

INSTRUCTION MANUAL

MODEL AP-142 SERIES

DIGITAL PANEL METER



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-142 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 130V or 180 to 260V 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 4 voltage ranges (For codes 12, 13 and 14, range can be selected through internal socket selection). The meter uses the dual-intergration method, and has high impedance low bias current, automatic zero adjustment circuit, automatic polarity selection and hold functions.

This meter can also be provided with a BCD parallel output board for system assembling. The output board uses a custom gate array and has isolated parallel output, try state control and a hold function. The meter can also output negative logic by selecting the appropriate internal soldered jumper wire.

2. SPECIFICATIONS

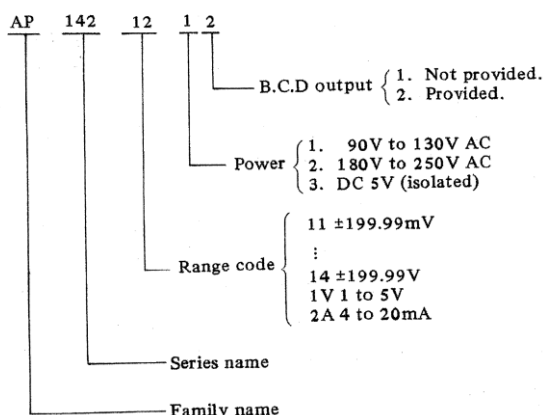
■DC Voltage Measurement

Model and Range Codes	Measured Range	Max. Resolution	Input Impedance	Max. Allowable Input Voltage
AP-142-11	$\pm 199.99\text{mV}$	$10\mu\text{V}$	$100\text{M}\Omega$	$\pm 250\text{V}$
AP-142-12	$\pm 1.999\text{V}$	$100\mu\text{V}$	$100\text{M}\Omega$	$\pm 250\text{V}$
AP-142-13	$\pm 19.999\text{V}$	1mV	$1\text{M}\Omega$	$\pm 250\text{V}$
AP-142-14	$\pm 199.99\text{V}$	10mV	$1\text{M}\Omega$	$\pm 500\text{V}$

Accuracy: $\pm 0.03\%$ rdg +1digit at $23^\circ\text{C} \pm 5^\circ\text{C}$

■Model Configuration

(Example)



3. COMMON SPECIFICATIONS

Measurement Function	: DC voltage measurement (Range 12, 13 and 14 codes can be selected by changing the internal sockets.)
Operation Method	: Dual slope integration
Input Circuit	: Single-ended (codes 11, 12, 13 and 14) Differential input (code, 12) (optional)
Input Bias Current	: 100pA (Typical)
Sampling Speed	: 2.5 times/sec.
Noise Rejection Ratio	: More than 50dB (NMR) (50/60Hz)
In-phase Voltage	: For differential input of $\pm 1\text{V}$ (Max.)
Max. Number of Display Digit	: 19999
Overrange Alarm	: For input signal exceeding maximum display; 0000 flashes for each digit.
Display	: LED (Light emitting diode) Numeric element Height: 14.2mm
Polarity Display	: When input signal is negative, a - sign is displayed automatically.
Output:	: Parallel BCD 1-2-4-8 (Positive logic), Negative is also available
Date output;	: TTL level, fan out 2
Polarity output;	: For (+) input voltage, Logic 1
Overrange output;	: TTL level, fan out 2
Print-out command output;	: When the display exceeds 19999 due to excessive input, logic 1
External Control	: TTL level, fan out 2
External hold;	: At the measurement end plus pulse is about 1ms wide
Working Temperature	: 0 to 50°C
Power	: AC, 90 to 130V AC Approx. 2VA (at 100V) 180 to 260V AC (via internal jumper wire selection) DC, 5V DC $\pm 5\%$ 140mA (Max.)
Dimensions	: 48mm (H) $\times$ 96mm (W) $\times$ 73mm (D) (DIN size)
Weight	: Approx. 160g (For AC) Approx. 92g (For DC)
Dielectric strength	: AC; Between input (L0) and grounding (E); DC $\pm 500\text{V}$ Power terminal, and input terminal, grounding (E) and COMMON; 1 minutes at 1500V AC, each. DC; Between input terminal (L0) and power terminal (0V); DC $\pm 300\text{V}$.
Insulation Resistance	: Between power terminal and grounding (E); More than $100\text{M}\Omega$ at 500V DC.
Accessories	: Connector, Connector setscrews, Instruction manual,
Option	: Contact us for measuring, scaling and unit displays other than standard voltage and current ranges.

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 the same line or at locations where frequent lightning occurs.

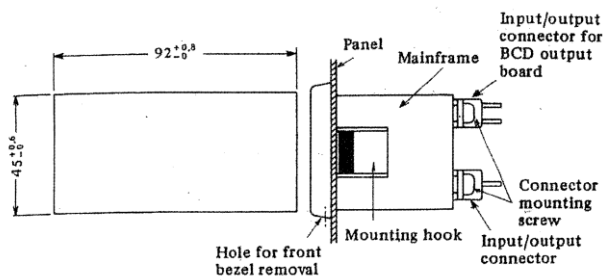
b) Shielding

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

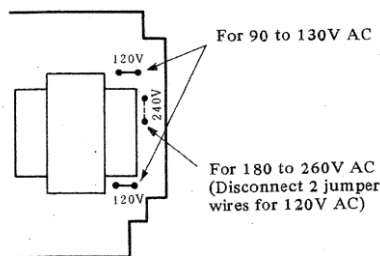
Insert a screwdriver into two holes in the bottom of the meter, then twist it to remove the front bezel. Next, pull the printed board out from the rear while expanding the case front.

4-3 Connector Connection

Connect the attached input/output connector to the female plug at the meter rear. 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 90 to 130V, although 180 to 260V can be used by selecting the appropriate internal jumper wire. 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.)



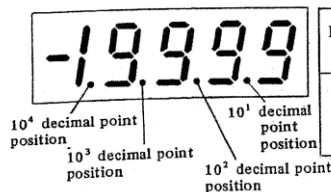
AC Power Selection Method

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 ¹	10 - 14
10 ²	11 - 14
10 ³	12 - 14
10 ⁴	13 - 14

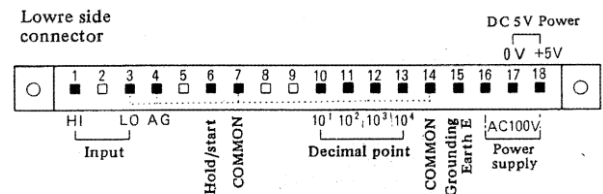


3) Input connection

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

For 12-range differential input (optional), connect the input signal between HI (1) and L0 (3), and always connect the L0 terminal to AG (4) unless there is in-phase voltage.

Input / Output Connection Diagram



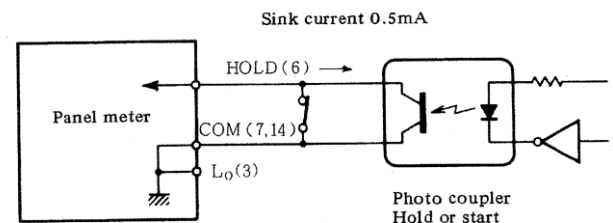
Note: Input L0 and COMMON have the same potential.

4) Hold and external start

By shorting the HOLD terminal (No.6) and COMMON (7 and 14), the value displayed just before the HOLD terminal (No.6) and COMMON are shorted is maintained.

In addition, opening them at the necessary timing starts measurement. [The necessary minimum time to measure a positive pulse from 0V to +5V for more than 1ms or contact signal (open) once is about 410ms.]

Input terminal (LO) and COMMON (7 and 14) are so connected that they are not DC-isolated. Therefore, use a mechanical contact signal such as a relay or switch for external control as 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 floated.)



[Fig. 3]

If the meter is provided with the BCD output board (optional), the hold terminals are on the upper terminal board. These terminals are isolated so that the isolation shown in Fig.3 is not required.

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 COMMON 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-142-12, 13 and -14 can be changed by pulling out the internal printed circuit board in accordance with Item 4.2-2), then changing the position of the 2-core shorting socket near the connector as shown in the following.

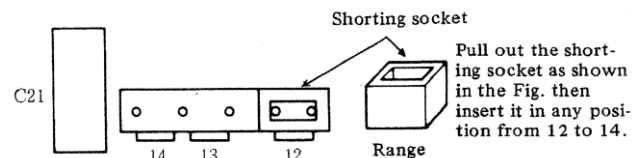
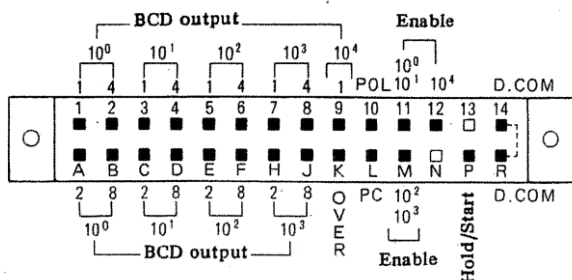


Diagram of socket at the rear of the printed circuit-board

When the range is changed, calibrate the meter in accordance with Item 6.2.

5. BCD PARALLEL OUTPUT OPTION(Upper Side Connector)

■ Input / Output Connector Connection Diagram

Upper side
connector for
BCD

Note: For 5V DC drive, the power supply voltage 0V and D.COM(14, R) have the same potential.

- 1) Data output changes to new data just before the printout command signal (P.C) rises after integration action ends. When reading data, synchronize it with the print-out command signal.
Data is printed out on command.
BCD(1-2-4-8) code positive logic.
• TTL level, fan out 2
- 2) Print-out command signal (P.C)
After integration action ends and new data is rewritten, a positive pulse of about 1ms wide is obtained.
• TTL level, fan out 2
- 3) Overflow output (OVER)
When the display exceeds 9999 due to input overflow: Logic "1"
• TTL level, fan out 2

4) Polarity output (POL)

When positive input: Logic "1"

• TTL level, fan out 2

5) External hold (HOLD)

By shorting the hold terminal (NO.P) and D.COM terminals (Nos. 14 and R), display and data output hold. Opening them at the necessary timing also starts measurement.

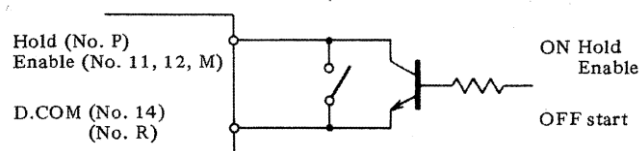
Sink current 0.5mA ON voltage, 0.5V or less

6) ENABLE

If $[10^0]$ and $[10^1]$ terminals, terminal(11) and $[10^2]$ and $[10^3]$ terminals, terminal (M), and $[10^4]$ terminals and terminal (120) are opened or set to TTL level "1", BCD data and polarity and OVER corresponding to each digit are output. Also, if each of the ENABLE terminals is shorted with digital COMMON (upper side connector 14, R) or set to TTL level "0", the BCD data output terminals corresponding to each digit are set to the try state high-impedance state. For control of the 10^4 -digit data terminals and polarity and OVER terminal output are set to the high-impedance state.

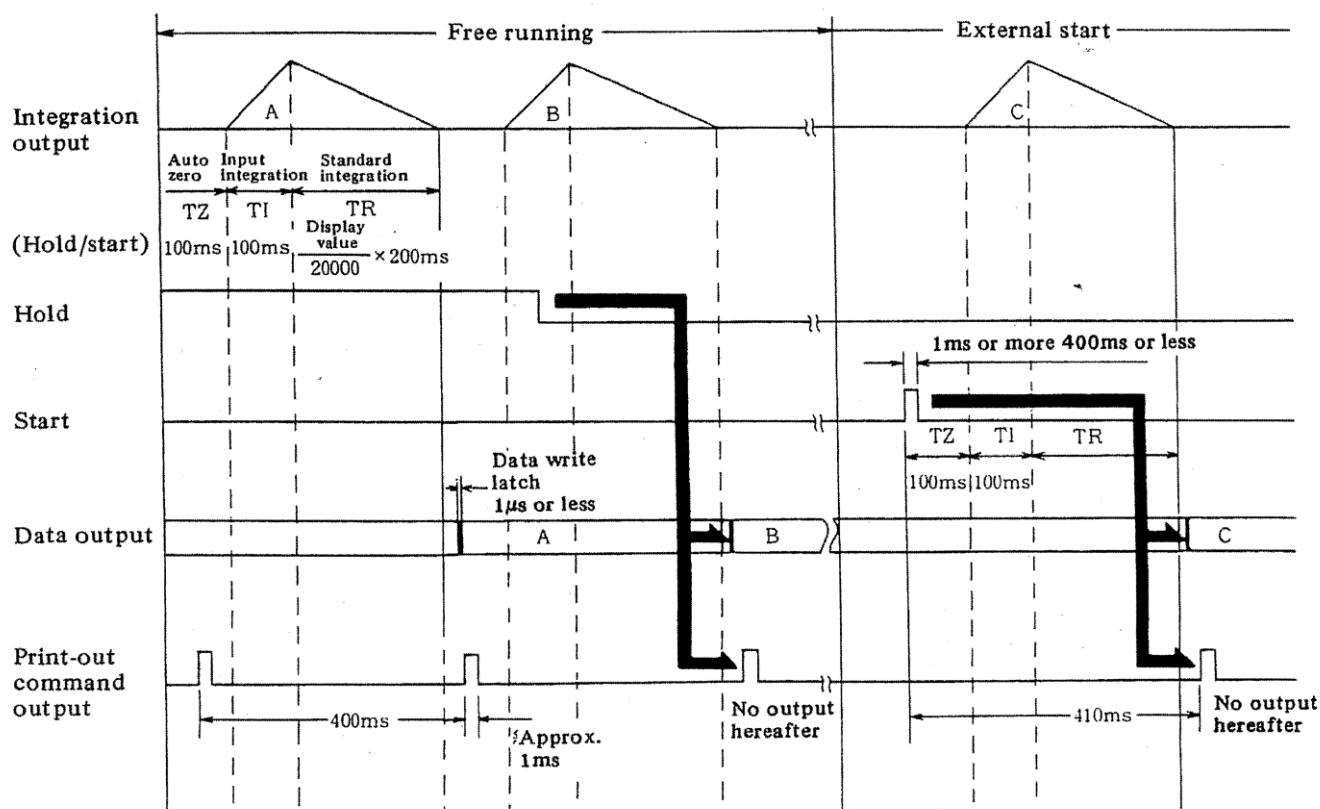
Sink current: 0.5mA, ON voltage +0.5V or less

When control is performed by using mechanical signal such as a relay or switch, pay attention to chatter generation. When control is performed by TTL or transistor, add the circuit shown in Fig. 5.



[Fig. 5]

AP-142 Timing Chart



6. MAINTENANCE and INSPECTION

6-1 Caution

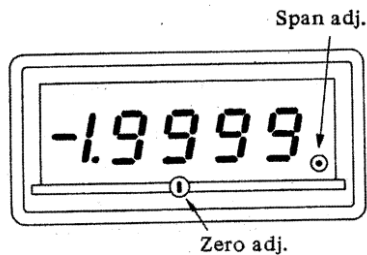
Store the meter where ambient temperature is between -10°C and $+70^{\circ}\text{C}$, and humidity is less than 60%. (Life may shorten due to temperature rise.)

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

6-2 Calibration

Ⓢ In order to assure the Initial accuracy over a long period of time, it is recommended that the meter be calibrated periodically.

When the meter is calibrated, it is necessary to use standard equipment with an accuracy of 0.01% or less.



Ⓢ Calibration procedures are as follows:

- (1) Remove the front bezel.
- (2) Connect the power to the meter for a warm up of 10 minutes or more prior to adjustment.
- (3) Zero adjustment
Short input terminals HI and LO and then turn the zero adjuster until the display shows 0000.
For 12-range differential input (optional), no zero adjuster is provided so check that the display shows 0000 by shorting terminals HI and LO.
- (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 $-19900 \pm 0.03\% \text{ rdg} \pm 1 \text{ digit}$.

7. WARRANTY

The warranty period is one year after delivery. Any trouble occurring during this period for reasons considered to be our responsibility will be repaired by us free of charge.

8. AFTER-SALE SERVICE

These meters are manufactured, tested and inspected under strict quality control and then shipped to the customer. However, should any trouble occur, contact our agent or us directly with the trouble written in detail.

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