Original instructions

WELD CHECKER®

MM-123B EU

OPERATION MANUAL

AMADA®

AA10OM1213142-01

Thank you for your purchase of our Weld Checker **MM-123B**.
Please read this manual carefully to ensure correct use. Keep the manual handy after reading for future reference.

Contents

EU Declaration of Conformity

1. Special Precautions

(1) Safety Precautions

Before using the weld tester, please read through the Safety Precautions carefully to ensure proper use.

- The precautions listed here are designed to ensure safe use and proactively prevent risks and damage to the user and other people. All precautions are critical for safety. Please read them all.
- The hazard signs have the following meanings:

 **DANGER**	Mishandling may cause imminent risk of death or serious injury.
 **WARNING**	Mishandling may cause risk of death or serious injury.
 **CAUTION**	Mishandling may cause risk of injury and physical damage.
	These signs represent “DON’Ts.” They warn of actions not covered by the product warranty” in the previous document.
	These signs represent “DOs" which must be observed by the product user.
	A sign within a triangular border indicates that a hazard (danger, warning or caution) is present.

DANGER

NEVER ATTEMPT to disassemble, repair or modify the instrument.

Do not touch any parts inside the instrument. Failure to observe this may result in an electric shock or fire.
For battery replacement, inspection or repair, please contact your dealer or us.

NEVER burn, destroy, cut, crush or chemically decompose the instrument.

This product incorporates parts containing gallium arsenide (GaAs).

WARNING

DO NOT place your hands between the electrodes.

When welding, be extremely careful not to get your fingers or hand caught in the electrodes.

During or immediately after welding, DO NOT touch the welded areas or electrode.

The welded areas of the workpiece, the electrodes and the welding machine's arm are extremely hot. To prevent burns, do not touch these areas.

Ground the instrument.

If the instrument is not grounded, you may receive an electric shock in the event of malfunction or current leak. Be sure to perform grounding work.

ALWAYS use the specified power supply.

Failure to use the power supply specified in the Operation Manual may result in a fire or electric shock.

Use the specified cables and connect them securely.

Failure to do so or improper connection may result in a fire or electric shock.

Keep the power and connection cables free of damage.

Do not walk on, twist or tug the cables.
Damaged cable may result in an electric shock, short circuit, or fire.
For repair or replacement, contact your dealer or us.

In the event of an anomaly, STOP the operation.

Continuing the operation with anomalies such as a generation of fumes, a burning odor, strange noise, or overheating unattended may result in an electric shock or fire. In the event of the above or other anomaly, immediately contact your dealer or us.

STAY AWAY from the instrument if you have a pace maker.

If you have a pacemaker, do not approach a welding machine in operation or the immediate area unless your doctor has given consent.
Welding machines generate a magnetic field which interferes with the operation of a pacemaker.

ALWAYS wear appropriate work clothing.

Wear protective gear such as gloves, a long-sleeved top and leather apron.
Surface flash and expulsion can cause burns if it contacts the skin.

CAUTION

ALWAYS wear protective goggles.

Directly looking at surface flash and expulsion during welding can temporary impair vision. Welding spatter can cause permanent eye damage, including blindness.

DO NOT splash water.

Electrical parts may cause an electric shock or short circuit if they become wet.

Keep the area clear of flammable objects.

Surface flash and expulsion generated during welding may ignite flammable objects, resulting in a fire. If work involves use of flammable items, place a non-flammable cover over such items.

DO NOT cover the instrument with a blanket or cloth.

During operation, do not cover the instrument with a blanket or cloth. This may lead to the instrument overheating and catching fire.

Install the instrument on a firm and level surface.

Injury may result if the equipment falls or is dropped.

Do not sit on or place objects on the instrument.

Failure to observe this precaution may lead to malfunction.

Wipe off dust from the power plug and securely insert it all the way.

Dust or improper insertion may lead to the plug heat up and catch fire.

Hold the power plug when removing or inserting it.

Removing the power plug by pulling on the cable may damage the power cable, resulting in an electric shock or causing the cable to catch fire.

If you do not use the instrument for extended periods, remove the power plug from the outlet.

Failure to do so may deteriorate the insulation, resulting in an electric shock, current leakage or fire.

Provide fire extinguishers.

Provide fire extinguishers at the welding site as a precautionary measure.

Perform maintenance and inspection on a regular basis.

Perform maintenance and inspection regularly and repair damaged areas and parts before using the instrument.

Wear soundproof earmuffs.

Loud noise may impair hearing.

(2) Precautions for Handling

- Avoid the following locations when installing the instrument:
  - Humid (above 90%) locations
  - Extremely hot (above 45°C) or cold (below 0°C) locations
  - Location where variation in environmental temperature is large
  - Near a high noise source
  - Location where chemical substances, etc. are handled
  - Location where condensation occurs
  - Dusty location
  - Location exposed to direct sunlight
  - Location that is inclined, insecure, unstable, or weak

- Check the voltage and power frequency before installation.

- Keep the exterior clean with a soft cloth or cloth lightly dampened with water. For stains, clean them off using a diluted neutral detergent or alcohol. Do not use thinner or benzene as they may cause discoloration or deformation.

- To prevent malfunction, do not allow any foreign objects such as screws or coins to enter the instrument.

- Operate the instrument according to the procedure described in the Operation Manual.

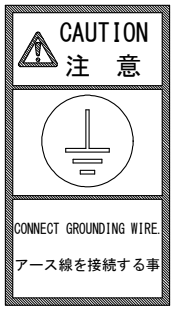
- Operate the switches and buttons with care. Rough operation or the use of a tool or pen tip may result in damage or malfunction.

(3) On Disposal

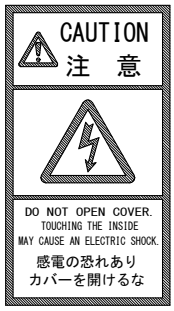
This product incorporates parts containing gallium arsenide (GaAs). At the time of disposal, separate it from general industrial waste or domestic waste and carry out the disposal in accordance with applicable laws and regulations.

(4) Warning Labels

A warning label is pasted on the instrument for safe use. The pasting place and meaning of each label are as shown below.



Pasting place: Top cover
Meaning: Caution for grounding wire connection



Pasting place: Top cover
Meaning: Danger of electric shock

2. Features

The Weld Checker **MM-123B** is a measuring instrument for monitoring the resistance welding.
The **MM-123B** can measure and display the welding current, voltage between electrodes, and weld time. The **MM-123B** enables quality control in welding.
The **MM-123B** has the following features.

- **Compact body**

  The outline is 187 x 70 x 248 (mm) and the weight is approx. 2 kg. The **MM-123B** can be installed anywhere and can be carried easily.

- **Supports a long-time welding current**

  The maximum measurement time is 3000 ms (150 CYC : 50 Hz). A long-time welding can be measured compared with 2000 ms (100 CYC : 50 Hz) of conventional models.

- **ISO17657-compliant measurement**

  In addition to the arithmetic mean RMS which is a conventional calculation system, the RMS in a whole current flow time which is the ISO17657-compliant calculation system can be selected by using the ISO-compliant toroidal coil (**MB-400P** and **MB-800P**).

- **Voltage measurement between electrodes**

  By using the voltage detection cable (option), welding current and voltage between electrodes can be measured simultaneously. To measure voltage, the relay cable (option) is required.

- **Low current measurement**

  By using the 10x sensitivity toroidal coil **MB-45G** (option), it is possible to measure current of 0.2 kA or less.

- **Managing measurement data with PC or server**

  You can transmit measurement data to your PC or server through the Ethernet communication.

- **Applicable to various welding currents**

  The **MM-123B** is applicable to any welding machine.

  [List of applicable welding currents]

  - Single-phase-AC
  - DC-inverter
  - AC-inverter
  - Transistor
  - Capacitor

- **Upper/Lower limit judgment function provided**

  When the measured value is outside the preset value, the trouble signal is output. This function is provided for quality control purpose.

- **Applicable to various power supplies**

  The **MM-123B** can be used with 100–240 V AC power supply. Also, the **MM-123B** can be operated with 24 V DC, allowing a variety of application.

- **Easy operation with a button**

  All operations are done with a switch. Operation is easy since there is not buttons and switches on the panel.

- **Easy-to-see LED display**

  Bright and clear 7-segment LED is employed. You can see characters on the display clearly from any angle.

3. Packaging

(1) Accessories

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

Item		Model No.	Q'ty
I/O connection connector	Case	DX-50-CV1	1
	Connector*2 (50 pins, male)	DX30A-50P(50)	1
Ferrite core*1		ZCAT3035-1330	1
Operation manual		AS1213143(OM1213141,OM1213142)	1

*1: Pass the LAN cable through this twice.

*2: The location of Pin 1 of the I/O connection connector DX30A-50P(50) is as shown below. For pressure contact, a dedicated jig is required. The I/O connection cable with connector is optionally available.

(2) Options

Item		Model No.
Power cable*1		KP-35 KS-16A SVT#18x3 B-TYPE (3-pin plug, for 100-120 V AC)
		KP244 VCTF3*1.25 KS16D 3M gray (Japan, for 200 V AC)
		CEE3P-W-1.8 (Round plug, for 200-240 V AC)
	3-pin/2-pin conversion adapter for power cable	KPR-24(SB)-B (for 100-120 V AC)
ISO toroidal coil*2		MB-400P-00 (approx. 120 mm in dia.) 1x sensitivity coil (with 400 mm bracket) (cable length of 3 m)
		MB-800P-00 (approx. 250 mm in dia.) 1x sensitivity coil (with 800 mm bracket) (cable length 3 m)
	ISO toroidal coil extension cable*3	SK-1211386 (2 m)
		SK-1211387 (5 m)
		SK-1211388 (10 m)
		SK-1211389 (20 m)
Toroidal coil*2*6		MB-45G-00 (approx. 45 mm in dia.) 10x sensitivity coil (mold type) (cable length of 3 m)
Voltage detection cable*4		SK-1205023 (cable length of 3 m)
Relay cable*4 (for branching current and voltage)		SK-1213144 (cable length of 0.2 m)
LAN cable		KB-FL6A-03BL (3 m)
Communication software		MA-725A-00-00
I/O conversion cable*5		SK-1205384 (cable length of 0.2 m)
Bracket		Z-02414-001(for fixing on table. 2 pieces required.)
I/O connection cable with connector*7		SK-1210081 (5 m)
		SK-1210082 (10 m)
		SK-1210083 (20 m)

*1: Exclusively for the **MM-123B**. Do not use for other devices.

*2: The **MM-123B** is exclusively for the ISO toroidal coil. Do not use with other toroidal coils.

*3: For extending the **MB-400P/800P** and the **MB-45G**.

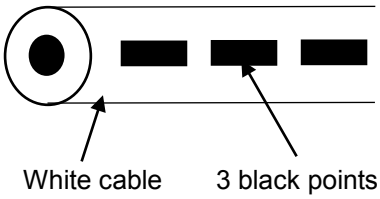
*4: For simultaneously measuring current and voltage, the relay cable (for branching current and voltage) is required.

*5: For converting the I/O connector dedicated for the **MM-122A**.

*6: The **MB-45G** has a measurement range of up to 1 kA. Do not use the measurement for over 1 kA because of failure cause the **MM-123B** and the **MB-45G**.

*7: The identification diagram of the I/O connection cable with connector's core is shown below.

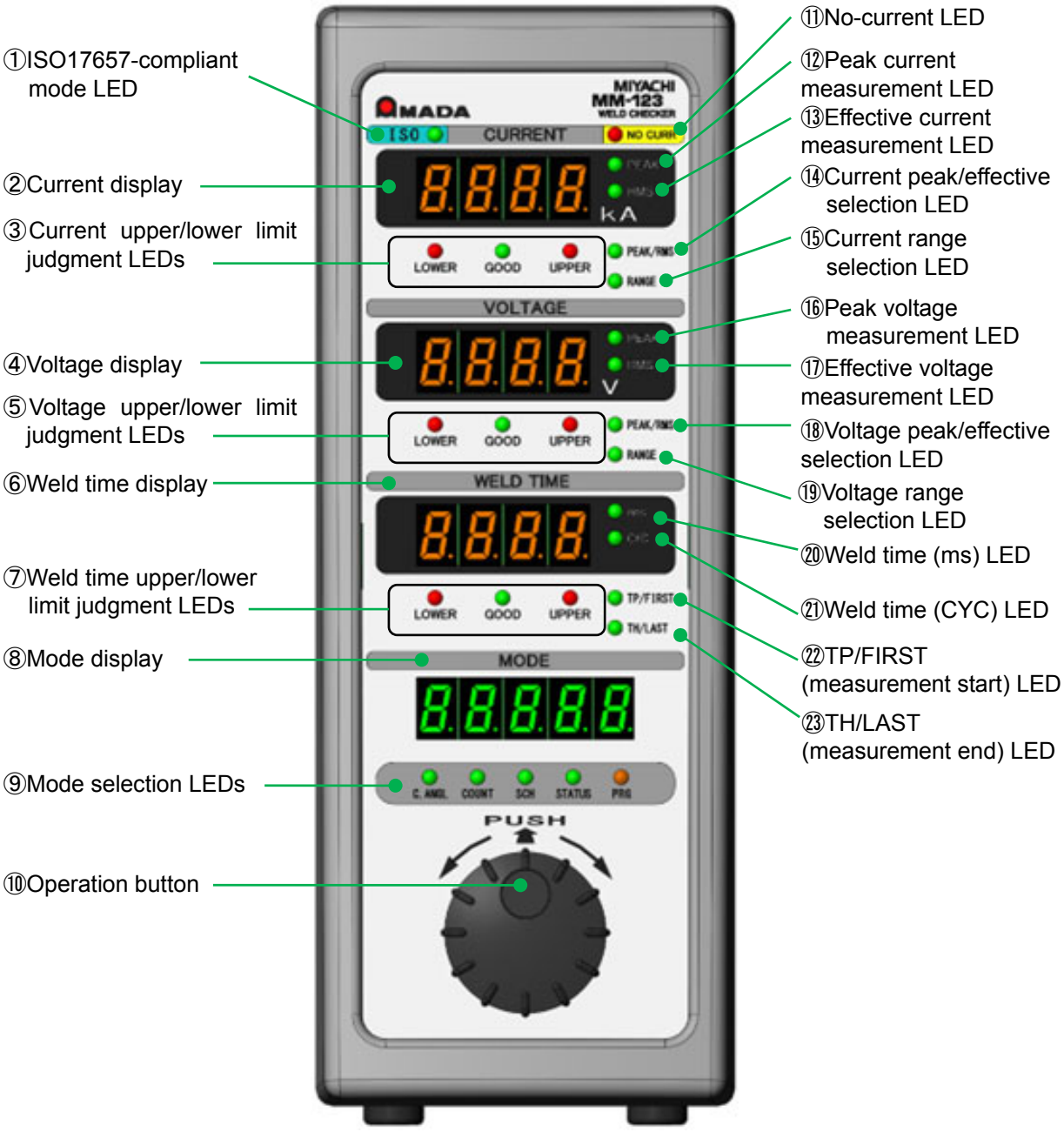
Example) Pin 49, White (■■■Black)



EXT.24V	1	Orange (■Black)
EXT.COM	2	Orange (■Red)
SCH1	3	Orange (■■■■Black)
SCH2	4	Orange (■■■■Red)
SCH4	5	Gray (■■■■Black)
SCH8	6	Gray (■■■■Red)
SCH16	7	White (■■■■Black)
(Not used)	8	Yellow (■■■■Black)
GATE	9	Yellow (■■■■Red)
COUNTUP.RST	10	Gray (■Black)
COM	11	Gray (■Red)
NO.CURR	12	Pink (■■■■Black)
NO.CURR24V	13	White (■Black)
NG.RESET	15	Yellow (■Black)
COM	16	Yellow (■Red)
COM	17	Yellow (■■■■■■■■■■Black)
SIG.COM	18	Pink (■Black)
(Not used)	19	Pink (■■■■■■■■■■Black)
TRG.SIG	20	Pink (■Red)
VOLT.SIG	21	Pink (■■■■Red)
CURR.SIG	22	Orange (■■Black)
SIG.COM	23	Orange (■■Red)
NO.CURR24V	25	White (■Red)
EXT.24V	26	Gray (■■Black)
EXT.24V	27	White (■■Black)
EXT.24V	28	Yellow (■■Black)
COM	30	Yellow (■■Red)
COM	31	White (■■Red)
COM	32	Gray (■■Red)
COM	33	Orange (■■■■■■■■■■Black)
NG24COM	34	Pink (■■Black)
NG24OUT	35	Pink (■■Red)
NG.L	37	Gray (■■■■■■■■■■Black)
NG-NG.H	39	Orange (■■■Black)
NG.COM	40	Orange (■■■Red)
(Not used)	41	White (■■■■■■■■■■Black)
(Not used)	42	White (■■■■■■■■■■Red)
GOOD	43	Gray (■■■Black)
GOOD.COM	44	Gray (■■■Red)
NO CURR	45	Yellow (■■■Black)
NO CURR	46	Yellow (■■■Red)
READY	47	Pink (■■■Black)
READY	48	Pink (■■■Red)
COUTUP	49	White (■■■Black)
COUNTUP.COM	50	White (■■■Red)
	FG	Cable shield

4. Name and Functions of Each Section

(1) Front



① ISO17657-compliant mode LED
Lights up when the ISO17657-compliant mode is selected.
When this LED lights up, the measurement result calculated with the measurement method complied with ISO17657 is displayed in the effective value measurement.

② Current display
Displays the selected measurement results of the current (peak or effective value) and the set value for the current upper/lower limit judgment.

③ Current upper/lower limit judgment LEDs
Indicate the result of the current upper/lower limit judgment. There are three LEDs, UPPER, GOOD and LOWER.

UPPER (red) lights up	When the measured current is higher than upper limit.
GOOD (green) lights up	When the measured current is the upper limit or lower and the lower limit or higher.
LOWER (red) lights up	When the measured current is lower than lower limit.

④ Voltage display
Displays the measurement results of the selected voltage (peak or effective value) and the set value for the voltage upper/lower limit judgment.

⑤ Voltage upper/lower limit judgment LEDs
Indicate the result of the selected voltage upper/lower limit judgment. There are three LEDs, UPPER, GOOD and LOWER.

UPPER (red) lights up	When the measured voltage is higher than upper limit.
GOOD (green) lights up	When the measured voltage is the upper limit or lower and the lower limit or higher.
LOWER (red) lights up	When the measured voltage is lower than lower limit.

⑥ Weld time display
Displays the measurement results of the weld time and the set value for the weld time upper/lower limit judgment. The unit for the weld time is CYC or ms.

⑦ Weld time upper/lower limit judgment LEDs
Indicates the result of the selected weld time upper/lower limit judgment. There are three LEDs, UPPER, GOOD and LOWER.

UPPER (red) lights up	When the weld time is higher than upper limit.
GOOD (green) lights up	When the weld time is the upper limit or lower and the lower limit or higher.
LOWER (red) lights up	When the weld time is lower than lower limit.

When the green LED (GOOD) lights up, the [GOOD] signal is output.
When the red LED (UPPER or LOWER) lights up, the [NG] signal is output.

⑧ Mode display
Displays the setting items, such as conduction angle, counter value, schedule number and status.

⑨ Mode selection LEDs
Data for the mode whose LED is on is displayed on the mode display. Turn the operation button to select a mode. For details, see **[7. (2) Basic Usage of the MM-123B]**.

⑩ Operation button
For all operations. This button can be pressed and turned right and left.

(Note) When operating the operation button, an LED not selected may light up for a moment. It is not malfunction.

⑪ No-current LED
Lights up when the welding current has not flowed (no-current), and the [NG] signal is output. To use the no-current judgment function, the [NO CURR] signal must be input. For details, see descriptions of Pins 12, 13, 25, 45, and 46 in **[5. (2) Description of the External I/O Signals]**.

⑫ Peak current measurement LED
Lights up when the peak current measurement is selected. When this LED is on, the current is displayed as the peak value.

⑬ Effective value of current measurement LED
Lights up when the effective value of current measurement is selected.
When the ISO17657-compliant mode LED is on, the current is displayed as the effective value in the ISO17657-compliant mode.
When the ISO17657-compliant mode LED is off, the current is displayed as the effective value in the original mode.

⑭ Current peak/effective selection LED
Lights up to select the current to be measured from peak and effective value in the program mode.

⑮ Current range selection LED
Lights up to change the current range in the program mode.

⑯ Peak voltage measurement LED
Lights up when the peak voltage measurement is selected. When this LED is on, the voltage is displayed as the peak value.

⑰ Effective value of voltage measurement LED
Lights up when the effective value of voltage measurement is selected.
When the ISO17657-compliant mode LED is on, the voltage is displayed as the effective value in the ISO17657-compliant mode.
When the ISO17657-compliant mode LED is off, the voltage is displayed as the effective value in the original mode.

⑱ Voltage peak/effective selection LED
Lights up to select the voltage to be measured from peak and effective value in the program mode.

⑲ Voltage range selection LED
Lights up to change the voltage range in the program mode.

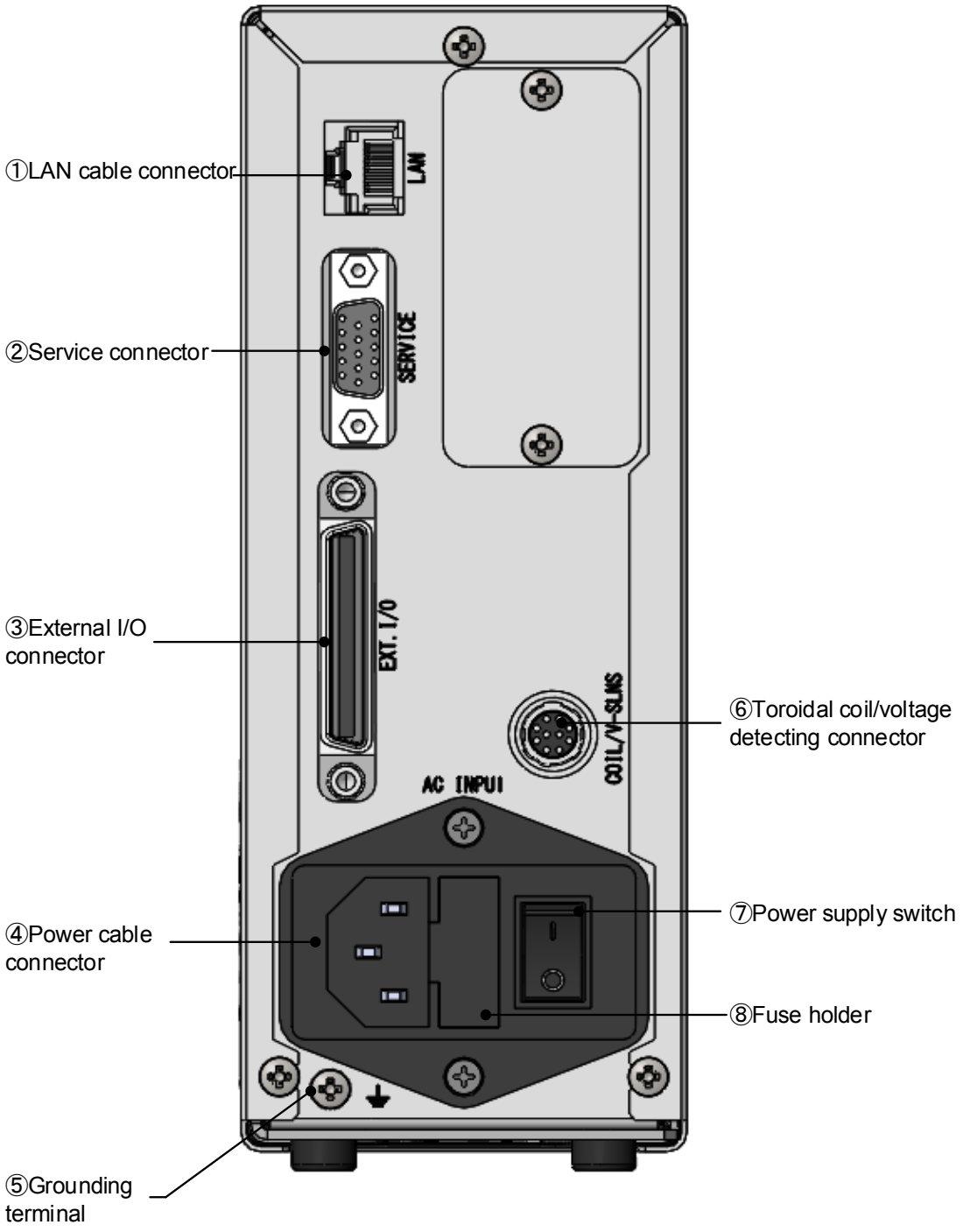
⑳ Weld time (ms) LED
Lights up when the weld time is selected in ms.
In the ISO17657-compliant mode, always blinks when the current measurement mode is dcSEC and the flow time is ON. For details, see **[7. (3) a. Selecting the Current Measurement Mode, Additional setting items of the current measurement mode]**.

㉑ Weld time (CYC) LED
Lights up when the weld time is selected in cycle.

㉒ TP/FIRST (measurement start) LED
Lights up to set the measurement start cycle (or start time) in the program mode. For details, see **[7. (3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST]**.
If this LED is on in the current measurement mode CAP-S or CAP-L, the TP (time peak) time is measured. For details, see **[7. (3) h. Selecting TP/TH (in the current measurement mode CAP-S and CAP-L only)]**.

㉓ TH/LAST (measurement end) LED
Lights up to set the measurement end cycle (or end time) in the program mode. For details, see **[7. (3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)**.
If this LED is on in the current measurement mode CAP-S or CAP-L, the TH (time half) time is measured. For details, see **[7. (3) h. Selecting TP/TH (in the current measurement mode CAP-S and CAP-L only)]**.

(2) Rear


①LAN cable connector
LAN
②Service connector
SERVICE
③External I/O connector
EXT. I/O
⑥Toroidal coil/voltage detecting connector
COIL/V-SENS
AC INPUT
④Power cable connector
⑦Power supply switch
⑧Fuse holder
⑤Grounding terminal

① LAN cable connector
For connection with the LAN cable for the Ethernet communication.

② Service connector
Do not connect anything.

③ External I/O connector
For connection with input and output signals from peripheral devices.

④ Power cable connector
Connects to the power cable (option) when the single-phase AC power supply (100–240 V) is used.

⑤ Grounding terminal
Use this terminal for grounding when the power cable with a grounding wire (option) is not used. Be sure to ground the **MM-123B** before use.

⑥ Toroidal coil/voltage detecting connector
When using the voltage measurement function, connect the toroidal coil (**MB-400P**/**MB-800P**/**MB-45G**) and the voltage detection cable using the relay cable (option).

⑦ Power supply switch
Turns on/off the power supply when the single-phase AC power supply (100–240 V) is used.

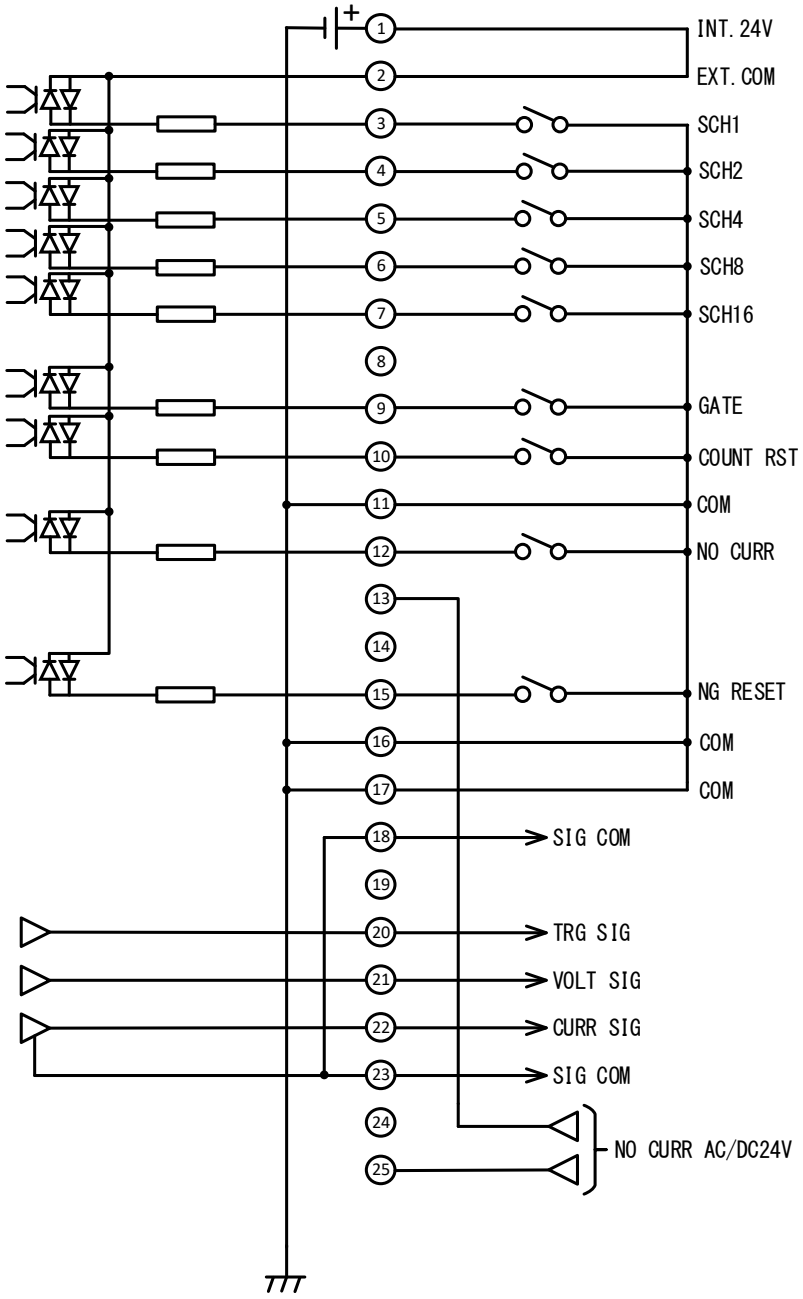
⑧ Fuse holder
Has a fuse inside.

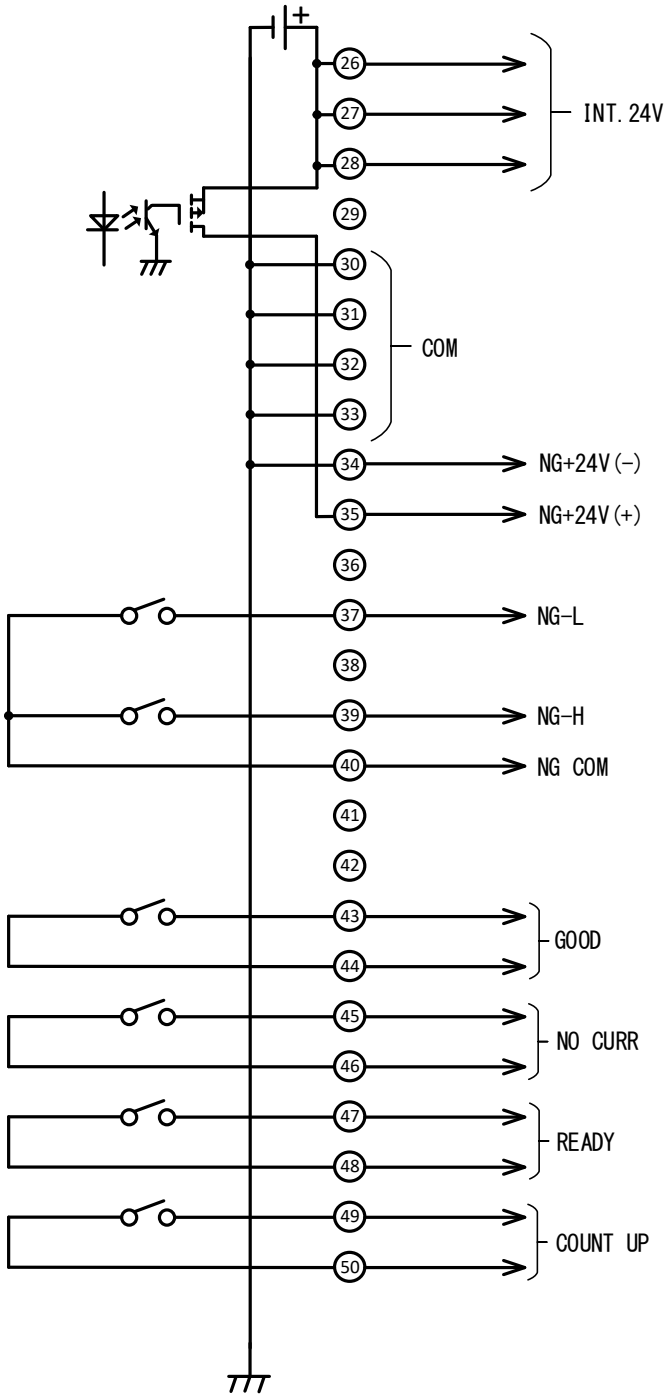
Fuse rating	250 V, 1 A, φ5 x 20 mm (Time delay, High interrupting capacity)

5. Interface

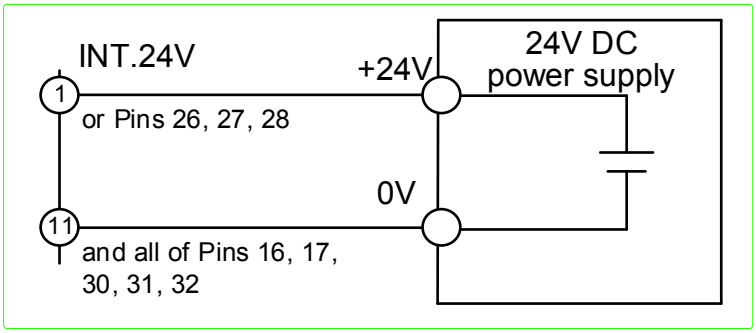
(1) Connection Diagram of the External I/O Signals

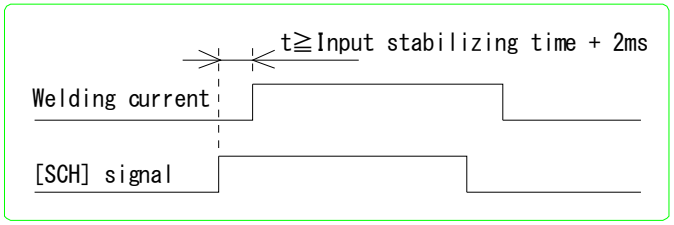
Description of each pin on the external I/O connector.
Input signal is explained as contact input.




+
26
27
28
INT. 24V
29
30
31
32
33
COM
34
NG+24V(-)
35
NG+24V(+)
36
37
NG-L
38
39
NG-H
40
NG COM
41
42
43
44
GOOD
45
46
NO CURR
47
48
READY
49
50
COUNT UP

(2) Description of the External I/O Signals

<table>
<tr><th>Pin No.</th><th>Name</th><th>Function</th></tr>
<tr><td>1, 26, 27, 28</td><td>INT.24V</td><td rowspan="2">Pins 1, 26, 27, and 28 are pins for the INT.24V. Pin 2 is the EXT.COM. Connect pins as follows:
When using contacts or NPN transistors (sink type) on a PLC as input signals to the I/O connector, connect either of INT.24V terminals and Pin 2.
When using PNP transistors (source type) on a PLC as input signals to the I/O connector, connect Pin 2 to the COM terminal of PLC.
The output capacity of the internal power supply is 24 V DC, 100 mA max.
For details, see [5. (3) Connection of Input Signals].
When the MM-123B is operated with 24 V DC, connect INT.24V terminal and all COM terminals (Pins 11, 16, 17, 30, 31, 32, and 33) as shown below.
 

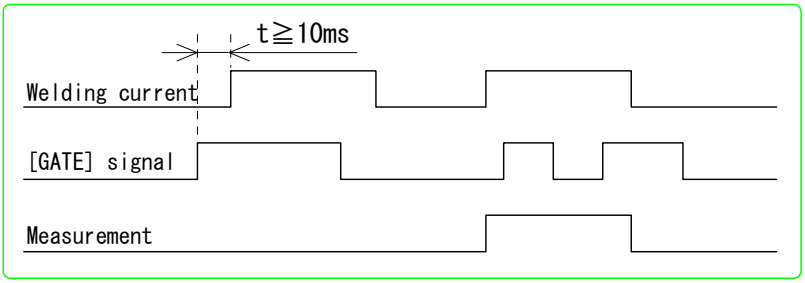
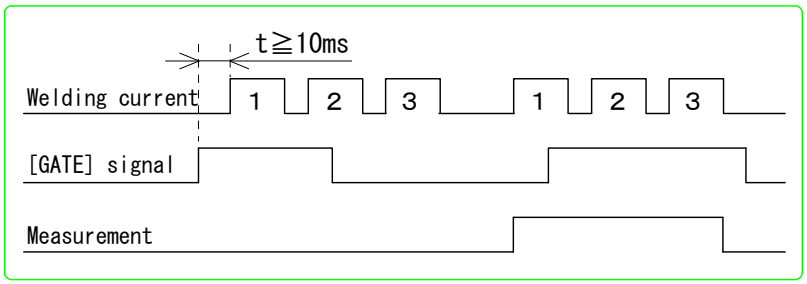
* When the MM-123B is operated with 24 V DC, do not connect the power cable to the power cable connector. Connecting 24 V DC and 100 V power supply simultaneously may lead to malfunction.</td></tr>
<tr><td>2</td><td>EXT.COM</td></tr>
<tr><td>3</td><td rowspan="5">3: SCH1
4: SCH2
5: SCH4
6: SCH8
7: SCH16</td><td rowspan="5">Input pins for selecting the schedule number.
Select the schedule number by combing the pin numbers whose circuits are closed among Pins 3 to 7. See table on the next page.
The schedule number selected by the I/O connector has priority over that set by the Weld Checker. When selecting the schedule number by the operation button on the Weld Checker, open the circuits of the Pins 3, 4, 5, 6 and 7.
Input the Schedule select [SCH] signal at least “input stabilizing time + 2 ms” before the welding current flows. The schedule number cannot be changed during measurement.
For details of the input stabilizing time, see [7. (5) h. System Setting (7) Input stabilizing time].
 
</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
</table>

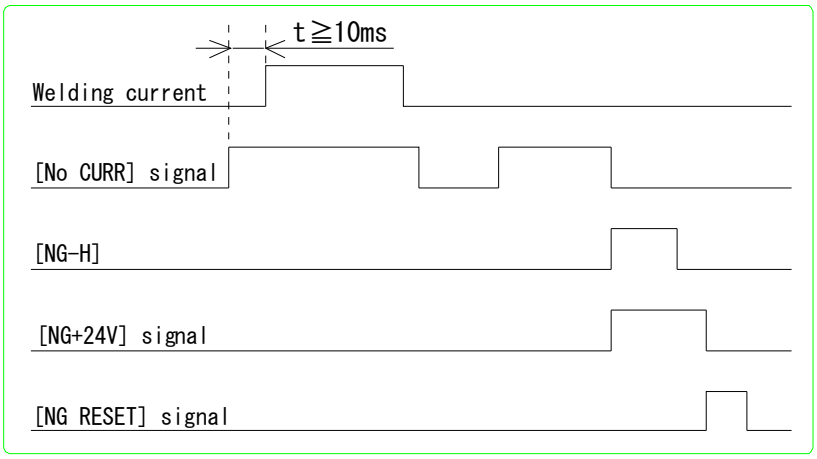
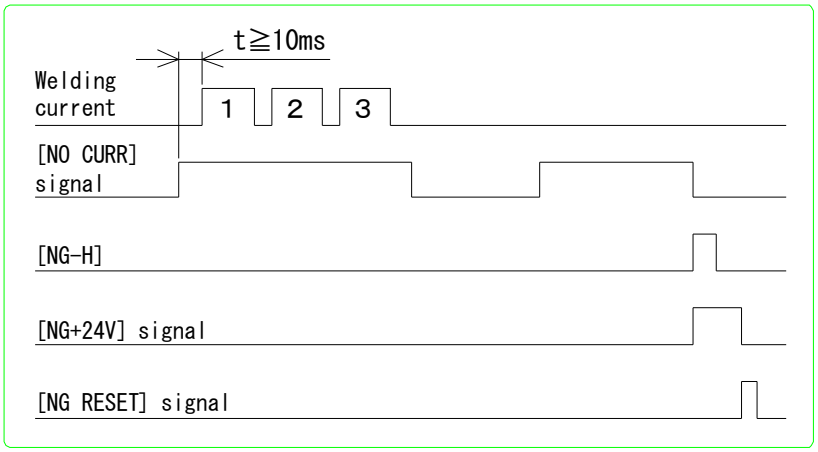
<Example combination of the SCH number and the SCH pin number>

Pin No. / SCH No.	7	6	5	4	3
1					●
2				●	
3				●	●
4			●		
5			●		●
6			●	●	
7			●	●	●
8		●			
9		●			●
10		●		●	
11		●		●	●
12		●	●		
13		●	●		●
14		●	●	●	
15		●	●	●	●
16	●				

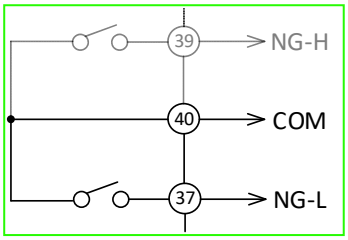
Pin No. / SCH No.	7	6	5	4	3
17	●				●
18	●			●	
19	●			●	●
20	●		●		
21	●		●		●
22	●		●	●	
23	●		●	●	●
24	●	●			
25	●	●			●
26	●	●		●	
27	●	●		●	●
28	●	●	●		
29	●	●	●		●
30	●	●	●	●	
31	●	●	●	●	●

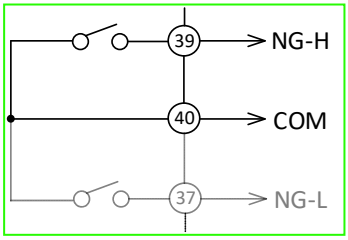
* When all pins are opened, the schedule number set by the main unit is selected.

Pin No.	Name	Function
8	-	Not used.
9	GATE	Input pin for the Measurement stop [GATE] signal. Used for selecting the welding current to measure. Measurement stops while this circuit is closed. In the impulse welding, the stopping interval of the measurement operation by the [GATE] signal is till the end of the impulse welding. When stopping the measurement, input the signal at least 10 ms before the welding current flows. Signals cannot be accepted during measurement (including impulse measurement). [Single-stage welding]  [Impulse welding] 
10	COUNT RST	Input pin for the [COUNT RST] signal. When this circuit is closed, the counter is reset to 0. • When the [COUNT UP] signal is output, the counter becomes 0 and the [COUNT UP] signal stops. • When the step counter function is used, the step counter becomes 0 and the step number is reset to 1. (Pressing the operation button for one second when the COUNT of the mode selection LEDs is on also resets the counter.)
11, 16, 17, 30, 31, 32, 33	COM	Common terminal for input signals.

Pin No.	Name	Function
12	NO CURR	Input pin for the No-current detecting [NO CURR] signal. Close the circuit at least 10 ms before the welding current flows, and open it after the welding current flows. If the welding current doesn't flow while this circuit is closed, it is judged as no-current when the circuit is opened, the no-current LED lights up and the [NG-H] and [NG+24V] signals are output. [Single-stage welding]  [Impulse welding] 
13, 25	NO CURR AC/DC24V	Input pins for the no-current detecting voltage. These are for detecting no-current by utilizing voltage. Input 24 V AC or DC voltage at least 10 ms before the welding current flows, and stop inputting after the welding current flows. If the welding current doesn't flow while the voltage is input to this circuit, it is judged as no-current when the input of the voltage stops, the no-current LED lights up and the [NG-H] and [NG+24V] signals are output. When 24 V DC or 24 V AC is used for the power supply of the solenoid valve for weld force, the welding head can be driven by connecting this pin to the head. In that case, when the weld forcing is ceased, no-current is detected.
14, 19, 24, 29, 36, 38, 41, 42	-	Not used.

Pin No.	Name	Function
15	NG RESET	Input pin for the [NG RESET] signal. If a trouble occurs, rectify the trouble and close this circuit. The [NG] signals are turned off. (See **[9. Fault Code List]** for fault codes.) If this circuit is closed when the [NG-L], [NG-H], [GOOD], [NG+24V] or [NO CURR] signal is hold, the hold status is canceled. (See **[7. (5) h. System Setting (8) Output time]** for hold.) Close at least for 2 ms and open. Also, Pin 15 does not function with normally closed. When a chattering occurs in a switch, input the [NG RESET] signal at least for "input stabilizing time + 2 ms."
18, 23	SIG COM	Common terminal for analog signals.
20	TRG SIG	Analog signal output pin for the trigger signal. Approx. 3.3 V is output when a current flows. This is used as the trigger for starting measurement when viewing the current waveform with oscilloscope.
21	VOLT SIG*1	Analog signal output pin for the voltage. This is for viewing the voltage waveform with oscilloscope. (Approx. 2 V / range maximum value)
22	CURR SIG*1	Analog output signal pin for the current. This is for viewing the current waveform with oscilloscope. (Approx. 2 V / range maximum value)
34	NG+24V(-)	Output pins for the [NG+24V] signal. Output capacity is 100 mA max. NG+24V is output ・ when the measurement item is outside the upper/lower limit. (For details, see **[7. (4) Upper/Lower Limit Judgment Function]**.) ・ when CCCC, EEEE or other error code is displayed. (For details, see **[9. Fault Code List]**.) When the [NG RESET] signal is input (when Pins 15 and 16 are closed), the output stops. Also, pressing the operation button resets the Trouble signal. 24 V DC relay and LED can be driven directly by the output power from this pin.
35	NG+24V(+)	

Pin No.	Name	Function
37	NG-L	The circuit between Pins 37 and 40 is output pin for the [NG] or [NG-L] signal.  Function is switched by the system setting. For details, see **[7. (5) h. System Setting (1) Upper/lower limit judgment output operation and (2) Error output]**. a HL1 and HLnc Close when the power supply is turned on. b HL2 and HLnc Close when the power supply is turned on. Open for the fixed time when the measured value is lower than the lower limit. (For the opened time, see **[7. (5) h. System Setting (8) Output time]**.) c HL1 and HLno Open when the power supply is turned on. d HL2 and HLno Close for the fixed time when the measured value is lower than the lower limit. (For the closed time, see **[7. (5) h. System Setting (8) Output time]**.) Contact capacity of semi-conductor relay: 24 V DC, 20 mA

<table>
<tr><th>Pin No.</th><th>Name</th><th>Function</th></tr>
<tr><td>39</td><td>NG-H</td><td>
The circuit between Pins 39 and 40 is output pin for the [NG] or [NG-H] signal.


Function is switched by the system setting. For details, see [7. (5) h. System Setting (1) Upper/lower limit judgment output operation and (2) Error output].

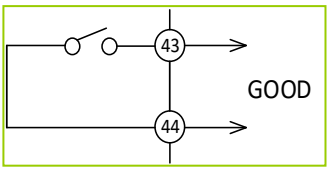
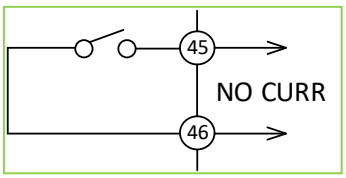
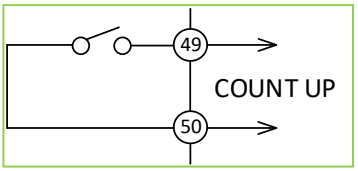
a HL1 and HLnc
Close when the power supply is turned on and open for the fixed time at the following situation. (For the opened time, see [7. (5) h. System Setting (8) Output time].)
・When the measurement result is higher than the upper limit or lower than the lower limit.
・When judged as no-current.
・When CCCC, EEEE or other error code is displayed. (For details, see [9. Fault Code List].)

b HL2 and HLnc
Close when the power supply is turned on and open for the fixed time at the following situation. (For the opened time, see [7. (5) h. System Setting (8) Output time].)
・When the measurement result is higher than the upper limit.
・When judged as no-current.
・When CCCC, EEEE or other error code is displayed. (For details, see [9. Fault Code List].)

c HL1 and HLno
Close for the fixed time at the following situation. (For the closed time, see [7. (5) h. System Setting (8) Output time].)
・When the measurement result is higher than the upper limit or lower than the lower limit.
・When judged as no-current.
・When CCCC, EEEE or other error code is displayed. (For details, see [9. Fault Code List].)

d HL2 and HLno
Close for the fixed time at the following situation. (For the closed time, see [7. (5) h. System Setting (8) Output time].)
・When the measurement result is higher than the upper limit.
・When judged as no-current.
・When CCCC, EEEE or other error code is displayed. (For details, see [9. Fault Code List].)

Contact capacity of semi-conductor relay: 24 V DC, 20 mA
</td></tr>
<tr><td>40</td><td>NG COM</td><td>Common terminal for NG-L and NG-H output signals.</td></tr>
</table>

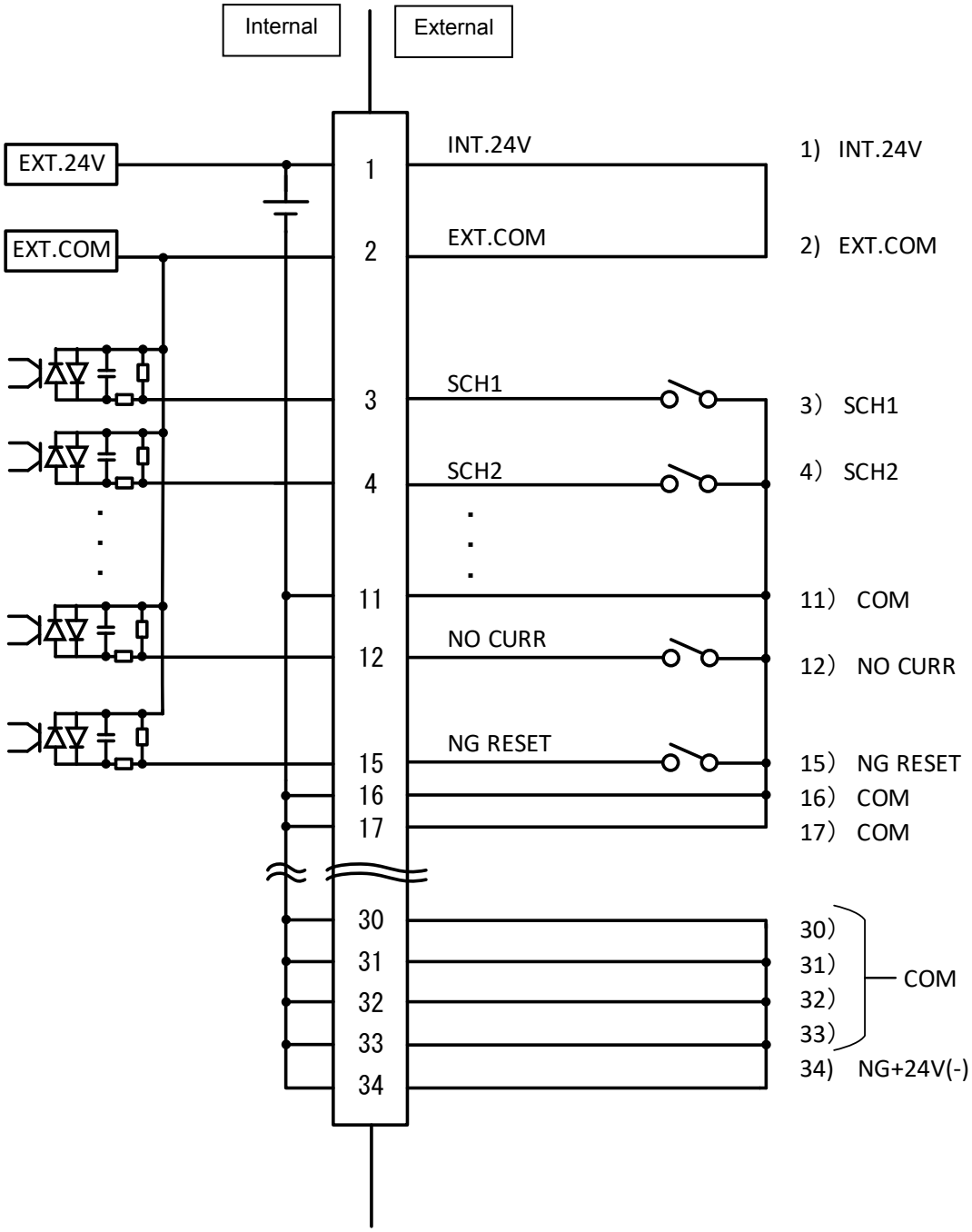
Pin No.	Name	Function
43, 44	GOOD	Output pins for the [GOOD] signal. Close for the fixed time when the measured value is within the range of the upper/lower limit judgment function. (For the closed time, see **[7. (5) h. System Setting (8) Output time]**.)  Contact capacity of semiconductor relay: 24 V DC, 20 mA
45, 46	NO CURR	Output pins for the [NO CURR] signal. Close for the fixed time when the no-current is detected. (For the closed time, **[7. (5) h. System Setting (8) Output time]**.)  Contact capacity of semiconductor relay: 24 V DC, 20 mA
47, 48	READY	Output pins for the [READY] signal. Closed when measurement is ready. Open while welding is measured and in the program mode. Contact capacity of semiconductor relay: 24 V DC, 20 mA
49, 50	COUNT UP	Output pins for the [COUNT UP] signal.  [When the preset counter is used] Close when the good count reaches the preset value. For the preset counter, see **[7. (5) a. Setting the Preset Counter (COUNT)]**. [When the step counter is used] Close when the count of the last step ends. For the step counter, see **[7. (5) b. Setting the Step Counter]**. When the number of the welds exceeds its setting, the counter display blinks. When the Counter reset [COUNT RST] signal is input, the counter is reset. Contact capacity of semiconductor relay: 24 V DC, 20 mA

*1: The analog output signal is not calibrated. Output impedance is 1 kΩ.

(3) Connection of Input Signals

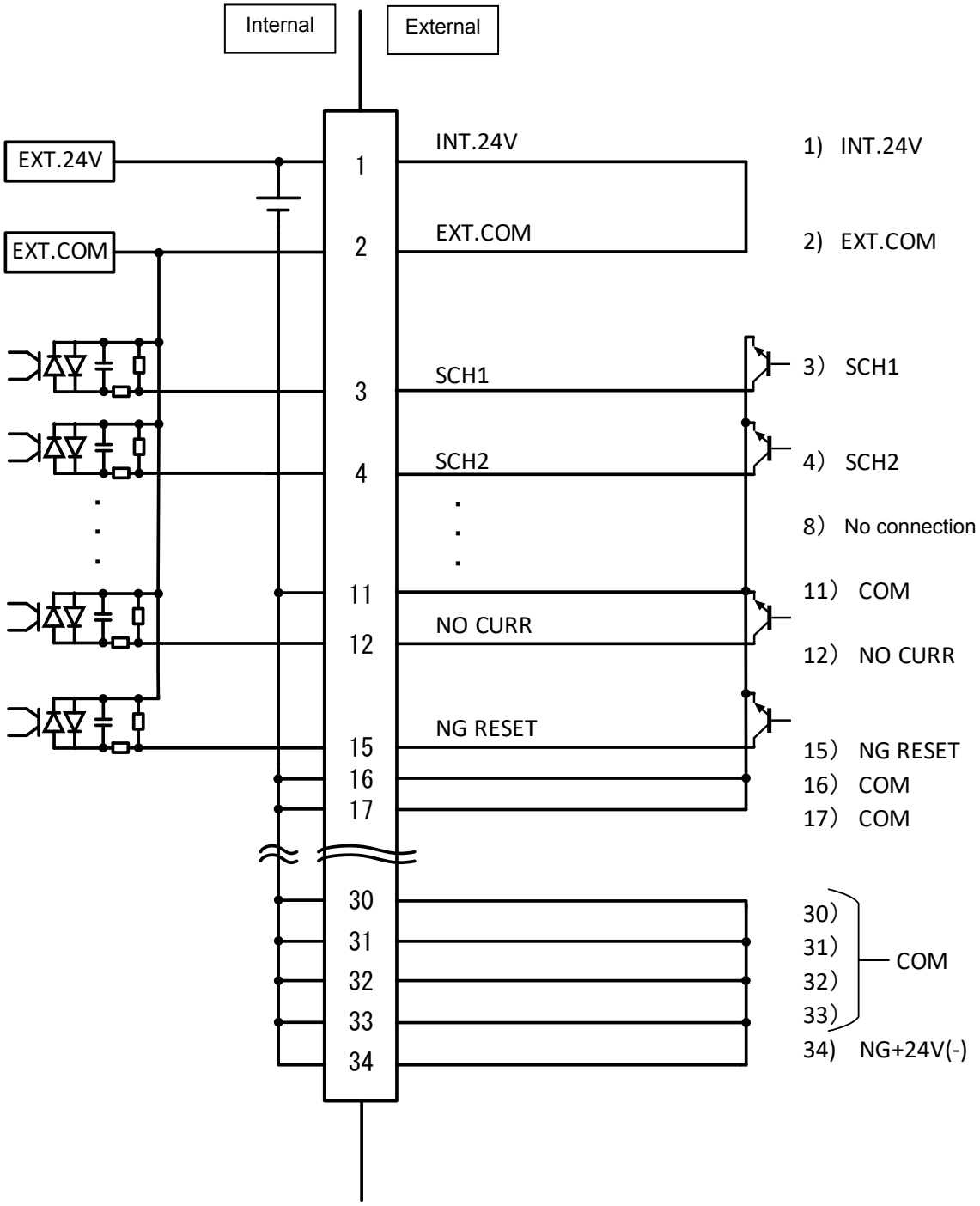
a. Connection with Device Having a Contact Input (when Using Internal Power Supply)

Connect pins 1 and 2.



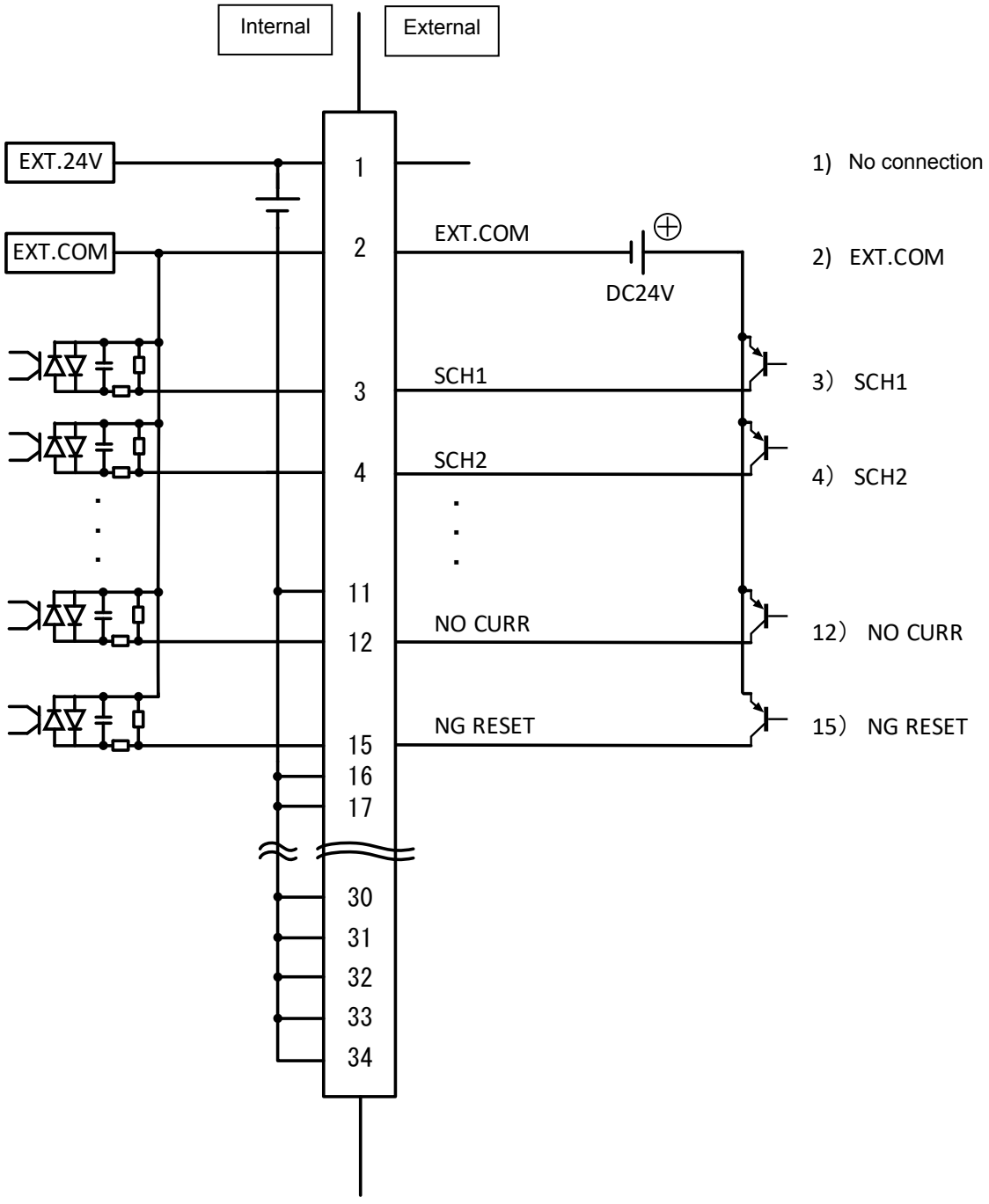
b. Connection with Device Featuring NPN Open Collector Output (when Using Internal Power Supply)

Connect pins 1 and 2.



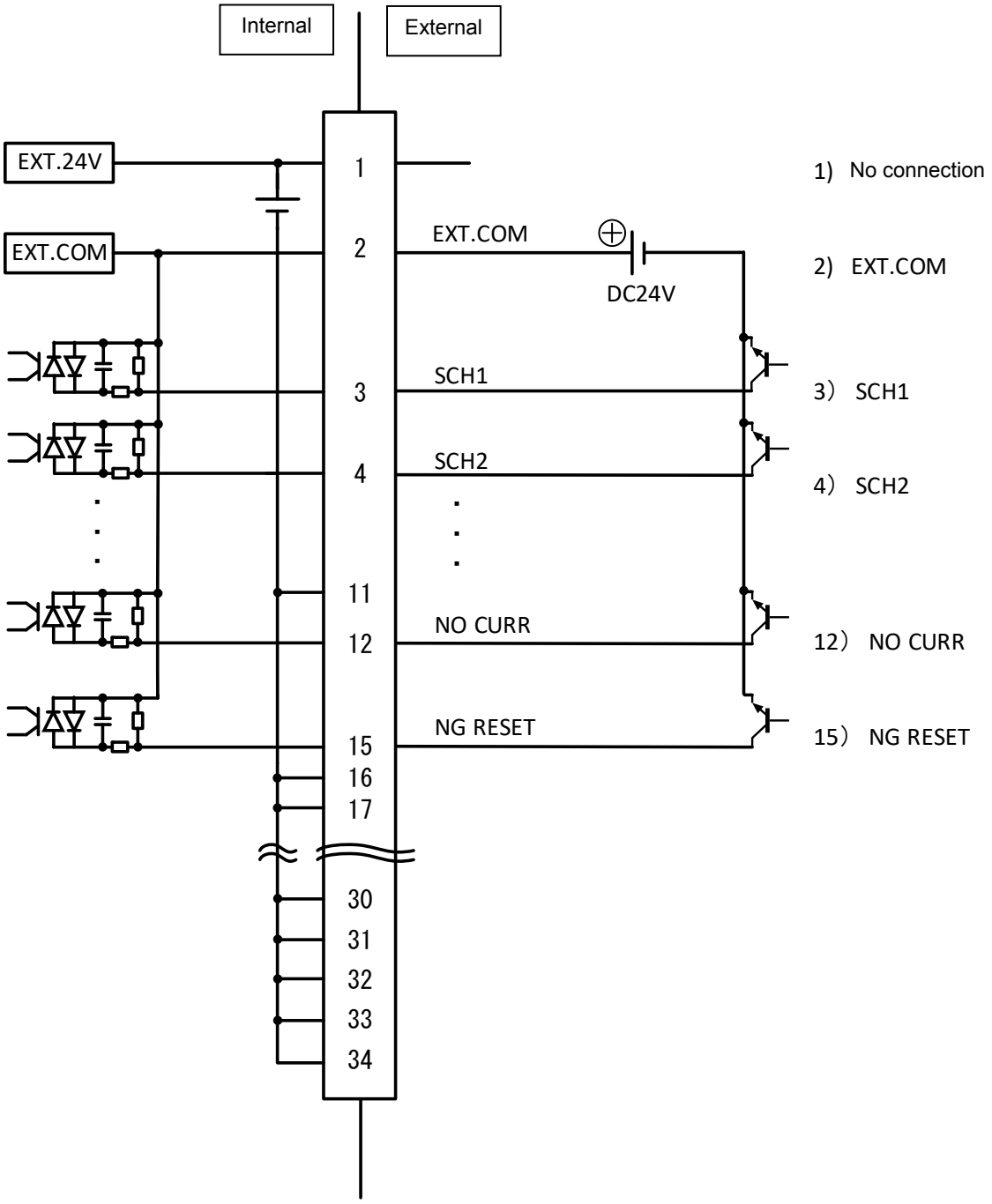
c. Connection with Device Featuring PNP Current Output (when Using External Power Supply)

Connect the negative side of an external 24 V DC power supply to pin 2.



d. Connection with Device Featuring NPN Open Collector Output (when Using External Power Supply)

Connect the positive side of an external 24 V DC power supply to pin 2.



6. Installation and Connections

(1) Installing the MM-123B

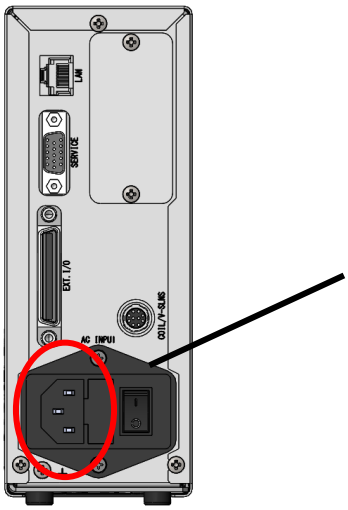
1) Place the **MM-123B** on a stable surface.

   * Use this Weld Checker in an upright position.

2) To comply with CE, arrange the IEC60947-2-compliant breaker on the upper side of the power supply of the **MM-123B**.

3) Connect the power cable to the power cable connector on the rear of the Weld Checker. 100 V AC to 240 V AC power supply can be used.

   Also, 24 V DC power supply can be used. See Pins 1, 26, 27 and 28 in **[5. (2) Description of the External I/O Signals]**. When using 24 V DC, do not connect the power cable to the power cable connector.

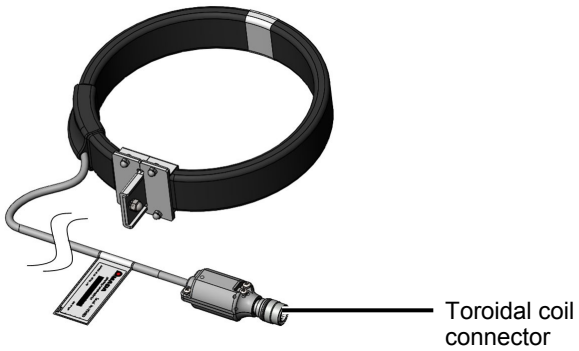


Do not connect the power cable to the power supply connector when using 24 V DC.

(2) Preparations for Measurement – Connection between the MM-123B and Sensors

a. Preparing the Toroidal Coil and the Voltage Detection Cable

Prepare the toroidal coil to measure the current or the voltage detection cable (SK-1205023) and the relay cable (branching current and voltage) (SK-1201740) to measure the voltage. Note that only voltage cannot be measured. To measure voltage, be sure to prepare a toroidal coil, too.



Toroidal coil (e.g., **MB-400P**)

Connect a toroidal coil suited to your operating environment.

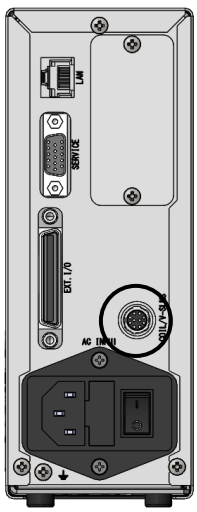
The toroidal coils of the following sizes can be used:

Toroidal coil model	Type
MB-400P	1x sensitivity coil (with 400 mm bracket), ISO17657-compliant type
MB-800P	1x sensitivity coil (with 800 mm bracket), ISO17657-compliant type
MB-45G	10x sensitivity coil (mold type) Max. measurement range: 1 kA Do not use the measurement for over 1 kA because of failure cause the **MM-123B** and the **MB-45G**

Follow the steps described below to connect the toroidal coil and the voltage detection cable.

1) When measuring current only

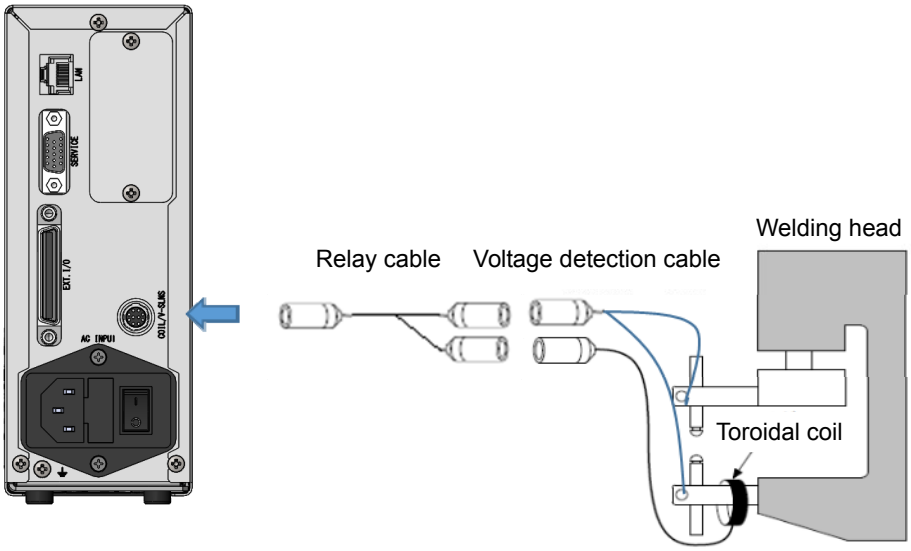
Plug the toroidal coil connector into the toroidal coil/voltage detecting connector on the rear panel of the **MM-123B**.



2) When measuring voltage

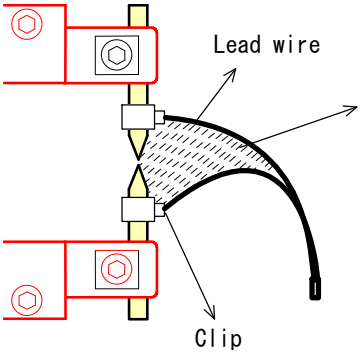
As shown below, plug the toroidal coil and the voltage detection cable into the relay cable (branching current and voltage).

Plug the relay cable (branching current and voltage) connector into the toroidal coil/voltage detecting connector on the rear panel of the **MM-123B**.

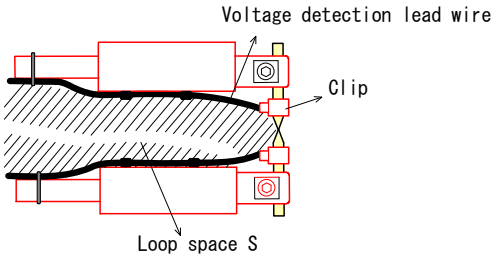


When connecting the voltage detection cable, be careful with the following:

The voltage detection cable picks up voltage induced by the welding current. To measure the voltage between the tips, connect the cable as shown below.



Make the distance between clips as small as possible, and twist the lead wires together so that induction voltage is reduced and the voltage between tips can be measured accurately.

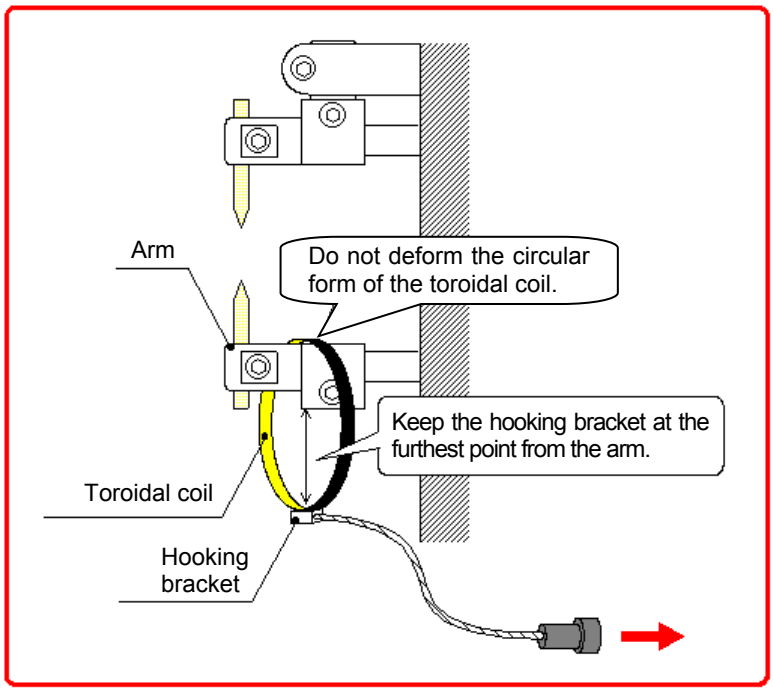


When the voltage detection cable wires are placed as shown to the left, voltage induced by the welding current is added to the voltage between tips. When monitoring voltage, fasten the lead wires so that the loop space S does not change and induction voltage does not fluctuate.

b. Connecting the toroidal coil to the welding machine or arm

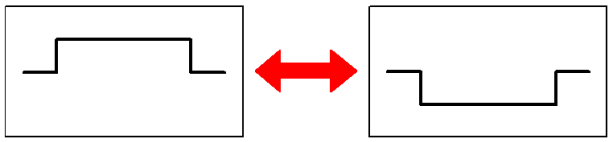
When fitting the coil, be careful with the following:

- Keep the toroidal coil's hooking bracket as far away from the welding machine's arm (secondary conductor) as possible.
- Do not deform the circular form of the toroidal coil when fitting it.



CAUTION

- If the toroidal coil is fitted in reverse orientation, the analog output waveforms measured with the oscilloscope are also shown in reverse.

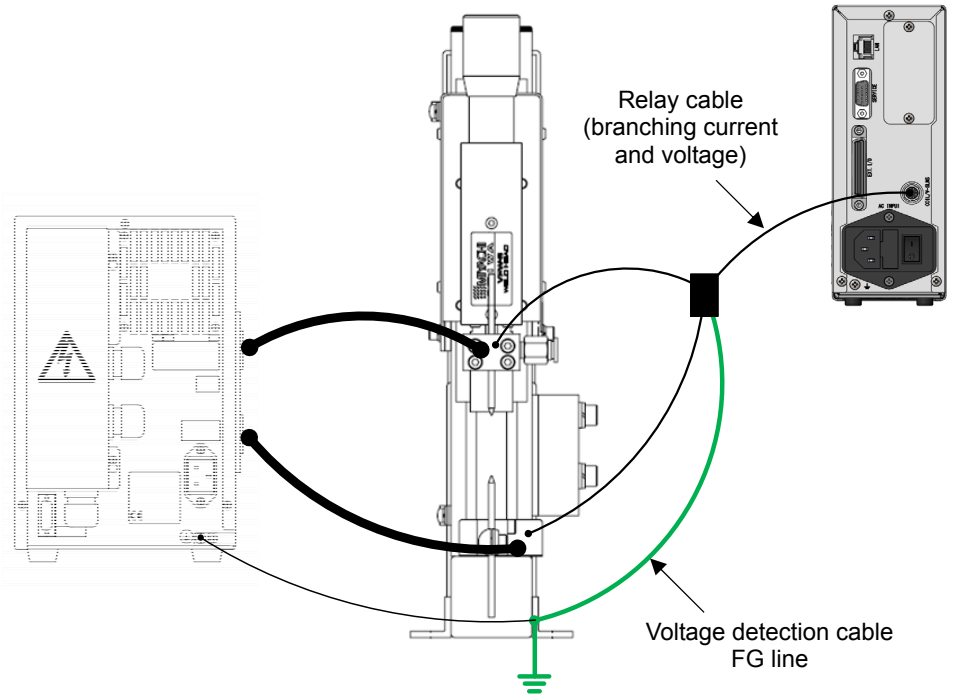


- For a band-type toroidal coil, do not deform it when fitting it. Repeated bending and extension may break internal wires.
- The ISO17657-compliant toroidal coil (**MB-400P**/**800P**) has an arrow. For DC measurement, match the direction of an arrow and a current.

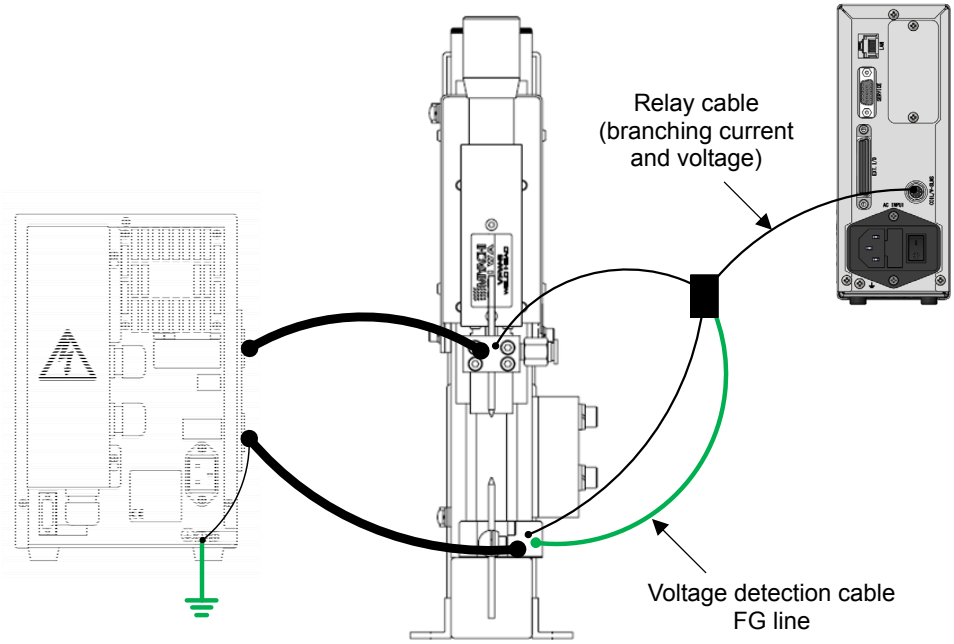
(3) Grounding the Voltage Detection Cable

Ground the FG line of the voltage detection cable in one of the following two ways:

a. When the welding head is grounded



b. When the welding head is not grounded



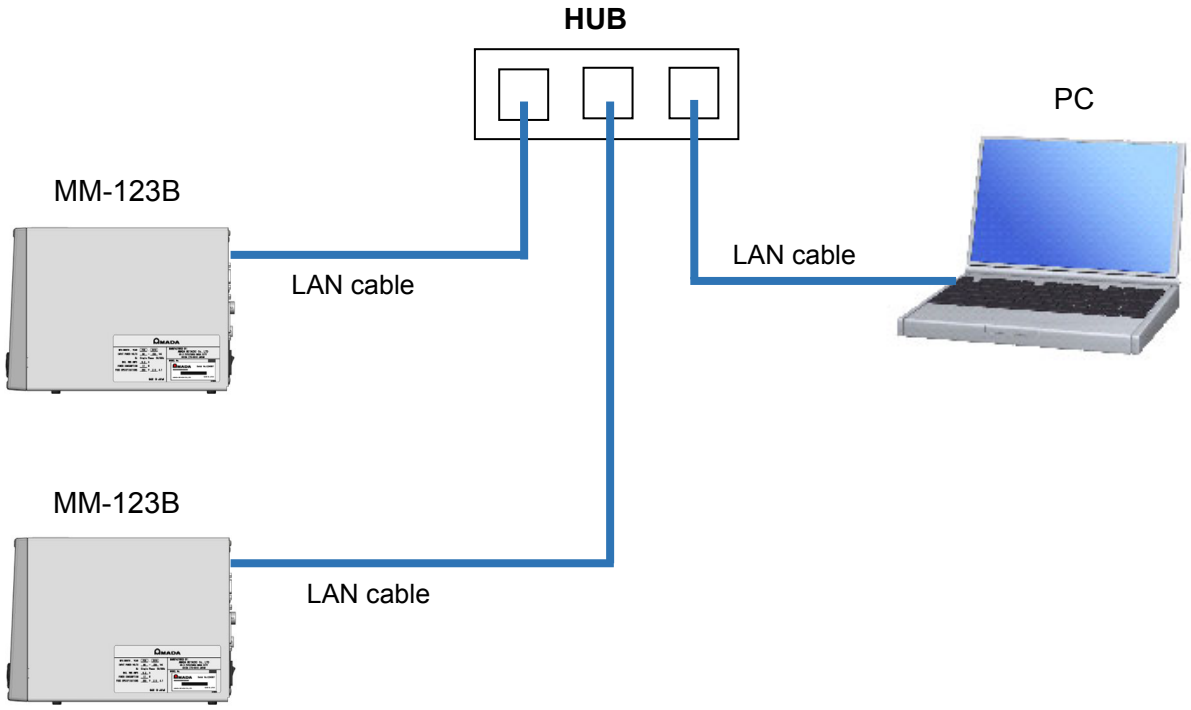
(4) Connecting the Communication Connector

The **MM-123B** employs the Ethernet communication.
Connect the **MM-123B** and PC/server with a LAN cable (option).
For details of communication, see **[8. Data Communication]**.

Example connection 1)

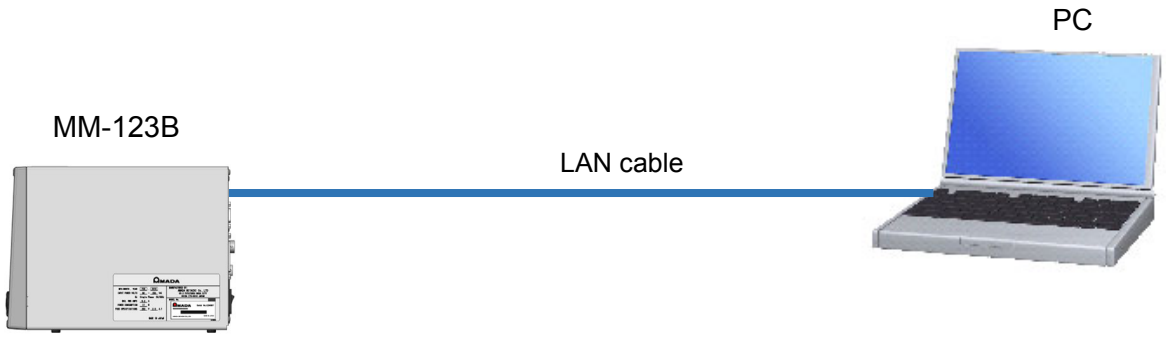
To connect the plural **MM-123B**s and a PC, prepare a LAN cable (option).

* Pass the LAN cable through the attached ferrite core twice.



Example connection 2)

To connect the **MM-123B** and PC one-on-one, prepare a LAN cable (option).

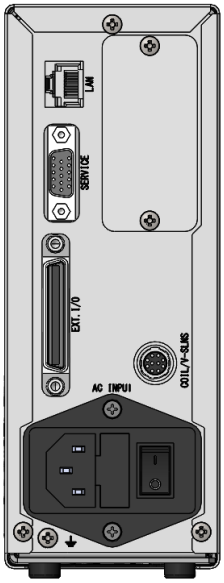


7. Basic Operation

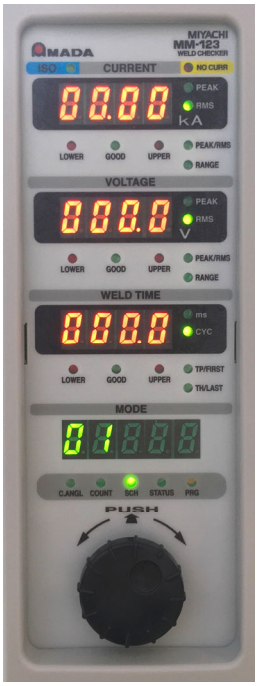
(1) Startup

1) Connect the toroidal coil.

2) Set the power supply switch on the rear panel to the ON position (– side).



3) After 8 seconds, LEDs light up. The picture below is a state at the time of shipping.



(2) Basic Usage of the MM-123B

The **MM-123B** has the following five modes.

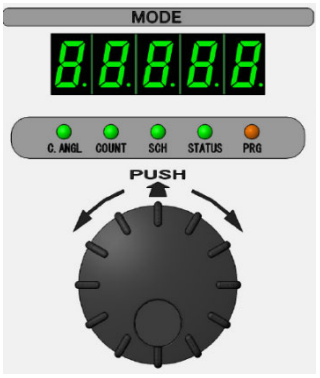
a. C.ANGL (conduction angle) mode

b. COUNT (count) mode

c. SCH (schedule) mode

d. STATUS (status) mode

e. PRG (program) mode



Turn the operation button to select the mode to use.

The mode selection LED indicates the present mode.

Use the operation button to switch the mode. Turn the operation button to turn on the LED corresponding to the desired mode.

The contents of display change depending on the selected mode.

a. C.ANGL (conduction angle) Mode

Displays the conduction angle of the AC welding current.

The displaying range is 30 to 180 and the unit is degree.
When the AC welding current is measured, the maximum conduction angle of the present welding is displayed on the mode display. In the single-phase AC welding machine, the maximum applicable current flows when the conduction angle is displayed as 180 (degree).

b. COUNT (count) Mode

Counts and displays the number of welds.

Functions as the preset counter or the step counter. For details, see **[7. (5) a. Setting the Preset Counter (COUNT)]** and **[7. (5) b. Setting the Step Counter]**.

When the operation button is pressed for one second with the number displayed, the counter is reset. However, the counter is not reset

- when the signal for the result of the upper/lower limit judgment ([NG-H], [NG-L], [GOOD]) is output by the OutHO method (For details, see **[7. (5) h. System Setting (8) Output time]**.)
- when the [NG+24V] is output, and

the signal output is turned off. Pressing the operation button again resets the counter. The I/O connector also resets the counter.

c. SCH (schedule) Mode

The **MM-123B** can set 31 schedules of the upper/lower limit of the current, voltage and weld time. In this mode, the present schedule number and step number are displayed, and the schedule number and the step number to measure are set. Measurement cannot be not made during setting.

How to change when STEP* is 0

(* For details, see **[7. (5) h. System Setting (9) Step counter]**.)

1) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

2) Press the operation button. The number blinks.

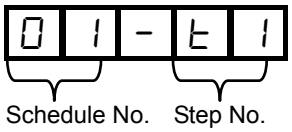
3) Turn the operation button to display the desired schedule number.

4) Press the operation button. Blinking stops and setting is completed.

How to change when STEP* is 1

(*For details, see **[7. (5) h. System Setting (9) Step counter]**.)

1) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number and the step number are displayed on the mode display.



2) Press the operation button. The schedule number blinks.

3) Turn the operation button to select the desired schedule number.

4) Press the operation button to establish the schedule number. The step number blinks.

5) Turn the operation button to select the desired step number.

6) Press the operation button to establish the step number. Blinking stops and the number turns on. Setting is completed.

However, the schedule number is not established

- when the signal for the result of the upper/lower limit judgment ([NG-H], [NG-L], [GOOD]) is output by the OutHO method (For details, see **[7. (5) h. System Setting (8) Output time]**.)
- when the [NG+24V] is output, and

the signal output is turned off. Pressing the operation button again resets the counter. The I/O connector also resets the counter. Priority is given to the selection by the I/O connector.

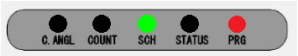
d. STATUS (status) Mode

Displays the present current measurement mode. For details, see **[7. (3) a. Selecting the Current Measurement Mode]**.

e. PRG (program) Mode

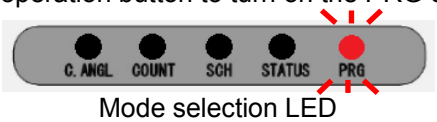
Sets and checks the various functions and schedules.

To input or change each setting of measurement schedules, preset counter and others, the **MM-123B** is required to be set in the program mode. This consists of the following three items.

Mode Selection LED	Contents
①COUNT setting mode 	• When the step counter function is OFF Sets the “preset counter.” The preset counter value currently set is displayed on the mode display. For details, see **[7. (5) a. Setting the Preset Counter (COUNT)]**. • When the step counter function is ON Sets the “step counter.” The step counter value currently set is displayed on the mode display. For details, see **[7. (5) b. Setting the Step Counter]**. For the details of the step counter function, see **[7. (5) h. System Setting (9) Step counter]**.
②SCH setting mode 	This mode is for setting schedules. The **MM-123B** can set 31 types of upper/lower judgment schedules of current, voltage and weld time. The schedule number currently set is displayed on the mode display.
③STATUS setting mode 	Various setting can be done. For details, see **[7. (5) c. STATUS Setting]**.

To set the **MM-123B** in the program mode,

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

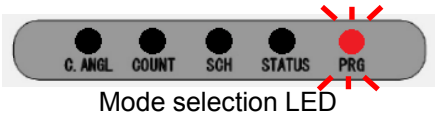


Mode selection LED

2) Press the operation button for one second while the PRG is on. Note that the mode is switched to the STATUS setting mode automatically when the operation button is not pressed in three seconds, even if the PRG is turned on.

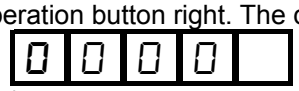
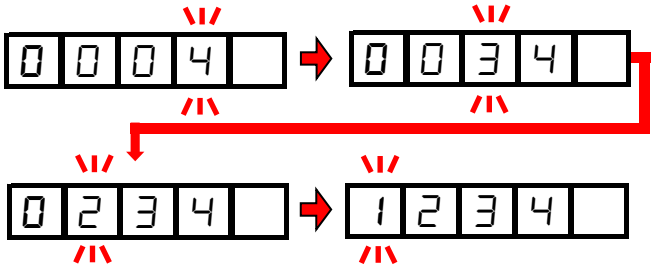
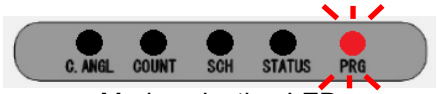
3)  is displayed on the mode display and the PRG blinks.

When the password is set to “0000”, the supervisor mode is always set and the password input screen is not displayed. For details, see **[7. (5) j. Password Setting]**.



Mode selection LED

4) Make settings in the supervisor mode or the operator mode.

Supervisor mode setting	Operator mode setting
1) Turn the operation button right. The display changes to  (password input screen). 2) Press the operation button and input a password by one digit. When the operation button is turned, the value changes. When pressed, the setting digit changes.  3) When the input password is correct, the PRG stops blinking and is turned on. If incorrect, the display returns to 1).  Mode selection LED ↓ Supervisor mode (The default password is “0000.”)	1) When the operation button is pressed, the PASS on the mode display disappears. The PRG remains blinking.  Mode selection LED ↓ Operator mode * When entering into the program mode with the supervisor mode, to enable the operator mode again, turn off the power. The supervisor mode is maintained unless the **MM-123B** is restarted and the password input screen is not displayed.

(3) Preparation for Measurement

To measure the welding current, the following settings of “a” to “d” are necessary. (To measure the peak value, the setting of “g” is unnecessary.)

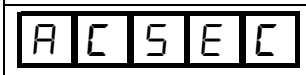
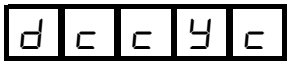
a. Selecting the current measurement mode
b. Selecting the schedule number to set
c. Selecting the peak and effective values of current
d. Selecting the current range
e. Selecting the peak and effective values of voltage
f. Selecting the voltage range
g. Setting the measurement start time (FIRST) and the measurement end time (LAST)
h. Selecting TP/TH (in the current measurement mode CAP-S and CAP-L only)

a. Selecting the Current Measurement Mode

Select the current measurement mode according to the welding power supply in use.

There are eight types of the welding current that the **MM-123B** can select, including the difference in the display method of the weld time.

The current measurement mode selected here is common to 31 schedules.

Measurement method	Description	Unit	Min. unit
	Measures the single-phase AC welding current. The frequency is AC 50/60 Hz, automatically selectable. (When using 24 V DC power supply, set 50/60 Hz manually.) *1 The factory setting is AC.	Cycle (CYC)	0.5 CYC
	Measures the AC inverter welding current. The currently selected frequency is displayed in the right three places. Set the frequency corresponding to your welding machine. *2	Cycle (CYC)	0.5 CYC
	Measures a welding current in an AC inverter welding machine.	Millisecond (ms)	1 ms
	Measures a welding current in a DC inverter welding machine.	Cycle (CYC)	0.5 CYC
	Measures a welding current in a DC inverter welding machine. In the ISO17657-compliant mode, the flow time can be set. *3	Millisecond (ms)	1 ms
	Used for measuring a welding current of a transistor welding machine.	Millisecond (ms)	0.01 ms
	Measures a welding current of a capacitor welding machine. The measurable time is 0.50 to 9.99 ms.	Millisecond (ms)	0.01 ms

Measurement method	Description	Unit	Min. unit
CAP-L	Measures a welding current of a capacitor welding machine. The measurable time is 05.0 to 99.9 ms.	Millisecond (ms)	0.1 ms

*1: The single-phase-AC welding power supply controls the magnitude of the current by setting the time when the welding current does not flow. Therefore, the measurement may end at the time when the current does not flow. This phenomenon can be eliminated by changing the cool time setting. For details, see **[7. (5) h. System Setting (6) Cool time]**.

*2: For details, see the following ① in Additional setting items of the current measurement mode.

*3: For details, see the following ② in Additional setting items of the current measurement mode.

How to select the current measurement mode

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button left to turn on the STATUS.
The present current measurement mode is displayed on the mode display.

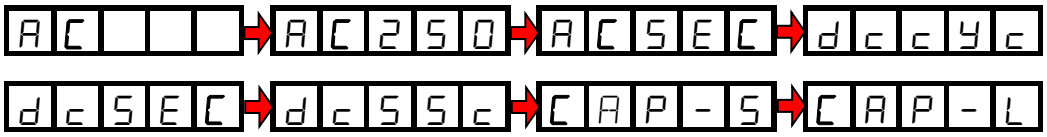
4) Press the operation button. 0r19 or

is displayed on the mode display.

5) When the operation button is turned right, Curr is displayed on the mode display.

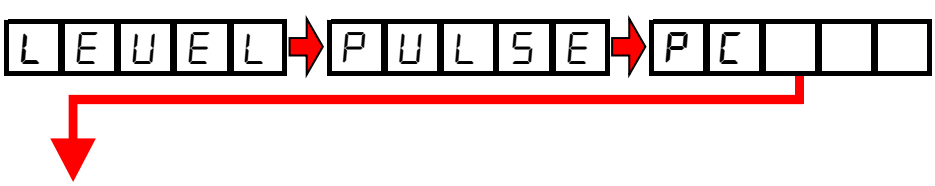
6) Press the operation button again. The present current measurement mode displayed on the mode display blinks.

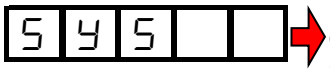
7) Turn the operation button to blink the desired item.



8) When the type of the current is established, Curr is displayed on the mode display.

9) Turn the operation button right.
Display is switched as figure below. Turn the operation button until all displays other than the PRG are turned off.





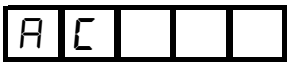
The set current measurement modes is displayed on the mode display and the STATUS of the mode selection LED lights up.

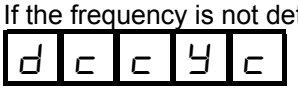
10) Turn the operation button right to turn on the PRG only.

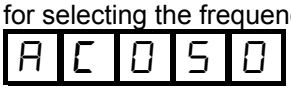
11) Press the operation button for one second.
The program mode is cancelled and the PRG is turned off.
The STATUS is turned on and the current measurement mode currently set is displayed on the mode display.

Additional setting items of the current measurement mode

When the following ① to ④ current measurement modes are selected, additional setting items are displayed.

① If the frequency is not detected automatically when 

or 

is selected (24 V DC power supply is used), the item for selecting the frequency appears.


is 50 Hz, and 

is 60 Hz. Turn the operation button to select the desired frequency, and press the operation button to establish it.

② When 

is selected, the flow time can be set when the calculation mode is the ISO-compliant mode. The flow time is the time until the welding time becomes 10% of the effective value. For details, see **[7. (5) d. Difference between the Original Mode and the ISO17657-compliant Mode]**.


indicates that the flow time is OFF.


indicates that the flow time is ON. When the flow time is ON, the weld time (ms) display LED blinks.

③ When 

is selected, the portion of numbers blinks. The numbers indicate the currently selected frequency. (250 Hz in the example above.) Set the frequency corresponding to your welding machine.
When using our AC inverter welding power supply, use the dedicated frequency registered in the **MM-123B**.

For how to set the frequency, see the following setting method.

When this mode ③ is selected, the decimal point is not displayed for the display (weld time upper limit/lower limit setting and measurement start/end).

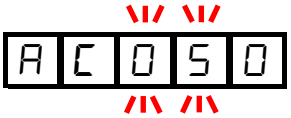
For the minimum 0.5 cycles, a decimal point is displayed after the lowest digit number as follows.

Ex: For weld time 5.0 cycles [0005]

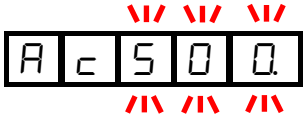
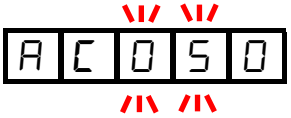
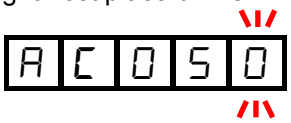
For weld time 5.5 cycles [0005.]

How to set the frequency

Example) When the currently set frequency is 50 Hz



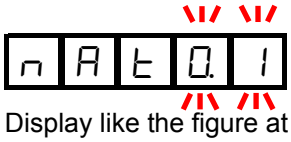
Turn the operation button left. Turn the operation button right.

Frequency (dedicated to our power supply)	**Frequency (normal)**
1) The right three places blink.  2) Turn the operation button left. The display changes in the following order: 500/417/294/250/200/167/143/125/111/100/91/83/77/71/67/63/59/56/53/50 Hz 3) When the operation button is pressed, setting is completed. * The dedicated frequency is displayed when the number exceeds 250. A decimal follows the value, for example “53.” or “56.”.	1) The second and third places from the right blink.  2) Turn the operation button right. The setting range is 50 Hz to 250 Hz. It can be set in 10-Hz increment. 3) When the operation button is pressed, the rightmost place blinks.  4) Turn the operation button right. The setting range is 50 Hz to 250 Hz. It can be set in 1-Hz increment. 5) When the operation button is pressed, setting is completed.

④ When 

or 

is selected, the item for setting the non-measurement time appears. The non-measurement time provides the time that the measurement is not made after measurement. This prevents the **MM-123B** from measuring the reset current after flowing the welding current particular to the capacitor welding machine.



Display like the figure at left blinks on the mode display. The right two places indicate the non-measurement time.
The setting range is 0.1 to 9.9 seconds. (0.1 seconds in the example above.)
Turn the operation button to change the number, and press the operation button to establish it.

b. Selecting the Schedule Number to Set

31 types of measurement schedules can be set. Select the schedule number.
When setting the upper/lower limit and the current/voltage range, make sure that the desired schedule number has been set.

How to select

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) Press the operation button. The number blinks.

5) Turn the operation button to display the desired number.

6) Press the operation button. Blinking stops and the schedule number selection is completed.

7) Turn the operation button to turn on the PRG only.

8) Press the operation button for one second.
The program mode is cancelled and the PRG is turned off.
The STATUS of the mode selection is turned on and the current measurement mode currently set is displayed on the mode display.

c. Selecting Peak or Effective Value of Current

The current measured in the **MM-123B** can be displayed as the effective value or the peak value.

Select the peak value or the effective value for each schedule number.

The value of the effective value display:
Effective value from measurement start time (FIRST) to measurement end (LAST).
See **[7. (3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

The value of the peak value display:
Maximum value of the welding current from the measurement start to end.

How to select

1) Turn the operation button to turn on the PRG of the mode selection LEDs.
2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).
3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.
4) When the operation button is pressed, the schedule number blinks.
5) Turn the operation button to select the desired schedule number.
6) When the operation button is pressed, blinking stops and setting is completed.
7) Turn the operation button to turn on the current peak/effective selection LED. The schedule number to set is also displayed on the mode display.
8) Press the operation button. Either of the peak current measurement LED or the effective value of current measurement LED blinks.
9) Turn the operation button to blink either of the peak current measurement LED or the effective value of current measurement LED.
10) When the operation button is pressed, blinking stops and setting is completed.
11) Turn the operation button to turn on the PRG only.
12) Press the operation button for one second to cancel the program mode.

d. Selecting the Current Range

Select the current range for each schedule number.

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the current range selection LED.

8) When the operation button is pressed, the number on the current display blinks. The schedule number to set is also displayed on the mode display.

9) Turn the operation button to select the current corresponding to your welding machine.
Select from 2.000, 20.00 and 200.0 (kA).

10) When the operation button is pressed, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

e. Selecting Peak or Effective Value of Voltage

The voltage measured in the **MM-123B** can be displayed as the effective value or the peak value for each welding schedule.

The value of the effective value display:
Effective value from measurement start time (FIRST) to measurement end (LAST).
See **[7. (3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

The value of the peak value display:
Maximum value of the voltage from the measurement start to end.

How to select

1) Turn the operation button to turn on the PRG of the mode selection LEDs.
2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).
3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.
4) When the operation button is pressed, the schedule number blinks.
5) Turn the operation button to select the desired schedule number.
6) When the operation button is pressed, blinking stops and setting is completed.
7) Turn the operation button to turn on the voltage peak/effective selection LED. The schedule number to set is also displayed on the mode display.
8) Press the operation button. Either of the peak voltage measurement LED or the effective value of voltage measurement LED blinks.
9) Turn the operation button to blink either of the peak voltage measurement LED or the effective value of voltage measurement LED.
10) When the operation button is pressed, blinking stops and setting is completed.
11) Turn the operation button to turn on the PRG only.
12) Press the operation button for one second to cancel the program mode. Select the peak value or the effective value for each schedule number.

f. Selecting the Voltage Range

Select the voltage range for each schedule number.

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the voltage range selection LED.

8) When the operation button is pressed, the number on the voltage display blinks. The schedule number to set is also displayed on the mode display.

9) Turn the operation button to select the voltage corresponding to your welding machine.
Select from 6.00 and 20.0 (V).

10) When the operation button is pressed, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)

The **MM-123B** can specify the interval between the welding current start and end and measure its current by setting the measurement start time (FIRST) and the measurement end time (LAST).

Set the measurement start time (FIRST) and the measurement end time (LAST) for each schedule number.

When the measurement unit is CYC, the current is measured in 0.5-cycle increment.

When the measurement unit is ms and the measurement method is the DC/AC inverter welding current, the current is measured in 1-ms increment.
When the measurement unit is ms and the measurement method is the transistor welding current, the current is measured in 0.01-ms increment.

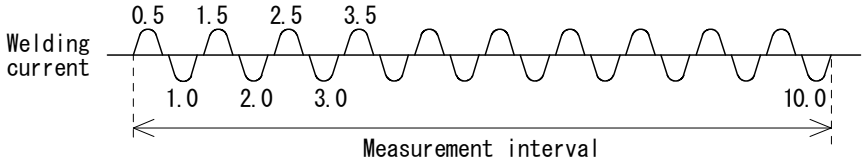
CAUTION

This setting doesn't function in the current measurement mode CAP-S and CAP-L.

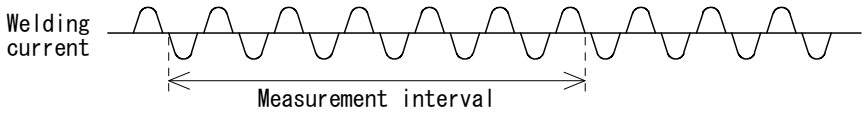
Example: When 10-cycle welding current is measured in AC welding machine

- To measure from start to end (the 10th cycle), set as follows:

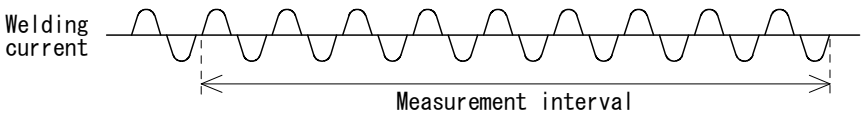
Measurement start time (FIRST) setting	0.0 or 0.5 cycle
Measurement end time (LAST) setting	10.0 cycle



- When setting FIRST to 1.0; LAST to 6.5,



- When setting FIRST to 1.5; LAST to 99.0,



Measurement ends when the welding current stops, even if LAST is set to 99.0.

The measurement interval is from FIRST to the time when the welding current stops.

When the weld time of the welding current is shorter than the measurement interval "settings of measurement start time (FIRST) and measurement end time (LAST)", the effective values of current and voltage may change depending on settings of the fall level and the end level. Set the proper measurement interval.

For details of the fall level and the end level, see **[7. (5) e. Setting the Various Levels]**.

How to set FIRST

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to display to turn on the TP/FIRST (measurement start) LED. The setting is displayed on the weld time display.
The schedule number to set is also displayed on the mode display.

8) Press the operation button. The rightmost place on the weld time display blinks.

   When [AC ---] (AC-inverter type) is selected in the current measurement mode, the decimal point is not displayed.

   For the minimum 0.5 cycles, a decimal point is displayed after the lowest digit number as follows.

   Ex: For weld time 5.0 cycles [0005]

   For weld time 5.5 cycles [0005.]

9) Turn the operation button to change the blinking number to the desired value.

10) Press the operation button to move the blinking place to the left.
Set the desired measurement start time. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

How to set LAST

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to display to turn on the TP/LAST (measurement end) LED. The setting is displayed on the weld time display.
The schedule number to set is also displayed on the mode display.

8) Press the operation button. The rightmost place on the weld time display blinks.

When [AC ---] (AC-inverter type) is selected in the current measurement mode, the decimal point is not displayed.

For the minimum 0.5 cycles, a decimal point is displayed after the lowest digit number as follows.

Ex: For weld time 5.0 cycles [0005]

For weld time 5.5 cycles [0005.]

9) Turn the operation button to change the blinking number to the desired value.

10) Press the operation button to move the blinking place to the left.
Set the desired measurement end time. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

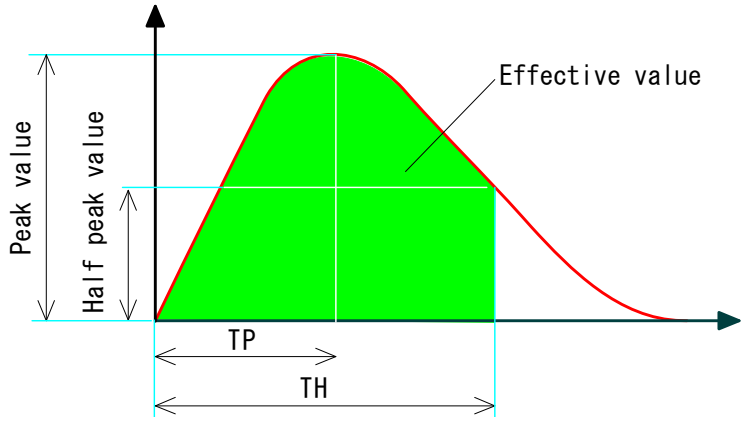
11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

h. Selecting TP/TH (in the current measurement mode CAP-S and CAP-L only)
When measuring the capacitor welding currrent, it is required to select the measured time from TP or TH.

Select TP or TH for each schedule number.

TP (TIME PEAK)	Time duration from the time the welding current starts flowing to the time at max. value
TH (TIME HALF)	Time duration from the time the welding current starts flowing to the time the current decreases to half of the max. value



In the current measurement mode CAP-S or CAP-L, the effective value over the TH is displayed.

How to select

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the TP/FIRST (measurement start) LED or the TH/LAST (measurement end) LED. The LED set presently lights up.

8) Press the operation button. The TP/FIRST (measurement start) LED or the TH/LAST (measurement end) LED blinks.
The present schedule number is also displayed on the mode display.

9) Select the measurement time.
Turn the operation button to blink the desired LED, TP/FIRST (measurement start) or TH/LAST (measurement end).

10) When the operation button is pressed, blinking stops and selecting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

(4) Upper/Lower Limit Judgment Function

The **MM-123B** is equipped with the upper/lower limit judgment function for current, voltage and weld time.

The upper/lower limit judgment function

Sets the upper/lower limit range of the current, voltage and weld time in advance.

Judges whether the actually measured current, voltage and weld time are within the set upper/lower limit range.

- When the measured value is within the range

  The [GOOD] signal is output, and the GOOD of the current, voltage and weld time upper/lower limit judgment LEDs lights up.

- When the measured value exceeds the upper limit

  The [NG+24V] and the [NG-H] signals are output from the external I/O according to **[7. (5) h. System Setting (1) Upper/lower limit judgment output operation]**, and the UPPER of the current, voltage and weld time upper/lower limit judgment LEDs lights up.

- When the measured value is less than the lower limit

  The [NG+24V] and the [NG-H] or the [NG-L] signals are output from the external I/O according to **[7. (5) h. System Setting (1) Upper/lower limit judgment output operation]**, and the LOWER of the current, voltage and weld time upper/lower limit judgment LEDs lights up.

a. Setting the Upper and Lower Limits of the Current

Set the upper/lower limit for each schedule number.

How to set the upper limit

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the UPPER of the current upper/lower limit judgment LEDs. The number on the current display is the upper limit.

8) Press the operation button. The rightmost place blinks.

9) Turn the operation button to change the blinking number to the desired value.

10) Press the operation button to move the blinking place to the left.
Set the desired value for all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

How to set the lower limit

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs.
The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the LOWER of the current upper/lower limit judgment LEDs. The number on the current display is the lower limit.

8) Press the operation button. The rightmost place blinks.

9) Turn the operation button to change the blinking number to the desired value.

10) Press the operation button to move the blinking place to the left.
Set the desired value for all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

b. Setting the Upper and Lower Limits of the Voltage
Set the upper/lower limit for each schedule number.

How to set the upper limit

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the UPPER of the voltage upper/lower limit judgment LEDs. The number on the voltage display is the upper limit.

8) Press the operation button. The rightmost place blinks.

9) Turn the operation button to change the blinking number to the desired value.

10) Press the operation button to move the blinking place to the left.
Set the desired value for all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

How to set the lower limit

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the LOWER of the voltage upper/lower limit judgment LEDs. The number on the voltage display is the lower limit.

8) Press the operation button. The rightmost place blinks.

9) Turn the operation button to change the blinking number to the desired value.

10) Press the operation button to move the blinking place to the left.
Set the desired value for all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

c. Setting the Upper and Lower Limits of the Weld Time
Set the upper/lower limit for each schedule number.

How to set the upper limit

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the UPPER of the weld time upper/lower limit judgment LEDs. The number on the weld time display is the upper limit.

8) Press the operation button. The rightmost place blinks.

9) Turn the operation button to change the blinking number to the desired value.

When [AC ---] (AC-inverter type) is selected in the current measurement mode, the decimal point is not displayed.

For the minimum 0.5 cycles, a decimal point is displayed after the lowest digit number as follows.

Ex: For weld time 5.0 cycles [0005]

For weld time 5.5 cycles [0005.]

10) Press the operation button to move the blinking place to the left.
Set the desired value for all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

How to set the lower limit

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs. The schedule number is displayed on the mode display.

4) When the operation button is pressed, the schedule number blinks.

5) Turn the operation button to select the desired schedule number.

6) When the operation button is pressed, blinking stops and setting is completed.

7) Turn the operation button to turn on the LOWER of the weld time upper/lower limit judgment LEDs. The number on the weld time display is the lower limit.

8) Press the operation button. The rightmost place blinks.

9) Turn the operation button to change the blinking number to the desired value.

When [AC ---] (AC-inverter type) is selected in the current measurement mode, the decimal point is not displayed.

For the minimum 0.5 cycles, a decimal point is displayed after the lowest digit number as follows.

Ex: For weld time 5.0 cycles [0005]

For weld time 5.5 cycles [0005.]

10) Press the operation button to move the blinking place to the left.
Set the desired value for all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

(5) Settings in the Program Mode

a. Setting the Preset Counter (COUNT)

The **MM-123B** has the preset counter function. The preset counter is common to 31 schedules.

The counter proceeds by 1 when the measurement results of all selected measurement items are within the upper/lower limit.

When the value of the counter reachs the setting, the display blinks and the [COUNT UP] signal is output. The maximun value of the counter is 99999. Values more than 99999 are displayed as 99999 with blinking. When the preset value is 00000, the preset counter doen't work.

How to set

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the COUNT of the mode selection LEDs. Five-digit number is displayed on the mode display. This is the present preset counter value.

4) Press the operation button. The rightmost place blinks.

5) Turn the operation button to change the blinking number to the desired value.

6) Press the operation button to move the blinking place to the left.
Set the desired value in all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

7) Turn the operation button to turn on the PRG only.

8) Press the operation button for one second to cancel the program mode.

b. Setting the Step Counter

When using the step counter function on the welding machine, set the step counter of the **MM-123B**. The weld count set for each step is common to 31 schedules.

When the step number is increased, the value of the upper/lower limit judgment is switched.

- Set the same step counter (step number and weld count) with the welding machine. The setting range is as follows:
  Step number: 1–9
  Weld count: 0–9999
- The step counter proceeds by 1 regardless of the result of the upper/lower limit judgment. (However, the counter doesn't proceed by 1 in the no-current status.)
- To use the step counter, turn on the step counter in advance. For details, see **[7. (5) h. System Setting (9) Step counter]**.)

CAUTION

The step counter function cannot be used in the current measurement mode dcSSC, CAP-S and CAP-L.

How to select

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the STATUS of the mode selection LEDs.

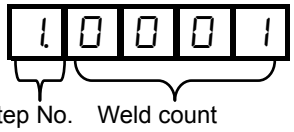
4) Press the operation button and turn it right to display "SYS."

5) Press the operation button and turn it right to display "StEP0."

6) When the operation button is pressed, the rightmost number blinks. Next, turn the operation button right to display "StEP1."
When the operation button is pressed at this time, the step counter function is enabled. For details, see **[7. (5) h. System Setting (9) Step counter]**.

7) When the operation button is turned, the system setting screen is released.

8) Turn the operation button to turn on the COUNT of the mode selection LEDs.
Five-digit number is displayed on the mode display.
There is a decimal point at the leftmost number. This shows the step number.
Four digits on the right of the decimal point is the weld count.



9) Press the operation button. The leftmost step number blinks.

10) Turn the operation button to select the desired step number.

11) Press the operation button to establish the step number.
The rightmost number blinks.

12) Set the weld count (the number of welds) for the step set above.
Turn the operation button to select the number. When the operation button is pressed, the number is established and the blinking place is moved to the left. Repeat this operation to establish four places.

13) When the second place from the left is blinking, blinking stops and setting is completed.

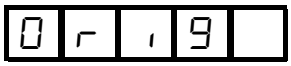
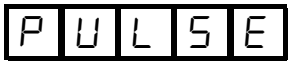
14) When the operation button is pressed again, the leftmost step number blinks. Select the next step number and set the weld count for the step.

15) Turn the operation button to turn on the PRG only.

16) Press the operation button for one second to cancel the program mode.

c. STATUS Setting

In the STATUS setting, various common conditions can be set.
Settings are common in all measurement schedules. It consists of the following six items.

Name	Mode display	Contents
① Effective value calculation mode setting	Original mode  ISO17657-compliant mode  * 	Makes setting for the effective value calculation method of the measurement interval. For details, see **[7. (5) d. Difference between the Original Mode and the ISO17657-compliant Mode]**. * The ISO17657-compliant LED at the upper left of the front surface of the main unit lights up in the ISO17657-compliant mode.
② Current measurement mode setting		Sets the measurement method of the welding power supply. For details, see **[7. (3) a. Selecting the Current Measurement Mode]**.
③ Measurement level setting		Makes setting for each level. For details, see **[7. (5) e. Setting the Various Levels]**.
④ Impulse setting		Makes setting of impulse measurement for each schedule. For details, see **[7. (5) f. Impulse Measurement]**.
⑤ Communication setting		The **MM-123B** uses the Ethernet communication. For details, see **[7. (5) g. Communication Setting]**.
⑥ System setting		Makes the system setting. For details, see **[7. (5) h. System Setting]**.

d. Difference between the Original Mode and the ISO17657-compliant Mode

① Difference of the effective value calculation method
The **MM-123B** has the following two calculation methods for the effective value.

- Original mode (arithmetic mean effective value)

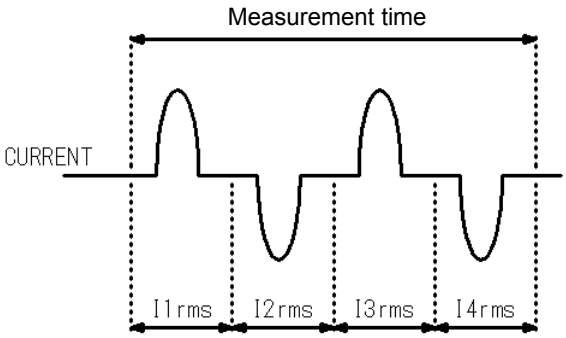
  Calculates the effective value in the measurement interval at a fixed interval and displays the arithmetic mean value as the measurement result. This is the calculation method mainly used in our weld checkers.

- ISO17657-compliant mode (effective value in all measurement intervals)

  Calculates the effective value in all measurement intervals and displays it as the measurement result. This is the calculation method specified in ISO17657.

Difference of current effective value calculation method

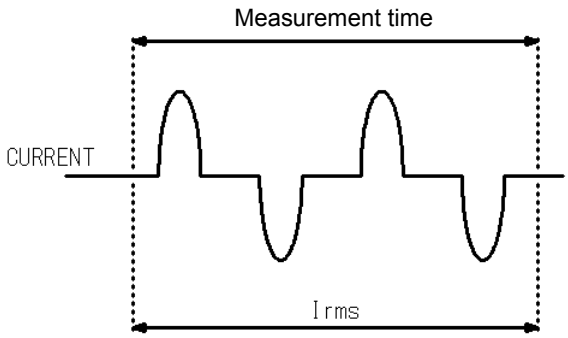
Original mode



Arithmetic mean effective current in the measurement interval
Arithmetic mean effective value =

$$\frac{I1rms + I2rms + I3rms + I4rms}{4}$$

ISO17657-compliant mode



Effective current in all measurement intervals

Effective value = Irms

② Difference of weld time
The measurement method for the weld time displayed in the **MM-123B** differs according to the measurement schedule currently set.

There are two measurement methods for the weld time in the current measurement modes dcSEC and dcSSc.

- Original mode

  Fall level:
  Time till the welding current reaches the fall level (10 to 90% of **peak value**)

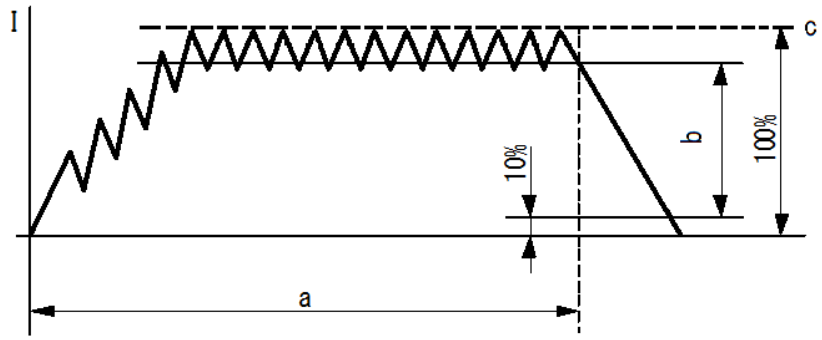
- ISO17657-compliant mode

  Fall level:
  Time till the welding current reaches the fall level (10 to 90% of **effective value**)

  Flow time:
  Time till the welding current reaches the fall level (10% of **effective value**) (The fall level is fixed.) For details, see **[7. (3) a. Selecting the Current Measurement Mode]**.

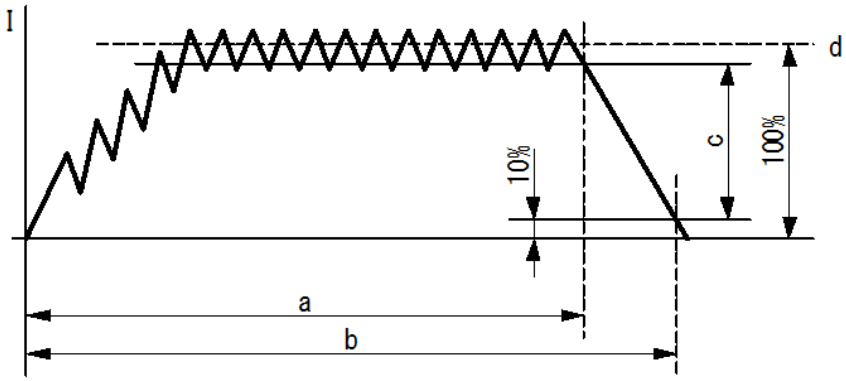
For the fall level, see **[7. (5) e. Setting the Various Levels]**.

Weld time in the original mode



a: Weld time till the fall level b: Fall level 10 to 90% c: Current peak value

Weld time in the ISO17657-compliant mode



a: Weld time till the fall level b: Flow time c: Fall level 10 to 90% d: Current effective value

<Difference with the weld time of the **MM-122A**>

In the current measurement modes dcSEC and dcSSc, the **MM-122A** displays the time till the effective value of the welding current falls below the end level as weld time. (The end level is set to 5%.)

On the other hand, the **MM-123B** measures the weld time by the fall level. When the **MM-122A** is replaced into the **MM-123B**, the weld time may be different. In this case, set the fall level to a lower value.

e. Setting the Various Levels

The **MM-123B** can adjust the measurement start and the end timing by setting the following three parameters.

(1) Current trigger sensitivity (tr 19)

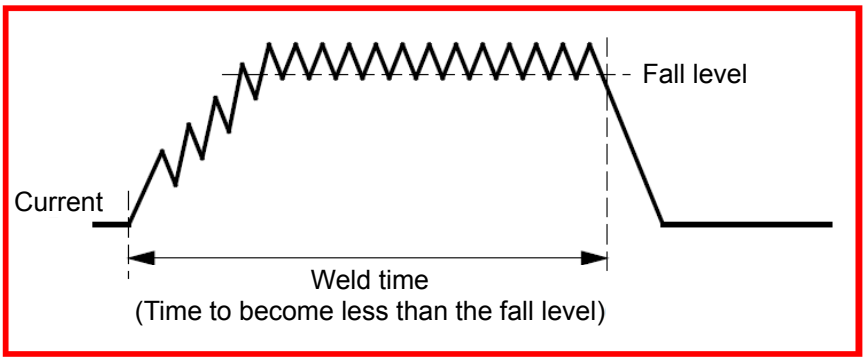
The current trigger sensitivity is a parameter of the sensitivity for detecting the welding current to start measurement. When the setting value is increased, the sensitivity for detecting the welding current becomes high.

1) When the operation button is pressed, the currently set current trigger sensitivity is displayed with blinking.
   The initial value is 90.
2) Turn the operation button to change the current trigger sensitivity. The setting range is 01 to 99. Repeat measurements and set a value not causing malfunction or a value that a measurement can be normally performed.
3) Press the operation button to establish the current trigger sensitivity.

Due to influence of noise or status of welding current, a malfunction such as “a measurement is not performed even when the current flows” or “a measurement starts even though a current does not flow” occurs.
Also, in the welding current with an upslope, a weak current at the beginning of flow is not detected and a weld time is measured shorter than an actual time. These phenomena may be eliminated by changing the sensitivity.
Also, when a wrong signal is detected or the welding current is too small for the measurement range, it is regarded as erroneous detection and ---- is displayed on the display other than the mode display.

(2) Fall level (FALL)

The **MM-123B** measures the time till the fall level setting as weld time in the measurement of the DC welding current.



1) When the operation button is pressed, the currently set fall level is displayed with blinking.
   The initial value is 80.
2) Turn the operation button to set the fall level.
   The setting range is 10 to 99% of the peak current value. The weld time becomes longer as the numerical value is smaller. For the difference of the operation of the fall level depending on the calculation mode, see **[7. (5) d. Difference between the Original Mode and the ISO17657-compliant Mode]**.
3) Press the operation button to establish the fall level.

(3) End level (End)

The **MM-123B** measures the time until the welding current reaches the end level as a single welding. Also, in the measurement of the AC welding current, the time till the end level is displayed as weld time. The weld time can be adjusted by setting this parameter.

1) When the operation button is pressed, the currently set end level is displayed with blinking.

The initial value is 05.0.

2) Turn the operation button to set the end level.
The setting is in the percentage of the effective value for the current range (1.5 to 15.0%) in use.
The weld time measurement is hardly ended as the numerical value is smaller. Be careful about it.

3) Press the operation button to establish the end level.

When the ripple of the welding current is increased, it falls below the end level even during welding and measurement may end. This phenomenon can by eliminated by lowing the end level or changing the current range.

For how to select the current trigger sensitivity, fall level and end level, see below:

How to select

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button left to turn on the STATUS of the mode selection LEDs.

4) Press the operation button.
Or19 or 150 is displayed on the mode display.

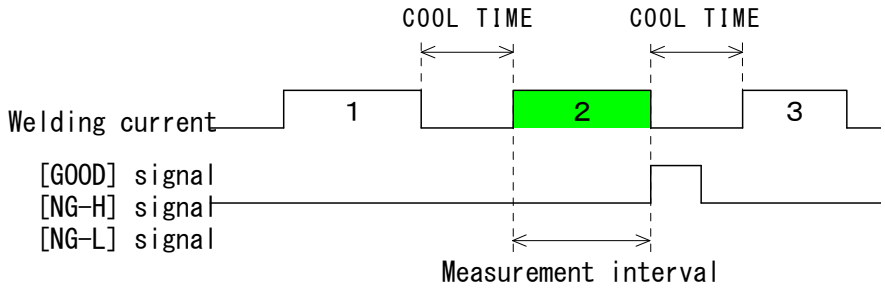
5) Turn the operation button right to change the display on the mode display to LEUEL.
Turn the operation button to select trig, FALL or End.

f. Impulse Measurement

More than one welding may be performed in one weld sequence.

With the impulse measurement function of the **MM-123B**, you can measure the stage you selected by setting the impulse number.

When the impulse number is set to 2:



If the welding current doesn't reach the stage set in the impulse measurement, the [NG+24V] signal and the [NG-H] signal are output. For details, see **[5. (2) Description of the External I/O Signals]**.

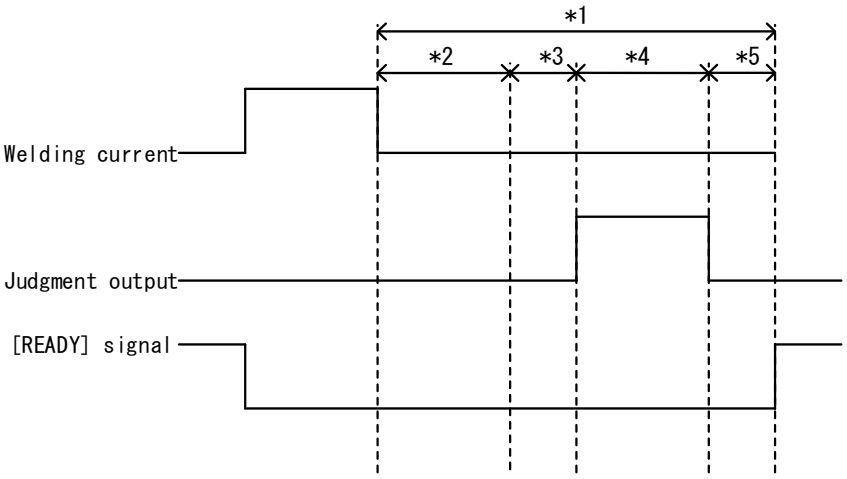
When the interval between weldings is 500 ms or more, the impulse measurement ends. In the impulse measurement, leave less than 500 ms between weldings.

CAUTION

Impulse measurement cannot be used in the current measurement mode CAP-S and CAP-L.

Canceling the impulse measurement

When the impulse number is set to 0, the impulse measurement is cancelled. When the impulse measurement is not used, leave the internal processing time or more between weldings (see figure below). Note that the next welding is not measured if the interval is short.



*1: Internal processing time

*2: Cool time (time from when the current falls down below the end level to the time set for the cool time. See **[7. (5) h. System Setting (6) Cool time]**.)

*3: Calculation time, 3 ms

*4: Output time (arbitrary set time (10 ms, 100 ms, HOLD (5 ms)). See **[7. (5) h. System Setting (6) Output time]**.)

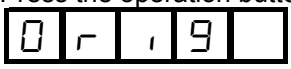
*5: Next measurement preparation time
When the current measurement mode is AC, AC*** (frequency), ACSEC, or dccyc, at least 10 ms is required. When dcSEC, dcSSc, CAP-S, or CAP-L, at least 3 ms required. Since it is confirmed that the current is not input, a longer time is required if input.

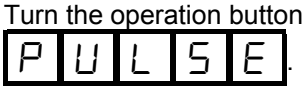
How to set

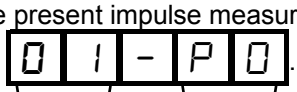
1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the STATUS of the mode selection LEDs.

4) Press the operation button.
 or  is displayed on the mode display.

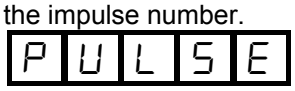
5) Turn the operation button right to change the display on the mode display to  .

6) Press the operation button.
The setting of the present impulse measurement setting is displayed on the mode display as  .
Schedule No. Impulse No.

7) The blinking number of the left two places is the schedule number. Turn the operation button to set the schedule number (1–31).

8) Press the operation button to establish the schedule number.
The impulse number (rightmost number) blinks.

9) Turn the operation button to set the impulse number (0–9).

10) Press the operation button to establish the impulse number.
Display on the mode display returns to  and setting is completed.

11) Turn the operation button to turn on the PRG only.

12) Press the operation button for one second to cancel the program mode.

g. Communication Setting

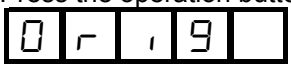
The **MM-123B** is equipped with the Ethernet communication function. It can transmit the measurement data to an external device such as PC and change measurement schedules from an external device.

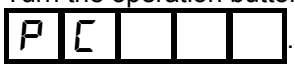
How to set

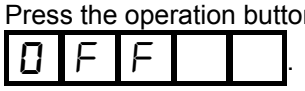
1) Turn the operation button to turn on the PRG of the mode selection LEDs.

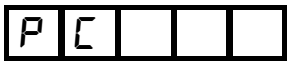
2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

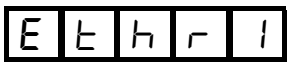
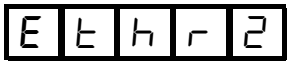
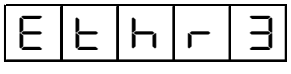
3) Turn the operation button left to turn on the STATUS of the mode selection LEDs.

4) Press the operation button.
 or  is displayed on the mode display.

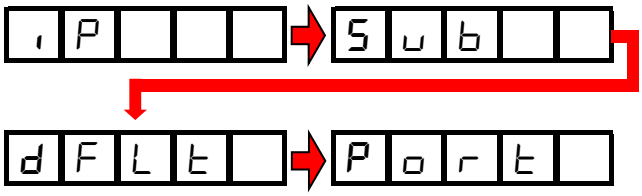
5) Turn the operation button to change the display on the mode display to  .

6) Press the operation button to change the display on the mode display to  .

7) When the operation button is pressed with  displayed,  is displayed.
Turn the operation button with  displayed to select the desired communication method.

	Ethernet communication is not done.
	Ethernet single-directional communication is done. It outputs measured value data.
	Ethernet bi-directional communication is done.
	Ethernet bi-directional communication is done. It outputs all cycle data. * When "dcSSc" (transistor type), "CAP-S" or "CAP-L" (capacitor type) is selected in the current measurement mode, or when "iSo" is selected in the effective value calculation mode, all cycle is not output. Do not choose this mode.

8) Press the operation button. The address selecting screen is displayed. Turn the operation button to display the desired setting item.



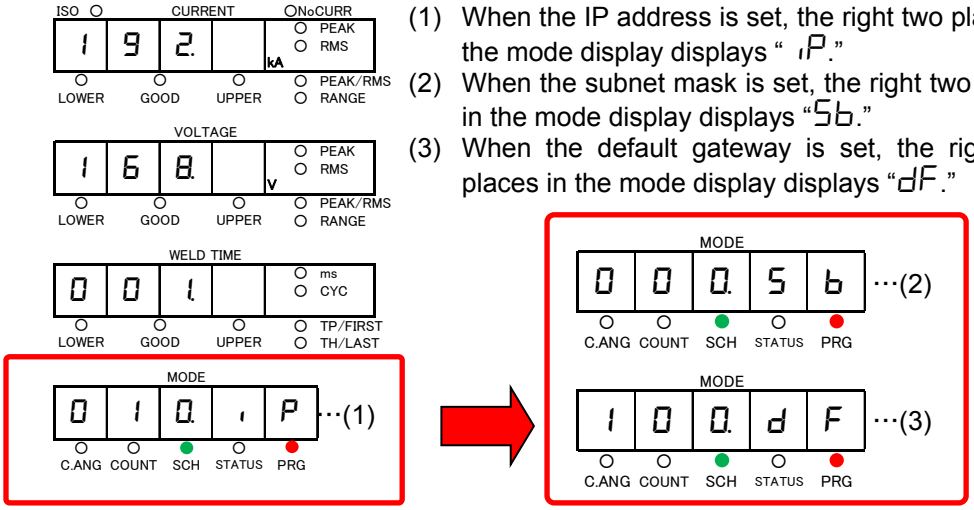
Press the operation button to move to the various setting screen.

iP	IP address: Initial value: 192.168.1.10*
Sub	Subnet mask: Initial value: 255.255.255.0
dFLt	Default gateway: Initial value: 192.168.1.100*
Port	Port number: Initial value: 1024*

* Use [192.168.1.11] or later for the IP address of the personal computer. However, do not set the IP address to the same as the default gateway. Set 1024 or later for the port number.

9) The setting methods of IP address, subnet mask, and default gateway are common.

An example of IP address (192.168.1.10) is shown below:



(1) When the IP address is set, the right two places in the mode display displays " iP."
(2) When the subnet mask is set, the right two places in the mode display displays "Sb."
(3) When the default gateway is set, the right two places in the mode display displays "dF."

10) IP address setting

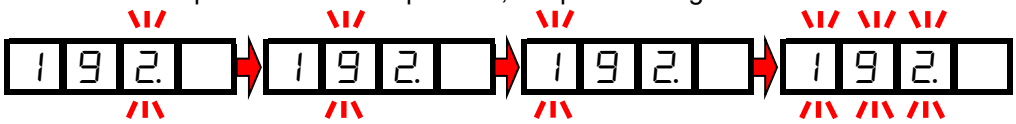
Display  on the mode display and press the operation button.

The screen display changes as follows.

11) When the operation button is pressed, the current display at the upper part blinks like  .

When the operation button is turned right, a blinking place moves.

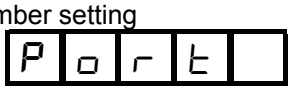
12) When the operation button is pressed, the setting screen is displayed and the right place blinks. When the operation button is turned, the number changes. When the operation button is pressed, the place changes.

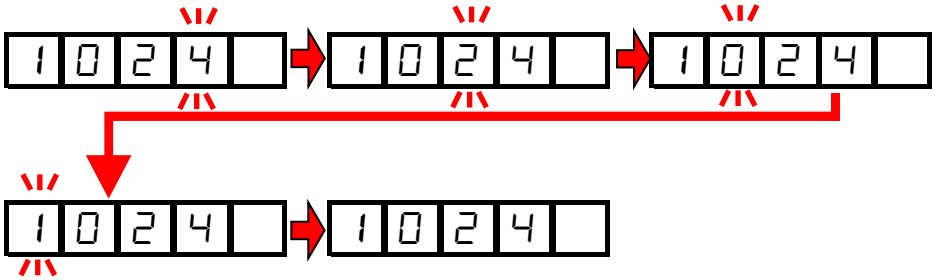


13) When settings of all rows are completed, turn the operation button right with  displayed.

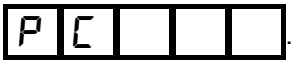
14) The address selection screen is displayed again. Perform settings of subnet mask and default gateway in the same manner.

15) Port number setting

Display  on the mode display and press the button to move to the port number setting screen.



16) When the operation button is pressed, setting is completed.

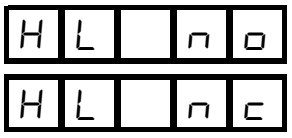
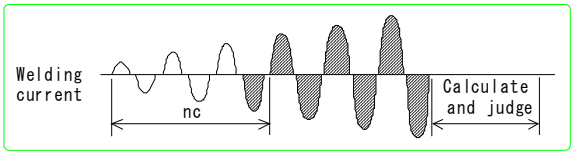
17) Turn the operation button right to return to  .

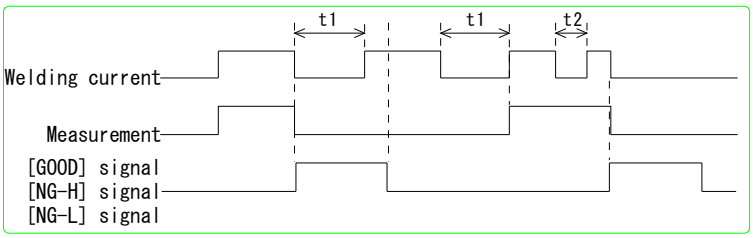
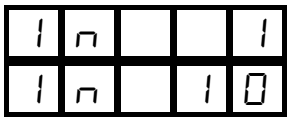
Now the address setting is completed.

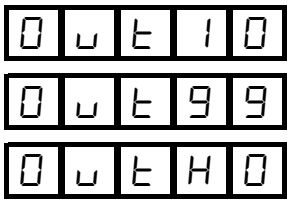
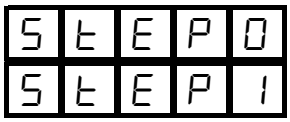
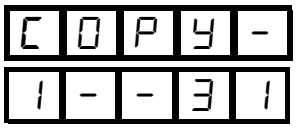
When you change the setting of the **MM-123B** or turn off the power supply, connect the **MM-123B** and the external devices again.

h. System Setting

In the system setting, input/output operation, toroidal coil setting, and various functions can be set. The settings in the system setting are common in all measurement schedules. The system setting consists of the following ten items:

Item	Contents
(1) Upper/lower limit judgment output operation 	HL 1: When the measured value is outside the setting of the upper/lower limit judgment or a trouble occurs, the circuit of Pins 39 and 40 on the I/O connector is opened. HL 2: When the measured value exceeds the setting of the upper limit judgment, the circuit of Pins 39 and 40 on the I/O connector is opened. When the measured value is lower than the setting of the lower limit judgment, the circuit of Pins 37 and 40 on the I/O connector is opened. (The output state during operation depends on the setting of the error output. The factory setting is HL 1.)
(2) Error output 	HL no: Pins 37, 39 and 40 on the I/O connector are opened in normal status. When the measured value is outside the setting of the upper/lower limit judgment or a trouble occurs, the circuits are closed. HL nc: Pins 37, 39 and 40 on the I/O connector are closed in normal status. When the measured value is outside the setting of the upper/lower limit judgment or a trouble occurs, the circuits are opened. (The factory setting is HL nc.)
(3) Coil sensitivity 	Set a sensitivity for a toroidal coil. Set according to the toroidal coil you are using. Coil 1: 1x sensitivity coil. Coil 10: 10x sensitivity coil. (The factory setting is Coil 1.)
(4) Conversion coefficient of toroidal coil 	Set a conversion coefficient of toroidal coil. For our ISO toroidal coil (**MB-400P/800P**), the rated conversion coefficient is 227.0 mV/kA. Do not change the setting. (The factory setting is 227.0.)
(5) Forced measurement time 	Even if the current at the beginning of the flow is immeasurably small (this often occurs when upslope is used), the welding current can be measured as long as the measurable large current (shown by slanted line in figure below) is included in the time setting for [nc].  The setting range is When the measurement unit is CYC: 0.5 to 49.5 When the measurement unit is ms: 01 to 99. Set the time shorter than the weld time. (The factory setting is CYC and 0.5.)

<table>
<tr><th>Item</th><th>Contents</th></tr>
<tr><td>(6) Cool time
  </td><td>When the actual cool time (time when the current does not flow) is shorter than the value set for this parameter in the current measurement, measurement is performed as a single welding.
The time setting is common to 31 schedules.
<table>
<tr><td>When measuring weld time in CYC</td><td>The setting range is 0.5 to 9.5 CYC and the initial value is 0.5 CYC.</td></tr>
<tr><td>When measuring weld time in ms</td><td>The setting range is 1 to 99 ms and the initial setting is 1ms.
If dcSSc is selected for the measured current, the settable time is 0.1 to 9.9 ms and the initial setting is 0.1 ms.</td></tr>
</table>
[Example] Cool time setting = 5 ms
t1 = 10 ms
t2 = 4 ms
When the items are set as above, it is judged that the welding ends in t1 and the welding continues in t2.
Set the total time (weld time + cool time) to be less than the measurable time.
Also, measurement is not done during judgment output. (See below.)
 
</td></tr>
<tr><td>(7) Input stabilizing time
  </td><td>Sets the delay time from a signal input to establishment. Chattering of input signals can be removed with this setting. The setting range is 1 ms or 10 ms.
(The factory setting is 10 ms.)</td></tr>
</table>

Item	Contents
(8) Output time 	Changes the output times of the [GOOD] signal, the [NG-H] signal and the [NG-L] signal. • When Out10 is set, the output times of the [GOOD] signal, the [NG-H] signal and the [NG-L] signal become 10 ms. The next current measurement cannot be made until the output ends. • When Out99 is set, the output times of the [GOOD] signal, the [NG-H] signal and the [NG-L] signal become 100 ms. The next current measurement cannot be made until the output ends. • When OutHO is set, the [GOOD] signal, the [NG-H] signal and the [NG-L] signal continue outputting. To cancel the output, flow the next current or input the [NG RESET]. (Output can be cancelled by pressing the operation button as well.) The next measurement is possible at least 5 ms after the [GOOD] or the [NG] signal is output. (The factory setting is Out99.)
(9) Step counter 	Sets the step counter function on/off. 0: Turns off the step counter function. 1: Turns on the step counter function. (The factory setting is StEP0.) For details, see **[7. (5) i. Setting the Upper/Lower Limit Judgment when Using the Step Counter Function]**.
(10) Password setting 	Sets the password used for the supervisor mode. For details, see **[7. (5) j. Password Setting]**.
(11) Schedule copy 	Copies the value of Schedule 1 to Schedules 2–31. How to operate 1) When the operation button is pressed, COPY blinks. 2) When the operation button is turned right, the display changes to 1--31. 3) When the operation button is pressed for more than one second, copying is finished and the display returns to COPY. If the operation button is pressed when COPY is displayed, the schedule is not copied and the display returns to COPY.

How to set

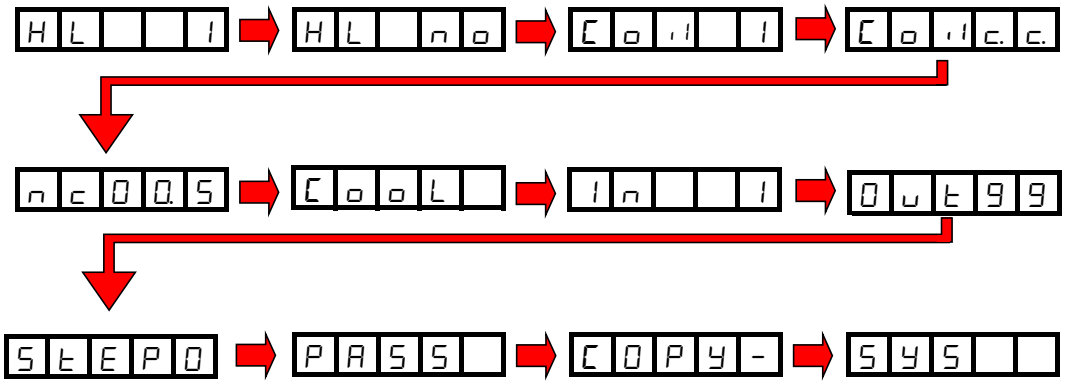
1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button left to turn on the STATUS of the mode selection LEDs.

4) Press the operation button. 0r19 or
iSo is displayed on the mode display.

5) Turn the operation button to display SYS on the mode display.
Press the operation button to move to the system setting screen.
Turn the operation button to display the desired setting item.

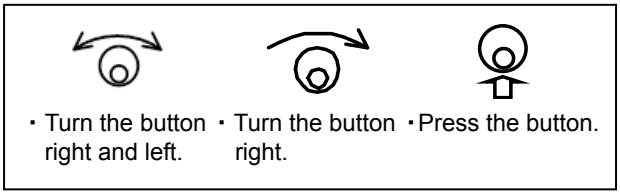


6) Press the operation button to move to each setting screen.
For details see How to set the system items as shown on the next page.

7) When the operation button is turned right with COPY- displayed on the mode display, the display returns to SYS.

How to set the system items

The setting items are switched as shown below. Change the setting by the operation button. The set value is displayed at the leading screen.



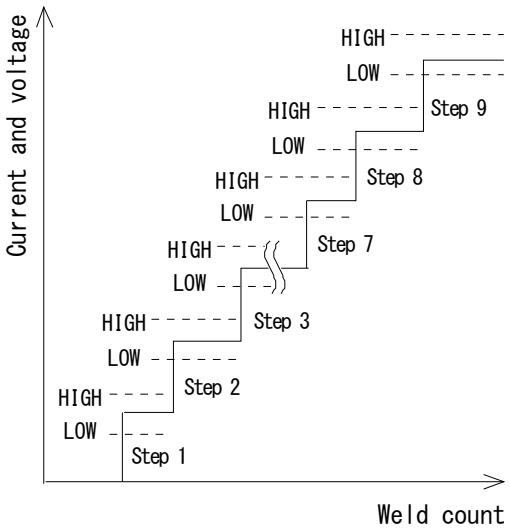
i. Setting the Upper/Lower Limit Judgment when Using the Step Counter Function
To use the step counter described in **[7. (5) b. Setting the Step Counter]**, the upper/lower limits of current and voltage must be set in advance.

As shown, a state that the upper/lower limits of current and voltage are set for each step is one schedule.

In the **MM-123B**, 31 schedules can be registered in total.

When setting the upper limit and the lower limit, make sure that the desired schedule number and step number has been set.

The setting of the measurement start time, the measurement end time and the weld time upper/lower limit are common to steps 1–9.

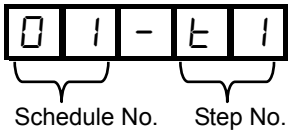


How to set

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button to turn on the SCH of the mode selection LEDs.
The schedule number and the step number are displayed on the mode display.
The left two places are the schedule number, and the rightmost number is the step number.



4) Press the operation button. The schedule number is displayed blinkingly.

5) Turn the operation button to select the desired schedule number.

6) Press the operation button to establish the schedule number.
The step number blinks.

7) Turn the operation button to select the desired step number.

8) Press the operation button to establish the step number.
Blinking stops and setting is completed.
When turning the operation button, you can go to the setting items for the measurement start time, the measurement end time, etc.
When the step number is 2–9, the items for the measurement start time, the measurement end time, the weld time upper/lower limit, weld time upper/lower limit, and the peak effective value selection are not displayed. The setting for step 1 is applied.
For details, see **[7. (3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**, **[7. (4) a. Setting the Upper and Lower Limits of the Current]** and **[7. (4) b. Setting the Upper and Lower Limits of the Voltage]**.

9) Turn the operation button to turn on the PRG only.

10) Press the operation button for one second.

j. Password Setting

The **MM-123B** can select a mode from the supervisor mode and the operator mode by setting a password. By selecting the operator mode, you can prevent schedules from being changed by mistake.

The differences are as follows:

Operation contents	Supervisor mode	Operator mode *1
Schedule setting in each screen	Can change	Cannot change
Counter reset in the measurement mode	Can perform	Can perform
Preset value setting in the PRG mode	Can change	Cannot change
ISO or original of STATUS	Can change	Cannot change
Current measurement mode of STATUS	Can change	Cannot change
Various level setting of STATUS	Can change	Cannot change
Impulse of STATUS	Can change	Cannot change
Communication of STATUS	Can change	Cannot change
System of STATUS	Can operate	Cannot change
Copy of SYSTEM	Can operate	Cannot operate
Schedule number in the measurement mode	Can change	Cannot change *2
Schedule number in the PRG mode	Can change	Can change
SCH1 to 31 in the external inputs	Can input	Can input
Counter reset in the external inputs	Can input	Can input

*1: In the operator mode, the mode display LED blinks for three seconds each time the operation button is turned in the operation mode.

*2: When you change the schedule number from 3 to 5 in the supervisor mode and switch the mode to the measurement mode, for example, the schedule number changes to 5. When you change the schedule number from 3 to 5 in the operator mode and switch the mode to the measurement mode, the schedule number returns to 3. (You cannot change the schedule number for measurement in the operator mode.)

How to set

1) Turn the operation button to turn on the PRG of the mode selection LEDs.

2) Press the operation button for one second while the PRG is on to set the **MM-123B** in the program mode (supervisor mode).

3) Turn the operation button left to turn on the STATUS of the mode selection LEDs.

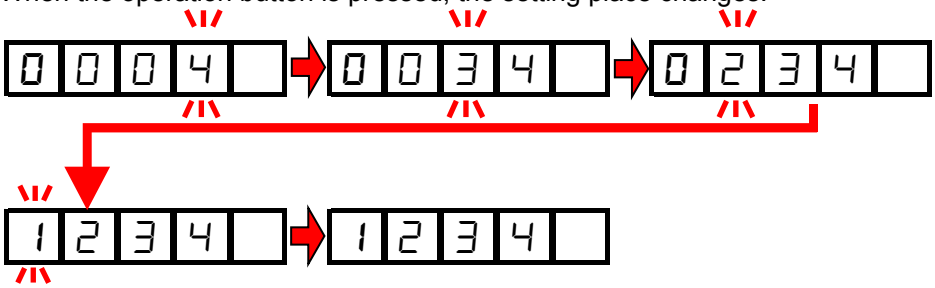
4) When the operation button is pressed,  is displayed on the mode display.

5) Press the operation button.

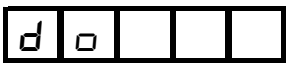
6) Turn the operation button to display  on the mode display.

7) When the operation button is pressed, the current password is displayed on the mode display.
The initial value is "0000."

8) Press the operation button. The rightmost place blinks. Turn the operation button to change the value.
When the operation button is pressed, the setting place changes. *



9) Press the operation button. Blinking stops and the set password is displayed.

10) When the operation button is pressed,  is displayed on the mode display.

11) When the operation button is pressed for one second, setting is completed.
When the operation button is turned, setting is cancelled.

12) To enable the operator mode, turn off the power.
When entering into the program mode with the supervisor mode, the supervisor mode is maintained unless the **MM-123B** is restarted.

* When the password is set to "0000", the supervisor mode is always set and the password input screen is not displayed.

(6) Checking Settings and Initializing

a. Checking the Setting and the Previously Measured Value

Press the operation button twice (within 0.5 ms) to check the present setting and the value measured previously. If the welding current flows during this status, the **MM-123B** returns to the measurement operation.

When the operation button is turned, the display of the **MM-123B** is switched in the order of  .

1) When the operation button is pressed twice (within 0.5 ms), only the schedule number is displayed.

2) The peak current measurement LED lights up.
The peak current measured previously is also displayed on the current display. If the peak current has not been measured, 0000 is displayed. (The location of the decimal point changes according to the measurement range.)

3) The effective value of current measurement LED lights up.
The effective value of current measured previously is also displayed on the current display. If the effective value of current has not been measured, 0000 is displayed. (The location of the decimal point changes according to the measurement range.)

4) The LOWER of the current upper/lower limit judgment LEDs lights up.
The lower limit of the current for the schedule number selected presently is also displayed on the current display.

5) The UPPER of the current upper/lower limit judgment LEDs lights up.
The upper limit of the current for the schedule number selected presently is also displayed on the current display.

6) The peak voltage measurement LED lights up.
The peak voltage measured previously is also displayed on the voltage display. If the peak voltage has not been measured, 0000 is displayed. (The location of the decimal point changes according to the measurement range.)

7) The effective value of voltage measurement LED lights up.
The effective voltage measured previously is also displayed on the voltage display. If the effective voltage has not been measured, 0000 is displayed. (The location of the decimal point changes according to the measurement range.)

8) The LOWER of the voltage upper/lower limit judgment LED lights up.
The lower limit of the voltage for the schedule number selected presently is also displayed on the weld time display.

9) The UPPER of the voltage upper/lower limit judgment LED lights up.
The upper limit of the voltage for the schedule number selected presently is also displayed on the weld time display.

10) The LOWER of the weld time upper/lower limit judgment LED lights up.
The lower limit of the weld time for the schedule number selected presently is also displayed on the weld time display.

11) The UPPER of the weld time upper/lower limit judgment LED lights up.
The upper limit of the weld time for the schedule number selected presently is also displayed on the weld time display.

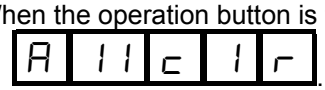
12) The TP/FIRST (measurement start) LED lights up.
The setting of measurement start for the schedule number displayed presently or the time of TP measured previously is also displayed on the current display. (In the current measurement mode CAP-S or CAP-L, the measured value of TP time is displayed. In other measurement modes, the FIRST (measurement start time) setting is displayed.)

13) The TP/LAST (measurement end) LED lights up.
The setting of measurement end for the schedule number displayed presently or the time of TH measured previously is also displayed on the current display. (In the current measurement mode CAP-S or CAP-L, the measured value of TH time is displayed. In other measurement modes, the LAST (measurement end time) setting is displayed.)

b. Initializing the Schedule Setting

1) Turn on the power supply switch with the operation button pressed. Keep pressing the operation button.

2) When the operation button is pressed for one second,  is displayed on the mode display.

3) When the operation button is turned a notch to the right, the display is changed to  .

4) When the operation button is pressed, the data is initialized and the **MM-123B** is restarted automatically.

* The schedule setting can be initialized only when the password is “0000” (supervisor mode). When the password is not “0000”,  is not displayed. For details of the password setting, see **[7. (5) j. Password Setting]**.

(7) Setting from Various Welding Power Supplies and Measurement Schedules

The setting examples of the **MM-123B** in a question-and-answer format from welding power supplies and setting schedules are explained below.
The setting method from the initial setting state is shown. If you have changed the setting, initialize it before setting. For details, see **[(6) Checking Settings and Initializing]**.

a. Selection of Calculation Method

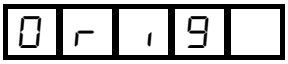
Select the calculation method and perform settings according to the setting method.
If you perform the same operation as the **MM-122A**, select ① Original.
If you perform the ISO17657-compliant operation, select ② ISO17657.

Calculation	Setting
Same operation as the **MM-122A**	① Original setting
Compliant operation with ISO17657	② ISO17657 setting

- Effective value measurement mode setting

For details, see **[(5) c. STATUS Setting ① Effective value calculation mode setting and (5) d. Difference between the Original Mode and the ISO17657-compliant Mode]**.

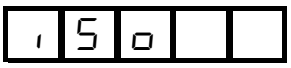
① Original

Set the effective value measurement mode to 

"original mode".

If you select the original, the LED of the ISO display on the upper left of the front of the main unit turns off.

② ISO17657

Set the effective value measurement mode to 

"ISO17657-compliant mode".

If you select the ISO17657, the LED of the ISO display on the upper left of the front of the main unit lights up.

The setting of **[a. Selection of Calculation Method]** is now complete. Go to **[b. Selection of Toroidal Coil]**.

b. Selection of Toroidal Coil

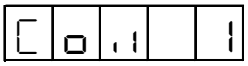
Select the toroidal coil to and perform settings according to the setting method.

Toroidal coil	Setting
MB-400P/MB-800P [1x coil]	① 1x setting
MB-45G [10x coil]	② 10x setting

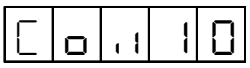
- Coil sensitivity setting

  For details, see **[(5) h. System Setting (3) Coil sensitivity]**.

  ① 1x setting

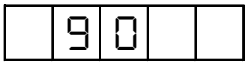
  Set the coil sensitivity to  "1 time".

  ② 10x setting

  Set the coil sensitivity to  "10 times".

- Current trigger sensitivity setting

  For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels]**.

  Normally, set the current trigger sensitivity to  (initial value).

  If the measurement does not start when a low welding current is measured, increase the current trigger sensitivity setting. If the measurement starts when no welding current is flowing, reduce the current trigger sensitivity setting.

The setting of **[b. Selection of Toroidal Coil]** is now complete. Go to **[c. Welding Power Supply Selection]**.

c. Welding Power Supply Selection

Select the type of your welding power supply and set according to the setting method.

Type of welding power supply	Setting
Single-phase AC type	① Single-phase AC setting
Single-phase rectifying type	② Single-phase rectification setting
AC inverter type	③ AC inverter setting
DC inverter type	④ DC inverter setting
Transistor type	⑤ Transistor setting
Capacitor type	⑥ Capacitor setting

The upper/lower limit judgment setting is common. Set it as necessary after setting the welding power supply.

- Current upper/lower limit judgment setting

  For details, see **[(4) a. Setting the Upper and Lower Limits of the Current]**.

  The current upper/lower limit judgement setting allows you to make judgments by setting the upper and lower limits of current measurement. Set it as necessary.

  It is possible to determine the quality of the welding by verifying the measurement range where the welding is acceptable and setting the upper/lower limits of the range.

  If you do not set the upper and lower limits, set the upper limit to "Maximum value (initial value)" and the lower limit to "Minimum value (initial value)".

- Voltage upper/lower limit judgment setting

  For details, see **[(4) b. Setting the Upper and Lower Limits of the Voltage]**.

  The voltage upper/lower limit judgment setting allows you to make judgments by setting the upper and lower limits of voltage measurement. Set it as necessary.

  It is possible to determine the quality of the welding by verifying the measurement range where the welding is acceptable and setting the upper/lower limits of the range.

  If you do not set the upper and lower limits, set the upper limit to "Maximum value (initial value)" and the lower limit to "Minimum value (initial value)".

- Weld time upper/lower limit judgment setting

  For details, see **[(4) c. Setting the Upper and Lower Limits of the Weld Time]**.

  The welding time upper/lower limit judgment setting allows you to make judgments by setting the upper and lower limits of weld time measurement. Set it as necessary.

  It is possible to determine the quality of the welding by verifying the measurement range where the welding is acceptable and setting the upper/lower limits of the range.

  If you do not set the upper and lower limits, set the upper limit to "Maximum value (initial value)" and the lower limit to "Minimum value (initial value)".

① Single-phase AC setting

- Current measurement mode setting

  For details, see **[(3) a. Selecting the Current Measurement Mode]**.

  Set the current measurement mode to  .

- Current range setting

  For details, see **[(3) d. Selecting the Current Range]**.

  If the current value is set, select a current range that is about 1.2 times larger than the set current value.

  If the current value is not set, set the current range to  “20.00kA”.

  As the time of measurement, if the current value is smaller than the current range one level lower, lower the current range. If the current value is over, increase the current range.

- Current peak value/RMS value setting

  For details, see **[(3) c. Selecting Peak or Effective Value of Current]**.

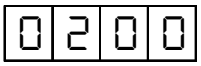
  Select the peak or effective value of current you want to measure.

  When measuring with the effective value, select the effective current measurement LED and set it.

  When measuring with the peak value, select the peak current measurement LED and set it.

- Voltage range setting

  For details, see **[(3) f. Selecting the Voltage Range]**.

  Set the voltage range to  “20.0V”.

  At the time of measurement, if the measured voltage value is smaller than the voltage range one level below, lower the voltage range.

- Voltage peak value/RMS value setting

  For details, see **[(3) e. Selecting Peak or Effective Value of Voltage]**.

  Select the method you want to measure.

  When measuring with the RMS value, select the effective voltage measurement LED and set it.

  When measuring with the peak value, select the peak voltage measurement LED and set it.

- Measurement start time (FIRST) setting and measurement end time (LAST) setting

  For details, see **[(3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

  Measurement start time (FIRST) setting and measurement end time (LAST) setting can be used to measure current/voltage RMS values by specifying an arbitrary range. If you want to measure a part of the section or measure the section excluding the upslope or downslope, set it as necessary.

  If you do not specify a range, set the measurement start time (FIRST) to "0.0CYC (initial value)" and the measurement end time (LAST) to "180.0CYC (initial value)".

- Forced measurement time setting

  For details, see **[(5) h. System Setting (5) Forced measurement time]**.

  Normally, set the forced measurement time setting to "1.0CYC".

  If the welding current flow is small (using upslope, etc.) and measurement cannot be performed, set the weld time or upslope time of the welder to the forced measurement time.

- End level setting

  For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels (3) End level]**.

  Normally, set the end level to "5.0% (initial value)".

  Increase the end level if the measurement of welding does not finish.

② Single-phase rectifying type

- Current measurement mode setting

  For details, see **[(3) a. Selecting the Current Measurement Mode]**.

  Set the current measurement mode to 

- Current range setting

  For details, see **[(3) d. Selecting the Current Range]**.

  If the current value is set, select a current range that is about 1.2 times larger than the set current value.

  If the current value is not set, set the current range to  "20.00kA".

  As the time of measurement, if the current value is smaller than the current range one level lower, lower the current range. If the current value is over, increase the current range.

- Current peak value/RMS value setting

  For details, see **[(3) c. Selecting Peak or Effective Value of Current]**.

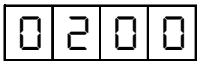
  Select the peak or effective value of current you want to measure.

  When measuring with the effective value, select the effective current measurement LED and set it.

  When measuring with the peak value, select the peak current measurement LED and set it.

- Voltage range setting

  For details, see **[(3) f. Selecting the Voltage Range]**.

  Set the voltage range to  "20.0V".

  At the time of measurement, if the measured voltage value is smaller than the voltage range one level below, lower the voltage range.

- Voltage peak value/RMS value setting

  For details, see **[(3) e. Selecting Peak or Effective Value of Voltage]**.

  Select the method you want to measure.

  When measuring with the RMS value, select the effective voltage measurement LED and set it.

  When measuring with the peak value, select the peak voltage measurement LED and set it.

- Measurement start time (FIRST) setting and measurement end time (LAST) setting

  For details, see **[(3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

  Measurement start time (FIRST) setting and measurement end time (LAST) setting can be used to measure current/voltage RMS values by specifying an arbitrary range. If you want to measure a part of the section or measure the section excluding the upslope or downslope, set it as necessary.

  If you do not specify a range, set the measurement start time (FIRST) to "0.0CYC (initial value)" and the measurement end time (LAST) to "180.0CYC (initial value)".

- Forced measurement time setting

  For details, see **[(5) h. System Setting (5) Forced measurement time]**.

  Normally, set the forced measurement time setting to "1.0CYC".

  If the welding current flow is small (using upslope, etc.) and measurement cannot be performed, set the weld time or upslope time of the welder to the forced measurement time.

- End level setting

  For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels (3) End level]**.

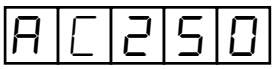
  Normally, set the end level to "5.0% (initial value)".

  Increase the end level if the measurement of welding does not finish.

③ AC inverter type

- Current measurement mode setting

  For details, see **[(3) a. Selecting the Current Measurement Mode]**.

  Set the current measurement mode to 

  Match the frequency with the welding frequency of the AC inverter type welding machine.

- Current range setting

  For details, see **[(3) d. Selecting the Current Range]**.

  If the current value is set, select a current range that is about 1.2 times larger than the set current value.

  If the current value is not set, set the current range to 

  "20.00kA".

  As the time of measurement, if the current value is smaller than the current range one level lower, lower the current range. If the current value is over, increase the current range.

- Current peak value/RMS value setting

  For details, see **[(3) c. Selecting Peak or Effective Value of Current]**.

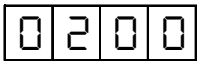
  Select the peak or effective value of current you want to measure.

  When measuring with the effective value, select the effective current measurement LED and set it.

  When measuring with the peak value, select the peak current measurement LED and set it.

- Voltage range setting

  For details, see **[(3) f. Selecting the Voltage Range]**.

  Set the voltage range to 

  "20.0V".

  At the time of measurement, if the measured voltage value is smaller than the voltage range one level below, lower the voltage range.

- Voltage peak value/RMS value setting

  For details, see **[(3) e. Selecting Peak or Effective Value of Voltage]**.

  Select the method you want to measure.

  When measuring with the RMS value, select the effective voltage measurement LED and set it.

  When measuring with the peak value, select the peak voltage measurement LED and set it.

- Measurement start time (FIRST) setting and measurement end time (LAST) setting

  For details, see **[(3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

  Measurement start time (FIRST) setting and measurement end time (LAST) setting can be used to measure current/voltage RMS values by specifying an arbitrary range. If you want to measure a part of the section or measure the section excluding the upslope or downslope, set it as necessary.

  If you do not specify a range, set the measurement start time (FIRST) to "0.0CYC (initial value)" and the measurement end time (LAST) to "1500.0CYC (initial value)".

- Forced measurement time setting

  For details, see **[(5) h. System Setting (5) Forced measurement time]**.

  Normally, set the forced measurement time setting to "1.0CYC".

  If the welding current flow is small (using upslope, etc.) and measurement cannot be performed, set the weld time or upslope time of the welder to the forced measurement time.

- End level setting

  For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels (3) End level]**.

  Normally, set the end level to "5.0% (initial value)".

  Increase the end level if the measurement of welding does not finish.

④ DC inverter type

- Current measurement mode setting

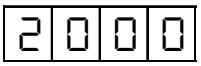
  For details, see **[(3) a. Selecting the Current Measurement Mode]**.

  Set the current measurement mode to 

- Current range setting

  For details, see **[(3) d. Selecting the Current Range]**.

  If the current value is set, select a current range that is about 1.2 times larger than the set current value.

  If the current value is not set, set the current range to  "20.00kA".

  As the time of measurement, if the current value is smaller than the current range one level lower, lower the current range. If the current value is over, increase the current range.

- Current peak value/RMS value setting

  For details, see **[(3) c. Selecting Peak or Effective Value of Current]**.

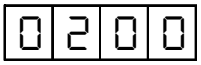
  Select the peak or effective value of current you want to measure.

  When measuring with the effective value, select the effective current measurement LED and set it.

  When measuring with the peak value, select the peak current measurement LED and set it.

- Voltage range setting

  For details, see **[(3) f. Selecting the Voltage Range]**.

  Set the voltage range to  "20.0V".

  At the time of measurement, if the measured voltage value is smaller than the voltage range one level below, lower the voltage range.

- Voltage peak value/RMS value setting

  For details, see **[(3) e. Selecting Peak or Effective Value of Voltage]**.

  Select the method you want to measure.

  When measuring with the RMS value, select the effective voltage measurement LED and set it.

  When measuring with the peak value, select the peak voltage measurement LED and set it.

- Measurement start time (FIRST) setting and measurement end time (LAST) setting

  For details, see **[(3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

  Measurement start time (FIRST) setting and measurement end time (LAST) setting can be used to measure current/voltage RMS values by specifying an arbitrary range. If you want to measure a part of the section or measure the section excluding the upslope or downslope, set it as necessary.

  If you do not specify a range, set the measurement start time (FIRST) to "0ms (initial value)" and the measurement end time (LAST) to "2000ms (initial value)".

- Forced measurement time setting

  For details, see **[(5) h. System Setting (5) Forced measurement time]**.

  Normally, set the forced measurement time setting to "5ms".

  If the welding time is shorter than 5 ms, set the welding time set in the welder.

  If the welding current flow is small (using upslope, etc.) and measurement cannot be performed, set the weld time or upslope time of the welder to the forced measurement time.

- End level setting

  For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels (3) End level]**.

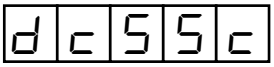
  Normally, set the end level to "5.0% (initial value)".

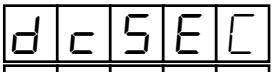
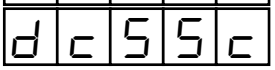
  Increase the end level if the measurement of welding does not finish.

⑤ Transistor type

- Current measurement mode setting

  For details, see **[(3) a. Selecting the Current Measurement Mode]**.

  Set the current measurement mode to  or 

   is measured in units of 1ms.
   is measured finer than 1ms, but up to 25ms.

- Current range setting

  For details, see **[(3) d. Selecting the Current Range]**.

  If the current value is set, select a current range that is about 1.2 times larger than the set current value.

  If the current value is not set, set the current range to  "20.00kA".

  As the time of measurement, if the current value is smaller than the current range one level lower, lower the current range. If the current value is over, increase the current range.

- Current peak value/RMS value setting

  For details, see **[(3) c. Selecting Peak or Effective Value of Current]**.

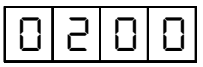
  Select the peak or effective value of current you want to measure.

  When measuring with the effective value, select the effective current measurement LED and set it.

  When measuring with the peak value, select the peak current measurement LED and set it.

- Voltage range setting

  For details, see **[(3) f. Selecting the Voltage Range]**.

  Set the voltage range to  "20.0V".

  At the time of measurement, if the measured voltage value is smaller than the voltage range one level below, lower the voltage range.

- Voltage peak value/RMS value setting

  For details, see **[(3) e. Selecting Peak or Effective Value of Voltage]**.

  Select the method you want to measure.

  When measuring with the RMS value, select the effective voltage measurement LED and set it.

  When measuring with the peak value, select the peak voltage measurement LED and set it.

- Measurement start time (FIRST) setting and measurement end time (LAST) setting

  For details, see **[(3) g. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

Measurement start time (FIRST) setting and measurement end time (LAST) setting can be used to measure current/voltage RMS values by specifying an arbitrary range. If you want to measure a part of the section or measure the section excluding the upslope or downslope, set it as necessary.

If you do not specify a range,

set the measurement start time (FIRST) to "0.0CYC (initial value)" and the measurement end time (LAST) to "2000.0CYC (initial value)"

set the measurement start time (FIRST) to "0.0ms (initial value)" and the measurement end time (LAST) to "25.00ms (initial value)"

- Forced measurement time setting

For details, see **[(5) h. System Setting (5) Forced measurement time]**.

Normally, set the forced measurement time setting to "5ms".

If the welding time is shorter than 5 ms, set the welding time set in the welder.

If the welding current flow is small (using upslope, etc.) and measurement cannot be performed, set the weld time or upslope time of the welder to the forced measurement time.

- End level setting

For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels (3) End level]**.

Normally, set the end level to "5.0% (initial value)".

Increase the end level if the measurement of welding does not finish.

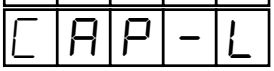
⑥ Capacitor type

- Current measurement mode setting

For details, see **[(3) a. Selecting the Current Measurement Mode]**.

Set the current measurement mode to  or  set it as necessary.

 has a measurement range of up to 9.99 ms.

 has a measurement range of up to 99.9 ms.

Current range setting

For details, see **[(3) d. Selecting the Current Range]**.

If the current value is set, select a current range that is about 1.2 times larger than the set current value.

If the current value is not set, set the current range to  "20.00kA".

As the time of measurement, if the current value is smaller than the current range one level lower, lower the current range. If the current value is over, increase the current range.

Current peak value/RMS value setting

For details, see **[(3) c. Selecting Peak or Effective Value of Current]**.

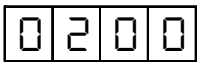
Select the peak or effective value of current you want to measure.

When measuring with the effective value, select the effective current measurement LED and set it.

When measuring with the peak value, select the peak current measurement LED and set it.

Voltage range setting

For details, see **[(3) f. Selecting the Voltage Range]**.

Set the voltage range to  "20.0V".

At the time of measurement, if the measured voltage value is smaller than the voltage range one level below, lower the voltage range.

Voltage peak value/RMS value setting

For details, see **[(3) e. Selecting Peak or Effective Value of Voltage]**.

Select the method you want to measure.

When measuring with the RMS value, select the effective voltage measurement LED and set it.

When measuring with the peak value, select the peak voltage measurement LED and set it.

- TP/TH setting

For details, see **【(3)h. Selecting TP/TH】**

Select the method you want to measure.

When measuring with the TP(TIME PEAK) value, select the TP(TIME PEAK) LED and set it.

When measuring with the TH(TIME HALF) value, select the TH(TIME HALF) LED and set it.

- Forced measurement time setting

For details, see **[(5) h. System Setting (5) Forced measurement time]**.

Normally, set the forced measurement time setting to "5ms".

If the welding time is shorter than 5 ms, set the welding time set in the welder.

If the welding current flow is small (using upslope, etc.) and measurement cannot be performed, set the weld time or upslope time of the welder to the forced measurement time.

- End level setting

For details, see **[(5) c. STATUS Setting and (5) e. Setting the Various Levels (3) End level]**.

Normally, set the end level to "5.0% (initial value)".

Increase the end level if the measurement of welding does not finish.

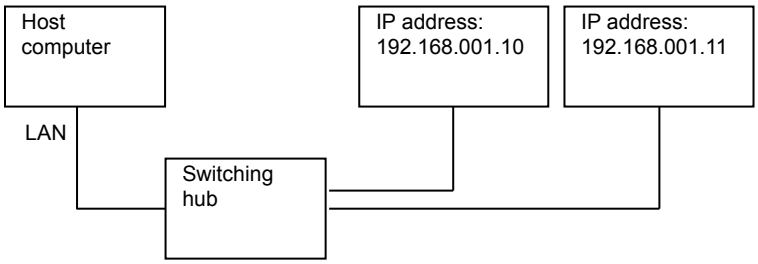
8. Data Communication

Monitoring data can be loaded from the **MM-123B** into the external PC. Also, schedule settings can be written from the external PC into the **MM-123B**.

(1) Data Transfer

Item	Description
System	Ethernet IEEE 802.3-compliant (10BASE-T/100BASE-TX protocol TCP/IP)
Character code	ASCII
Checksum data	None
Connector	Ethernet: RJ45 connector

(2) Configuration



* Prepare the switching hub at customer's side.
* The LAN cable is optional. Use a cable of Category 6 or higher.
* How to establish communication

Establish connection from the computer to the **MM-123B**. Connect it to IP address and port number set in the **MM-123B**. Use TCP/IP for communication protocol.

Example)

Computer IP address: 192.168.1.12, Subnet mask: 255.255.255.0

MM-123B IP address: 192.168.1.10, Subnet mask: 255.255.255.0, Port No.: 1024

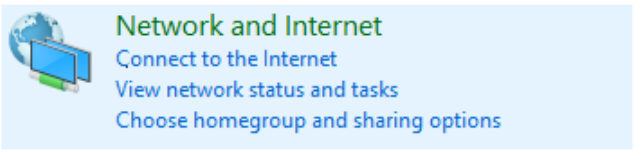
Establish connection from the computer to the **MM-123B** with settings of IP address: 192.168.1.10 and port number: 1024.

Since connection is released when the settings of the **MM-123B** (mode, device number, IP address, subnet mask, default gateway, and port number) are changed, the power supply of the **MM-123B** is turned off, and communication from the **MM-123B** cannot be made, establish connection again.

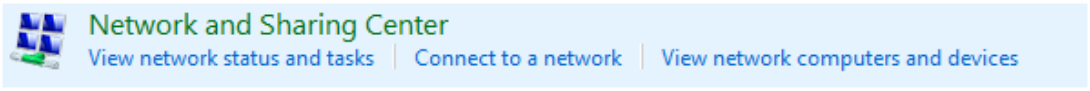
[IP address setting]
Set the IP address of the personal computer.
The IP address of the **MM-123B** has been set to [192.168.1.10] at the factory. Use [192.168.1.11] or later for the IP address of the personal computer. However, do not set the IP address to the same as the default gateway.

Setting procedure (for Windows 10)

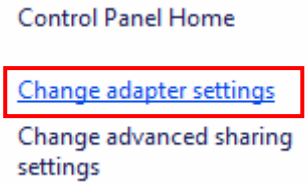
1) From the control panel, select the [Network and Internet].



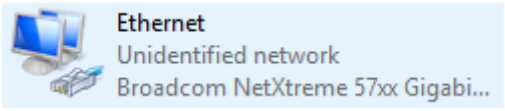
2) Select the [Network and Sharing Center].



3) Select the [Change adapter settings].

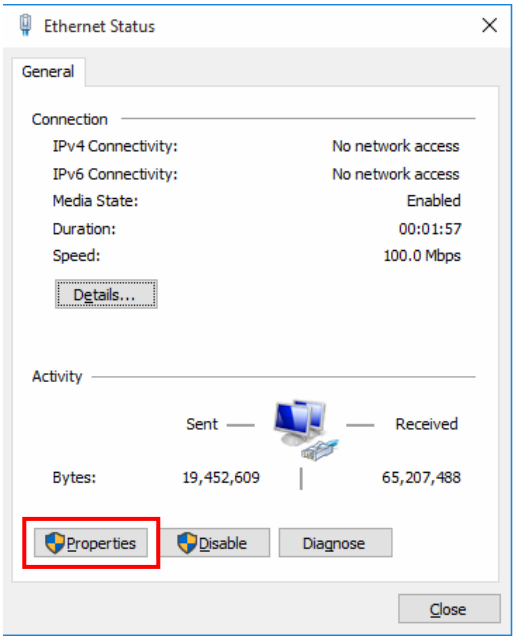


4) Select a network card to use.

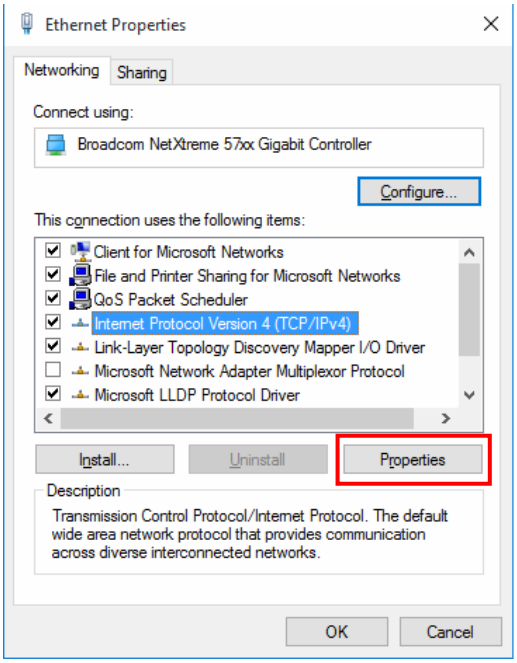


* Displays vary according to the personal computer or network card in use.

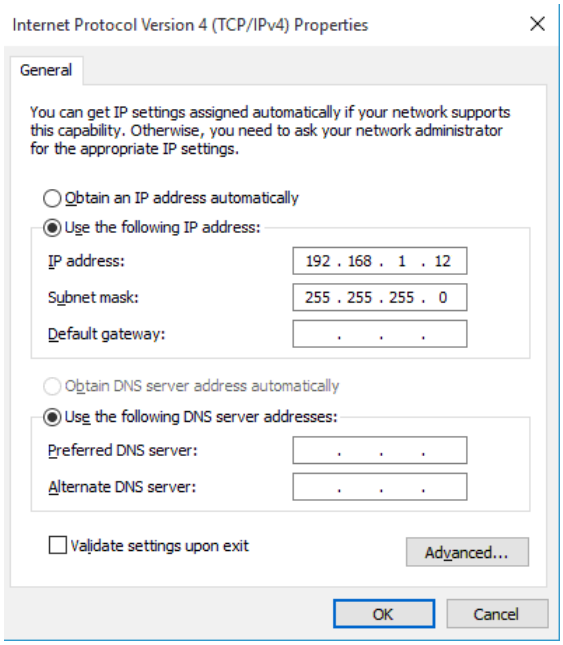
5) Click the [Properties].



6) Select the [Internet Protocol Version 4(TCP/IPv4)] and click the [Properties].



7) Input the IP address. Set the IP address as shown below and click the [OK].



Now the IP address setting is completed.

Set 1024 to 5000 for the port number. When you change the setting of the **MM-123B**, turn off the power supply, or disconnect the LAN cable, connect the **MM-123B** again.

(3) Communication Protocol (Single-Directional Communication)

Refer to **[7. (5) g. Communication Setting]** to set the communication method to Ethernet single-directional communication.

Data is output one-sidedly from the **MM-123B** after the welding current has measured and a fault has occurred.

a. Monitor Data

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	01		2
5	Delimiter	,		1
6	Current measurement mode	n	0: AC (Single-phase AC measurement) 1: AC--- (AC inverter CYC measurement) 2: ACSEC (AC inverter ms measurement) 3: dccyc (DC inverter CYC measurement) 4: dcSEC (DC inverter ms measurement) 5: dcSSc (Transistor measurement) 6: CAP-S (Capacitor short-time measurement) 7: CAP-L (Capacitor long-time measurement)	1
7	Delimiter	,		1
8	Effective value calculation mode	n	0: Original mode 1: ISO17657-compliant mode	1
9	Delimiter	,		1
10	Step number	n	0 (Step counter OFF) 1 to 9 (Step counter ON)	1
11	Delimiter	,		1
12	Weld counter (Total counter)	nnnnn	00000 to 99999 (Step counter OFF) 00000 to 09999 (Step counter ON)	5
13	Delimiter	,		1
14	Current peak value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error -: No judgment	1
15	Delimiter	,		1
16	Current peak value	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
17	Delimiter	,		1
18	Unit of Current peak value	kA		2

	Item	Display	Range	Length
19	Delimiter	,		1
20	Voltage effective value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error -: No judgment	1
21	Delimiter	,		1
22	Voltage effective value	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
23	Delimiter	,		1
24	Unit of Voltage effective value	kA		2
25	Delimiter	,		1
26	Voltage peak value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error -: No judgment	1
27	Delimiter	,		1
28	Voltage peak value	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
29	Delimiter	,		1
30	Unit of Voltage peak value	V		1
31	Delimiter	,		1
32	Voltage effective value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error -: No judgment	1
33	Delimiter	,		1
34	Voltage effective value	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
35	Delimiter	,		1
36	Unit of Voltage effective value	V		1
37	Delimiter	,		1
38	Weld time/TP time judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error -: No judgment	1
39	Delimiter	,		1

	Item	Display	Range	Length
40	Weld time/TP time	nnnnnn	0000.0 to 0180.0 (AC) *1 (0.5CYC step) 0000.0 to 1500.0 (AC---) *1 (0.5CYC step) 000000 to 003000 (ACSEC) 0000.0 to 0120.0 (dccyc) *1 (0.5CYC step) 000000 to 002000 (dcSEC) 000.00 to 025.00 (dcSSc) 000.00 to 009.99 (CAP-S) 0000.0 to 0099.9 (CAP-L)	6
41	Delimiter	,		1
42	Unit of Weld time/TP time	nnn	CYC (AC) (AC---) (dccyc) ms_ (ACSEC) (dcSEC) (dcSSc) (CAP-S) (CAP-L) *2	3
43	Delimiter	,		1
44	Flow time/TH time judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error -: No judgment	1
45	Delimiter	,		1
46	Flow time/TH time	nnnnnn	- Flow time-noncompliant (fixed to 0) 0000.0 (AC) 0000.0 (AC---) 000000 (ACSEC) 0000.0 (dccyc) 000.00 (dcSSc) - Flow time 000000 to 002000 (dcSEC) - TH time 000.00 to 009.99 (CAP-S) 0000.0 to 0099.9 (CAP-L)	6
47	Delimiter	,		1
48	Unit of Flow time/TH time	nnn	CYC (AC) (AC---) (dccyc) ms_ (ACSEC) (dcSEC) (dcSSc) (CAP-S) (CAP-L) *2	3
49	Delimiter	,		1
50	Maximum conduction angle	nnn	000 to 180 *3	3
51	Delimiter	,		1
52	Unit of Maximum conduction angle	deg		3
53	Return code	[CR]	(0x0d)	1
54	Feed code	[LF]	(0x0a)	1

*1: The range changes depending on the frequency to measure.
*2: A space falls into "_" for digit matching.

*3: When the current measurement mode is dcSEC, dcSSc, ACSEC, dccyc, CAP-S, or CAP-L, the maximum conduction angle is 000 degrees.

Communication example)

① Monitor data of SCH.# 1 and the current measurement mode “AC” is transmitted from the MM-123B.

“MM-123B → Host computer”
!01S01,0,1,0,00001,-,02.55,kA,G,01.10,kA,G,1.80,V,-,1.07,V,G,0008.0,CYC,-,0000.0,CYC,070,deg[CR][LF]

② Monitor data of SCH.# 2 and the current measurement mode “dcSEC” is transmitted from the MM-123B.

“MM-123B → Host computer”
!02S01,4,0,0,00001,-,01.53,kA,G,01.47,kA,G,1.80,V,-,1.07,V,G,000050,ms_,-,000000,ms_,000,deg[CR][LF]

b. All Cycle data

The data sent from the **MM-123B** to the host computer is as follows.
Set Ethr3 for one-way Ethernet communication.

* Not output when "dcSSc" (transistor type), "CAP-S" or "CAP-L" (capacitor type) is selected by the current measurement mode, or when "iSo" is selected of the effective value calculation mode. Do not set Ethr3 for one-way Ethernet communication.

① Measured value data

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	02		2
5	Delimiter	,		1
a. Measured value data 6 "Current measurement mode" to 52 "Maximum conduction angle unit"				
53	New line Code	[CR]	(0x0d)	1
54	Return code	[LF]	(0x0a)	1

② All cycle data

	Item	Display	Range	Length
1	Time	nnnnnn	0000.0 to 1500.0 (CYC) *1 000000 to 003000 (ms) *1	6
2	Delimiter	,		1
3	Time unit	nnn	CYC (AC) (AC---) (dccyc) ms_ (ACSEC) (dcSEC) *2	3
4	Delimiter	,		1
5	Range of measurement	n	*: Within measuring range -: Out of measuring range	1
6	Delimiter	,		1
7	current	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
8	Delimiter	,		1
9	Current unit	kA		2
10	Delimiter	,		1
11	Voltage	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
12	Delimiter	,		1
13	voltage unit	V		1
14	Delimiter	,	*3	1
15	Conduction angle	nnn	000 to 180 *3	3
16	Delimiter	,	*3	1
17	Conduction angle unit	deg	*3	3

	Item	Display	Range	Length
18	New line Code	[CR]	(0x0d)	1
19	Return code	[LF]	(0x0a)	1
Items 1 to 19 are output for the number of all cycle data. The conduction angle may not be output.*3 In that case, 14, 16 "Delimiter", 15 "Conductive angle", 17 "Conductive angle unit" will not be output.				
20	end of transmission	[EOT]	(0x04)	1

*1: The range changes depending on the current measurement mode.
*2: A space is entered in "_" for digit alignment.
*3: Not output when the current measurement mode is "AC---", "dcSEC", "ACSEC", or "dccyc".

Communication example)

① Monitor data of SCH.# 1 and the current measurement mode “AC” is transmitted from the MM-123B.

“MM-123B → Host computer”
!01S01,0,1,0,00001,-,02.55,kA,G,01.10,kA,G,1.80,V,-,1.07,V,G,0008.0,CYC,-,0000.0,CYC,070,deg[CR][LF]
0000.5,CYC,_,00.90,kA,0.95,V,058,deg[CR][LF]
0001.0,CYC,*,00.95,kA,1.00,V,060,deg[CR][LF]
.
.
.
0007.5,CYC,*,01.25,kA,1.00,V,070,deg[CR][LF]
0008.0,CYC,_,01.25,kA,1.00,V,070,deg[CR][LF]
[EOT]

② Monitor data of SCH.# 2 and the current measurement mode “dcSEC” is transmitted from the MM-123B.

“MM-123B → Host computer”
!02S01,4,0,0,00001,-,01.53,kA,G,01.47,kA,G,1.80,V,-,1.07,V,G,000050,ms_,-,000000,ms_,000,deg[CR][LF]
000001,ms_,_,01.30,kA,0.95,V[CR][LF]
000002,ms_,*,01.35,kA,1.00,V[CR][LF]
.
.
.
000049,ms_,*,01.50,kA,1.20,V[CR][LF]
000050,ms_,_,01.50,kA,1.20,V[CR][LF]
[EOT]

c. Error Data

The following data is output when some fault occurs in the measurement operation of the **MM-123B**.

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	99		2
5	Delimiter	,		1
6	Step number	n	0 (Step counter OFF) 1 to 9 (Step counter ON)	1
7	Delimiter	,		1
8	Counter	nnnnn	00000 to 99999 (Step counter OFF) 00000 to 09999 (Step counter ON)	5
9	Delimiter	,		1
10	Preset counter up	n	0: OFF 1: ON	1
11	Delimiter	,		1
12	Step counter up	n	0: OFF 1: ON	1
13	Delimiter	,		1
14	No-current error	n	0: OFF 1: ON	1
15	Delimiter	,		1
16	Impulse error	n	0: OFF 1: ON	1
17	Return code	[CR]	(0x0d)	1
18	Feed code	[LF]	(0x0a)	1

Communication example)

Error data (no-current data) of SCH.# 1 is transmitted from the MM-123B.

“MM-123B → Host computer”
!01S99,0,00001,0,0,1,0[CR][LF]

(4) Communication Protocol (Bi-Directional Communication)

Refer to **[7. (5) g. Communication Setting]** to set the communication method to Ethernet bi-directional communication (Ethr2).

Monitor data can be read and schedule data can be read or written according to the command on the host computer side. However, each item cannot be read or written.

Data can be read or written in the bi-directional communication of the **MM-123B** is as follows:

a. Reading the Monitor Data

b. Reading the All Cycle Data

c. Reading and Writing the Upper and Lower Limit Value Data of Current

d. Reading and Writing the Upper and Lower Limit Value Data of Current of Each Step

e. Reading and Writing the Upper and Lower Limit Value Data of Voltage

f. Reading and Writing the Upper and Lower Limit Value Data of Voltage of Each Step

g. Reading and Writing the Upper and Lower Limit Value Data of Weld Time

h. Reading and Writing the Upper and Lower Limit Value Data of Weld Time (TP/TH)

i. Reading and Writing the System Setting Data

j. Reading and Writing the Counter Data of Each Step

k. Reading and Writing the I/O Setting Data

l. Reading and Writing the Communication Setting Data

There are two ways. One is data that can be written by two-way communication can be written to the flash memory built into the MM-123B (Even if the power is turned off, the conditions and settings written by two-way communication are retained.) and the other is a method that does not write to flash memory(When the power is turned off, the conditions and settings written by two-way communication are not retained.)

If you frequently write conditions and settings with two-way communication, use a method that does not write to flash memory.

Writing method	Limitations
How to write to flash memory writing code: W	Write to the flash memory built into the MM-123B. Even if the power is turned off, the conditions and settings written with write code W are retained. Note that flash memory has a write limit (approximately 100,000 times). Conditions and settings that have been changed using screen operations are retained even when the power is turned off.
How not to write to flash memory writing code: V	Does not write to the flash memory built into the MM-123B. When the power is turned off, the conditions and settings written with write code V are not retained. In writing code V, be sure to write the conditions

	and settings. Then take measurements. For items other than those to be written with write code V, change them by operating the screen or write with write code W. Conditions and settings changed by screen operations are retained even when the power is turned off. Also, after writing with the write code V, if you save the related items by operating the screen, they will be written to the flash memory, so they will be retained even if the power is turned off.

Data is returned from the MM-123B when a read/write command is sent from the host computer.

When sending a command, do not send the next command until the reply data is returned or the timeout period has passed.

When using the write command, the newly set data will be returned from MM-123B for confirmation. If you write invalid data that is out of range or does not meet the conditions, the currently set value will be returned for confirmation.

(If only part of the message is incorrect, the normal data will be rewritten and sent back, and the incorrect data will be returned with the set value.)

Do not perform two-way communication during setting operations and until the READY signal is output.
Also, do not perform the next measurement until the communication output is completed.

a. Reading the Monitor Data

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	00	Fixed (only 00 is available) *1	2
4	Item code	S		1
5	Item number	01		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

*1: The data measured in the last time is output. When there is no measurement data, “0” is output for the monitor data.

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is the same as the monitor data of the single-directional communication.
(For details, see **[(3) a. Monitor Data]**.)

Communication example)

① Reading the monitor data

“Host computer → MM-123B”
#R00S01*[CR][LF]

“MM-123B → Host computer”
!01S01,0,1,0,00001,-,02.55,kA,G,01.10,kA,G,0.00,V,-,0.00,V,G,0008.0,CYC,-,0000.0,CYC,070,deg[CR][LF]

b. Reading the All Cycle Data

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	00	Fixed (only 00 is available) *1	2
4	Item code	S		1
5	Item number	02		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

*1: The data measured in the last time is output. When there is no measurement data, “0” is output for the monitor data.

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is the same as the all cycle data of the single-directional communication.
(For details, see **[(3) b. All Cycle Data]**.)

Communication example)

① Reading the all cycle data

“Host computer → MM-123B”
#R00S02*[CR][LF]

“MM-123B → Host computer”
!01S01,0,1,0,00001,-,02.55,kA,G,01.10,kA,G,1.80,V,-,1.07,V,G,0008.0,CYC,-,0000.0,CYC,070,deg[CR][LF]
0000.5,CYC,_,00.90,kA,0.95,V,058,deg[CR][LF]
0001.0,CYC,_,00.95,kA,1.00,V,060,deg[CR][LF]
.
.
.
0007.5,CYC,*,01.25,kA,1.00,V,070,deg[CR][LF]
0008.0,CYC,*,01.25,kA,1.00,V,070,deg[CR][LF]
[EOT]

c. Reading and Writing the Upper and Lower Limit Value Data of Current

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	10		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	10		2
5	Delimiter	,		1
6	Current range	n	0: 2.000kA range 1: 20.00kA range 2: 200.0kA range	1
7	Delimiter	,		1
8	Measurement current PEAK/RMS	n	0: PEAK (peak value display) 1: RMS (effective value display)	1
9	Delimiter	,		1
10	Peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
11	Delimiter	,		1
12	Unit of Current value	kA		2
13	Delimiter	,		1
14	Peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
15	Delimiter	,		1
16	Unit of Current value	kA		2
17	Return code	[CR]	(0x0d)	1
18	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	10		2
6	Delimiter	,		1
7 to 17	Same as 6 to 16 of <Output data for reading request>			
18	Return code	[CR]	(0x0d)	1
19	Feed code	[LF]	(0x0a)	1

Communication example)

① Reads the setting data of the current upper/lower limit value of SCH.# 1.

"Host computer → MM-123B"
#R01S10*[CR][LF]

"MM-123B → Host computer"
!01S10,1,1,20.00,kA,00.50,kA[CR][LF]

② Writes the setting data of the current upper/lower limit value in SCH.# 2.

"Host computer → MM-123B"
#W02S10,1,1,20.00,kA,01.50,kA[CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!02S10,1,1,20.00,kA,01.50,kA[CR][LF]

d. Reading and Writing the Upper and Lower Limit Value Data of Current of Each Step

* Used when the step counter function is ON.

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	11		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	11		2
5	Delimiter	,		1
6	Current range	n	0: 2.000kA range 1: 20.00kA range 2: 200.0kA range	1
7	Delimiter	,		1
8	Measurement current PEAK/RMS	n	0: PEAK (peak value display) 1: RMS (effective value display)	1
9	Delimiter	,		1
10	STEP1 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
11	Delimiter	,		1
12	Unit of Current value	kA		2
13	Delimiter	,		1
14	STEP1 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
15	Delimiter	,		1
16	Unit of Current value	kA		2
17	Delimiter	,		1

	Item	Display	Range	Length
18	STEP2 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
19	Delimiter	,		1
20	Unit of Current value	kA		2
21	Delimiter	,		1
22	STEP2 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
23	Delimiter	,		1
24	Unit of Current value	kA		2
25	Delimiter	,		1
26	STEP3 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
27	Delimiter	,		1
28	Unit of Current value	kA		2
29	Delimiter	,		1
30	STEP3 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
31	Delimiter	,		1
32	Unit of Current value	kA		2
33	Delimiter	,		1
34	STEP4 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
35	Delimiter	,		1
36	Unit of Current value	kA		2
37	Delimiter	,		1
38	STEP4 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
39	Delimiter	,		1
40	Unit of Current value	kA		2
41	Delimiter	,		1
42	STEP5 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
43	Delimiter	,		1
44	Unit of Current value	kA		2
45	Delimiter	,		1

	Item	Display	Range	Length
46	STEP5 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
47	Delimiter	,		1
48	Unit of Current value	kA		2
49	Delimiter	,		1
50	STEP6 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
51	Delimiter	,		1
52	Unit of Current value	kA		2
53	Delimiter	,		1
54	STEP6 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
55	Delimiter	,		1
56	Unit of Current value	kA		2
57	Delimiter	,		1
58	STEP7 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
59	Delimiter	,		1
60	Unit of Current value	kA		2
61	Delimiter	,		1
62	STEP7 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
63	Delimiter	,		1
64	Unit of Current value	kA		2
65	Delimiter	,		1
66	STEP8 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
67	Delimiter	,		1
68	Unit of Current value	kA		2
69	Delimiter	,		1
70	STEP8 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
71	Delimiter	,		1
72	Unit of Current value	kA		2
73	Delimiter	,		1

	Item	Display	Range	Length
74	STEP9 peak/effective value current upper limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
75	Delimiter	,		1
76	Unit of Current value	kA		2
77	Delimiter	,		1
78	STEP9 peak/effective value current lower limit	nnnnn	0.000 to 2.000 (2.000kA range) 00.00 to 20.00 (20.00kA range) 000.0 to 200.0 (200.0kA range)	5
79	Delimiter	,		1
80	Unit of Current value	kA		2
81	Return code	[CR]	(0x0d)	1
82	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	11		2
6	Delimiter	,		1
7 to 81	Same as 6 to 80 of <Output data for reading request>			
82	Return code	[CR]	(0x0d)	1
83	Feed code	[LF]	(0x0a)	1

Communication example)

① Reads the setting data of the current upper/lower limit value of each step of SCH.# 1.

"Host computer → MM-123B"
#R01S11*[CR][LF]

"MM-123B → Host computer"
!01S11,1,1,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA,20.00,kA,00.00,kA
[CR][LF]

② Writes the setting data of the current upper/lower limit value of each step in SCH.# 1.

"Host computer → MM-123B"
#W01S11,1,1,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA [CR][LF]

“MM-123B → Host computer” (sent for check when the written data is within the range.)
!01S11,1,1,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.0
0,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA,20.00,kA,02.00,kA
[CR][LF]

e. Reading and Writing the Upper and Lower Limit Value Data of Voltage

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	12		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	12		2
5	Delimiter	,		1
6	Voltage range	n	0: 6.00V range 1: 20.0V range	1
7	Delimiter	,		1
8	Measurement voltage PEAK/RMS	n	0: PEAK (peak value judgment) 1: RMS (effective value judgment)	1
9	Delimiter	,		1
10	Peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
11	Delimiter	,		1
12	Unit of Voltage value	V		1
13	Delimiter	,		1
14	Peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
15	Delimiter	,		1
16	Unit of Voltage value	V		1
17	Return code	[CR]	(0x0d)	1
18	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	12		2
6	Delimiter	,		1
7 to 17	Same as 6 to 16 of <Output data for reading request>			
18	Return code	[CR]	(0x0d)	1
19	Feed code	[LF]	(0x0a)	1

Communication example)

① Reads the setting data of the voltage upper/lower limit value of SCH.# 1.

"Host computer → MM-123B"
#R01S12*[CR][LF]

"MM-123B → Host computer"
!01S12,1,1,20.0,V,00.0,V[CR][LF]

② Writes the setting data of the voltage upper/lower limit value in SCH.# 2.

"Host computer → MM-123B"
#W02S12,1,1,10.0,V,00.0,V[CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!02S12,1,1,10.0,V,00.0,V [CR][LF]

f. Reading and Writing the Upper and Lower Limit Value Data of Voltage of Each Step

* Used when the step counter function is ON.

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	13		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	13		2
5	Delimiter	,		1
6	Voltage range	n	0: 6.00V range 1: 20.0V range	1
7	Delimiter	,		1
8	Measurement voltage PEAK/RMS	n	0: PEAK (peak value display) 1: RMS (effective value display)	1
9	Delimiter	,		1
10	STEP1 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
11	Delimiter	,		1
12	Unit of Voltage value	V		1
13	Delimiter	,		1
14	STEP1 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
15	Delimiter	,		1
16	Unit of Voltage value	V		1
17	Delimiter	,		1
18	STEP2 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
19	Delimiter	,		1
20	Unit of Voltage value	V		1

	Item	Display	Range	Length
21	Delimiter	,		1
22	STEP2 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
23	Delimiter	,		1
24	Unit of Voltage value	V		1
25	Delimiter	,		1
26	STEP3 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
27	Delimiter	,		1
28	Unit of Voltage value	V		1
29	Delimiter	,		1
30	STEP3 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
31	Delimiter	,		1
32	Unit of Voltage value	V		1
33	Delimiter	,		1
34	STEP4 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
35	Delimiter	,		1
36	Unit of Voltage value	V		1
37	Delimiter	,		1
38	STEP4 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
39	Delimiter	,		1
40	Unit of Voltage value	V		1
41	Delimiter	,		1
42	STEP5 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
43	Delimiter	,		1
44	Unit of Voltage value	V		1
45	Delimiter	,		1
46	STEP5 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
47	Delimiter	,		1
48	Unit of Voltage value	V		1
49	Delimiter	,		1
50	STEP6 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
51	Delimiter	,		1
52	Unit of Voltage value	V		1
53	Delimiter	,		1

	Item	Display	Range	Length
54	STEP6 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
55	Delimiter	,		1
56	Unit of Voltage value	V		1
57	Delimiter	,		1
58	STEP7 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
59	Delimiter	,		1
60	Unit of Voltage value	V		1
61	Delimiter	,		1
62	STEP7 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
63	Delimiter	,		1
64	Unit of Voltage value	V		1
65	Delimiter	,		1
66	STEP8 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
67	Delimiter	,		1
68	Unit of Voltage value	V		1
69	Delimiter	,		1
70	STEP8 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
71	Delimiter	,		1
72	Unit of Voltage value	V		1
73	Delimiter	,		1
74	STEP9 peak/effective value voltage upper limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
75	Delimiter	,		1
76	Unit of Voltage value	V		1
77	Delimiter	,		1
78	STEP9 peak/effective value voltage lower limit	nnnn	0.00 to 6.00 (6V range) 00.0 to 20.0 (20V range)	4
79	Delimiter	,		1
80	Unit of Voltage value	V		1
81	Return code	[CR]	(0x0d)	1
82	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	13		2
6	Delimiter	,		1
7 to 81	Same as 6 to 80 of <Output data for reading request>			
82	Return code	[CR]	(0x0d)	1
83	Feed code	[LF]	(0x0a)	1

Communication example)

① Reads the setting data of the voltage upper/lower limit value of each step of SCH.# 1.

"Host computer → MM-123B"
#R01S13*[CR][LF]

"MM-123B → Host computer"
!01S13,1,1,20.0,V,00.0,V,20.0,V,00.0,V,20.0,V,00.0,V,20.0,V,00.0,V,20.0,V,00.0,V,20.0,V,0
0.0,V,20.0,V,00.0,V,20.0,V,00.0,V,20.0,V,00.0,V [CR][LF]

② Writes the setting data of the voltage upper/lower limit value of each step in SCH.# 1.

"Host computer → MM-123B"
#W01S13,1,1,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V
,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V [CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!01S13,1,1,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,0
0.0,V,10.0,V,00.0,V,10.0,V,00.0,V,10.0,V,00.0,V[CR][LF]

g. Reading and Writing the Upper and Lower Limit Value Data of Weld Time

* Used when the current measurement mode is AC, AC---, ACSEC. Dccyc, dcSEC, or dcSSc.

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	14		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	14		2
5	Delimiter	,		1
6	Impulse number	n	0 to 9	1
7	Delimiter	,		1
8	Weld time upper limit	nnnnnn	0000.0 to 0180.0 (AC) *1 (0.5CYC step) 0000.0 to 1500.0 (AC---) *1 (0.5CYC step) 0000.0 to 0120.0 (dccyc) *1 (0.5CYC step) 000000 to 003000 (ACSEC) 000000 to 002000 (dcSEC) 000.00 to 025.00 (dcSSc)	6
9	Delimiter	,		1
10	Unit of Weld time upper limit	nnn	CYC (AC) CYC (AC---) CYC (dccyc) ms_ (ACSEC) *2 ms_ (dcSEC) *2 ms_ (dcSSc) *2	3
11	Delimiter	,		1

	Item	Display	Range	Length
12	Weld time lower limit	nnnnnn	0000.0 to 0180.0 (AC) *1 (0.5CYC step) 0000.0 to 1500.0 (AC---) *1 (0.5CYC step) 0000.0 to 0120.0 (dccyc) *1 (0.5CYC step) 000000 to 003000 (ACSEC) 000000 to 002000 (dcSEC) 000.00 to 025.00 (dcSSc)	6
13	Delimiter	,		1
14	Unit of Weld time lower limit	nnn	CYC (AC) CYC (AC---) CYC (dccyc) ms_ (ACSEC) *2 ms_ (dcSEC) *2 ms_ (dcSSc) *2	3
15	Delimiter	,		1
16	Measurement start time	nnnnnn	0000.0 to 0180.0 (AC) *1 (0.5CYC step) 0000.0 to 1500.0 (AC---) *1 (0.5CYC step) 0000.0 to 0120.0 (dccyc) *1 (0.5CYC step) 000000 to 003000 (ACSEC) 000000 to 002000 (dcSEC) 000.00 to 025.00 (dcSSc)	6
17	Delimiter	,		1
18	Unit of Measurement start time	nnn	CYC (AC) CYC (AC---) CYC (dccyc) ms_ (ACSEC) *2 ms_ (dcSEC) *2 ms_ (dcSSc) *2	3
19	Delimiter	,		1
20	Measurement end time	nnnnnn	0000.0 to 0180.0 (AC) *1 (0.5CYC step) 0000.0 to 1500.0 (AC---) *1 (0.5CYC step) 0000.0 to 0120.0 (dccyc) *1 (0.5CYC step) 000000 to 003000 (ACSEC) 000000 to 002000 (dcSEC) 000.00 to 025.00 (dcSSc)	6
21	Delimiter	,		1

	Item	Display	Range	Length
22	Unit of Measurement end time	nnn	CYC (AC) CYC (AC---) CYC (dccyc) ms_ (ACSEC) *2 ms_ (dcSEC) *2 ms_ (dcSSc) *2	3
23	Return code	[CR]	(0x0d)	1
24	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	14		2
6	Delimiter	,		1
7 to 23	Same as 6 to 22 of <Output data for reading request>			
24	Return code	[CR]	(0x0d)	1
25	Feed code	[LF]	(0x0a)	1

*1: The range changes depending on the frequency to measure.
*2: A space falls into "_" for digit matching.

Communication example)

① Reads the setting data of the weld time upper/lower limit value of SCH.# 1.

"Host computer → MM-123B"
#R01S14*[CR][LF]

"MM-123B → Host computer"
!01S14,0,002000,ms_,000000,ms_,000000,ms_,002000,ms_[CR][LF]

② Writes the setting data of the weld time upper/lower limit value in SCH.# 1.

"Host computer → MM-123B"
#W02S14,0,001000,ms_,000000,ms_,000000,ms_,001000,ms_[CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!02S14,0,001000,ms_,000000,ms_,000000,ms_,001000,ms_[CR][LF]

h. Reading and Writing the Upper and Lower Limit Value Data of Weld Time (TP/TH)

* Used when the current measurement mode is CAP-S or CAP-L.

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	15		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	nn	01 to 31	2
3	Item code	S		1
4	Item number	15		2
5	Delimiter	,		1
6	Measurement time TP/TH	0	0: TP (TP time display) 1: TH (TH time display)	1
7	Delimiter	,		1
8	Upper limit of Weld time TP Upper limit of Weld time TH	nnnn	0.00 to 9.99 (CAP-S) 00.0 to 99.9 (CAP-L)	4
9	Delimiter	,		1
10	Unit of Time	ms_ *1		3
11	Delimiter	,		1
12	Lower limit of Weld time TP Lower limit of Weld time TH	nnnn	0.00 to 9.99 (CAP-S) 00.0 to 99.9 (CAP-L)	4
13	Delimiter	,		1
14	Unit of Time	ms_ *1		3
15	Return code	[CR]	(0x0d)	1
16	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	nn	01 to 31	2
4	Item code	S		1
5	Item number	15		2
6	Delimiter	,		1
7 to 15	Same as 6 to 14 of <Output data for reading request>			
16	Return code	[CR]	(0x0d)	1
17	Feed code	[LF]	(0x0a)	1

*1: A space falls into "_" for digit matching.

Communication example)

① Reads the setting data of the weld time (TP/TH) upper/lower limit value of SCH.# 1.

"Host computer → MM-123B"
#R01S15*[CR][LF]

"MM-123B → Host computer"
!01S15,1,9.99,ms_,0.00,ms_[CR][LF]

② Writes the setting data of the weld time (TP/TH) upper/lower limit value in SCH.# 1.

"Host computer → MM-123B"
#W01S15,1,5.99,ms_,0.00,ms_[CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!01S15,1,5.99,ms_,0.00,ms_[CR][LF]

i. Reading and Writing the System Setting Data

<Reading request data>
Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	00	2
4	Item code	S		1
5	Item number	20		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>
Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	00		2
3	Item code	S		1
4	Item number	20		2
5	Delimiter	,		1
6	Preset counter	nnnnn	00000 to 99999	5
7	Delimiter	,		1
8	Current measurement mode	n	0: AC (Single-phase AC measurement) 1: AC--- (AC inverter CYC measurement) 2: ACSEC (AC inverter ms measurement) 3: dccyc (DC inverter CYC measurement) 4: dcSEC (DC inverter ms measurement) 5: dcSSc (Transistor measurement) 6: CAP-S (Capacitor short-time measurement) 7: CAP-L (Capacitor long-time measurement)	1
9	Delimiter	,		1
10	Effective value calculation mode	n	0: Original mode 1: ISO17657-compliant mode	1
11	Delimiter	,		1

	Item	Display	Range	Length
12	Measurement frequency	nnn	030: 050.[Hz] display 031: 053.[Hz] display 032: 056.[Hz] display 033: 059.[Hz] display 034: 063.[Hz] display 035: 067.[Hz] display 036: 071.[Hz] display 037: 077.[Hz] display 038: 083.[Hz] display 039: 091.[Hz] display 040: 100.[Hz] display 041: 111.[Hz] display 042: 125.[Hz] display 043: 143.[Hz] display 044: 167.[Hz] display 045: 200.[Hz] display 046: 250.[Hz] display 047: 294.[Hz] display 048: 417.[Hz] display 049: 500.[Hz] display 050 to 250[Hz] (commercial frequency)	3
13	Delimiter	,		1
14	Cool time (CYC) Cool time (ms)	nnn	0.5 to 9.5 (AC) (AC---) (dccyc) (0.5CYC step) 001 to 099 (ACSEC) (dcSEC) 0.1 to 9.9 (dcSSC)	3
15	Delimiter	,		1
16	Unit of Cool time	nnn	CYC (AC) (AC---) (dccyc) ms_ (ACSEC) (dcSEC) *1 ms_ (dcSSC) *1	3
17	Delimiter	,		1
18	Fall level	nn	10 to 90	2
19	Delimiter	,		1
20	Unit of Fall level	%		1
21	Delimiter	,		1
22	Forced measurement time (CYC) Forced measurement time (ms)	nnnn	00.5 to 49.5 (AC) (AC---) (dccyc) (0.5CYC step) 0001 to 0099 (ACSEC) (dcSEC) (CAP-S) (CAP-L)	4
23	Delimiter	,		1
24	Unit of Forced measurement time	nnn	CYC (AC) (AC---) (dccyc) ms_ (ACSEC) (dcSEC) (CAP-S) (CAP-L) *1	3
25	Delimiter	,		1
26	Non-measurement time	nnn	0.1 to 9.9	3
27	Delimiter	,		1
28	Unit of Non-measurement time	s		1
29	Delimiter	,		1

	Item	Display	Range	Length
30	End level	nnnn	01.5 to 15.0	4
31	Delimiter	,		1
32	Unit of End level	%		1
33	Delimiter	,		1
34	Flow time setting	n	0: Flow time OFF setting 1: Flow time ON setting	1
35	Delimiter	,		1
36	Current trigger level	nn	01 to 99	2
37	Delimiter	,		1
38	Col sensitivity setting	n	0: 1x sensitivity 1: 10 x sensitivity	1
39	Delimiter	,		1
40	Coil conversion factor setting	nnnnn	Fixed to 227.0	5
41	Delimiter	,		1
42	Unit of Coil conversion factor setting	mV/kA		5
43	Return code	[CR]	(0x0d)	1
44	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	00		2
4	Item code	S		1
5	Item number	20		2
6	Delimiter	,		1
7 to 43	Same as 6 to 42 of <Output data for reading request>			
44	Return code	[CR]	(0x0d)	1
45	Feed code	[LF]	(0x0a)	1

*1: A space falls into "_" for digit matching.

Communication example)

① Reading the system setting data

"Host computer → MM-123B"
#R00S20*[CR][LF]

"MM-123B → Host computer"
!00S20,00000,6,0,050,001,ms_,80,%,0005,ms_,0.1,s,05.0,%,0,90,0,227.0,mV/kA [CR][LF]

② Writing the system setting data

“Host computer → MM-123B”
#W00S20,00000,6,0,050,001,ms_,70,%,0010,ms_,0.5,s,05.0,%,0,90,0,227.0,mV/kA
[CR][LF]

“MM-123B → Host computer” (sent for check when the written data is within the range.)
!00S20,00000,6,0,050,001,ms_,70,%,0010,ms_,0.5,s,05.0,%,0,90,0,227.0,mV/kA [CR][LF]

j. Reading and Writing the Counter Data of Each Step

Used when the current measurement mode is AC, AC---, ACSEC, dccyc, or dcSEC and the step counter function is ON.

<Reading request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	00	2
4	Item code	S		1
5	Item number	21		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	00		2
3	Item code	S		1
4	Item number	21		2
5	Delimiter	,		1
6	Step counter setting	n	0: StEP0 (Step counter OFF) 1: StEP1 (Step counter ON)	1
7	Delimiter	,		1
8	STEP1 count	nnnn	0000 to 9999	4
9	Delimiter	,		1
10	STEP2 count	nnnn	0000 to 9999	4
11	Delimiter	,		1
12	STEP3 count	nnnn	0000 to 9999	4
13	Delimiter	,		1
14	STEP4 count	nnnn	0000 to 9999	4
15	Delimiter	,		1
16	STEP5 count	nnnn	0000 to 9999	4
17	Delimiter	,		1
18	STEP6 count	nnnn	0000 to 9999	4
19	Delimiter	,		1
20	STEP7 count	nnnn	0000 to 9999	4
21	Delimiter	,		1
22	STEP8 count	nnnn	0000 to 9999	4
23	Delimiter	,		1

	Item	Display	Range	Length
24	STEP9 count	nnnn	0000 to 9999	4
25	Return code	[CR]	(0x0d)	1
26	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	00		2
4	Item code	S		1
5	Item number	21		2
6	Delimiter	,		1
7 to 25	Same as 6 to 24 of <Output data for reading request>			
26	Return code	[CR]	(0x0d)	1
27	Feed code	[LF]	(0x0a)	1

Communication example)

① Reading the counter setting data of each step

"Host computer → MM-123B"
#R00S21*[CR][LF]

"MM-123B → Host computer"
!00S21,1,0000,0000,0000,0000,0000,0000,0000,0000,0000 [CR][LF]

② Writing the counter setting data of each step

"Host computer → MM-123B"
#W00S21,1,1000,2000,3000,4000,5000,6000,7000,8000,9000 [CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!00S21,1,1000,2000,3000,4000,5000,6000,7000,8000,9000 [CR][LF]

k. Reading and Writing the I/O Setting Data

<Reading request data>
Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	00	2
4	Item code	S		1
5	Item number	22		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>
Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	00		2
3	Item code	S		1
4	Item number	22		2
5	Delimiter	,		1
6	Upper/lower limit judgment output 動作	n	0: HL1 1: HL2	1
7	Delimiter	,		1
8	Error output	n	0: HL nc 1: HL no	1
9	Delimiter	,		1
10	Input stabilizing time setting	n	0: 1ms 1: 10ms	1
11	Delimiter	,		1
12	Output time	n	0: 10ms 1: 100ms 2: HOLD	1
13	Return code	[CR]	(0x0d)	1
14	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Write code	W V	Holds the written data even if the power is turned off. Does not hold the written data if the power is turned off.	1
3	Schedule number	00		2
4	Item code	S		1
5	Item number	22		2
6	Delimiter	,		1
7 to 13	Same as 6 to 12 of <Output data for reading request>			
14	Return code	[CR]	(0x0d)	1
15	Feed code	[LF]	(0x0a)	1

Communication example)

① Reading the I/O setting data

"Host computer → MM-123B"
#R00S22*[CR][LF]

"MM-123B → Host computer"
!00S22,0,0,0,0 [CR][LF]

② Writing the I/O setting data

"Host computer → MM-123B"
#W00S22,1,1,1,1 [CR][LF]

"MM-123B → Host computer" (sent for check when the written data is within the range.)
!00S22,1,1,1,1 [CR][LF]

I. Reading and Writing the Communication Setting Data

<Reading request data>
Commands transmitted from the host computer to the **MM-123B** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Read code	R		1
3	Schedule number	nn	00	2
4	Item code	S		1
5	Item number	29		2
6	All contents	*		1
7	Return code	[CR]	(0x0d)	1
8	Feed code	[LF]	(0x0a)	1

<Output data for reading request>
Commands transmitted from the **MM-123B** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Schedule number	00		2
3	Item code	S		1
4	Item number	29		2
5	Delimiter	,		1
6	System	n	0: OFF 1: Ether1 2: Ether2 3: Ether3	1
7	Delimiter	,		1
8	IP address	nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
9	Delimiter	,		1
10	Subnet mask	nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3

	Item	Display	Range	Length
11	Delimiter	,		1
12	Default gateway	nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
			Space	1
		nnn	000 to 255	3
13	Delimiter	,		1
14	Port number	nnnn	1024 to 5000	4
15	Return code	[CR]	(0x0d)	1
16	Feed code	[LF]	(0x0a)	1

Communication example)

① Reading the communication setting data

"Host computer → MM-123B"
#R00S29*[CR][LF]

"MM-123B → Host computer"
!00S29,2,192_168_001_010,255_255_255_000,192_168_001_001,1024[CR][LF]

* A space falls into "_".

9. Fault Code List

The **MM-123B** lets you know the occurrence of troubles by lighting up LEDs or displaying fault codes.

Fault code (Display name)	Cause	Measures
E-01 (Mode display)	• Trouble of the flash memory • A part of schedule setting data is lost or broken because of electrostatic noise and so on.	Depress the operation button to reset the error. Check the setting data and input it correctly. To initialize the setting data to initial values, see **[7. (6) b. Initializing the Schedule Setting]**. If the fault code is displayed when the power supply switch is turned on, the **MM-123B** may have been broken. Consult us.
E-02 (Mode display)	Trouble of the sub memory (FeRAM)	
E-03 (Mode display)	The current trigger signal continues to be detected.	If, after measurement, the welding current continues to flow, bring the current trigger down below the end level. If the error is not eliminated, the **MM-123B** may have been broken. Consult us.
E-04 (Mode display)	A trouble has occurred in the setting function of the start sensitivity level.	Turn off the power supply, and then turn on again. If E-04 is displayed when the power supply switch is turned on, the **MM-123B** may have been broken. Consult us.
E-05 (Mode display)	The built-in 24 V DC power, output from the rear terminal, was overloaded.	Turn off the power, and check the I/O connections on the rear. • Check if the 24 V DC power supply is not shorted. • Check if nothing with the large current capacity is connected. Do not use the internal power supply of the **MM-123B** for the purpose other than the external input/output signal.
E-06 (Mode display)	A problem was detected in the frequency detection circuit.	Turn off the power and on again. Check if the input power supply in use has disturbance in frequency.
cccc (Current, voltage, time display)	The current has stopped during the impulse measurement before it reaches the set stage.	Check the impulse setting. Also, check whether the welding power supply is working normally.

Fault code (Display name)	Cause	Measures
EEEE (Current, voltage, time display)	The measured welding current or torch voltage/weld time has exceeded the measurable range.	Check the current range and voltage range settings. Also, check whether the welding power supply is working normally. * For current and voltage, the peak value may exceed the measurable range even if the effective value is within it.

10. Specifications

(1) Measurement Specification

Target	Specification	
Current	Measurement range	0.100 to 2.000 kA 01.00 to 20.00 kA 010.0 to 200.0 kA
	Measurement time	<Current measurement mode> · AC (50 Hz, 60 Hz) Measurement accuracy ±0.0 cycle 000.5 to 150.0 CYC (50 Hz), 000.5 to 180.0 CYC (60 Hz) · AC--- (50 to 500 Hz) Measurement accuracy ±0.0 cycle 000.5 to 150.0 CYC (50 Hz), 000.5 to 187.5 CYC (62.5 Hz), 0000.5 to 1500.0 CYC (500 Hz) · ACSEC Measurement accuracy ±1 ms 0001 to 3000 ms · dcSEC 0001 to 2000 ms · dccyc 000.5 to 100.0 CYC (50 Hz), 000.5 to 120.0 CYC (60 Hz) · dcSSc (in 0.02-ms increment) 00.50 to 25.00 ms · CAP-S Measurement accuracy ±0.02 ms 0.50 to 9.99 ms, TP/TH selection* · CAP-L Measurement accuracy ±0.1 ms 5.0 to 99.9 ms, TP/TH selection * * TP: Time duration from the time the welding current starts flowing to the time at max. value TH: Time duration from the time the welding current starts flowing to the time the current decreases to half of the max. value

Target	Specification	
Current	Measurement item	Maximum value (peak value) within the current flow time or RMS in the interval from the start to end of the measurement RMS depending on the measurement mode CYC mode: Arithmetic mean RMS every half-cycle (original mode) RMS of all measurement range (ISO17657-compliant mode) ms mode: Arithmetic mean RMS every 1 ms (original mode) RMS of all measurement range (ISO17657-compliant mode) ms-SHORT mode: RMS in the interval from the start to end of the measurement
	Measurement accuracy	Accuracy depending on the RMS calculation mode ISO17657-compliant mode: ± 2% of full scale (excluding sensor error) Original mode: ± 2%rdg+10dgt (excluding sensor error) ± 2%rdg+4dgt (excluding sensor error)
	Detection method	Toroidal coil MB-800P, MB-400P (ISO17657-compliant) MB-45G Max. measurement range: 1 kA Do not use the measurement for over 1 kA because of failure cause the **MM-123B** and the **MB-45G**
Voltage	Measurement range	6.00 V range: 0.30 to 6.00 V 20.0 V range: 01.0 to 20.0 V
	Measurement item	Maximum value (peak value) within the current flow time or RMS in the interval from the start to end of the measurement RMS depending on the measurement mode CYC mode: Arithmetic mean RMS every half-cycle (original mode) RMS of all measurement range (ISO17657-compliant mode) ms mode: Arithmetic mean RMS every 1 ms (original mode) RMS of all measurement range (ISO17657-compliant mode) ms-SHORT mode: RMS in the interval from the start to end of the measurement
	Measurement accuracy	± 2% of full scale (excluding sensor error)

Target	Specification	
Conduction angle	Measurement range	0 to 180 degrees
	Measured values	Max. conduction angle over measurement interval
	Measurement accuracy	± 9 degrees
Measured value display	Peak current RMS current (ISO17657-compliant mode) Average RMS current (Original mode) Peak voltage RMS voltage (ISO17657-compliant mode) Average RMS voltage (Original mode) Conduction angle Weld time Weld time TP Weld time TH Flow time Weld count (Good count)	
Impulse measurement	Impulse number: 0 to 9 (31 schedules) Only the pulse of the set number set is measured. When the impulse number is set to 0, measurement is performed normally (measured each time the current flows.) (This doesn't function in the current measurement mode CAP-S or CAP-L.)	
Judgment function	Upper/lower limit judgment of current (31 schedules) (279 schedules (31 schedules x 9 steps) when the step counter function is ON) Upper/lower limit judgment of voltage (31 schedules) (279 schedules (31 schedules x 9 steps) when the step counter function is ON) Upper/lower limit judgment of weld time (31 schedules) No-current judgment	
Input signal	[SCH] signals (SCH1, SCH2, SCH4, SCH8, and SCH16) [NG RESET] signal [COUNT UP RST] signal [GATE] signal [NO CURR] signal (contact or 24 V AC/DC)	

Target	Specification
Output signal	[READY] signal (semiconductor relay) Contact capacity: 24 V DC, 20 mA
	[GOOD] signal (semiconductor relay) Contact capacity: 24 V DC, 20 mA
	[NG-H]/[NG-L] signal (semiconductor relay) Contact capacity: 24 V DC, 20mA
	[NG+24V] output Output capacity: 24 V DC, 100 mA max.
	[COUNT UP] signal (semiconductor relay) Contact capacity: 24 V DC, 20 mA
	[NO CURR] signal (semiconductor relay) Contact capacity: 24 V DC, 20 mA
Counter	The function can be selected from preset counter and the step counter. Preset counter Good counter: 00000 to 99999 (When 00000 is set, the counter function is disabled. The counter proceeds by 1 when all measurement results are within the upper/lower limit.) Step counter Step number: 1 to 9 Weld count: 0 to 9999 (This doesn't function in the current measurement mode dcSSc, CAP-S or CAP-L.)

(2) Specification of the MM-123B

Item		Specification
Display contents		Current, voltage, time
External data output		Ethernet (TCP/IP)
Number of schedules		31 schedules
Rated input voltage		90–250 V AC (50/60 Hz) or 24 V DC ±10%
Power consumption		12 W max.
Operating environment*1	Operating ambient temperature	0–45°C
	Operating ambient humidity	90% max. (no condensation)
	Temperature during transport or storage	-10–55°C
	Humidity during transport or storage	90% max. (no condensation)
	Altitude	1000 m max.
Outline dimensions		187 mm (H) x 70 mm (W) x 248 mm (D) (excluding protrusions)
Mass		Approx. 2 kg (excluding options)
Overvoltage category		II
Case protection		IP20

*1: 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.

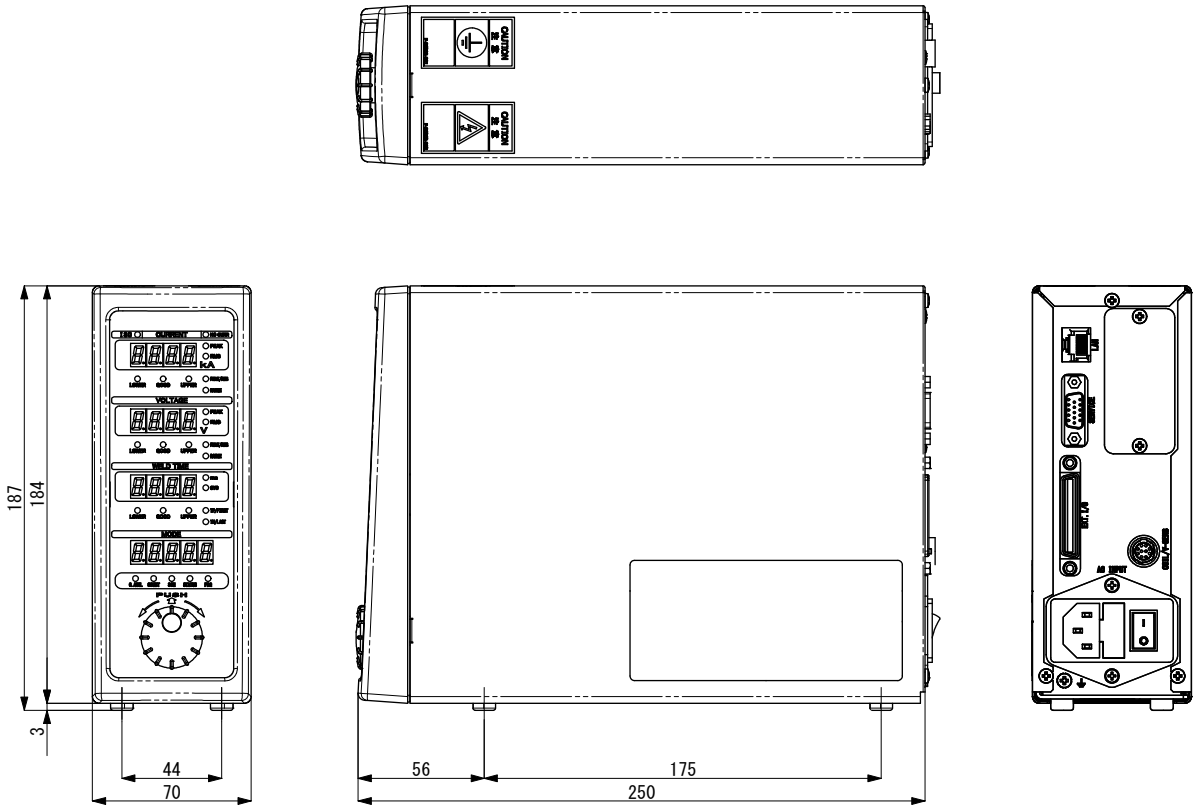
11. Calibration

Regular calibration is required to maintain the **MM-123B** performance.
Calibration is conducted at our facility.
For calibration, please send your toroidal coil together with the **MM-123B**. Depending on the operating environment, the extent of deterioration varies from one **MM-123B** to another. Therefore, the **MM-123B** must be calibrated together with the toroidal coil as a set.
For more information about calibration, contact us.

12. Outline Drawing

(1) Body

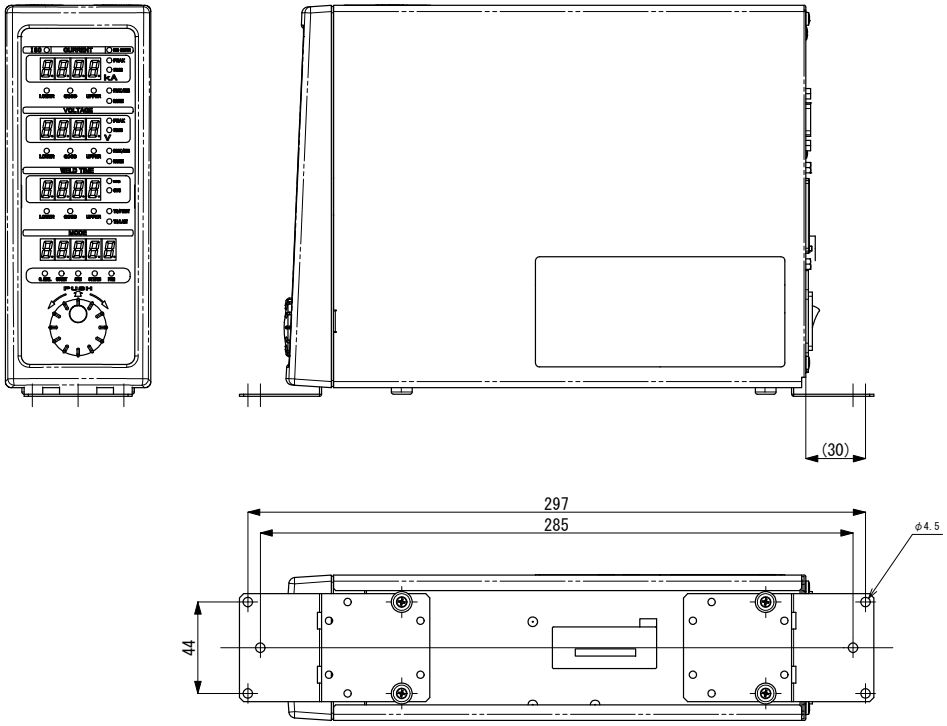
(Dimensions in mm)



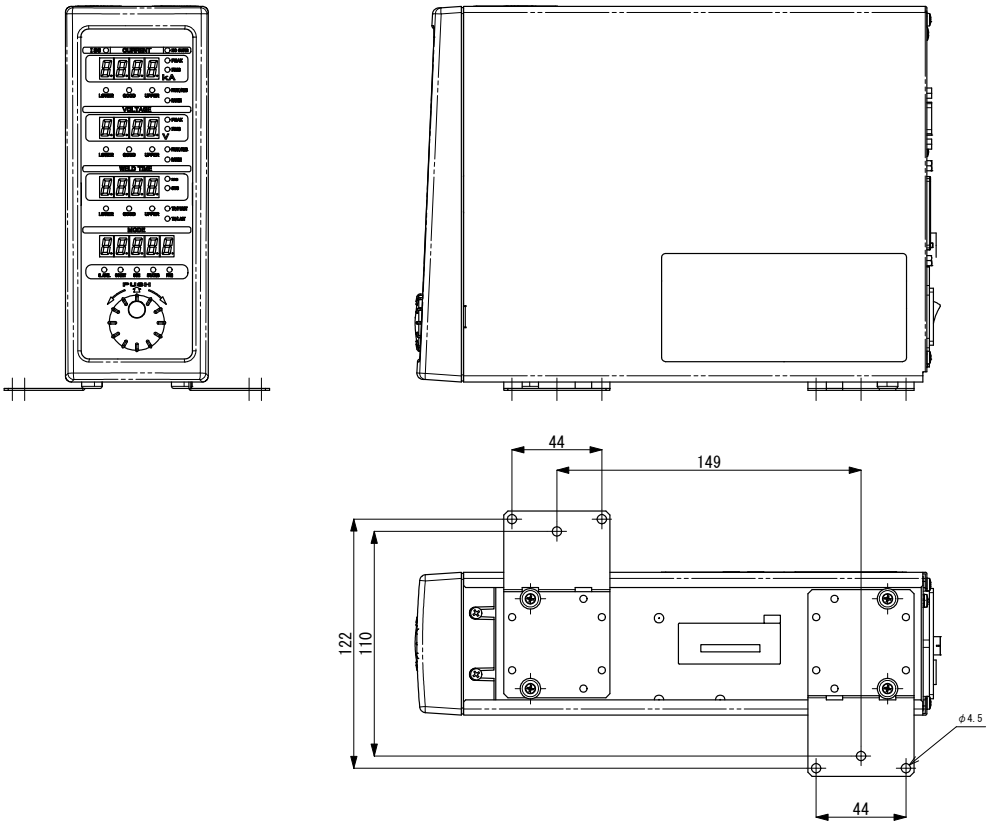
(2) Drawings for Mounting Bracket

(Dimensions in mm)

a. Front and Rear Mounting



b. Right and Left Mounting



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