Laser Scanning System for Welding

GWM-PFL/DDL/FL/ DDL2-000/STD2-001/STD2-002

OPERATION MANUAL

- Scanner Controller -

AMADA®

AA12OM1178704-23

About This Documentation

Thank you for purchasing our GWM-PFL/DDL/FL/DDL2-000/STD2-001/STD2-002 Laser Scanning System for Welding.

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

1. Organization

This document for the GWM-PFL/DDL/FL/DDL2-000/STD2-001/STD2-002 Laser Scanning System for Welding describes installation, maintenance and system specifications. For instructions for welding control using the SWDraw2 application, refer to the manual for SWDraw2.

The documentation comprises the following sections:

- Scanner Controller

  Describes the part names, installation, maintenance, and specifications of the scanner controller.

- Scanner Head

  Describes the part names, installation, maintenance, and specifications of the scanner head.

- Warranty
- Address List

2. Note

- This manual is intended for GWM-PFL/DDL/FL/DDL2-000/STD2-001/STD2-002. Figures and screenshots are based on the GWM-PFL, unless information for the GWM-DDL/FL is significantly different.
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- 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).

3. 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) 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.

(2) 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.

(3) The system should be used in an ambient temperature range of 5°C to 35°C and humidity 80% RH or lower 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.)

(4) 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.

(5) 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.

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

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

(8) Do not turn off the power switch of the scanner controller while a computer is connected to the scanner controller.

(9) 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 scanner controller.

(10) If a computer is connected, never disconnect the USB cable before turning off the power switch of the scanner controller.

(11) 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.

(12) Use only memory cards purchased from us. If commercial cards are used, the unit may not function normally.

(13) Before inserting or removing memory cards, always turn off the power switch of the scanner controller. If the power switch of the scanner controller is on when cards are inserted or removed, data may be lost or the memory card may become unusable.

(14) Back up memory card data regularly. If the memory card data becomes corrupted, it may prevent normal scanning or the equipment may not start.

(15) The number of times memory cards are inserted or removed depends on the manufacturer's nominal number of times (10000 times).

(16) 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.

* 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 is a high-speed spot laser welding system which uses a digital scanner in the emitter for laser light sent via optical fiber.

By combining with following laser equipments, consistent, high-quality, high-speed multi-spot welding can be achieved.

GWM-PFL/STD2-001: ML-3000 Series
GWM-DDL/DDL2-000: ML-5100 Series
GWM-FL/STD2-002: ML-6800C/MF-C Series

In addition to high-speed schedule-switching and waveform control functions that are the feature of feedback lasers, the system features a galvanoscanner optical system allowing high-precision, high-speed beam scanning. This enables high-quality, consistent, high-speed welding for multi-parameter welding on different materials within the same workpiece as well as multi-spot welding for identical materials.

- Consistent, high-speed seam welding

  Achieves CW high-speed seam welding. However, cannot be used exceeding the maximum ratings of the laser equipment.

- Consistent, high-speed multi-parameter spot welding

  The power feedback laser system (waveform control function and high-speed schedule switching function) facilitates multi-parameter spot welding for different materials and thicknesses within the same workpiece.

- High-precision beam scanning function

  The digital scanner improves scanner performance such as reduction of temperature drift, and precision of repetition position.

- System configuration to suit customer requirements

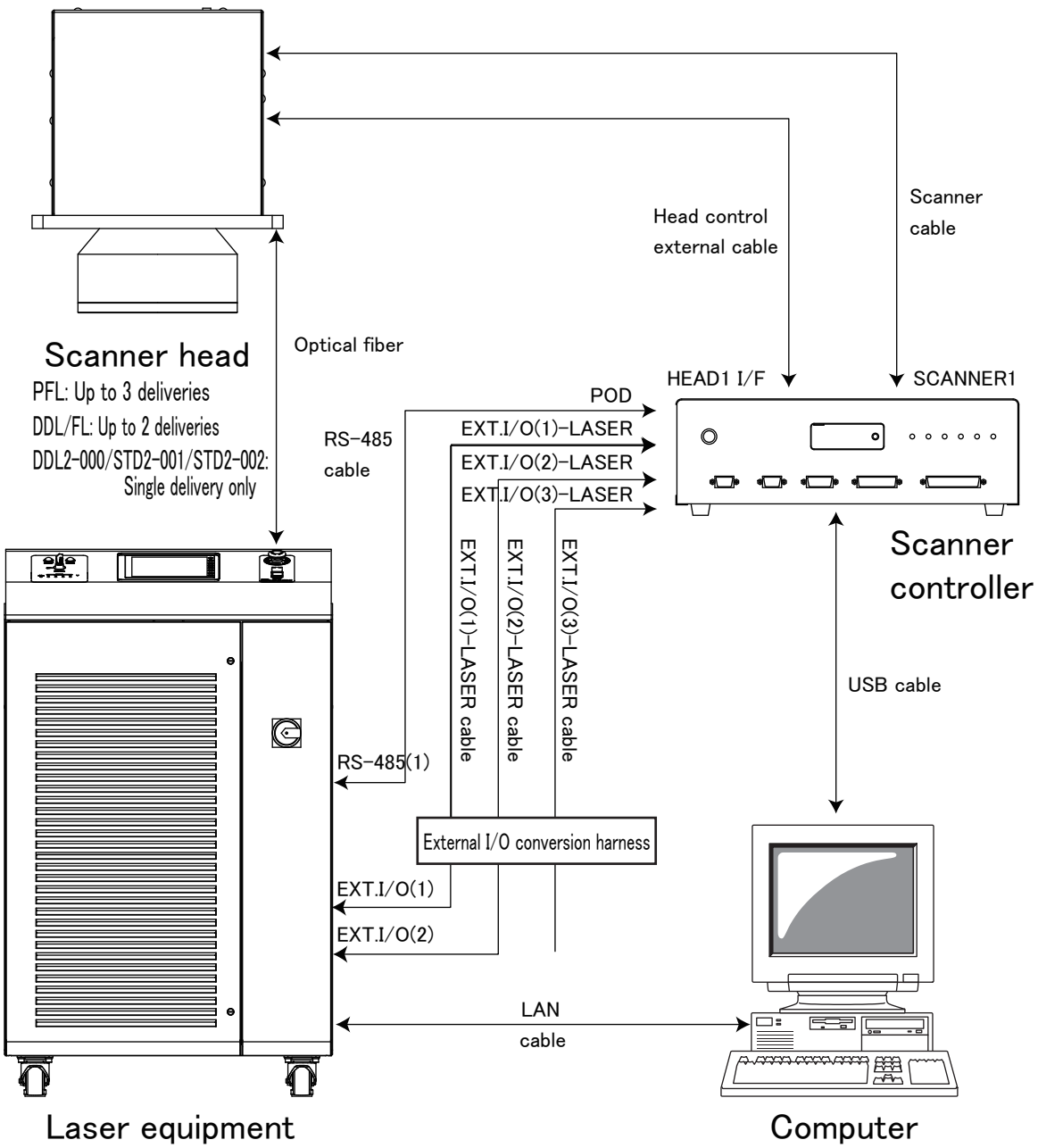
  Can be combined with the ML Series laser equipment to create a system able to cope with fine welding or high-output applications such as copper welding.

- Multiscanner welding

  GWM-PFL can control up to 3 scanner heads simultaneously. GWM-DDL/FL can control up to 2 scanner heads simultaneously. (GWM-STD2-001/STD2-002/DDL2-000 can control only one scanner.)

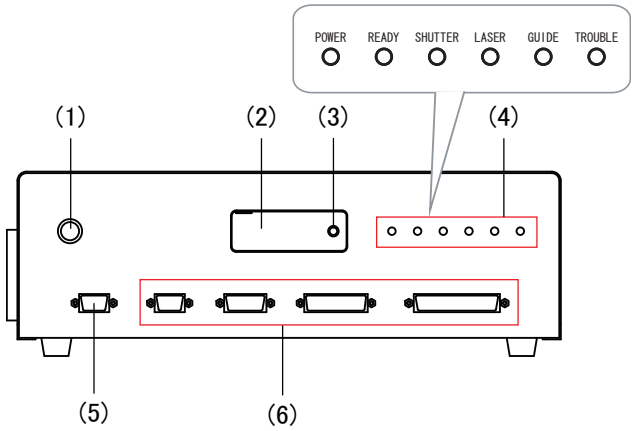
Chapter 3 System Configuration

1. Overall Configuration



2. Name and Functions of Each Section

2.1. Front



(1) LASER CONTROL button

Switches the control method.

Turn ON to control the equipment by the scanner controller.

Turn OFF to operate the laser equipment independently.

(2) Memory card slot

For loading and saving scanning data.

Insert a memory card to prepare the scanner controller for use.

CAUTION	Always turn OFF the power switch before inserting or removing memory cards. If the power switch is on when cards are inserted or removed, data may be lost or the memory card may be rendered unusable. We recommend backing up your data at periodic intervals to prevent data loss. (Refer to "Chapter 9-3. Backup Lithium Battery Replacement" (page 58) .) Use only the specified memory cards. Use of non-specified commercial cards may result in aberrant function.

(3) Access indicator

Remains lit during memory card access.

CAUTION	Do not turn OFF the power switch when the access indicator is lit. Turning OFF the power switch when the indicator is lit may result in data loss or unreadable memory cards.

(4) Panel indicators

Panel indicators light in accordance with the status of the equipment as follows:

POWER	The equipment is ON.
READY	LD is ON in the laser equipment and the equipment is ready to scan.
SHUTTER	The resonator shutter in the laser equipment is open.

LASER	Scanning underway.
GUIDE	The guide beam is ON.
TROUBLE	An error occurred.

(5) RS-232C connector

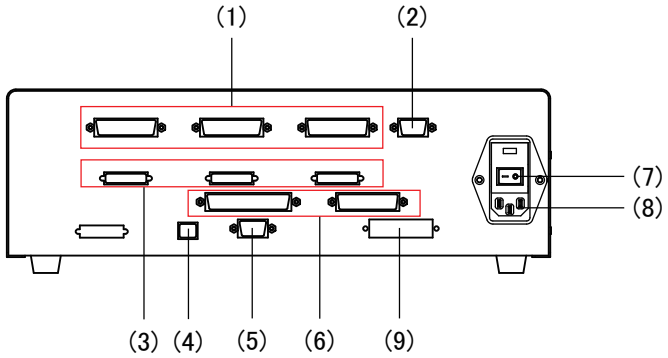
For external communications.

(6) EXT. I/O (1) to (4)-USER connector

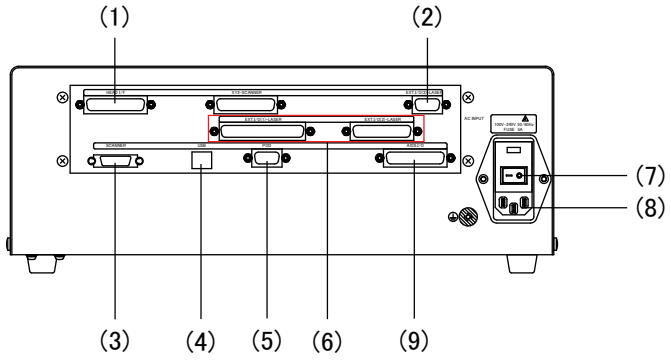
Connector for I/O signals to control the scanner controller from an external device.

2.2. Rear

GWM-PFL/DDL/FL



GWM-DDL2-000/STD2-001/STD2-002



(1) HEAD1 to 3 I/F connector

For connection to the scanner head using the head control external cable.

Insert the head shorting connector for the unused connector.

(2) EXT. I/O (3)-LASER connector

Connector for I/O signals to control the laser equipment from the scanner controller.

Connect to the external I/O conversion harness using the EXT. I/O (3)-LASER cable.

(3) SCANNER1 to 3 connector

For connection to the scanner head using the scanner cable.

(4) USB connector

For communications with a computer.

Used to send data to/receive data from a computer.

Connect to a computer using the USB cable.

(5) POD connector

For communications with the laser equipment.

Connect to the RS-485 (1) connector of the laser equipment using the RS-485 cable.

(6) EXT. I/O (1)/(2)-LASER connector

Connector for I/O signals to control the laser equipment from the scanner controller.

Connect to the external I/O conversion harness using the EXT. I/O (1)/(2)-LASER cable.

(7) Power switch

Turn ON to supply power.

Turn OFF to cut the power supply and stop the equipment.

(8) Power supply connector

For connection to the power cable.

(9) AXIS. I/O connector

Connector for I/O signals of the carriage control.

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 scanner controller and accessories	Approx. 661 (H) x 601 (W) x 494 (D) mm	Approx. 8 kg

1.2. Checking the Contents of Container

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

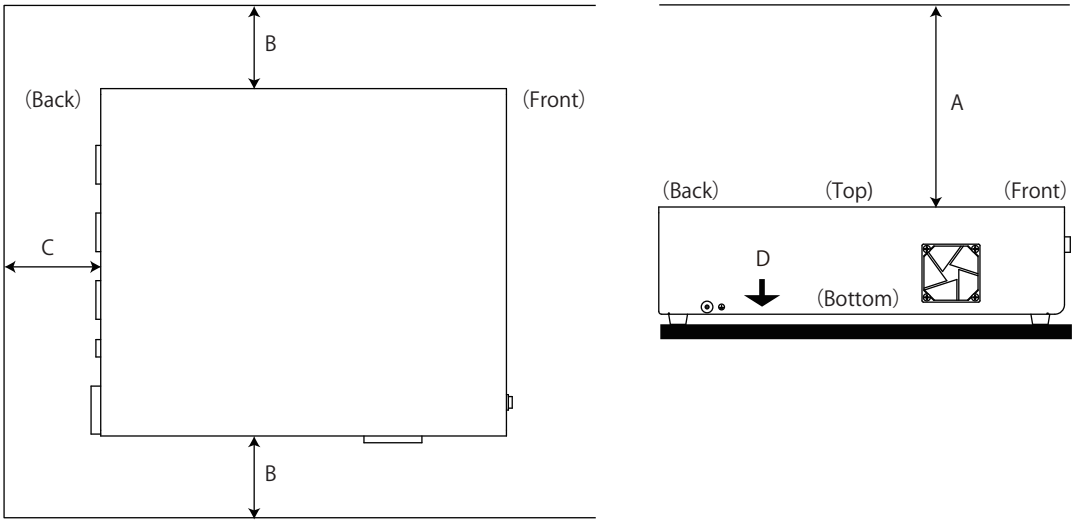
Component	Quantity
Scanner controller	1
EXT. I/O (1)-LASER cable	1
EXT. I/O (2)-LASER cable	1
EXT. I/O (3)-LASER cable	1
RS-485 cable	1
Head control external cable	1 (× Number of branches)
Scanner cable	1 (× Number of branches)
USB cable	1
LAN cable	1
Power cable	1
Operation manual for GWM series CD-ROM	1
Operation manual for SWDraw2 CD-ROM	1
PC software SWDraw2	1
Head shorting connector	2
I/O connector (3)	1

Component	Quantity
FL/PL welder I/O conversion harness	1

2. Installation

2.1. Installation Requirements

Refer to the following figure when determining a location to install the scanner controller. For more efficient cooling, choose a location where it is not too close to the walls.
Additionally, make sure the front of the equipment is easily accessible.



Required Clearance and Mass Support

A. Clearance on top	At least 300 mm
B. Clearance on both sides	At least 300 mm
C. Clearance in back	At least 300 mm
D. Mass	Approx. 6.9 kg
Air intake/exhaust	Left side/right side

2.2. Connections

The software driver must be installed before connecting a computer to the scanner controller. Refer to the manual for SWDraw2 for instructions on installing the driver.

2.3. Ground Connection

Be sure to ground the power cable.

Chapter 5 Starting/Stopping the Equipment

1. Starting the Equipment

Before startup, confirm the following points.

- The laser equipment, scanner controller, and computer are off.
- The laser equipment, scanner controller, and computer are connected with the USB cable.
- The laser equipment and computer are connected with the LAN cable.
- A memory card is correctly inserted.

CAUTION	Before starting SWDraw2, exit all other applications.

1 Turn on the laser equipment.

2 Turn on the laser equipment Control key switch.

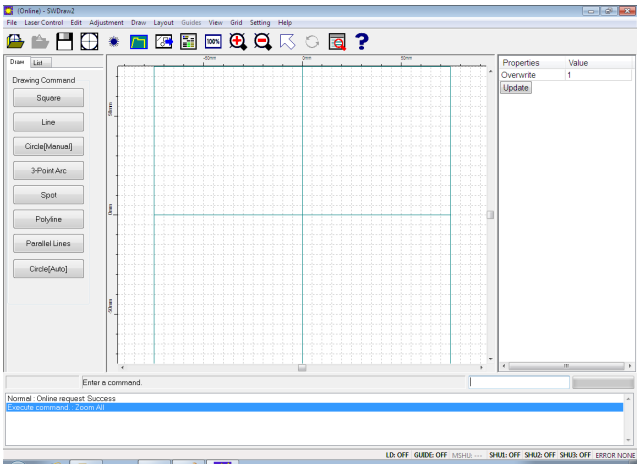
3 Turn on the scanner controller.

CAUTION	Do not remove memory cards or turn off the power switch during self-diagnosis. Otherwise, the data may become corrupted and the memory card may become unusable.

4 After self-diagnosis is complete, the Power indicator alone should remain lit. After confirming it is lit, 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 [SWDraw2] icon on the desktop to start the SWDraw2 application.
After SWDraw2 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 scanner controller is online.

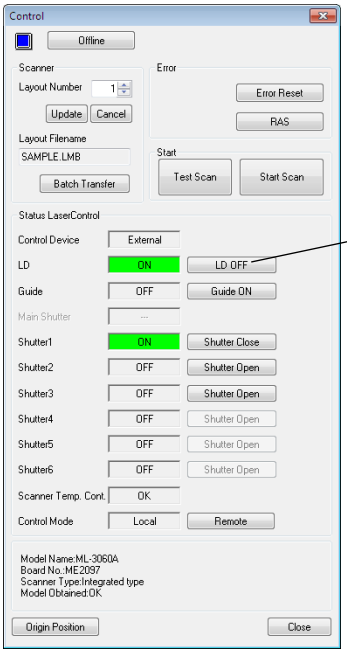
8 Turn on the [LASER CONTROL] button on the scanner controller.

Equipment startup is now complete.

2. Stopping the Equipment

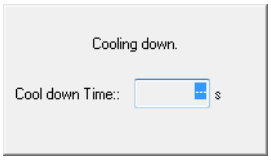
1 From the menu, select [Laser Control] -> [Control].
The [Control] screen appears.

2 Click the [LD OFF] button.



[LD OFF] button

3 The READY indicator on the scanner controller flashes and the "Cooling down" message is displayed on the Drawing screen while operation is stopped. The length of time for which the SCAN READY indicator flashes depends on the laser equipment.



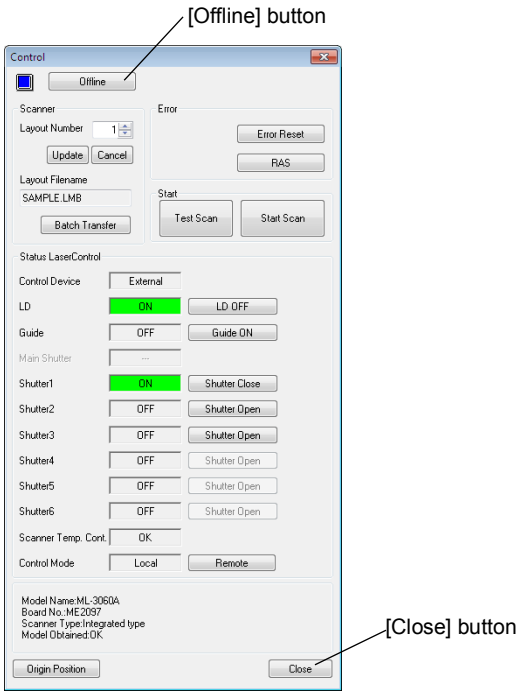
CAUTION	Do not turn off the power switch while the Drawing screen displays the "Cooling down" message. Shutting off the power switch while the system is stopped will significantly reduce the life of the laser equipment.

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 SCAN READY indicator on the scanner controller will go out after the LD has finished shutting down. The "Cooling down" message disappears on the Drawing screen.

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

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



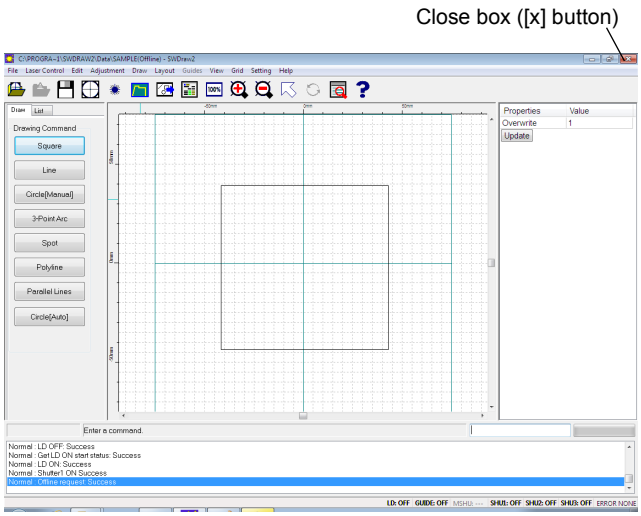
7 To exit SWDraw2, select [File] -> [Exit] from the menu or click the Close box ([x] button) in the top-right corner of the screen.

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

9 Turn off the power of scanner controller.

10 Turn off the laser equipment.

System shutdown is now complete.



Chapter 6 Interface

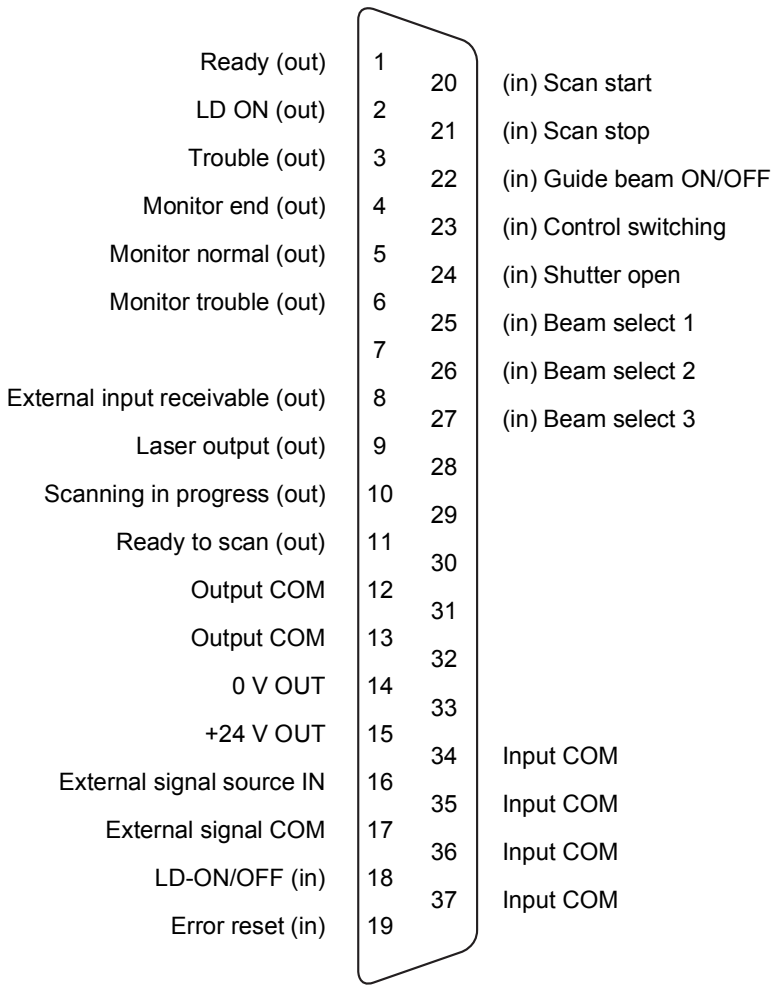
1. Pin Layout

ATTENTION	Use a connecting cable with a shield line and terminate the shield line appropriately. We recommend that the shielded part is connected to the user device side only, but you can change the connection according to the state of noise at the installation site.

1.1. External Input and Output (EXT. I/O (1)-USER)

Connector for Unit: D-Sub 37 Pins, Female

Connector for User Device: D-Sub 37 Pins, Male M2.6



1.1.1. Input signals

Pin No.	Signal	Description
16	External signal source IN	Input terminal for the external signal power supply. Connect it to Pin 14 or Pin 15, depending on the input signal circuit. Input 24V DC.
17	External signal COM	Common input terminal for external signals. Connect it to Pin 15 or Pin 14, depending on the input signal circuit.
18	LD-ON/OFF	When this Pin 18-COM circuit is closed, the LD is turned on. When the circuit is opened, the LD is turned off.
19	Error reset (Trouble reset)	Close input cancels the trouble output.
20	Scan start (Laser start) *1	Laser is output when closed.
21	Scan stop (Laser stop) *1	Laser output is stopped when closed.
22	Guide beam ON/OFF	Guide beam turns on at rising edge of closing and turns off at falling edge of opening.
23	Control switching	While this Pin 23-COM circuit is closed, the remote mode is set and the external input signals are effective.
24	**(For ML-3000/ML-6800C/ MF-C Series)** Unused	Do not connect anything.
	(For ML-5100 Series) Shutter open	When this Pin 24-COM circuit is closed, shutter is opened and the unit becomes ready to project a laser beam.
25	**(For ML-3000/ML-6800C/ MF-C Series)** Beam select 1	When this Pin 25-COM circuit is closed, laser beam input unit 1 is selected and the unit becomes ready to project a laser beam.
	(For ML-5100 Series) Unused	Do not connect anything.
26	**(For ML-3000/ML-6800C/ MF-C Series)** Beam select 2	When this Pin 26-COM circuit is closed, laser beam input unit 2 is selected and the unit becomes ready to project a laser beam.
	(For ML-5100 Series) Unused	Do not connect anything.
27	**(For ML-3000/ML-6800C/ MF-C Series)** Beam select 3	When this Pin 27-COM circuit is closed, laser beam input unit 3 is selected and the unit becomes ready to project a laser beam.
	(For ML-5100 Series) Unused	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	Unused	Do not connect anything.
33	Unused	Do not connect anything.
34	Input COM	Common terminal for input signals.

Pin No.	Signal	Description
35	Input COM	Common terminal for input signals.
36	Input COM	Common terminal for input signals.
37	Input COM	Common terminal for input signals.

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

1.1.2. Output signals

Pin No.	Signal	Description
1	Ready	When the LD is turned on and the laser is ready to output, this Pin 1-COM circuit is closed internally.
2	LD ON	While the LD is supplied, this Pin 2-COM circuit is closed internally.
3	Trouble	If trouble arises, this Pin 3-COM circuit is opened internally until it is reset.
4	Monitor end	After the laser is output, this Pin 4-COM circuit is closed internally for 40 ms. This is the same as the end signal of the laser equipment.
5	Monitor normal	When the monitor value of laser energy is in the range of "HIGH" and "LOW" set on the MONITOR screen, the circuit is closed for 40 ms.
6	Monitor trouble	When the monitor value of laser energy is out of the range of "HIGH" and "LOW" set on the MONITOR screen, the circuit is closed for 40 ms.
7	Unused	Do not connect anything.
8	External input receivable	When an external input signal is acceptable (when the section between Pin 23 and COM is in a closed circuit), the circuit is closed. In the open circuit status, an external input signal is not acceptable if it is input.
9	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.
10	Scanning in progress	Closed during scanning.
11	Ready to scan*1	Closed when scanning is possible.
12	Output COM	Common terminal for output signals.
13	Output COM	Common terminal for output signals.
14	0V OUT	Power supply for output signals. Do not use it for any other purpose.
15	+24V OUT	Power supply for input signals. Do not use it for any other purpose.

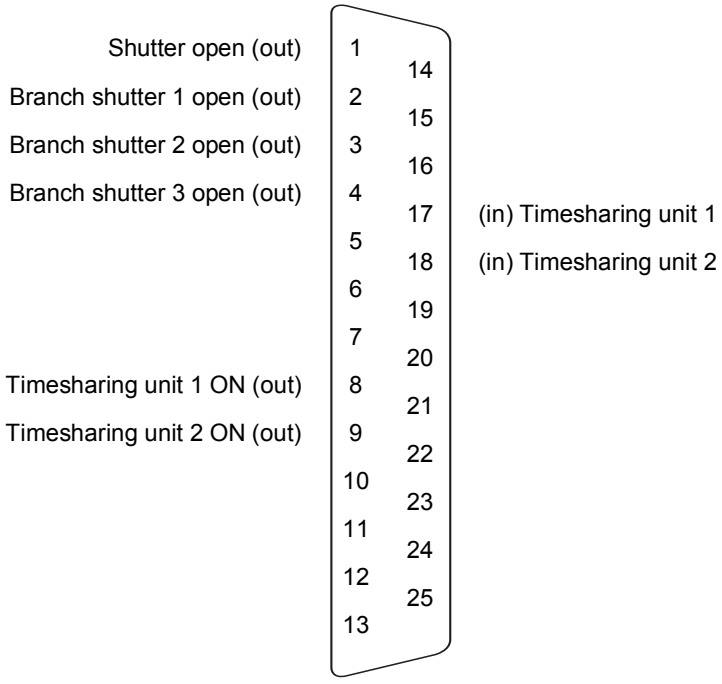
Output format：Open collector output
Output rating ：24 V DC, 70 mA max

*1 This signal is open during scanning and when writing data to the memory card.

1.2. External Input and Output (EXT. I/O (2)-USER)

Connector for Unit: D-Sub 25 Pins, Female

Connector for User Device: D-Sub 25 Pins, Male M2.6



1.2.1. Input signals

Pin No.	Signal	Description
15	Unused	Do not connect anything.
16	Unused	Do not connect anything.
17	Timesharing unit 1	When the section between this pin and COM is put in a closed circuit, timesharing unit 1 is operated so that laser light can be output from input unit 1.
18	Timesharing unit 2	When the section between this pin and COM is put in a closed circuit, timesharing unit 2 is operated so that laser light can be output from input unit 2.
19	Unused	Do not connect anything.
20	Unused	Do not connect anything.
21	Unused	Do not connect anything.
22	Unused	Do not connect anything.
23	Unused	Do not connect anything.
24	Unused	Do not connect anything.
25	Unused	Do not connect anything.

1.2.2. Output signals

Pin No.	Signal	Description
1	**(For ML-3000/ML-6800C/ MF-C Series)** Unused	Do not connect anything.
	(For ML-5100 Series) Shutter open	While shutter is open, this Pin 1-COM circuit closes internally.
2	Branch shutter 1 open	While branch shutter 1 is open, this Pin 2-COM circuit closes internally.
3	Branch shutter 2 open	While branch shutter 2 is open, this Pin 3-COM circuit closes internally.
4	Branch shutter 3 open	While branch shutter 3 is open, this Pin 4-COM circuit closes internally.
5	Unused	Do not connect anything.
6	Unused	Do not connect anything.
7	Unused	Do not connect anything.
8	Timesharing unit 1 ON	While timesharing unit 1 is operated, this Pin 8-COM circuit closes internally.
9	Timesharing unit 2 ON	While timesharing unit 2 is operated, this Pin 9-COM circuit closes internally.
10	Unused	Do not connect anything.
11	Unused	Do not connect anything.
12	Unused	Do not connect anything.
13	Unused	Do not connect anything.
14	Unused	Do not connect anything.

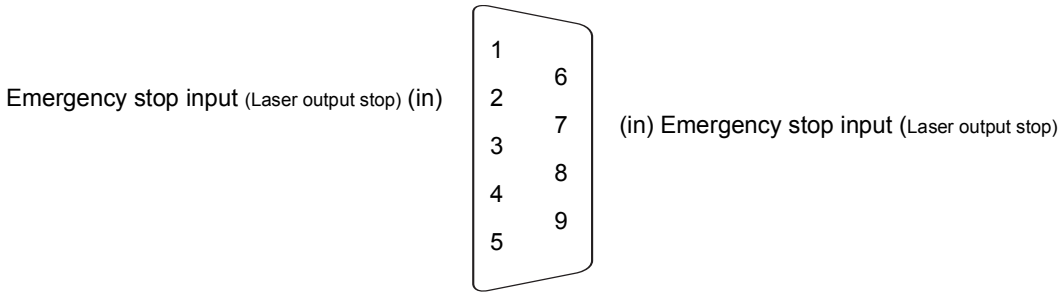
Output format : Open collector output
Output rating : 24 V DC, 70 mA max

1.3. External Input and Output (EXT. I/O (3)-USER)

CAUTION	To comply with the ISO13849-1 (dual emergency stops), use the E-STOP connector on the laser equipment and do not use this connector. This connector can be used only when you need to use the same connection with our old products (GWM-STD series). Install the attached I/O connector (3) when not in use.

Connector for Unit: D-Sub 9 Pins, Female

Connector for User Device: D-Sub 9 Pins, Male M2.6



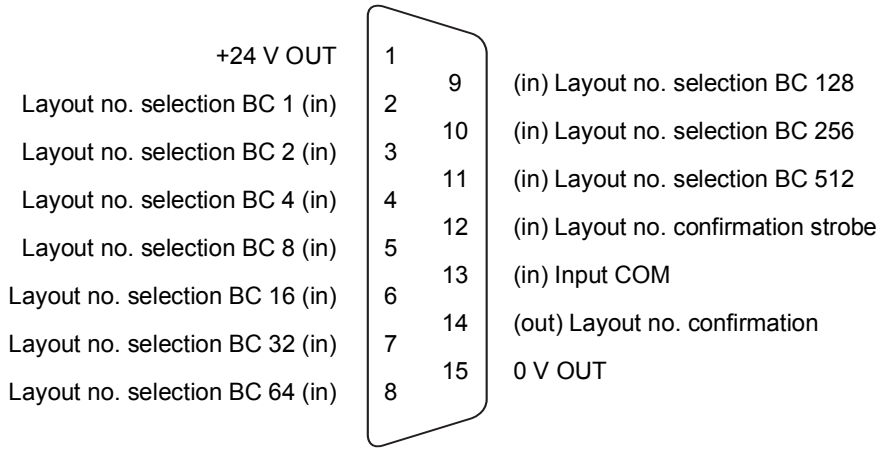
1.3.1. Input signals

Pin No.	Signal	Description
2	Emergency stop input	Open input stops laser output and switches to LD-OFF. When scanning is performed with a computer, this is needed to be closed.
7	Emergency stop input	Open input stops laser output and switches to LD-OFF. When scanning is performed with a computer, this is needed to be closed.

1.4. Extended External Input and Output (EXT. I/O (4)-USER)

Connector for Unit: D-Sub 15 Pins, Female

Connector for User Device: D-Sub 15 Pins, Male M2.6



1.4.1. Input signals

Pin No.	Signal	Description
2	Layout no. selection	Layout number selection input (binary code 1)
3		Layout number selection input (binary code 2)
4		Layout number selection input (binary code 4)
5		Layout number selection input (binary code 8)
6		Layout number selection input (binary code 16)
7		Layout number selection input (binary code 32)
8		Layout number selection input (binary code 64)
9		Layout number selection input (binary code 128)
10		Layout number selection input (binary code 256)
11		Layout number selection input (binary code 512)
12	Layout no. confirmation strobe	When closed, the layout number is confirmed.
13	Input COM	Common terminal for input signals.

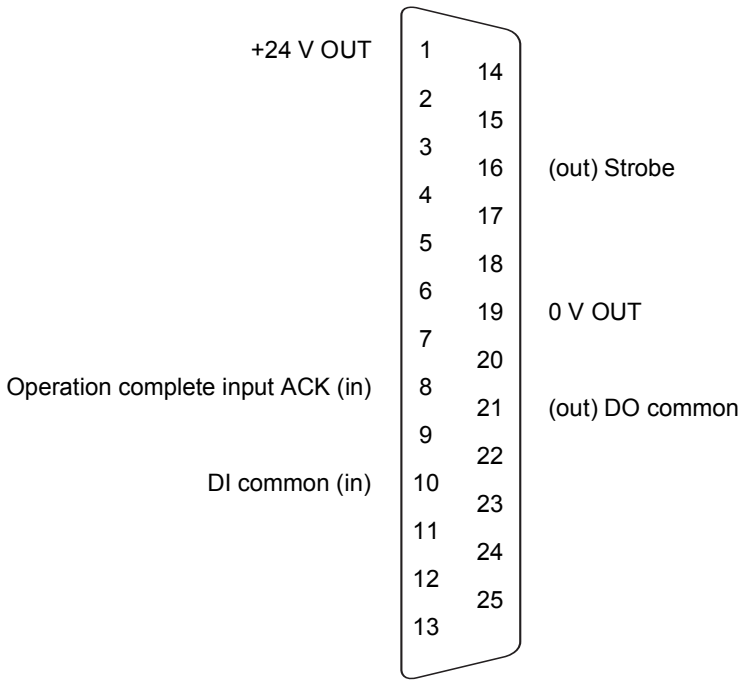
1.4.2. Output signals

Pin No.	Signal	Description
1	+24 V OUT	Power supply for input signals. Do not use it for any other purpose.
14	Layout no. confirmation	Close (ON) output is supplied with the layout number confirmation.
15	0 V OUT	Power supply for output signals. Do not use it for any other purpose.

1.5. Carriage Control Input and Output (AXIS. I/O)

Connector for Unit: D-Sub 25 Pins, Male

Connector for User Device: D-Sub 25 Pins, Female M2.6



1.5.1. Input signals

Pin No.	Signal	Description
1	+24 V OUT	Power supply for external I/O.
2	Unused	Do not connect anything.
3	Unused	Do not connect anything.
4	Unused	Do not connect anything.
5	Unused	Do not connect anything.
6	Unused	Do not connect anything.
7	Unused	Do not connect anything.
8	Operation complete input ACK	The carriage control operation is checked to resume the scanning operation.
9	Unused	Do not connect anything.
10	DI common	Common terminal for input signals.
19	0 V OUT	Ground for +24 V DC output.
20	Unused	Do not connect anything.
24	Unused	Do not connect anything.
25	Unused	Do not connect anything.

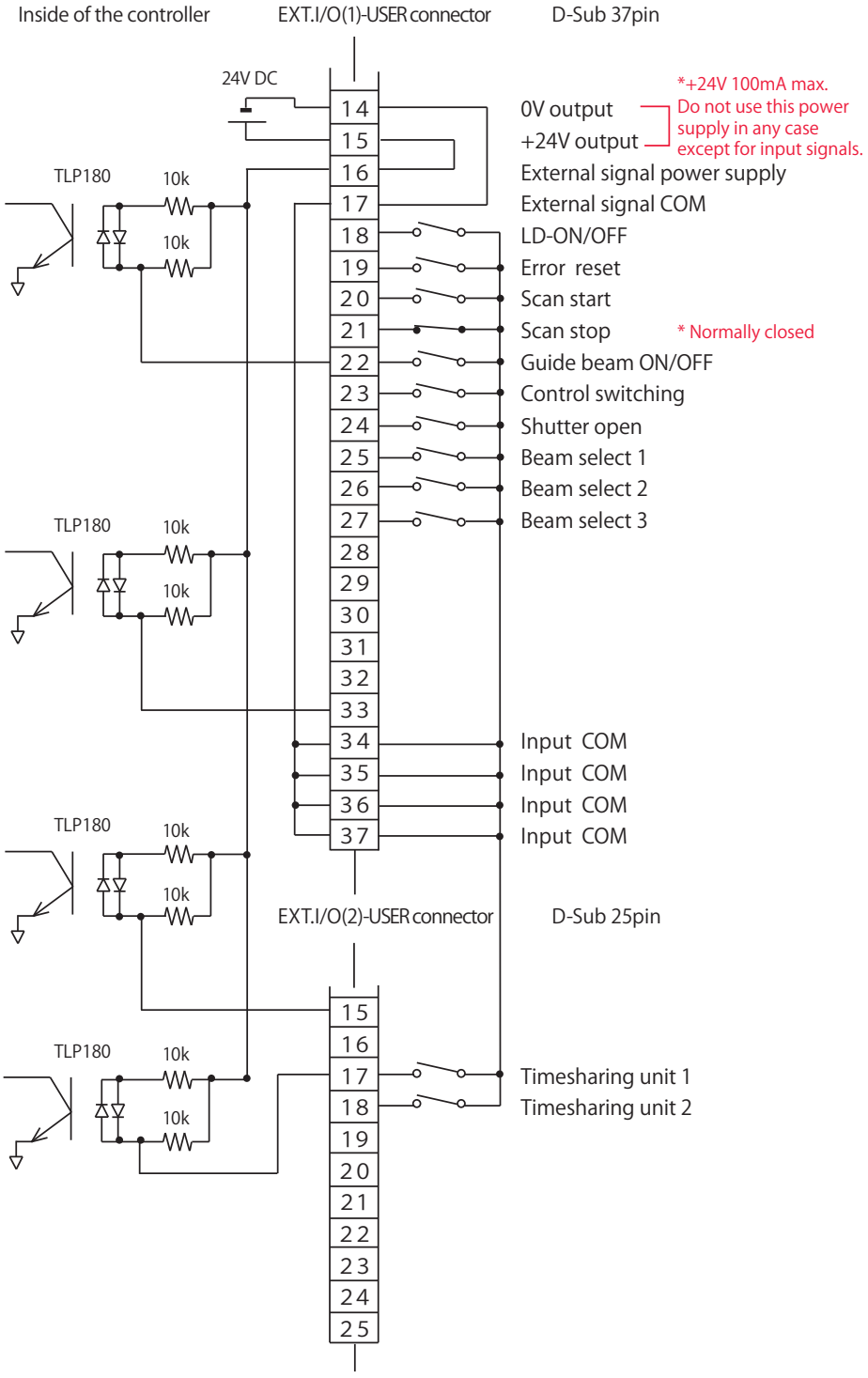
1.5.2. Output signals

Pin No.	Signal	Description
11	Unused	Do not connect anything.
12	Unused	Do not connect anything.
13	Unused	Do not connect anything.
14	Unused	Do not connect anything.
15	Unused	Do not connect anything.
16	Strobe	Turned ON when the carriage control operation is permitted.
17	Unused	Do not connect anything.
18	Unused	Do not connect anything.
21	DO common	Common terminal for output signals.
22	Unused	Do not connect anything.
23	Unused	Do not connect anything.

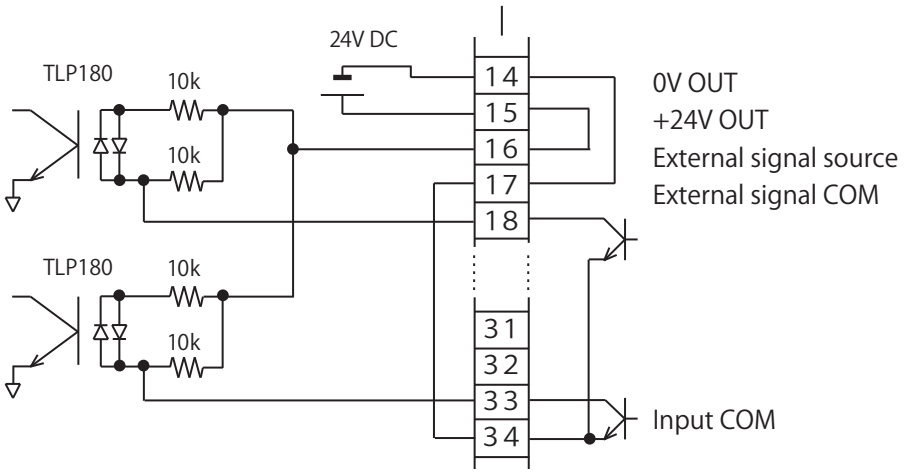
2. Example Connection

2.1. External Input and Output (EXT. I/O (1)-USER, EXT. I/O (2)-USER)

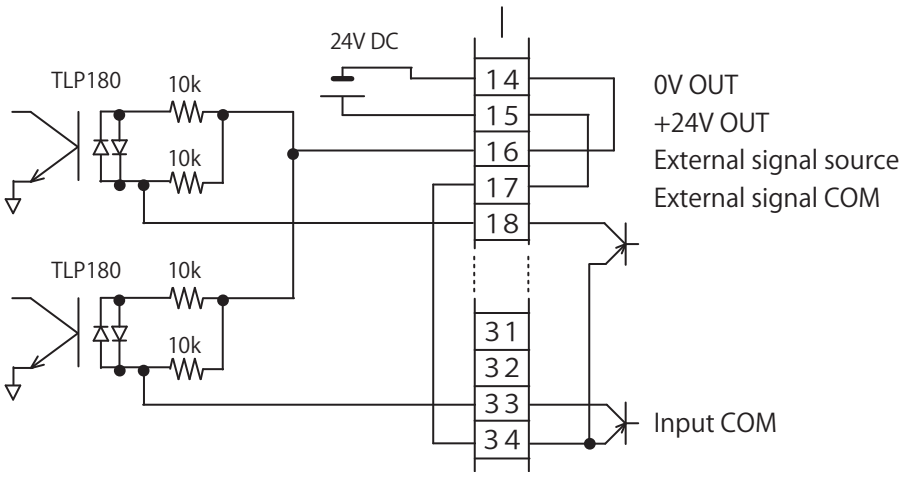
2.1.1. When external inputs are contacts



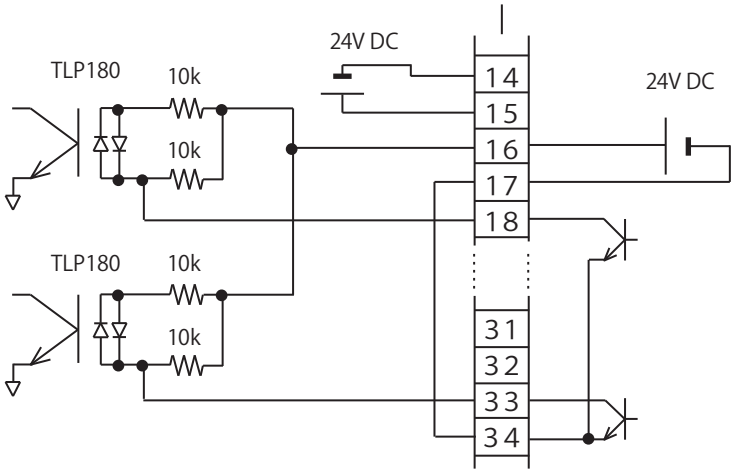
2.1.2. When external inputs are NPN transistors



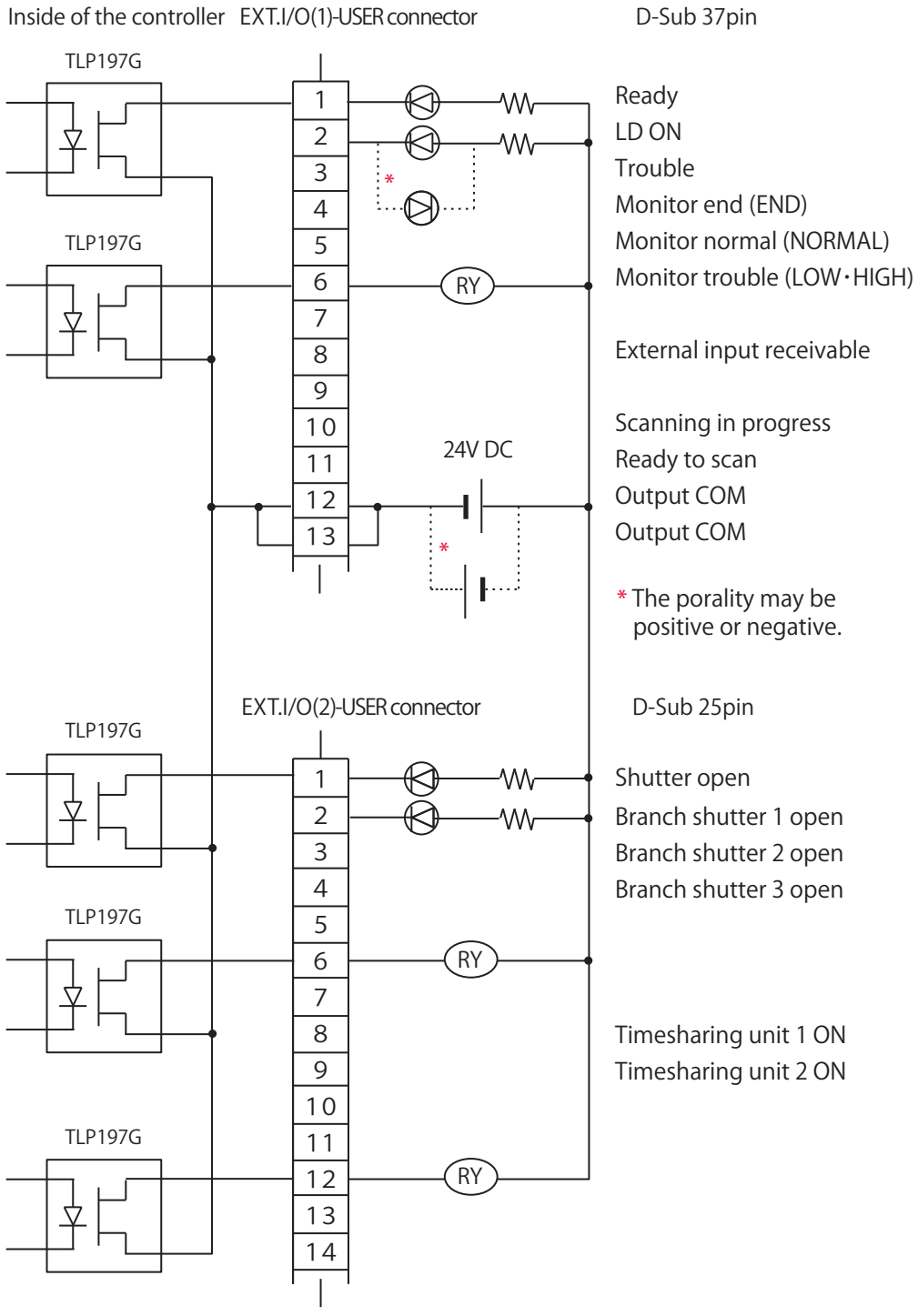
2.1.3. When external inputs are PNP transistors



2.1.4. When external power source is supplied

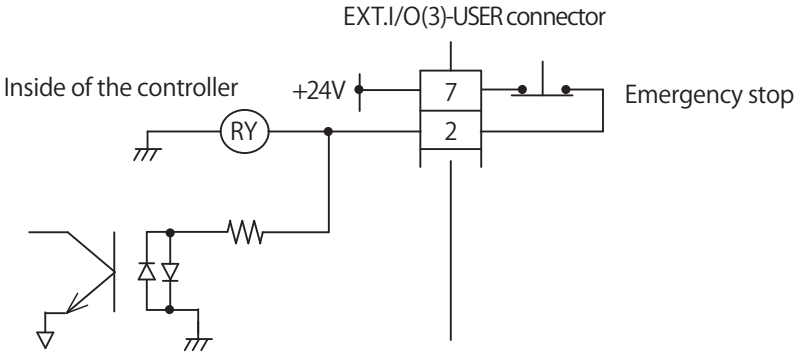


2.1.5. Example connection of external output signals



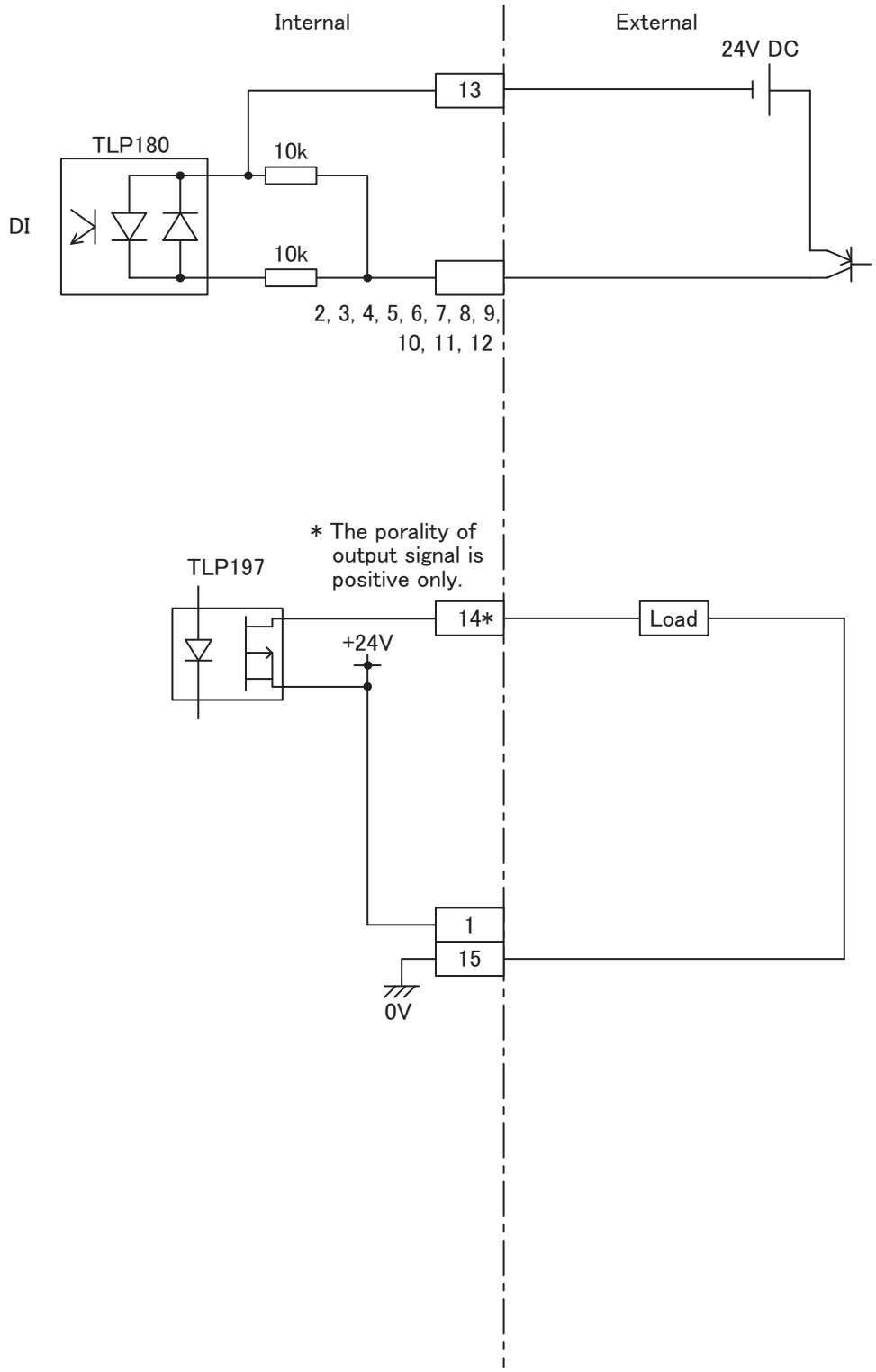
Type of output: Photo MOS relay output
Rating of output: 24V DC, 20mA max.

2.2. External Input and Output (EXT. I/O (3)-USER)

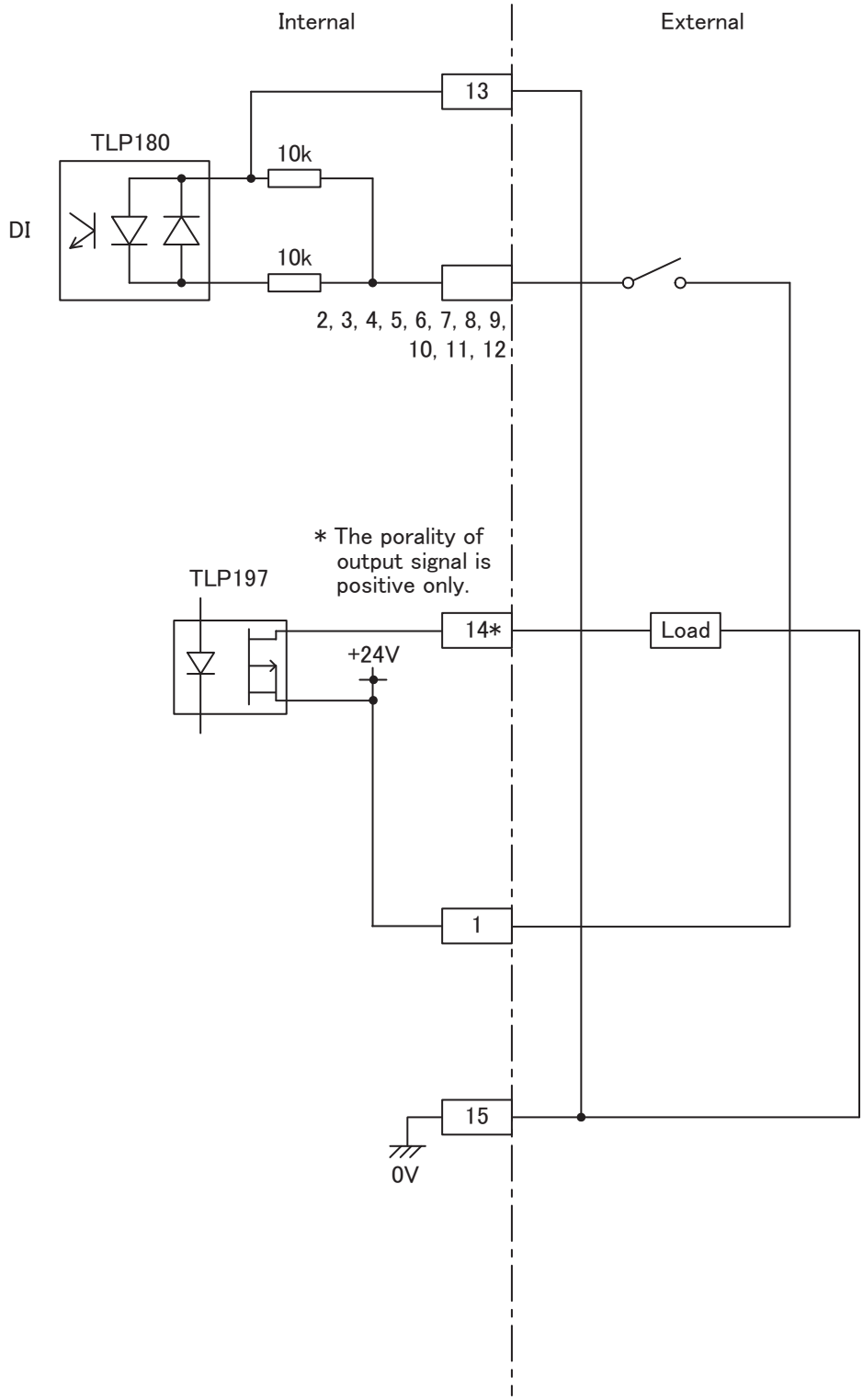


2.3. Extended External Input and Output (EXT. I/O (4)-USER)

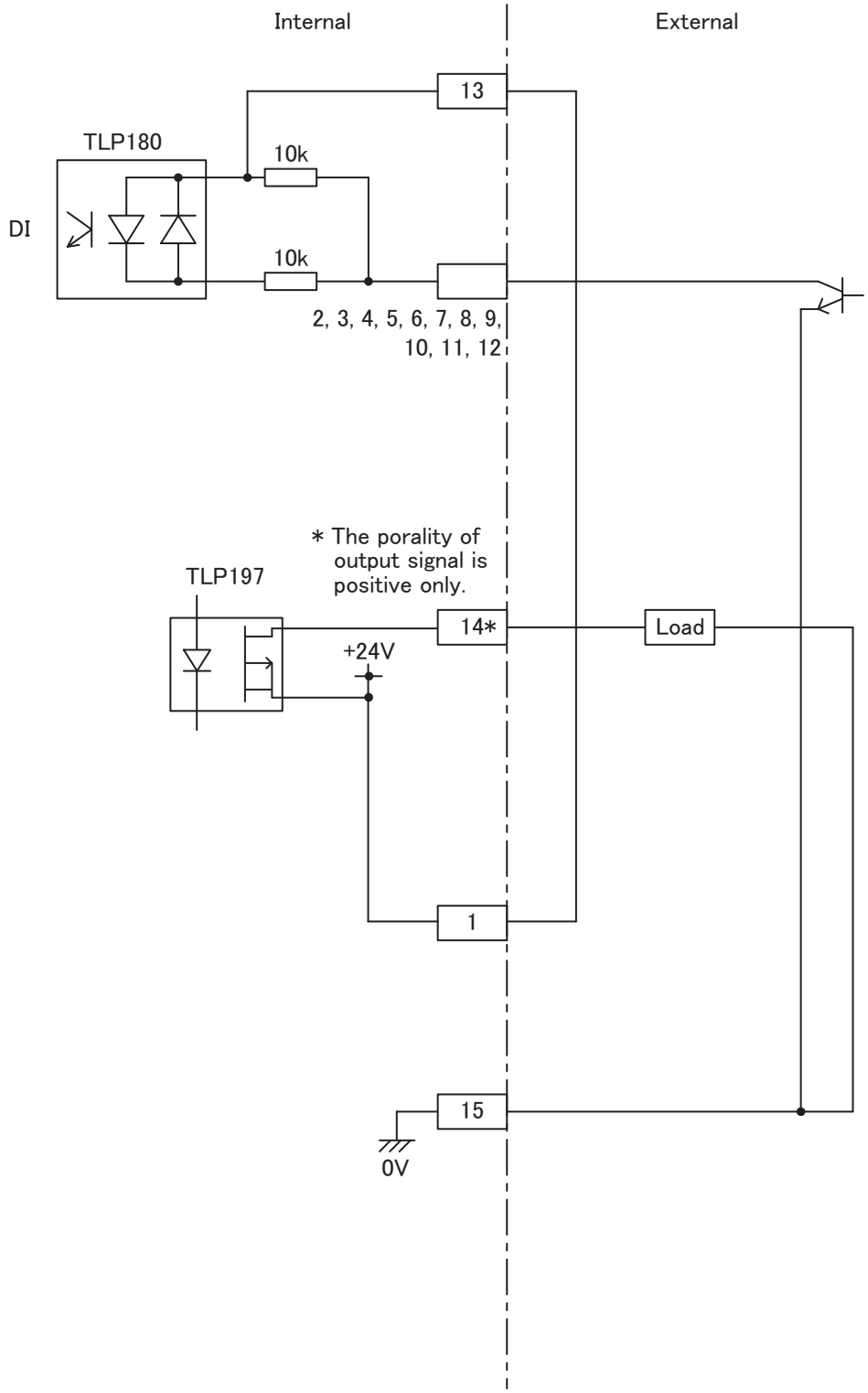
2.3.1. When connected to 24 V DC source output PLC



2.3.2. When using contact signal

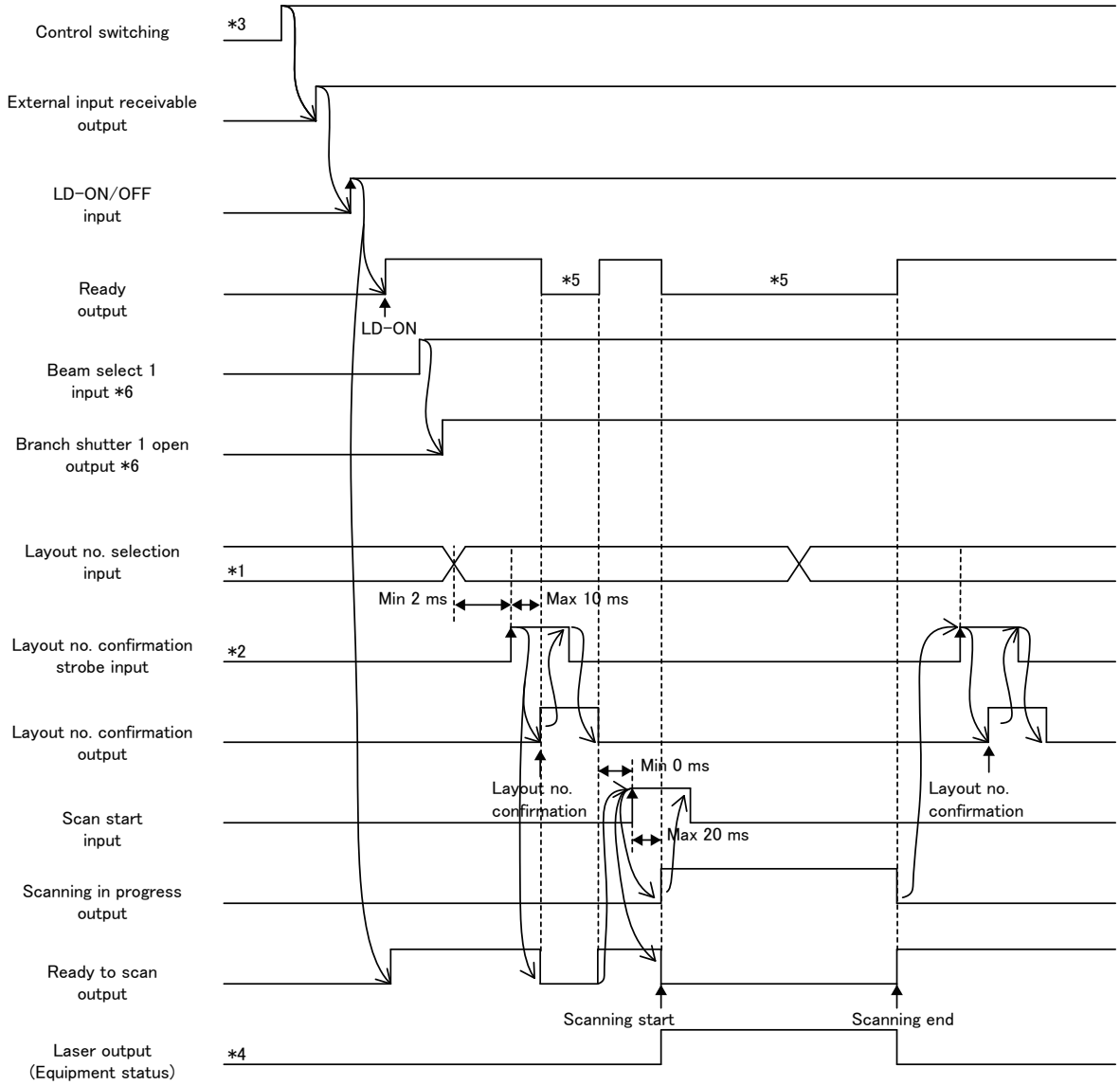


2.3.3. When using open collector signal



3. Timing

3.1. During Normal Operations (Single Delivery)



*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 input. Layout no. confirmation input is enabled while startup ready output is on and laser outputting output is off.

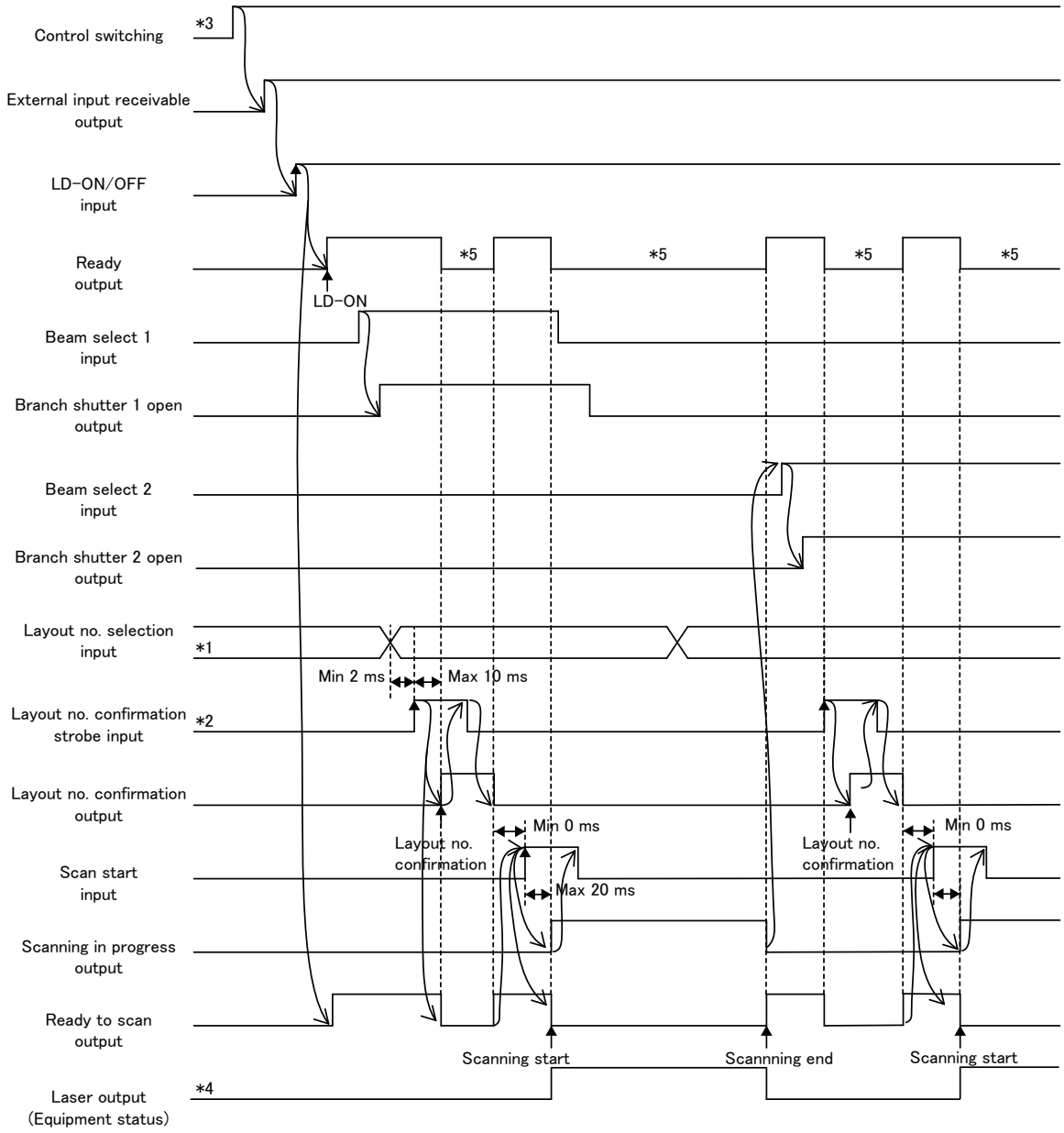
*3 The control switching can be set from a computer or the Control switching input on the EXT. I/O (1)-USER.

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

*5 The ready output becomes off when the ready to scan output is off.

*6 For ML-5100 series, use the shutter open input instead of the beam select input, and the shutter open output instead of the branch shutter open output.

3.2. During Normal Operations (2-timesharing Delivery)



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

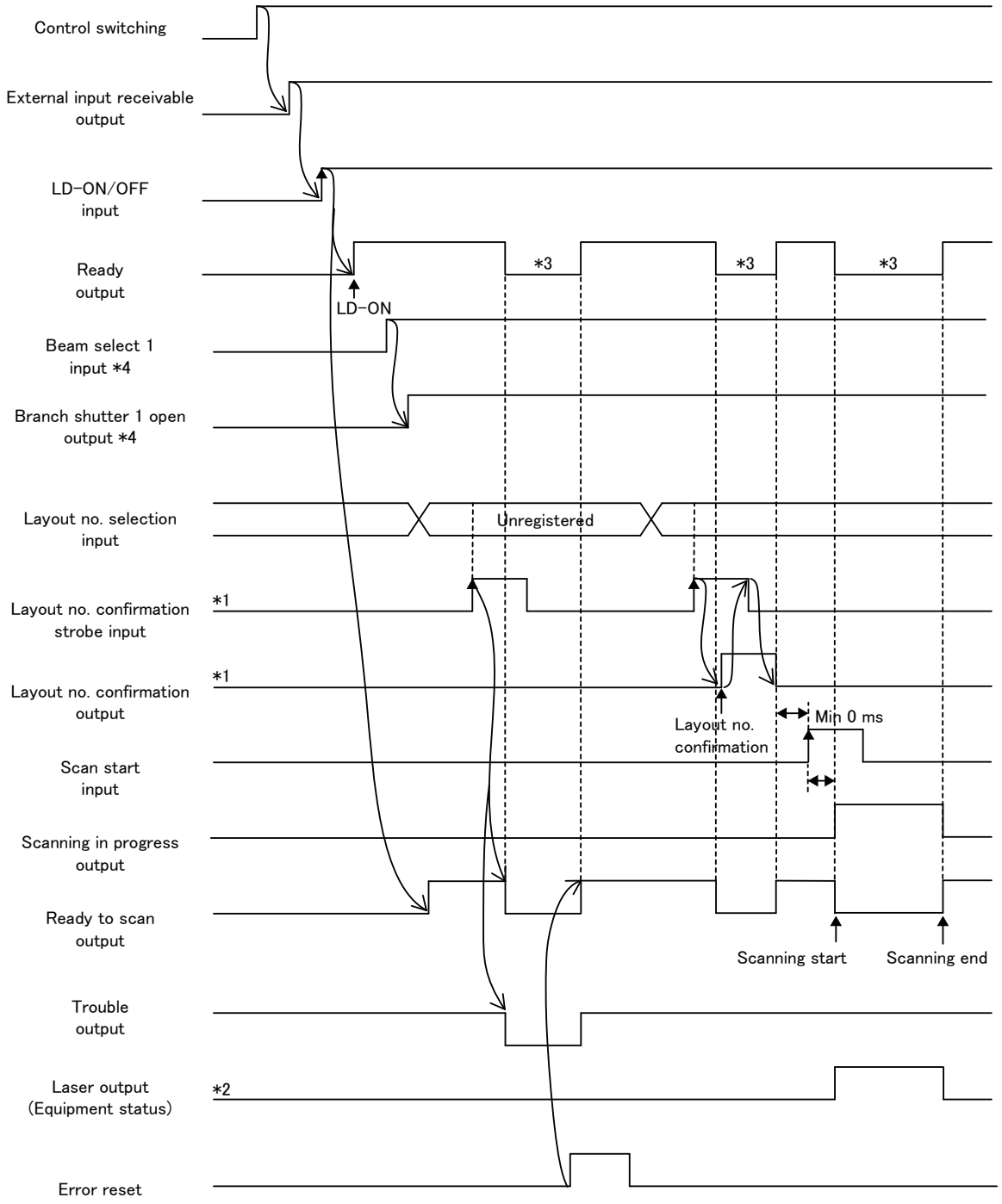
*2 Layout no. is confirmed at rising edge of Layout no. confirmation input. Layout no. confirmation input is enabled while startup ready output is on and laser outputting output is off.

*3 The control switching can be set from a computer or the Control switching input on the EXT. I/O (1)-USER.

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

*5 The ready output becomes off when the ready to scan output is off.

3.3. During Data Errors (Errors from Unregistered Layouts)



*1 The unregistered layout error occurs when the layout no. confirmation is not output even one second after the layout no. confirmation strobe input.

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

*3 The ready output becomes off when the ready to scan output is off.

*4 For ML-5100 series, use the shutter open input instead of the beam select input, and the shutter open output instead of the branch shutter open output.

4. RS-232C Communication Functions

4.1. Overview

You can transfer data to the scanner controller via serial communications, as well as setting and reading scanning schedules from a connected computer.

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

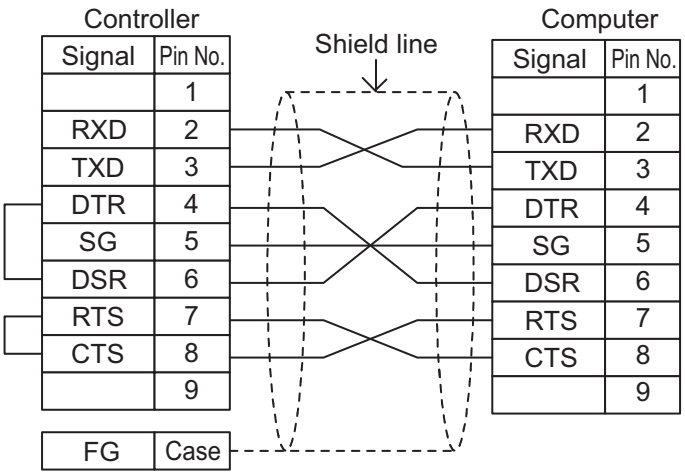
4.2. Interface

(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.

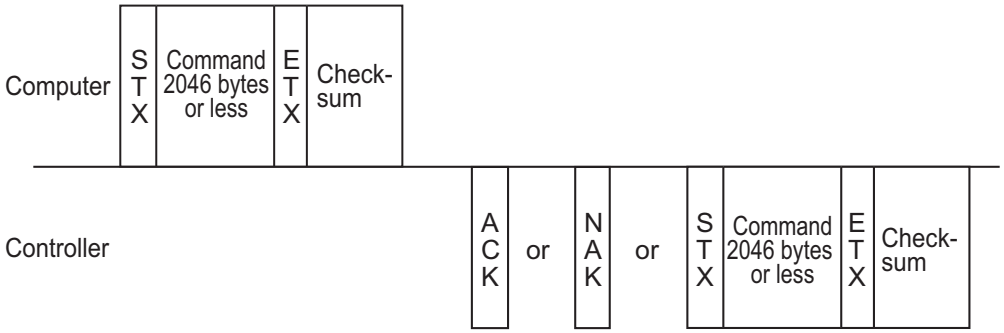
4.3. Instructions for RS-232C Communications

RS-232C communications with the scanner controller involve exchange of ASCII data.

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

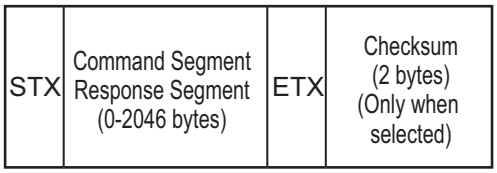
If a transmission error occurs (parity errors, for example), the data is discarded.

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 scanner controller, data basically consists of the following elements:



(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
YOR	YOW		Y-axis offset	1 µm
XYR	XYW		X-axis offset Y-axis offset Axial rotation angle	1 µm 1 µm 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)
DSR	DSW		Opening/closing branch shutters	0: Closing branch shutter 1: Opening branch shutter
SSR	SSW		Opening/closing shutters	0: Closing shutter 1: Opening shutter
MRR	MRW	Scanning data	Scanning data	Layout number
ERR		Maintenance	Reset errors	
TRB			Error code acquisition	
WSR	WSW		Scanner warm-up execution	
WWWR00		Lase power monitor control	Power monitor data acquisition	
WWWR95			Power monitor count 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) DSR*/DSW (Opening/closing branch shutter) (only for ML-3000/ML-6800C/MF-C Series)
* The DSR command is valid for the controller version V00-05E or later.

Read/Write the status of branch shutter.

■ Read (DSR)

Computer -> Controller	: DSR
Controller -> Computer	: S0, S1, S2, S3, S4, S5

S0	Branch shutter 1 status	0: Closed	1: Open
S1	Branch shutter 2 status	0: Closed	1: Open
S2	Branch shutter 3 status	0: Closed	1: Open
S3	Branch shutter 4 status	0: Closed	1: Open
S2	Branch shutter 5 status	0: Closed	1: Open
S3	Branch shutter 6 status	0: Closed	1: Open

■ Write (DSW t0, t1)

t0: Branch shutter No. (1 to 6)
t1: Opening/closing status (0: Closing, 1: opening)

(11) SSR/SSW (Opening/closing shutter) (only for ML-5100 Series)

Read/Write the status of shutter.

In this setting, 0 = Opening and 1 = Closing.

(12) MRR/MRW (Scanning data)

Obtain (read) the value of the existing layout number and specified line or change (write) the settings.

■ Read array data (MRR s0, 1, 5, s3)

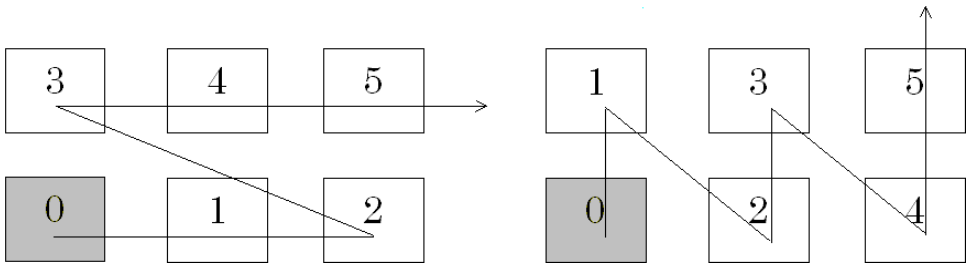
s0: Layout number
s3: Array no. (More than one can be specified)

Example	
When obtaining the value of layout #1 and arrays 1, 2, and 10	
Computer -> Controller	: MRR1, 1, 5, 1, 2, 10
Controller -> Computer	: 10000,0,45000001,20000,0,0,20000,20000,0 Matrix No. 1: X offset 10.000mm, Y offset 0.000mm, Axis rotation angle 45.000001° Matrix No. 2: X offset 20.000mm, Y offset 0.000mm, Axis rotation angle 0.000000° Matrix No. 10: X offset 20.000mm, Y offset 20.000mm, Axis rotation angle 0.000000°

■ Write array data (MRW t0,1,5,t3,t4,t5,t6)

t0: Layout number
t3: Matrix number (0 to 9999)
t4: X offset (unit: µm)
t5: Y offset (unit: µm)
t6: Axis rotation angle (unit: 0.000001°) When -180.000000 is specified, the matrix No. is not scanned.

Example
When changing X offset of Layout No. 1 and Matrix No. 10 to 20.000 mm; Y offset to 20.000 mm; Axis rotation angle to 0.000000°.
Computer -> Controller : MRW1, 1, 5, 10, 20000, 200000, 0

Matrix No.
The matrix No. indicates the scanning order of matrix, and sequence numbers 0 to 9999 are assigned. When creating a matrix with SWDraw2, the matrix No. is different if the matrix is created with "Row priority" or "Column priority."
<Row priority> <Column priority>


ATTENTION	X offset and Y offset of matrix are absolute coordinates from an origin (0, 0). The center of axis rotation angle is the lower left coordinates of a figure.

(13) ERR (Reset Errors)

Clear the current error.

Computer -> Controller : ERR

(14) 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.

(15) WSR/WSW (Scanner warm-up execution)

Obtain (Read) the current status of scanner warm-up.

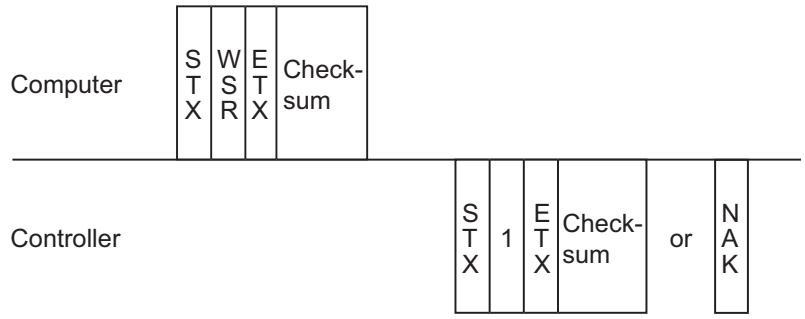
Also, executes scanner warm-up.

■ Read (WSR)

s0: Scanner warm-up status (0: Warm-up at a stop, 1: Warm-up in execution, 2: Cannot be executed due to warm-up at a stop)

Example

When warm-up is in execution

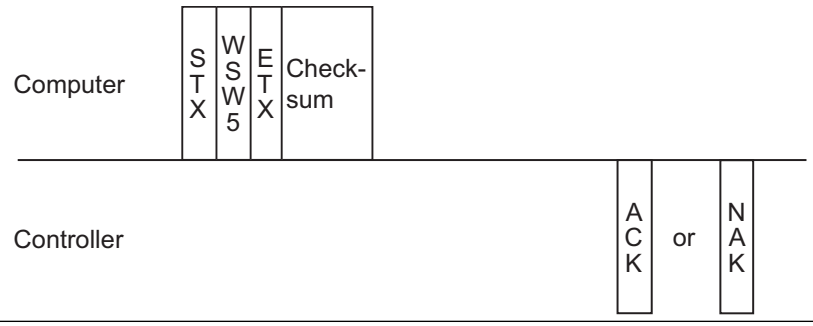


■ Write (WSW)

t0: Number of warm-ups (Number of round-trip times of scanner) (10 times if shortened)

Example

When executing 5 times of warm-up



(16) WWWR00 (Power monitor data acquisition)

Obtain (Read) the power monitor data.

Computer -> Controller	: WWWR00t0t1

t0	Schedule No.	0000 to 0255	
t1	Data No. (Set 99 to obtain values of items shown at right delimited by commas at a time.)	01	Schedule No. of laser power monitor data
		02	Unused
		03	Laser Energy
		04	Number of laser power monitor waveforms
		05	Flash pulse width

Controller -> Computer	: s0

	Setting of t1		Data range
s0	01	Schedule No. of laser power monitor data	0000 to 0255
	02	Unused	Fixed to 000
	03	Laser Energy	000000 to 999999 (×0.01J)
	04	Number of laser power monitor waveforms	000 to 100
	05	Flash pulse width	0000 to 5000 (×0.1ms)

Example
When obtaining the laser energy (99.99 J) of the schedule No. 0001
Computer -> Controller : WWWR00000103
Controller -> Computer : 009999

(17) WWWR95 (Power monitor count acquisition)

Obtain (Read) the power monitor count.

Computer -> Controller	: WWWR95t0t1

t0	Schedule No.	0000 to 0255	
t1	Data No. (Set 99 to obtain values of items shown at right delimited by commas at a time.)	01	Total number of outputs until the present
		02	Number of outputs of appropriate energy
		03	Average power of output laser light

Controller -> Computer	: s0

	Setting of t1		Data range
s0	01	Total number of outputs until the present	000000000 to 999999999
	02	Number of outputs of appropriate energy	000000000 to 999999999
	03	Average power of output laser light	000000 to 999999 (×1W)

Example
When obtaining the number of outputs of appropriate energy (100 times) of the schedule No. 0001
Computer -> Controller : WWWR95000102
Controller -> Computer : 000000100

Chapter 7 Specifications

1. Basic Specifications

Item		Specifications
Ambient temperature		5°C to 35°C (with no condensation or freeze) Note: Contact us when using in ambient temperature below 5°C.
Ambient humidity		80% RH or lower (with no condensation or freeze)
Temperature during storage		-10°C to 55°C (with no condensation or freeze)
Humidity during storage		80% RH or lower (with no condensation or freeze)
Vibration during transport (with packaged)		1.0 G or less (horizontal), 2.0 G or less (vertical)
Impact during transport (with packaged)		10.0 G or less (horizontal), 20.0 G or less (vertical)
Dust		8 mg/m^3 or less
Electromagnetic compatibility standards	Immunity	Complied with the following: IEC61000-4-2 (Electro-static immunity: Contact discharge±6kV, Aerial discharge±8kV) IEC61000-4-3 (Radiated field: 10V/m 80-1000MHz) IEC61000-4-4 (Fast transient burst noise: Power supply±2kV, Transmission line±1kV) IEC61000-4-5 (Lightning surge: Power supply (L1-L2) ±1kV, Power supply (L1-E,L2-E) ±2kV) IEC61000-4-6 (Conducted immunity: 10V/m 0.15-80MHz) IEC61000-4-8 (Magnetic field immunity: 36A/m) IEC61000-4-11 (Dips/Interrupts)
	Emission	Complied with the following: EN55011:2007+A2:2007 (Radiated disturbance) EN55011:2007+A2:2007 (Conducted disturbance)
Power supply voltage		Single-phase, 100 V AC to 240 V AC ±15% (50/60 Hz ±3%)
Power consumption		Average: Approx. 45 W, Peak: Approx. 140 W
External dimensions*		360(W) mm × 420(D) mm × 122(H) mm
Mass		Approx. 6.9 kg

* The connector at the cable connection portion, LASER CONTROL button and filter (with cover) are not included.

2. Components

Item		Model No.	Specifications	Length	Quantity
Scanner controller	GWM-PFL/ DDL/FL	AS1177691	-	-	1
	GWM-DDL2-000/ STD2-001/ STD2-002	LP1201114	-	-	1
Scanner head	GWM-PFL/ STD2-001	LP1190960	1060 to 1100 nm	-	1 (× No. of branches)
	GWM-DDL/ DDL2-000	AS1183580	905 to 925 nm	-	1 (× No. of branches)
	GWM-FL/ STD2-002	LP1190889	1060 to 1100 nm	-	1 (× No. of branches)
	GWM-DDL2-000	LP1201207	905 to 925 nm	-	1
	GWM-STD2-001/ STD2-002	LP1201182	1060 to 1100 nm	-	1
EXT. I/O (1)-LASER cable		NSDJ-PP-JS-37-10	Between Scanner controller and Laser equipment, D-Sub 37 pin	10 m	1
EXT. I/O (2)-LASER cable		NSDJ-PP-JS-25-10	Between Scanner controller and Laser equipment, D-Sub 25 pin	10 m	1
EXT. I/O (3)-LASER cable		NSDJ-PP-JS-9-10	Between Scanner controller and Laser equipment, D-Sub 9 pin	10 m	1
RS-485 cable	GWM-PFL/ DDL/FL	AS1202425	Between Scanner controller and Laser equipment	10 m	1
	GWM-DDL2-000/ STD2-001/ STD2-002	AS1201223		10 m	1
Head control external cable	GWM-PFL/ DDL/FL	AS1202431	Between Scanner controller and Scanner head, High density D-Sub 44 pin	5 m	1 (× No. of branches)
	GWM-DDL2-000/ STD2-001/ STD2-002	AS1155387		5 m	1
Scanner cable	GWM-PFL/ DDL/FL	AS1201214	Between Scanner controller and Scanner head, Twinax cable 26 pin	5 m	1 (× No. of branches)
	GWM-DDL2-000/ STD2-001/ STD2-002	AS1201217		5 m	1

Item	Model No.	Specifications	Length	Quantity
USB cable	PNUC2-AB-5M	Between Scanner controller and Computer	5 m	1
LAN cable	UTP5EXN-3IV	Between Laser equipment and Computer	3 m	1
Power cable	AS1201213	Ratings of 125 V AC, 7 A Note: Be sure to use within its rating. Appropriate cable should be provided by customer when using with power supply voltages exceeding 125 V AC.	5 m	1
FL-PL welder I/O conversion harness	AS1172103	Between EXT.I/O-LASER cable and Laser equipment	0.4 m	1

3. Accessories

The model numbers of accessories are subject to change without notice. Depending on the part to be changed, the mounting screw shape may change and a necessary tool may be different. For the latest parts information, contact a nearest sales office.

Item		Model No.	Specifications	Quantity
Operation manual for GWM series CD-ROM	GWM-PFL/ STD2-001	AS1178726	-	1
	GWM-DDL/ DDL2-000	AS1183583	-	1
	GWM-FL/ STD2-002	AS1190390	-	1
Operation manual for SWDraw2 CD-ROM		AS1201118	-	1
PC software SWDraw2		AS1177027	-	1
Head shorting connector		AS1164496	High density D-Sub 44 pin Note: The same number of connectors as unused heads are required if not using any head I/F connector.	2
I/O connector (3)		A-03376-001	-	1

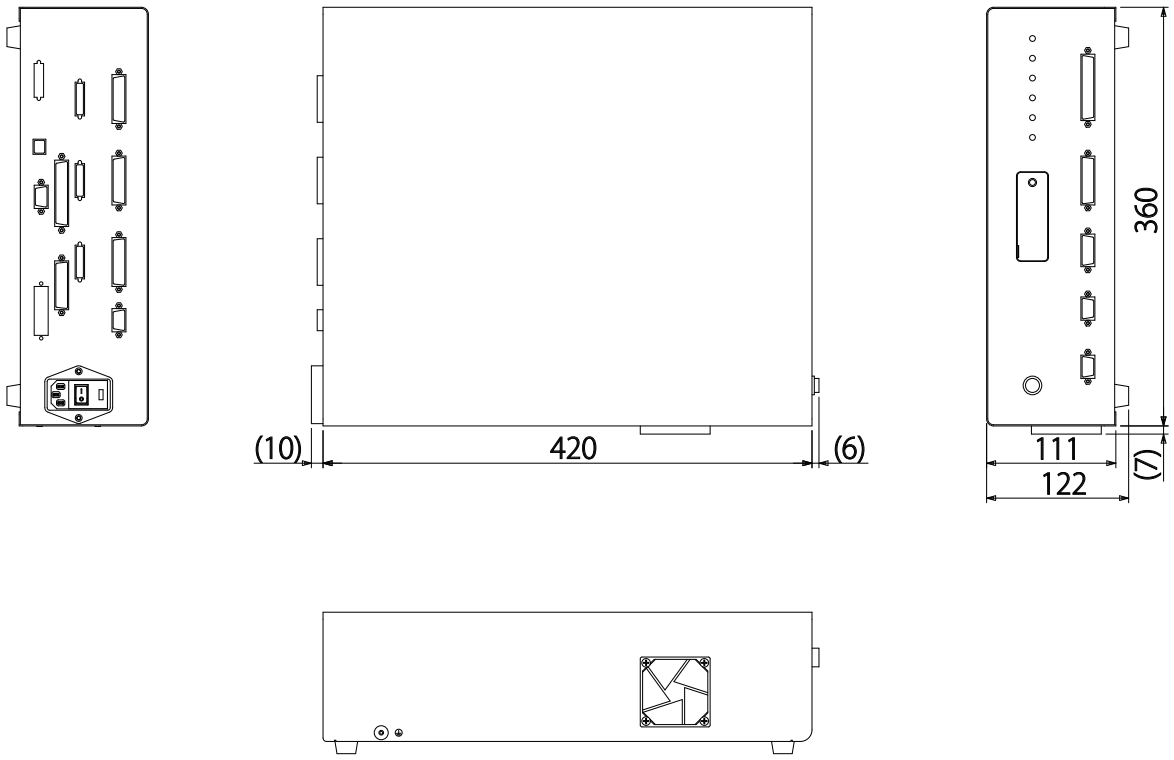
4. Optional Items

Item	Specifications
Computer	For computer specs, Please check the instruction manual for the software SWDraw2 for Laser Scanning System for Welding. Manual number: OM1201123 Reference: Appendix A
Laser equipment	The following laser equipments can be used. **[GWM-PFL/STD2-001]** **• ML-3000 series** **[GWM-DDL/DDL2-000]** **• ML-5100 series** **[GWM-FL/STD2-002]** **• ML-6800C/MF-C series**
Optical fiber	Optical fiber should be selected to suit laser equipment and laser schedules used.
CCD camera unit	A camera and video monitor can be combined to allow machining to be checked during operation. Contact us for details.

Chapter 8 Outline Drawing

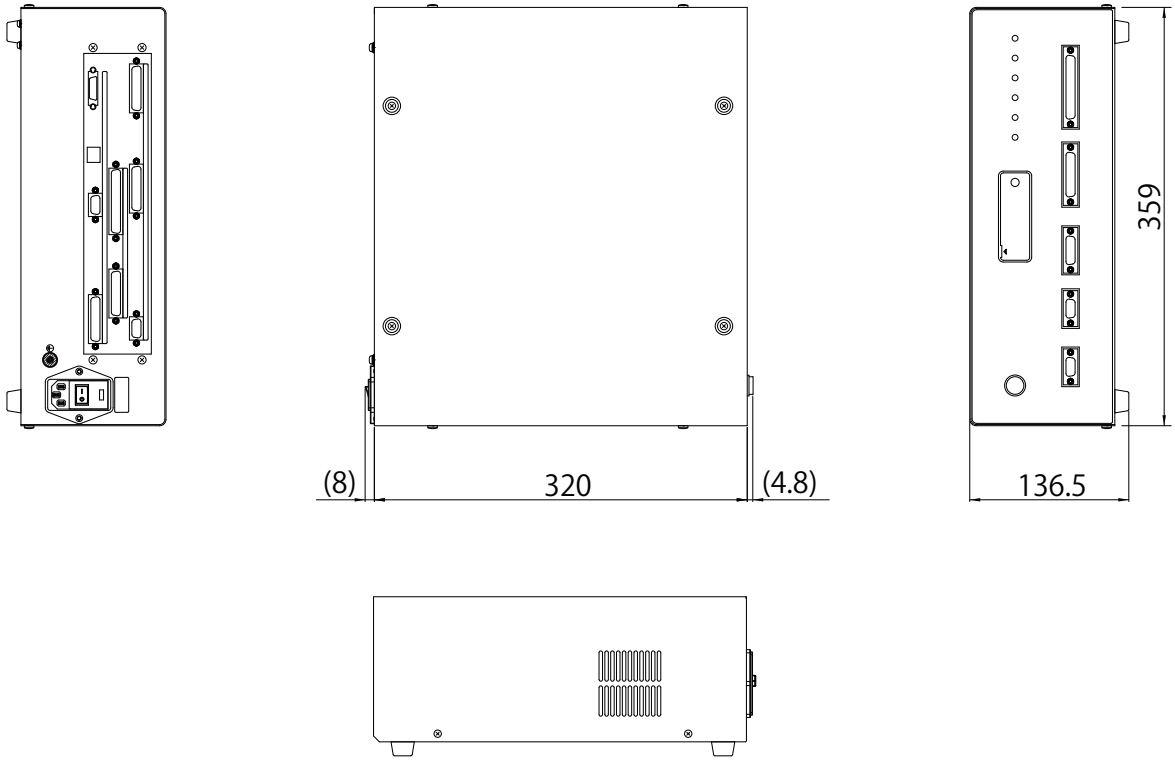
1. GWM-PFL/DDL/FL

Dimensions in mm



2. GWM-DDL2-000/STD2-001/STD2-002

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 and comprehensive overhauls once every two years.

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	CR2450/BK	3 years	Replace at end of service life See "Chapter 9-3. Backup Lithium Battery Replacement" (page 58) .

*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 scanner controller includes a lithium backup battery. If this battery is exhausted, settings in the memory will be lost when the power switch of the scanner controller 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

3.2. Preparation

Have the following ready when replacing the lithium battery.

- New lithium battery
- Phillips screwdriver

3.3. Replacing the Lithium Battery

1 About thirty minutes before replacing the battery, turn ON the power switch of the scanner controller to activate the battery. This step is required to charge the internal power supply, which is used for data storage during battery replacement. This step may be omitted if the equipment has been in use for more than thirty minutes.

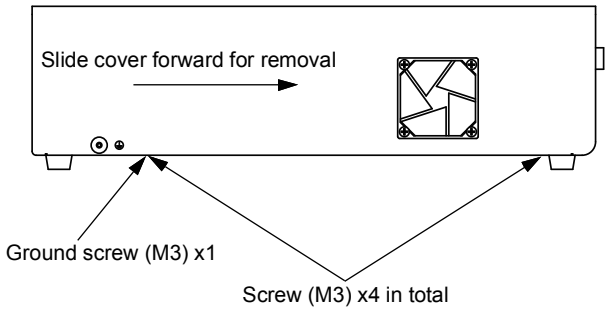
2 On the scanner controller, turn OFF the power switch.

■ GWM-PFL/DDL/FL

3 Unscrew the screw connected to ground on side of the scanner controller.

4 Unscrew the four screws on bottom of the scanner controller on either side.

5 Remove the cover by pulling it towards you.

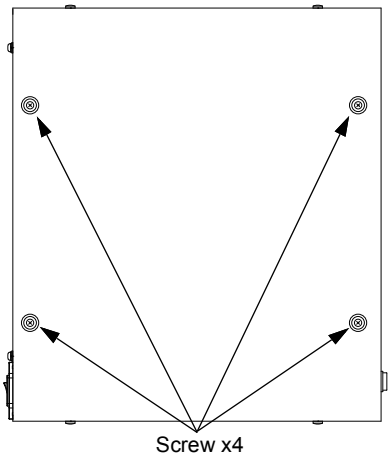


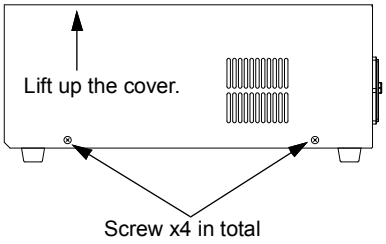
■ GWM-DDL2-000/STD2-001/STD2-002

6 Unscrew the screw connected to ground on side of the scanner controller.

7 Unscrew the four screws on bottom of the scanner controller on either side.

8 Remove the cover by pulling it towards you.



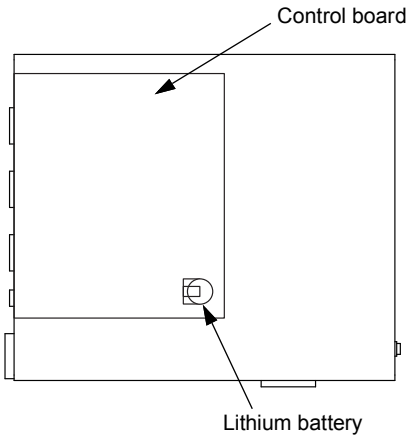


9 Remove the control board's lithium battery.

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

11 Replace the cover.

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



4. Memory Card Management

We recommend backing up the data on memory cards to your computer periodically in case of accidents.

Additionally, be sure to save a copy of the data before using the equipment for the first time.

When inserting the memory card, be careful not to break a pin of the memory card slot.

To back upTo back up data, you will need a compact flash reader or a compact flash adapter, which must be provided separately.

4.1. Backing Up Memory Cards

1 Connect the compact flash reader or adapter to a computer so that the computer recognizes the memory card.

For more information, refer to the documentation for the compact flash device.

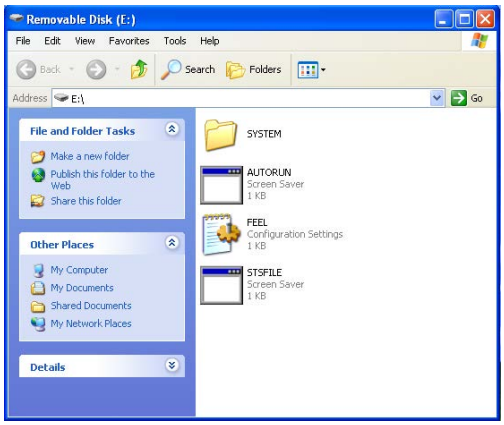
2 Double-click the [My Computer] icon to confirm that the memory card is correctly recognized.

If the additional memory card drive is displayed, you are ready to start backing up the card.

If not, refer to the documentation for the compact flash product for more information.

3 The memory card drive structure is as follows:

- SYSTEM
- AUTORUN
- Stsfile
- feel

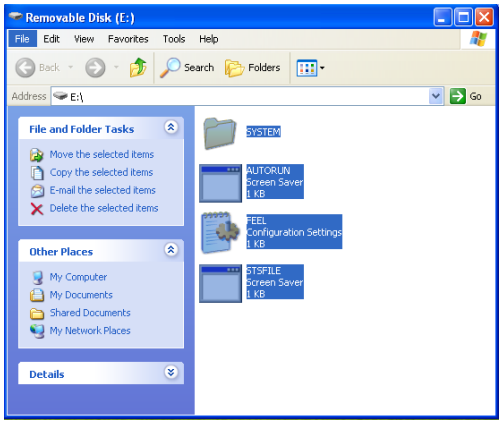


4 Select [Select All] from the [Edit] menu.

All file icons are highlighted.

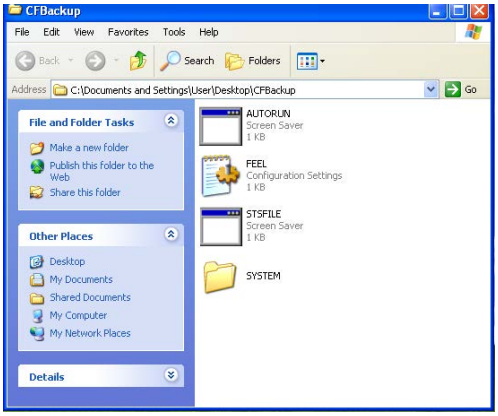
5 Select [Copy] from the [Edit] menu.

6 Navigate to the target directory for storing a backup copy of the files.



7 Select [Paste] from the [Edit] menu.

The screenshot at right shows an example when the memory card contents are copied to the folder "CFBackup" created on the desktop.



The files have now been backed up.

4.2. Restoring Data to Memory Cards

Data previously backed up can be restored to a memory card.

1 Connect the compact flash reader or adapter to a computer so that the computer recognizes the memory card.

For more information, refer to the documentation for the compact flash device.

2 Double-click the [My Computer] icon to confirm that the memory card is correctly recognized.

If the additional memory card drive is displayed, you are ready to start backing up the card.

If not, refer to the documentation for the compact flash product for more information.

3 Access the directory of the memory card drive.

4 Select [Select All] from the [Edit] menu.

All file icons are highlighted.

5 Press the <Delete> key.

6 Navigate to the directory of the backup copies.

7 Select [Select All] from the [Edit] menu.

All file icons are highlighted.

8 Select [Copy] from the [Edit] menu.

9 Navigate to the directory of the memory card drive.

10 Select [Paste] from the [Edit] menu.

Backed-up data has now been restored to the memory card.

4.3. Checking Available Memory Card Space

If you encounter problems when transferring data from the computer, check the amount of free space left on the memory card.

1 Connect the compact flash reader or adapter to a computer so that the computer recognizes the memory card.

For more information, refer to the documentation for the compact flash device.

2 Double-click the [My Computer] icon to confirm that the memory card is correctly recognized.

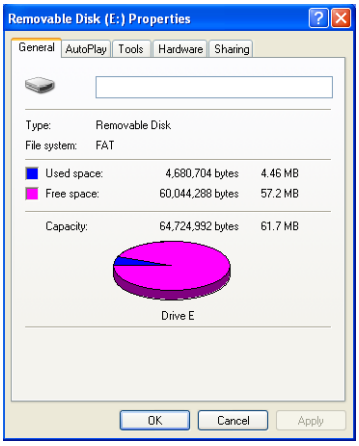
If the additional memory card drive is displayed, you are ready to start backing up the card.

If not, refer to the documentation for the compact flash product for more information.

3 Right-click on the memory card drive icon and select [Properties].

At least 10% of the memory card space must be available or frequent errors may result.

In this case, use a higher-capacity memory card (sold separately).



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 SWDraw2.

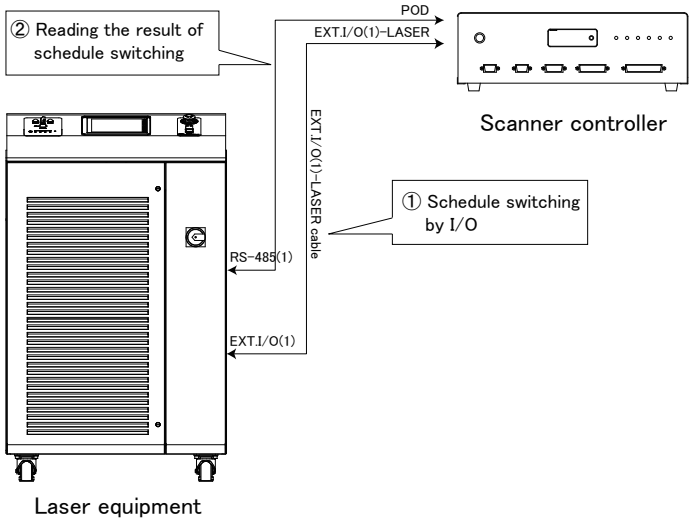
The errors not described below indicate errors occurred in the laser equipment. For details, refer to the operation manual for the connected laser equipment.

	Error details	Corrective action
1001	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1002	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1003	Component not registered	Component data is not registered. Register data.
1004	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1005	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1006	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1007	Layout data not registered	Layout data is not registered.Register data. Select a layout number other than "0."
1008	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1009	Scanning speed error	Scanning speed setting error. Adjust scanning speed.
1010	ACK timeout	No ACK (operation complete) response from conveyor within time limit. Check the conveyor.
1011	Layout command error	Layout error. Restart the system and PC before sending the layout data.
1012	Layout parameter error	Layout error. Restart the system and PC before sending the layout data.
1013	Insufficient layout command error	Layout error. Restart the system and PC before sending the layout data.
1014	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1015	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1016	Scanning area error	Layout error. Reset the system and PC before sending the layout data.
1017	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1018	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.

	Error details	Corrective action
1019	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1020	Battery voltage low	The system battery voltage is low. Replace the battery.
1022	Emergency stop	An emergency stop signal was input. Close the external I/O control connector external emergency stop input. Or release the EMERGENCY STOP button on the system front or control panel.
1060 to 1079	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1083	Memory card error	Memory card error. Contact us if this error occurs even after turning on the power again.
1084	Memory card capacity exceeded	The memory card is full. Either delete data or use a new memory card.
1085 to 1096	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1097	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1098	RAM registration memory exceeded	Contact us if this message appears.
1099	Component registration memory exceeded	Component registration exceeds the memory available, or the component cannot be registered. Re-register the component.
1100	Layout registration memory exceeded	Layout file registration exceeds the memory available, or the layout file cannot be registered. Re-register the layout file.
1110	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1111	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1112	Controller error	Controller error. Contact us if this error occurs even after turning on the power again.
1113	RS-485 Command Error	An error occurred with RS-485 command. Confirm whether the right laser equipment is connected.
1114	RS-485 Communication Error	Can't communicate with the laser equipment. Check the RS-485 cable is connected.
1115	Memory Switch Error	Memory switch error. Contact us if this message appears.
1116	Welder Registration Error	Welder registration error. Contact us if this message appears.
1117	Scanner Connection Error	Scanner connection error. Confirm that the connection is performed correctly.
1118	I/O Cable Connection Error	The EXT. I/O (1)-LASER cable between the scanner controller and the laser equipment is disconnected. Confirm that the connection is performed correctly.
1120	LED Defect: Safety Shutter Open (1)	There is a problem with the Shutter alarm lamp. If the error persists after restarting, contact us.

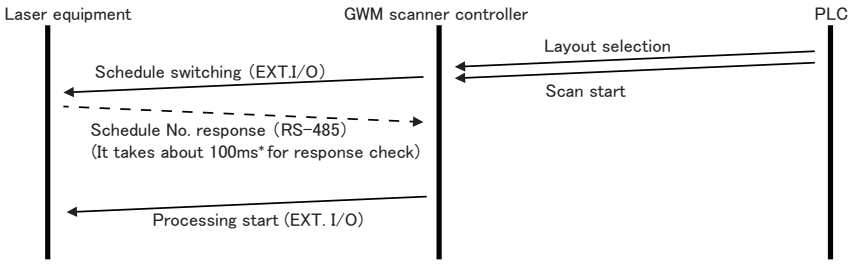
	Error details	Corrective action
1121	LED Defect: LD On (1)	There is a problem with the LD alarm lamp. If the error persists after restarting, contact us.
1122	THERMAL Fiber Interlocked (1)	Thermal Interlock of the scanner head is on. Please cool down the unit for a while. If the problem still exists after cooling, contact us.
1123	Head Cover Open (1)	The head cover is detached. Attach the cover. In addition, the short-circuit connector on the rear may be removed. Check the connector.
1124	Scanner Monitor Unit Error (1)	An error is detected in the scanner monitor unit. Confirm that the cooling water flows in the scanner head correctly. If the error persists following these measures, contact us.
1130	LED Defect: Safety Shutter Open (2)	Thermal Interlock of the scanner head is on. Please cool down the unit for a while. If the problem still exists after cooling, contact us.
1131	LED Defect: LD On (2)	There is a problem with the LD alarm lamp. If the error persists after restarting, contact us.
1132	THERMAL Fiber Interlocked (2)	Thermal Interlock of the scanner head is on. Please cool down the unit for a while. If the problem still exists after cooling, contact us.
1133	Head Cover Open (2)	The head cover is detached. Attach the cover. In addition, the short-circuit connector on the rear may be removed. Check the connector.
1134	Scanner Monitor Unit Error (2)	An error is detected in the scanner monitor unit. Confirm that the cooling water flows in the scanner head correctly. If the error persists following these measures, contact us.
1140	LED Defect: Safety Shutter Open (3)	There is a problem with the Shutter alarm lamp. If the error persists after restarting, contact us.
1141	LED Defect: LD On (3)	There is a problem with the LD alarm lamp. If the error persists after restarting, contact us.
1142	THERMAL Fiber Interlocked (3)	Thermal Interlock of the scanner head is on. Please cool down the unit for a while. If the problem still exists after cooling, contact us.
1143	Head Cover Open (3)	The head cover is detached. Attach the cover. In addition, the short-circuit connector on the rear may be removed. Check the connector.
1144	Scanner Monitor Unit Error (3)	An error is detected in the scanner monitor unit. Confirm that the cooling water flows in the scanner head correctly. If the error persists following these measures, contact us.
1194	Scanner Temp or Flow Error	About 30 minutes has passed since the LD is turned on with the scanner temperature or the flow warning. For the scanner with the monitor unit, check the flow rate (water or air).
1195	Model unregistered	An welder not registered in controller.ini in the CF card has been connected.
1196	CPLD version error	CPLD1 version of the welder IF board is too old.
1197	FPGA version error	Scanner FPGA version is too old.
1198	Message file error	LogMsg.ini in the CF card cannot be read.
1199	Schedule ready signal timeout	A valid schedule have not been entered or the laser device is not ready.
1200	Schedule number Switching error[*1]	The laser device schedule number cannot be switched. Check that the EXT. I/O (1)-LASER cable between the scanner controller and laser device is connected correctly. If error recurs, consult us.

*1 This error is displayed only when the following schedule handshake function is selected.
The GWM scanner controller switches a schedule of the welder through the EXT. I/O (1)-LASER cable. The open-loop control is adopted for speeding up the schedule switching when [Handshaking] is set to OFF, but the check function by the handshake using the RS-485 cable is available by setting it to ON.

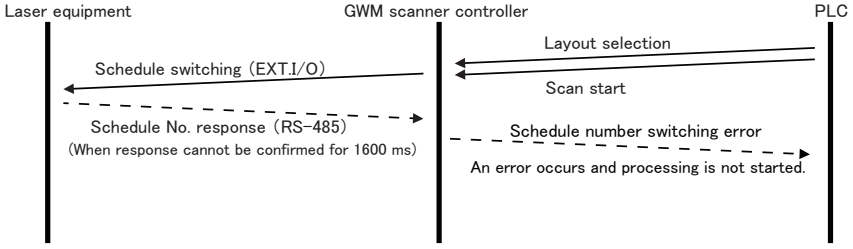


Handshake sequence (A broken line indicates operation when [Handshaking] is ON.)

[At normal operations]



[At abnormal operations]



* Compared with operation when [Handshaking] is OFF, about 100 ms of takt increases for each schedule switching for checking the response of a schedule number. Also, when the response of a schedule number cannot be confirmed for 1600 ms, the schedule number switching error occurs.

Chapter 11 Laser Equipment Settings

[CONFIG screen RS-485 COMM settings]

(Refer to "**CONFIG Screen**" in the laser equipment Operation Manual.)

BAUD RATE 57600: Sets transfer speed to 57,600 bps.
PARITY EVEN: Sets parity to even.
DATA BIT 8BIT: Sets data bit to 8 bits.
STOP BIT 2BIT: Sets stop bit to 2 bits.