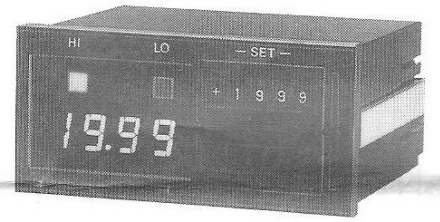
INSTRUCTION MANUAL
Digital Meter Relay
Model AM-111 Series



1. OUTLINE

The AM-111 Series Digital Meter Relay a single setting digital meter relay combining 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 analog meter relays.

The measured input is displayed on the panel meter and is compared without error with the set value in the digital set point selector.

2. SPECIFICATIONS

• DC Voltage Measurement

Model and Range Codes	Measuring Range	Max. Resolution	Input Impedance	Max. Allowable Input Voltage
AM-111-10	±19.99 mV	10 μV	100 MΩ	±250 V
AM-111-11	±199.9 mV	100 μV	100 MΩ	±250 V
AM-111-12	±1.999 V	1 mV	100 MΩ	±250 V
AM-111-13	±19.99 V	10 mV	10 MΩ	±250 V
AM-111-14	±199.9 V	100 mV	10 MΩ	±500 V

Accuracy: ±0.1% rdg ±1 digit at 23°C ±5°C

• DC Current Measurement

Model and Range Codes	Measuring Range	Max. Resolution	Internal Resistance	Max. Allowable Input Voltage
AM-111-21	±199.9 μA	100 nA	1 KΩ	±10 mA
AM-111-22	±1.999 mA	1 μA	100 Ω	±50 mA
AM-111-23	±19.99 mA	10 μA	10 Ω	±150 mA
AM-111-24	±199.9 mA	100 μA	1 Ω	±500 mA
AM-111-25	±1.999 A	1 mA	0.1 Ω	±3 A

Accuracy: ±0.2% rdg ±1 digit at 23 °C ±5°C
Only for AM-111-25, ±0.3% rdg ±1 digit

• Model Code

AM − 111 − □□ − □□

- Output
  - 1. Display, 2. Analog, 3. Transistor, 4. Analog, Transistor, → 2.5/sec
  - 5. Display, 6. Analog, 7. Transistor, 8. Analog, Transistor → 12.5 or 15/sec
- Power
  - 1 90 ~ 132 V AC
  - 2 180 ~ 264 V AC
- Range Code
  - 10 ⋮ 14
  - 21 ⋮ 25
  - 1V
  - 2A

3. COMMON SPECIFICATION

• Measurement Section

1. Measurement Function: DC voltage measurement (Range 12, 13 and 14 can be selected by changing internal socket). DC Current Measurement.
2. Operation Method: Dual integration.
3. Input Circuit: Single ended type.
4. Input Bias Current: 50PA (Typical)
5. Conversion Rate: 2.5 times/sec. Option (12.5 times/sec. at 50 Hz, 15 times/sec. at 60 Hz).
6. Normal Mode Noise: More than 40 dB (50/60 Hz) Rejection Ratio
7. Overrange Alarm: Display stops at 1999 and flashes.
8. Display: LED (Light emitting diode), Numeric elements, Height; 10.2 mm.
9. Polarity Display: When input signal is negative, a "−" sign is displayed automatically.
10. 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;
    Can be set at desired position.

• Comparator Section

1. Control Method: Digital comparator.
2. Setting Range: +1999 ~ 0 ~ -1999
   (Manual setting by digital switch)
3. Comparison Operation: By sampling speed.
4. Comparison Conditions (Display): Desired value ≧ Set value-Hi
   Desired value < Set value-Lo
5. Comparison Relay Output: Contact capacity of each relay
   - AC250 V 0.1 A Resistive load
   - AC120 V 0.5 A Resistive load
   - DC 28 V 1A
6. External Control: Reset;
   Comparison operation stops by TTL level setting or reset terminal and COMMON terminal (the bottom) shorted.

• Common Specifications

1. Working Temperature Range: 0 to 50°C
   90 to 132 V AC 50/60 Hz
   180 to 264 V AC 50/60 Hz
   (Jumper wire selection)
3. Power Consumption: Approx. 2.0 VA (At 100 V AC)
4. External Dimensions: 48mm(H)×96mm(W)×94.5mm(D) (DIN size)
5. Weight: 270 g
6. Dielectric Strength: 500 VDC between input (Lo) and earth (E)
   1500 V AC each between power terminal and input terminal, earth(E), COMMON, relay output for a 1 minute.
7. Insulation Resistance: Between above each terminal; More than 100 MΩ at 500 V DC.
8. Accessory: Instruction manual.
9. Option:
   - 1 ~ 5 V
   - 4 ~ 20 mA
   - Transistor open collector output
   - Analog output

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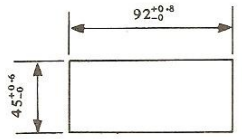
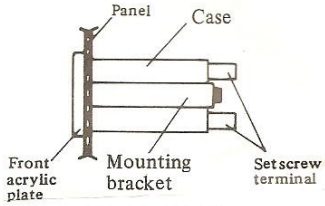
4. HANDLING

4.1 Mounting and Configuration

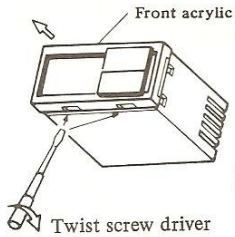
1) Panel mounting
Cut a rectangular opening as shown in Fig. 1, insert the instrument in the panel as shown in Fig. 2, and then tighten the instrument from the rear using the mounting bracket.



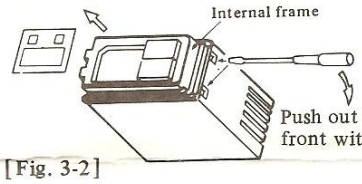
[Fig. 1]



[Fig. 2] Side View



[Fig. 3-1]



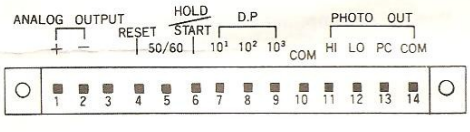
[Fig. 3-2]

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

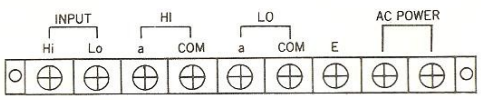
4.2 Terminal Connection

The terminal connections are shown in Fig. 4.

Upper Connector



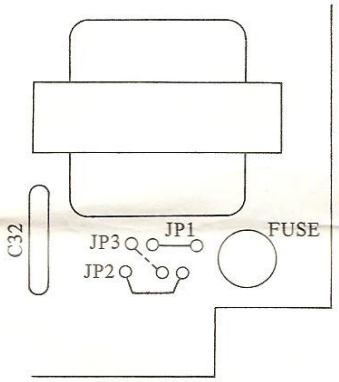
Lower Screw Terminal



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 bottom terminal(Since the meter is not provided with a power switch, it is ready to operate as soon as power is supplied).
Use a supply voltage of 90~132 V or 180~264 V can be used by selecting the appropriate internal jumper wire.



- AC90~132 V
  JP1, JP2 short
  JP3 open
- AC180~264 V
  JP1, JP2 open
  JP3 short

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 other signal wire.
(ii) Use a 2-conductor shielded wire for the signal line with the outer shield and one of the conductors connected at signal point to the Lo input terminal.
(iii) If the input signal is superimposed with the 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 point of lowest possible potential.

3) E terminal
If the meter is affected by external noise, ground the E terminal to the earth. Note that large grounding resistance may induce noise.

4) Sampling speed change (only for the high-speed sampling Model) by the power frequency.
Use the terminal for 50/60 Hz selection of the 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.)

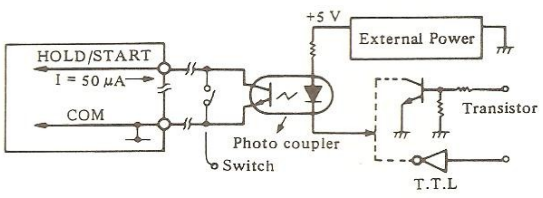
5. SYSTEM FUNCTIONS

5.1 Start/Hold:

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.



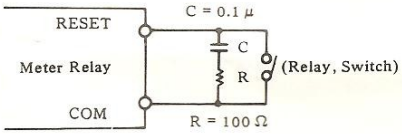
[Fig. 5]

5.2 Reset:

By shorting the RESET and COMMON terminals (at the terminal bottom) or setting the TTL to the "0" level, the comparison relay outputs of 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 off. (Logic "0").

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

Note: When controlling the operation with the relay contact point, pay close attention to the malfunction caused by chattering. In order to prevent 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), and LO (a, COM). Contact point configurations are as follows:

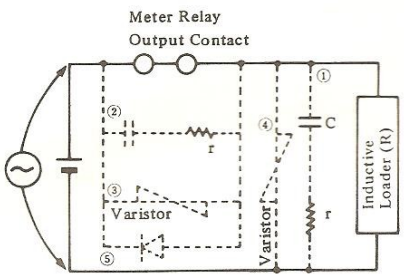
Relay Output Comparator Output	HI side	LO side
HI	ON	OFF
LO	OFF	ON

ON: Conductible between COM and a
OFF: Open between COM and b

*Contact capacity of each relay

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

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

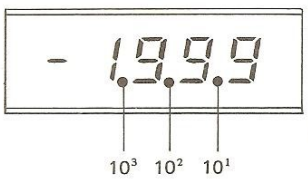


1 AC and DC
r ≃ R C: 0.1 μF
2 DC
Required the r ≃ number more than 10 Ω
AC R ≪ r
In this case, the impedance of R is sufficiently small to the ones of C or r.
3 4 AC and DC
5 Only DC

* Depend upon the loading characteristics, the aboves are not always corresponding to the specified items. It is necessary to reconfirm at the customer before commencing operations.

6. DECIMAL POINT SELECTION

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



Decimal Point to be Lit	Connector Terminal Nos. Connected
10^1	7 — 10
10^2	8 — 10
10^3	9 — 10

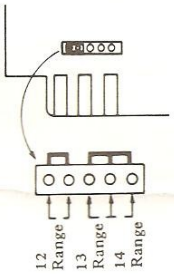
[Fig. 7]

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

Any one of 12, 13 and 14 voltage ranges of the AM-111 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 ST1, any one of 12, 13 and 14 ranges can be set.



[Fig. 8]

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 Range (Standard)

The calibration methods are:

When 1 V power is input; Turn the zero adjust to display 000.
When 4.90 V power is input; Turn the full scale adjust to display 1950.

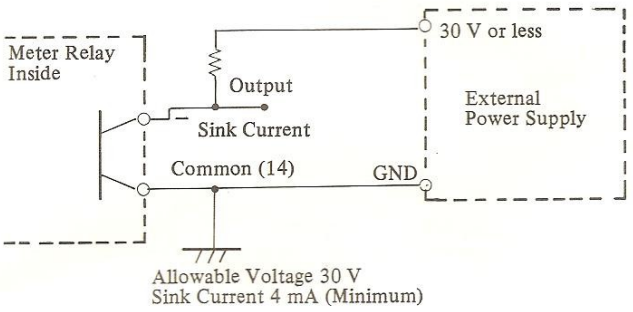
8.2 4 to 20 mA Range (Standard)

The calibration methods are:

With 4 mA input; Turn the zero adjust to display 000.
With 19.6 mA input; Turn the full scale adjust to display 1950.

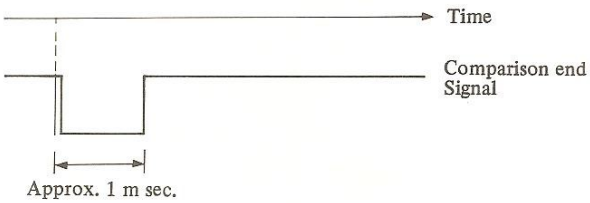
8.3 Transistor Open Collector Output (Photo-coupler isolation output)

Open collector outputs Hi(11), Lo(12), and PC(13), and output common(14) are connected as shown in Fig. 9.



[Fig. 9]

• Comparison end signal (PC) at the internal comparison end



[Fig. 10]

9. MAINTENANCE AND INSPECTION

9.1 Cautions for Storing

Store the meter according to the following temperature and humidity specifications. When possible store the meter in the vinyl bag and box that it was supplied in.

Storing temperature: -10°C +70°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 a or silicon cloth and not with volatile liquids such as thinners and alcohols.

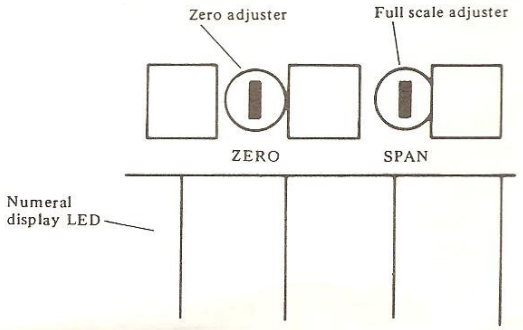
9.3 Calibration

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

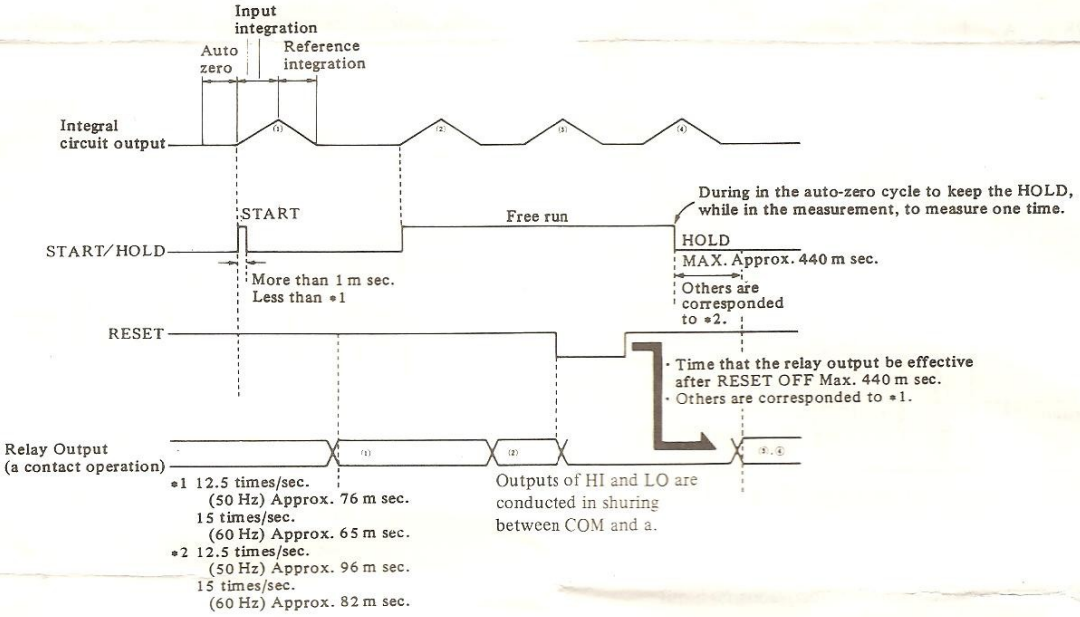
When calibrating it is necessary to use standard equipment (voltage/current generator) with an accuracy of 0.01% or better.

Calibration procedures are as follows:

1) Remove the front acrylic plate as shown Fig. 3-1.
2) Connect the power to the meter relay for a warm up of 10 minutes or more, then calibrate it at 23°C ±5°C.
3) Zero adjustment
   Short input terminals HI and LO, and turn the zero adjust to display 000.
4) Full scale adjustment
   Apply voltage or current corresponding to the full scale (1990), then turn the full scale adjust until the display shows 1990, Next apply voltage with (-) polarity to check the display shows -1990 ±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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