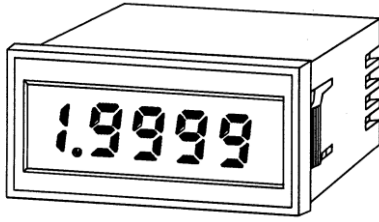


# INSTRUCTION MANUAL

## Digital Panel Meter

### MODEL AP-141 Series



#### 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) The 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) After read this manual, please keep it as anytime can see.

#### 1. OUTLINE

The AP-141 Series digital panel meter conforms to standard dimension DIN and uses a highly reliable 4-1/2 digit, one tip LSI. Power supply is 90 to 132V or 180 to 264V (AC jumper wire selection), and the 5V drive meter's input terminal L0 and 5V power terminal are isolated. The display has large LED elements (Height:14.2mm) and can show 3 voltage range which can be changed through internal socket selection. The meter uses the dual integration method, and has high impedance low bias current, automatic zero adjustment circuit, automatic polarity selection and hold functions.

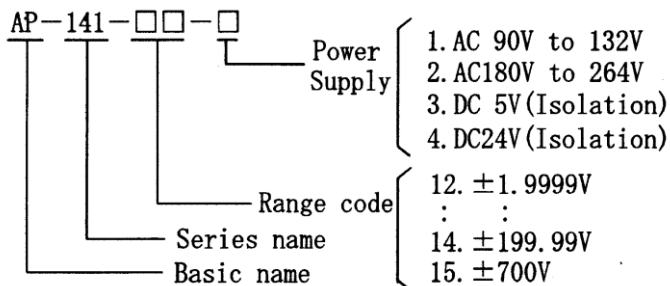
#### 2. SPECIFICATIONS

##### ■DC Voltage Measurement

Model and Range Codes	Measured Range	Max. Resolution	Input Impedance	Max. Allowable Input Voltage
AP-141-12	$\pm 1.9999V$	$100 \mu V$	$100M\Omega$	$\pm 100V$
AP-141-13	$\pm 19.999V$	$1mV$	$1M\Omega$	$\pm 250V$
AP-141-14	$\pm 199.99V$	$10mV$	$1M\Omega$	$\pm 500V$
AP-141-15	$\pm 700.0V$	$100mV$	$10M\Omega$	$\pm 700V$

Accuracy:  $\pm (0.03\% \text{ of rdg} + 1\text{digit})$  ( $23^\circ C \pm 5^\circ C$  35 to 85% RH)

##### ■Model Configuration



#### 3. COMMON SPECIFICATION

Measurement Function	: DC voltage measurement (Range 12, 13 and 14 can be selected by changing internal sockets.)
Operation Method	: Dual slope integration
Input Circuit	: Single ended (5V DC power is isolated.)
Input Bias Current	: 100pA (Typical)
Sampling Speed	: 2.5 times/sec.
Normal Mode Rejection Ratio	: More than 50dB (50/60Hz)
Maximum Display	: 19999

Overrange Alarm	: When inputs exceed the maximum display 0000 or -0000 flashes.
Display	: LED (Light Emitting Diode) numeric element Height: 14.2mm red
Polarity	: Automatic polarity selection.
Polarity Display	: When input signal is negative, a - sign is displayed automatically.
External Control	: External hold Negative signal 0V contact signal. External start. From 0V to a positive pulse of +5V for more than 1 ms, or contact signal.
Decimal Point	: Settable to any position.
Working Temperature	: 0 to 50°C, 35 to 85%RH (Nodew-Condense)
Power Supply	: For AC, 90 to 132V AC 50/60Hz, Approx. 2VA (at 100V) 180 to 264V AC (Jumper wire selection.) For DC, DC 5V $\pm 5\%$ 140mA (TYP)
Dimensions	: 96mm (W) $\times$ 48mm (H) $\times$ 73mm (D)
Weight	: AC; approx. 160g (Mainframe) DC; approx. 92g (Mainframe)
Dielectric strength	: AC Between input (L0) and grounding (E); DC $\pm 500V$ Power terminal, and COM; 1 minutes at 1500V AC, each. DC Between input terminal (L0) and power terminal (0V); DC $\pm 500V$ .
Insulation Resistance	: Between power terminal and grounding (E); More than 100M $\Omega$ at 500V DC.
Accessories	: Connector, Connector setscrews, Instruction manual,

#### 4. HANDLING

##### 4-1 Preparation Prior to Operation and General Precautions

- 1) Use this meter only where ambient temperature is 0 to 50°C and humidity is less than 85%, and pay special attention to dew condensation.
- 2) Use the meter only in absence of dust, chemicals and gases harmful to electronic parts.
- 3) Do not subject the meter to shock or vibration.
- 4) Noise

##### a) Power circuit

It is actually impossible to assemble a perfect noise prevention circuit in such a small meter. Therefore, use a surge absorption circuit such as an external line filter or baristor to prevent excess surge when the meter is used when magnetic switch is actuated in same line or at locations where frequent lightning occurs.

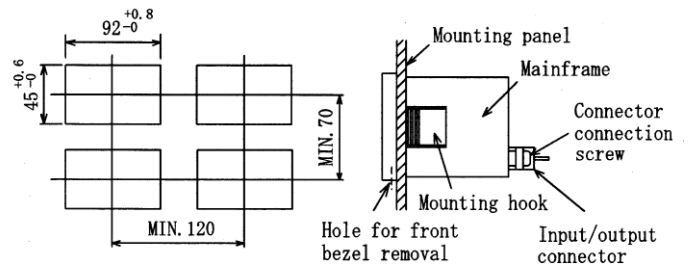
##### b) Shielding

If noise becomes a problem, connect terminal E (15) for AC, or 0V terminal (17) for DC, to the earth or the device grounding terminal. Also if space induction causes a problem, cover the molded meter case with a metal plate.

##### 4-2 Mounting

##### 1) Panel Mounting

Make a panel cutout as shown in Fig. 1, then insert the meter into the panel from the front as shown in Fig. 2 and push it into the panel. (Panel thickness: 0.8 to 5mm)



[Fig. 1]

[Fig. 2]

##### 2) Removal of internal printed circuit board

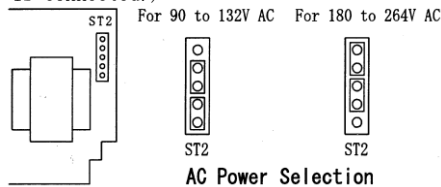
Insert a screwdriver into two holes in the bottom of the meter, then twist it to remove the front bezel. Next, pull the printed board out from the rear while expanding the front case.

## 4-3 Connector Connection

Connect the attached input/output connector to the female plug at the meter near. Since the connector is provided with the wrong insertion prevention key, do not connect it upside down. After inserting the connector, tighten both ends using the attached screws.

## 1) Power connection

For AC, connect the power to connector the terminal Nos.16 and 18. Use a supply voltage of 180 to 264V can be used by select. For DC, connect the power to connector terminal Nos. 17 and 18, using a power supply voltage of 5V DC $\pm$ 5%. (Since the meter is not provided with a power switch, it is ready to use as soon as power is connected.)



## 2) Decimal-point setting

Any decimal-point can be set by connecting between terminals shown below.

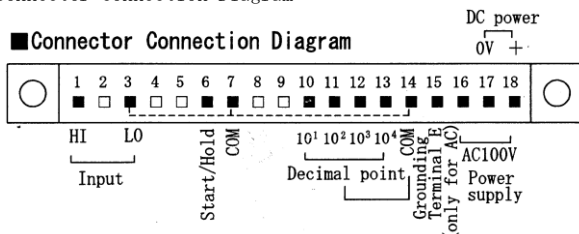
Although the decimal-point is not set to any specific position prior to shipment, any decimal-point position can be set by shorting the following connector terminals on site by the customer.

Decimal Point to be Lit	Connector Terminal Nos. Connected
10 <sup>1</sup>	10-14
10 <sup>2</sup>	11-14
10 <sup>3</sup>	12-14
10 <sup>4</sup>	13-14

## 3) Input connection

Connect an input signal (DC voltage) to terminal Nos.1 and 3. Use a 2-core shielded cable to connect a shielded wire to input terminal L0 at one point on the signal source side. If induction noise causes a problem, connect grounding terminal E to the earth or case.

## ■ Connector Connection Diagram



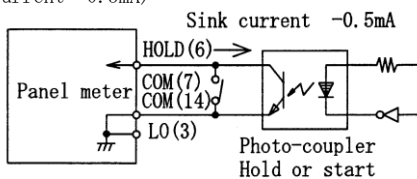
Note: Inputs L0 and COM have the same potential.

## 4) Hold and external start

The displayed value can be held by shorting the HOLD terminal (NO. 6 with the COM terminal (NO. 7 and 14), or by setting the HOLD terminal to level "0". Measurement also starts by opening these terminals or setting the HOLD terminal to level "1" at the necessary timing. [The necessary minimum time to measure a positive pulse] from 0V to +5V for more than 1ms or contact signal (open) once is about 400ms.]

Input terminal (LO) and COM (7 and 14) are so connected that they are not DC-isolated. Therefore, use a mechanical much as possible. When controlling with TTL or transistors add an external circuit as shown in Fig.3. (This circuit is always necessary for isolation when the input is floated.)

(Level "0" 0 to 1.5V, Level "1" 3.5 to 5V, Sink current -0.5mA)



[Fig. 3]

## 5) Common terminals

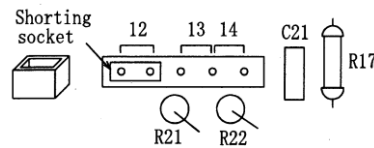
Common terminals for the digital circuit are Nos.7 and 14. They are connected to input terminal L0 internally, but do not wire L0 to the digital side, as this may result in meter malfunction.

## 6) Grounding terminal (For AC drive)

Grounding terminal E (No. 15) is connected to input terminal L0 and COM terminals via a 4700PF (withstanding voltage:500V). If noise causes a problem, connect grounding terminal E to the earth or the case.

## 7) Range change

The ranges of AP-101-12, 13 and -14 can be changed by pulling out the internal printed circuit board in accordance with Item near 4.2-2), then changing the position of the 2-core shorting socket near the connector as shown in the following.



Pull out the shorting socket as shown in the Fig, then insert it in any position from 12 to 14.

Diagram of socket at the rear of the printed circuit-board

When the range is changed, calibrate the meter in accordance with Item 5.2.

## 5. MAINTENANCE and INSPECTION

## 5-1 Caution

Store the meter where ambient temperature is between -10°C and +70°C, and humidity is less than 60%. When using this meter at a location with dust, occasionally remove the meter mainframe from the case to remove dust. (Temperature increase in the internal parts may shorten meter life.)

Since the bezel is made of plastic, do not wipe stains off with volatile liquids such as thinners.

## 5-2 Calibration

① In order to assure the initial accuracy over a period of time, it is recommended that the meter be calibration periodically. When the meter is calibrated, it is necessary to use standard equipment with an accuracy of 0.01% or less.

② Calibration procedures are as follows:

(1) Remove the front bezel.

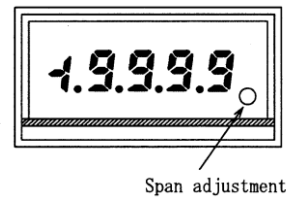
(2) Connect the power to the meter for a warm up of 20 minutes or more prior to adjustment.

(3) Zero adjustment

Short input terminals HI and LO to check that the display shows 0000.

(4) Span adjustment

Apply voltage with +polarity to the input corresponding to the fullscale(19900), then turn the span adjuster VR until the display shows 19900. Next, apply voltage with -polarity to check that the display shows the value of -19900 $\pm$ 0.03% rdg  $\pm$ 1digit.



## 6. 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 Electric Industry 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.

## 7. 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 Electric Industry sales agent or Watanabe Electric Industry directly giving as much information on problem as possible.

**watanabe**

WATANABE ELECTRIC INDUSTRY CO., LTD.

6-16-19, Jingumae, Shibuya-ku, Tokyo 150-0001, Japan

Phone: (81)3-3400-6141

Homepage <http://www.watanabe-electric.co.jp/en/>