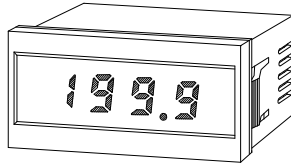


INSTRUCTION MANUAL

DIGITAL PANEL METER

MODEL AP-101 Series



Warning

Incorrect handling may cause death or injury.



Attention



The mark on the label indicates the measuring range in the specification of item 1.



Do not disassemble or touch the interior while the power is ON.
This may cause an electric shock.



Caution

- (1) The application of voltage or current exceeding its maximum allowable value to the input terminals may result in instrument damage.
- (2) The supply of power out of its allowable range may cause fire, electric shock or instrument failure.
- (3) The content of this manual may subject to change without prior notice for product improvement.
- (4) This manual is carefully prepared. However, if any question arises, or any mistake, omission or suggestion is found in the content of this manual, contact your nearest our sales agent.
- (5) Make this manual available easily anytime.

On the AP-101, connect the control inputs (HOLD, Decimal point) to base-isolated devies when the input signal is 70V DC or more.

1. Specifications

●DC Voltage Measurement

Model & Range Code	Measuring Range	Maximum Resolution	Input Impedance	Maximum Allowable Input voltage
AP-101-11	$\pm 199.9\text{mV}$	$100\text{ }\mu\text{V}$	$100\text{M}\Omega$	$\pm 250\text{V}$
AP-101-12	$\pm 1.999\text{V}$	1mV	$100\text{M}\Omega$	$\pm 250\text{V}$
AP-101-13	$\pm 19.99\text{V}$	10mV	$10\text{M}\Omega$	$\pm 250\text{V}$
AP-101-14	$\pm 199.9\text{V}$	100mV	$10\text{M}\Omega$	$\pm 500\text{V}$
AP-101-15	$\pm 700\text{V}$	1V	$10\text{M}\Omega$	$\pm 700\text{V}$

Accuracy: $\pm (0.1\% \text{ of rdg} + 1\text{digit})$ (at $23^\circ\text{C} \pm 5^\circ\text{C}$ 35 to 85% RH)
[$\pm (0.3\% \text{ of rdg} + 1\text{digit})$ only for AP-101-15]

●DC Current Measurement

Model & Range Code	Measuring Range	Maximum Resolution	Internal Resistance	Maximum Allowable Current
AP-101-21	$\pm 199.9\text{ }\mu\text{A}$	100nA	$1\text{k}\Omega$	$\pm 10\text{mA}$
AP-101-22	$\pm 1.999\text{mA}$	$1\text{ }\mu\text{A}$	100Ω	$\pm 50\text{mA}$
AP-101-23	$\pm 19.99\text{mA}$	$10\text{ }\mu\text{A}$	10Ω	$\pm 150\text{mA}$
AP-101-24	$\pm 199.9\text{mA}$	$100\text{ }\mu\text{A}$	1Ω	$\pm 500\text{mA}$
AP-101-25	$\pm 1.999\text{A}$	1mA	0.1Ω	$\pm 3\text{A}$

Accuracy: $\pm (0.2\% \text{ of rdg} + 1\text{digit})$ (at $23^\circ\text{C} \pm 5^\circ\text{C}$ 35 to 85% RH)
[$\pm (0.3\% \text{ of rdg} + 1\text{digit})$ only for AP-101-25]

●Model Configuration

(Example)

AP-101-11-1

Power supply

1. AC 90V to 132V
2. AC180V to 264V
3. DC 5V
4. DC24V

Range code

11. $\pm 199.9\text{mV}$
12. $\pm 1.999\text{V}$
13. $\pm 19.99\text{V}$
14. $\pm 199.9\text{V}$
15. $\pm 700\text{V}$
21. $\pm 199.9\text{ }\mu\text{A}$
22. $\pm 1.999\text{mA}$
23. $\pm 19.99\text{mA}$
24. $\pm 199.9\text{mA}$
25. $\pm 1.999\text{A}$

Series

Basic Model

The above standards do not apply to the panel meter with "15 range".

2. Common Specifications

Measuring function	: DC voltage measurement, DC current measurement Specify one model from among 9 models.
Operation method	: Dual slope integration
Input circuit	: Single-ended type
Input bias current	: 50pA(Typical)
Sampling speed	: 2.5 times/sec.
Noise elimination	: NMR 40dB TYP(50/60Hz)
Max. No. of display digits	: 1999
Overrange alarm	: 1999 or -1999 flashes when an input exceeding the maximum display range is applied.
Display	: LED(Light Emitting Diode numeric element) Height; 14.2mm red
Polarity	: Automatic Polarity selection
Polarity display	: " - " is displayed automatically if input signal becomes negative.
External control	: • External display hold A negative signal of 0V or a contact signal. • External start A positive pulse from 0V to +5V for more than 400ms. or a contact signal(open)
Decimal point	: Settable to any digit position
Operating temperature/humidity	: 0 to 50°C /35 to 85%RH (Nodew-Condense)
Storage temperature	: -10 to 70°C , 60%RH max.
Power supply	: For AC, 90V to 132V 50/60Hz 2.0VA (MAX.) (at 100V) 180V to 264V For DC, 5V DC $\pm 5\%$ 150mA(MAX) Isolated 24V DC $\pm 20\%$ 40mA(MAX) Isolated
Dimensions	: 96mm(W) \times 48mm(H) \times 73mm(D)
Weight	: For AC; Approx. 150g(Mainframe) For DC; Approx. 85g(Mainframe)
Dielectric strength	: For AC; 2100VAC for 1 minute between power supply terminal and input terminal/COMMON For DC; DC $\pm 500\text{V}$ between input (LO) terminal and power terminal(0V)
Insulation resistance	: More than $100\text{M}\Omega$ at 500VDC between power terminal and input terminal
Accessories	: Instruction manual, connector
Standards	: EN61326-1 EMI:Class A EMS:Industrial locations ※Cable length:30m or less ※In the case of DC drive DC power supply port: DC connections between parts of equipment EN61010 The above standards do not apply to the panel meter with "15 range". EN IEC 63000
Setup enviroment	: Installation category II, Pollution degree2 (ICE1010-1)
Altitude	: 2000m max.

3. Operation

- 3-1 General cautions and preparation prior to operation
- 1) This instrument should be used at an ambient temperature of 0 to 50°C and a humidity of 80% or less, paying special attention to dew condensation.
 - 2) It must be used at a location free of dust.
 - 3) Care should be taken to prevent vibration and shock.
 - 4) Noise

(a) Electric circuit

Because it is difficult for such a small instrument as this to accommodate a perfect noise prevention circuit, use a surge absorbing circuit such as an external line filter or varistor to prevent excess surge when the instrument is used at a location where lightening frequently occurs or magnetic switches are likely to be actuated on the same power line.

(b) Shielding

If noise causes a problem, connect the E terminal(11) for AC, or the power 0V terminal(17) for DC to the ground or equipment grounding terminal.

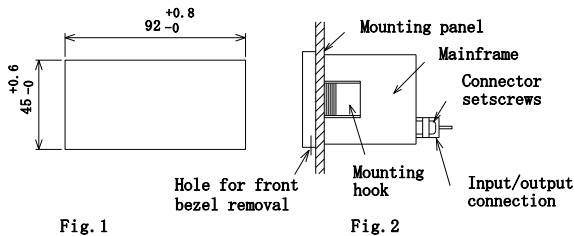
If space induction causes a problem, it can be prevented by covering the instrument case with a metal plate.

3-2 Mounting

1) Panel mounting

Make a rectangular cutout as shown in Fig.1, insert the instrument in the panel as shown in Fig.2, and then fully push the instrument into the panel.

(It is recommended that panel thickness be from 0.8 to 5mm)



3-3 Connector connection

Insert the attached input/output connector in the rear of the panel meter. The connector is provided with an incorrect insertion prevention key, so it is easy to make sure that it is not connected upside down. After insertion, tighten the both sides with the attached screws.

1) Power connection

For AC, connect power to terminals 16 to 18, operate the instrument at a power supply voltage of 90 to 132V or 180 to 264V.

Because the meter also has no fuse, install a fuse (for 0.2A) outside of the meter, if necessary.

For DC, connect power to terminals 17 to 18, Power variation in this case is 5V DC±5% or 24V DC±20% (Because this instrument is not provided with a power supply switch, it starts operating when power is supplied.)

2) Decimal-point setting

The decimal point can be freely set to the desired position when the following connector terminals are shorted. However, because the decimal point is not set prior to shipment, it must be set at the appropriate position by the customer.

Decimal point at 1 0³ digit

Decimal point at 1 0² digit

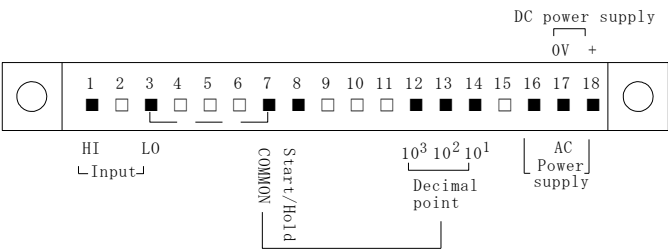
Decimal point at 1 0¹ digit

Decimal point lit	Connector Terminal Nos. connected
10 ¹	14-7
10 ²	13-7
10 ³	12-7

3) Input connection

Connect an input signal (DC voltage or DC current to terminals 1 to 3. Use a 2-core shielded cable and connect the shield to the input LO side at one point near the signal source.

● Connector Connection Diagram



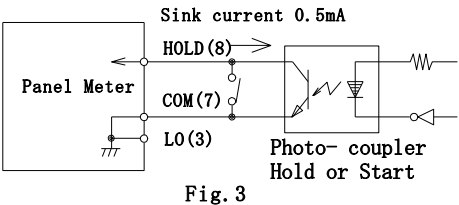
Note: Input LO and COMMON have the same potential.

△ marks indicate vacant terminals, but do not use them as junction terminals.

4) Display hold and external start

Displayed value is hold to the value just after the hold (No. 8) and COMMON (No. 7) terminals are shorted. In addition, measurement starts when these terminals are opened at the necessary timing. {Positive pulse from 0V to +5V for more than 400ms, or contact signal (open)}

The minimum time required for one measurement is about 400 ms. In addition, as the input (LO) and COMMON (7) terminals are connected and not DC-isolated, use a mechanical contact signal such as a relay or switch for control as much as possible. When performing control by TTL. Or transistor, and such an external circuit in Fig.3. (This circuit is absolutely necessary for isolation when the input is floated.)



5) COMMON terminal

This is the digital circuit COMMON terminal (No. 7) which is internally connected to the LO terminal. However, do not connect the digital circuit to the LO terminal to prevent measurement error.

4. Maintenance

4-1 Caution for maintenance

The storage temperature of this instrument should be between -10°C and +70°C at a relative humidity of 60% or less.

As the instrument case and bezel are made of molded plastic, do not use a volatile liquid such as thinner to clean them.

5. Warranty

This meter is warranted for a period of one year from date of delivery. Any defect which occurs in this period and is undoubtedly caused by Watanabe's faults will be remedied free of charge.

This warranty does not apply to the meter showing abuse or damage which has been altered or repaired by others except as authorized by Watanabe Electric Industry.

6. After-sale Service

This meter is delivered after being manufactured, tested and inspected under strict quality control.

However, if any problem does occur, contact your nearest Watanabe sales agent giving as much information on problem as possible.