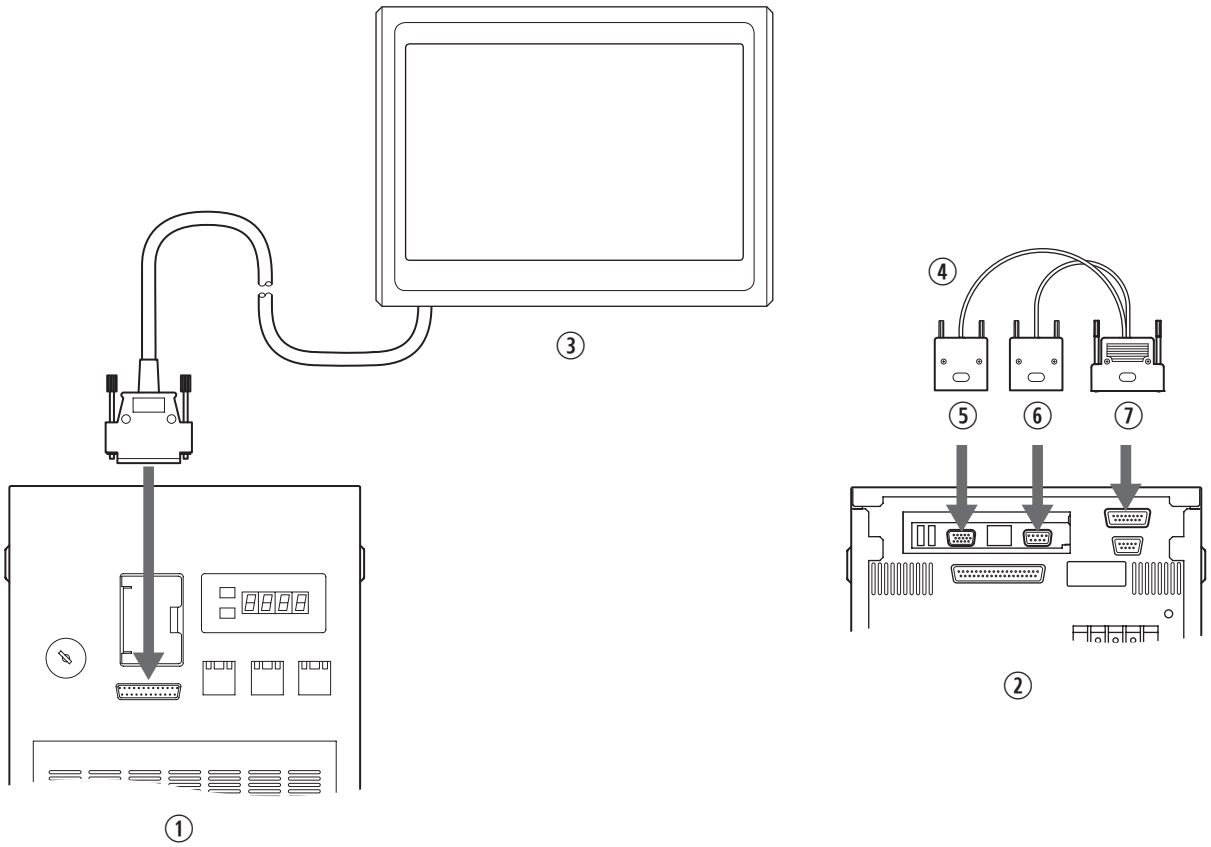
Connect the commercially available monitor and mouse to the controller.
The drawing data and other lasing parameters are set by the mouse operation.
Refer to “Connection of Monitor and Mouse” (P.60).



Mouse Monitor

■ Connection of touch panel console

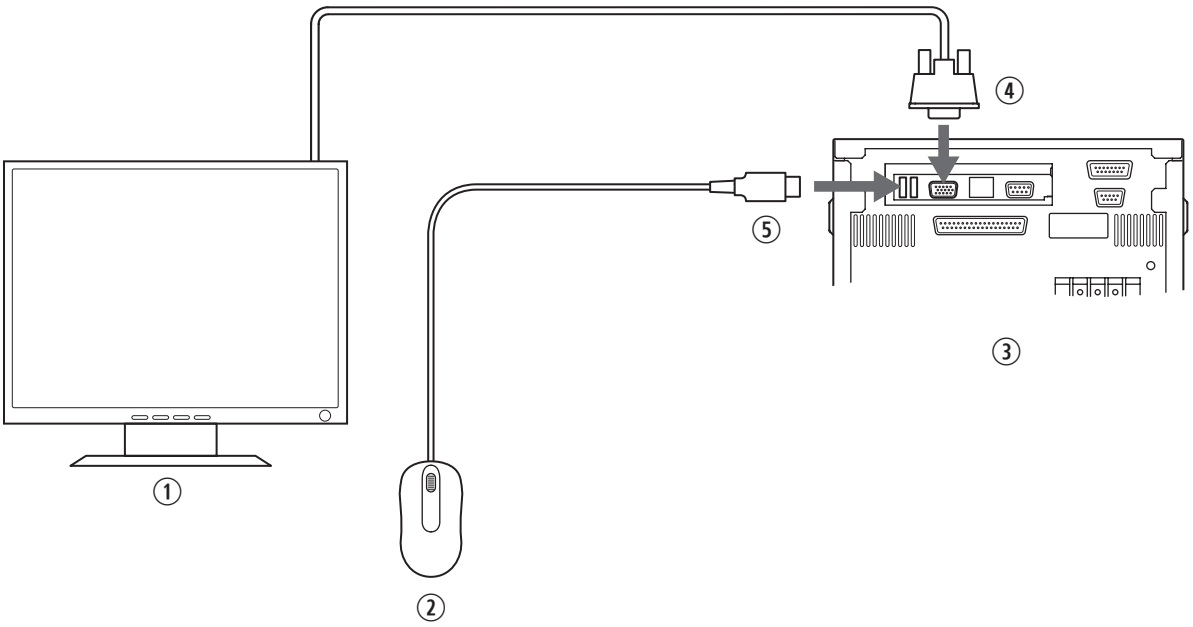
- When using the touch panel console LP-ADP40 / LP-ADP50, connect the return harness to the rear of the controller.
- Turn OFF the power of laser welding machine when connecting or disconnecting the touch panel console.



No.	Description
①	Front side of controller
②	Rear side of controller
③	LP-ADP40 / LP-ADP50: Touch panel console
④	Return harness
⑤	VGA OUT
⑥	RETURN OUT
⑦	(VGA+RETURN) IN

■ Connection of Monitor and Mouse

- Be sure to check the operation status when using the monitor and mouse beforehand. This connection status does not warrant all operations of VGA monitor and USB mouse.
- Do not take out and put in a monitor, and a mouse in being powered on.
- When using monitor and mouse, do not connect the return harness.
- USB hub cannot be used for this product.
- There is 1 port on the front of the controller and 2 ports on the back for USB connector A. USB mouse can be connected in any of these ports.



No.	Description
①	Monitor: VGA terminal (15-pin 3-row) (Recommended pixel count: 640 × 480 or more)
②	Mouse: USB mouse with Human interface device (HID) class
③	Rear side of controller
④	To VGA OUT connector
⑤	To USB connector A

2-5-4 Installation of attached software

The following software is stored in the attached CD-ROM “Laser Processing Utility_VL-W1”.
To use these software, install the data in the CD-ROM to the commercially available PC.

■ Stored data in the CD-ROM

Name of software	Description
Logo Data Conversion Software	Converts the drawing data in DXF/JPEG/BMP/HPGL formats to the laser welding machine dedicated format “VEC”.
Logo Data Editing Software	Creates and edits the drawing data in VEC format.

■ Operating environment

Install the attached CD-ROM “Laser Processing Utility_VL-W1” in the following environment.

Item	Installation requirements
OS *1	Microsoft® Windows® 11 Pro 64bit Microsoft® Windows® 10 Pro 32bit, 64bit
Free area on hard disk	100MB or more
CD-ROM drive *2	1 set or more
USB port *3	USB1.1 or later
Memory capacity	1GB or more
CPU	1GHz or more
Display resolution	1024 x 768 pixels or above
Others	Pointing device such as a mouse and character input device such as a keyboard

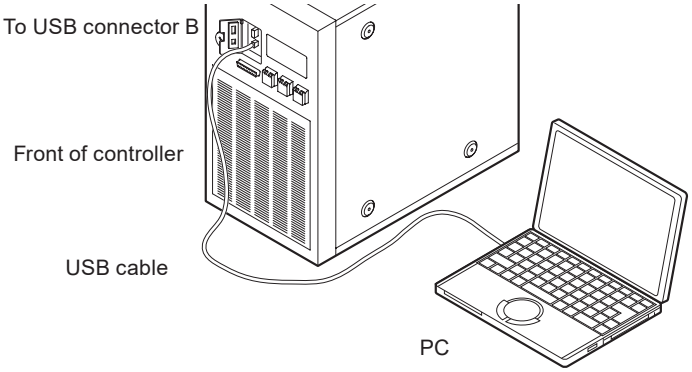
*1 : OS versions of which Microsoft has ended support are excluded. The CPU type, memory capacity, hard-disk space, and display function required to operate each OS should be provided in accordance with the recommendation of Microsoft.
*2 : To install the software on a PC without a CD-ROM drive, copy all CD-ROM data to the PC using external storage media such as a USB flash drive before installation.
*3 : We do not guarantee the connection of all PC and laser welding machine.

■ Installation procedures

Set the CD-ROM “Laser Processing Utility_VL-W1” to the PC and the installation will start automatically.
Install “Laser Processing Utility_VL-W1-N” by following the instructions shown on the screen.
If the installation screen does not appear, double-click on following file to start installation.
[CD-ROM]\Setup\setup.exe

■ Connecting with Logo Data Editing software

When uploading the drawing file (.VEC) created by the attached software “Logo Data Editing” to the laser welding machine, connect the PC with the attached USB cable.

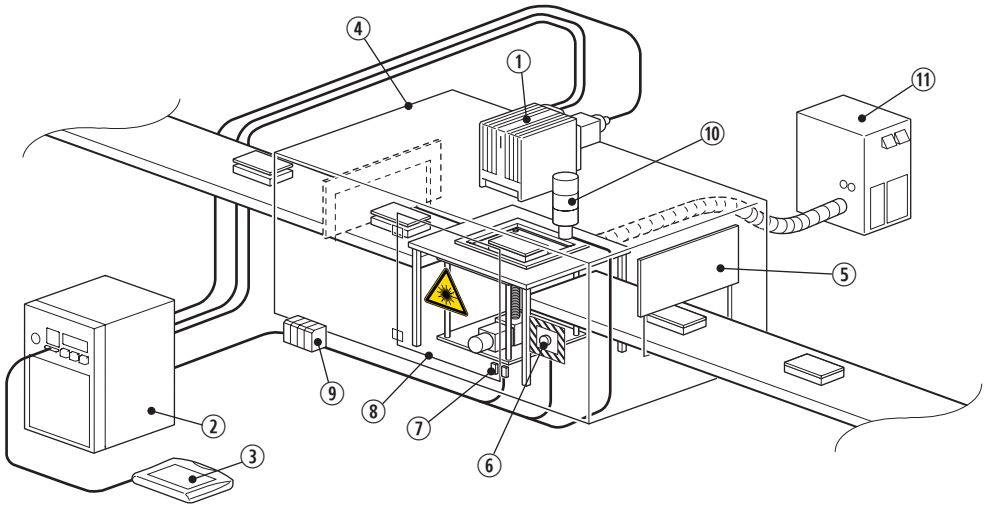


Reference

- For details of uploading a VEC file, refer to Operation manual and Logo data editing operation manual.
- If the communication error occurs with the Logo Data editing software, the USB driver may not have been installed correctly. Re-install the USB driver.
- Updating the USB driver may resolve the error. The latest version of the USB driver can be downloaded from our Internet website.
  https://industry.panasonic.com/global/en/downloads/?tab=software

2-6 Construction of System

The following figure shows the construction sample of the system.



No.	Description	Installation and control sample
①	Laser welding machine head	—
②	Laser welding machine controller	—
③	Touch panel console for laser welding machine setting and monitoring	—
④	Protective enclosure	—
⑤	Laser protection shutter for working object gateway	Construct a control system which will separate (cut off) the laser beams or shut off the laser power when it is open.
⑥	Emergency stop switch	Construct a control system for shutting off the laser power source when it is opened.
⑦	Safety switch	
⑧	Door for the maintenance	
⑨	Safety relay unit or safety PLC, etc.	Connect both INTERLOCK 1 and INTERLOCK 2 or both SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT terminals to the devices ⑤ to ⑧ using the relay output terminal of the safety relay unit or the safety PLC. Besides INTERLOCK connectors, it can also be connected to other I/O signals such as LASER STOP terminals with the devices ⑤ to ⑧ depending on the control specifications.
⑩	Laser radiation warning light	For indication of the status of the laser welding machine, connect each output signal such as ALARM OUT, LASER SUPPLY OUT or LASING OUT to the warning light.
⑪	Dust collector	Put the suction port of the dust collector near the lasing position.

Notice

- INTERLOCK 1&2 IN on the interlock connectors are connected to the operating coil of the internal relay in the controller. Connect INTERLOCK 1&2 IN to INTERLOCK 1&2 COM. with the non-voltage contact (dry contact) such as a relay or a switch. Do not connect with the voltage contact such as a transistor.

Reference

- When constructing a system compatible to ISO 11553-1/ISO 13849-1, design the system for shutting off the laser power with the following control in accordance with the standards.
  - Redundant interlock system by using both INTERLOCK 1 and INTERLOCK 2 connected to safety PLC or safety relay unit
  - Redundant monitoring system by using both SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT connected to safety PLC or safety relay unit

3 Operation Method

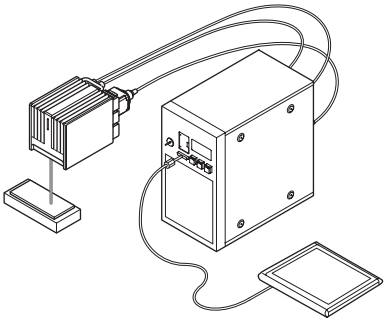
3-1 Type of Operations

The laser welding machine can be controlled by the following method:

Control by the manually screen operation

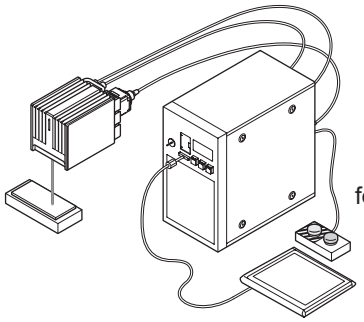
To irradiate the laser by the screen operation, select the control methods from the followings:

- Test lasing
  Test lasing executes the laser radiation manually with the selected file.
  Use Test lasing when you want to check the lasing results while changing the setting parameters, such as during the testing to find the appropriate parameters or the maintenance work.



Touch panel console

- Run mode operation
  Run mode is an operation method to configure the settings of the laser welding machine by manual screen operation and to control the lasing start signal from the external devices such as switches or sensors connected to I/O terminal.
  Use this operation mode to configure the laser welding machine without using the external control devices as PLC.



Switch for lasing trigger

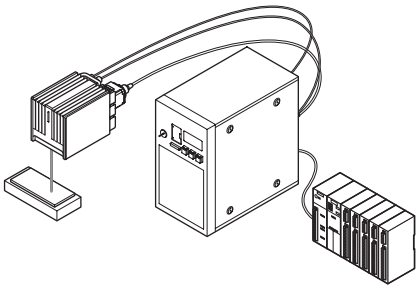
Reference

- Refer to “3-3-4 Test lasing and Run mode operation” (P.74).

Control by external devices (remote control mode)

The operation method for automatic control.
I/O or communication commands control the operations such as laser pumping and lasing by connecting the laser welding machine to the external control device as PLC.
The following external control methods are available. These controls can be combined.

- I/O control
- Communication command control (RS-232C)



External control device such as PLC

Reference

- For details on the external control, refer to “3-4 Operation by External Devices” (P.75).

3-2 Start-up & Termination

⚠WARNING	• It is obligated by IEC/FDA/JIS that laser products shall incorporate a key-actuated master control. Actuation of this product is basically controlled by the key switch located on the front of the controller. However, in considering situations when the laser welding machine is operating as a part of a larger system, the laser welding machine turns on if the key switch is already in ON position, and power is supplied. In this case, be sure that the external system controls the operation of the laser welding machine with a key-actuated master control.

■ Start-up

1. Set up the laser welding machine.

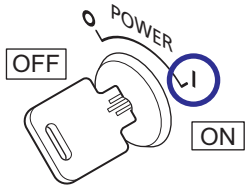
Connect the head and controller.

Connect the touch panel console or monitor and mouse to the controller.

Refer to “2-5 Connecting Laser Welding Machine” (P.54).

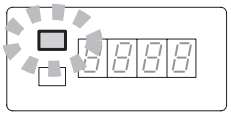
2. Turn ON the key switch of the controller.

The main indicator on the controller flashes in green.



3. After approx. 75 seconds, system starts up.

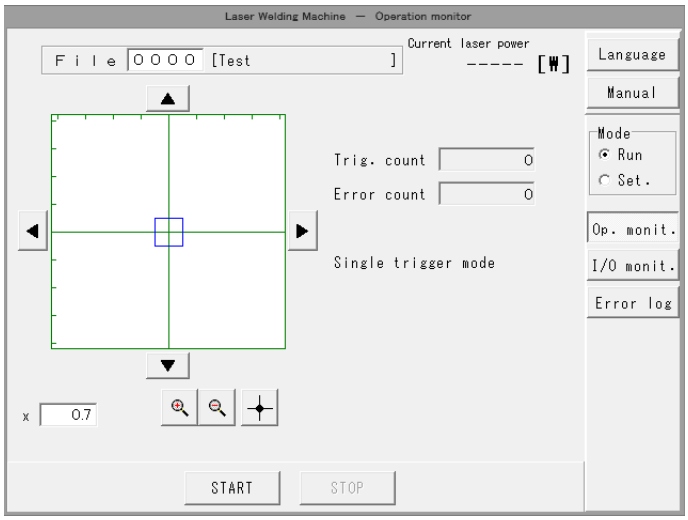
The main indicator changes into lighted-up status.



Notice

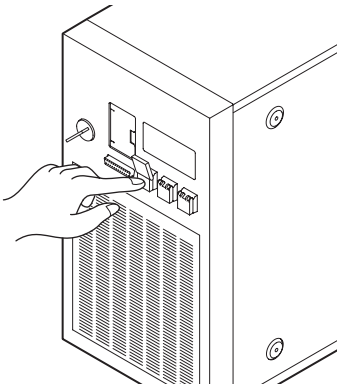
- Do not turn off the power supply until completing the system start.
- In case of turning ON the power supply after turning OFF, leave the interval at least 5 seconds between ON and OFF.

4. Operation monitor will appear.



■ Termination

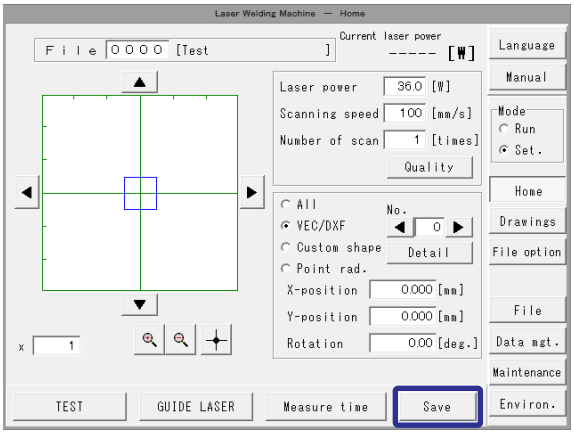
1. Turn off the laser supply switch on the controller.



Reference

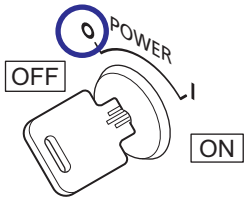
- Under the remote control mode, turn off the laser supply by using LASER SUPPLY IN (X9) on I/O terminal or the serial communication command for the laser pumping (LSR).

2. If you want to save the file, click “Save”.



3. Turn off the key switch and pull it out from the controller.

The system key should be in safekeeping by a laser safety manager.



3-3 Operation by Manual Setting

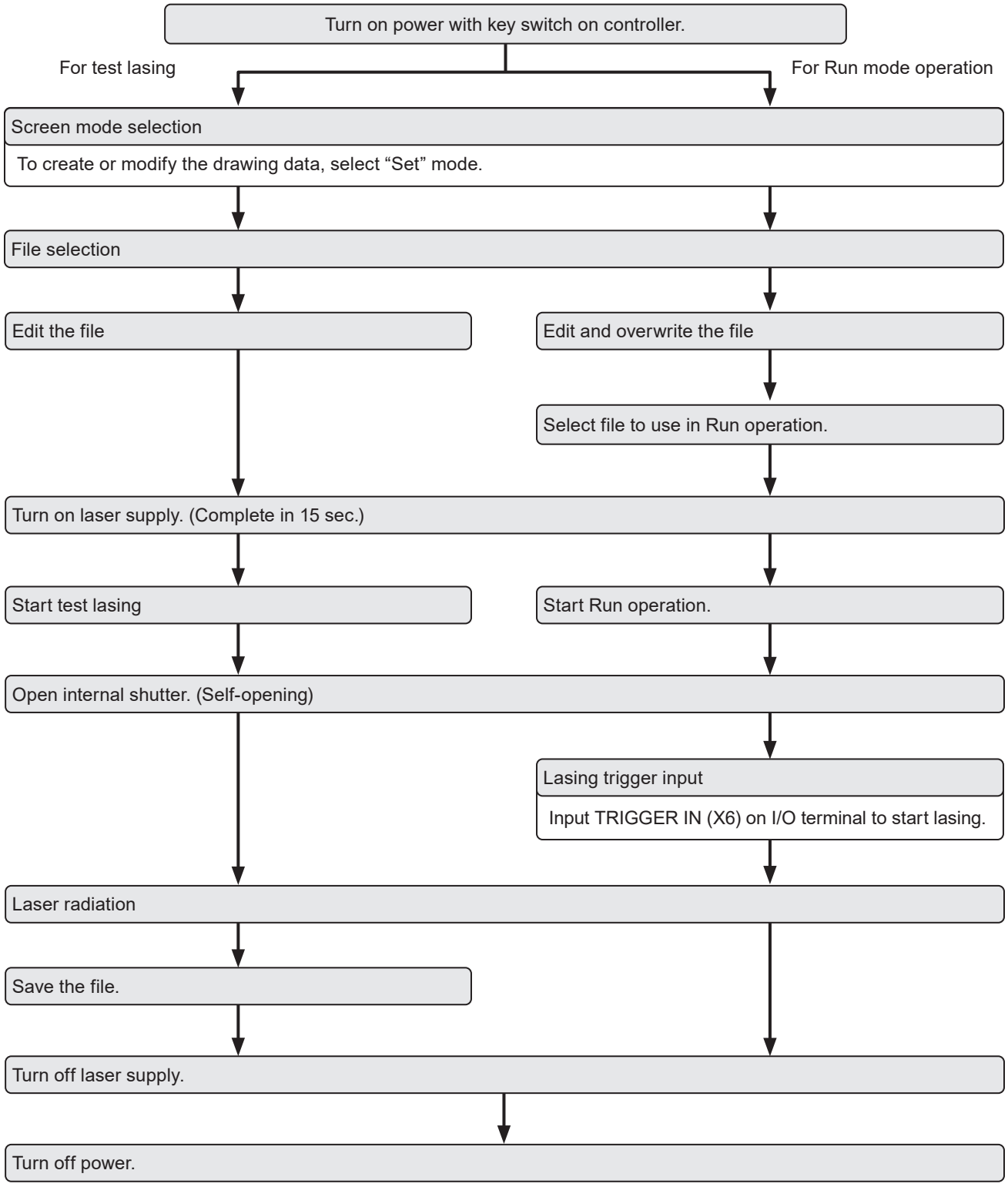
The setting data for the laser processing is configured with the display operation connected to the controller. It is also possible to control the laser welding machine by operating the display in test lasing or run mode operation.

Reference

- For the setting details, refer to “Operation Manual”.

3-3-1 Operation procedure

■ From file editing to laser radiation



3-3-2 Screen types

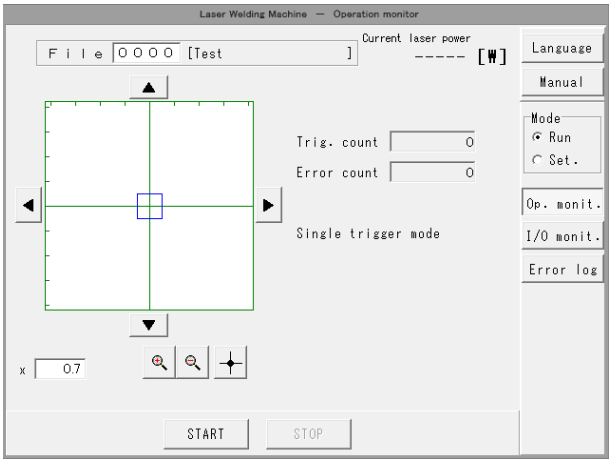
There are “Setting” mode and “Run” mode for the operation screen of the laser welding machine.
The applicable screen varies depending on this mode.

Reference

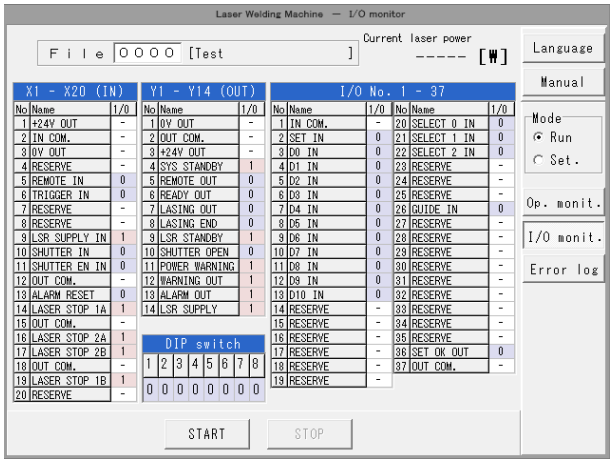
- For the setting details, refer to “Operation Manual”.

■ Run mode

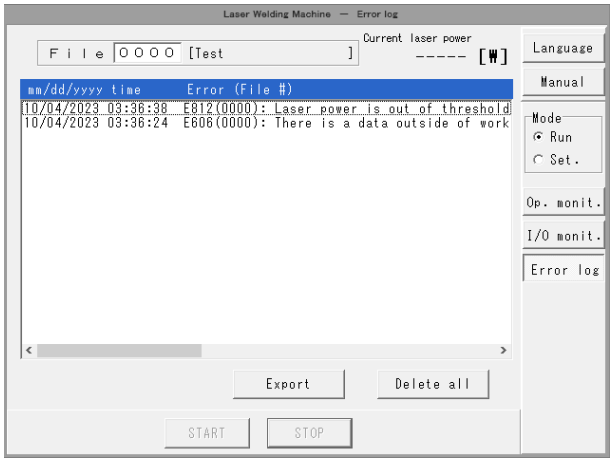
Run mode is the screen mode to confirm the operating status of laser welding machine during the remote control or running operation.



Operation monitor:
Displays the working image of the selected file.



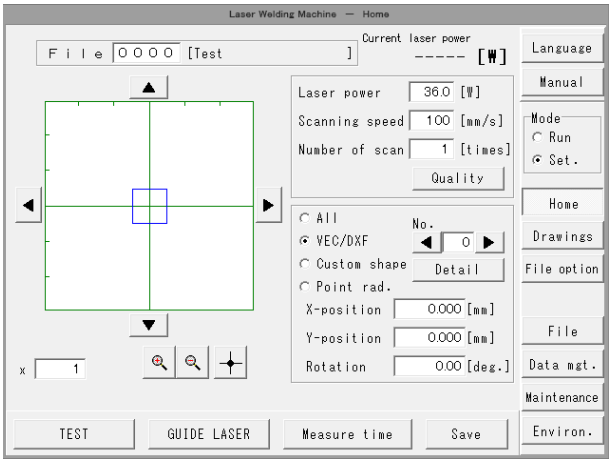
I/O monitor:
Displays the ON/OFF state of I/O.



Error log:
Displays the errors occurred in the laser welding machine.

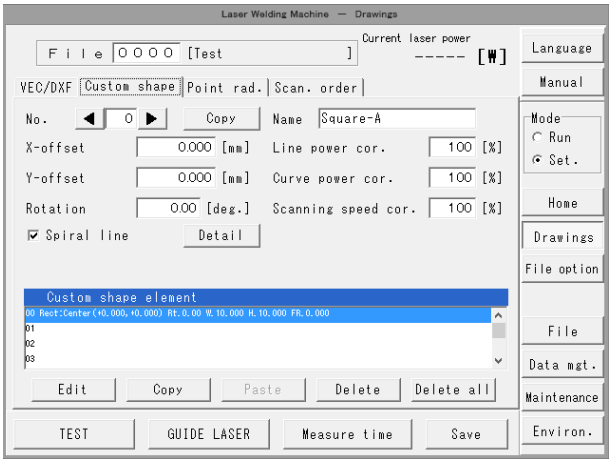
■ Setting mode

Setting mode is the screen mode to configure the drawing data and parameters. In this mode, environment setting and data management of the laser welding machine are also done.



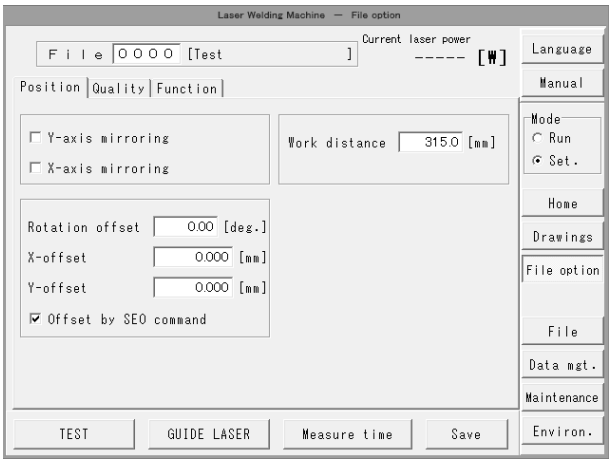
Home

- Shows drawing image.
- Sets laser power and scanning speed.
- Adjusts lasing position.
- Controls test lasing.
- Controls guide laser.



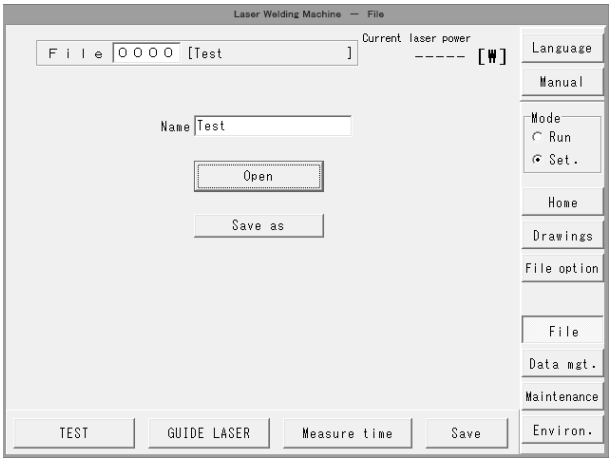
Drawings

- Sets drawing data.
- Modifies scanning order of drawings.



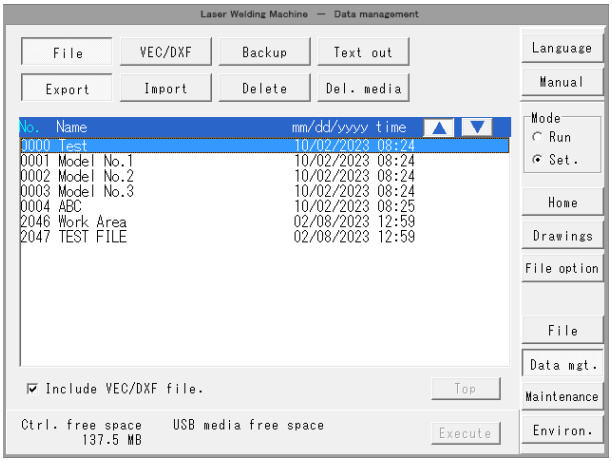
File option

- Adjusts the layout for all data in a file.
- Sets the monitoring condition of the laser power.



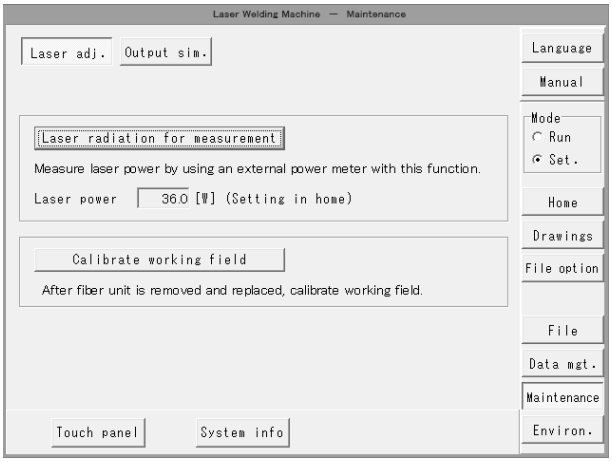
File

- Select a setting file
- Set a file name
- Copy a setting file to other file number.



Data management

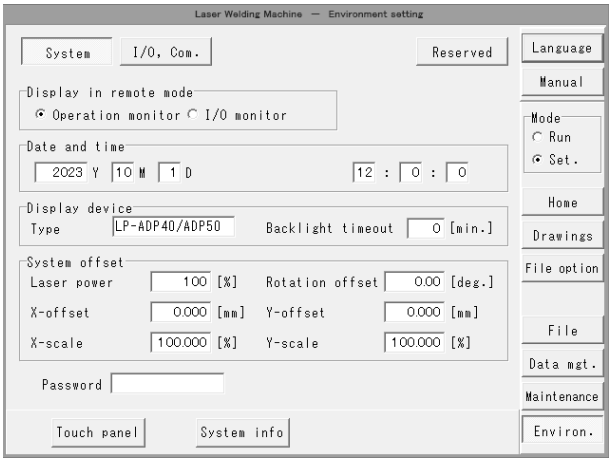
- Add/delete setting files and VEC/DXF files.
- Export the backup data from the laser welding machine.
- Import the externally saved backup data to the laser welding machine.



Maintenance

- Irradiate the laser for measurement. *
- Simulate ON/OFF operation of the output signals.

* To measure the laser output, you need a power meter available in stores.

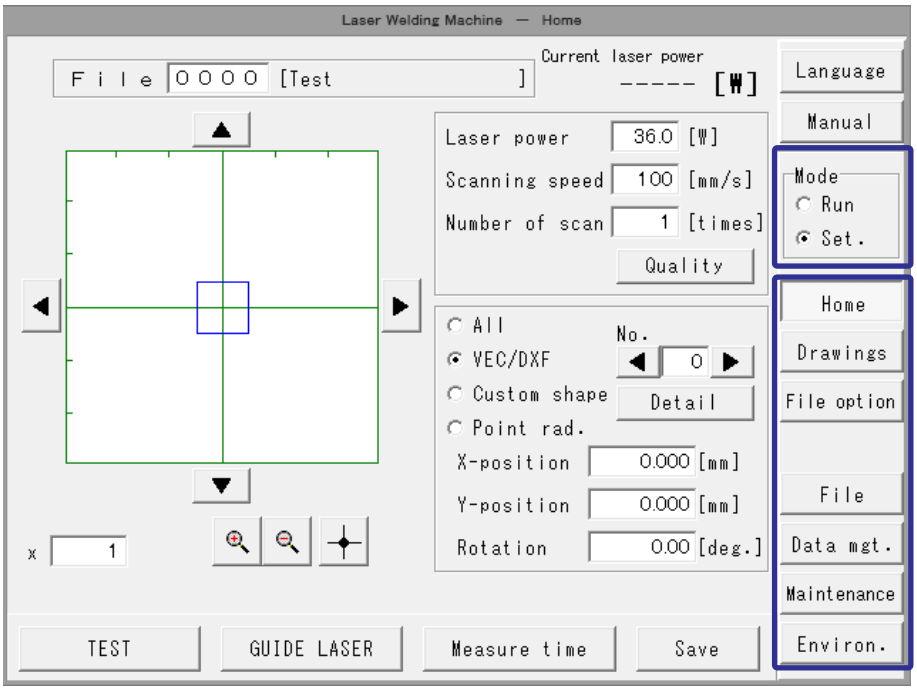


Environment setting

- Configure the I/O and communication conditions for the external control.
- Set the password to restrict access to the setting screen.
- Configure the laser power and offset value of the lasing position for all the data in the laser welding machine.
- Check the system information.

3-3-3 Screen selection

The display screen is switched by clicking screen names on the right menu.
Select the screen mode between Run or Setting. Depending on the selected mode, available screen buttons appear on the right menu.



Reference

- With a password set in the environment setting screen, the password is required to change the screen mode from “Run” to “Setting”.
- Under the remote control mode, only Operation monitor is available.

Notice

- The password function is designed for the purpose to prevent a wrong configuration or unintended operation. You cannot use this password for security purpose.

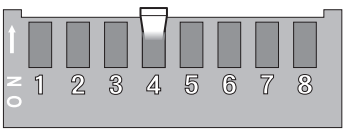
■ When password is forgotten

If you have configured the password on the environment setting screen, the password is required to change the screen mode from “Run” to “Setting”.
If you have forgotten this password, confirm the password according to the following procedures:

1. Turn OFF the power of laser welding machine.

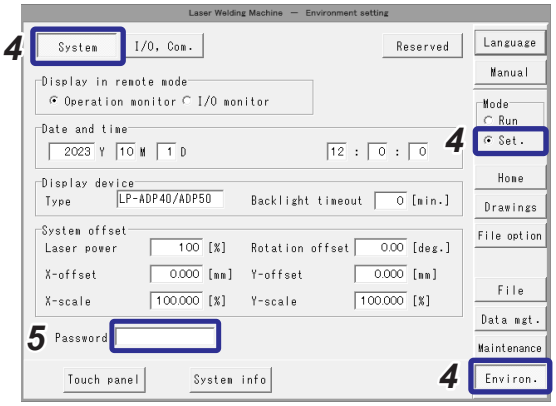
2. Turn ON the DIP switch No. 4 on the rear of the controller.

The access to the setting mode is unlocked.



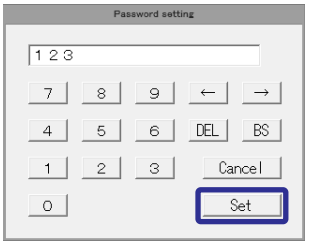
3. Turn ON the power of laser welding machine.

4. Select the screen mode to “Set” and click “Environment” - “System”.



5. Click input field of the password.

6. The currently set password is displayed.



7. To change the password, input the new one and click “Set”.

- To keep the current password, click “Cancel”.
- If you don't use the password protection, input nothing and click “Set”.

8. To use the password protection, turn OFF the power of laser welding machine and then turn OFF the DIP switch No. 4.

3-3-4 Test lasing and Run mode operation

To irradiate the laser by the screen operation, operate the laser welding machine in test lasing or run mode operation.

■ Test lasing procedure

Test lasing executes the laser radiation manually with the selected file.

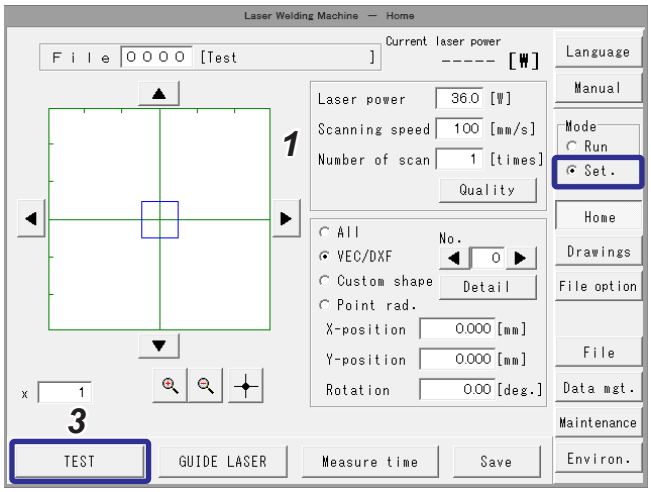
1. Set laser power, scanning speed and other parameters.

2. Turn ON the laser supply switch on the controller to start laser pumping.

3. Click “TEST”.

Test lasing is available on the following screen.

- Home
- Drawings
- File option
- File



4. The confirmation dialog box will appear. To start lasing, click “OK”.

Reference

- If the message “Lasing pause was detected.” appears after the test lasing, change Data compile mode to Precompiled in File option menu.
- When executing the processing time measurement before the test lasing, you can know the possibility of Lasing pause warning preliminarily.

■ RUN mode procedure

Run mode is an operation method to configure the settings of the laser welding machine by manual screen operation and to control the lasing start signal from the external devices such as switches or sensors connected to I/O terminal.

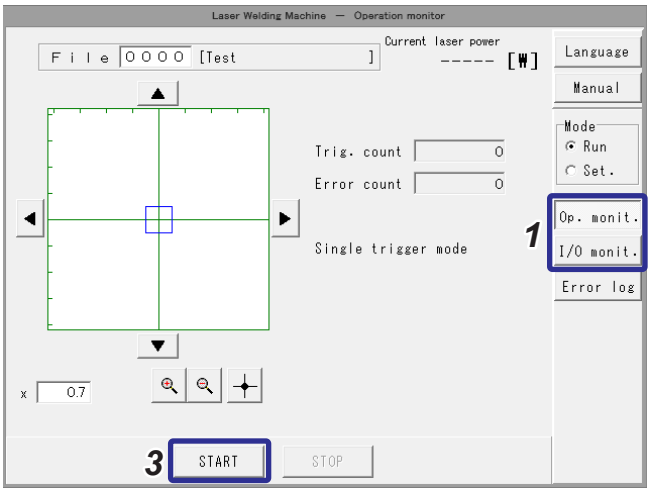
1. Set the screen mode to “Run” and select any of the following screens:

- Operation monitor
- I/O monitor

2. Turn ON the laser supply switch on the controller to start laser pumping.

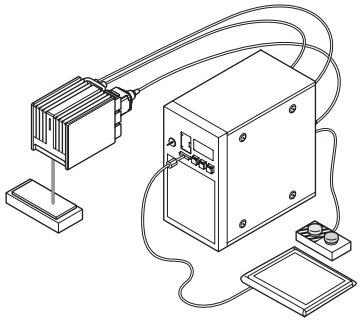
3. Click “START”.

Under the RUN mode operation, the laser welding machine is in the standby status for the lasing start signal from I/O terminal X6: TRIGGER IN.



4. Laser radiation starts by turning on TRIGGER IN (X6) on the I/O terminal.

Connect a switch or sensor to X6: TRIGGER IN on the I/O terminal as the input method of the lasing start signal (trigger).



Switch for lasing trigger

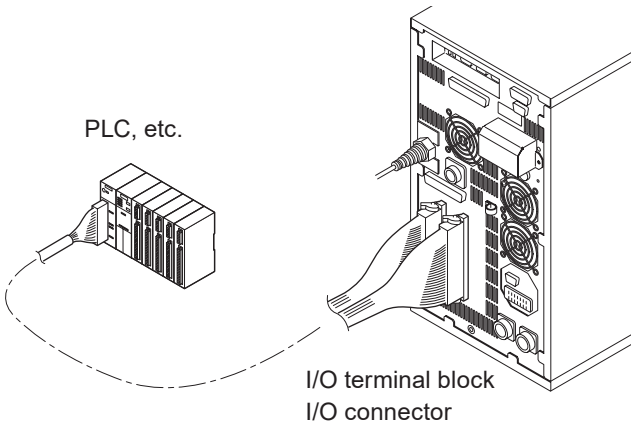
3-4 Operation by External Devices

3-4-1 Operation method using external control device

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

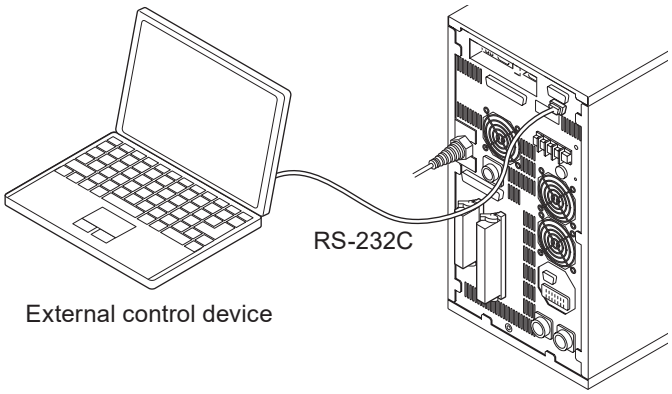
External control using I/O : Remote mode operation

Controls the laser welding machine from external devices such as PLC using various I/O signals loaded into the laser welding machine.
For details, refer to “4 External Control Using I/O” (P.82).



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

Use the RS-232C interface for controlling the laser welding machine from an external device such as PLC using communication commands.
For details, refer to “5 External Control by Communication Commands” (P.122) and “Serial Communication Command Guide”.

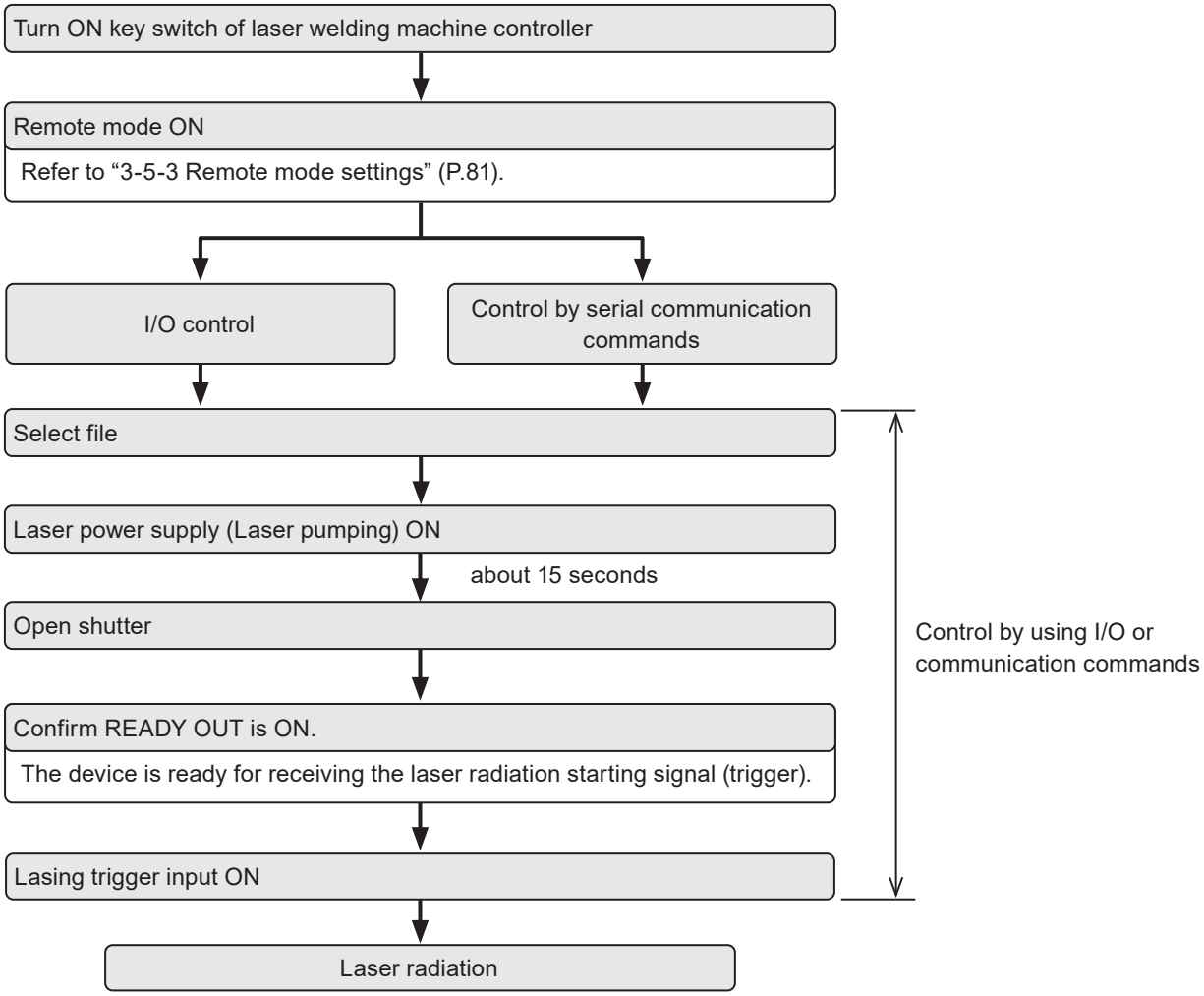


Reference

- It is available to the external control combining I/O, and serial communication commands.
- To input lasing trigger with I/O and configure other settings with a screen operation manually, use Run mode. For details, refer to “3-3-4 Test lasing and Run mode operation” (P.74).
- For the communication details to monitor the laser power at lasing, refer to “6 Laser Power Monitoring Function” (P.126).

3-4-2 Operation procedure with external control

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



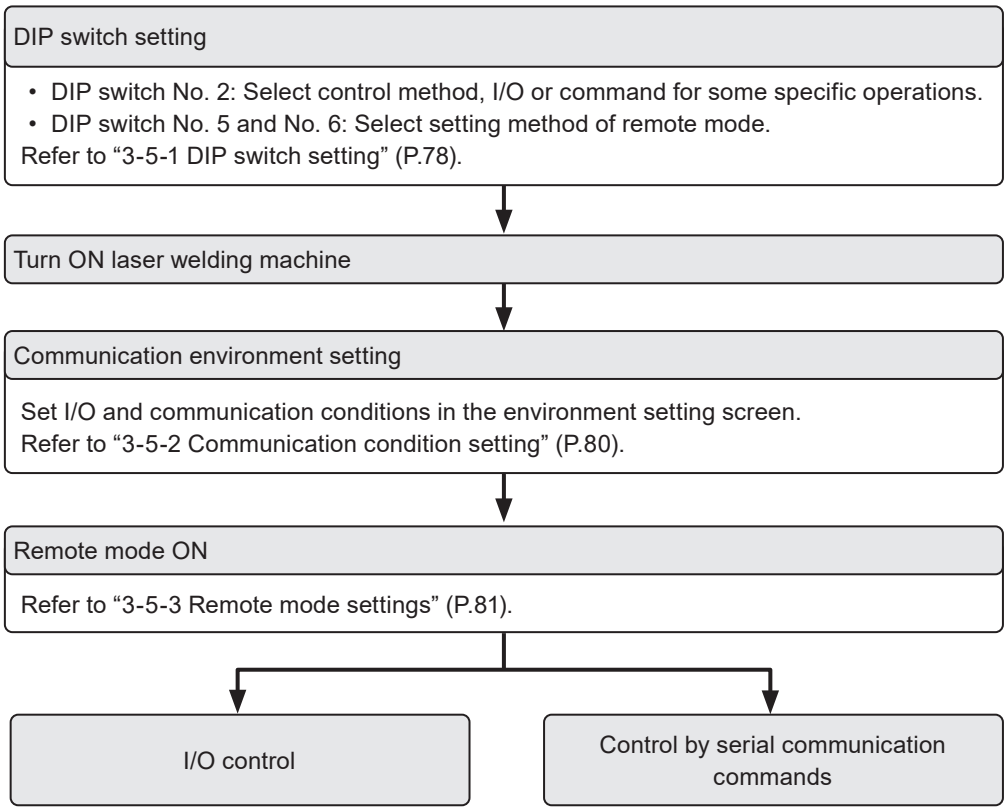
Reference

- It is available to the external control combining I/O, and serial communication commands.
- Configure the environment setting on the I/O communication in advance before using external control. Refer to “3-5 Before External Control” (P.77).

3-5 Before External Control

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

■ Setting flow to start external control



3-5-1 DIP switch setting

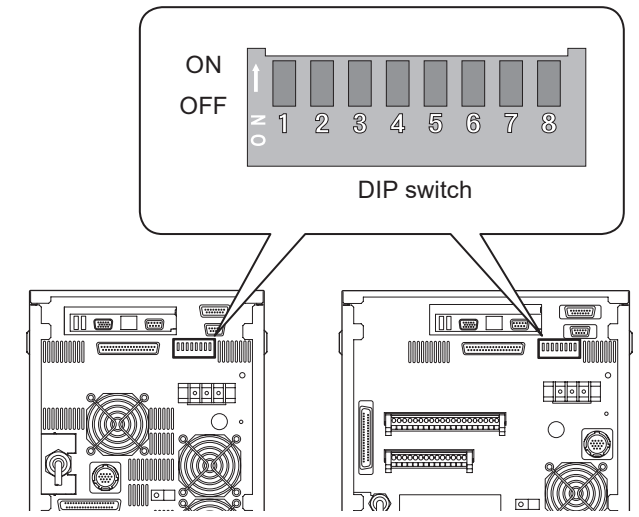
Set the operational options for the external control with the DIP switch equipped on the controller rear side.

Reference

- The initial setting of all DIP switches is OFF.
- Turn OFF the power at DIP switch setting.
- For the details on DIP switch, refer to “3-5-1 DIP switch setting” (P.78).

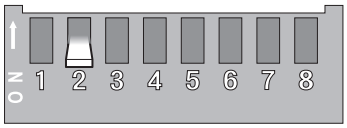
1. Turn OFF the power of laser welding machine.

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



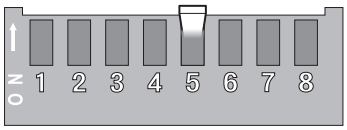
Rear of controller

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



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

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

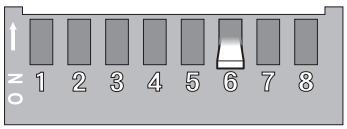


DIP switch No. 5	Setting method of remote mode
ON	Use the input signal of X5 “REMOTE IN” on I/O terminal.
OFF(initial setting)	Use the remote switch on the front of the controller.

Reference

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

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



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

Reference

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

⚠WARNING

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

6. Install the DIP switch cover to the controller.

Notice

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

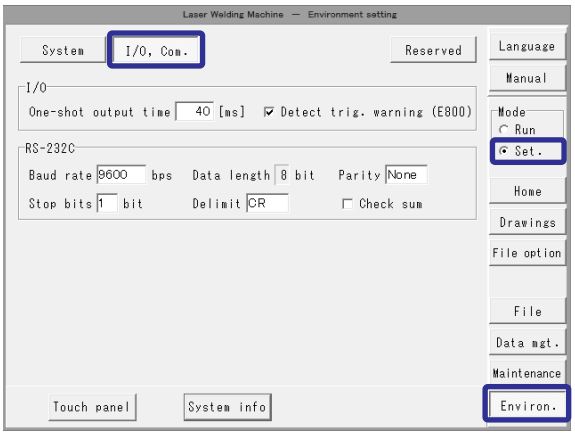
7. Turn ON the power of laser welding machine.

3-5-2 Communication condition setting

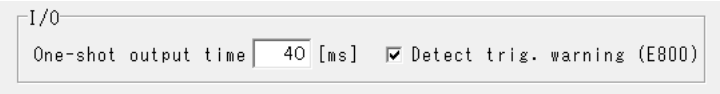
To control the laser welding machine by using I/O or communication commands, configure the following items in advance on the environment setting screen.

1. Select the screen mode to “Set”.

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



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

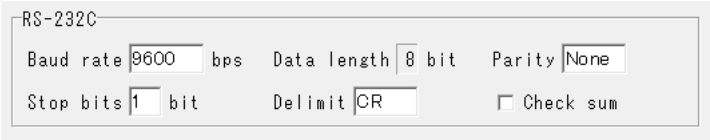


- One-shot output time:
  Sets the output duration for some signals such as LASING END OUT (Y8) and SET OK OUT (No.36).
  Setting range: 20 ms to 510 ms (initial value is 40 ms)

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

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

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



Reference

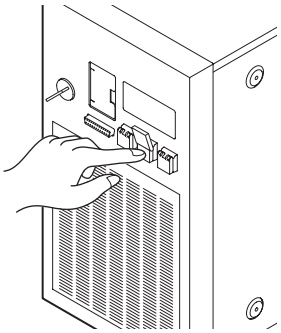
- The laser welding machine can be controlled by I/O and communication commands combined.
- The parameters on the environment setting screen are applied to the laser welding machine directly without saving.
- Specify the “Flow control” to “None” at the communication port settings of the external control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

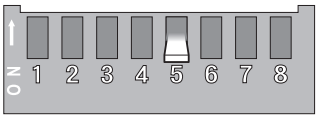
3-5-3 Remote mode settings

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

Use the remote switch on the front of the controller.

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

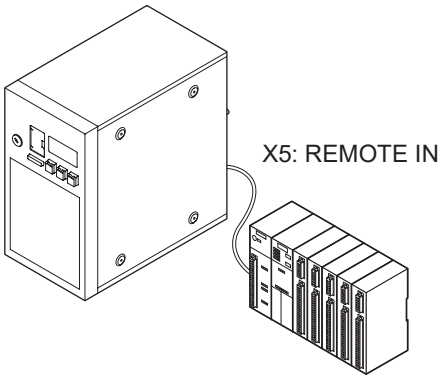


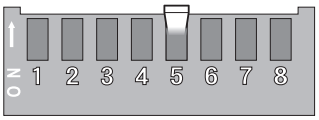


Turn OFF the DIP switch No. 5.
Refer to “1-6-3 DIP switch” (P.38).

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

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





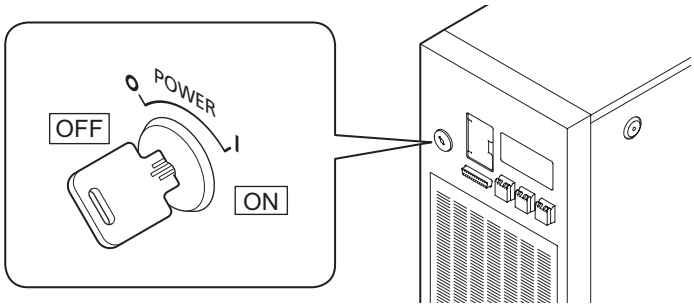
Turn ON the DIP switch No. 5.
Refer to “1-6-3 DIP switch” (P.38).

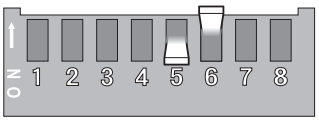
Reference

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

Start the laser welding machine in the remote mode

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





Turn OFF the DIP switch No. 5 and turn ON the DIP switch No. 6.
Refer to “1-6-3 DIP switch” (P.38).

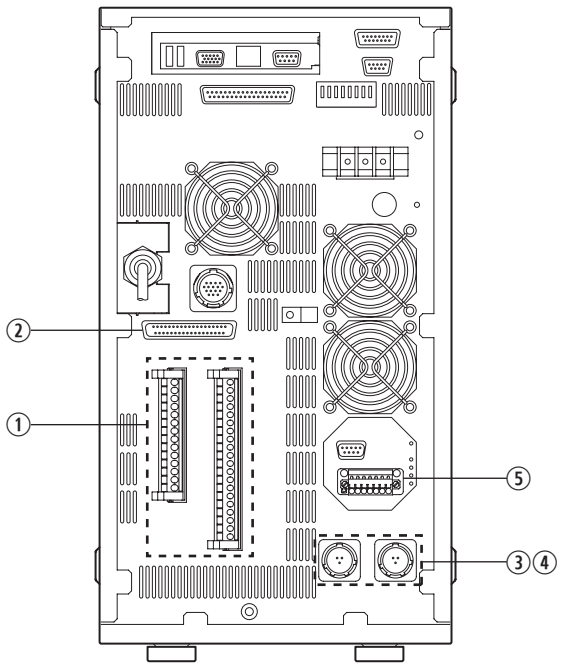
Reference

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

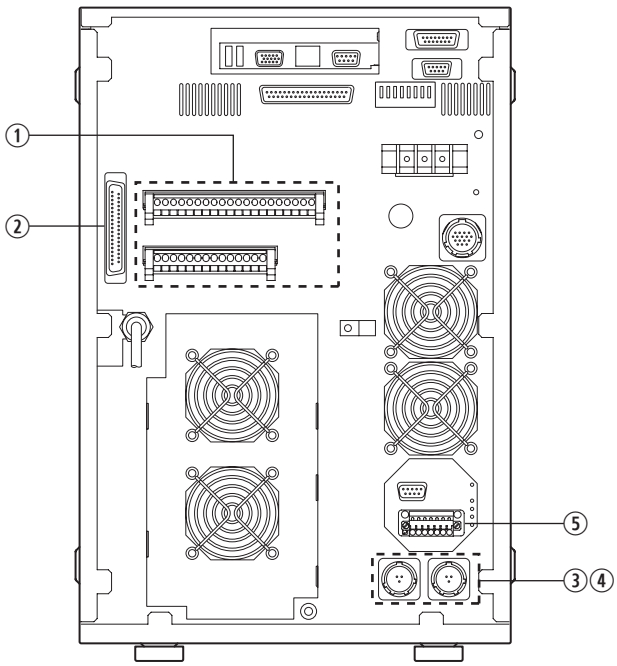
4 External Control Using I/O

4-1 I/O Control Settings

This product has the following I/O interfaces on the rear side of the controller.



VL-W1500-N, VL-W1506-N



VL-W1A00-N, VL-W1A06-N

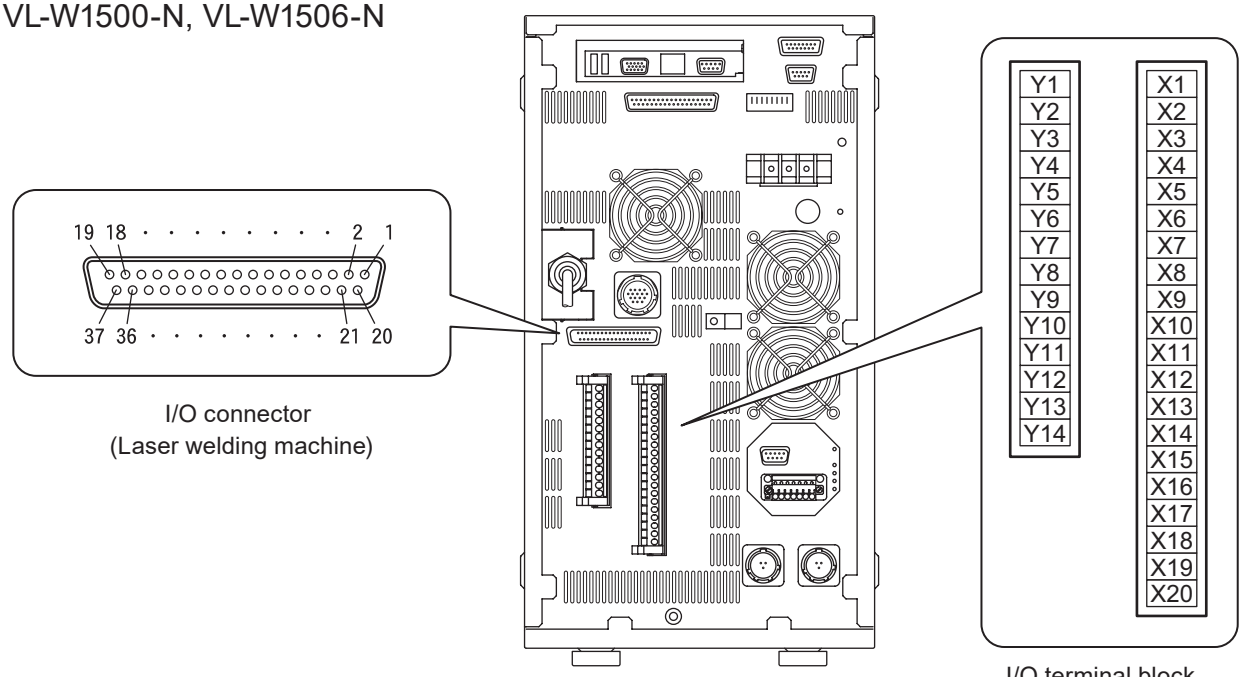
No.	Name	Description
①	I/O terminal	Input and output terminals to control the laser welding machine externally. Refer to “4-2 I/O Interface Specification” (P.84).
②	I/O connector	
③	Interlock connector 1	Input and output terminals to construct the interlock system to stop the laser radiation. Refer to “4-4 Interlock Connector” (P.104).
④	Interlock connector 2	
⑤	Shutter close output terminal (terminal No. 1 to 3)	Output terminals to confirm the shutter closing status. Refer to “4-5 Shutter Close Output” (P.108).

4-2 I/O Interface Specification

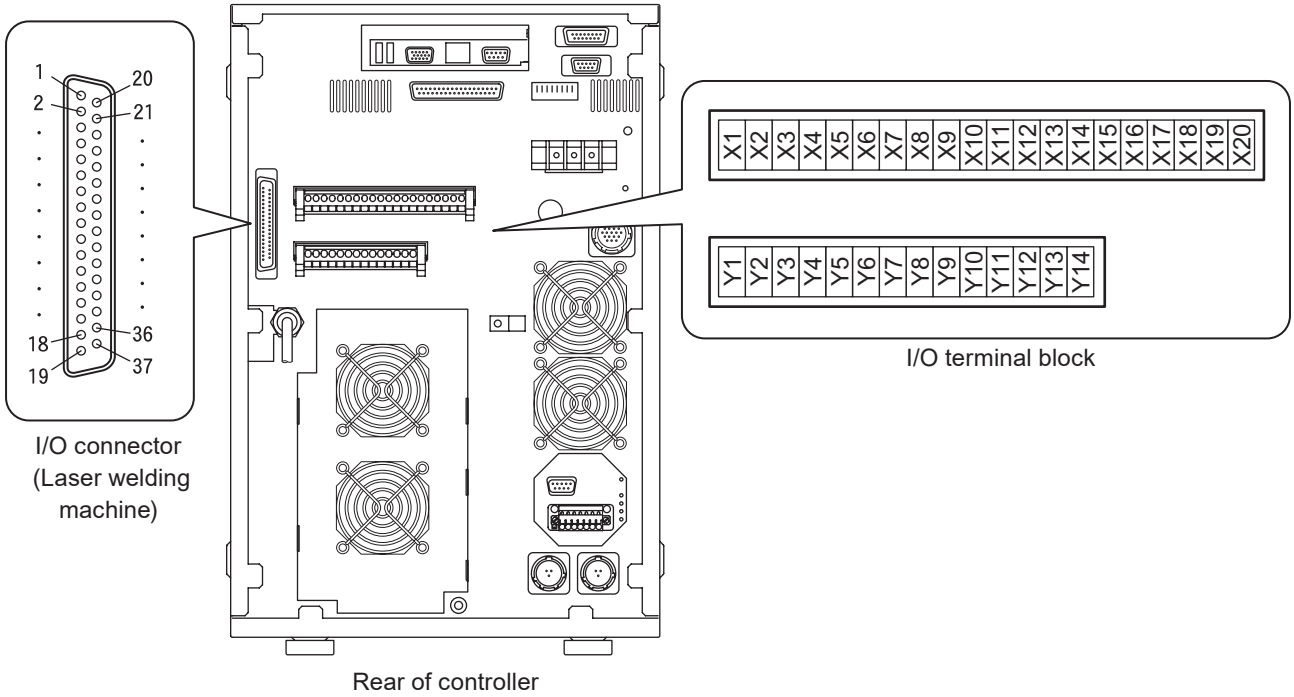
The I/O terminal block and the I/O connector are available as the external control I/O interface of this product.

- I/O terminal block: Loaded with the basic input/output to control the laser welding machine.
- I/O connector: Loaded with the input/output for data configuration such as selecting a file number and the input/output for the specific functions.

■ VL-W1500-N, VL-W1506-N



■ VL-W1A00-N, VL-W1A06-N



Reference

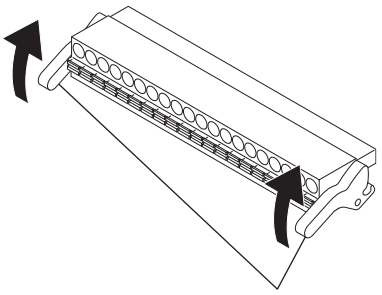
- Before using I/O, configure the environment settings. Refer to “3-5 Before External Control” (P.77).

■ Connector specifications and models

Connector position		Model	Manufacturer name
I/O terminal block	On the laser welding machine side	• Input: MSTBVA 2.5/20-G-5.08-LR • Output: MSTBVA 2.5/14-G-5.08-LR	Phoenix Contact
	User side	Attached accessories • Input: FKC_2.5/20-ST-5.08-LR • Output: FKC_2.5/14-ST-5.08-LR	
I/O connector	On the laser welding machine side: D-sub 37 pin female (Screw type: M2.6, female)	—	Hirose Electric Co., Ltd.
	User side: D-sub 37 pin male (Screw type: M2.6, male)	Attached accessories • Connector: HDCB-37PF (05) • Connector Cover: HDC-CTH 1(10)	

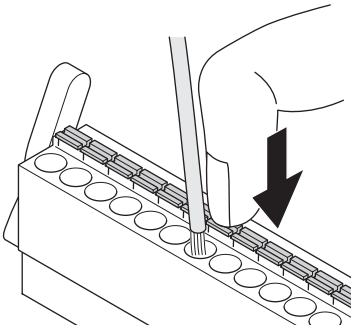
■ I/O terminal block

I/O terminal block can be removed by holding up the hooks.

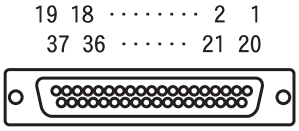


Hook

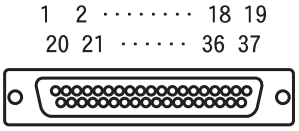
For the wiring of I/O terminal or removing jumper wires, push the pinch as shown in the figure to open the wiring aperture.



■ I/O connector



On the laser welding machine side (Female)



User side: attached accessory (Male)

* This view is facing the connecting surface.

4-2-1 Signals and details of I/O terminal block

The I/O terminal block is loaded with the basic input/output to control the laser welding machine.

■ List of signals

No.	Name
X1	24V OUT: Internal power 24V
X2	IN COM.
X3	0V OUT: Internal power 0V
X4	RESERVE
X5	REMOTE IN
X6	TRIGGER IN
X7	RESERVE
X8	RESERVE
X9	LASER SUPPLY IN
X10	SHUTTER IN
X11	SHUTTER ENABLE IN
X12	OUT COM.
X13	ALARM RESET IN
X14	LASER STOP 1A IN
X15	OUT COM.
X16	LASER STOP 2A IN
X17	LASER STOP 2B IN
X18	OUT COM.
X19	LASER STOP 1B IN
X20	RESERVE

No.	Name
Y1	0V OUT: Internal power 0V
Y2	OUT COM.
Y3	24V OUT: Internal power 24V
Y4	SYSTEM STANDBY OUT
Y5	REMOTE OUT
Y6	READY OUT
Y7	LASING OUT
Y8	LASING END OUT
Y9	LASER STANDBY OUT
Y10	SHUTTER OPEN OUT
Y11	POWER WARNING OUT
Y12	WARNING OUT
Y13	ALARM OUT
Y14	LASER SUPPLY OUT

Reference

- Use the internal power (X1, X3, Y1, Y3) as the power supply when operating the laser welding machine alone. Do not connect anything when using the external power supply.
- Do not connect anything to RESERVE terminals.
- OUT COM. terminals of Y2, X12, X15 and X18 are the common terminal connected internally.
- X11-X12, X14-X15, X16-X17-X18, and X18-X19 are short-circuited respectively for the shipment. For details, refer to “4-3-1 Factory default wiring” (P.99).
- For details on the terminal block connection, refer to “4-3 Connecting I/O Terminal Block” (P.99).

■ Input signal operation on the I/O terminal block

Reference

- The ON/OFF listed in this section refers to the ON/OFF operations. It does not refer to the voltage level (High/Low).

No.	Name and description
X1	24V OUT: Internal power supply + 24V DC (max. output current 300mA) Power for I/O control when the laser welding machine is not connected to the external control device. X1 and Y3 are the common terminal connected internally.

Notice

- Make sure to use X3 or Y1 for the 0V of the internal power 24V (X1 and Y3). Do not mix the connecting pattern for using external and internal power supply.
- Do not connect anything to this when using the external power supply.
- When using the internal power supply (X1, X3, Y1, Y3), the total current of the power supply for the external device and the consumption current for the I/O control should be less than 300mA.

X2	IN COM.: Input common The common terminal for each input of the I/O terminal and I/O connector. IN COM. (X2) and IN COM. (No.1) of I/O connector are the common terminal connected internally. In case of NPN connection, this terminal is connected to the “+ (plus)” side of power which is used for control. In case of PNP connection, this terminal is connected to the “- (minus)” side of power which is used for control. For details, refer to “4-3-2 Connecting common terminals” (P.100).

Notice

- Do not invert the power wiring of I/O terminal and I/O connector. It may cause a failure.
- When this terminal is connected to the power supply, it is not necessary to supply the power to the other IN COM. on I/O connector.

X3	0V OUT: Internal power supply 0V Power for I/O control when the laser welding machine is not connected to the external control device. Y1 and X3 are the common terminal connected internally.

Notice

- Make sure to use X1 or Y3 for the internal power 0V (X3 and Y1). Do not mix the connecting pattern for using external and internal power supply.
- Do not connect anything to this when using the external power supply.

X4	RESERVE: System reservation Do not connect externally.
X5	REMOTE IN: Remote mode input While this input is turned on, the laser welding machine operates in the remote mode which can be controlled externally by I/O and serial communication commands. To transit to the remote mode using this terminal, turn ON the DIP switch No. 5 in advance. Refer to “3-5-3 Remote mode settings” (P.81).
X6	TRIGGER IN: Lasing trigger input The signal to start laser radiation. Starts lasing by edge of input ON. This signal can be accepted while READY OUT (Y6) is turned ON. When the trigger mode is set to “single trigger”, one lasing operation is executed by the edge of turning on of TRIGGER IN. When the trigger mode is set to “continuous trigger”, lasing operation is repeated while TRIGGER IN is on.

Reference

- When the trigger delay time is set in the selected file, lasing operation starts after the delay time.
- Trigger mode is specified in each file by settings in the file option screen of the laser welding machine.

No.	Name and description
X7 X8	RESERVE: System reservation RESERVE: System reservation Do not connect externally.
X9	LASER SUPPLY IN: Laser pumping input While this input is turned on, the laser is pumped to enable the radiation. It takes approximately 15 seconds from turning on LASER SUPPLY IN to completion of laser pumping. This terminal is available when the DIP switch No. 2 is turned OFF.
X10	SHUTTER IN: Shutter open input While this input is turned on, the internal shutter opens. The control of this terminal is enabled when SHUTTER ENABLE IN (X11) is ON. There is a delay time of around 200ms to max. 1 second from turning ON/OFF of SHUTTER IN for the actual shutter open / close operation time. This terminal is available when the DIP switch No. 2 is turned OFF.
X11	SHUTTER ENABLE IN: Shutter open enable input Control by SHUTTER IN (X10) is available while SHUTTER ENABLE IN (X11) is turned ON. To control opening and closing the shutter by SHUTTER IN (X10) only, short-circuit SHUTTER ENABLE IN (X11) and OUT COM. (X12, X15, X18 or Y2).

⚠WARNING	⃠
	• Do not use SHUTTER IN (X10) and SHUTTER ENABLE IN (X11) as an emergency stop or the interlock. Turning OFF these terminals during laser radiation will not close the shutter until the lasing operation completes.

X12	OUT COM.: Output common The common terminal for each output of the I/O terminal and I/O connector. Y2, X12, X15, X18 and No. 37 of I/O connector are the common terminal connected internally. In case of NPN connection, this terminal is connected to the “- (minus)” side of power which is used for control. In case of PNP connection, this terminal is connected to the “+ (plus)” side of power which is used for control.
X13	ALARM RESET IN The reset input for restoring the system from the alarm status. Make sure to verify the safety by eliminating the alarm causes before turning this input ON. The errors you can restore by the alarm reset are as follows: • E004 • E011 • E260 • E700 For the alarms you are unable to reset such as the ones caused by hardware or system error, restart the laser welding machine.

<table>
<tr><th>No.</th><th>Name and description</th></tr>
<tr><td>X14
X19
X16
X17</td><td>LASER STOP 1A IN
LASER STOP 1B IN
LASER STOP 2A IN
LASER STOP 2B IN
Use these terminals to stop the laser radiation or disable the laser radiation temporarily.
When between LASER STOP 1A/1B IN (X14, X19) or LASER STOP 2A/2B IN (X16, X17) and OUT COM. are disconnected, the laser radiation will be disabled.
The laser welding machine operates as shown below according to the terminal and its open status. For details, refer to “Laser welding machine operation when functions for safety measures are input” (P.92).
<table>
<tr><th>Terminal connection</th><th>Status when the terminal is open</th><th>Shutter</th><th>Laser pumping</th></tr>
<tr><td rowspan="2">LASER STOP 1A IN (X14) - OUT COM.
LASER STOP 1B IN (X19) - OUT COM.</td><td>Laser is not radiating</td><td>Close</td><td>Hold ON</td></tr>
<tr><td>Radiating the laser</td><td>Close</td><td>OFF</td></tr>
<tr><td>LASER STOP 2A IN (X16) - OUT COM.
LASER STOP 2B IN (X17) - OUT COM.</td><td>The same operation at all times</td><td>Close</td><td>OFF</td></tr>
</table>
The function relating to safety must be shut off mechanically. Therefore, it is recommended to wire these terminals at no-voltage contact (dry contact).
If you need to shut off the laser pumping physically, user the interlock connector instead of these terminals.</td></tr>
<tr><td>X15
X18</td><td>OUT COM.: Output common
OUT COM.: Output common
The common terminal for each output of the I/O terminal and I/O connector. Y2, X12, X15, X18 and No. 37 of I/O connector are the common terminal connected internally.
In case of NPN connection, this terminal is connected to the “- (minus)” side of power which is used for control.
In case of PNP connection, this terminal is connected to the “+ (plus)” side of power which is used for control.</td></tr>
<tr><td>X20</td><td>RESERVE: System reservation
Do not connect externally.</td></tr>
</table>

■ Output signal operation on the I/O terminal block

Reference

- The ON/OFF listed in this section refers to the ON/OFF operations. It does not refer to the voltage level (High/Low).

No.	Name and description
Y1	0V OUT: Internal power supply 0V Power for I/O control when the laser welding machine is not connected to the external control device. Y1 and X3 are the common terminal connected internally.

Notice

- Make sure to use X1 or Y3 for the internal power 0V (X3 and Y1). Do not mix the connecting pattern for using external and internal power supply.
- Do not connect anything to this when using the external power supply.

Y2	OUT COM.: Output common The common terminal for each output of the I/O terminal and I/O connector. OUT COM. (Y2, X12, X15, X18) and OUT COM. (No.37) of I/O connector are the common terminal connected internally. In case of NPN connection, this terminal is connected to the “- (minus)” side of power which is used for control. In case of PNP connection, this terminal is connected to the “+ (plus)” side of power which is used for control. For details, refer to “4-3-2 Connecting common terminals” (P.100).

Notice

- Do not invert the power wiring of I/O terminal and I/O connector. It may cause a failure.
- When this terminal is connected to the power supply, it is not necessary to supply the power to the other OUT COM. on I/O connector.

Y3	24V OUT: Internal power supply + 24V DC (max. output current 300mA) Power for I/O control when the laser welding machine is not connected to the external control device. X1 and Y3 are the common terminal connected internally.

Notice

- Make sure to use X3 or Y1 for the 0V of the internal power 24V (X1 and Y3). Do not mix the connecting pattern for using external and internal power supply.
- Do not connect anything to this when using the external power supply.
- When using the internal power supply (X1, X3, Y1, Y3), the total current of the power supply for the external device and the consumption current for the I/O control should be less than 300mA.

Y4	SYSTEM STANDBY OUT: System startup completed output SYSTEM STANDBY OUT turns ON for the duration from the completion of the start-up until turning OFF the power. Output ON in approximately 75 seconds after key switch is turned ON.
Y5	REMOTE OUT: Remote mode output The output is ON during the remote mode. Make sure that this terminal is turned ON and start the external control by I/O or serial communication commands.

No.	Name and description
Y6	READY OUT: Trigger ready output When TRIGGER IN (X6) becomes acceptable (the laser radiation becomes ready), this output turns ON. To turn on READY OUT (Y6) the following conditions are required: • No error has occurred • Laser pumping has completed • Internal shutter is open • The file number switching process has completed • When the file with the setting to use SEO command is selected, SEO command is transmitted by every trigger input. • When the serial communication control uses the command reception permission (MKM command), the reception permission state is turned OFF. Reference • When Data compile mode is set to Precompiled in File option menu, the required time for turning on READY OUT (Y6) after opening the shutter or changing the file is longer.
Y7	LASING OUT: Laser radiation output Output ON during laser radiation. If the lasing time is shorter than the specified one-shot output time, LASING OUT remains ON until the one-shot output time ends.
Y8	LASING END OUT: Laser radiation completed output Output ON when the lasing operation ended. Even when the lasing operation is interrupted due to the alarm, LASING END OUT (Y8) turns ON. This is One-shot output. Notice • LASING END OUT indicates that the laser welding machine has finished or interrupted the lasing operation. It does not mean whether the lasing quality is normal or abnormal.
Y9	LASER STANDBY OUT: Laser pumping completion output LASER STANDBY OUT turns ON for the duration from the completion of the laser pumping until turning OFF the laser pumping. The output turns ON approximately 15 seconds after the laser pumping started.
Y10	SHUTTER OPEN OUT Output ON during internal shutter of the head opening. There is a delay time of around 200ms to max. 1 second from turning ON/OFF of SHUTTER IN (X10) to turning ON/OFF of SHUTTER OPEN OUT (Y10). Reference • To monitor the shutter operation for the safety control system, use SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT (Shutter close output terminal No.2, 3). Refer to “4-5 Shutter Close Output” (P.108). • SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
Y11	POWER WARNING OUT POWER WARNING OUT indicates the warning “E812” occurrence, which notifies the measured laser power [W] is out of the threshold. It turns OFF when the measured laser power [W] is out of the threshold and keeps OFF state until one-shot output time is passed after the lasing operation. Without the setting of the warning threshold of laser power, this output does not work. Reference • This warning is released automatically after the lasing operation. • The power warning occurrence does not affect the ON/OFF state of WARNING OUT (Y12). • For the power data output, refer to “6-1 Laser Power Monitoring Details” (P.127).

No.	Name and description
Y12	WARNING OUT Output OFF at warning occurrence. Contents of warning are indicated by codes in file No./error code indicator of the controller. Refer to “Error Indication” (P.165) for contents of warning.
Y13	ALARM OUT Output OFF at alarm occurrence. When an alarm occurs, laser supply turns OFF. Contents of alarm are indicated by codes in file No./error code indicator of the controller. Refer to “Error Indication” (P.165) for contents of alarm.
Y14	LASER SUPPLY OUT To show the on/off state of the laser supply by using the external warning light or other indicator, connect this terminal to them.

Reference

- To confirm if the laser pumping is completed, use LASER STANDBY OUT (Y9).

Reference

- Set the output time of the one-shot duration on the environment setting screen. The setting range is 20 ms to 510 ms. The initial setting value is 40 ms. One-shot output time has a small margin of error for the setting value.

■ Laser welding machine operation when functions for safety measures are input

If INTERLOCK or LASER STOP 2A/2B IN is opened, regardless laser emission ON/OFF status, the laser is powered OFF and the shutter is closed.
The operation behavior of LASER STOP 1A/1B IN varies depending on the laser emission ON/OFF status.

Terminal name	Laser welding machine operation	Release method	Remarks
INTERLOCK 1 INTERLOCK 2	• Laser pumping: OFF • Internal shutter: CLOSE • Status: Alarm E260 *1	Close both INTERLOCK 1 and INTERLOCK 2 connections respectively and input the alarm reset.	Shuts off the power of the laser oscillator by the hardware operation through a relay.
LASER STOP 1A IN LASER STOP 1B IN	Opened during laser emission • Laser pumping: OFF • Internal shutter: CLOSE • Status: Alarm E011	Close both LASER STOP 1A IN and LASER STOP 1B IN connections respectively and input the alarm reset.	Shuts off the power of the laser oscillator by the software operation via internal circuits.
	Opened at non-emitting with opened shutter • Laser pumping: Hold ON • Internal shutter: CLOSE • Status: Warning E811	Close both LASER STOP 1A IN and LASER STOP 1B IN connections respectively.	
LASER STOP 2A IN LASER STOP 2B IN	• Laser pumping: OFF • Internal shutter: CLOSE • Status: Alarm E004 *1	Close both LASER STOP 2A IN and LASER STOP 2B IN connections respectively and input the alarm reset.	

*1 : Under the non-remote control mode when the shutter is closed (non-emitting status), the error does not occur.

4-2-2 Signals and details of I/O connector

The I/O connector is loaded with the input/output for data setting such as selecting a number and the input/output for the specific functions.

■ List of signals

No.	Name
1	IN COM.: Input common
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	RESERVE: System reservation
15	
16	
17	
18	
19	
20	SELECT 0 IN
21	SELECT 1 IN
22	SELECT 2 IN
23	RESERVE: System reservation
24	
25	
26	GUIDE IN: Guide laser radiation input

No.	Name
27	RESERVE: System reservation
28	
29	
30	
31	
32	
33	
34	
35	
36	SET OK OUT
37	OUT COM.: Output common

Reference

- Common terminals (IN COM. or OUT COM.) on the I/O connector and the I/O terminal block are connected internally. When IN COM. and OUT COM. on the I/O terminal block are connected to the power supply, it is not necessary to supply the power to the other IN COM. and OUT COM. on I/O connector.
- Do not connect anything to RESERVE terminals.
- For the pin arrangement of the I/O connector, refer to “4-2 I/O Interface Specification” (P.84).

■ Input signal operation on the I/O connector

Reference

- The ON/OFF listed in this section refers to the ON/OFF operations. It does not refer to the voltage level (High/Low).

No.	Name and description
1	IN COM.: Input common The common terminal for each input of the I/O terminal and I/O connector. This terminal and IN COM. (X2) of I/O terminal are the common terminal connected internally. In case of NPN connection, this terminal is connected to the “+ (plus)” side of power which is used for control. In case of PNP connection, this terminal is connected to the “- (minus)” side of power which is used for control. For details on the connection, refer to “4-3-2 Connecting common terminals” (P.100). **Notice** • Do not invert the power wiring of I/O terminal and I/O connector. It may cause a failure. • When IN COM. (X2) of I/O terminal is connected to the power supply, it is not necessary to supply the power to the other IN COM. on I/O connector.
2	SET IN Turn ON this signal when executing the input of D0 IN to D10 IN (No.3 to 13) and SELECT 0 IN to SELECT 2 IN (No.20 to 22). Turn ON SET IN with maintaining the input status of D0 IN to D10 IN and SELECT 0 IN to SELECT 2 IN. The input operation is executed at the timing of the edge of turning ON. SET IN is required to control the following operations by I/O. • File No. selection • Selection of counter type to reset
3 to 13	D0 IN to D10 IN : Number input Set the number for one of the following targets selected at SELECT 0 IN to SELECT 2 IN (No.20 to 22). ① File No. ② Counter type to reset

① File No. (SELECT 0 IN to SELECT 2 IN: All OFF)
Input when changing the file number of 0 to 2047.
Specify the file number in the binary system as D0 to D10 and turn ON SET IN (No.2).
Indicate values in the binary system as ON/OFF of D0 to D10 with D0 being the lowest digit value.

Example: When selecting the file No. 618
Select “010 0110 1010”, which represents 618 in a 16-bit binary system, by specifying ON/OFF of D0 to D10 as shown in the below table.

Terminal	File No. (binary)	INPUT
D0	0	OFF
D1	1	ON
D2	0	OFF
D3	1	ON
D4	0	OFF
D5	1	ON
D6	1	ON
D7	0	OFF
D8	0	OFF
D9	1	ON
D10	0	OFF

No.	Name and description
	② Counter type to reset (SELECT 0 IN: ON) Resets the trigger count and the error count for the selected file to “0”. Set D0 IN to specify the counter type to reset and turn ON SET IN (No.2). Reference • It is not possible to reset only the trigger count.
14 to 19	RESERVE: System reservation Do not connect externally.
20 21 22	SELECT 0 IN SELECT 1 IN SELECT 2 IN With SELECT 0 IN to SELECT 2 IN, the setting target of D0 IN to D10 IN and Guide laser indication target are specified. • Select the setting target of D0 IN to D10 IN Specify SELECT 0 IN to SELECT 2 IN corresponding to the setting target shown below. Keeping the input of SELECT 0 IN to SELECT 2 IN and D0 IN to D10 IN (No.3 to 13), turn ON SET IN (No.2). • Select guide laser indication target Specify SELECT 0 IN to SELECT 2 IN corresponding to the indication target of guide laser as shown below. Keeping the input of SELECT 0 IN to SELECT 2 IN, turn ON GUIDE IN (No.26).
23 to 25	RESERVE: System reservation Do not connect externally.
26	GUIDE IN: Guide laser radiation input The guide laser irradiates while this input is turned ON. (Up to 60 minutes) Determine the guide laser radiation details by the combination of SELECT 0 IN to SELECT 2 IN (No. 20 to No. 22). Keep the input state of SELECT 0 IN to SELECT 2 IN while GUIDE IN is turned ON. This terminal is available when the DIP switch No. 2 is turned OFF. Input this terminal with the shutter closed. Reference • Availability of the guide laser varies depending on LASER STOP 1A/1B IN, LASER STOP 2A/2B IN and INTERLOCK state as follows.
27 to 35	RESERVE: System reservation Do not connect externally.

Counter type to reset	D0
both trigger count and error count	OFF
Error count	ON

Setting target of D0 IN to D10 IN	SELECT 0	SELECT 1	SELECT 2
File No.	OFF	OFF	OFF
Counter type to reset	ON	OFF	OFF

Indication by guide laser	SELECT 0	SELECT 1	SELECT 2
Work distance	OFF	OFF	OFF
Scanning image	ON	OFF	OFF
Working field	OFF	ON	OFF
Masked data	ON	ON	OFF

I/O and INTERLOCK state	Guide laser availability
When LASER STOP 1A/1B IN is open	Available
When LASER STOP 2A/2B IN is open	Not available
When INTERLOCK terminals are open under non-remote control mode	Available
When INTERLOCK terminals are open under remote control mode	Not available

■ I/O connector output signal operation

Reference

- The ON/OFF listed in this section refers to the ON/OFF operations. It does not refer to the voltage level (High/Low).

No.	Name and description
36	SET OK OUT The output turns ON when the file No. selection or the resetting counter type selection has completed by the input of SET IN (No. 2). This is one-shot output. Reference • SET OK OUT is a response to SET IN (No.2). To verify if the laser welding machine has entered into the lasing ready state (trigger input acceptance state), check by READY OUT (Y6). • Set the output time of the one-shot duration on the environment setting screen. The setting range is 20 ms to 510 ms. The initial setting value is 40 ms. One-shot output time has a small margin of error for the setting value.
37	OUT COM.: Output common The common terminal for each output of the I/O terminal and I/O connector. This terminal and OUT COM. (Y2, X12, X15, X18) of I/O terminal are the common terminal connected internally. In case of NPN connection, this terminal is connected to the “- (minus)” side of power which is used for control. In case of PNP connection, this terminal is connected to the “+ (plus)” side of power which is used for control. For details on the connection, refer to “4-3-2 Connecting common terminals” (P.100). Notice • Do not invert the power wiring of I/O terminal and I/O connector. It may cause a failure. • When OUT COM. (Y2, X12, X15 or X18) of I/O terminal is connected to the power supply, it is not necessary to supply the power to the other OUT COM. on I/O connector.

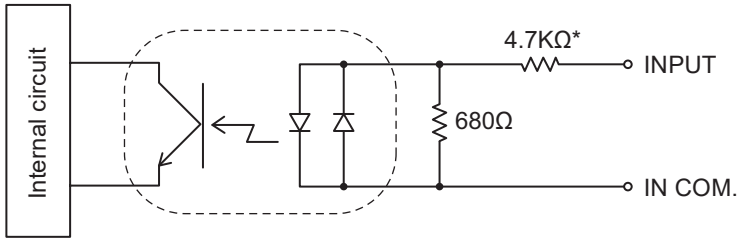
4-2-3 Input rating and input circuit

This section shows the input rating and the input circuit for the I/O terminal block input and the I/O connector input. Note that the input rating and circuit of the interlock connector are different from those shown here. Refer to “4-4-2 Input and output circuit of interlock” (P.106).

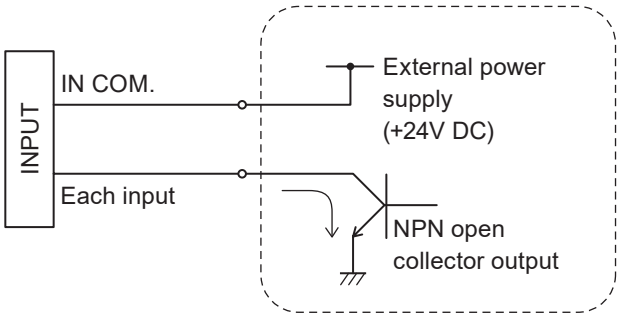
■ Input rating

Item	I/O terminal block input, I/O connector input
Input form	Bidirectional photo coupler insulation input
Input ON voltage	Difference of voltages between input and input common: 19.6V or more
Input OFF voltage	Difference of voltages between input and input common: No more than 4V or open
Rated input voltage	+24V DC+/-10%

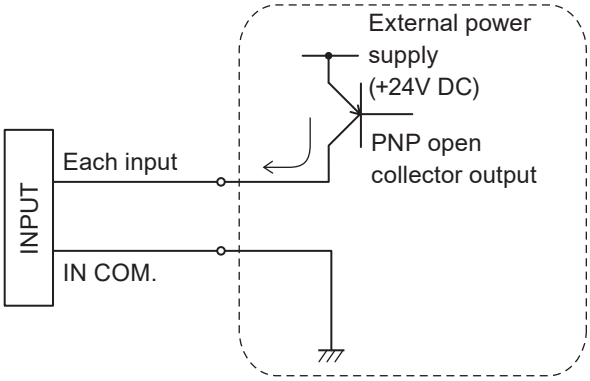
■ Input circuit



■ NPN sample



■ PNP sample



Notice

- This product supports both the NPN transistor output and the PNP transistor output. However, the wiring from I/O terminal block and the I/O connector respectively cannot be used as NPN/PNP mixed. Operate the product after selecting either NPN or PNP.
- Do not short-circuit 24V (X1, Y3) and 0V (Y1, X3). Also, do not short-circuit IN COM. (X2) and OUT COM. (Y2, X12, X15, X18). Starting the laser welding machine with these terminals short-circuited will cause the laser welding machine to malfunction.

Reference

- Respective inputs are bidirectional photo-coupler inputs. The regulation for input ON is based on the ON status of photo-coupler.
- IN COM. (X2) on the I/O terminal block and IN COM. (No.1) on the I/O connector are the common terminals connected internally.
- Connect the power supply to IN COM. and OUT COM.
- Wiring LASER STOP 1/LASER STOP 2 terminals by non-voltage contact (dry contact) is recommended.
- DC 2-wire sensor cannot be connected to any input.

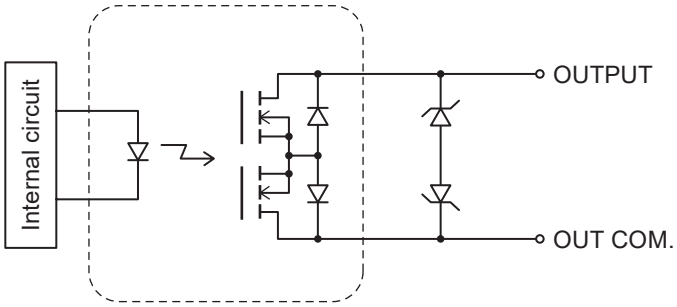
4-2-4 Output rating and output circuit

This section shows the output rating and the output circuit for the I/O terminal block output and the I/O connector output. Note that the output rating and circuit of the interlock connector, and the shutter close output terminal are different from those shown here. Refer to “4-4-2 Input and output circuit of interlock” (P.106), “4-5-2 Output circuit” (P.109).

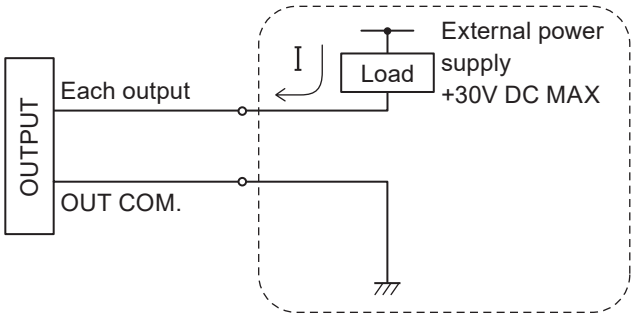
■ Output rating

Item	I/O terminal block output	I/O connector output
Output form	NPN/PNP photo-coupler (insulated output)	
Protection function for short-circuit	None	
Max. output current	50mA	20mA
Max. applied voltage	+30V DC	
Residual voltage	+2.0V DC or less	

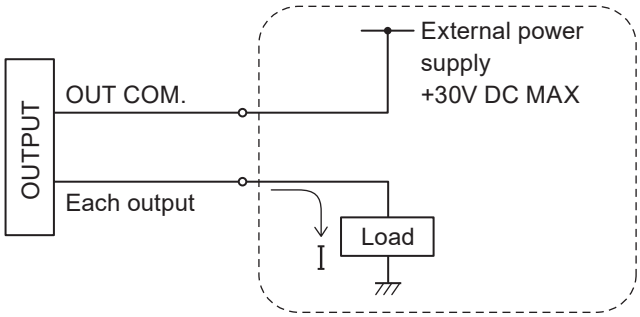
■ Output circuit



■ NPN sample



■ PNP sample



I: I/O terminal block output MAX 50mA
I/O connector output MAX 20mA

Notice

- This product supports both the NPN transistor output and the PNP transistor output. However, the wiring from I/O terminal block and the I/O connector respectively cannot be used as NPN/PNP mixed. Operate the product after selecting either NPN or PNP.
- Do not short-circuit 24V (X1, Y3) and 0V (Y1, X3). Also, do not short-circuit IN COM. (X2) and OUT COM. (Y2, X12, X15, X18). Starting the laser welding machine with these terminals short-circuited will cause the laser welding machine to malfunction.
- The applied voltage and input/output current to each terminal must not exceed each maximum value shown above. Exceeding the maximum applied voltage and the maximum output current will cause the laser welding machine to malfunction.

Reference

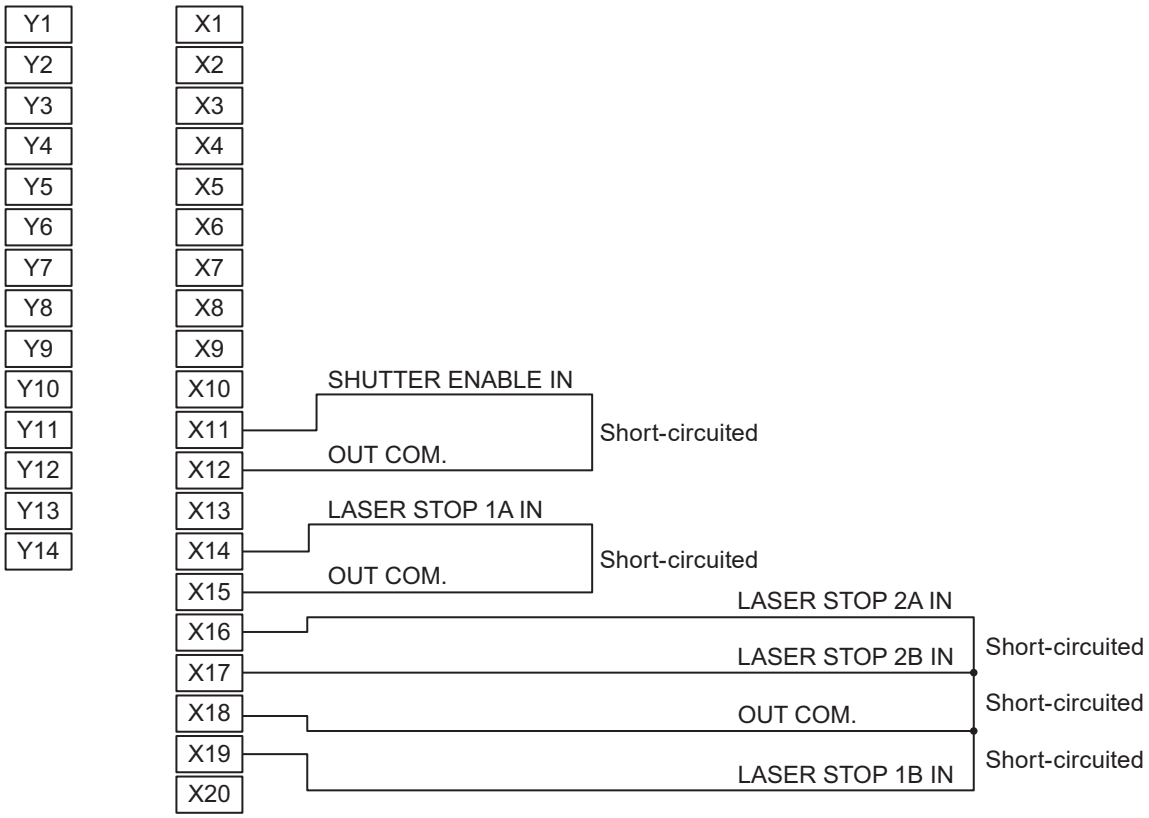
- Respective outputs are photo-coupler outputs. The regulation for output ON is based on the ON status of photo-coupler.
- OUT COM. (Y2, X12, X15, X18) on the I/O terminal block and OUT COM. (No.37) on the I/O connector are the common terminals connected internally.
- Connect the power supply to IN COM. and OUT COM.

4-3 Connecting I/O Terminal Block

⚠WARNING • Make sure that the power is turned OFF at wiring.

4-3-1 Factory default wiring

The following terminals are connected by jumper wires at the factory default. Remove these jumper wires when you connect them to an external device.



I/O terminal block

Notice

- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (X3, Y1). Also, do not short-circuit IN COM. (X2) and OUT COM. (Y2, X12, X15, X18). Starting the laser welding machine with these terminals short-circuited will cause the laser welding machine to malfunction.

Reference

- To enable the laser radiation, connect the power supply to IN COM. and OUT COM. in addition to the above mentioned terminals. Refer to “4-3-2 Connecting common terminals” (P.100).
- The following terminals of the I/O terminal block are the common terminals connected internally.
  - X1 and Y3: 24V OUT
  - X3 and Y1: 0V OUT
  - Y2 X12, X15 and X18: OUT COM.

4-3-2 Connecting common terminals

Connect IN COM.(X2) and OUT COM.(Y2) respectively to the power supply to supply power for input and output.
Common terminals (IN COM. or OUT COM.) on the I/O connector and the I/O terminal block are connected internally.
Supply the power to the one side of IN COM. and OUT COM.

	Use the internal power	Use the external power
NPN connection	IN COM. (X2) - 24V OUT (X1) OUT COM. (Y2) - 0V OUT (Y1)	IN COM. (X2) - 24V OUT COM. (Y2) - 0V
PNP connection	IN COM. (X2) - 0V OUT (X3) OUT COM. (Y2) - 24V OUT (Y3)	IN COM. (X2) - 0V OUT COM. (Y2) - 24V

Notice

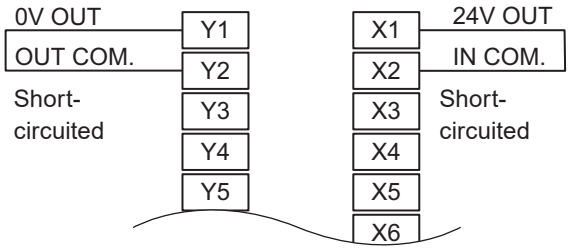
- Do not invert the power wiring of I/O terminal and I/O connector. It may cause a failure.
- Do not short-circuit 24V OUT (X1, Y3) and 0V OUT (Y1, X3). Also, do not short-circuit IN COM. (X2) and OUT COM. (Y2, X12, X15, X18). Starting the laser welding machine with these terminals short-circuited will cause the laser welding machine to malfunction.
- Do not mix up with the external and internal power supplies.
- Do not mix the NPN and PNP connecting patterns.
- If you use the internal power supply of the I/O terminal block, make sure that the total load does not exceed 300mA.
- If you control the laser welding machine by the external power such as PLC, do not connect anything to the internal power 24V OUT (X1, Y3) or 0V OUT (X3, Y1) of the I/O terminal block. If a jumper wire is installed, remove it.

Reference

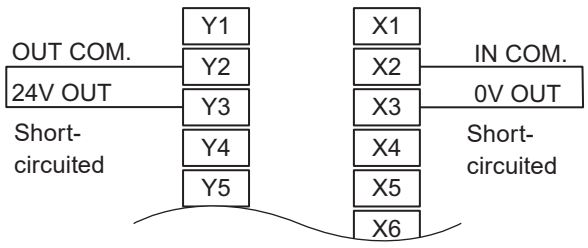
- OUT COM. terminals of Y2, X12, X15 and X18 are the common terminal connected internally. Supply the power to one of them.

■ To use the internal power (the I/O terminal block is not connected to an external control device)

NPN connection

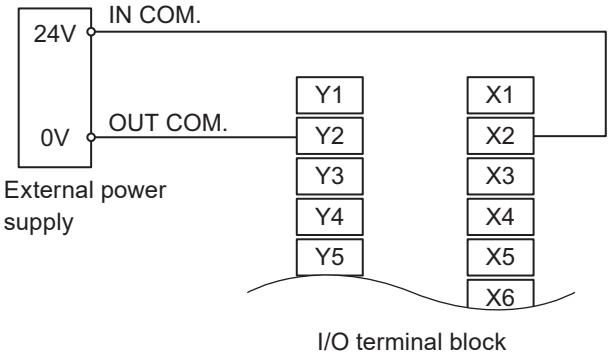


PNP connection

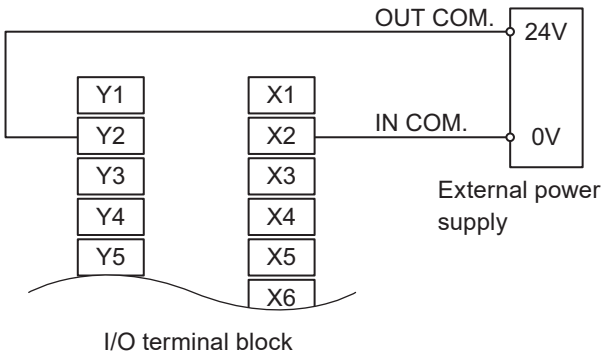


■ To use the external power (connected to an external control device such as PLC)

NPN connection



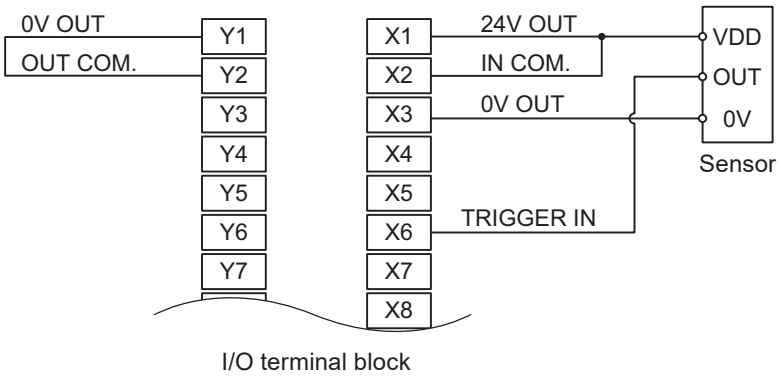
PNP connection



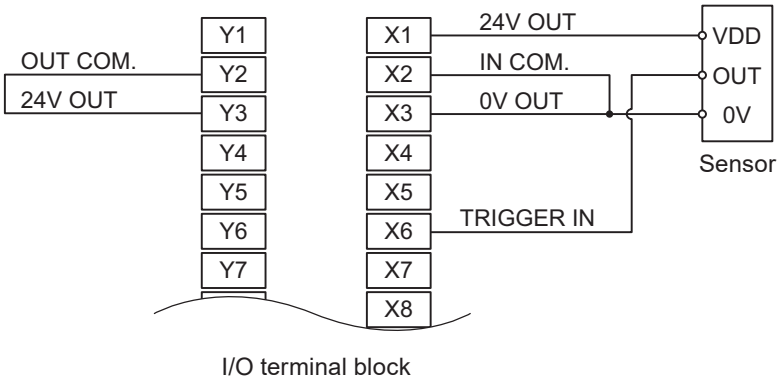
4-3-3 Sensor connection example

■ Use the sensor as a lasing trigger (operate the sensor by the internal power)

NPN connection



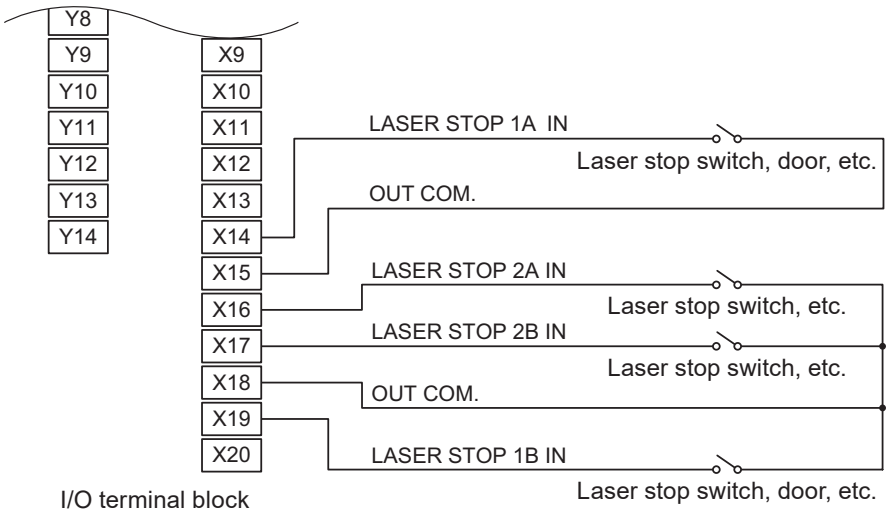
PNP connection



4-3-4 Connection example of laser stop terminals

The following terminals are used to stop the laser radiation or disable the laser radiation temporarily.
When these terminals are disconnected, the laser radiation will be disabled.
Between LASER STOP IN and OUT COM., an external device, such as door switch or laser stop switch can be connected.

LASER STOP 1A IN (X14)	—	OUT COM. (X15)
LASER STOP 1B IN (X19)	—	OUT COM. (X18)
LASER STOP 2A IN (X16)	—	OUT COM. (X18)
LASER STOP 2B IN (X17)	—	OUT COM. (X18)



Reference

- To construct the interlock system to stop laser pumping and radiation forcibly by the hardware operation, use the interlock connectors instead of LASER STOP terminals. Refer to “4-4 Interlock Connector” (P.104).
- For details on the operation of input terminals for safety measurement, refer to “Laser welding machine operation when functions for safety measures are input” (P.92).
- OUT COM. terminals of Y2, X12, X15 and X18 are the common terminal connected internally.

4-3-5 Checking the I/O terminal status

Check the I/O connection status and its operation using the following functions.

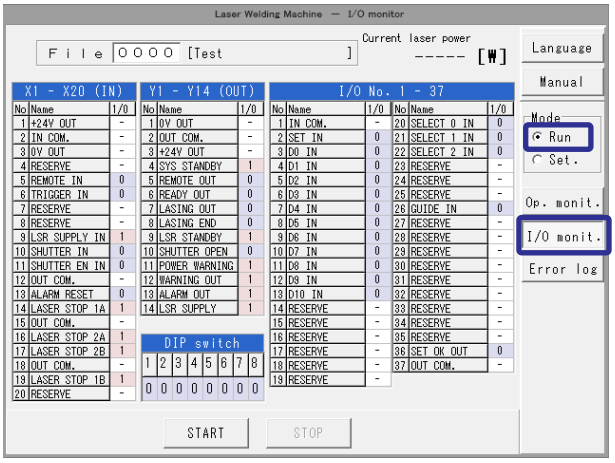
■ I/O monitor

I/O monitor indicates ON/OFF status of the I/O terminals on the laser welding machine.
Open the I/O monitor with the following procedure.

1. Select the screen mode to “Run”.

2. Click “I/O monit.” on the right menu.

3. The I/O monitor appears.



Reference

- The I/O monitor is updated at every 200 ms in remote mode and at 20 ms in non-remote mode.
- There is a margin of error between the actual input/output time and the ON/OFF time displayed on the screen.

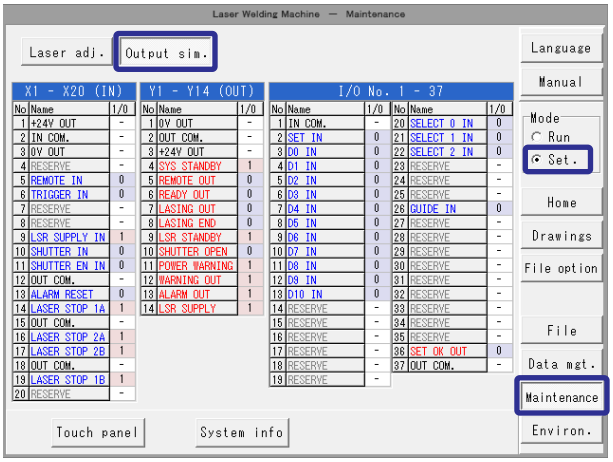
■ Output simulation

With the output simulation you can check the output signals of the laser welding machine without an actual operation.
Use this function to confirm the operation of the external devices connected with the laser welding machine.
Output simulation starts with the following procedure.

1. Select the screen mode to “Set”.

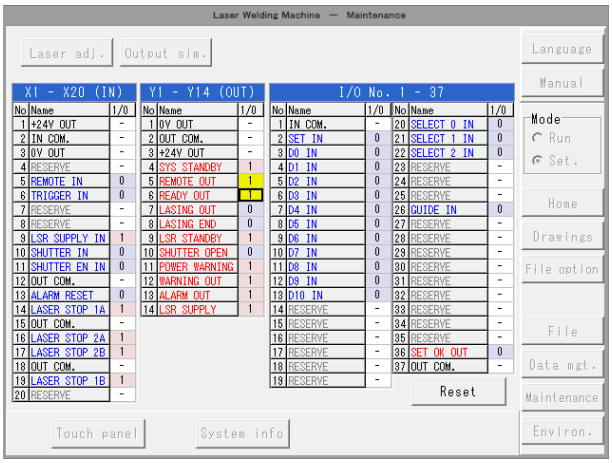
2. Click “Maintenance” on the right menu.

3. Click “Output sim.”.



4. Output simulation table appears.

Click the output terminal name to simulate, then the output status of the laser welding machine changes.

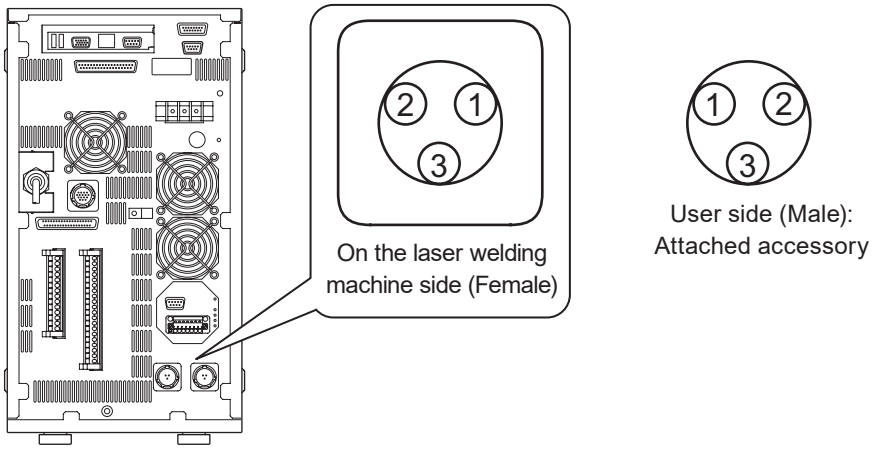


4-4 Interlock Connector

Use the interlock connectors to construct the interlock system to stop laser pumping and radiation forcibly.
When the connection between INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) are opened, the laser pumping is turned OFF and the shutter is closed.

4-4-1 Connector type and signals

■ Connector type



Connector type		Model	Manufacturer name
On the laser welding machine side	3-pin, female	SRCN2A13-3S	Japan Aviation Electronics Industry, Ltd.
User side	3-pin, male	Attached accessory: SRCN6A13-3P	

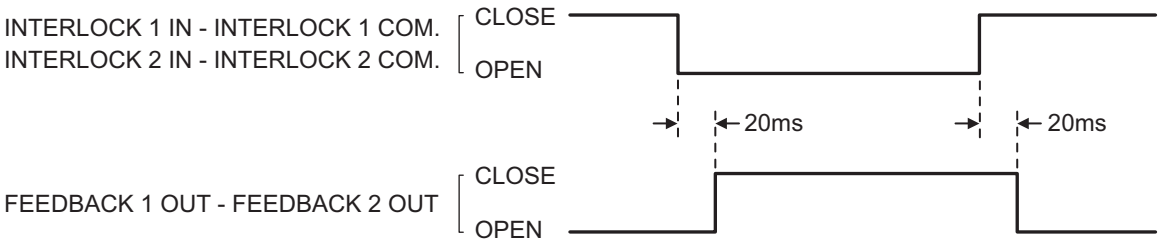
Reference

- In the attached interlock connectors, INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) are short-circuited at the delivery state.

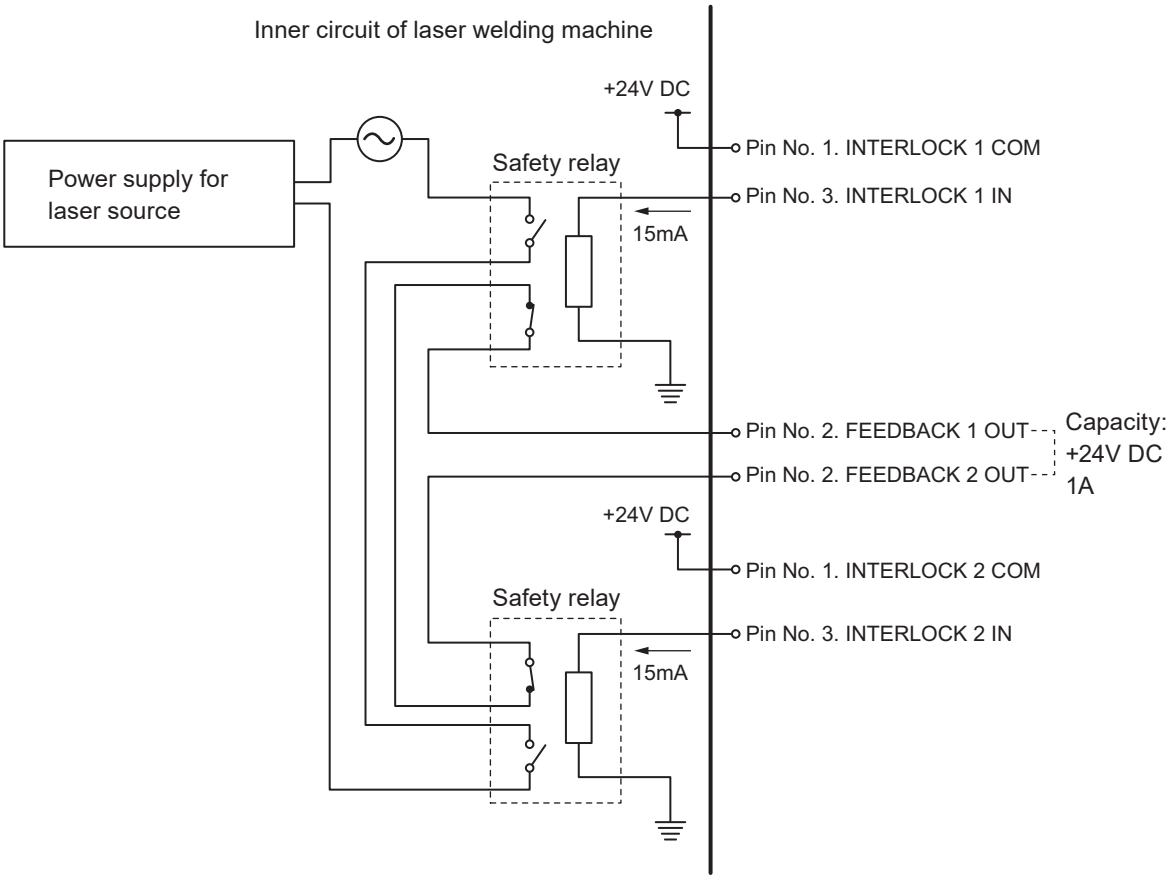
■ Signals and details of interlock connector

Notice

- INTERLOCK 1&2 IN on the interlock connector are connected to the operating coil of the internal relay in the controller. Connect INTERLOCK 1&2 IN and INTERLOCK 1&2 COM. with the non-voltage contact (dry contact) such as a relay or a switch. Do not connect with the voltage contact such as a transistor.

No.	Name and description
1	INTERLOCK 1 COM. (on Interlock 1 connector) INTERLOCK 2 COM. (on Interlock 2 connector) Common terminal for the interlock connector. Connect each INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) with the non-voltage contact (relay output terminal etc.) of the safety devices such as door, switch or safety PLC. **Reference** • INTERLOCK 1 COM. and INTERLOCK 2 COM. are not connected to the common terminals (IN COM., OUT COM.) of I/O terminal and I/O connector.
2	FEEDBACK 1 OUT (on Interlock 1 connector) FEEDBACK 2 OUT (on Interlock 2 connector) When the connection of INTERLOCK 1 IN - INTERLOCK 1 COM. and INTERLOCK 2 IN - INTERLOCK 2 COM. are both “OPEN” (not connected) status, the connection between FEEDBACK 1 OUT - FEEDBACK 2 OUT becomes “CLOSE” status. By using these terminals, the contact failure of Interlock internal circuit can be detected. Since FEEDBACK 1 OUT and FEEDBACK 2 OUT are connected internally, the contact status of INTERLOCK 1 IN and INTERLOCK 2 IN cannot be monitored individually. The connection between FEEDBACK 1 OUT and FEEDBACK 2 OUT is switched open and closed with a delay of approx. 20 ms with reference to the status of INTERLOCK 1 IN and INTERLOCK 2 IN as shown below. 
3	INTERLOCK 1 IN (on Interlock 1 connector) INTERLOCK 2 IN (on Interlock 2 connector) To enable the laser radiation, connect INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) with the non-voltage contact (dry contact) such as a relay or a switch. When the connection between INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) is opened, the laser pumping is turned OFF and the shutter is closed. While INTERLOCK 1 IN or INTERLOCK 2 IN are opened, the LED indicators on the rear of the controller light up.

4-4-2 Input and output circuit of interlock

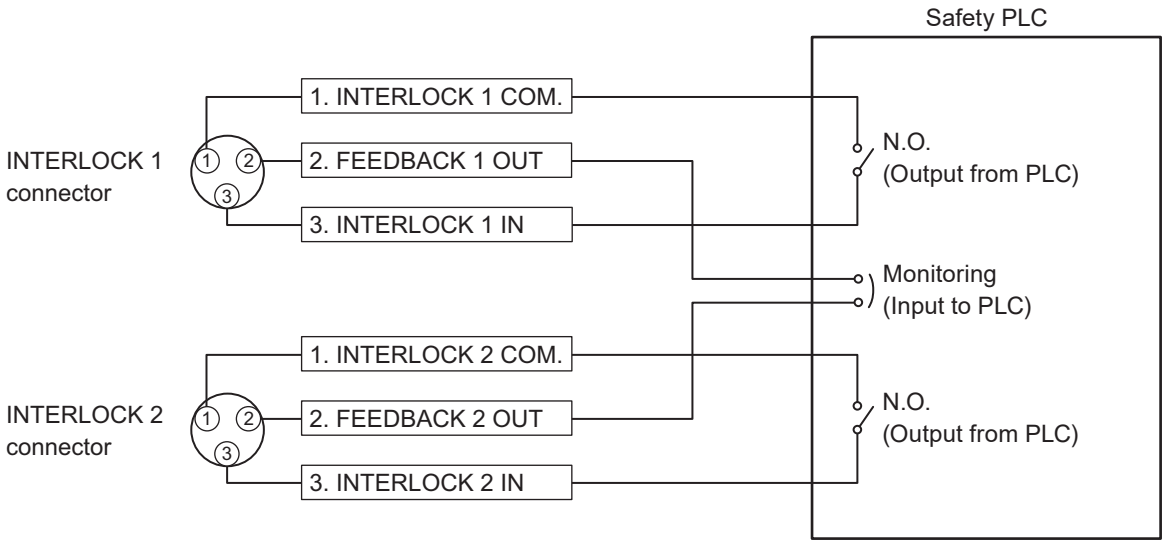


4-4-3 Connection of interlock connector

Connect each INTERLOCK IN and INTERLOCK COM. with the non-voltage contact (relay output terminal etc.) of the safety devices such as door, switch or safety PLC.

Notice

- INTERLOCK 1&2 IN on the interlock connector are connected to the operating coil of the internal relay in the controller. Connect INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) with the non-voltage contact (dry contact) such as a relay or a switch. Do not connect with the voltage contact such as a transistor.



Reference

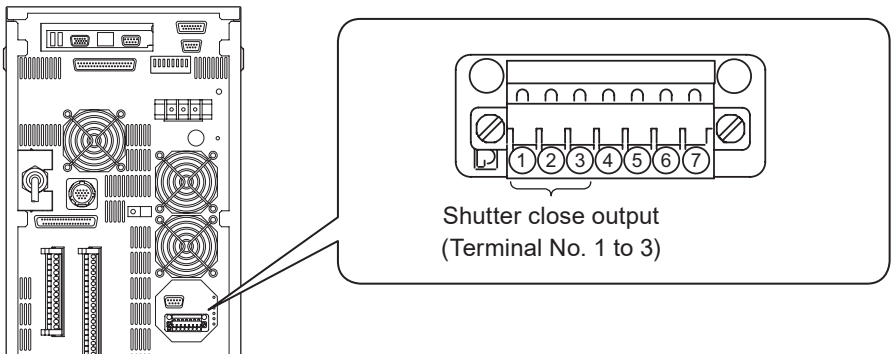
- In the attached interlock connectors, INTERLOCK IN (No.3) and INTERLOCK COM. (No.1) are short-circuited at the delivery state.
- It is recommended to connect the interlock connectors to the external safety device by using the relay output terminal of the safety relay unit or the safety PLC.
  Refer to “2-6 Construction of System” (P.63) and “4-5-3 Connecting sample of shutter close output” (P.110).

4-5 Shutter Close Output

To monitor the shutter close state, independent double output signals of SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT are equipped on the controller.
Connect these signals to the external safety control unit to ensure the shutter status of the laser system.

4-5-1 Shutter close output terminal

Shutter close output terminal is equipped on the rear side of the controller.



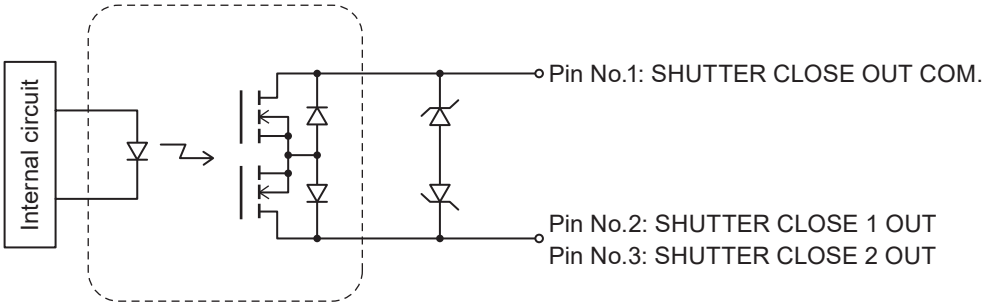
Rear of controller

Connector type		Model	Manufacturer name
On the laser welding machine side	Dedicated connector	DFK-MC 1.5/ 7-GF-3.81	Phoenix Contact
User side		Attached accessory: FK-MCP1.5/7-STF-3.81	

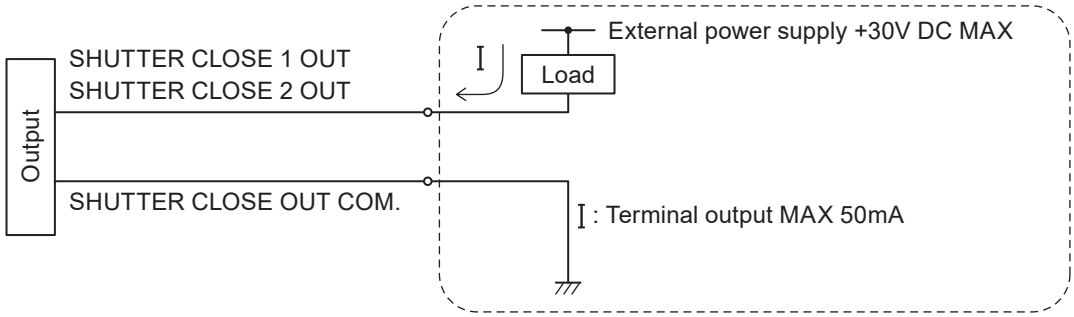
No.	Name	Description
1	SHUTTER CLOSE OUT COM.	Output common terminal for SHUTTER CLOSE 1 OUT (No. 2) and SHUTTER CLOSE 2 OUT (No. 3).
2	SHUTTER CLOSE 1 OUT	Both SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT turn ON when the shutter in the head is closed. Connect these signals to the external safety control unit, such as a safety PLC, to construct the safety monitoring system. SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT will be output by the same operation, but their output timing has a margin of error. While SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT are turned ON, the LED indicators on the rear of the controller light up.
3	SHUTTER CLOSE 2 OUT	
4-7	RESERVE	Do not connect anything.

4-5-2 Output circuit

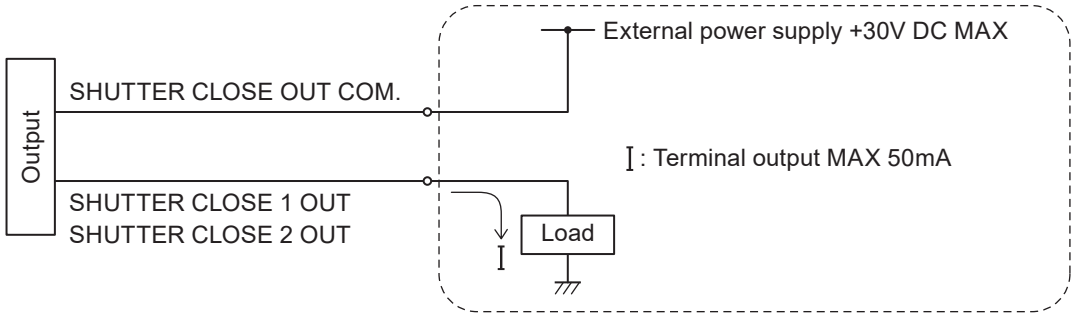
Item	Specifications
Output form	NPN/PNP photo-coupler (insulated output)
Protection function for short-circuit	None
Max. output current	50mA
Max. applied voltage	+30V DC
Residual voltage	+2.0V DC or less



■ NPN connecting sample



■ PNP connecting sample



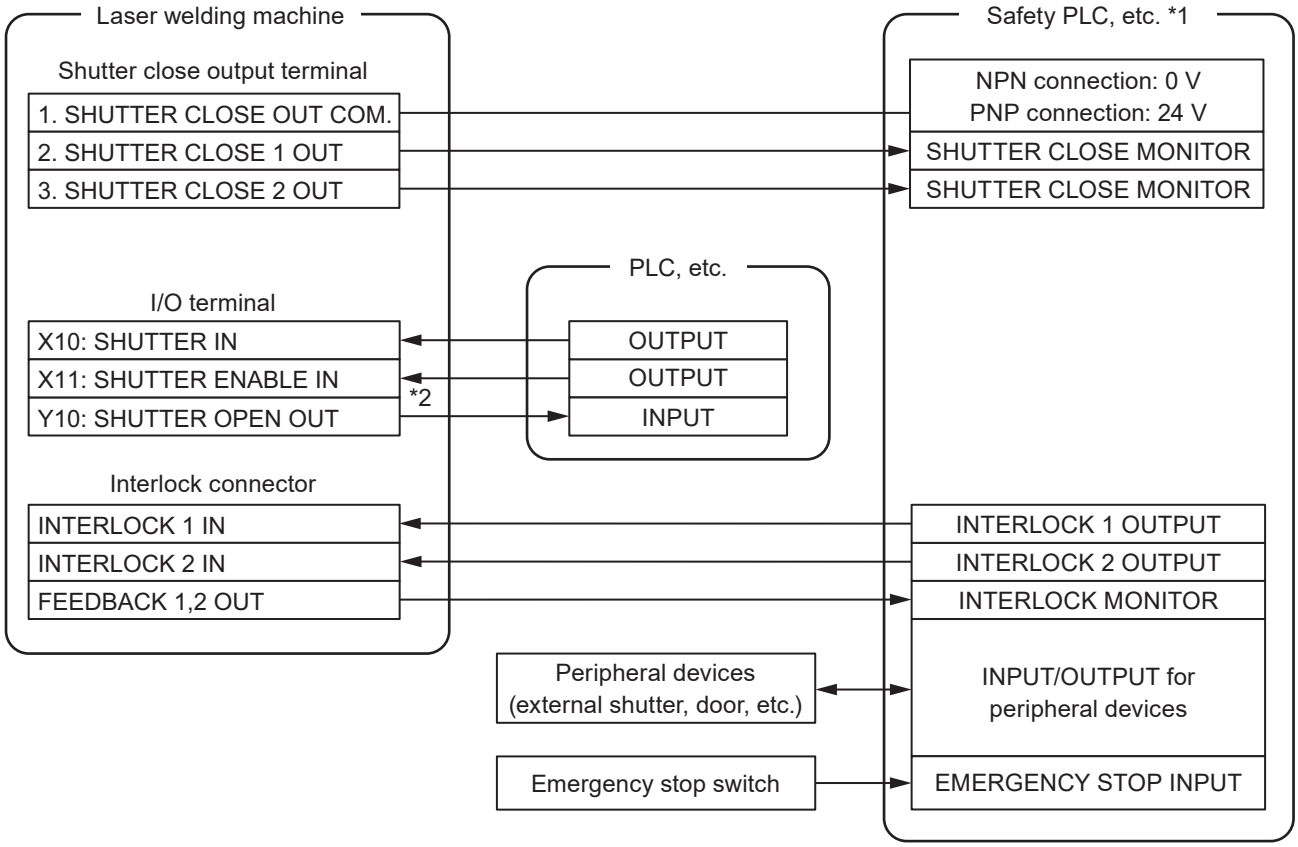
Notice

- The applied voltage and input/output current to each terminal must not exceed the maximum applied voltage and current. Otherwise, it may cause the product failure.

Reference

- SHUTTER CLOSE OUT COM. is not connected with OUT COM. (Y2, X12, X15, X18, No.37) on the I/O terminal and I/O connector.

4-5-3 Connecting sample of shutter close output



*1 : It is recommended to connect the safety devices such as safety PLC for the connection with shutter close output terminal and interlock connectors.

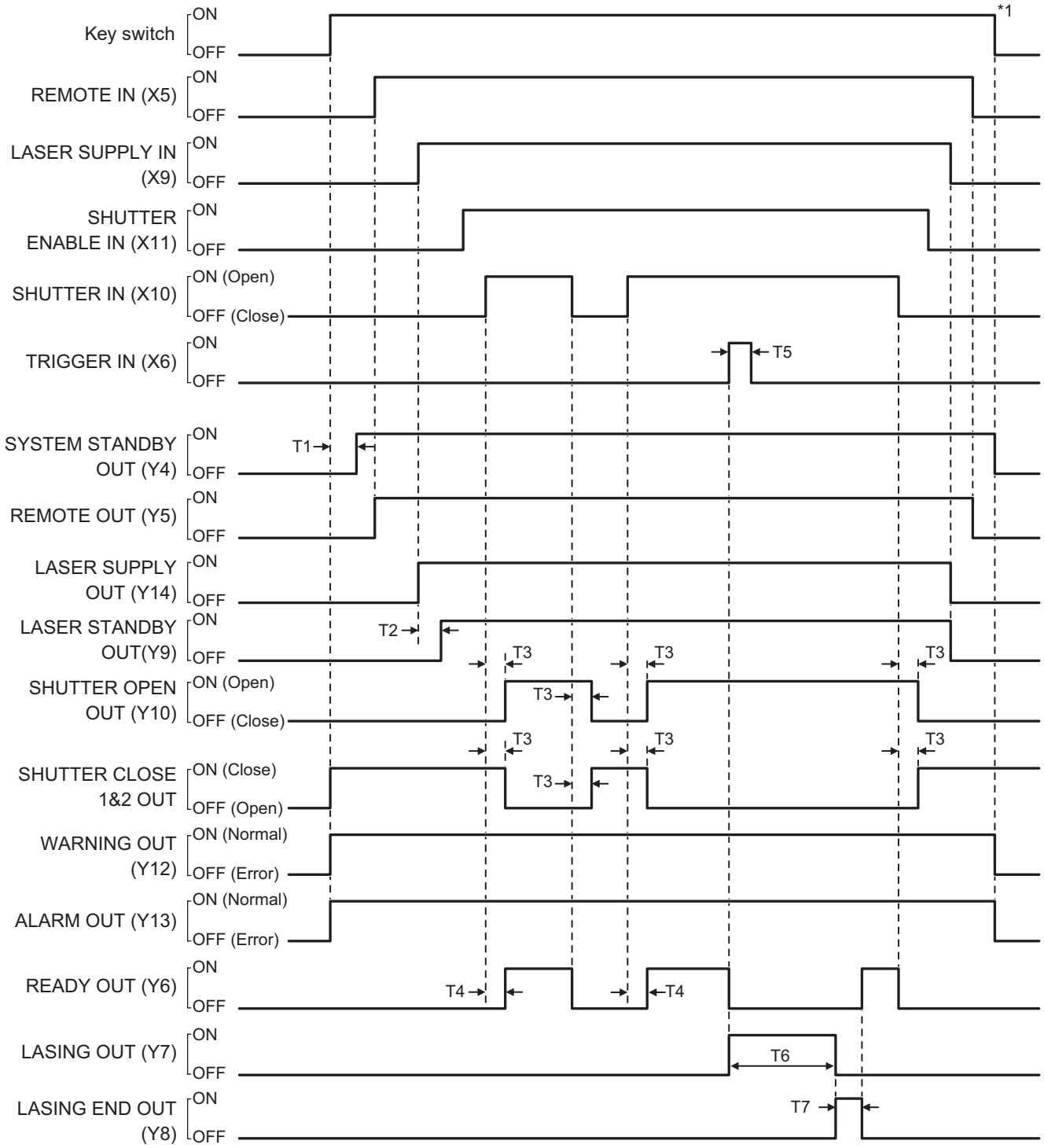
*2 : Do not use SHUTTER OPEN OUT (Y10) for the safety confirmation purpose. To monitor the shutter operation for the safety control system, use SHUTTER CLOSE 1 OUT and SHUTTER CLOSE 2 OUT (Shutter close output terminal No.2, 3).

4-6 Basic Control Timing Chart

Reference

- ON/OFF on the timing chart refers to ON/OFF operations. It does not refer to the voltage level (High/Low).
- In the following timing charts, the timing of output operation corresponding to the each input has a small delay of 0 ms or more.

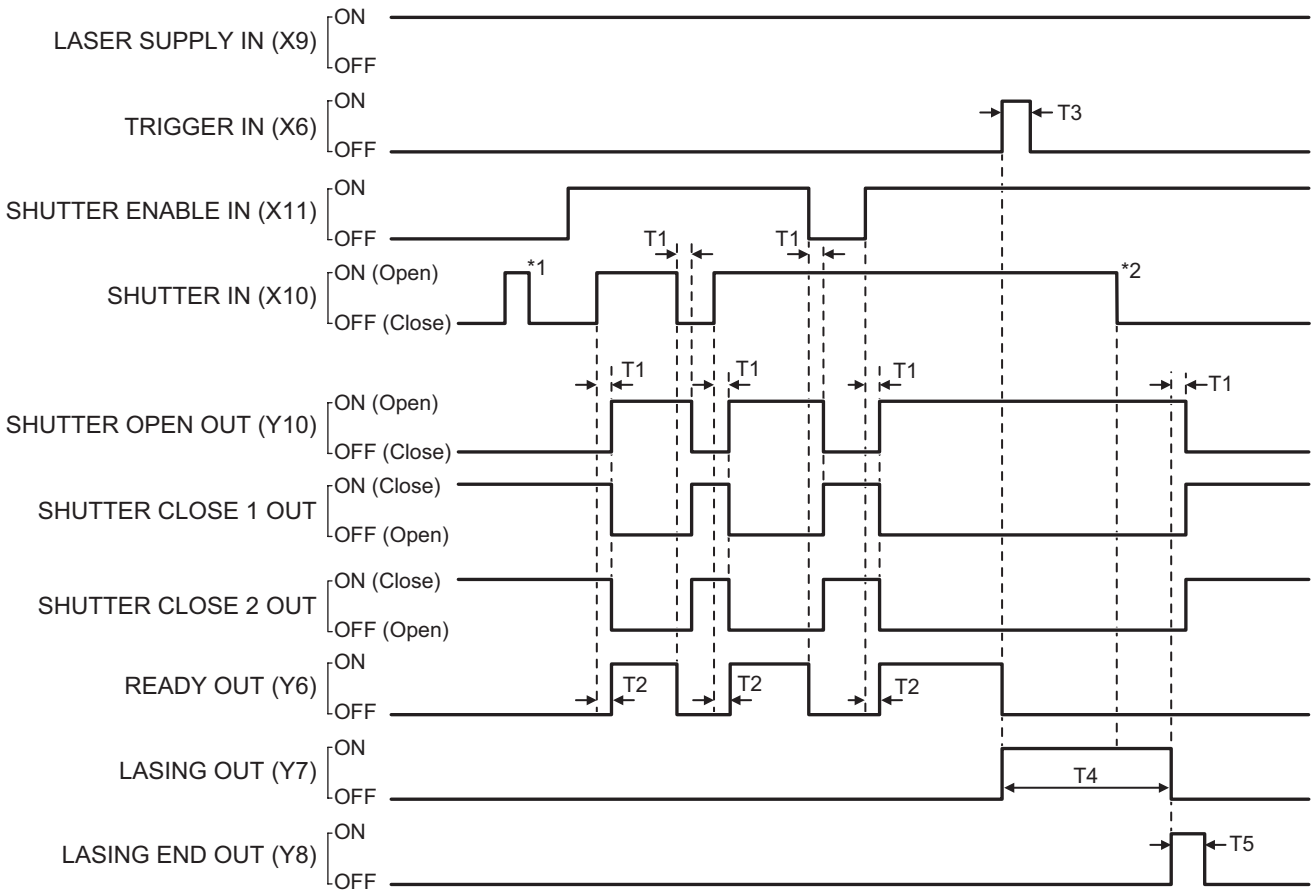
4-6-1 Flow from startup to lasing



*1 : Turn off the key switch with the laser supply (laser pumping) turned off or with the shutter closed.

Item	Time	Remarks
T1	Approx. 75 sec.	It is the system startup time. Turn ON the remote mode upon verifying SYSTEM STANDBY OUT (Y4).
T2	Approx. 15 sec.	It is the time from turning on LASER SUPPLY IN (X9) to completion of laser pumping.
T3	Around 200ms to max. 1 sec.	SHUTTER OPEN OUT (Y10) and SHUTTER CLOSE 1&2 OUT (Shutter close output terminal No.2, 3) have a delay time of up to one second from turning ON of SHUTTER IN (X10) for the actual shutter open / close operation time. SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
T4	—	Setup time of the laser welding machine to start the lasing operation. • In the laser pumping completed state: Time for data creation. It varies depending on the quantity of the setting data. • When the laser pumping is not completed: Time for data creation or time for laser pumping, whichever is longer.
T5	10 ms or more	Keep the ON status for 10 ms or more.
T6	—	When TRIGGER IN (X6) is accepted, LASING OUT (Y7) is turned ON.
T7	20 to 510 ms	One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value. READY OUT (Y6) is not turned ON while LASING END OUT (Y8) is ON.

4-6-2 Shutter open/close

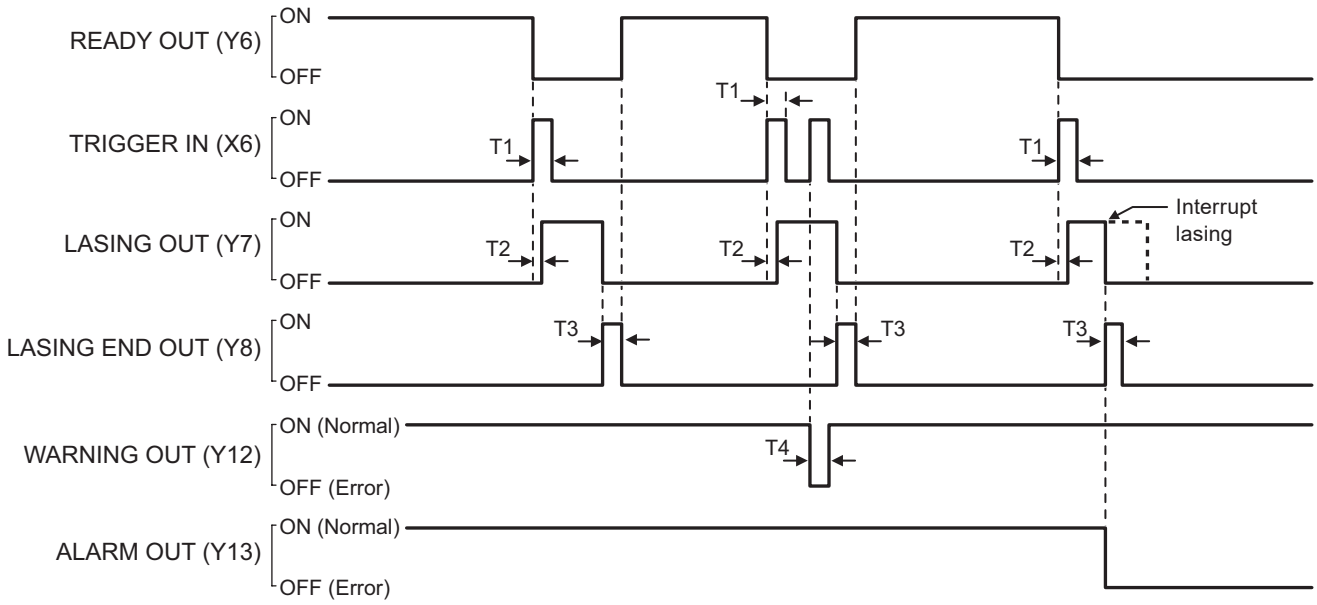


*1 : SHUTTER IN (X10) is accepted and the shutter opens only when SHUTTER ENABLE IN (X11) is turned on.
*2 : If SHUTTER IN (X10) was turned off during the lasing operation, the shutter closes after the lasing operation has completed.

Item	Time	Remarks
T1	Around 200ms to max. 1 sec.	SHUTTER OPEN OUT (Y10) and SHUTTER CLOSE 1&2 OUT (Shutter close output terminal No.2, 3) have a delay time of up to one second from turning ON of SHUTTER IN (X10) for the actual shutter open / close operation time. SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
T2	—	Setup time of the laser welding machine to start the lasing operation. • In the laser pumping completed state: Time for data creation. It varies depending on the quantity of the setting data.
T3	10 ms or more	Keep the ON status for 10 ms or more.
T4	—	When TRIGGER IN (X6) is accepted, LASING OUT (Y7) is turned ON.
T5	20 to 510 ms	One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.

4-6-3 Lasing trigger input: Single trigger

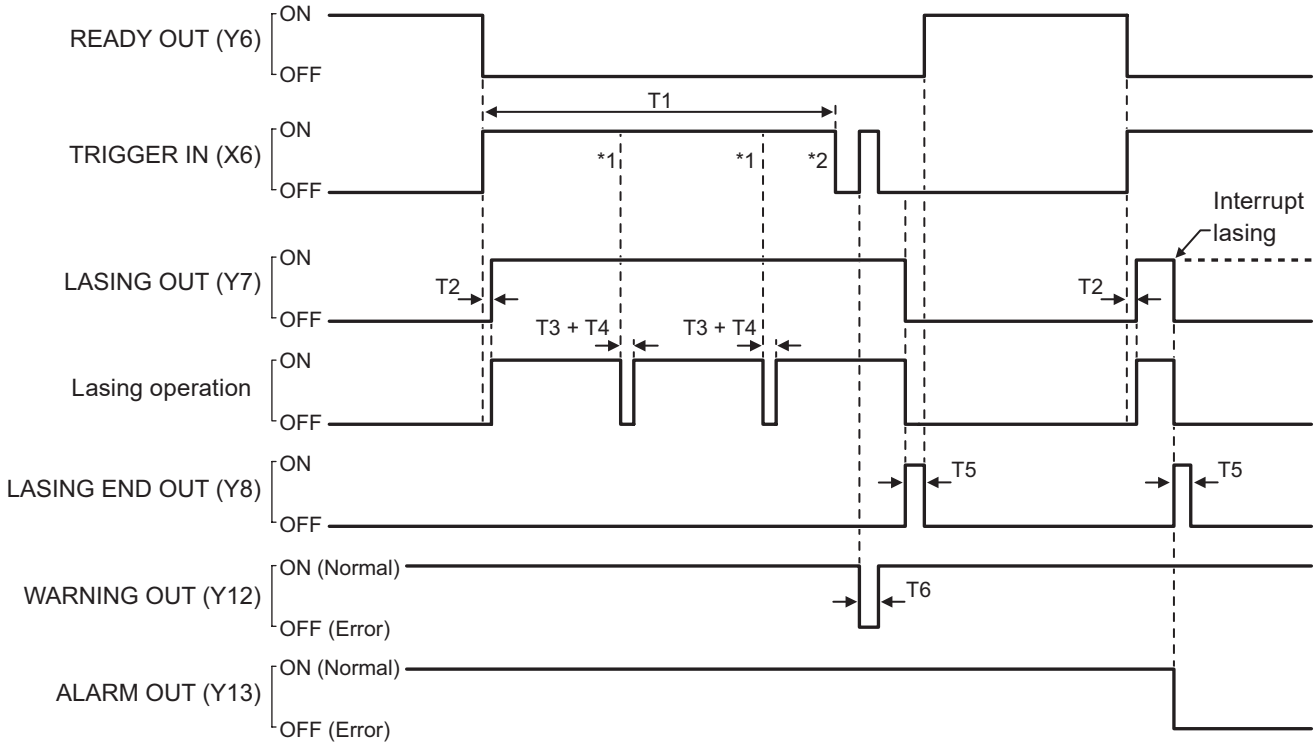
When the trigger mode is set to “single trigger” in the file option screen, one lasing operation is executed by the edge of turning on of TRIGGER IN (X6).



Item	Time	Remarks
T1	10 ms or more	Keep the ON status for 10 ms or more.
T2	0 to 5000 ms	When the trigger delay time is set in the selected file, lasing operation starts after the delay time.
T3	20 to 510 ms	This is the output to notify that the lasing operation ended. Even when the lasing operation is interrupted due to the alarm or warning occurrence, LASING END OUT (Y8) turns ON. This is One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value. READY OUT (Y6) is not turned ON while LASING END OUT (Y8) is ON.
T4	20 to 510 ms	It outputs a warning to notify that an invalid trigger was input when TRIGGER IN (X6) was input during the lasing operation. This is One-shot output. You can turn this warning off by the settings.

4-6-4 Lasing trigger input: Continuous trigger

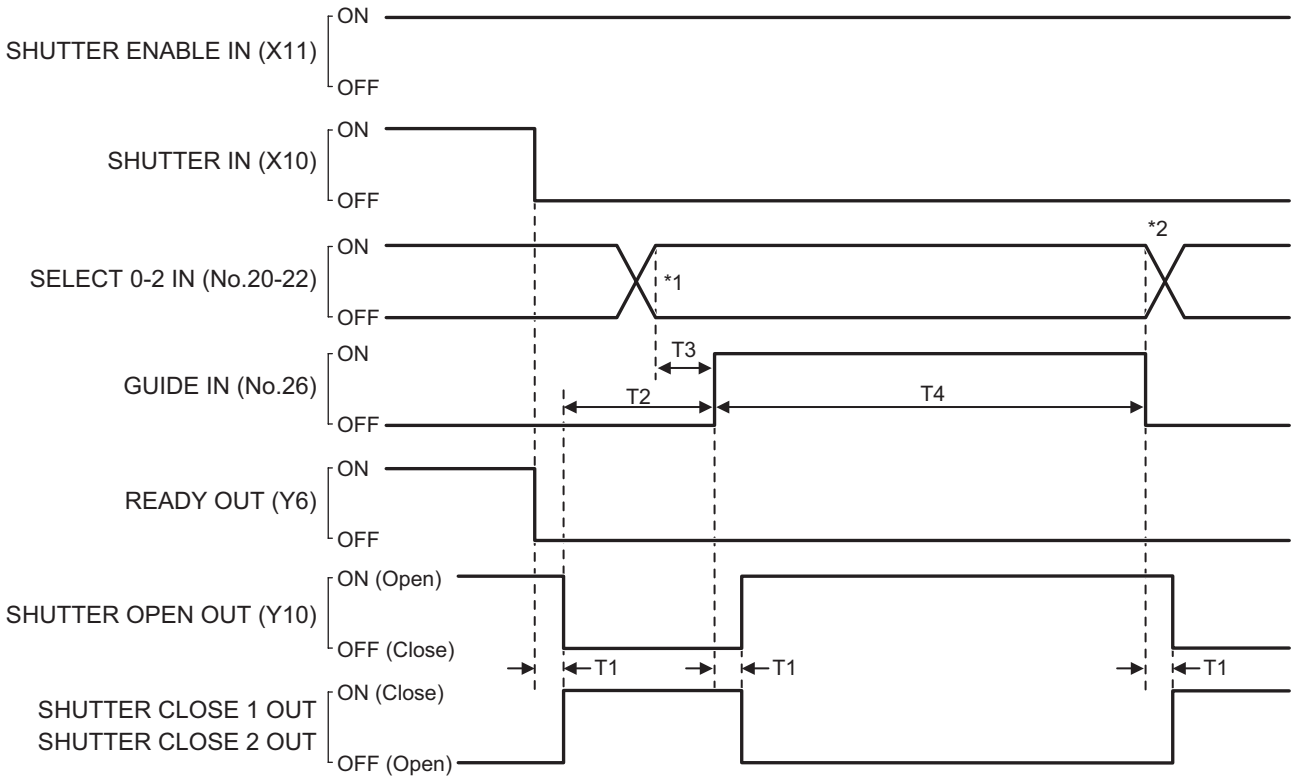
When the trigger mode is set to “continuous trigger” in the file option screen, lasing operation is repeated while TRIGGER IN (X6) is on.



*1 : If TRIGGER IN (X6) is still ON at the completion of the lasing operation, the lasing operation starts again.
*2 : If TRIGGER IN (X6) turns OFF when the lasing operation is running, the lasing operation is terminated after finishing the running operation.

Item	Time	Remarks
T1	10 ms or more	Keep the ON status for the duration of repeating the lasing operation.
T2	0 to 5000 ms	When the trigger delay time is set in the selected file, lasing operation starts after the delay time.
T3	Around 10ms to 100 ms	There is a certain interval between each lasing operation. The interval duration is defined by the setting data.
T4	0.0 to 60.0 sec.	When the scanning interval is set, the next lasing operation starts after a lapse of the setting period.
T5	20 to 510 ms	This is the output to notify that the lasing operation ended. Even when the lasing operation is interrupted due to the alarm or warning occurrence, LASING END OUT (Y8) turns ON. This is One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value. READY OUT (Y6) is not turned ON while LASING END OUT (Y8) is ON.
T6	20 to 510 ms	It outputs a warning to notify that an invalid trigger was input when TRIGGER IN (X6) was input during the lasing operation. This is One-shot output. You can turn this warning off by the settings.

4-6-5 Guide laser radiation input



Item	Time	Remarks
T1	Around 200ms to max. 1 sec.	SHUTTER OPEN OUT (Y10) and SHUTTER CLOSE 1&2 OUT (Shutter close output terminal No.2, 3) have a delay time of up to one second from turning ON of SHUTTER IN (X10) for the actual shutter open / close operation time. SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
T2	0 ms or more	Turn on GUIDE IN (No.26) with the shutter closed.
T3	0.5 ms or more	After a lapse of 0.5ms or more from specifying SELECT 0 IN to SELECT 2 IN (No.20-22), turn on GUIDE IN (No.26).
T4	Max. 60 minutes	The guide laser is stopped automatically after passing 60 minutes from start-up.

*1 : Select the indication contents of the guide laser with SELECT 0 IN to SELECT 2 IN as follows.

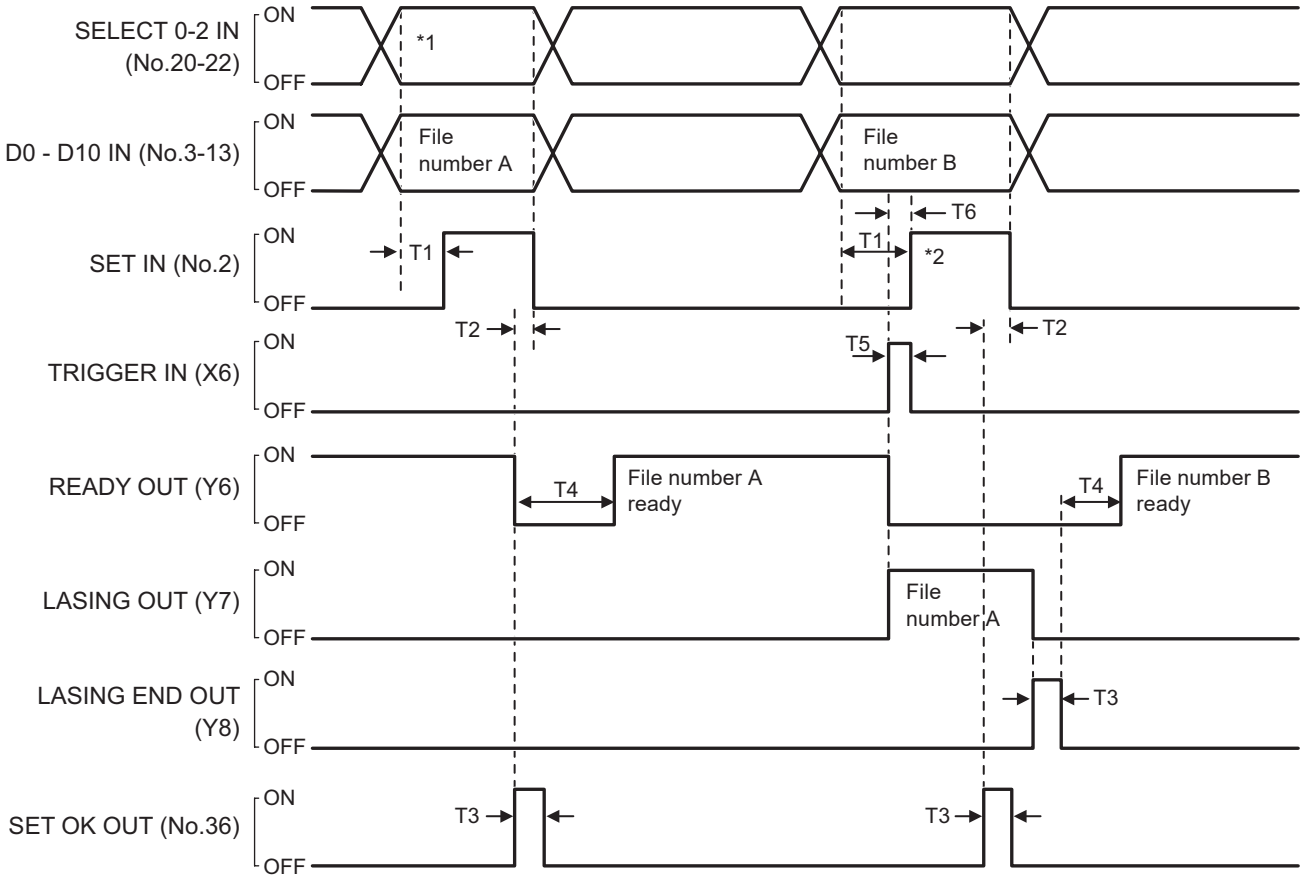
Indication by guide laser	SELECT 0 IN (No. 20)	SELECT 1 IN (No. 21)	SELECT 2 IN (No. 22)
Work distance	OFF	OFF	OFF
Scanning image	ON	OFF	OFF
Working field	OFF	ON	OFF
Masked data	ON	ON	OFF

*2 : Keep the input state of SELECT 0 IN to SELECT 2 IN (No.20-22) while GUIDE IN (No.26) is turned ON.

Reference

- Guide indication by I/O is available when the DIP switch No. 2 is turned to OFF.
- If inputting GUIDE IN (No.26) repeatedly, turn ON GUIDE IN at intervals of more than 500 ms.
- Guide laser cannot radiate in the following state.
  - LASER STOP 2A/2B IN (X16, 17) in I/O terminal are opened.
  - INTERLOCK terminals are opened at the remote mode.

4-6-6 Select file



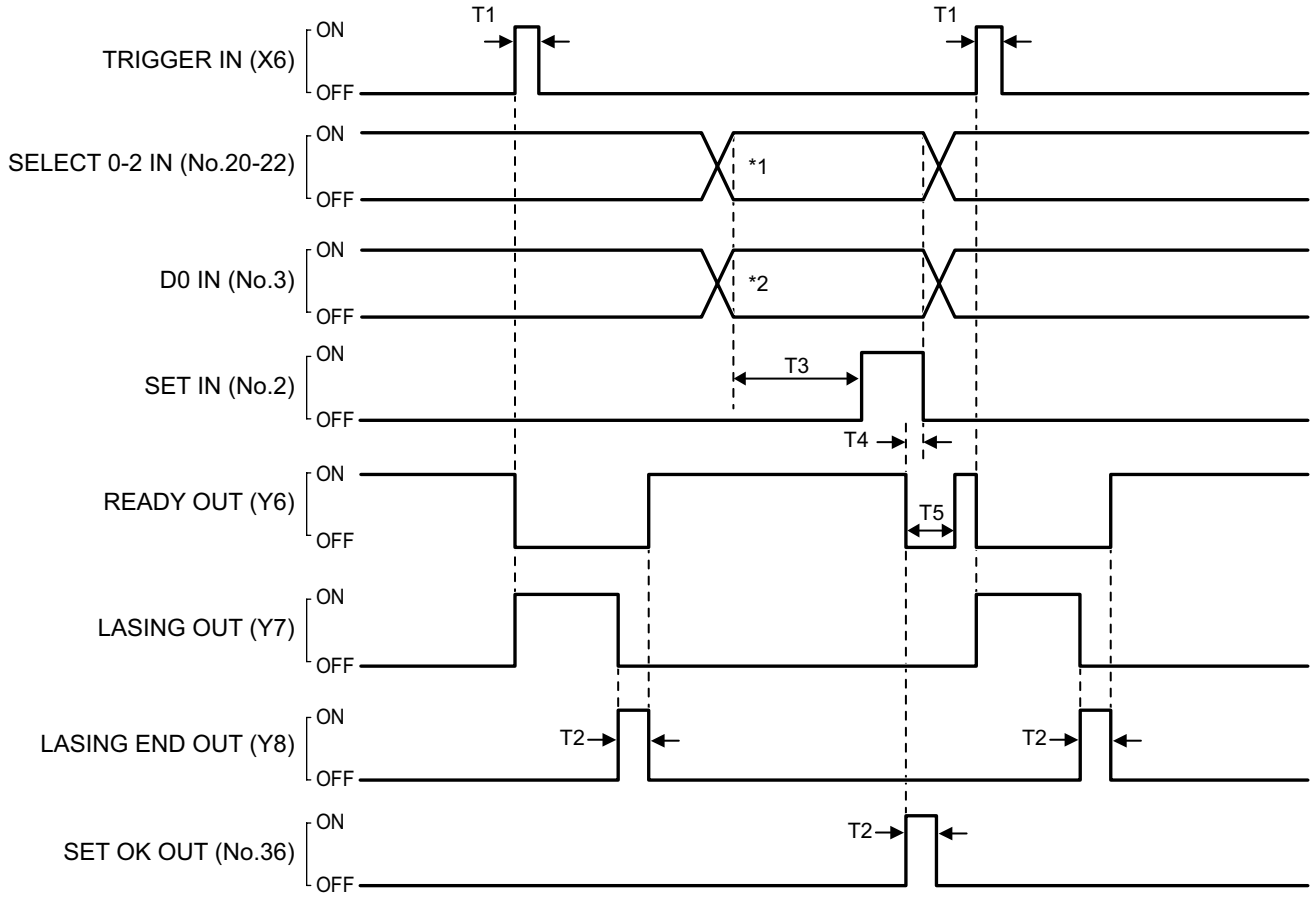
Item	Time	Remarks
T1	0.5 ms or more	After a lapse of 0.5ms or more from specifying SELECT 0 IN to SELECT 2 IN and D0 IN to D10 IN, turn on SET IN (No.2).
T2	0 ms or more	Keep the input until SET OK OUT (No.36) turns on.
T3	20 to 510 ms	One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.
T4	—	Setup time of the laser welding machine to start the lasing operation. • In the laser pumping completed state: Time for data creation. It varies depending on the quantity of the setting data. • When the laser pumping is not completed: Time for data creation or time for laser pumping, whichever is longer.
T5	10 ms or more	Keep the ON status for 10 ms or more.
T6	0 ms or more	To input the next file number right after TRIGGER IN (X6), input SET IN (No.2) after LASING OUT (Y7) turns ON.

*1 : Turn off SELECT 0 IN to SELECT 2 IN (No.20-22) when you specify a file number.
*2 : You can input the next file number during the lasing operation. If the lasing operation was being executed when you turned on SET IN (No.2), the file number changes after the lasing operation completes.

Reference

- If the “select file” is executed, immediately after system startup (approx. 30 seconds), the required time for turning on READY OUT (Y6) is longer.

4-6-7 Trigger counter reset input



Item	Time	Remarks
T1	10 ms or more	Keep the ON status for 10 ms or more.
T2	20 to 510 ms	One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.
T3	0.5 ms or more	After a lapse of 0.5ms or more from specifying D0 IN (No.3), turn on SET IN (No.2).
T4	0 ms or more	Keep the input until SET OK OUT (No.36) turns on.
T5	—	Setup time of the laser welding machine to start the lasing operation.

*1 : To reset the counter, set SELECT 0 IN to SELECT 2 IN (No.20-22) as follows.

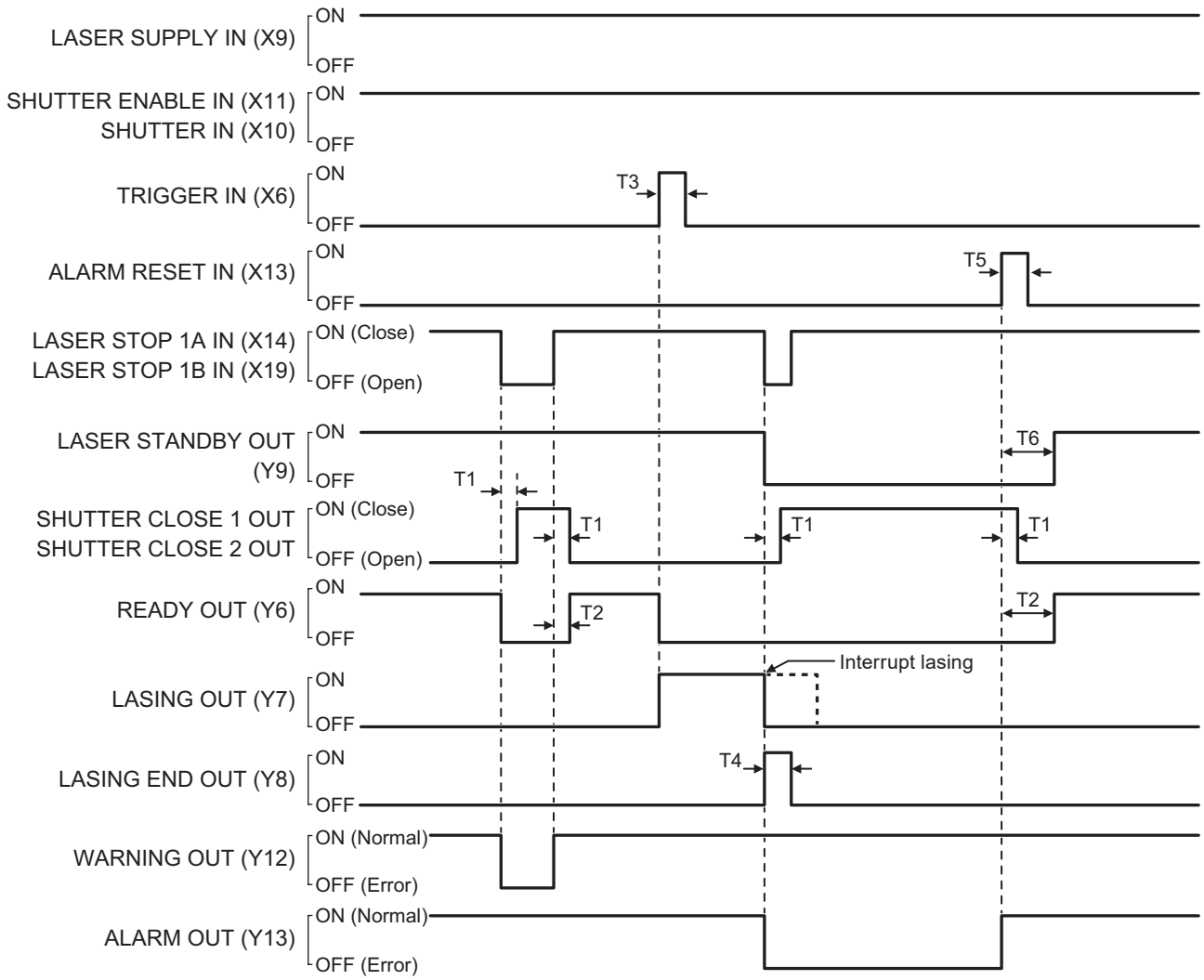
Number input target	SELECT 0 IN (No. 20)	SELECT 1 IN (No. 21)	SELECT 2 IN (No. 22)
Counter type to reset	ON	OFF	OFF

*2 : Set D0 IN (No.3) to specify the counter type to reset.

- When D0 IN (No.3) is OFF: Both Trigger count and Error count are reset.
- When D0 IN (No.3) is ON: Error count is reset.

4-6-8 Laser stop 1 input

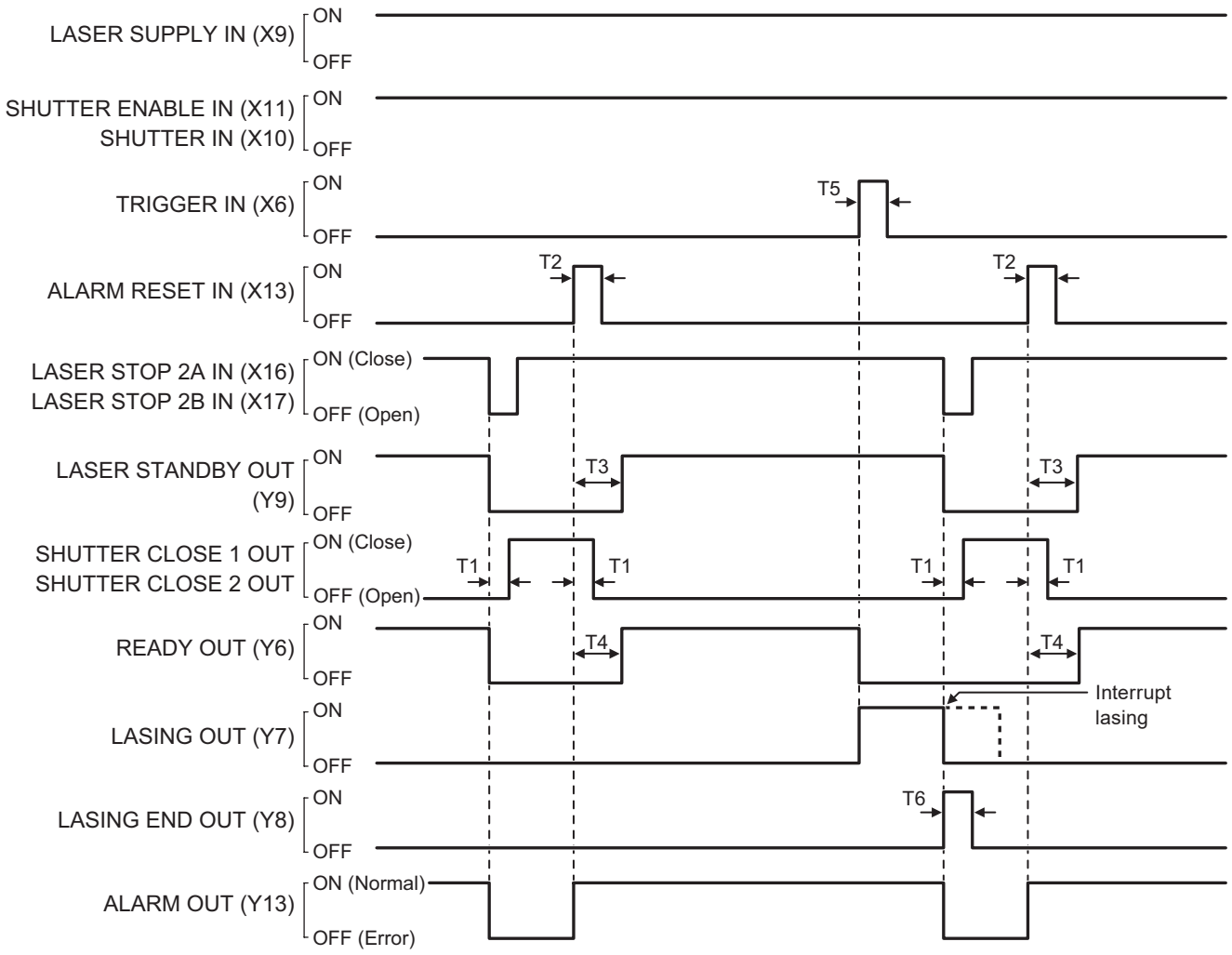
If LASER STOP 1A/1B IN (X14, X19) is released when laser is not radiating, the shutter is closed keeping the laser pumping on. If LASER STOP 1A/1B IN (X14, X19) is released when laser is radiating, the laser pumping is turned off, and the shutter is closed. Refer to “Laser welding machine operation when functions for safety measures are input” (P.92).



Item	Time	Remarks
T1	Around 200ms to max. 1 sec.	SHUTTER OPEN OUT (Y10) and SHUTTER CLOSE 1&2 OUT (Shutter close output terminal No.2, 3) have a delay time of up to one second from turning ON of SHUTTER IN (X10) for the actual shutter open / close operation time. SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
T2	—	Setup time of the laser welding machine to start the lasing operation. • In the laser pumping completed state: Time for data creation. It varies depending on the quantity of the setting data. • When the laser pumping is not completed: Time for data creation or time for laser pumping, whichever is longer.
T3	10 ms or more	Keep the ON status for 10 ms or more.
T4	20 to 510 ms	Even when the lasing operation is interrupted due to the alarm, LASING END OUT (Y8) turns ON. This is One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.
T5	100 ms or more	Keep the ON status for 100 ms or more.
T6	Approx. 15 sec.	It is the time from turning on LASER SUPPLY IN (X9) to completion of laser pumping.

4-6-9 Laser stop 2 input

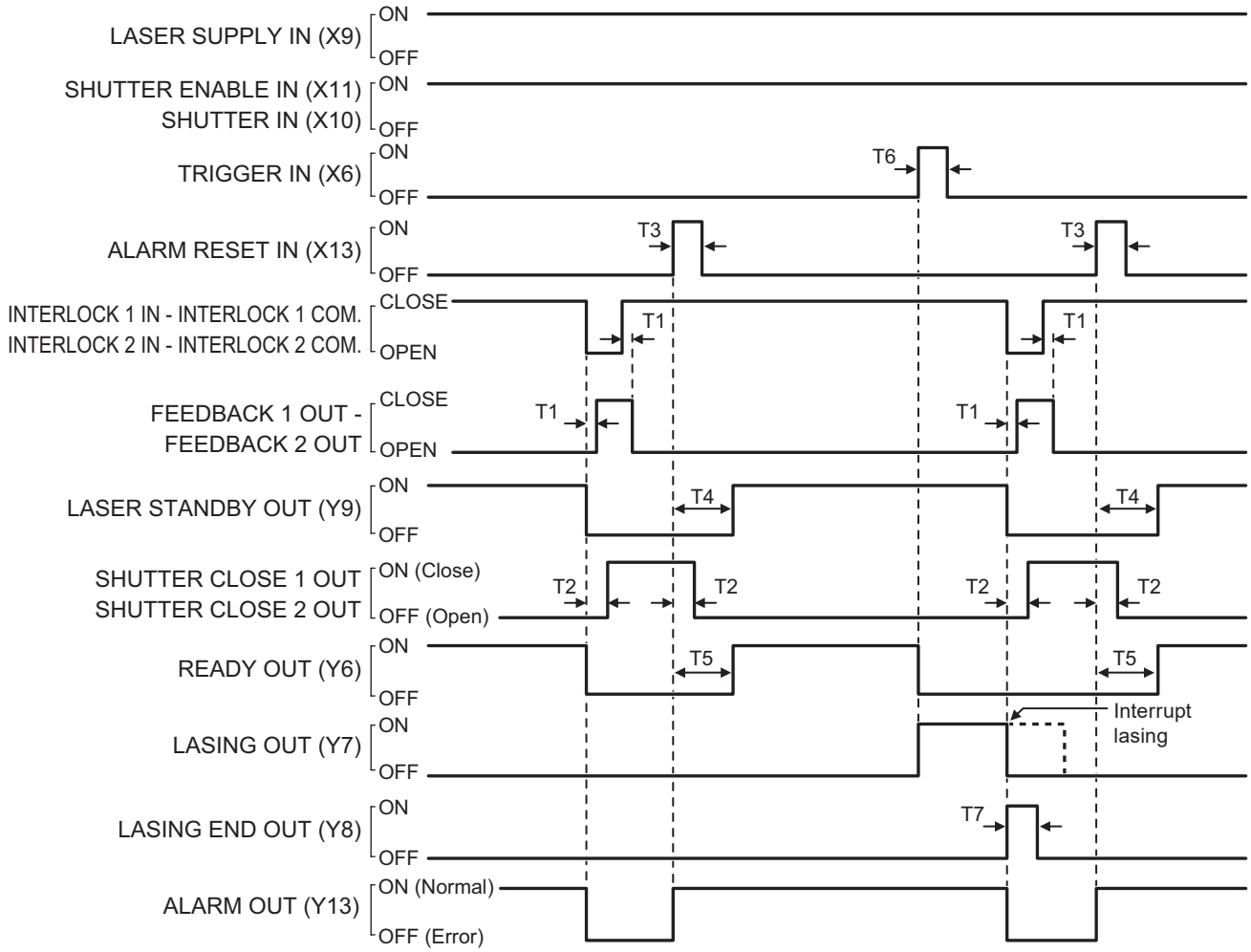
If LASER STOP 2A/2B IN (X16, X17) is released, the laser pumping is turned off and the shutter is closed, regardless of whether or not the laser is radiating. Refer to “Laser welding machine operation when functions for safety measures are input” (P.92).



Item	Time	Remarks
T1	Around 200ms to max. 1 sec.	SHUTTER OPEN OUT (Y10) and SHUTTER CLOSE 1&2 OUT (Shutter close output terminal No.2, 3) have a delay time of up to one second from turning ON of SHUTTER IN (X10) for the actual shutter open / close operation time. SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
T2	100 ms or more	Keep the ON status for 100 ms or more.
T3	Approx. 15 sec.	It is the time from turning on LASER SUPPLY IN (X9) to completion of laser pumping.
T4	—	Time for data creation or time for laser pumping, whichever is longer.
T5	10 ms or more	Keep the ON status for 10 ms or more.
T6	20 to 510 ms	Even when the lasing operation is interrupted due to the alarm, LASING END OUT (Y8) turns ON. This is One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.

4-6-10 Interlock input

If interlock is opened, the laser pumping is turned off and the shutter is closed, regardless of whether or not the laser is radiating. Refer to “Laser welding machine operation when functions for safety measures are input” (P.92).

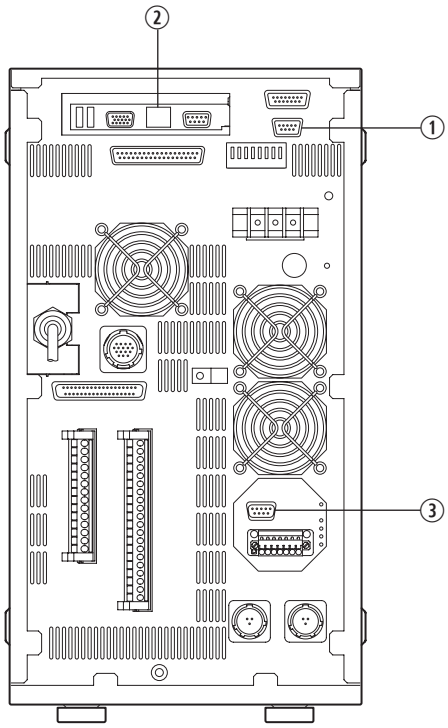


Item	Time	Remarks
T1	Approx. 20 ms	FEEDBACK OUT is switched open and closed with a delay of approx. 20 ms with reference to INTERLOCK 1 IN and INTERLOCK 2 IN status.
T2	Around 200ms to max. 1 sec.	SHUTTER OPEN OUT (Y10) and SHUTTER CLOSE 1&2 OUT (Shutter close output terminal No.2, 3) have a delay time of up to one second from turning ON of SHUTTER IN (X10) for the actual shutter open / close operation time. SHUTTER OPEN OUT and SHUTTER CLOSE 1&2 OUT will be output by the same operation, but their output timing has a margin of error.
T3	100 ms or more	Keep the ON status for 100 ms or more.
T4	Approx. 15 sec.	It is the time from turning on LASER SUPPLY IN (X9) to completion of laser pumping.
T5	—	Time for data creation or time for laser pumping, whichever is longer.
T6	10 ms or more	Keep the ON status for 10ms or more.
T7	20 to 510 ms	Even when the lasing operation is interrupted due to the alarm, LASING END OUT (Y8) turns ON. This is One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.

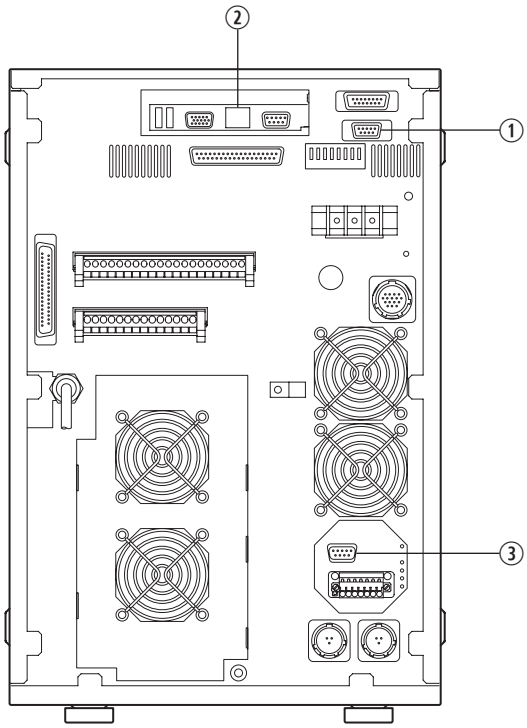
5 External Control by Communication Commands

5-1 Serial Communication Interfaces

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



VL-W1500-N, VL-W1506-N



VL-W1A00-N, VL-W1A06-N

No.	Item	Description
①	RS-232C port for external control	Interfaces to control the laser welding machine by using serial communication commands.
②	RESERVE	Reserved port
③	RS-232C port for power monitoring	Interface to monitor the laser power at lasing with a serial communication data. For the details of power monitoring, refer to “6-2 Serial Data Output of Power Data” (P.130).

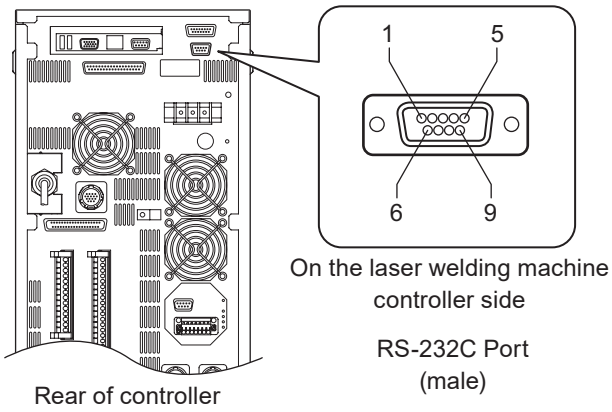
5-2 RS-232C for External Control

Reference

- For the details of RS-232C for power monitoring, refer to “6-2 Serial Data Output of Power Data” (P.130).

5-2-1 Interface specifications and connection

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



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

■ Signals of RS-232C connector

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

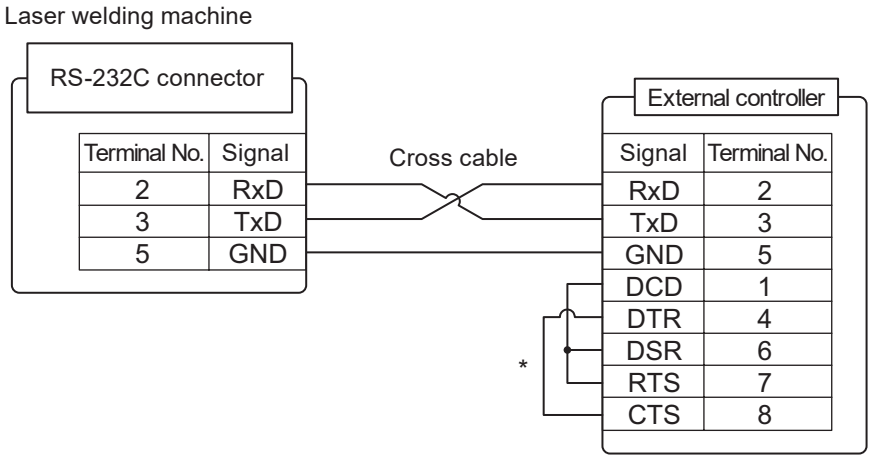
Reference

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

■ Connecting to external control devices

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

Connection example



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

5-2-2 Communication conditions

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

Reference

- For the details of the setting method of communication conditions, refer to “3-5-2 Communication condition setting” (P.80).

6 Laser Power Monitoring Function

6-1 Laser Power Monitoring Details

6-1-1 Overview of laser power monitoring

This is the function to measure the laser power in watt during the lasing operation automatically and output the results by the serial communication data.
With the setting of warning threshold of laser power or laser energy, POWER WARNING OUT (Y11) on I/O terminal turns on when the measured value is out of the threshold.

■ Power data monitoring procedures

Connecting of RS-232C for power data

Refer to “6-2-1 RS-232C connector for power monitoring” (P.130).

↓

Communication condition setting

Refer to “6-2-2 Communication conditions for power monitoring” (P.131).

↓

Turn ON key switch of laser welding machine controller

↓

Threshold setting of laser energy or laser power at lasing (when POWER WARNING OUT (Y11) is used)

Set the threshold based on the actual power and energy measured at test lasing with each file. Refer to Operation Manual.

↓

Output mode setting by command

Set the output mode every time after powered up of the laser welding machine.
Refer to “6-2-4 Communication data format” (P.134).

↓

Laser radiation

↓

Laser power output with serial communication data

Refer to “Response data for laser power” (P.137).

↓

Completion of laser radiation

↓

Laser energy output with serial communication data

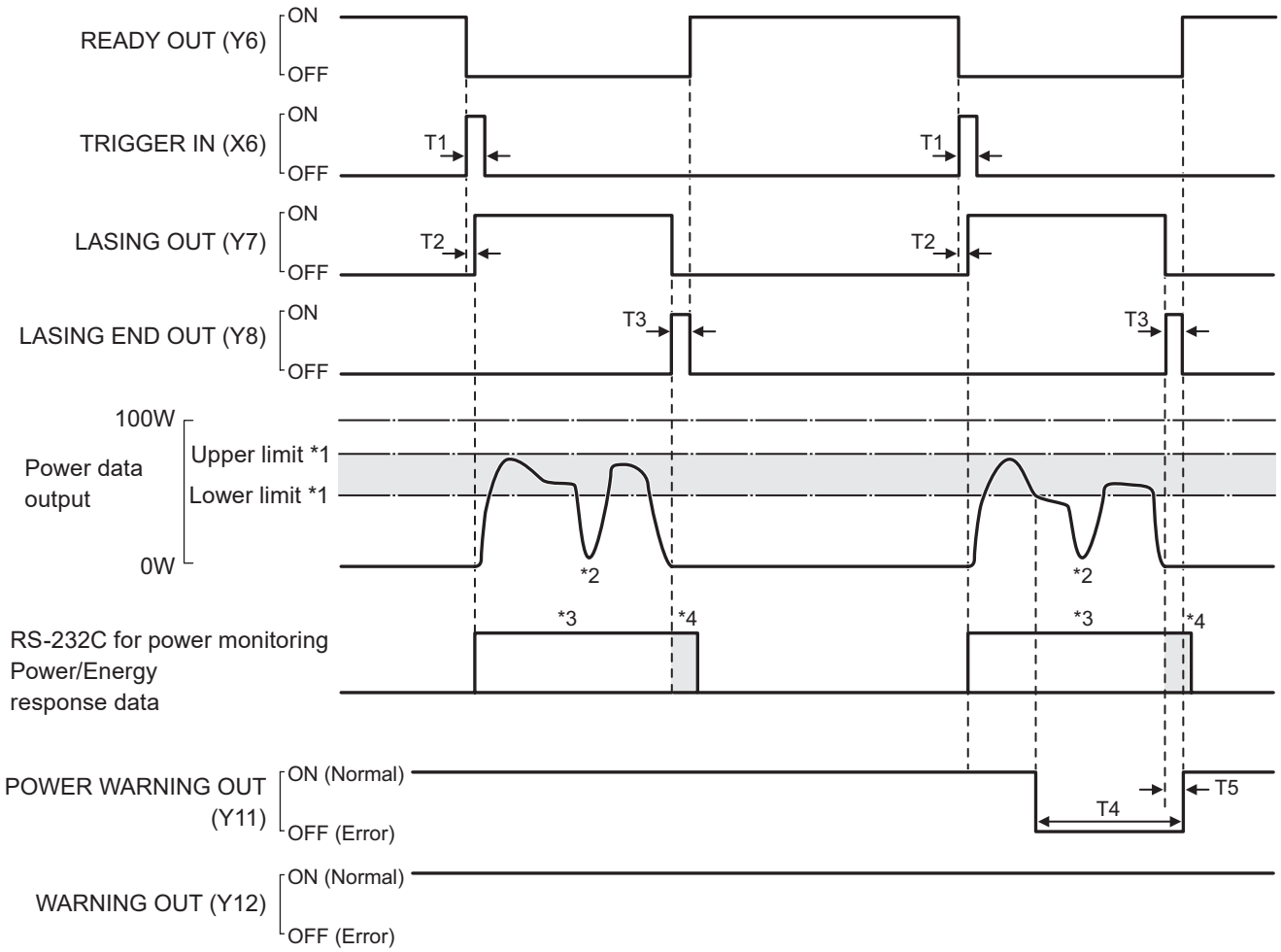
Refer to “Response data for laser energy” (P.138).

Reference

- The laser power data is output regardless the remote mode ON/OFF state of the laser welding machine.
- The power monitor function is a function to monitor fluctuations in the output laser power. The measurement results by the power monitor function may have max. ± 3.6W* difference from the laser power setting results.

* There may be a max. ± 3.6W difference for VL-W1A00-N/VL-W1A06-N and a max. ± 1.8W difference for VL-W1500-N/VL-W1506-N.
The power monitor installed in this product is not a measuring instrument. The setting difference between the laser power setting value and the power monitor measurement value may increase with the number of years of use. Use a commercially available power meter during daily maintenance and check the difference. When this difference interferes with the customer's operation, our service staff will inspection and repair. Contact our agency.

6-1-2 Timing chart of power data output



*1 : POWER WARNING OUT (Y11) becomes effective when the warning threshold of laser power is set.
*2 : If the laser power is measured at the laser off moment such as the interval of scanning lines, the measured laser power may be low. In this case, the measured results become invalid at the warning threshold detection.
*3 : Output value of laser power [W]: During the lasing operation, measured data is sent at the setting intervals (10 ms or 100 ms).
*4 : Output value of laser energy [mJ]: The measured laser energy is sent at the end of the lasing operation. The laser energy value is output when the laser power [W] and laser energy value [mJ] are specified in the output mode.

Item	Time	Remarks
T1	10 ms or more	Keep the ON status for 10 ms or more.
T2	—	When the trigger delay time is set in the selected file, lasing operation starts after the delay time.
T3	20 to 510 ms	This is the output to notify that the lasing operation ended. Even when the lasing operation is interrupted due to the alarm or warning occurrence, LASING END OUT (Y8) turns ON. This is One-shot output. Set the output time on the environment setting screen. There is a small margin of error for the setting value.
T4	—	POWER WARNING OUT indicates the warning “E812” occurrence, which notifies the measured laser power [W] is out of the threshold. It turns OFF when the measured laser power [W] is out of the threshold and keeps OFF state until one-shot output time is passed after the lasing operation. Without the setting of the warning threshold of laser power, this output does not work.
T5	20 to 510 ms	

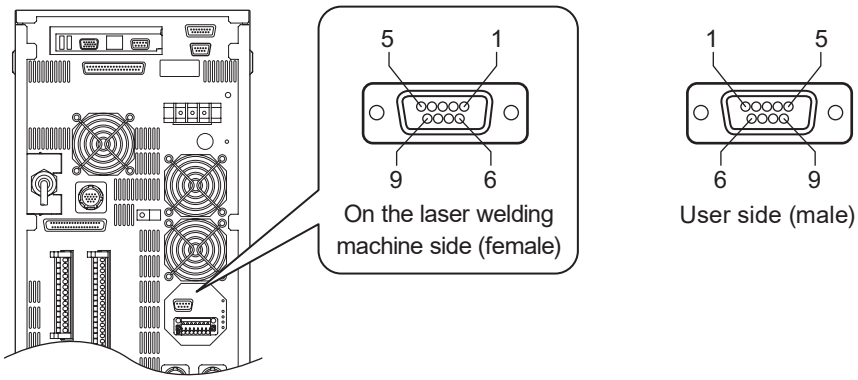
Reference

- During the power/energy response, the command cannot be accepted.
- The power warning occurrence does not affect the ON/OFF state of WARNING OUT (Y12).
- Even when the lasing operation is interrupted due to the error occurrence, POWER WARNING OUT (Y11) is ON (Normal).

6-2 Serial Data Output of Power Data

Here describes the communication setting and details to output the measurement result of the laser power with serial data.

6-2-1 RS-232C connector for power monitoring



Connector position	Connector specifications	Model	Manufacturer name
On the laser welding machine side	D-sub 9-pin, female Screw type: M2.6 male	—	—
User side	D-sub 9-pin, male Screw type: M2.6 female	Recommended connector HDEB-9PF(05)	Hirose Electric Co., Ltd.
		Recommended connector cover HDE-CTH1(10)	

■ Signals on RS-232C connector for power monitoring

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

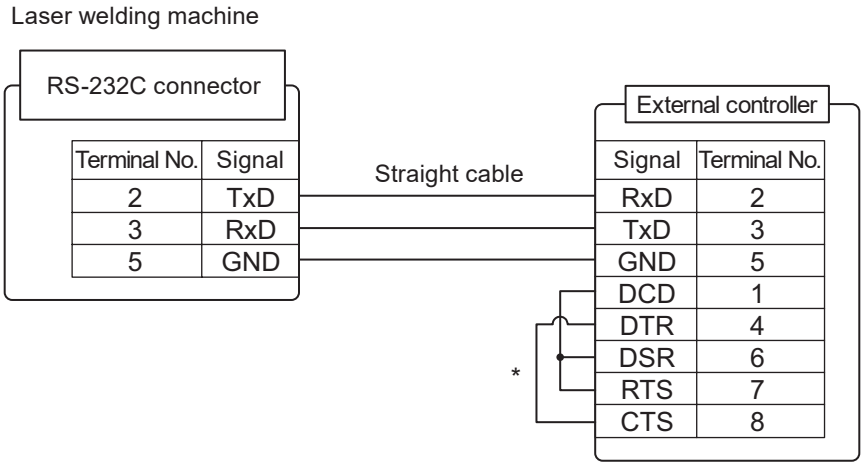
Reference

- The GND pin of the RS-232C connector for power monitoring is common to the body of the laser welding machine.
- To connect RS-232C terminal without using a commercially available RS-232C cable, connect only 3 signals of RxD, TxD and GND and do not use other signals on the laser welding machine side.

■ Connecting to external control devices

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

Connection example



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

6-2-2 Communication conditions for power monitoring

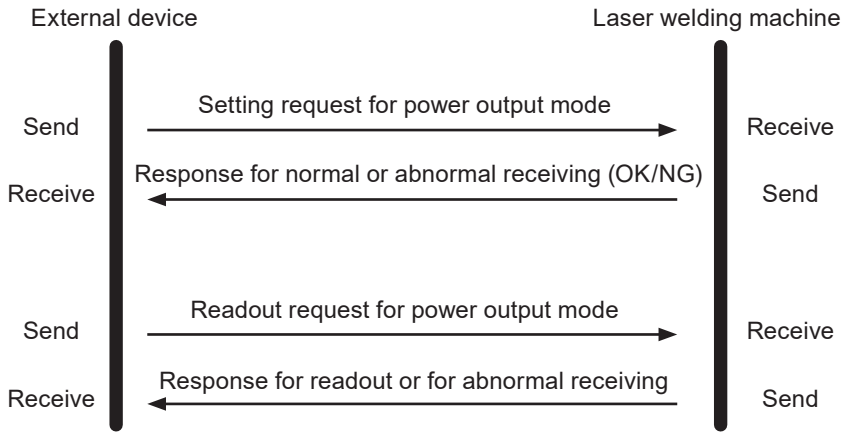
The communication condition for the power monitoring is fixed. Set the external control device to conform to the following communication condition.

Item	RS-232C communication conditions
Synchro system	Start-stop method
Communication	Communication full-duplex transmission
Baud rate	19200 bps
Data length	8bit
Parity	Odd
Stop Bits	1bit
Flow control	None
Check sum	Not applicable
Delimiter	CR
Start code	@ (40(HEX))
Reception timer	Timeout monitoring ON (5 sec.)

6-2-3 Communication sequence

■ Communication sequence of setting/readout request data

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



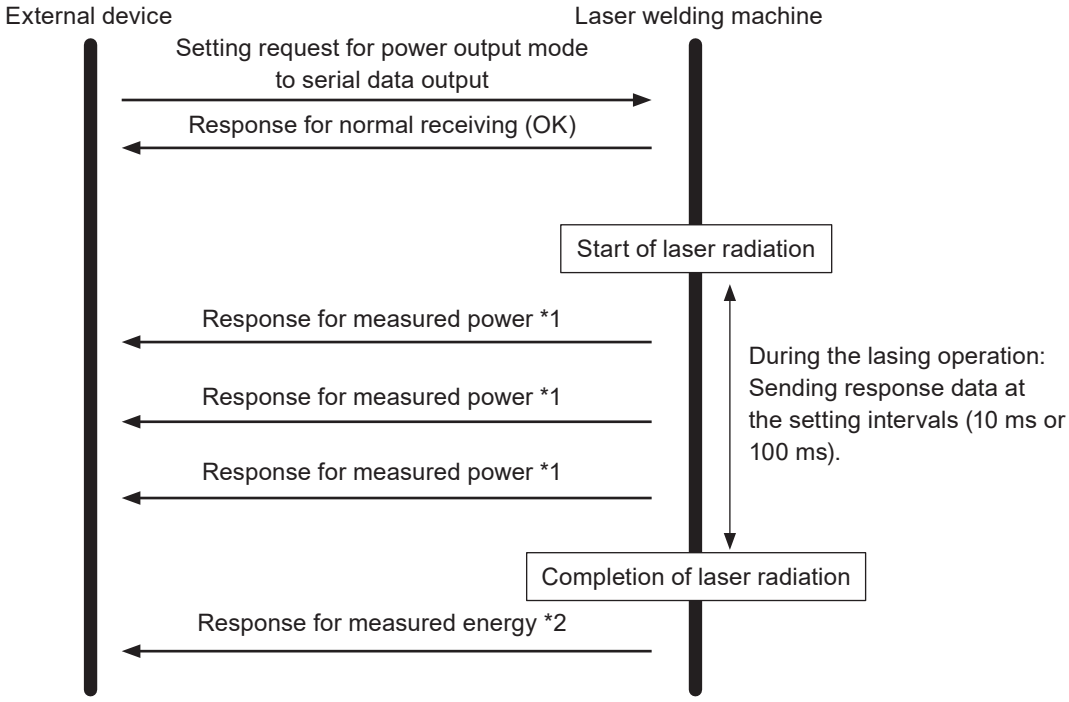
Reference

- The time-out duration of this product is set to 5 seconds from receiving the communication data from the head till the end transmitted from the external device. If a reception time-out occurs, the communication data transmitted will be discarded and the laser welding machine will not transmit the response data. To resume the communication, transmit the correct data once again.

■ Communication sequence for the power data output

The laser welding machine transmits the laser power or laser energy automatically with the following timing:

- When the serial data output of laser power [W] is allowed, the response data is transmitted during the lasing operation at the setting intervals (10 ms or 100 ms).
- When the serial data output of laser energy [mJ] is allowed, the response data is transmitted at the end of the lasing operation.



*1 : Transmitted when the serial data output of laser power [W] is allowed at the power output mode setting.
*2 : Transmitted when the serial data output of laser energy [mJ] is allowed at the power output mode setting.

6-2-4 Communication data format

Use the ASCII code for the communication data when monitoring the laser power with the serial communication data. The characters enclosed with double quotation marks (“ ”) in the description below indicate the ASCII code. The characters enclosed with [ ] indicate the control characters.

■ Basic data format

Head			End
Start code “@”	Command *1	Data defined per data and command type	Delimiter [CR]
1 Byte	1 Byte		1 Byte

Item	Description
Start code	Code to identify the data head. Use always [STX]: 02 (HEX) as a start code.
Command *1	One-byte alphabetic character representing the request or response data type. It fixed to the following alphabetic character: • Setting request of power output mode: “M” • Readout request of power output mode: “R” • Response for laser power: “P” • Response for laser energy: “E”
Delimiter	Code to identify the end of data. Use always [CR]: 0D (HEX) as a delimiter.

*1 : There is no command character in the response data for normal or abnormal receiving to the setting request.

Reference

- Check sum is not supported to the power monitoring data.
- There is no separating character among the each terms.
- When using the external device set by 2-byte, [NUL]: 00(HEX) can be used. Add [NUL] before the start code or after the delimiter.

■ Input data

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

Data type	Input data
Start code	“@” : 40(HEX)
Command	“M”: 4D(HEX) “R”: 52(HEX) “P”: 50(HEX) “E”: 45(HEX)
Numerical value	“0”–“9”: 30(HEX) to 39(HEX)
Delimiter	[CR]: 0D(HEX)

Reference

- For details on the ASCII code, refer to “Character Code Table” in Serial Communication Command Guide.
- It is not allowed to shorten the numeric data length. Even “0” in upper digit cannot be omitted.

■ Setting request / Readout response of power output mode

Select the output mode of the power data.
When using the serial data output, set the output mode by this command every time after powered up of the laser welding machine.

Start code “@”	Command “M”	Output mode	Output interval	Delimiter [CR]
1 Byte	1 Byte	1 Byte	1 Byte	1 Byte

■ Readout request data

Start code “@”	Command “R”	Delimiter [CR]
1 Byte	1 Byte	1 Byte

Data description

Name	Data length [Byte]	Data content
Output mode	1	“1”: Serial data of laser power [W] “2”: Serial data of laser energy [mJ] “3”: Serial data of laser power [W] and laser energy [mJ]
Output interval	1	“0”: 10 ms “1”: 100 ms
Total data length	2	Fixed length.

Reference

- Send this command after the completion of the system start-up of the laser welding machine.
- During the lasing operation, this command is not acceptable.
- This command can be sent regardless the remote mode ON/OFF state of the laser welding machine.
- To output the power data with the serial data, set the output mode every time after powered up of the laser welding machine.

Data example

Condition:
- Setting

Output mode = 3, Output interval = 1

Transmission data	@	M	3	1	[CR]

- Readout

Transmission data	@	R	[CR]

Response data	@	M	3	1	[CR]

■ Response data format for normal receiving

Response data to transmit when the request data with command “M” is accepted normally.
The response code is fixed to “OK”.

Start code “@”	Response code “OK”	Delimiter [CR]
1 Byte	2 Byte	1 Byte

■ Response data format for abnormal receiving

Response data to transmit when the request data are not acceptable.
The error cause is indicated with the sub response code.

Start code “@”	Response code “NG”	Sub response code “01”–“99”	Delimiter [CR]
1 Byte	2 Byte	2 Byte	1 Byte

Reference

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

Details of sub response code

The error cause is displayed in two numerical characters when the laser welding machine cannot accept the request data.

Sub response code	Error cause
“01”	Unacceptable command because the system is during the power up process.
“02”	Unacceptable command during the lasing operation.
“03”	No applicable command.
“04”	Incorrect data length.
“05”	Invalid data part. • Incorrect value is in the data part. • Unsupported characters are in the data part.
“98” “99”	Unable to communicate due to the system error.

■ Response data for laser power

When the serial data output of laser power [W] is allowed at the power output mode setting, the following response data is transmitted during the lasing operation at the setting intervals (10 ms or 100 ms).

Start code “@”	Command “P”	Threshold monitoring	Laser power	Delimiter [CR]
1 Byte	1 Byte	1 Byte	4 Byte	1 Byte

Data description

Name	Data length [Byte]	Data content	Remarks
Threshold monitoring	1	“0”: Normal (within the warning threshold) “1”: Abnormal (out of the warning threshold)	• Indicates if the measurement result of the laser power is in the preset threshold or not. • If the warning threshold is not specified, this response data is always “0”: Normal. • If the laser power is measured at the laser off moment such as the interval of scanning lines, the measured results become invalid at the warning threshold detection and this response data is always “0”: Normal.
Laser power	4	“0000”–“1000” 1 represents 0.1W in this field.	If the laser power is measured at the laser off moment such as the interval of scanning lines, the measured laser power may be low.
Total data length	5	Fixed length.	

Reference

- Laser energy and laser power monitoring function do not provide the warranty of the quality of the laser processing results. It is not possible to detect the defect in the laser processing quality caused by the external factors.
- The response data for laser power is transmitted only during the lasing operation.
- This response data is transmitted automatically regardless the setting or status of the external control device.
- This response data is transmitted automatically regardless the remote mode ON/OFF state of the laser welding machine.
- This response data is transmitted to the all lasing operation including test lasing and laser radiation for measurement.

Data example

Condition:
- Response for laser power

Threshold monitoring = 1, Laser power = 40.5W

Response data	@	P	10405	[CR]

■ Response data for laser energy

When the serial data output of laser energy [mJ] is allowed at the power output mode setting, the following response data is transmitted at the end of the lasing operation (after LASING END OUT turns on).

Start code “@”	Command “E”	Threshold monitoring	Laser energy	Delimiter [CR]
1 Byte	1 Byte	1 Byte	9 Byte	1 Byte

Data description

Name	Data length [Byte]	Data content	Remarks
Threshold monitoring	1	“0”: Normal (within the warning threshold) “1”: Abnormal (out of the warning threshold)	• Indicates if the measurement result of the laser energy is in the preset threshold or not. • If the warning threshold is not specified, this response data is always “0”: Normal.
Laser energy	9	“000000000”–“429496729” [mJ]	Even when the lasing operation is interrupted due to the error occurrence, the laser energy is responded.
Total data length	10	Fixed length.	

Reference

- Laser energy and laser power monitoring function do not provide the warranty of the quality of the laser processing results. It is not possible to detect the defect in the laser processing quality caused by the external factors.
- This response data is transmitted automatically regardless the setting or status of the external control device.
- This response data is transmitted automatically regardless the remote mode ON/OFF state of the laser welding machine.
- This response data is transmitted to the all lasing operation including test lasing and laser radiation for measurement.
- If the laser energy is lower than 1000 mJ or the lasing time is shorter than 0.4 second, the measurement results may be unstable.
- When the trigger mode is set to “Continuous trigger”, the response of the laser energy shows the total energy of the all lasing operation repeated during the period from turning on of TRIGGER IN to turning on of LASING END OUT.

Data example

Condition:
- Response for laser energy

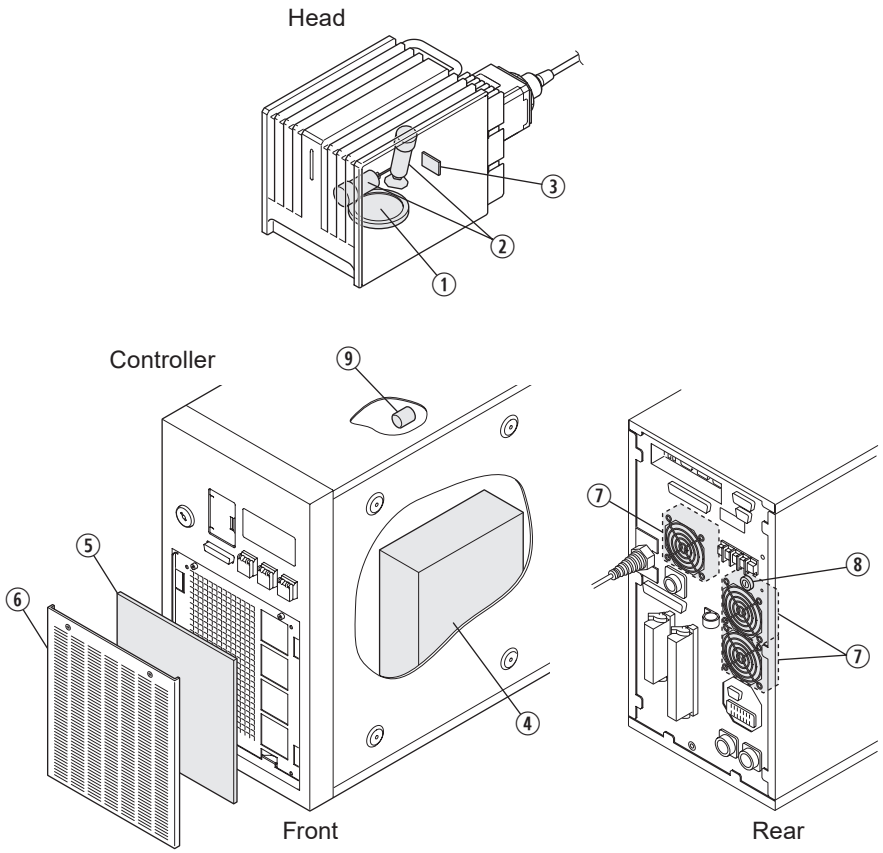
Threshold monitoring = 1, Laser energy = 30000

Response data	@	E	1000030000	[CR]

7 Maintenance

7-1 Maintenance Items

Listed below are typical parts that require cleaning or replacement depending on the usage environment or duration of service of the laser welding machine. Some parts are maintainable by the customer, and other parts are required to be repaired or replaced by our service representative, depending on the types of parts and the defects.
For purchasing replacement parts or requesting our service representative to repair or replace parts, contact our sales agency.



No.	Parts name	Main cause for degradation	Daily maintenance	Replacement when degraded or defective
①	Protection glass of laser emission port	Contamination	Cleaning	Customer-replaceable
②	Galvano scanner	Aging	—	By our service representative
③	Internal shutter	Aging	—	By our service representative
④	Laser oscillator	Aging	Check output power	By our service representative
⑤	Air filter	Contamination	Cleaning	Customer-replaceable
⑥	Intake vent	Contamination	Cleaning	—
⑦	Air-cooling fan	Contamination	Cleaning	By our service representative
⑧	Fuse	Blown	—	Customer-replaceable
⑨	Battery inside the controller	Aging	—	By our service representative

Notice

- Be sure to use our specified replacement parts. If the user applies any other fuses than the specified one, failure might result.

Reference

- Some optional items cannot be sold due to regulations in each country or region. For detailed information, please contact our sales office.

7-2 Maintenance Details of Parts

⚠WARNING

- Maintenance work must be conducted with the power to the laser welding machine turned OFF, and the AC power cable disconnected. Doing so may cause exposure to the laser beam or electrical shock.
- Do not insert your hands or objects to the exhaust port of each unit or the gaps between units during the maintenance work. This may result in injuries, electrical shock, or failure of the laser welding machine.

7-2-1 Protection glass of laser emission port

A protection glass is attached to the laser emission port (lens). It protects the lens from dirt or damage. An antireflection coating is applied to the protection glass surface in order to maintain appropriate transmittance.
Do not remove the protection glass during operation.

■ Effect from deterioration

The surface of the laser emission port may become contaminated by the dust and smoke during the laser processing. Using laser welding machine with the contaminated laser emission port may cause the lens to get burned in. This may also scratch the lens surface, or even peel off the surface coating depending on how it is used or cleaned.
Operations under these conditions will degrade transmittance of laser, which may lead to deterioration in quality of laser processing.

■ Replacement interval

- Deterioration in quality of laser processing (density reduction, incomplete processing) is observed.
- There is contamination or scratch that cannot be removed by cleaning.

■ Replacement method

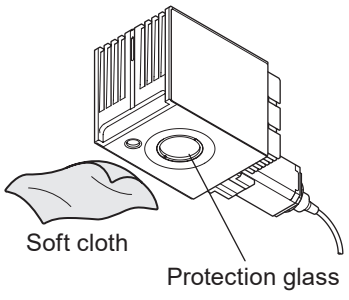
- Replace the protection glass of the laser emission port referring to “7-2-2 Replacement of the protection glass” (P.142). If any damage of the laser emission port is observed when the protection glass is removed, our service representative handles the replacement. Contact our sales office.

■ Cleaning steps for protection glass of laser emission port (Daily maintenance)

In order to maintain stable laser processing quality, the protection glass of laser emission port needs to be cleaned regularly according to the usage environment.

1. Turn OFF the key switch of the controller, and disconnect the AC power cable.

2. Clean the protection glass of laser emission port with an air duster for optics, and wipe it lightly with a soft cloth. If a contamination is severe, use a soft cloth immersed in ethanol to wipe it.



Notice

- Do not wipe the protection glass of laser emission port strongly, or touch it with a sharp pointed object. Laser welding machine might become faulty.

⚠WARNING

- Never use an inflammable air duster. The laser beam may ignite the gas, resulting in fire.

7-2-2 Replacement of the protection glass

In case that any contamination that cannot be cleaned adhering to the protection glass of laser emission port or any damage on the glass surface, replace the protection glass according to the following procedure.

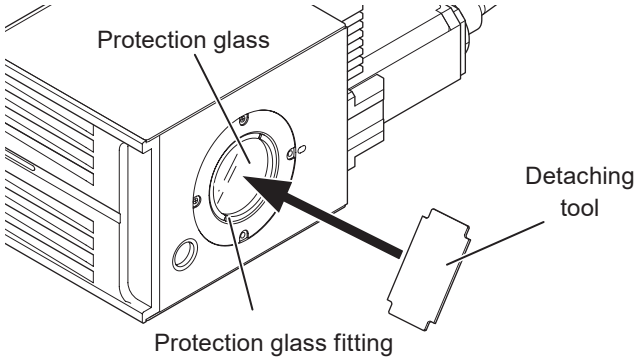
■ Models of replacement parts

Model	Applicable laser welding machine	Remarks
LP-ACV70	VL-W1500-N, VL-W1506-N VL-W1A00-N, VL-W1A06-N	A protection glass fitting tool is attached.

■ Replacement procedure

1. Turn off the key switch of controller and disconnect AC power cable.

2. Lay the head of the laser welding machine on its side.



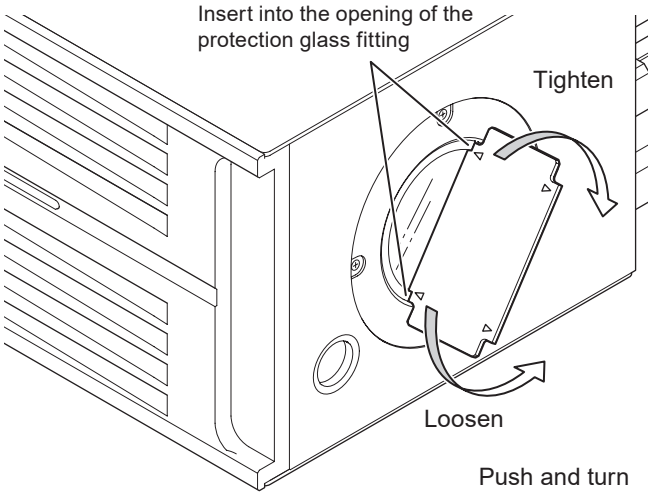
3. Using the detaching tool, detach the protection glass by loosening and removing the fitting.

When the protection glass fitting is removed, the protection glass may suddenly fall out.

Please make sure to be ready to hold it with a soft cloth.

4. Replace the protection glass.

(There is no front or back for the protection glass.)



5. Attach the protection glass fitting using the detaching tool.

Tighten the protection glass fitting with a torque of around 1 N·m.

Or tighten lightly until a resistance is felt. From that point, tighten about 4 mm (circumference).

Notice

- Do not tighten the protection glass with an extra force. It will lead to damages to the protection glass.
- Once the protection glass is removed, there is another glass inside. Do not remove this glass.
- Do not operate the laser welding machine without the protection glass on the laser emission port.

7-2-3 Air filter

One air filter is placed in the air-cooling area of the controller.

■ Effect from deterioration

The air filter soiled with dust may reduce the cooling effect of the air-cooling fan. This may cause the performance to degrade, or failure of the laser welding machine.

■ Replacement interval

- There is a broken part, or contamination that cannot be removed by cleaning.

■ Models of replacement parts

For details of purchasing air filters, please contact our sales agency.

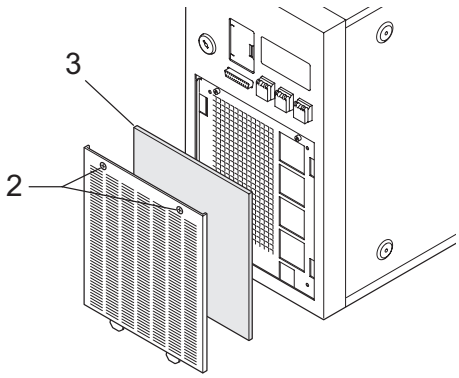
Model	Remarks
LP-AFT50x5	Set of 5 pieces for the controller

■ Steps for cleaning (Daily maintenance) and replacement of air filter

Clean air filters regularly according to the usage environment.

1. Turn OFF the key switch of the controller, and disconnect the AC power cable.

2. Loosen the screws of front panel at 2 positions, and remove them.



3. Remove the filter.

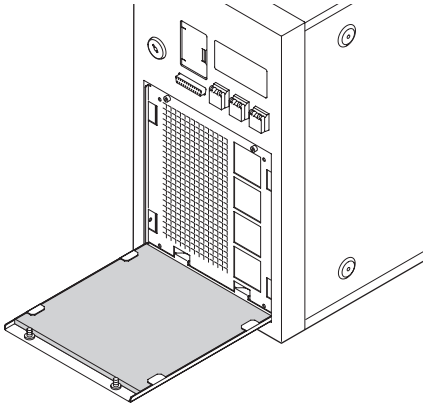
4. Clean the filter with neutral detergent and air-dry it.

5. Attach the dried filter onto the front panel, and tighten it with the screws.

Tightening torque: 0.3N·m

Notice

- Do not attach the filter when it is wet. This may cause the cooling capacity to degrade, or failure of the laser welding machine.



7-2-4 Air-cooling fan and intake vent

The air-cooling fans are equipped on the controller.
If any dust adhered onto the fans or intake vent may decrease the cooling performance and cause the performance to degrade, or failure of the laser welding machine.
Clean them regularly according to the usage environment.

■ Effect from deterioration of the fans

Depending on the usage environment, any dust or oil adhered onto the fan may impair air flow rate of the fan or even stop the rotation of the fan. When the cool performance decreases, the temperature in the electric circuit or laser oscillator will go up, which may cause an error or stoppage of laser radiation. Also, a temperature rise in the housing will foster deterioration in the internal parts, which may cause the product performance to degrade, or failure.

■ Replacement interval of the fans

- The fan does not rotate, or the rotating speed is low.
- There is contamination on the fan.
- Abnormal noise is generated from the fan.
- Almost five years have passed since delivery. *

* The replacement interval may differ depending on the usage environment and conditions.

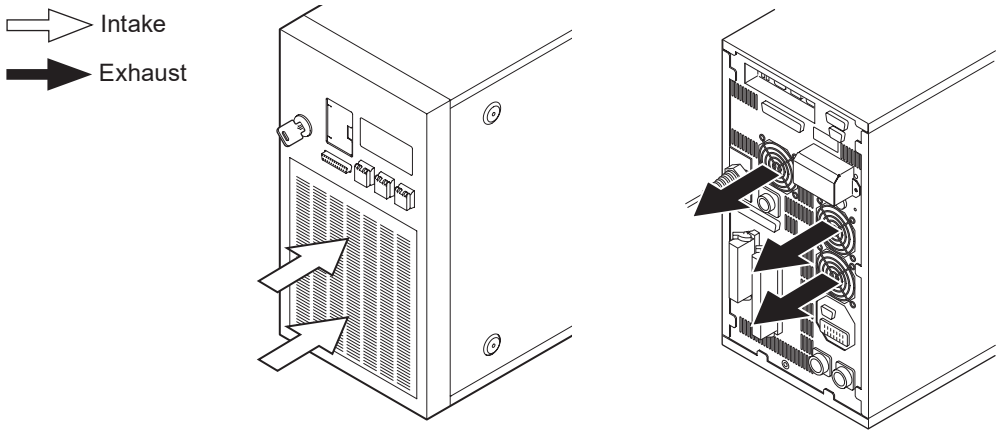
■ Replacement method

Our service representative handles the maintenance and replacement. Contact our sales office.

■ Steps for cleaning of air-cooling area (Daily maintenance)

1. Turn OFF the key switch of the controller, and disconnect the AC power cable.

2. Remove dust and dirt adhered onto the intake vent and fans by vacuum cleaner.



Notice

- Do not blow the air in the intake vent and fans. If dust comes to the inside of the controller, it may cause the failure of the laser welding machine.

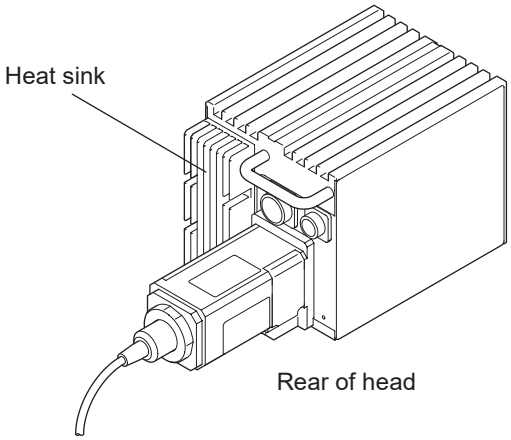
3. Wipe the residual contamination with a dried cloth. If a contamination is severe, use a cloth wrung out with neutral detergent to wipe it. Then, remove the detergent with a cloth wrung out of water.

Notice

- Keep water from entering the controller inside.

7-2-5 Cleaning of head

Natural-cooling system is used in the head, thus the cooling effect will significantly drop if dust or oil is adhered to the surface. Clean the head surface according to the operation environment.



Notice

- Do not clean the laser radiation indicator with alcohol. It may cause deformation, alteration or breakage of the indicator.

7-2-6 Replacement of gasket

In the following parts, O-rings are installed for the ingress protection. If there are signs of deterioration or damage in the O-ring, replace it.

- In the fiber unit connection part
- In the output beam diameter control cover connection part

■ Models of replacement parts

For details of purchasing the gasket, contact our sales office.

Model	Remarks
LP-APK10X5	Set of gaskets with the following contents. • 5 O-rings, middle size: for the fiber unit connection • 5 O-rings, small size: for the output beam diameter control cover connection

Notice

- To keep the IP protection of the product, please follow the below notes.
  - Do not expose the gaskets to the direct sunlight and away from heat and moisture.
  - Store the gaskets in a dustless area and where less air enters.
  - Do not open the package just before use.
  - Do not hang the gaskets. When they are hung, some parts will be deformed.

■ Steps for replacement

Refer to “2-3-6 Detaching / attaching the fiber unit” (P.47) and “2-3-7 Output beam diameter control” (P.51).

7-2-7 Laser oscillator

A fiber laser oscillator is installed in the controller. The laser beam output from the oscillator is delivered through the fiber cable to the head. The laser is scanned and focused in the head and emitted to the target materials.

■ Effect from deterioration

Laser output characteristics such as laser power will deteriorate over time due to aging of oscillator. As the laser output characteristics deteriorate, symptoms such as ununiform laser power density or unstable processing quality, etc. may occur.
Also, as cooling efficiency of the oscillator decreases because of the usage environment, the electronic parts in the oscillator may become defective and unable to irradiate the laser.

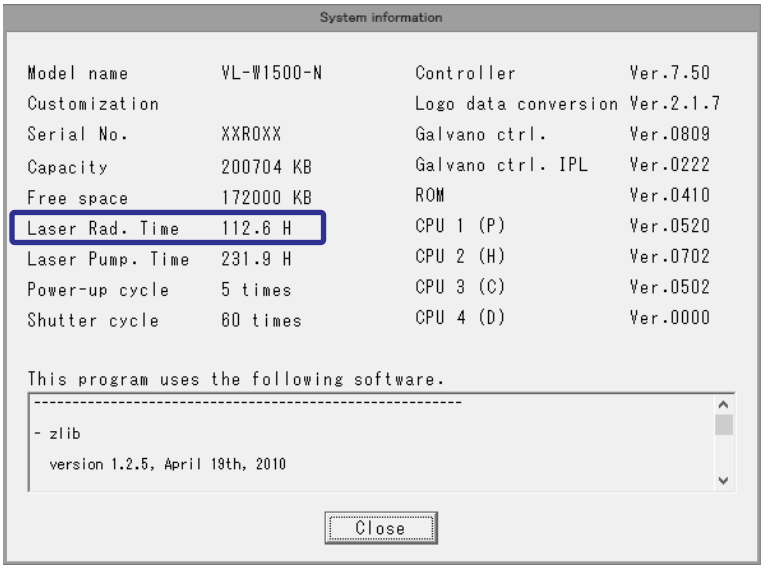
■ Replacement interval

- Deterioration in quality of laser processing (density reduction, incomplete processing) is observed.
- Setting a large value for the laser power is not reflected in the quality of the laser processing.
- The laser power measured with a commercial power meter has decreased by 20%, compared to the delivery status.
- The total radiation time has exceeded 30,000 hours.*
- Alarm for laser error occurred.

* The replacement interval may differ depending on the usage environment and conditions.

■ How to confirm operating hours

Click “Environ.” on the right menu and click “System info”.
The total number time of the laser radiation is displayed on the screen.



■ Replacement method

Our service representative handles the maintenance and replacement. Contact our sales office.

■ Confirm laser output (Daily inspection)

Confirm the laser output regularly in order to maintain consistent laser processing quality.
The laser output should be measured with a commercially available meter using the following steps:

Reference

- It is also possible to check the approximate laser power by using the laser power monitoring function. To control the laser power with higher accuracy, measure the power regularly by using the commercially available power meter. For the laser power monitoring function, refer to Operation Manual.

1. Prepare a commercially available power meter.

Notice

- Use the power meter with the following specifications:
  - The damage threshold (maximum average power density) of the detector is more than 10kW/cm^2.
  - The size of the detector is more than ϕ 10mm.
- Be sure to use the calibrated power meter.
- A difference may arise under the high/low temperature. Measuring power with normal temperature (20 to 30 Celsius degree) is recommended.
- Before measuring the laser power, make sure there is no contamination in the laser emission port. If the laser emission port is contaminated or damaged, an error may result in the measurement of the laser power.

2. Set the output beam diameter to 2.0 mm in the head of laser welding machine.

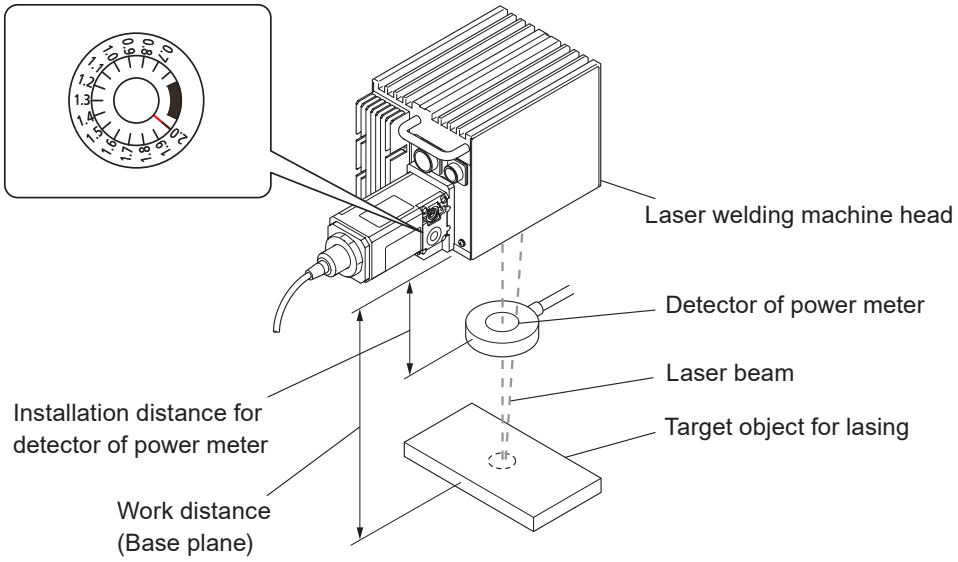
Refer to “2-3-7 Output beam diameter control” (P.51).

3. Install the power meter.

Put the detector of the laser power meter vertically down from the center of the laser emission port and place it at the following distance, i.e. one-third to half of the specified work distance of the laser welding machine.

Laser welding machine	Installation distance for detector of power meter *1
VL-W1500-N, VL-W1A00-N	Approx. 150 mm
VL-W1506-N, VL-W1A06-N	Approx. 400 mm

*1 : The values represent the recommended values for the case where the damage threshold (maximum average power density) of the detector of power meter is 10kW/cm^2.



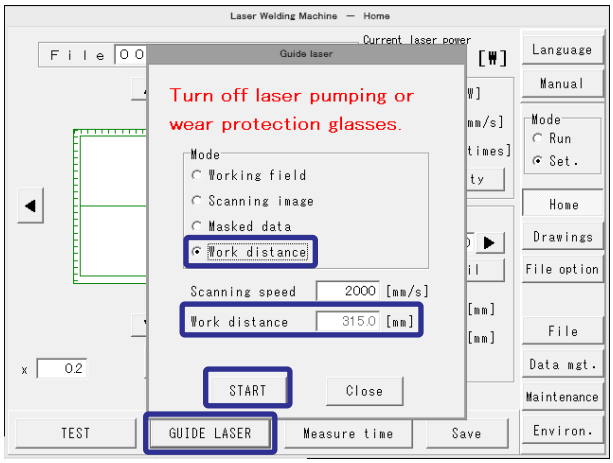
Notice

- Make sure to set the output beam diameter to 2.0 mm in the head of laser welding machine. The smaller beam diameter may cause destruction of the power meter.

4. To confirm the lasing position to the detector of the power meter, click “GUIDE LASER”.

Confirm the work distance value shown in guide laser screen is set to the base position * and then select the mode to “Work distance”.

* : VL-W1500-N / VL-W1A00-N: 315 mm
VL-W1506-N / VL-W1A06-N: 685 mm



5. Click “START”.

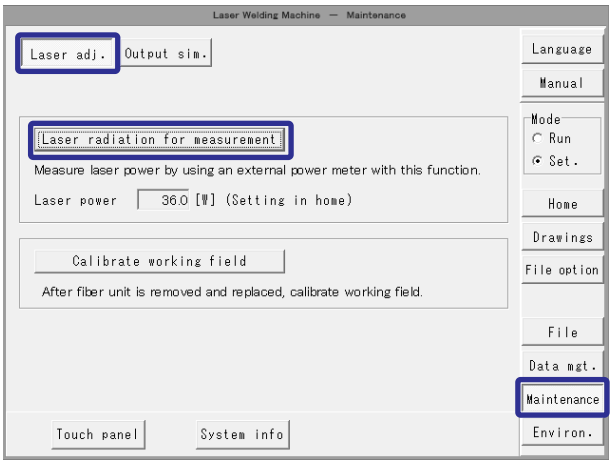
Place the detector so that the cross indication of the guide laser radiates on the center of the detector. (Do not set it to the position where the dot indication and cross indication overlap.)

Reference

- If the work distance is set other than the base position, the center of the cross indication does not refer to the center of the working field.

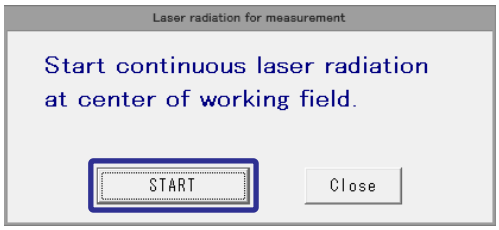
6. Turn ON the laser supply switch on the controller to start laser pumping.

7. Click “Maintenance” on the right menu and select “Laser adj.” tab.



8. Click “Laser radiation for measurement”.

Click “START” in the laser radiation confirmation dialog to irradiate the laser.



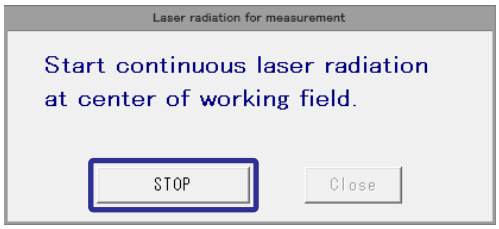
Reference

- The laser power set in Home screen is applied to the power setting of Laser radiation for measurement.
- If the laser power is corrected in System offset of the environment setting, the corrected value is applied also to the power for the measurement.
- The laser radiates to the center of the working field. The X-/Y-offset value in System offset of the environment setting is not applied to the lasing position of this function.
- For stable measurement results, it is recommended to obtain the average output value by measuring the output after about 30 seconds from the start of laser radiation for 10 to 30 seconds. However, if laser radiates more than 1 minute, make sure it does not exceed the damage threshold of the power meter.

⚠WARNING

- Be sure to wear protective goggles.
- During the radiation, the laser energy is concentrated to one point. Use due caution with long period radiation, it may cause a fire or damage to the object.

9. Click “STOP” to stop laser radiation.

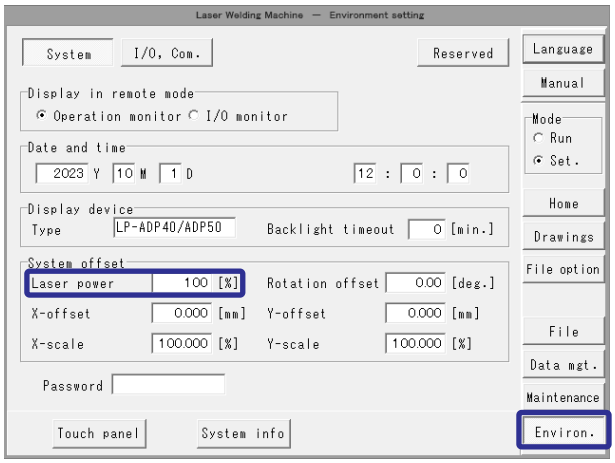


10. Check the measurement results of the power meter. If the power decays lower than the initial status, correct the laser power setting value using the “System Offset” parameter of the “Environment Setting” screen.

Setting range of laser power correction: 50 to 200 [%]

Example:

If the measured power is 35W though the setting power is 36W (about 3% lower than the expected power), set the system offset to 103%. It increases the laser power setting 3% above the current settings internally in all files.



Notice

- If the power decays more than 20%, compared to the initial status, the laser oscillator needs maintenance. Contact our sales office or representatives.

Reference

- If the corrected value exceeds the upper limit of the setting, the corrected value is the same as the upper limit.

7-2-8 Galvano scanner

Galvano scanner is a scanner for radiating the laser beam along the coordinates of the setting data.
The galvano scanner scans the setting data by controlling the angle of galvano mirror mounted onto the axis of rotation of motor with two axes to create drawings for the laser processing.

■ Effect from deterioration

Uneven wear may occur on the bearing inside the galvano scanner depending upon operating frequency and conditions. If uneven wear develops, accurate reproducing may become difficult, resulting in skewness or misalignment of the drawing lines.

■ Replacement interval

- Deterioration in quality of the drawing lines, misalignment of lasing position, or incomplete processing is observed.
- Warning for galvanometer error occurred.
- Galvano scanner has been used for almost five years.*

* The replacement interval may differ depending on the usage environment and conditions.

■ Replacement method

Our service representative handles the maintenance and replacement. Contact our sales office.

7-2-9 Internal shutter

The internal shutter is opened and closed by the rotary solenoid to shut off the path of laser beam.

■ Effect from deterioration

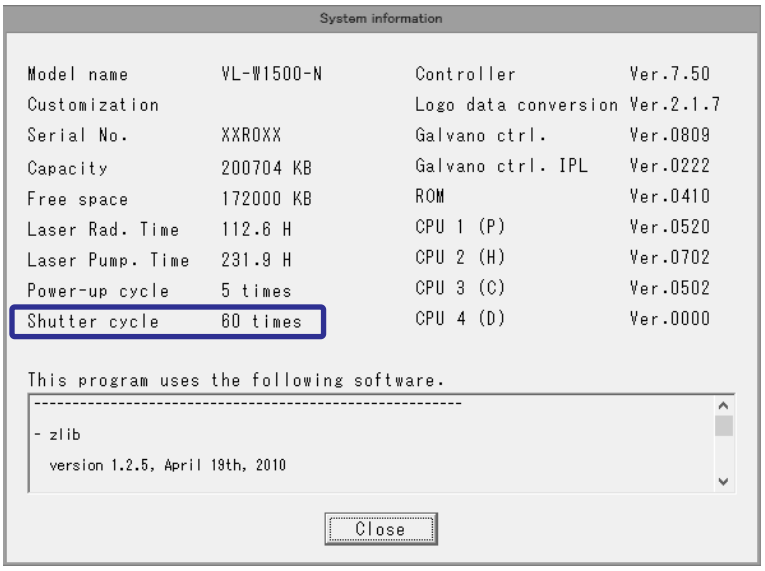
When the rotation torque of the rotary solenoid declines, the opening/closing speed of the internal shutter is decreased or the shutter may not work. In this case, an error “Internal shutter failure” occurs in the laser welding machine and lasing operation cannot be performed.

■ Replacement interval

- Total number of opening/closing operations has exceeded two million.
- Alarm for internal shutter error occurred.

■ How to confirm the number of opening/closing operations

Click “Environ.” on the right menu and click “System info”.
The total number of the shutter operation is displayed on the screen.



■ Replacement method

Our service representative handles the maintenance and replacement. Contact our sales office.

7-2-10 Battery inside the controller

A lithium primary battery is contained inside the controller as battery for clock or calendar of the laser welding machine. Based on this internal clock, the date and time information for the saving data and error log is updated.

■ Effect from deterioration

When the battery inside the controller runs out due to aging, the date and time of the internal clock may be out of synchronization when the laser welding machine is turned OFF. If you start the laser welding machine in such a condition, the warning for internal clock (E251) may occur and the date and time setting is required. The warning is temporarily released by resetting the date and time, however, once the power supply of the laser welding machine is turned to off, the warning will reoccur or the internal clock will show the wrong time.

■ Replacement interval

- Warning for internal clock (E251) occurred.
- Almost five years have passed since delivery.

■ Replacement method

Our service representative handles the maintenance and replacement. Contact our sales office.

7-2-11 Replacement of fuse

Replace fuse of the controller when blowing.
The power of the laser welding machine cannot be turned on if the fuse is blown.

■ Models of replacement parts

Be sure to use the following type of fuse: If the user applies any other fuses than the specified one, failure might result.

Type	Model
Time lag fuse (Rating 250V 10A)	0215010 (made by Littelfuse)

■ Steps for replacement

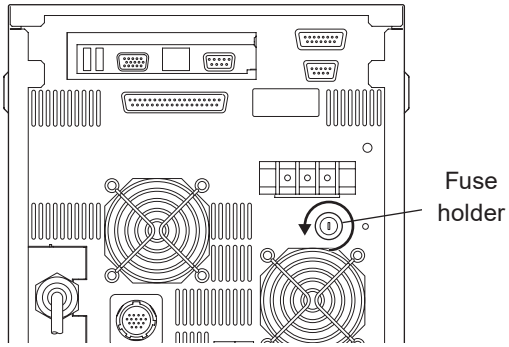
1. Remove causes for fuse blowing.

2. Turn OFF the key switch of the controller, and disconnect the AC power cable.

3. Turn the fuse holder on the back side, and remove the fuse.

4. Replace it with new one.

5. Turn the fuse holder, and install the fuse.



7-3 Obtaining Backup Data

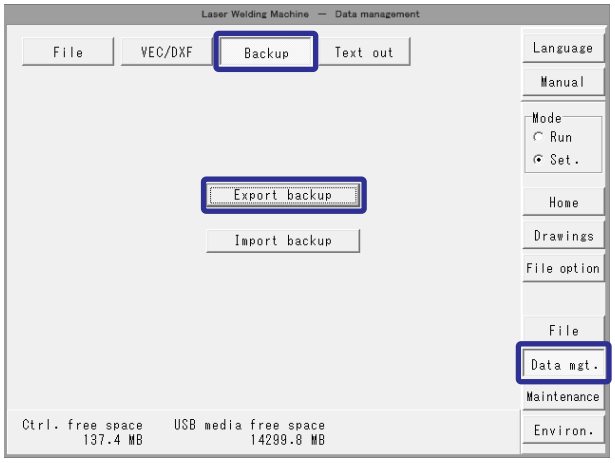
Data in the laser welding machine can be backed up and restored to the other laser welding machine.
Obtain and keep a backup of data registered in the laser welding machine periodically in case of replacing laser welding machines for repairing and maintaining purposes.

■ Steps for obtaining backup data (daily maintenance)

1. Select the screen mode to “Set”.

2. Insert a USB memory to the controller of the laser welding machine.

3. Click “Data mgt.” on the right menu and click “Backup”.



4. Click “Export backup”.

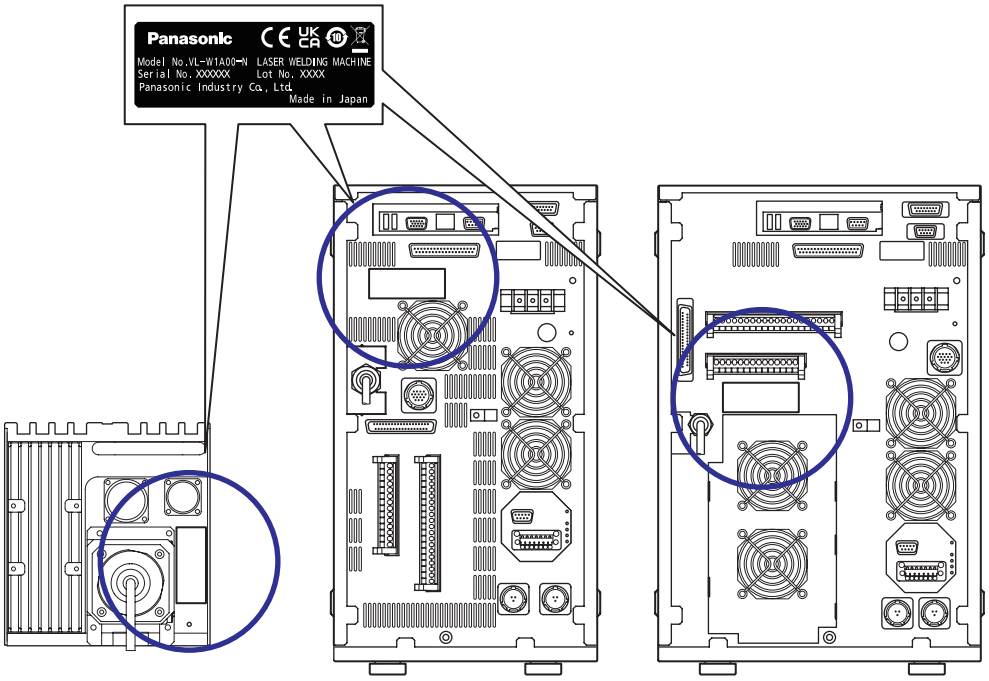
5. Input the backup name, and then click “Set”.

7-4 Serial No. Checking Method

Notify our sales office or representatives of the laser processing welding serial No. for inspection or repair.
The head and controller is delivered with the same serial numbers.

■ Check it on laser welding machine

The serial No. of the laser welding machine is written on the area marked by a circle in the figure below.



Rear of head

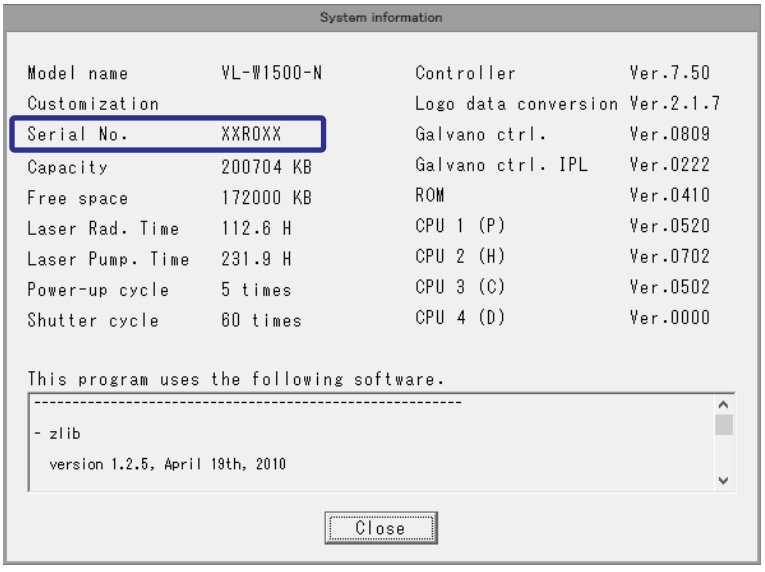
Rear of controller

VL-W1500-N, VL-W1506-N

VL-W1A00-N, VL-W1A06-N

■ Check it on environment setting screen

Click “Environ.” on the right menu and click “System info”.
The serial number of the controller is displayed on the screen.



7-5 Disposal of Laser Welding Machine

To dispose of the laser welding machine, in accordance with the regional regulation, please request the industrial waste disposer. Dispose of the laser welding machine as industrial waste, and never discard it with regular trash.

Notice

- Be sure to delete all registered data when transferring or discarding the laser welding machine. Retained data might result in illegal read out and leaking of information by a third-party with malicious intent.

■ Disposal of old equipment and batteries

Only for European Union and countries with recycling systems



These symbols on the products, packaging, and/or accompanying documents mean 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 applicable collection points in accordance with your national legislation.
By disposing of them correctly, you will help to save valuable resources and prevent any potential negative effects on human health and the environment.
For more information about collection and recycling, please contact your local municipality.
Penalties may be applicable for incorrect disposal of this waste, in accordance with national legislation.



Note for the battery symbol (bottom symbol)
This symbol might be used in combination with a chemical symbol. In this case it complies with the requirement set by the Directive for the chemical involved.

■ Detaching method of batteries

In case of disposal of this product in the European Union, remove the battery with the following procedures and segregate it properly in accordance with the EU Battery Directive (2006/66/EC).

⚠WARNING	• When detaching the exhausted battery, be sure to disconnect the AC power cable so that the power cannot be supplied to the device. There is a risk of electrical shock.

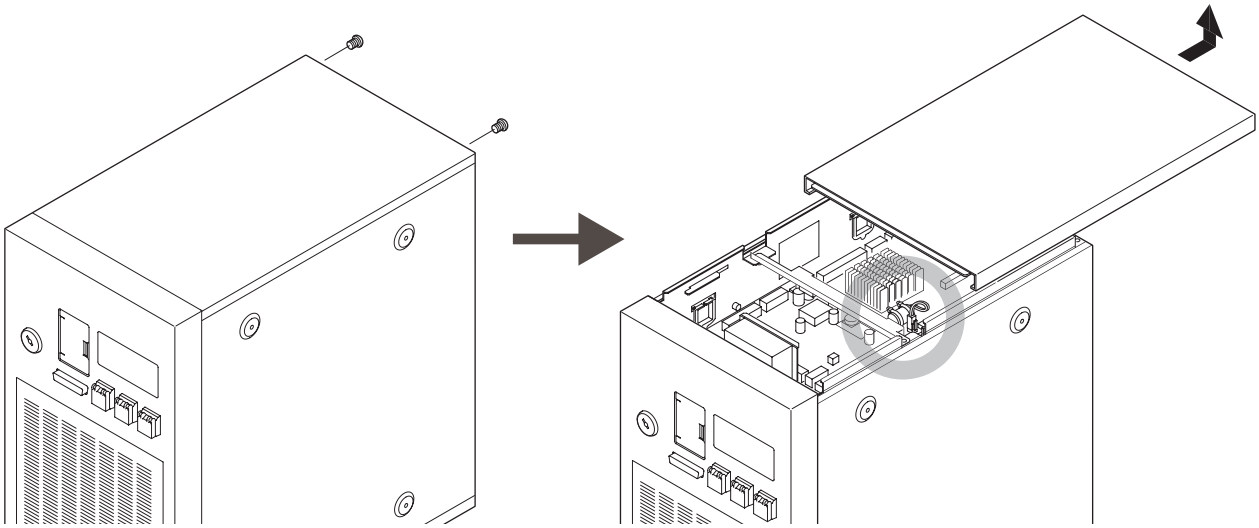
Notice

- This method is never described with the replacing method of the battery. The customer should call our service representative to replace the battery.

1. Remove the top cover of the controller.

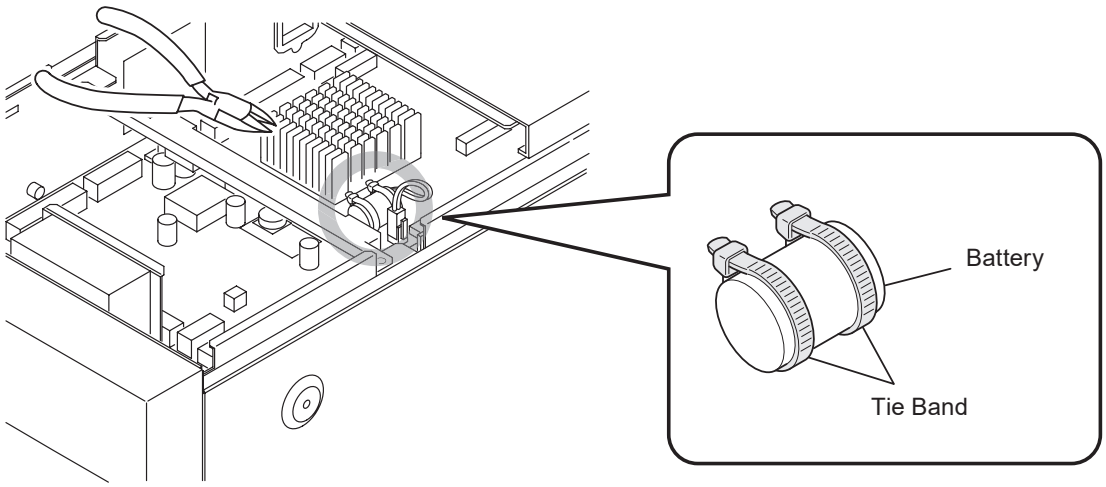
Remove 2 screws of the top cover as shown in the figure below, and then slide the cover backward.

After removing the cover, the battery is installed in the position as shown in the right figure below (surrounded with circle).



2. Remove the used battery as shown in the figure below.

Cut 2 banding bands by using the nipper. Then, remove the connector of the battery, and remove the battery from the board.



Troubleshooting

Troubleshooting

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

■ Start-up

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

■ Laser pumping (Laser supply)

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

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

■ Display/Configuration

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

■ Lasing operation

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

■ Lasing quality

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

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

■ External control

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

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

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

Error Indication

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

Alarm

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

■ Release method of alarm

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

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

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

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

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

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

Warning

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

■ Release method of warning

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

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

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

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

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

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MEMO

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