Original instructions

PULSETIG WELD CHECKER

MM-140A EU

OPERATION MANUAL

AMADA

AA04OM1202878-08

Thank you for your purchase of our PULSETIG Weld Checker **MM-140A**.
Please read this manual carefully to ensure correct use. Keep the manual handy after reading for future reference.

Contents

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
  - 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.

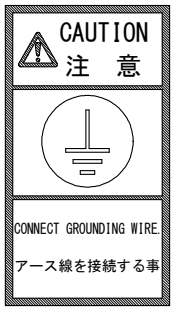
- Operate the switches and buttons with care. Rough operation or the use of a tool or pen tip may result in damage or malfunction.

(3) On Disposal

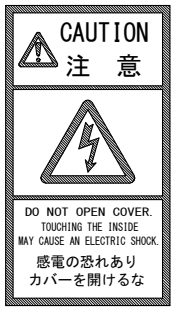
This product incorporates parts containing gallium arsenide (GaAs). At the time of disposal, separate it from general industrial waste or domestic waste and carry out the disposal in accordance with applicable laws and regulations.

(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 PULSETIG Weld Checker **MM-140A** is a measuring instrument for monitoring the TIG welding.
The **MM-140A** can measure and display the welding current, torch voltage*1, weld time, and shield gas flow rate of our pulsed TIG welding power supply **MAWA** series. The **MM-140A** enables quality control in pulsed TIG welding.
The **MM-140A** has the following features.

- **Compact body**

  The outline is 187 x 70 x 250 (mm) and the weight is 2.3 kg. The **MM-140A** can be installed anywhere and can be carried easily.

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

  A long-time pulsed TIG welding can be measured with 9999 ms of the maximum measurement time.

- **Supports torch voltage*1 measurement**

  The welding current and the torch voltage can be measured simultaneously.

- **Supports shield gas flow rate measurement**

  The shield gas flow rate can be measured with the shield gas flow sensor.

- **Measuring modulation frequency**

  You can check if the **MM-140A** operates with the modulation frequency set in the welding power supply.

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

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

- **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-140A** can be used with 100–240 V AC power supply. Also, the **MM-140A** 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.

*1: The torch voltage is available only to the touch-start model.

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*1 (50 pins, male)	DX30A-50P(50)	1
Ferrite core		NFT-12	1
Operation manual		AS1202880	1

*1: 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

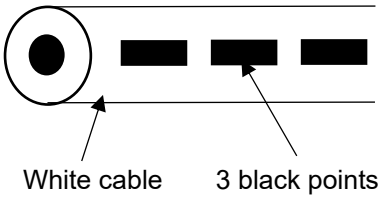
Item	Model No.
Current sensor (3 m)	RS-C300-3000, current sensor for TIG (300 A)
	RS-C050-3000, current sensor for TIG (50 A)
Relay cable (200 mm)	SK-1202967
Power cable*1 (3 m)	KP-35 KS-16A SVT#18x3 B-TYPE (3-pin plug, for 100-120 V AC)
	KP244 VCTF3*1.25 KS16D 3M gray (Japan, for 200 V AC)
	CEE3P-W-1.8 (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)
Torch voltage detection cable (3 m)	SK-1202980
Shield gas flow sensor cable (3 m)	SK-1202981
LAN cable (3 m)	KB-FL6A-03BL
Bracket (for fixing on table. 2 pieces required.)	Z-02414-001

Item	Model No.
I/O connection cable with connector*2	SK-1210081 (5 m)
	SK-1210082 (10 m)
	SK-1210083 (20 m)

*1: Exclusively for the **MM-140A**. Do not use for other devices.

*2: 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)
EXTERNAL_IN	8	Yellow (■■■■Black)
(Not used)	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)
EXTERNAL SIG	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)
RANGE OVER	41	White (■■■■■■■■■■Black)
RANGE OVER	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

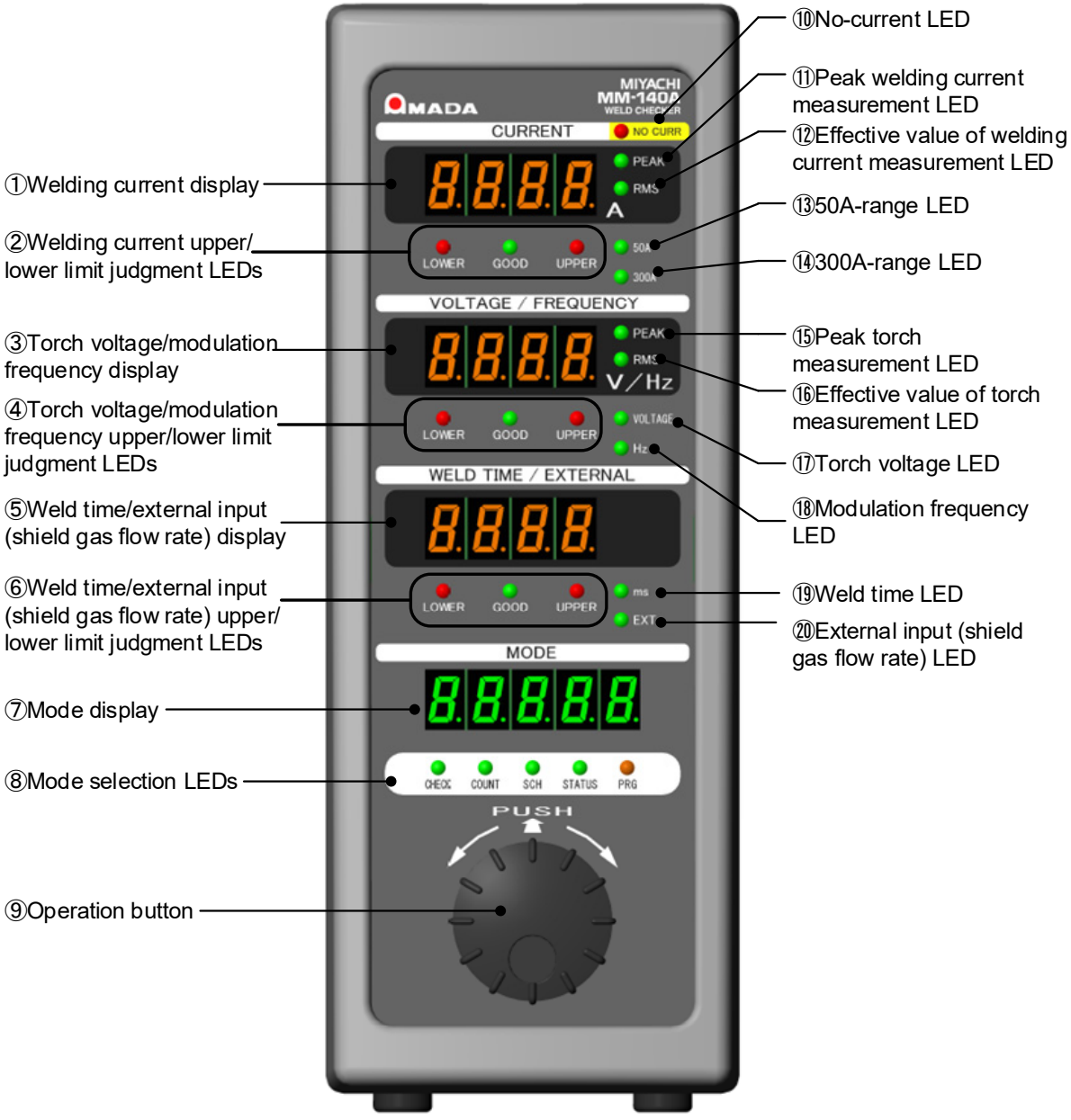
(3) Recommended Parts

Item	Model No.
Shield gas flow sensor*1	PF2M7 series, analog output 4 mA to 20 mA product (example of SMC, PF2M710-C6-D-M)
Ferrite core	E04SRM381913 (manufactured by SEIWA)

*1: Ar is recommended for the shield gas flow sensor. For detail specifications, contact the manufacturer.

4. Name and Functions of Each Section

(1) Front



① Welding 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.

② Welding 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.

③ Torch voltage/modulation frequency display
According to the setting, the torch voltage or modulation frequency is displayed.
When the torch voltage is selected, this displays the measurement results of the torch voltage and the set value for the torch voltage upper/lower limit judgment.
When the modulation frequency is selected, this displays the measurement results of the modulation frequency and the set value for the modulation frequency upper/lower limit judgment.

④ Torch voltage/modulation frequency upper/lower limit judgment LEDs
Indicate the result of the selected torch voltage/modulation frequency upper/lower limit judgment. There are three LEDs, UPPER, GOOD and LOWER.

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

⑤ Weld time/external input (shield gas flow rate) display
According to the setting, the weld time or external input (shield gas flow rate) is displayed.
When the weld time is selected, this 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 ms.
When the external input (shield gas flow rate) is selected, this displays the measurement results of the external input (shield gas flow rate) and the set value for the external input (shield gas flow rate) upper/lower limit judgment.

⑥ Weld time/external input (shield gas flow rate) upper/lower limit judgment LEDs
Indicates the result of the selected weld time or external input (shield gas flow rate) upper/lower limit judgment. There are three LEDs, UPPER, GOOD and LOWER.

UPPER (red) lights up	When the measured weld time is higher than upper limit. (When the measured external input (shield gas flow rate) is higher than upper limit.)

GOOD (green) lights up	When the measured weld time is the upper limit or lower and the lower limit or higher. (When the measured external input (shield gas flow rate) is the upper limit or lower and the lower limit or higher.)
LOWER (red) lights up	When the measured weld time is lower than lower limit. (When the measured external input (shield gas flow rate) is lower than lower limit.)

⑦ Mode display
Displays the setting items, such as check, schedule number and status.

⑧ 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-140A]**.

⑨ 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.

⑩ 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 and 25 in **[5. (2) Description of the External I/O Signals]**.

⑪ Peak welding 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.

⑫ Effective value of welding current measurement LED
Lights up when the effective value of current measurement is selected. When this LED is on, the current is displayed as the effective value.

⑬ 50A-range LED
Lights up when the 50A-range is set.

⑭ 300A-range LED
Lights up when the 300A-range is set.

⑮ Peak torch voltage measurement LED
Lights up when the peak torch voltage measurement is selected. When this LED is on, the torch is displayed as the peak value.

⑯ Effective value of torch measurement LED
Lights up when the effective value of torch voltage measurement is selected. When this LED is on, the torch is displayed as the effective value.

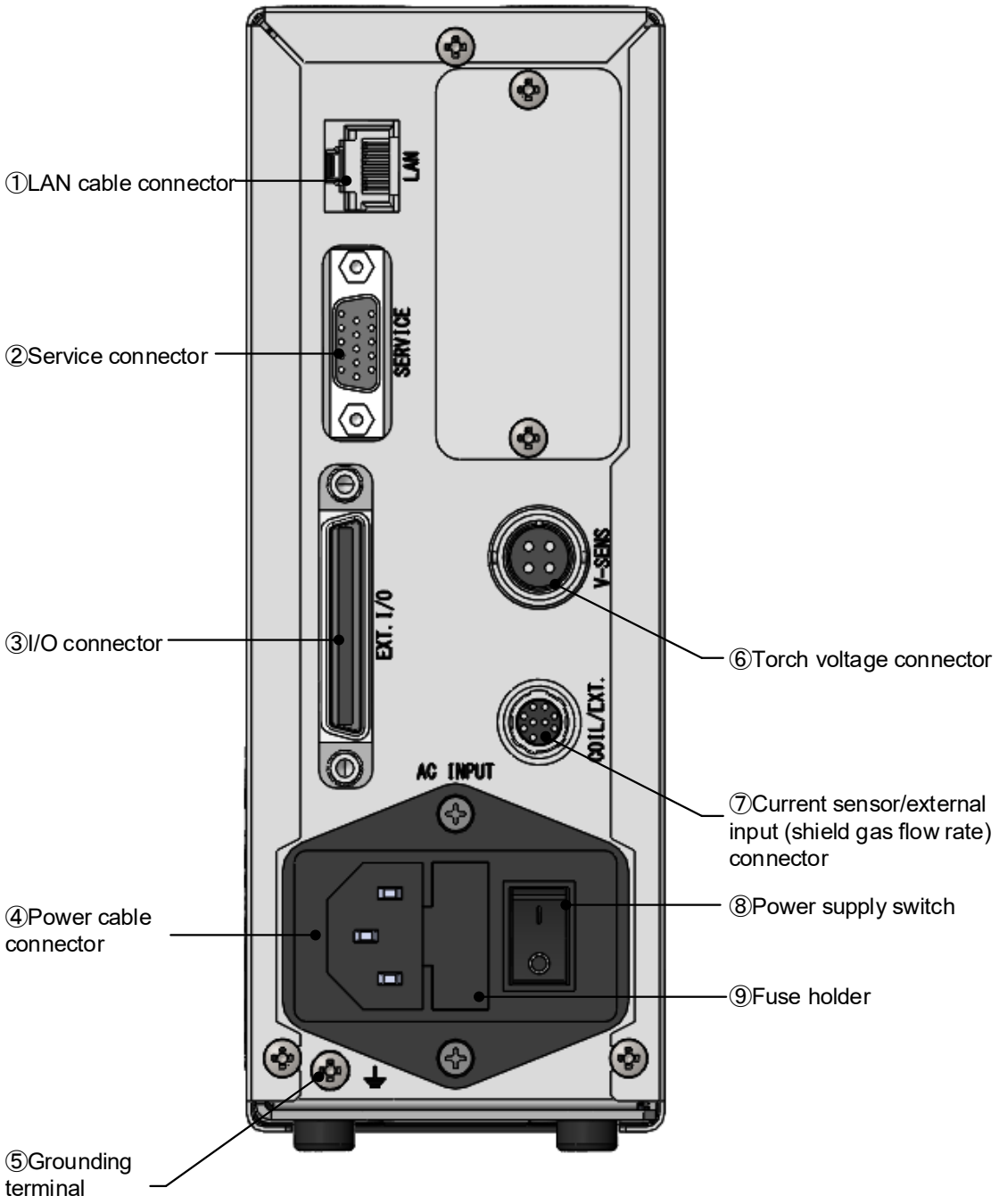
⑰ Torch voltage LED
Lights up when the torch voltage is selected.

⑱ Modulation frequency LED
Lights up when the modulation frequency is selected.

⑲ Weld time LED
Lights up when the weld time is selected.

⑳ External input (shield gas flow rate) LED
Lights up when the external input (shield gas flow rate) is selected.

(2) Rear


①LAN cable connector
②Service connector
③I/O connector
④Power cable connector
⑤Grounding terminal
⑥Torch voltage connector
⑦Current sensor/external input (shield gas flow rate) connector
⑧Power supply switch
⑨Fuse holder
LAN
SERVICE
EXT. I/O
V-SENS
COIL/EXT.
AC INPUT

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

② Service connector
Do not connect anything.

③ 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
Be sure to ground the **MM-140A** before use.

⑥ Torch voltage connector
Connects to the torch voltage detection cable (option).

⑦ Current sensor/external input (shield gas flow rate) connector
Connects to the current sensor for detecting the welding current. Can be connected simultaneously with the shield gas flow sensor by connecting the relay cable (option).

⑧ Power supply switch
Turns on/off the power supply when the single-phase AC power supply (100–240 V) is used.

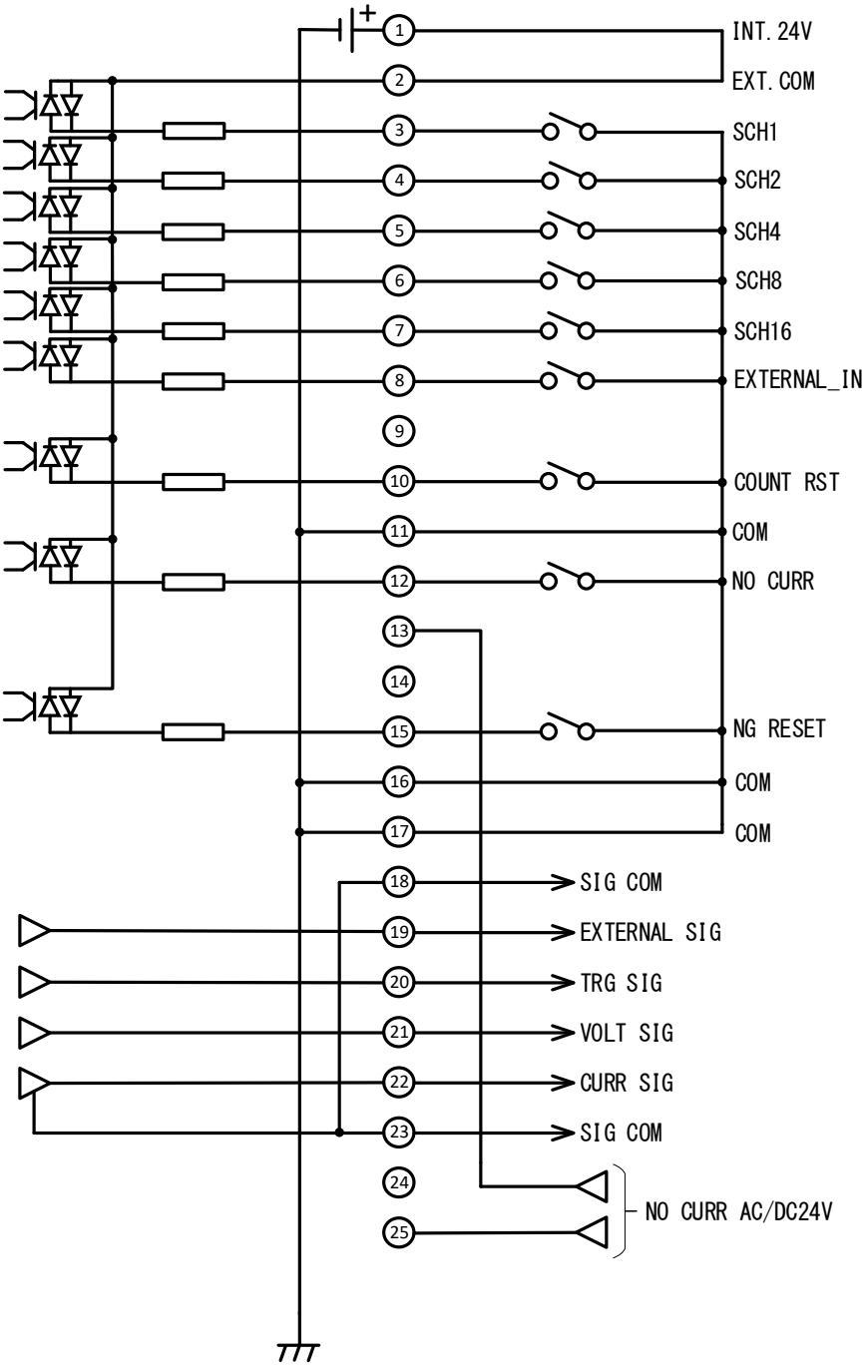
⑨ Fuse holder
Has a fuse inside.

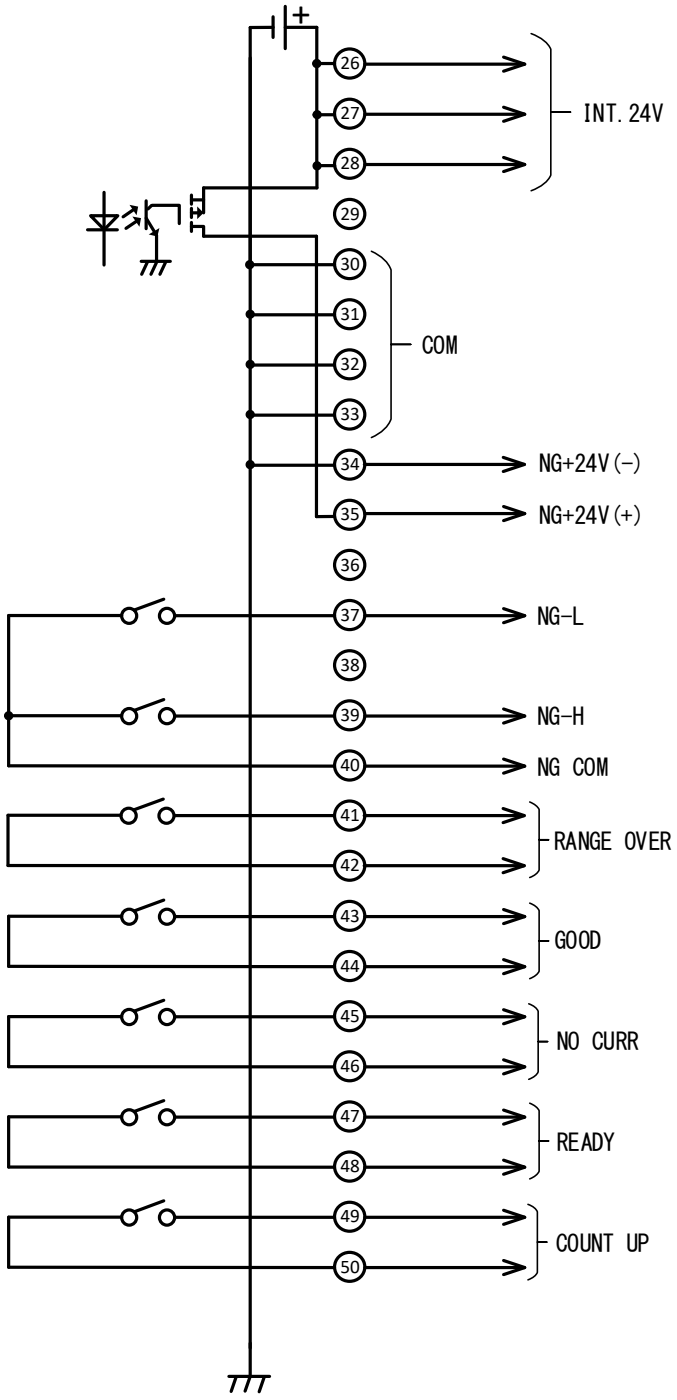
Fuse rating	250 V, 2 A, φ5 x 20 mm (Time delay, High interrupting capacity)

5. Interface

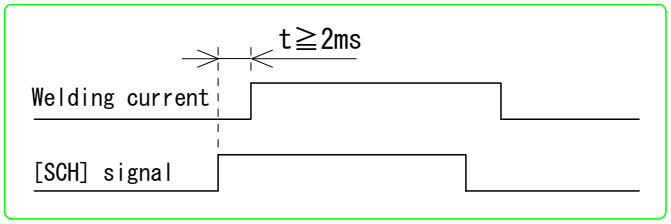
(1) Connection Diagram of the External I/O Signals

Description of each pin on the 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
RANGE OVER
43
44
GOOD
45
46
NO CURR
47
48
READY
49
50
COUNT UP

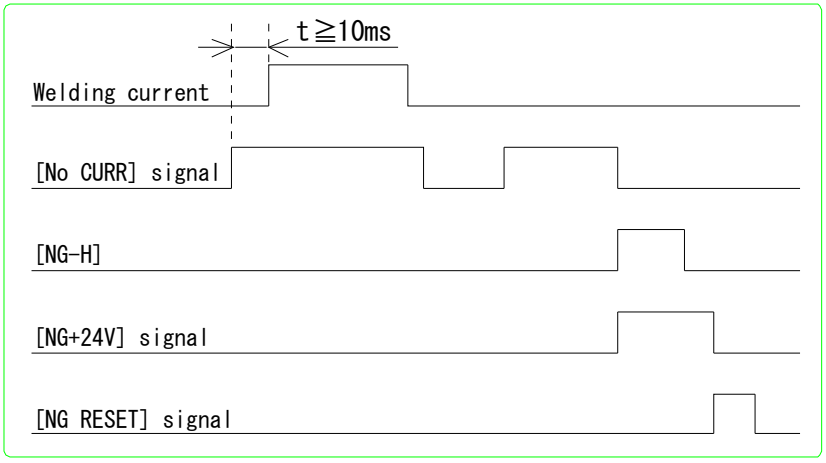
(2) Description of the External I/O Signals

Pin No.	Name	Function
1 26 27 28	INT.24V	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. Contact capacity is 24 V DC, 100 mA. For details, see **[5. (3) Connection of Input Signals]**.
2	EXT.COM	
3 4 5 6 7	3: SCH1 4: SCH2 5: SCH4 6: SCH8 7: SCH16	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 2 ms before the welding current flows. The schedule number cannot be changed during measurement. When a chattering occurs in a switch, input the Schedule select [SCH] signal at least “chattering time + 2 ms” beforehand. 

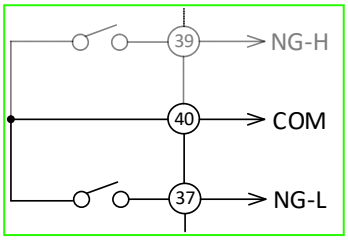
Pin No. / SCH No.	7	6	5	4	3
1					●
2				●	
3				●	●
4			●		
5			●		●
6			●	●	
7			●	●	●
8		●			
9		●			●
10		●		●	
11		●		●	●
12		●	●		
13		●	●		●
14		●	●	●	
15		●	●	●	●
16	●				

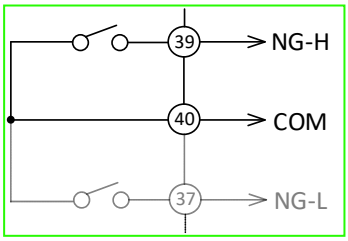
Pin No. / SCH No.	7	6	5	4	3
17	●				●
18	●			●	
19	●			●	●
20	●		●		
21	●		●		●
22	●		●	●	
23	●		●	●	●
24	●	●			
25	●	●			●
26	●	●		●	
27	●	●		●	●
28	●	●	●		
29	●	●	●		●
30	●	●	●	●	
31	●	●	●	●	●

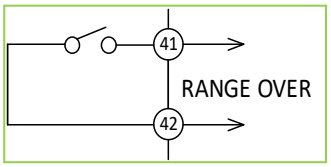
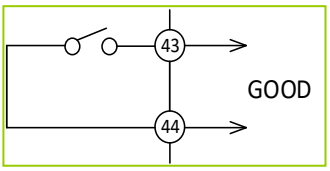
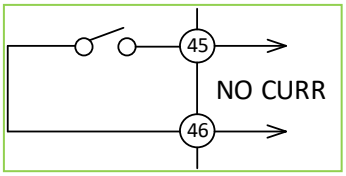
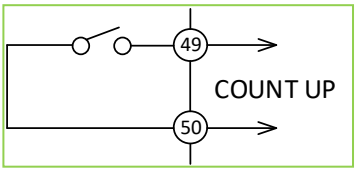
* When all pins are opened, the schedule number set by the main unit is selected.

Pin No.	Name	Function
8	EXTERNAL_ IN	The trigger input terminal of external I/O for start measurement of the external input (shield gas flow rate). The shield gas flow rate is measured by using the opening/closing signal of the solenoid valve as a trigger.
9,14 24,29 36,38	-	Not used.
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. (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.
12	NO CURR	Input pin for the no-current detecting [NO CURR] signal. Used when inputting the contact signal of the no-current to input the no-current. 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, the no-current LED lights up when the circuit is opened. Keep a chattering in a switch below 1 ms. When a chattering time is long, the time will be judged as no-current. 
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, the no-current LED lights up when the input of the voltage stops.

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) e. System Setting (8) Judgment signal 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 "chattering time + 2 ms."
18 23	SIG COM	Common terminal for analog signals.
19	EXTERNAL SIG*1	Analog output signal terminal for the external input (shield gas flow rate). Approx. 1 V is output with 4 mA input and approx. 5 V is output with 20 mA input. (When our recommended shield gas flow sensor is used, approx. 2 V is externally output with the flow rate 2.5 ℓ.)
20	TRG SIG	Analog output signal terminal for the trigger state. Approx. 3.3 V is output while the **MM-140A** is operating for measurement.
21	VOLT SIG*1	Analog output signal terminal for the voltage between torches. Approx. 4.6 V is externally output with 120 V input.
22	CURR SIG*1	Output pin for the current waveform [CURR SIG] signal. Analog output signal terminal for the welding current. This is for viewing the current waveform with oscilloscope. Output power is ・approx. 4.8 V output with 60 A input in 50 A range, and ・approx. 4.8 V output with 350 A input in 300 A range.
34	NG+24V(-)	Output pins for the [NG+24V] signal. Pin 35 is plus (+) terminal. Output capacity is 100 mA max. 24 V DC is output ・when the measurement item is outside the upper/lower limit. For details, see **[7. (4) Upper/Lower Limit Judgment Function]**. ・when a trouble occurs. For details, see **[9. Fault Code List]**. 24 V DC relay and LED can be turned on directly by the output power from this pin. 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.
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) e. 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) e. System Setting (8) Judgment signal 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) e. System Setting (8) Judgment signal output time]**.) Contact capacity of semi-conductor relay: 24 V DC, 20 mA

Pin No.	Name	Function
39	NG-H	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) e. 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) e. System Setting (8) Judgment signal output time]**.) ・When the measurement result is higher than the upper limit or lower than the lower limit. ・When judged as no-current. ・When an error code EEEE is displayed. Also, Pins 39 and 40 are opened until they are reset when a trouble (Memory trouble or 24 V DC overcurrent) occurs. 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) e. System Setting (8) Judgment signal output time]**.) ・When the measurement result is higher than the upper limit. ・When judged as no-current. ・When an error code EEEE is displayed. Also, Pins 39 and 40 are opened until they are reset when a trouble (Memory trouble or 24 V DC overcurrent) occurs. c HL1 and HLno Close for the fixed time at the following situation. (For the closed time, see **[7. (5) e. System Setting (8) Judgment signal output time]**.) ・When the measurement result is higher than the upper limit or lower than the lower limit. ・When judged as no-current. ・When an error code EEEE is displayed. Also, Pins 39 and 40 are closed until they are reset when a trouble (Memory trouble or 24 V DC overcurrent) occurs. d HL2 and HLno Close for the fixed time at the following situation. (For the closed time, see **[7. (5) e. System Setting (8) Judgment signal output time]**.) ・When the measurement result is higher than the upper limit. ・When judged as no-current. ・When an error code EEEE is displayed. Also, Pins 39 and 40 are closed until they are reset when a trouble (Memory trouble or 24 V DC overcurrent) occurs. Contact capacity of semi-conductor relay: 24V DC, 20 mA

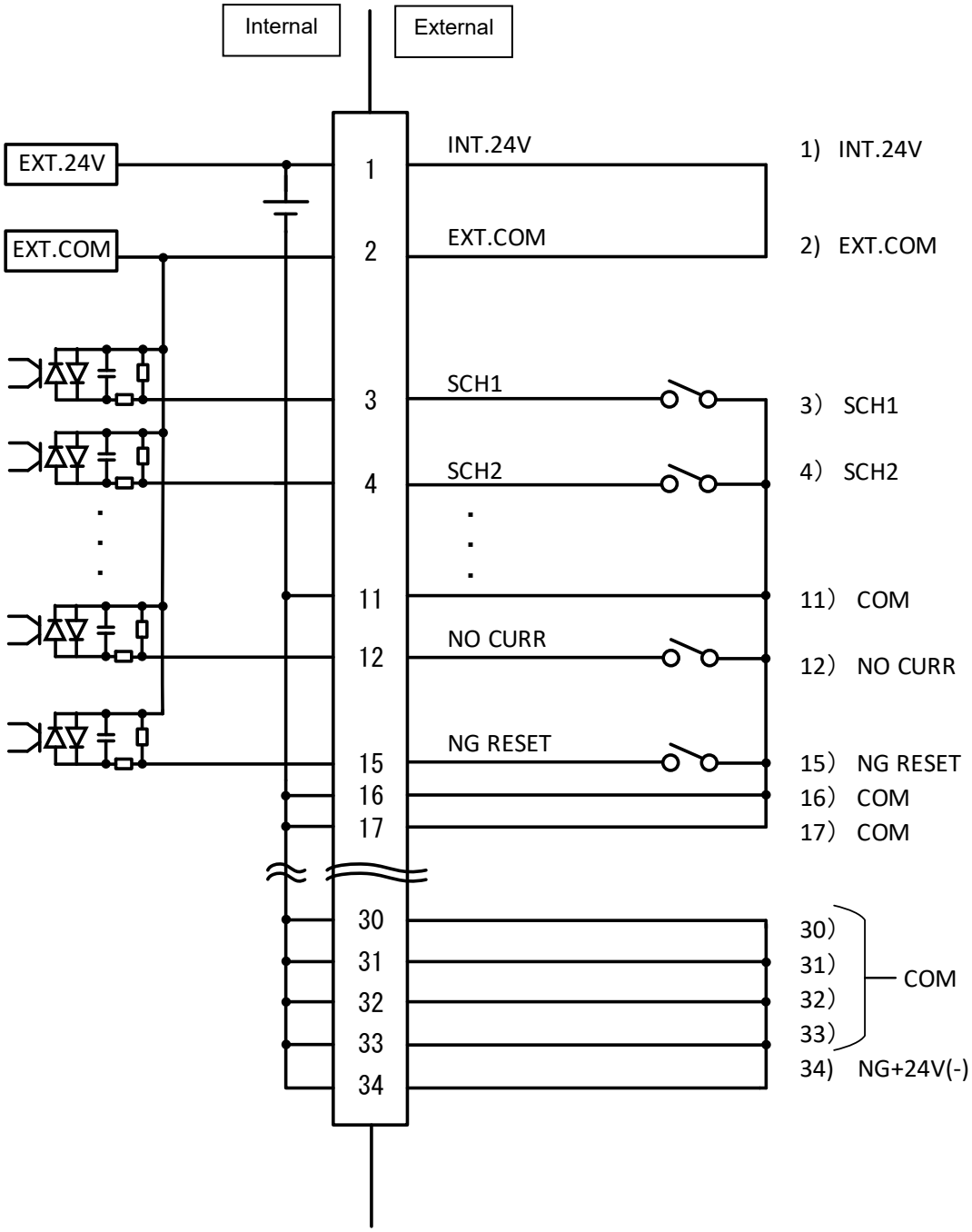
Pin No.	Name	Function
40	NG COM	Common terminal for NG-L and NG-H output signals.
41 42	RANGE OVER	Output pins for the [RANGE OVER] signal.  Close for the fixed time when the measured value is out of the measurable range of each range. (For the closed time, see **[7. (5) e. System Setting (8) Judgment signal output time]**.) Range: ・Current range (50A range): larger than 60.00 A ・Current range (300A range): larger than 350.0 A ・Voltage range: larger than 120.0 V ・Weld time: longer than 9999 ms ・External input (shield gas flow rate): larger than 20 mA Contact capacity of semiconductor relay: 24 V DC, 20 mA
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) e. System Setting (8) Judgment signal 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) e. System Setting (8) Judgment signal output time]**.) Contact capacity of semiconductor relay: 24 V DC, 20 mA
47 48	READY	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, these close when the good count reaches the preset value. For the preset counter, see **[7. (5) a. Setting the Preset Counter (COUNT)]**. When the good count 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

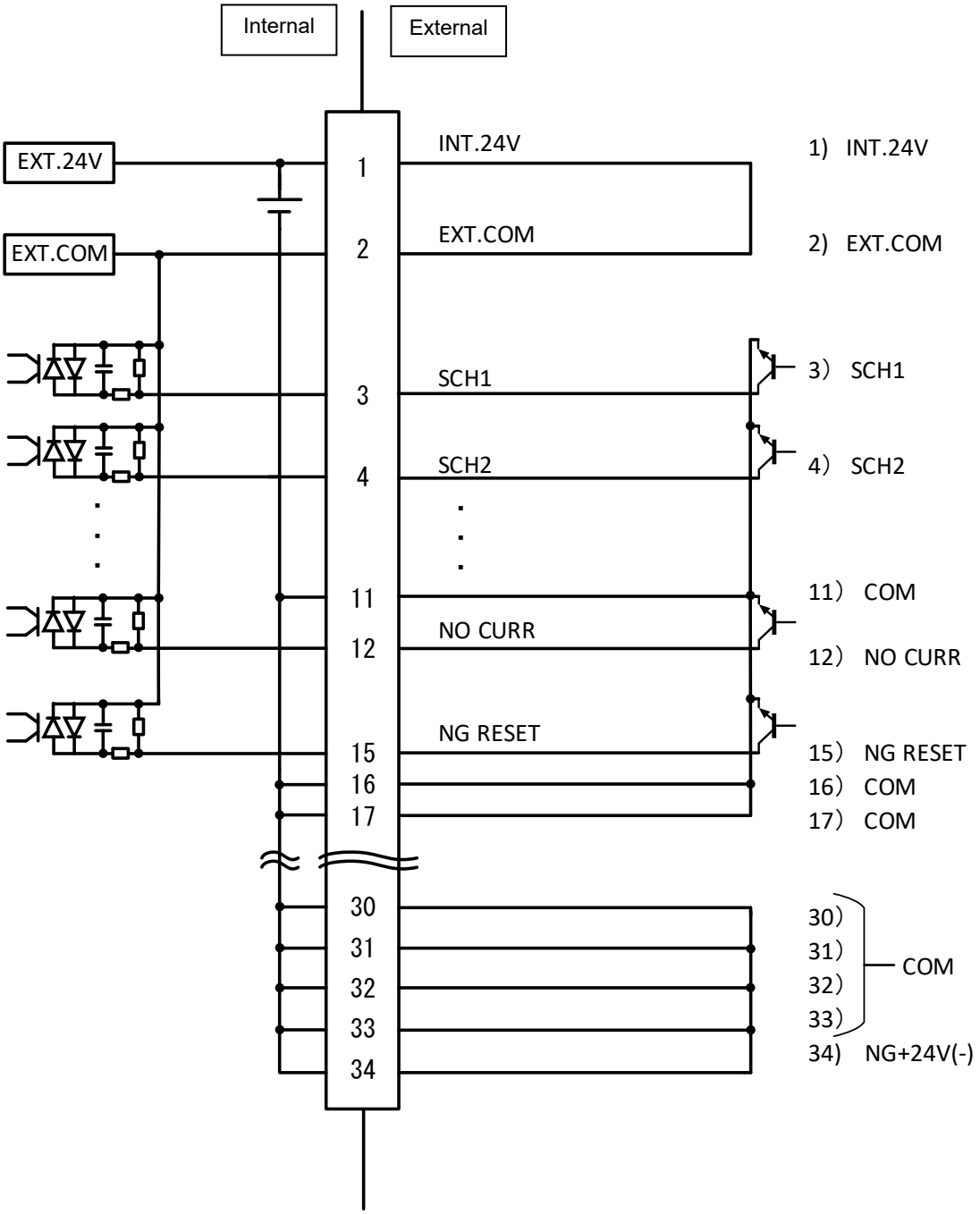
a. Connection with Device Having a Contact Input (when Using Internal Power Supply)

Connect pins 1 and 2.



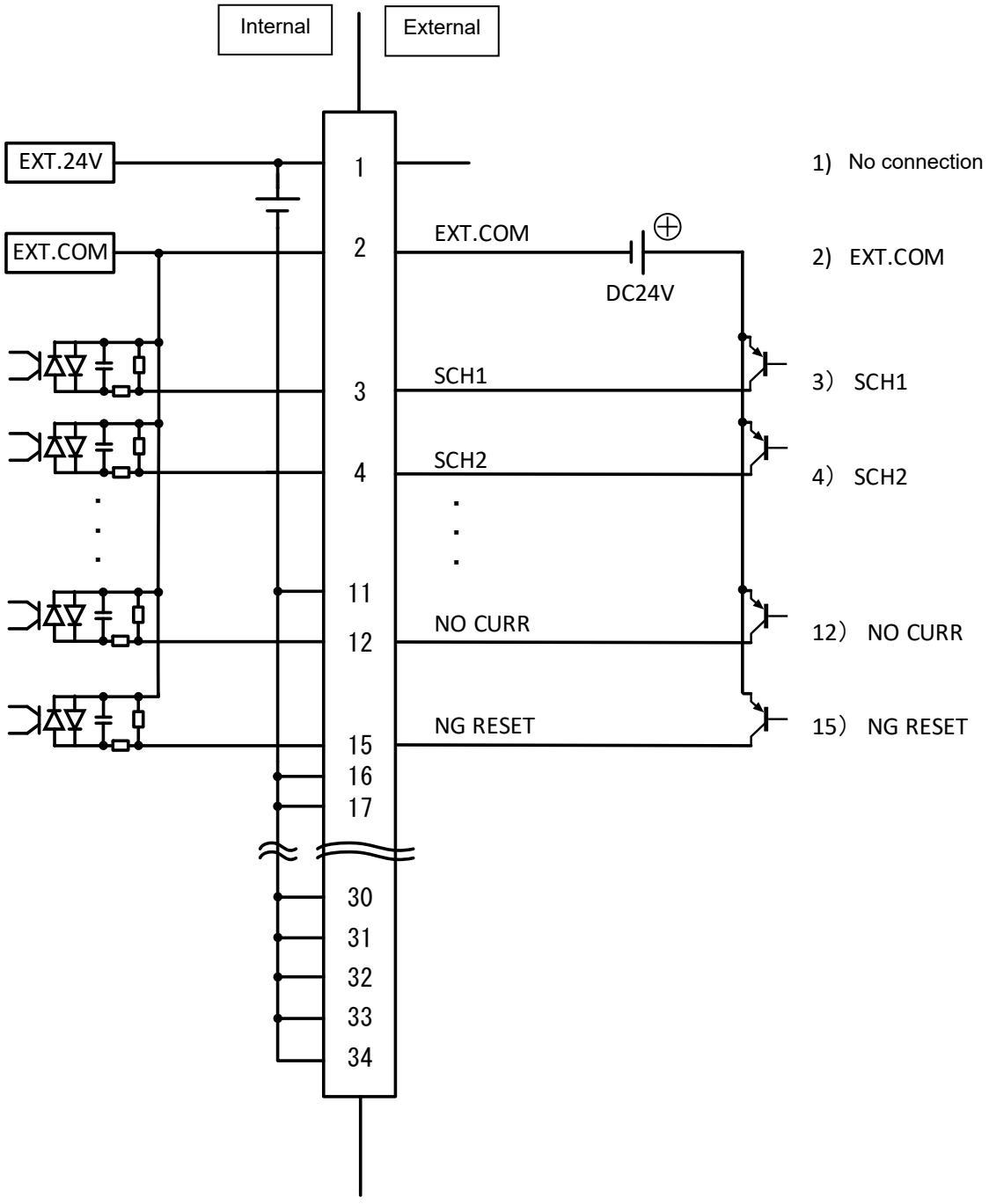
b. Connection with Device Featuring NPN Open Collector Output (when Using Internal Power Supply)

Connect pins 1 and 2.



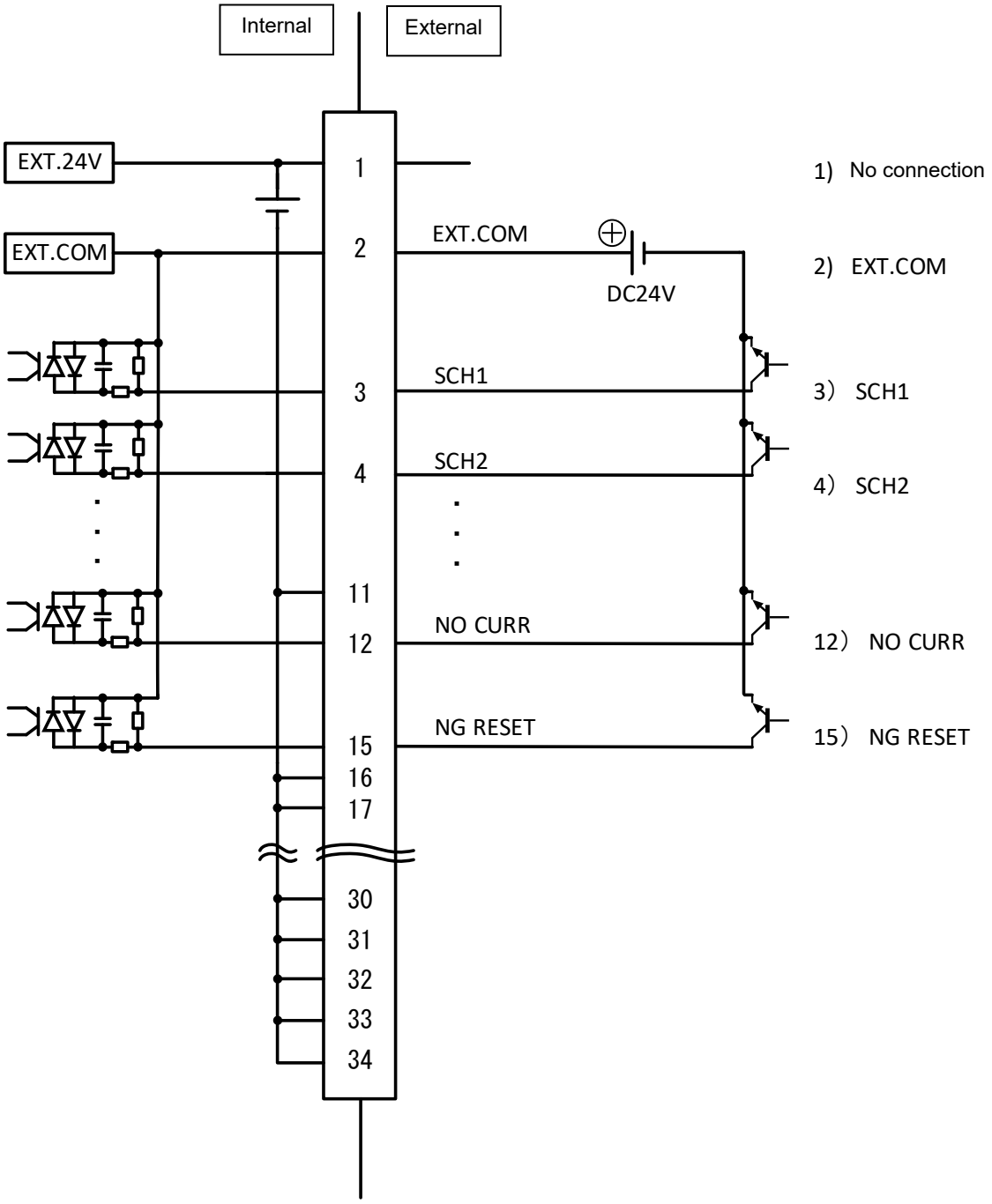
c. Connection with Device Featuring PNP Current Output (when Using External Power Supply)

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-140A

1) Place the **MM-140A** 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-140A**.

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.

(2) Preparations for Measurement – Connection between the MM-140A and Sensors

a. Connecting the Current Sensor (Option)

Purchase a current sensor suitable for use.

RS-C300-3000	Current sensor for 300 A
RS-C050-3000	Current sensor for 50 A

(Note) Be sure to turn on the power after connecting the current sensor, otherwise it affects the measurement function.

An arrow is printed at the upper part of the CT current sensor case.

Connect it taking care of the direction.

Current sensor (RS-C300-3000)

b. Connecting the Torch Voltage Detection Cable (Option)

Exclusively for the **MM-140A**. Since “White line is +” and “black line is -”, the voltage cannot be measured when connected in an opposite way. Take care of it.

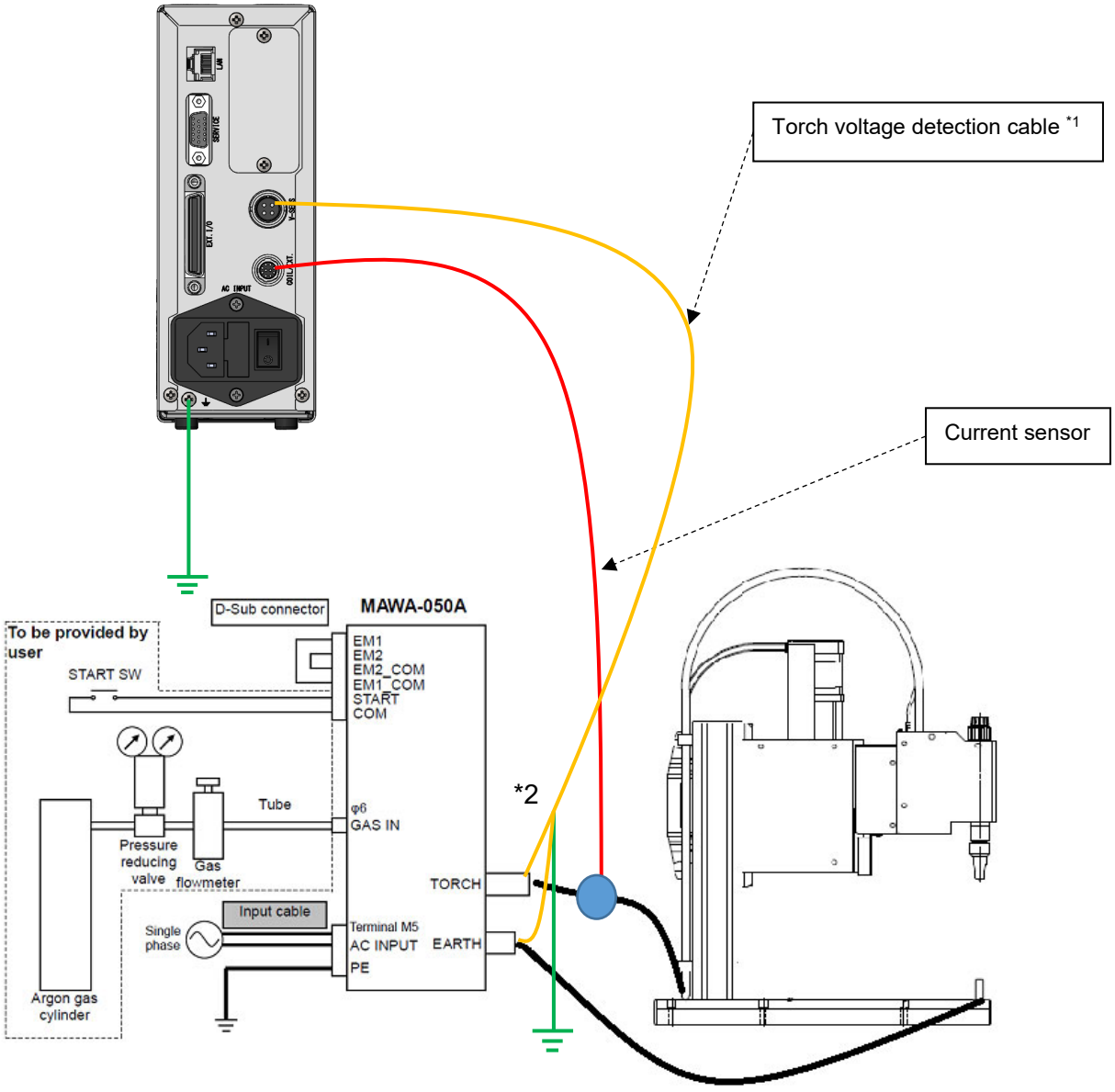
SK-1202980	Torch voltage detection cable

c. Connecting the Shield Gas Flow Sensor Cable (Option)

To connect the shield gas flow sensor, a relay cable (option) is required.

SK-1202981	Shield gas flow sensor cable
SK-1202967	Relay cable

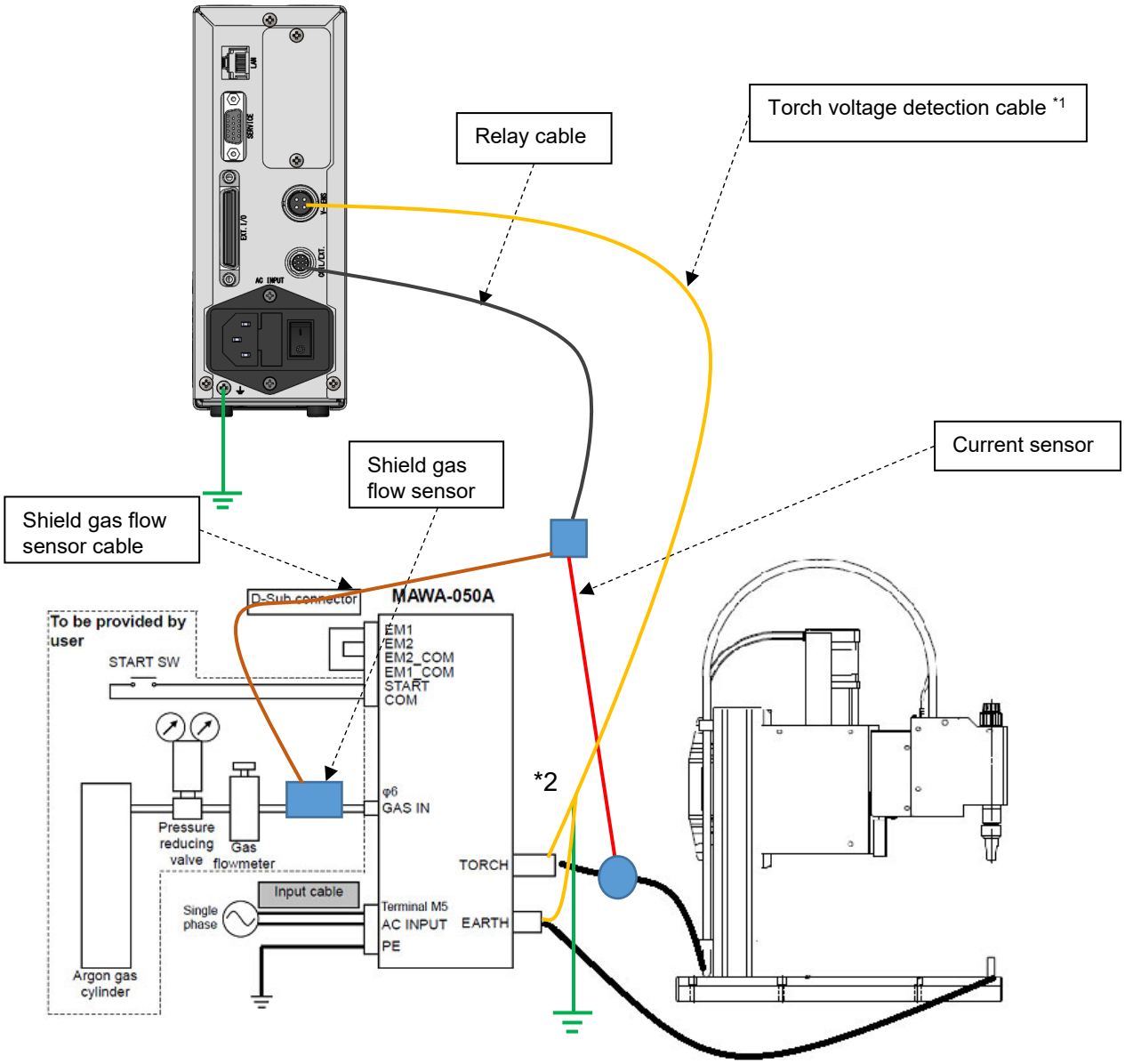
Example connection 1) When not connecting the shield gas flow sensor input



*1: The torch voltage can be measured only by the touch-start model.

*2: Connect the shield of the torch voltage detection cable to the same FG as the **MM-140A** (checker main unit).

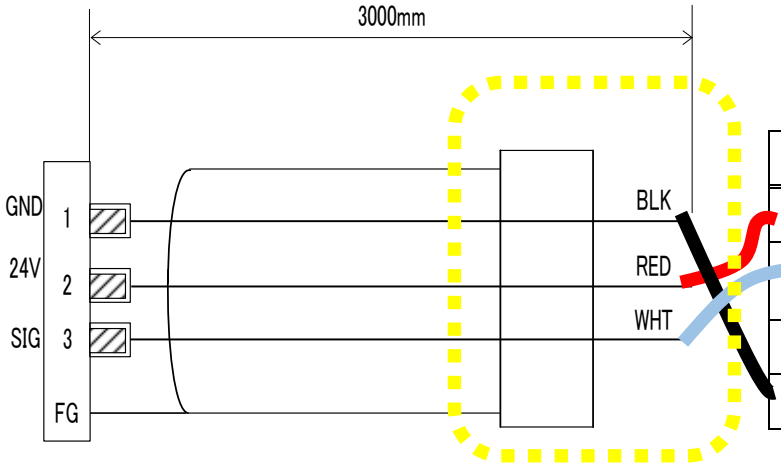
Example connection 2) When connecting the shield gas flow sensor input



*1: The torch voltage can be measured only by the touch-start model.

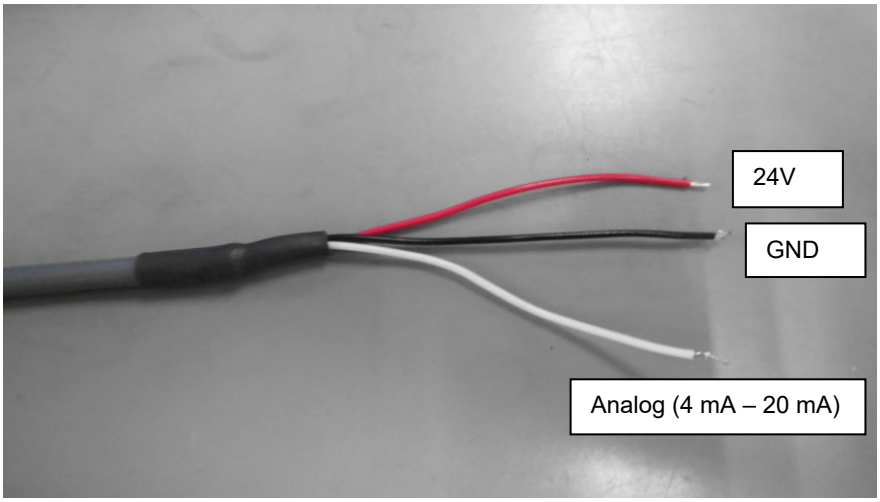
*2: Connect the shield of the torch voltage detection cable to the same FG as the **MM-140A** (checker main unit).

Example connection between the shield gas flow sensor cable (SK-1202981) and the shield gas flow sensor (PFM7)



PF2M7 (input connector)

Pin No.	Color	Contents
1	BRN	DC(+)
2	WHT	OUT2/ analog output
3	BLK	OUT1
4	BLU	DC(-)



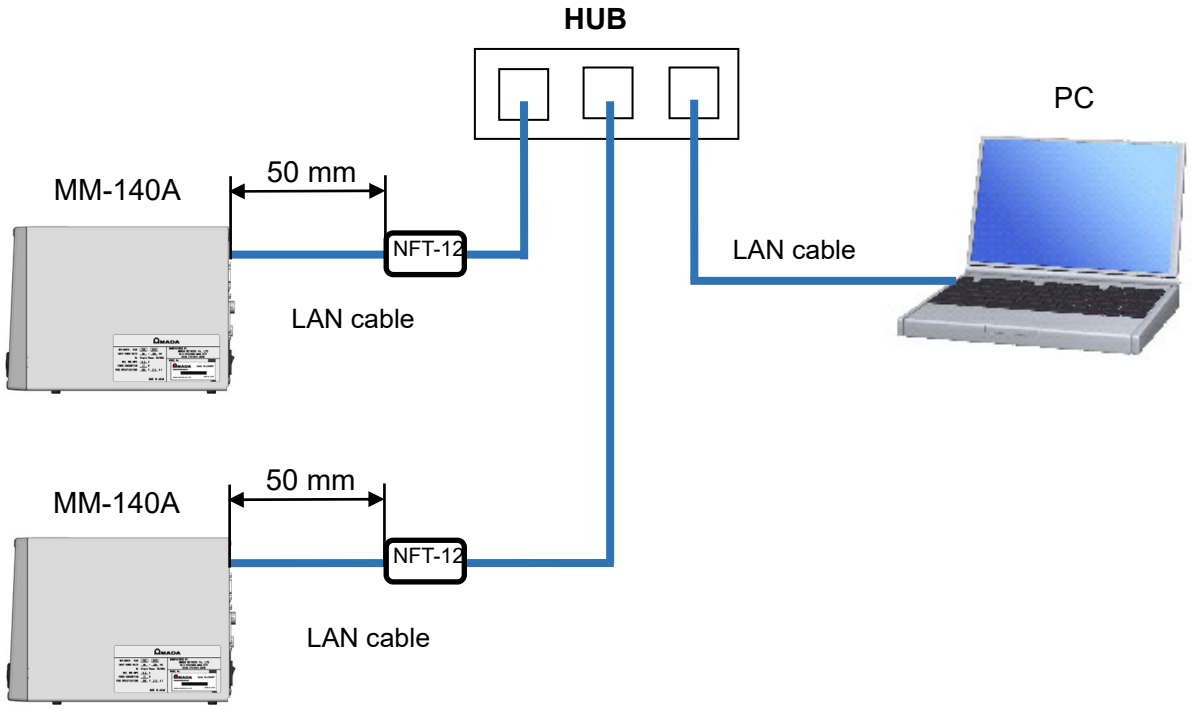
(3) Connecting the Communication Connector

The **MM-140A** employs the Ethernet communication.
Connect the **MM-140A** and PC/server with a LAN cable (option).
For details of communication, see **[8. Data Communication]**.

Example connection 1)

To connect the plural **MM-140A**s and a PC, prepare a LAN cable (option).

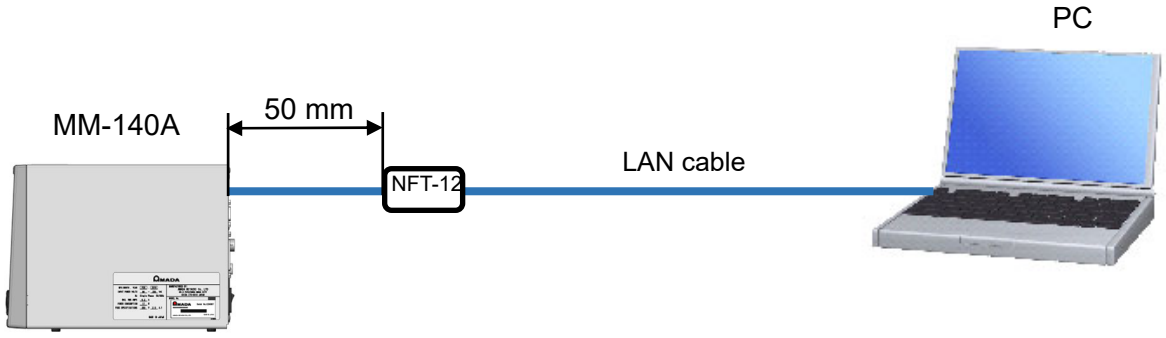
* Install the attached ferrite core (NFT-12) as shown below. If the communication is interrupted under a high noise environment, install the recommended E04SRM381913 (manufactured by SEIWA) by passing the cable through it four times.



Example connection 2)

To connect the **MM-140A** and PC one-on-one, prepare a LAN cable (option).

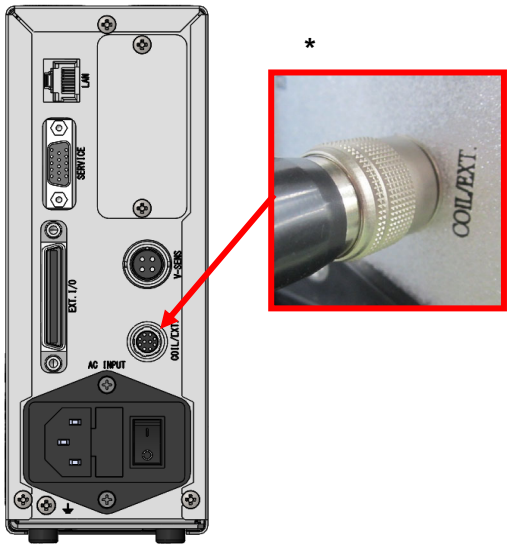
* Install the attached ferrite core (NFT-12) as shown below. If the communication is interrupted under a high noise environment, install the recommended E04SRM381913 (manufactured by SEIWA) by passing the cable through it four times.



7. Basic Operation

(1) Startup

1) Connect the current sensor (option).



2) Set the power supply switch on the rear panel to the ON position (– side).
* Be sure to turn on the power after connecting a current sensor, otherwise it affects the measurement function.

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

(2) Basic Usage of the MM-140A

The **MM-140A** has the following six modes.

a. CHECK (check)

b. COUNT (count)

c. SCH (schedule)

d. PRG (program)

e. Simple selection of the external input (shield gas flow rate) display

f. Simple selection of the weld time simple selection display

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. CHECK (check) Mode

1) See **[7. (2) e. Simply Selecting the External Input (Shield Gas Flow Rate) Display]** to select the weld time/external input (shield gas flow rate) display.

2) Turn on the CHECK of the mode selection LEDs and press the operation button.

3) The CHECK of the mode selection LEDs blinks and a real-time measured value is displayed at the weld time/external input (shield gas flow rate) display. The displayed value is an instantaneous value.

4) The real-time measurement stops when the operation button is pressed, turned, or the welding measurement starts.

b. COUNT (count) Mode

Counts and displays the number of appropriate welds.

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

When the operation button is pressed for one second with the number displayed, the counter is reset.

The good judgment is counted up only when the all of currently selected items (welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate) are within the upper/lower limit range.

c. SCH (schedule) Mode

The **MM-140A** can set 31 schedules of the upper/lower limit of the welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate). In this mode, the present schedule number is displayed, and the schedule number to measure is set.

Also, measurement can be made during operation. The setting contents are changed after measurement.

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

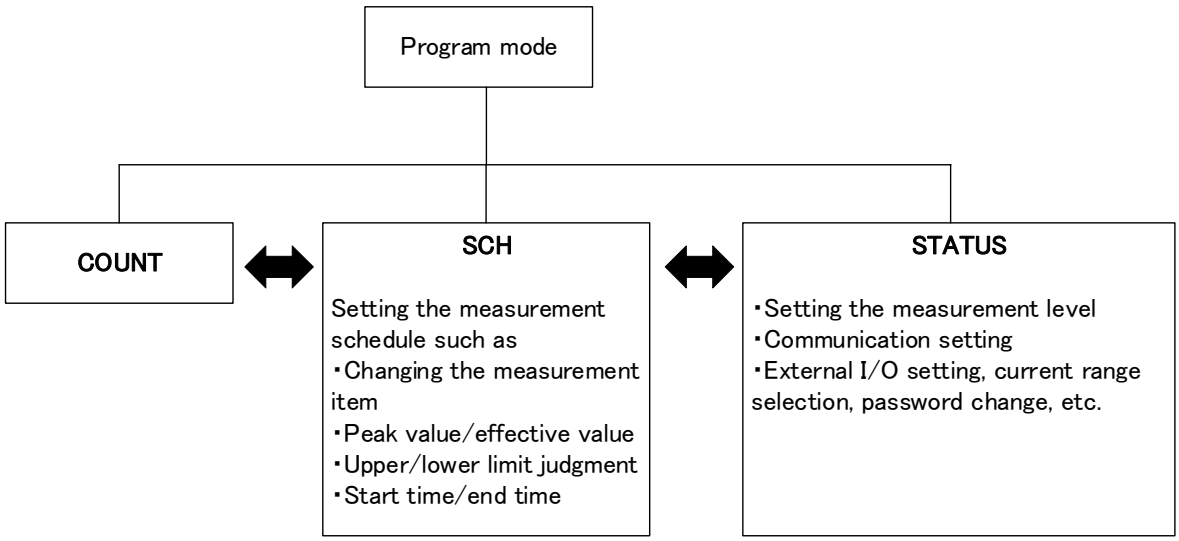
2) Press the operation button. The number blinks.
Measurement can be made even when the number blinks. The schedule number is the blinking number.

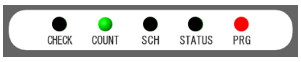
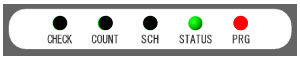
3) Turn the operation button to display the desired schedule number.

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

d. PRG (program) Mode

Sets and checks the various functions and schedules. The contents of the program mode are as follows:



Mode Selection LED	Contents
COUNT setting mode 	Sets the “preset counter.” When the counter value reaches the “preset counter”, the COUNT UP signal is output. The setting range is 00000 to 99999. For details, see **[7. (5) a. Setting the Preset Counter (COUNT)]**. * The preset counter value currently set is displayed on the mode display.
SCH setting mode 	This mode is for setting schedules. The **MM-140A** can set 31 types of upper/lower judgment schedules of welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate). * The schedule number currently set is displayed on the mode display. Schedules can be set.
STATUS setting mode 	Various setting can be done by pressing the operation button while the STATUS is lit. For details, see **[7. (5) b. Status Setting (STATUS)]**.

To input or change each setting, the **MM-140A** is required to be set in the program mode. To prevent schedules from being changed by mistake, there are two modes, the supervisor mode and the operator mode. The differences are as follows:

Operation contents	Supervisor mode	Operator mode
Schedule setting in each screen	Can change	Cannot change *1
Counter reset	Can operate	Can operate
Level setting of STATUS	Can change	Cannot change *1
Ethernet communication of STATUS	Can change	Cannot change *1
SYSTEM of STATUS	Can operate	Can operate *3
Copy of schedule	Can operate	Cannot operate
Schedule number in the measurement mode	Can change	Cannot change *4
Schedule number in the PRG mode	Can change	Can change *5
SCH1 to 31 in the external inputs	Can input	Can input
Counter reset in the external inputs	Can input	Can input

*1: The setting contents can be checked by pressing the operation button.

*2: The setting contents can be checked and the screen can be proceeded by pressing the operation button.

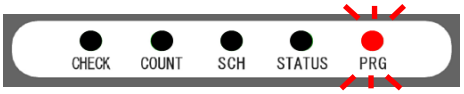
*3: The setting contents can be checked by pressing the operation button. Settings cannot be changed.

*4: In the operator mode, the SCH of the mode selection LEDs blinks.

*5: 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.)

To set the **MM-140A** in the program mode,

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

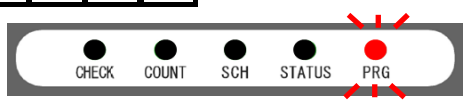


Mode selection LED

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.

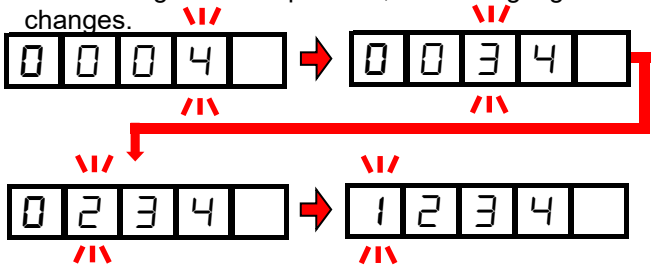
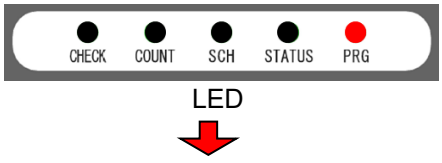
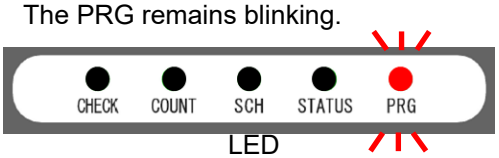
3) 

is displayed on the mode display and the PRG blinks.



Mode selection LED

4) Make settings in the supervisor mode or the operator mode.
Note that the mode is return to the STATUS setting mode when nothing is input for a certain time or welding starts.

Supervisor mode setting	Operator mode setting
1) Turn the operation button right. The display changes to 0000. 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).  LED Supervisor mode	1) When the operation button is pressed, the PASS on the mode display disappears. The PRG remains blinking.  LED Operator mode

* When the password is set to “0000”, the operator mode functions become invalid. The factory setting is”0000.” Refer to **[7. (5) g. Password Setting]** to change the password.

e. Simply Selecting the External Input (Shield Gas Flow Rate) Display

The simple selection function is used for performing the check mode even when the weld time is displayed.

1) Turn on the operation button during the measurement mode to make the external input (shield gas flow rate) measurement LED blink.

2) When the operation button is pressed, the external input (shield gas flow rate) display can be switched.

3) When the mode is returned from the program mode to the measurement mode or the **MM-140A** starts measurement, the display returns to the SCH setting.

* The display at the simple selection returns to the SCH setting after welding. For details, see **[7. (3) e. Selecting Weld Time or External Input (Shield Gas Flow Rate)]**.

f. Simply Selecting the Weld Time Display

The simple selection function is used for performing the check mode even when the external input (shield gas flow rate) is displayed.

1) Turn on the operation button during the measurement mode to make the weld time measurement LED blink.

2) When the operation button is pressed, the external input (shield gas flow rate) display can be switched.

3) When the mode is returned from the program mode to the measurement mode or the **MM-140A** starts measurement, the display returns to the SCH setting.

* The display at the simple selection returns to the SCH setting after welding. For details, see **[7. (3) e. Selecting Weld Time or External Input (Shield Gas Flow Rate)]**.

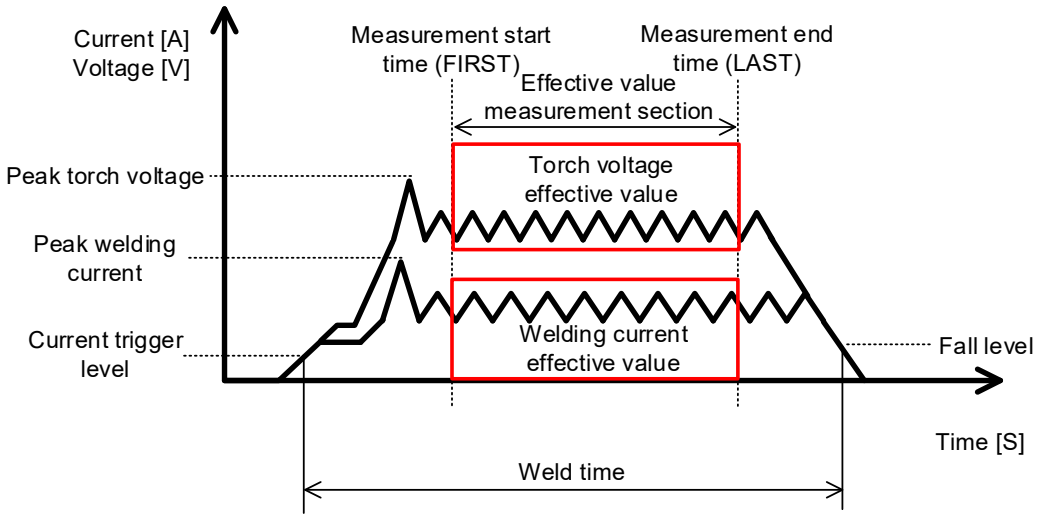
(3) Preparation for Measurement

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

a. Selecting the schedule number to set
b. Selecting the peak and effective values of welding current
c. Selecting the torch voltage and modulation frequency
b. Selecting the peak and effective values of torch voltage
e. Selecting the weld time and external input (shield gas flow rate)
f. Setting the measurement start time (FIRST) and the measurement end time (LAST)

The measurement items are welding current *1, torch voltage *1, modulation frequency *2, weld time, and external input (shield gas flow rate)*3

*1: The measurement section of the effective value of the welding current and the torch voltage is between measurement start time (FIRST) and measurement end (LAST).
When the measurement section is indefinite, the measurement start can be determined by the welding current value.
For details, see **[7. (3) f. Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.
The measurement section of peak is the welding section.



*2: The measurement section of modulation frequency is between measurement start time (FIRST) and measurement end (LAST).
For details, see **[7. (5) c. Setting the Various Levels (6) Modulation frequency measurement threshold current value]**.

*3: By connecting the shield gas flow sensor, the shied gas flow rate can be monitored. The unit in this case is “ℓ (liter) / min.”
For the measurement section, see **[7. (5) c. Setting the Various Levels (4) External input (shield gas flow rate) measurement start level]**.

a. Selecting the Schedule Number to Set

31 types of judgment schedules can be set. Select the schedule number.
When setting the upper limit and the lower limit, 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-140A** in the program mode. (Input a password in the operator 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 selecting 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. Selecting Peak or Effective Value of Welding Current

The welding current measured in the **MM-140A** 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) Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

The value of the peak value display → Maximum value from the welding current 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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to turn on the peak welding current measurement LED or the effective value of welding current measurement LED. (The peak welding current measurement LED or the effective value of welding current measurement LED is turned on depending on the present setting.) The schedule number to set is also displayed on the mode display.

4) Press the operation button. Either of the peak welding current measurement LED or the effective value of welding current measurement LED blinks.

5) Turn the operation button to blink either of the peak welding current measurement LED or the effective value of welding current measurement LED.

6) When the operation button is pressed, 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. Select the peak value or the effective value for each schedule number.

c. Selecting Torch Voltage or Modulation Frequency

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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to turn on the torch voltage LED or the modulation frequency LED. (The torch voltage LED or the modulation frequency LED is turned on depending on the present setting.) The schedule number to set is also displayed on the mode display.

4) Press the operation button. Either of the torch voltage LED or the modulation frequency LED blinks.

5) Turn the operation button to blink either of the torch voltage LED or the modulation frequency LED.

6) When the operation button is pressed, 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.

* When measuring the modulation frequency, refer to **[7. (5) c. Setting the Various Levels (6) modulation frequency measurement threshold current value]**.

d. Selecting Peak or Effective Value of Torch Voltage

The torch voltage measured in the **MM-140A** 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) Setting the Measurement Start Time (FIRST) and the Measurement End Time (LAST)]**.

The value of the peak value display → Maximum value of the instantaneous values sampled between the welding current start and 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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to turn on the peak torch voltage LED or the effective value of torch voltage LED. (The peak torch voltage LED or the effective value of torch voltage LED is turned on depending on the present setting.) The schedule number to set is also displayed on the mode display.

4) Press the operation button. Either of the peak torch voltage LED or the effective value of torch voltage LED blinks.

5) Turn the operation button to blink either of the peak torch voltage LED or the effective value of torch voltage LED.

6) When the operation button is pressed, 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. Select the peak value or the effective value for each schedule number.

e. Selecting Weld Time or External Input (Shield Gas Flow Rate)

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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to turn on the weld time LED or the external input (shield gas flow rate) LED. (The weld time LED or the external input (shield gas flow rate) LED is turned on depending on the present setting.) The schedule number to set is also displayed on the mode display.

4) Press the operation button. Either of the weld time LED or the external input (shield gas flow rate) LED blinks.

5) Turn the operation button to blink either of the weld time LED or the external input (shield gas flow rate) LED.

6) When the operation button is pressed, 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.

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

The **MM-140A** can specify the section between the welding current measurement start (FIRST) and the welding current measurement end (LAST) and measure the effective value.

To measure the welding current effective value, torch voltage effective value, and modulation frequency, the measurement start time and the measurement end time should be set.

Set the measurement start time and the measurement end time for each schedule number. The measurement start time and the measurement end time can be set in 1-ms increment.

How to set the measurement start time (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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to display  on the torch voltage/modulation frequency display.
The setting is displayed on the weld time/external input (shield gas flow rate) display. The schedule number to set is also displayed on the mode display.

4) Press the operation button. The rightmost place on the weld time/external input (shield gas flow rate) display 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 measurement start time (FIRST). 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.

How to set the measurement end time (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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to display  on the torch voltage/modulation frequency.
The setting is displayed on the weld time/external input (shield gas flow rate) display. The schedule number to set is also displayed on the mode display.

4) Press the operation button. The rightmost place on the weld time/external input (shield gas flow rate) display 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 measurement end time (LAST). 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.

* When the measurement start time (FIRST) and the measurement end (LAST) is set to 0, the weld time (from the current trigger to the fall level) becomes the measurement time.

(4) Upper/Lower Limit Judgment Function

The **MM-140A** is equipped with the upper/lower limit judgment function for welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate). The upper/lower limit judgment can be set for each schedule number.

The upper/lower limit judgment function

Sets the upper/lower limit range of the welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate) in advance.

↓

Judges whether the actually measured welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate) are within the set upper/lower limit range.

↓

- When the selected measured value is within the range

  The [GOOD] signal is output, and the GOOD of the selected welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate) upper/lower limit judgment LEDs lights up.

- When the selected 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) e. System Setting (1) Upper/lower limit judgment output operation]**, and the UPPER of the selected welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate) upper/lower limit judgment LEDs lights up.

- When the selected 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) e. System Setting (1) Upper/lower limit judgment output operation]**, and the LOWER of the selected welding current, torch voltage, modulation frequency, weld time, and external input (shield gas flow rate) upper/lower limit judgment LEDs lights up.

a. Setting the Upper and Lower Limits of the Welding 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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to turn on the UPPER of the welding current upper/lower limit judgment LEDs. The number on the welding current display is the upper limit. The schedule number to set is also displayed on the mode display.

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 for 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.

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-140A** in the program mode. (Input a password in the operator mode.)

3) Turn the operation button to turn on the LOWER of the welding current upper/lower limit judgment LEDs. The number on the welding current display is the lower limit. The schedule number to set is also displayed on the mode display.

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 for 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 Upper and Lower Limits of the Torch 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-140A** in the program mode. (Input a password in the operator mode.)

3) When the torch voltage/modulation frequency display is set to the modulation frequency, turn the operation button to change the setting to the torch voltage.

4) Turn the operation button to turn on the UPPER of the torch voltage/modulation frequency upper/lower limit judgment LEDs. The number on the torch voltage/modulation frequency display is the upper limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

9) 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-140A** in the program mode. (Input a password in the operator mode.)

3) When the torch voltage/modulation frequency display is set to the modulation frequency, turn the operation button to change the setting to the torch voltage.

4) Turn the operation button to turn on the LOWER of the torch voltage/modulation frequency upper/lower limit judgment LEDs. The number on the torch voltage/modulation frequency display is the lower limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

9) 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-140A** in the program mode. (Input a password in the operator mode.)

3) When the weld time/external input (shield gas flow rate) display is set to the external input (shield gas flow rate), turn the operation button to change the setting to the weld time.

4) Turn the operation button to turn on the UPPER of the weld time/external input (shield gas flow rate) upper/lower limit judgment LEDs. The number on the weld time/external input (shield gas flow rate) display is the upper limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

9) 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-140A** in the program mode. (Input a password in the operator mode.)

3) When the weld time/external input (shield gas flow rate) display is set to the external input (shield gas flow rate), turn the operation button to change the setting to the weld time.

4) Turn the operation button to turn on the LOWER of the weld time/external input (shield gas flow rate) upper/lower limit judgment LEDs. The number on the weld time/external input (shield gas flow rate) display is the lower limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

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

d. Setting the Upper and Lower Limits of the External Input (Shield Gas Flow Rate)

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-140A** in the program mode. (Input a password in the operator mode.)

3) When the weld time/external input (shield gas flow rate) display is set to the weld time, turn the operation button to change the setting to the external input (shield gas flow rate).

4) Turn the operation button to turn on the UPPER of the weld time/external input (shield gas flow rate) upper/lower limit judgment LEDs. The number on the weld time/external input (shield gas flow rate) display is the upper limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

9) 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-140A** in the program mode. (Input a password in the operator mode.)

3) When the weld time/external input (shield gas flow rate) display is set to the weld time, turn the operation button to change the setting to the external input (shield gas flow rate).

4) Turn the operation button to turn on the LOWER of the weld time/external input (shield gas flow rate) upper/lower limit judgment LEDs. The number on the weld time/external input (shield gas flow rate) display is the lower limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

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

e. Setting the Upper and Lower Limits of the Modulation Frequency

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-140A** in the program mode. (Input a password in the operator mode.)

3) When the torch voltage/modulation frequency display is set to the torch voltage, turn the operation button to change the setting to the modulation frequency.

4) Turn the operation button to turn on the UPPER of the torch voltage/modulation frequency upper/lower limit judgment LEDs. The number on the torch voltage/modulation frequency display is the upper limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

9) 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-140A** in the program mode. (Input a password in the operator mode.)

3) When the torch voltage/modulation frequency display is set to the torch voltage, turn the operation button to change the setting to the modulation frequency.

4) Turn the operation button to turn on the LOWER of the torch voltage/modulation frequency upper/lower limit judgment LEDs. The number on the torch voltage/modulation frequency display is the lower limit. The schedule number to set is also displayed on the mode display.

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

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

7) 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.

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

9) 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-140A** 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.

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-140A** in the program mode. (Input a password in the operator 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.

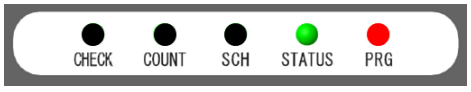
6) Press the operation button to move the blinking place to the left. Set the desired value in all places. When the operation button is pressed while the leftmost place is blinking, blinking stops and setting is completed.

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

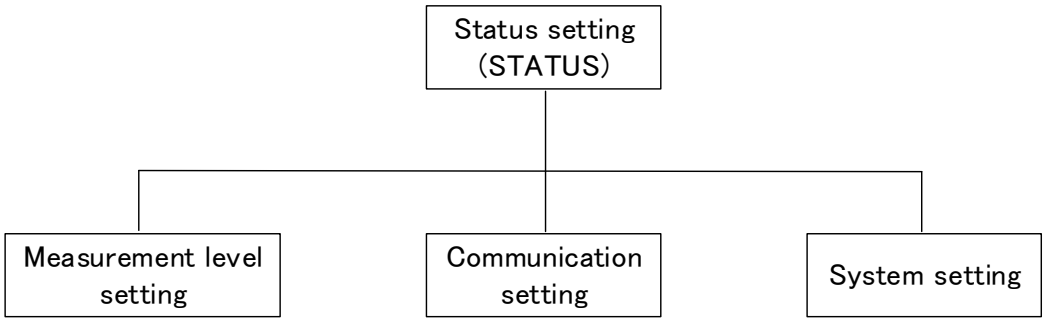
8) Press the operation button for one second to cancel the program mode.

b. Status Setting (STATUS)

The contents of the status setting and the mode display of 7-segment LED are as follows:



Mode selection LED



Mode display	Contents
LEUEL	Makes setting for each level. For details, see **[7. (5) c. Setting the Various Levels]**.
Pc	The **MM-140A** uses the Ethernet communication. For details, see **[7. (5) d. Communication Setting]**.
SYS	Makes the system setting. Various times, external I/O, password, and CT coil can be set. For details, see **[7. (5) e. System Setting]**.

c. Changing the Various Levels

How to select

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

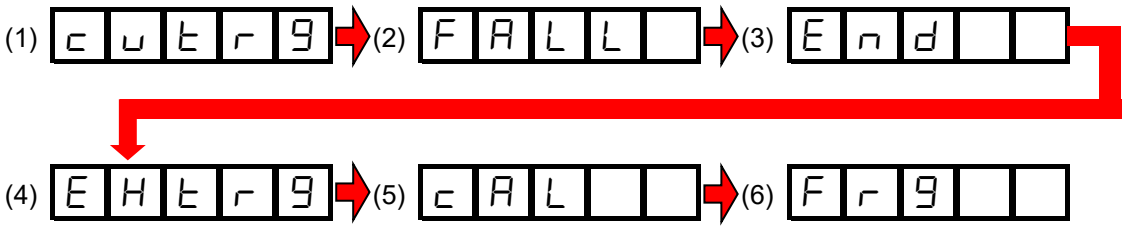
2) Press the operation button for one second while the PRG is on to set the **MM-140A** in the program mode. (Input a password in the operator mode.)

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

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

5) Press the operation button.

6) Turn the operation button to display the desired level setting.



The contents of each display is as in the following table:

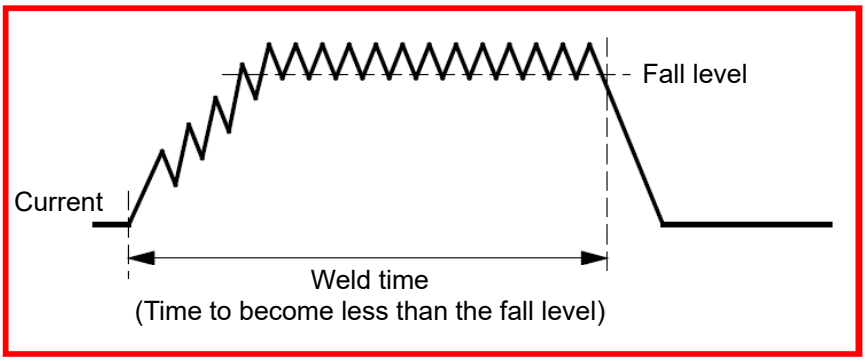
(1) Current trigger level (cutr9)

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 defects may be resolved by changing the trigger level.

1) When the operation button is pressed, the currently set current trigger level is displayed with blinking.
   The initial value is 50.
2) Turn the operation button to change the current trigger level. The setting range is 01 to 99.
   When the numeric value is increased, the sensitivity becomes high. Note that too high sensitivity causes malfunction.
   Even while the current trigger level is set, the welding current can be measured.
   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 level.

(2) Fall level (FALL)

The weld time can be measured to the fall level.



1) When the operation button is pressed, the currently set fall level is displayed with blinking.
   The initial value is 10.
2) Turn the operation button to set the fall level.
   The setting range is 01 to 99% of the peak current value.
   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 fall level.
   Be sure to set so as to become fall level ≥ measurement end level.

(3) Measurement end level (End)

1) When the operation button is pressed, the currently set measurement end level is displayed with blinking.
   The initial value is 05.
2) Turn the operation button to set the measurement end level.
   The setting range is 01 to 15% of the peak current value.
   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 measurement end level.

(4) External input (shield gas flow rate) measurement start level (EHtr9)

1) When the operation button is pressed, the currently set external input (shield gas flow rate) measurement start level is displayed with blinking.

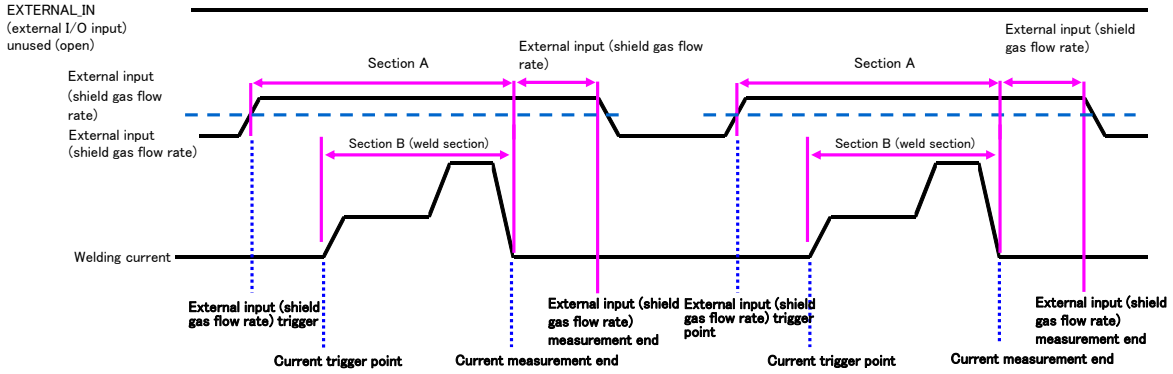
The initial value is 00.0.

2) Turn the operation button to set the external input (shield gas flow rate) measurement start level. The setting range is 00.0 to 99.9.
When the numeric value is increased, the sensitivity becomes high. Note that too high sensitivity causes malfunction.

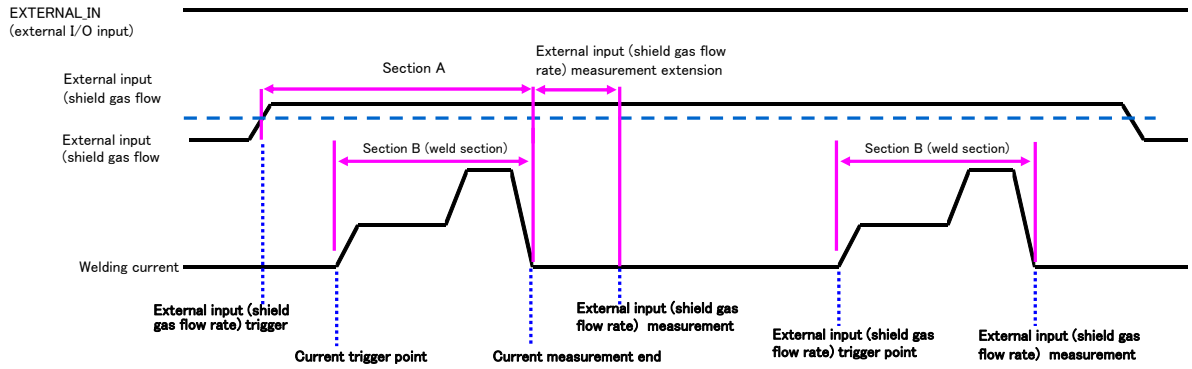
3) Press the operation button to establish the external input (shield gas flow rate) measurement start level.

<External input (shield gas flow rate) measurement start level>
There are two ways for external input (shield gas flow rate) measurement start level; the way to start measurement by the EXTERNAL_IN (external I/O input) and the way to start measurement by a threshold of the external input (shield gas flow rate) input.
The way to start measurement by the EXTERNAL_IN (external I/O input) is prioritized over the way to start measurement by a threshold of the external input (shield gas flow rate) input.

● External input (shield gas flow rate) input threshold trigger

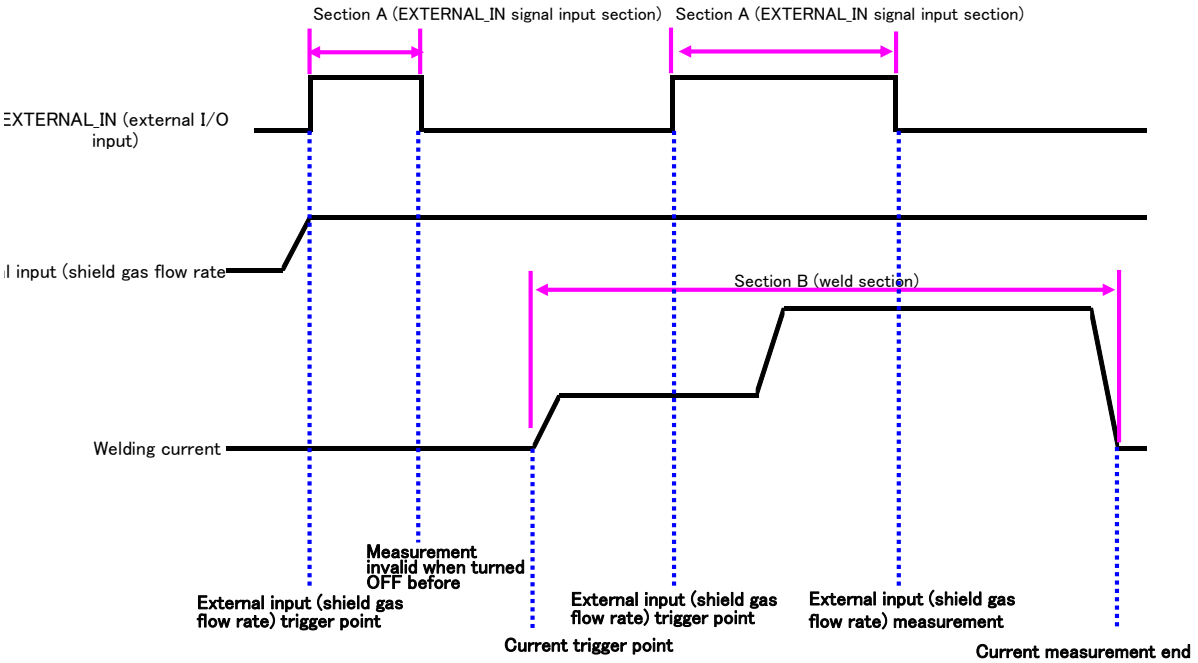


The measurement section of the external input (shield gas flow rate) input is section A + external input (shield gas flow rate) measurement end extension time.
(For setting of external input (shield gas flow rate) measurement end extension time, refer to **[7. (5) f. External Input (Shield Gas Flow Rate) Measurement End Extension Time)]**.
However, the external input (shield gas flow rate) input value does not become less than a threshold, operation is as in the following figure:



The first measurement section is section A + external input (shield gas flow rate) measurement end extension time, and the second or later is section B.

● EXTERNAL_IN (external I/O input)
The measurement section is the input section of the EXTERNAL_IN signal of section A.
When no current flows while the EXTERNAL_IN signal is input, the measurement becomes invalid and cannot be performed.



When the EXTERNAL_IN (external I/O input) is input while the external input (shield gas flow rate) input is being triggered, the EXTERNAL_IN (external I/O input) is prioritized.

(5) Calculation start level (cAL)

1) When the operation button is pressed, the currently set calculation start level is displayed.
The initial value is 00.

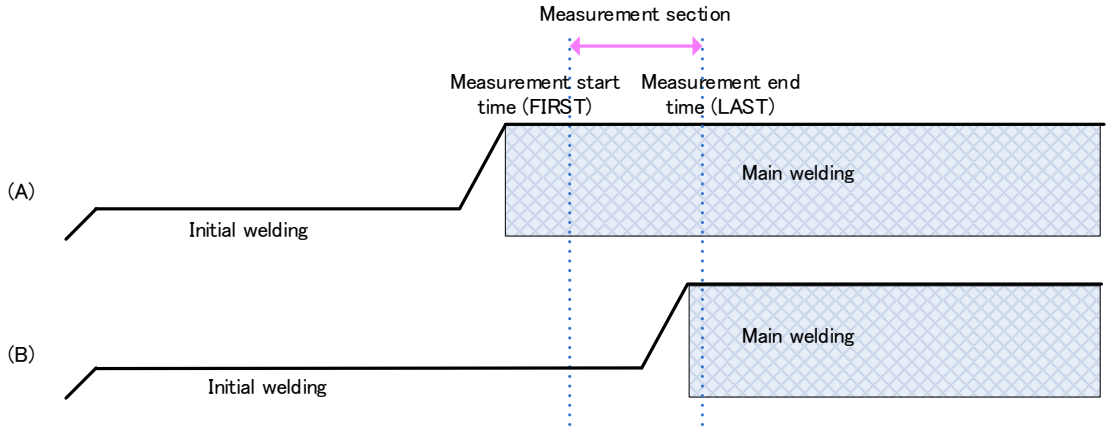
2) Turn the operation button to change the value of the calculation start level. When the operation button is pressed, the setting place changes.
The setting range is 00 to 99. Setting 00 turns off this function.
Based on the set current range, calculation start level is calculated.

Example) In 300-A range and calculation start level 50, 300 × 0.5 = 150 A is the current trigger value.

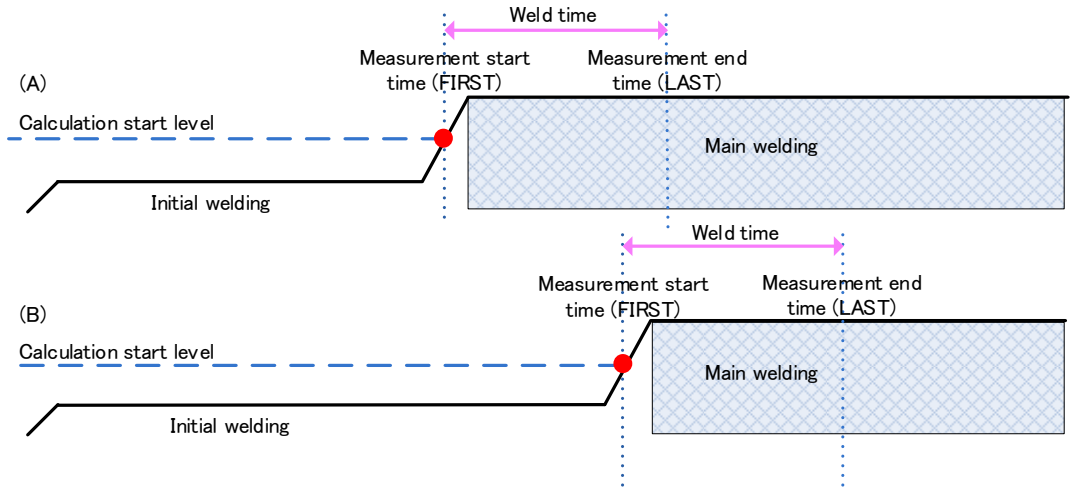
When the numeric value is increased, the sensitivity becomes high. Note that too high sensitivity causes malfunction.
Even while the calculation start level is set, the welding current can be measured.
Repeat measurements and set a value not causing malfunction or a value that a measurement can be normally performed.

3) Press the operation button to establish the calculation start level.

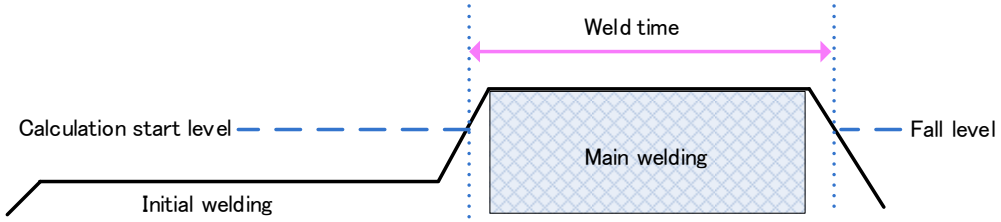
<Calculation start level>
When the timing switching from the initial welding to the main welding is not constant due to a stroke of the movable welding head, the section set for the measurement start time (FIRST) and the measurement end time (LAST) can be measured always at the same timing by setting the calculation start level.



As shown in the figures (A) and (B), when the initial weld time is not constant due to a stroke of the welding head, the main welding and the measurement section may be deviated and the measurement result may change significantly.
When the calculation start level is set as shown in the figures (A) and (B) below, the measurement section is set with the rise of the main welding as the starting point and the welding is stably measured.

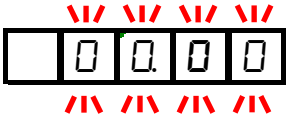


The weld time measured with this function is calculated from the calculation start level.
To measure the weld time of the main welding only, set the calculation start level. (When the measurement start time (FIRST) and the measurement end time (LAST) are set to 0, the weld time is the measurement section.)

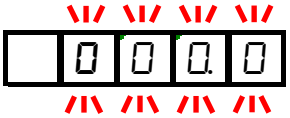


(6) Modulation frequency measurement threshold current value (F r 9)

1) When the operation button is pressed, the currently set modulation frequency measurement threshold current value is displayed with blinking.
When 50-A range is selected, the initial value is 00.00.



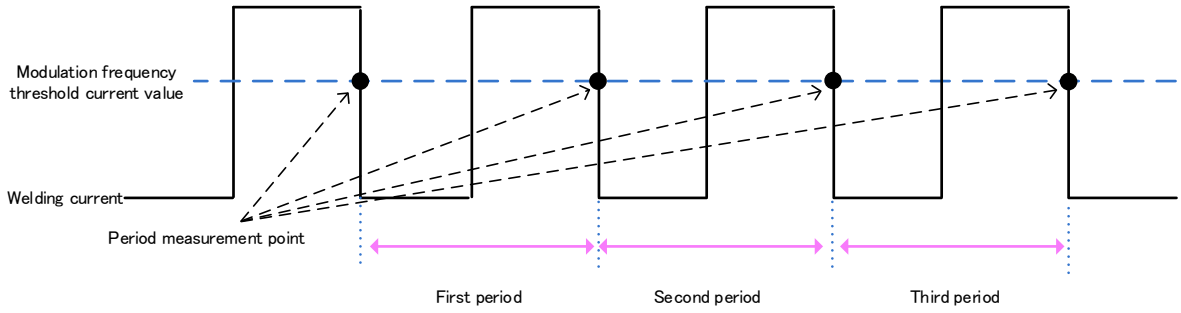
When 300-A range is selected, the initial value is 000.0.



2) Turn the operation button to set modulation frequency measurement threshold current value.
The setting range is
50-A range: 00.00 to 50.00 A. Setting 00.00 turns off this function.
300-A range: 000.0 to 300.0 A. Setting 000.0 turns off this function.
Specify the welding current value that drops at modulation.
When the welding current does not drop to the value set here, the modulation frequency is not measured.
Also, when the modulation frequency is not set in the welding machine, turn off this function. When the modulation frequency is selected, “0000” is displayed as the measurement result.

3) Press the operation button to establish the modulation frequency measurement threshold current value.

<Modulation frequency measurement threshold current value>
● When measuring the modulation frequency
Set the modulation frequency measurement threshold current value. The setting range is as follows according to the current range:
50-A range: 1.0 to 50.00 A
300-A range: 1.0 to 300.0 A
The modulation frequency is measured at the period measurement point in the following figure when the welding current drops. When measuring the modulation frequency, set it according to the modulation change of the welding current to check.



When the welding current does not drop to the modulation frequency threshold current value and cannot be measured, “0000” is displayed as the measurement result.

● Measurement range of modulation frequency
The modulation frequency between measurement start time (FIRST) and measurement end time (LAST) is measured.
The modulation frequency outside of the measurement section is not measured.
When the measurement start time (FIRST) is set to 0 ms and the measurement end time (LAST) is set to 0 ms, all sections are the modulation frequency measurement section.
When the calculation start level is set, the modulation frequency measurement section starts from the calculation start level.

*1: When measuring the modulation frequency, set the measurement end level and fall level smaller than the modulation base current. When it is higher than the base current, the measurement

ends.

*2: It may be difficult to measure the modulation frequency in the following operating environment.
- The modulation frequency is high.
- The difference between welding current and base current is small.
- The duty ratio of modulation is large.
- A ripple of a welding current is large.

*3: The representable value of the modulation frequency is the sampling frequency (19.98 μsec) as shown below:

Representable value list (Unit: Hz)						
3367	1122	673	481	374	306	259
3156	1097	664	476	371	304	257
2970	1074	655	472	368	302	256
2805	1052	647	467	365	300	255
2658	1030	639	463	363	298	253
2525	1010	631	459	360	297	252
2405	990	623	455	358	295	251
2295	971	615	450	355	293	250
2195	952	608	446	353	291	248
2104	935	601	443	350	290	247
2020	918	594	439	348	288	246
1942	901	587	435	345	286	245
1870	886	580	431	343	285	243
1803	870	573	428	341	283	242
1741	856	567	424	338	282	241
1683	841	561	420	336	280	240
1629	827	555	417	334	279	239
1578	814	548	413	332	277	238
1530	801	543	410	330	275	237
1485	789	537	407	327	274	236
1443	777	531	404	325	273	234
1402	765	526	400	323	271	233
1365	753	520	397	321	270	232
1329	742	515	394	319	268	231
1295	731	510	391	317	267	230
1262	721	505	388	315	265	
1231	711	500	385	313	264	
1202	701	495	382	311	263	
1174	691	490	379	309	261	
1147	682	485	376	307	260	

[Reference] Shown below is a model of the modulation frequency threshold setting when the modulation of the **MAWA-300B** is measured.
The modulation frequency does not drop to the base current as the Duty is larger. It can be measured by setting the threshold to a close value to the welding current.

Welding schedule:
Power supply … MAWA-300B
Welding current 100 A
Base current 15 A

MAWA power supply Modulation frequency setting	MM-140A modulation threshold setting		
	Duty 90 %	Duty 50 %	Duty 10 %
10Hz	50A	50A	50A
20Hz	50A	50A	50A
30Hz	50A	50A	50A
40Hz	50A	50A	50A
50Hz	50A	50A	50A
60Hz	50A	50A	50A
70Hz	50A	50A	50A
80Hz	50A	50A	50A
90Hz	50A	50A	50A
100Hz	50A	50A	50A
200Hz	80A	50A	50A
300Hz	80A	50A	50A
400Hz	90A	50A	50A
500Hz	90A	50A	50A
600Hz	90A	50A	50A
700Hz	90A	50A	50A
800Hz	95A	80A	50A
900Hz	95A	80A	50A
1000Hz	95A	80A	50A
1100Hz	95A	80A	50A
1200Hz	95A	80A	50A
1300Hz	95A	80A	50A
1400Hz	95A	80A	50A
1500Hz	95A	80A	50A
1600Hz	98A	80A	50A
1700Hz	98A	80A	50A
1800Hz	98A	80A	50A
1900Hz	98A	80A	50A
2000Hz	98A	80A	50A
2100Hz	98A	80A	50A
2200Hz	98A	80A	50A
2300Hz	98A	80A	50A
2400Hz	98A	80A	50A
2500Hz	98A	80A	50A
2600Hz	98A	80A	50A
2700Hz	98A	80A	50A
2800Hz	98A	80A	50A
2900Hz	98A	80A	50A
3000Hz	98A	80A	50A

d. Communication Setting

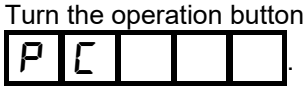
How to selecet

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

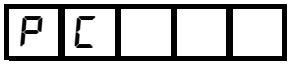
2) Press the operation button for one second while the PRG is on to set the **MM-140A** in the program mode. (Input a password in the operator mode.)

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

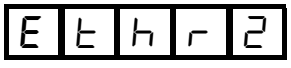
4) Press the operation button.  is displayed on the mode display.

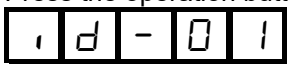
5) Turn the operation button to change the display on the mode display to  .

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.

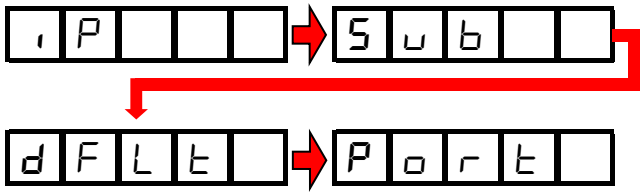
Turn the operation button with  displayed to select the desired communication method.

	Ethernet communication is not done.
	Ethernet single-directional communication is done.
	Ethernet bi-directional communication is done.

8) Press the operation button to move to the device number setting screen.  is displayed on the mode display.

9) Turn the operation button to set the number. Press the operation button to establish it.

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

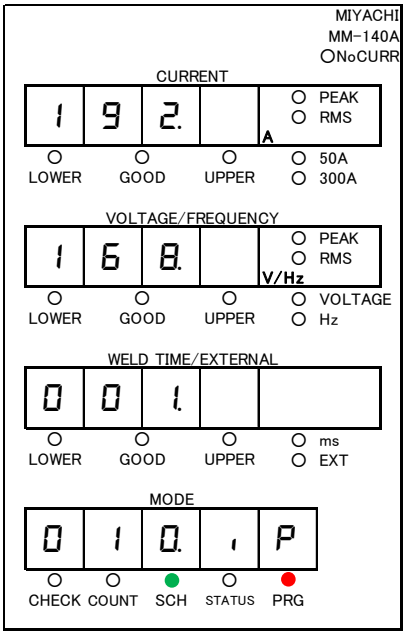


When the operation button is pressed with the desired setting item is displayed, the address setting screen in 7) is displayed.

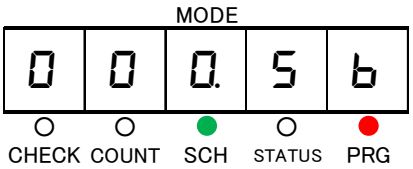
iP	IP address: Specifies the computer by address on network. Communication can be done by inputting the set value to the PC.
Sub	Subnet mask: Value for dividing IP address into network address and host address. Communication can be done by inputting the set value to the PC.
dFLt	Default gateway: Used for communicating with another network. Communication can be done by inputting the set value to the PC.
Port	Port number: Set the port number and fix the connection destination. Communication can be done by inputting the set value to the PC.

11) The setting methods of IP address, subnet mask, and default gateway are common.
When the IP address is set, the right two places in the mode display displays "iP."
When the subnet mask is set, the right two places in the mode display displays "Sb."
When the default gateway is set, the right two places in the mode display displays "dF."

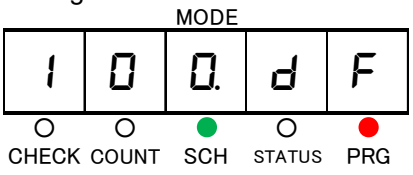
An example of IP address (192.168.001.010) is shown below:



・Mode display at subnet mask setting



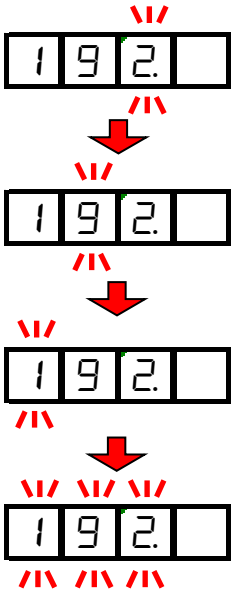
・Mode display at default gateway setting



12) When the operation button is pressed, the display blinks like  .

When the operation button is turned, a row changes and blinks.

13) 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.



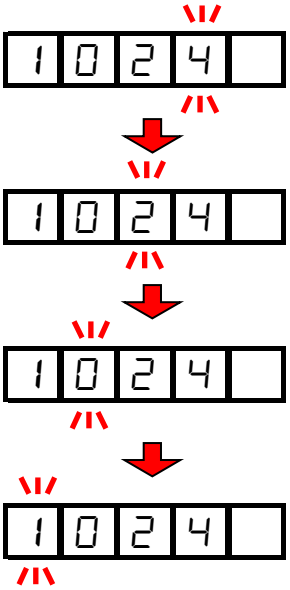
14) When setting is completed, turn the operation button to select a row to set. The setting method is the same as 9).

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

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

17) Turn the operation button right.

18)  is displayed on the mode display. Press the button to move to the port number setting screen.

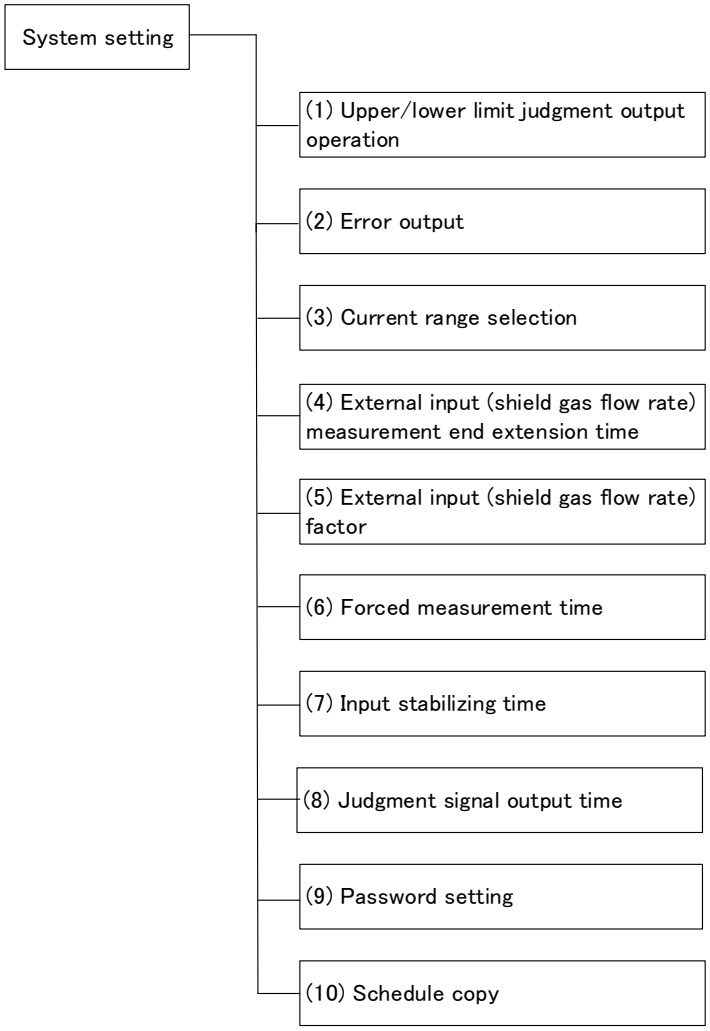


19) When the operation button is pressed, setting is completed.

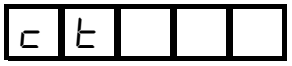
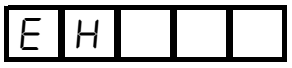
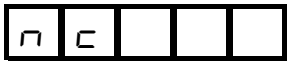
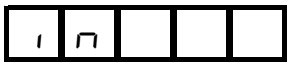
20) Turn the operation button right to return to the address selecting screen.

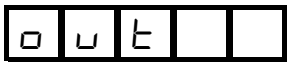
e. System Setting

The contents of the system setting and 7-segment LED display are as follows:



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 factory setting is HL 1.)

Item	Contents
(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) Current range selection  	ct 0: The current range is set to 50 A. Use the current sensor for 50 A. ct 1: The current range is set to 300 A. Use the current sensor for 300 A. (The factory setting is ct 1.)
(4) External input (shield gas flow rate) measurement end extension time  	Sets the time to continue measuring EXTERNAL_IN (external I/O input) even after the welding end. Example: By inputting the shield gas flow sensor to the external input (shield gas flow rate), the average value of the external input (shield gas flow rate) including the after-flow time of Ar gas is calculated. For details, see **[7. (5) f. External Input (Shield Gas Flow Rate) Measurement End Extension Time]**. (The factory setting is 00000.)
(5) External input (shield gas flow rate) factor  	Factor for digitalizing the EXT input of 4 mA-20 mA input. Based on the following formula, the value of the external input (shield gas flow rate) is calculated. external input (shield gas flow rate) value = (input current x 250 - 1) ÷ external input (shield gas flow rate) factor The setting range is 0.1 to 9.9. (The factory setting is 0.4.)
(6) Forced measurement time  	If the current is very small at the beginning of the flow, it may not be measured. (This often occurs when upslope is used.) The setting range is 00 to 99 ms. (The factory setting is 01 ms.)
(7) Input stabilizing time  	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 to 10 ms. (The factory setting is 10 ms.)

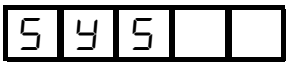
Item	Contents
(8) Judgment signal output time 	Changes the output times of the [GOOD] signal, the [NG-H] signal and the [NG-L] signal. ・When Out10 is set, the output times of the [GOOD] signal, the [NG-H] signal and the [NG-L] signal become 10 ms. The next current measurement cannot be made until the 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. The next measurement is possible at least 5 ms after the [GOOD] or the [NG] signal is output. (The factory setting is Out99.)
(9) Password setting 	Sets the password used for the supervisor mode. For how to set, see **[7. (5) g. Password Setting]**. (The factory setting is 0000.)
(10) Schedule copy 	Copies the value of Schedule 1 to Schedules 2–31. How to operate When copy- is displayed, turn the operation button right. The display changes to 1--31. 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 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-140A** in the program mode. (Input a password in the operator mode.)

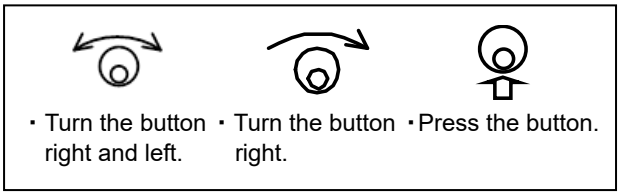
3) Turn the operation button left to turn on the STATUS of the mode selection LEDs.

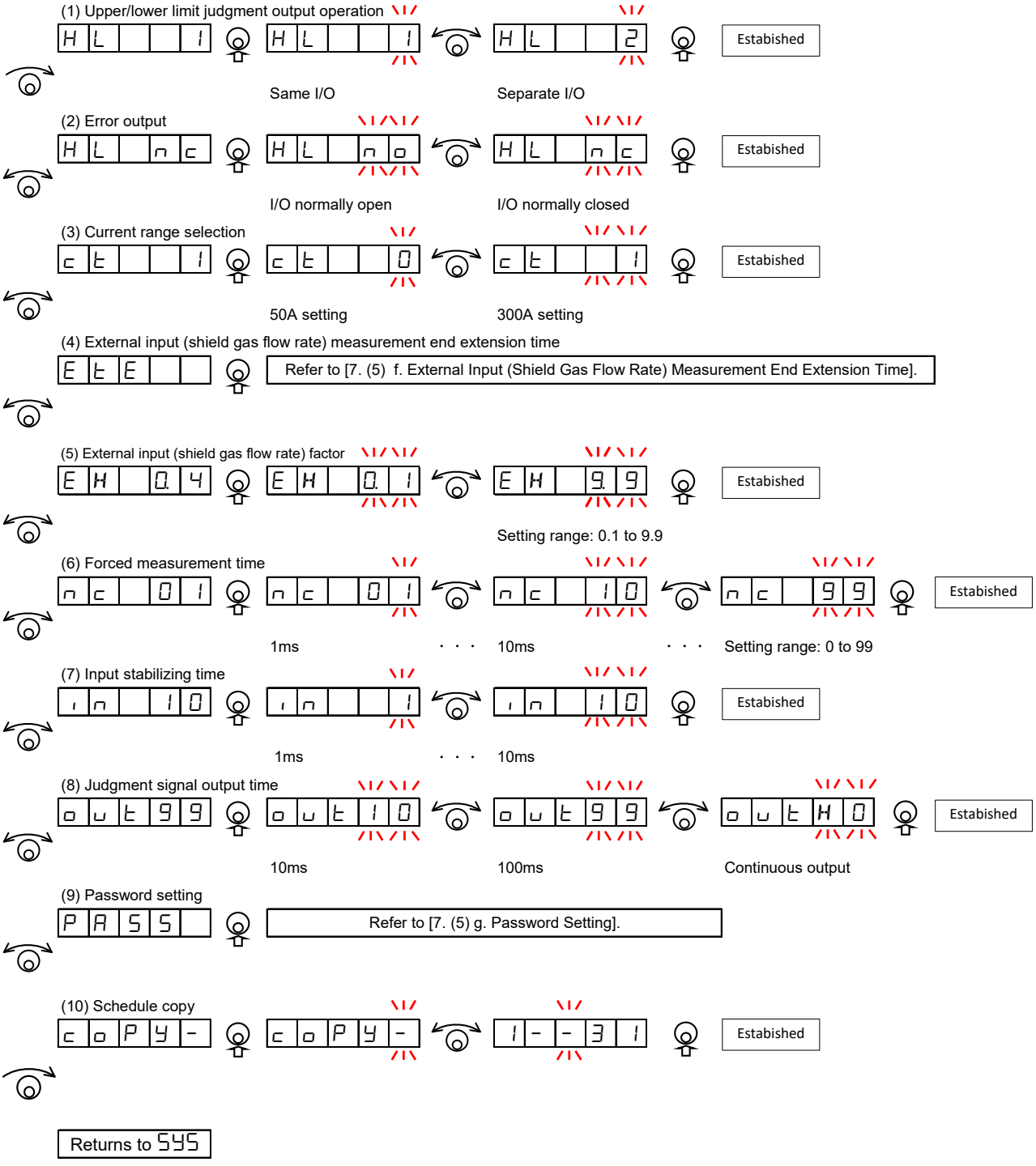
4) Press the operation button.  is displayed on the mode display.

5) Press the operation button. When the operation button is turned, the setting item is switched as shown in the next page.

<Setting operation procedure>

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





f. External Input (Shield Gas Flow Rate) Measurement End Extension Time

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-140A** in the program mode. (Input a password in the operator mode.)

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

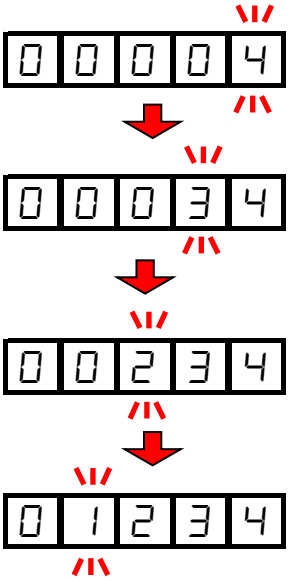
4) When the operation button is pressed,  is displayed on the mode display.

5) Press the operation button.

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

7) Press the operation button. The current external input (shield gas flow rate) measurement end extension time is displayed on the mode display and the rightmost place blinks.
The initial value is "00000."

8) Turn the operation button to change the value. When the operation button is pressed, the setting place changes. The setting range is 00000 to 20000 ms.



9) When the operation button is pressed, setting is completed. The mode display changes to  .

g. Password Setting

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-140A** in the program mode. (Input a password in the operator mode.)

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

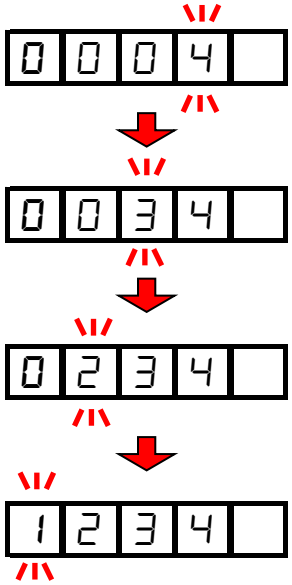
4) When the operation button is pressed, SYS is displayed on the mode display.

5) Press the operation button.

6) Turn the operation button to display PASS 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, do 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 canceled.

* When the password is set to "0000", the password input is not necessary when entering into the PRG mode.

(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-140A** returns to the measurement operation. The settings other than this can be checked in the program mode.

When the operation button is turned, the display of the **MM-140A** 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 welding current display. (If the peak current has not been measured, 0000 is displayed.)

3) The effective value of current measurement LED lights up.
The effective value of current measured previously is also displayed on the welding current display. (If the effective value of current has not been measured, 0000 is displayed.)

4) The LOWER of the welding current upper/lower limit judgment LEDs lights up.
The lower limit of the current for the schedule number displayed presently is also displayed on the welding current display. (The initial setting is 000.0 (300-A range) or 00.00 (50-A range).)

5) The UPPER of the welding current upper/lower limit judgment LEDs lights up.
The upper limit of the current for the schedule number displayed presently is also displayed on the welding current display. (The initial setting is 350.0 (300-A range) or 60.00 (50-A range).)

6) <When the voltage display is set>
The peak torch voltage measurement LED lights up.
The peak voltage measured previously is also displayed on the torch voltage/modulation frequency display. (If the peak voltage has not been measured, 0000 is displayed.)

<When the modulation frequency display is set>

There is no peak value. Proceed to 7).

7) <When the voltage display is set>
The effective value of torch measurement LED lights up.
The effective voltage measured previously is also displayed on the torch voltage/modulation frequency display.

<When the modulation frequency display is set>

The modulation frequency measured previously is displayed on the torch voltage/modulation frequency display.

8) <When the voltage display is set>
The LOWER of the torch voltage/modulation frequency upper/lower limit judgment LED lights up.
The lower limit of the voltage for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 000.0.)

<When the modulation frequency display is set>

The LOWER of the torch voltage/modulation frequency upper/lower limit judgment LED lights up.
The lower limit of the modulation frequency for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 0000.)

9) <When the voltage display is set>
The UPPER of the torch voltage/modulation frequency upper/lower limit judgment LED lights up.
The upper limit of the voltage for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 120.0.)

<When the modulation frequency display is set>

The UPPER of the torch voltage/modulation frequency upper/lower limit judgment LED lights up.
The upper limit of the modulation frequency for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 3000.)

10) <When the weld time display is set>
The weld time measured previously is displayed on the weld time/external input (shield gas flow rate) display.

<When the external input (shield gas flow rate) display is set>

The average value of the external input (shield gas flow rate) measured previously is displayed on the weld time/external input (shield gas flow rate) display.

11) <When the weld time display is set>
The LOWER of the weld time/external input (shield gas flow rate) upper/lower limit judgment LED lights up.
The lower limit of the weld time for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 0000.)

<When the external input (shield gas flow rate) display is set>

The LOWER of the torch voltage/modulation frequency upper/lower limit judgment LED lights up.
The lower limit of the external input (shield gas flow rate) for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 00.0.)

12) <When the weld time display is set>
The UPPER of the weld time/external input (shield gas flow rate) upper/lower limit judgment LED lights up.
The upper limit of the weld time for the schedule number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 5000.)

<When the external input (shield gas flow rate) display is set>

The UPPER of the torch voltage/modulation frequency upper/lower limit judgment LED lights up.
The upper limit of the external input (shield gas flow rate) for the schedule

number displayed presently is also displayed on the weld time/external input (shield gas flow rate) display. (The initial setting is 99.9.)

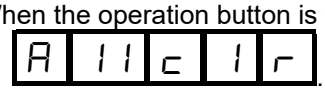
13) The “First” is displayed on the torch voltage/modulation frequency display. The measurement start time is displayed on the weld time/external input (shield gas flow rate) display.

14) The “Last” is displayed on the torch voltage/modulation frequency display. The measurement end time is displayed on the weld time/external input (shield gas flow rate) display.

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 for one second, the data is initialized.

8. Data Communication

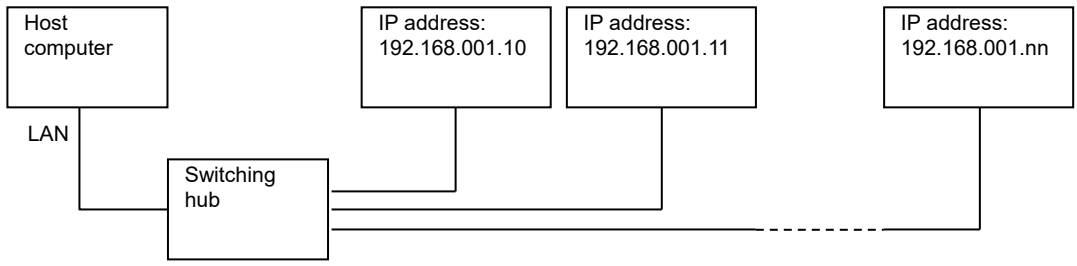
Monitoring data can be loaded from the **MM-140A** into the external PC. Also, schedule settings can be written from the external PC into the **MM-140A**.

(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

a. Ethernet



* 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-140A**. Connect it to IP address and port number set in the **MM-140A**. Use TCP/IP for communication protocol.

Example)

Computer IP address: 192.168.1.12, Subnet mask: 255.255.255.0

MM-140A IP address: 192.168.1.10, Subnet mask: 255.255.255.0, Port No.: 1024

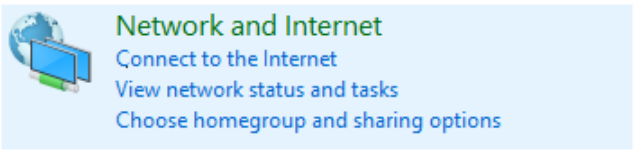
Establish connection from the computer to the **MM-140A** with settings of IP address: 192.168.1.10 and port number: 1024.

Since connection is released when the settings of the **MM-140A** (mode, device number, IP address, subnet mask, default gateway, and port number) are changed, the power supply of the **MM-140A** is turned off, and communication from the **MM-140A** cannot be made, establish connection again.

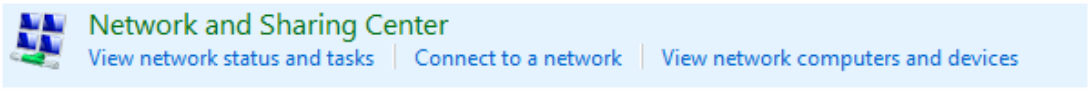
[IP address setting]
Set the IP address of the personal computer.
The IP address of the **MM-140A** has been set to [192.168.1.10] at the factory. Use [192.168.1.11] or later for the IP address of the personal computer. However, do not set the IP address to the same as the default gateway.

Setting procedure (for Windows 10)

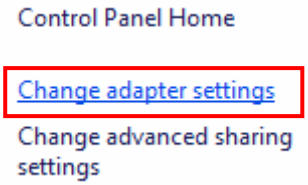
1) From the control panel, select the [Network and Internet].



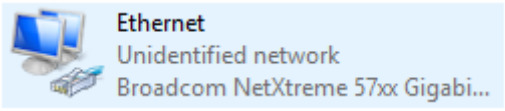
2) Select the [Network and Sharing Center].



3) Select the [Change adapter settings].

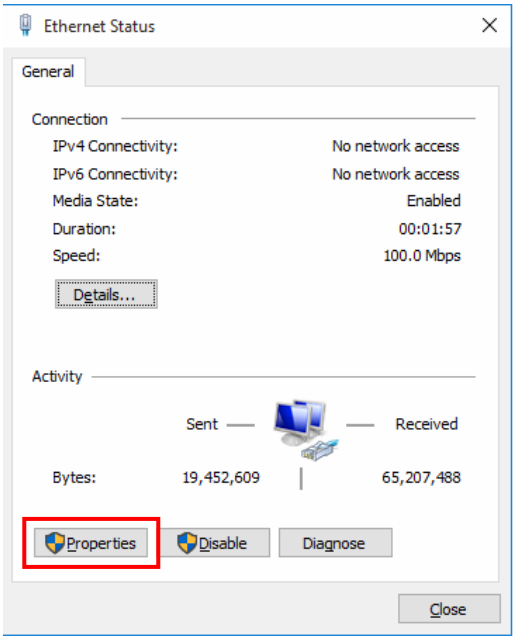


4) Select a network card to use.

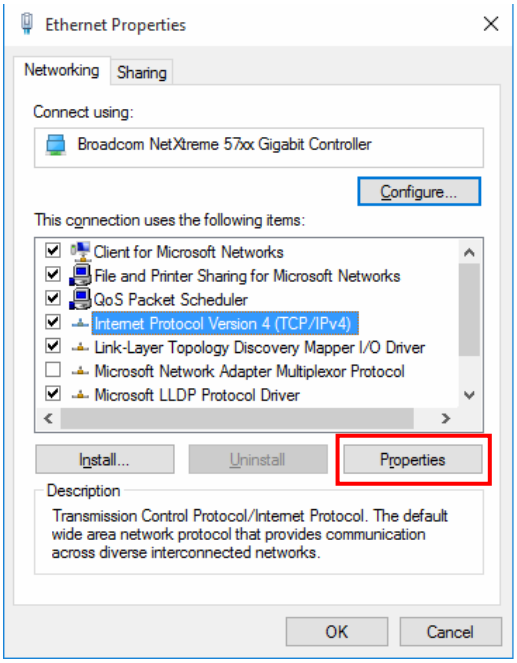


* Displays vary according to the personal computer or network card in use.

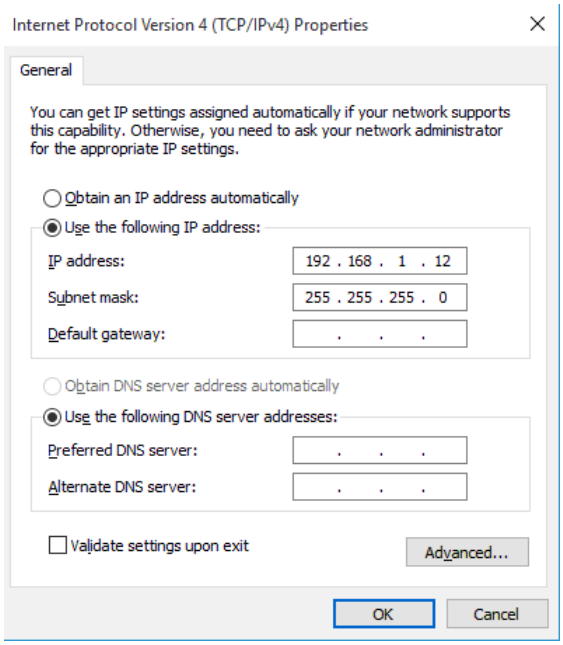
5) Click the [Properties].



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-140A**, turn off the power supply, or disconnect the LAN cable, connect the **MM-140A** again.

(3) Communication Protocol (Single-Directional Communication)

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

Data is output one-sidedly from the **MM-140A** after the welding current has measured and a fault has occurred.

a. Monitor Data

Commands transmitted from the **MM-140A** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	nnn	001 to 031	3
4	Item code	S		1
5	Item number	01		2
6	Delimiter	:		1
7	Count	nnnnn	00000 to 99999	5
8	Delimiter	,		1
9	Peak current value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
10	Delimiter	,		
11	Peak current value	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
12	Delimiter	,		1
13	Effective current value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
14	Delimiter	,		1
15	Effective current value	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
16	Delimiter	,		1
17	Peak voltage value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
18	Delimiter	,		1
19	Peak voltage value	nnn.nV	000.0 to 120.0V	6
20	Delimiter	,		1

	Item	Display	Range	Length
21	Effective voltage value judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
22	Delimiter	,		1
23	Effective voltage value	nnn.nV	000.0 to 120.0V	6
24	Delimiter	,		1
25	Average external input (shield gas flow rate) input judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
26	Delimiter	,		1
27	Average external input (shield gas flow rate) input value	nn.n	00.0 to 99.9	4
28	Delimiter	,		1
29	Modulation frequency judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
30	Delimiter	,		1
31	Modulation frequency	nnnnHz	0000 to 3500Hz	6
32	Delimiter	,		1
33	Weld time judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
34	Delimiter	,		1
35	Weld time	nnnnms	0000 to 9999ms	6
36	Return code	[CR]	(0x0d)	1
37	Feed code	[LF]	(0x0a)	1

Communication example of single-directional communication (monitor data)

Monitor data of Device number 01 and Schedule number 1 (current range: 300 A) is transmitted to the **MM-140A**.

"**MM-140A** → Host computer"

!01001S01:00138,G,252.3A,G,249.8A,G,020.2V,G,016.4V,G,00.0,G,0000Hz,G,0153ms[CR][LF]

b. Error Data

The following data is output when the preset counter of the **MM-140A** is counted up or no-current error is detected.

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	nnn	001 to 031	3
4	Error transmitting code	E		1
5	Delimiter	:		1
6	Count	nnnnn	00000 to 99999	5
7	Delimiter	,		1
8	Error code	nn	13 (preset counter-up)	2
			15 (no-current error)	
9	Return code	[CR]	(0x0d)	1
10	Feed code	[LF]	(0x0a)	1

Communication example of single-directional communication (error data)

① The following data is transmitted from the **MM-140A** set to Device number 01 and Schedule number 1 when the preset counter is counted up

"**MM-140A** → Host computer"

!01001E:99999,13[CR][LF]

② The following data is transmitted from the **MM-140A** set to Device number 01 and Schedule number 1 when no-current error is detected.

"**MM-140A** → Host computer"

!01001E:99999,15[CR][LF]

(4) Communication Protocol (Bi-Directional Communication)

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

Monitor data can be read and schedule data can be read or written according to the command on the host computer side.

When the read/write command is sent from the host computer, the **MM-140A** sends back data.
Do not send the next command until the data is sent back or the timeout time passes when sending command.

When using write command, a newly set data is returned from the **MM-140A** for check. Compare the schedule of write command with that of the data sent back to check that it has been correctly changed.

When a wrong data is written, currently set value is returned for check. (When a part of telegraphic message is wrong, normal data is converted and sent back, and the wrong data returnes the setting value.)

a. Reading the Monitor Data

<Reading request data>

Commands transmitted from the host computer to the **MM-140A** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Schedule number	nnn	001 to 031	3
5	Item code	S		1
6	Item number	01		2
7	All contents	*		1
8	Return code	[CR]	(0x0d)	1
9	Feed code	[LF]	(0x0a)	1

Communication example) #01R001S01*

<Output data for reading request>

Commands transmitted from the **MM-140A** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	nnn	001 to 031	3
4	Item code	S		1
5	Item number	01		2
6	Delimiter	:		1
7	Count	nnnnn	00000 to 99999	5
8	Delimiter	,		1

	Item	Display	Range	Length
9	Peak current judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
10	Delimiter	,		
11	Peak current value	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
12	Delimiter	,		1
13	Effective current judgment	n	-: No judgment G: Normal U: Upper limit error L: Lower limit error O: Range over error	1
14	Delimiter	,		1
15	Effective current value	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
16	Delimiter	,		1
17	Peak voltage judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
18	Delimiter	,		1
19	Peak voltage value	nnn.nV	000.0 to 120.0V	6
20	Delimiter	,		1
21	Effective voltage judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
22	Delimiter	,		1
23	Effective voltage value	nnn.nV	000.0 to 120.0V	6
24	Delimiter	,		1
25	Average external input (shield gas flow rate) input judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
26	Delimiter	,		1
27	Average external input (shield gas flow rate) input value	nn.n	00.0 to 99.9	4
28	Delimiter	,		1
29	Modulation frequency judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
30	Delimiter	,		1
31	Modulation frequency	nnnnHz	0000 to 3500Hz	6
32	Delimiter	,		1

	Item	Display	Range	Length
33	Weld time judgment	n	U: Upper limit error G: Normal L: Lower limit error O: Range over error	1
34	Delimiter	,		1
35	Weld time	nnnnms	0000 to 9999ms	6
36	Return code	[CR]	(0x0d)	1
37	Feed code	[LF]	(0x0a)	1

Communication example of bi-directional communication (reading the monitor data)

Reading the monitor data of Device number 02 and Schedule number 3 (current range: 300 A)

"Host computer → **MM-140A**"

#02R003S01*[CR][LF]

"**MM-140A** → Host computer"

!02003S01:00138,G,252.3A,G,249.8A,G,020.2V,G,016.4V,G,00.0,G,0000Hz,G,0153ms[CR][LF]

b. Reading and Writing the Level Setting Data and System Setting Data

<Reading request data>

Commands transmitted from the host computer to the **MM-140A** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Schedule number	nnn	000 to 031	3
5	Item code	S		1
6	Item number	11		2
7	All contents	*		1
8	Return code	[CR]	(0x0d)	1
9	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-140A** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	000		3
4	Item code	S		1
5	Item number	11		2
6	Delimiter	:		1
7	Preset counter	nnnnn	00000 to 99999	5
8	Delimiter	,		1
9	Current range	n	0: 50 A 1: 300 A	1
10	Delimiter	,		1
11	Current trigger level	nn%	01 to 99%	3
12	Delimiter	,		1
13	Fall level (Weld time measurement end level)	nn%	01 to 99%	3
14	Delimiter	,		
15	Measurement end level	nn%	01 to 99%	3
16	Delimiter	,		1
17	External input (shield gas flow rate) trigger level	nn.n	00.0 to 99.9	4
18	Delimiter	,		1
19	Calculation start level	nn%	00%: OFF 01 to 99%	3
20	Delimiter	,		1
21	Modulation frequency measurement threshold level	nn.nnA nnn.nA	00.00 to 50.00A (50A range) 000.0 to 300.0A (300A range)	6

	Item	Display	Range	Length
22	Delimiter	,		1
23	Upper/lower limit I/O setting	n	0: HL 1 (upper/lower limit output to the same terminal) 1: HL 2 (upper/lower limit output to the separate terminals)	1
24	Delimiter	,		1
25	I/O open/close setting	n	0: HL nc (nc output) 1: HL no (no output)	1
26	Delimiter	,		1
27	Average external input (shield gas flow rate) measurement end extension time	nnnnnms	00000 to 20000ms	7
28	Delimiter	,		1
29	External input (shield gas flow rate) factor	n.n	0.1 to 9.9	3
30	Delimiter	,		1
31	Forced measurement time	nnms	00 to 99ms	4
32	Delimiter	,		1
33	External input stabilizing time setting	n	0: stabilizing time 1 ms 1: stabilizing time 10 ms	1
34	Delimiter	,		1
35	External output time	n	0: output time 10 ms 1: output time 100 ms 2: output time HOLD	1
36	Return code	[CR]	(0x0d)	1
37	Feed code	[LF]	(0x0a)	1

Communication example)
!01001S11:00010,1,50%,05%,05%,00.0,00%,000.0A,0,0,00000ms,0.4,01ms,1,1
(factory setting)

<Writing request data>

Commands transmitted from the host computer to the **MM-140A** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Write code	W		1
4	Schedule number	nnn	000 to 031	3
5	Item code	S		1
6	Item number	11		2
7	Delimiter	:		1
8 to 36	Same as 7 to 35 of <Output data for reading request>			
37	Return code	[CR]	(0x0d)	1
38	Feed code	[LF]	(0x0a)	1

Communication example of bi-directional communication
(reading and writing the level setting data and system setting data)

① Reading the level setting data and system setting data of Device number 01 (current range: 300 A)

"Host computer → **MM-140A**"

#01R000S11*[CR][LF]

"**MM-140A** → Host computer"

!01000S11:00000,1,50%,05%,05%,00.0,00%,000.0A,0,0,00000ms,0.4,01ms,1,1[CR][LF]

② Writing the level setting data and system setting data of Device number 03 (current range: 300 A)

"Host computer → **MM-140A**"

#03W000S11:00000,1,50%,05%,05%,00.0,00%,000.0A,0,0,00000ms,0.4,01ms,1,1[CR][LF]

"**MM-140A** → Host computer" (sent for check when the written data is within the setting range.)

!03000S11:00000,1,50%,05%,05%,00.0,00%,000.0A,0,0,00000ms,0.4,01ms,1,1[CR][LF]

c. Reading and Writing the Schedule Setting Data

<Reading request data>

Commands transmitted from the host computer to the **MM-140A** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Schedule number	nnn	001 to 031	3
5	Item code	S		1
6	Item number	10		2
7	All contents	*		1
8	Return code	[CR]	(0x0d)	1
9	Feed code	[LF]	(0x0a)	1

<Output data for reading request>

Commands transmitted from the **MM-140A** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	nnn	001 to 031	3
4	Item code	S		1
5	Item number	10		2
6	Delimiter	:		1
7	Weld time upper limit	nnnnms	0000 to 9999ms	6
8	Delimiter	,		1
9	Weld time lower limit	nnnnms	0000 to 9999ms	6
10	Delimiter	,		1
11	Measurement start time	nnnnms	0000 to 9999ms	6
12	Delimiter	,		1
13	Measurement end time	nnnnms	0000 to 9999ms	6
14	Delimiter	,		1
15	Measurement current PEAK/RMS	nn	00: PEAK 01: RMS	2
16	Delimiter	,		1
17	Effective current upper limit	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
18	Delimiter	,		1
19	Effective current lower limit	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
20	Delimiter	,		1
21	Peak current upper limit	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
22	Delimiter	,		1

	Item	Display	Range	Length
23	Peak current lower limit	nn.nnA nnn.nA	00.00 to 60.00A (50A range) 000.0 to 350.0A (300A range)	6
24	Delimiter	,		1
25	Measurement voltage PEAK/RMS	nn	00: PEAK 01: RMS	2
26	Delimiter	,		1
27	Effective voltage upper limit	nnn.nV	000.0 to 120.0V	6
28	Delimiter	,		1
29	Effective voltage lower limit	nnn.nV	000.0 to 120.0V	6
30	Delimiter	,		1
31	Peak voltage upper limit	nnn.nV	000.0 to 120.0V	6
32	Delimiter	,		1
33	Peak voltage lower limit	nnn.nV	000.0 to 120.0V	6
34	Delimiter	,		1
35	Average external input (shield gas flow rate) upper limit	nn.n	00.0 to 99.9	4
36	Delimiter	,		1
37	Average external input (shield gas flow rate) lower limit	nn.n	00.0 to 99.9	4
38	Delimiter	,		1
39	Modulation frequency upper limit	nnnnHz	0000 to 3500Hz	6
40	Delimiter	,		1
41	Modulation frequency lower limit	nnnnHz	0000 to 3500Hz	6
42	Return code	[CR]	(0x0d)	1
43	Feed code	[LF]	(0x0a)	1

<Writing request data>

Commands transmitted from the host computer to the **MM-140A** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	W		1
4	Schedule number	nnn	000 to 031	3
5	Item code	S		1
6	Item number	10		2
7	Delimiter	:		1
8 to 42	Same as 7 to 41 of <Output data for reading request>			
43	Return code	[CR]	(0x0d)	1
44	Feed code	[LF]	(0x0a)	1

Communication example of bi-directional communication
(reading and writing the schedule setting data)

① Reading the schedule setting data of Device number 01 and Schedule number 1 (current range: 300 A)

"Host computer → **MM-140A**"

#01R001S10*[CR][LF]

"**MM-140A** → Host computer"

!01001S10:5000ms,0000ms,0000ms,0000ms,01,350.0A,000.0A,350.0A,000.0A,01,120.0V,000.0V,120.0V,000.0V,10.0,00.0,3000Hz,0000Hz[CR][LF]

② Writing the schedule setting data of Device number 02 and Schedule number 1 (current range: 300 A)

"Host computer → **MM-140A**"

#02W001S10:5000ms,0000ms,0000ms,0000ms,01,350.0A,000.0A,350.0A,000.0A,01,120.0V,000.0V,120.0V,000.0V,10.0,00.0,3000Hz,0000Hz[CR][LF]

"**MM-140A** → Host computer" (sent for check when the written data is within the setting range.)

!02001S10:5000ms,0000ms,0000ms,0000ms,01,350.0A,000.0A,350.0A,000.0A,01,120.0V,000.0V,120.0V,000.0V,10.0,00.0,3000Hz,0000Hz[CR][LF]

d. Reading the Communication Setting Data

<Reading request data>

Commands transmitted from the host computer to the **MM-140A** is as follows:

	Item	Display	Range	Length
1	Start code	#		1
2	Device number	nn	01 to 31	2
3	Read code	R		1
4	Schedule number	nnn	001 to 031	3
5	Item code	S		1
6	Item number	20		2
7	All contents	*		1
8	Return code	[CR]	(0x0d)	1
9	Feed code	[LF]	(0x0a)	1

Communication example) #01R001S20*

<Output data for reading request>

Commands transmitted from the **MM-140A** to the host computer is as follows:

	Item	Display	Range	Length
1	Start code	!		1
2	Device number	nn	01 to 31	2
3	Schedule number	nnn	001 to 031	3
4	Item code	S		1
5	Item number	20		2
6	Delimiter	:		1
7	System	n	0: OFF 1: ETHERNET1 2: ETHERNET2	1
8	Delimiter	,		1
9	Device number	nn	01 to 31	2
10	Delimiter	,		1
11	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
12	Delimiter	,		1

	Item	Display	Range	Length
13	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
14	Delimiter	,		1
15	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
16	Delimiter	,		1
17	Pirt number	nnnn	1024 to 5000	4
18	Return code	[CR]	(0x0d)	1
19	Feed code	[LF]	(0x0a)	1

Communication example bi-directional communication
(reading the communication setting data)

① Reading the communication setting data of Device number 01

"Host computer → **MM-140A**"

#01R000S20*[CR][LF]

"**MM-140A** → Host computer"

!01000S20:2,01,192␣168␣␣␣1␣␣10,255␣255␣255␣␣␣0,192␣168␣␣␣1␣100,1024[CR][LF]

(Note) "␣" indicates a space.

9. Fault Code List

The **MM-140A** 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. If E-01 is displayed when the power supply switch is turned on, the **MM-140A** may have been broken. Consult us.
E-02 (Mode display)	Trouble of the sub memory (FeRAM)	Depress the operation button. If E-02 is displayed when the power supply switch is turned on, the **MM-140A** may have been broken. Consult us.
E-03 (Mode display)	Current trigger error The current trigger signal continues to be detected.	If, after measurement, the current trigger continues to be applied, bring the current trigger down below the trigger level after measurement. If the error is not eliminated, the **MM-140A** needs repair. Please contact 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 again, repair is required. 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-140A** for the purpose other than the external input/output signal.

Fault code (Display name)	Cause	Measures
EEEE (Welding current display or weld time/external input (shield gas flow rate) display)	The measured welding current or torch voltage/weld time has exceeded the measurable range.	Welding current: Check the current range. External input (shield gas flow rate): Check that the external input (shield gas flow rate) factor. Also, check that the shield gas flow sensor is working normally. Weld time: Check the fall level. Welding current and voltage: Check whether the welding power supply is working normally. The error can be released by depressing the operation button.

About the retry function at a high-voltage start of the welding power supply **MAWA** series
When the retry function at a high-voltage start of the **MAWA** series works, the current at the time of retry may be measured according to the current trigger threshold and forced measurement time. In that case, even when the **MAWA** welding power supply displays GOOD, the **MM-140A** becomes NG in the upper/lower limit judgment. Adjust it by the current trigger threshold and forced measurement time.

10. Specifications

(1) Measurement Specification

Target	Specification	
Current	Measurement range	[Each schedule] ・01.00–50.00 A ・015.0–300.0 A
	Measurement item	[Common to all schedules] ・Peak value Peak value within weld section (all sections) ・Effective value Effective value between start and end
	Measurement accuracy	±2% (full scale) (excluding sensor error)
	Detection method	DC current sensor (hall current detection)
Voltage *	Measurement range	001.0–120.0 V
	Measurement item	[Common to all schedules] ・Peak value Peak value within weld section (all sections) ・Effective value Effective value between start and end
	Measurement accuracy	±2% (full scale)
Weld time	Measurement range	0000–9999 ms (±3 ms)
	Measurement item	Full weld time between the current measurement start and the end
	Upper/lower limit judgment	0000–9999 ms
External input (shield gas flow rate)	Measurement range	00.0–10.0 (4–20 mA)
	Measurement time	00000–50000 ms (±3 ms)
	Measurement item	[Common to all schedules] ・Average value Average value of between start and end
	Measurement accuracy	±2% (full scale) (excluding sensor error)
	Detection method	General input of 4–20 mA
Modulation frequency	Measurement range	0–3000 Hz (reference due to sampling performance)

Judgment function	Upper/lower limit judgment of current (31 schedules) Upper/lower limit judgment of voltage (31 schedules) Upper/lower limit judgment of weld time (31 schedules) Upper/lower limit judgment of external input (shield gas flow rate) (31 schedules) Upper/lower limit judgment of modulation frequency (31 schedules) No-current judgment
Preset counter	[Common to all schedules] Good counter (00000–99999)
Communication	Type [Common to all schedules] Ethernet (TCP/IP)
	System [Common to all schedules] ・Single-directional communication ・Bi-directional communication
	IP address [Common to all schedules] 000.000.000.000–255.255.255.255
	Device No. 01–31
	Communication item [Common to all schedules] Single-directional communication ・Error data (device error) ・Monitor data Bi-directional communication ・Error data (device error) ・Monitor data ・Schedule setting

* Cannot be measured in the high-voltage start model.

(2) Specification of the MM-140A

Item		Specification
Display contents		Welding current, torch voltage (touch-start model only), weld time, external input (shield gas flow rate), modulation frequency
Input signal		Signal Refer to **[5. Interface]**. Contacts, NPN transistors (sink type), and PNP transistors (source type) can be connected.
		Input stabilizing time [Common to all schedules] ・1 ms ・10 ms
Output signal		Signal Refer to **[5. Interface]**. Photo-MOS relay output: Contact capacity 24 V DC, 20 mA
		Output setting [Common to all schedules] ・NORMAL OPEN ・NORMAL CLOSE * Contact capacity: 24 V DC, 20 mA * Upper/lower limit judgment error, error output
		Output time [Common to all schedules] ・10 ms ・100 ms ・HOLD
External data output		Ethernet (protocol:TCP/IP)
Number of schedules		31 schedules
Rated input voltage		Single-phase 90–250 V AC (50/60 Hz), 24 V DC ±10%
Power consumption		17 W
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 250 mm (D) (excluding protrusions)
Mass		Approx. 2.3 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.

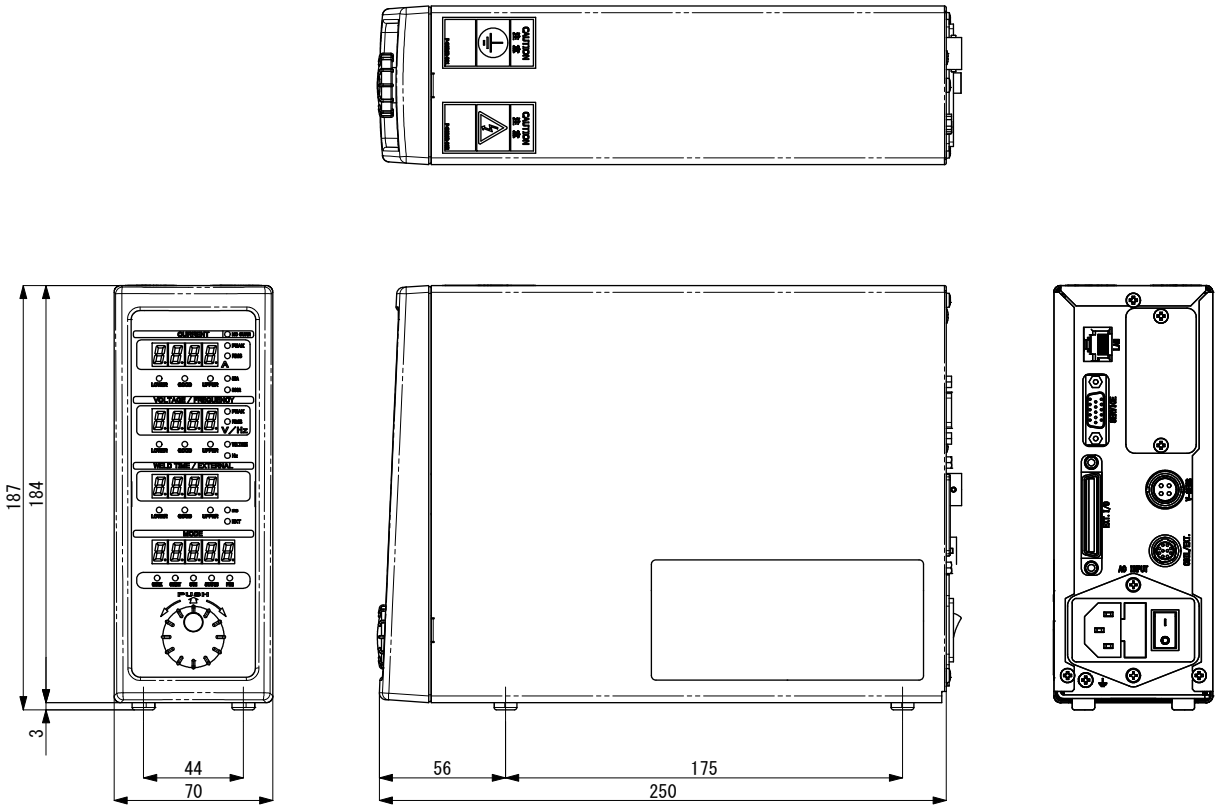
11. Calibration

Regular calibration is required to maintain the **MM-140A** performance.
Calibration is conducted at our facility.
For calibration, please send your current sensor together with the **MM-140A**. Depending on the operating environment, the extent of deterioration varies from one **MM-140A** to another. Therefore, the **MM-140A** must be calibrated together with the current sensor as a set.
For more information about calibration, contact us.

12. Outline Drawing

(1) Body

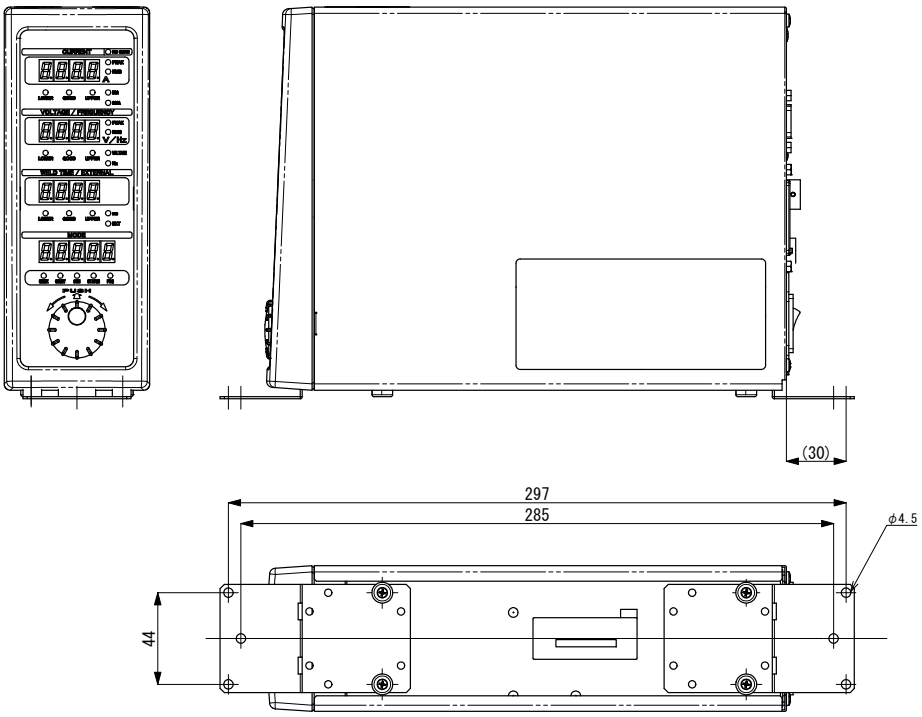
(Dimensions in mm)



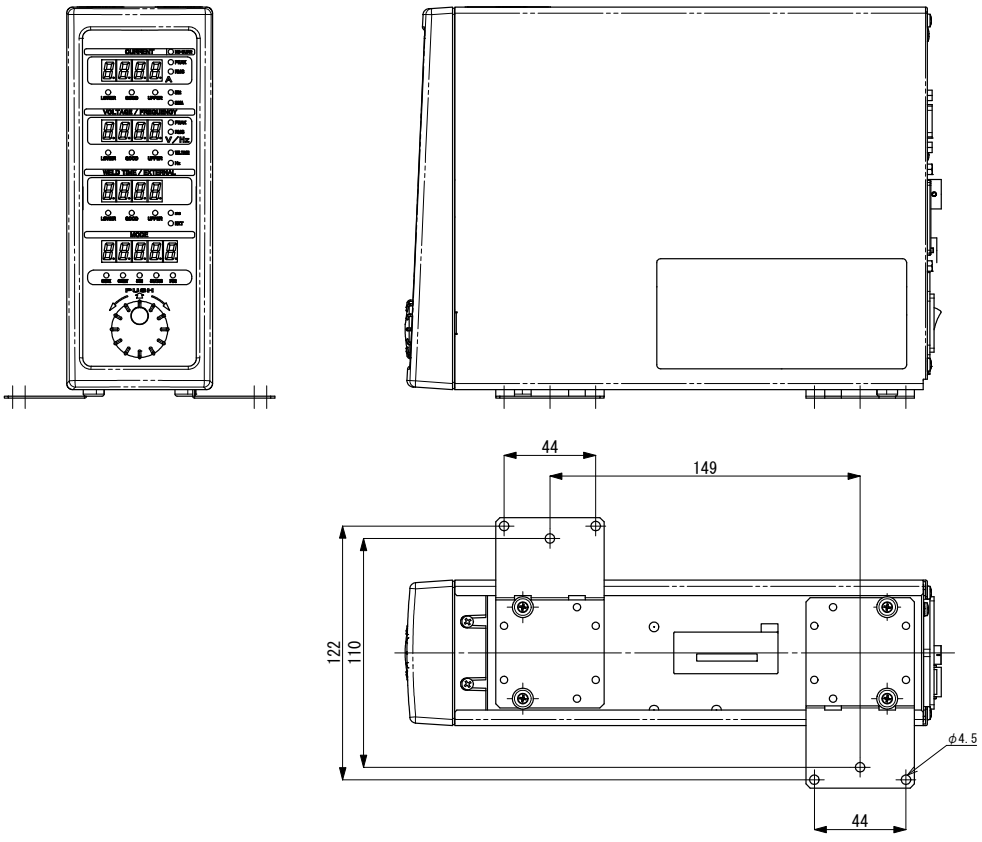
(2) Drawings for Mounting Bracket

(Dimensions in mm)

a. Front and Rear Mounting

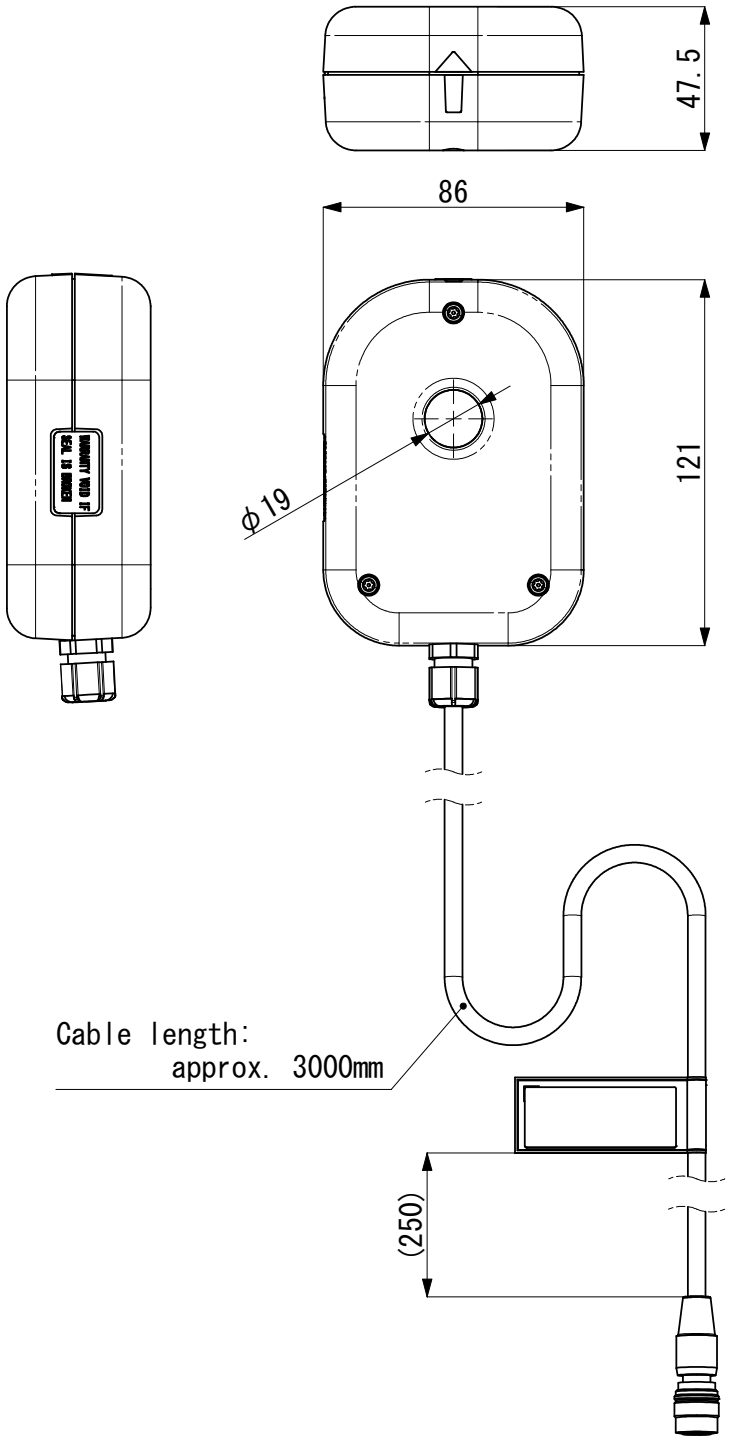


b. Right and Left Mounting



(3) Current Sensor (Common to RS-C300-3000/RS-C050-3000)

(Dimensions in mm)



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CE

AMADA WELD TECH CO., LTD.

EU Declaration of Conformity

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

Herewith declares in his own sole responsibility conformity of the product

Designation: **Pulsed TIG Weld checker**

Types/Serial Number, etc.: **MM-140A-00-00**

With applicable regulations below

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

Harmonized European/International Standards applied:
ISO 12100 : 2010
ISO 13849-1 : 2015
ISO 61010-1 : 2010+A1 : 2016
IEC 61326-1 : 2020

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

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

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

2021. 5. 18

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

T. Jingu

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

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

64G091-07-5