KEYENCE

96M14647

3-Axis UV Laser Marker

MD-U1000 Series User's Manual

Read this manual before using the system in order to achieve maximum performance.
Keep this manual in a safe place for future reference.

Symbols

The following symbols alert you to important messages. Be sure to read these messages carefully.

DANGER	**Indicates a hazardous situation which, if not avoided, will result in death or serious injury.**
WARNING	**Indicates a hazardous situation which, if not avoided, could result in death or serious injury.**
CAUTION	**Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.**
NOTICE	**Indicates a situation which, if not avoided, could result in product damage as well as property damage.**

Important	**Indicates cautions and limitations that must be followed during operation.**
Point	**Indicates additional information on proper operation.**
Reference	**Indicates tips for better understanding or useful information.**

Indicates the reference pages and items in this manual.

Table of Contents

1 Introduction

This User's Manual provides general information regarding installation in order to ensure safe and accurate performance, including I/O connections to external devices and product maintenance.
To configure or operate the laser marker, use the touch panel console (MC-P1) or the laser marker setting software, Marking Builder 3 (sold separately). For more about these operations, see the PDF manual stored in the CD-ROM.
Read this manual before using the product in order to achieve maximum performance.
Keep this manual in a safe place after reading it so that it can be used at any time.

1-1 Precautions

(1) No part of this manual may be reprinted or reproduced in any form or by any means without the prior written permission of KEYENCE CORPORATION.

(2) The content of this manual is subject to change without notice.

(3) KEYENCE has thoroughly checked and reviewed this manual. Please contact the sales office listed at the end of this manual if you have any questions or comments regarding this manual, or if you find an error.

(4) KEYENCE assumes no liability for damages resulting from the use of the information in this manual, item 3 above notwithstanding.

(5) KEYENCE will replace any incomplete or incorrectly collated manual.

1-2 Registered Trademarks

Company names and product names that are mentioned in this manual are registered trademarks or trademark of respective companies.

1-3 Other

We bill at actual cost for dispatching engineers for repairing at domestic remote area or abroad within the term of warranty and limit of warranty coverage. (* However, this is limited to situations when a KEYENCE representative can be dispatched and maintenance is possible.)
After repair, if failure occurs again on the same part, KEYENCE will be liable for six months.

2 Safety Information for MD-U1000 Series

2-1 General Precautions

DANGER	・ **Do not use this product for the purpose to protect a human body or a part of human body.** ・ **This product is not intended for use as explosion-proof product. Do not use this product in hazardous location and/or potentially explosive atmosphere.**
WARNING	・ **If this product is not used as per the stipulations of this company, then the validity of the product guarantee might not be functional.**
CAUTION	・ **At startup and during operation, be sure to monitor the functions and performance of the MD-U1000 Series.** ・ **We recommend that you take substantial safety measures to avoid any damage in the event a problem occurs.**
NOTICE	・ **Do not open or modify the MD-U1000 Series or use it in any way other than those described in the specifications.** ・ **When the MD-U1000 Series is used in combination with other instruments, functions and performance may be degraded, depending on operating conditions and the surrounding environment.**

Important **Do not expose the MD-U1000 Series and peripheral devices to sudden temperature change, as this may cause condensation.**

2-2 Safety Precautions on Laser Product

Laser Specifications

The MD-U1000 Series incorporates a laser. Based on the laser safety requirements specified in IEC60825-1 and FDA(CDRH)21CFR Part 1040.10, this product is classified as Class 4 (marking laser) and Class 2 (guide laser/working distance pointer laser) laser product.
The following is the classification and specifications of the laser.

Class 4 (marking laser)
Class 4 laser is defined as "Laser products for which intrabeam viewing and skin exposure is hazardous and for which the viewing of diffuse reflections may be hazardous. These lasers also often represent a fire hazard."

■ **Laser specifications**

Model	MD-U1000C/1020C
Laser medium	YVO4
Wavelength	355 nm
Maximum output power	10 W
Pulse frequency	CW, 40 to 400 kHz
Pulse width	10 to 100 ns
Laser Class	Class 4 Laser Product (IEC60825-1, FDA(CDRH) Part 1040.10*2)
Visibility	Invisible

*1 The maximum average output power means the maximum value of output that can be output from a laser oscillator itself.
*2 The laser classification for FDA(CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.

■ **MPE / NOHD**

	Standard type	Wide area type
Model	MD-U1000C	MD-U1020C
MPE (mW/cm^2) Maximum Permissible Exposure	1.01	
NOHD (m) Nominal Ocular Hazard Distance	32.27	59.26

* The assumed exposure duration for the determination of MPE and NOHD is 30000 sec.

Class 2 (guide laser/working distance pointer laser)
Class 2 laser is defined as, "Laser products that emit visible radiation in the wavelength range from 400 nm to 700 nm that are safe for momentary exposures but can be hazardous for deliberate staring into the beam."

■ **Laser specifications**

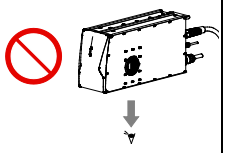
Model	MD-U1000C/1020C
Laser medium	LD (laser diode)
Wavelength	655 nm
Maximum output	1.0 mW
Pulse width	Continuous
Laser Class	Class 2 Laser Product (IEC60825-1, FDA(CDRH) Part 1040.10*)
Visibility	Visible

* The laser classification for FDA(CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.

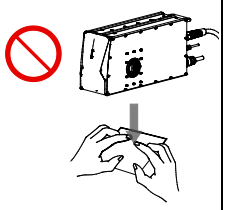
WARNING

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.
Follow the instructions mentioned in this manual. Otherwise, injury to the human body (eyes and skin) may result.

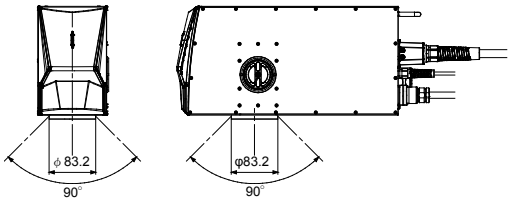
1. Do not expose eyes to laser radiation or diffuse reflection.
   Exposing eyes to laser radiation or diffuse reflection may cause blindness.



2. Do not expose skin to laser radiation or diffuse reflection.
   Be careful that you do not insert a hand or other body part into the marking area during operation. Doing so may cause damage to skin, such as burns.

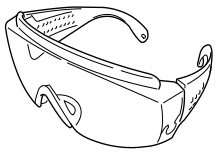


3. While the laser radiation emission warning lights, the area from the center of the window shown below is the hazardous area to which the laser will be emitted. If a part of body or an object catching fire enters this range, eyes or skin may be damaged or fire may be caused. Considering the hazardous characteristic of this range, make sure to cover with an enclosure which has appropriate reflectance and heat characteristic.

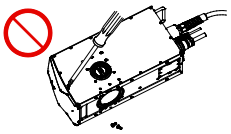


4. Terminating the beam path.
To avoid eye or skin exposure to direct or scattered laser radiation, the laser beam emitted by the MD-U1000 Series must be terminated at the end of its useful path by a diffusely reflecting material of appropriate reflectivity and thermal properties or by absorbers.

5. Wear protective eye goggles appropriate for the laser beam wavelength.
Wear protective eye goggles of which the optical density for the 355 nm wavelength is 6 or more and with which the laser emission warning can be confirmed.
Even when wearing protective eye goggles, avoid eye exposure to direct or scattered laser radiation.

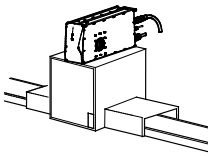


6. Do not disassemble the MD-U1000 Series.
Otherwise exposure to laser radiation and electric shock may result.
The MD-U1000 Series is not under warranty and cannot be repaired if it has been disassembled.

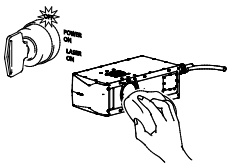


WARNING

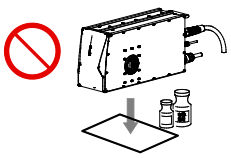
7. Enclose the area to which the laser will be emitted with protective housing.
The protective housing, which has proper reflectance and thermal characteristics, shall be installed to prevent human access to laser beam reflected from the target for marking or the surrounding objects.
Install the MD-U1000 series so that the path of the laser beam is not as the same height as that of human eyes.



8. Be sure to turn off the laser emission and wear protective eye goggles before performing maintenance tasks such as cleaning the window surface.
Otherwise exposure to unintentional laser radiation may result.

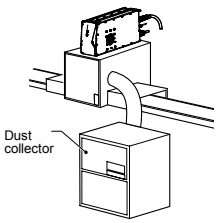


9. Do not use the MD-U1000 Series near flammable materials.
Do not place any flammable objects or gas (organic solvents) near the beam path of the marking laser.
This may cause a fire.



10. Before performing wiring to the power input of the controller, check that the main power supply is off.
Failure to do so may lead to electric shock.

11. Eliminate dust or fumes occurring during marking using an appropriate dust/fume collector to prevent these particles from entering human body. Depending on the marking target material, this may cause damage to human body.
When a dust collector is installed, exercise caution to prevent dust from accumulating in the duct and clean the dust collector periodically.
Accumulated dust may lead to fire or dust explosions.



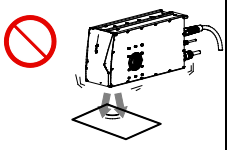
WARNING

12. MD-U1000 series generate unintentional electromagnetic fields that may affect pacemaker function. This product complies with the emission limits according to EN55011, Group 1, Class A equipment. If you use a pacemaker, consult your physician or the manufacturer of your device.

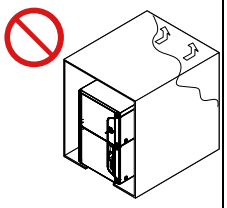
13. Do not use the MD-U1000 Series in any way other than that described in this manual. Otherwise exposure to unintentional laser radiation may result.

14. Do not use this product in the state with external damage.

1. Do not use the MD-U1000 Series in environments where it may be subject to vibrations or shocks. This can cause damage to the optical parts of the marking unit and can result in misprints or low quality markings.

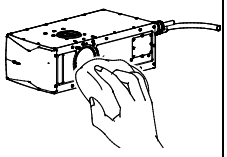


2. When installing the MD-U1000 Series, be sure to allow for the appropriate amount of space and ventilation.
If the marking unit/controller is covered with something, exhaust may cycle into the intake vent. This can raise the inside temperature resulting in reduced laser output and possible damage. Do not place anything directly above the exhaust vent. “5 Hardware Installation” (page 14)



NOTICE

3. Prevent dust or dirt from adhering to the marking unit window. Adhesion of dust or dirt may cause problems such as burning on the window surface, pealing of the coating, and improper marking.
Regularly clean the window by using a blower to blow dust off or by wipe it with a cloth dampened with acetone or ethanol.
“7 Maintenance” (page 29)



4. Be sure to use the MD-U1000 marking unit only with the MD-U1000 controller.
Connecting the marking unit or controller of a model other than the MD-U1000 Series leads to product damage.
Follow the steps below when connecting the MD-U1000 Series to prevent errors due to noise
- Check that the controller input and output connections are performed correctly.
- Isolate the connection cables and external control cables from other power lines. Do not bind them together.
- Use an AC power line just for the controller. Do not use an AC power line that is used by other devices.

5. Do not use the MD-U1000 Series in an environment with large amounts of dust or an oily mist.

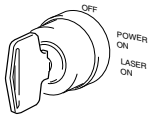
6. The MD-U1000 Series is a precision device. For transportation, be sure to use the packing material used during the shipment from KEYENCE. Otherwise, transportation could cause malfunctions or damage. Keep the packaging materials for future use.

2-3 Functions for Safety Measures

The MD-U1000 Series has the following Functions for safety measures.

■ Key-operated power switch (Key control/Beam stop)

The MD-U1000 Series main unit starts up by turning the key-operated power switch. Pull out the key when the MD-U1000 Series is not being used.



■ Laser radiation emission warning

When the key-operated power switch is turned to [LASER ON], the unit enters a state in which the laser can oscillate, and the laser radiation emission warning lights up. A laser radiation emission warning is located at the top of the marking unit and in front of the controller unit.

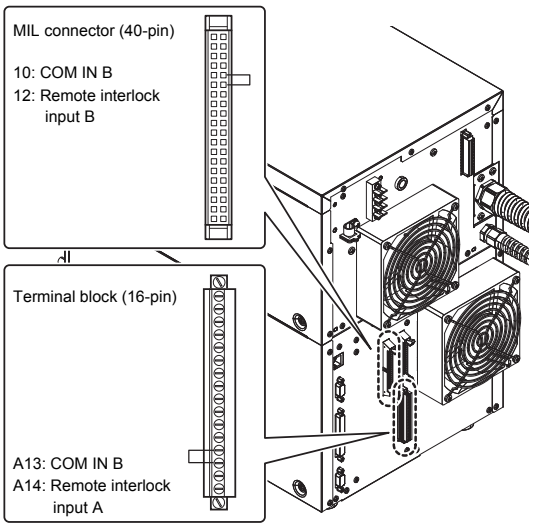
The laser radiation emission warning indicates the statuses as follows:

	Marking unit	Controller
Laser not excited	Off	
Laser excited	Green	Green *1
When the laser excitation completion input contactor control input is off	Off	
When the laser excitation completion input contactor control input is on	Green	Green *1
Laser being emitted	Orange	
Error	Red	
Interlock	Off	

*1 Lights up in green when the key switch is in "LASER ON" state and remote interlock input, laser excitation input, safety input (contactor) are not open.

■ Remote interlock input terminal

As for the remote interlock input, enter it into two circuits of A (terminal A14) and B (terminal 12) simultaneously. This product is designed with the premise that input is made simultaneously on two circuits.
Opening either of the terminals stops laser emissions and stops all marking operations on the MD-U1000 Series.
With both of the terminals short-circuited, turn the key-operated power switch to back to [POWER ON] once, then turn to [LASER ON] again to enable resumption of laser emission.
The terminals are shorted with a metal bar at the time of factory shipment.
This corresponds to the interlock connector specified in the IEC60825-1.



"Control Inputs & Outputs (I/O Terminals)" (page 18)

■ Manual reset

If an error occurs, remove the cause of the error, turn the key-operated power switch back to [POWER ON] once, and then turn it to [LASER ON] again to recover operations.
Recovery can also be achieved by error reset input (terminal block), error reset commands from external communication (RS-232C/Ethernet), or by pressing the [Reset Error] button on "Marking Builder 3" or on the console screen.

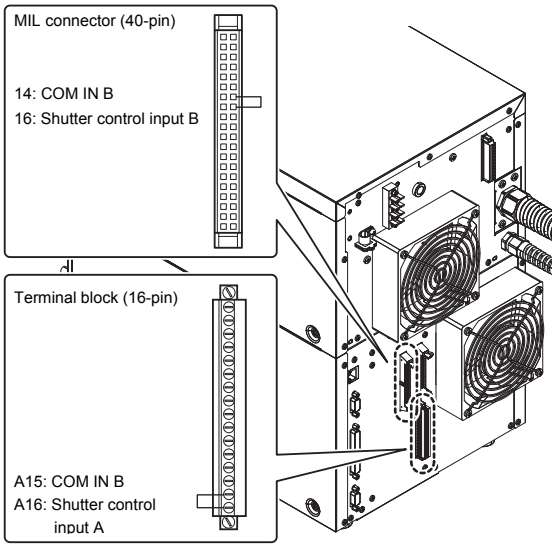
Important **When stopping the laser by power interruption of such as a remote interlock input terminal and instantaneous power failure, be sure to clear an error by manual, without building a system that execute clearing the error automatically after resuming.**

■ Laser shutter measures

Closes the shutter located inside the marking unit, to prevent laser beam emission.

■ Shutter control input terminal

As for the shutter control input, enter it into two circuits of A (terminal A16) and B (terminal 16) simultaneously. This product is designed with the premise that input is made simultaneously on two circuits.
Opening either of the terminals closes the shutter and stops the laser emissions.
Short-circuiting both of the terminals opens the shutter and makes laser emissions possible.
The terminals shorted with a metal bar at the time of factory shipment.
This corresponds to the second interlock connector specified in the IEC60825-1.



"Control Inputs & Outputs (I/O Terminals)" (page 18)

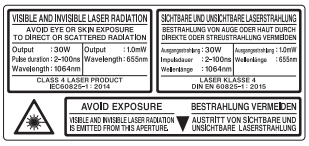
Labels

The following warning/explanatory/aperture labels are attached to the head.
These labels are available in six types: Japanese/Chinese (Simplified), English/German, Chinese (Traditional)/Korean, Italian/French, Thai and Spanish.

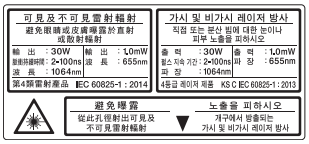
■ Warning/Explanatory/Aperture label

Japanese/Chinese (Simplified)

English/German



Chinese (Traditional)/Korean

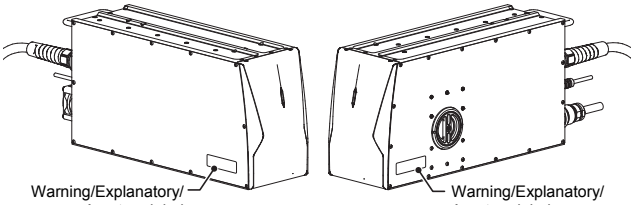


Italian/French

Thai

Spanish

■ Attachment positions



The Japanese/Chinese (Simplified) and English/German labels have been attached at the locations above before shipment.

▶ Important **Be sure to attach the Warning/Explanatory/Aperture label in the language understandable to operators at the same recognizable locations shown in the figure above.**

Safety Measures

The MD-U1000 Series is a Class 4 laser product. Take all appropriate safety measures.

■ Use of remote interlock input terminal and shutter control input terminal

Connect each input terminal to an emergency master disconnect interlock or to room, door, or fixture interlocks. Connect the remote interlock input to the place where the manual reset is needed, and the shutter control input to the place where it is not needed. As for the remote interlock input (terminal A14 and terminal 12) and the shutter control input (terminal A16 and terminal 16), enter them into two circuits of individual terminals simultaneously.

■ Key operated power switch (Key control)

To prevent operation of the laser system by unauthorized users, the key should be managed by the Laser Safety Officer.

■ Setting the warning indication sign and controlled area

Post a warning sign at the entrance to the area in which the MD-U1000 Series is installed in order to ensure that workers and outsiders are informed about the dangers.

■ Terminating the beam path

Installation must be performed so that it reduces the possibility of unintentional laser radiation on any object, including a target for marking, machine or a part of machine, under normal condition and a foreseeable fault condition.
To avoid eye or skin exposure to direct or scattered laser radiation under these conditions, the laser beam emitted by the MD-U1000 Series must be terminated at the end of its useful path by a diffusely reflecting material of appropriate reflectivity and thermal properties or by absorbers.

■ Eye protection

In the controlled area in which the MD-U1000 Series is installed, wear protective eye goggles, regardless of whether normal use or maintenance, in case of accidental exposure to laser emission.

■ Protective clothing

Laser radiation may cause skin burn or burning of clothing. Wear burn-resistant and temperature-resistant clothing with minimal skin exposure.

■ Appointing a laser safety officer

Appoint a safety officer who has knowledge and experience in handling laser products in order to enforce safety management. The responsibilities of the Laser Safety Officer are as follows:

1. Suggesting prevention measures related to laser emission
2. Setting up the laser controlled area (area in which there is a risk of exposure to laser emission from the laser products)
3. Managing the key for the key-operated power switch
4. Checking the protective equipment and its use
5. Training for operators

3 Precautions on Regulations and Standards

3-1 CE and UKCA Markings

■ CE and UKCA Markings

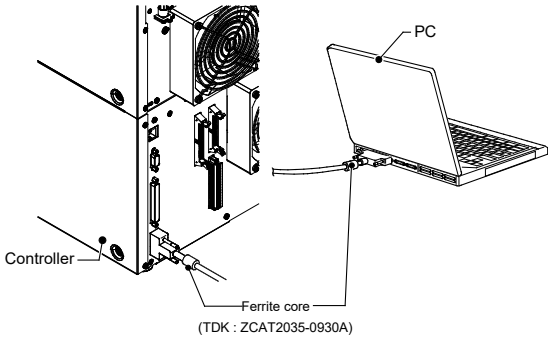
Keyence Corporation has confirmed that this product complies with the essential requirements of the applicable EC Directive(s) and UK regulations, based on the following specifications.
Be sure to consider the following specifications when using this product in a Member State of European Union and in the United Kingdom.

EMC Directive (CE) and Electromagnetic Compatibility Regulations (UKCA)

Applicable Standard
EMI: (BS)EN55011, Class A
EMS: (BS)EN61000-6-2

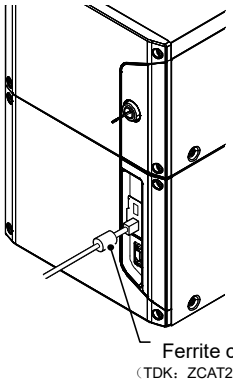
■ RS-232C shielded cable connection

One ferrite core (TDK: ZCAT2035-0930A) must be installed at each end of the RS-232C shielded cable (two in total).



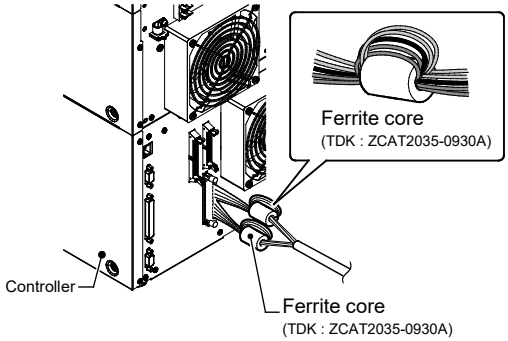
■ USB cable connection

Use the USB 2.0 cable OP-66844 (2 m) and install one ferrite core (TDK: ZCAT2035-0930A) to the controller side.



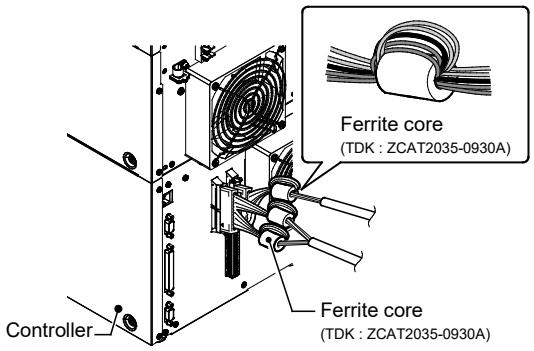
■ I/O terminal block connection

One ferrite core (TDK: ZCAT2035-0930A) must be installed for fewer than 10 non-shielded lines that are connected to the external I/O terminal.



■ Connector (MIL) connection

One ferrite core (TDK: ZCAT2035-0930A) must be installed for fewer than 12 non-shielded lines that are connected to the external I/O terminal.



Use cables shorter than 30 m to connect the controller unit and its external devices.

Important **These specifications do not give any guarantee that the end product with this product incorporated complies with the essential requirements of EMC Directive and Electromagnetic Compatibility Regulations.**
The manufacturer of the end product is solely responsible for the compliance on the end product itself according to EMC Directive and Electromagnetic Compatibility Regulations.

Low-Voltage Directive (CE) and Electrical Equipment (Safety) Regulations (UKCA)

Applicable Standard
(BS)EN60825-1 Class 4 Laser Product
(BS)EN61010-1

■ Installation

- You must perform an appropriate installation of the MD-U1000 Series after conducting a sufficient risk assessment for the target machine.
- The MD-U1000 Series is designed as Class I Equipment. Therefore, be sure to connect the protective conductor terminal on the power terminal block to the protective earthing conductor in building installation.
  Install a multiple-pole switch or circuit-breaker to disconnect from all supply conductors. It should be suitably located, easily reached and marked as the disconnecting device for this product.
  (Recommended breaking capacity: 15A)
- A circuit-breaker suitable for isolation in accordance with IEC 60947-2.
- Use this product at the altitude of 2000 m or less.
- Use this product under pollution degree 2.
- Overvoltage Category II
- Indoor use only

■ Replacing a fuse

The fuse can be replaced in the MD-U1000 Series. When replacing the fuse, use a fuse that meets the following rating and complies with the EU Product Safety Standard.

- Rating : AC250V 10A Time-lug fuse
- Recommended fuse : 0218010.MPX, Littelfuse,Inc.

■ **Laser safety precautions**

Refer to "Safety Precautions on Laser Product" (Page 4) in this User's Manual.
Poisonous gases may be generated depending on the materials to be marked or processed. (*)
Be sure to prepare a dust/fume collector or a similar device in order to fully eliminate dusts or fumes.
Fully purify exhaust gas before emission.
For the regulation on exhaust gas emission, contact a public institution of your country, state, or region.

* Materials to be marked on or processed, and the typical poisonous gases generated
Material name: Generated gas
- Cutting plastics: Aliphatic hydrocarbons, aromatic hydrocarbons, polyhalogenated polynuclear hydrocarbons
- Ceramic processing: Oxides of aluminium

After installation, affix the warning label shown below on the location that can be recognized even from outside the danger zone.

3-2 CSA Certificate

This product complies with the following CSA and UL standards and has been certified by CSA.
- Applicable Standard: CAN/CSA C22.2 No.61010-1, UL61010-1

Be sure to consider the following specifications when using this product as a product certified by CSA.

■ **Installation**

- The MD-U1000 Series is designed as a Class I Equipment. Be sure to connect the protective conductor terminal on the power terminal block to the protective earthing conductor in building installation.
- Use this product at the altitude of 2000 m or less.
- Install a multiple-pole switch or circuit-breaker to disconnect from all supply conductors. It should be suitably located, easily reached and marked as the disconnecting device for this product. (Recommended breaking capacity: 15A)
- In North America, use the round hole power terminal block cover and connect the NPT (National Pipe Thread Tapered) 3/4 type of power connection conduit.
- Use this product under pollution degree 2.
- Overvoltage Category II
- Indoor use only

■ **Replacing a fuse**

The fuse can be replaced in the MD-U1000 Series. When replacing the fuse, use a fuse that meets the following rating and complies with the CSA Product Safety Standard.

- Rating : AC250V 10A Time-lag fuse
- Recommended fuse : 0218010.P , Littelfuse,Inc.

■ **Laser safety precautions**

Make sure to refer to "Safety Precautions on Laser Product" (Page 4) in this manual.

3-3 FCC Regulations

This product complies with the following regulations specified by the FCC.
- Applicable regulation FCC Part 15 Subpart B ClassA

Note:
This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference inwhich case the user will be required to correct the interference at his own expense.

■ **FCC CAUTION**

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

3-4 Best Management Practice for Perchlorate Materials - California only

This product uses components containing perchlorate material. When you ship this product or your endproduct installing this product to California, you must label or mark the following statement on the exterior of all outer shipping packages and on consumer packages or you must include the following statement in an instruction manual or MSDS accompanied with the product.

"Perchlorate Material – special handling may apply, See www.dtsc.ca.gov/hazardouswaste/perchlorate."

3-5 Registration of KC Marking

Class A Equipment
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

A 급 기기 (업무용 방송통신기자재)
이 기기는 업무용 (A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을주의하시기 바라며 , 가정외의 지역에서 사용하는 것을 목적으로 합니다 .

3-6 Standard/Regulation

For precautions on each standard/regulation, see page 8 and 9.

1. The MD-U1000 Series complies with the following EU Directives and EN Standards.

   EU Directives
   - EMC Directive
   - Low Voltage Directive
   - RoHS Directive

   EN Standards
   - EN61010-1
   - EN60825-1 Laser Class4/Class2
   - EN55011 Class A
   - EN61000-6-2
   - EN50581

2. The MD-U1000 Series complies with the following CSA Standards and UL standards and has been certified by CSA group.
   - CAN/CSA C22.2 No.61010-1
   - UL61010-1

   The MD-U1000 Series also complies with the following regulations.
   - 21CFR Part 1040.10 Laser Class4/Class2*
     * The classification is based on IEC60825-1 following the Laser Notice No.50 from FDA (CDRH).
   - FCC Part 15B Class A Digital Device
   - ICES-001 Class A ISM equipment

4 Preparing the Equipment

4-1 Preparing the Hardware

Checking the Package Contents

The MD-U1000 Series includes the following items. Check the contents before using the system in order to ensure optimum performance.

☐ Laser marker unit…1

NOTICE	**The marking unit cannot be separated from the controller. Disconnecting the fiber cable/Q-switch cable by force may cause malfunction.**

☐ Key …2

☐ Marking unit control cable …1

☐ Round hole power terminal block cover …1

☐ User's Manual …1 (Japanese/English/Chinese/German)

☐ PDF manual …1 (Japanese/English/Chinese/German /Korean/French/Spanish/Italian/Thai)

☐ Warning/Explanatory/Aperture label set …1
Japanese/Chinese (Simplified), English/German, Chinese (Traditional)/Korean, Italian/French, Thai, and Spanish

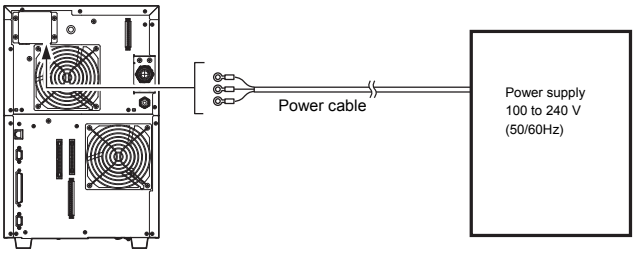
☐ Generated material warning label …1

* We have thoroughly inspected the package contents before shipment. However, in the event of missing or broken items, please contact your nearest KEYENCE office.

Required Materials

This section explains the cables and computer software that are required when connecting the MD-U1000 Series to a computer, a touch panel console, or commercially available VGA display monitor and mouse.

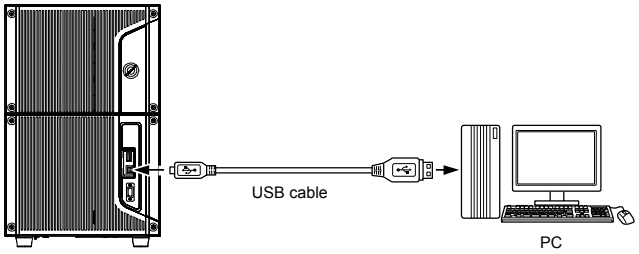
■ Power cable for power input to the controller



Connect the rated cable to power supply sources that meet the following specifications for MD-U1000 series.

- MD-U1000 Series: Single-phase AC100 to 240 V ±10% 50/60 Hz, Max. 800 VA

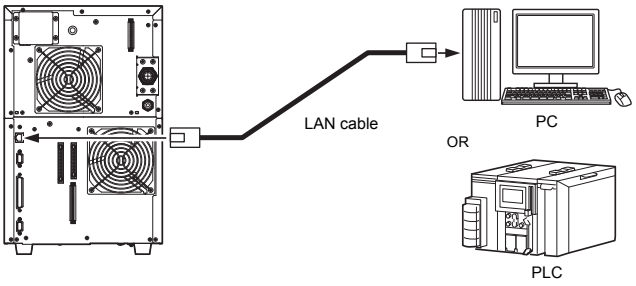
■ USB cable (When using a computer with Marking Builder 3 software installed.)



Important **The USB connector port complies with Ver. 2.0 specifications. Purchase a USB 2.0 compatible cable.**

Reference **The USB cable OP-66844 (2 m) is available as an option.**

■ LAN cable (When using a PC (Marking Builder 3) or when controlling the MD-U1000 Series via an external device such as a PC or PLC)

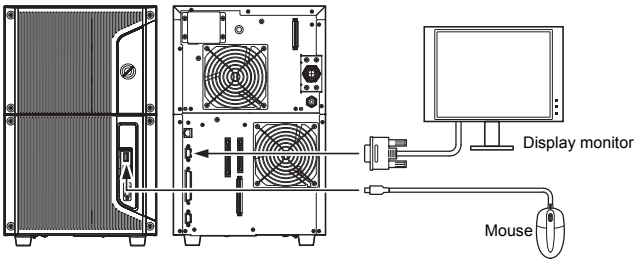


Important **Either of a cross cable or a straight cable can be used for the LAN cable.**

■ Display monitor (VGA) and mouse

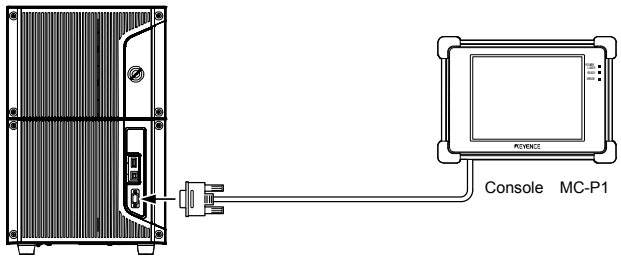
A display monitor (VGA, 640 x 480 pixels or more) and a USB mouse can be connected to the controller.
The operations equivalent to those of MC-P1 can be performed with a display monitor and a mouse.
Connect the display monitor via the monitor cable (with VGA D-sub15-pin (protruding) terminal).

Important
- **When connecting the mouse and the commercially available display monitor, be sure to check the operation beforehand.**
  *** Operation confirmed, recommendable mouse: OP-87506**



NOTICE	**Do not connect a commercially available display monitor to the console terminal on the front panel of the controller. Doing so may damage the display monitor and the controller.**

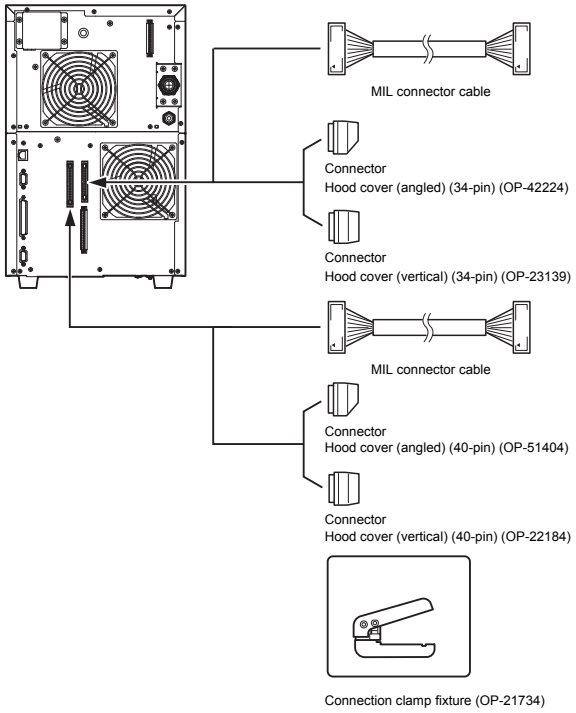
■ **Touch panel console (optional)**



■ **Connecting the MIL connector**

The controller comes with 40-pin and 34-pin MIL connectors (protruding).
When connecting the device, use the MIL connector cable and harness (commercial products) or the connector (depressed) (optional) with the clamping fixture (optional).

Reference **The connector and clamping fixture are available as options.**



Selection and installation of illumination

The built-in camera of the marking unit can be used for monitoring of the marking surface or reading 2D codes.
Prepare an additional light source to ensure sufficient brightness for capturing images of or viewing the target surface.

Computer Software (sold separately)

This section explains about the types of computer software available for use with the laser marker.

■ **Types of software**

When configuring or operating the laser marker with a computer, the "Marking Builder 3" software is required.
The software also includes optional add-on tools for each type of function depending on the application.

Reference **The optional add-on tools cannot be used if the " Marking Builder 3" software is not installed.**

PC software

- Laser Marker Setting Software " Marking Builder 3" (MB3-H2D4-DVD)
  2D settings can be configured on the laser marking base software.

Add-on tool software

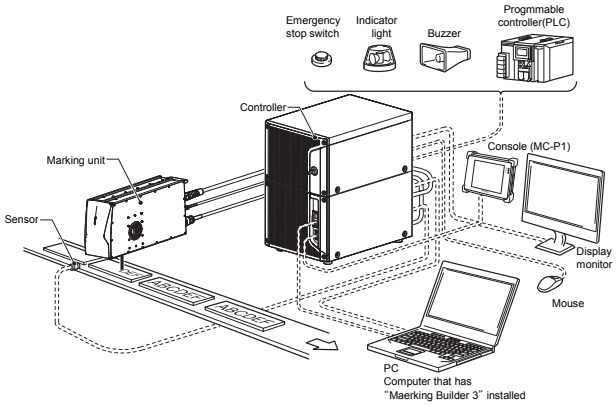
- 3D editing tool (MB3-H3D1)
  Adds 3D basic settings and a Z-MAP transformation tool (Z-MAP Creator) to "Marking Builder 3".
- 2D coder reader add-in tool (MD-XAD1/MD-XAD1A)
  Adds 2D code reader functionality to the controller by using the "Marking Builder 3".

Important **Select MB3-HA1U when using the 2D code reader add-in tool in North America.**

System Configuration

The minimum system configuration is as follows:

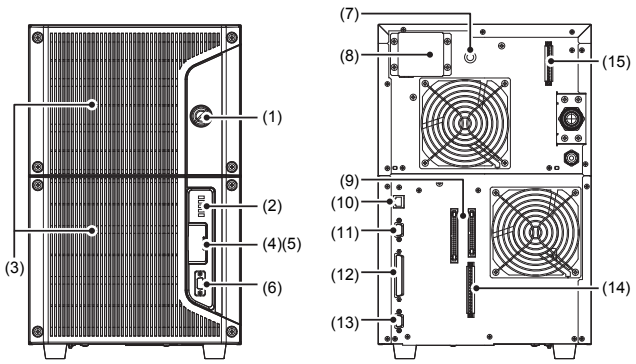
- Controller/Marking unit
- Personal computer, the console (MC-P1), or a commercially available display monitor (VGA) and a USB mouse
  * The operations equivalent to those of console can be performed.
- Sensor to provide an input signal for starting the marking operation (or a device that has an equivalent function)
- When the moving speed of workpiece is not constant at On-the-fly Marking, the encoder is required.



4-2 Part Names

This section describes the part names and functions of the MD-U1000 Series.

Controller



(1) Key operated power switch

Used to turn on/off the controller unit and the marking unit.

(2) LED

Indicates operation status.

- POWER Illuminates green when the power is ON.
- LASER Laser radiation emission warning. Illuminates green when the key-operated power switch is set to the "LASER ON" position.
- READY Illuminates green when marking is possible. Flashes orange when the system is starting.
- ERROR Illuminates red when an error occurs. Flashes red when a warning occurs.
- USB Illuminates orange while the controller is accessing a USB memory.

(3) Air filter

(4) USB port (A connector)

The terminal is used to connect USB media, mouse or barcode reader.

- Connect a commercially available USB medium to register data into the laser marker or to back up the data in the laser marker.
  * Operation confirmed, recommendable USB medium: OP-87502 (1 GB)
- Using a USB mouse and a commercially available display monitor allows the same operation as the MC-P1.
  * Operation confirmed, recommendable mouse: OP-87506
- When connecting to barcode reader, set the barcode reader keyboard type to "DOS/V" and then connect it. Send communication commands from barcode reader, then control the controller.
  * Operation confirmed, recommendable barcode reader: HR-100

(5) USB port (B connector)

Connect to a computer that has " Marking Builder 3" installed.

(6) Optional console connector

Connect the MC-P1 console to this connector.

(7) Fuse (Time-lag fuse 250V, 10A)

(8) Power terminal block

(9) Controller I/O connector (MIL)

For connecting devices such as sensors, encoders, or programmable logic controllers.

(10) RJ-45 (Ethernet) connector

Can perform Ethernet communication with an external device such as a PC or PLC. Also, operation is possible after connecting to a PC in which " Marking Builder 3" has been installed.

(11) Monitor connector (D-sub 15-pin (depressed))

Connect a monitor equipped with the VGA terminal.

(12) Marking unit control connector

Connect the marking unit with the marking unit control connector.

(13) RS-232C serial port (D-sub 9-pin (protruding))

Connect a personal computer or a programmable logic controller to this port for external control.

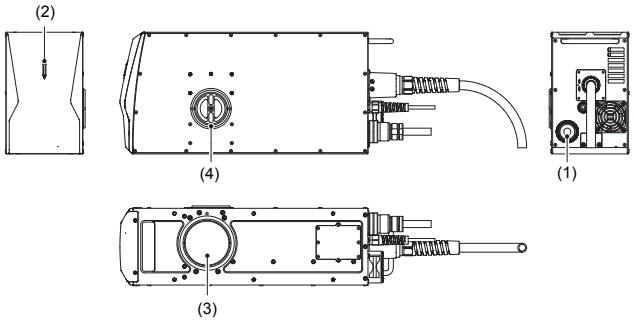
(14) Controller I/O terminal block

For connecting devices such as sensors, encoders, or programmable logic controllers.

(15) Contactor control terminal block

Used to control the marking laser output externally from a connected safety controller, etc.

Marking unit



(1) Marking unit control connector

Connects the controller to the marking unit control cable.

(2) Laser radiation emission warning

Indicates the status of laser emission.
(For details, refer to "2-3 Functions for Safety Measures" on page 6.)

(3) Window

The laser beam is concentrated and emitted from this window.

(4) Dry agent replacing cap

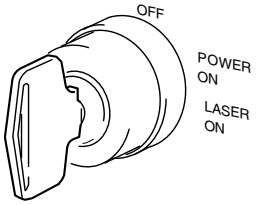
It is open when the dry agent inside the marking unit. Replace the dry agent once a year.

4-3 Turning Power ON/OFF

This section describes turning the power on and off, and starting up the system.

Turning Power ON/OFF

Use the key-operated power switch to turn the power ON/OFF.



- Turning power ON: Turn the key-operated power switch to the [POWER ON] or [LASER ON] position.
- Turning power OFF: Turn the key-operated power switch to the [OFF] position.

Important **When turning the switch from the [POWER ON] position to the [LASER ON] position, briefly pause for at least one second at the [POWER ON] position before turning to [LASER ON]. If the switch is turned too quickly, the ERROR LED will light.**

There are two different power-on states: POWER ON and LASER ON.

Key-operated power switch position	Power	Connection with PC	Marking Laser output	Guide Laser Distance Pointer
POWER ON	ON	ON	OFF	OFF
LASER ON	ON	ON	ON	ON

Starting Up the System

Turn the key-operated power switch to the [POWER ON] position. The system will start in about 20 seconds.
Once the key-operated power switch is turned to the [LASER ON] position, the temperature adjustment starts. After the adjustment is complete, a buzzer sounds three times and the READY output turns on.

Important
- **The temperature adjustment may take 15 minutes or longer when the system is started at a low temperature.**
- **When the program pre-expansion function for the Unit Setup of the controller is on, the expansion of the specified program number starts at the same time as the system startup. Even when the temperature adjustment is complete, the READY output does not turn on until the extraction finishes.**

4-4 Resetting an Error

After removing the cause of the error, perform one of the following operations:

- Turn the key switch to either [POWER ON] or [OFF] once and then turn it back to [LASER ON] again.
- Short-circuit between the error reset terminal (terminal A11) and the COM IN B terminal.
- Error reset commands are sent from the RS-232C/Ethernet communication.
- Click the [Error Reset] button on the "Marking Builder 3" screen or press the [Reset Error] key on the "MC-P1" screen (or press the [Reset Error] key when a commercially available display monitor (VGA) and a USB mouse are used).

Important **When stopping the laser by power interruption of such as a remote interlock input terminal and instantaneous power failure, be sure to clear an error by manual, without building a system that execute clearing the error automatically after resuming.**

5 Hardware Installation

5-1 Installation Environment

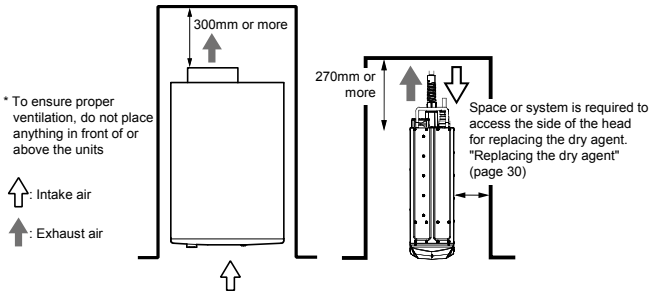
Installation Environment and Clearance Conditions

The MD-U1000 Series should be installed under the following environmental conditions:

Power	MD-U1000 Series: Single-phase AC100 to 240 V ±10% 50/60 Hz, Max. 800 VA	
Environment	Ambient temperature	0 to 40°C
	Relative humidity	30 to 85% RH (No condensation)
	Storage ambient temperature	-10 to 60°C (No freezing)
	Operating environment	An environment where the unit is not subjected to excessive dust particles, oil or liquid mist, rapid temperature changes or strong vibration/shock.

Installation of the controller unit and the marking unit

Install the controller and the marking unit with enough space clearances around them.



NOTICE

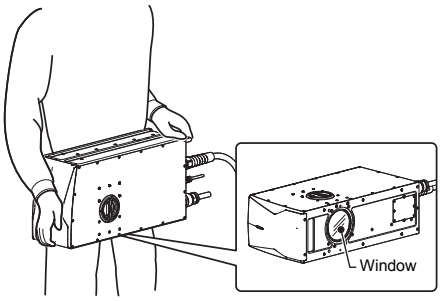
- **Provide at least the minimum space clearances shown in the illustration above. Do not block any ventilation holes of the controller and use it in a well-ventilated environment. If not enough space is provided, the internal temperature rises, weakening the laser power and causing malfunction.**
- **The controller must be installed on a level surface.**
- **Make sure to install the marking unit so the laser radiation emission indicator on the front side of the marking unit can be seen when using with its entire area surrounded. Also, space or system is required to access the side of the head for replacing the dry agent. "Replacing the dry agent" (page 30)**
- **To release heat, install the marking unit on the aluminum plate with the thickness of 10 mm or more or other materials with the equivalent degree of heat dissipation.**
- **The window glass will be cooled due to the air flow around the head, which may cause condensation. Change the air flow, or install the protective glass to mitigate the temperature change.**

5-2 Installing the Marking Unit

Installing the Marking Unit

When installing the marking unit, pay attention to the following points:

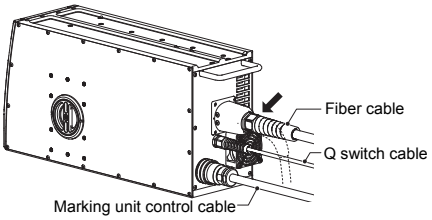
- When carrying the marking unit, hold the handles at the front and rear of the unit and be careful not to touch the window located on the underside.
- Do not carry the marking unit by the fiber cable.



CAUTION

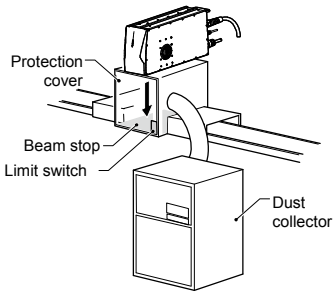
When carrying the marking unit, hold it firmly with both hands. Otherwise, a falling accident may cause injury.

Provide a minimum bending radius of 70 mm for the marking unit control cable and Q-switch cable connected at the rear of the marking unit.
Provide a minimum bending radius of 110 mm for the fiber cable.
The fiber cable of the MD-U1000 series can be bent from the portion as indicated in the following figure:

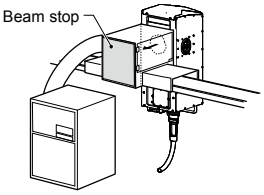


■ **Installation example**

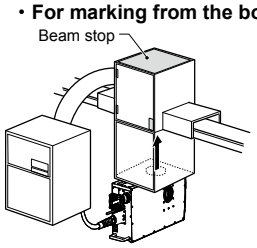
• For marking from the top



• For marking from the side



• For marking from the bottom



WARNING

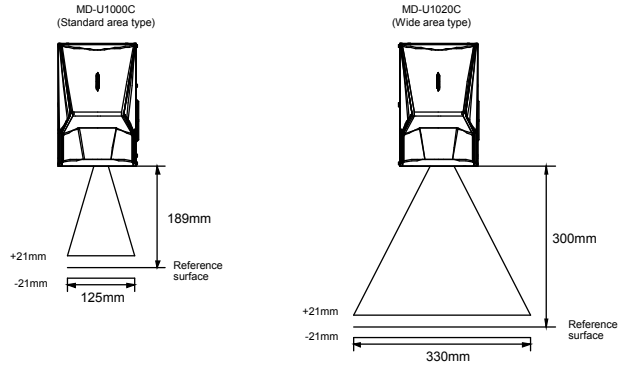
- **The protective housing or others made from metals, which are free from degradation by ultraviolet light and have proper reflectance and thermal characteristics, shall be installed to prevent human access to laser beam reflected from the target for marking or the surrounding objects.**
- **Do not install in such a way that the laser beam passes at eye level when operating this product.**
- **Installation must be performed so that it reduces the possibility of unintentional laser radiation on any object, including a target for marking, machine or a part of machine, under normal condition and a foreseeable fault condition.**
  To avoid eye or skin exposure to direct or scattered laser radiation under these conditions, the laser beam emitted by the MD-U1000 Series must be terminated at the end of its useful path by a diffusely reflecting material of appropriate reflectivity and thermal properties or by absorbers.
- **Provide safety interlock(s) for access panel(s) of the protective housing to prevent human access to the marking laser, if applicable. (e.g. A limit switch which is attached to the access panel with connecting to the remote interlock input terminal or shutter control input terminal)**
- **Thoroughly remove dust or fumes produced during marking using a dust collector, etc. to prevent these particles from entering human body.**

NOTICE

- **Thoroughly remove dust or fumes produced during marking using a dust collector or other method and prevent these particles from entering inside the marking unit or adhering to the window surface.**
- **When a glass plate is installed between the marking unit and target surface to prevent the window from getting dirty, the laser reflected from the glass surface may damage the optical components inside the marking unit. Be sure to use the optional glass shielding (OP-88240).**
- **Do not use this product in locations where this product is subjected to vibration or impact.**
- **Secure enough space for installation and use this product always in the well-ventilated environment.**
- **Do not use this product in dusty areas or oil-mist environment.**

Marking Area and Working Distance

The marking area and working distance vary depending on the model.

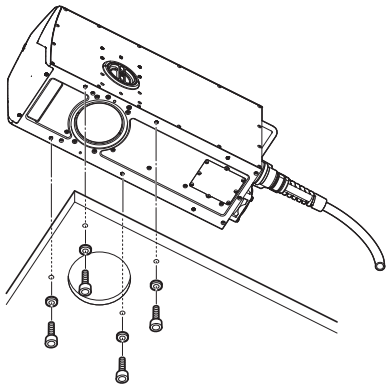


Important

Although the working distance can be adjusted easily with a distance pointer or the automatic focus function, the resulted distance is based on rough estimation.
To adjust the working distance precisely, determine the optimum position by measuring the actual working distance with an instrument or by checking the marking result.

Installing the Marking Unit

The installation of the marking unit is free from orientation constraints, which means that it may be installed vertically, horizontally, or in any desired position. To fasten the marking unit, make sure that you place it on a parallel mount (plate) and fix it with screws in four places or more on the underside plate.

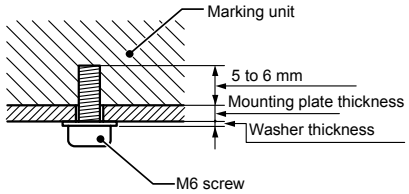


CAUTION

Install the marking unit on the aluminum plate with the thickness of 10 mm or more or other materials with the equivalent strength. Otherwise, a falling accident may cause injury.

■ **Length of mounting screws**

To determine the length of the mounting screws, factor in the thickness of the mounting plate and the thickness of the washer.



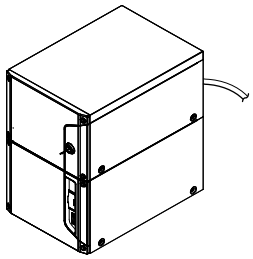
NOTICE

Install the marking unit by tightening the screws with a tightening torque of 2.4 Nm.

5-3 Installing the Controller Unit

Installing the Controller Unit

Vertical orientation is standard for the installation of the controller unit. Do not install the controller unit in a horizontal position.



Vertical-position installation

CAUTION

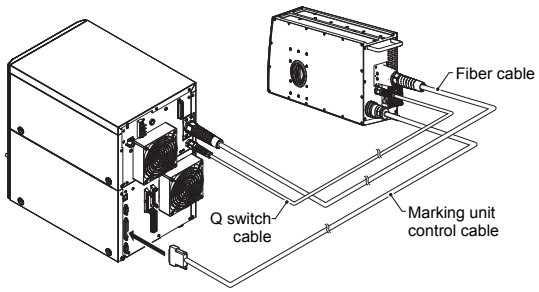
When carrying the controller, hold it firmly with both hands. Otherwise, a falling accident may cause injury.

NOTICE

To secure the controller by using the M4 screws fastening the plastic feet on the controller bottom, check the length of the screws. (Screw depth: 6 mm max.)
Otherwise, the internal components may be damaged.

5-4 Connecting the Hardware

Connecting the Controller and the Marking Unit



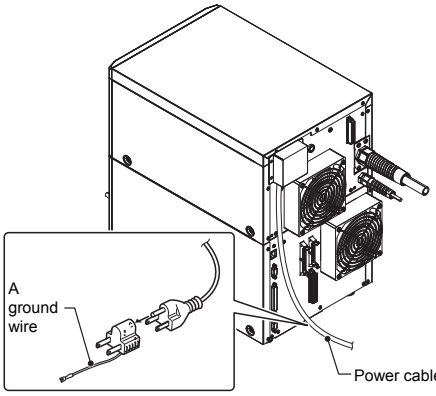
NOTICE

- **Be sure to use the dedicated control cables supplied with the marking unit. Connecting the marking unit or controller with a cable of other models will result in product damage.**
- **After connecting each connection cable, make sure to lock it and confirm it connected securely.**
- **The laser fiber cable and the Q switch cable are connected to the rear of the controller and marking unit. These cables cannot be disconnected. Attempting to disconnect these cables leads to product damage.**
- **Isolate the connection cables and external control cables from other power lines. Do not bind the connection cables together as electrical noise can cause malfunction of the marking or controller unit.**
- **Check that there are no breakage/damage or others by aging degradation or impact on the cable. Otherwise, some accident such as firing or injury or others may result.**
- **When the cable is damaged, do not touch the internal conductor. Otherwise, it may cause an electric shock.**

Connecting the Power Cable

Connect an AC power cable to the controller.
Use a power cable that satisfies the ratings of the controller.

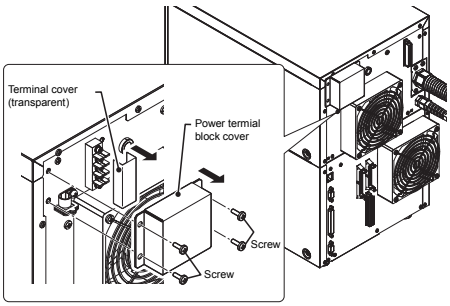
NOTICE	• **Choose a stable power source to ensure that no electrical noise is generated by the power source.** • **If noise is generated by the power source, block it with the use of a noise isolation transformer. Otherwise, it may cause irregularities in marking.** • **Do not connect to three-phase power supply.**



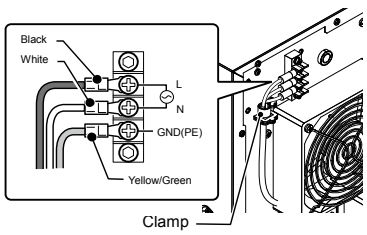
WARNING	**Before connecting the cable, be sure to turn the power source off. Otherwise electric damage or product damage may result.**

Connecting to the power terminal block

1. Remove the power terminal block cover and the terminal cover (transparent).

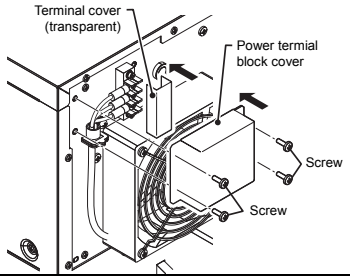


2. Pass the power cable through the clamp and the power terminal block cover, attach the three wires to the terminals, and then tighten the screws.
   Connect the wires of the power cable in the order of the power supply (L, N) and the GND (PE) from top to bottom when the controller is in a vertical position and secure them to the controller with a clamp.

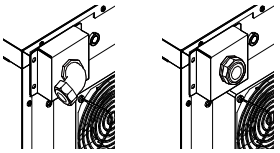


NOTICE	**Tighten the screws for the power terminal block and clamp with a tightening torque of 0.8 Nm.**

3. Set the power terminal block cover and the terminal cover (transparent).



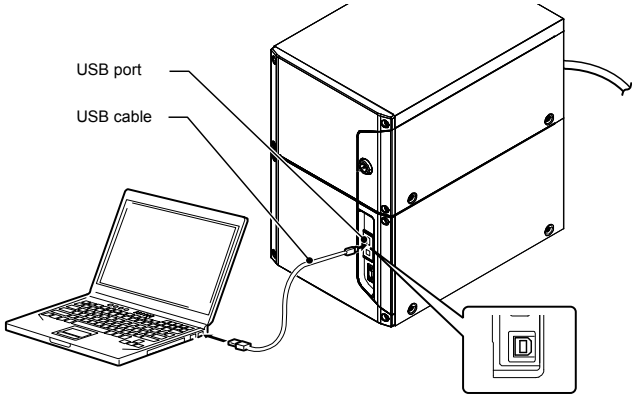
NOTICE	• **Tighten the screws for the power terminal block cover with a tightening torque of 0.8 Nm.** • **In North America, use the round hole power terminal block cover and connect the NPT (National Pipe Thread Tapered) 3/4 type of power connection conduit.**



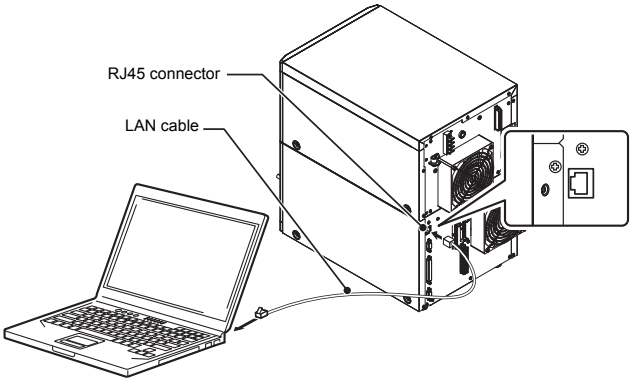
5-5 Connecting a PC with "Marking Builder 3" installed

Connect a PC on which "Marking Builder 3" has been installed to the controller with a USB 2.0 cable or a LAN cable.

USB cable connection



LAN cable connection



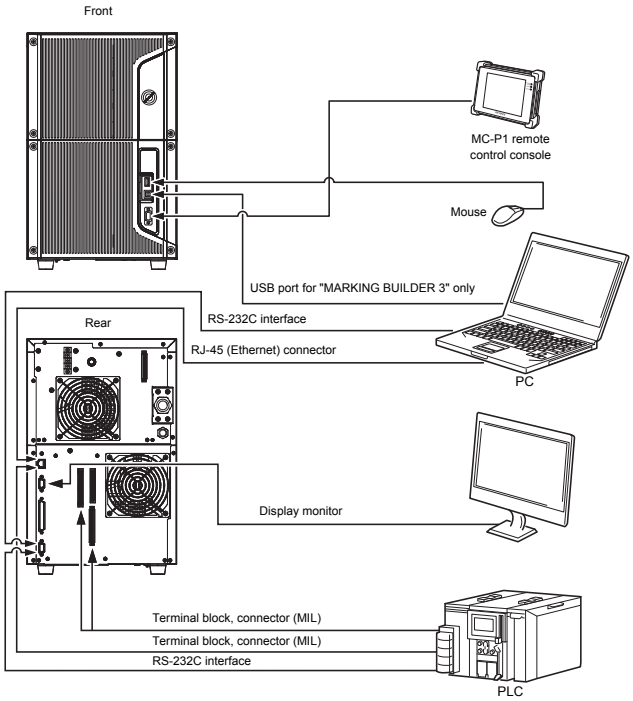
Important	**For LAN connection, use a UTP or STP cable that is category 5e or above.**

MEMO

6 Connection to External Equipment

6-1 External Control System

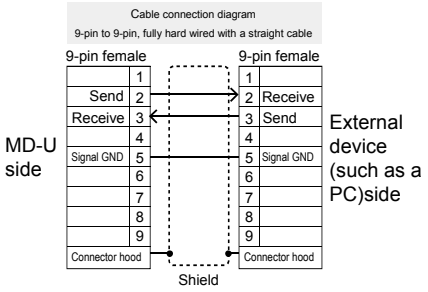
Connecting the Hardware



■ **Interfaces**

1. USB 2.0 port (A, B)
2. Console connector (15-pin D-sub)
3. VGA monitor connector (15-pin D-sub)
4. RS-232C serial port (9-pin D-sub)

The connector on the controller is a D-sub 9-pin (male) type. Connect the controller to an external device using an RS-232C straight cable. The wiring for the controller side and the external device side is shown below.



Important

・Use shielded cables for the communication cables.
・Use #4-40 inch screws to fix the connector to the controller.

5. RJ-45 (Ethernet) connector

■ **Control input-output (I/O terminals)**

1. Connector input-output (MIL 40-pin/MIL 34-pin)
2. Terminal block input-output
3. Contactor control terminal block

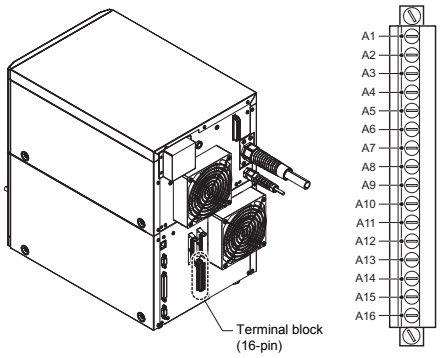
6-2 Control Inputs & Outputs (I/O Terminals)

Important

Do not do preliminary solder on the part of the wire front end treatment connected to the European terminal. A bad connection may be caused because of aging degradation.

Control Input/Output Terminal Block

■ **Terminal Block (16-pin)**



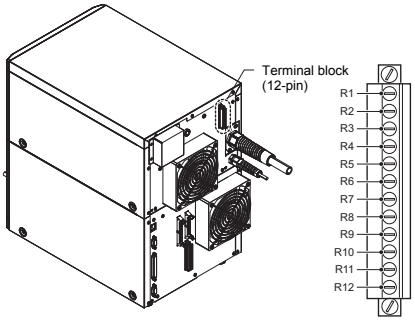
Terminal arrangement of terminal block (16-pin)

A1	+24V	A9	Trigger input
A2	GND for +24 V	A10	Encoder input
A3	Error output	A11	Error reset input
A4	Warning output	A12	COM IN B
A5	Trigger READY output	A13	COM IN B
A6	Marking output	A14	Remote interlock input A
A7	Marking complete output	A15	COM IN B
A8	COM OUT	A16	Shutter control input A

* Be sure to use the GND (pin A2) for +24 V for the GND for 24 V power (pin A1).
* All COM IN B terminals are internally connected.

Contactor control terminal block

■ **Terminal arrangement of terminal block (12-pin)**



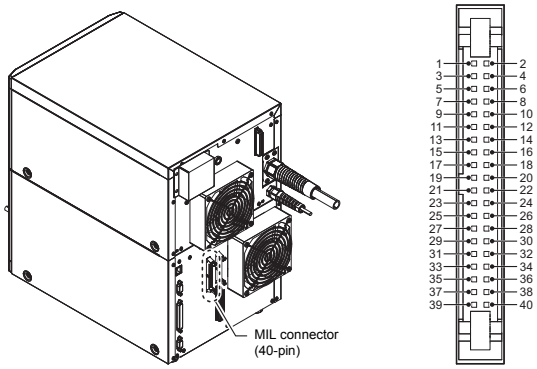
Terminal arrangement of terminal block (12-pin)

R1	24V FOR MAINTENANCE	R7	SAFETY_IN_B
R2	24V FOR MAINTENANCE	R8	SAFETY_COM_B
R3	SAFETY_IN_A	R9	DEVICE_MON_B
R4	SAFETY_COM_A	R10	DEVICE_MON_COM_B
R5	DEVICE_MON_A	R11	COM_R
R6	DEVICE_MON_COM_A	R12	COM_R

* COM_R (R11, R12) terminals are independent of COM OUT and COM IN B terminals of the controller I/O terminal block (16 pin) and MIL terminal block.
* Before shipment, R1-R3, R2-R7, R4-R11 and R8-R12 are short-circuited.
When connecting to an external control device, remove the short harness.

Control Input/Output MIL Connector

■ MIL connector (40-pin)

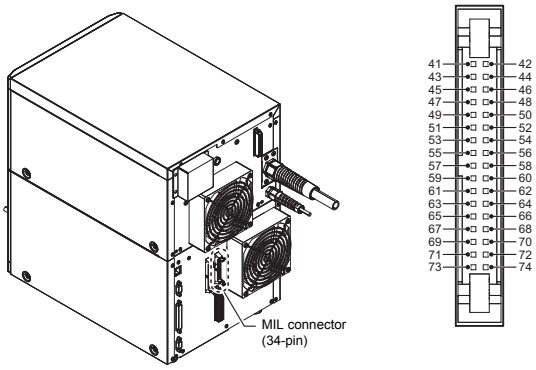


Terminal arrangement of MIL connector (40-pin)

Terminals as seen on the left side		Terminals as seen on the right side	
1	Reserved (input)	2	+24V
3	Reserved (input)	4	COM IN A
5	COM IN B	6	GND for +24 V
7	Not used	8	COM IN B
9	Trigger lock input	10	COM IN B
11	Marking confirmation input	12	Remote interlock input B
13	Error emission detection input	14	COM IN B
15	Guide laser marking input	16	Shutter control input B
17	Guide laser marking output	18	COM IN B
19	Mark./2D Code Check OK Output	20	Laser excitation input
21	Mark./2D Code Check NG Output	22	Not used
23	COM OUT	24	Not used
25	Shutter status output	26	Reserved (input)
27	Not used	28	Not used
29	Reserved (input)	30	Machinery operation mode disable input
31	Reserved (input)	32	Laser control input
33	Not used	34	COM IN B
35	Not used	36	Not used
37	Not used	38	Not used
39	Not used	40	Not used

* Terminals 7, 22, 24, 27, 28, 33, 35, 36, 37, 38, 39, and 40 are not used.
They are not connected internally.
* All COM IN B terminals are internally connected.

■ MIL connector (34-pin)



Terminal arrangement of MIL connector (34-pin)

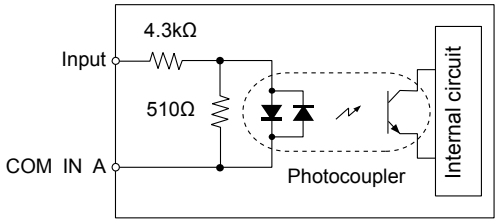
Terminals as seen on the left side		Terminals as seen on the right side	
41	COM IN B	42	Ready For Switch Set. Output
43	Z-axis position fixation input	44	Reserved (Output)
45	Z-axis position control COM	46	Reserved (Output)
47	Z-axis position control input	48	COM OUT
49	I/O specified character confirmation input	50	Date attached output/counter termination output 4
51	Program number confirmation input	52	Counter termination output 3
53	No./Value set input 2^{10}	54	Counter termination output 2
55	No./Value set input 2^{9}	56	Counter termination output 1
57	No./Value set input 2^{8}	58	Laser indicator output
59	No./Value set input 2^{7}	60	Fixed output
61	No./Value set input 2^{6}	62	Reserved (input)
63	No./Value set input 2^{5}	64	Output logic inversion input
65	No./Value set input 2^{4}	66	Current Control Input
67	No./Value set input 2^{3}	68	Date hold input
69	No./Value set input 2^{2}	70	Count-down input
71	No./Value set input 2^{1}	72	Count-up input
73	No./Value set input 2^{0}	74	Counter reset input

* All COM IN B terminals are internally connected.

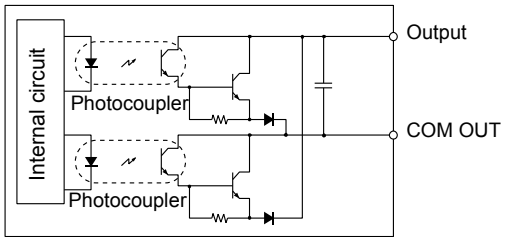
Control Input/Output Specifications

■ Internal circuit diagram

Input: Terminals 2 and 4, and 6 and 8 are shorted, and are compatible with no-voltage input when shipped.
・ Applied voltage: 24 to 30 V



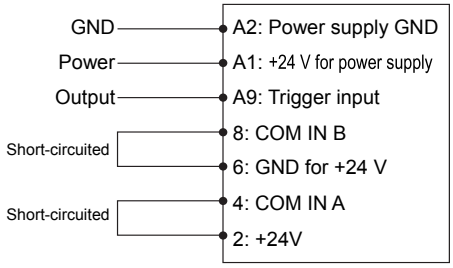
Output: NPN/PNP open collector
- Maximum applied voltage: 30 V
- Maximum sink current: 50 mA



NOTICE	**- The NPN and PNP connection cannot be used together. Use either of NPN or PNP for all connection.** **- Do not short-circuit COM IN A and COM OUT. This may cause a product breakdown.**

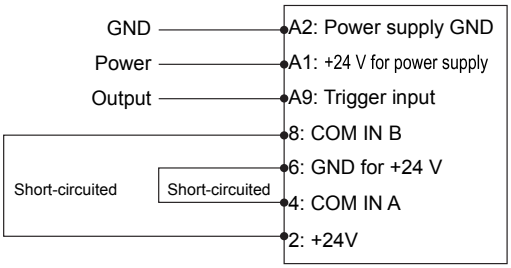
■ Sensor connection example

NPN output sensor connection example



* While using NPN input, short circuit between pins 2-4 and pins 6-8.

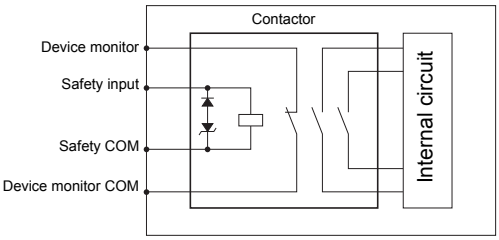
PNP output sensor connection example



* While using PNP input, short circuit between pins 2-8 and between pins 4-6.

Contactor control terminal block specifications

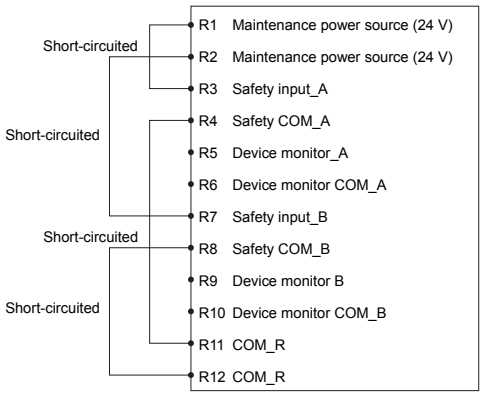
■ Internal circuit diagram



Safety input (Coil)
Applied voltage: 24 VDC (16.8 V to 31.2 V)
Average power consumption: 1.8 W * At power-on and during retention
* Applied voltage for Safety COM

Device monitor (Relay output)
Maximum applied voltage: 30 V
Maximum sink current: 50 mA
Minimum load current: 5 mA
Response time (ON): 100 msec
Response time (OFF): 100 msec
* Chattering will occur due to relay contact.

■ Default state



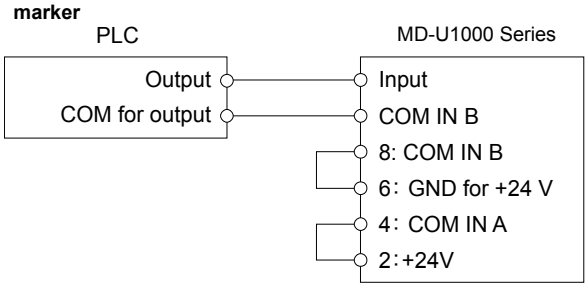
- If voltage application of safety input is interrupted, power supply to the laser oscillator is interrupted and laser emission stops.
- The device monitor status can be checked on the terminal block monitor of MARKING BUILDER2.

WARNING	**- Do not use "24V FOR MAINTENANCE" and "COM-R" terminals except for maintenance of this product. (Disconnect the short harnesses before wiring.) Unintentional laser radiation may occur due to loss of control of the contactor.** **- Do not use "24V FOR MAINTENANCE" and "COM-R" terminals for external devices. This may cause loss of the safety function of the machine to which this product is installed.**

NOTICE	**Do not reversely connect to the safety input terminal. Product failure may occur.**

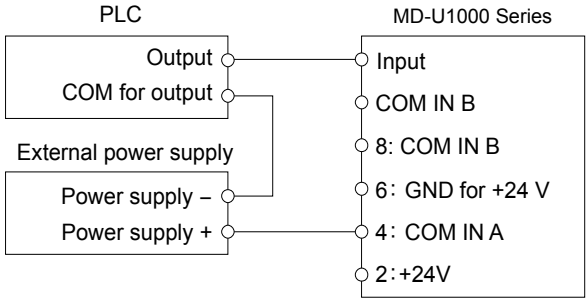
[1] Input Terminal Connections (NPN Method)

(1) Connections that use the internal power source of the laser marker



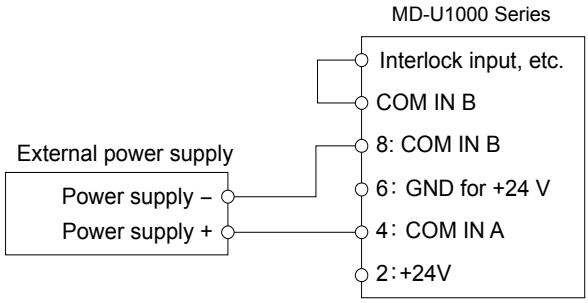
- Short the wiring between pins 2 and 4 and the one between pins 6 and 8.
- COM IN B is shared internally.

(2) Connections that use an external power supply



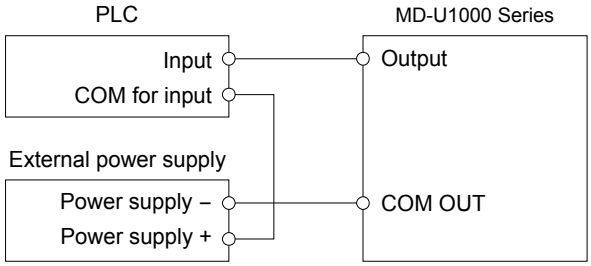
- Remove the factory-default short-circuit wire between pins 2 and 4, and the one between pins 6 and 8.

(3) Connections that use an external power source to keep the interlock, shutter control, and laser excitation input always ON



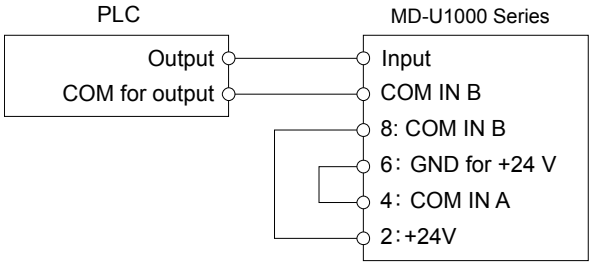
- Short the input that will be always ON with COM IN B. After this, connect COM IN B to the – side of the external power supply.
- COM IN B is shared internally.

[3] Output Terminal Connections (NPN Method)



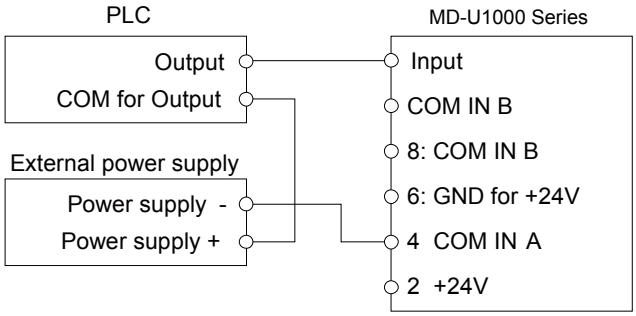
[2] Input Terminal Connections (PNP Method)

(1) Connections that use the internal power source of the laser marker



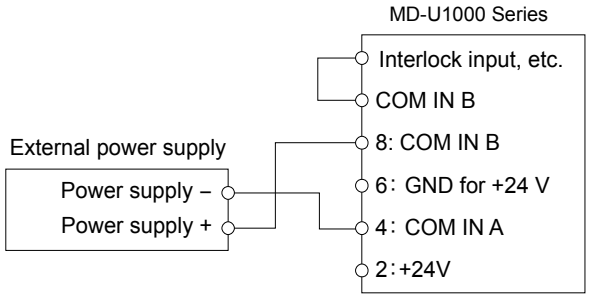
- Short the wiring between pins 2 and 8 and the one between pins 4 and 6.
- COM IN B is shared internally.

(2) Connections that use an external power supply



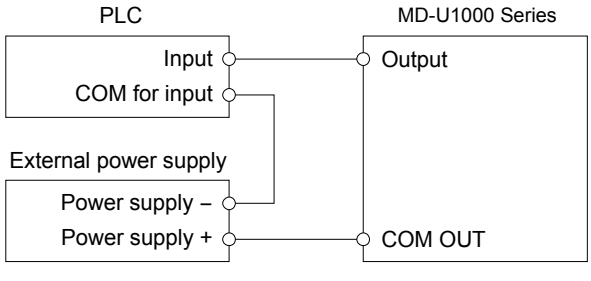
- Remove the factory-default short-circuit wire between pins 2 and 4, and the one between pins 6 and 8.

(3) Connections that use an external power supply to keep emergency stop, shutter control, and laser indicator input always ON



- Short the input that will be always ON with COM IN B. After this, connect COM IN B to the + side of the external power supply.
- COM IN B is shared internally.

[4] Output Terminal Connections (PNP Method)



6-3 Control I/O Signal

Input pulses of 10 ms or longer for the shutter control input A (B) and remote interlock input A (B); and pulses of 1 ms or longer for other input signals (except for the encoder input).
An external device connected to an input must use its open collector (transistor type) output. Use of a mechanical relay can result in contact chatter and may cause a malfunction.

Input signal

■ Terminal block (16-pin) input signal

Terminal No.	Terminal name	Function
A9	Trigger input	Starts marking. Inputs a marking start signal from a sensor or similar device. This input is accepted when the trigger READY output is on.
A10	Encoder input	An encoder should be connected to this terminal when it is used for moving marking. The encoder should be able to generate 30 pulses/mm or greater, and should be used at a maximum response frequency of 100 kHz. Use incremental encoder.
A11	Error reset input	Clears an error condition. When an error occurs, remove the cause of the error, and then input this signal to clear the error. Besides using this method, you can also recover from an error condition by turning the keyoperated power switch back to the [POWER ON] position once and then returning it to the [LASER ON] position, by using the laser marker setting software "Marking Builder 3," or by using the [Reset Error] key on the console (sold separately). You can also clear the error using external communication (RS-232C/Ethernet). This terminal is specified in IEC60825-1 as a manual reset.
A14	Remote interlock input A	Stops the laser emission in an emergency. When this terminal is open, all the laser marking operations are halted immediately. The power supply to the laser is turned off and the internal shutter is closed. This input is shorted with a short harness when shipped. To resume operation, clear the error. This terminal is a remote interlock connector specified in the IEC60825-1.
A16	Shutter control input A	Temporarily stops the emission of marking laser. (The internal shutter closes) Opening this terminal will stop the marking laser output, but will maintain the laser excitation state. If this terminal is opened while marking is in progress, the marking is stopped immediately; and the ready state is resumed as soon as the terminal is shorted. (This input is shorted with a short harness when shipped.) This corresponds to the second interlock connector specified in the IEC60825-1. * Use machinery operation mode disable input (pin 30) when opening and closing the shutter at a high frequency.

■ MIL connector (40-pin) input signal

Terminal No.	Terminal name	Function
9	Trigger lock input	Disables trigger input signals. In the operating mode, the trigger input is disabled while input to this terminal is on. If input to this terminal is turned on during marking, the controller enters the trigger lock state after completing the marking session.
11	Marking confirmation input	Detects if the marking is actually taking place properly. Switches the [Marking Confirmation input] parameter between valid and invalid for "Unit Setup" in "Marking Builder 3" and "SETUP" on the touch panel. An external sensor, like an infrared sensor or thermal sensor, can be used to confirm the emission of the marking laser. The output of that sensor is sent to this input. If no input is received from the time the marking starts to when the marking is complete, an error condition occurs indicating the laser was not emitted during marking.
12	Remote interlock input B	Stops the laser emission in an emergency. The same function as "A14 Remote interlock input A" (This input is shorted with a short harness when shipped.) This terminal is a remote interlock connector specified in the IEC60825-1.
13	Error emission detection input	An external sensor, like an infrared sensor, can be used to confirm the emission of the marking laser. The output of that sensor is sent to this input. If an input is received to this terminal when the marking unit is not marking, an error will occur indicating that the marking laser was detected when it should not have been.
15	Guide laser trigger input	Illuminates the guide laser or distance pointer selected with numeric input.
16	Shutter control input B	Stops the laser emission tentatively. (The internal shutter is closed.) The same function as "A16 Shutter control input A" This input is shorted with a short harness when shipped. This corresponds to the second interlock connector specified in the IEC60825-1.
20	Laser excitation input	Starts laser excitation. When this input is given with key-operated power switch in [LASER ON] position, the laser goes to exited state. This input is shorted with a short harness when shipped.
30	Machinery operation mode disable input	Temporarily stops the emission of marking laser, but the internal shutter remains open. This input is used to stop the laser emission at any position midway through processing a workpiece.
32	Laser control input	Stops the marking laser and guide laser. The internal shutter closes while the laser control input is on.

■ **MIL connector (34-pin) input signal**

Terminal No.	Terminal name	Function
42	Ready For Switch Set. Output	Only turned on when Switch Set, counter UP/DOWN/RESET is available. A5 when it is a setting other than 1 print set in on-the-fly marking settings: synchronize with Trigger Ready and output it.
43	Z-axis position fixation input	Use when the calibration method on the height direction is [External Displacement Sensor].
45	Z-axis position control COM	Special COM terminal for pin 47.
47	Z-axis analog position control input	Moves to the position corresponding to the Z-axis coordinate (±21 mm*1) set by analog voltage. Connect a device equipped with separate analog voltage output. *1 Varies according to setting value of installation position correction. Maximum applied voltage: ±10 V
49	I/0 specified character confirmation input	Confirms the selected I/O specified character. When this terminal is short-circuited, the I/O specified character selected with terminals 63, 65, 67, 69, 71, and 73 is confirmed. This input is accepted when the trigger READY output is on.
51	Program number confirmation input	Confirms the selected program number. When this terminal is short-circuited, setting number selected with terminals 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, and 73 is fixed and changed.
53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73	No./Value set input	Selects (1) program number, (2) counter number, (3) I/O specified character, or (4) guide laser value. (1) Program number selection Select a program number (from 2000 programs at maximum) stored in the controller. The program will be switched to this number when the program number confirmation input on terminal 51 turns on. (2) Counter number selection Select a counter number for which you reset the current counter value or increment/decrement the value. Such counter operations are executed upon the input to terminal 70 (count-down input), 72 (count-up input), or 74 (counter reset input). An individual counter number is specified from 0 to 9, while a common counter number (A-J) is specified from 10 to 19. (3) I/O specified character selection Select an I/O specified character (36 settings at maximum). The character will be switched when the confirmation input on terminal 49 turns on. The number to be selected is represented in binary code, with 1 representing ON (short-circuit) and 0 representing OFF (open). (4) Guide laser type selection Select from 0: Distance pointer, 1: Guide laser (single-time), 2: Guide laser (continuous), 3: Guide laser (area frame), 4: Guide laser (workpiece image), or 5: Guide laser (block frame). Example: Switching the program number to 350 When 350 (decimal) is represented with base 2, the number is 101011110 and so give input as follows. Terminal number…Setting number…Input status 53……..0……..OFF 55……..0……..OFF 57……..1……..ON 59……..0……..OF 61……..1……..ON 63……..0……..OFF Terminal number…Setting number…Input status 65……..1……..ON 67……..1……..ON 69……..1……..ON 71……..1……..ON 73……..0……..OFF
64	Output logic inversion input	The logic of the error/warning output is inversed while input to this terminal is on.
68	Date hold input	When this input is activated, the previous date information will be retained when the internal clock passes 00:00:00 (12:00 AM). The previous date information is retained by subtracting one day off the internal clock.
70	Count-down input	Decrements the selected counter. When this terminal is shorted, the current value of the counter, whose counter number is specified by terminals 65, 67, 69, 71, and 73, is decremented by one. At this time, the current number of mark repetitions is reset to zero. An individual counter number is specified from 0 to 9, while a common counter number (A-J) is specified from 10 to 19.
72	Count-up input	Increments the selected counter. When this terminal is shorted, the current value of the counter, whose counter number is specified by terminals 65, 67, 69, 71, and 73, is incremented by one. At this time, the current number of mark repetitions is reset to zero. An individual counter number is specified from 0 to 9, while a common counter number (A-J) is specified from 10 to 19.
74	Counter reset input	Resets the selected counter. Short-circuiting this terminal resets the current values of the counter numbers selected with Nos. 65, 67, 69, 71, and 73. At this time, the current marking count is reset to zero. Select individual counter numbers with Nos. 0 to 9, and common counter numbers (A to J) with Nos. 10 to 19.

Output signal

■ **Terminal block (16-pin) output signal**

Terminal No.	Terminal name	Function
A1	24 VDC power output	Maximum current output is 0.3 A. * Pin A2 is the dedicated GND for the power 24 V (pin A1) output.
A3	Error output	A signal is output when an error occurs. A signal is output when an abnormal condition occurs or when the remote interlock input terminal is opened. At this time, the internal shutter closes and the [ERROR] LED on the controller unit lights in red. It will be resumed by clearing the error (terminal block input, screen button operation, and key operation) after removing each cause. When stopping the laser by power interruption of such as a remote interlock input terminal and instantaneous power failure, be sure to clear an error by manual, without building a system that execute clearing the error automatically after resuming.
A4	Warning output	A signal is output when a warning occurs. This output can be inversed with the input to terminal 64.
A5	Trigger READY output	A signal is output when the marking unit is ready for marking.
A6	Marking output	A signal is output while the marking operation is in progress. This output remains on from the trigger input to the end of marking.
A7	Marking complete output	A pulse is output the instant the marking operation is successfully completed. The maximum pulse width is 1000 ms*. The instant the next trigger is input during the output pulse, the pulse turns OFF. * The pulse width can be set within the range between 1 and 1000 ms with Marking Builder 3.

■ **MIL connector (40-pin) output signal**

Terminal No.	Terminal name	Function
19	Mark./2D Code Check OK Output	When Marking Confirmation/2D Code Reader function is being used, or when Marking Confirmation/Reading succeeds, it remains on for a certain period of time.
21	Mark./2D Code Check NG Output	When Marking Confirmation/2D Code Reader function is being used, or when Marking Confirmation/Reading fails, it remains on for a certain period of time.
25	Shutter status output	Outputs whether the internal shutter is open or closed. Goes ON when shutter is open.

■ **MIL connector (34-pin) output signal**

Terminal No.	Terminal name	Function
42	Ready For Switch Set. Output	Only turned on when Switch Set, counter UP/DOWN/RESET is available. A5 when it is a setting other than 1 print set in on-the-fly marking settings: synchronize with Trigger Ready and output it.
50	Date attached output and counter termination output	Output can be assigned after selecting from counter termination output and date-attached output. When date-hold input is turned on, date-attached output gives output about 1 second after internal clock of controller passes 00:00:00 and retains the output until date-hold input is turned off.
52, 54, 56	Counter completion output	Gives output at the point of time when counter (individual/common counter) finishes marking the last value. Output is arbitrarily assigned from individual/common counter (0 to 9, A to J) in four kinds of terminals (No.50, 52, 54, 56).
58	Laser indicator output	Gives output when the laser is excited.
60	Fixed output	Gives output at the point in time when switching is completed to the number specified with the program number confirmation input (No. 51), count-up input (No. 72), count-down input (No. 70), counter reset input (No. 74), or I/O specified character confirmation input (No. 49). Also, it is output when the ON/OFF of Current Control Input (No.66) has been incorporated.

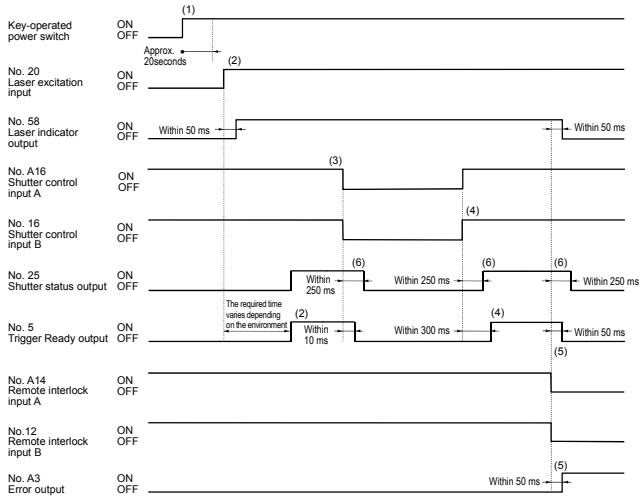
Contactor control Input/Output

■ **Terminal block (12-pin) I/O signal**

Terminal No.	Terminal name	Function
R1,R2	Maintenance power source (24 V)	Power source dedicated for contactor control Power source to forcibly activate the built-in contactor. * Do not use as a power source for an external device.
R3	Safety input A	Stops the emission of marking laser tentatively. If voltage application of this terminal is interrupted, power supply to the laser oscillator is interrupted and laser emission stops. When the terminal is short-circuited again, marking possible status is restored. (Before shipment, it is short-circuited with the maintenance power source (R1 terminal).
R4	Safety COM A	Negative (-) side of Safety input A (Before shipment, it is short-circuited with COM_R (R11 terminal).)
R5	Device monitor A	Outputs during voltage application of Safety input A terminal (Normally closed).
R6	Device monitor COM A	The other side of Device monitor A (Normally closed)
R7	Safety input B	Stops the emission of marking laser tentatively. If voltage application of this terminal is interrupted, power supply to the laser oscillator is interrupted and laser emission stops. When the terminal is short-circuited again, marking possible status is restored. (Before shipment, it is short-circuited with the maintenance power source (R2 terminal).)
R8	Safety COM B	Negative (-) side of Safety input B (Before shipment, it is short-circuited with COM_R (R12 terminal).)
R9	Device monitor B	Outputs during voltage application of Safety input B terminal (Normally closed).
R10	Device monitor COM B	The other side of Device monitor B (Normally closed).
R11,R12	COM_R	GND for the maintenance power source. * This GND is insulated from FG or other GNDs of the device.

6-4 Timing Chart

Start-up Activity



(1) System starts up after about 20 seconds after key-operated power switch of controller is turned to [LASER ON].
(When the program pre-expansion is turned off and a USB memory is not connected)

(2) After the system is started and the laser excitation input is active, the laser excitation output is turned on within 50 ms. The Trigger Ready output will be turned on after the temperature adjustment is completed (the required adjustment time varies depending on the environment) and marking can be started.

(3) When both shutter Control inputs A and B are on (short-circuited), marking is possible.

(4) When Shutter control inputs A and B revert back (short-circuited), Trigger Ready output turns on within 300 ms.

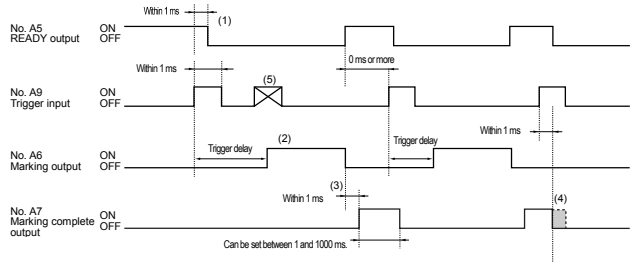
(5) When both remote interlock inputs A and B are ON (short-circuited), it enters startup status. If one of them is turned off (open), all operations are terminated and error output turns on.
The operation can be resumed when the error is cleared.

(6) Chattering may occur on the shutter within 250ms. Design it in consideration of the chattering when using this output to the safety device.

* The cancellation cannot be operated from the remote interlock input A/B falling edge until 2 seconds elapse.

Behavior of Trigger Ready, Ready For Switch Set, Marking, and Marking Complete Outputs in Response to Trigger Input

■ Single-time marking (Stationary marking)



(1) The READY output turns off within 1 ms after the rising edge (turning ON) of the Trigger input.

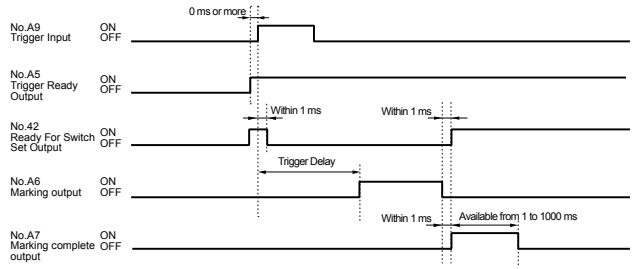
(2) Marking output turns on after trigger delay is completed and turns off after marking is completed.

(3) Within 1 ms after the falling edge (turning OFF) of the marking output, the Marking complete output will be activated for 1000 ms maximum.

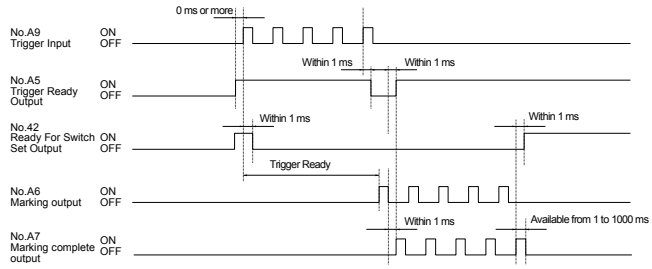
(4) If the Trigger input turns on while the Marking complete output is on, the Marking complete output will be turned off within 1 ms.

(5) The input for starting the marking operation when the Ready output is OFF will be disabled.

■ 1 print is set in on-the-fly marking settings (when interval is long)

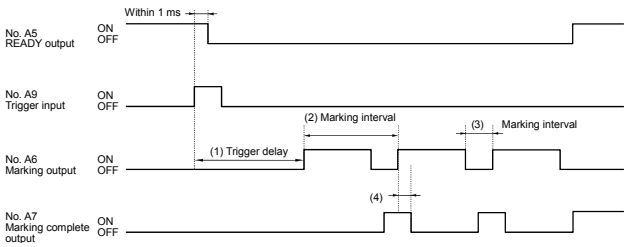


■ 1 print is set in on-the-fly marking settings (when interval is short)



- The trigger input can be received up to five times from the time when a trigger input has been received until the marking is completed. If more than five trigger inputs are stocked, turn off the Trigger Ready Output.
- Ready For Switch Set will not be turned on until the marking completes.

■ Continuous marking (with the number of mark repetitions specified)



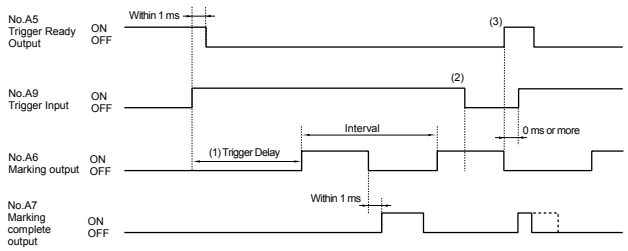
(1) Marking output turns on after the trigger delay has completed and turns off after the marking is completed.
The timing of the second and subsequent markings is determined by the marking interval setting.

(2) Marking interval for on-the-fly marking.

(3) Marking interval for stationary marking (Time: s)

(4) When the marking output is turned on during the marking complete output, it is turned off after "Marking Complete Output Time" for Unit Setup passes.
* The trigger delay varies depending on the settings.

■ Continuous marking (marking during the trigger is on: only valid for on-the-fly marking)



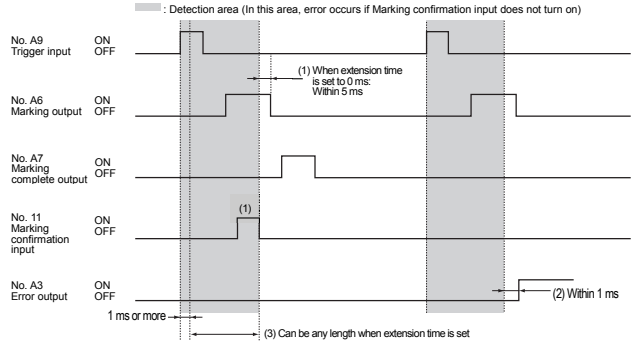
(1) Marking output turns on after the Trigger Delay has completed and turns off after the marking is completed.
The timing of the second and subsequent markings is determined by the marking interval setting.

(2) During Trigger Delay or marking, even when the Start Marking Input is OFF, the marking continues till the end.

(3) After the Trigger input turns off, the timing of turning on Trigger Ready Output becomes the timing of turning off marking output.

Marking Confirmation Input

Detects whether the marking has occurred. Validates or invalidates the [Marking Confirmation input] in the Unit setup for "Marking Builder 3". If setting is [Valid], an external sensor, like an infrared sensor or thermal sensor, detects the laser emission and the output of that sensor is sent to this input.
If this input does not turn on between a trigger input and the next trigger input or within the specified period from a trigger, the marking loss detection error occurs.

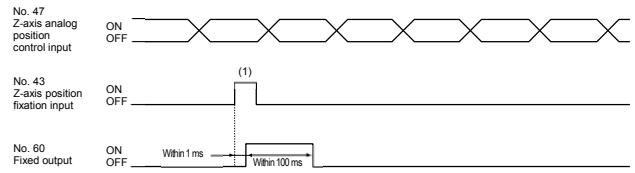


(1) When the extension time setting of the marking confirmation input is 0 ms, no error output occurs as long as the marking confirmation input turns on within the range from 1 ms or more after a trigger input is turned on to 5 ms or less before the marking output turns off.

(2) The error output turns on if the marking confirmation input does not turn on within the range stated in (1).

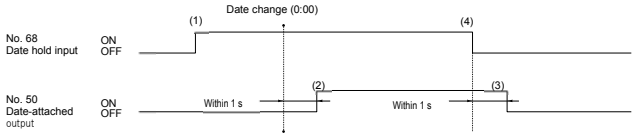
(3) If the extension time setting of the marking confirmation input is set other than to 0 ms, the detection area can be extended up to 255 s.

Z-axis Analog Position Control



(1) When an external displacement sensor has been set, the Z coordinate is determined according to the analog value at the time of the Z-axis position fixation input.
In this case, the trigger READY output does not turn off.

Date Hold and Date-attached Output

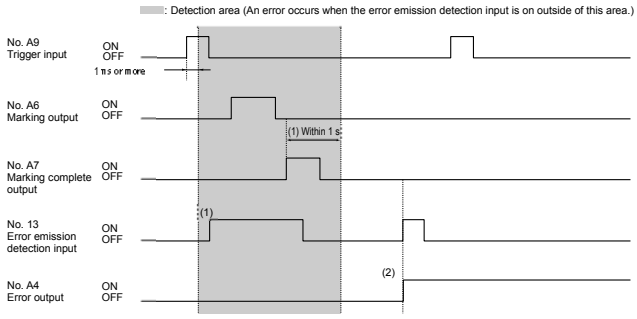


(1) Date hold input is set to ON before date change (0:00). If the date is changed at this time, marking of the previous day is continued.

(2) Within 1 s after the date is changed, date-attached output turns on and the output remains the same.

(3) Within 1 s after date-hold input is turned off, date-attached output turns off.

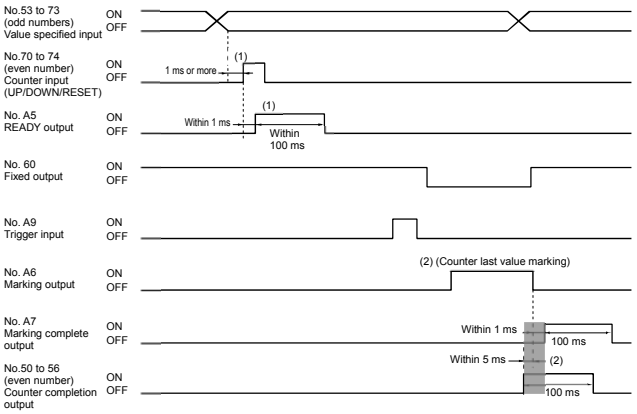
Error Emission Detection Input



(1) Within the detection range from 1 ms or more after the trigger input is turned on to 1 sec or less after the marking complete output turns on, no error output occurs even if the error emission detection input turns on.

(2) Outside the (1) range, when the error emission detection input is turned on, or when the error emission detection input is turned on although it exceeded the (1) range, the error output will be performed.

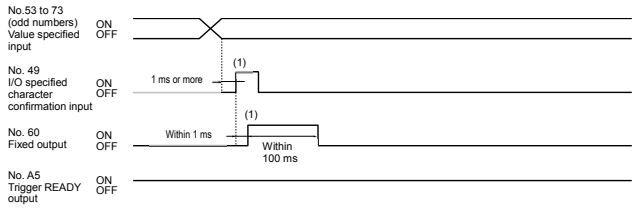
Counter UP/DOWN/RESET Input and Counter Termination Output



(1) After counter number is set, counter UP/DOWN/RESET input is turned on for more than 1 ms. If counter input is fixed, fixed output gives an output of max.100 ms pulse within 1 ms.

(2) Within 5 ms before the marking complete output of the counter last value, or within 1 ms after the marking complete output turns on, counter completed output gives a output of max.100 ms pulse.
* Set in advance the target counter number in I/O of unit setup.

I/O Specified Character Confirmation Input

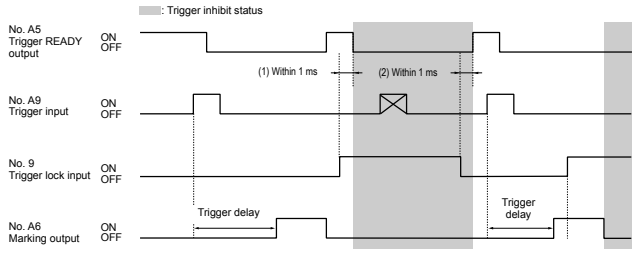


(1) Set the I/O specified character number, wait for 1 ms or more and then turn on the I/O specified character confirmation input.
Within 1 ms after the I/O specified character confirmation input is fixed, the fixed output turns on to output pulses for 100 ms at maximum.

* The I/0 specified character input should be turned on while the trigger READY output is on.

Behavior of Trigger Lock Input

■ Single-time marking

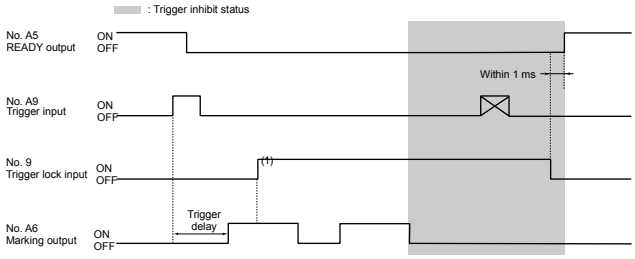


(1) When the trigger lock input is turned on, the trigger READY output turns off within 1 ms and subsequent trigger inputs will be ignored.

(2) When the trigger lock input is turned off, the trigger READY output turns on within 1 ms and then the trigger lock state is cleared.

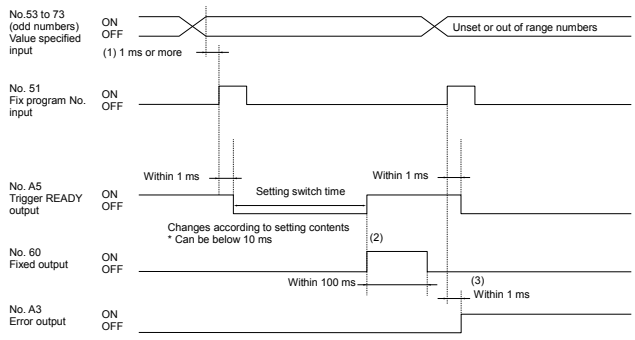
(3) When the trigger lock input is turned on during marking, the marking does not stop. The trigger lock state starts after the marking is completed.
* The trigger delay varies depending on the settings.

■ Continuous marking (with the number of mark repetitions specified)



(1) When the trigger inhibit input is turned on after the trigger input is turned on, the trigger lock state does not start until the marking of the specified number of mark repetitions is completed. The trigger lock state starts immediately after the marking finishes.
* The trigger delay varies depending on the settings.

Behavior of Number/Value Set Input and Program Number Confirmation Input

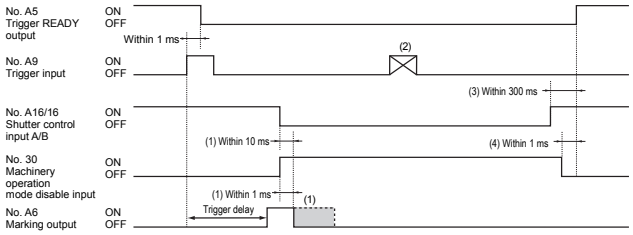


(1) Select a program number, wait 1 ms or more and then turn on the confirmation input.

(2) When the program number is confirmed, the trigger READY output and fixed output turn on simultaneously.

(3) If any Unset or out-of-range number has been selected, fix program No. input causes an error and the Error output turns on within 1 ms. At the same time, the READY output turns off.
Simultaneously, the Ready output turns off.

Behavior of Shutter Control Input/Machinery Operation Mode Disable Input



(1) Marking is discontinued within 10 ms after the Shutter control input turns off (Open). Marking is discontinued within 1 ms after the Machinery operation mode disable input turns on.

(2) While the shutter control input or the machinery operation mode disable input is on, the trigger READY output stays off so that no trigger input is accepted.

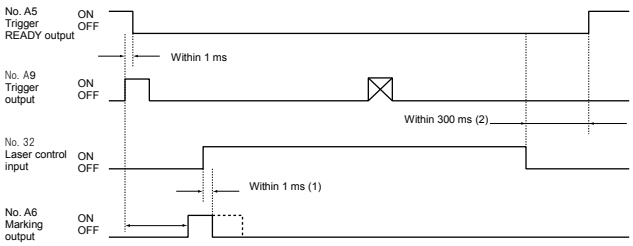
(3) When the Shutter control is reset, the READY output turns on within 300 ms and marking becomes possible.

(4) When the Machinery Operation Mode Disable input is reset, the READY output turns on within 1 ms and marking becomes possible.

Behavior of the Shutter control/Machinery operation mode disable input
- Continuous marking is also discontinued in the same manner.
- The shutter is closed when Shutter control input is turned off and open when the machinery operation mode disable input is turned on.
- The trigger delay varies depending on the settings.
- When [Unit Setup] - [Inverse machinery operation mode disable input] is set to ON on the controller, ON/OFF of the machinery operation mode disable input can be inversed.
- When [Unit Setup] - [I/O Setting] - [Ignore input signals under] is set to 0 ms on the controller, a period from the time when "Machinery operation mode disable input" is turned ON to the time when the laser stops will be within 5 µs.

* The trigger delay varies depending on the settings.

Behavior of Laser Control Input



(1) After the laser control input is turned on, the marking laser and the guide laser are stopped within 1 ms, and the Marking output turns off.

(2) After the laser control input is turned off, the trigger READY output turns on within 300 ms.

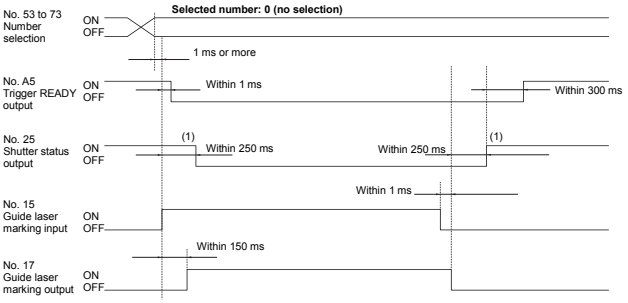
Behavior of the laser control input
- Continuous marking is also discontinued in the same manner.
- The shutter is closed when the marking laser is stopped.

* The trigger delay varies depending on the settings.

* When [Unit Setup] - [Inverse laser control input] is set to ON on the controller, ON/OFF of the laser control input can be inversed.

Guide Laser I/O Behavior

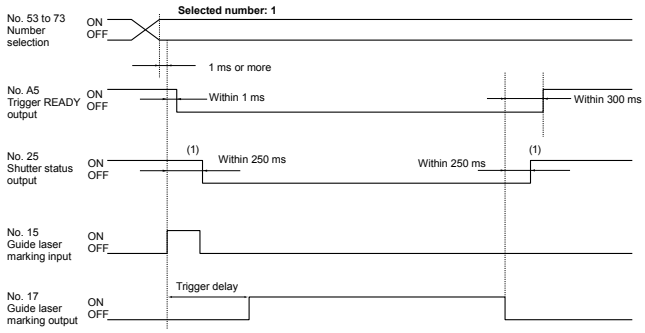
■ Distance pointer illumination



- When the number for the distance pointer is selected, the distance pointer lights up while the guide laser marking input is turned on.

(1) Chattering may occur on the shutter within 250ms. Design it in consideration of the chattering when using this output to the safety device.

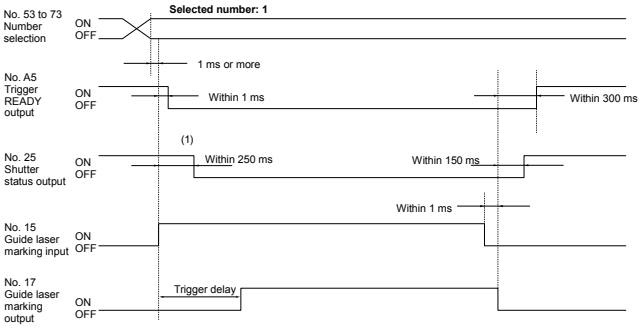
■ Guide laser emission (single-time)



- Invalid when setting on-the-fly marking.

(1) Chattering may occur on the shutter within 250ms. Design it in consideration of the chattering when using this output to the safety device.

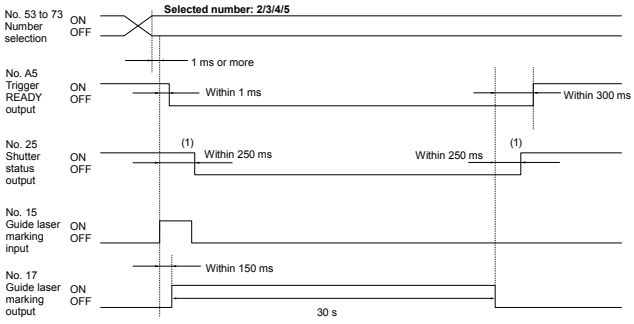
■ Guide laser emission (single-time) (fixed point setting while trigger is on)



- When the fixed point setting while trigger is on is set, the guide laser is emitted while the guide laser marking input is turned on.

(1) Chattering may occur on the shutter within 250ms. Design it in consideration of the chattering when using this output to the safety device.

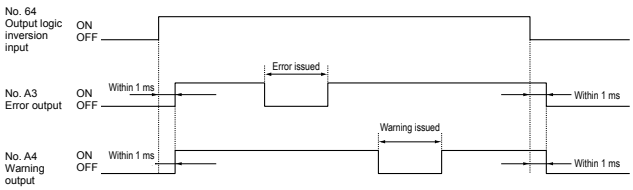
■ Guide laser marking (continuous/area frame/workpiece image/block frame)



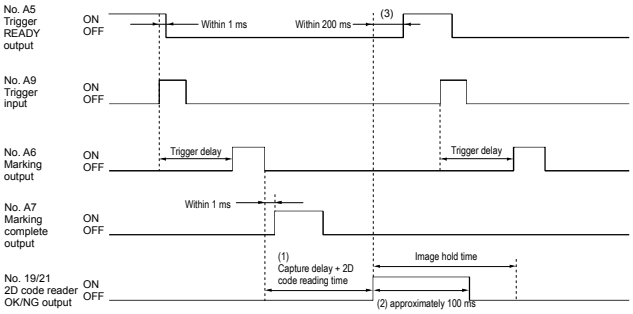
- When the guide laser marking input is accepted, the guide laser marking is continued for 30 seconds.
  To stop the guide laser marking in progress, turn on the laser control input or machinery operation mode disable input.
- Invalid when setting on-the-fly marking.

(1) Chattering may occur on the shutter within 250ms. Design it in consideration of the chattering when using this output to the safety device.

Behavior of Output Logic Inversion Input



Behavior of 2D Code Reader OK/NG Outputs



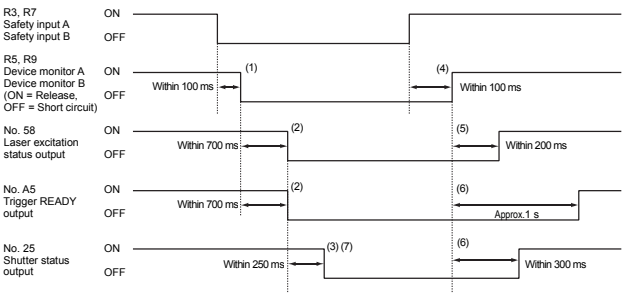
(1) The 2D code reading time varies depending on the coordinates and marking quality of the 2D code to be read.
The period from the marking completion to the reading start can be extended with the capture delay setting.

(2) When 2D code reading finishes, the 2D code reader OK output or NG output turns on to output pulses for approximately 100 ms at maximum.

(3) When 2D code reading finishes, the Trigger Ready Output turns on within 200 ms. If the image hold time has been set, the trigger input is effective even during the image hold time.

* The trigger delay varies depending on the settings.
* The capture delay and image hold time settings can be changed from [Program Setup] - [2D code reader].
* When the continuous marking is set, 2D code reading starts after the final marking.

Contactor control



(1) Device monitor A (B) turns off within 100 ms from the falling edge (OFF) of Safety input A (B).

(2) Laser excitation status output and READY output turn off within 700 ms from the falling edge (OFF) of Device monitor A (B).

(3) Shutter status output turns off within 250 ms from the falling edge (OFF) of Laser excitation status output and READY output.

(4) Device monitor A (B) turns on within 100 ms after recovery (ON) of Safety input A (B).

(5) Laser excitation status output turns on within 200 ms from the rising edge (ON) of Device monitor A (B).

(6) The shutter status output turns on within 300 ms from the rising edge (ON) of Device monitor A (B), and trigger READY output turns on 1 s .

(7) Chattering may occur on the shutter within 250ms. Design it in consideration of the chattering when using this output to the safety device.

* When the controller is in the following conditions, the contactor state cannot be detected.
- Laser not excited (Key-operated power switch: Power On, Laser excitation input: OFF)
- Remote interlock
- Adjusting LD Temperature

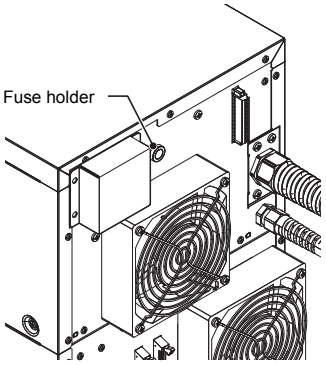
7 Maintenance

7-1 Maintenance Part

WARNING	**Be sure that an engineer with specialized electrical knowledge performs the maintenance described in this chapter. Mistakenly touching high voltage areas may cause an electric shock.**

The table below lists the replacement parts for the MD-U1000 Series.

Part name	Recommended replacement timing
Air filter (OP-87888)	Replace or clean the air filter when dust or dirt has built up on the filter surface. Replace the air filter if torn or damaged.
Marking unit fan (OP-87889)	Replace the fan of the marking unit when it stops operation.
Dry agent for the head (OP-88242)	The expiry date for use of the dry agent is one year. Replace it once a year.
Time-lag fuse	Replace the fuse when blown. ・ Rating : 250 V, 10 A, Time-lag fuse ・ Recommended fuse : 0218010.MXP,Littelfuse,Inc.

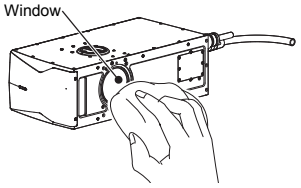


NOTICE	**・ Be sure to use replacement parts specified by KEYENCE. Failure to use the parts specified by KEYENCE can result in damage to the unit. ・ Clean the filter periodically. If the filter is clogged, the internal temperature rises, causing the MD-U1000 Series to malfunction.**

7-2 Maintenance

Cleaning the window

When the window surface of the marking unit becomes dirty, the laser beam transmittance decreases, resulting in faint marking or the absence of marking.
Periodically wipe the window gently with a cloth dampened with acetone or ethanol to remove dirt.



WARNING	**Be sure to turn off the power before cleaning the window. If the laser is mistakenly emitted during cleaning, the laser may enter directly into your or someone's eye, resulting in loss of eyesight.**

NOTICE	**Never use cleaning solutions other than acetone or ethanol to wipe the window. Do not wipe it directly with a dry cloth. Doing so may scratch the lens or remove the protective coating.**

Cleaning/replacing the air filters of the controller

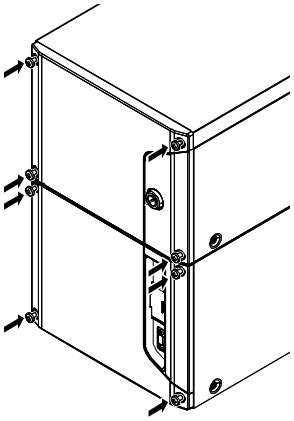
Clean or replace the air filters of the controller periodically.

CAUTION	**Before cleaning the air filter of the controller, be sure to turn off the power. Mistakenly touching high voltage areas may cause an electric shock.**

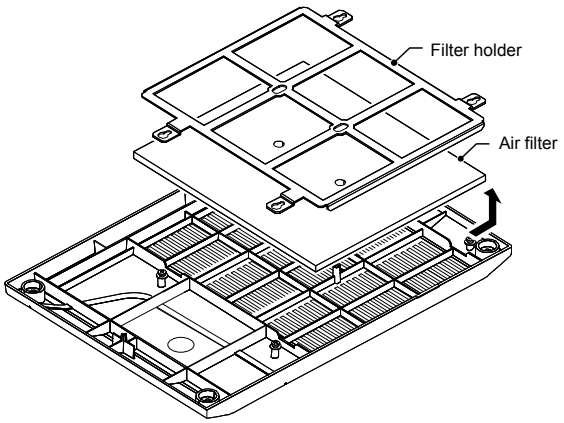
NOTICE	**・ If the MD-U1000 Series is used with a dirty air filter, the temperature inside the marking unit rises, weakening the laser power or causing malfunction. ・ After removing the air filter, never insert metal chips or foreign material into the ventilation port. Doing so may lead to a breakdown of the unit.**

1. Turn the key-operated switch of the controller to the "OFF" position to turn off the power.

2. Loosen the eight screws on the upper and lower front panels.



3. Remove the filter holder and the filter from the panel.



NOTICE	**・ Handle the air filter carefully to prevent it from being damaged. ・ Never allow it to dry in direct sunlight.**

4. Remove the air filter. Clean it with neutral detergent, and allow it to air dry in the shade.

5. Reverse the above procedures (Steps 1-3) to attach the dried air filter to the controller.

NOTICE	**・ Tighten the screw with a tightening torque of 0.4 Nm. ・ The sizes of the upper and lower filters are different. Be sure to attach them correctly. Upper filter: 176 x 154 mm, lower filter: 196 x 154 mm**

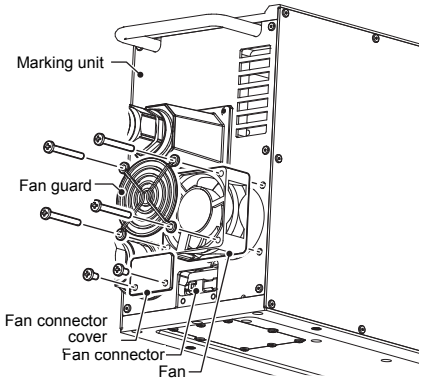
Replacing the fan of the marking unit

Replace the fan of the marking unit when it stops operation.

CAUTION	• **Be sure to turn off the power before replacing the fan of the marking unit. Mistakenly touching the terminals may cause an electric shock. The rotating fan may cause injury.**

1. Turn the key-operated switch of the controller to the "OFF" position to turn off the power.

2. Remove the two screws (M4 x 8) securing the fan connector cover and the four screws (M4 x 35) securing the fan at the rear of the marking unit and remove the following:
   • Fan connector cover
   • Fan guard



3. Disconnect the fan connector and remove the fan from the marking unit.

4. Reverse the above procedures (Steps 1-3) to attach a new fan to the marking unit.

NOTICE	• **Tighten the screws with a tightening torque of 0.8 Nm.**

CAUTION	• **Do not forget to attach the fan guard. Otherwise, the rotating fan may cause injury.**

Replacing the dry agent

Replace it once a year.

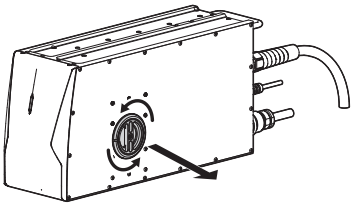
WARNING	**It is dangerous if the laser beam is irradiated. Be sure to turn off the power when replacing the dry agent.**

CAUTION	**Replace it quickly in a clean environment to minimalize entering dust or dirt into the space for the dry agent. Also, check that dirt does not stick to the dry agent.**

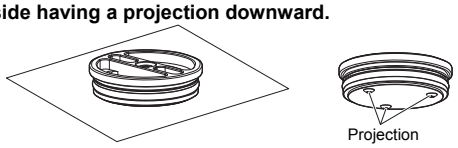
NOTICE	**The expiry date for use of the dry agent is one year after unsealing the package (five years of storage limitation with unopened state). When starting the laser marker with the expired state, "Warning for replacing the dry agent of the head" will occur.**

1. Turn the key-operated switch of the controller to the "OFF" position to turn off the power.

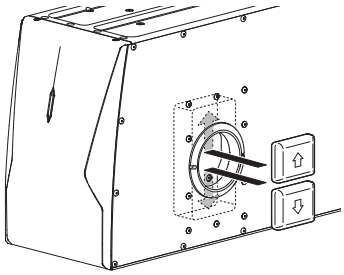
2. Turn the cap on the side of the head to remove it.



CAUTION	• **The cap should be opened/closed only when replacing the dry agent.** • **Place the removed cap on the clean place with the side having a projection downward.**

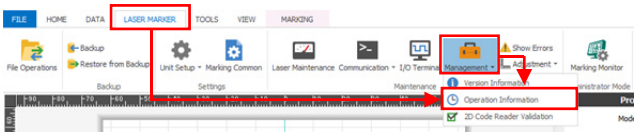


3. Replace the dry agent. Insert it along with the direction of the arrow described on the dry agent.

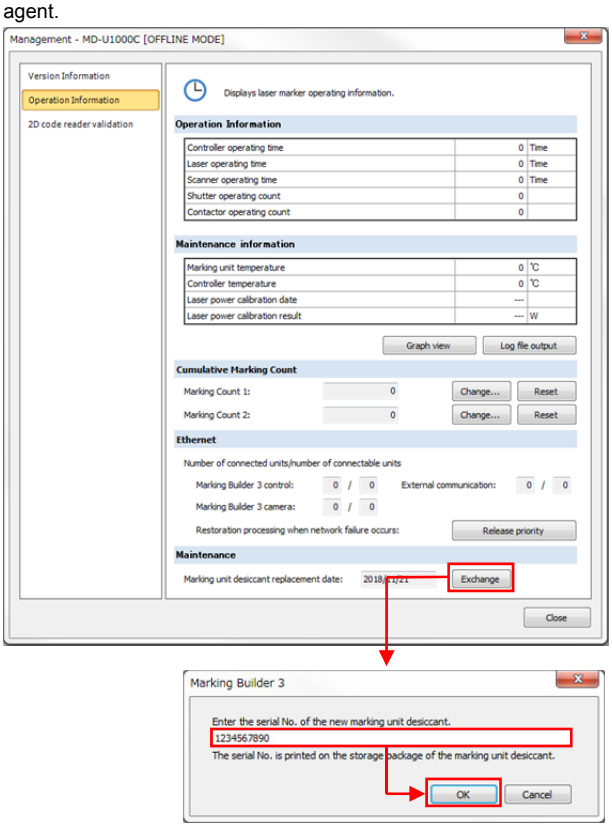


4. Fit the cap with the reverse procedure of 2. Tighten the cap until it does not turn more. Check that it does not engage the dry agent.

5. Start the laser marker, and have connection with Marking Builder 3, then select "Laser Marker > Administration > Operation Information."



6. Press the "Replace" button, enter a serial number, and press "OK." The serial number is described on the storage package of the dry agent.



8 Troubleshooting

8-1 Troubleshooting

Problems, Causes, and Remedies

If a problem occurs during operation, first check the following troubleshooting items. If you cannot fix the problem, contact your nearest KEYENCE office.

Problem	Cause/Remedy
Power is not turning on	The power supply cable is not connected properly. Check the cable connection.
No marking occurs	Working distance is not set appropriately.*1 *1 MD-U1000C : ±21mm/ MD-U1020C : ±21mm
	The Z coordinate for block layout is not set to an appropriate value.
	The Z coordinate correction for Unit Setup is not set to an appropriate value.
	The Z coordinate for block layout is not set to an appropriate value.
	Marking condition such as scanning speed and laser power are not set to appropriate values.
	Workpiece position does not match marking position.
	Laser beam cannot pass through because the window is dirty.
Marking is misprinted	Scanning speed and laser power are not set to appropriate values.
	Vibration is affecting workpiece and marking unit.
	There are water drops, dust, or dirt on the workpiece surface.
	Laser beam cannot pass through because the window is dirty. Wipe off the dirt gently with a cloth dampened with acetone or ethanol while paying attention not to scratch the window.
	Noise is conveyed through the marking unit control cable or power supply cable. Check the cable connection and grounding.
	Laser ON/OFF timing is incorrect. Adjust the laser ON/OFF timing to an appropriate setting.
	The spot variation is not set to an appropriate value.

8-2 Error Messages

Error Messages

When an error occurs, the ERROR LED on the controller illuminates. The error can be cleared by removing its cause according to the error code, name, and remedy in the following list, and then setting the power switch to [POWER ON] once and setting it to [LASER ON] again.
A software error or an interlock error can be cleared with the [Reset Error] button, external communication (RS-232C/Ethernet), or I/O terminal.

Error No.	Error name	Remedy
E000	Laser reflected wave error	Since it may recover when the oscillation tube gets warm, run a warm up for approx. 30 minutes while the key switch is in LASER ON state, and then restart the it. A repair is needed if the recovery fails or if the error occurs frequently.
E001	Laser high-temperature error	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E002	Laser overvoltage error	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the recovery fails, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. A repair is needed if there is no problem with the cable.
E003	Marking unit Comm error	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the problem reoccurs, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. Noise may be entering the device if there is no problem in the cable and the error occurs in a sporadic manner.
E004	Scanner error	If the error occurs at every startup, a repair is needed because the scanner is defective. If the error occurs during marking, check if it occurs at a lower scan speed. If reducing the scan speed resolves this error, use a scan speed that does not cause the error.
E005	Shutter error	A repair is needed if the error occurs at every startup. If the error is cleared by a restart, it may have been a temporary catching. There is no problem if the error does not reoccur.
E007	Marking unit model error	A repair is needed because it is highly likely that the memory data in the marking unit have been lost. Noise may be entering the device if this error occurs.
E008	Controller Version Error	Upgrade the version of the marking unit and controller by following the procedure below. Select [LASER MARKER] - [Management] - [Version Information] in the ribbon menu, and then run [Version Upgrade].
E011	Built-in memory card unrecognizable error	Please contact our branch office closest to you.
E012	Marking Unit Data Error	A repair is needed because the memory data in the marking unit have been lost. Noise may be entering the device if this error occurs.
E013	Expansion memory-full error	Disable the [Program pre-expansion] function or reduce the target program range by following the procedure below. Select [LASER MARKER] - [Unit Setup] - [Expansion Processing] - [Version Information] in the ribbon menu, and disable the [Program pre-expansion] function.
E014	Mark memory-full error	The number of blocks in the program trying to perform marking or the number of matrix cells is too large. Address the issue by dividing the program into multiple programs. If the program contains logo data having a large number of lines, this error can be caused even by a single block. In such a case, address the issue by splitting the logo and dividing the program into multiple programs.
E015	No program error	Transfer the program to the controller by following the procedure below. Select [LASER MARKER] - [File Operations] in the ribbon menu, and then transfer the program settings to the controller.
E017	No font file error	Transfer the required fonts to the controller by following the procedure below. Select [LASER MARKER] - [Marking Common] - [Font] in the ribbon menu, and then register the font to an appropriate font No.

Error No.	Error name	Remedy
E019	Mark trigger error	Set an adequate trigger delay by following the procedure below. Select [HOME] - [Program Settings] - [Motionless Marking/On-the-fly Marking] in the ribbon menu, and then enter an adequate value in [Trigger Delay].
E020	Expansion memory-full error 2	Delete the unwanted fonts by following the procedure below. Select [LASER MARKER] - [Marking Common] - [Font] in the ribbon menu, and then delete the unwanted font(s). If there are no unwanted fonts, address the issue by reducing the character types in the fonts. Reduce the character types by following the procedure below. Select [TOOLS] - [Font Architect] in the ribbon menu, and open the font currently being used. Since the [CJK Unified Ideographs] group contains all of the SJIS Kanji characters, you can delete Kanji characters that are not used. Once the font has been modified, transfer it to the controller from [File Operations] - [Font] in the ribbon menu.
E022	Over-Area Error	Check and modify the program so that the mark data does not extend beyond the marking area. If there is no problem with the program, the marking may have gone beyond the marking area due to the position correction and workpiece position adjustment. Check and modify the position correction and workpiece position adjustment values by following the procedure below. ・ Select [LASER MARKER] - [Unit Setup] - [Basic Setting] - [Focal Distance and Position Correction] in the ribbon menu, and enter an adequate value for each coordinate. ・ Select [HOME] - [Program Settings] - [Position Adjustment] - [Correct inside the horizontal plane] in the ribbon menu, and then enter an adequate value in [Correction amount].
E023	On-the-fly Marking Over-Area Error	Address the issue by reducing the line speed or increasing the scan speed. If you are using the [Marking Range] setting for on-the-fly marking, address the issue by increasing the range.
E024	File verification error	Prepare the version upgrade data again and run the version upgrade.
E025	Logo file error	Transfer the required data to the controller by following the procedure below. Select [LASER MARKER] - [File Operations] in the ribbon menu, and then transfer the required data to the controller.
E026	Custom character file error	Transfer the required custom character data to the controller by following the procedure below. Select [LASER MARKER] - [File Operations] in the ribbon menu, and then transfer the required custom character data to the controller.
E027	Encoding Disabled Error	Check the program barcode and 2D code encoding character settings by following the procedure below. ・ Check if the number of character digits is adequate for the set symbol size. ・ Check if there are any strings that cannot be input.

Error No.	Error name	Remedy
E028	Switching program unexecutable error	Wait until the program is saved.
E029	Scanner error 2	A repair is needed if the error occurs at every startup or marking. Noise may be entering the device if it occurs randomly.
E030	Expiration setting error	Modify it so that the mark data after expiration will be between the year 1900 and 2100.
E031	Restart error	If you switched on the AC power supply again intentionally, it will recover once the error is reset. If this was not intentional, install a UPS because it is highly likely that a momentary power loss has occurred.
E032	Logo/custom character enlargement error	Reduce the size of the block containing the logo or custom character.
E033	Skip cross error	Reduce the skip cross setting or increase the character size.
E034	Encoding Disabled Error	Check the program barcode and 2D code encoding character settings by following the procedure below. ・ Check if the number of character digits is adequate for the set symbol size. ・ Check if there are any strings that cannot be input.
E035	Quick change of character expansion error	Register the character type(s) you wish to change as high speed edit characters. You can register a character for high speed editing using the [Register Character for High Speed Editing (IR)] command.
E038	Logo custom character buffer full error	Disable the [Program pre-expansion] function or reduce the target program range by following the procedure below. Select [LASER MARKER] - [Unit Setup] - [Expansion Processing] - [Version Information] in the ribbon menu, and then correct the [Program pre-expansion] function.
E039	Wobble/Scratch incorrect setting error	Set the scan speed to 3000mm/s or lower in the marking parameters.
E040	Link block error	Check that the link destination block is set to [Mark].
E041	3D marking position incorrect range error	Change the block position on the 3D shape in the block layout to an adequate value.
E042	Marking loss detection error	Check the settings and wiring of the sensor connected to the marking confirmation input.
E043	Accidental emission detection error	
E044	Z Area over error	Take adequate measures to suppress the fluctuations in the workpiece height.
E045	Unregistered barcode error	Register the barcode to be used in advance by following the procedure below. Select [LASER MARKER] - [Unit Setup] - [Option] - [Barcode verification] in the ribbon menu, and perform [Register code].
E046	Warm up setting error	Transfer the warm up program to program No. 1999. Make sure that the warm up program does not contain the following functions: "Counter, On-the-fly Marking, 2D Code Reader, Auto Focus, Marking Confirmation, Matrix, Group, Fixed Point While Trigger is on"

Error No.	Error name	Remedy
E047	3D Error of size of block	Review the 3D block parameters.
E048	Z-MAP file error	Transfer the required Z-MAP data to the controller by following the procedure below. Select [LASER MARKER] - [File Operations] - [Z-MAP] in the ribbon menu, and then transfer the required Z-MAP data to the controller.
E049	No font error	Since a custom character with no marking lines cannot be used, check the fonts and custom characters and delete any data that have no marking lines.
E050	Marking data generation error	Set an adequate trigger delay by following the procedure below. Select [HOME] - [Program Settings] - [Motionless Marking/On-the-fly Marking] in the ribbon menu, and then enter an adequate value in [Trigger Delay].
E051	System Error 2	Please check the following: ・ Transfer the program again if DataMatrix is included. ・ If the Wobble setting is included, transfer the program again after setting the overlap rate to a lower value.
E052	System Error 3	A repair is needed if the problem persists after a restart. Noise may be entering the device if this error occurs.
E053	System Error 4	Internal data may be corrupted if the problem persists even after a restart. Restore the data using the backup data from before the problem occurred, or transfer all data again.
E054	System Error 5	If the error persists after a restart, there may be a problem in the processing of external communications. Check if external communications from multiple devices are active or if there is any mistake in the communication command. Noise may be entering the device if the error occurs in a sporadic manner.
E055	System Error 6	Internal data may be corrupted if the problem persists even after a restart. Restore the data using the backup data from before the problem occurred, or transfer all data again.
E056	System Error 7	A repair is needed if the problem persists after a restart.
E057	System Error 8	Restart the device and take the necessary measures. If the problem occurs in a specific program, transfer the program to the controller again.
E058	System Error 9	Restart the device and take the necessary measures. If it occurs in a specific program, there may be a problem in the multiple processing. If a multiple setting exists, switch to a single setting and check if the error persists.
E059	System Error 10	Internal data may be corrupted if the problem persists even after a restart. Transfer the program from the PC to the controller again.
E061	System Error 12	A repair is needed if the problem persists after a restart.

Error No.	Error name	Remedy
E062	System Error 13	Internal data may be corrupted if the problem persists even after a restart. Restore the data using the backup data from before the problem occurred, or transfer all data again.
E063	System Error 14	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the recovery fails, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. A repair is needed if there is no problem with the cable.
E066	System Error 17	Internal data may be corrupted if the problem persists even after a restart. Restore the data using the backup data from before the problem occurred, or transfer all data again.
E067 to E068	System Error 18 to 19	A repair is needed if the problem persists after a restart. This error can occur when there is miswiring in the terminal block. Check if the same error occurs even after disconnecting all terminal blocks.
E069 to E071	System Error 20 to 22	A repair is needed if the problem persists after a restart.
E072	System Error 23	Please contact our branch office closest to you.
E073 to E075	System Error 24 to 26	A repair is needed if the problem persists after a restart.
E090	Internal clock incorrect setting error	Set the internal clock again. If the problem persists after a restart, a repair is needed because the built-in battery is out of power.
E091	Internal clock access error	Set the internal clock again. If the problem persists after a restart, the controller needs to be repaired because the built-in battery is out of power.
E100	LD high-temperature error	Check if the filter of the controller is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E101	LD low-temperature error	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
E102	Marking unit High-Temperature Error	Please check whether the ambient temperature is within the specification range. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E104	Qsw stop error	Check if there is any abnormal bending in the Q switch cable. A repair is needed if there is no problem with the cable.
E105	Q switch power error	
E106	Qsw control error	
E107	Qsw run check error	

Error No.	Error name	Remedy
E110	Laser power auto-calibration error	If there is a problem in the marking, make adjustments by increasing the laser output. If there is a problem in the marking, a repair is needed even if the output is 100%.
E111	Height upper limit error	If this was not intended, change the upper range limit by following the procedure below. Select [HOME] - [Program Settings] - [Position Adjustment] in the ribbon menu, and then enter an adequate upper limit value in [Range settings:].
E112	Height lower limit error	If this was not intended, change the lower range limit by following the procedure below. Select [HOME] - [Program Settings] - [Position Adjustment] in the ribbon menu, and then enter an adequate lower limit value in [Range settings].
E113	Height measurement failure error	Height measurement may be impossible in the following cases: • Distance measuring light cannot be detected correctly because of the surface condition of the workpiece. • Distance measuring light cannot be detected because the lighting in the rack is too bright.
E114	Current setting error	Transfer the currently marking program again.
E132	Voltage Drop Error	The AC power voltage may be unstable. Install a UPS and feed AC power from the UPS to the device. Noise may be entering the device if the error occurs in a sporadic manner.
E137	System Error 27	A repair is needed if the problem persists after a restart.
E138	System Error 28	This error tends to occur when marking on a highly reflective workpiece. Reduce the marking output, or avoid printing near the point of origin so that the laser beam reflected from the workpiece does not enter the marking unit.
E139	System Error 29	A repair is needed if the problem persists after a restart.
E141 to E143	System Error 31 to 33	
E144	Laser Reflection error	This error tends to occur when marking on a highly reflective workpiece. Reduce the marking output, or avoid printing near the point of origin so that the laser beam reflected from the workpiece does not enter the marking unit.
E202	Controller top fan error	Check if there are any foreign materials on the fan, and then restart the device.
E203	Controller bottom fan error	
E204	Head control cable unconnected error	Check the cable connection between the marking unit and controller, and then restart the device. If the recovery fails, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. A repair is needed if there is no problem with the cable.
E205	Head Power Cable Unconnected Error	
E206	Marking unit fan lock error	Check if there are any foreign materials on the fan, and then restart the device.
E220 to E222	System Error 34 to 36	A repair is needed if the problem persists after a restart.

Error No.	Error name	Remedy
E224	System Error 38	Restart the device and take the necessary measures. Noise may be entering the device if the error occurs in a sporadic manner.
E225 to E228	System Error 39 to 42	A repair is needed if the problem persists after a restart.
E229	System Error 43	Upgrade the version of the marking unit and controller by following the procedure below. Select [LASER MARKER] - [Management] - [Version Information] in the ribbon menu, and then run [Version Upgrade].
E230 to E232	System Error 44 to 46	A repair is needed if the problem persists after a restart.
E233	System Error 47	Restart the device and take the necessary measures. Noise may be entering the device if this error occurs.
E234	LD temperature unadjustable error	Check if the ambient temperature is changing rapidly. A repair is needed if the problem persists even when the ambient temperature is stable.
E236 to E237	System Error 50 to 51	A repair is needed if the problem persists after a restart.
E238 to E239	System Error 52 to 53	
E240 to E250	System Error 60 to 70	
E252 to E255	Scanner error 3 to 6	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the recovery fails, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. A repair is needed if there is no problem with the cable.
E257	Controller Power Error	A repair is needed if the problem persists after a restart. This error can occur when there is miswiring in the terminal block. Check if the same error occurs even after disconnecting all terminal blocks.
E258	Voltage Drop Error	The AC power voltage may be unstable. Install a UPS and feed AC power from the UPS to the device.
E259	24V Voltage Drop Error	The power consumption of the connected device may be exceeding 0.3A. Check if the same error occurs even after disconnecting the external device from the service power supply. Also, this error can occur when there is miswiring in the terminal block. Check if the same error occurs even after disconnecting all terminal blocks.
E270	Controller high-temperature error	Check if the filter of the controller is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E271	Controller low-temperature error	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.

Error No.	Error name	Remedy
E272	Marking unit high-temperature error (laser tube)	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E280	Marking unit high-temperature error (plate)	
E281	Marking unit low-temperature error (plate)	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
E282	Marking unit high-temperature error (board)	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E283	Marking unit low-temperature error (board)	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
E284	Scanner high-temperature error	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E285	Scanner low-temperature error	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
E286	Error of High Temperature on Beam Sampler	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
E287	Marking unit high-temperature error (top)	
E288	Marking unit low-temperature error (top)	Please check whether the ambient temperature is within the specification range. If the error occurs when the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
E290	Contactor status error	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the recovery fails, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. A repair is needed if there is no problem with the cable.
E291	Marking unit Comm error 2	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the problem reoccurs, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. Noise may be entering the device if there is no problem in the cable and the error occurs in a sporadic manner.

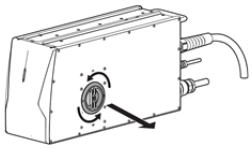
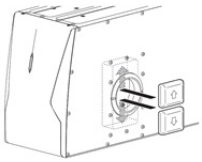
Error No.	Error name	Remedy
E292	SSR status error	A repair is needed if the problem persists after a restart.
E293	Interlock status error	
E294	System Error 80	
E295	SD card setting file error	
E296 to E297	System Error 81 to 82	
E298 to E299	Marking unit Comm error 3 to 4	Switch off the power, unplug the cable between the marking unit and controller, and then restart the device. If the problem reoccurs, check if there are broken pins or breaks in the cable. Replace the cable if any problem is found. Noise may be entering the device if there is no problem in the cable and the error occurs in a sporadic manner.
E300 to E319	Memory check error 1 to 20	Data will be initialized by the system restart. Restore the data using the backup data from before the problem occurred, or transfer all data again.
E400 to E430	Scanner error X00 to X30	A repair is needed if the problem persists after a restart.
E432 to E462	Scanner error Y00 to Y30	
E500 to E531	Marker head system error 00 to 31	

When any of the Memory Check Errors 1 to 20 occurs, turn off the power, and then turn it on again.
The program setting described in "Remedy" is initialized upon the restart.
If you use that program, reconfigure the setting.

- For E317, the running program No. switches to No. 0000 upon the restart.

Warning Message

Error No.	Error name	Remedy
W001	Laser temperature warning	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W101	Marking unit fan warning	Check if there are any foreign materials on the fan.
W102	USB flash drive access failure warning	Format the USB flash drive in FAT** format and try again. Use a different USB flash drive if the error reoccurs.
W103	Inter-CPU communication timeout warning	Noise may be entering the device if this error occurs.
W105	Laser control board parameter warning	A repair is needed if the problem persists after a restart.
W106	Marking unit board parameter warning	
W107	Controller board parameter warning	
W110	Laser power output decay alarm	A repair is needed if there is a problem in the marking. If the laser output is low, you may continue using it in this state. A repair is needed if the problem is affecting the marking.
W111	Insufficient marking energy alarm	If this was not intended, change the threshold setting by following the procedure below. Select [HOME] - [Program settings] - [Option] - [Marking Energy Check] in the ribbon menu, and correct the threshold.
W112	Excess marking energy Alarm	
W113	Power monitor sensor warning	A repair is needed if the problem persists after a restart.
W114	Laser power calibration warning	The error will stop if you reduce the laser power calibration warning threshold. A repair is needed if you cannot perform marking even with the laser output at 100%. You can modify the warning threshold for the laser power calibration from below. Select [LASER MARKER] - [Laser Maintenance] in the ribbon menu, and modify the laser power calibration warning threshold.
W122	Laser Unit Temperature Warning 1	Check if the filter of the controller is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W123	Laser Reflection Warning	This error tends to occur when marking on a highly reflective workpiece. Reduce the marking output, or modify the program to angle the laser such that the laser beam reflected from the workpiece does not come back into the marking unit.
W125	Voltage Drop Warning	The AC power voltage may be unstable. Install a UPS and feed AC power from the UPS to the device. Noise may be entering the device if the error occurs in a sporadic manner.
W150	Height upper limit warning	If this was not intended, change the parameter by following the procedure below. Select [HOME] - [Program Settings] - [Position Adjustment] - [Correct height direction] in the ribbon menu, and correct the range settings.
W151	Height lower limit warning	
W152	2D code quality drop warning	Adjust the marking parameters and lighting conditions.
W160	Controller high-temperature warning	Check if the filter of the controller is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W161	Controller low-temperature warning	Please check whether the ambient temperature is within the specification range. If the error occurs when the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
W162	LD high-temperature warning	Check if the filter of the controller is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W163	LD low-temperature warning	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
W170	Marking unit high-temperature warning (plate)	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W171	Marking unit low-temperature warning (plate)	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
W172	Marking unit high-temperature warning (board)	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W173	Marking unit low-temperature warning (board)	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
W174	Scanner high-temperature warning	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.

Error No.	Error name	Remedy
W175	Scanner low-temperature warning	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
W176	Marking unit high-temperature warning (top)	Check if the filter of the marking unit is clogged. If no problem is found in the filter, reduce the ambient temperature or install a spot cooler. If the ambient temperature is not high, the temperature sensor is very likely defective and needs to be repaired.
W177	Marking unit low-temperature warning (top)	Please check whether the ambient temperature is within the specification range. If the ambient temperature is not low, the temperature sensor is very likely defective and needs to be repaired.
W180	Marking unit desiccant replacement warning	Replace the desiccant in the marking unit by following the procedure below. 1. Prepare a new marking unit desiccant. 2. Turn the key switch of the controller to the [OFF] position to turn off the power. 3. Remove the cap for the desiccant on the right side of the marking unit.  Place the removed cap in a clean location. 4. Replace the used desiccant with a new one.  5. Mount the cap. Be careful not to bite the desiccant into the cap when fastening it. 6. Select [LASER MARKER] - [Maintenance] in the ribbon menu, and then press the [Replace] button under [Maintenance]. 7. Enter the serial No. of the new desiccant, and then click the [OK] button. The serial No. is printed on the storage package of the desiccant.
W400 to W414	Scanner warning X00 to X14	A repair is needed if the problem persists after a restart.
W416 to W430	Scanner warning Y00 to Y14	
W500 to W531	Marker head system warning 00 to 31	

Marking Disabled Due to Input from an External Device

This error occurs when the marking unit receives an input from the I/O terminal block at the rear of the controller and cannot perform marking. The laser oscillation stops when the remote interlock input, laser excitation input, and safety input (contactor) are opened.
If one of these errors occurs, reset the system to the ready state by following the remedies listed below and then restart the marking process.

Error No.	Error name	Remedy
T000	Remote interlock in use	Reset the error by setting the interlock input A/B on the terminal block to ON.
T001	Controlling Shutter	Set the shutter control input A/B of the terminal block to ON.
T002	Trigger lock in use	Please check the following: ・ The trigger inhibit input of the terminal block is ON ・ [Cancel Marking] is selected for test marking in the console or MarkingBuilder 3.
T003	Laser Disabled	Disable the marking laser disable input of the terminal block. You can change the normally open and normally closed settings from below. Select [LASER MARKER] - [Unit Setup] - [I/O Setting] in the ribbon menu, and then correct the value in [Invert input function].
T004	Processing Operation Mode Disabled	Disable the processing disable input of the terminal block. You can change the normally open and normally closed settings from below. Select [LASER MARKER] - [Unit Setup] - [I/O Setting] in the ribbon menu, and then correct the value in [Invert input function].
T005	Distance pointer ON	Turn off the distance pointer.
T006	Unexcited laser state	Please check the following states: ・ Turn the key switch to LASER ON. ・ Turn ON the laser excitation input of the terminal block.
T007	Adjusting LD temperature	Please wait.
T008	Warming up	
T009	Auto-calibrating laser power	
T010	Adjusting laser oscillator temperature	
T011	Contactor input OFF	Set the contactor input A/B of the terminal block to ON.
T012	Communication shutter control in progress	Open the shutter using the ActiveX command.
T013	Upgrading the version	Please wait.
T014	Safety shutter input OFF	Set the safety shutter input A/B to ON.

Software Errors

These errors occur when an attempt is made to perform marking when the marking data is not set appropriately.
The controller LED does not change when a software error occurs.
If a software error occurs during operation, check the marking data according to the following list. Then correct the settings to restart marking.

Error No.	Error name	Remedy
S000	Program incorrect error	Check whether the parameter is within the input range. Create the program again if no corrupt location can be found.
S001	Program memory full error	Remove the unwanted programs in the controller.
S002	Built-in memory card full error	Remove the unwanted logos, fonts, and Z-MAP data in the controller.
S003	USB flash drive full error	Remove any unwanted data from the USB flash drive.
S004	USB flash drive not inserted error	Perform the operation after inserting a USB flash drive.
S005	USB flash drive cannot be recognized error	Format the USB flash drive in FAT** format and try again. Try using a different USB flash drive if the error reoccurs.
S006	Priority error	The console and/or external communication has acquired communication priority. Check if the other devices are in test marking or finder mode, and perform the operation after exiting from these modes.
S008	No-File Error	Perform the communication again using an existing file as the target.
S009	Busy Error	Perform the operation while READY is in ON state.
S010	No marking block error	Set the marking flag to ON for one or more target blocks (palettes).
S011	Logos/custom characters over error	Reduce the number of files.
S012	Illegal optimization error	Reduce the line speed or adjust the character size, etc.
S013	Scan Optimize unexecutable error	Set the quality level of all blocks to [Customize].
S014	Program operation during execution error	A currently running program cannot be deleted.
S015	Logo/custom character file operation error	First remove the program that is using the logo or custom character you wish to delete.
S016	Test Mark Unexecutable Error	Start test marking after the device has gone into READY state.
S017	Fixed point marking parameter error	Modify the program to make sure that the fixed point and 3D shape blocks are not mixed.
S018	Barcode/2D code illegal setting error	Please enter an encoding string.
S019	All-setup restoration error	Make sure to use the backup data from the same model.
S020	Data Length Error	Noise may be entering the external communication cable if the error occurs in a sporadic manner.
S021	Program No. unregistration error	Transfer the program to the controller by following the procedure below. Select [LASER MARKER] - [File Operations] in the ribbon menu, and then transfer the program settings to the controller.
S022	Block# no registration error	Transfer the program to the controller by following the procedure below. Select [LASER MARKER] - [File Operations] in the ribbon menu, and then transfer the program settings to the controller.
S023	Status error	Reset the error and try marking again.
S024	Illegal Command Error	Acquire the communication history and check the parameter input range and block type.
S025	Checksum Error	Check if the checksum settings for the laser marker and external devices (PLC, etc.) are both ON. If there is no problem in the above, check if the checksum calculation method of the PLC is set to horizontal parity (Exclusive OR). Noise may be entering the external communication cable if the error occurs in a sporadic manner.
S026	Format error	Acquire the communication history and check the command details. If a comma (,) is used in the string, change it to "%044A" (special code representing a comma) before sending it.
S027	Command Unrecognizable Error	Acquire the communication history and check the command details.
S028	Response data length error	Modify the request command to reduce the response data length.
S029	Mark data request error	Send the command after the marking has completed.
S030	Group number unregistered error	Group the blocks in the program using MarkingBuilder 3. You can group blocks by following the procedure below. Select and right-click on a block to open the context menu, and then select [Grouping].
S050	Quick change of character setup error	Check the following when using the high speed character edit command. ・ Check if the block you wish to change is subject to high speed string editing. ・ Check that the string to be sent is registered as the character type that supports high speed string editing.
S051	Sample Marking Unexecutable Error	Commence sample marking in READY state.
S052	Laser inspection unexecutable error	Commence inspection laser in READY state.
S060	Block type incorrect setting error	Create the program again.
S061	Block assignment incorrect setting error	
S062	Character size incorrect setting error	Modify the blocks whose character aspect ratio is greater than 1:5 or 5:1.
S063	Character assignment incorrect setting error	Create the program again.
S064	Character advanced incorrect setting error	
S065	Marking condition incorrect setting error	
S066	Barcode/2D code illegal setting error	
S067	Continuous marking incorrect setting error	
S068	Movement/marking direction incorrect setting error	
S069	Program incorrect setting error	

Error No.	Error name	Remedy
S070	Matrix information incorrect setting error	Create the program again.
S071	Matrix cell information incorrect setting error	
S072	Character string incorrect setting error	
S073	Individual counter incorrect setting error	
S074	Common counter incorrect setting error	Configure the common counter settings again by following the procedure below. You can configure it by selecting [LASER MARKER] - [Marking Common] in the ribbon menu, followed by [Common Counter].
S075	Encoding information incorrect setting error	Configure the encoding setting again. You can configure it by selecting [LASER MARKER] - [Marking Common] in the ribbon menu, followed by [Encoding].
S076	System information incorrect setting error	Create the program again.
S077	Font replacement information incorrect setting error	
S078	Font scaling information incorrect setting error	Configure the character scaling settings again. You can configure it by selecting [LASER MARKER] - [Marking Common] in the ribbon menu, followed by [Character scaling].
S079	Font skip cross width information incorrect setting error	Configure the character skip cross settings again. You can configure it by selecting [LASER MARKER] - [Marking Common] in the ribbon menu, followed by [Character skip cross].
S080	Logo/custom character buffer information incorrect setting error	Create the program again.
S081	Current value incorrect setting error	
S082	3D system information incorrect setting error	
S083	3D information incorrect setting error	
S084	Operation limitation error	Delete the program that is using the [2D code reader function], or activate the [2D code reader function].
S085	Version of data outside support	The loaded program has been created in a higher version than the currently running MarkingBuilder 3. Upgrade the currently running Marking Builder 3 to the latest version, or downgrade the version of the loaded program.
S086	Wobble Incorrect Setting Error	Check if the marking line width, overlap rate and scan speed settings are within range.
S087	2D code reading error	Modify the program so that it is readable in test marking, and then run the program again.

Error No.	Error name	Remedy
S088	Working distance measurement error	Height measurement may be impossible in the following cases: ・ Distance measuring light cannot be detected correctly because of the surface condition of the workpiece. ・ Distance measuring light cannot be detected because the lighting in the rack is too bright.
S089	Working distance measurement limitation error	Measure the work distance in READY state.
S090	Registered barcode error	Change the barcode verification string.
S091	Barcode/2D code link setting error	Please check the following: ・ Check if the 2D code overprinting setting is enabled for the target block. ・ Check if the target overprinting No. exists.
S092	Barcode illegal registration state error	Configure it in either MarkingBuilder 3 or the console.
S093	Marking Confirmation Function Error	Check if the mark data exist in the field of view of the confirmation coordinates.
S094	TrueType font file size error	Reduce the number of TrueType font types being used.
S095	Model limitation error	Cannot be used.
S096	Open priority error	Restart the device.
S097	File Access Error	File may be read-only. Check the file attribute and try again.
S098	Serial No. error	Enter the correct serial No.
S099	Duplicate Serial No.	The serial code of the desiccant can only be used once. Purchase and replace with a new desiccant.

MEMO

Appendix

A-1 Specifications

■ **Basic specifications**

		Standard area	Wide area
Model	Marking unit (Controller + Marking unit)	MD-U1000C	MD-U1020C
	Console (sold separately)	MC-P1	
	2D Code Reader add-in	MD-XAD1 / MD-XAD1A	
Marking method		XYZ 3-axis simultaneous scanning method	
Marking laser		YVO4: Laser Class 4 Laser Product (IEC60825-1, FDA(CDRH) Part 1040.10) *1	
	Wavelength	355 nm	
	Output	2.5 W (at 40 kHz)	
Q switch frequency		CW, 40 to 400 kHz	
Guide laser, Working distance pointer		Semiconductor laser, Wavelength: 655 nm (Class 2 Laser Product)	
Marking area		125 x 125 x 42 mm	330 x 330 x 42 mm
Standard working distance (± variable width)		189 mm (±21 mm)	300 mm (±21 mm)
Marking resolution		2 µm	5 µm
Scan speed		Max. 12000 mm/s	Max. 8000 mm/s
Character type	Font	Original font (number, letters, katakana, hiragana, kanji)/User font/TrueType font/OpenType font *2	
	Barcode	CODE39/ITF/2of5/NW7 (CODABAR)/JAN/CODE128/EAN/UPC-A/UPC-E/CODE93	
	2D Code	QR code/Micro QR code/DataMatrix (ECC200/GS1 DataMatrix)	
	GS1 DataBar	GS1 DataBar/GS1 DataBar CC-A/GS1 DataBar Stacked/GS1 DataBar Stacked CC-A/ GS1 DataBar Limited/GS1 DataBar Limited CC-A/ GS1 DataBar Truncated/ GS1 DataBar Truncated CC-A	
	Logo image	Custom character font and logo (CAD) data, BMP/JPEG/PNG/TIF	
Marking parameters	Work status	Stationary/On-the-fly (Constant speed/Encoder)	
	Marking size (marking height and width)	0.01 to 125 mm	0.01 to 330 mm
	No. of registered programs	Max. 2000 programs	
	No. of program blocks	256 blocks	
I/O (Input-output)		Terminal block I/O, MIL connector I/O, Contactor control I/O	
Interfaces		RS-232C/USB2.0/Ethernet (100BASE-TX/10BASE-T) *3	
Marking unit installation direction		All directions	
Marking unit cable length		4.3 ±0.1 m	
Cooling method		Forced air cooling	
Rated voltage / rated power consumption		Single-phase AC100 to 240 V ±10% 50/60 Hz, Max. 800 VA	
Overvoltage category		II	
Pollution degree		2	
Enclosure rating (Marking unit)		IP64	
Environmental resistance	Storage ambient temperature	-10 to 60°C (No freezing)	
	Ambient temperature	0 to 40°C	
	Storage ambient humidity	30 to 85% (No condensation)	
	Ambient humidity		
Weight	Controller	23.5 kg	
	Marking unit	18.0 kg	
	Console	2.0 kg	
Standard/Regulation		EU Directives (EMC Directive, Low Voltage Directive, RoHS Directive)/EN Standards (EN55011, EN 61010-1, EN60825-1, EN61000-6-2, EN50581)/CSA Standards and UL Standards (CAN/CSA C22.2 No.61010-1, UL61010-1)/North America Standards (FCC Part 15B, ICES-001 Class A) /China RoHS	

*1: The laser classification for FDA(CDRH) is implemented based on IEC60825-1 in accordance with the requirements of Laser Notice No.50.
*2: TrueType font and OpenType font only support the fonts when the property of "embedded fonts" is "installable" or "editable". Confirm the property of [Font] from [Control panel].
*3: The USB ports are the port for the USB memory/USB mouse/barcode reader (A connector) and the port dedicated to Marking Builder 3 (ActiveX) (B connector).
The Ethernet port supports the communication with Marking Builder 3 (ActiveX), TCP/IP communication, PROFINET, and EtherNet/IP.

■ **MPE (Maximum Permissible Exposure)/NOHD (Nominal Ocular Hazard Distance)**

	Standard area	Wide area
Marking unit model	MD-U1000C	MD-U1020C
MPE (Maximum Permissible Exposure) (mW/cm^2)	1.01	
NOHD (Nominal Ocular Hazard Distance) (m)	32.27	59.26

* MPE/NOHD described above is the value calculated by specifying the exposure duration as 30,000 seconds.

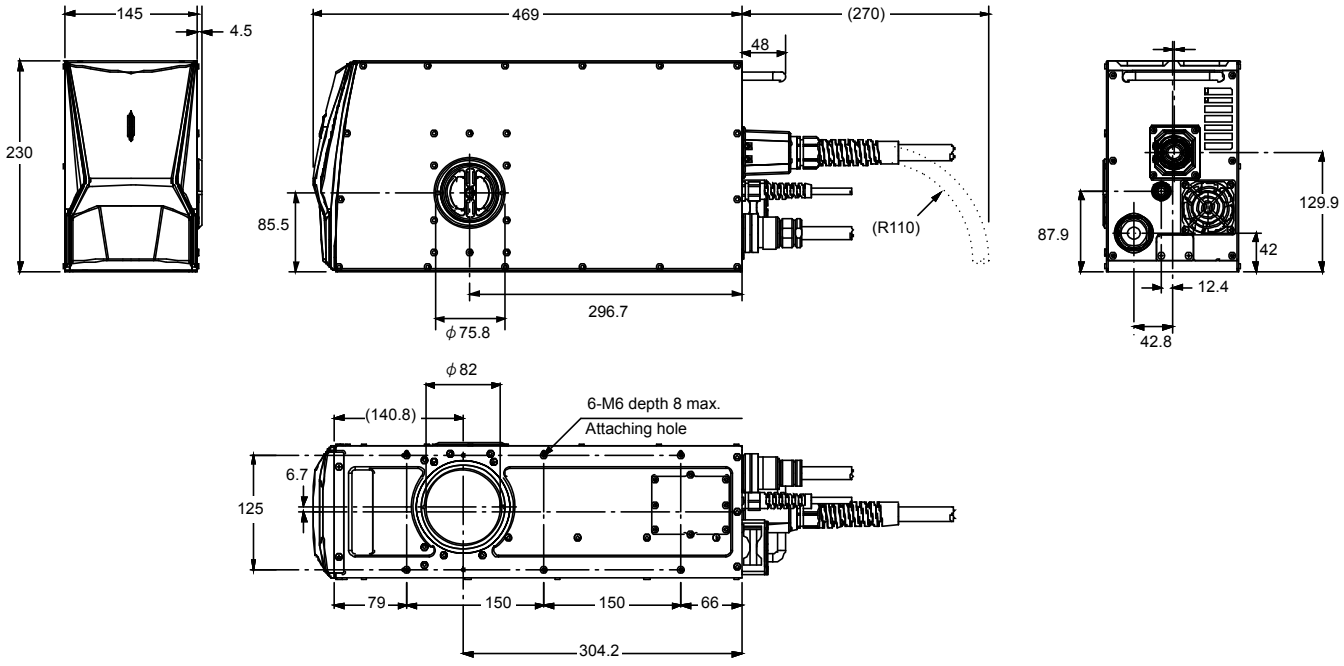
■ **PC software specifications**

Model	Overview
MB3-H2D4-DVD	Marking Builder 3 Ver.4 *1 2D setting and editing software (focal distance/inclination correction/variable spot/distance pointer adjustment)
MB3-H3D1	Marking Builder 3 3D add-in software (marking on planes, cylinders, cones, or spheres/Z-MAP marking/Auto focus)

* 1 Marking Builder 3 Ver2/3, Marking Builder 2 Ver7 is also included.

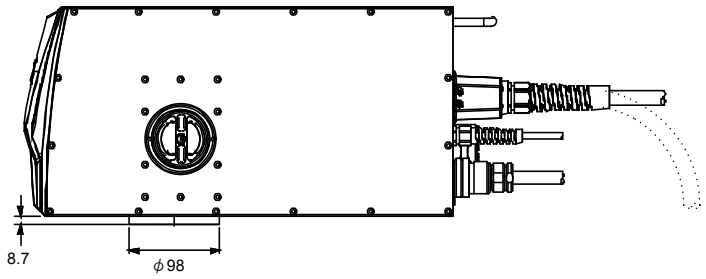
A-2 Dimensions

■ **Marking unit**



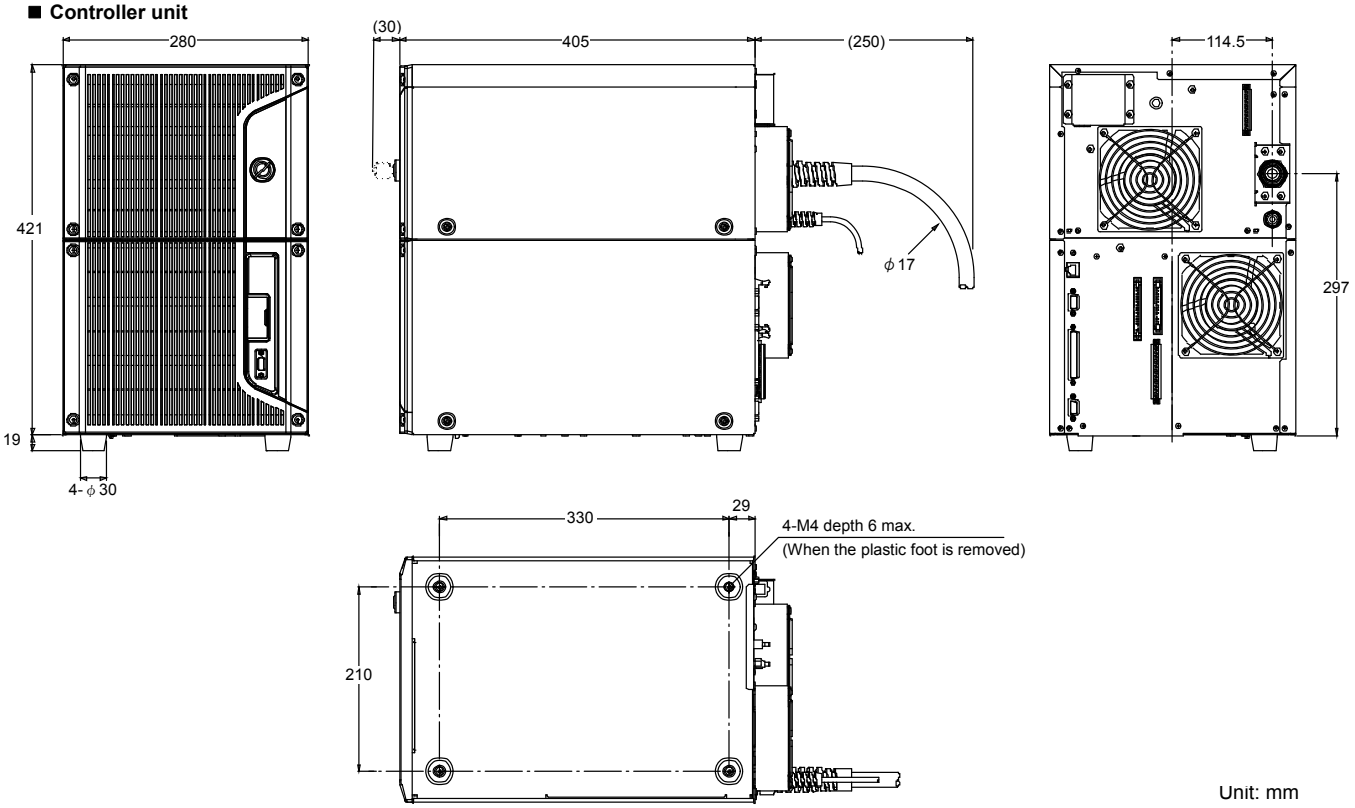
Unit: mm

OP-88240 is attached.



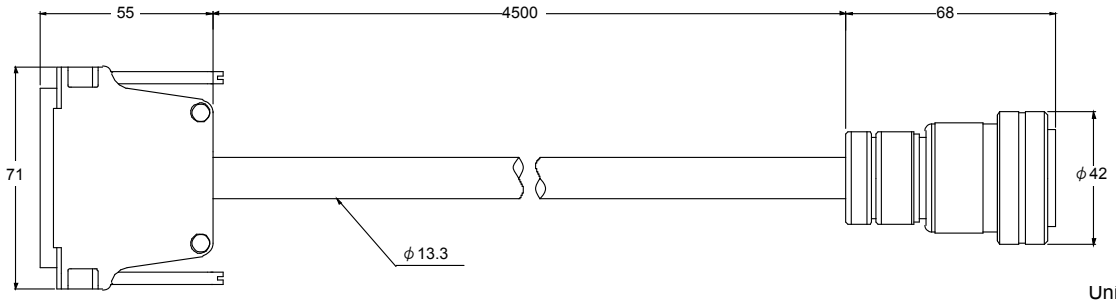
Unit: mm

■ **Controller unit**



Unit: mm

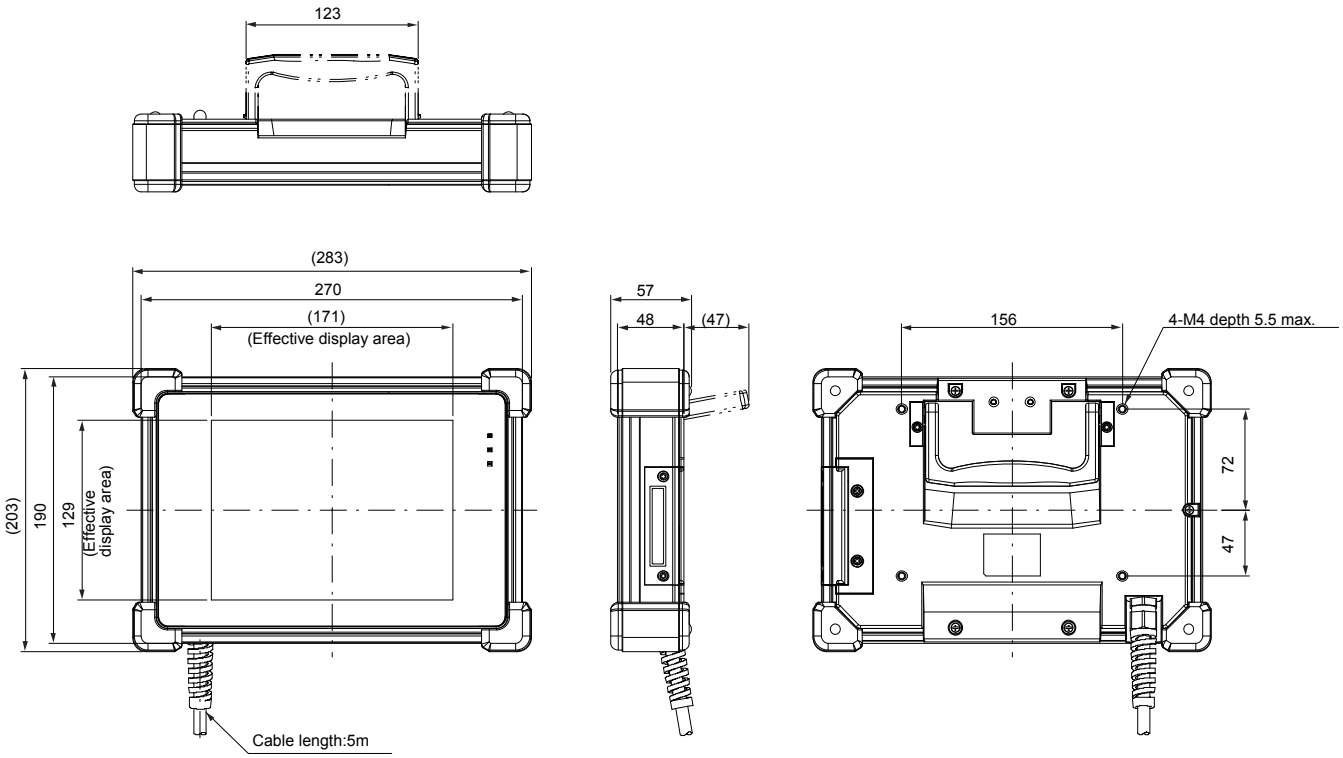
■ **Marking unit control cable**



Unit: mm

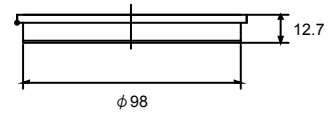
A
Appendix

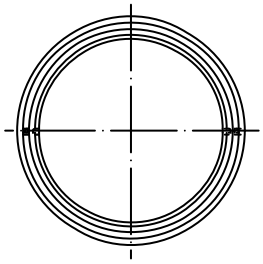
■ **Touch panel console MC-P1 (sold separately)**



Unit: mm

■ **Protective glass OP-88240 (sold separately)**





Unit: mm

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E 1101-3

Revision History

Date of printing	Version	Revision contents
January 2018	Official release	
March 2018	2nd edition	
March 2018	3rd edition	
May 2020	4th edition	
September 2021	5th edition	

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