Original instructions

TRANSISTOR WELDING POWER SUPPLY

MD-A4000B-05-□□
MD-A1000B-05-□□
MD-B2000B-05-□□
MD-C2000B-05-□□

EU

OPERATION MANUAL

AMADA®

AA01OM1185329-08

Thank you for purchasing our **MD Series**, Transistor Welding Power Supply.
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.

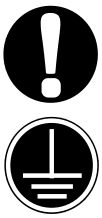
⚠ WARNING

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

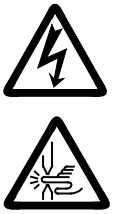
⚠ CAUTION

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, 100–120/200–240VAC 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.

(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.

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

- Do not install this Welding 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 Welding 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 Welding Power Supply, since they can cause a malfunction.

- Operate the Welding 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.

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

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

- The I/O signal line to start the Power Supply is not attached. Prepare the crimp-on terminal and line for wiring to the terminal block.

(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

Model	Power supply voltage	Type
MD-A1000B-05-30	100 – 120V AC	Standard type
MD-A1000B-05-31	200 – 240V AC	
MD-A4000B-05-30	100 – 120V AC	Standard type
MD-A4000B-05-31	200 – 240V AC	
MD-B2000B-05-30	100 – 120V AC	Polarity switching type
MD-B2000B-05-31	200 – 240V AC	
MD-C2000B-05-30	100 – 120V AC	Two-channel type
MD-C2000B-05-31	200 – 240V AC	

2. Features

MD-A1000B, **MD-A4000B**, **MD-B2000B**, and **MD-C2000B** 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-A1000B/A4000B: Standard type

MD-B2000B: Polarity switching type

MD-C2000B: Two-channel type

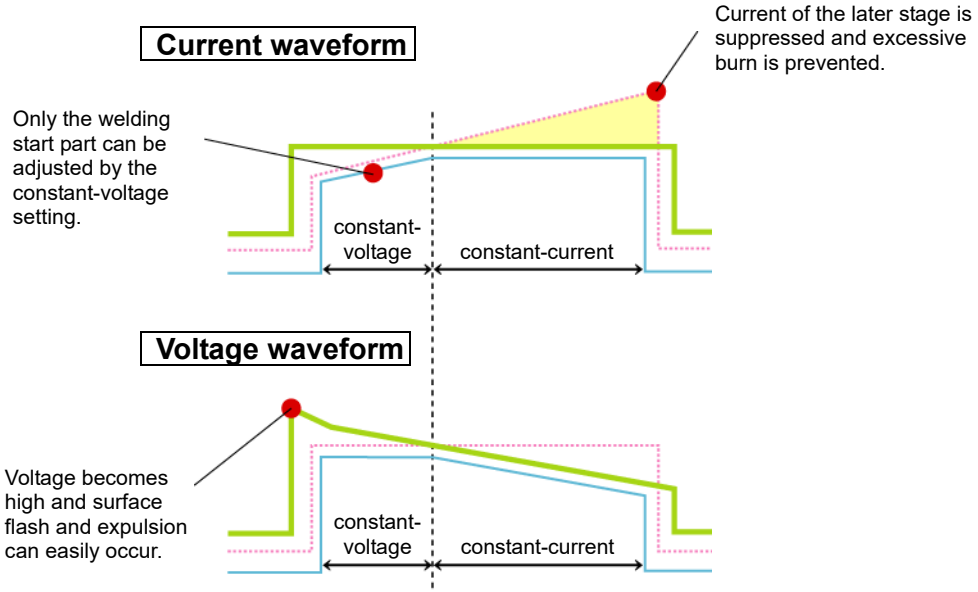
■ The switching method adopted for welding current control permits the small model to achieve high output and high efficiency.

■ 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.

3. Packaging

(1) Accessories

Item	Model No.	Q'ty
Operation manual	AS1185841(OM1185328,OM1185329)	1

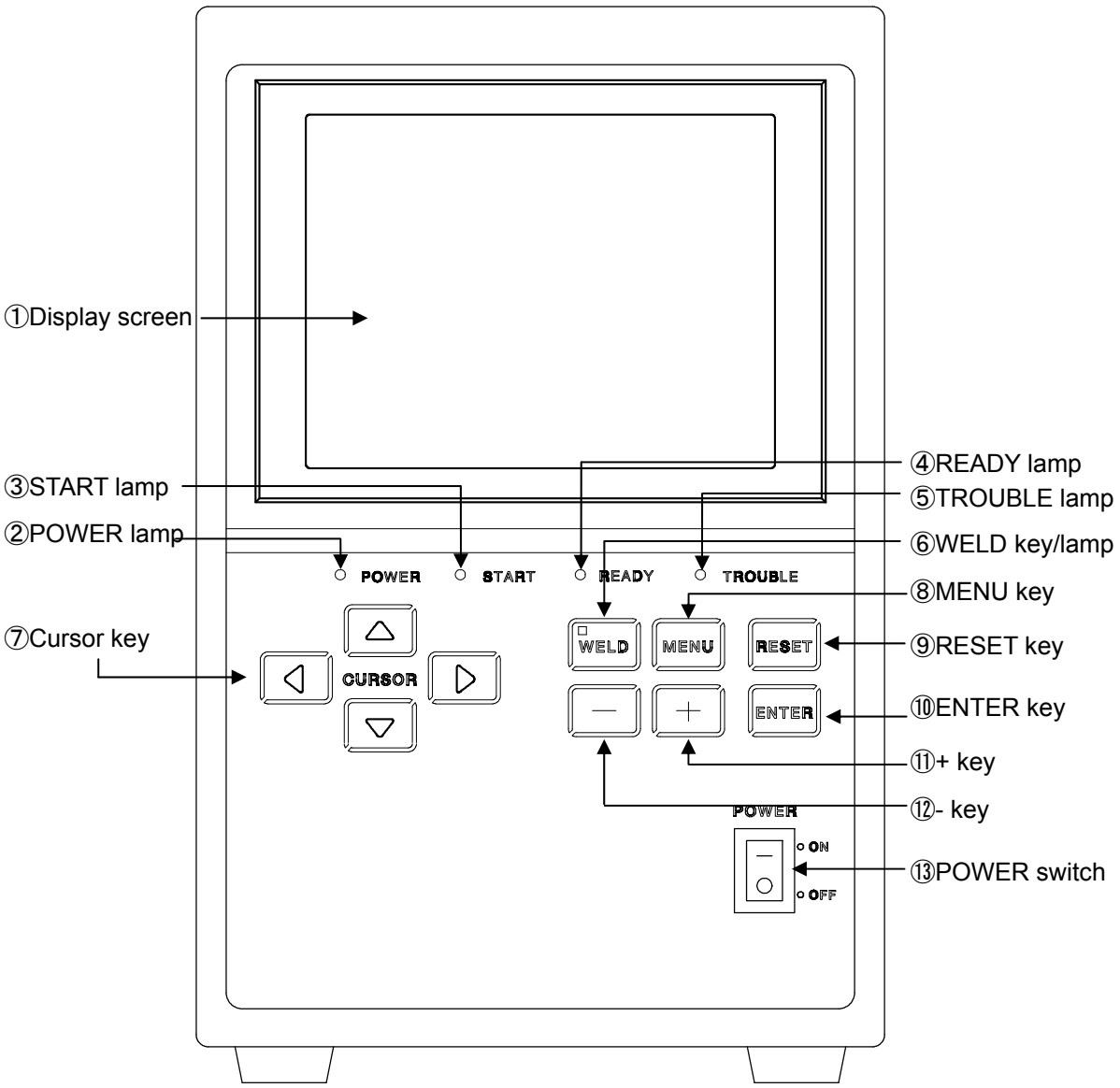
(2) Options

Item		Model No.
Power cable*1	100 to 120V AC	KP-35 KS-16A SVT#18 x 3 B-TYPE (3-pin plug)
	200V AC	KP244 VCTF3*1.25 KS16D 3m gray (for Japan)
	200 to 240V AC	CEE3P-W-1.8 (Round-shaped plug)
3 pin – 2 pin conversion adapter for power cable*1	100 to 120V AC	KPR-24(SB)-B
START cable	1m	A-03081-001
	3m	A-03081-002
V SENS cable	1m-long, Crimp-on terminal on head side: M6	A-03082-001
	3m-long, Crimp-on terminal on head side: M6	A-03082-002
	1m-long, Crimp-on terminal on head side: M3	A-03082-003
	3m-long, Crimp-on terminal on head side: M3	A-03082-004
Secondary cable		Various types are available. Contact us.
RS-485 connector kit (Connector-mounting screw, Screw (in mm))		L-04742-002

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

4. Name and Functions of Each Section

(1) Front Panel



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

② POWER lamp
Comes on when the POWER switch is turned on, the power is supplied, and the equipment functions normally.

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

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 WELD ON/OFF terminal of the control signal terminal strip on the rear panel 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.
To turn ON and OFF the WELD key, hold it down for approx. 1 second.

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.

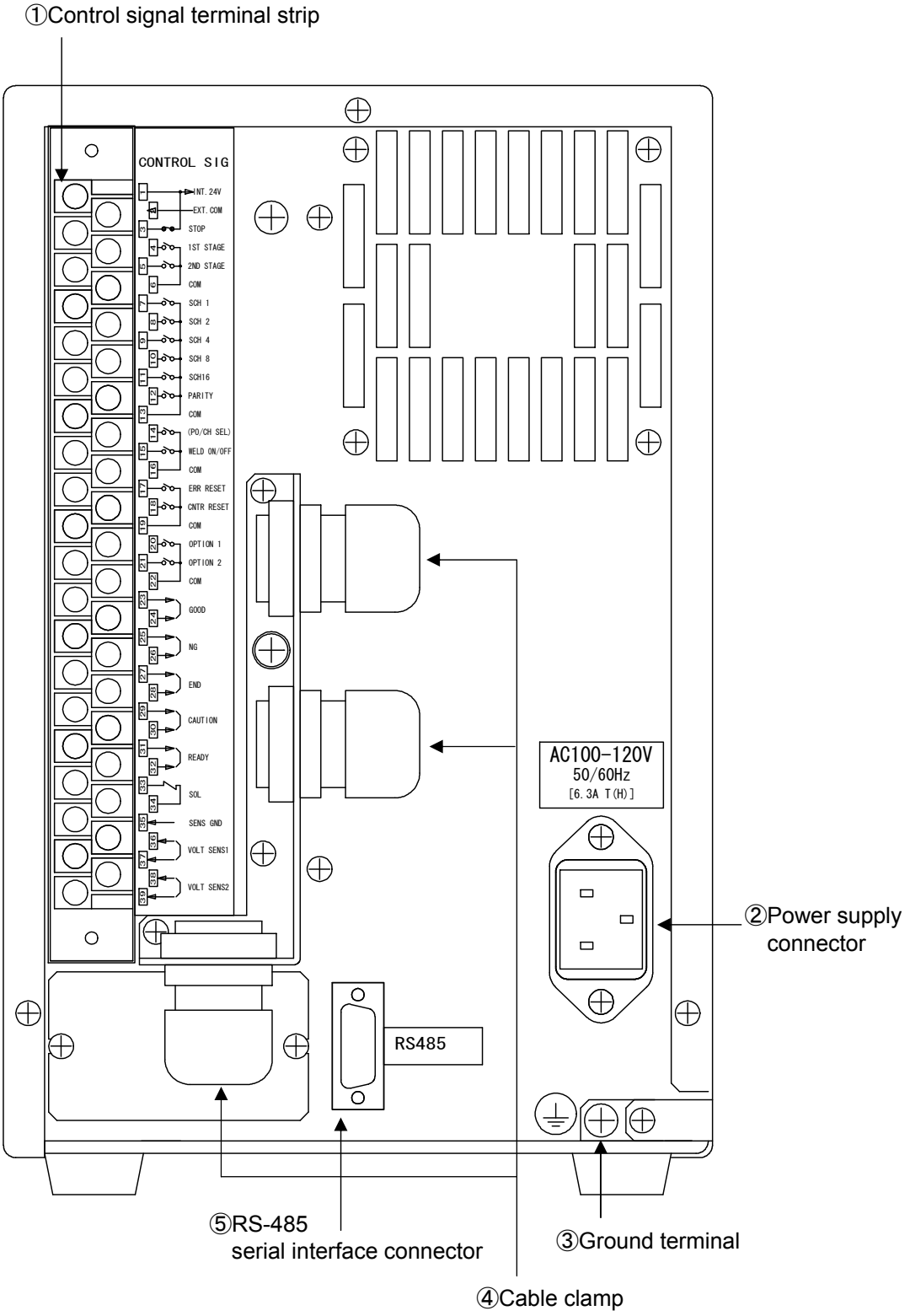
⑩ ENTER key
Used to determine the set values and selected items. Press this key for each item to determine the changed contents.

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.

(2) Rear Panel


①Control signal terminal strip
CONTROL SIG
INT. 24V
EXT. COM
STOP
1ST STAGE
2ND STAGE
COM
SCH 1
SCH 2
SCH 4
SCH 8
SCH16
PARITY
COM
(PO/CH SEL)
WELD ON/OFF
COM
ERR RESET
CNTR RESET
COM
OPTION 1
OPTION 2
COM
GOOD
NG
END
CAUTION
READY
SOL
SENS GND
VOLT SENS1
VOLT SENS2
AC100-120V
50/60Hz
[6.3A T(H)]
②Power supply connector
RS485
⑤RS-485 serial interface connector
③Ground terminal
④Cable clamp

① Control signal terminal strip

Terminal No.	Description
1	**[INT.24V] terminal** 24 V DC is output. Connect Terminal 1 to Terminal 2 to use a contact or NPN transistor (open collector) as input signals (for starting and schedule selection). CAUTION Use Terminal 1 only for connection to Terminal 2 or Terminal 3. Connection to other terminals will result in equipment failure.
2	**[EXT.COM] terminal** Connect Terminal 2 to Terminal 1 to use an NPN transistor. This terminal is used as a COM terminal when a PNP transistor is used. (Refer to **5. Connection**.)
3	**[STOP] terminal** In most cases, connect Terminal 3 to Terminal 1. When this terminal is opened, an operation stop error is displayed and operation stops. Open this terminal to stop the sequence in the middle of operation when using the start function with self-holding. CAUTION This terminal does not have the emergency stop function. When emergency stop is necessary, install a circuit that breaks power supply to the equipment.
4	**[1st.STAGE] terminal** 1st.STAGE start input terminal. Set START SIG. INPUT on the STATUS screen before using this terminal. (Refer to **6.(6) ⑲START SIG. INPUT**.) To start the weld sequence with the combination of the [1st.STAGE] and [2nd.STAGE] terminals, set START SIG. INPUT to 1ST+2ND. **[When START SIG. INPUT is 1ST+2ND]** Close this terminal, and 24 V DC is output from the [SOL] terminal of Terminals 33 and 34. When the [1st.STAGE] terminal is opened in this state, the weld force is released. Since the weld sequence will not be started, the compression position can be adjusted or checked. When the [2nd.STAGE] is closed with the [1st.STAGE] terminal closed, the weld sequence starts and welding at an optimal position is possible. When the [1st.STAGE] terminal is open, the weld sequence does not start even if the [2nd.STAGE] terminal is closed. **[When START SIG. INPUT is 2ND]** The weld sequence does not start even if the 1st.STAGE terminal is closed. To use the [1st.STAGE] terminal, set START SIG.INPUT to 1ST+2ND.

<table>
<tr><th>Terminal No.</th><th colspan="3">Description</th></tr>
<tr><td>5</td><td colspan="3">[2nd.STAGE] terminal
2nd.STAGE start input terminal.
Set START SIG. INPUT on the STATUS screen before using this terminal. (Refer to 6.(6) ⑲START SIG. INPUT.)
To start the weld sequence with the [2nd.STAGE] terminal, set START SIG. INPUT to 2ND.
To start the weld sequence with the combination of the [1st.STAGE] and the [2nd.STAGE] terminals, set START SIG. INPUT to 1ST+2ND.
[When START SIG. INPUT is 1ST+2ND]
When the [2nd.STAGE] terminals is closed with [1st.STAGE] terminal closed, the weld sequence is started in the usual manner.
When the [1st.STAGE] terminal is open, the weld sequence does not start even if the [2nd.STAGE] terminal is closed.
[When START SIG. INPUT is 2ND]
When the [2nd.STAGE] terminal is closed, 24 V DC is output from the [SOL] terminal of Terminals 33 and 34, the weld force is applied, and the weld sequence starts.</td></tr>
<tr><td>6.13.
19.22</td><td colspan="3">[COM] terminals
[COM] terminals to use a contact or NPN transistor.</td></tr>
<tr><td>7</td><td rowspan="5">Schedule-select terminals</td><td rowspan="5">SCH 1
SCH 2
SCH 4
SCH 8
SCH 16</td><td rowspan="5">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 terminals. (Refer to Table of schedule Nos. and corresponding schedule-select terminals.)</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td><td colspan="3">[PARITY] terminal
Functions when the external schedule select with parity is selected. (Refer to 6.(6) ⑦SCHEDULE.)
This terminal 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] terminal. [The number of closed circuits is 1.]
"When setting 6 for schedule No."
Close SCH2 and 4, and close the [PARITY] terminal. [The number of closed circuits is 3.]</td></tr>
<tr><td>14</td><td colspan="3">[PO/CH SEL] terminal
Input terminal for output changeover selection.
(This function is provided only for MD-B2000B and MD-C2000B.)<table><tr><td>MD-B2000B</td><td>The direction of the welding current flow when the circuit is open is opposite to that when the circuit is closed. (Refer to 5.(4) ⑤Operation of MD-B2000B.)</td></tr><tr><td>MD-C2000B</td><td>Open circuit: Select output channel 1.
Closed circuit: Select output channel 2.</td></tr></table></td></tr>
</table>

Terminal No.	Description
15	**[WELD ON/OFF] terminal** When this terminal is opened, the flow of welding current is not allowed when the weld sequence is started. Use this terminal to tentatively activate the equipment.
17	**[ERR RESET] terminal** 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 inputs ([1st.STAGE] and [2nd.STAGE] terminals) opened.
18	**[CNTR RESET] terminal** Closes the circuit to reset the counter.
20.21	**[OPTION] terminals** Reserve input terminals. (Keep these terminals open without connecting, otherwise the equipment may be damaged.)
23.24	**[GOOD] terminals** Normal signal output terminal. 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.)
25.26	**[NG] terminals** Fault signal output terminals. 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.)
27.28	**[END] terminals** End signal output terminals. 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.)
29.30	**[CAUTION] output terminals** Caution signal output terminals. If a fault occurs in items that are set in the ON position for ERROR SETTING (Refer to **6.(6) ㉒ERROR 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.)

Terminal No.	Description
31.32	**[READY] terminals** Ready signal output terminals. 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.)
33.34	**[SOL] terminals** 24 V DC output terminals for driving solenoid valve. Terminal 33 is [+] and Terminal 34 is [-]. The current-carrying capacity is 0.2 A. Drives solenoid valves of up to 24 V DC, 5 W.
35	**[SENS GUARD] terminal** Shielded wire connection terminal for the V SENS cable. Connected to the chassis inside.
36.37	**[V-SENS 1] terminals** Connection terminals for the V SENS cable. There is no polarity. For **MD-C2000B**, the terminals are V SENS cable connection terminals for channel 1. When the V SENS cable is not connected in the constant-current control, short on Terminals 36 and 37.
38.39	**[V-SENS 2] terminals** These terminals function in **MD-C2000B** only. V SENS cable connection terminals for channel 2. When the V SENS cable is not connected in the constant-current control, short on Terminals 38 and 39.

Table of schedule Nos. and corresponding schedule-select terminals
(●: 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	●	●	●	●	●	○

NB: Schedule 1 is selected when all schedule-select terminals are open.

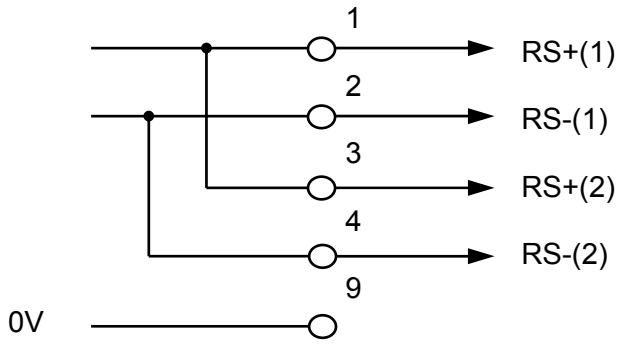
② Power supply connector
Connects the power cable (option).

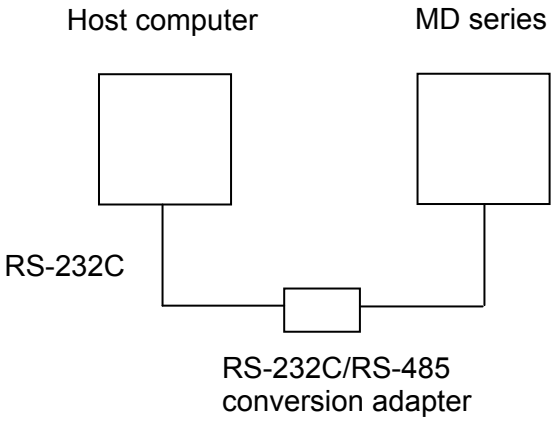
③ Ground terminal
Use this terminal for grounding when the ground wire of the power cable (option) is not used.

④ Cable clamp
Cable clamp for passing through the control signal cable.

⑤ RS-485 serial interface connector

D-Sub connector 9-pin (female)



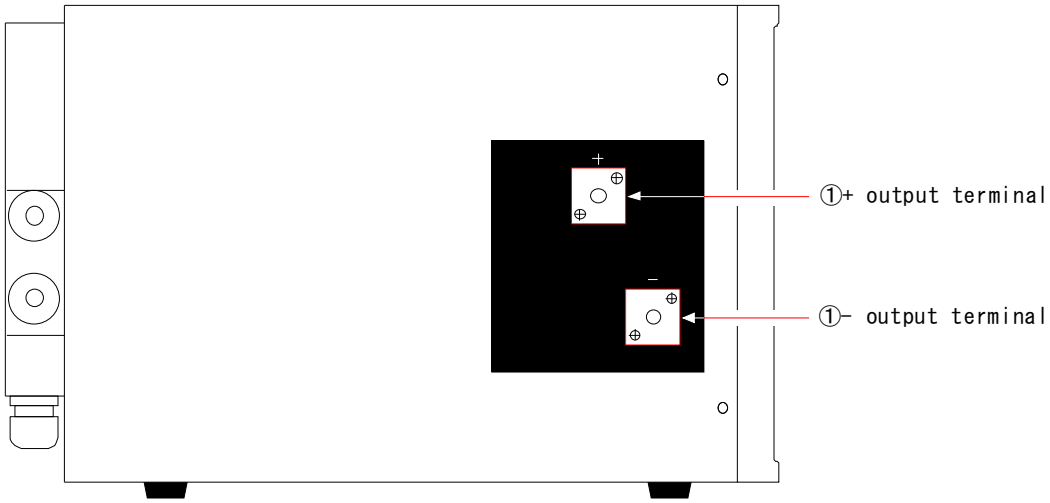


Note 1) Only a device can be connected.
Note 2) The RS-232C/RS-485 conversion adapter is not included in the accessories.

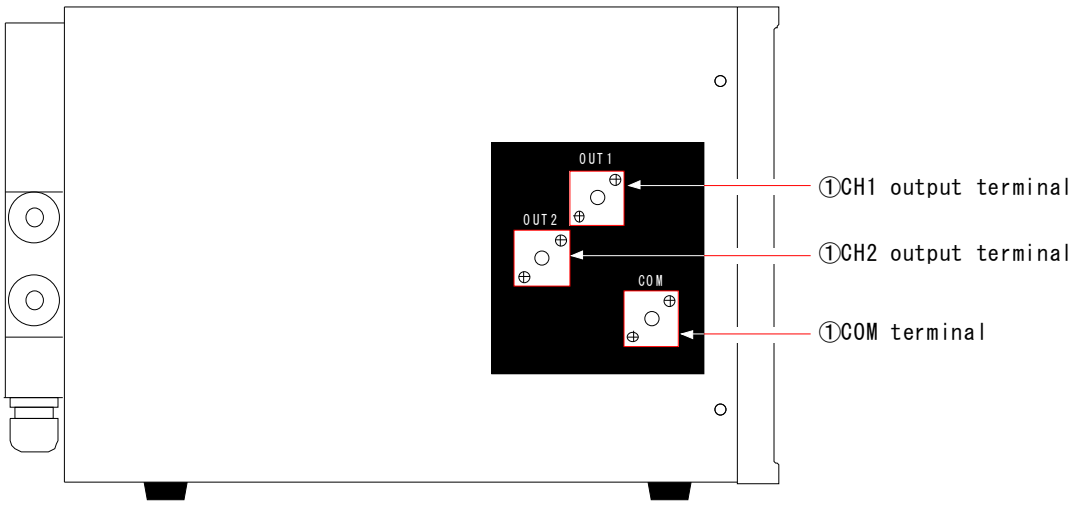
(3) Side Panel

The welding current output terminal is on the left side when viewed from the front.

MD-A1000B / A4000B / B2000B



MD-C2000B



① +/- output terminals, CH1/CH2 output terminals, and COM terminal

Output terminals for the welding current.

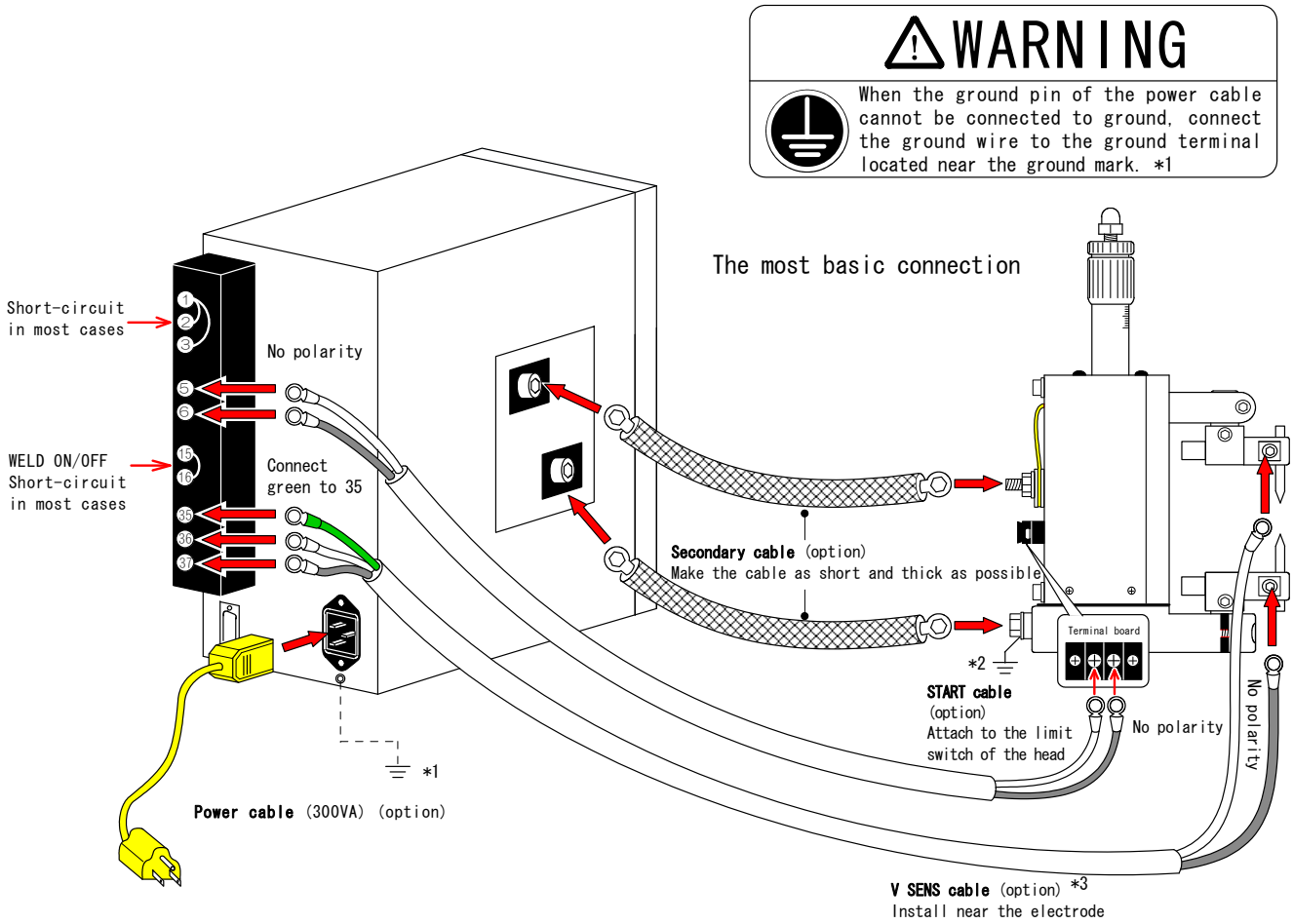
Note) Since these output terminals are for the welding current, do not input the external voltage.

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

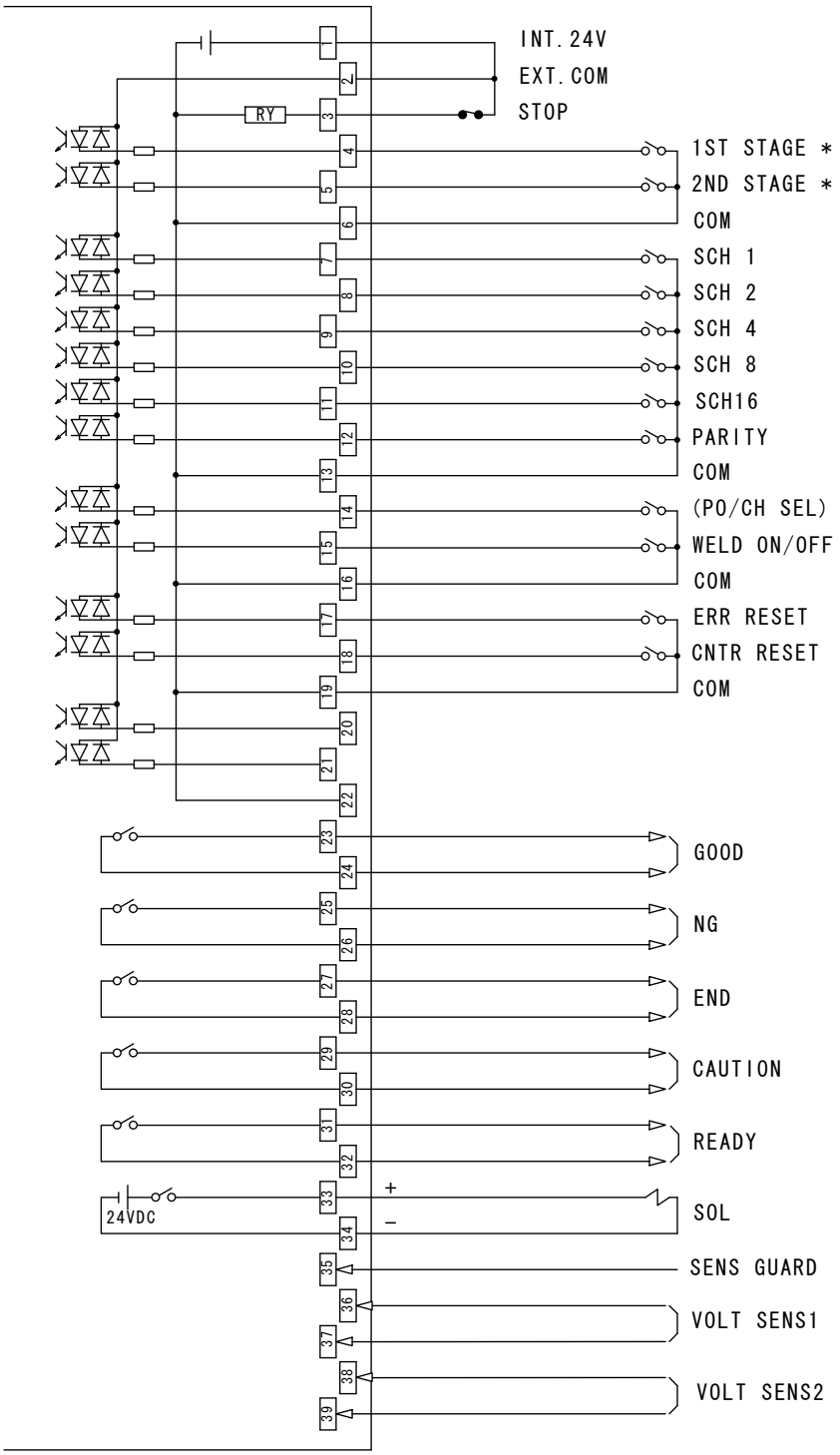
(1) Basic Connection



*2 For safety, be sure to connect one side of the output terminal of the power supply to ground.

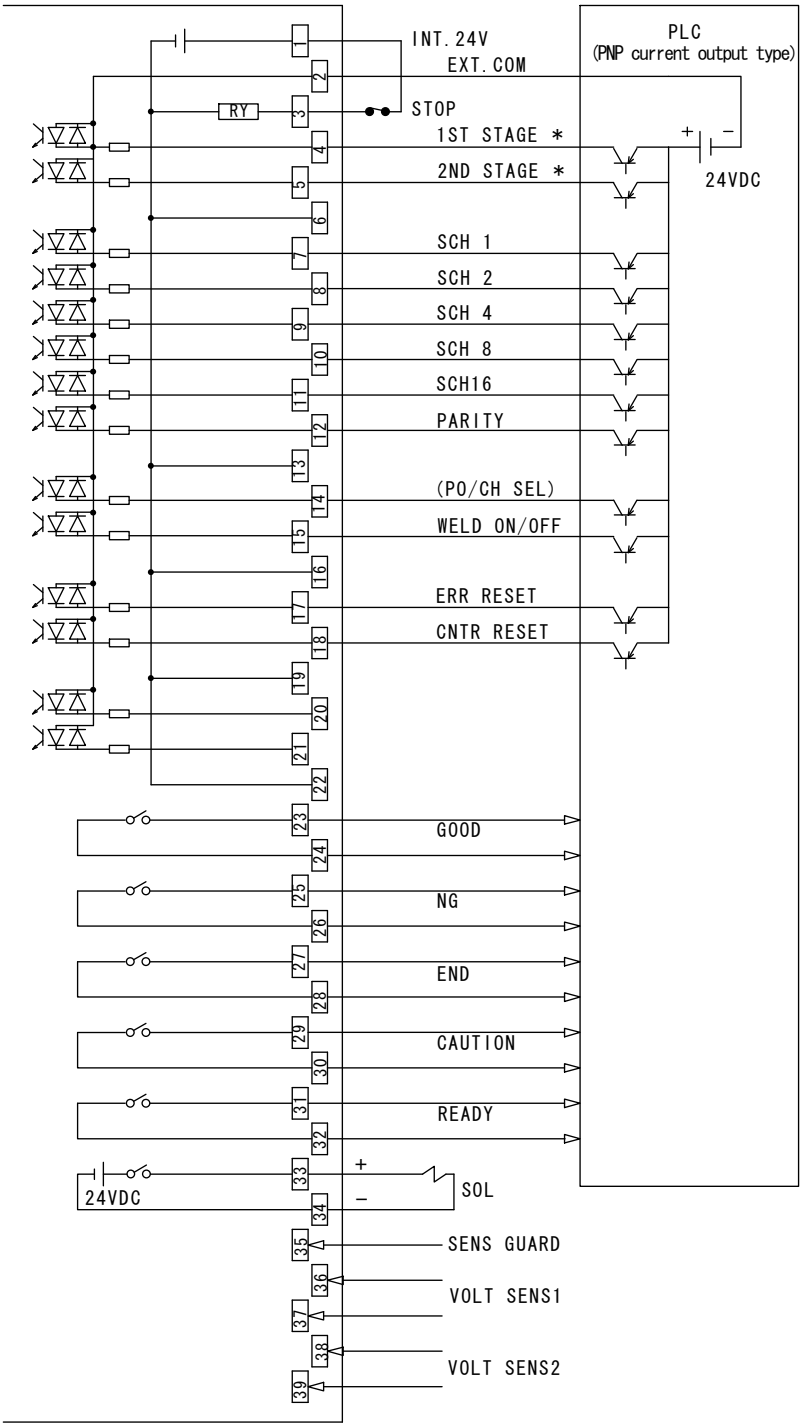
*3 Connect the [V SENS] cable though the equipment can be operated without it in the constant-current control.
If not, refer to **4. (2) ①Control signal terminal strip**.
Be sure to connect it in the constant-voltage control or the combination control of constant-current and constant-voltage.

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



* Set START SIG.INPUT on the STATUS screen before using these terminals (Refer to 6.(6)⑲START SIG.INPUT.)
To start the weld sequence with the 2nd.STAGE terminal, set START SIG.INPUT to 2ND. To start the weld sequence with the combination of the 1st.STAGE and the 2nd.STAGE terminals, set START SIG.INPUT to 1ST+2ND.

(3) Connecting PNP (Source) Transistors



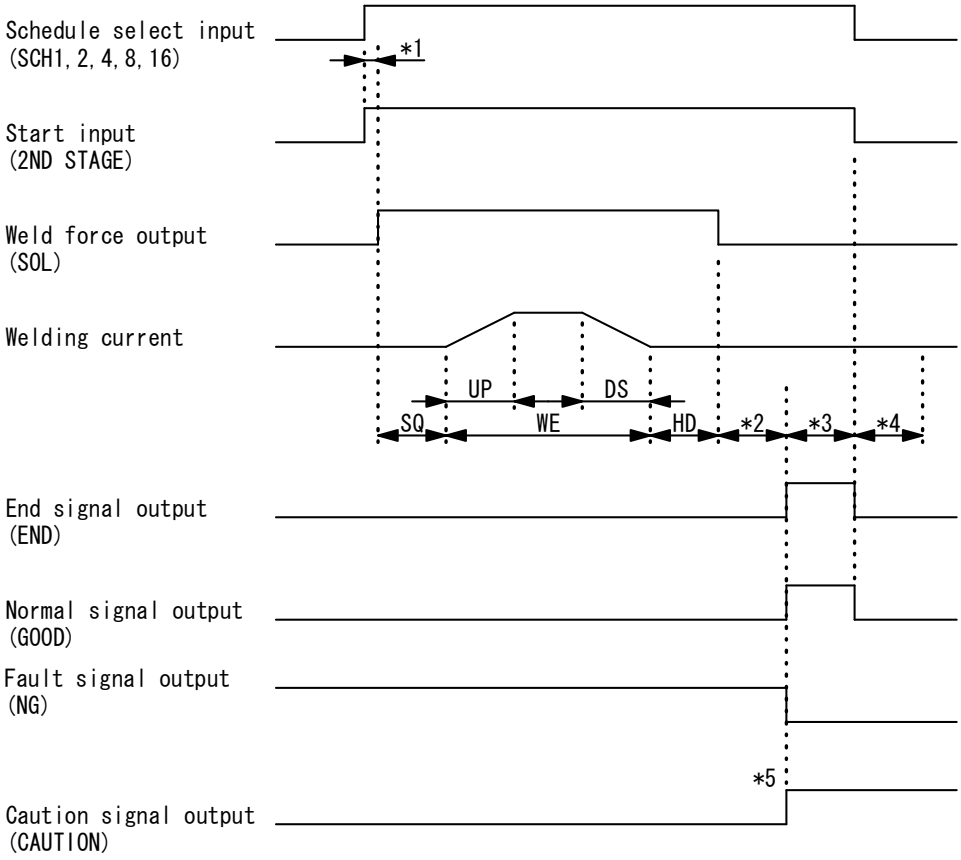
* Set START SIG.INPUT on the STATUS screen before using these terminals (Refer to 6.(6)⑲START SIG.INPUT.)
To start the weld sequence with the 2nd.STAGE terminal, set START SIG.INPUT to 2ND. To start the weld sequence with the combination of the 1st.STAGE and the 2nd.STAGE terminals, set START SIG.INPUT to 1ST+2ND.

(4) Timing Chart

① Basic weld cycle sequence (Common to MD series)

● **Standard starting**

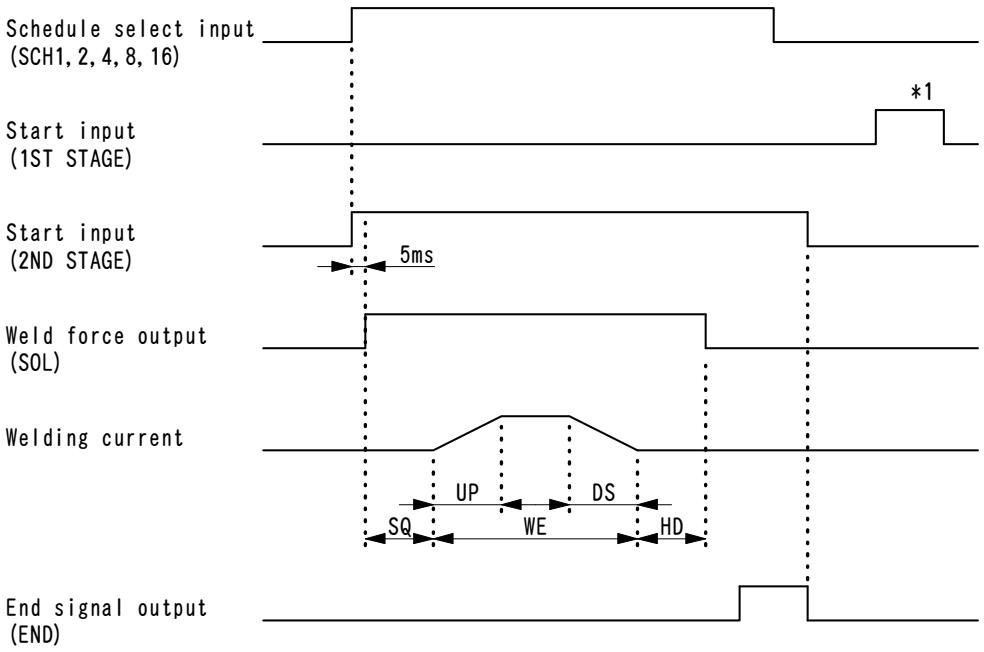
(When SCHEDULE MODE on the STATUS screen is set to SINGLE and START SIG. INPUT on the STATUS screen is set to 2ND)



Remarks SQ: Squeeze time UP: Upslope time WE: Weld time
DS: Downslope time HD: Hold time

*1: Time of schedule-select and start signals, and holding (Refer to ② On the schedule-select and start signals.)
*2: Monitor calculation time (10 ms)
*3: End signal output time (Refer to ③ On the end signal output time.)
*4: Screen display time, communication time (Refer to ④ On the screen display time and communication time.)
*5: Normal, fault, and caution signals: When the monitor value is within the setting range, a normal signal is output. When the monitor value is outside the range or a fault occurs, a fault or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

● **2nd.STAGE only,**
Weld force output and weld sequence operation by start input
(When SCHEDULE MODE on the STATUS screen is set to SINGLE and START SIG. INPUT on the STATUS screen is set to 2ND)

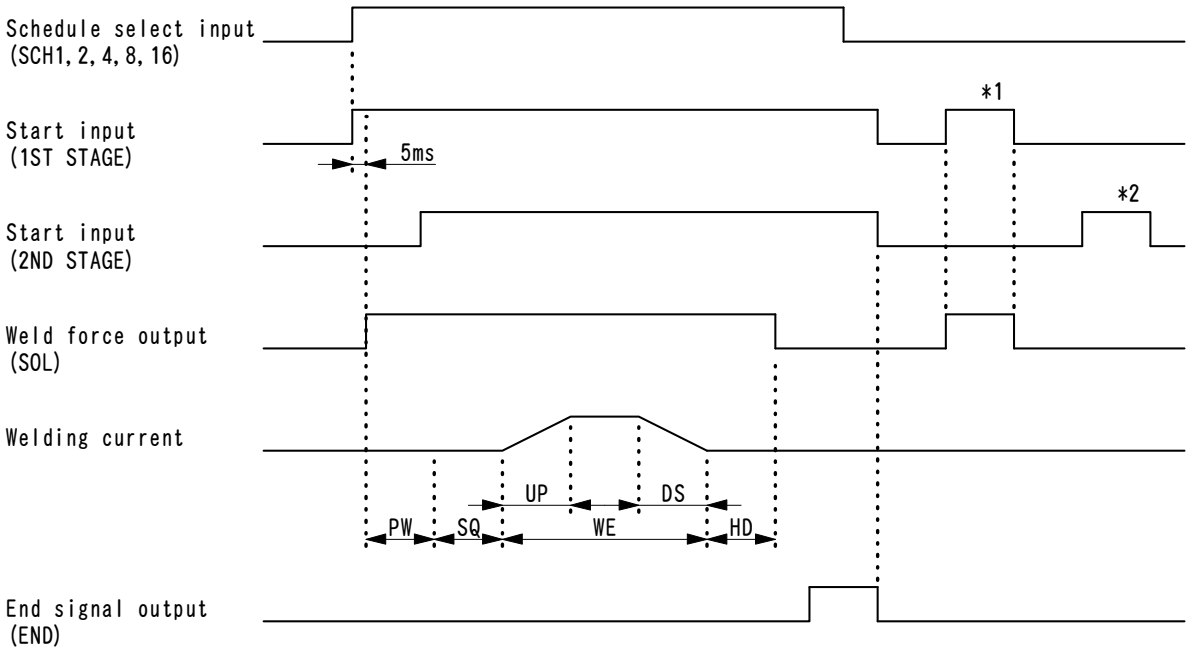


Remarks SQ: Squeeze time UP: Upslope time WE: Weld time
DS: Downslope time HD: Hold time

*1: The weld sequence does not start even if the 1st.STAGE terminal is closed.

The timing of start input (2ND STAGE), end signal, etc. is the same as that of the standard starting.

- **Combination of 1st.STAGE and 2nd.STAGE,**
  Starting by simultaneous use of weld force output and weld force limit switch
  (When SCHEDULE MODE on the STATUS screen is set to SINGLE and START SIG. INPUT on the STATUS screen is set to 1ST+2ND)



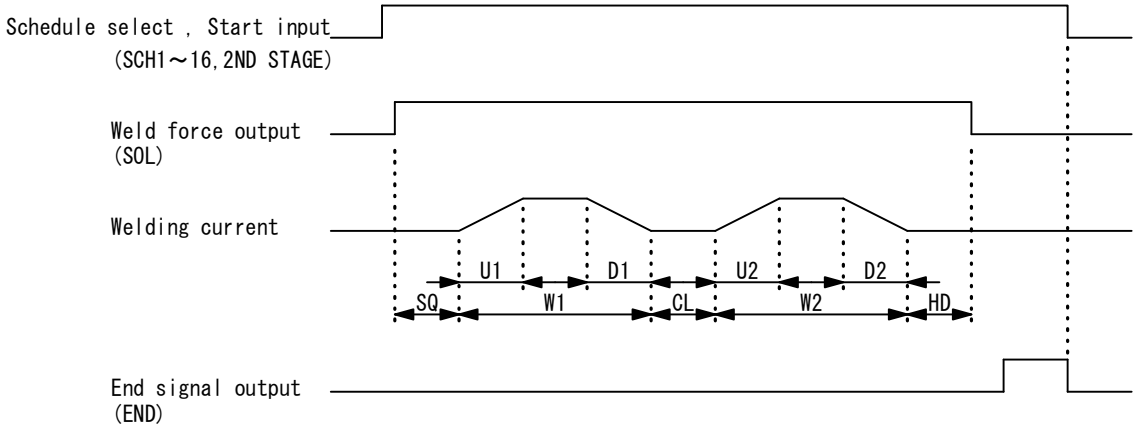
Remarks PW: Weld force limit switch waiting time
SQ: Squeeze time UP: Upslope time WE: Weld time
DS: Downslope time HD: Hold time

*1: Close the 1st.STAGE terminal, and 24 V DC is output from the SOL terminal of Terminals 33 and 34.
When the 1st.STAGE terminal is opened in this state, the weld force is released.

*2: When the 1st.STAGE terminal is open, the weld sequence does not start even if the 2nd.STAGE terminal is closed.

The timing of start input (2ND STAGE), end signal, etc. is the same as that of the standard starting.

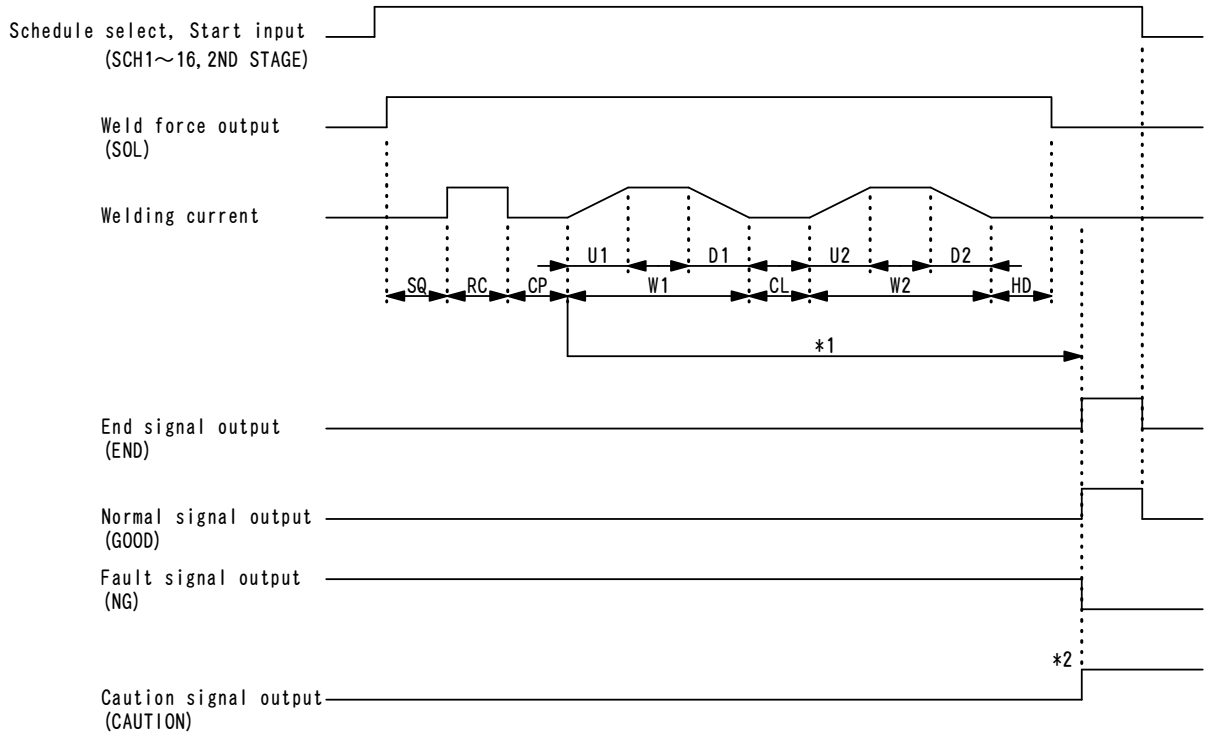
● **Starting when 2-step welding is selected**
(When SCHEDULE MODE on the STATUS screen is set to DOUBLE and START SIG. INPUT on the STATUS screen is set to 2ND)



Remarks
SQ: Squeeze time
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

The timing of schedule select, start input, end signal, etc. is the same as that of the standard starting.

● **Starting when precheck and 2-step welding are selected**
(When SCHEDULE MODE on the STATUS screen is set to DOUBLE and START SIG. INPUT on the STATUS screen is set to 2ND)



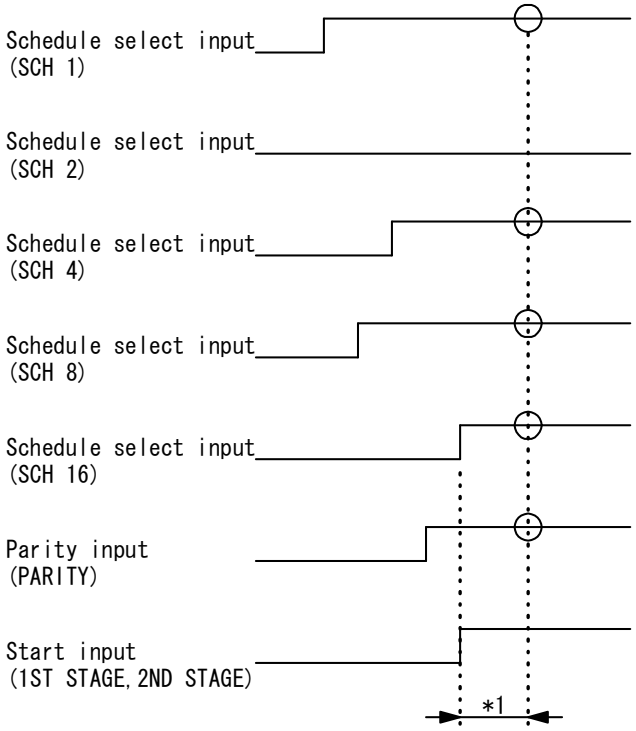
Remarks SQ: Squeeze time RC: Resistance precheck time
CP: Resistance judging time (2 ms) U1: Upslope 1 time
W1: Weld 1 time D1: Downslope 1 time
CL: Cool time U2: Upslope 2 time W2: Weld 2 time
D2: Downslope 2 time HD: Hold time

*1: Welding is not performed in W1 and W2 when a fault or caution occurs in precheck welding.
*2: Normal, fault, and caution signals: When the monitor value is within the setting range, a normal signal is output. When the monitor value is outside the range or a fault occurs, a fault or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

The timing of schedule select, start input, end signal, etc. is the same as that of the standard starting.

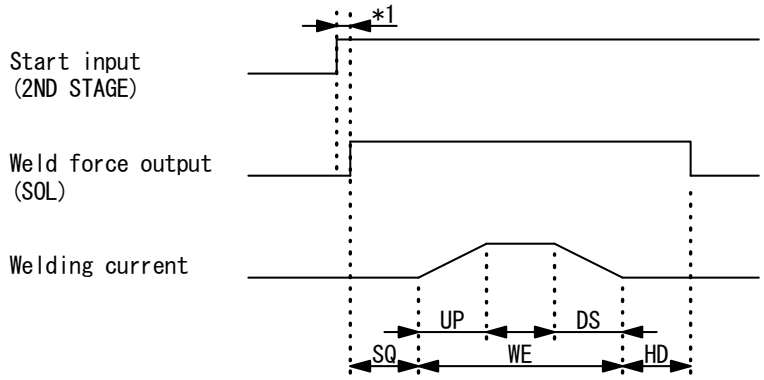
② On the schedule-select and start signals (Common to MD series)

● Selection of welding schedule



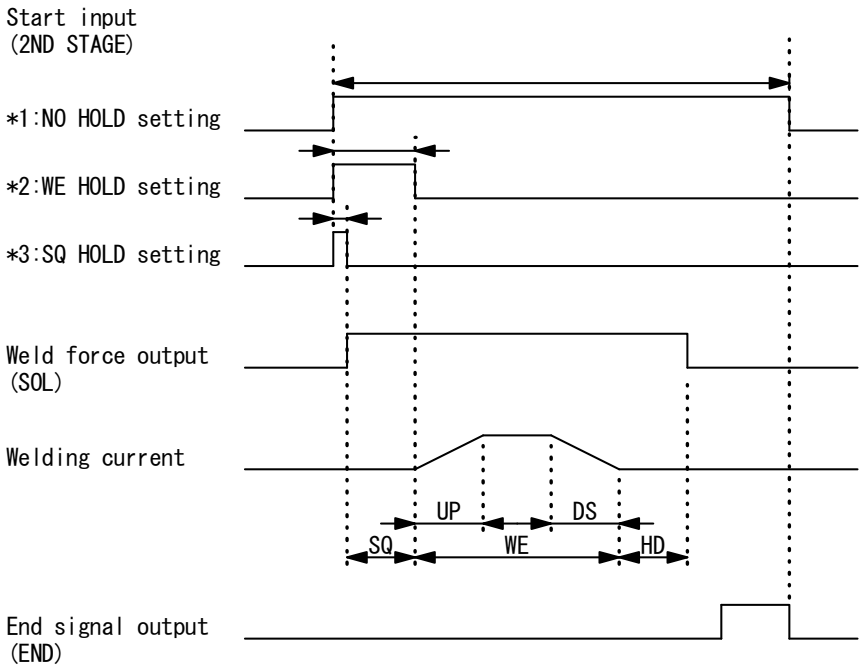
*1: The welding schedule is decided after the start signal is input and the time set for START SIG.TIME on the STATUS screen goes by.
In the example above, schedule select 1, 4, 8 and 16, and parity are turned ON, and welding is performed with the schedule No. 29.

● Time duration from start signal input to weld force start



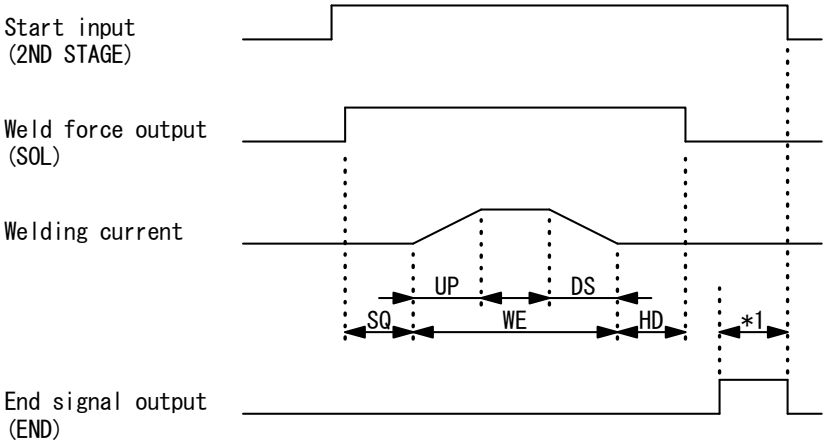
*1: Time duration from schedule or start input to weld force start: Changes depending on the setting of START SIG.TIME on the STATUS screen. The following time is required; 1 ms for 1-ms setting, 5 ms for 5-ms setting, 10 ms for 10-ms setting, and 20 ms for 20-ms setting.

● **On the start signal holding**



*1: When START SIG.HOLD on the STATUS screen is set to NO HOLD, turn on the start signal until the end signal 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.

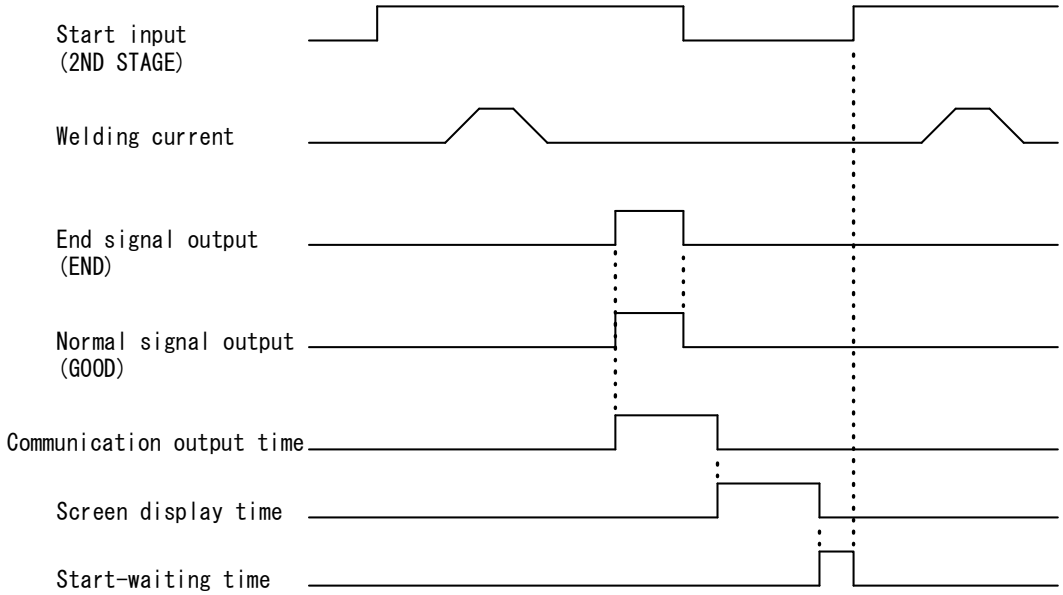
③ On the end signal output time (Common to MD series)



*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 2ND STAGE is ON.

④ On the screen display time and communication time (Common to MD series (except the sequential welding mode of MD-C))

● **When the monitor value is within the setting range or a fault does not occur during welding**



・Communication output time ----------86 ms max.
Communication output of monitor value. Outputs after the start of the end signal output.

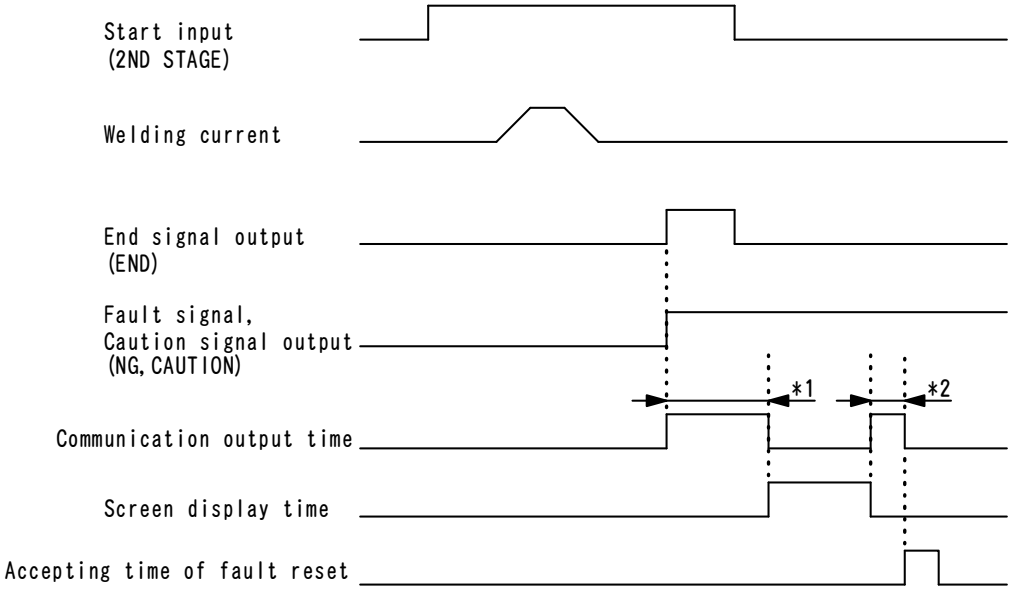
・Screen display time
The display time varies by screen. Displays the screen after the end of communication output.

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 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 the communication output ends. 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----------5 ms
The start-waiting time is the time duration required to turn off the start input.
Also, the status does not change until the start-waiting time is turned off even if the input signal such as schedule, polarity-switching, channel-switching, etc. is changed.

● **When the monitor value is outside the setting range or a fault occurs during welding**



・Communication output time (*1)---------86 ms max.
Communication output of monitor value. Outputs after the start of the end signal output.

・Communication output time (*2)---------25 ms max.
Communication output of fault code. Outputs after the end of screen display.

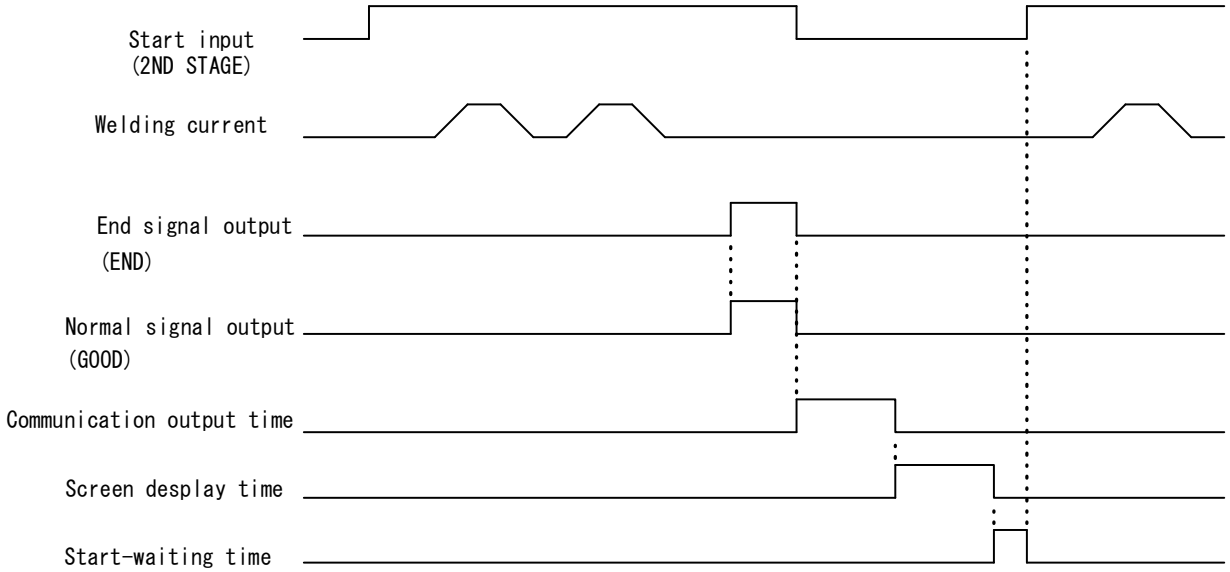
・Screen display time
The display time varies by screen. Displays the screen after the end of communication output (*1).

Menu screen ----------50 ms max.
SCHEDULE screen----------117 ms max.
MONITOR screen----------181 ms max.
COMPARATOR screen----------104 ms max.
PRECHECK screen ----------74ms max.
STATUS screen----------50 ms max.

・Accepting time for fault reset----------5 ms
The accepting time for fault reset is the time duration until the acceptance of the fault reset.
For the processing time at fault reset, refer to ⑨ On the fault reset.

Sequential welding mode of MD-C2000B

- **When the monitor value is within the setting range or a fault does not occur during welding**



・Communication output time ----------170 ms max.
Communication output of monitor value. Outputs after the start of the end signal output.

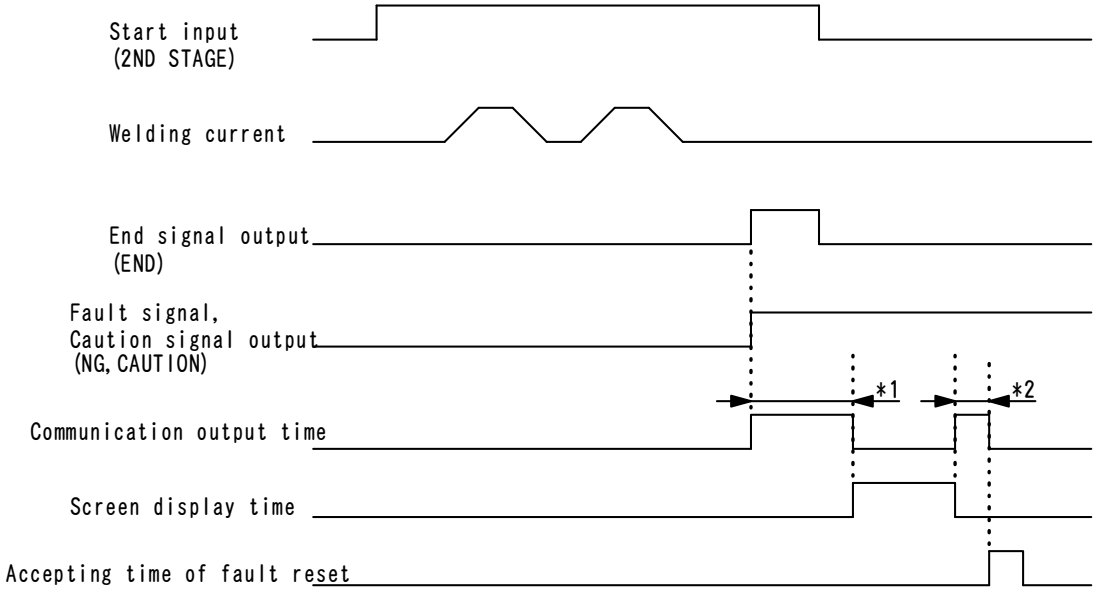
・Screen display time
The display time varies by screen. Displays the screen after the end of communication output.

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 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 the communication output ends. When the screen display is canceled to accept the start, the start stability time is [START SIG.TIME setting + 5 ms maximum].

・Waiting time for start signal----------5 ms
The waiting time for start signal is the time duration required to turn off the start input.
Also, the status does not change until the start-waiting time is turned off even if the input signal such as schedule, polarity-switching, channel-switching, etc. is changed.

● **When the monitor value is outside the setting range or a fault occurs during welding**



・Communication output time(*1) ----------170 ms max.
Communication output of monitor value. Outputs after the start of the end signal output.

・Communication output time (*2)----------25 ms max.
Communication output of fault code. Outputs after the end of screen display.

・Screen display time
The display time varies by screen. Displays the screen after the end of communication output (*1).

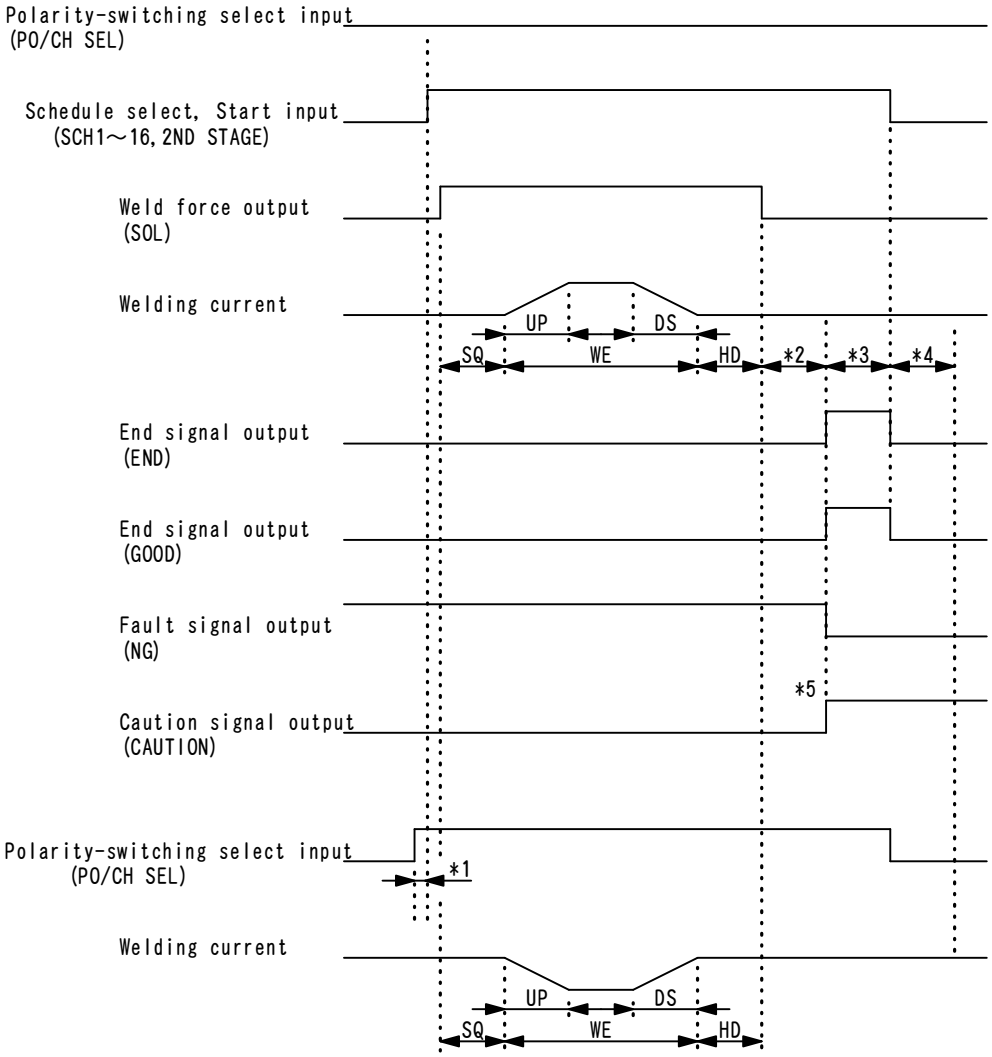
Menu screen ----------50 ms max.
SCHEDULE screen----------117 ms max.
MONITOR screen----------181 ms max.
COMPARATOR screen----------104 ms max.
PRECHECK screen ----------74 ms max.
STATUS screen----------50 ms max.

・Accepting time for fault reset----------5 ms
The accepting time for fault reset is the time duration until the acceptance of the fault reset.
For the processing time at fault reset, refer to ⑨ On the fault reset.

⑤ Operation of MD-B2000B

● **When the standard mode is selected**

(When SCHEDULE MODE on the STATUS screen is set to SINGLE and START SIG. INPUT on the STATUS screen is set to 2ND)

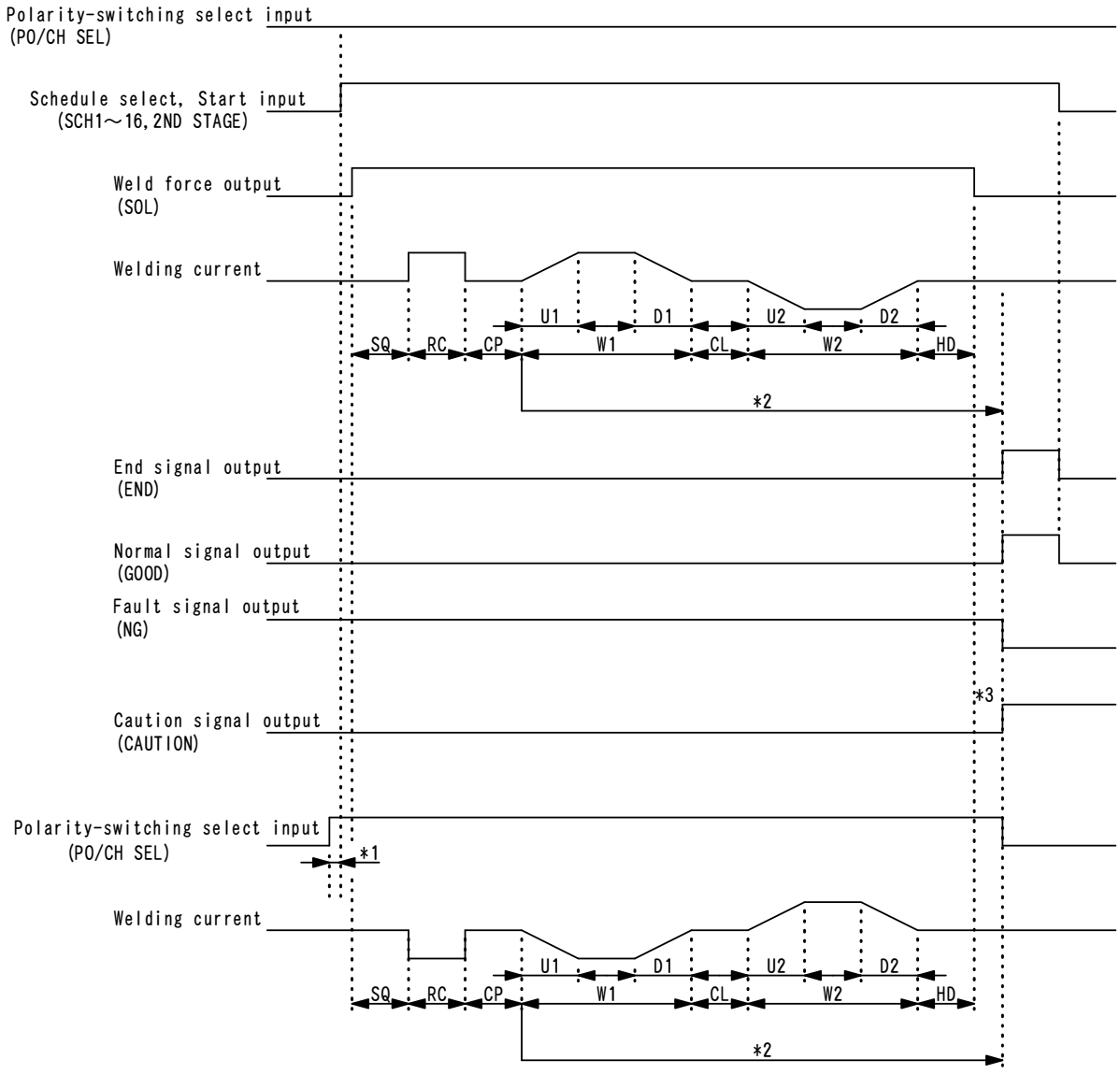


Remarks SQ: Squeeze time UP: Upslope time WE: Weld time
DS: Downslope time HD: Hold time

*1: Time of polarity-switching signal (Refer to ⑥ On the polarity-switching signal.)
*2: Monitor calculation time (10 ms)
*3: End signal output time (Refer to ③ On the end signal output time.)
*4: Screen display time, communication time (Refer to ④ On the screen display time and communication time.)
*5: Normal, fault, and caution signals: When the monitor value is within the setting range, a normal signal is output. When the monitor value is outside the range or a fault occurs, a fault or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

The timing of schedule select, start input, end signal, etc. is the same as that of the standard starting.

● **When the polarity-switching method is selected**
(When SCHEDULE MODE on the STATUS screen is set to DOUBLE and START SIG. INPUT on the STATUS screen is set to 2ND)



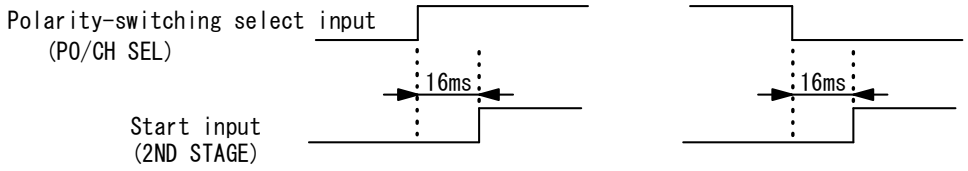
Remarks SQ: Squeeze time RC: Resistance precheck time
CP: Resistance judging time (2 ms) U1: Upslope 1 time
W1: Weld 1 time D1: Downslope 1 time CL: Cool time
U2: Upslope 2 time W2: Weld 2 time
D2: Downslope 2 time HD: Hold time

*1: Time of polarity-switching signal (Refer to ⑥ On the polarity-switching signal.)
*2: Welding is not performed in W1 and W2 when a fault or caution occurs in precheck welding.
*3: Normal, fault, and caution signals: When the monitor value is within the setting range, a normal signal is output. When the monitor value is outside the range or a fault occurs, a fault or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

The timing of schedule select, start input, end signal, etc. is the same as that of the standard mode.

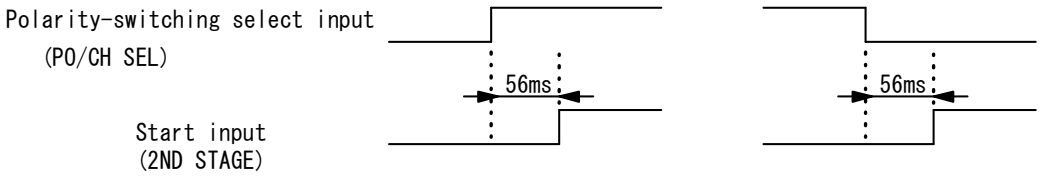
⑥ On the polarity-switching signal (MD-B2000B only)

● Screen other than SCHEDULE screen



Input the polarity-switching signal 10 ms or more before start signal.

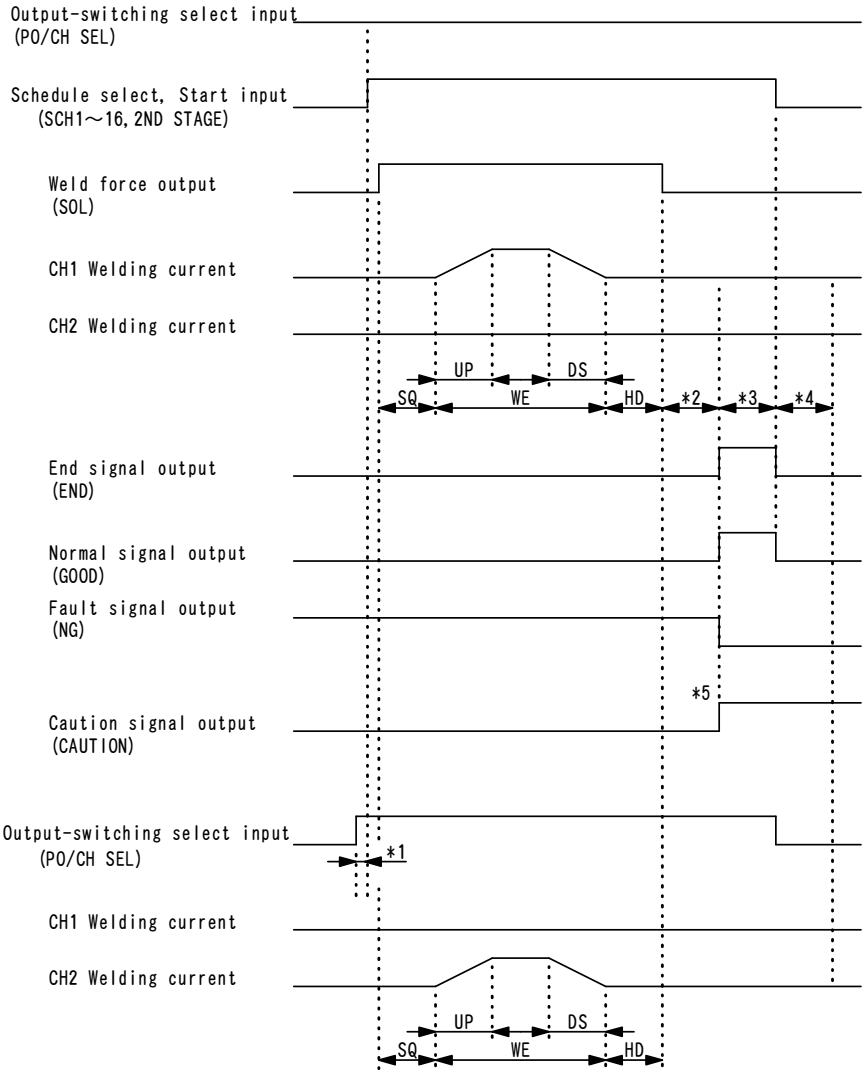
● SCHEDULE screen



Input the polarity-switching signal 56 ms or more before the start signal.
The display of the schedule waveform on the SCHEDULE screen is changed.

⑦ Operation of MD-C2000B

● **When the standard mode is selected**
(When SCHEDULE MODE on the STATUS screen is set to SINGLE and START SIG. INPUT on the STATUS screen is set to 2ND)



Remarks SQ: Squeeze time UP: Upslope time WE: Weld time
DS: Downslope time HD: Hold time

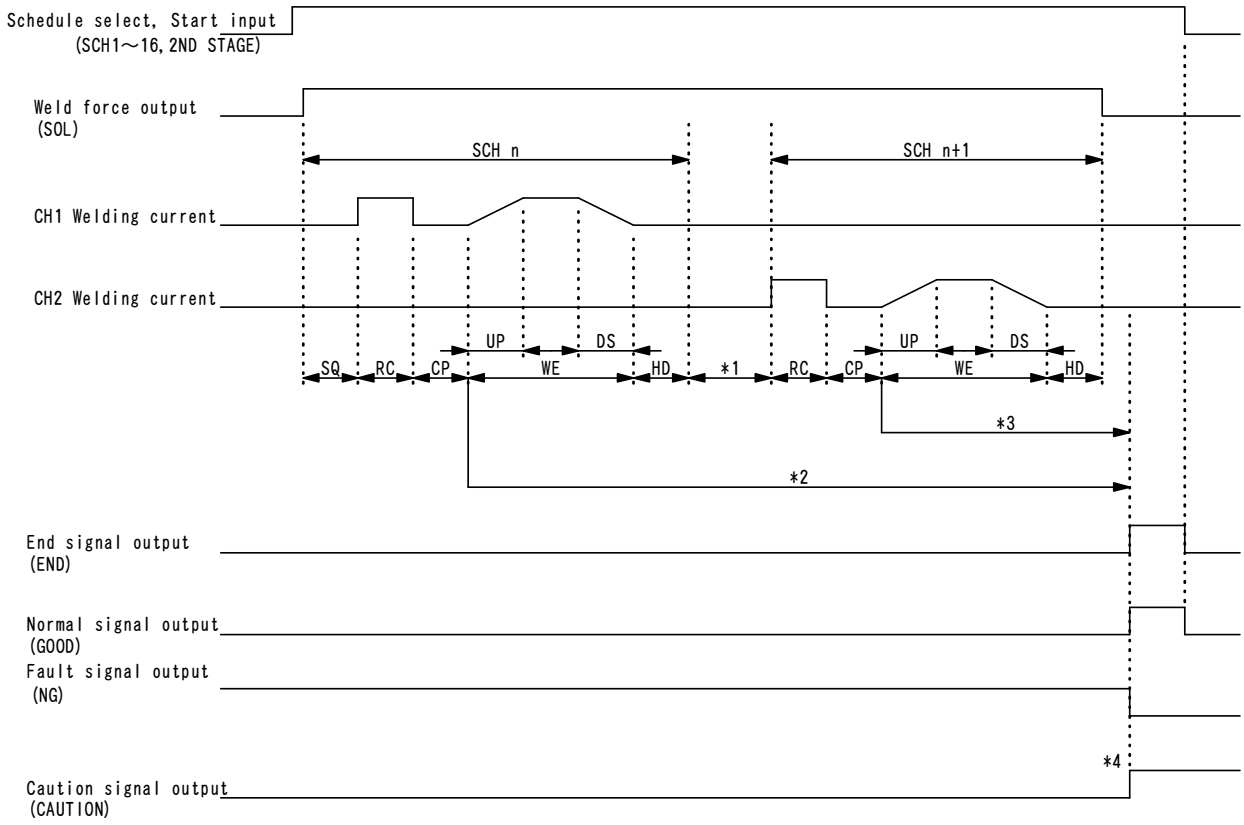
*1: Time of output-switching signal (Refer to ⑧ On the output-switching signal.)
*2: Monitor calculation time (10 ms)
*3: End signal output time (Refer to ③ On the end signal output time.)
*4: Screen display time, communication time (Refer to ④ On the screen display time and communication time.)
*5: Normal, fault, and caution signals: When the monitor value is within the setting range, a normal signal is output. When the monitor value is outside the range or a fault occurs, a fault or caution signal is output. The selection of fault signal or caution signal can be changed on the ERROR SETTING screen.

The timing of schedule select, start input, end signal, etc. is the same as that of the standard starting.

● **When the sequential welding mode is selected**

In the sequential welding mode, welding is initially conducted via CH1 according to the selected schedule, and via CH2 according to the next schedule.

(When SCHEDULE MODE on the STATUS screen is set to SINGLE and START SIG. INPUT on the STATUS screen is set to 2ND)



Remarks SQ: Squeeze time RC: Resistance precheck time
CP: Resistance judging time (2 ms) UP: Upslope time
WE: Weld time DS: Downslope time HD: Hold time

*1: Monitor calculation time and Channel-switching time (15ms).

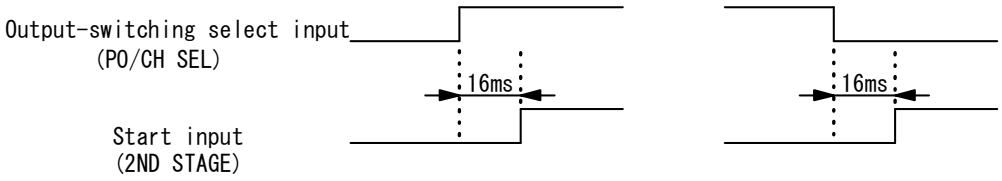
*2: Fault or caution occurs in precheck welding for CH1: In case of fault, welding is not performed in WE for both CH1 and CH2. In case of caution, welding is not performed in WE for CH1, but welding is performed in precheck and WE for CH2.

*3: Fault or caution occurs in precheck welding for CH2: Welding is not performed in WE for CH2.

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

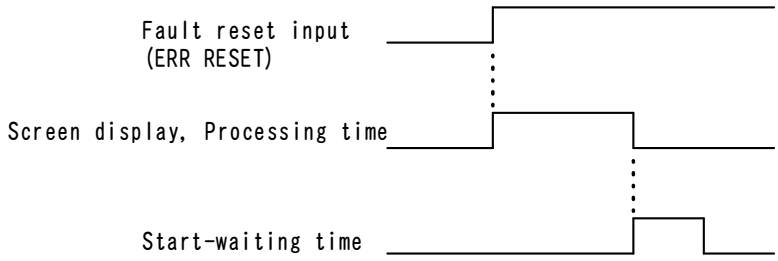
The timing of schedule select, start input, end signal, etc. is the same as that of the standard mode.

⑧ On the output-switching signal (MD-C2000B only)



Input output-switching signals 10 ms or more before start signal.

⑨ On the fault reset



- Screen display time----------212 ms max

- Start-waiting time----------5 ms
  Accepts a start after the start-waiting time.

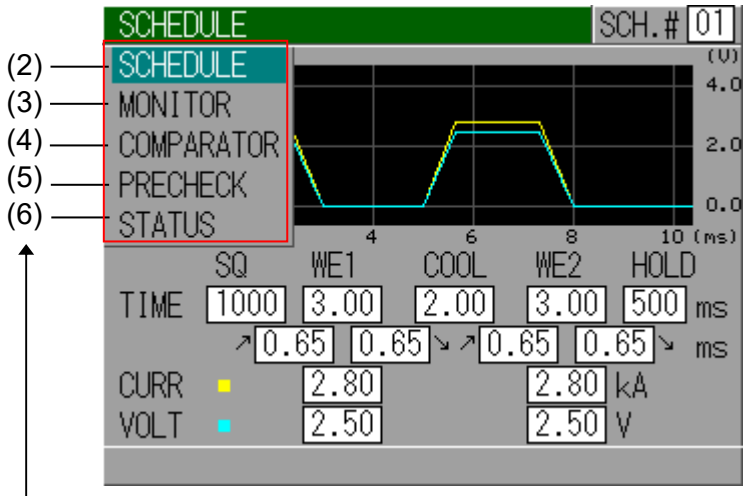
6. Explanation of the Screen

(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.

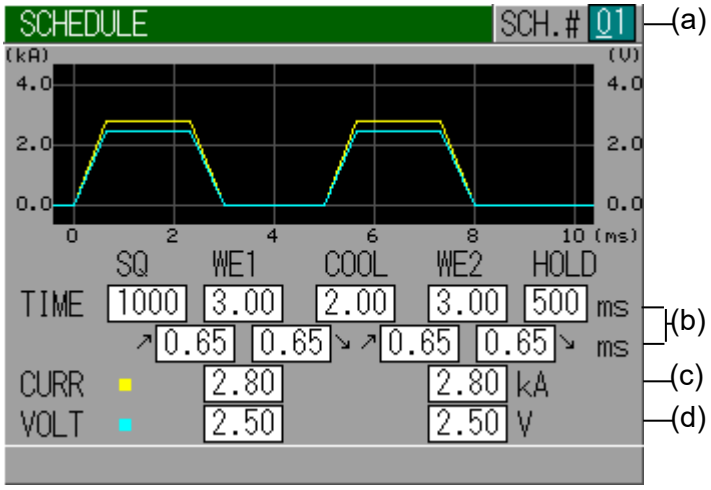


The numbers of (2) to (6) show the paragraph No. in the chapter.

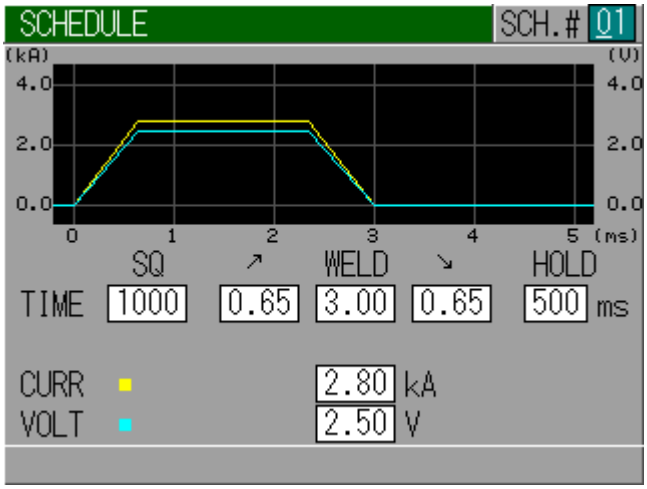
(2) Setting the Schedule (SCHEDULE Screen)

Sets the schedule (welding condition).
Up to 31 weld 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 at the dimension of ms.
Refer to **5. (4) Timing Chart** on 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

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

(d) VOLT

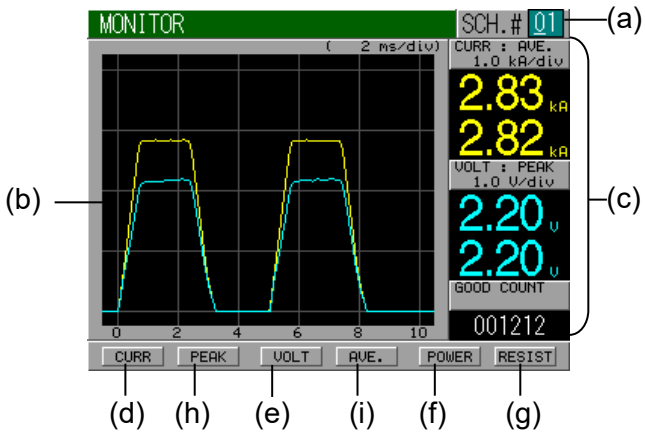
Control voltage value. WE1 and WE2 are set, respectively.
When CONTROL on the STATUS screen is set to CURR, VOLT is not displayed.
Also, CONTROL is set to VOLT, CURR is not displayed.

(3) Displaying the Measured Value (MONITOR Screen)

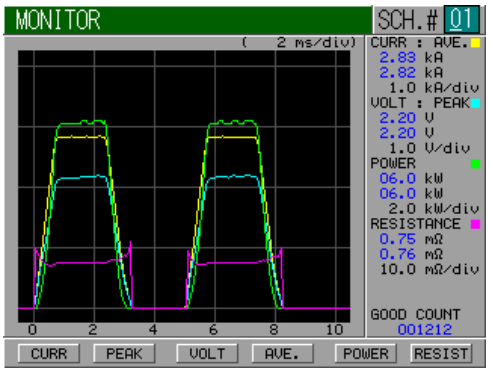
Displays the measured value of current, voltage, power, and resistance at welding.
Current is indicated in yellow solid line, Voltage is cyan, Power is green, and Resistance is magenta.
Move the cursor ( ) to function key (**(d)** to **(g)**) to be selected and press the ENTER key to display the desired 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]

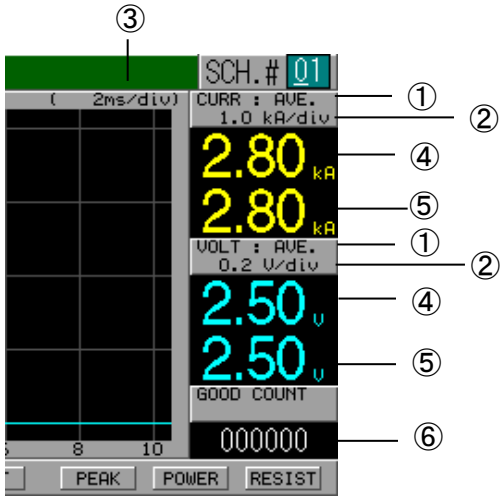


(a) SCH.#
Denotes No. of SCHEDULE (welding condition).
Input the schedule number that you want to check the waveform and measured value. After welding, the number is switched to the schedule number of the welding.

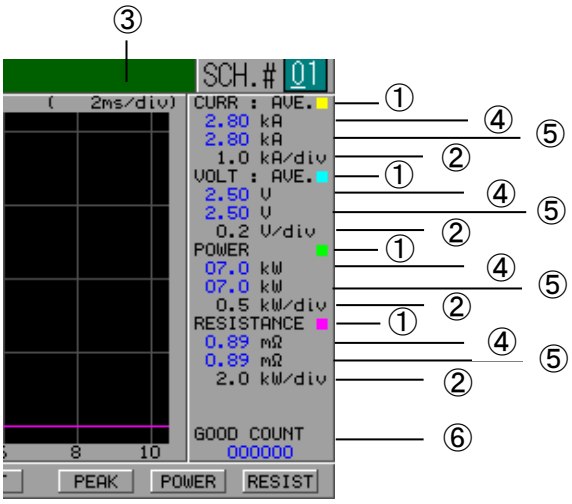
(b) Waveform
Displays the measured waveform of the item selected among current, voltage, power and resistance.

(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 control signal terminal strip.

(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.

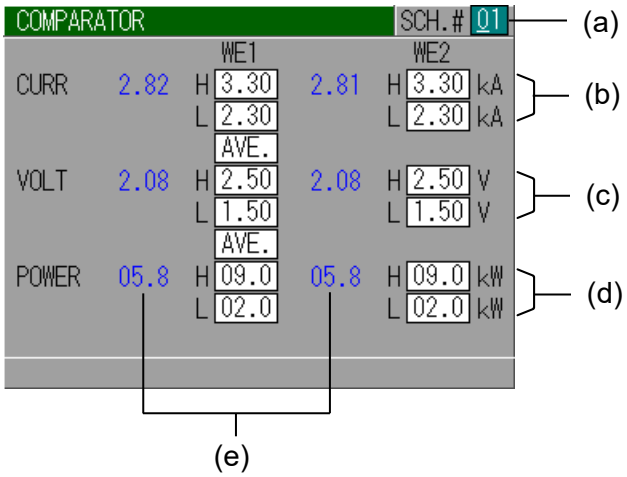
(g) RESIST
Selects whether to display the waveform of resistance.

(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 trouble 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 or 000 A to 999 A.
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 0.00 kW to 9.99 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.

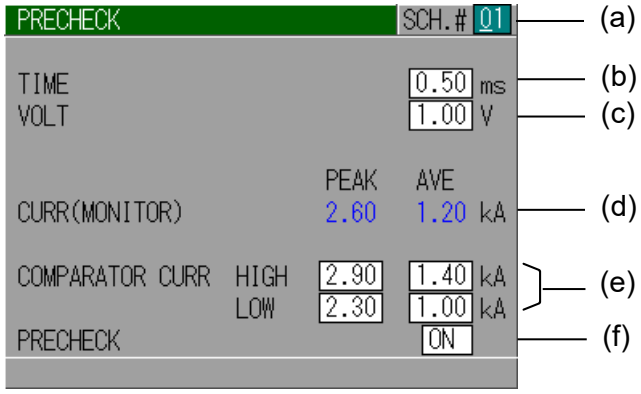
Note) Waveform and measured value hold the latest data of each schedule. When the power is turned off, all values are cleared.

(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

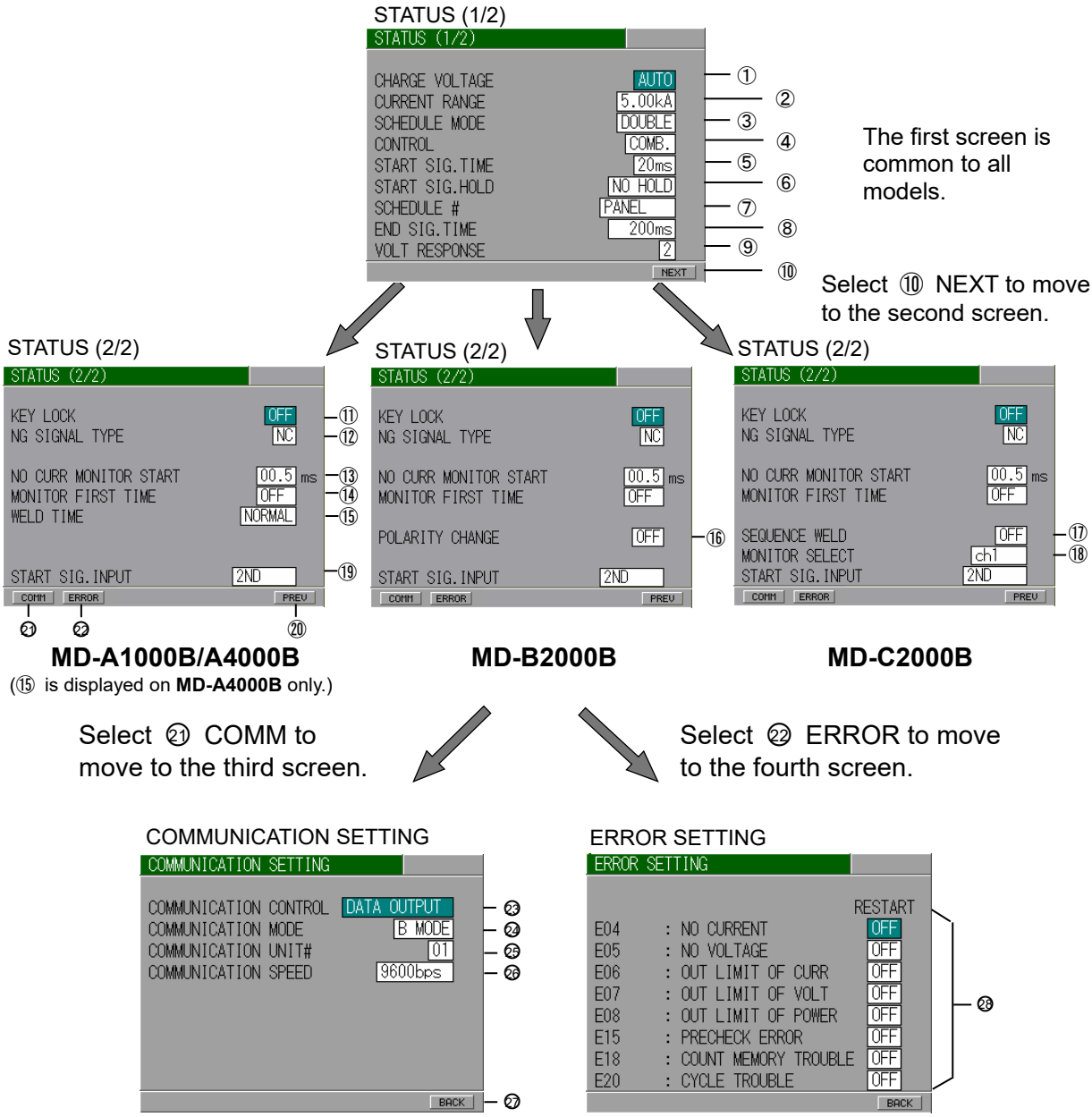
Sets whether to perform the precheck welding (ON) or not (OFF).

(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 three STATUS screens are actually used.)
- Press the + or - key to change the settings.
- Finally, press the ENTER key to complete the setting operation.



① CHARGE VOLTAGE

The charging voltage can be fixed.
The following voltages can be set: AUTO / 6 / 8 / 10 / 12 / 14 / 16 / 18 / 20 / 22 / 24 / 26 / 28 / 30 V.
When AUTO is selected, the charging voltage is automatically set according to the current range.
To maximize the performance of the equipment, keep the setting at AUTO whenever possible.

② CURRENT RANGE

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

Model No.	Range
MD-A1000B	250 A 500 A 1.50 kA
MD-A4000B	500 A 999 A 2.00 kA 5.00 kA
MD-B2000B **MD-C2000B**	250 A 500 A 999 A 3.00 kA

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 The constant-voltage control method and the constant-current-control method function simultaneously, and priority is given to the control method with the lower 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.
WE HOLD	Self-holding is valid from the beginning of the weld sequence.
NO HOLD	No self-holding. Input the start signal until the end of the sequence.

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 terminal on the rear panel.
EXT. (P) External schedule-select method (With parity)	The schedule is selected by closing the schedule-select terminal and [PARITY] terminal on the rear panel.

Input the parity so that the sum total of the closed circuits of the schedule-select terminal and [PARITY] terminal is an odd number. (Refer to **4.(2) ①Control signal terminal strip**.)

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.STAGE] terminal 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 trouble occurs.
NO	Opens the circuit normally; closes when a trouble 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 (MD-A4000B only)

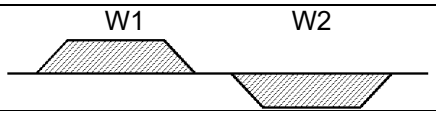
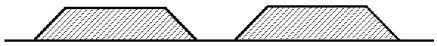
Sets the length of weld time.

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 W1, COOL and W2 so that the total becomes 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-B2000B only)

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

ON	Opposite direction	
OFF	Same direction	

⑰ SEQUENCE WELD (MD-C2000B only)

ON	Weld via. channel 1 according to the selected schedule, and then weld via. channel 2 according to the next schedule. **Example 1:** When operation is started while SCH1 is selected, welding is possible via CH1 during SCH1, and then welding is possible via CH2 during SCH2. **Example 2:** When operation is started while SCH2 is selected, welding is possible via CH1 during SCH2, and then welding is possible via CH2 during SCH3.
OFF	The channel for output is selected by an external I/O.

When using this function in ON, it is recommended that you select the External Schedule Select (EXT. (NP) or EXT. (P)). If Panel Control (PANEL) is selected, SEQUENCE WELD cannot be turned on.

⑱ MONITOR SELECT (MD-C2000B only)

When ON is selected for SEQUENCE WELD, you can choose the monitor display mode.

ch1	Only the result of welding in output [ch1] is displayed.
ch2	Only the result of welding in output [ch2] is displayed.
ch1<>2	[ch1] or [ch2] output is displayed alternately for every welding.

⑲ START SIG. INPUT

Selects the operation mode of the start input.

2ND	To start the weld sequence with the [2nd.STAGE] terminal, use this setting. When the [2nd.STAGE] terminal is closed, the [SOL] terminal operates and the weld sequence starts. * The weld sequence does not start even if the [1st.STAGE] terminal is closed.
1ST+2ND	To start the weld sequence with the combination of the [1st.STAGE] and [2nd.STAGE] terminals, use this setting. When the [1st.STAGE] terminal is closed, the [SOL] terminal operates. Then when the [2nd.STAGE] terminal is closed, the weld sequence starts. * When the [1st.STAGE] terminal is open, the weld sequence does not start even if the [2nd.STAGE] terminal is closed.

⑳ PREV

Moves to the STATUS (1/2) screen.

㉑ COMM

Moves to the COMMUNICATION SETTING screen.

㉒ ERROR
Moves to the ERROR SETTING screen.

㉓ 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**.

㉔ COMMUNICATION MODE
Selects a communication mode. Valid when COMMUNICATION CONTROL is set to DATA OUTPUT.

B MODE	Performs the same one-way communication.
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**.

㉕ 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.

㉖ COMMUNICATION SPEED
Selects a communication speed.

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

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

㉗ BACK
Moves to the STATUS (2/2) screen.

㉘ ERROR SETTING
The signal output when an error occurred (trouble/caution signals) can be set for each item.

Error code	Contents
E04: NO CURRENT	No current
E05: NO VOLTAGE	No voltage

Error code	Contents
E06, E09: OUT LIMIT OF CURR	Fault of current
E07, E10: OUT LIMIT OF VOLT	Fault of voltage
E08, E11: 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 **MD-A4000B** is given here as an example.
The settings to be made are as follows:

Schedule No.:	#15
Welding 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 **MD-A4000B**.

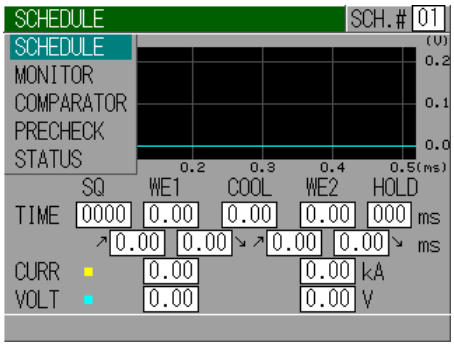
② Turn the POWER switch on and press the MENU key.

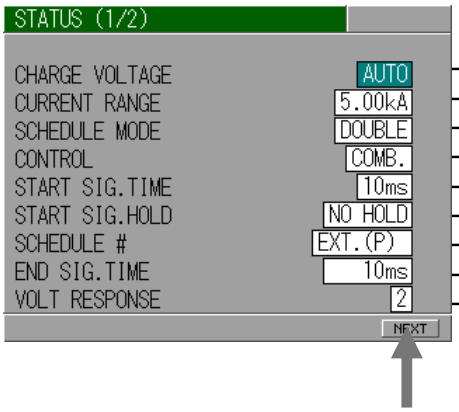
CAUTION

Check that the display screen and lamps are turned on normally and the fan motor is operated.

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

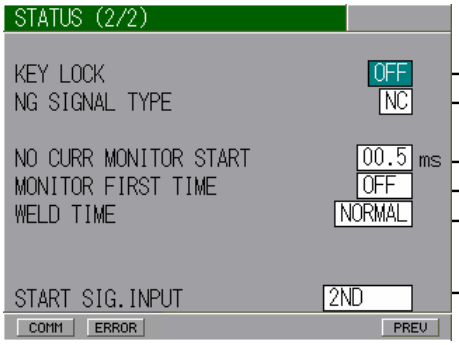
④ Set functions on the STATUS screen.
Move the cursor to the desired item and select the function by the + and - keys.
Press the ENTER key, and the selected function is valid.





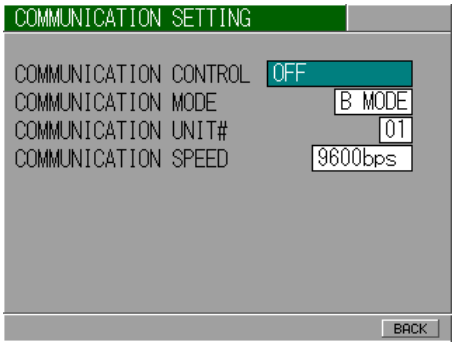
→In most cases, AUTO should be used.
→Set the nearest value above the welding current.
→Select 2-step for welding.
→Combination control of constant-current and constant-voltage.
→Set 10 ms because of the sequencer (PLC) connection.
→Set for operation only during input of the start signal.
→Select the schedule with a parity from the sequencer.
→Set the end signal output to 10 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.



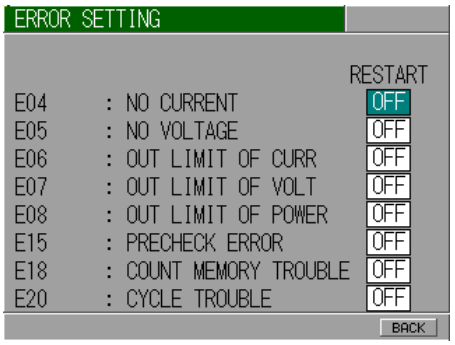
→Enter [OFF] to change the schedule.
→Set the output type of trouble signal to NC.
→Set the detection start time of no current/no voltage to 0.5 ms.
→Set the measurement start time to OFF.
→Set the length of weld time to NORMAL.
→Selects the operation mode of the start input.
To start the weld sequence with the 2nd.STAGE terminal, set START SIG. INPUT to 2ND.
To start the weld sequence with the combination of the 1st.STAGE and the 2nd.STAGE terminals, set START SIG. INPUT to 1ST+2ND.

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



To perform communication, set items referring to **6. (6) ㉓COMMUNICATION CONTROL** to **㉘COMMUNICATION 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.

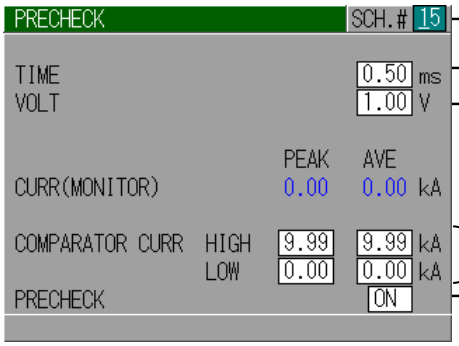


Set the signals (trouble/caution signals) to be output when a fault occurs.
In this example, all items are set OFF to output the trouble signal.

(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.

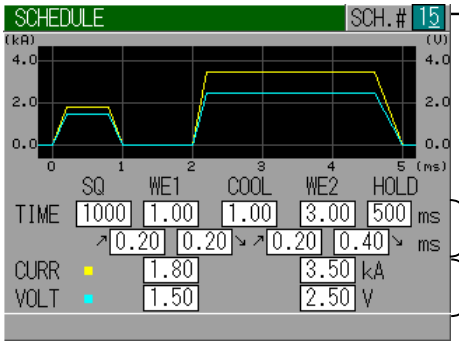
⑧ Next, select PRECHECK and press the ENTER key.
Set the precheck ON/OFF and precheck conditions.



→Set the schedule No. to 15.
→Set the weld time for precheck at 0.50 ms.
→Set the voltage to 1.00 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.

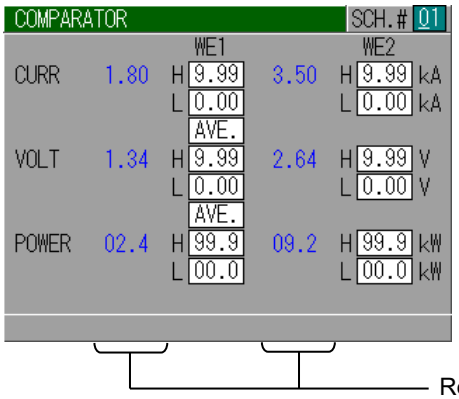
⑪ Press the WELD key on the front panel to turn the WELD lamp on.
To turn ON the WELD key, hold it down for approx. 1 second.

⑫ Turn on (close) the WELD ON/OFF of the control signal terminal strip on the rear panel.
Check that the READY lamp on the front panel is on.

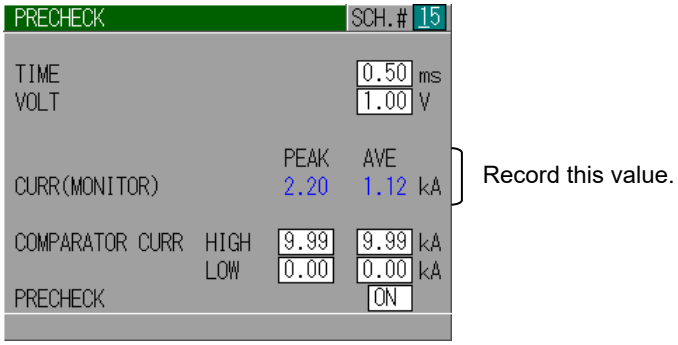
> The READY lamp comes on when the WELD lamp on the front panel comes on and Terminals 15 and 16 (WELD ON/OFF) of the control signal terminal strip on the rear panel are closed.
> It goes out when a fault occurs, welding, or charging.

⑬ Input the schedule-select signal.
Turn on (close) SCH1/SCH2/SCH4/SCH8 (as well as PARITY) of the control signal terminal strip on the rear panel to select schedule No.15.

⑭ Turn on (close) the 2nd stage 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.

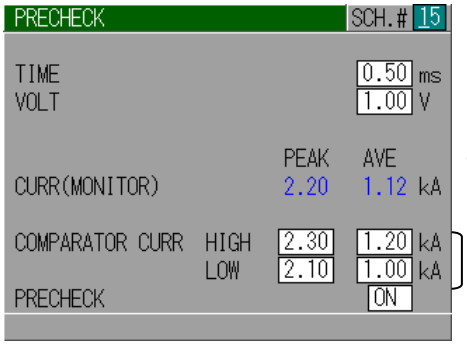


⑮ Then change the menu screen to the PRECHECK screen.
Record the measured value here as well.



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

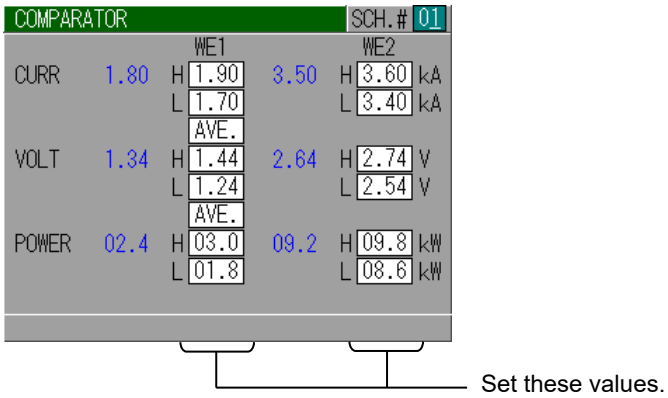
⑯ When welding is satisfactory, set the monitor value.



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 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. Error 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 **11. 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** An error 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** The equipment is overheated. Stop operation, let the equipment to cool off, and press the RESET button.
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.
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.

No.	Name of fault displayed on the screen Explanation of fault and corrective measures
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.
E09	**OUT LIMIT OF CURRENT(CH2)** (**MD-C2000B** only) The measured welding current of channel 2 has been outside of the monitor range set on the COMPARATOR screen.
E10	**OUT LIMIT OF VOLTAGE(CH2)** (**MD-C2000B** only) The measured voltage between the electrodes of channel 2 has been outside of the monitor range set on the COMPARATOR screen.
E11	**OUT LIMIT OF POWER(CH2)** (**MD-C2000B** only) The measured welding power of channel 2 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.
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 No.1 and No.3 (STOP) of terminals on the rear panel 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. When the V SENS cable is not connected in the constant-current control, short on Terminals 36 and 37 (Terminals 36 and 37 and Terminals 38 and 39 in **MD-C2000B**).
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	000 to 999[A] ,!!!!*3
	*.**,*2			0.00 to 9.99[kA] ,!!!!*3
E	***,*1		Average value	000 to 999[A] ,!!!!*3
	*.**,*2			0.00 to 9.99[kA] ,!!!!*3
F	*.**,	WELD: Voltage	Peak value	0.00 to 9.99[V] ,!!!!*3
G	*.**,		Average value	0.00 to 9.99[V] ,!!!!*3
H	*.**,*1	WELD: Power average value		0.00 to 9.99[kW] ,!!!!*3
	**.*,*2			00.0 to 99.9[kW] ,!!!!*3
I	*.**	WELD: Resistance average value		0.00 to 9.99[mΩ] ,!!!!*3
J	[CR]	CR code		0DH (fixed)

*1: When CURRENT RANGE on the STATUS screen is ***A.
*2: When CURRENT RANGE on the STATUS screen is *.**kA.
*3: 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	000 to 999[A] ,!!!!*3
	*.**,*2			0.00 to 9.99[kA] ,!!!!*3
E	***,*1		Average value	000 to 999[A] ,!!!!*3
	*.**,*2			0.00 to 9.99[kA] ,!!!!*3
F	*.**,	W1: Voltage 1	Peak value	0.00 to 9.99[V] ,!!!!*3
G	*.**,		Average value	0.00 to 9.99[V] ,!!!!*3
H	*.**,*1	W1: Power 1 average value		0.00 to 9.99[kW] ,!!!!*3
	**.*,*2			00.0 to 99.9[kW] ,!!!!*3
I	*.**,	W1: Resistance 1 average value		0.00 to 9.99[mΩ] ,!!!!*3
J	W2,	Welding code (2-step welding)		W2 (fixed)
K	***,*1	W2: Weld 2	Peak value	000 to 999[A] ,!!!!*3
	*.**,*2			0.00 to 9.99[kA] ,!!!!*3
L	***,*1		Average value	000 to 999[A] ,!!!!*3
	*.**,*2			0.00 to 9.99[kA] ,!!!!*3
M	*.**,	W2: Voltage 2	Peak value	0.00 to 9.99[V] ,!!!!*3
N	*.**,		Average value	0.00 to 9.99[V] ,!!!!*3
O	*.**,*1	W2: Power 2 average value		0.00 to 9.99[kW] ,!!!!*3
	**.*,*2			00.0 to 99.9[kW] ,!!!!*3
P	*.**	W2: Resistance 2 average value		0.00 to 9.99[mΩ] ,!!!!*3
Q	[CR]	CR code		0DH (fixed)

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

③ At the occurrence of fault

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

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

Item	Character string	Content	Range
A	E:	Fault send code	E: (fixed)
B	**[*1]	Fault code	01 to 20
C	[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,
0.50, 1.00 [CR][LF]

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 _A: Current value in A (_ indicates space) kA: Current value in kA		A or kA
F	W1,	Welding code (1-step welding)		W1 (fixed)
G	****,*1	WELD: Current	Peak value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
H	****,*1		Average value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
I	*.**,	WELD: Voltage	Peak value	0.00 to 9.99[V] ,----*5
J	*.**,		Average value	0.00 to 9.99[V] ,----*5
K	*.**,*1	WELD: Power average value		0.00 to 9.99[kW] ,----*5
	**.*,*2			00.0 to 99.9[kW] ,----*5
L	*.**,	WELD: Resistance average value		0.00 to 9.99[mΩ] ,----*5
M	*.**,*3	WELD: Weld time (Set time)		0.00 to 9.99[ms]
	**.*,*4			00.0 to 99.9[ms]
N	P,	Welding code (Precheck welding)		P (fixed)
O	****,*1	PRECHECK: Current	Peak value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
P	****,*1		Average value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
Q	*.**3	PRECHECK: Weld time (Set time)		0.00 to 1.00[ms]
	**.*4			00.0 to 01.0[ms]
R	[CR][LF]	CR, LF code		0DH 0AH (fixed)

*1: When CURRENT RANGE on the STATUS screen is ***A.
*2: When CURRENT RANGE on the STATUS screen is *.**kA.
*3: When WELD TIME on the STATUS screen is NORMAL.
*4: When WELD TIME on the STATUS screen is LONG.
*5: 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 _A: Current value in A (_ indicates space) kA: Current value in kA		A or kA
F	W1,	Welding code (1-step welding)		W1 (fixed)
G	****,*1	W1: Weld 1	Peak value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
H	*.**,*1		Average value	0000 to 0999[A] ,----*5
	**.*,*2			0.00 to 9.99[kA] ,----*5
I	*.**,	W1: Voltage 1	Peak value	0.00 to 9.99[V] ,----*5
J	*.**,		Average value	0.00 to 9.99[V] ,----*5
K	*.**,*1	W1: Power 1 average value		0.00 to 9.99[kW] ,----*5
	**.*,*2			00.0 to 99.9[kW] ,----*5
L	*.**,	W1: Resistance 1 average value		0.00 to 9.99[mΩ] ,----*5
M	*.**,*3	W1: Weld 1 time (Set time)		0.00 to 9.99[ms]
	**.*,*4			00.0 to 99.9[ms]
N	W2,	Welding code (2-step welding)		W2 (fixed)
O	****,*1	W2: Weld 2	Peak value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
P	****,*1		Average value	0000 to 0999[A] ,----*5
	*.**,*2			0.00 to 9.99[kA] ,----*5
Q	*.**,	W2: Voltage 2	Peak value	0.00 to 9.99[V] ,----*5
R	*.**,		Average value	0.00 to 9.99[V] ,----*5
S	*.**,*1	W2: Power 2 average value		0.00 to 9.99[kW] ,----*5
	**.*,*2			00.0 to 99.9[kW] ,----*5
T	*.**,	W2: Resistance 2 average value		0.00 to 9.99[mΩ] , ----*5
U	*.**,*3	W2: Weld 2 time (Set time)		0.00 to 9.99[ms]
	**.*,*4			00.0 to 99.9[ms]
V	P,	Welding code (Precheck welding)		P (fixed)

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

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

③ At the occurrence of fault

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

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

Item	Character string	Content	Range
A	E:	Fault send code	E: (fixed)
B	**,	Device No.	01 to 31
C	**,	Schedule No.	01 to 31
D	**[*1]	Fault code	01 to 20
E	[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-A4000B,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">3</td><td>Writing of data (with data storage)</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">4</td><td>Writing of data (without data storage)</td><td># Device No. V 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 V SH1 SH2 SH3 CD1 CD2 CD3 : Data [CR] [LF]
#01V008S01: 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.
・When the power is turned off, the written data is cleared.
・When Specified code No. S03 is written, the data is saved.
・When the data is changed by panel operations after data saved, the data is saved.
・To hold the written data even after the power is turned off, use the Writing of data (with data storage).</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>
</table>

<table>
<tr><th>Item</th><th>Command</th><th>Code</th></tr>
<tr><td rowspan="2">6</td><td>Resetting of fault</td><td># Device No. W or V 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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA	-
G	****,*3	WE: Current value	0000 to 0999[A] *5	1
	*.**,*4		0.00 to 9.99[kA] *5	0.01
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 ***A.
*4: When CURRENT RANGE on the STATUS screen is *.**kA.
*5: 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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA	-
K	****,*3	W1: Weld 1 current	0000 to 0999[A] *5	1
	*.**,*4		0.00 to 9.99[kA] *5	0.01
L	****,*3	W2: Weld 2 current	0000 to 0999[A] *5	1
	*.**,*4		0.00 to 9.99[kA] *5	0.01
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 ***A.
*4: When CURRENT RANGE on the STATUS screen is *.**kA.
*5: 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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA	-
B	****,*1	WE: Current upper limit	0000 to 0999[A]	1
	*.**,*2		0.00 to 9.99[kA]	0.01
C	****,*1	WE: Current lower limit	0000 to 0999[A]	1
	*.**,*2		0.00 to 9.99[kA]	0.01
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	0.00 to 9.99[kW]	0.01
	**.*,*2		00.0 to 99.9[kW]	0.1
I	*.**,*1	WE: Power lower limit	0.00 to 9.99[kW]	0.01
	**.*,*2		00.0 to 99.9[kW]	0.1

*1: When CURRENT RANGE on the STATUS screen is ***A.
*2: 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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA	-
B	****,*1	W1: Weld 1 current upper limit	0000 to 0999[A]	1
	*.**,*2		0.00 to 9.99[kA]	0.01
C	****,*1	W1: Weld 1 current lower limit	0000 to 0999[A]	1
	*.**,*2		0.00 to 9.99[kA]	0.01
D	****,*1	W2: Weld 2 current upper limit	0000 to 0999[A]	1
	*.**,*2		0.00 to 9.99[kA]	0.01
E	****,*1	W2: Weld 2 current lower limit	0000 to 0999[A]	1
	*.**,*2		0.00 to 9.99[kA]	0.01
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	0.00 to 9.99[kW]	0.01
	**.*,*2		00.0 to 99.9[kW]	0.1
M	*.**,*1	W1: Weld 1 power lower limit	0.00 to 9.99[kW]	0.01
	**.*,*2		00.0 to 99.9[kW]	0.1
N	*.**,*1	W2: Weld 2 power upper limit	0.00 to 9.99[kW]	0.01
	**.*,*2		00.0 to 99.9[kW]	0.1
O	*.**,*1	W2: Weld 2 power lower limit	0.00 to 9.99[kW]	0.01
	**.*,*2		00.0 to 99.9[kW]	0.1

*1: When CURRENT RANGE on the STATUS screen is ***A.

*2: 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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA	-
E	****,*3	RC: Current peak value upper limit	0000 to 0999[A]	1
	*.**,*4		0.00 to 9.99[kA]	0.01
F	****,*3	RC: Current peak value lower limit	0000 to 0999[A]	1
	*.**,*4		0.00 to 9.99[kA]	0.01
G	****,*3	RC: Current average value upper limit	0000 to 0999[A]	1
	*.**,*4		0.00 to 9.99[kA]	0.01
H	****,*3	RC: Current average value lower limit	0000 to 0999[A]	1
	*.**,*4		0.00 to 9.99[kA]	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 ***A.
*4: 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, 4, 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: AUTO 07: 18V 01: 6V 08: 20V 02: 8V 09: 22V 03: 10V 10: 24V 04: 12V 11: 26V 05: 14V 12: 28V 06: 16V 13: 30V	00 to 13	-
B	*,	CURRENT RANGE: MD-A4000B 0: 500A 1: 999A 2: 2.00kA 3: 5.00kA MD-B2000B/C2000B 0: 250A 1: 500A 2: 999A 3: 3.00kA MD-A1000B 0: 250A 1: 500A 2: 1.50kA	0 to 3	1
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

Item	Character string	Content	Range	Increment/ Decrement
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	4 (fixed)	-
M	**.*,	NO CURR MONITOR START: Start time of no current/no voltage detection	00.5 to 99.9[ms]	0.1
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	*,*1	WELD TIME: Length of weld time 0: NORMAL 1: LONG	0 to 1	1
P	*,*2	POLARITY CHANGE: Welding polarity method 0: OFF 1: ON	0 to 1	1
Q	*,*3 *4	SEQUENCE WELD: Sequence welding 0: OFF 1: ON	0 to 1	1
R	*,*3	MONITOR SELECT: Monitor selection method 0: ch1 1: ch2 2: ch1<>2	0 to 2	1
S	*	START SIG. INPUT: Start operation mode 0: 2ND 1: 1ST+2ND	0 to 1	1

*1: Function for **MD-A4000B** only. For other models, set to 0.
*2: Function for **MD-B2000B** only. For other models, set to 0.
*3: Function for **MD-C2000B** only. For other models, set to 0.
*4: When setting SEQUENCE WELD to ON, set SCHEDULE# to an external schedule-select method (EXT.(P) or EXT.(NP)).

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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA
C	****,*1	WELD: Current peak value	0000 to 0999[A] ,----*5
	*.**,*2		0.00 to 9.99[kA] ,----*5
D	*.**,*1	WELD: Current average value	0000 to 0999[A] ,----*5
	**.*,*2		0.00 to 9.99[kA] ,----*5
E	*.**,	WELD: Voltage peak value	0.00 to 9.99[V] ,----*5
F	*.**,	WELD: Voltage average value	0.00 to 9.99[V] ,----*5
G	*.**,*1	WELD: Power average value	0.00 to 9.99[kW] ,----*5
	**.*,*2		00.0 to 99.9[kW] ,----*5
H	*.**,	WELD: Resistance average value	0.00 to 9.99[mΩ] ,----*5
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	0000 to 0999[A] ,----*5
	*.**,*2		0.00 to 9.99[kA] ,----*5
K	*.**,*1	PRECHECK: Current average value	0000 to 0999[A] ,----*5
	**.*,*2		0.00 to 9.99[kA] ,----*5
L	*.**3	PRECHECK: Weld time (Set time)	0.00 to 1.00[ms]
	**.*4		00.0 to 01.0[ms]

*1: When CURRENT RANGE on the STATUS screen is ***A.
*2: When CURRENT RANGE on the STATUS screen is *.**kA.
*3: When WELD TIME on the STATUS screen is NORMAL.
*4: When WELD TIME on the STATUS screen is LONG.
*5: 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 _A: Current value in A (_ indicates space) kA: Current value in kA	A or kA
C	****,*1	W1: Current 1 peak value	0000 to 0999[A] ,----*5
	*.**,*2		0.00 to 9.99[kA] ,----*5
D	*.**,*1	W1: Current 1 average value	0.00 to 9.99[kA] ,----*5
	**.*,*2		00.0 to 99.0[kA] ,----*5
E	*.**,	W1: Voltage 1 peak value	0.00 to 9.99[V] ,----*5
F	*.**,	W1: Voltage 1 average value	0.00 to 9.99[V] ,----*5
G	*.**,*1	W1: Power 1 average value	0.00 to 9.99[kW] ,----*5
	**.*,*2		00.0 to 99.9[kW] ,----*5
H	*.**,	W1: Resistance 1 average value	0.00 to 9.99[mΩ] ,----*5
I	*.**,*3	W1: Weld 1 time (Set time)	0.00 to 9.99[ms]
	**.*,*4		00.0 to 99.9[ms]
J	****,*1	W2: Current 2 peak value	0000 to 0999[A] ,----*5
	*.**,*2		0.00 to 9.99[kA] ,----*5
K	*.**,*1	W2: Current 2 average value	0000 to 0999[A] ,----*5
	**.*,*2		0.00 to 9.99[kA] ,----*5
L	*.**,	W2: Voltage 2 peak value	0.00 to 9.99[V] ,----*5
M	*.**,	W2: Voltage 2 average value	0.00 to 9.99[V] ,----*5
N	*.**,*1	W2: Power 2 average value	0.00 to 9.99[kW] ,----*5
	**.*,*2		00.0 to 99.9[kW] ,----*5
O	*.**,	W2: Resistance 2 average value	0.00 to 9.99[mΩ] ,----*5
P	*.**,*3	W2: Weld 2 time (Set time)	0.00 to 9.99[ms]
	**.*,*4		00.0 to 99.9[ms]
Q	****,*1	PRECHECK: Current peak value	0000 to 0999[A] ,----*5
	*.**,*2		0.00 to 9.99[kA] ,----*5

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

*1: When CURRENT RANGE on the STATUS screen is ***A.
*2: When CURRENT RANGE on the STATUS screen is *.**kA.
*3: When WELD TIME on the STATUS screen is NORMAL.
*4: When WELD TIME on the STATUS screen is LONG.
*5: 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-B4000B	500A	****	0000 to 0500[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	999A	****	0000 to 0999[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	2.00kA	*.**	0.00 to 2.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
	5.00kA	*.**	0.00 to 5.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
MD-B2000B MD-C2000B	250A	****	0000 to 0250[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	500A	****	0000 to 0500[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	999A	****	0000 to 0999[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	3.00kA	*.**	0.00 to 3.00[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]
MD-B2000B MD-C2000B	250A	****	0000 to 0250[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	500A	****	0000 to 0500[A]	0000 to 0999[A]	*.**	0.00 to 9.99[kW]
	1.50kA	*.**	0.00 to 1.50[kA]	0.00 to 9.99[kA]	**.*	00.0 to 99.9[kW]

10. Specifications

(1) Specifications

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

Power supply	Single-phase, 100V AC-10% to 120V AC+10% or 200V AC-10% to 240V AC+10% (50/60Hz) The voltage is cannot be selected. (Fixed on shipment.)	
Control method	Switching control by transistor The basic frequency is 125kHz, and the frequency is 1/integer of it. Maximum is 125kHz (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 with the lower set value.
Timer setting	1-step weld sequence a. Squeeze : 0000–9999ms b. Precheck weld : 0.00–1.00ms *1 c. Precheck judgment : 2ms (fixed) *1 d. Upslope : 0.00–9.99ms [00.0–99.9ms *2] *3 e. Weld : 0.00–9.99ms [00.0–99.9ms *2] f. Downslope : 0.00–9.99ms [00.0–99.9ms *2] *3 g. Hold : 000–999ms	
	2-step weld sequence a. Squeeze : 0000–9999ms b. Precheck weld : 0.00–1.00ms *1 c. Precheck judgment : 2ms (fixed) *1 d. Upslope 1 : 0.00–9.99ms [00.0–99.9ms *2] *4 e. Weld 1 : 0.00–9.99ms [00.0–99.9ms *2] f. Downslope 1 : 0.00–9.99ms [00.0–99.9ms *2] *4 g. Cool : 0.00–9.99ms [00.0–49.9ms *2] h. Upslope 2 : 0.00–9.99ms [00.0–99.9ms *2] *5 i. Weld 2 : 0.00–9.99ms [00.0–99.9ms *2] j. Downslope 2 : 0.00–9.99ms [00.0–99.9ms *2] *5 k. Hold : 000–999ms Set the total time of Weld 1, Cool and Weld 2 to 100ms 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 Time settings in [ ] are only for **MD-A4000B**.
*3 Included in weld time.
*4 Included in weld 1 time.
*5 Included in weld 2 time.

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

Current range (Common to all schedules)	**MD-A4000B**	500A/999A/2.00kA/5.00kA
	MD-B2000B **MD-C2000B**	250A/500A/999A/3.00kA
	MD-A1000B	250A/500A/1.50kA
Current setting range	**MD-A4000B**	·000–500A (1A increment) ·000–999A (1A increment) ·0.00–2.00kA (0.01kA increment) ·0.00–5.00kA (0.01kA increment)
	MD-B2000B **MD-C2000B**	·000–250A (1A increment) ·000–500A (1A increment) ·000–999A (1A increment) ·0.00–3.00kA (0.01kA increment)
	MD-A1000B	·000–250A (1A increment) ·000–500A (1A increment) ·0.00–1.50kA (0.01kA increment)
Voltage setting range	0.00–9.99V (0.01V increment)	
Current setting accuracy	±3% of maximum range (When the specified load used.)	
Voltage setting accuracy	±3% of maximum range (When the specified load used. Inductive component not included.)	
Repetition speed	Refer to **(2) Duty Cycle**.	
Resistance precheck function	Voltage setting range	0.00–9.99V (0.01V increment)
	Current upper limit setting range	000–999A 0.00–9.99kA (The unit automatically changes according to the current range.)
	Current lower limit setting range	000–999A 0.00–9.99kA (The unit automatically changes according to the current range.)
	Weld time setting range	0.00–1.00ms
Monitor value setting	WE1 and WE2 setting range (Average current or peak current) 000–999A 0.00–9.99kA (The unit automatically changes according to the current range.)	
	WE1 and WE2 setting range (Average voltage or peak voltage) 0.00–9.99V	
	WE1 and WE2 setting range 0.00–9.99kW 0.0–99.9kW (The kW range automatically changes according to the current range.)	
Charge voltage setting (Common to all schedules)	AUTO setting	**MD-A4000B** 5.00kA range: 30V, 2.00kA range: 28V 999A range: 24V, 500A range: 20V
		MD-B2000B/C2000B 3.00kA range: 30V, 999A range: 28V 500A range: 24V, 250A range: 20V
		MD-A1000B 1.5kA range: 30V, 500A range: 28V 250A range: 24V
	Manual setting	Setting by **CHARGE VOLTAGE**: 6–30V (2V increment)

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 GOOD signal output time (Common to all schedules)	Set by **END SIG. TIME** Fixed output during the time set within 10–200 ms (10ms 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 weld only) ON: The polarity of WE2 is opposite to that of WE1. OFF: The polarity of WE2 is the same as that of WE1.
Channel select[*7] (Common to all schedules)	Set by **SEQUENCE WELD** ON: The selected schedule and the next schedule make a set. The current is output through channel 1 according to the selected schedule, and then, through channel 2 according to the next schedule. OFF: The output channel is selected by the external I/O.
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 (Common to all schedules)	Set by **NO CURR MONITOR START** 00.5–99.9ms
Measured value start time (Common to all schedules)	Set by **MONITOR START TIME** OFF, 00.0–99.9ms
Start operation mode (Common to all schedules)	Set by **START SIG. INPUT** 2ND: When the 2nd.STAGE terminal is closed, the weld sequence starts. The weld sequence does not start even if the 1st.STAGE terminal is closed. 1ST+2ND: When the 1st.STAGE terminal is closed, the SOL terminal operates. Then when the 2nd.STAGE terminal is closed, the weld sequence starts. When the 1st.STAGE terminal is open, the weld sequence does not start even if the 2nd.STAGE terminal is closed.

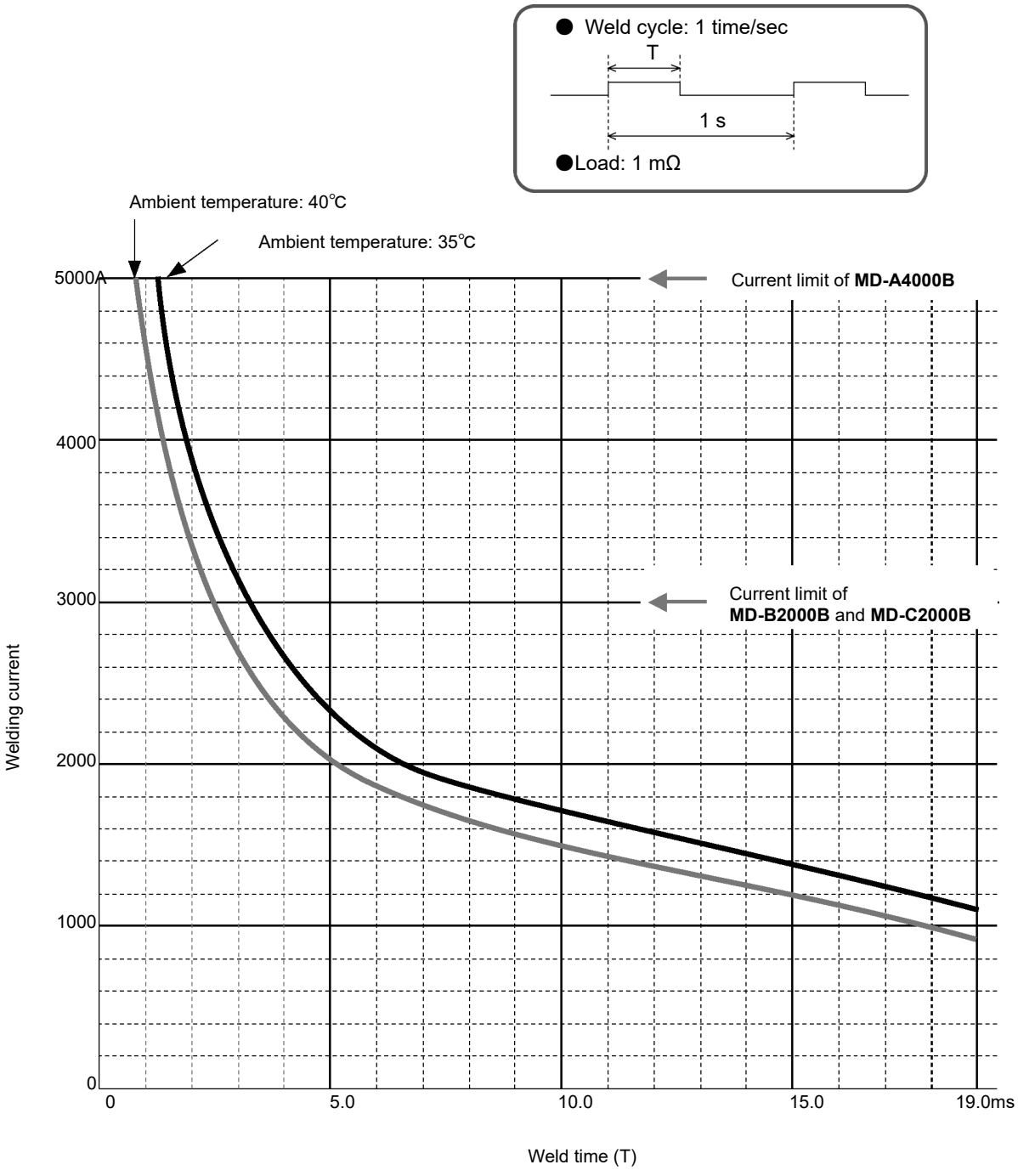
[*6] **MD-B2000B** only
[*7] **MD-C2000B** only

Battery for counter memory	Lithium battery (CR2450) Lifetime: Approx. 5 years after shipment
Operation environment*8	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
Heat-resistant class	E
Case protection	IP20
Power consumption	300W maximum
Dimensions	269 (H) x 172 (W) x 390 (D) mm (Projections not included.)
Mass	19kg (**MD-A1000B** alone is 15kg.)

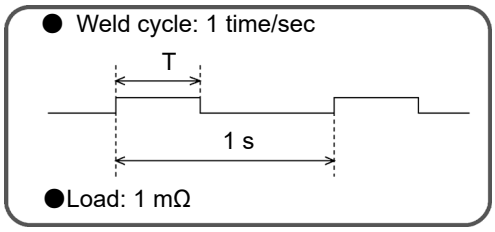
*8 Use this product in the environment without conductive dust. If conductive dust enters in the product, this may result in a failure, electric shock, or fire. When using this product in this environment, make contact with us.

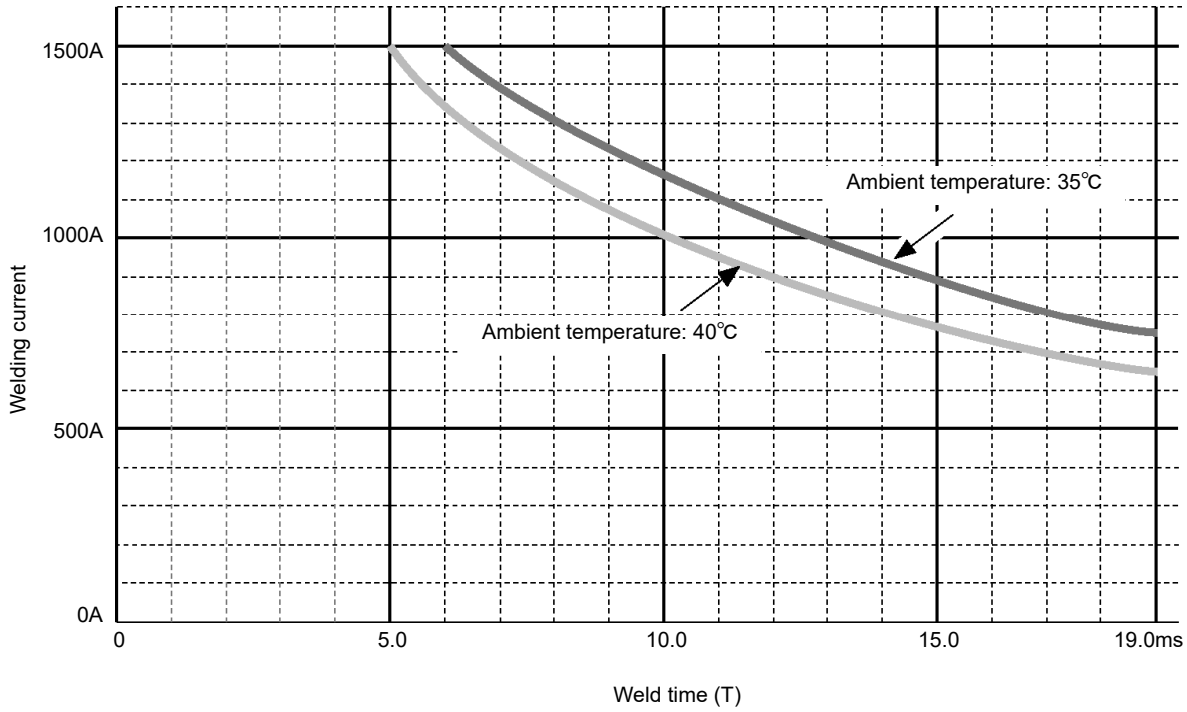
(2) Duty Cycle

● **MD-A4000B/B2000B/C2000B**



● **MD-A1000B**





(3) Board List for Maintenance

For repair or replacement, contact us.

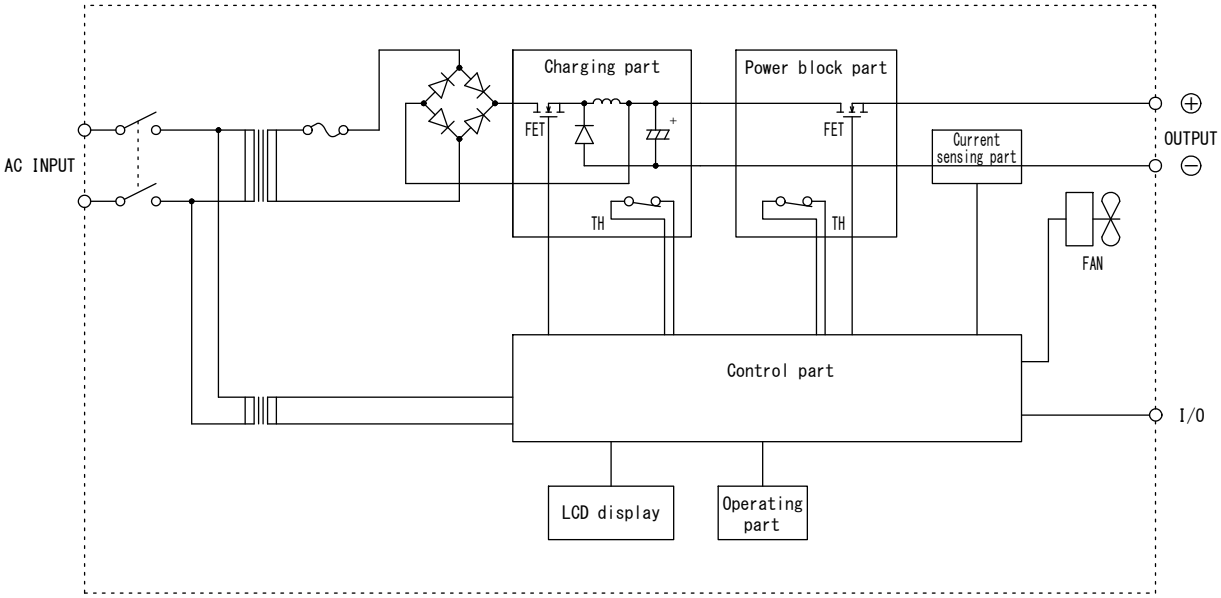
Model / Board	MD-A4000B -05-30/-05-31	MD-B2000B -05-30/-05-31	MD-C2000B -05-30/-05-31	MD-A1000B -05-30/-05-31
Main control board	ME-3086-11S1			ME-3086-10S1
Charge board	ME-1876-00			
Power block board	ME-3102-00			

(4) Major Components List

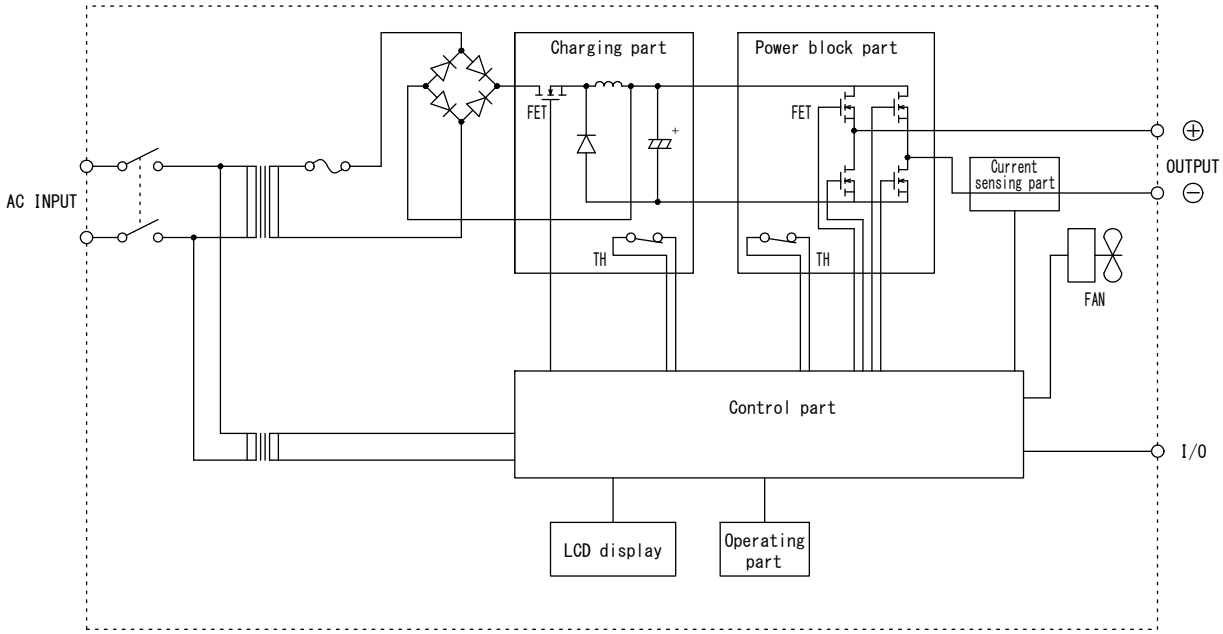
Item	Q'ty	
	MD-A4000B MD-B2000B MD-C2000B	MD-A1000B
Power transformer	2	2
Fan motor	1	1
Fuse	1	1
Switch	1	1
Thermal protector	9	3
Diode	2	2
FET	80	20

(5) Schematic

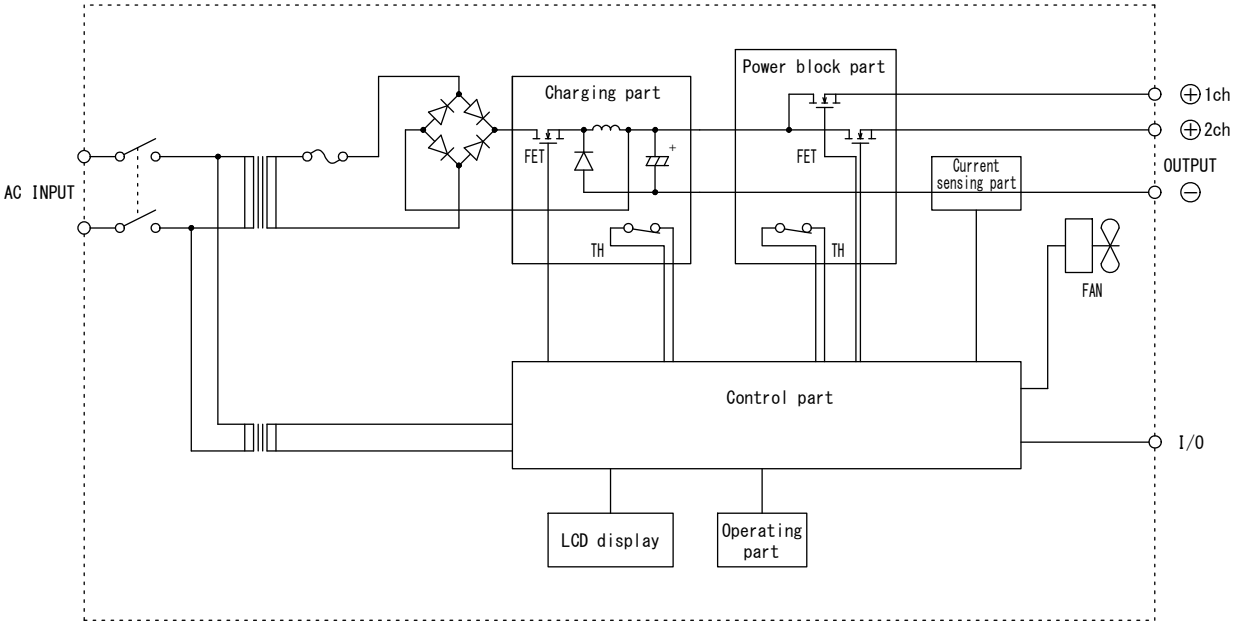
● **MD-A4000B/A1000B**



● MD-B2000B



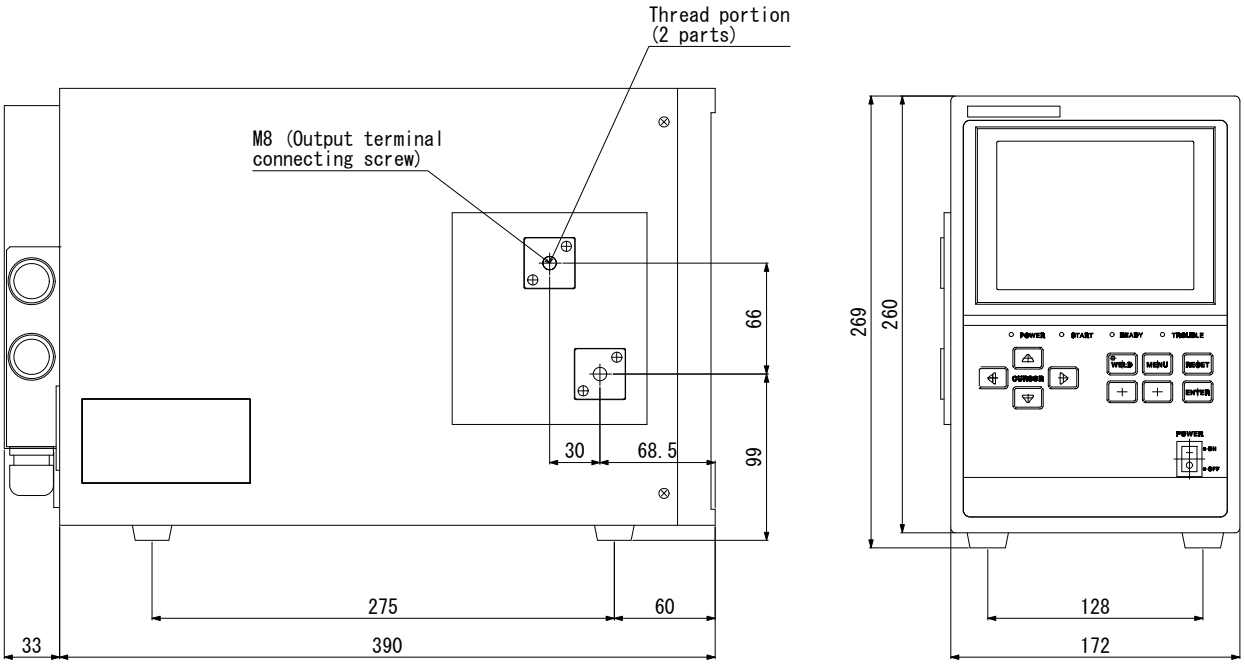
● MD-C2000B

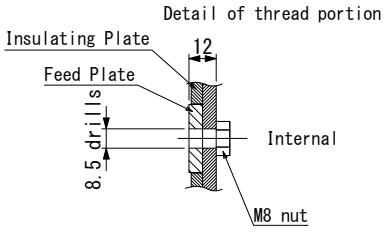


11. Outline Drawing

● **MD-A1000B / A4000B / B2000B**

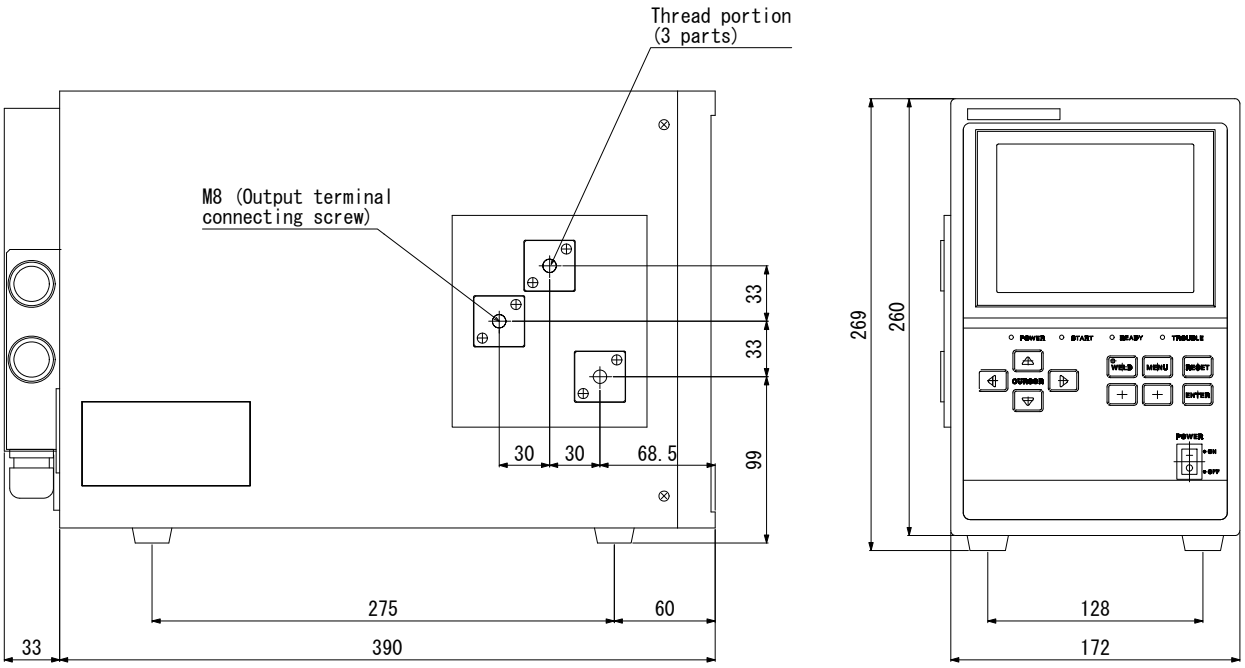
(Dimensions in mm)

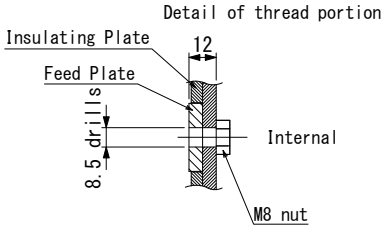




● MD-C2000B

(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	H								
		L								
	VOLT WE1	H								
		L								
	VOLT WE2	H								
		L								
	VOLT AVE/PEAK	H								
		L								
	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	
	SEQUENCE WELD	
	MONITOR SELECT	
	START SIG.INPUT	
COMMUNICATION SETTING	COMMUNICATION CONTROL	
	COMMUNICATION MODE	
	COMMUNICATION UNIT #	
	COMMUNICATION SPEED	
ERROR SETTING	E04:NO CURRENT	
	E05:NO VOLTAGE	
	E06/E09:OUT LIMIT OF CURR	
	E07/E10:OUT LIMIT OF VOLT	
	E08/E11:OUT LIMIT OF POWER	
	E15:PRECHECK ERROR	
	E18:COUNT MEMORY TROUBLE	
	E20:CYCLE TROUBLE	

Index

CE

AMADA WELD TECH CO., LTD.

EU Declaration of Conformity

The company/manufacturer: **AMADA WELD TECH CO., LTD.**
95-3, Futatsuka, Noda-City, 278-0016 JAPAN

Herewith declares in his own sole responsibility conformity of the product

Designation: **Transistor Welding Power Supply**

Types/Serial Number, etc.: **MD-A1000B-05-30 / MD-A1000B-05-31**
MD-A4000B-05-30 / MD-A4000B-05-31
MD-B2000B-05-30 / MD-B2000B-05-31
MD-C2000B-05-30 / MD-C2000B-05-31

With applicable regulations below

EC Directive: **Low Voltage Directive 2014/35/EU**
EMC Directive 2014/30/EU
RoHS Directive 2011/65/EU , (EU)2015 / 863

Harmonized European/International Standards applied:
ISO 12100 : 2010 , ISO 13849-1 : 2015
IEC 60204-1 : 2016
IEC 62135-1 : 2015 / COR1 : 2016 , IEC 62135-2 : 2020

Importer Distributor in EU:
(please place distributor/importer stamp here)

AMADA WELD TECH GmbH
Lindberghstrasse 1, DE-82178 Puchheim, GERMANY
Tel: + 49 8983 9403 - 0

Division: **AMADA WELD TECH CO., LTD.**

2021.5.18

Noda-City/Japan 2021-05-18
Place and Date

T. Jingu

Toshiakii Jingu / General Manager Quality Guarantee Department
Name/Signature/Position

Note: This Declaration certifies conformity with the above mentioned Directive(s), but gives no assurances of properties within the meaning of the Law concerning product liability and ProdSG. It becomes invalid if any technical or other modification are carried out without manufacturers consent.

64G091-07-5