

INSTRUCTION MANUAL

Digital Meter Relay

Model AM-121 Series



1. OUTLINE

The AM-121 Series Digital Meter Relay is a 2 step setting digital meter relay combined with the functions of a digital meter and a digital comparator.

The advantage in using this digital switch is the non-setting error feature, which is not available in any other analog meter relays.

The measured result is displayed on a panel meter and is determined correctly without an error by comparing it with the set value in the digital mode.

The meter input/output can be wired correctly by applying setscrews available with the mainframe.

2. SPECIFICATIONS

• DC Voltage Measurement

Model and Range Codes	Measuring Range	Max. Resolution	Input Impedance	Max. Allowable Input Voltage
AM-121-10	$\pm 19.99\text{mV}$	$10\mu\text{V}$	$100\text{M}\Omega$	$\pm 250\text{V}$
AM-121-11	$\pm 199.9\text{mV}$	$100\mu\text{V}$	$100\text{M}\Omega$	$\pm 250\text{V}$
AM-121-12	$\pm 1.999\text{V}$	1mV	$100\text{M}\Omega$	$\pm 250\text{V}$
AM-121-13	$\pm 19.99\text{V}$	10mV	$10\text{M}\Omega$	$\pm 250\text{V}$
AM-121-14	$\pm 199.9\text{V}$	100mV	$10\text{M}\Omega$	$\pm 500\text{V}$

Accuracy: $\pm 0.1\%$ rdg ± 1 digit at $23^\circ\text{C} \pm 5^\circ\text{C}$

• DC Current Measurement

Model and Range Codes	Measuring Range	Max. Resolution	Internal Resistance	Max. Allowable Input Current
AM-121-21	$\pm 199.9\mu\text{A}$	100nA	$1\text{K}\Omega$	$\pm 10\text{mA}$
AM-121-22	$\pm 1.999\text{mA}$	$1\mu\text{A}$	100Ω	$\pm 50\text{mA}$
AM-121-23	$\pm 19.99\text{mA}$	$10\mu\text{A}$	10Ω	$\pm 150\text{mA}$
AM-121-24	$\pm 199.9\text{mA}$	$100\mu\text{A}$	1Ω	$\pm 500\text{mA}$
AM-121-25	$\pm 1.999\text{A}$	1mA	0.1Ω	$\pm 3\text{A}$

Accuracy: $\pm 0.2\%$ rdg ± 1 digit at $23^\circ\text{C} \pm 5^\circ\text{C}$
Only for AM-121-25, $\pm 0.3\%$ rdg ± 1 digit

3. COMMON SPECIFICATION

• Measurement Section

- Measurement Function : DC voltage measurement (Range 12, 13 and 14 can be selected by changing internal socket).
DC Current Measurement.
- Operation Method : Dual integration.
- Input Circuit : Single ended type.
- Input Bias Current : 50pA (Typical)
- Sampling Speed : 2.5 times/sec.
Optional (12.5 times/sec. at 50 Hz,
15 times/sec. at 60 Hz).
- Normal Mode Noise Rejection Ratio : More than 40 dB (50/60 Hz)
- Overrange Alarm : Display stops at 1999 and flashes.

- Display : LED (Light emitting diode). Numeric elements, Height; 10.2 mm.
- Polarity Display : When input signal is negative, a "—" sign is displayed automatically.
- External Control : HOLD;
Started with COMMON (the bottom) and START/HOLD terminals shorted.
START;
Positive pulse from 0 V to +5 V in pulse width of 1 ms or more, or contact signal input between COMMON terminal and START terminal.
Decimal point;
Settable (Set range at shipment)

• Comparator Section

- Control Method : Digital comparator.
- Setting Range : High and low limit setting including polarity (+1999 to 0 to -1999) Manual setting by digital switch.
- Comparison Operation : By sampling speed.
- Comparison Conditions (Display) : Desired value $>$ High limit set value - HI (Red LED lights up).
High limit set value \geq Desired value \geq Low limit set value - Go (Green LED lights up).
Desired value $<$ Low limit set value - Lo (Red LED lights up)
- Comparison Relay Output : Contact capacity of each relay

AC 250 V 0.1A	Resistive load
AC 120 V 0.5A	"
DC 28 V 1A	"
- External Control : Reset
Comparison operation stops by TTL level setting or reset terminal and COMMON terminal (the bottom) shorted.

• Common Specifications

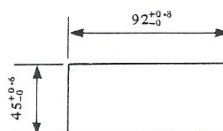
- Working Temperature Range : 0 to 50°C
- Power : 90 to 132 VAC 50/60 Hz
180 to 264 VAC 50/60 Hz
(Jumper wire selection)
- Power Consumption : Approx. 2.0 VA (At 100 V AC)
- External Dimensions : 48 mm(H) \times 96 mm(W) \times 94.5 mm(D)
(DIN size)
- Weight : 350 g
- Dielectric Strength : 500 V DC between input terminal (Lo) and grounding terminal (E).
1500 V AC each between power terminal and input terminal, grounding (E), COMMON, relay output for a 1 minute.
- Insulation Resistance : Between above each terminal; More than $100\text{M}\Omega$ at 500 V DC.
- Accessory : Instruction manual.
- Option : Scaling
Other than standard voltage and current ranges (such as 1 to 5 V and 4 to 20 mA, respectively) are available to incorporate.
- Setting specifications
High/high limit (HH)
High limit (HI)
or
Low limit (LO)
Low/low limit (LL)

4. HANDLING

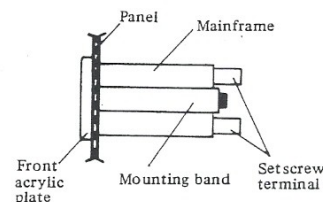
4.1 Mounting and Configuration

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 tighten the instrument from the rear using a metal band.



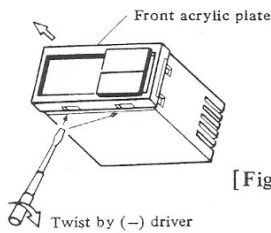
[Fig. 1]



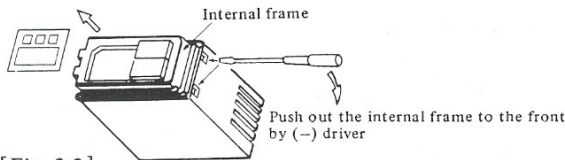
[Fig. 2] Side Panel



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[Fig. 3-1]



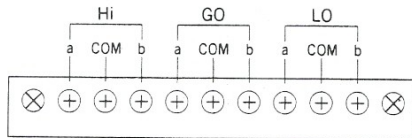
[Fig. 3-2]

- 2) Removal of the internal printed circuit board.
 - Remove the front acrylic plate as shown in Fig. 3-1.
 - Remove the internal frame using driver, inserted into the both side rectangular cutout and push it out.
 - Pull the digital switch and the printed board out lightly from the front while expanding the front case and removing the rear screw terminals.
 - Also insert the digital switch circuit board into the mainframe while expanding the front case to prevent the damage for lead wires.

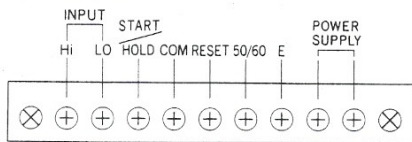
4.2 Terminal Connection

The terminal connections are shown in Fig. 4.

Upper Screw Terminal



Lower Screw Terminal



Note: For the terminal selecting 50/60 Hz, use only when sampling speed is 12.5 times/sec. and 15 times/sec.

[Fig. 4]

- 1) Power connection
Connect the power to the POWER at the terminal to bottom. Since the meter is not provided with a power switch, it is ready to operate as soon as power is supplied.
- 2) Input signal connection
Connect the input signal (DC voltage·current) to terminals, INPUT HI (+) and INPUT (LO) (-).
 - (i) Shorten the input signal wire as much as possible, and separate them from the other signal wire.
 - (ii) Use a 2-core shielded cable for the input signal when it passes through a location with a lot of external noise, and connect its outer shield to the LO side at a signal source.
 - (iii) If the input signal is superimposed with high-frequency noise, use a low-pass filter in the input signal line. However, in this case, response time lag may occur due to filter time constant. Therefore, pay close attention to the meter's operating condition.
 - (iv) Do not apply input voltage or current to the meter exceeding the maximum allowable values.
 - (v) To measure current, a measured signal may be grounded or floated. However, if the signal is grounded, insert the meter relay input to the meter at the point of lowest possible potential.

- 3) E terminal
If the meter is affected by external noise, ground the E terminal to the earth. Note, however, that large grounding resistance may induce noise.
- 4) Sampling speed change (only for the high-speed sampling Model) by power frequency.
Use the terminal for 50/60 Hz selection by power frequency as follows:
 - For 50 Hz: 5 V or open (12.5 times/sec.)
 - For 60 Hz: 0 V or connect to COM terminal (at the terminal bottom, 15 times/sec.)

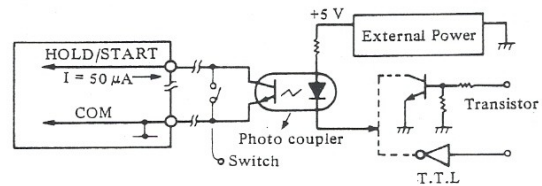
5. SYSTEM FUNCTIONS

5.1 Start/Hold: START/HOLD

Shorting the START/HOLD and COM terminals (at the terminal bottom), holds the value displayed and the comparison result, (Logic "0") while opening them at the necessary timing starts measurement and comparison.

Input terminal (LO) and COMMON (at the terminal bottom) are so connected inside the meter that they are the same potential. Therefore, use a mechanical contact signal such as a relay or switch for external control.

When controlling with a TTL or transistor, add an external circuit (isolator) as shown in Fig. 5.



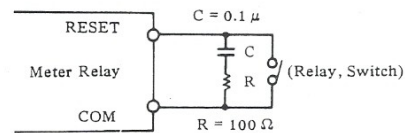
[Fig. 5]

5.2 Reset: RESET

By shorting the RESET and COMMON terminals (at the terminal bottom) or setting the TTL to the "0" level, comparison relay output as HI, GO and LO are conducted between the relay COMMON terminal and b contact point. The displayed LEDs for HI, GO and LO are all light out. (Logic "0").

The short-circuit current for START/HOLD and RESET is approx. 50 μA.

Note: When controlling the operation at the relay contact point, pay close attention to the malfunction caused by the chattering. In order to prevent the chattering, the circuit shown in Fig. 6 is effective.



[Fig. 6]

5.3 Comparator Relay Contact Point Output

The relay contact point outputs are HI (a, COM, b), GO (a, COM, b) and LO (a, COM, b). Contact point configurations are as follows:

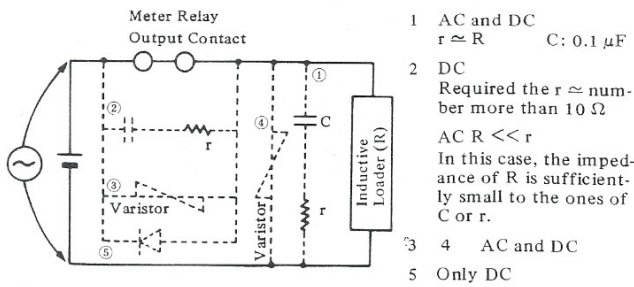
Relay Output Comparator Output	HI side	GO side	LO side
HI	a	b	b
GO	b	a	b
LO	b	b	a

a: Conductible between COM and a
b: Conductible between COM and b

* Contact capacity of each relay

AC 120 V 0.5 A	Resistive load
AC 250 V 0.1 A	
DC 28 V 1 A	

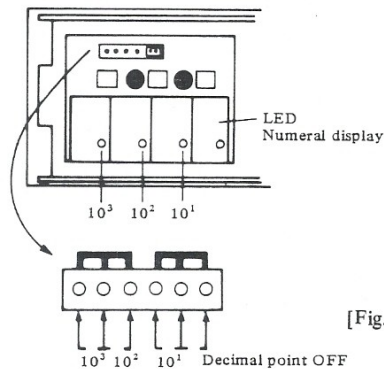
When opening and closing the inductive load (relay, solenoid), it is recommendable to insert the contact (point) protection circuit into the meter in order to prevent the contact troubles such as a welding keeping the reliability and the life for the contact (point).



6. DECIMAL POINT SELECTION

The decimal point can be lit up optionally. However, desired range unit is set prior to shipment.

Remove the acrylic plate as shown in Fig. 3-1. By shorting the terminal above the determining LED by shorting socket, any decimal points can be lit up.

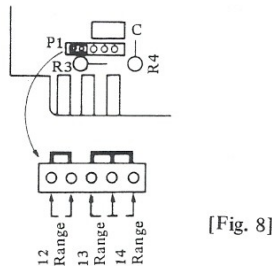


7. RANGE SELECTION (SETTING RANGES FOR 12, 13 AND 14)

Any one of 12, 13 and 14 of the AM-121 can be selected by changing the internal terminal connections.

Remove the internal circuit board as in Item 4.1.2.

By replacing the shorting socket on the bottom of the circuit board P1, any one of 12, 13 and 14 ranges can be set.



Further to the above, when changing the range, be sure that it is calibrated in accordance with the calibration method in Item 9.3.

8. OPTIONAL FUNCTIONS

8.1 1 to 5 V Range (Standard)

The calibration methods are:

When 1 V power is input; Turn the zero adjuster to display 000.

When 4.90 V power is input; Turn the full scale adjuster to display 1950.

8.2 4 to 20 mA Range (Standard)

The calibration methods are:

When 4 mA power is input; Turn the zero adjuster to display 000.

When 19.6 mA power is input; Turn the full scale adjuster to display 1950.

8.3 Comparator Section

The comparison conditions for AM-121 are HI, GO and LO, and the optional HH, HI, GO and GO, LO, LL.

1) HH, HI, GO

• Comparison conditions

Desired value > High high limit set value

HH, HI (Red LED lights up)

High/high limit value \geq Desired value \geq High limit value

HI (Red LED lights up)

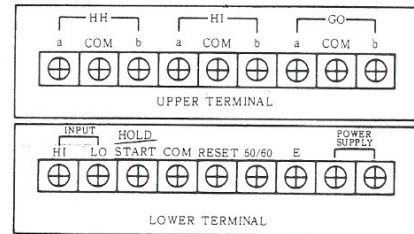
High limit value > Desired value

GO (Green LED lights up)

• Comparator Relay Output (Refer to Fig. 9)

Relay Output Comparison Output	HH side	HI side	GO side
HH	a	a	b
HI	b	a	b
GO	b	b	a

a: Conductible between COM and a
b: Conductible between COM and b



[Fig. 9]

2) GO, LO, LL

• Comparison conditions

Desired value > Low set value

GO (Green LED lights up)

Low limit set value \geq Desired value \geq Low/low limit value

LO (Red LED lights up)

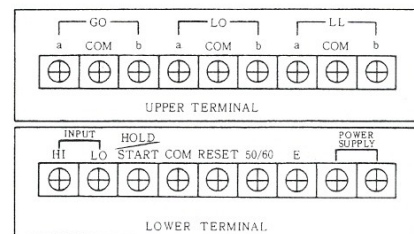
Low/low limit value > Desired value

LL, LO (Red LED lights up)

• Comparison Relay Output (Refer to Fig. 10)

Relay Output Comparison Output	GO side	LO side	LL side
GO	a	b	b
LO	b	a	b
LL	b	a	a

a: Conductible between COM and a
b: Conductible between COM and b



[Fig. 10]

9. MAINTENANCE AND INSPECTION

9.1 Cautions for Storing

If the digital meter relay is not used for a long time, store the meter relay in the shade with low humidity covering with vinyl sheet and packing in the corrugated card board used at the shipment.

Storing temperature: $-10^{\circ}\text{C} + 70^{\circ}\text{C}$
Storing humidity: Less than 60 %

9.2 Cautions in Maintenance

Since the front bezel is made of plastic, it is necessary to wipe stains off with dry cloth or silicon cloth and not with volatile liquids such as thinners and alcohols.

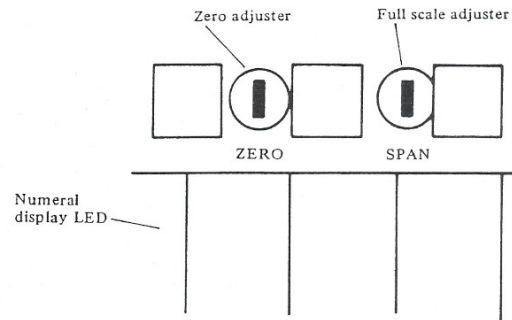
9.3 Calibration

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

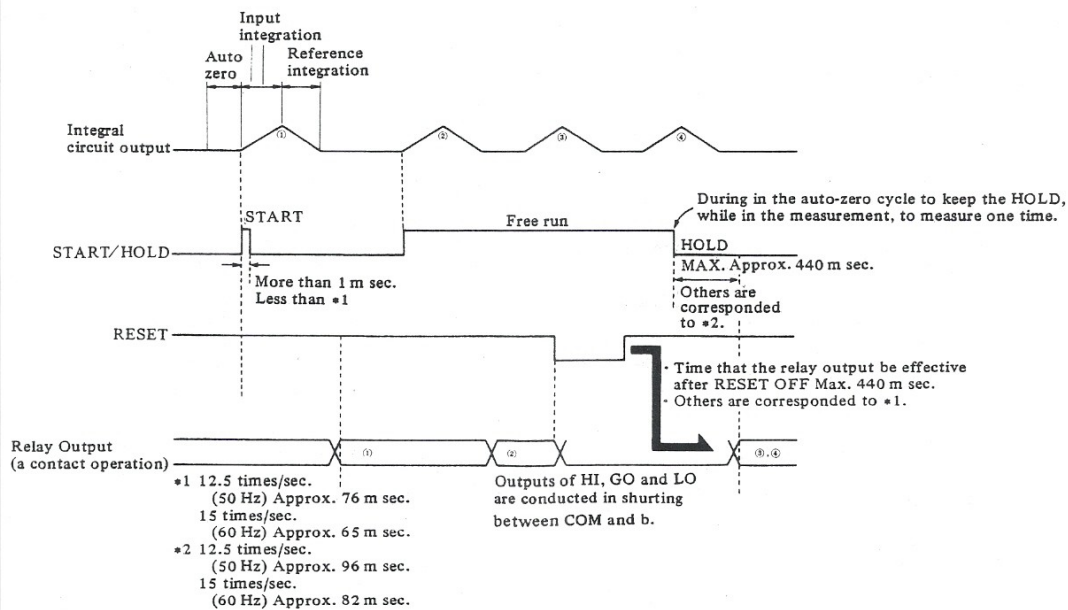
When the meter relay is calibrated, it is necessary to use standard equipment (voltage/current generator) with an accuracy of 0.01 % or better.

Calibration procedures are as follows:

- 1) Remove the front acrylic plate as shown in Fig. 3-1.
- 2) Connecting the power to the meter relay for a warm up of 10 minutes or more, then calibrate it at $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$.
- 3) Zero adjustment
Short input terminals HI and LO, and turn the zero adjuster to display 000.
- 4) Full scale adjustment
Apply voltage or current corresponding to the full scale (1990), then turn the full scale adjuster until the display shows 1990. Next apply voltage with (-) polarity to check the display shows $-1990 \pm 0.1\%$ rdg (reading) ± 1 digit. (See Fig. 11)



[Fig. 11]



[Fig. 12] Timing Chart (Sampling speed 2.5 times/sec.)



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