Original instructions

TRANSISTOR WELDING POWER SUPPLY

MD-A10000A
MD-B5000A

EU

OPERATION MANUAL

AMADA®

OM1185327

MD-A10000A/MD-B5000A-E10-202308

Thank you for purchasing our product.
For correct use, read this Operation Manual carefully. After reading, save it properly for future reference.

Contents

1. Special Precautions

(1) Safety Precautions

Before using, read "Safety Precautions" carefully to understand the correct method of use.

- These precautions are shown for safe use of our products and for prevention of damage or injury to operators or others.
  Be sure to read each of them, since all of them are important for safety.
- The meaning of the words and symbols is as follows.

⚠ DANGER

Denotes operations and practices that may imminently result in serious injury or loss of life if not correctly followed.

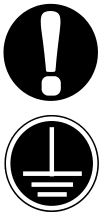
⚠ WARNING

Denotes operations and practices that may result in serious injury or loss of life if not correctly followed.

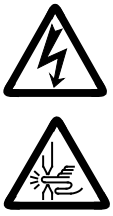
⚠ CAUTION

Denotes operations and practices that may result in personal injury or damage to the Power Supply, if not correctly followed.

These symbols denote "prohibition".
They are warnings about actions out of the scope of the warranty of the product.



These symbols denote actions which operators must take.



Each symbol with a triangle denotes that the content gives notice of DANGER, WARNING or CAUTION to the operator.

⚠ DANGER

Do not touch the inside of the Power Supply unnecessarily
Since very high voltages are applied to the interior of this Power Supply, it is very dangerous to touch it unnecessarily.

Never disassemble, repair or modify the Power Supply
These actions can cause electric shock and fire. Consult us or your distributor for inspection and repair.

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

⚠ WARNING

Do not put your hands between the electrodes
When welding, keep your fingers and hands away from the electrodes.

Do not touch any welded part or electrodes during welding and just after welding finished
The welded part of a workpiece, electrodes and arm are very hot.
Do not touch them; otherwise you may be burnt.

Ground this Power Supply
If the Power Supply is not grounded, you may get an electric shock when there is trouble, or when electricity leaks.

Apply Single-phase, 100–120/200–240V AC power supply
Application of a voltage out of the specified range can cause fire and electric shock.

Connect the specified cables securely
Cables of insufficient current capacities and loose connections can cause fire and electric shock.

Do not damage the power cable and connecting cables
Do not tread on, twist or tense any cable. The power cable and connecting cables may be broken, and that can cause electric shock and fire.
If any part needs to be repaired or replaced, consult us or your distributor.

Stop the operation if any trouble occurs
Continuous operation after occurrence of a trouble such as burning smell, abnormal sound, abnormal heat, smoke, etc. can cause electric shock and fire. If such a trouble occurs, immediately consult us or your distributor.

Persons with pacemakers must stay clear of the welding machine
A person who uses a pacemaker must not approach the welding machine or walk around the welding shop while the welding machine is in operation, without being permitted by his/her doctor. The welding machine generates a magnetic field and has effects on the operation of the pacemaker while it is turned on.

Protective gear must be worn
Put on protective gear such as protective gloves, long-sleeve jacket, leather apron, etc. Surface flash and expulsion can burn the skin if they touch the skin.

Wear protective glasses
If you look at the flash directly during welding, your eyes may be damaged.
If any surface flash and expulsion gets in your eye, you may lose your eyesight.

⚠ CAUTION

Do not splash water on the Power Supply
Water splashed over the electric parts can cause electric shock and short circuits.

Use proper tools (wire strippers, pressure wire connectors, etc) for termination of the connecting cables
Do not cut the conductor of wire. A flaw on it can cause fire and electric shock.

Install the Power Supply on firm and level surface
If the Power Supply falls or drops, injury may result.

Do not place a water container on the Power Supply
If water spills, insulation will deteriorate, and this may cause electric leak and fire.

Keep combustible matter away from the welding machine
Surface flash and expulsion can ignite combustible matter. If it is impossible to remove all combustible matter, cover them with non-combustible material.

Do not cover the Power Supply with a blanket, cloth, etc.
If such a cover is used, it may be overheated and burn.

Do not use this Power Supply for purposes other than welding
Use of this Power Supply in a manner other than specified can cause electric shock and fire.

Use ear protectors
Loud noises can damage hearing.

Keep a fire extinguisher nearby
Keep a fire extinguisher in the welding shop in case of fire.

Maintain and inspect the Power Supply periodically
Maintain and inspect the Power Supply periodically, and repair any damage nearby before starting operation.

Avoid contact of any metal object such as tool with the output terminals or the metal part of the secondary conductor
The contact situation can cause the shorted state and the contact portion may be overheated and scattered.

(2) Precautions for Handling

- When transporting or moving the Power Supply, do not lay it down. Also, handle the Power Supply with care so as not to make an impact such as drop on it. Moving the Power Supply by hand must be done by at least two people.

- Install this Power Supply on a firm and level surface. If it is inclined, malfunction may result.

- Do not install this Power Supply in the following:
  - Damp places where humidity is higher than 90%,
  - Hot or cold places where temperatures are above 40°C or below 5°C,
  - Places near a high noise source,
  - Places where chemicals are handled,
  - Places where water will be condensed
  - Dusty places, and
  - Places at an altitude above 1000 meters.

- Clean the outside of the Power Supply with a soft, dry cloth or one wet with a little water. If it is very dirty, use diluted neutral detergent or alcohol. Do not use paint thinner, benzine, etc., since they can discolor or deform the Welding Transformer.

- Do not put a screw, a coin, etc., in the Power Supply, since they can cause a malfunction.

- Operate the Power Supply according to the method described in this operation manual.

- Operate the switches and buttons carefully by hand. If they are operated roughly or with the tip of a screwdriver, a pen, etc., this will cause malfunction or damage.

- Operate the switches and buttons one at a time. If two or more of them are operated at a time, the Power Supply may have trouble or may be broken.

- The Power Supply is not equipped with auxiliary power such as an outlet for lighting.

- The welding head and the secondary conductor for connecting the welding head with the Power Supply are separately needed to use the Power Supply.

- The I/O signal line and RS-485 communication signal line to start the Power Supply are not attached. Solder lines to the attached I/O connector and RS-485 connector.

(3) On 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.

(4) Function Difference Depending on Model

"Master" and "Slave" in this Operation Manual correspond to the following models.

Model			Power supply voltage	Connection type
MD-A10000A	**-00-00**	**-00-50**	100V – 120V	Master (for 1-slave connection)
	-00-01	**-00-51**	200V – 240V	
	-00-02	**-00-52**	100V – 120V	Master (for 2-slave connection)
	-00-03	**-00-53**	200V – 240V	
	-00-04	**-00-54**	100V – 120V	Master (for 3-slave connection)
	-00-05	**-00-55**	200V – 240V	
	-00-06	**-00-56**	100V – 120V	Master (for 4-slave connection)
	-00-07	**-00-57**	200V – 240V	
	-00-08	**-00-58**	100V – 120V	Master (for 5-slave connection)
	-00-09	**-00-59**	200V – 240V	
	-00-10	**-00-60**	100V – 120V	Master (for 6-slave connection)
	-00-11	**-00-61**	200V – 240V	
	-00-12	**-00-62**	100V – 120V	Master (for 7-slave connection)
	-00-13	**-00-63**	200V – 240V	
	-00-14	**-00-64**	100V – 120V	Master (for 8-slave connection)
	-00-15	**-00-65**	200V – 240V	
	-00-16	**-00-66**	100V – 120V	Master (for 9-slave connection)
	-00-17	**-00-67**	200V – 240V	
	-00-18	**-00-68**	100V – 120V	Master (for 10-slave connection)
	-00-19	**-00-69**	200V – 240V	
	-00-20	**-00-70**	100V – 120V	Master (for 11-slave connection)
	-00-21	**-00-71**	200V – 240V	
	-00-22	**-00-72**	100V – 120V	Master (for 0-slave connection)
	-00-23	**-00-73**	200V – 240V	
	-	**-00-75**	200V – 240V	Master ()
	-00-30		100V – 120V	Slave (Connection cable: 0.6 m)
	-00-31		200V – 240V	
	-00-32		100V – 120V	Slave (Connection cable: 3 m)
	-00-33		200V – 240V	

Model			Power supply voltage	Connection type
MD-B5000A	-00-00	-00-50	100V – 120V	Master (for 1-slave connection)
	-00-01	-00-51	200V – 240V	
	-00-30		100V – 120V	Slave (Connection cable: 0.6 m)
	-00-31		200V – 240V	

2. Features

MD-A10000A and **MD-B5000A** are transistor welding power supplies for precision welding. Small power supply units can be used since all welding is powered by energy accumulated in a capacitor.

MD-A10000A: Standard type
MD-B5000A: Polarity switching type

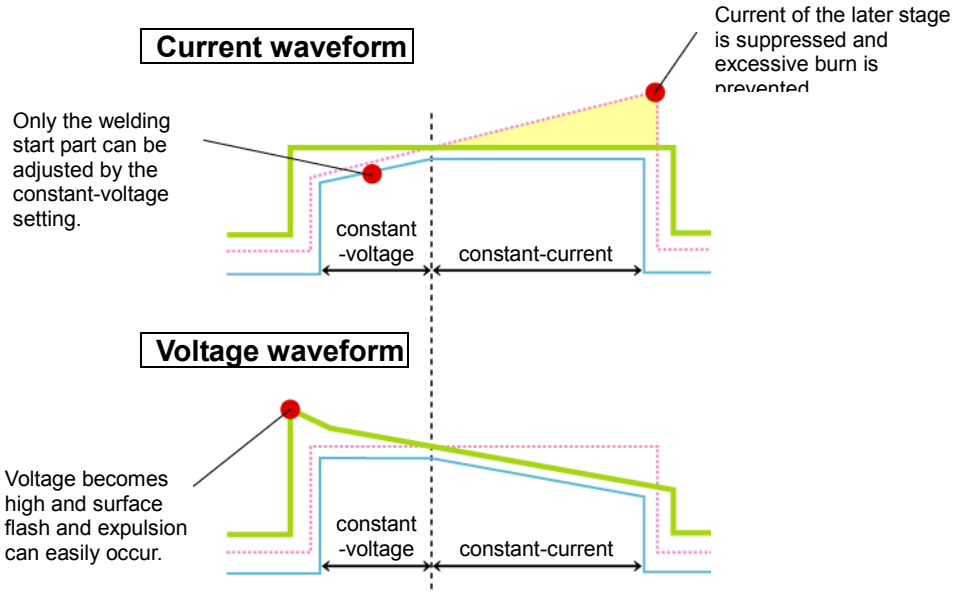
■ The switching method adopted for welding current control permits the small model to achieve high output and high efficiency.

■ Select any of the following three control methods:

- **Constant-current control (——)**
  Realizes a stable welding since a fixed current is supplied regardless of the resistance of workpiece.

- **Constant-voltage control (·····)**
  Controls the voltage between electrodes. Welding free of surface flash and expulsion can be performed since the voltage is fixed from the start and the current is reduced even the welding of material having high specific resistance and the welding of workpiece having high contact resistance such as cross wire.

- **Combination control of constant-current and constant-voltage (——)**
  In the early stage of welding, welding free of surface flash and expulsion can be performed by the constant-voltage setting. The weld time to start of constant current can be adjusted.



■ The quick welding current rise is optimal for fine welding.

- Large current can be supplied by connecting two or more **MD-A10000A**s/ **MD-B5000A**s.

  MD-A10000A: 12 devices maximum (1 master and 0 to 11 slave(s))
  MD-B5000A: 2 devices maximum (1 master and 1 slave)

3. Packaging

(1) 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.

① MD-A10000A-00-00/-00-01/-00-02/-00-03/-00-04/-00-05/-00-06/-00-07/-00-08/ -00-09/-00-10/-00-11/-00-12/-00-13/-00-14/-00-15/-00-16/-00-17/-00-18/ -00-19/-00-20/-00-21/-00-22/-00-23, MD-B5000A-00-00/-00-01

Item		Model No.	Q'ty
Connector (D-Sub, 25 pins, Male)	Case	HDB-CTH(10)	1
	Plug	HDBB-25(05)	1
V SENS cable (1.5 m)		44904	1

② MD-A10000A-00-50/-00-51/-00-52/-00-53/-00-54/-00-55/-00-56/-00-57/-00-58/ -00-59/-00-60/-00-61/-00-62/-00-63/-00-64/-00-65/-00-66/-00-67/-00-68/ -00-69/-00-70/-00-71/-00-72/-00-73/-00-75, MD-B5000A-00-50/-00-51

Item		Model No.	Q'ty
Connector (D-Sub, 25 pins, Male)	Case	HDB-CTH(10)	1
	Plug	HDBB-25(05)	1
V SENS cable (1.5 m)		SK-1214072	1

③ MD-A10000A-00-30/-00-31

Item	Model No.	Q'ty
Control cable 600	AS1155728	1
Coil cable 3000	AS1155727	1

④ MD-A10000A-00-32/-00-33

Item	Model No.	Q'ty
Control cable 3000	AS1155729	1
Coil cable 3000	AS1155727	1

⑤ **MD-B5000A-00-30/-00-31**

Item	Model No.	Q'ty
Control cable 600	AS1155728	1
Coil cable 600	AS1158001	1

(2) Options

① **MD-A10000A-00-00/-00-02/-00-04/-00-06/-00-08/-00-10/-00-12/-00-14/-00-16/-00-18/-00-20/-00-22/-00-30/-00-32/-00-50/-00-52/-00-54/-00-56/-00-58/-00-60/-00-62/-00-64/-00-66/-00-68/-00-70/-00-72,**
MD-B5000A-00-00/-00-30/-00-50

Item	Model No.
Power cable*1	KP-35 KS-16A SVT#18 x 3 B-TYPE (3-pin plug, 100 to 120 V AC)
3 pin – 2 pin conversion adapter for power cable	KPR-24(SB)-B (100 to 120 V AC)
RS-485 connector kit (Connector-mounting screw, Screw (in mm))	AEP1215501

*1: Exclusively for the MD series. Do not use for other devices.

② **MD-A10000A-00-01/-00-03/-00-05/-00-07/-00-09/-00-11/-00-13/-00-15/-00-17/-00-19/-00-21/-00-23/-00-31/-00-33/-00-51/-00-53/-00-55/-00-57/-00-59/-00-61/-00-63/-00-65/-00-67/-00-69/-00-71/-00-73/-00-75,**
MD-B5000A-00-01/-00-31/-00-51

Item	Model No.
Power cable*1	KP-244 KS-16D VCTF3*1.25mm 3m (For Japan, 200 V AC)
	CEE3P-W-1.8 (Round-shaped plug, 200 to 240 V AC)
	GBP-F-GBSS-3 (For China, 220 V AC)
RS-485 connector kit (Connector-mounting screw, Screw (in mm))	AEP1215501

*1: Exclusively for the MD series. Do not use for other devices.

③**MD-A10000A-00-00/-00-01/-00-02/-00-03/-00-04/-00-05/-00-06/-00-07/-00-08/ -00-09/-00-10/-00-11/-00-12/-00-13/-00-14/-00-15/-00-16/-00-17/-00-18/ -00-19/-00-20/-00-21/-00-22/-00-23, MD-B5000A-00-00/-00-01**

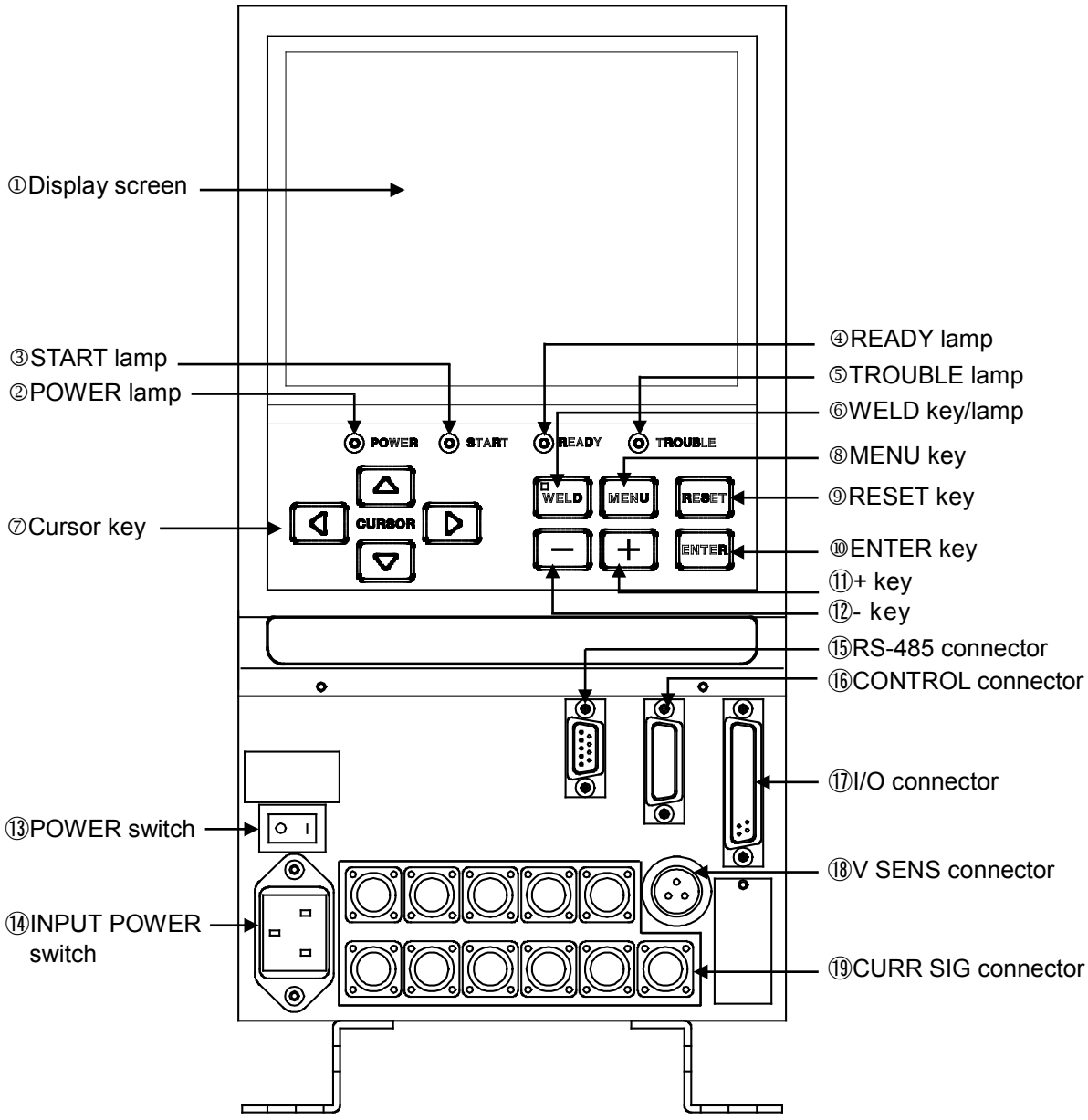
Item	Model No.
Voltage Detction Joint Cable	AEP1216326

(Note) The current 3-pin V SENS connector is discontinued and will switch to 4-pin after stock runs out. At the same time, the V sense cable will also be replaced due to the discontinuation of the connector. Preparing the above conversion cable so that customers who are using products with 3-pin connectors can use the new V-sense cable.

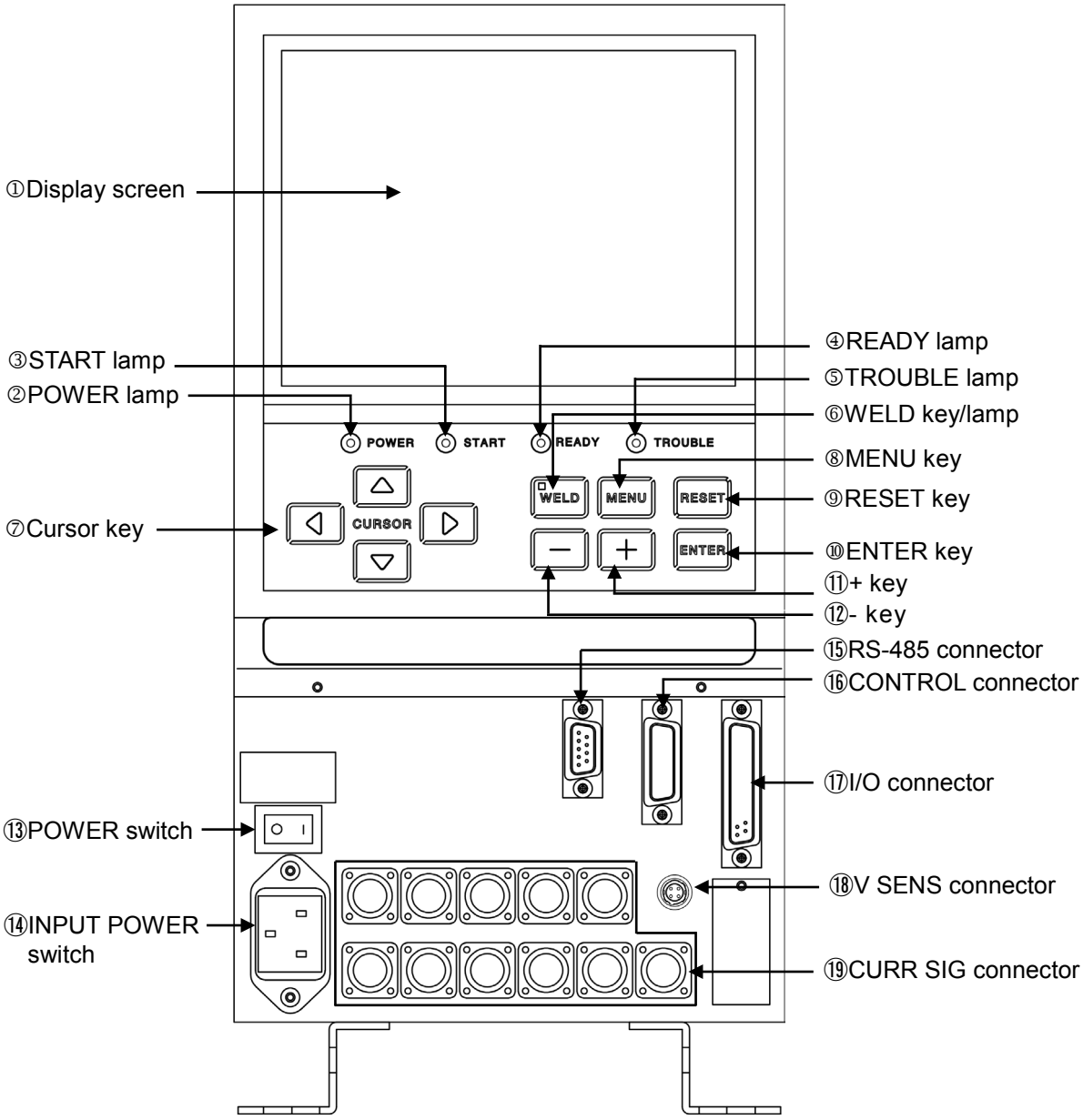
4. Name and Functions of Each Section

(1) Front (Master)

1)MD-A10000A-00-00～23（MD-B5000A-00-00～01）



2)MA-A10000A-00-50～75（MD-B5000A-00-50～51）



① **Display screen**
Displays the welding schedule, welding current monitor value, and other information.

② **POWER lamp**
Comes on when the power is supplied after the POWER switch is turned on.
Note) This lamp does not indicate the power state of all connected devices. For the power state of each device, check the POWER lamp on each device.

③ **START lamp**
Comes on when the sequence starts after the start signal is input.

④ **READY lamp**
Comes on when the welding current is ready to be supplied to the equipment.
The following conditions must be met for this lamp to come on:
- The WELD lamp on the front panel is on.
- The WE ON/OFF signal of the I/O connector is closed.
- No fault is occurring.
- Not in the middle of welding or charging

⑤ **TROUBLE lamp**
Comes on when a fault occurs.

⑥ **WELD key / WELD lamp**
Used to start the sequence without applying the welding current.
The welding current will not flow when this key is pressed and the WELD lamp goes out.

⑦ **Cursor key**
Moves the cursor on the display screen vertically and horizontally.

⑧ **MENU key**
Press this key to display the menu screen.

⑨ **RESET key**
When a fault is displayed, remove the cause and press this key. This will reset the fault display.

⑩ **ENTER key**
Used to determine the set values and selected items. Press this key for each item to determine the changed contents.

⑪ **+ key**
Press this key to increase the value of the item.

⑫ **- key**
Press this key to decrease the value of the item.

⑬ **POWER switch**
Turn this switch on to switch the power on.

⑭ **INPUT POWER connector**
Connects the power cable (optional).

⑮ RS-485 connector

Used to communicate with the sequencer and personal computer. For connection and contents, refer to **9. External Communication Function**.

⑯ CONTROL connector

Used to connect to the slave. For connection, refer to **5. (2) Connection between Master and Slave**.
(**MD-A10000A-00-75**)

⑰ I/O connector

Pin No.	Description		
1	**INT.24V** 24 V DC is output. Connect Pin 1 to Pin 14 to use a contact or NPN transistor (open collector) as input signals (for starting and schedule selection). CAUTION → Use Pin 1 only for connection to Pin 14 or Pin 2. Connection to other pins will result in equipment failure.		
2	**STOP** In most cases, connect Pin 2 to Pin 1. When this pin is opened, an operation stop error is displayed and operation stops. Open this pin to stop the sequence in the middle of operation when using the start function with self-holding. CAUTION → This pin does not have the emergency stop function. When emergency stop is necessary, install a circuit that breaks power supply to the equipment.		
3	**2ND** Close this pin, and the weld sequence is started in the usual manner.		
4 17 5 18 6	**Schedule select**	**SCH 1** **SCH 2** **SCH 4** **SCH 8** **SCH 16**	Terminal for selection of schedule No. Functions when the external schedule select is selected. (Refer to **6. (6)⑦SCHEDULE**.) The schedule No is the sum of the SCH Nos. of the closed pins. (Refer to Table of schedule Nos. and corresponding schedule-select pins.)
7 16	**COM** **COM** pins to use a contact or NPN transistor.		
8	**WE ON/OFF** When this pin is opened, the flow of welding current is not allowed when the weld sequence is started. Use this pin to tentatively activate the equipment.		

Pin No.	Description
9	**CNTR RESET** Closes the circuit to reset the counter.
10 22	**NC** Reserve input pins. (Keep these pins open without connecting, otherwise the equipment may be damaged.)
11	**NG** Fault signal output pins. The circuit is closed when the power supply is turned on. The circuit is opened in the following cases: ・When the measured value exceeds the range set on the COMPARATOR screen and the PRECHECK screen after the weld sequence is over. ・When operational trouble occurs. When a fault occurs, operation is stopped until the reset signal is input. You can change the function so that the circuit is opened normally and closed in the case above. (Refer to **6. (6)⑫NG SIGNAL TYPE**.) The contact rating is 24 V DC, 20 mA. (A semiconductor switch is used.)
12	**CAUTION** Caution signal output pins. If a fault occurs in items that are set in the ON position for ERROR SETTING (Refer to **6. (6)㉕ERROR SETTING**) on the STATUS screen, this circuit is closed after the weld sequence is over. If a fault occurs, operation can be continued without stopping the sequence. To cancel the output, input the reset signal or start signal. The contact rating is 24 V DC, 20 mA. (A semiconductor switch is used.)
13	**OUT COM** COM for output pins; GOOD, NG, END, CAUTION and READY.
14	**EXT.COM** Connect Pin 14 to Pin 1 to use an NPN transistor. This pin is used as a COM pin when a PNP transistor is used (refer to **5. Connection**). When inputting the external voltage, use 24 V DC.
15	**NC** Reserve input pins. (Keep this pin open without connecting, otherwise the equipment may be damaged.)

Pin No.	Description
19	**PARITY** Functions when the external schedule select with parity is selected. (Refer to **6. (6)⑦SCHEDULE**.) This pin permits detection of nonconformance due to disconnection of the schedule-select signal conductor. Set so that the sum of the number of closed circuits for the schedule-select signal conductors and the PARITY signal conductor is always an odd number. EXAMPLE "When setting 2 for schedule No." Close SCH2 and open the PARITY pin. [The number of closed circuits is 1.] "When setting 6 for schedule No." Close SCH2 and 4, and close the PARITY pin. [The number of closed circuits is 3.]
20	**PO SEL** Input pin for output changeover selection. (This function is provided only for **MD-B5000A**.) The direction of the welding current flow when the circuit is open is opposite to that when the circuit is closed. (Refer to **5. (5)②MD-B series**.)
21	**ERR RESET** When a fault is displayed, remove the cause of the fault and close the circuit. This resets the fault display. CAUTION Be sure to reset with the Start input (2ND signal) opened.
23	**GOOD** Normal signal output pin. Closes the circuit for a certain duration when the measured value is judged to be within the range set on the COMPARATOR screen after the weld sequence is over. The circuit-closing time can be set within the range of 10–200 ms in 10 ms steps. The contact rating is 24 V DC, 20 mA. (A semiconductor switch is used.)
24	**END** End signal output pins. Close the circuit for a certain duration after sequence operation is over. The circuit-closing time can be set within the range of 10–200 ms in 10 ms steps. The signal is output during sequence operation in the WELD OFF state as well. The contact rating is 24 V DC, 20 mA. (A semiconductor switch is used.)
25	**READY** Ready signal output pins. Closed at the time when weld current is ready for being supplied. Open during welding, charging or in the occurrence of NG. The contact rating is 24 V DC, 20 mA. (A semiconductor switch is used.)

Table of schedule Nos. and corresponding schedule-select pins
(●: Closed circuit ○: Open circuit)

Schedule No.	SCH1	SCH2	SCH4	SCH8	SCH16	PARITY
1	●	○	○	○	○	○
2	○	●	○	○	○	○
3	●	●	○	○	○	●
4	○	○	●	○	○	○
5	●	○	●	○	○	●
6	○	●	●	○	○	●
7	●	●	●	○	○	○
8	○	○	○	●	○	○
9	●	○	○	●	○	●
10	○	●	○	●	○	●
11	●	●	○	●	○	○
12	○	○	●	●	○	●
13	●	○	●	●	○	○
14	○	●	●	●	○	○
15	●	●	●	●	○	●
16	○	○	○	○	●	○
17	●	○	○	○	●	●
18	○	●	○	○	●	●
19	●	●	○	○	●	○
20	○	○	●	○	●	●
21	●	○	●	○	●	○
22	○	●	●	○	●	○
23	●	●	●	○	●	●
24	○	○	○	●	●	●
25	●	○	○	●	●	○
26	○	●	○	●	●	○
27	●	●	○	●	●	●
28	○	○	●	●	●	○
29	●	○	●	●	●	●
30	○	●	●	●	●	●
31	●	●	●	●	●	○

Note) Schedule 1 is selected when all schedule-select signals are open.

⑱ V SENS connector

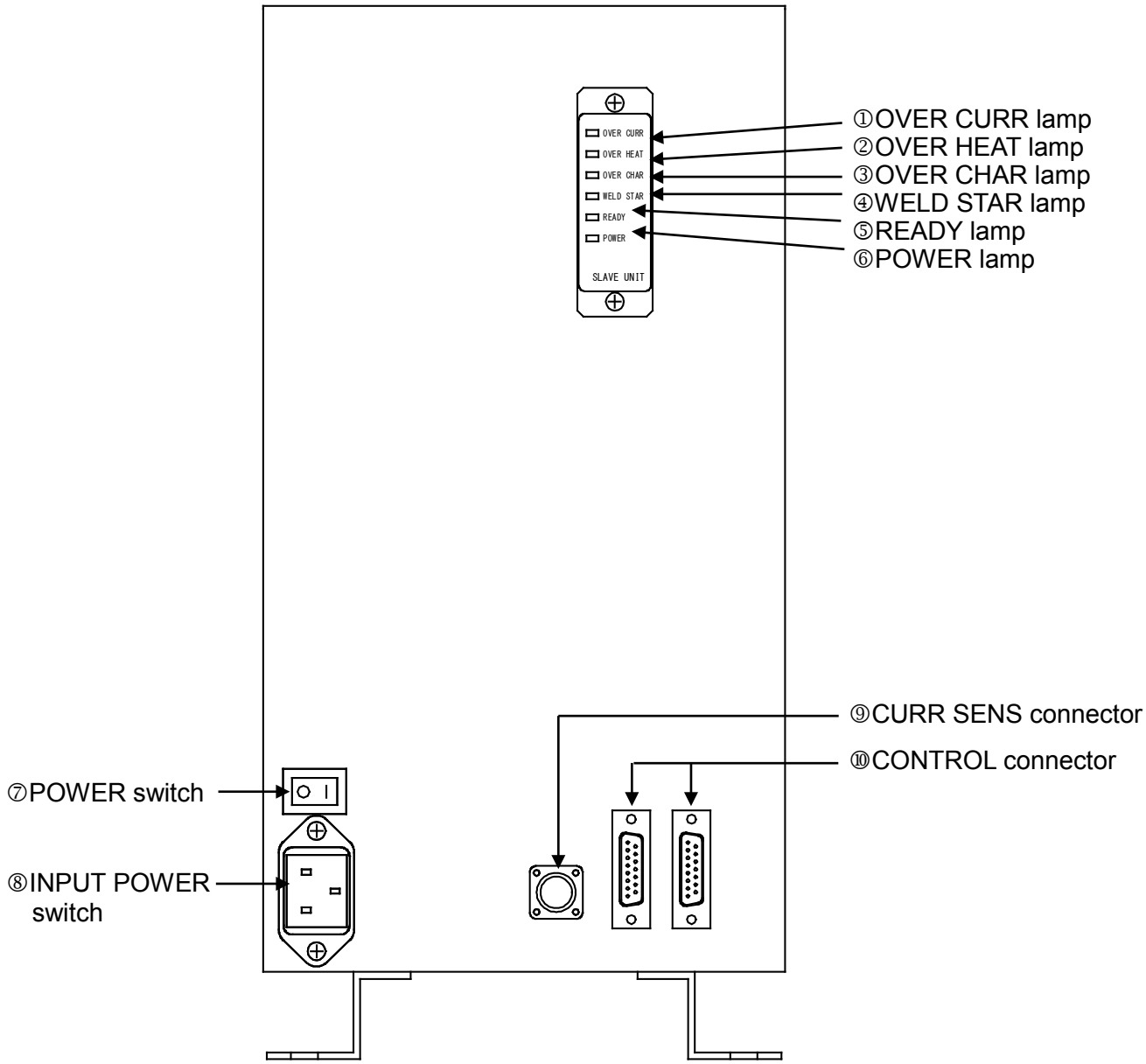
Connecting terminal for the V SENS cable.
Connect to it near the welding head. There is no polarity.
When the V SENS cable is not connected, the “E19:VOLT SENS ERROR” occurs.
The V SENS connector changes depending on the model.
Current products: MD-A10000A-00-00~23/MD-B5000A-00-00~01 are 3-pin, but will be replaced by alternative products due to discontinuation of connector production.
Replacement products: MD-A10000A-00-50~75/MD-B5000A-00-50~51 will be 4 pins.

⑲ **CURR SIG2–12 connectors**

Used to connect to the slave. For connection, refer to **5. (2) Connection between Master and Slave**.

(**MD-A10000A-00-75**)

(2) Front (Slave)



① OVER CURR lamp
Comes on when the over current is detected.
For details, refer to “E03:TRIP OF THERMO” in **8. Fault Code**.

② OVER HEAT lamp
Comes on when the equipment is overheated.
For details, refer to “E03:TRIP OF THERMO” in **8. Fault Code**.

③ OVER CHAR lamp
Comes on when the charge voltage is too high.
For details, refer to “E13:CHARGE TROUBLE(OVER)” in **8. Fault Code**.

④ **WELD STAR lamp**
Comes on when welding.
The START lamp on the master comes on during the weld sequence operation, but the WELD STAR lamp on the slave comes on only during welding.
Notes)
- In a short welding, it may be hard to see the illumination of the WELD STAR lamp.
- Check the welding operation by the START lamp on the master, not the WELD STAR lamp on the slave.

⑤ **READY lamp**
Comes on when the welding current is ready to be supplied to the equipment.
The following conditions must be met for this lamp to come on:
・No fault is occurring.
・Not in the middle of charging
Note) The READY lamp on the master indicates the state of all connected devices, but that on the slave indicates the state of each device only.

⑥ **POWER lamp**
Comes on when the power is supplied after the POWER switch is turned on.
Note) This lamp indicate the power state of each device. For the power state of each device, check the POWER lamp on each device.

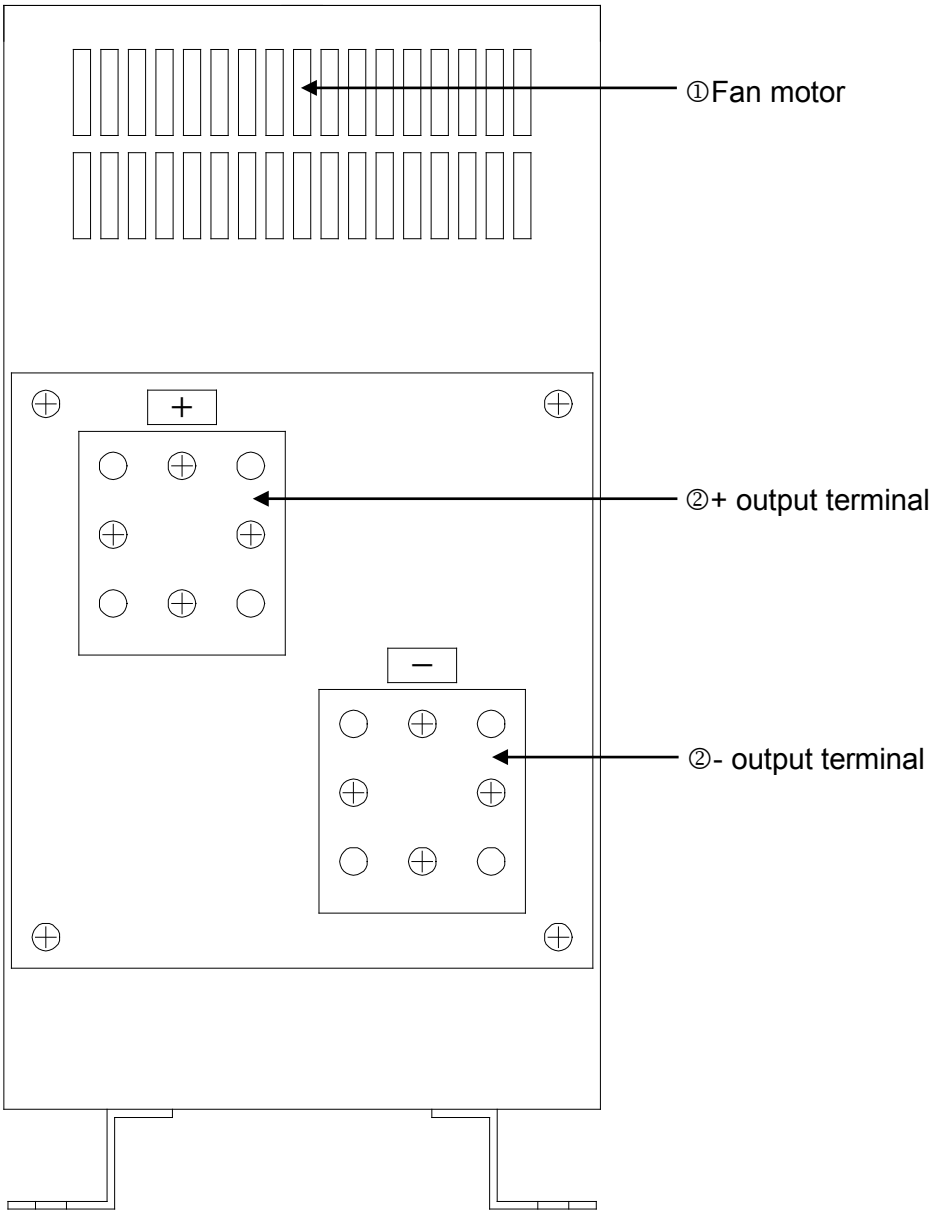
⑦ **POWER switch**
Turn this switch on to switch the power on.

⑧ **INPUT POWER connector**
Connects the power cable (optional).

⑨ **CURR SENS connector (CURR SIG)**
Used to connect to the slave. For connection, refer to **5. (2) Connection between Master and Slave**.

⑩ **CONTROL connector**
Used to connect to the slave. For connection, refer to **5. (2) Connection between Master and Slave**.

(3) Rear



① **Fan motor**
Cools the inside of the equipment.

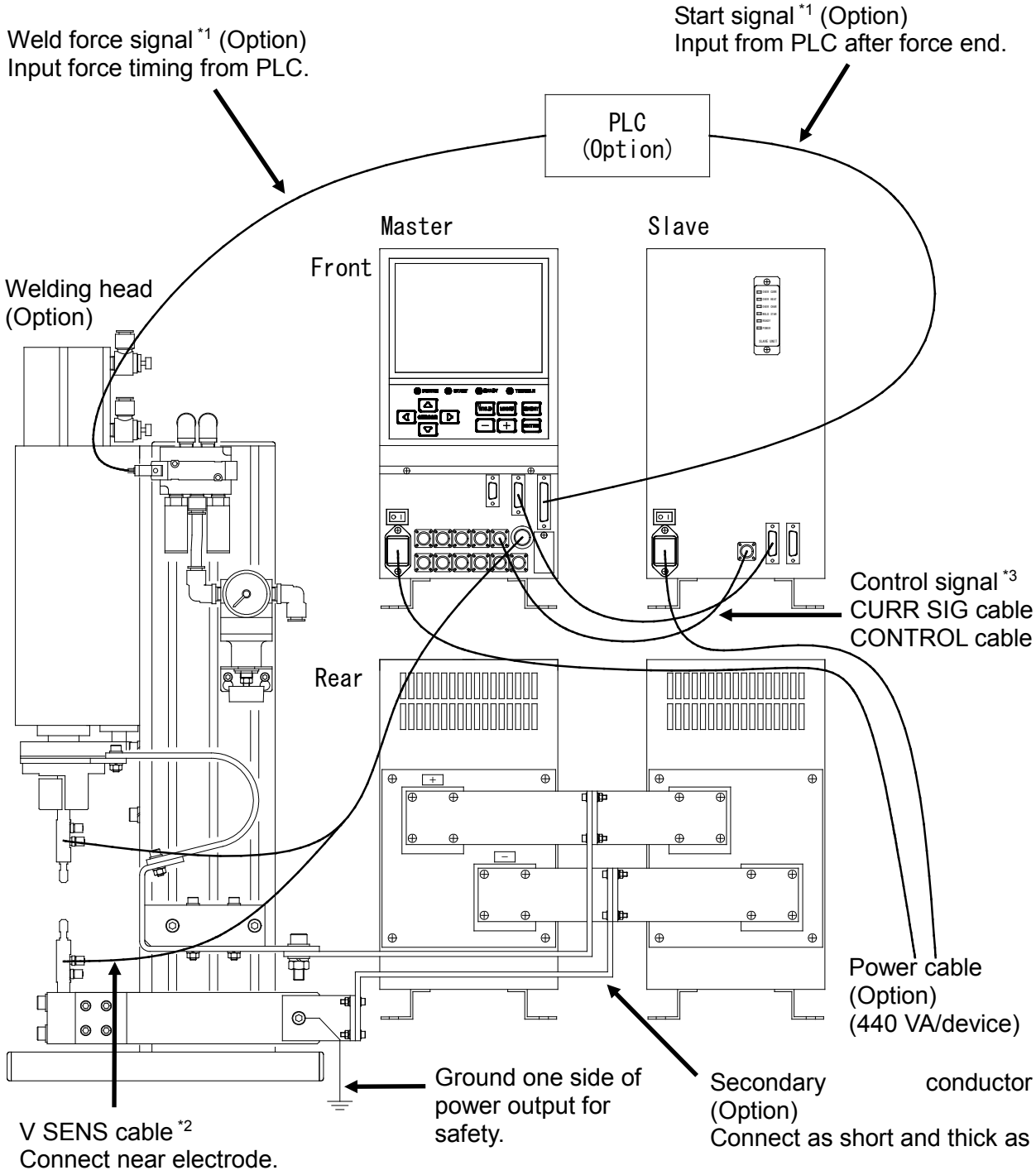
② **+/- output terminals**
Output terminals for the welding current.
Note) Since these output terminals are for the welding current, do not input the external voltage.

CAUTION

Avoid contact of any metal object such as tool with the output terminals. The contact situation can cause the shorted state and the contact portion may be overheated and scattered. Accordingly, prepare the fire-retarding protective cover.

5. Connection

(1) Basic Connection

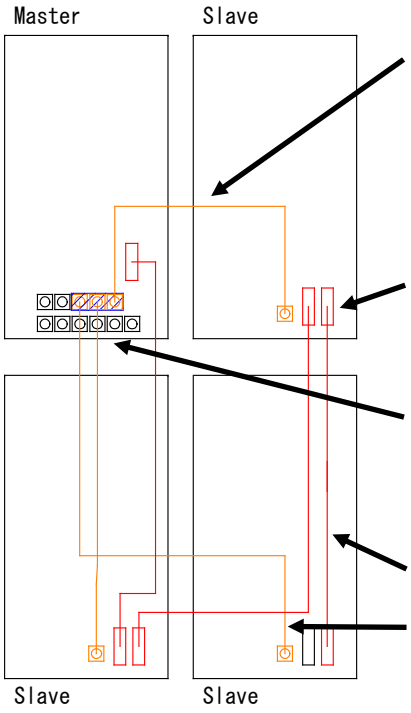


*1: For the timing of weld force and start, see **(5) Timing Chart**.
*2: Be sure to connect the V SENS cable. When the V SENS cable is connected to somewhere away from electrode (secondary conductor, etc.), the response speed of voltage detection becomes slow even under the constant-current control.
*3: For connecting the control signal, see **(2) Connection between Master and Slave**.
*4: Install this device with a clearance of at least 20 cm between the wall and the rear.

(2) Connection between Master and Slave

Connect each device with the CONTROL connector and the CURR SIG connector.

- Connect each device with the CONTROL connector. There is no rule about the order of connection and you can connect to either connector. Connect them depending on arrangement of devices.
- The position to connect the CURR SIG connector to the master is specified, so be sure to connect to the specified connector. When it is connected to the connector other than the specified, the welding is not performed correctly.
  There is no rule about the order of connection in the specified connectors, so connect them depending on arrangement of devices.



The position to connect the CURR SIG connector to the master is specified (the connectors shown with diagonal line).
There is no rule about the order of connection in the specified connectors, so connect them depending on arrangement of devices.

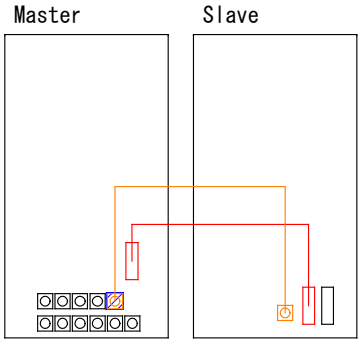
CONTROL connector

CURR SIG connector

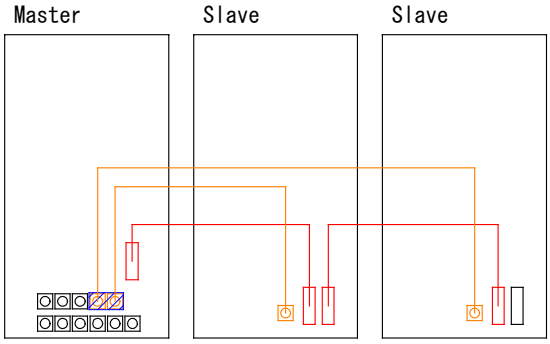
There is no rule about the order of connecting the CONTROL connectors, so connect them depending on arrangement of devices.

CURR SENS connector (CURR SIG)

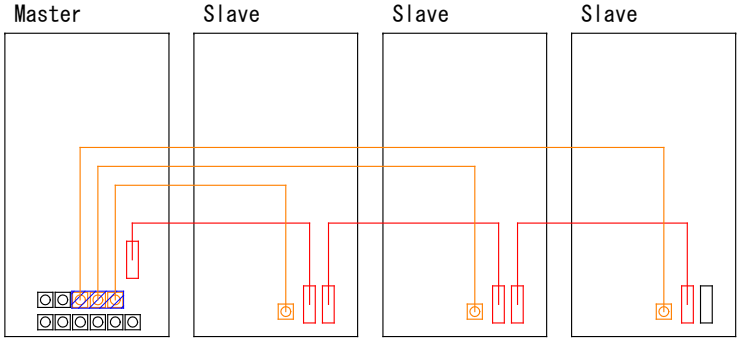
When connecting 1 master and 1 slave



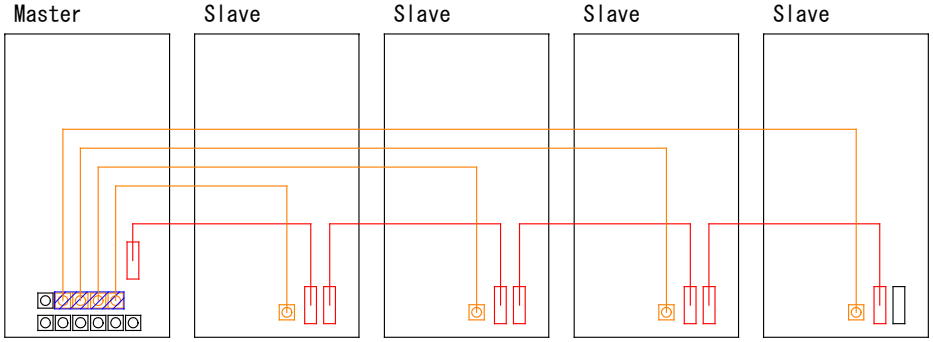
When connecting 1 master and 2 slaves



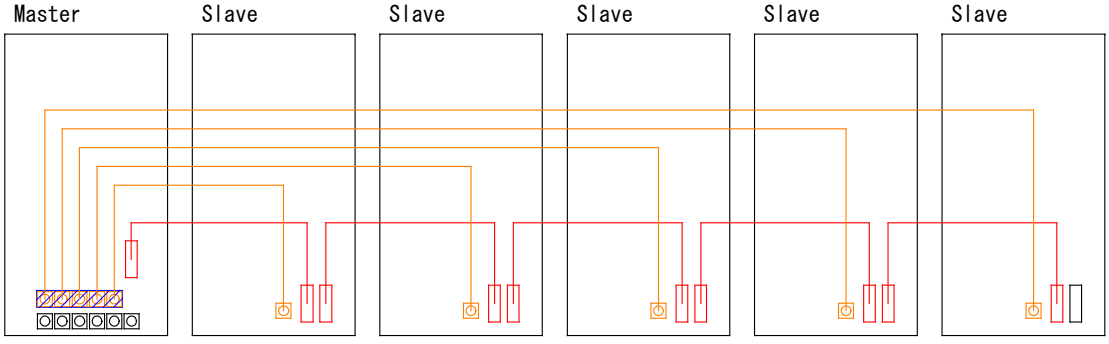
When connecting 1 master and 3 slaves



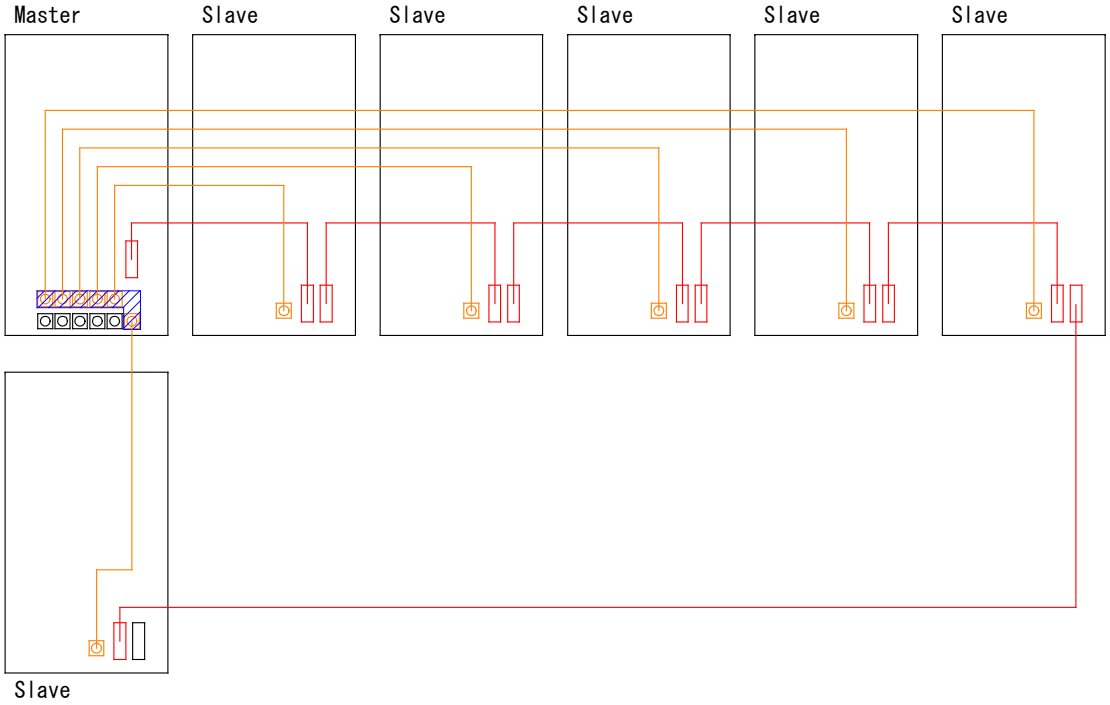
When connecting 1 master and 4 slaves



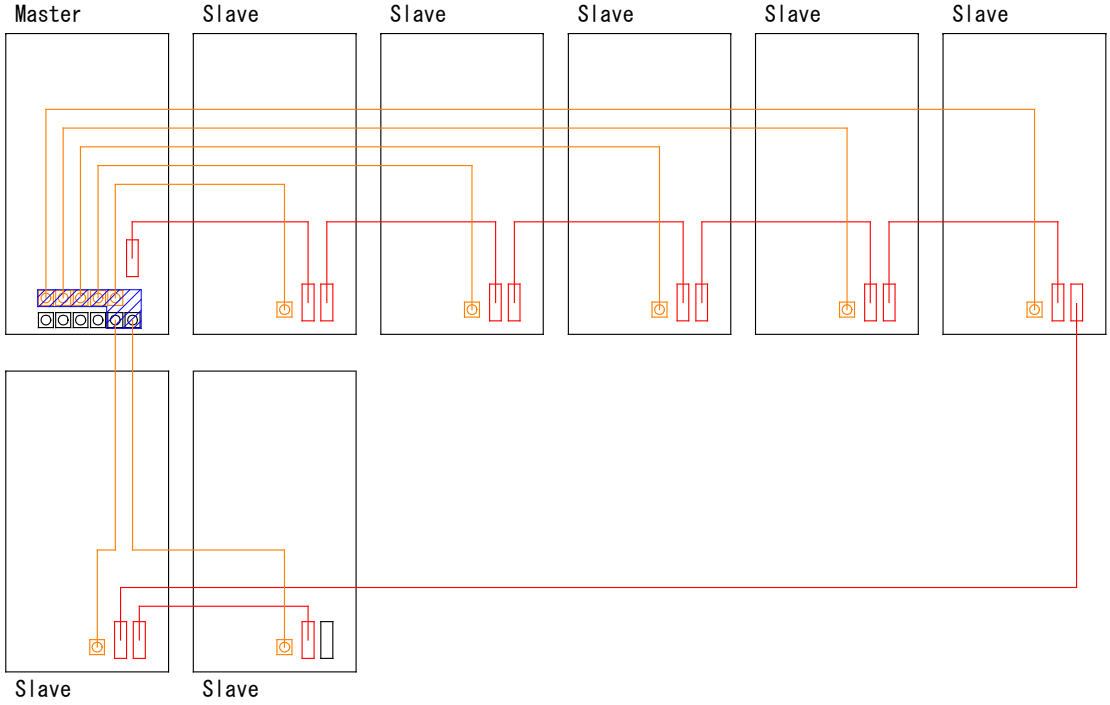
When connecting 1 master and 5 slaves



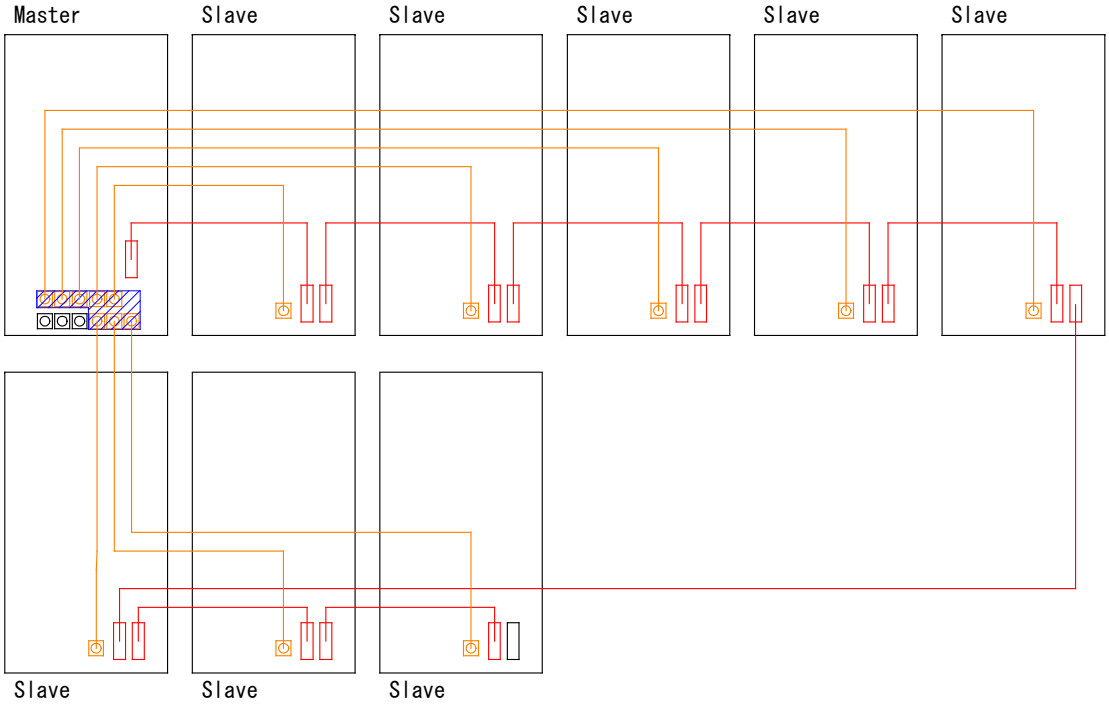
When connecting 1 master and 6 slaves



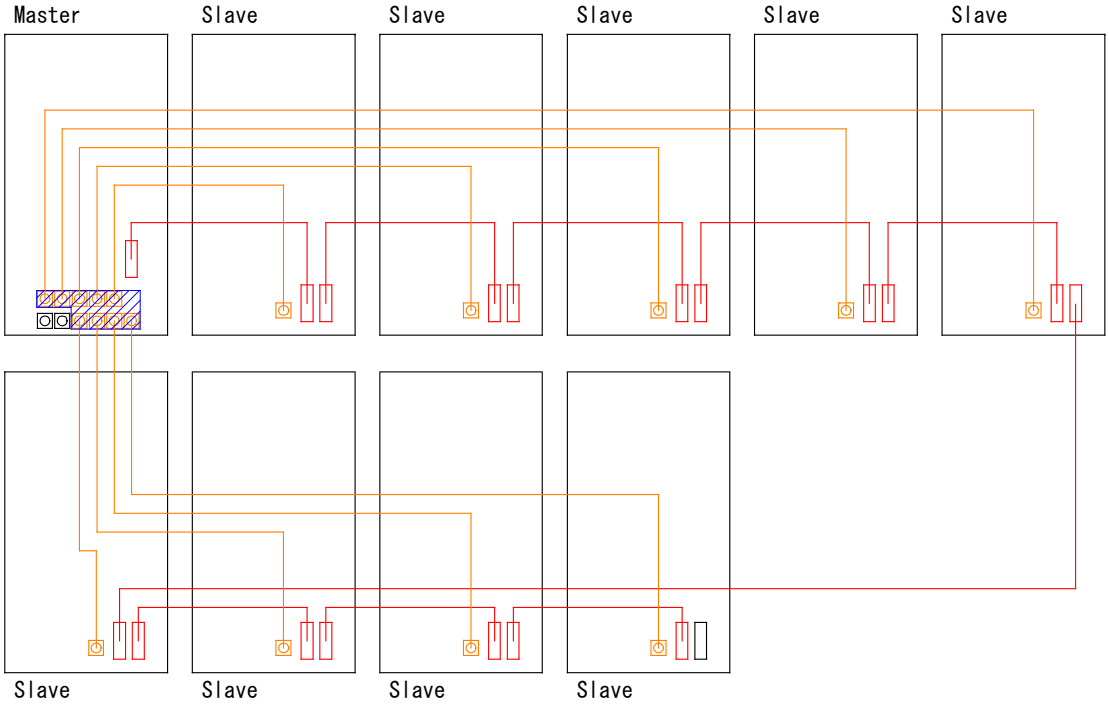
When connecting 1 master and 7 slaves



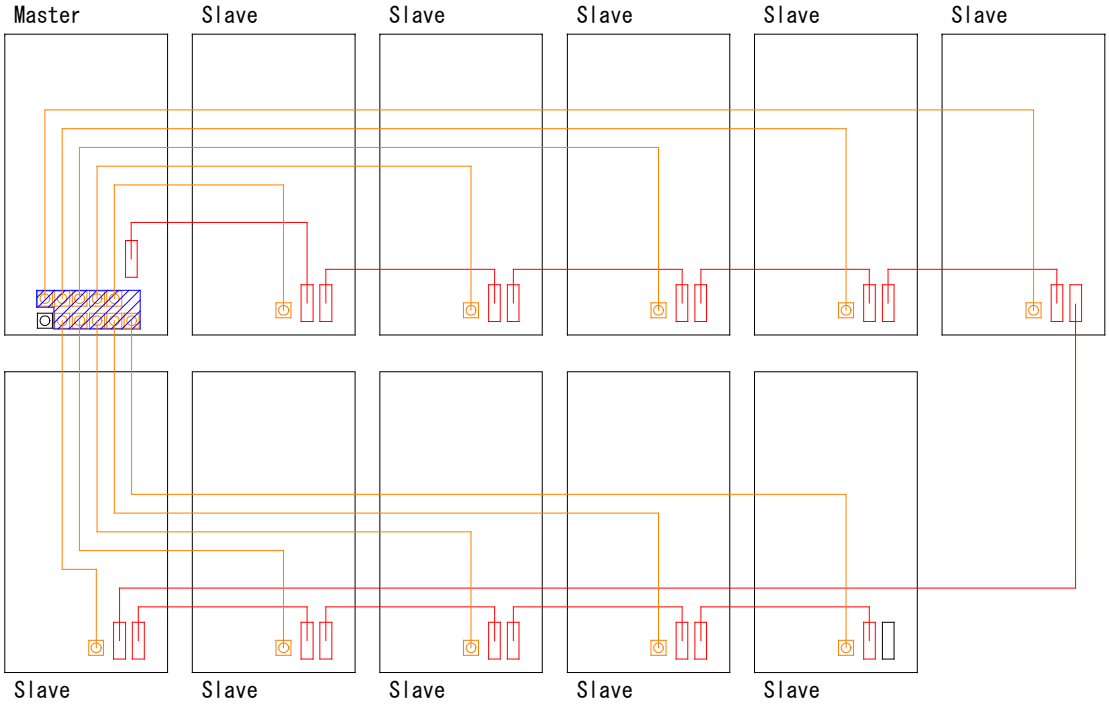
When connecting 1 master and 8 slaves



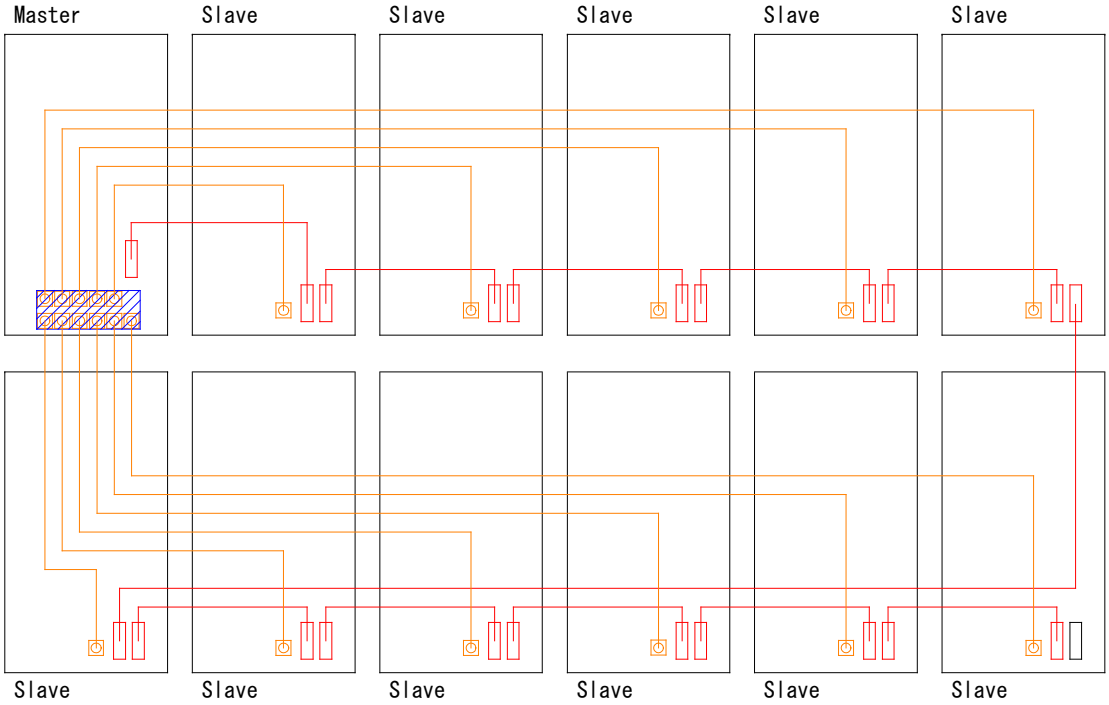
When connecting 1 master and 9 slaves



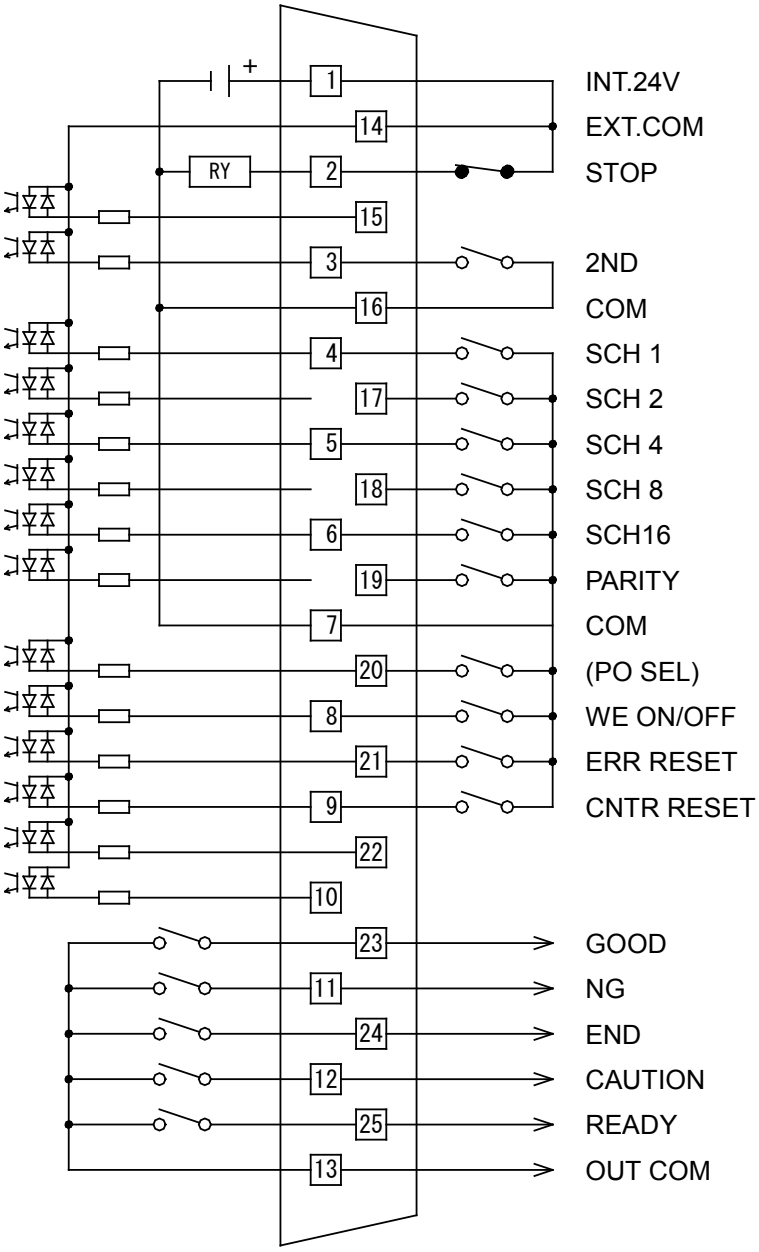
When connecting 1 master and 10 slaves



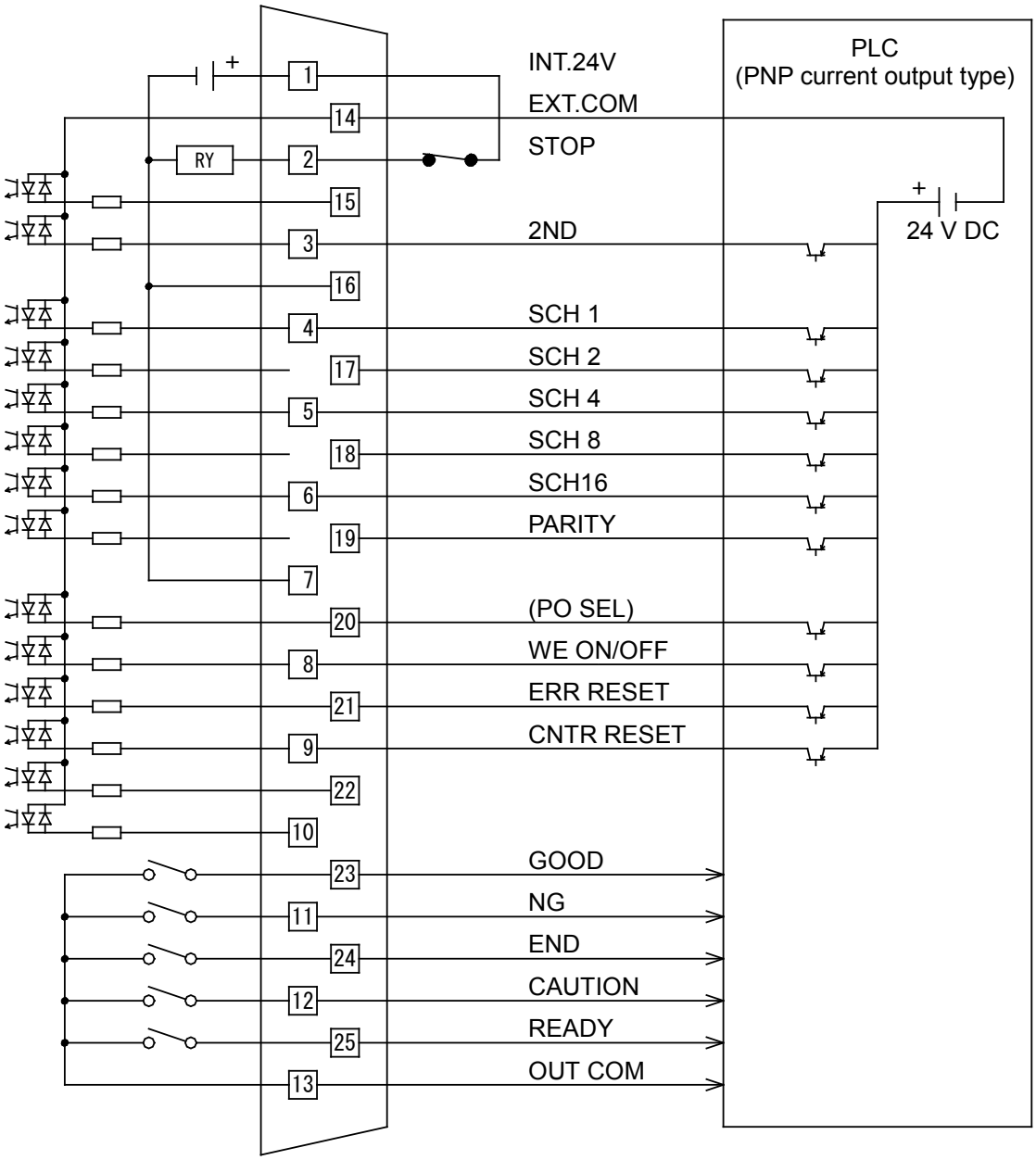
When connecting 1 master and 11 slaves



(3) Connecting Contacts or NPN (Open Collector) Transistors



(4) Connecting PNP (Source) Transistors

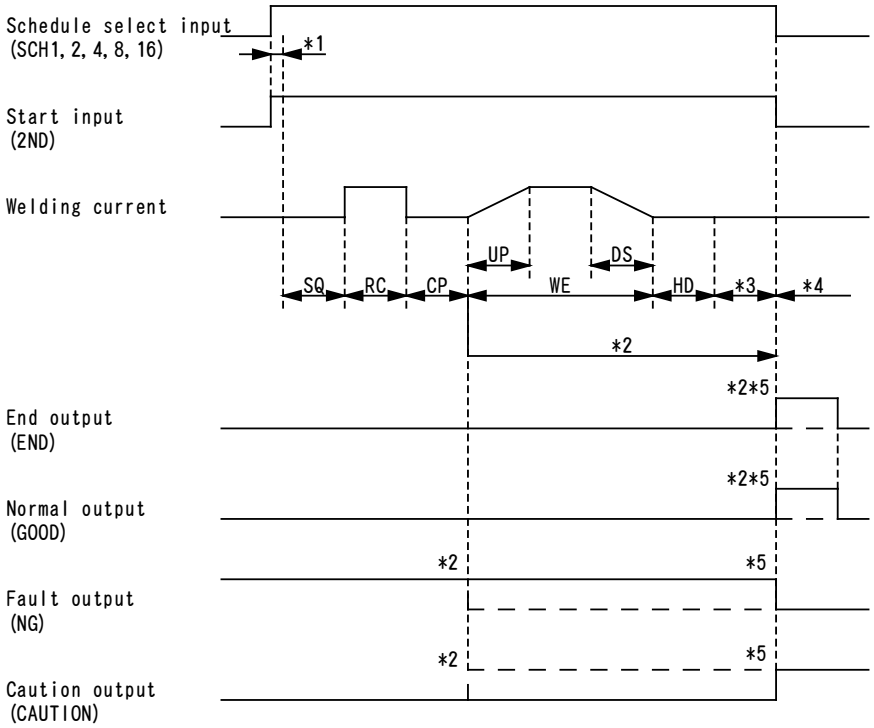


(5) Timing Chart

① MD-A series

▪ 1-step welding

(When SCHEDULE MODE on the STATUS screen is set to SINGLE)



Remarks

SQ: Squeeze time	RC: Precheck weld time
CP: Precheck judgment time (2 ms)	UP: Upslope time
WE: Weld time	DS: Downslope time
HD: Hold time	

*1: For the timing of schedule select signal and start signal, refer to ③ **External input signal**.

*2: When a fault or caution occurs in precheck welding, welding is not performed in WE and the fault signal or the caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen. At this time, the end signal and the normal signal are not output.

*3: Monitor calculation time (10 ms)

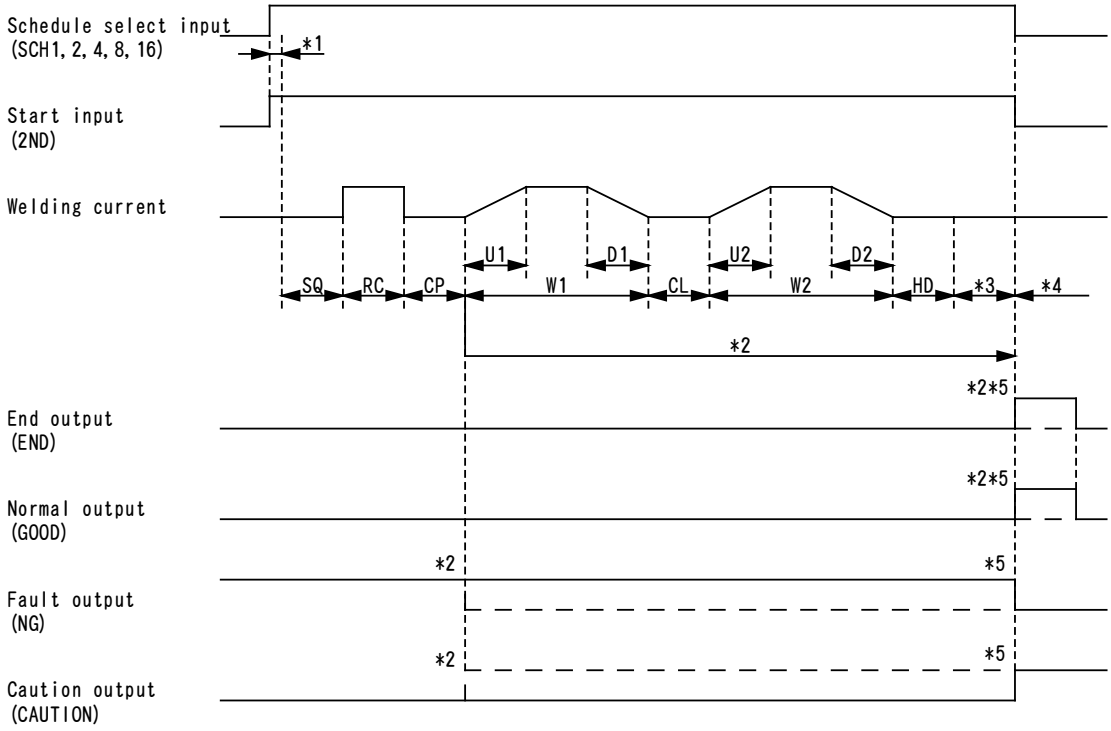
*4: For the output time of end signal and normal signal, refer to ④ **External output signal**. For the processing time of screen display time, communication output time, etc., refer to ⑤ **Screen display and communication time**.

*5: When the monitor value is within the setting range, the normal signal is output. When the monitor value is outside the range or a fault occurs, a fault signal or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

*6: The weld force signal cannot be controlled with this device. Control it by PLC or the like. For the timing of weld force, refer to ⑥ **Weld force signal**.

・2-step welding

(When SCHEDULE MODE on the STATUS screen is set to DOUBLE)



Remarks

SQ: Squeeze time	RC: Precheck weld time
CP: Precheck judgment time (2 ms)	U1: Upslope 1 time
W1: Weld 1 time	D1: Downslope 1 time
CL: Cool time	U2: Upslope 2 time
W2: Weld 2 time	D2: Downslope 2 time
HD: Hold time	

*1: For the timing of schedule select signal and start signal, refer to ③ **External input signal**.

*2: When a fault or caution occurs in precheck welding, welding is not performed in W1 and W2 and the fault signal or the caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen. At this time, the end signal and the normal signal are not output.

*3: Monitor calculation time (10 ms)

*4: For the output time of end signal and normal signal, refer to ④ **External output signal**. For the processing time of screen display time, communication output time, etc., refer to ⑤ **Screen display and communication time**.

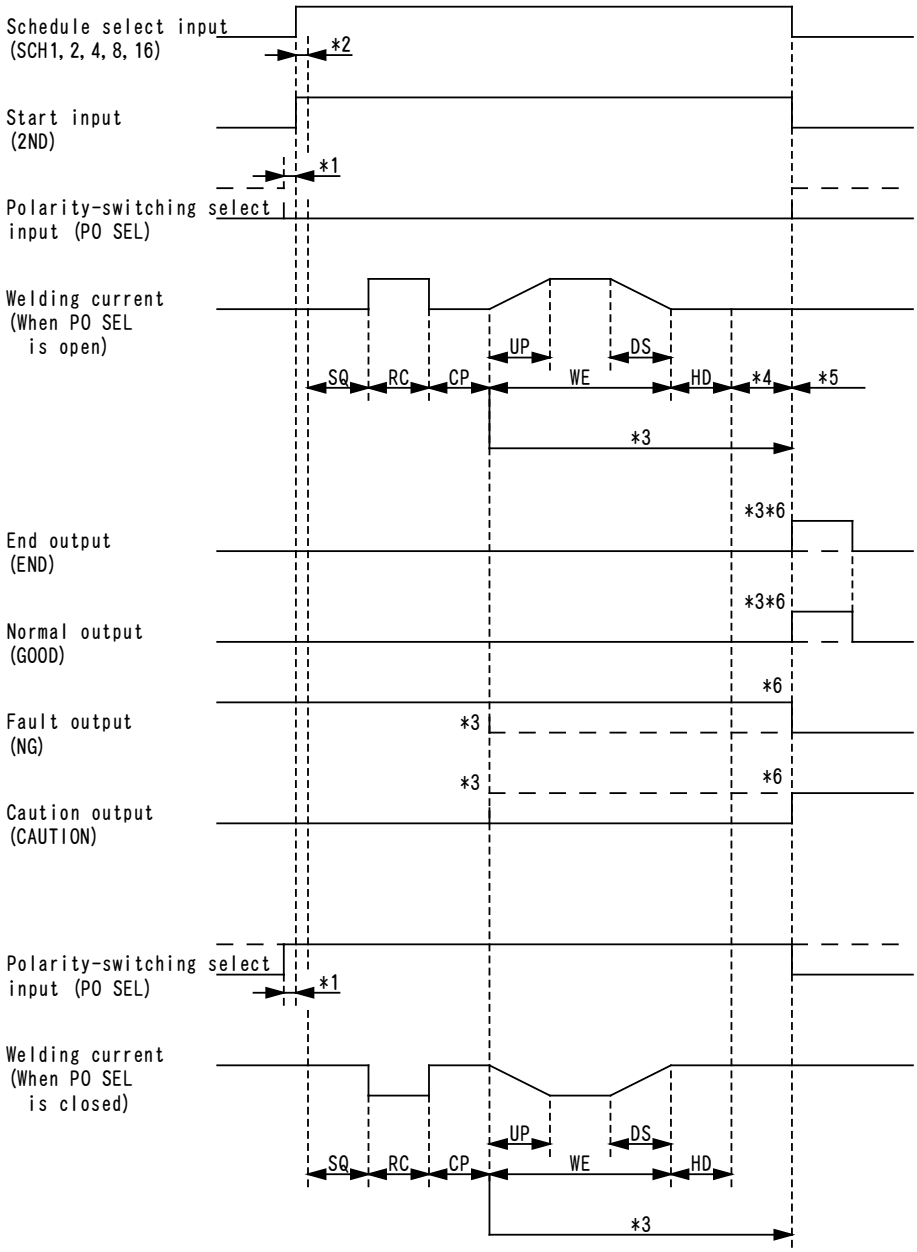
*5: When the monitor value is within the setting range, the normal signal is output. When the monitor value is outside the range or a fault occurs, a fault signal or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

*6: The weld force signal cannot be controlled with this device. Control it by PLC or the like. For the timing of weld force, refer to ⑥ **Weld force signal**.

② MD-B series

・1-step welding

(When SCHEDULE MODE on the STATUS screen is set to SINGLE)



Remarks

SQ: Squeeze time
RC: Precheck weld time
CP: Precheck judgment time (2 ms)
UP: Upslope time
WE: Weld time
DS: Downslope time
HD: Hold time

*1: For the timing of polarity-switching select signal, refer to ③ **External input signal**.

*2: For the timing of schedule select signal and start signal, refer to ③ **External input signal**.

*3: When a fault or caution occurs in precheck welding, welding is not performed in WE and the fault signal or the caution signal is output.

The selection of fault signal or caution signal can be changed on the ERROR SETTING screen. At this time, the end signal and the normal signal are not output.

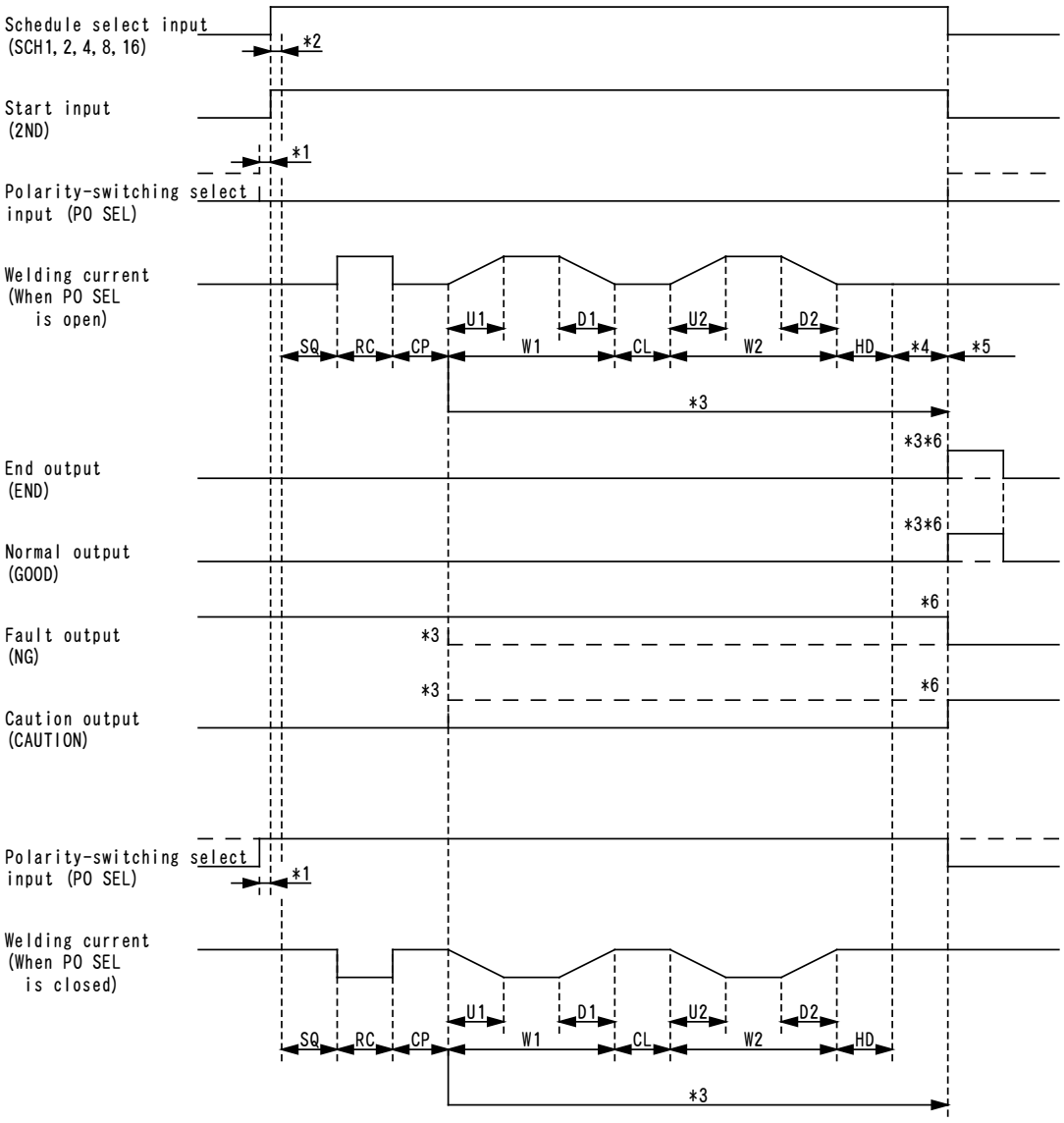
*4: Monitor calculation time (10 ms)

*5: For the output time of end signal and normal signal, refer to ④ **External output signal**. For the processing time of screen display time, communication output time, etc., refer to ⑤ **Screen display and communication time**.

*6: When the monitor value is within the setting range, the normal signal is output. When the monitor value is outside the range or a fault occurs, a fault signal or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

*7: The weld force signal cannot be controlled with this device. Control it by PLC or the like. For the timing of weld force, refer to ⑥ **Weld force signal**.

- **2-step welding without polarity switching**
  (When SCHEDULE MODE is set to DOUBLE; POLARITY CHANGE to OFF on the STATUS screen)



Remarks

SQ: Squeeze time	RC: Precheck weld time
CP: Precheck judgment time (2 ms)	U1: Upslope 1 time
W1: Weld 1 time	D1: Downslope 1 time
CL: Cool time	U2: Upslope 2 time
W2: Weld 2 time	D2: Downslope 2 time
HD: Hold time	

*1: For the timing of polarity-switching select signal, refer to ③ **External input signal**.

*2: For the timing of schedule select signal and start signal, refer to ③ **External input signal**.

*3: When a fault or caution occurs in precheck welding, welding is not performed in W1 and W2 and the fault signal or the caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen. At this time, the end signal and the normal signal are not output.

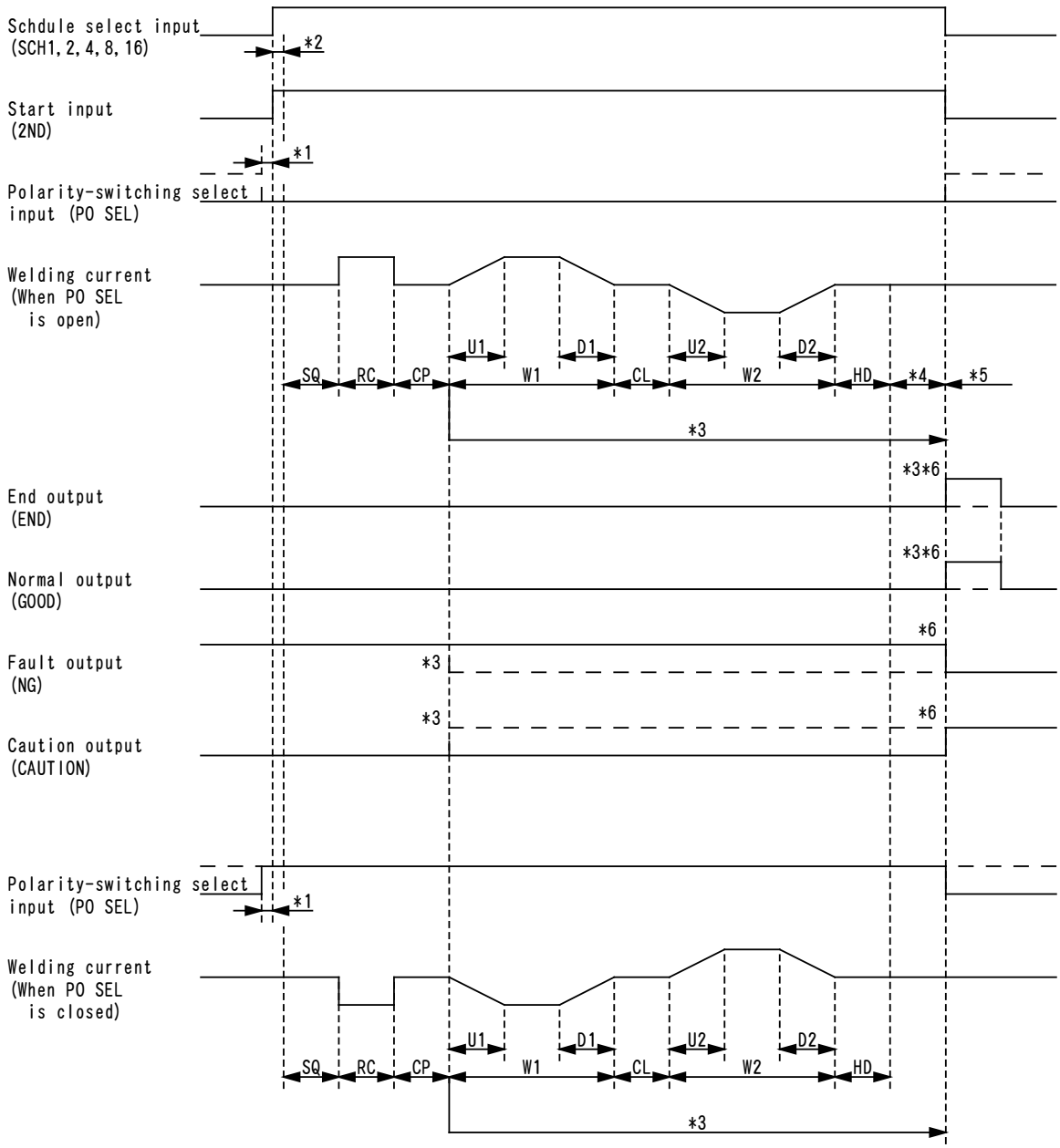
*4: Monitor calculation time (10 ms)

*5: For the output time of end signal and normal signal, refer to ④ **External output signal**. For the processing time of screen display time, communication output time, etc., refer to ⑤ **Screen display and communication time**.

*6: When the monitor value is within the setting range, the normal signal is output. When the monitor value is outside the range or a fault occurs, a fault signal or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

*7: The weld force signal cannot be controlled with this device. Control it by PLC or the like. For the timing of weld force, refer to ⑥ **Weld force signal**.

- **2-step welding with polarity switching**
  (When SCHEDULE MODE is set to DOUBLE; POLARITY CHANGE to ON on the STATUS screen)



Remarks

SQ: Squeeze time	RC: Precheck weld time
CP: Precheck judgment time (2 ms)	U1: Upslope 1 time
W1: Weld 1 time	D1: Downslope 1 time
CL: Cool time	U2: Upslope 2 time
W2: Weld 2 time	D2: Downslope 2 time
HD: Hold time	

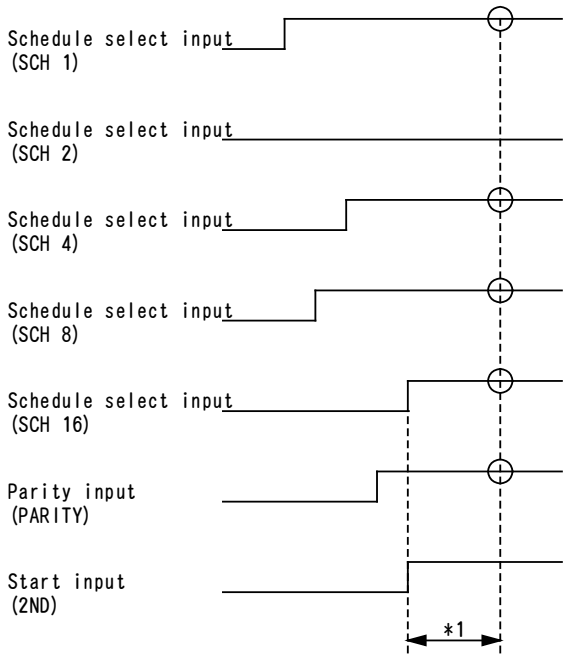
*1: For the timing of polarity-switching select signal, refer to ③ **External input signal**.

*2: For the timing of schedule select signal and start signal, refer to ③ **External input signal**.

*3: When a fault or caution occurs in precheck welding, welding is not performed in W1 and W2 and the fault signal or the caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen. At this time, the end signal and the normal signal are not output.
*4: Monitor calculation time (10 ms)
*5: For the output time of end signal and normal signal, refer to ④ **External output signal**. For the processing time of screen display time, communication output time, etc., refer to ⑤ **Screen display and communication time**.
*6: When the monitor value is within the setting range, the normal signal is output. When the monitor value is outside the range or a fault occurs, a fault signal or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.
*7: The weld force signal cannot be controlled with this device. Control it by PLC or the like. For the timing of weld force, refer to ⑥ **Weld force signal**.

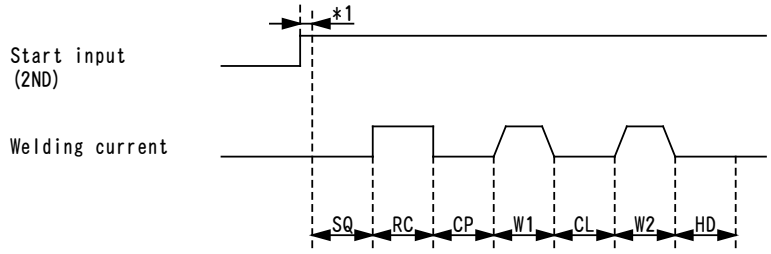
③ External input signal

・Selection of schedule number (Common to MD series)



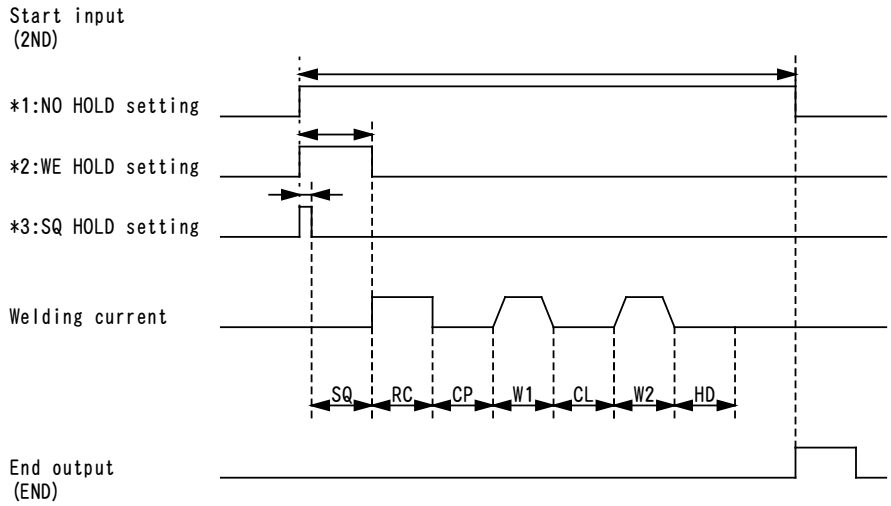
*1: The welding schedule is decided when the time set for START SIG. TIME on the STATUS screen goes by after the start input.
In the example above, schedule select 1, 4, 8 and 16, and parity are turned ON, and welding is performed with the schedule No. 29.

・Time duration from start input to weld sequence start (Common to MD series)



*1: Time duration from start input to weld sequence start changes depending on the setting of START SIG. TIME on the STATUS screen. The following time is required; 1 ms for 1-ms setting, 5 ms for 5-ms setting, 10 ms for 10-ms setting, and 20 ms for 20-ms setting.

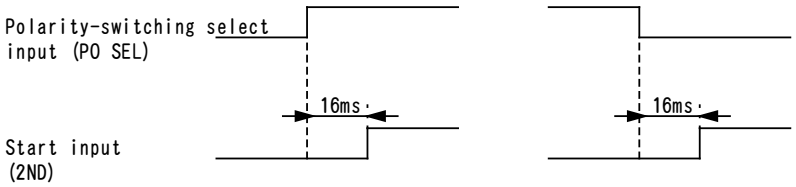
・Hold time of start signal (Common to MD series)



*1: When START SIG. HOLD on the STATUS screen is set to NO HOLD, turn on the start signal until the end output.
*2: When START SIG. HOLD on the STATUS screen is set to WE HOLD, turn on the start signal until the squeeze end.
*3: When START SIG. HOLD on the STATUS screen is set to SQ HOLD, turn on the start signal until the squeeze start.

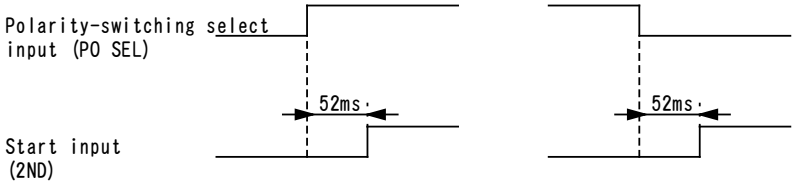
・Polarity-switching select signal (MD-B series only)

Screen other than SCHEDULE screen



Input the polarity-switching select signal 16 ms or more before the start signal.

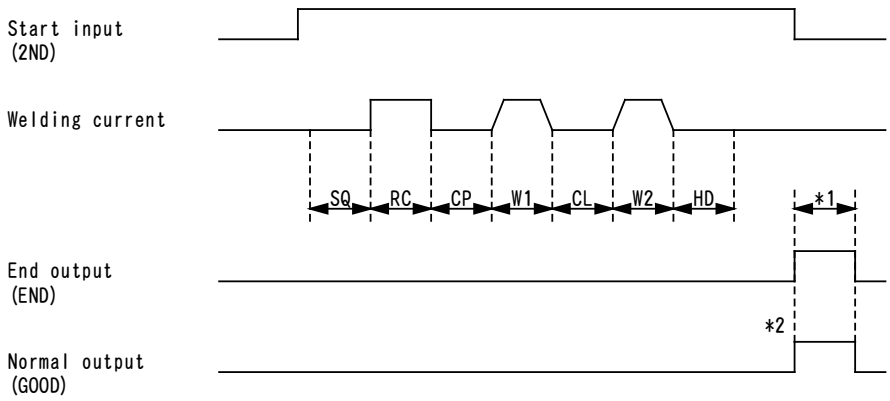
SCHEDULE screen



Input the polarity-switching select signal 52 ms or more before the start signal.
The waveform display on the SCHEDULE screen is changed.

④ External output signal (Common to MD series)

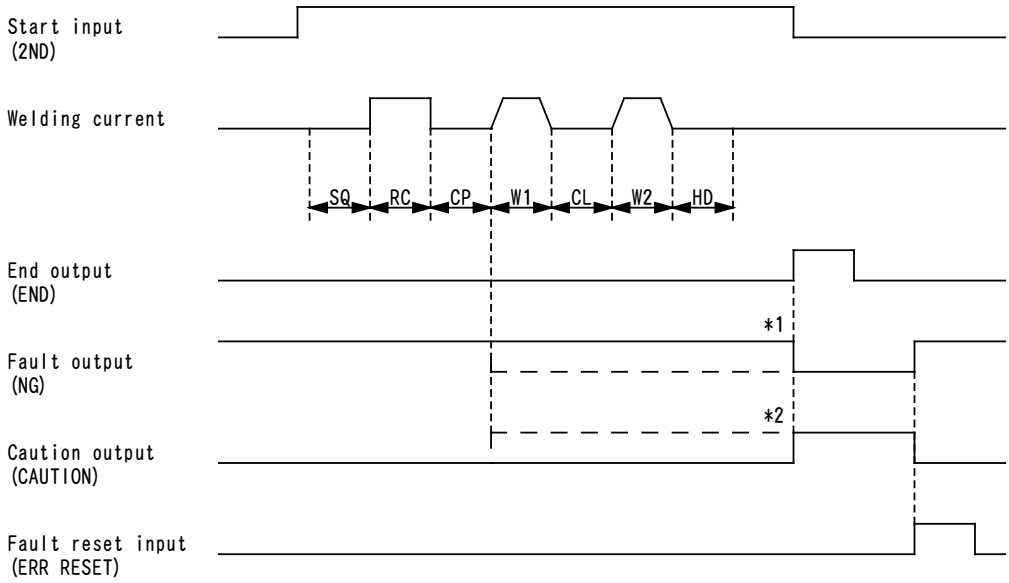
・Output time of end signal and normal signal



*1: Changes depending on the setting of END SIG. TIME on the STATUS screen. When the setting is 10 ms to 200 ms, the end signal is output for the set time. When the setting is 10 ms + ST, in addition to at least 10 ms, the end signal is output while the start input is ON.

*2: When no fault or caution occurs, the normal signal is output for the same time as that of the end signal. For the timing of output, refer to ① **MD-A series** and ② **MD-B series**.

・Output time of fault signal and caution signal

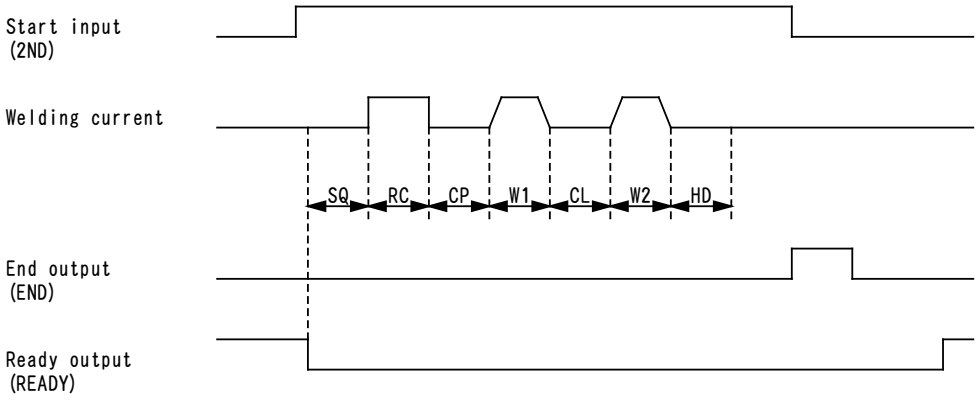


*1: The fault signal is output when a fault occurs. Outputs until the fault reset is input.

*2: The caution signal is output when a caution occurs. Outputs until the fault reset is input and the next start is input.

The output timing of fault signal and caution signal is as follows.
When the monitor value of the precheck welding is outside the setting range, the signal is output after precheck judgment.
When the monitor value is outside the setting range, the signal is output with the same timing as that of the end signal.
Other fault signals or caution signals are output when a fault or caution occurs.

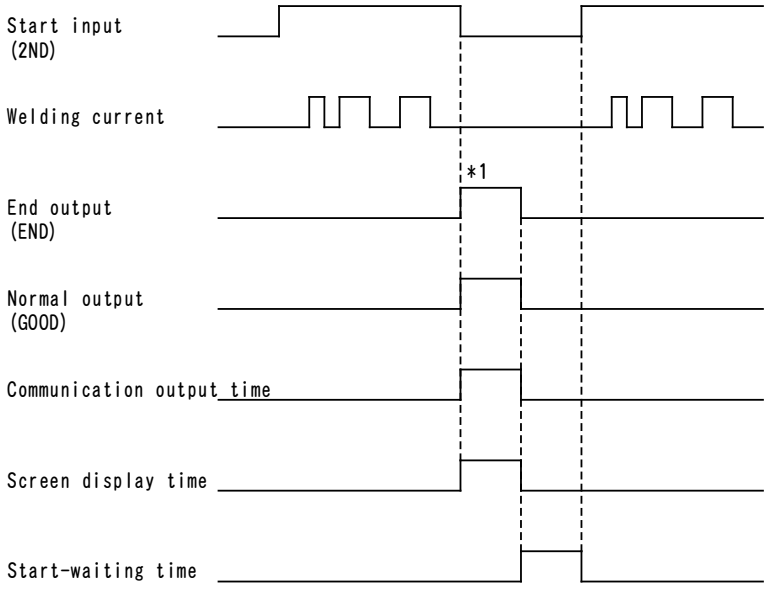
· Ready signal



The ready signal is turned off when weld sequence is operated, fault occurs, or welding is turned off.
The signal is turned off when the weld sequence starts and turned on when the welding is being processed and the charging is complete. When a fault occurs during welding operation, it is turned off until a fault reset is input.
Welding processing is complete after end output, screen display, and communication output are all complete.

⑤ Screen display and communication time (Common to MD series)

・When a fault and caution do not occur during welding



*1: For the timing of the end signal, refer to ① **MD-A series** and ② **MD-B series**.

Communication output time
Communication output of monitor value. Outputs after the start of end output.

When COMMUNICATION MODE on the STATUS screen is B MODE
- 9600 bps of communication speed: 86 ms max.
- 19200 bps of communication speed: 47 ms max.
- 38400 bps of communication speed: 26 ms max.

When COMMUNICATION MODE on the STATUS screen is C MODE
- 9600 bps of communication speed: 136 ms max.
- 19200 bps of communication speed: 72 ms max.
- 38400 bps of communication speed: 39 ms max.

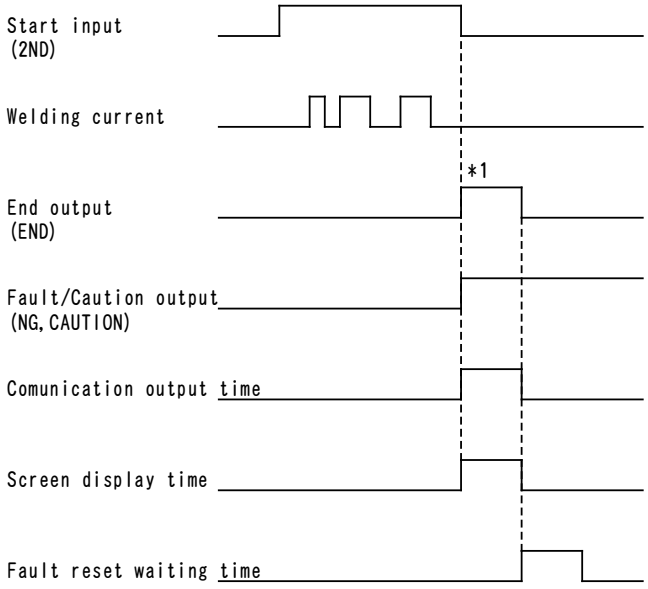
Screen display time
The display time varies by screen. Displays the screen after the start of end output.

- Menu screen: 14 ms max.
- SCHEDULE screen: 80 ms max.
- MONITOR screen: 145 ms max.
- COMPARATOR screen: 66 ms max.
- PRECHECK screen: 37 ms max.
- STATUS screen: 14 ms max.

When the start signal is input while the MONITOR screen is displayed, the screen display is canceled to accept the next start. The next start is accepted 5 ms after end output and communication output are complete. When the screen display is canceled to accept the start, the start stability time is [START SIG. TIME setting + 5 ms maximum].

Start-waiting time
Time duration required to turn off the start input after end output, communication output, and screen display are all complete.
Start-waiting time: 5 ms
Also, the status does not change until the start-waiting time goes by even if the input signal such as schedule select, polarity-switching select, etc. is changed.

・When a fault and caution occur during welding



*1: For the timing of the end signal, refer to ① **MD-A series** and ② **MD-B series**.

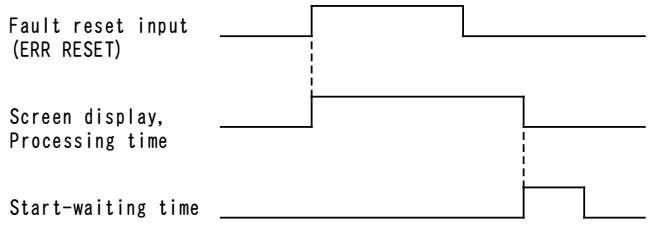
Communication output time
Communication output of monitor value. Outputs after the start of end output.
When COMMUNICATION MODE on the STATUS screen is B MODE
9600 bps of communication speed: 110 ms max.
19200 bps of communication speed: 59 ms max.
38400 bps of communication speed: 32 ms max.
When COMMUNICATION MODE on the STATUS screen is C MODE
9600 bps of communication speed: 161 ms max.
19200 bps of communication speed: 85 ms max.
38400 bps of communication speed: 45 ms max.

Screen display time
The display time varies by screen. Displays the screen after the start of end output.

Menu screen:	46 ms max.
SCHEDULE screen:	112 ms max.
MONITOR screen:	178 ms max.
COMPARATOR screen:	98 ms max.
PRECHECK screen:	69 ms max.
STATUS screen:	46 ms max.

Fault reset waiting time
Time duration until the acceptance of the fault reset after end output, communication output, and screen display are all complete.
Fault reset waiting time: 5 ms
For the processing time at fault reset, refer to **Screen display at fault reset**.

▪ Screen display at fault reset

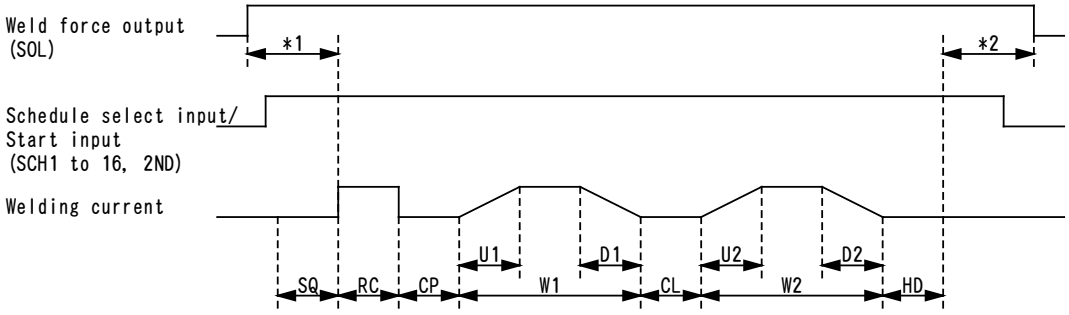


Fault reset input time
Input at least 30 ms.
For the timing of the acceptance of the fault reset, refer to ⑤ **Screen display and communication time**.

Screen display time
Fault reset processing and screen display time.
Screen display: 212 ms max.

Start-waiting time
Time duration required to turn off the start input after screen display is complete.
Start-waiting time: 5 ms

⑥ Weld force signal (Common to MD series)



The function to control the weld force signal is not provided. Control the weld force by PLC or the like.

*1: Keep the weld force stable before the squeeze time is over. When not setting SQ, keep it stable before the squeeze time starts.
*2: Turn off the weld force after the hold time is over.

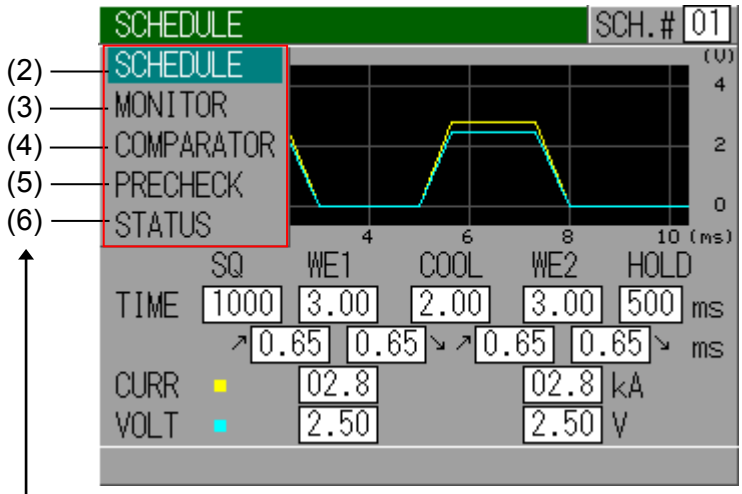
6. Explanation of the Screen

(1) Menu Screen

Setting of Values

Move the cursor ( ) to the number or ON (or OFF) to be set or changed and press +/- key to complete such setting as input of a number or change of ON/OFF.

The MD series has various functions, which are set in the respective screens.
Press the MENU key on the front panel to display the menu screen.
At the upper left of the screen, each function is displayed as a menu form.
Move the cursor ( ) to an item you desire; press the ENTER key to go to the selected screen.

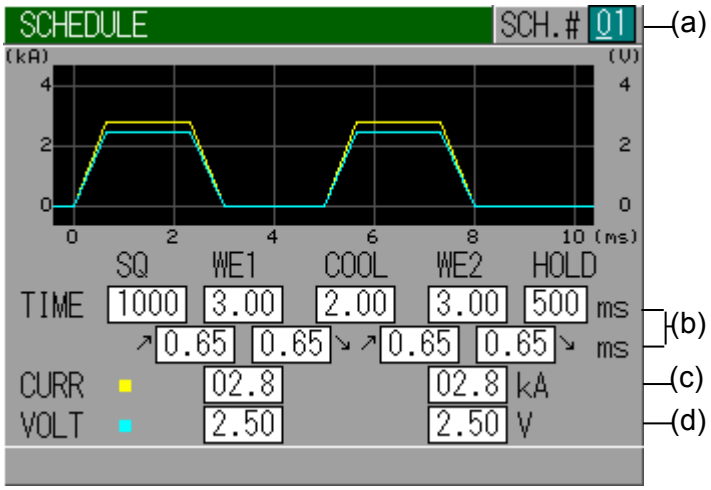


The numbers of (2) to (6) show the paragraph No. in the chapter.

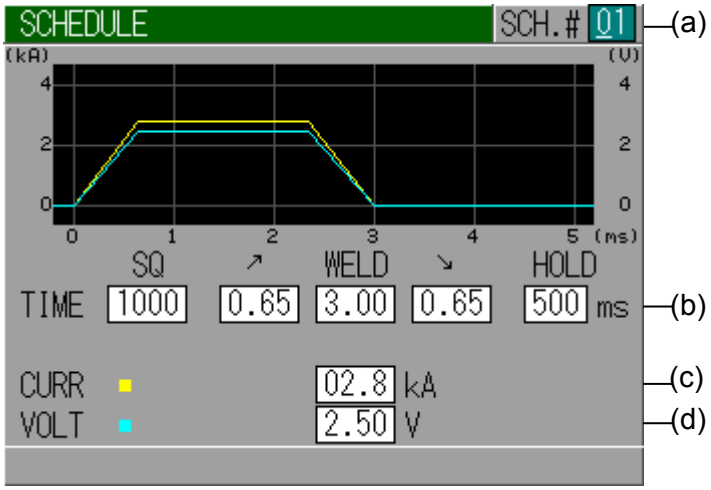
(2) Setting the Schedule (SCHEDULE Screen)

Sets the schedule (welding condition).
Up to 31 welding schedules can be set on the MD series.
The screen is used to set the length of weld time, weld current and so on.
Move the cursor ( ) to SCHEDULE and press the ENTER key to display the SCHEDULE screen as follows.

① When 2-step weld sequence is selected
When SCHEDULE MODE on the STATUS screen is set to DOUBLE



② When 1-step weld sequence is selected
When SCHEDULE MODE on the STATUS screen is set to SINGLE



(a) SCH.#
Denotes No. of SCHEDULE (welding condition).
Input the schedule number to set. After welding, the number is switched to the schedule number of the welding.

(b) TIME

Time period of each movement in welding is set in the unit of ms.
Refer to **5. (5) Timing Chart** for the relation of each period.

SQ	Time required until appropriate force is applied to the workpiece.
WE1	Time during which WE1 welding current is applied.
COOL	Time during which welding current is stopped and the workpiece is cooled.
WE2	Time during which WE2 welding current is applied.
HOLD	Time during which the workpiece is held after the welding current has been applied.
↗ (*1)	Upslope (gradual increase in welding current) time. Set it for WE1 and WE2 respectively.
↘ (*1)	Downslope (gradual decrease in welding current) time. Set it for WE1 and WE2 respectively.

*1: When the welding portion except upslope and downslope is short (there is not so much of a difference between the weld time (WE1 and WE2) and the time of [upslope + downslope]), the set current value and the monitored average value may be different. The difference between the set value and the monitored value varies depending on the rise rate of current.
The monitored interval can be set in MONITOR FIRST TIME. (Refer to **(6)⑮MONITOR FIRST TIME**.)

(c) CURR (*2)

Control current value. WE1 and WE2 are set, respectively.
When CONTROL on the STATUS screen is set to CURR, VOLT is not displayed.
Also, when CONTROL is set to VOLT, CURR is not displayed.

(d) VOLT (*2)

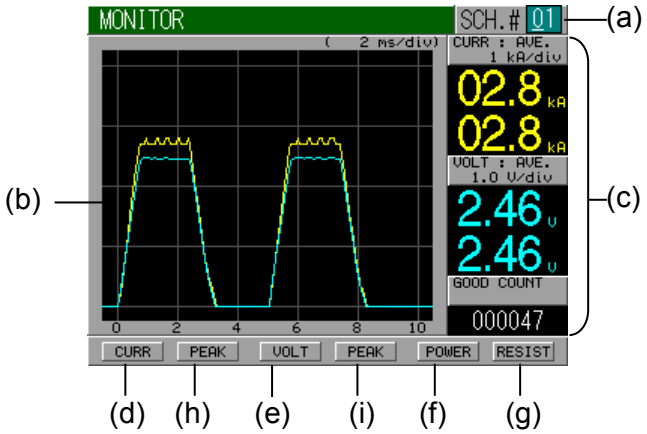
Control voltage value. WE1 and WE2 are set, respectively.
When CONTROL on the STATUS screen is set to CURR, VOLT is not displayed.
Also, when CONTROL is set to VOLT, CURR is not displayed.

*2: Set the current value for welding so that the current flows within the range of 10% to 100% of the maximum current value. The current value can be checked on the MONITOR screen.

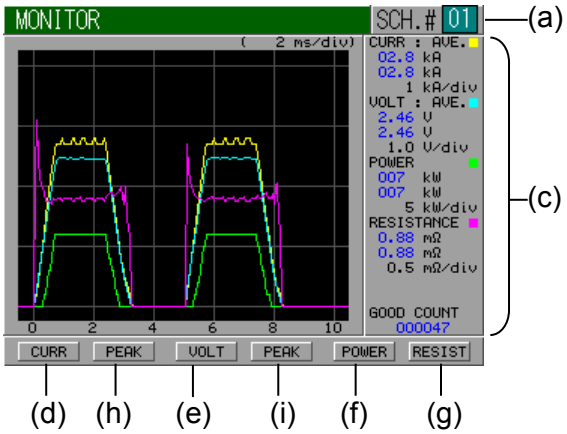
(3) Displaying the Measured Value (MONITOR Screen)

Displays the measured value of current, voltage, power, and resistance at welding.
Current is indicated in yellow solid line, Voltage is cyan, Power is green, and Resistance is magenta.
Move the cursor ( ) to function key ((d) to (g)) to be selected and press the ENTER key to display the desired screen. Press one more time the ENTER key to erase the displayed data.
Average value (AVE) and peak value (PEAK) of measured current and voltage can be switched by pressing the ENTER key after selecting the function key ((h), (i)).
Note) Waveform and measured value hold the latest data of each schedule. When the power is turned off, all values are cleared.

[When displaying data of two or less]



[When displaying data of three or more]



(a) SCH.#

Denotes No. of SCHEDULE (welding condition).
Input the schedule number that you want to check the waveform and measured value. After welding, the number is switched to the schedule number of the welding.

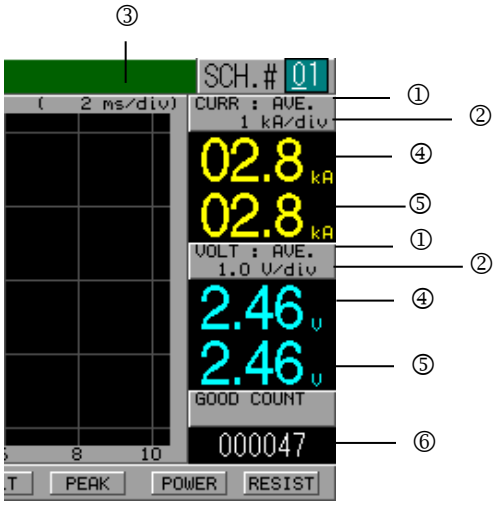
(b) Waveform

Displays the measured waveform of the item selected among current, voltage, power and resistance.

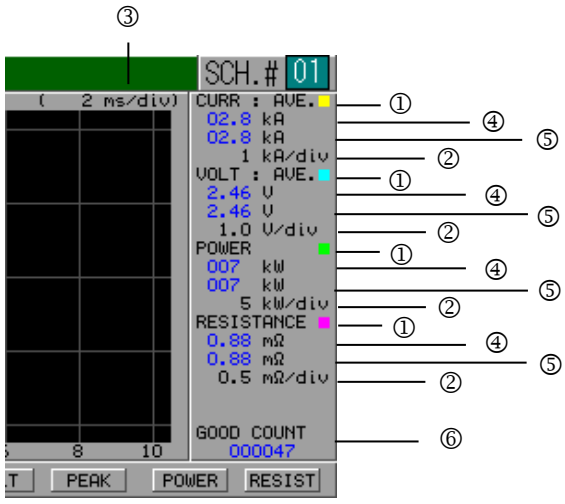
(c) Measured value

Displays the average and peal values of the item selected among current, voltage, power and resistance, and count of the welding judged good.

[When displaying data of two or less]



[When displaying data of three or more]



① Selected measured item

CURR : AVE ...	Displays the average value of current.
CURR : PEAK ...	Displays the peak value of current.
VOLT : AVE ...	Displays the average value of voltage.
VOLT : PEAK ...	Displays the peak value of voltage.
POWER ...	Displays the average value of power.
RESISTANCE ...	Displays the average value of resistance.

② Grid spacing of waveform (vertical axis)
Displays the grid spacing for vertical axis of each waveform.

③ Grid spacing of waveform (horizontal axis)
Displays the grid spacing for time axis of waveform.

④ Measured value of WE1
Displays the measured value of WE1 welding for each measured value.

⑤ Measured value of WE2
Displays the measured value of WE2 welding for each measured value.
Not displayed when SCHEDULE MODE on the STATUS screen is set to SINGLE.

⑥ Count
Displays the count of the welding judged good.

When the measured value exceeds the display range, --- is displayed.
To reset the value of GOOD COUNT, input CNTR RESET of the I/O connector.

(d) CURR

Selects whether to display the waveform of current and the average value/peal value.
Refer to (h) for switching of the average value and the peak value.

(e) VOLT
Selects whether to display the waveform of voltage and the average value/peal value.
Refer to (i) for switching of the average value and the peak value.

(f) POWER
Selects whether to display the waveform of power.

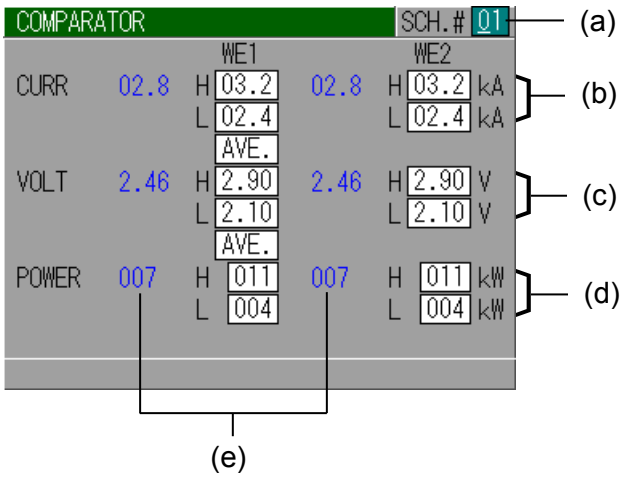
(g) RESIST
Selects whether to display the waveform of resistance.

(h) PEAK or AVE
Selects the average value or peak value of current.
Note) Average value and peak value can not be displayed simultaneously.

(i) PEAK or AVE
Selects the average value or peak value of voltage.
Note) Average value and peak value can not be displayed simultaneously.

(4) Setting Upper/Lower Limits for Judgment (COMPARATOR Screen)

Screen for setting the upper and lower limits of current, voltage, and power (called monitor values).
Measured values within the set monitor value range are judged good, and those out of the range are judged no good. (If measured values and monitor values are the same, they are judged good.)
When the judgment is no good, a fault signal or a caution signal is output.



(a) SCH.#
Denotes No. of SCHEDULE (welding condition).
Input the schedule number to set. After welding, the number is switched to the schedule number of the welding.

(b) CURR

Set the upper limit (H) and the lower limit (L) of current for WE1 and WE2 respectively.

The setting range is 0.00 kA to 9.99 kA, 00.0 kA to 99.9 kA or 000 kA to 999 kA.

You can select either AVE (average value) or PEAK (peak value) for upper/lower limit judgment.

When SCHEDULE MODE on the STATUS screen is set to SINGLE, upper limit (H), lower limit (L) and measured value of WE2 are not displayed.

(c) VOLT

Set the upper limit (H) and the lower limit (L) of voltage for WE1 and WE2 respectively.

The setting range is 0.00 V to 9.99 V.

You can select either AVE (average value) or PEAK (peak value) for upper/lower limit judgment.

When SCHEDULE MODE on the STATUS screen is set to SINGLE, upper limit (H), lower limit (L) and measured value of WE2 are not displayed.

(d) POWER

Set the upper limit (H) and the lower limit (L) of power for WE1 and WE2 respectively.

The setting range is 00.0 kW to 99.9 kW or 000 kW to 999 kW.

When SCHEDULE MODE on the STATUS screen is set to SINGLE, upper limit (H), lower limit (L) and measured value of WE2 are not displayed.

(e) Measured value

Displays the measured value of previous welding.

When SCHEDULE MODE on the STATUS screen is set to SINGLE, upper limit (H), lower limit (L) and measured value of WE2 are not displayed.

When the measured value exceeds the display range, --- is displayed.

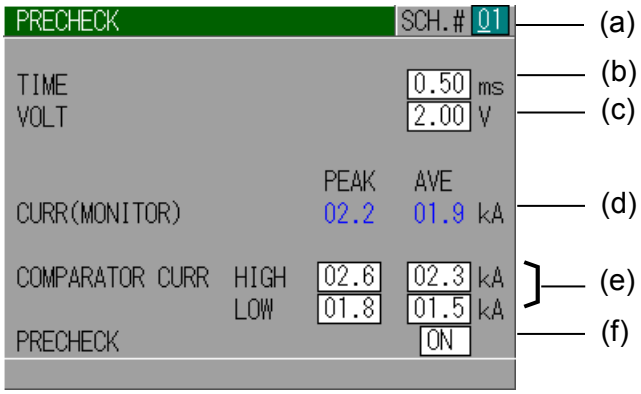
Note) Waveform and measured value hold the latest data of each schedule. When the power is turned off, all values are cleared.

(5) Setting the Precheck Welding (PRECHECK Screen)

Screen for setting the weld time and control voltage for precheck welding.
The precheck welding is a function to apply a small current under constant-voltage control before regular welding to confirm that the part to weld is set correctly by means of the measured current value.
The state of the part to weld is checked by the judgment of the current value changing according to the resistance value under constant-voltage control. When the value exceeds the upper or lower limit of precheck current, the fault or caution of “E15:PRECHECK ERROR” occurs.

For precheck welding, set the voltage and time not enough to perform a welding. For the upper and lower limits of precheck current, check and set the current value changing according to the normal or abnormal state of the part to weld. When the part to weld is not set, the resistance value becomes low and the current value to measure becomes higher than normal. On the other hand, when two or more parts are set or the contact is poor, the resistance value becomes high and the current value to measure becomes lower than normal.

Note) When there is not much of a difference between the current values to measure in the normal and abnormal states of the part to weld, the current values may not be judged normally.



(a) SCH.#

Denotes No. of SCHEDULE (welding condition).
Input the schedule number to set. After welding, the number is switched to the schedule number of the welding.

(b) TIME

Sets the time of precheck welding.
The setting range is 0.00 ms to 1.00 ms. Precheck is not performed at 0.00 ms.

(c) VOLT

Sets the voltage of precheck welding.

(d) CURR(MONITOR)

Displays the measured current value of precheck welding.
Displays PEAK (peak value) and AVE (average value) respectively.
Note) Waveform and measured value hold the latest data of each schedule. When the power is turned off, all values are cleared.

(e) COMPARATOR CURR

HIGH: Upper limit of current for precheck welding
Set the upper limit of current for PEAK (peak value) and AVE (average value) respectively.
LOW: Lower limit of current for precheck welding
Set the lower limit of current for PEAK (peak value) and AVE (average value) respectively.

(f) PRECHECK

Sets whether to perform the precheck welding (ON) or not (OFF).

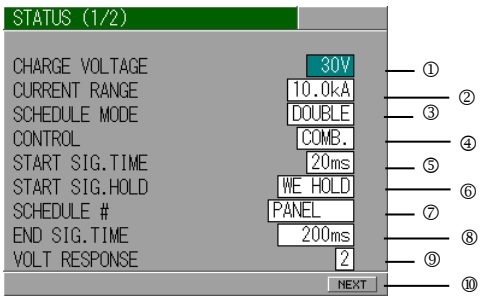
(6) Changing the Initial Settings (STATUS Screen)

Screen for changing the initial settings for the equipment.
Detailed settings can be made to suit the customer's operating environment.
Thoroughly read this operation manual before changing the initial settings.

Setting method

- Move the cursor to the item to change.
  (There are many items, so four STATUS screens are actually used.)
- Press the + or - key to change the settings.
- Finally, press the ENTER key to complete the setting operation.

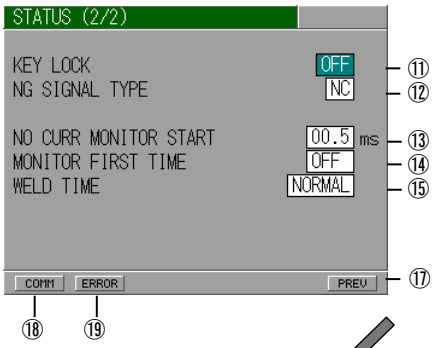
STATUS (1/2)



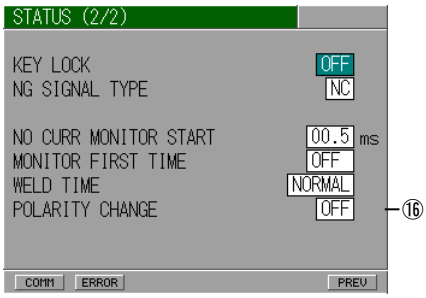
The first screen is common to all models.

Select ⑩ NEXT to move to the second screen.

STATUS (2/2) (**MD-A10000A**)



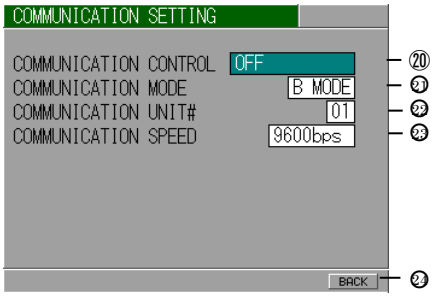
STATUS (2/2) (**MD-B5000A**)



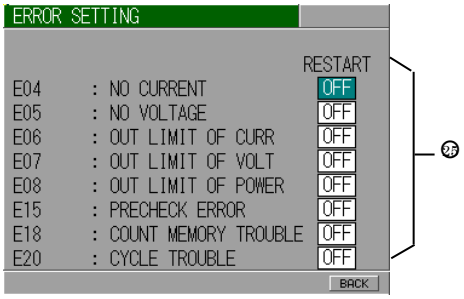
Select ⑱ COMM to move to the third screen.

Select ⑲ ERROR to move to the fourth screen.

COMMUNICATION SETTING



ERROR SETTING



① **CHARGE VOLTAGE**

The charging voltage can be fixed.
The settable voltage is 30 V.

② **CURRENT RANGE**

This equipment permits selection of the current range according to the magnitude of the welding current.

Model No.	Number of connection	Range
MD-A10000A	Master: 1 Slave: 0	1.00kA/2.00kA/4.00kA/10.0kA
	Master: 1 Slave: 1	2.00kA/4.00kA/8.00kA/20.0kA
	Master: 1 Slave: 2	3.00kA/6.00kA/12.0kA/30.0kA
	Master: 1 Slave: 3	4.00kA/8.00kA/16.0kA/40.0kA
	Master: 1 Slave: 4	5.00kA/10.0kA/20.0kA/50.0kA
	Master: 1 Slave: 5	6.00kA/12.0kA/24.0kA/60.0kA
	Master: 1 Slave: 6	7.00kA/14.0kA/28.0kA/70.0kA
	Master: 1 Slave: 7	8.00kA/16.0kA/32.0kA/80.0kA
	Master: 1 Slave: 8	9.00kA/18.0kA/36.0kA/90.0kA
	Master: 1 Slave: 9	10.0kA/20.0kA/40.0kA/100kA
	Master: 1 Slave: 10	11.0kA/22.0kA/44.0kA/110kA
	Master: 1 Slave: 11	12.0kA/24.0kA/48.0kA/120kA
MD-B5000A	Master: 1 Slave: 1	1.00kA/2.00kA/4.00kA/10.0kA

③ **SCHEDULE MODE**

Switches between the 1-step and 2-step weld sequences.
When 2-step welding is unnecessary, select 1-step welding. Since there are fewer items to be set for 1-step welding, this will make the screen display easier to see.

SINGLE	1-step weld sequence
DOUBLE	2-step weld sequence

④ **CONTROL**
Selects the welding control method.

COMB.	Combination control of constant-current and constant-voltage controls The constant-voltage control method and the constant-current-control method function simultaneously, and priority is given to the control method whichever reaches the set value.
VOLT	Constant-voltage control Controls so that the voltage detected by the V SENS cable attached between electrodes will be the set voltage.
CURR	Constant-current control Controls so that the welding current will be the set current.

⑤ **START SIG. TIME**
Sets the delay time between the input of the start signal and the start of the weld sequence.
Under this setting, chattering of the start switch can be disregarded.
Select the set value from among 20 / 10 / 5 / 1 ms.
The delay time can be fully minimized when a non-chattering switch is used.

⑥ **START SIG. HOLD**
Selects the self-holding timing for starting.

SQ HOLD	Self-holding is valid from the beginning of the squeeze sequence. Even when the start signal is opened during the sequence operation, the sequence does not stop.
WE HOLD	Self-holding is valid from the beginning of the weld sequence. When the start signal is opened during the squeeze time (SQ), the sequence stops.
NO HOLD	No self-holding. Input the start signal until the end of the sequence. When the start signal is opened during the sequence operation, the sequence stops. Note) When the start signal is opened before the sequence end, “E20:CYCLE TROUBLE” occurs.

For details, refer to **5. (5)③External Input Signals**.

⑦ **SCHEDULE #**
Determines the schedule selection method.

PANEL	The schedule is selected via the panel.
EXT. (NP) External schedule-select method (without parity)	The schedule is selected by closing the schedule-select signals of the I/O connector.
EXT. (P) External schedule-select method (with parity)	The schedule is selected by closing the schedule-select signal and PARITY signal of the I/O connector.

Input the parity so that the sum total of the closed circuits of the schedule-select signal and PARITY signal is an odd number. (Refer to **4. (1)⑰ I/O connector**.)

⑧ END SIG. TIME

Selects the output time duration of the end signal.

10/20/30....200ms	The output time is selected within the range of 10–200 ms in 10 ms steps.
10ms+ST	The signal is output while the 2ND signal is closed in addition to the minimum 10 ms.

⑨ VOLT RESPONSE

Changes the response speed of voltage detection under constant-voltage control.

When the response speed is changed, the current rise subtly changes under constant-voltage control. (Decrease the value, and the current rise portion tends to overshoot.)

The set value can be changed within the range from 1 to 4.

In most cases, the initial setting should not be changed.

⑩ NEXT

Moves to the STATUS (2/2) screen.

⑪ KEY LOCK

Prevents the details of schedule from being changed via the panel.

Prevents changes in the various set values when the panel keys are pressed.

ON	Change impossible
OFF	Change possible

⑫ NG SIGNAL TYPE

Selects the output type of the NG signal.

NC	Closes the circuit when the power supply is turned on; opens when a fault occurs.
NO	Opens the circuit normally; closes when a fault occurs.

⑬ NO CURR MONITOR START

Sets no current and no voltage monitoring start (neglecting) time.

No current and no voltage are not detected between the welding start and this setting.

The setting range is 00.5 ms to 99.9 ms.

In most cases, the initial setting should not be changed.

⑭ MONITOR FIRST TIME

Sets the interval not calculating the measured value.

OFF	AVE (average value) measures the interval except upslope and downslope. PEAK (peak value) measures the entire interval of weld time. Upslope and downslope are included in the measurement interval.
00.0ms to **99.9ms**	AVE (average value) measures the interval except the welding start to this setting and downslope regardless the upslope setting. PEAK (peak value) measures the interval except the welding start to this setting regardless the upslope/downslope setting.

In most cases, the initial setting should not be changed.

⑮ WELD TIME

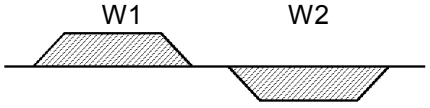
Sets the length of weld time.

NORMAL	The setting ranges are W1: 0.00 to 9.99 ms, COOL: 0.00 to 9.99 ms, and W2: 0.00 to 9.99 ms.
LONG	The setting ranges are W1: 00.0 to 99.9 ms, COOL: 00.0 to 49.9 ms, and W2: 00.0 to 99.9 ms. Set the total time of W1, CO and W2 to 100 ms or less.

Time period for which a welding can be performed
The time period for which a welding can be performed depends on the setting of current value and the status of load. Check the measured value and waveform on the MONITOR screen to set the welding. When the current value and weld time higher than the output capacity of the equipment are set, the power is reduced during welding.

⑯ POLARITY CHANGE (MD-B5000A only)

Selects the current direction of both W1 and W2 when 2-step welding is used.

ON	Opposite direction	
OFF	Same direction	

⑰ PREV

Moves to the STATUS (1/2) screen.

⑱ COMM

Moves to the COMMUNICATION SETTING screen.

⑲ ERROR

Moves to the ERROR SETTING screen.

⑳ COMMUNICATION CONTROL

Selects a communication function.

OFF	No communication
DATA OUTPUT	One-way communication. The monitor value and error code are output after welding and in the occurrence of error.
BI-DIRECTION	Two-way communication. Data is output for the communication request from a personal computer, etc. Schedules can be changed and monitor values can be output.

For contents output in communication, refer to **9. External Communication Function**.

㉑ COMMUNICATION MODE

Selects a communication mode. Valid when COMMUNICATION CONTROL is set to DATA OUTPUT.

B MODE	Performs the same one-way communication as **MD-A1000B**, **MD-A4000B**, **MD-A8000B**, **MD-B2000B**, **MD-B4000B**, and **MD-C2000B**.
C MODE	Adds the weld time, monitor value of precheck welding, etc. to B MODE and performs the one-way communication.

For contents output in communication, refer to **9. External Communication Function**.

㉒ COMMUNICATION UNIT#

Inputs the device No. (ID#). The range is 01 to 31.
When performing the two-way communication between two or more devices, assign one device No. for one device.

㉓ COMMUNICATION SPEED

Selects a communication speed.

9600	Communication at 9600 bps
19200	Communication at 19200 bps
38400	Communication at 38400 bps

When the communication can not be performed well, slow down the use a communication speed.

㉔ BACK

Moves to the STATUS (2/2) screen.

㉕ ERROR SETTING

The signal output when a fault occurred (fault/caution signals) can be set for each item.

Fault code	Contents
E04: NO CURRENT	No current
E05: NO VOLTAGE	No voltage
E06: OUT LIMIT OF CURR	Fault of current
E07: OUT LIMIT OF VOLT	Fault of voltage
E08: OUT LIMIT OF POWER	Fault of power
E15: PRECHECK ERROR	Precheck error
E18: COUNT MEMORY TROUBLE	Count memory trouble
E20: CYCLE TROUBLE	The start signal is turned off during welding.

7. Basic Operation

The operation method for the **MD-A10000A** is given here as an example.
The settings to be made are as follows:

Schedule No.:	#15
Weld sequence:	2-step
Precheck function:	ON
Welding method:	COMB.
Monitor values:	average current and average voltage

Change these settings to suit your purpose of use.

① Refer to **5. Connection**, and connect peripheral equipment correctly to the **MD-A10000A**.

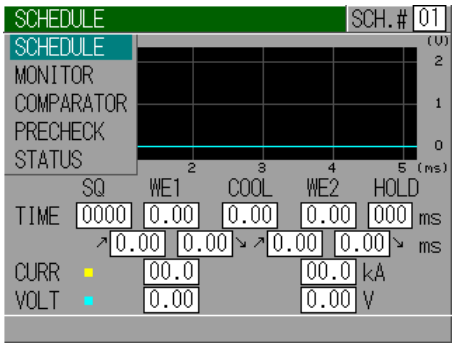
② Turn the POWER switches of all connected devices on and press the MENU key.

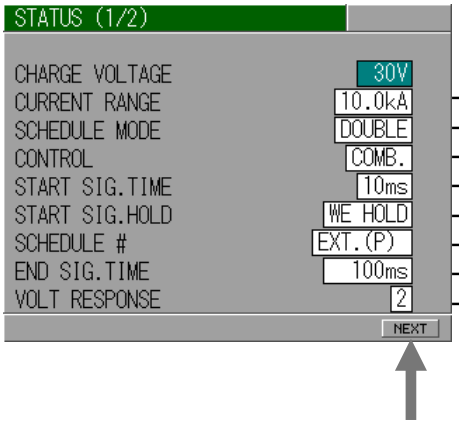
CAUTION Turn on the POWER switch of the slave device before turning on that of the master device. Otherwise, a fault may occur.

CAUTION Check that the display screens and lamps of all connected devices are turned on normally and the fan motors are operated.

③ Select STATUS by the cursor keys (△▽) and press the ENTER key.

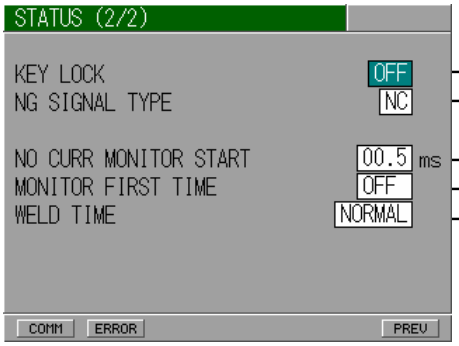
④ Set functions on the STATUS screen.
Move the cursor to the desired item and select the function by the + and - keys.
Press the ENTER key, and the selected function is valid.





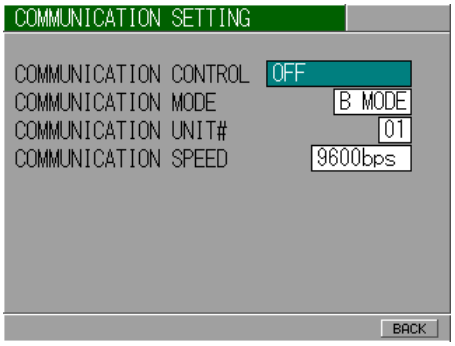
→ Set the nearest value above the welding current.
→ Select 2-step for welding.
→ Combined control of constant current and constant voltage.
→ Set 10 ms because of the sequencer (PLC) connection.
→ Set for self-holding from the beginning of weld sequence.
→ Select the schedule with a parity from the sequencer.
→ Set the end signal output to 100 ms.
→ In most cases, it should be used as it is.

⑤ Move the cursor to NEXT and press the ENTER key. The second screen appears.



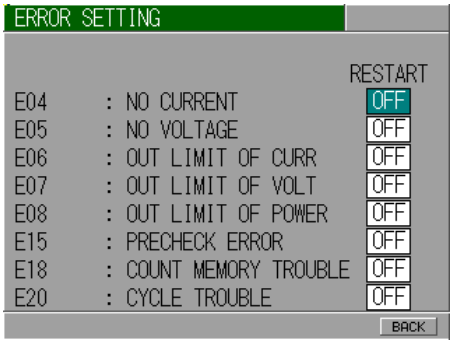
→Enter [OFF] to change the schedule.
→Set the output type of trouble signal to NC.
→Set the detection start time of no current/no voltage to 0.5 ms.
→Set the measurement start time to OFF.
→Set the length of weld time to NORMAL.

⑥ Move the cursor to COMM and press the ENTER key to go to the following screen.



To perform communication, set items referring to **6. (6) ⑳COMMUNICATION CONTROL** to **㉓COMMUNICATION SPEED**.
In this example, set as shown at left not to perform communication.
Move the cursor to BACK and press the ENTER key to move to the second screen of the STATUS screen.

⑦ Move the cursor to ERROR and press the ENTER key to go to the following screen.

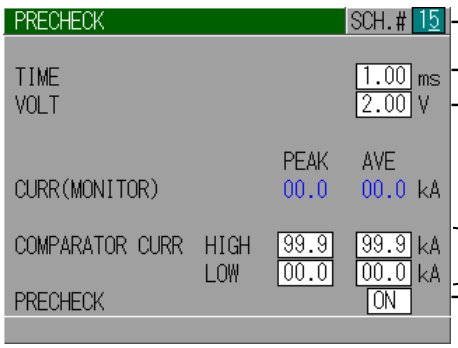


Set the signals (trouble/caution signals) to be output when a fault occurs.
In this example, all items are set OFF to output the trouble signal.

(ON: Caution signal output; start signal acceptable
OFF: Trouble signal output; start signal unacceptable)

Operation on the STATUS screen is now complete.
Press the MENU key to return to the menu screen.

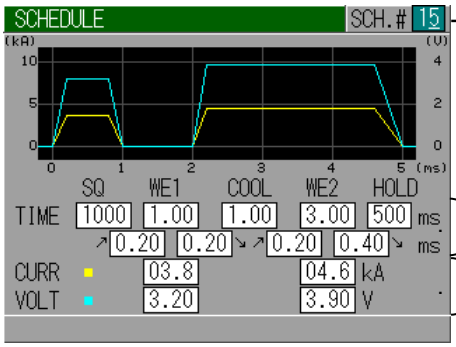
⑧ Next, select PRECHECK and press the ENTER key.
Set the precheck ON/OFF and precheck conditions.



→Set the schedule No. to 15.
→Set the weld time for precheck at 1.00 ms.
→Set the voltage to 2.00 V.
Set the range of precheck.
(Set a wide range here.)
→Use the precheck function.

Operation on the PRECHECK screen is now complete.
Press the MENU key to return to the menu screen.

⑨ Select SCHEDULE and press the ENTER key.



→ Set the schedule No. to 15.

Set the weld time.

Set the current and voltage.

⑩ Move to the welding test. Perform the actual welding and check to see if the welding schedule is set correctly.
Press the MENU key and return to the menu screen.
Next, select COMPARATOR, and press the ENTER key to go to the COMPARATOR screen.

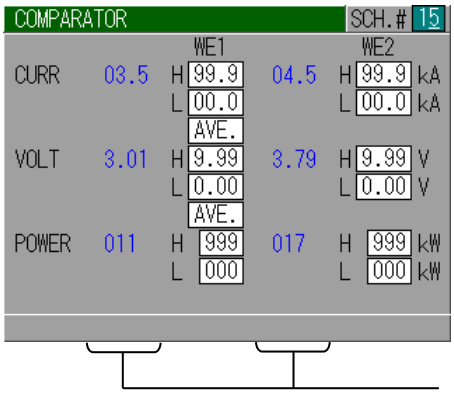
⑪ Press the WELD key on the front panel to turn the WELD lamp on.

⑫ Turn on (close) the WE ON/OFF of the I/O connector on the front panel.
Check that the READY lamp on the front panel is on.

> The READY lamp comes on when the WELD lamp on the front panel comes on and Pin 8 (WE ON/OFF) of the I/O connector on the front panel are closed.
> It goes out when a fault occurs, welding, or charging.

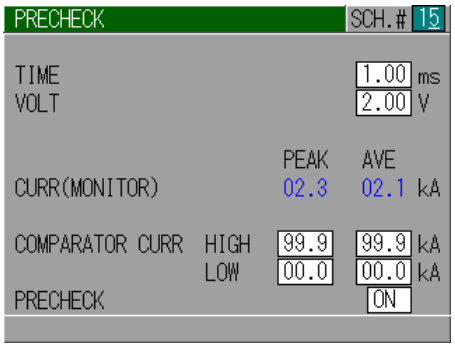
⑬ Input the schedule-select signal.
Turn on (close) SCH1/SCH2/SCH4/SCH8/SCH16 (as well as PARITY) of the I/O connector on the front panel to select schedule No.15.

⑭ Turn on (close) the 2ND start input to start welding.
The welding starts when the weld force signal is output and the welding head begins to apply weld force.
Record the monitor values shown at this time.
You can check that each device is performing welding by the illumination of the WELD STAR lamp on the slave.



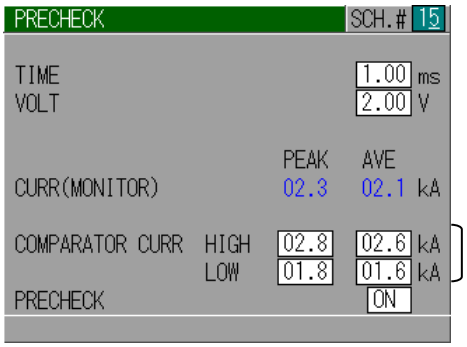
Record these values.

⑮ Then change the menu screen to the PRECHECK screen.
Record the measured value here as well.



Check the welding state, and repeat operations ⑨ to ⑮ to obtain an optimal result.

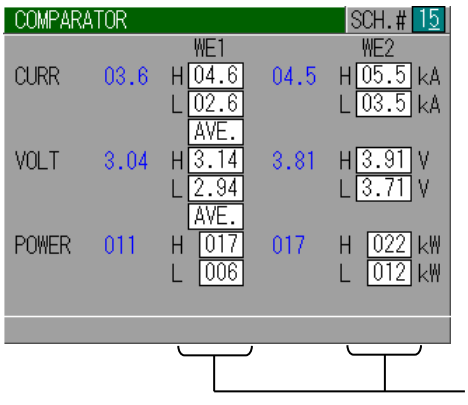
⑯ When welding is satisfactory, set the monitor value.



Change to the PRECHECK screen, and set the precheck judgment range.
(Set the HIGH and LOW values so that the optimal value will be in the center according to the dispersion of the values measured in ⑮.)

Lower the voltage when the peak current of precheck welding is flowing around the current value set for CURRENT RANGE on the STATUS screen. Since the current is also put a limit with the maximum current at the precheck welding, the precheck welding will not be performed correctly.

⑰ Next, move to the COMPARATOR screen and set the upper and lower limit ranges of the CURR, VOLT, and POWER.
(Set H at the maximum value and L at the minimum value when upper-lower limit judgment is not desired.)



⑱ Conduct operations ⑨ to ⑰ for all schedule Nos. to use, and welding under multiple conditions will be possible.

8. Fault Code

No.	Name of fault displayed on the screen Explanation of fault and corrective measures
E01	**MEMORY TROUBLE** The schedule and other data saved in the memory are broken down. Check all set values. The following are conceivable causes of loss or corruption of data stored in memory. ・ Strong power noise and electrostatic noise ・ Faults in the supply voltage due to thunderbolts or lightning conduction ・ Exceed in writing count limit of flash memory It is convenient to write down set values in case of data corruption or loss. (Use **12. Schedule Data Table**.) Initialize the memory by turning the POWER switch ON while pressing the MENU key. This resets all set values to the factory values set before shipment. Re-set the values that you recorded on paper beforehand. If E01: MEMORY TROUBLE is displayed again, repair is required. Contact us.
E02	**SYSTEM ERROR** A fault has been detected in the MD series. Once turn off power and turn on again. If E02: SYSTEM ERROR is displayed again, repair is required. Contact us.
E03	**TRIP OF THERMO** Stop operation, let the equipment to cool off, and press the RESET button. The device is overheated or the overcurrent is flowing. The trouble state of the slave device can be checked by the indication on the slave device. If nothing is displayed on the slave device, a fault is occurring on the master device. When the OVER HEAT lamp comes on, the device is overheated. When the OVER CURR lamp comes on, the overcurrent is flowing.
E04	**NO CURRENT** The welding current is not flowing. Or the welding current measured value is less than 1.3% of the set current range. Check the electrode contact and wiring of the welding head. If the upslope time is long when the set current value is small, the indication may appear. No current is not detected between the start of welding and the time set for NO CURR MONITOR START.

No.	Name of fault displayed on the screen Explanation of fault and corrective measures
E05	**NO VOLTAGE** The voltage between electrodes is 0.07 V or less. Or the V SENS cable is disconnected. Check the condition and position of the V SENS cable connection. This fault will not be displayed when CURR is selected on CONTROL setting. (Refer to **6. (6)④CONTROL**.) No voltage is not detected between the start of welding and the time set for NO CURR MONITOR START, and during downslope.
E06	**OUT LIMIT OF CURRENT** The measured value of welding current has been outside of the monitor range set on the COMPARATOR screen.
E07	**OUT LIMIT OF VOLTAGE** The measured voltage between electrodes has been outside of the monitor range set on the COMPARATOR screen.
E08	**OUT LIMIT OF POWER** The measured welding power has been outside of the monitor range set on the COMPARATOR screen.
E12	**CHARGE TROUBLE(LACK)** Failure of charging circuit. This message appears when charging is not completed within 7 seconds after power is turned on. Turn off the power immediately and contact us or your distributor.
E13	**CHARGE TROUBLE(OVER)** Failure of the charging circuit. Displayed when the charging voltage is too high. Turn off the power immediately and contact us or your distributor. The trouble state of the slave device can be checked by the OVER CHAR lamp on the slave device. If nothing is displayed on the slave device, a fault is occurring on the master device.
E14	**TRANSISTOR TROUBLE** Fault of the welding control circuit. Welding current is output continuously. Turn off the power immediately and contact us or your distributor.
E15	**PRECHECK ERROR** Displayed when the current exceeds the upper or lower limit of the current range set on the PRECHECK screen when the precheck weld is used. Check the contact of electrodes and the state of the weldment.
E16	**ABORT** The jumper wires between Pin 1 and Pin 2 (STOP) of the I/O connector are disconnected.
E17	**START PARITY ERROR** Displayed when a parity error occurs during operation with SCHEDULE set to EXT.(P). (Refer to **6. (6)⑦SCHEDULE**.)

No.	**Name of fault displayed on the screen** Explanation of fault and corrective measures
E18	**COUNT MEMORY TROUBLE** Counts of GOOD COUNT are damaged. The following are conceivable causes of damage of counted data. ・ Strong power noise and electrostatic noise ・ Faults in the supply voltage due to thunderbolts or lightning conduction ・ Decrease in voltage of battery for memory backup
E19	**VOLT SENS ERROR** The V SENS cable is broken or disconnected. Confirm the connection of the V SENS cable.
E20	**CYCLE TROUBLE** Occurs when START SIG. HOLD on the STATUS screen is set to NO HOLD and the start signal is turned off during welding. Input the start signal until the end of HOLD.

9. External Communication Function

(1) Communication Specifications

Item	Content
Transmission mode	RS-485, Asynchronous, Half-Duplex
Transmission rate	9600, 19200, 38400 bps
Data format	Start bit: 1, Data bit: 8, Stop bit: 1, Parity bit: Even
Character code	Output in ASCII code LF code: [LF] 0AH, CR code: [CR] 0DH Space: [SP] 32H
Connector	D-Sub 9 pins connector 1: RS+, 2: RS-, 3: RS+, 4: RS-, 9: SG

(2) Single-Directional Communication B Mode

(COMMUNICATION MODE on STATUS Screen is B MODE)

① 1-step welding (When SCHEDULE MODE on the STATUS screen is set to SINGLE)

Data strings: M: W1, 01, 5.00, 4.50, 4.50, 4.00, 18.0, 0.89 [CR]
A B C D E F G H I J

Ex.) M: W1,01,5.00,4.50,4.50,4.00,18.0,0.89[CR]

Item	Character string	Content		Range
A	M:	Monitor value sending code		M: (fixed)
B	W1,	Welding code (1-step welding)		W1 (fixed)
C	**,	Schedule No.		01 to 31
D	*.**,*1	WELD: Current	Peak value	0.00 to 9.99[kA] ,----*4
	**.*,*2			00.0 to 99.9[kA] ,----*4
	***,*3			000 to 999[kA] ,---*4
E	*.**,*1		Average value	0.00 to 9.99[kA] ,----*4
	**.*,*2			00.0 to 99.9[kA] ,----*4
	***,*3			000 to 999[kA] ,---*4
F	*.**,	WELD: Voltage	Peak value	0.00 to 9.99[V] ,----*4
G	*.**,		Average value	0.00 to 9.99[V] ,----*4
H	**.*,*1	WELD: Power average value		00.0 to 99.9[kW] ,----*4
	***,*2*3			000 to 999[kW] ,---*4
I	*.**	WELD: Resistance average value		0.00 to 9.99[mΩ] ,----*4
J	[CR]	CR code		0DH (fixed)

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.
*4: When the value exceeds the display range.

② 2-step welding (When SCHEDULE MODE on the STATUS screen is set to DOUBLE)

Data strings: M: W1, 01, 5.00, 4.50, 4.50, 4.00, 18.0, 0.89, W2, 5.00, 4.50, 4.50, 4.00, 18.0, 0.89 [CR]
A B C D E F G H I J K L M N O P Q

Ex.) M: W1,01,5.00,4.50,4.50,4.00,18.0,0.89,W2,5.00,4.50,4.50,4.00,18.0,0.89[CR]

Item	Character string	Content		Range
A	M:	Monitor value sending code		M: (fixed)
B	W1,	Welding code (1-step welding)		W1 (fixed)
C	**,	Schedule No.		01 to 31
D	*.**,*1	W1: Weld 1	Peak value	0.00 to 9.99[kA] ,----*4
	**.*,*2			00.0 to 99.9[kA] ,----*4
	***,*3			000 to 999[kA] ,---*4
E	*.**,*1		Average value	0.00 to 9.99[kA] ,----*4
	**.*,*2			00.0 to 99.9[kA] ,----*4
	***,*3			000 to 999[kA] ,---*4
F	*.**,	W1: Voltage 1	Peak value	0.00 to 9.99[V] ,----*4
G	*.**,		Average value	0.00 to 9.99[V] ,----*4
H	**.*,*1	W1: Power 1 average value		00.0 to 99.9[kW] ,----*4
	***,*2*3			000 to 999[kW] ,---*4
I	*.**,	W1: Resistance 1 average value		0.00 to 9.99[mΩ] ,----*4
J	W2,	Welding code (2-step welding)		W2 (fixed)
K	*.**,*1	W2: Weld 2	Peak value	0.00 to 9.99[kA] ,----*4
	**.*,*2			00.0 to 99.9[kA] ,----*4
	***,*3			000 to 999[kA] ,---*4
L	*.**,*1		Average value	0.00 to 9.99[kA] ,----*4
	**.*,*2			00.0 to 99.9[kA] ,----*4
	***,*3			000 to 999[kA] ,---*4
M	*.**,	W2: Voltage 2	Peak value	0.00 to 9.99[V] ,----*4
N	*.**,		Average value	0.00 to 9.99[V] ,----*4
O	**.*,*1	W2: Power 2 average value		00.0 to 99.9[kW] ,----*4
	***,*2*3			000 to 999[kW] ,---*4
P	*.**	W2: Resistance 2 average value		0.00 to 9.99[mΩ] ,----*4
Q	[CR]	CR code		0DH (fixed)

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.
*4: When the value exceeds the display range.

③ At the occurrence of fault

In case of one fault
Data strings: E: 01, 06 [CR]
A B C D
Ex.) E: 01,06[CR]

In case of five faults
Data strings: E: 01, 06, 07, 08, 09, 10 [CR]
A B C C C C C D
Ex.) E: 01,06,07,08,09,10[CR]

Item	Character string	Content	Range
A	E:	Fault send code	E: (fixed)
B	**,	Schedule No.	01 to 31
C	**[*1]	Fault code	01 to 20
D	[CR]	CR code	0DH (fixed)

*1: Up to five fault codes are output. If two or more fault codes exist, the codes are separated with ",". If no fault exists, E00 is output.

(3) Single-Directional Communication C Mode

(COMMUNICATION MODE on STATUS Screen is C MODE)

① 1-step welding (When SCHEDULE MODE on the STATUS screen is set to SINGLE)

Data strings: M: 01, 01, 001212, kA, W1, 5.00, 4.50, 4.50, 4.00, 18.0, 0.89, 2.00, P, 1.00,
A B C D E F G H I J K L M N O
0.50, 1.00 [CR][LF]
P Q R

Ex.) M: 01,01,001212,kA,W1,5.00,4.50,4.50,4.00,18.0,0.89,2.00,P,1.00,0.50,1.00[CR][LF]

Item	Character string	Content		Range
A	M:	Monitor value sending code		M: (fixed)
B	**,	Device No.		01 to 31
C	**,	Schedule No.		01 to 31
D	******,	Counter		000000 to 999999
E	**,	Unit of current value kA: Current value in kA		kA
F	W1,	Welding code (1-step welding)		W1 (fixed)
G	*.**,*1	WELD: Current	Peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
H	*.**,*1		Average value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
I	*.**,	WELD: Voltage	Peak value	0.00 to 9.99[V] ,----*6
J	*.**,		Average value	0.00 to 9.99[V] ,----*6
K	**.*,*1	WELD: Power average value		00.0 to 99.9[kW] ,----*6
	****,*2*3			0000 to 0999[kW] ,----*6
L	*.**,	WELD: Resistance average value		0.00 to 9.99[mΩ] ,----*6
M	*.**,*4	WELD: Weld time (Set time)		0.00 to 9.99[ms]
	**.*,*5			00.0 to 99.9[ms]
N	P,	Welding code (Precheck welding)		P (fixed)
O	*.**,*1	PRECHECK: Current	Peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
P	*.**,*1		Average value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
Q	*.**4	PRECHECK: Weld time (Set time)		0.00 to 1.00[ms]
	**.*5			00.0 to 01.0[ms]
R	[CR][LF]	CR, LF code		0DH 0AH (fixed)

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.
*4: When WELD TIME on the STATUS screen is NORMAL.
*5: When WELD TIME on the STATUS screen is LONG.
*6: When the value exceeds the display range.

② 2-step welding (When SCHEDULE MODE on the STATUS screen is set to DOUBLE)

Data strings: M: 01, 01, 001212, kA, W1, 5.00, 4.50, 4.50, 4.00, 18.0, 0.89, 2.00,
A B C D E F G H I J K L M
W2, 5.00, 4.50, 4.50, 4.00, 18.0, 0.89, 2.00, P, 1.00, 0.50, 1.00 [CR][LF]
N O P Q R S T U V W X Y Z

Ex.) M: 01,01,001212,kA,W1,5.00,4.50,4.50,4.00,18.0,0.89,2.00,W2,5.00,4.50,4.50,4.00,
18.0,0.89,2.00,P,1.00,0.50,1.00[CR][LF]

Item	Character string	Content		Range
A	M:	Monitor value sending code		M: (fixed)
B	**,	Device No.		01 to 31
C	**,	Schedule No.		01 to 31
D	******,	Counter		000000 to 999999
E	**,	Unit of current value kA: Current value in kA		kA
F	W1,	Welding code (1-step welding)		W1 (fixed)
G	*.**,*1	W1: Weld 1	Peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
H	*.**,*1		Average value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
I	*.**,	W1: Voltage 1	Peak value	0.00 to 9.99[V] ,----*6
J	*.**,		Average value	0.00 to 9.99[V] ,----*6
K	**.*,*1	W1: Power 1 average value		00.0 to 99.9[kW] ,----*6
	****,*2*3			0000 to 0999[kW] ,----*6
L	*.**,	W1: Resistance 1 average value		0.00 to 9.99[mΩ] ,----*6
M	*.**,*4	W1: Weld 1 time (Set time)		0.00 to 9.99[ms]
	**.*,*5			00.0 to 99.9[ms]
N	W2,	Welding code (2-step welding)		W2 (fixed)
O	*.**,*1	W2: Weld 2	Peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
P	*.**,*1		Average value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
Q	*.**,	W2: Voltage 2	Peak value	0.00 to 9.99[V] ,----*6
R	*.**,		Average value	0.00 to 9.99[V] ,----*6
S	**.*,*1	W2: Power 2 average value		00.0 to 99.9[kW] , ----*6
	****,*2*3			0000 to 0999[kW] , ----*6
T	*.**,	W2: Resistance 2 average value		0.00 to 9.99[mΩ] , ----*6

Item	Character string	Content		Range
U	*.**,*4	W2: Weld 2 time (Set time)		0.00 to 9.99[ms]
	**.*,*5			00.0 to 99.9[ms]
V	P,	Welding code (Precheck welding)		P (fixed)
W	*.**,*1	PRECHECK: Current	Peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
X	*.**,*1		Average value	0.00 to 9.99[kA] ,----*6
	**.*,*2			00.0 to 99.9[kA] ,----*6
	****,*3			0000 to 0999[kA] ,----*6
Y	*.**4	PRECHECK: Weld time (Set time)		0.00 to 1.00[ms]
	**.*5			00.0 to 01.0[ms]
Z	[CR][LF]	CR, LF code		0DH 0AH (fixed)

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.
*4: When WELD TIME on the STATUS screen is NORMAL.
*5: When WELD TIME on the STATUS screen is LONG.
*6: When the value exceeds the display range.

③ At the occurrence of fault

In case of one fault
Data strings: E: 01, 06 [CR][LF]
A B C D
Ex.) E: 01,06[CR][LF]

In case of five faults
Data strings: E: 01, 06, 07, 08, 09, 10 [CR][LF]
A B C C C C C D
Ex.) E: 01,06,07,08,09,10[CR][LF]

Item	Character string	Content	Range
A	E:	Fault send code	E: (fixed)
B	**,	Schedule No.	01 to 31
C	**[*1]	Fault code	01 to 20
D	[CR][LF]	CR, LF code	0DH 0AH (fixed)

*1: Up to five fault codes are output. If two or more fault codes exist, the codes are separated with ",". If no fault exists, E00 is output.

(4) Bi-Directional Communication Mode

① Protocol

・Description of symbol

Symbol	Content	Range
ID1, ID2	Device No. (ID1: Ten's place, ID2: One's place)	01 to 31
SH1, SH2, SH3	Schedule No. (SH1: Hundred's place, SH2: Ten's place, SH3: One's place)	001 to 031
CD1, CD2, CD3	Specified code No. CD1: Specified code CD2, CD3: Code No. (CD2: Ten's place, CD3: One's place)	CD1: Alphabet CD2, CD3: 00 to 99

・Description of protocol

Item	Command	Code
1	Inquiry about Model and ROM version	# Device No. I
	Ex.: Read Model and ROM version of Device No. 01. Host PC -> MD series # ID1 ID2 I [CR] [LF] #01I[CR][LF] MD series -> Host PC ! ID1 ID2 : Model , ROM version [CR] [LF] !01: MD-A10000A,V00-01A[CR][LF] ・When the Device No. (ID1, ID2) is **, all connected devices respond. The time-lag of response is 100 ms multiplied by the Device No.	
2	Reading of data	# Device No. R Schedule No. Specified code No.
	Ex.: Read the data of Schedule No. 8 and Specified code No. S01 of Device No. 01. Host PC -> MD series # ID1 ID2 R SH1 SH2 SH3 CD1 CD2 CD3 [CR] [LF] #01R008S01[CR][LF] MD series -> Host PC ! ID1 ID2 SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF] !01008S01: Data [CR][LF] ・See ② Data code table for the data order.	

<table>
<tr><th>Item</th><th>Command</th><th>Code</th></tr>
<tr><td rowspan="2">4</td><td>Writing of data</td><td># Device No. W Schedule No. Specified code No. : Data</td></tr>
<tr><td colspan="2">Ex.: Write Schedule No. 8 of Device No. 01 and data of Specified code No. S01.

Host PC -> MD series
ID1 ID2 W SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF]
#01W008S01: Data [CR][LF]

MD series -> Host PC
! ID1 ID2 SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF]
!01008S01: Data [CR][LF]

・See ② Data code table for the data order.</td></tr>
<tr><td rowspan="2">5</td><td>Reading of fault data</td><td># Device No. R Schedule No. Specified code No.</td></tr>
<tr><td colspan="2">Ex.: Read fault data of Device No. 01

Host PC -> MD series
ID1 ID2 R SH1 SH2 SH3 CD1 CD2 CD3 [CR] [LF]
#01R000S13[CR][LF]

MD series -> Host PC
! ID1 ID2 SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF]
!01001S13: Data [CR][LF]

・Write 000 for Schedule No. (SH1, SH2, SH3).
・Write S13 for Specified code No. (CD1, CD2, CD3).
・See ② Data code table for the data order.
・Schedule No. for data output from the MD series becomes last-welded Schedule No.</td></tr>
<tr><td rowspan="2">6</td><td>Resetting of fault</td><td># Device No. W Schedule No. Specified code No. : Data</td></tr>
<tr><td colspan="2">Ex.: Reset the fault of Device No. 01.

Host PC -> MD series
ID1 ID2 W SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF]
#01W000S13: E00[CR][LF]

MD series -> Host PC
! ID1 ID2 SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF]
!01001S13: E00[CR][LF]

・Write 000 for Schedule No. (SH1, SH2, SH3).
・Write S13 for Specified code No. (CD1, CD2, CD3).
・Schedule No. for data output from the MD series becomes last-welded Schedule No.
・E00 is output for data.</td></tr>
</table>

② Data code table

1) Specified code No. table

Specified code No.	Content
S01	SCHEDULE screen setting (Only when SCHEDULE MODE on the STATUS screen is SINGLE) Changes the conditions of weld sequence. Specify Schedule No. and Specified code No. to perform reading and writing.
S02	SCHEDULE screen setting (Only when SCHEDULE MODE on the STATUS screen is DOUBLE) Changes the conditions of weld sequence. Specify the schedule No. and specified code No. to perform reading and writing.
S03	MONITOR screen setting Changes the items displayed on the MONITOR screen. Specify the specified code No. to perform reading and writing. Set 000 for Schedule No.
S04	COMPARATOR screen setting (Only when SCHEDULE MODE on the STATUS screen is SINGLE) Changes the upper/lower limit of monitor value. Specify the schedule No. and specified code No. to perform reading and writing.
S05	COMPARATOR screen setting (Only when SCHEDULE MODE on the STATUS screen is DOUBLE) Changes the upper/lower limit of monitor value. Specify the schedule No. and specified code No. to perform reading and writing.
S06	PRECHECK screen setting Changes the conditions of precheck welding. Specify the schedule No. and specified code No. to perform reading and writing.
S07	STATUS screen setting Changes the initial setting. Specify the specified code No. to perform reading and writing. Set 000 for Schedule No.
S08	COMMUNICATION SETTING screen setting Changes the communication setting. Specify the specified code No. to perform reading and writing. Set 000 for Schedule No.
S09	ERROR SETTING screen setting Selects the signal output when a fault occur from fault and caution. Specify the specified code No. to perform reading and writing. Set 000 for Schedule No.
S11 (Read only)	Monitor value output (Only when SCHEDULE MODE on the STATUS screen is SINGLE) Outputs the last monitor value of each schedule No. Specify the schedule No. and specified code No. to perform reading.
S12 (Read only)	Monitor value output (Only when SCHEDULE MODE on the STATUS screen is DOUBLE) Outputs the last monitor value of each schedule No. Specify the schedule No. and specified code No. to perform reading.
S13	Output and resetting of fault item Outputs and resets the occurring fault code Specify the specified code No. to perform reading and writing. Set 000 for Schedule No.

2) Specified code No.: S01 (SCHEDULE screen)

Used when SCHEDULE MODE on the STATUS screen is SINGLE.
In case of DOUBLE, use Specified code No. S02.

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series
#01R008S01[CR][LF]

MD series -> Host PC
!01008S01: 0100, 1.00, 5.00, 1.00, 100, kA, 2.00, 1.00 [CR][LF]
A B C D E F G H

Item	Character string	Content	Range	Increment/ Decrement
A	****,	SQ: Squeeze time	0000 to 9999[ms]	1
B	*.**,*1	UP: Upslope time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
C	*.**,*1	WE: Weld time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
D	*.**,*1	DS: Downslope time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
E	***,	HD: Hold time	000 to 999[ms]	1
F	**,	Unit of current value kA: Current value in kA	kA	-
G	*.**,*3	WE: Current value	0.00 to 9.99[kA] *6	0.01
	**.*,*4		00.0 to 99.9[kA] *6	0.1
	****,*5		0000 to 0999[kA] *6	1
H	*.**	WE: Voltage value	0.00 to 9.99[V]	0.01

*1: When WELD TIME on the STATUS screen is NORMAL.
*2: When WELD TIME on the STATUS screen is LONG.
*3: When CURRENT RANGE on the STATUS screen is *.**kA.
*4: When CURRENT RANGE on the STATUS screen is **.*kA.
*5: When CURRENT RANGE on the STATUS screen is ***kA.
*6: Range depends on CURRENT RANGE on the STATUS screen.

3) Specified code No.: S02 (SCHEDULE screen)

Used when SCHEDULE MODE on the STATUS screen is DOUBLE.
In case of SINGLE, use Specified code No. S01.

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series
#01R008S02[CR][LF]

MD series -> Host PC
!01008S02: 0100, 1.00, 5.00, 1.00, 2.00, 1.00, 4.00, 1.00, 100, kA,
A B C D E F G H I J
2.00, 3.00, 1.00, 1.50 [CR][LF]
K L M N

Item	Character string	Content	Range	Increment/ Decrement
A	****,	SQ: Squeeze time	0000 to 9999[ms]	1
B	*.**,*1	U1: Upslope 1 time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
C	*.**,*1	W1: Weld 1 time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
D	*.**,*1	D1: Downslope 1 time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
E	*.**,*1	CL: Cool time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 49.9[ms]	0.1
F	*.**,*1	U2: Upslope 2 time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
G	*.**,*1	W2: Weld 2 time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
H	*.**,*1	D2: Downslope 2 time	0.00 to 9.99[ms]	0.01
	**.*,*2		00.0 to 99.9[ms]	0.1
I	***,	HD: Hold time	000 to 999[ms]	1
J	**,	Unit of current value kA: Current value in kA	kA	-
K	*.**,*3	W1: Weld 1 current	0.00 to 9.99[kA] *6	0.01
	**.*,*4		00.0 to 99.9[kA] *6	0.1
	****,*5		0000 to 0999[kA] *6	1
L	*.**,*3	W2: Weld 2 current	0.00 to 9.99[kA] *6	0.01
	**.*,*4		00.0 to 99.9[kA] *6	0.1
	****,*5		0000 to 0999[kA] *6	1
M	*.**,	W1: Weld 1 voltage	0.00 to 9.99[V]	0.01
N	*.**	W2: Weld 2 voltage	0.00 to 9.99[V]	0.01

*1: When WELD TIME on the STATUS screen is NORMAL.
*2: When WELD TIME on the STATUS screen is LONG.
*3: When CURRENT RANGE on the STATUS screen is *.**kA.
*4: When CURRENT RANGE on the STATUS screen is **.*kA.
*5: When CURRENT RANGE on the STATUS screen is ***kA.
*6: Range depends on CURRENT RANGE on the STATUS screen.

4) Specified code No.: S03 (MONITOR screen)

Data strings: When reading Device No. 01 (Set 000 for Schedule No.)

Host PC -> MD series
#01R000S03[CR][LF]

MD series -> Host PC
!01000S03: 1, 1, 0, 0, 1, 1 [CR][LF]
A B C D E F

Item	Character string	Content	Range	Increment/ Decrement
A	*,	Display of current monitor value 0: Hide 1: Display	0 to 1	1
B	*,	Display of voltage monitor value 0: Hide 1: Display	0 to 1	1
C	*,	Display of power monitor value 0: Hide 1: Display	0 to 1	1
D	*,	Display of resistance monitor value 0: Hide 1: Display	0 to 1	1
E	*,	Displayed item of current monitor value 0: Average value 1: Peak value	0 to 1	1
F	*	Displayed item of voltage monitor value 0: Average value 1: Peak value	0 to 1	1

5) Specified code No.: S04 (COMPARATOR screen)

Used when SCHEDULE MODE on the STATUS screen is SINGLE.
In case of DOUBLE, use Specified code No. S05.

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series
#01R008S04[CR][LF]

MD series -> Host PC
!01008S04: kA, 2.20, 1.80, 0, 1.20, 0.80, 0, 02.2, 01.8 [CR][LF]
A B C D E F G H I

Item	Character string	Content	Range	Increment/ Decrement
A	**,	Unit of current value kA: Current value in kA	kA	-
B	*.**,*1	WE: Current upper limit	0.00 to 9.99[kA]	0.01
	**.*,*2		00.0 to 99.9[kA]	0.1
	****,*3		0000 to 0999[kA]	1
C	*.**,*1	WE: Current lower limit	0.00 to 9.99[kA]	0.01
	**.*,*2		00.0 to 99.9[kA]	0.1
	****,*3		0000 to 0999[kA]	1
D	*,	Current judgment setting 0: With average value 1: With peak value	0 to 1	1
E	*.**,	WE: Voltage upper limit	0.00 to 9.99[V]	0.01
F	*.**,	WE: Voltage lower limit	0.00 to 9.99[V]	0.01
G	*,	Voltage judgment setting 0: With average value 1: With peak value	0 to 1	1
H	**.*,*1	WE: Power upper limit	00.0 to 99.9[kW]	0.1
	****,*2*3		0000 to 0999[kW]	1
I	**.*,*1	WE: Power lower limit	00.0 to 99.9[kW]	0.1
	****,*2*3		0000 to 0999[kW]	1

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.

6) Specified code No.: S05 (COMPARATOR screen)

Used when SCHEDULE MODE on the STATUS screen is DOUBLE.
In case of SINGLE, use Specified code No. S04.

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series
#01R008S05[CR][LF]

MD series -> Host PC
!01008S05: kA, 2.20, 1.80, 3.20, 2.80, 0, 1.20, 0.80, 1.70, 1.30, 0,
A B C D E F G H I J K
02.2, 01.8, 04.7, 04.3 [CR][LF]
L M N O

Item	Character string	Content	Range	Increment/ Decrement
A	**,	Unit of current value kA: Current value in kA	kA	-
B	*.**,*1	W1: Weld 1 current upper limit	0.00 to 9.99[kA]	0.01
	**.*,*2		00.0 to 99.9[kA]	0.1
	****,*3		0000 to 0999[kA]	1
C	*.**,*1	W1: Weld 1 current lower limit	0.00 to 9.99[kA]	0.01
	**.*,*2		00.0 to 99.9[kA]	0.1
	****,*3		0000 to 0999[kA]	1
D	*.**,*1	W2: Weld 2 current upper limit	0.00 to 9.99[kA]	0.01
	**.*,*2		00.0 to 99.9[kA]	0.1
	****,*3		0000 to 0999[kA]	1
E	*.**,*1	W2: Weld 2 current lower limit	0.00 to 9.99[kA]	0.01
	**.*,*2		00.0 to 99.9[kA]	0.1
	****,*3		0000 to 0999[kA]	1
F	*,	Current judgment setting 0: With average value 1: With peak value	0 to 1	1
G	*.**,	W1: Weld 1 voltage upper limit	0.00 to 9.99[V]	0.01
H	*.**,	W1: Weld 1 voltage lower limit	0.00 to 9.99[V]	0.01
I	*.**,	W2: Weld 2 voltage upper limit	0.00 to 9.99[V]	0.01
J	*.**,	W2: Weld 2 voltage lower limit	0.00 to 9.99[V]	0.01
K	*,	Voltage judgment setting 0: With average value 1: With peak value	0 to 1	1
L	**.*,*1	W1: Weld 1 power upper limit	00.0 to 99.9[kW]	0.1
	****,*2*3		0000 to 0999[kW]	1
M	**.*,*1	W1: Weld 1 power lower limit	00.0 to 99.9[kW]	0.1
	****,*2*3		0000 to 0999[kW]	1

Item	Character string	Content	Range	Increment/ Decrement
N	**.*,*1	W2: Weld 2 power upper limit	00.0 to 99.9[kW]	0.1
	****,*2*3		0000 to 0999[kW]	1
O	**.* *1	W2: Weld 2 power lower limit	00.0 to 99.9[kW]	0.1
	**** *2*3		0000 to 0999[kW]	1

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.

7) Specified code No.: S06 (PRECHECK screen)

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series

#01R008S06[CR][LF]

MD series -> Host PC

!01008S06: 1, 1.00, 0.50, kA, 2.20, 1.80, 1.20, 0.80 [CR][LF]

A B C D E F G H

Item	Character string	Content	Range	Increment/ Decrement
A	*,	0: Precheck welding OFF 1: Precheck welding ON	0 to 1	1
B	*.**,*1	RC: Time	0.00 to 1.00[ms]	0.01
	**.*,*2		00.0 to 01.0[ms]	0.1
C	*.**,	RC: Voltage	0.00 to 9.99[V]	0.01
D	**,	Unit of current value kA: Current value in kA	kA	-
E	*.**,*3	RC: Current peak value upper limit	0.00 to 9.99[kA]	0.01
	**.*,*4		00.0 to 99.9[kA]	0.1
	****,*5		0000 to 0999[kA]	1
F	*.**,*3	RC: Current peak value lower limit	0.00 to 9.99[kA]	0.01
	**.*,*4		00.0 to 99.9[kA]	0.1
	****,*5		0000 to 0999[kA]	1
G	*.**,*3	RC: Current average value upper limit	0.00 to 9.99[kA]	0.01
	**.*,*4		00.0 to 99.9[kA]	0.1
	****,*5		0000 to 0999[kA]	1
H	*.** *3	RC: Current average value lower limit	0.00 to 9.99[kA]	0.01
	**.* *4		00.0 to 99.9[kA]	0.1
	**** *5		0000 to 0999[kA]	1

*1: When WELD TIME on the STATUS screen is NORMAL.
*2: When WELD TIME on the STATUS screen is LONG.
*3: When CURRENT RANGE on the STATUS screen is *.**kA.
*4: When CURRENT RANGE on the STATUS screen is **.*kA.
*5: When CURRENT RANGE on the STATUS screen is ***kA.

8) Specified code No.: S07 (STATUS screen)

Data strings: When reading Device No. 01 (Set 000 for Schedule No.)

Host PC -> MD series

#01R000S07[CR][LF]

MD series -> Host PC

!01000S07: 00, 3, 1, 0, 3, 2, 0, 1, 1, 0, 0, 3, 00.5, -00.1, 0, 0, 0, 0 [CR][LF]

A B C D E F G H I J K L M N O P Q R

Item	Character string	Content	Range	Increment/ Decrement
A	**,	CHARGE VOLTAGE: Charge voltage 00: 30V	00 (fixed)	-
B	*,	CURRENT RANGE: Current range MD-A10000A (slave: 0) 0: 1.00kA 1: 2.00kA 2: 4.00kA 3: 10.0kA MD-A10000A (slave: 1) 0: 2.00kA 1: 4.00kA 2: 8.00kA 3: 20.0kA MD-A10000A (slave: 2) 0: 3.00kA 1: 6.00kA 2: 12.0kA 3: 30.0kA MD-A10000A (slave: 3) 0: 4.00kA 1: 8.00kA 2: 16.0kA 3: 40.0kA MD-A10000A (slave: 4) 0: 5.00kA 1: 10.0kA 2: 20.0kA 3: 50.0kA MD-A10000A (slave: 5) 0: 6.00kA 1: 12.0kA 2: 24.0kA 3: 60.0kA MD-A10000A (slave: 6) 0: 7.00kA 1: 14.0kA 2: 28.0kA 3: 70.0kA MD-A10000A (slave: 7) 0: 8.00kA 1: 16.0kA 2: 32.0kA 3: 80.0kA MD-A10000A (slave: 8) 0: 9.00kA 1: 18.0kA 2: 36.0kA 3: 90.0kA MD-A10000A (slave: 9) 0: 10.0kA 1: 20.0kA 2: 40.0kA 3: 100kA MD-A10000A (slave: 10) 0: 11.0kA 1: 22.0kA 2: 44.0kA 3: 110kA MD-A10000A (slave: 11) 0: 12.0kA 1: 24.0kA 2: 48.0kA 3: 120kA MD-B5000A (slave: 1) 0: 1.00kA 1: 2.00kA 2: 4.00kA 3: 10.0kA	0 to 3	1

Item	Character string	Content	Range	Increment/ Decrement
C	*,	SCHEDULE MODE: Number of steps 0: SINGLE 1: DOUBLE	0 to 1	1
D	*,	CONTROL: Welding control method 0: CURR 1: VOLT 2: COMB.	0 to 2	1
E	*,	START SIG.TIME: Start delay time 0: 1ms 1: 5ms 2: 10ms 3: 20ms	0 to 3	1
F	*,	START SIG.HOLD: Start self-holding 0: NO HOLD 1: WE HOLD 2: SQ HOLD	0 to 2	1
G	*,	SCHEDULE#: Schedule selection method 0: EXT.(P) 1: EXT.(NP) 2: PANEL	0 to 2	1
H	**,	END SIG.TIME: End signal time 0: 10ms+ST 1: 10ms 2: 20ms 3: 30ms 4: 40ms 5: 50ms 6: 60ms 7: 70ms 8: 80ms 9: 90ms 10: 100ms 11: 110ms 12: 120ms 13: 130ms 14: 140ms 15: 150ms 16: 160ms 17: 170ms 18: 180ms 19: 190ms 20: 200ms	0 to 20	1
I	*,	VOLT RESPONSE: Voltage detection response 0: 1 1: 2 2: 3 3: 4	0 to 3	1
J	*,	KEY LOCK: Disabling the schedule via panel 0: Can be changed 1: Can not be changed	0 to 1	1
K	*,	NG SIGNAL TYPE: NG output type 0: NC 1: NO	0 to 1	1
L	*,	LCD CONTRAST: Brightness of screen	0 (fixed)	-
M	**.*,	NO CURR MONITOR START: Start time of no current/no voltage detection	00.5 to 99.9[ms]	0.1

Item	Character string	Content	Range	Increment/ Decrement
N	***.*,	MONITOR START TIME: Measurement interval setting -00.1: OFF 000.0 to 099.9: measurement start time [ms]	-00.1 to 099.9	0.1
O	*,	WELD TIME: Length of weld time 0: NORMAL 1: LONG	0 to 1	1
P	*,*1	POLARITY CHANGE: Welding polarity method 0: OFF 1: ON	0 to 1	1
Q	*,*2	SEQUENCE WELD: Sequence welding 0	0	1
R	* *2	MONITOR SELECT: Monitor selection method 0	0	1

*1: Function for **MD-B5000A** only. For other models, set to 0.
*2: Set to 0.

9) Specified code No.: S08 (COMMUNICATION SETTING screen)

Data strings: When reading Device No. 01 (Set 000 for Schedule No.)

Host PC -> MD series

#01R000S08[CR][LF]

MD series -> Host PC

!01000S08: 0, 0, 01, 0 [CR][LF]

A B C D

Item	Character string	Content	Range	Increment/ Decrement
A	*,	COMMUNICATION CONTROL: Communication function setting 0: OFF 1: DATA OUTPUT 2: BI-DIRECTION	0 to 2	1
B	*,	COMMUNICATION MODE: Communication mode setting 0: B MODE 1: C MODE	0 to 1	1
C	**,	COMMUNICATION UNIT#: Device No.	1 to 31	1
D	*	COMMUNICATION SPEED: Communication speed 0: 9600bps 1: 19200bps 2: 38400bps	0 to 2	1

*1: When changing the communication setting, change the communication setting on the host computer side, too.

10) Specified code No.: S09 (ERROR SETTING screen)

Data strings: When reading Device No. 01 (Set 000 for Schedule No.)

Host PC -> MD series

#01R000S09[CR][LF]

MD series -> Host PC

!01000S09: 0, 0, 0, 0, 0, 0, 0, 0 [CR][LF]

A B C D E F G H

Item	Character string	Content	Range	Increment/ Decrement
-	-	ERROR SETTING: Fault/caution setting 0: Caution 1: Fault	-	-
A	*,	NO CURRENT	0 to 1	1
B	*,	NO VOLTAGE	0 to 1	1
C	*,	OUT LIMIT OF CURR	0 to 1	1
D	*,	OUT LIMIT OF VOLT	0 to 1	1
E	*,	OUT LIMIT OF POWER	0 to 1	1
F	*,	PRECHECK ERROR	0 to 1	1
G	*,	COUNT MEMORY TROUBLE	0 to 1	1
H	*	CYCLE TROUBLE	0 to 1	1

11) Specified code No.: S11 (Monitor value output)

Used when SCHEDULE MODE on the STATUS screen is SINGLE.
In case of DOUBLE, use Specified code No. S12.

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series
#01R008S11[CR][LF]

MD series -> Host PC
!01008S11: 001212, kA, 2.00, 1.86, 3.20, 2.61, 04.9, 1.40, 1.00, 1.43, 0.75, 1.00
A B C D E F G H I J K L
[CR][LF]

Item	Character string	Content	Range
A	******,	Counter	000000 to 999999
B	**,	Unit of current value kA: Current value in kA	kA
C	*.**,*1	WELD: Current peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
D	*.**,*1	WELD: Current average value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
E	*.**,	WELD: Voltage peak value	0.00 to 9.99[V] ,----*6
F	*.**,	WELD: Voltage average value	0.00 to 9.99[V] ,----*6
G	**.*,*1	WELD: Power average value	00.0 to 99.9[kW] ,----*6
	****,*2*3		0000 to 0999[kW] ,----*6
H	*.**,	WELD: Resistance average value	0.00 to 9.99[mΩ] ,----*6
I	*.**,*4	WELD: Weld time (Set time)	0.00 to 9.99[ms]
	**.*,*5		00.0 to 99.9[ms]
J	*.**,*1	PRECHECK: Current peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
K	*.**,*1	PRECHECK: Current average value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
L	*.**4	PRECHECK: Weld time (Set time)	0.00 to 1.00[ms]
	**.*5		00.0 to 01.0[ms]

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.
*4: When WELD TIME on the STATUS screen is NORMAL.
*5: When WELD TIME on the STATUS screen is LONG.
*6: When the value exceeds the display range.

12) Specified code No.: S12 (Monitor value output)

Used when SCHEDULE MODE on the STATUS screen is DOUBLE.
In case of SINGLE, use Specified code No. S11.

Data strings: When reading Device No. 01 and Schedule No. 008

Host PC -> MD series
#01R008S12[CR][LF]

MD series -> Host PC
!01008S12: 001212, kA, 2.00, 1.86, 3.20, 2.61, 04.9, 1.40, 1.00, 3.02, 2.73,
A B C D E F G H I J K
4.32, 3.87, 10.6, 1.42, 1.00, 1.43, 0.75, 1.00 [CR][LF]
L M N O P Q R S

Item	Character string	Content	Range
A	******,	Counter	000000 to 999999
B	**,	Unit of current value kA: Current value in kA	kA
C	*.**,*1	W1: Current 1 peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
D	*.**,*1	W1: Current 1 average value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
E	*.**,	W1: Voltage 1 peak value	0.00 to 9.99[V] ,----*6
F	*.**,	W1: Voltage 1 average value	0.00 to 9.99[V] ,----*6
G	**.*,*1	W1: Power 1 average value	00.0 to 99.9[kW] ,----*6
	****,*2*3		0000 to 0999[kW] ,----*6
H	*.**,	W1: Resistance 1 average value	0.00 to 9.99[mΩ] ,----*6
I	*.**,*4	W1: Weld 1 time (Set time)	0.00 to 9.99[ms]
	**.*,*5		00.0 to 99.9[ms]
J	*.**,*1	W2: Current 2 peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
K	*.**,*1	W2: Current 2 average value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
L	*.**,	W2: Voltage 2 peak value	0.00 to 9.99[V] ,----*6
M	*.**,	W2: Voltage 2 average value	0.00 to 9.99[V] ,----*6
N	**.*,*1	W2: Power 2 average value	00.0 to 99.9[kW] ,----*6
	****,*2*3		0000 to 0999[kW] ,----*6
O	*.**,	W2: Resistance 2 average value	0.00 to 9.99[mΩ] ,----*6

Item	Character string	Content	Range
P	*.**,*4	W2: Weld 2 time (Set time)	0.00 to 9.99[ms]
	**.*,*5		00.0 to 99.9[ms]
Q	*.**,*1	PRECHECK: Current peak value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
R	*.**,*1	PRECHECK: Current average value	0.00 to 9.99[kA] ,----*6
	**.*,*2		00.0 to 99.0[kA] ,----*6
	****,*3		0000 to 0999[kA] ,----*6
S	*.** *4	PRECHECK: Weld time (Set time)	0.00 to 1.00[ms]
	**.* *5		00.0 to 01.0[ms]

*1: When CURRENT RANGE on the STATUS screen is *.**kA.
*2: When CURRENT RANGE on the STATUS screen is **.*kA.
*3: When CURRENT RANGE on the STATUS screen is ***kA.
*4: When WELD TIME on the STATUS screen is NORMAL.
*5: When WELD TIME on the STATUS screen is LONG.
*6: When the value exceeds the display range.

13) Specified code No.: S13 (Output and resetting of fault item)

Data strings: When reading Device No. 01 (Set 000 for Schedule No.)

Host PC -> MD series

#01R000S13[CR][LF]

MD series -> Host PC (in case of one fault)

!01000S13: E06 [CR][LF]
A

MD series -> Host PC (in case of five faults)

!01000S13: E06, E07, E08, E09, E10 [CR][LF]
A A A A A

Item	Character string	Content	Range
A	E**[*1]	Fault code	00 to 20

*1: Up to five fault codes are output. If two or more fault codes exist, the codes are separated with ",". If no fault exists, E00 is output.

14) Range setting and output range of current value and power value

Model No.	Range	Current value			Power value	
		Character string	Range on SCHEDULE screen	Range on other screens	Character string	Range
MD-A10000A Slave: 0	1.00kA	*.**	0.00 to 1.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	2.00kA	*.**	0.00 to 2.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	4.00kA	*.**	0.00 to 4.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	10.0kA	**.*	00.0 to 10.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 1	2.00kA	*.**	0.00 to 2.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	4.00kA	*.**	0.00 to 4.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	8.00kA	*.**	0.00 to 8.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	20.0kA	**.*	00.0 to 20.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 2	3.00kA	*.**	0.00 to 3.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	6.00kA	*.**	0.00 to 6.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	12.0kA	**.*	00.0 to 12.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	30.0kA	**.*	00.0 to 30.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 3	4.00kA	*.**	0.00 to 4.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	8.00kA	*.**	0.00 to 8.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	16.0kA	**.*	00.0 to 16.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	40.0kA	**.*	00.0 to 40.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 4	5.00kA	*.**	0.00 to 5.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	10.0kA	**.*	00.0 to 10.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	20.0kA	**.*	00.0 to 20.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	50.0kA	**.*	00.0 to 50.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 5	6.00kA	*.**	0.00 to 6.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	12.0kA	**.*	00.0 to 12.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	24.0kA	**.*	00.0 to 24.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	60.0kA	**.*	00.0 to 60.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 6	7.00kA	*.**	0.00 to 7.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	14.0kA	**.*	00.0 to 14.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	28.0kA	**.*	00.0 to 28.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	70.0kA	**.*	00.0 to 70.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 7	8.00kA	*.**	0.00 to 8.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	16.0kA	**.*	00.0 to 16.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	32.0kA	**.*	00.0 to 32.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	80.0kA	**.*	00.0 to 80.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 8	9.00kA	*.**	0.00 to 9.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	18.0kA	**.*	00.0 to 18.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	36.0kA	**.*	00.0 to 36.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	90.0kA	**.*	00.0 to 90.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]

Model No.	Range	Current value			Power value	
		Character string	Range on SCHEDULE screen	Range on other screens	Character string	Range
MD-A10000A Slave: 9	10.0kA	**.*	00.0 to 10.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	20.0kA	**.*	00.0 to 20.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	40.0kA	**.*	00.0 to 40.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	100kA	****	0000 to 0100[kA]	0000 to 0999[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 10	11.0kA	**.*	00.0 to 11.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	22.0kA	**.*	00.0 to 22.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	44.0kA	**.*	00.0 to 44.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	110kA	****	0000 to 0110[kA]	0000 to 0999[kA]	****	0000 to 0999[kW]
MD-A10000A Slave: 11	12.0kA	**.*	00.0 to 12.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	24.0kA	**.*	00.0 to 24.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	48.0kA	**.*	00.0 to 48.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]
	120kA	****	0000 to 0120[kA]	0000 to 0999[kA]	****	0000 to 0999[kW]
MD-B5000A Slave: 1	1.00kA	*.**	0.00 to 1.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	2.00kA	*.**	0.00 to 2.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	4.00kA	*.**	0.00 to 4.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	10.0kA	**.*	00.0 to 10.0[kA]	00.0 to 99.9[kA]	****	0000 to 0999[kW]

10. Specifications

(1) Product Specifications

(Items in [ ] can be set for each schedule.)

Power supply	Single-phase, 100 V AC-10% to 120 V AC +10% or 200 V AC-10% to 240 V AC +10% (50/60 Hz) The voltage is cannot be selected. (Fixed on shipment.)	
Control method	Switching control by transistor The basic frequency is 125 kHz, and the frequency is 1/integer of it. Maximum is 125 kHz (frequency is variable automatically).	
Welding current control	Constant-current control method	Controls so that the welding current will be the set current.
	Constant-voltage control method	Controls so that the voltage detected by the V SENS cable attached between electrodes will be the set voltage.
	Combination control of constant-current and constant-voltage	The constant-voltage control method and the constant-current-control method function simultaneously, and priority is given to the control method whichever reaches the set value.
Timer setting	[1-step weld sequence] a. Squeeze : 0000–9999 ms b. Precheck weld : 0.00–1.00 ms [*1] c. Precheck judgment : 2 ms (fixed) [*1] d. Upslope : 0.00–9.99 ms [00.0–99.9 ms] [*2] e. Weld : 0.00–9.99 ms [00.0–99.9 ms] f. Downslope : 0.00–9.99 ms [00.0–99.9 ms] [*2] g. Hold : 000–999 ms	
	[2-step weld sequence] a. Squeeze : 0000–9999 ms b. Precheck weld : 0.00–1.00 ms [*1] c. Precheck judgment : 2 ms (fixed) [*1] d. Upslope 1 : 0.00–9.99 ms [00.0–99.9 ms] [*3] e. Weld 1 : 0.00–9.99 ms [00.0–99.9 ms] f. Downslope 1 : 0.00–9.99 ms [00.0–99.9 ms] [*3] g. Cool : 0.00–9.99 ms [00.0–49.9 ms] h. Upslope 2 : 0.00–9.99 ms [00.0–99.9 ms] [*4] i. Weld 2 : 0.00–9.99 ms [00.0–99.9 ms] j. Downslope 2 : 0.00–9.99 ms [00.0–99.9 ms] [*4] k. Hold : 000–999 ms Set the total time of Weld 1, Cool and Weld 2 to 100 ms or less.	

[*1] This item is not shown on the SCHEDULE screen. A dedicated setting screen is used for setting. The set value is ignored when the precheck function is set to OFF.
[*2] Included in weld time.
[*3] Included in weld 1 time.
[*4] Included in weld 2 time.

(Items in ☐ can be set for each schedule.)

<table>
<tr><td rowspan="15">Current range
(Common to all schedules)</td><td rowspan="14">MD-A10000A</td><td>Master: 1
Slave: 0</td><td>1.00kA/2.00kA/4.00kA/10.0kA</td></tr>
<tr><td>Master: 1
Slave: 1</td><td>2.00kA/4.00kA/8.00kA/20.0kA</td></tr>
<tr><td>Master: 1
Slave: 2</td><td>3.00kA/6.00kA/12.0kA/30.0kA</td></tr>
<tr><td>Master: 1
Slave: 3</td><td>4.00kA/8.00kA/16.0kA/40.0kA</td></tr>
<tr><td>Master: 1
Slave: 4</td><td>5.00kA/10.0kA/20.0kA/50.0kA</td></tr>
<tr><td>Master: 1
Slave: 5</td><td>6.00kA/12.0kA/24.0kA/60.0kA</td></tr>
<tr><td>Master: 1
Slave: 6</td><td>7.00kA/14.0kA/28.0kA/70.0kA</td></tr>
<tr><td>Master: 1
Slave: 7</td><td>8.00kA/16.0kA/32.0kA/80.0kA</td></tr>
<tr><td>Master: 1
Slave: 8</td><td>9.00kA/18.0kA/36.0kA/90.0kA</td></tr>
<tr><td>Master: 1
Slave: 9</td><td>10.0kA/20.0kA/40.0kA/100kA</td></tr>
<tr><td>Master: 1
Slave: 10</td><td>11.0kA/22.0kA/44.0kA/110kA</td></tr>
<tr><td>Master: 1
Slave: 11</td><td>12.0kA/24.0kA/48.0kA/120kA</td></tr>
<tr><td colspan="2">Note) The number of connected devices is fixed on shipment.</td></tr>
<tr><td>MD-B5000A</td><td>Master: 1
Slave: 1</td><td>1.00kA/2.00kA/4.00kA/10.0kA</td></tr>
<tr><td rowspan="3">Current setting range [*5]</td><td colspan="2">MD-A10000A
Master: 1, Slave: 0
・0.00–1.00 kA (0.01kA increment)
・0.00–2.00 kA (0.01kA increment)
・0.00–4.00 kA (0.01kA increment)
・00.0–10.0 kA (0.1kA increment)</td><td>MD-A10000A
Master: 1, Slave: 1
・0.00–2.00 kA (0.01kA increment)
・0.00–4.00 kA (0.01kA increment)
・0.00–8.00 kA (0.01kA increment)
・00.0–20.0 kA (0.1kA increment)</td></tr>
<tr><td colspan="2">MD-A10000A
Master: 1, Slave: 2
・0.00–3.00 kA (0.01kA increment)
・0.00–6.00 kA (0.01kA increment)
・00.0–12.0 kA (0.1kA increment)
・00.0–30.0 kA (0.1kA increment)</td><td>MD-A10000A
Master: 1, Slave: 3
・0.00–4.00 kA (0.01kA increment)
・0.00–8.00 kA (0.01kA increment)
・00.0–16.0 kA (0.1kA increment)
・00.0–40.0 kA (0.1kA increment)</td></tr>
<tr><td colspan="2">MD-A10000A
Master: 1, Slave: 4
・0.00–5.00 kA (0.01kA increment)
・00.0–10.0 kA (0.1kA increment)
・00.0–20.0 kA (0.1kA increment)
・00.0–50.0 kA (0.1kA increment)</td><td>MD-A10000A
Master: 1, Slave: 5
・0.00–6.00 kA (0.01kA increment)
・00.0–12.0 kA (0.1kA increment)
・00.0–24.0 kA (0.1kA increment)
・00.0–60.0 kA (0.1kA increment)</td></tr>
</table>

[*5] The maximum current available for welding depends on the load such as the welding head used.

<table>
<tr><td rowspan="5">Current setting range *5</td><td>MD-A10000A
Master: 1, Slave: 6
・0.00–7.00 kA (0.01kA increment)
・00.0–14.0 kA (0.1kA increment)
・00.0–28.0 kA (0.1kA increment)
・00.0–70.0 kA (0.1kA increment)</td><td>MD-A10000A
Master: 1, Slave: 7
・0.00–8.00 kA (0.01kA increment)
・00.0–16.0 kA (0.1kA increment)
・00.0–32.0 kA (0.1kA increment)
・00.0–80.0 kA (0.1kA increment)</td></tr>
<tr><td>MD-A10000A
Master: 1, Slave: 8
・0.00–9.00 kA (0.01kA increment)
・00.0–18.0 kA (0.1kA increment)
・00.0–36.0 kA (0.1kA increment)
・00.0–90.0 kA (0.1kA increment)</td><td>MD-A10000A
Master: 1, Slave: 9
・00.0–10.0 kA (0.1kA increment)
・00.0–20.0 kA (0.1kA increment)
・00.0–40.0 kA (0.1kA increment)
・000–100 kA (1kA increment)</td></tr>
<tr><td>MD-A10000A
Master: 1, Slave: 10
・00.0–11.0 kA (0.1kA increment)
・00.0–22.0 kA (0.1kA increment)
・00.0–44.0 kA (0.1kA increment)
・000–110 kA (1kA increment)</td><td>MD-A10000A
Master: 1, Slave: 11
・00.0–12.0 kA (0.1kA increment)
・00.0–24.0 kA (0.1kA increment)
・00.0–48.0 kA (0.1kA increment)
・000–120 kA (1kA increment)</td></tr>
<tr><td>MD-B5000A
Master: 1, Slave: 1
・0.00–1.00 kA (0.01kA increment)
・0.00–2.00 kA (0.01kA increment)
・0.00–4.00 kA (0.01kA increment)
・00.0–10.0 kA (0.1kA increment)</td><td></td></tr>
<tr><td colspan="2">0.00–9.99 V (0.01 V increment)</td></tr>
<tr><td>Voltage setting range</td><td colspan="2">0.00–9.99 V (0.01 V increment)</td></tr>
<tr><td>Current setting accuracy</td><td colspan="2">±3% of maximum range (When the specified load used.)</td></tr>
<tr><td>Voltage setting accuracy</td><td colspan="2">±3% of maximum range (When the specified load used. Inductive component not included.)</td></tr>
<tr><td>Repetition speed</td><td colspan="2">Refer to (2) Duty Cycle Graph.</td></tr>
<tr><td rowspan="4">Resistance precheck function</td><td>Voltage setting range</td><td>0.00–9.99 V (0.01 V increment)</td></tr>
<tr><td>Current upper limit setting range</td><td>0.00–9.99 kA, 00.0–99.9 kA, 000–999 kA
(Changes according to the current range.)</td></tr>
<tr><td>Current lower limit setting range</td><td>0.00–9.99 kA, 00.0–99.9 kA, 000–999 kA
(Changes according to the current range.)</td></tr>
<tr><td>Weld time setting range</td><td>0.00–1.00 ms</td></tr>
<tr><td rowspan="3">Monitor value setting</td><td colspan="2">WE1 and WE2 setting range (Average current or peak current)
0.00–9.99 kA, 00.0–99.9 kA, 000–999 kA
(Changes according to the current range.)</td></tr>
<tr><td colspan="2">WE1 and WE2 setting range (Average voltage or peak voltage)
0.00–9.99 V</td></tr>
<tr><td colspan="2">WE1 and WE2 setting range
00.0–99.9 kW, 000–999 kW (Changes according to the current range.)</td></tr>
<tr><td>Charge voltage setting
(Common to all schedules)</td><td colspan="2">30 V (fixed)</td></tr>
</table>

*5 The maximum current available for welding depends on the load such as the welding head used.

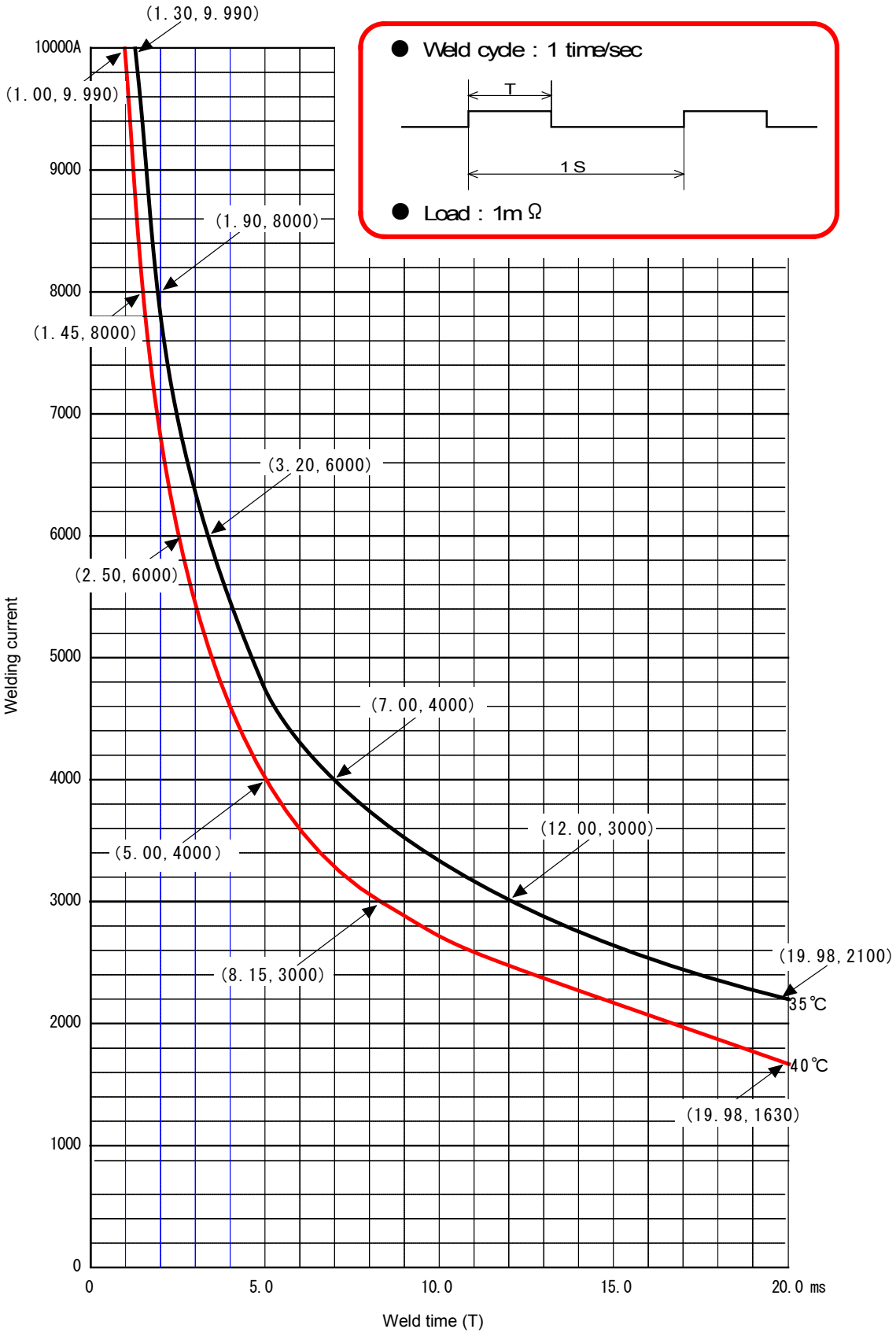
Counter (MONITOR screen)	0–999999 Counts only when the current/voltage monitor judgment is good. (Counting continues even if schedules are changed.)
Self-hold method (Common to all schedules)	Set by **START SIG HOLD** NO HOLD (There is no self-hold.) SQ HOLD (Self-hold from the beginning of SQ) WE HOLD (Self-hold from the beginning of weld)
Schedule select method (Common to all schedules)	Set by **SCHEDULE** EXT.(P) (Selection by binary data with odd-numbered parity) EXT.(NP) (Selection by binary data ignoring the parity bit) PANEL (Selection via panel)
Start signal stabilizing time (Common to all schedules)	Set by **START SIG. TIME** Selected from among 1/5/10/20 ms
End signal and Normal signal output time (Common to all schedules)	Set by **END SIG. TIME** Fixed output during the time set within 10–200 ms (10 ms increment) or output for 10 ms + time during which the start signal is input.
Data write-in (Common to all schedules)	Set by **KEY LOCK** When ON is set, data write-in from the panel is disabled.
Output polarity select [*6] (Common to all schedules)	Set by **POLARITY CHANGE** (2-step welding only) ON: The polarity of WE2 is opposite to that of WE1. OFF: The polarity of WE2 is the same as that of WE1.
Voltage detection response select (Common to all schedules)	Set by **VOLT RESPONSE** Selected from among 1/2/3/4 steps
No current, no voltage neglecting time	Set by **NO CURR MONITOR START** 00.5–99.9 ms
Measured value start time	Set by **MONITOR START TIME** OFF, 00.0–99.9 ms
Battery for counter memory	Lithium battery (CR2450) Lifetime: Approx. 5 years after shipment
Operation environment[*7]	Temperature 5°–40°C and humidity 90% or less (Dew condensation not allowed), altitude 1000 meters or lower
Storage environment	Temperature -10°–55°C and dew condensation not allowed
Power consumption	430 W maximum
Maximum output capacity	891 J
Heat-resistant class	E
Case protection	IP20
Dimensions	Master: 350 (H) x 174 (W) x 636 (D) mm (Projections not included) Slave: 350 (H) x 174 (W) x 614 (D) mm (Projections not included)
Mass	37 kg

[*6] **MD-B5000A** only

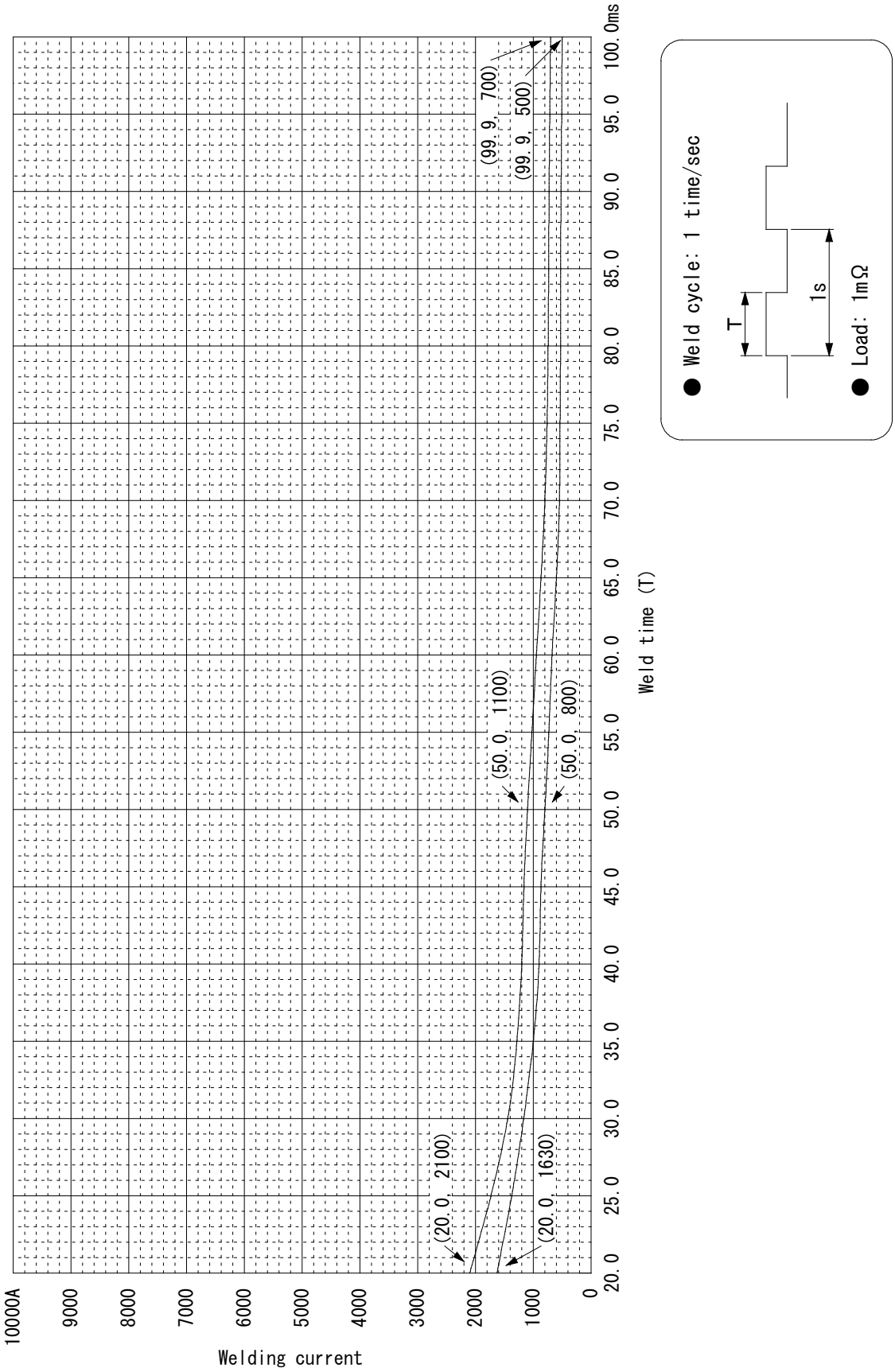
[*7] Use this product in the environment without conductive dust. If conductive dust enters in the product, this may result in a failure, electric shock, or fire. When using this product in this environment, make contact with us.

(2) Duty Cycle Graph

① Weld Time : 0 to 20.0 ms



② Weld Time : 20.0 to 100.0 ms



How to Read the Duty Cycle Graph

Ex.) When performing welding with 6000 A in a temperature of 40°C using 1 master and 1 slave (The number of connected devices: 2)

Divide the current value by the number of devices to calculate the current per device, and then find the weld time referring to the duty cycle graph based on the obtained current value.

Current per device: 6000 A / 2 devices = 3000 A
3000 A/40°C: Weld time: 8.15 ms

Therefore, in the case of above example, the welding up to 8.15 ms per second can be performed.

CAUTION

These are duty cycle graphs in 1 mΩ load. When the load capacity changes, the time to perform welding per second may change, too.

(3) Board List for Maintenance

For repair or replacement, contact us.

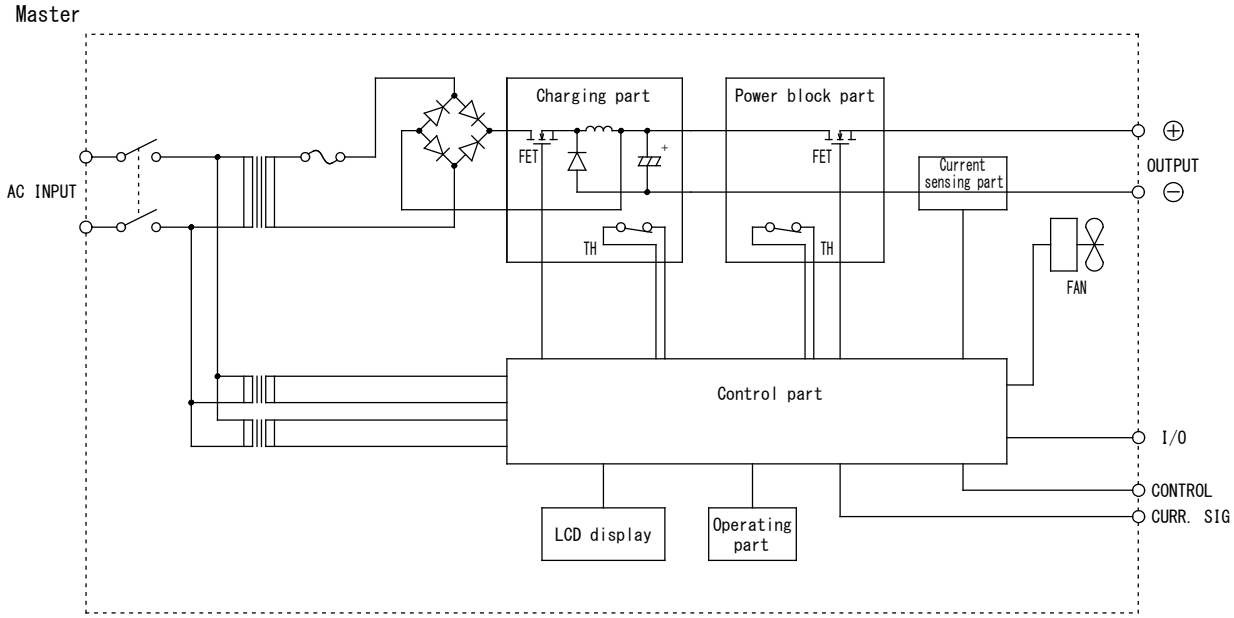
Board	Master	Slave
Main control board	ME-3086-13S1	-
Charge board	ME-1876-00	ME-1876-00
Power block board	ME-3102-00	ME-3102-00
Charge control board	ME-3118-00	ME-3118-01
Relay board	AS1157006	AS1157006

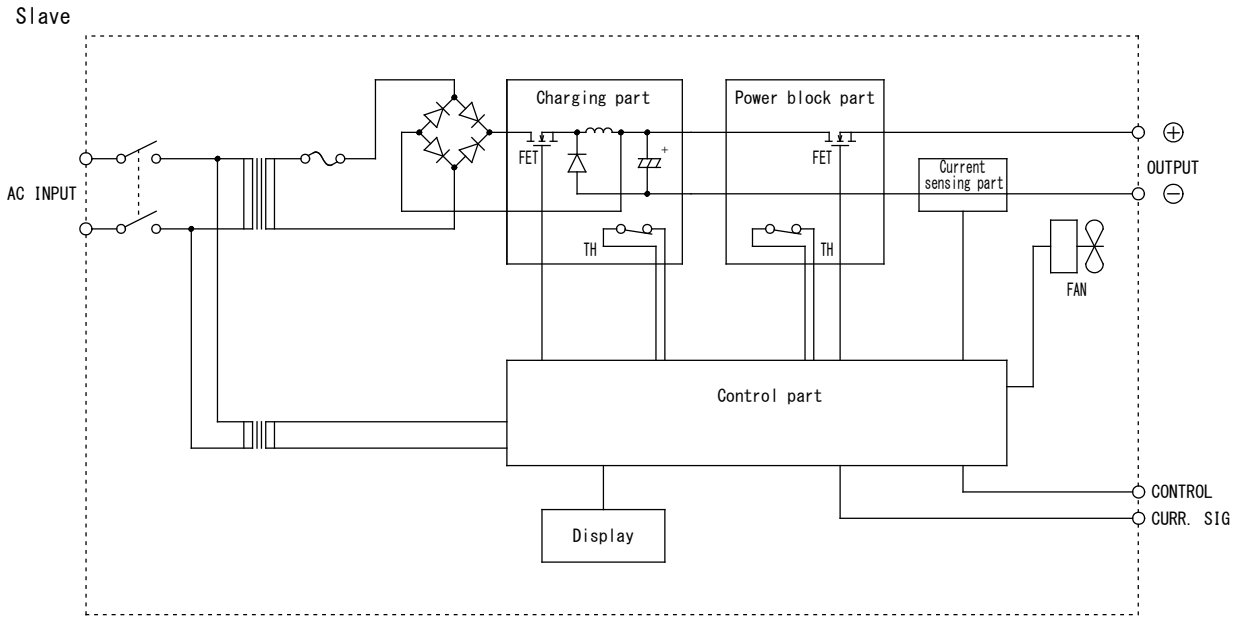
(4) Major Components List

Item	Q'ty	
	Master	Slave
Power transformer	3	2
Fan motor	1	1
Fuse	1	1
Switch	1	1
Thermal protector	21	21
Diode	2	2
FET	200	200

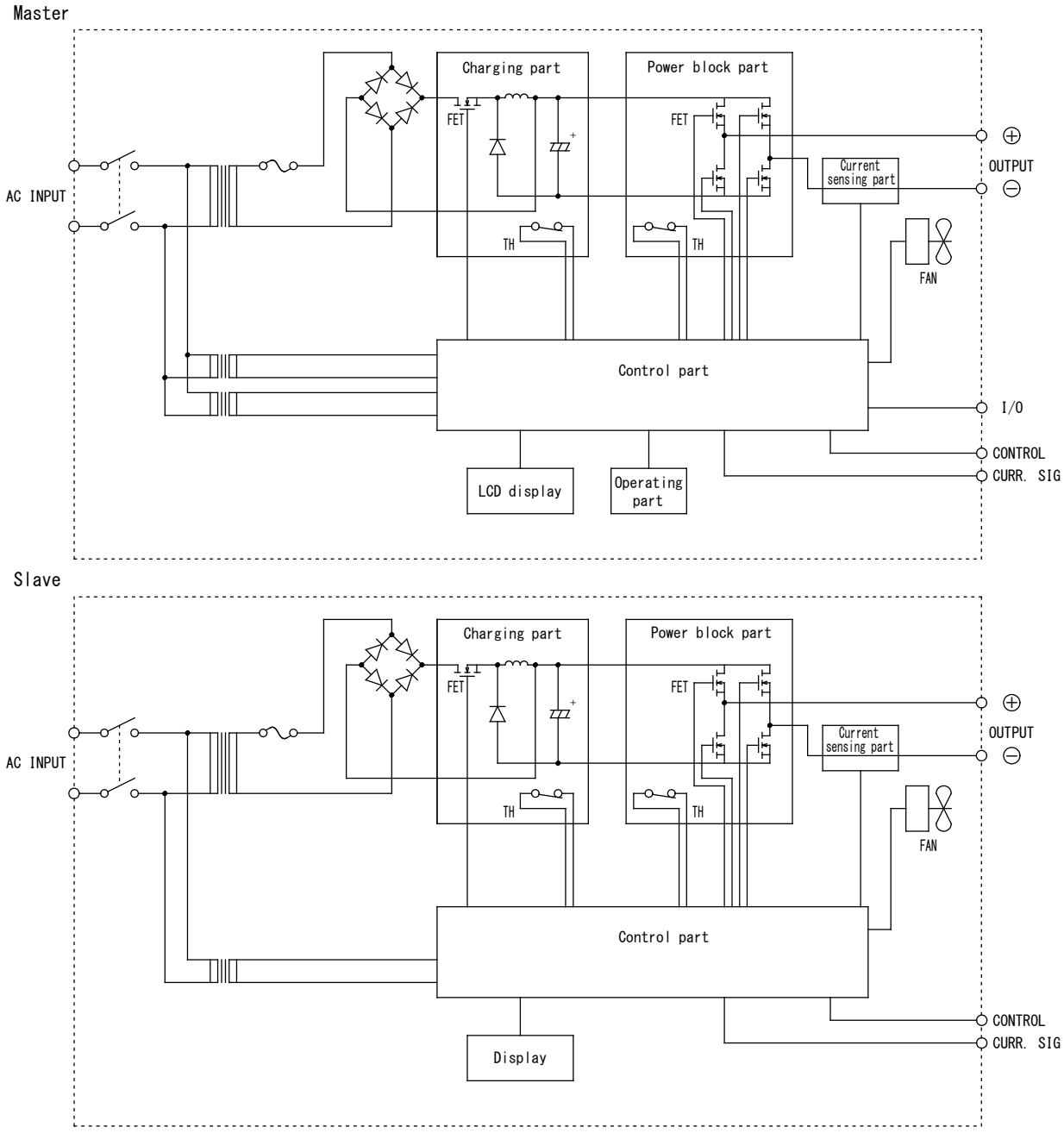
(5) Schematic

① MD-A10000A





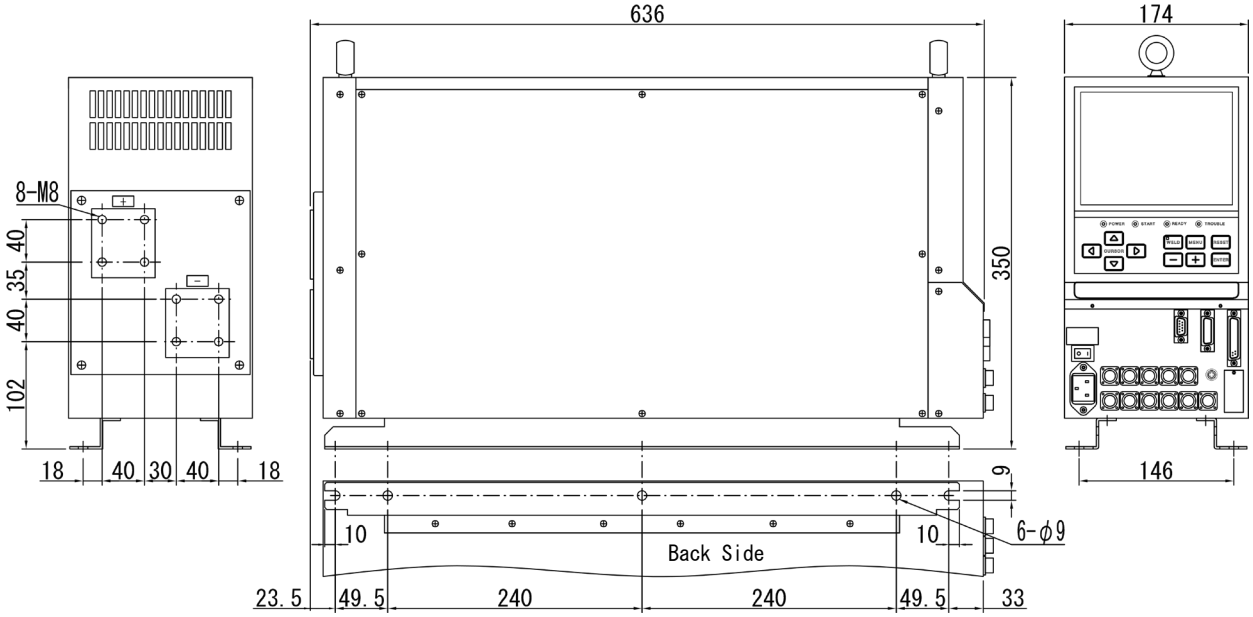
② MD-B5000A


Master
Charging part
Power block part
FET
FET
Current sensing part
OUTPUT
AC INPUT
TH
TH
FAN
Control part
I/O
CONTROL
CURR. SIG
LCD display
Operating part
Slave
Charging part
Power block part
FET
FET
Current sensing part
OUTPUT
AC INPUT
TH
TH
FAN
Control part
CONTROL
CURR. SIG
Display

11. Outline Drawing

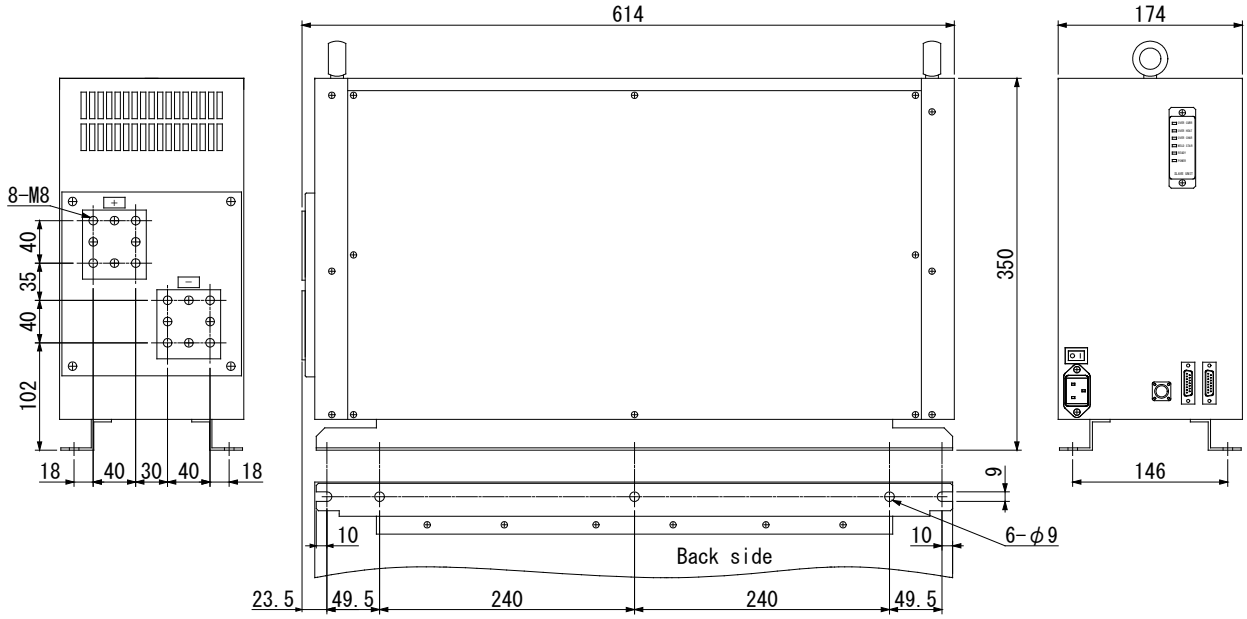
(1) Master

(Dimensions in mm)



(2) Slave

(Dimensions in mm)



12. Schedule Data Table

SCH.#										
SCHEDULE	SQ									
	↗									
	WE1									
	↘									
	COOL									
	↗									
	WE2									
	↘									
	HOLD									
	CURR	WE1								
		WE2								
	VOLT	WE1								
		WE2								
COMPARATOR	CURR WE1	H								
		L								
	CURR WE2	H								
		L								
	CURR AVE/PEAK									
	VOLT WE1	H								
		L								
	VOLT WE2	H								
		L								
	VOLT AVE/PEAK									
	POWER WE1	H								
		L								
	POWER WE2	H								
		L								
PRECHECK	TIME									
	VOLT									
	PEAK	HIGH								
		LOW								
	AVE	HIGH								
		LOW								
	ON/OFF									

STATUS	CHARGE VOLTAGE	
	CURRENT RANGE	
	SCHEDULE MODE	
	CONTROL	
	START SIG. TIME	
	START SIG. HOLD	
	SCHEDULE #	
	END SIG. TIME	
	VOLT RESPONSE	
	KEY LOCK	
	NG SIGNAL TYPE	
	NO CURR MONITOR START	
	MONITOR FIRST TIME	
	WELD TIME	
	POLARITY CHANGE	
COMMUNICATION SETTING	COMMUNICATION CONTROL	
	COMMUNICATION MODE	
	COMMUNICATION UNIT #	
	COMMUNICATION SPEED	
ERROR SETTING	E04:NO CURRENT	
	E05:NO VOLTAGE	
	E06:OUT LIMIT OF CURR	
	E07:OUT LIMIT OF VOLT	
	E08:OUT LIMIT OF POWER	
	E15:PRECHECK ERROR	
	E18:COUNT MEMORY TROUBLE	
	E20:CYCLE TROUBLE	

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