Original instructions

Laser Control Unit

CL-E100A EU

OPERATION MANUAL

AMADA

AB03OM1203749-09

About This Documentation

Thank you for purchasing our CL-E100A Laser Control Unit.

Please read this manual carefully to ensure correct use of the product. Keep the manual handy after reading for future reference.

This document for the CL-E100A Laser Control Unit describes installation, maintenance, and specifications. Refer to the manual for the laser equipment for functions specific to the laser equipment and the manual for SWDraw3 for instructions for welding control using the SWDraw3 application.

1. Note

- Company and product names in this manual are trademarks or registered trademarks of their respective owners.
- Unauthorized reproduction of this manual in whole or part is prohibited.
- The contents of this manual are subject to change without notice.
- Every effort has been made to ensure the accuracy of this information. If you come across oversights or errors, please notify your dealer.
- Be sure to read the user's manuals for any equipment used in conjunction with the system (e.g., documentation for computer systems).

2. Symbols Used in this Manual

 CAUTION	Indicates instructions that must be followed to prevent hardware or software damage or operating errors.
 ATTENTION	Indicates additional information on a particular topic.

Menus, icons, buttons, windows, tabs	Enclosed in brackets. Example: Click the [OK] button.
Keyboard keys	Enclosed in angle brackets. Example: Press the <Tab> key.
References	Enclosed in quotes. Example: Refer to "Chapter 8-3.2 Changing Passwords" (page 5).

Contents

Chapter 1 Special Precautions

1. Safety Precautions

Read these Safety Precautions thoroughly before use to ensure correct use of the system.

- The precaution points indicated here are intended to ensure safe operation of the system and prevent hazards or injury to users and other personnel.

  They are important details relating to safety and must be read carefully.

- The indications have the following meanings.

⚠ DANGER	Indicates that incorrect operation risks death or serious injury to personnel.
⚠ WARNING	Indicates that incorrect operation may result in death or serious injury to personnel.
⚠ CAUTION	Indicates that incorrect operation may result in injury to personnel or damage to property.

Indicates prohibited actions and warns of actions not covered by the product warranty.

Indicates actions that must be performed by users.

The triangular symbol indicates details that supplement DANGER, WARNING, or CAUTION points.


⚠ DANGER

Never dismantle, repair, or modify the system. Doing so may result in electric shock or fire.
Otherwise there is a risk of electric shock or fire. Do not attempt maintenance other than that described in the Operation Manual.

Do not look into or touch the beam.
Direct and scattered laser light is dangerous. Looking directly at the laser source risks blindness.

Never burn, destroy, cut, crush or chemically decompose the system.
This product incorporates parts containing gallium arsenide (GaAs).

⚠ WARNING

Wear protective goggles.
Protective goggles must always be worn when using the system.
Care must be taken even when wearing protective goggles, as looking directly at the laser source through protective goggles risks blindness. Protective goggles attenuate the laser beam, but does not block it.

Never subject parts of the body to laser radiation.
Otherwise there is a risk of burn injuries.

Do not damage power or connector cables.
Do not crush, twist, or pull cables. Damaged cables may result in electric shock, short-circuiting, or fire.
Contact your dealer or us if repair or replacement is necessary.

Connect securely using the specified cables.
Using cables with inadequate capacity or improper connections may result in fire or electric shock.

Connect optical fibers securely.
Improper connection may result in burn injuries or fire.

Stop using the system if a problem arises.
If a problem occurs such as a burning smell, abnormal noise, overheating, or smoke emission, continuing to use the system may result in electric shock or fire.
Contact your dealer or us immediately.

Use a stopper.
Laser radiation is hazardous to personnel.When operating the laser during maintenance work, use a stopper (light-absorbing/scattering body capable of withstanding high temperatures) to prevent laser emission beyond the stopper.

⚠ WARNING

Wear protective work clothing.
Wear protective clothing such as gloves, long-sleeved clothing, and a leather apron.
Spatter will cause burn injuries if it lands on the skin.

⚠ CAUTION

Keep away from water.
Subjecting electrical components to water may result in electric shock or short-circuiting.

Install in a firm location.
Otherwise there is a risk of injury if the system topples or falls from the installation location.

Keep away from flammable materials.
Otherwise there is a risk of fire if spatter created during laser emission lands on flammable materials.
If flammable materials cannot be removed from the vicinity, they must be covered with a non-flammable cover.

Provide fire extinguishers.
Fire extinguishers must be provided in the welding work area in case of fire.

Inspect and maintain the system periodically.
Inspect and maintain the system periodically, repairing damaged parts and components before use.

Do not point the laser beam at flammable materials.
Do not point the laser beam at flammable or combustible materials. Otherwise there is a risk of fire.

Keep connector plugs clean and insert fully.
There is a risk of overheating and fire if dust is allowed to accumulate or if plugs are not fully inserted.

Hold the plug body when inserting or removing.
There is a risk of damage to the cable and electric shock or fire if the cable is pulled to unplug.

Do not cover with blankets or sheets.
Do not cover the system with blankets or sheets while in use. Otherwise there is a risk of over-heating and fire.

2. Operating Precautions

(1) Surely install the emergency stop mechanism for safety.

Read the manual for the laser equipment carefully for connection and operation of the emergency stop to confirm that it is surely installed.

(2) A person knowledgeable about laser radiation and laser systems should be appointed as a laser safety manager.

The laser safety manager should be responsible for managing the system key switches, providing safety instruction to laser operators, and supervising operations.

(3) Areas in which lasers are used must be partitioned from other areas by enclosing with fences.

These areas should be managed by a supervisor and marked with signs to prevent entry by unauthorized personnel.

(4) The system should be used in an ambient temperature range of 5°C to 40°C and humidity 20% to 85% RH with no sudden temperature fluctuations. Avoid using the system in the following locations.

- Locations with dust or oil mist present
- Locations subject to vibration or impact
- Locations in which chemicals are used
- Locations subject to high noise
- Locations susceptible to condensation
- Locations with high concentrations of CO_2, NO_x, or SO_x (The ion-exchange resin life may be reduced by exposure to CO_2 concentrations of 0.1% or more.)

(5) There is a risk of condensation forming on the lens surface and debris adhering if the ambient temperature changes suddenly such as when turning on the heating in cold conditions. Avoid sudden temperature fluctuations. There is a likelihood that condensation has formed if the output decreases during initial operation. Stop using the system immediately, and check the lens surface if there is a likelihood of condensation.

(6) The exterior of the system should be wiped clean using a soft or moist cloth. If the exterior is particularly dirty, wipe clean using diluted detergent or alcohol.

(7) Do not drop foreign objects such as screws inside the system, as this may result in failure of the system.

(8) Operate the system as described in the attached Operation Manual.

(9) Do not turn off the power switch of the laser control unit while a computer is connected to the laser control unit.

(10) If a computer is connected, it will continue to access the memory card for about 15 seconds after going offline. During this time, do not turn off the power switch of the laser control unit.

(11) If a computer is connected, never disconnect the LAN cable before turning off the power switch of the laser control unit.

(12) For more consistent scanning allow the unit to warm up for about 10 to 30 minutes after turning it on. The warmup time varies depending on the temperature and workpiece material.

(13) When a supervisor or operator enters the area where the laser is used, protective measures not to exceed the MPE* level must be taken.

* MPE: The maximum level of permissible exposure of the eyes or skin to laser beams. Abbreviation of Maximum Permissible Exposure.

(14) For optimal performance, we recommend performing annual inspections. For more information, please contact us.

* For other information on managing laser equipment or the MPE level, refer to the following standards.

IEC Standards IEC60825-1 "Safety of laser products Part1: Equipment Classifications, requirements and use's guide"

3. For Disposal

This product incorporates parts containing gallium arsenide (GaAs). At the time of disposal, separate it from general industrial waste or domestic waste and carry out the disposal in accordance with applicable laws and regulations.

Chapter 2 Features

This product can be combined with the laser welder and the scanner head unit to achieve a high-speed multi-spot seam laser welding system.

- Consistent, high-speed multi-parameter spot welding

  Multi-parameter spot welding for different materials and thicknesses within the same workpiece is facilitated.

- Cooperation with the scanner head unit

  The scanner head unit realizes a high-speed welding at an arbitrary position and wobbling.

- System configuration to suit customer requirements

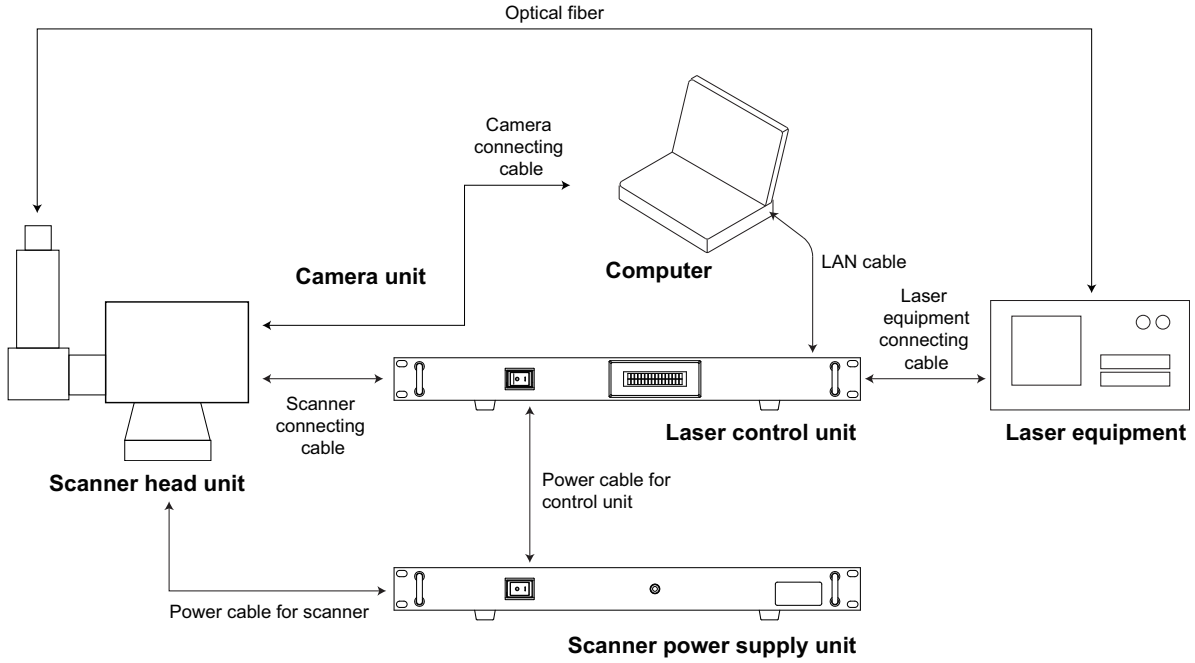
  Can be combined with commercially available laser welders to create a system able to cope with fine welding or high-output applications such as copper welding.

- Compact body corresponding to 19-inch 1U rack

  The outline is 482.6 x 547 x 320 (mm) and the weight is 5 kg. The CL-E100A is 19-inch 1U rack size and can be installed anywhere.

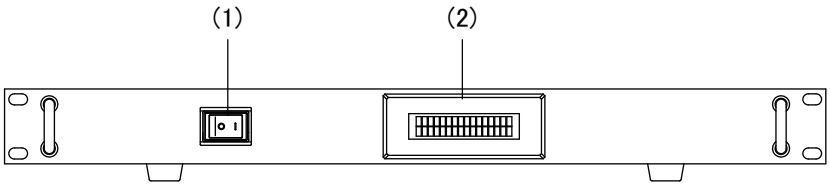
Chapter 3 System Configuration

1. Overall Configuration



2. Name and Functions of Each Section

2.1. Front



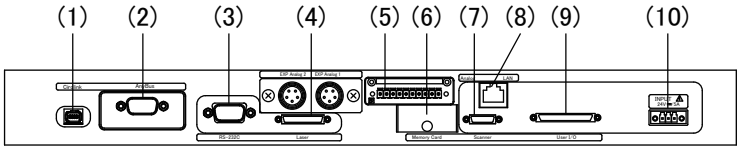
(1) Power switch

Turn ON/OFF the power supply.

(2) LCD

The status (LD, guide beam, and error) and error codes are displayed.

2.2. Rear



(1) CircLink connector

For maintenance. Do not connect anything.

(2) Anybus connector (option)

Terminal for external network.

Used when the optional EtherNet/IP is used.

(3) RS-232C connector

For external communications.

(4) Laser I/F connector (HDR 50 pin)

For connection with a stand-alone-type laser welder equipped with the interlock function.

Connector for I/O signals to control a laser welder from the laser control unit.

(5) Analog connector (1851313)

The memory card reads and saves data used for scanning. The laser control unit can be operated only when the memory card is inserted.

Install the attached noise filter on the cable connected to the analog connector by turning it 4 times.

(6) Memory card slot

The memory card is inserted. Do not remove it.

(7) Scanner I/F connector

For connection to the scanner head unit using the scanner cable. (XY2-100, 16 bits)

(8) Ethernet connector

Used to connect to the personal computer with the attached LAN cable. The LAN standard is compatible with 100BASE-TX.

(9) User I/O connector (HDRA 68 pin)

Connector for input and output with the external device (PLC, etc.).

(10) Power supply connector (1940101)

Power supply voltage input: 24 V DC, Typ 1.2 A (5 A max.)

Chapter 4 Installation

1. Unpacking

1.1. Lifting and Transporting Container

 CAUTION	When moving the container, use a cart or ensure at least two people carry it.

	Dimension	Mass (including contents)
Container for laser control unit and accessories	Approx. 520 (H) x 650 (W) x 575 (D) mm	Approx. 17 kg

1.2. Checking the Contents of Container

Verify that contents of the container agree with the following list.

Component	Quantity
Laser control unit	1
Operation manual for CL-E100A CD-ROM	1
Operation manual for SWDraw3 CD-ROM	1
PC software SWDraw3	1
LAN cable	1
68-core connector harness	1
Laser welder connecting cable	1
Noise filter	1

2. Installation

2.1. Installation Requirements

The system should be used in an ambient temperature range of 5°C to 40°C and humidity 20% to 85% RH with no sudden temperature fluctuations. Avoid using the system in the following locations.

- Locations with dust or oil mist present
- Locations subject to vibration or impact
- Locations in which chemicals are used
- Locations subject to high noise
- Locations susceptible to condensation
- Locations with high concentrations of CO_2, NO_x, or SO_x (The ion-exchange resin life may be reduced by exposure to CO_2 concentrations of 0.1% or more.)

Also, this unit is a 1U product of the EIA standard. When storing it in a rack, remove the rubber foots at the bottom of the unit.

2.2. Connections

The IP address must be set before connecting a computer to the laser control unit. Refer to the manual for SWDraw3 for instructions on setting the IP address.

2.3. Ground Connection

Be sure to ground the power cable. Pin 3 on the power supply connector is FG.

CAUTION	Supplying power without grounding may cause malfunction.

Chapter 5 Starting/Stopping the Equipment

1. Starting the Equipment

Before startup, confirm the following points.

- The laser welder, laser control unit, and computer are off.
- The laser welder, laser control unit, and computer are connected with the LAN cable.

1 Turn on the laser welder.

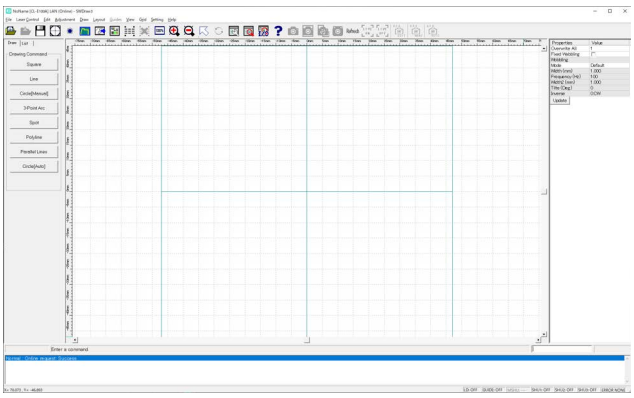
2 Turn on the laser welder Control key switch.

3 Turn on the laser control unit. “INITIAL” is displayed for Status on LCD and self-diagnosis begins.

CAUTION	When reversing the order of steps 2 and 3, the error No. 1030 may occur. Execute the reset operation.

4 After self-diagnosis is complete, “READY” is displayed for Status on LCD. After confirming it is displayed, go to the next step.

5 Start the computer.
After confirming that the computer is running, go to the next step.



6 Double-click the [SWDraw3] icon on the desktop to start the SWDraw3 application.
After SWDraw3 starts, the Drawing screen is displayed.

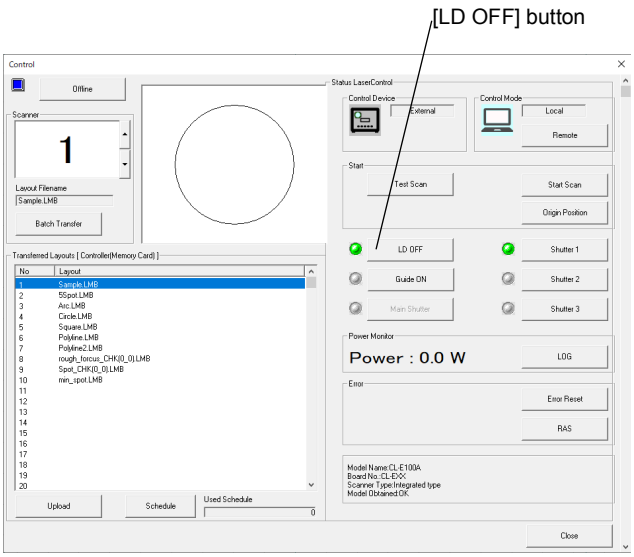
7 Confirm that the equipment is connected correctly by checking the status display field on the Drawing screen.
"Online" displayed in the title bar indicates that the laser control unit is online.

Equipment startup is now complete.

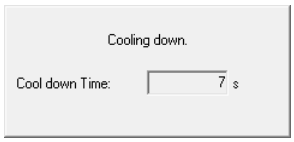
2. Stopping the Equipment

1 From the menu, select [Laser Control] -> [Control].
The [Control] screen appears.

2 When the [LD] is ON, click the [LD OFF] button.



3 The "Cooling down" message is displayed on the Drawing screen while operation is stopped.



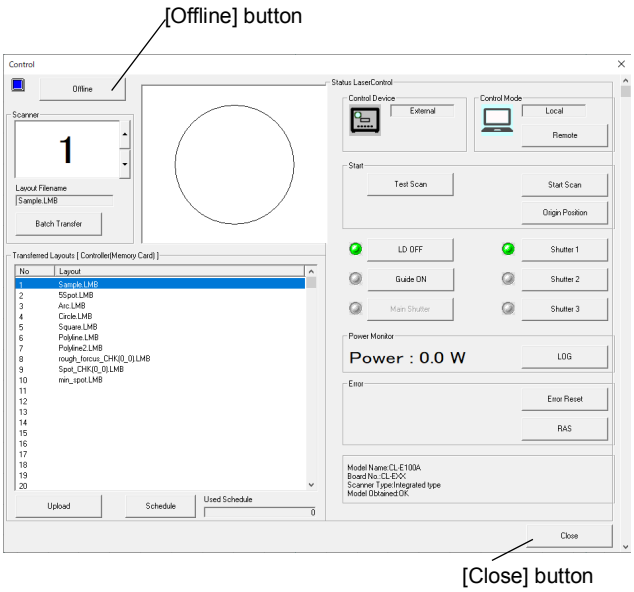
⚠ CAUTION	Do not turn off the power switch while the Drawing screen displays the "Cooling down" message. Shutting off the power switch while the system is stopped will significantly reduce the life of the laser welder.

⚠ CAUTION	Do not shut off the power while "Online" is displayed in the title bar. Shutting off the power switch while [Online] is displayed may result in the loss of data on memory card, preventing the system from restarting.

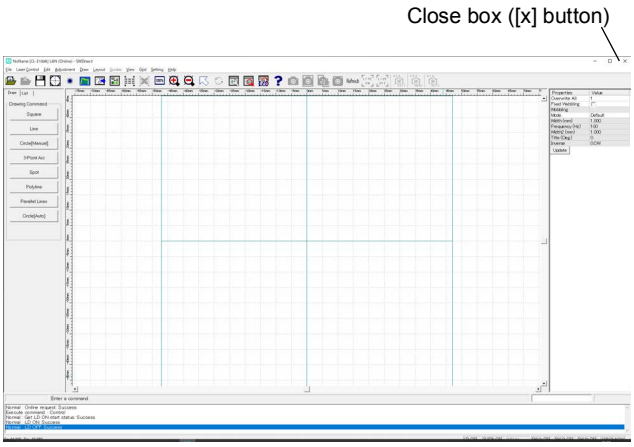
4 The "Cooling down" message disappears on the Drawing screen after the LD has finished shutting down.

5 Click the [Offline] button on the [Control] screen.

6 Click the [Close] button to close the [Control] screen.



7 To exit SWDraw3, select [File] -> [Exit] from the menu or click the Close box ([x] button) in the top-right corner of the screen.



8 Exit Windows by selecting [Turn Off Computer] from the Start menu, and then turn off the computer.

9 Turn off the power of laser control unit.

10 Turn off the laser welder Control key switch.

11 Turn off the laser welder.

System shutdown is now complete.

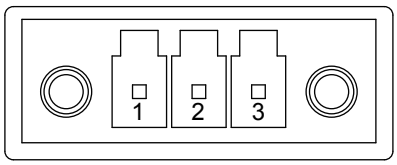
Chapter 6 Interface

1. Pin Layout

1.1. Power Supply Connector

Connector for Unit: 3.5 mm pitch, 3-pole socket

Connector for User Device: 3.5 mm pitch, 3-pole connector



Pin No.	Signal	Description
1	+24V	Input 24 V of the main power supply.
2	GND	GND for 24 V.
3	FG	Connect safety ground or cable shield.

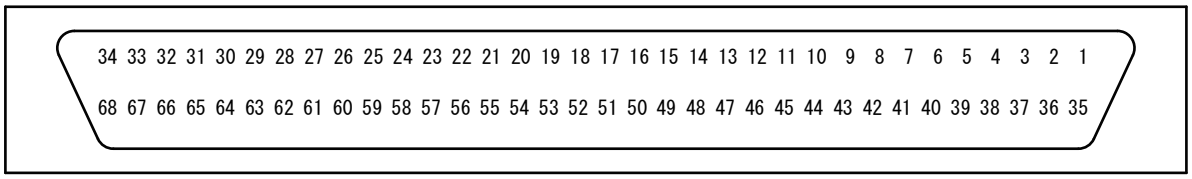
CAUTION	• Supplying power without grounding may cause malfunction. • Use the cable supplied with the scanner power supply unit CL-P115A/148A.

1.2. External Input and Output (User I/O)

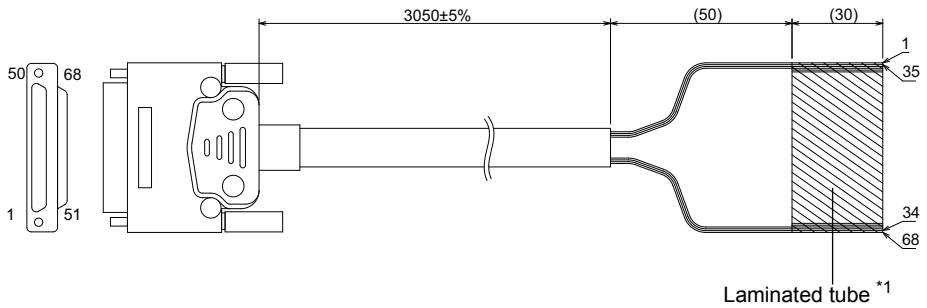
Connector for Unit: HDRA 68 Pins, Female

Connector for User Device: HDRA 68 Pins, Male

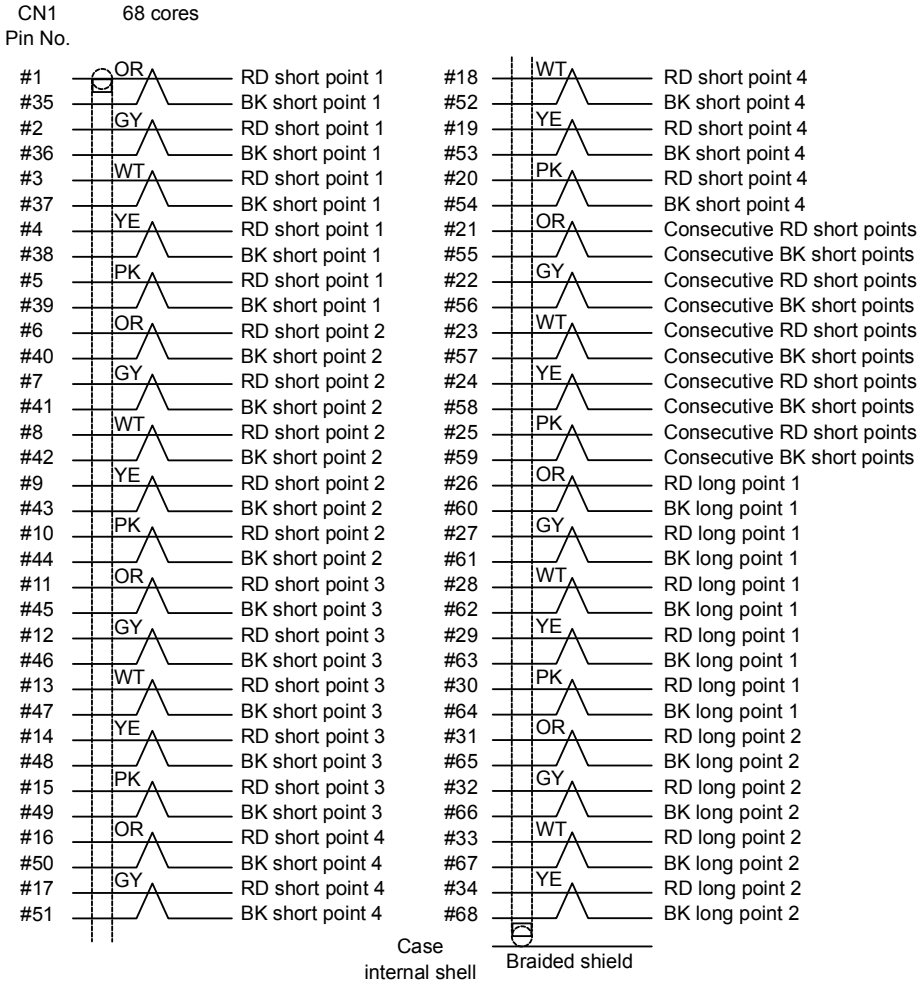
ATTENTION	Connect it to the shielded portion of the case when using the shielded cable. Do not use it as SG (signal ground).



A one-end harness (HDRA68N3C300) is attached for the User I/O connector.



Wiring diagram



*1: Terminal treatment
Cables are aligned at the laminated part in order. When performing wiring, peel them from the laminate tape. Also, avoid the use of the part peeled from the laminate tape (30 mm) since the cable coating may be deformed. In addition, the laminated part cannot be used for pressure contact.

1.2.1. Input signals

Pin No.	Signal	Description
3	Input COM	Common terminal for input signals. Internally connected with Pin 37.
4	Scan start (Laser start) *1	Effective only when the remote mode is enabled. Laser is output when closed.
5	Scan stop (Laser stop)	Effective only when the remote mode is enabled. Laser output is stopped when closed.
6	LD-ON/OFF	When this Pin 6-COM circuit is closed, the LD is turned on. When the circuit is opened, the LD is turned off.
7	Guide beam ON/OFF	Guide beam turns on at rising edge of closing and turns off at falling edge of opening.
8	Error reset (Trouble reset)	Close input cancels the trouble output.

Pin No.	Signal	Description
9	Unused	Do not connect anything.
10	Unused	Do not connect anything.
11	Point skip	Close input proceeds to the next point. (CW mode)
12	Control switching	While this Pin 12-COM circuit is closed, the remote mode is set and the external input signals are effective.
13	Operation complete input ACK	The carriage control operation is checked to resume the scanning operation.
14	Reserve	Do not connect anything.
15	Reserve	Do not connect anything.
16	Layout no. selection	Layout number selection input (binary code 1)
17		Layout number selection input (binary code 2)
18		Layout number selection input (binary code 4)
19		Layout number selection input (binary code 8)
20		Layout number selection input (binary code 16)
21		Layout number selection input (binary code 32)
22		Layout number selection input (binary code 64)
23		Layout number selection input (binary code 128)
24		Layout number selection input (binary code 256)
25		Layout number selection input (binary code 512)
26	Layout no. confirmation strobe	Close (ON) output checks the layout number and confirms it at the time of the closing edge.
27	Reserve	Do not connect anything.
28	Unused	Do not connect anything.
29	Unused	Do not connect anything.
30	Unused	Do not connect anything.
31	Unused	Do not connect anything.
32	Output COM	Common terminal for output signals. Internally connected with Pin 66.
37	Input COM	Common terminal for input signals. Internally connected with Pin 3.
62	Unused	Do not connect anything.
63	Unused	Do not connect anything.
64	Unused	Do not connect anything.
65	Unused	Do not connect anything.
66	Output COM	Common terminal for output signals. Internally connected with Pin 32.

*1: This signal is enabled when "Remote" is selected on the PC operating screen or the Control switching input on the User I/O. It is disabled when "Local" is selected.

1.2.2. Output signals

Pin No.	Signal	Description
1	+24 V OUT	Power supply for external input and output (User I/O). Do not use it for any other purpose.
2	+24 V OUT	Power supply for external input and output (User I/O). Do not use it for any other purpose.
33	+24 V OUT	Power supply for external input and output (User I/O). Do not use it for any other purpose.
34	+24 V OUT	Power supply for external I/O. Do not use it for any other purpose.
35	0 V OUT	GND for external I/O. Do not use it for any other purpose.
36	0 V OUT	GND for external I/O. Do not use it for any other purpose.
38	Laser output (for indicator)	While the laser is output, this pin is closed internally. This is a signal for turning on an indicator during laser output. Do not use for timing control.
39	LD ON	While the LD is supplied, this Pin 39-COM circuit is closed internally.
40	Guide beam ON	While the guide beam is turned on, this Pin 40-COM circuit is closed internally.
41	Ready	When the LD or high voltage is turned on and the laser is ready to output, this Pin 41-COM circuit is closed internally.
42	Trouble	If trouble arises, this Pin 42-COM circuit is opened internally until it is reset.
43	Warning	If warning arises, this Pin 43-COM circuit is opened internally until it is reset.
44	Reserve	Do not connect anything.
45	Reserve	Do not connect anything.
46	Reserve	Do not connect anything.
47	Remote	When the remote mode is set, this Pin 47-COM circuit is closed internally.
48	External input receivable	If the circuit status is open, an external input signal is disabled.
49	Bootable	While the LD is supplied, this Pin 49-COM circuit is closed internally.
50	Strobe	Turned ON when the carriage control operation is permitted.
51	Reserve	Do not connect anything.
52	Reserve	Do not connect anything.
53	Data error	When an unregistered layout no. is selected, this Pin 53-COM circuit is closed internally until it is reset.

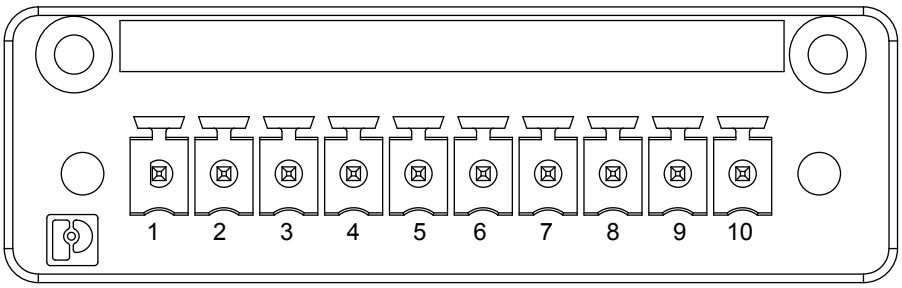
Pin No.	Signal	Description
54	Reserve	Do not connect anything.
55	Scan start trigger	Outputs the trigger signal for scan start. Can be used as the external trigger of a measuring instrument such as an oscilloscope or our MM-L series.
56	Layout no. confirmation	Close (ON) output is supplied with the layout number confirmation.
57	Unused	Do not connect anything.
58	Unused	Do not connect anything.
59	Unused	Do not connect anything.
61	Unused	Do not connect anything.
67	0 V OUT	GND for external I/O. Do not use it for any other purpose.
68	0 V OUT	GND for external I/O. Do not use it for any other purpose.

Output format : Open collector output
Output rating : 24 V DC, 70 mA max

1.3. Analog Connector

Connector for Unit: 3.81 mm pitch, 10-pole socket

Connector for User Device: 3.81 mm pitch, 10-pole connector



Pin No.	Signal	Description
1	Power monitor	The monitor waveform of the laser power is output as analog signal. *1
2	AGND	GND for analog output.
3	Reflected light monitor	The monitor waveform of the reflected light is output as analog signal. *1
4	AGND	GND for analog output.
5	Unused	Do not connect anything.
6	Unused	Do not connect anything.
7	Unused	Do not connect anything.

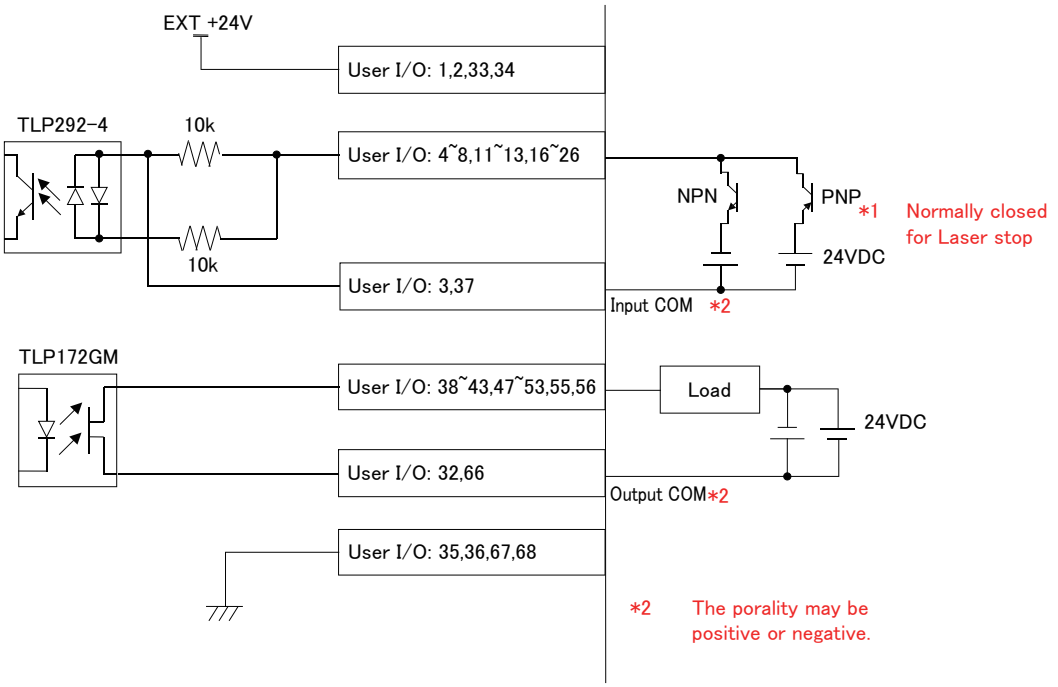
Pin No.	Signal	Description
8	Unused	Do not connect anything.
9	Unused	Do not connect anything.
10	Unused	Do not connect anything.

*1: Not function when connected with the laser welder not having an analog output signal.

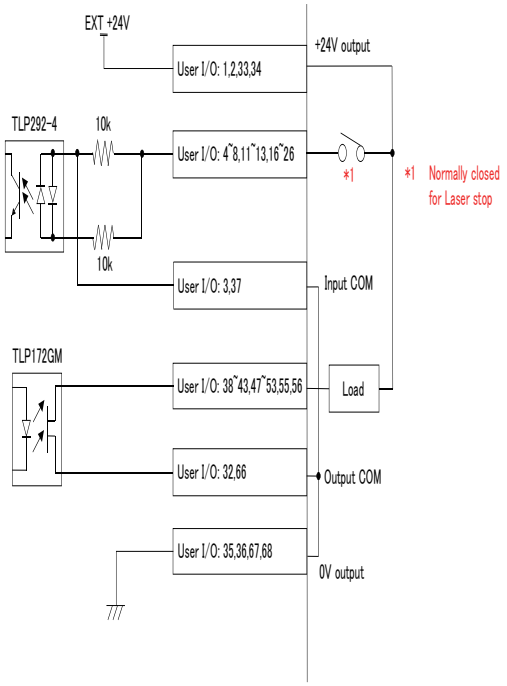
2. Example Connection

2.1. External Input and Output (User I/O)

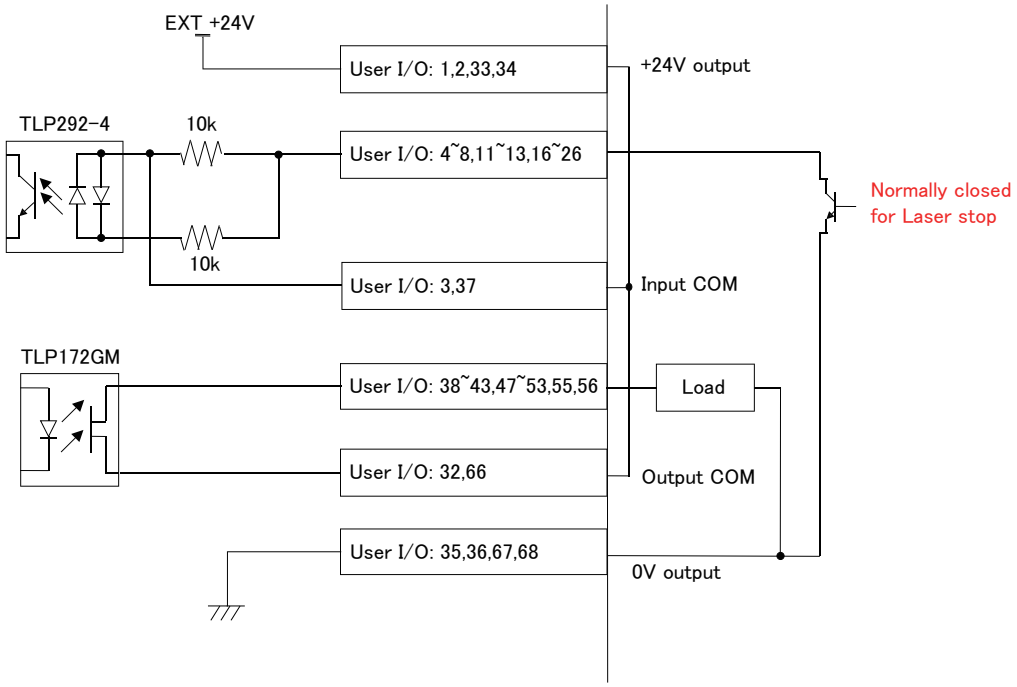
2.1.1. When connected to the external power source



2.1.2. When using contact signal

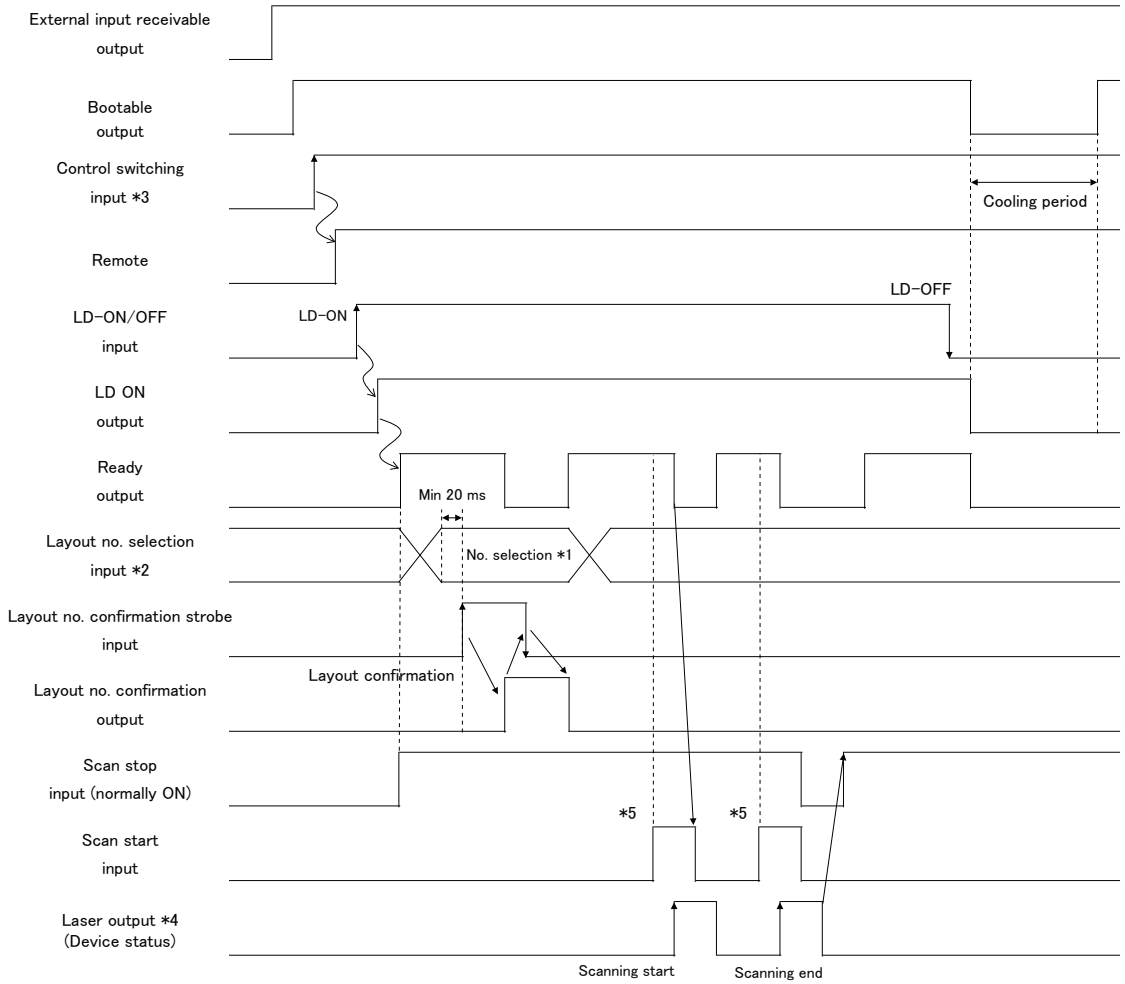


2.1.3. When using open collector signal



3. Timing

3.1. During Normal Operations



*1 Layout no. input setting range: 1 to 1023. Treated as 1 if set to 0.

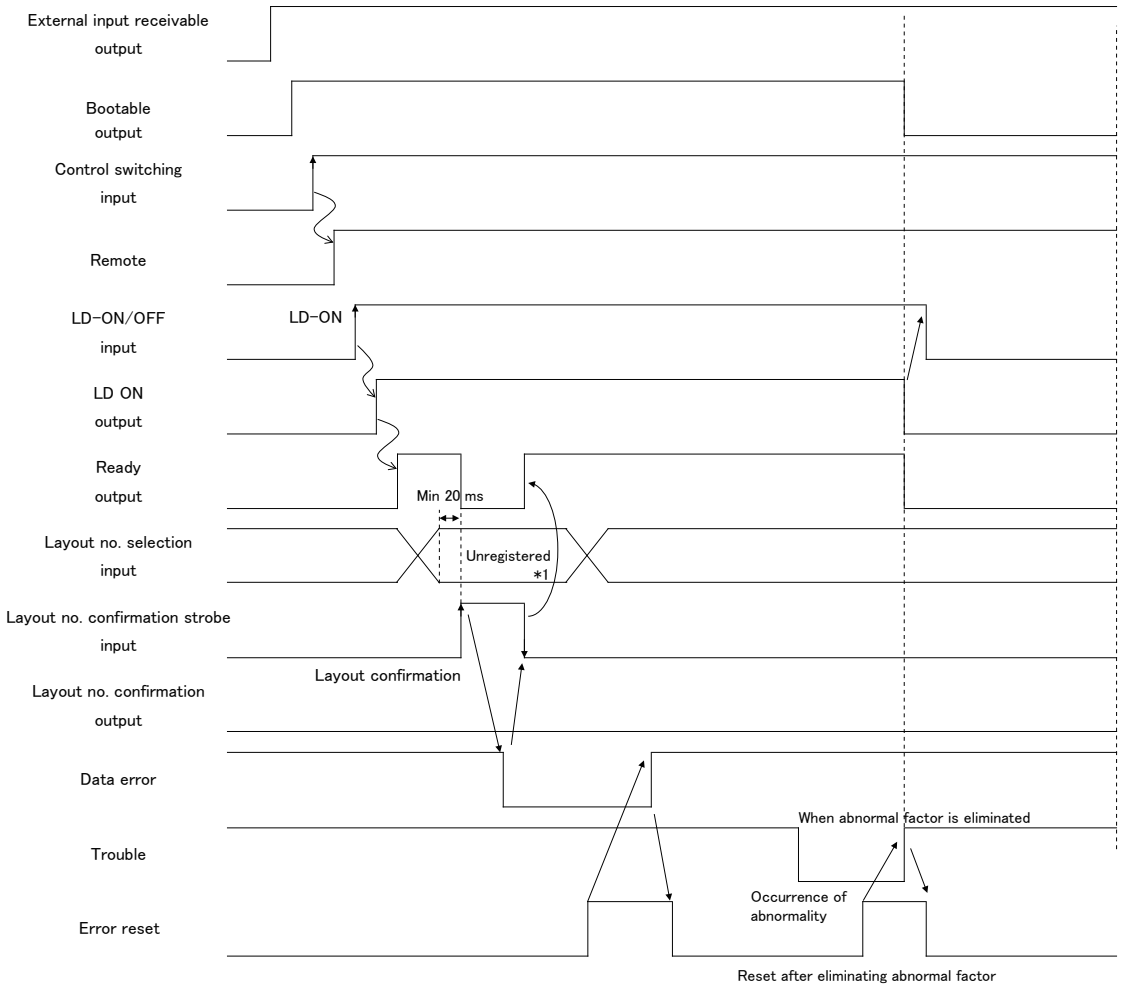
*2 Layout no. is confirmed at rising edge of Layout no. confirmation strobe input. Layout no. confirmation strobe input is enabled while External receivable output is on and Laser outputting output is off.
Do not change the layout number by the time of falling of Layout no. confirmation strobe input.

*3 The control switching can be set from a computer or the Control switching input on the User I/O.

*4 The laser output indicates the equipment status. Other signals indicate the I/O signals.

*5 Confirm that Ready is on before turning on Scan start.

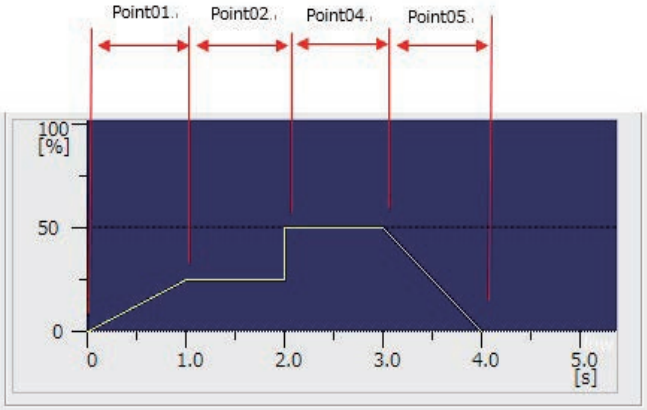
3.2. During Errors (Unregistered Layouts and Other Errors)



*1 When an unregistered number is selected at the time of the layout no. confirmation strobe input, the layout no. before confirmation is selected.

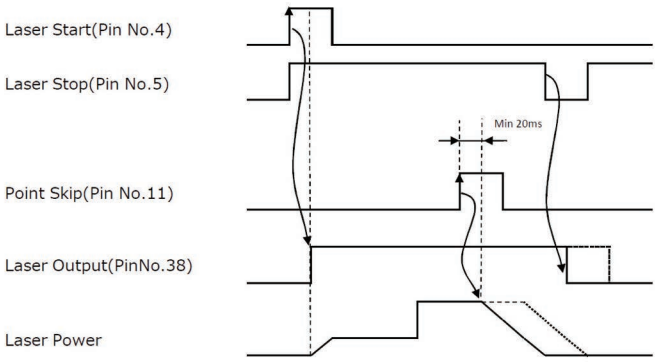
3.3. Point skip function

Each time a user I/O point skip signal is input, the currently irradiated point is skipped and the next point is advanced.(However, points with no time elapsed like point 03 in the figure below are not eligible.)



	POINT01	POINT02	POINT03	POINT04	POINT05
TIME[s]	1.0	1.0	0.0	1.0	1.0
POWER[%]	50.00	50.00	100.00	100.00	0.00

(Example) When point skip is executed in the middle of point 04 with the above waveform settings.



*The laser operates as above, but the layout operates only for the time set in advance in the layout of SWDraw3. (In the figure above, laser output signal)

*If the laser timing is advanced by point skip, input the laser stop signal at the timing when the laser irradiation is completed to stop the layout operation.

4. RS-232C Communication Functions

4.1. Overview

You can transfer data to the laser control unit via serial communications, as well as setting and reading scanning conditions from a connected computer.

Data communicated via serial ports is sent and received bit by bit (sequentially) over two separate lines.

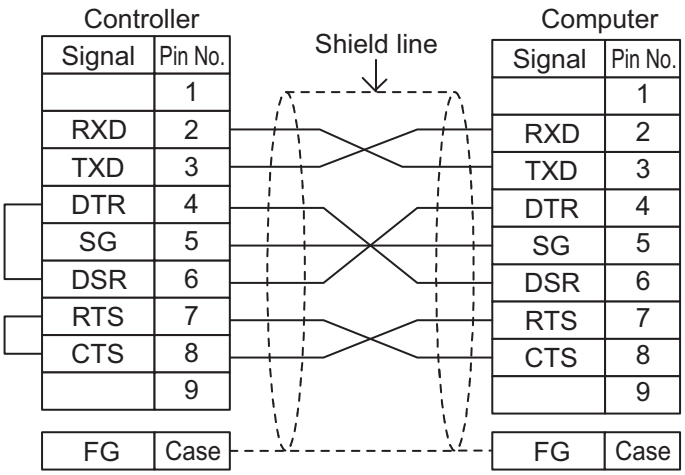
4.2. Interface

(1) Cable specifications

The specifications for the connecting cable are given below.

- D-Sub 9 pins, female
- UNC is used for nos. 4-40
- Cross-connected
- A shield line included
- Maximum length: 10 m

Connection example: Connected to a computer



The pin assignments are given below.

Pin	Signal	Description
1	-	-
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	SG	Signal Ground
6	DSR	Data Set Ready

Pin	Signal	Description
7	RTS	Request To Send
8	CTS	Clear To Send
9	-	-
-	FG	Frame Ground: safety ground or cable shield

 ATTENTION	Use a connecting cable with a shield line. Make sure that the case you connect to is designed to resist electromagnetic interference (EMI).

(2) Communication settings

Communication settings specifics are given below.

Item	Value
Electrical interface	Conforms to the RS-232C specification
Method	Asynchronous*1
Data bit length	8 bits
Stop bit length	1 bit
Parity check*2	Even
Baud rate*3	9600 bps
Flow control*4	No
Checksum*5	OFF
Delimiter ETX	OFF

*1 Asynchronous communications involve interspersing control signals with the individual characters being sent. Specifically, the “start bit” and “stop bit” (indicating the start and end of the character, respectively) are added. If there is no data to send, only the stop bit signal will be sent. To receive data, the receiving side repeatedly acknowledges readiness to receive the next character after detecting a start bit.

*2 Parity check: parity-based error detection method. A single parity bit, 0 or 1 for binary data, indicates whether the amount of data is even or odd.

*3 Baud rate: communications rate. The volume of data transmitted per second in bits is given in bps.

*4 Flow control: control used to manage halting and resumption of data transmission between devices exchanging data.

*5 Checksum: error detection method for received data. Data totals are calculated and transmitted with data; the totals are calculated once again on the receiving side and compared to the transmitted totals. Sums that fail to match indicate an error.

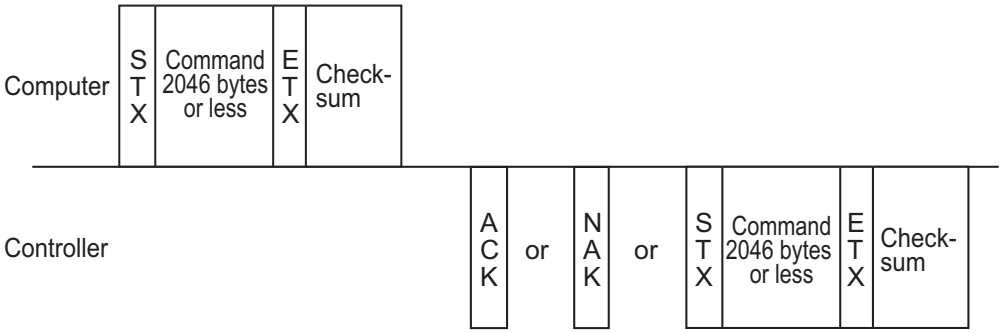
4.3. Instructions for RS-232C Communications

RS-232C communications with the laser control unit involve exchange of ASCII data.

Up to 2048 bytes may be sent or received at a time, including STX and ETX.

If a transmission error occurs (parity errors, for example), the data is discarded.

Only after successful reception up to the point of ETX will an ACK, NAK, or the usual data be returned.



4.4. Communications Protocol

In RS-232C communications with the laser control unit, data basically consists of the following elements:

STX	Command Segment Response Segment (0-2046 bytes)	ETX	Checksum (2 bytes) (Only when selected)

(1) Transmission control code

The transmission control codes are as follows:

Name	Value	Details
STX	0x02	Start transmission
ETX	0x03	End transmission
ACK	0x06	Acknowledge successful reception
NAK	0x15	Negative acknowledgment; processing errors occurred during reception

Conditions under which a NAK is returned:
• Incorrect checksum • Specified command does not exist. • Specified value exceeds the setting range. • Insufficient internal RAM • Specified command cannot be executed at this time (for example, if a command is issued to begin scanning when scanning is not possible).

(2) Numerical notation

- Signs

Plus	Nothing is added before the number.
Minus	0x2D is added before the character. Hexadecimal notation itself does not indicate the sign of a value.

- Values

The value itself is expressed as a decimal number unless otherwise specified.

Decimal numbers	Available ASCII codes are from 0x30 to 0x39.
Hexadecimal numbers (in the checksum segment)	A value from 0x41 to 0x46 is added to the ASCII code available for the decimal numbers. Lowercase letters cannot be used.

- Data with decimals

Examples of numerical notation
The decimal number "1": ..... 0x31 The decimal number "-1": ..... 0x2D, 0x31 The hexadecimal number "FFA0": ..... 0x46, 0x46, 0x41, 0x30 The axial rotation angle is "45.000000°": 45000000

(3) String notation

ASCII code (symbols and alphanumeric)	Single-byte code from 0x20 to 0x7F
Single-byte katakana	Single-byte code from 0xA1 to 0xDF
Kanji	Double-byte Shift-JIS code starting with a code from 0x80 to 0x9F or from 0xE0 to 0xFF

Example of string notation
12345 ..... 0x31, 0x32, 0x33, 0x34, 0x35, 0xB1, 0xB2, 0xB3, 0xB4, 0xB5 (10 bytes) ABC ..... 0x8A, 0xBF, 0x8E, 0x9A, 0x41, 0x42, 0x43 (7 bytes)

* Commas are generally not expressed since commas are special characters used as delimiters. To indicate a comma used as a comma, add the special character "\" before the character. Characters after "\" are not treated as delimiters. Use "\," to designate a comma. To express "\," use "\\".

* Strings can be up to 40 bytes unless otherwise specified.

4.5. Commands

The commands are listed below.

The beginning of a command segment signify specific command itself.

Command		Function details		
Read	Write	Parameter		Setting increment/details
RTR	RTW	X and Y axes	Axial rotation angle	0.000001°
XOR	XOW		X-axis offset	1 µm (0.001 mm)
YOR	YOW		Y-axis offset	1 µm (0.001 mm)
XYR	XYW		X-axis offset Y-axis offset Axial rotation angle	1 µm (0.001 mm) 1 µm (0.001 mm) 0.000001°
LMR	LMW	Laser control	Laser start	0: OFF 1: ON
MSR	MSW		Scanning start	0: End 1: Scanning in progress
TSR	TSW		Test scanning start	0: End 1: Test scanning in progress
GLR	GLW		Guide beam	0: OFF 1: ON
LNR	LNW		Layout number selection	Layout number
RLR	RLW		Toggle external control	0: Local (internal) 1: Remote (external)
ERR		Maintenance	Reset errors	
TRB			Error code acquisition	
PORR		Lase power monitor control	Power monitor data acquisition	

4.5.1. Command Details

(1) RTR/RTW (Axial rotation angle)

Read/Write the axial rotation angle at which all layout data is rotated.

The setting increment is 0.000001°.

(2) XOR/XOW (X-axis offset)

Read/Write the X-axis offset for all the layout data.

The setting increment is 1 µm.

(3) YOR/YOW (Y-axis offset)

Read/Write the Y-axis offset for all layout data.

The setting increment is 1 µm.

(4) XYR/XYW (X-axis offset, Y-axis offset, Axial rotation angle)

Read/Write the X-axis offset, Y-axis offset and axial rotation angle for all layout data.

- Write (XYW t0, t1, t2)

  t0: X-axis offset (unit: 1 µm)
  t1: Y-axis offset (unit: 1 µm)
  t2: Axial rotation angle (unit: 0.000001°)

(5) LMR/LMW (Laser start)

Read/Write the LD activation status.

In this setting, 0 = OFF and 1 = ON.

(6) MSR/MSW (Scanning start), TSR/TSW (Test scanning start)

Read/Write the scanning status.

In the read setting, 0 = Finished and 1 = Scanning in progress.

In the write setting, 0 = Stop scanning and 1 = Start scanning.

Writing 1 (to start scanning) is valid only under local (internal) control. Writing 0 (to stop scanning) is valid under both local and remote control.

(7) GLR/GLW (Guide beam)

Read/Write the guide beam activation status.

In this setting, 0 = OFF and 1 = ON.

(8) LNR/LNW (Layout number selection)

Read the currently selected layout number.

Also used to change the layout number by writing the specified layout number instead.

(9) RLR/RLW (Toggle external control)

Obtain the current status of the device used for external control.

Also used to switch the control method.

In this setting, 0 = Local (Internal) and 1 = Remote (External).

Local	The layout number can be set and scanning initiated from the touch panel, computer, or device connected via RS-232C.
Remote	The layout number can be set and scanning initiated with an external I/O signal.

(10) ERR (Reset Errors)

Clear the current error.

Computer -> Controller	: ERR

(11) TRB (Error code acquisition)

Obtain all current error codes.

Example
Emergency stop and layout command errors have occurred
Computer -> Controller : TRB
Controller -> Computer : 11, 22
When multiple errors have occurred, all error codes are returned, delimited by commas. (Error codes are not sent in ascending order by error code number.) If no error occurs, only STX, ETX, and checksum are returned.

(12) PORR (Power monitor data acquisition)

Obtains the average laser output of the entire layout scanned the most recently.

The value of the power monitor data is reset at the scan start and determined after the scan end.

The power monitor data is displayed based on the power monitor signal of the laser equipment from the scan start to end of one layout. Therefore, it may be different from the power monitor value of the laser equipment or the measured value of the power meter.

Controller -> Computer	: s0,s1

s0	Power monitor data	Less than 100 W: 0.000□ to 99.999□ 100 W or more / less than 1000 W: 100.00□ to 999.99□ 1000 W or more: 1000.0□ to 99999.9□ (□ denotes a single-bite space.)
s1	Unit	Watt: W□□□ (□ denotes a single-bite space.)

Example
When obtaining the power monitor data (123.45 W) of the layout No. 1
Computer -> Controller : PORR
Controller -> Computer : 123.45□,W□□□

CAUTION	This function is available only when the laser equipment has the power monitor signal.

Chapter 7 Specifications

1. Basic Specifications

Item		Specifications
Ambient temperature		5°C to 40°C Note: Contact us when using in ambient temperature below 5°C.
Ambient humidity		20% to 85% RH (with no condensation or freeze)
Temperature during storage		-10°C to 60°C (with no condensation or freeze)
Humidity during storage		10% to 85% RH (with no condensation or freeze)
Vibration during transport (with packaged)		ASTM D 4728 Level2
Impact during transport (with packaged)		ASTM D 4169-05 Level2
Waterproof, Dust		IP32
Electromagnetic compatibility standards	Immunity	Complied with the following: IEC61000-4-2 (Electro-static immunity) IEC61000-4-3 (Radiated field) IEC61000-4-4 (Fast transient burst noise) IEC61000-4-5 (Lightning surge) IEC61000-4-6 (Conducted immunity) IEC61000-4-8 (Magnetic field immunity) IEC61000-4-11 (Dips/Interrupts)
	Emission	Complied with the following: EN55011 (Radiated disturbance) EN55011 (Conducted disturbance)
Power supply voltage		24 V DC (±3%)
Power consumption		Approx. 20 W
External dimensions		430(W) mm × 320(D) mm × 44(H) mm (Not including projections)
Mass		Approx. 5 kg

2. Accessories

Item	Model No. or specification	Quantity
Operation manual for CL-E100A CD-ROM	AS1203739	1
Operation manual for SWDraw3 CD-ROM	AS1206501	1
PC software SWDraw3	AS1206506	1
LAN cable (5 m)	Compliant with CAT5e IEEE802.3ab 1000BASE-T	1
68-core connector harness	HDRA68N3C300	1
Laser welder connecting cable	Depends on the laser welder used	1
Noise filter *1	ZCAT3035-1330	1

*1 The noise filter is used when a cable is connected to the analog connector. For details, see "Chapter 3-2. Name and Functions of Each Section" (page 10) .

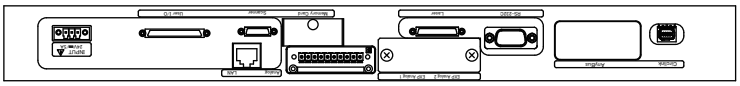
3. Optional Items

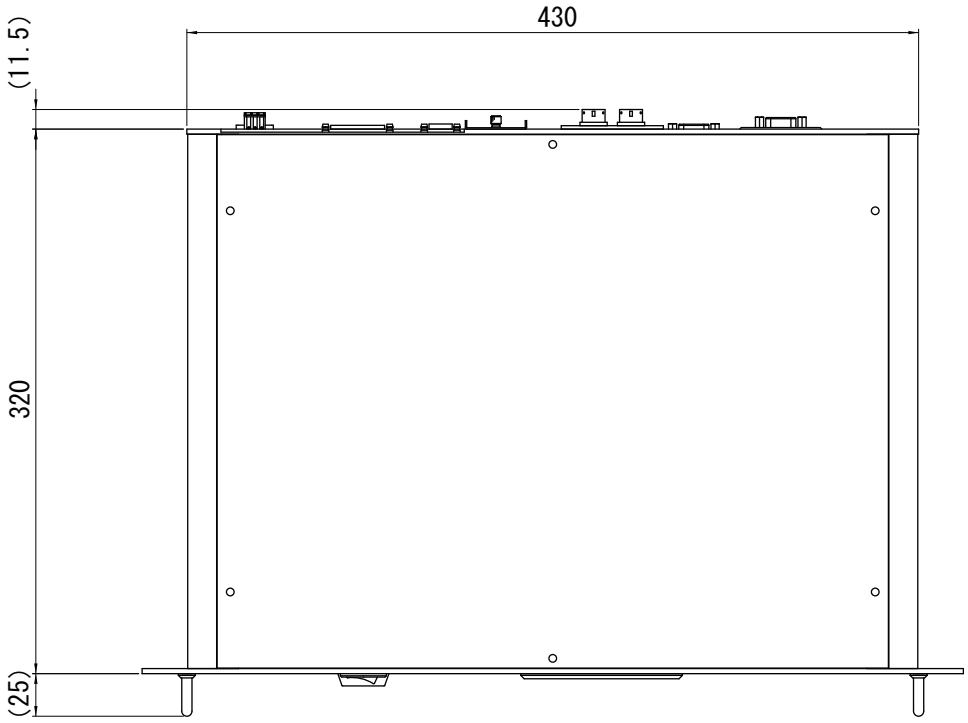
Item	Specifications	
Computer	CPU	Intel Celeron 3867U or better, Intel Core i5-7442EQ or better (when using the camera unit[*1])
	Memory	2 GB or more, 16 GB or more (when using the camera unit[*1])
	Hard disk space	5 GB or more
	Display resolution	1024 x 768 dots or more, 1366 x 768 dots or more (when using the camera unit[*1])
	Optical drive	DVD-ROM drive
	Interface	Keyboard/mouse/LAN(10/100M)/LAN(1000M) for connecting the camera ×1[*2] (when using the camera unit[*1])
	Operating system	Windows 10 Pro, 64 bit Japanese/English Windows 11 Pro, Japanese/English
Laser welder	Typical example of available laser welders: • **ML-U300AS** • **ML-U500AS** • **YLR series (IPG-made)** • **YLS series (IPG-made)** For other laser welders, contact us.	
Optical fiber	Optical fiber should be selected to suit laser welder and laser conditions used.	
Scanner power supply unit	• **CL-P115A** • **CL-P148A**	
Scanner head unit	• **CL-H201A-00-00** • **CL-H601A-01-00**	

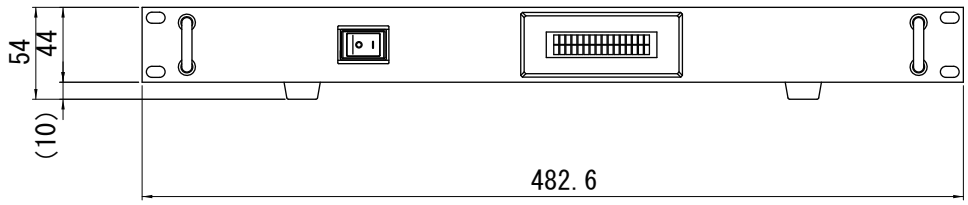
*1 The camera unit is an option for the scanner head unit.
*2 Jumbo packet 9 Kbyte or more.

Chapter 8 Outline Drawing

Dimensions in mm







Chapter 9 Inspection and Parts Replacement

1. Before Inspection and Parts Replacement

This section describes simple maintenance tasks that can be performed by users.

 CAUTION	Before performing any maintenance tasks, turn OFF the equipment and wait at least five minutes to stop the equipment safely. Touching the equipment interior when it is on may result in electric shock.

 CAUTION	• Use our genuine maintenance parts. • For defect caused by non-genuine maintenance parts or use of non-genuine maintenance parts, the repair is charged even if it is still within the maintenance contract period or the warranty period.

For optimal performance, we recommend performing annual inspections.

For more information, please contact us.

2. Parts Replacement

As user-serviceable parts wear with use, performance will decline, eventually requiring repairs or replacement.
Inspect the unit regularly, referring to the guidelines provided in the following table:

Component	Model No.	Schedule*1 (Recommended)	Maintenance
Lithium battery*2	CR2032 3V	3 years	Replace at end of service life See "Chapter 9-3. Backup Lithium Battery Replacement" (page 41) .

*1 The schedule means the maintenance time or expected life of the part, and is different from the warranty period.

*2 The service life will be shorter if the equipment is shut down for extended period.

3. Backup Lithium Battery Replacement

3.1. Lithium Battery

The laser control unit includes a lithium backup battery. If this battery is exhausted, a time cannot be held when the power switch is turned OFF. Purchase a new battery from us and replace the battery when either of the conditions below is met.

- Three years have passed since the battery was replaced
- Within one week after battery errors are displayed

The lithium battery is not used as an auxiliary power supply.

3.2. Preparation

Have the following ready when replacing the lithium battery.

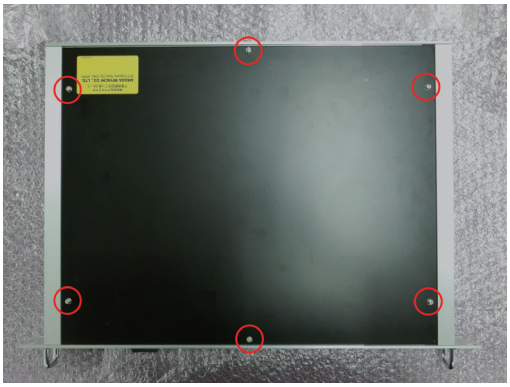
- New lithium battery
- Phillips screwdriver

3.3. Replacing the Lithium Battery

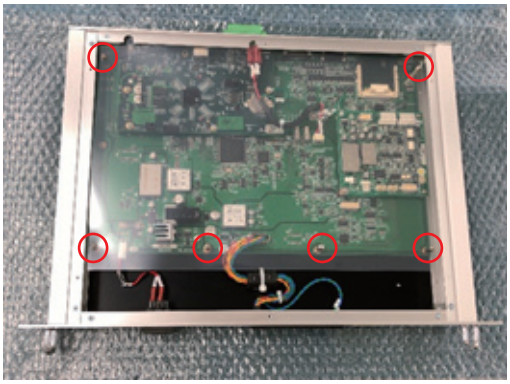
1 Turn OFF the power switch on the front and disconnect the power cable.

CAUTION	The battery is not completely discharged even when the power switch is turned off. Be sure to disconnect the power cable.

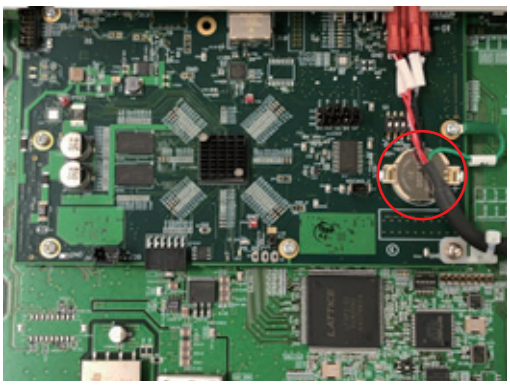
2 Unscrew the six screws on bottom on the top to remove the black metal plate.



3 Unscrew the six screws to remove the transparent cover.



4 Remove the control board's lithium battery.



CAUTION	Perform with dry hands or wear an insulation glove.

5 Insert the new lithium battery. Confirm correct polarity before insertion.

6 Replace the cover and the metal plate.

ATTENTION	Follow your local environmental regulations for battery disposal because Lithium Battery contains dangerous materials.

7 Set the time from the SWDraw3.

Chapter 10 Error Messages

If a system error occurs, pressing the [RAS] button displays details of the error on the PC. For details of the [RAS] button, refer to the manual for SWDraw3.

	Error details	LD	User I/O (output)	Corrective action
1003	Part Unregistered	-	Data error	Register data.The part has not been registered. Register the data.
1007	Layout Data Unregistered	-	Data error	The layout data has not been registered. Register the data. Choose a starting number other than "0".
1008	Loops (100) Excessive	-	Data error	If this message is displayed, please contact us.
1009	Scanning Speed Error	-	Data error	Scanning speed setting error. Adjust scanning speed.
1010	ACK Timeout	-	Data error	There is no ACK response (indicating completion) from the transfer unit within the allotted time. Check the transfer unit.
1011	Layout Command Error	-	Data error	Layout error. After restarting the controller and your computer, transfer the layout data.
1012	Layout Parameter Error	-	Data error	Layout error. After restarting the controller and your computer, transfer the layout data.
1013	Insufficient Layout Command Error	-	Data error	Layout error. After restarting the controller and your computer, transfer the layout data.
1016	Scanning Area Error	-	Data error	Layout error. Reset the system and PC before sending the layout data.
1020	Battery Voltage Low	-	Warning	Low battery voltage. Replace the battery.
1030	Laser interlocked	OFF	Error	Interlock signal of the laser equipment was detected. Cancel the interlock signal or press the [Error Reset] button of the laser equipment. Otherwise, press the [Error Reset] button from SWDraw. For more information, please refer to the instruction manual of the laser equipment. If this error message still appears after resetting, please contact us.
1045	Power Monitor Value Error	OFF	Error	The power monitoring value exceeds the alarm setting upper and lower limits. Please check the output of the laser device.
1046	Power Monitor Setting file Error	-	Data error	Access failed due to damage to the files related to the power monitor. The alarm setting is automatically set to OFF. Please check the alarm settings.
1060	Controller Error	-	Data error	There is a problem with the controller. If the error persists after restarting, please contact us.

	Error details	LD	User I/O (output)	Corrective action
1070	Setting Range Over	-	Data error	The maximum number of lines has been exceeded. Reduce the number of lines.
1074	Controller Error	OFF	Error	There is a problem with the controller. If the error persists after restarting, please contact us.
1084	Memory Card Full	OFF	Error	The capacity of memory card is full. Delete the data or prepare a new memory card.
1085	Memory Card Error	OFF	Error	There is a problem with the memory card. If the error persists after restarting, please contact us.
1098	Out Of Memory: RAM Registration	-	Data error	If these massages are displayed, please contact us.
1099	Out Of Memory: Part Registration	-	Data error	Memory capacity has been reached when attempting to register a part, or the part may be unsupported. Check part registration.
1100	Out Of Memory: Layout Registration	OFF	Error	Memory capacity has been reached when attempting to register a layout file, or the layout file may be unsupported. Check layout file registration.
1117	Scanner Connection Error	OFF	Error	A scanner connection error has occurred. Confirm the connection.
1184	AC Power Down	OFF	Error	AC power has been disconnected. If you turn off the power without turning off the LD, this error is added to RAS. Please turn off the power after turning off the LD.
1190	Data buffer overflow	-	Data error	The figure size exceeded the limit for data. Reduce the size of the data.
1200	Schedule Data controller version error	-	Data error	The controller version of schedule data is incorrect. Please check the controller version.
1201	Schedule Data peak power error	-	Data error	It is outside the setting range of peak power of schedule data. Check the setting value.
1202	Schedule Data frequency error	-	Data error	It is outside the setting range of schedule data frequency. Check the setting value.
1203	Schedule Data duty error	-	Data error	It is out of the setting range of the duty ratio of schedule data. Check the setting value.
1204	Schedule Data upslope power error	-	Data error	It is out of the setting range of the up slope power of schedule data. Check the setting value.
1205	Schedule Data downslope power error	-	Data error	It is out of the setting range of down slope power of schedule data. Check the setting value.
1206	Schedule Data upslope distance error	-	Data error	It is out of the setting range of the up slope distance of schedule data. Check the setting value.

	Error details	LD	User I/O (output)	Corrective action
1207	Schedule Data downslope distance error	-	Data error	It is outside the setting range of the down slope distance of schedule data. Check the setting value.
1208	Schedule Data upslope time error	-	Data error	It is out of the setting range of the up slope time of schedule data. Check the setting value.
1209	Schedule Data downslope time error	-	Data error	It is outside the setting range of the down slope time of schedule data. Check the setting value.
1211	Analog Power Slope line slope points error	-	Data error	The specified slope is abnormal. Check the schedule data and layout length.
1213	Analog Power Slope spot slope not feasible	-	Data error	The specified slope exceeds the layout time. Check schedule data and layout time.
1214	Analog Power Slope spot slope points error	-	Data error	The specified slope is abnormal. Check schedule data and layout time.
1216	Controller error (specifying laser engine error)	-	Data error	The specified laser engine can not be recognized. Check the connected engine from System parameter settings.
1217	APA Error (pattern matching failure)	-	Data error	APA pattern matching failed.
1218	APA Error (connection error)	-	Data error	Disconnected from PC during APA processing. Please check the connection with the PC.
1220	Scanner Error (Power or Over position)	OFF	Error	Scanner power error or position is out of range. Please check the scanner connection or layout settings.
1221	Scanner Error (Temperature)	OFF	Error	A scanner temperature error has occurred.
1223	Scanner Error (Position acknowledge X axis)	OFF	Error	An error occurred in the X coordinate operation of the scanner. Please check the scanning speed setting.
1224	Scanner Error (Position acknowledge Y axis)	OFF	Error	An error occurred in the Y coordinate operation of the scanner. Please check the scanning speed setting.
1241	Schedule data error (internal error)	-	Data error	If these massages are displayed, please contact us.
1242	Schedule data error (power setting)	-	Data error	Set power exceeds the set range. Change the set power setting.
1243	Schedule data error (REPEAT setting)	-	Data error	REPEAT (pps) is out of the set range. Change the setting value of REPEAT.
1244	Schedule data error (SHOT setting)	-	Data error	The number of SHOTs exceeds the set range. Change the setting value of SHOT number.
1246	Schedule data error (modulation setting)	-	Data error	The modulation setting value exceeds the setting range. Change the modulation setting.
1247	Schedule data error (TIME setting)	-	Data error	TIME The set value exceeds the set range. Change the TIME setting.

	Error details	LD	User I/O (output)	Corrective action
1248	Schedule data error (FIX SLOPE setting)	-	Data error	SLOPE setting is out of the configurable range. Set it so that SLOPE <= FLASH.
1249	Schedule data error (total output time setting)	-	Data error	Total output time exceeds the set range. Change the TIME setting.
1250	Schedule data error (total output time and REPEAT)	-	Data error	Total output time and REPEAT settings are inconsistent. Reduce the total output time or the value of REPEAT.
1251	Schedule data error (COUNT setting)	-	Data error	Count The setting exceeds the setting range. Set a value larger than the total number of previous POINTs.
1252	Schedule data error (pulse energy)	-	Data error	Pulse energy (J) exceeds the set range. Change the set power, POWER, and TIME settings.
1253	Schedule data error (average output)	-	Data error	Average output (W) setting range is exceeded. Change the set power, POWER, TIME, and REPEAT settings.
1254	Schedule data error (maximum power)	-	Data error	Maximum POWER (%) setting exceeds the configurable range. Change the set power and POWER settings.
1255	Schedule data error (SEAM power)	-	Data error	POWER (SEAM) setting exceeds the setting range. Change the POWER setting (SEAM).
1256	Schedule data error (minimum power)	-	Data error	Minimum POWER (%) is below the configurable range. Change the set power and POWER settings.