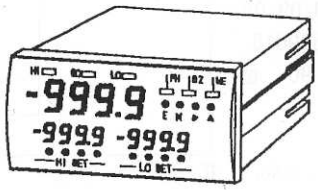
DIGITAL METER RELAY
MODEL AM-123 SERIES
INSTRUCTION MANUAL



■ **Meaning of WARNING marking**

⚠ WARNING	This marking indicates that the erroneous operation of this meter may result in death or serious injury.

■ **CAUTION markings**

⚠ CAUTION	
⚠	Serious injury may result if any operation other than that described in this manual is performed.
⊘	Do not touch the inside of the meter with power or input turned on. If so, an electric shock may result.

⚠ 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

Please do not push the keys with hard things (e.g. pen) to avoid damage.

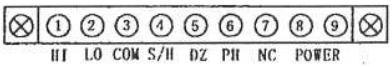
Caution when using the AM-123 together with equipment conforming to the EN/IEC standards! For the AM-123 with an input signal of 70VDC or more, connect S/H, DZ and PH to equipment whose foundation is electrically isolated.

Thank you for purchasing the Model AM-123 Series digital meter relay. Prior to operation, please check that the meter has not been damaged during transportation or there are no discrepancies between your and our specifications.

1. Before operation

1-1 Terminal connection

■ **Lower screw terminal board**



⚠ Caution:

NC indicates a vacant terminal, but do not use it as a junction terminal.

①②:Input terminals (HI, LO)
① is for the HI side and ② for the LO side.

③:Common (COM)
Common terminal of control input.
(This terminal is shorted internally with the LO terminal, but never use the LO terminal as a common input terminal.)

④:Start/Hold terminal (S/H)
Holds the measured data or the result of comparison just before this terminal is shorted.

⑤:Digital zero terminal (DZ)
Measures the input with the value displayed just before set to "zero."
The succeeding display thus becomes (Input value-Digital zero value)=Displayed value (Measured value).
If "digital zero" and "peak hold" are simultaneously controlled, the former has priority over the latter.

⑥:Peak hold terminal (PH)
Always displays the maximum or minimum value, or the difference between the minimum and maximum value depending on the type of function selected from among "Condition data."
If this terminal is turned off, each peak value is cleared.

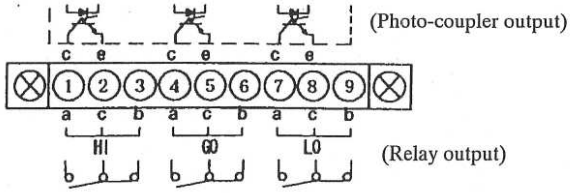
Note:
If the input exceeds the measurement range during peak hold measurement, all of the decimal points flash. If this happens, turn off "PH" once to return the meter to normal display.

⑧⑨:Power terminals, 90 to 264VAC (AC POWER)

⚠ As this meter is not provided with a power supply switch, the meter is ready to operate just when power is connected to the meter.

Each control function starts functioning with the relevant terminal shorted with the COM terminal on the lower screw terminal board or set to level "0."
It is released with the terminal opened or set to level "1."
Input rating of each control terminal:
Level "1"; 3.5 to 5V
Level "0"; 0 to 1.5V
Input current; Less than -0.5mA

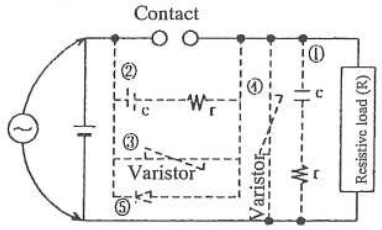
■ **Upper screw terminal board**



① to ⑨: Comparison output terminals
Set to either relay output or photo-coupler output depending on the specification of the AM-123.

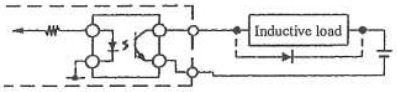
- For relay output
  Contact capacity:
  120VAC/0.5A, 28VDC/1A, Resistive load
  Use the relay within its rated capacity.
- Photo-coupler output (NPN type open-collector output)
  Output capacity:
  Voltage 30V max., Current 50mA max.
  Saturated output voltage: Less than 1.2V at 50mA
  Do not apply reverse voltage to the photo-coupler. Use the photo-coupler within its rated capacity.

In addition, when switching an inductive load (relay or solenoid), it is recommended that a contact protection circuit be inserted into the load line in order to prevent contact damage (welding, etc.) caused by electric arc or to lengthen a contact service life.

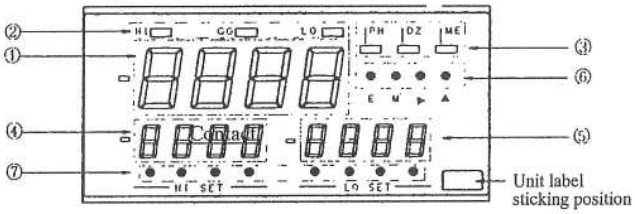


① For AC/DC
r ≃ R C = 0.1μF
② For DC
(r ≃ Requires 20 to 30Ω or more.)
For AC R « r
(When R impedance is extremely smaller than cr impedance)
③④ For AC/DC
⑤ For DC only

* The above values may not be exactly correct depending on the load used. Therefore, finally determine these valves in the actual circuit.
In addition, when driving an inductive load by photo-coupler output, insert a protection circuit into the load line as shown below.
* For details, see the respective brochure for the inductive load used.



1-2 Functional description



① Main monitor display unit:
Measured value display, error display and set mode display (Display color: Red, green or organge. Selectable)

② Comparison output indication:
Indicates each state of comparison output. (Indication color: Not selectable)
HI: Red GO: Green LO: Orange

③ Function indication:
PH (peak hold):
Peak hold function
Lit when activated. (Indication color: Red)
DZ (Digital Zero):
Digital zero function
Lit when activated. (Indication color: Red)
ME (Storage of DZ value):
Lit with the backup function turned on. (Indication color: Red)

④ Sub-monitor display unit 1:
High setpoint display, message display and peak value display. (Display color: Green, Not selectable)

⑤ Sub-monitor display unit 2:
Low setpoint display, input display and peak value/valley value display. (Display color: Green, Not selectable)

⑥ Operation keys
E (Enter key):
Used for double function operation and data establishment.
Also used for return to measurement state.
M (Mode key):
Selection of each setting data item, establishment of shift data, scaling data check and display status setting of peak/valley value.
▶(Shift key):
Condition data item setting and shift data item selection
▲(Increment key):
Condition data setting and digital zero setting.
Note 1:
Double function operation means switch operation to enter into the respective setting mode by pressing the corresponding switch while pressing the E switch.
Note 2:
Condition data setting means the setting to determine the activation status of each function for this meter.

⑦ Comparison value setting keys:
Used for setting high/low setpoint and various data.
(Dedicated directly to each digit.)

1-3 Message display in each setting mode (function)

In each of the setting and check modes, messages are displayed on the main monitor display unit and the sub-monitor display unit 1, and data is displayed on the sub-monitor display unit 2. The following table shows each message function. Therefore, refer to this table when the meaning of the displayed message (item) becomes unclear during the setting.

■ **Condition data**

In sequence of item	1	2	3	4	5	6	7	8
Function	Peak hold	Decimal point setting	Input range	Sampling period	Power frequency	No. of moving averaging times	Fixed zero	Display blanking
Message display	PuH (PVH)	dEP (DEP)	rAnG (KANG)	SMP (SMP)	cYcL (CYCL)	MAu (MAV)	FiX (FIX)	bLnP (BLNK)
In sequence of item	9	10	11					
Function	Digital zero backup	Display color select	Operation protect					
Message display	bUP (B.UP)	MCLr (M.CLK)	Pro (PRO)					

■ **Comparison data and scaling data**

In sequence of item	Function	Message display	In sequence of item	Function	Message display
1	Full scale setting	FSc (FSC)	7	HI hysteresis setting	H-HY (H-HY)
2	Full scale input	FIn (FIN)	8	LO hysteresis setting	H-Lo (H-LO)
3	Offset setting	oFS (OFS)			
4	Offset input	oIn (OIN)			
5	Digital limiter HI setpoint	dLHY (DLHY)			
6	Digital limiter LO setpoint	dLLo (DLLO)			

■ **Other functions and data (During double function operation)**

In sequence of item	1	2	3
Function	Peak value display	Valley value display	Peak valley value display
Message display	PEAK (PEAK)	VALE (VALE)	
Operation key	E + M	M	M

Press the E + M keys. Every time the M key is pressed, Steps 1 to 3 are repeated. (For details, see item 2-4).

In sequence of item	1
Function	Shift data setting
Message display	SHF (SHIF)
Operation key	E + ▶

In sequence of item	1
Function	Digital zero
Message display	Lighting of DZ monitor LED
Operation key	E +▲

Note: No control can be performed while turned on from the ⑤(DZ) terminal.

2. How to use each function

The messages (items) in each relevant setting mode are displayed on the main display unit and the monitor display unit 1. In addition, as the set data is displayed on the sub-monitor display unit 2, set the data by referring to the following item.

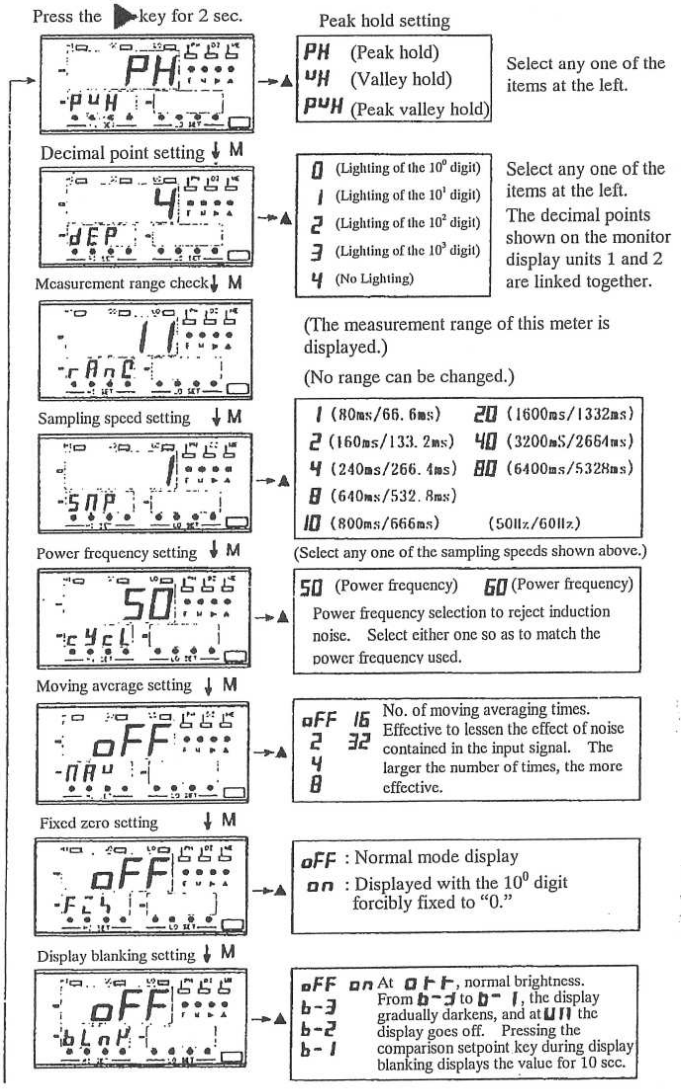
Condition data setting is to set the data which determines the activation status of each function of this meter.

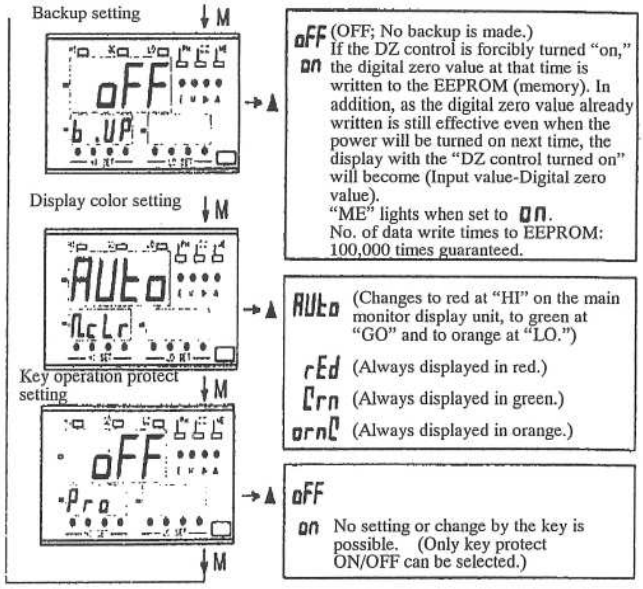
Note:

The measurement action of this meter is suspended during the setting corresponding to the relevant function.

2-1. Setting condition data

First, press the ▶ key on the upper right side of the front for 2 sec to set the meter to the condition data setting mode as shown in the following. The condition data is displayed on the main monitor display unit everytime the "M" key is pressed and then is set by the ▲ key. The data thus set becomes effective by the "E" key to return the meter to the measurement state. (Main monitor display color: Red, green or orange can be selected.)





Note:
If the "E" key is pressed, the meter is set to the normal measured-value display mode from any set mode.

2-2. Setting comparison value

The desired comparison value can be set for each digit by pressing either one of the HI SET and LO SET keys. Press the comparison value setting key corresponding to the digit to be changed. Thus the decimal point in that digit flashes to be ready to enter the data. After the setting, press the "E" key to establish the data thus entered.

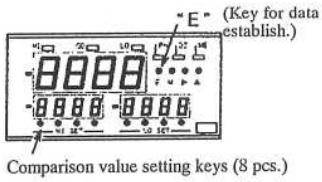
If no key operation is performed for more than 10 sec during the setting, the setpoint becomes invalid to return the meter to the measurement state.

(Pressing the comparison value setting key even during display blanking, the value is displayed for 10 sec to enable the change of the setpoint.)

Setting range: -9999 to 9999

Requirement for setting:

HI setpoint > LO setpoint

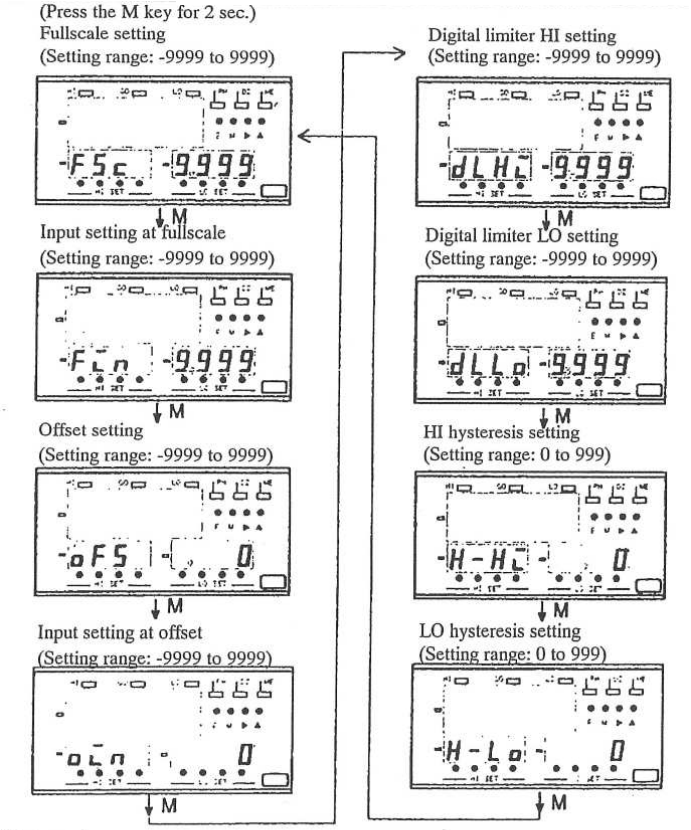


Note:
If any setting which does not satisfy the above requirement, Err is displayed. Therefore in this case, re-set the comparison value.

2-3. Setting scaling and hysteresis

For scaling or hysteresis setting, first press the "M" key for 2 sec to set the meter to the set mode. Thus, the decimal point in the setting digit flashes to enable the setting in that digit.

Every time the "M" key is pressed after the setting, the meter is succeedingly set to any set mode as shown below. Press the "E" key to establish the data after the setting.



Note 1:
The data becomes effective just when the "E" key is pressed during the setting in any mode to return the meter to the measurement state.

Note 2:
FLn (fullscale input setting) is set to an initial value of 1V→5.000 or 2A→20.00 for instrumentation signal input, but oLn (offset input setting) becomes 0. Therefore set each offset input to 1V→1.000 or 2A→4.00, respectively.

■ **Digital limiter**

When the HI and LO digital limiters are set, the normal display is made while the setting is within the HI and LO setting range, but the respective setpoint is displayed if the setting is out of the HI or LO setting range not to update the display.
(Requirement for setting: DLHI > DLLO)

■ **Hysteresis**

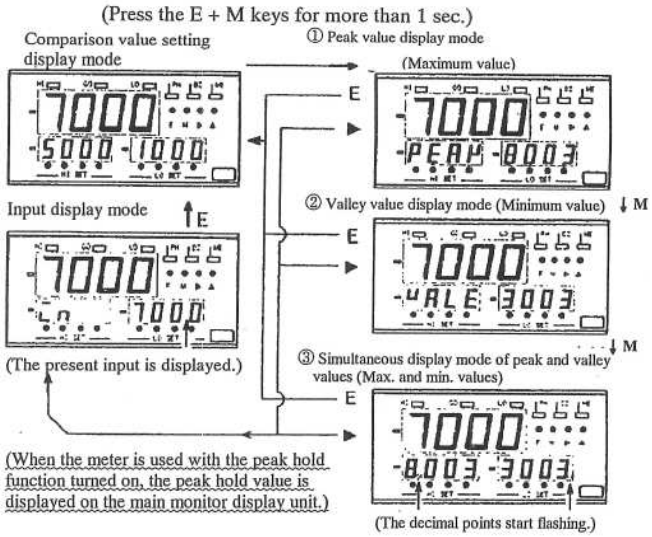
A hysteresis of 1 to 999 digits (dead band) is available for the respective HI or LO comparison setting. The hysteresis is set to the inner side of the HI setpooint and the outer side of the LO setpoint.

2-4. Setting other functions and data

[By double function operation:
For details see the previous item (1-2 Note:1).]

■ **Peak value/valley value display function**

(Monitor function useful for checking the maximum and minimum values, etc.)
The sub-monitor display units 1 and 2 can show the respective message, and peak and valley values. In addition, the main monitor display unit shows the measured value (present value). The procedures for this operation are as follows.



Note 1:
Pressing the ▶ key with the meter set to the input display mode, the meter returns to the display mode just before the input display mode.

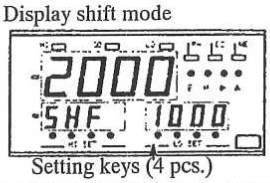
Note 2:
If the peak or valley value overflows, all of the decimal points on the sub-monitor display unit 2 flash. In addition, if the peak and valley values overflow simultaneously, all of the decimal points on any one of the sub-monitor display units 1 and 2 flash.
When releasing the data (flashing stop), press the ▲ key (CLEAR).

Note 3:
Pressing the "M" key in Step ③ above returns the meter to ①.

Note 4:
If the "E+M" keys are pressed next time, the meter will be set to the display mode just before it returns to the previous comparison value setting display mode to always update and show the latest maximum and minimum values. However, if the power is turned off, the peak value will be displayed with the power turned on next time. Thus the previous data is re-written to the new data.

■ **Display shift display function**

This meter can freely shift and show only the display without changing the slope of the input signal.
The procedure for this operation is as follows,
Pressing the "E+ ▶" keys for more than 1 sec sets the meter to the display shift mode.

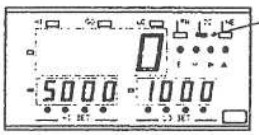


This can be freely set by the comparison value setting keys on the LO SET side. The setpoint becomes effective just when the "M" key is pressed, and the measured value established by the "E" key and shifted in equal to the setpoint is displayed.
(Setting range: -9999 to 9999)

■ **Digital zero function**

Digital zero can also be set by key operation.
This function is the same as that of ⑤ on the lower screw terminal board at the back of the meter.
Pressing the "E+▲" keys for more than 1 sec makes the digital zero function effective.

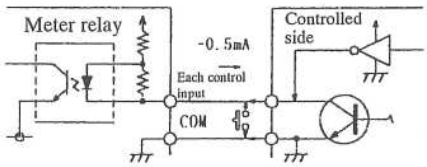
Thus, the meter starts measurement with the value displayed just before the keys are pressed set to "zero."
Pressing the keys again releases the function.



Note 1:
The digital zero value is updated if turned on by the ⑤ terminal when DZ is turned on by key operation.
Note 2:
No DZ operation can be performed by key operation with the ⑤ terminal shorted with the COM terminal ③.

2-5. Control terminal

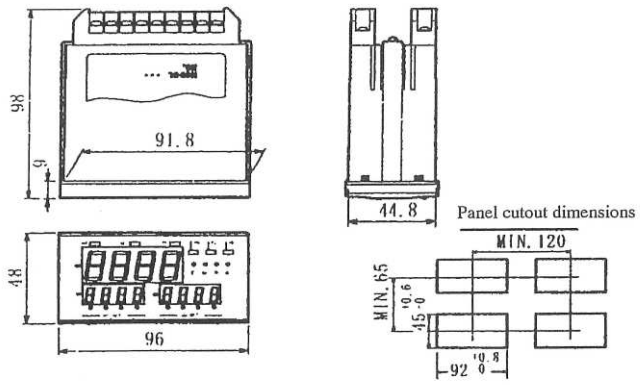
As each control signal input, use dry contacts. If transistors are used for signal input, they need to be open-collector output. For contact input, use the contacts for extremely small current.



Input rating of each control terminal:
Level "1"; 3.5 to 5V
Level "0"; 0 to 1.5V
Input current; Less than -0.5mA

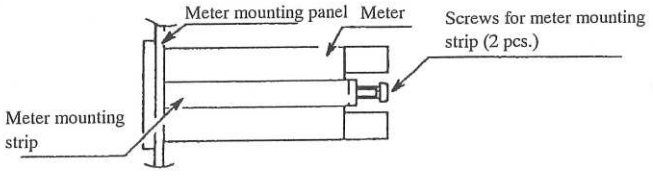
3. Dimensions and mounting

■ Dimensions



■ Mounting

Make the panel cutout as shown in the panel cutout drawing, and then insert the meter, as shown in the following diagram, into the mounting panel from the panel front. Then, secure the meter with the strip from the rear.



⚠ Caution

(1) Recomended mounting panel thickness: 0.8 to 5mm
Tightening torque: 0.39 to 0.49 N.m (4 to 5 kg.cm)
(2) Do not mount the meter at places where:
- it is exposed to the direct sunshine,
- the ambient temperature and humidity are not between 0 and 50°C, and 35 and 85% respectively.
- dew may condense due to rapid temperature changes.
- there are chemicals or corrosive gases harmful to electrical parts, or there is dust.

(3) Do not apply any vibration or shock to the meter.
(4) When mounting the meter in equipment, fully ventilate the inside of the equipment so that the inside temperature does not exceed 50°C.

4. Error messages

Display	Details of error	Remedy
dAt7. Any on of the a, b and c segments lights. DP flashes.	Internal memory is abnormal.	Turn the power on again. However, if the meter does not recover, contact our sales agent or Asahi directly.
d.. ∃.. Decimal point: Flashing	Digital zero value backup data is abnormal.	Try to write the digital zero value. (See "b.uP" in "Condition data setting.")
C.O.n. flashing	Comparison data is abnormal.	Re-set the comparison data.
nE.E. flashing	Scaling data is abnormal.	Re-set the scaling data.
C.o.n.d. flashing	Condition data is abnormal.	Re-set the condition data.
99.87. Decimal point: Flashing (The numeric value display changes depending on the situation.)	Input value or displayed value exceeded the measuring range during peak hold action.	Release the peak hold action once.
oL.-oL	Input value or displayed value exceeded the measuring range.	Use the meter within the specified measuring or display range.
uAIt	Microcomputer waits for data input.	If the setting is changed with the start/hold or peak hold function activated, release each action once.
r.A.n.G.	Internal memory is abnormal	Turn on the power again. If the meter does not recover, contact our sales agent or us directly.
S.H.F. .	Shift data is abnormal.	Re-set the shift data.

In order to prevent erroneous operation in advance, use shielded cables or take necessary measures for noise.

5. Initial setpoints of varius data

As the initial values prior to factory shipment, the following data items are set.

■ Condition data

Display	Function	Initial value
PuH (PVH)	Peak hold type setting	PH
dEP (DEP)	Position of decimal point setting	4
rAnG (RANG)	Range check	Range specified when purchased.
SMP (SMP)	Sampling period setting	1
cYcL (CYCL)	Power frequency setting	50
MAu (MAV)	No. of moving averaging times setting	oFF
FIX (FIX)	Zero fixed to the 10^0 digit	oFF
bLnK (BLNK)	Display blanking	oFF
b.uP (B.UP)	Digital zero backup	oFF
MCLr (MCLR)	Main monitor unit display color setting	AUto
Pro (PRO)	Key operation protect setting	oFF

■ **Scaling data**

Display	Function	Initial value
		11 to 14, 21 to 25
FSc (FSC)	Full scale setting	9999
FLn (FIN)	Input at full scale	9999
oFS (OFS)	Offset setting	0
oLn (OIN)	Input at offset	0
dLHL (DLHI)	Digital limiter HI setting	9999
dLLo (DLLO)	Digital limiter LO setting	-9999
H-HL (H-HI)	Hysteresis HI setting	0
H-Lo (H-LO)	Hysteresis LO setting	0

Note:
The initial value of FLn (input setting corresponding to fullscale) is set as follows for the relevant instrumentation signal input.

Display	Function	Initial value	
		1V	2A
FLn (FIN)	Input at full scale	5.000	20.00

■ **Comparison data**

Function	Initial value
HI comparison value setting	5000
LO comparison value setting	1000

6. Specifications

■ **DC voltage measurement**

Range	Measuring range	Display	Input impedance	Max. allowable input voltage
AM-123-11	±99.99mV	Offset ±9999 Full scale ±9999	100MΩ	±250V
AM-123-12	±999.9mV		100MΩ	±250V
AM-123-13	±9.999V		1MΩ	±250V
AM-123-14	±99.99V		1MΩ	±250V
AM-123-1V	1 to 5V		1MΩ	±250V

Accuracy: ±(0.03% of rdg. +2 digits)
(At 23°C±5°C/35 to 85% RH)

■ **DC current measurement**

Range	Measuring range	Display	Internal resistance	Max. allowable input current
AM-123-22	±999.9μA	Offset ±9999 Full scale ±9999	100Ω	±50mA
AM-123-23	±9.999mA		10Ω	±150mA
AM-123-24	±99.99mA		1Ω	±500mA
AM-123-25	±999.9mA		0.1Ω	±3A
AM-123-2A	4 to 20mA		51Ω	±70mA

Accuracy: ±(0.1% of rdg. +2 digits)
(At 23°C±5°C/35 to 85% RH)
Only for the "25" range type:
±(0.3% of rdg. + 2 digits)

* For each type, the accuracy applies when the calculated value of (FSC-OFC)/(FIN-OIN) is less than 1.

■ **Model No. configuration**

AM-123- □□ □□

- Comparison output: 1. Relay output, 2. Photo-coupler output
- Power supply: 1. 90V to 264V AC
- Range code: 11, 12, 13, 14, 1V / 22, 23, 24, 25, 2A
- Series name
- Basic Model No.

■ **General specifications**

● **Measurement block**

Measurement function:
Specify DC voltage or DC current measurement.
Input circuit:
Single-ended type
Operation method:
Double integral
Sampling speed:
12.5 times/sec (50 Hz) or 15 times/sec (60 Hz), Selectable
Noise rejection ratio:
NMR, More than 50 dB (50/60 Hz)
Display: 7-segment LEDs
(Light emitting diode numeric elements)
Main monitor display unit;
Character height, 14.2m
[Red/green/orange: Settable to any color.)
Sub-monitor display units; Character height, 8mm (Green: Fixed)
Porarity display:
"—" is displayed when the result of computation is minus.
Overrange warning:
"oL" or "-oL" is displayed for the input signal of exceeding the display range.
Maximum display:
±9999 (4 digits)
Decimal point:
Can be set to any position (By operation switch)
Zero display:
Leading zero suppression

● **External control:**

Hold: With the S/H terminal shorted with the COM terminal or set to level "0"
Start: With the S/H terminal opened from the COM terminal or set to level "1"
Digital zero:
Displayed value is shown as "zero" just before with the DZ terminal shorted with the COM terminal or set to level "0" to store that value.

Peak hold / Valley hold / Peak valley hold: Enters the function set with the PH terminal shorted with the COM terminal or set to level "0."

Level "0": 0 to 1.5V
Level "1": 3.5 to 5V
Input current: Less than -0.5mA

● **Comparator**

Control method:
Computation by microcomputer
Setting range:
High/low settings including polarity
-9999 to 0 to +9999
Comparison action: By sampling speed

Requirements for comparison

Requirements for comparison	Result of comparison
HI setpoint<Displayed value	HI
HI setpoint≦Displayed value≦LO setpoint	GO
LO measured value>Displayed value	LO

Relay output:
Contact capacity
125VAC, 0.5A Resistive load
28VDC, 1A Resistive load
Photo-coupler output (NPN type):
Voltage; 30V max.
Current; 50mA max.
Saturated output voltage; Less than 1.2V at 50mA
Hysteresis:
Can be set between 1 and 999 digits for each comparison setpoint.

■ **Common specifications**

Memory backup:
EEPROM is used to retain the set data for 10 years. (No. of write times: 100,000 times guaranteed)
Data write to EEPROM:
Main data and condition data are written to the EEPROM when the meter returns to the operation state (press the "E" key) after they have been set. Also written when digital zero becomes effective with digital zero backup turned on.
Operating temperature/humidity range:
0 to 50°C/35 to 85% RH (Non-condensing)
Storage temperature/humidity range:
-10 to 70°C/less than 60% RH
Power supply:
90 to 264V AC (50/60 Hz)
Power consumption:
4VA (TYP) (At 100VAC)
Dimensions:
96(W) × 48(H) × 98(D)mm
DIN size
Weight: Approx. 280g

Dielectric strength:
Between input terminal and comparison output; For 1 min. at 500V DC
Between power terminal and input terminal/case/comparison output; For 1 min. at 2000V AC
Insulation resistance:
Between each terminal above; More than 100MΩ at 500V DC
Noise resistance:
Power terminal; Normal/common mode ±1500V
Square wave of 1ns (rise), Noise width 500 ns
Accessories:

Instruction manual	1 copy
Unit label	1 pc.
Terminal cover	1 pc.

7. Calibration

In order to assure the initial accuracy for a long period of time, periodically calibrate the meter. Before calibrating the meter, contact our sales agent or us directly.

8. Warranty and after-sale service

1) 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 Asahi'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 co.,Ltd.

2) 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 or Watanabe directly giving as much information on problem as possible.

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