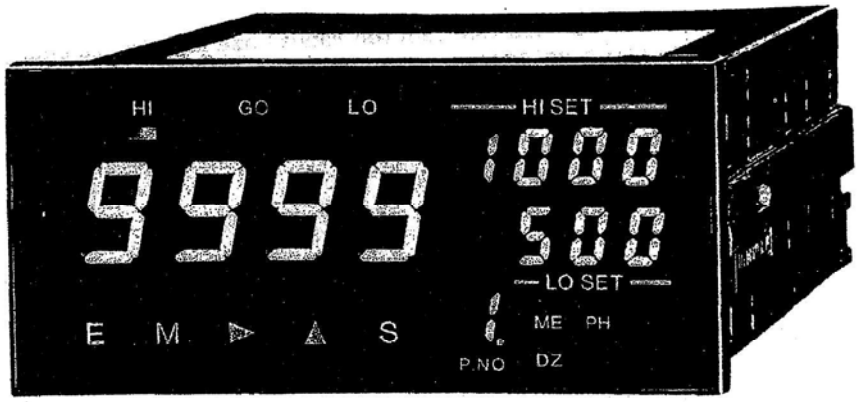
INSTRUCTION MANUAL

HIGH-SPEED STRAIN GAUGE METER RELAY

MODEL ASG-158



WATANABE ELECTRIC INDUSTRY CO., LTD.

Introduction

Thank you for purchasing our ASG-158 digital strain gauge meter relay, this time.
Prior to operation, please check that there is no damage during transportation, nor discrepancy between your ordered and our manufactured specifications.
Please take care that this instruction manual is always available to the operator of this meter.

Safety precautions

⚠ Precautions

(1) If voltage or current exceeding the allowable maximum voltage or current is applied to the input terminals, the meter may be damaged.

(2) Apply power within the applicable range of the meter. Otherwise fire, electric shock or meter damage may result.

(3) The contents of this instruction manual are subject to change without prior notice.

(4) This instruction manual is carefully prepared. However,if any mistake or omission is found, contact your nearest Watanabe sales agent or Watanabe directly.

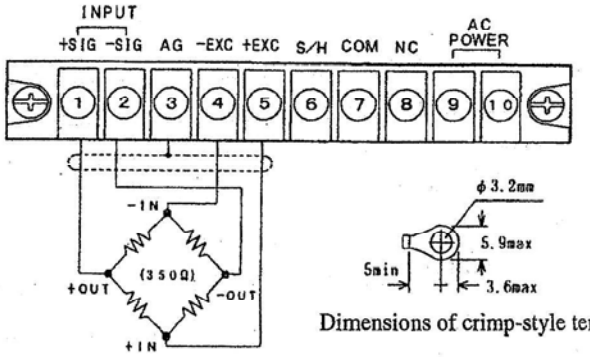
(5) Keep this manual available easily anytime.

Contents

1. Before operation

1-1 Terminal connection

■ Lower screw terminal board

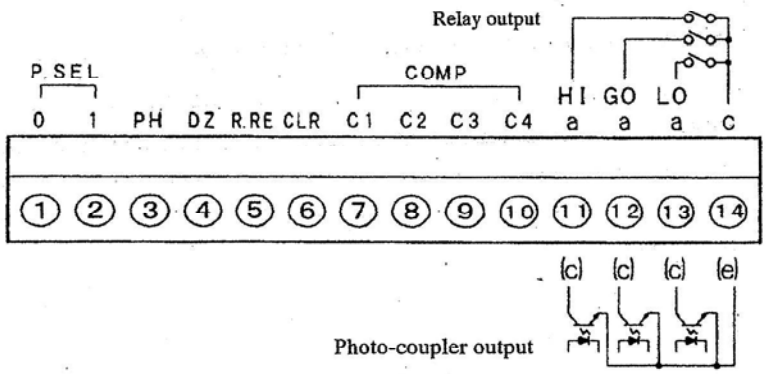


Dimensions of crimp-style terminal lug

Terminal No.	Function name	Description
①②	Input terminals (±SIG)	Sensor input terminals.
③	Analog ground (AG)	Input analog ground.
④⑤	Sensor power terminals (±EXC)	Sensor supply terminals.
⑥	START/HOLD terminal (S/H)	Holds the measured data/comparison result just before this terminal is shorted.
⑦	COMMON (COM)	Control input common terminal. [Isolated from the AG terminal (No.③).]
⑧	NC	Vacant terminal, but do not use it as a junction terminal.
⑨⑩	Power terminals (AC POWER)	Connect power for this meter to these terminals.

■ Upper screw terminal board

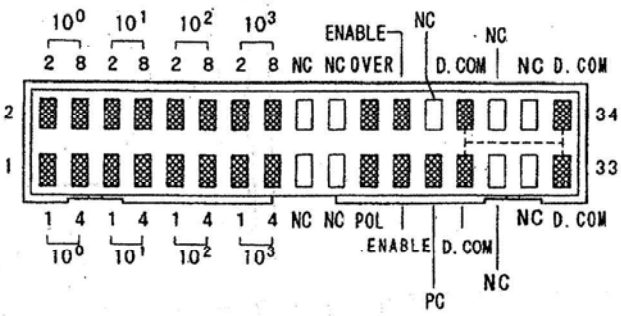
Upper screw terminal board



Terminal No.	Function name	Description
①②	Pattern select terminals (P.SEL)	Terminals where the pattern used is changed.
③	Peak hold terminal (PH)	Controls peak hold operation.
④	Digital zero terminal (DZ)	Conducts measurement with the displayed value just before this terminal is shorted set to "ZERO."
⑤	Relay reset terminal (R.RE)	Used when all of the comparison outputs are turned off.
⑥	Clear terminal (CLR)	Sets the peak hold value or comparison result to its initial state.
⑦⑧⑨⑩	SPC function terminals (COMP C1 to C4)	Decides the result of comparison using the number selected Note: When the SPC function is valid, see Chapter 3 items 3-3 "SPC function."
⑪⑫⑬⑭	Comparison output terminals	◎ Relay output Relay output terminals for comparison outputs HI, GO and LO. "c" contacts are connected in common on ⑭. Use these terminals at their rated capacity. 125 VAC/0.5A, 30 VDC/1A, Resistive load ◎ Photo-coupler output HI, GO and LO photo-coupler output terminals (NPN open-collector). ⑪⑫⑬: Collector side ⑭: Emitter side Use these terminals at their rated capacity. In addition, do not apply reverse voltage. Sink current: 20 mA max. (Less than 30 V) Less than 1.2 V at 20 mA

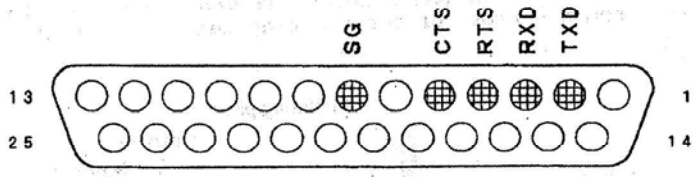
For the data output specification, the input/output terminals are as shown in the following.

■ **BCD output connector (Attached with press-in connector with strain relief)**
A plug conforming to the MIL Standard. Use the connector attached.
In addition, interchangeable with any socket conforming to the MIL Standard and available in the market.
Either of TTL and NPN open-collector outputs is available.



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

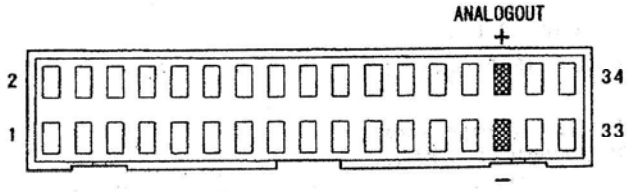
■ **RS-232C D-sub connector**
No connector is attached to the meter. Use a D-sub 25-P connector available in the market.
Applicable connector: 17JE-23250-02 (D8A) (Made by DDK)



Caution
○ means a vacant terminal, but do not use it as a junction terminal.

Note 1)
For RS-232C, see the instruction manual for "ASG-158 Series RS-232C."

■ **Analog output connector (Attached with press-in connector with strain relief)**

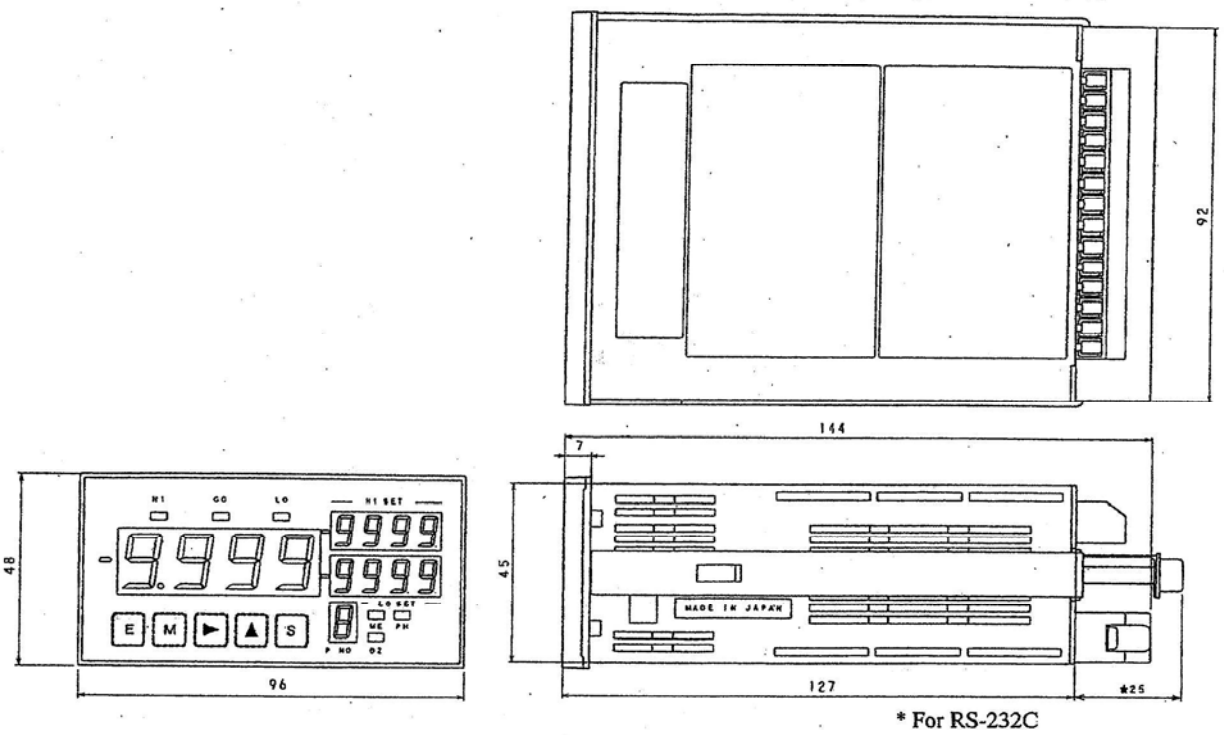


Caution
□ means a vacant terminal, but do not use it as a junction terminal.

Note 1)
For the analog output specification, either of outputs of 4 to 20 mA and 0 to 10 V is available.

1-2 Dimensions and mounting

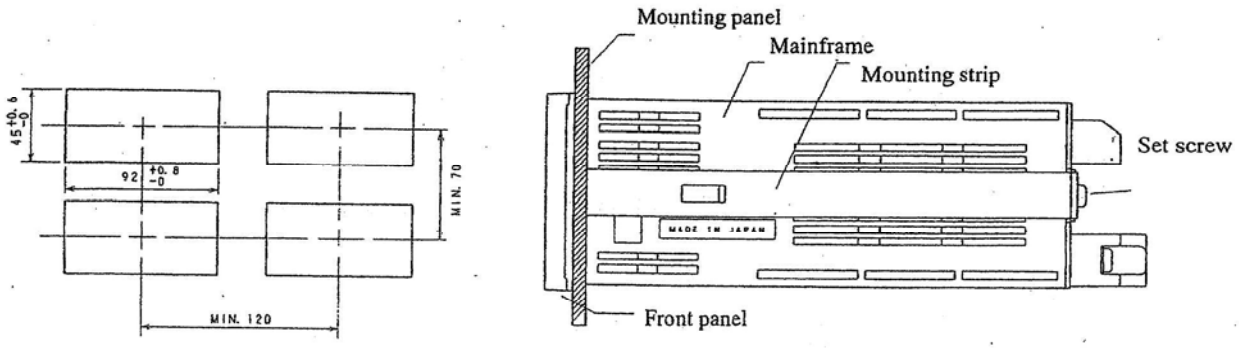
■ Dimensions (The following Figures are for the meter with the RS-232C specification.)



* For RS-232C

■ Mounting

Make the panel cutout as show in the panel cutout diagram, and then insert the meter in the panel as shown in the following from the front of the mounting panel. Finally, secure the meter from the rear with a mounting strip.



⚠ Caution

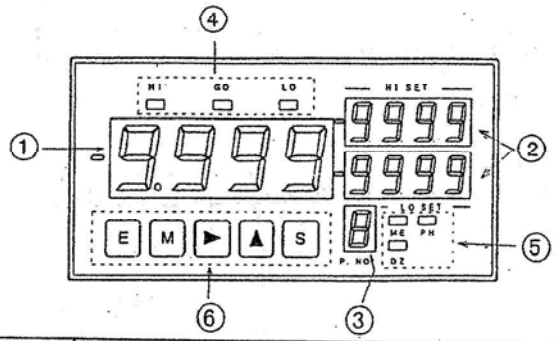
1) Recommended panel thickness: 0.8 to 5 mm
   Tighting torque: Approx. 0.39 to 0.49 N.m

2) Do not install the meter at places where:
   - it is exposed to the direct sunshine,
   - ambient temperature and humidity are not within 0 to 50°C and 35 to 85% RH, respectively,
   - a change in temperature is rapid and as a result dew may condense,
   - there are chemicals and/or corrosive gases harmful to electrical parts and also there is much dust.

3) Do not apply vibration or shock to the meter.

4) When the meter is mounted within equipment, fully ventilate the inside of the equipment so that the inner temperature will not exceed 50°C.

1-3 Functional description



No.	Name		Function
①	Main display		Measured value/error Calibration value/comparison value/data during condition data setting, in SET mode
②	Monitor display		HI setpoint/LO setpoint/max. value/min. value/difference between max. and min. values/message in SET mode
③	Pattern display		Comparison data pattern/scaling data pattern/comparisons 1 to 4
④	Comparison output display		Comparison output state
⑤	Function display	ME (Memory of DZ value)	Lit when the digital zero value backup function is selected.
		DZ (Digital zero)	Lit when the digital zero function is activated. Lit when the input is stabilized during calibration.
		PH (Peak hold)	Lit when the peak hold function (peak/valley/peak valley) is activated.
⑥	Sheet switch	Ⓔ (Enter key)	Used for double function operation/data establishment/measurement operation reset.
		Ⓜ (Mode key)	Used for selection of each data setting item/comparison setting data check.
		▶ (Shift key)	Used for selection of each data setting digit/scaling setting data check.
		▲ (Increment key)	Used for each data item setting (Shift from 0 to 9 and from -1 to -9 in due order). Used for condition data check.
		Ⓢ (SET key)	Used for display selection by double function operation/clear operation.

Note 1) Double function operation:
Key operation to enter the respective mode by pressing any other key while pressing any one of the Ⓔ, Ⓢ and ▶ keys.

Note 2) Condition data setting:
Data setting to decide the activation state of each function of this meter.

1-4 List of double function key operations

Operation key	Function	Operation	Chapter/item to be referred to
Ⓔ + ▲ 3 sec.	Condition data setting (Measurement operation suspended)	Shift the item by the Ⓜ key (Pro → bAUd). Set the data by the ▶ and ▲ keys. Return to measurement operation by the Ⓔ key. Can be set only when Pro is set to oFF.	Chapter 2. Item 2-2
Ⓔ + Ⓜ	Comparison setpoint (Measurement operation suspended)	Shift the item by the Ⓜ key (P- → PuH). Set the data by the ▲ and ▶ keys. Return to measurement operation by the Ⓔ key. Can be set when Pro is set to 01 or oFF.	Chapter 2 Item 2-3
Ⓔ + ▶ 3 sec.	Calibration setting (Measurement operation suspended)	Shift the item by the Ⓜ key (cAL 1 → SPAn). Set the data by the ▲ and ▶ keys. Return to measurement operation by the Ⓔ key. Can be set only when Pro is set to 02 or oFF.	Chapter 2 Item 2-4
Ⓢ + Ⓜ	Display of max. value, min. value or diff. between max. and min. values. ((Measurement operation suspended)	Shift the item by the Ⓜ key (MAX → MIn → M-n). Return to measurement operation by the Ⓔ key.	Chapter 2 Item 2-5
Ⓢ + ▲	Display of result of comparison (Measurement operation suspended)	Change the comparison from 1 to 4 by the ▲ key. Return to measurement operation by the Ⓔ key.	Chapter 3 Item 3-4
▶ + ▲	Pattern change (Measurement operation suspended)	Each time the ▶ + ▲ keys are pressed, the pattern changes. Valid only when the PSEL condition data setting is set to "In" (inside).	Chapter 2 Item 3-5

Note 1) For double function key operation, always press the Ⓔ, Ⓢ or ▶ key first. Otherwise, the respective function is not accepted.

Note 2) For operation with no time display in the above double function key operation, the respective function is accepted 0.5 sec. after the keys are pressed.

2. How to use each function

2-1-1 Initializing the setpoint

Turn the power on while pressing the ⓢ key and if the ⓢ key is continuously pressed until all of the LEDs are lit, each data returns to the following initial setpoint.

2-1-2 Initial setpoint of each data

■ Condition data

Display	Function	Initial value
Pro (Pro)	Key operation protect setting	oFF
SMP (SMP)	Sampling speed setting	50
dcy (dcy)	Display speed setting	25
McP (McP)	SPC function setting	oFF
ct1～4 (ct1～4)	Comparison timer time setting Note 1)	0
AEnw (AEnw)	Variation point hold band setting Note 2)	0
MAV (MAV)	Setting of No. of moving averaging times	oFF
S-H (S/H)	Start hold type setting	A
P-H (P/H)	Peak hold type setting	A
Std (Std)	Start delay time setting	0
rLd (rLd)	Comparison output delay time setting	0

Display	Function	Initial value
trt (trt)	Tracking zero time setting	0
trw (trw)	Tracking zero band setting	1
Fi- (Fi-)	Fixed zero setting	oFF
PSEL (PSEL)	Pattern select control setting	oUt
c-c (c-c)	Clear control setting	oUt
ZAd (ZAd)	Zero adjust control, setting	oFF
bUP (bUP)	Digital zero value backup setting	oFF
ELPw (ELPw)	Initial peak removal width setting	0
ELPt (ELPt)	Initial peak removal time setting	0
AoHi (AoHi)	Analog output HI setting Note 3)	9999
AoLo (AoLo)	Analog output LO setting Note 3)	0
bAUd (bAUd)	Baud rate setting Note 4)	9600

Note 1) Displayed when McP is set to on.
Note 2) Displayed when McP is set to oFF.
Note 3) Displayed for the meter with the analog output specifications.
Note 4) Used for the meter with the RS-232C output specification.
Note 5) Condition data is valid for and common to each pattern from 1 to 4.

■ Comparison data

Display	Function	Initial value
S-Hi (S-Hi)	HI comparison setpoint	1000
S-Lo (S-Lo)	LO comparison setpoint	500
H-Hi (H-Hi)	HI hysteresis value setting Note 1)	0
H-Lo (H-Lo)	LO hysteresis value setting Note 1)	0
PvH (PvH)	Peak hold mode setting Note 2)	PH

Setting item	Pattern 1 (P1)				Pattern 2 (P2)			
	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)
S-HI	1000	1000	1000	1000	1000	1000	1000	1000
S-LO	500	500	500	500	500	500	500	500
H-HI	0	—	—	—	0	—	—	—
H-LO	0	—	—	—	0	—	—	—
PVH	PH	PH	PH	PH	PH	PH	PH	PH

Setting item	Pattern 3 (P3)				Pattern 4 (P4)			
	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)
S-HI	1000	1000	1000	1000	1000	1000	1000	1000
S-LO	500	500	500	500	500	500	500	500
H-HI	0	—	—	—	0	—	—	—
H-LO	0	—	—	—	0	—	—	—
PVH	PH	PH	PH	PH	PH	PH	PH	PH

Note 1) Hysteresis acts on the comparison 1 (C1) value of each pattern from 1 to 4.
This is valid when McP is set to oFF in the condition data setting.
Note 2) The peak hold mode can be set independently of each comparison from 1 to 4, but is common to all of patterns from 1 to 4.

■ Calibration data

Display	Function	Initial value
d.P. (d.p.)	Decimal-point setting	.... 0.000
ZEro (ZEro)	Zero value	0.000
SPin (SPin)	Input value	1.000
SPAn (SPAn)	Displayed value	9900

The decimal point is set to "None."

2-2 Condition data

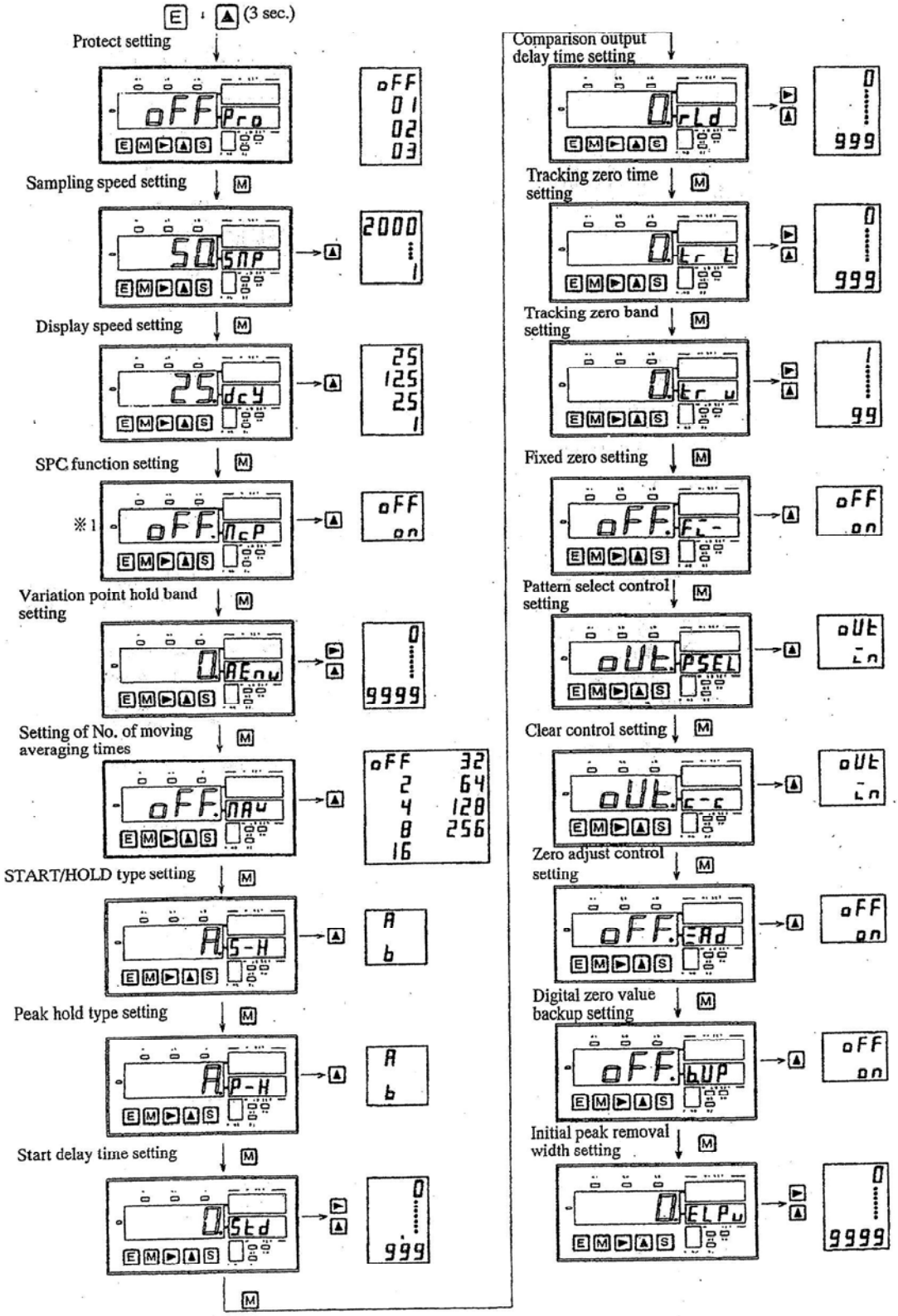
2-2-1 Condition data setting

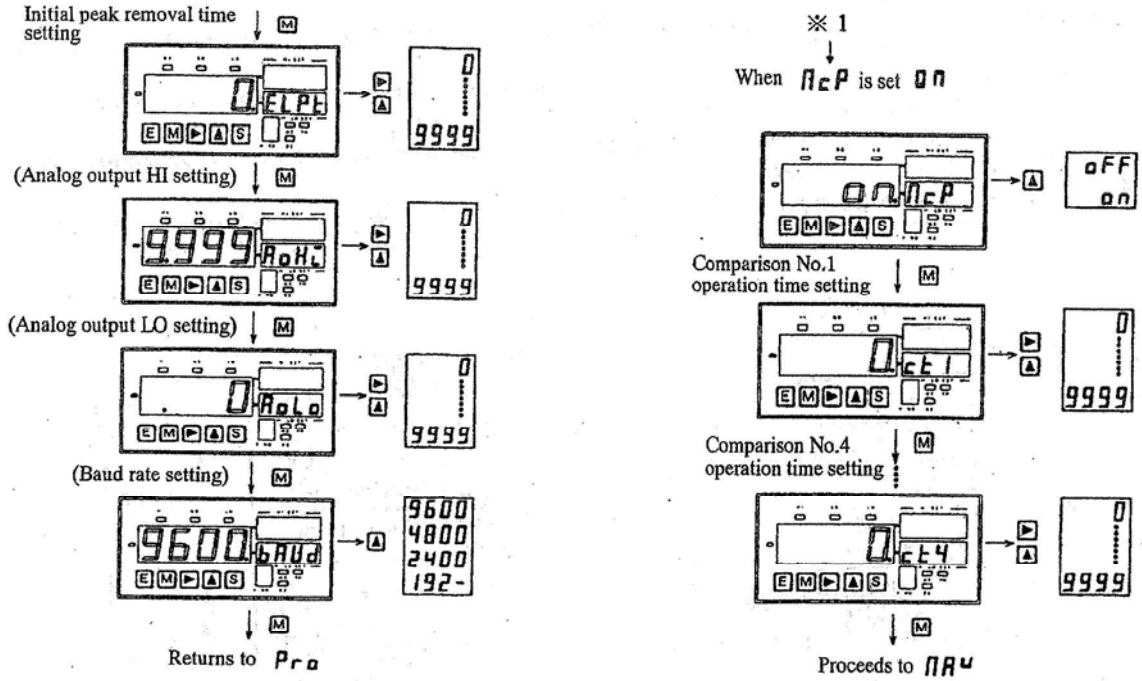
Condition data setting means data setting which determines the activation state of each function of this meter.

Pressing the Ⓔ + ▲ keys (3 sec.) at the front sets the meter to the condition data setting mode as shown in the following. The setting can be changed when Pro is set to oFF.

Each condition is displayed on the monitor display unit each time the Ⓜ key is pressed. Therefore, set the desired data by the ▲ or ▶ key.

The data thus set becomes valid by the Ⓔ key and the meter is in measurement operation. The BCD output during the setting becomes "0000." In addition, the analog output becomes 0 mA (0V).





Note 1) Pressing the Ⓔ key during the setting writes the data to the EEPROM. Then, the meter returns to measurement operation.

Note 2) *1 The meter changes to this display from the SPC function setting when the SPC function setting is turned on.

Note 3) Measurement operation is suspended during the setting.

2-2-2 Description of condition data

● Pro (Protect setting)

Sets key operation protect.

oFF ... The operation of Ⓔ + Ⓜ and Ⓔ + ▶ (3 sec.) is enabled and as a result the comparison setpoint and calibration can be changed. In addition, pressing the Ⓜ key after Pro is displayed moves to the condition data. Thus, the data can be changed.

01 .... Only the operation of Ⓔ + Ⓜ is enabled, and as a result the comparison setpoint can be changed.

02 .... Only the operation of Ⓔ + ▶ (3 sec.) is enabled and as a result the calibration can be changed.

03 .... The operation of Ⓔ + Ⓜ and Ⓔ + ▶ (3 sec.) is not accepted. No comparison setting, calibration or condition data setting (other than the protect setting) can be changed.

Note) No comparison operation is performed during the setting. The comparison output is turned "OFF." The BCD output during the setting becomes "0000." In addition, the analog output becomes 0 mA (0V). If the meter returns to measurement operation after the setting is finished, the meter is reset in the same state as that where clear operation is executed. (See chapter 3, item 3-3-6 "Clear.")

● SMP (Sampling speed setting)

The sampling speed is set.

Sampling speed (Times/sec.)			
Display	Times/sec.	Display	Times/sec.
2000	2000	20	20
1000	1000	10	10
500	500	5	5
200	200	2	2
100	100	1	1
50	50	—	—

● dcY (Display speed setting)

The display updating speed is set.

Display	Updating speed
25	25 times/sec.
12.5	12.5 times/sec.
2.5	2.5 times/sec.
1	1 time/sec.

● nCP [SPC (Section Point Compare) function setting]

It is set whether or not comparisons from 1 to 4 are used.

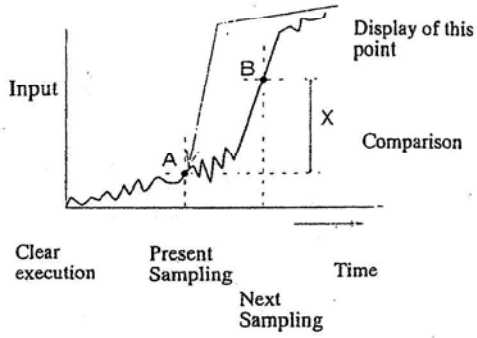
oFF ...Each comparison terminal from 1 to 4 and comparison timer operation are invalid. Comparison and peak hold operations are performed using the contents of comparison 1 (C1). At this time, the ct 1 to 4 condition data setting is not displayed.

on . Each comparison terminal from 1 to 4 and comparison timer operation are valid. (Refer to Chapter 3, items 3-3 and 3-4 "SPC function.) At this time, **AEnu** (variation point hold band setting) is not displayed.

- **ct 1~4** (Comparison timer setting)
  Sets the time to perform comparison operation after initial peak removal operation is finished.
  Setting range: 0 to 9999 ms
  If 0 is set, no timer operation is performed.
  When the SPC function terminal (each comparison terminal from C1 to C4) is controlled before operation is performed by the timer, terminal operation has priority over others. There is no condition for the setting of Ct1 to 4, but Ct4 has the highest priority. Therefore Ct1 to 3 are not operated after Ct4 is finished by the timer or terminal. (For removing the initial peak, see Chapter 2, item 3-2 "Initial peak removal function.")
  Displayed when **AcP** is set to **on**. For this operation, see Chapter 3, item 3-3-2 "Timer setting."

Note) The timer starts counting immediately when the meter returns to measurement operation after the timer is set.

- **AEnu** (Variation point hold band setting)
  Sets variation point hold operation.
  Sets the amount of variation between the present and next samplings. If the amount of variation between samplings A and B becomes larger than the setpoint, the value at point A is held to output the result of comparison.
  Hereafter, the result is held until the displayed value is cleared. If CLEAR is executed by the (8) key or on the CLR terminal, the hold state is released.
  This action is taken by the amount of variation in the positive direction if the setpoint is positive, while in the negative direction if the setpoint is negative. No action is taken at a setpoint of "0."
  Displayed when **AcP** is set to **oFF**.



- **nAu** (Setting of No. of moving averaging times)
  Sets the number of moving averaging times. This setting is effective to lessen the effect of noise contained in the signal. Set any one of **oFF**、**2**、**4**、**8**、**16**、**32**、**64**、**128**、and **256**.
  The larger the number of moving averaging times, the higher the filter effect.
- **S-H** (START/HOLD type setting)
  Sets the external terminal (S/H) operation type. The setting of **A** (A) results in the free-run type, while the setting of **b** (B) results in the one-shot type.
  See Chapter 3, item 3-1 (5) and Chapter 6 "Timing chart."
- **P-H** (Peak hold type setting)
  Sets the external terminal (P/H) operation type. The setting of **A** (A) results in the progressing type, while the setting of **b** (B) results in the result type.
  If **AcP** is set to **on**, only the **A** type of operation is performed even with **b** set.
  See Chapter 3, item 3-1 (2) and item 6 "Timing chart."
- **Std** (Start delay time setting)
  Sets the time until the actual signal is captured after the S/H terminal is controlled and as a result the meter is in the start state.
  Setting time: 0 to 999 ms
- **rld** (Relay delay time setting)
  Sets the delay time until the actual comparison output is turned "OFF" when the decision of comparison changes from "ON" to "OFF".
  Setting time: 0 to 999 ms
  For the relay output, a delay time of 10 ms occurs even if the setting is between "0 and 10."
- **tr t** (Tracking zero time setting)
  Sets the correction time of the tracking zero function.
  Setting time: 0 to 999
  See Chapter 3, item 3-6 "Tracking zero function."
- **tr u** (Tracking zero band setting)
  Sets the correction band of the tracking zero function.
  Setting band: 1 to 99 digits
  See Chapter 3, item 3-6 "Tracking zero function."
- **FL-** (Fixed zero setting)
  Sets the fixed zero point.
  When set to **on**, the 10^0 digit is forcibly fixed to the zero point.
- **PSEL** (Pattern select control setting)
  Sets pattern select control.
  When set to **Lin**, controlled internally (front key) and via RS-232C, while when set to **out**, externally (screw terminal board).
  See Chapter 3, item 3-1-1) "Pattern select."

- CLr (Clear control setting)
  Sets whether clear control is performed from the terminal board or front key.
  out ....Clear control is performed from the external terminal (CLR).
  on.....Clear control is performed through key operation (S + 3 sec.).
  For details on clear control, see Chapter 3, item 3-1-6.

- ZAd (Zero adjust control setting)
  Sets whether or not zero adjustment is conducted by the ▲ key.
  oFF.....No zero adjustment is conducted even if the ▲ is pressed.
  on .....Zero adjustment is conducted if the ▲ is pressed (3 sec.).
  For details on zero adjust control, see Chapter 3, item 3-5 "Zero adjust function."

- b.UP (Digital zero backup control function)
  Sets digital zero backup.
  oFF.....No digital zero backup is performed.
  on .....If the DZ control terminal is turned ON, the digital zero value at this time is written to the EEPROM (memory). This value becomes valid when this meter is operated next time while the DZ control terminal is being turned ON, and the display becomes (Input value-Digital zero value). When the backup function is set to on, the "ME" monitor LED lights.
  No. of data write times to EEPROM: 100,000 guaranteed

- ELPu (Initial peak removal width setting)
  Sets the initial peak removal width.
  Setting width: 0 to 9999 digits
  For this operation, see Chapter 3, item 3-3 "Initial peak removal function."

- ELPt (Initial peak removal time setting)
  Sets the time from detecting the initial peak to releasing the initial peak removal function.
  Setting time: 0 to 9999 ms
  No peak removal operation is performed at a setting of 0.
  For this operation, see Chapter 3, item 3-3 "Initial peak removal function."

- AoHc, AoLo (Analog output scaling)
  AoHc .... Sets the displayed value at an analog output of 20 mA (10 V).
  AoLo .... Sets the displayed value at an analog output of 4 mA (0 V).
  These are displayed only for the meter with the analog output specification.
  Setting range: 0 to ±9999

- bAUd (Baud rate setting)
  Sets the baud rate in RS-232C communication.
  9600 .... 9600 bps
  4800 .... 4800 bps
  2400 .... 2400 bps
  192..... 19200 bps

  Sets this baud rate for the meter with the RS-232C specification. The baud rate changes if returned to measurement operation by changing the setting.
  For details on RS-232C, see the instruction manual for "ASG-158 Series RS-232C."

2-3 Comparison setting

2-3-1 Comparison data setting

This is to set any value which is compared with a measured value.

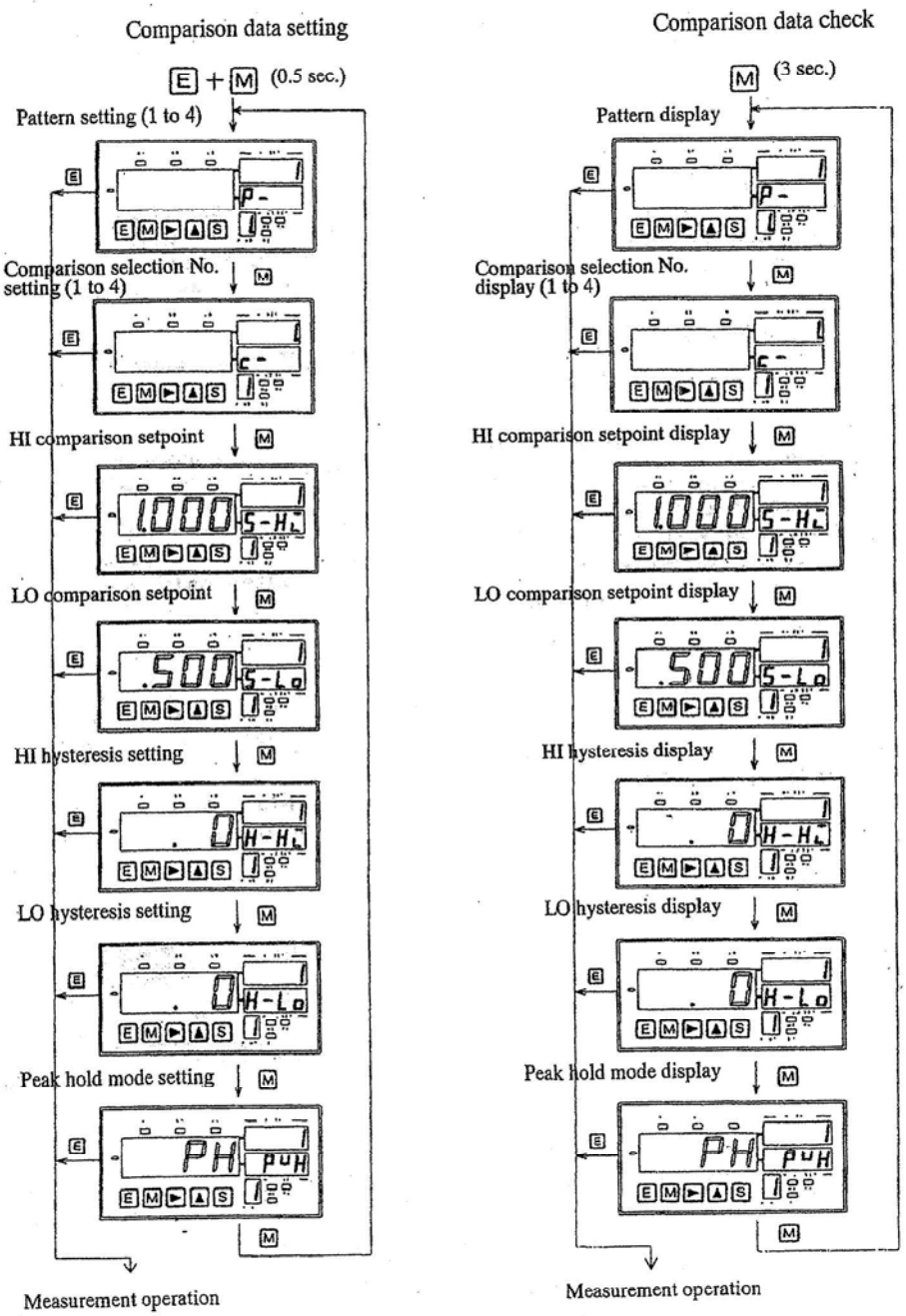
Pressing the Ⓔ + Ⓜ (0.5 sec.) front keys changes to the comparison setting mode as shown in the following. In addition, pressing the Ⓜ key (3 sec.) enables only the comparison data corresponding to the pattern now selected to be checked.

No operation of Ⓔ + Ⓜ can be performed if Pro(condition data setting) is set to 02 or 03.

No comparison operation is performed during the setting. The comparison output is turned "OFF." The BCD output during the setting becomes "0000." In addition, the analog output becomes 0 mA (0 V).

If returned to measurement operation after the setting is finished, the meter is reset in the same state as that where clear operation is executed.

(See Chapter 3, item 3-3-6 "Clear")



The setpoint is displayed on the main display unit. Becomes valid just when the Ⓔ key is pressed to return to measurement operation.

Note 1) As a setting condition, HI setpoint > LO setpoint needs to be satisfied. Otherwise Err is displayed to return to S-HI.

Note 2) Measurement operation is suspended during the setting.

2-3-2 Description of comparison data setting

1) Setting method

After the meter enters the comparison data setting mode, the pattern display unit shows the pattern to be set. Change the pattern by pressing the [▲] key while the decimal point on the pattern display LED flashes.

Next, pressing the [M] key displays "C -" on the LO setting display unit and the comparison number is displayed on the HI setting display unit to make the decimal point flashing.

Press the [▲] key to set the number in which the comparison value is set. The setpoint corresponding to the number set here is used when COMP C1 to C4 or Ct1 to Ct4 (for timer setting) is operated.

Next, each time the [M] key is pressed, each of the HI comparison setpoint, LO hysteresis value and peak hold mode to be set on the monitor display unit is displayed, while the main display unit displays the respective data.

Press the [▶] key to shift the digit and press the [▲] key to set the numeric value. After the meter enters the setting mode, the decimal point in the setting digit flashes.

Setting range: Comparison value; -9999 to 9999
Peak hold mode; PH (peak hold), VH (valley hold) and PVH (peak valley hold)

Setting condition: S-HI > S-LO
$(S - HI) \geqq (S - LO) + (H - LO)$
$(S - LO) \leqq (S - HI) - (H - HI)$

Pressing the [M] key for 3 sec. during measurement operation can check the comparison setpoint. This operation is the same as that of changing the comparison setting, but no setpoint can be changed. In addition, only the contents corresponding to the pattern number set at that time can be checked. If there is no key operation while in checking, the meter returns to measurement operation about 16 sec. later.

Note: This operation cannot be performed with the max. or min. value displayed on the monitor display unit.

2) Hysteresis

For this meter, hysteresis can be added to the comparison setpoint.

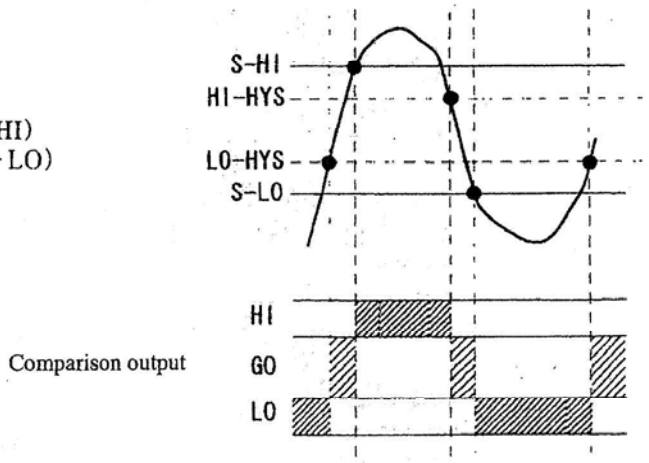
As this meter is so designed that hysteresis is added to the lower side of the HI comparison setpoint and to the upper side of the LO comparison setpoint.

HI and LO hysteresis bands can be independently set within the setting range from 5 to 999 digits.

When the meter is used with the peak hold mode turned ON, this hysteresis is ignored even if set.

It can be set only in comparison 1 (C - 1) and is activated only when the SPC function is invalid [if the nCP (condition data setting) is set to oFF].

$$HI-HYS = (S-HI) - (H-HI)$$
$$LO-HYS = (S-LO) + (H-LO)$$



3) Peak hold mode

This meter can set the peak hold mode for each of comparisons 1 to 4. However, the peak hold mode is common to patterns 1 to 4.

(Example: If the peak hold mode corresponding to comparison 1 is set to "uH", the peak hold mode of patterns 1 to 4 corresponding to comparison 1 becomes "uH.")

PH (Peakhold)..... Always displays the maximum measured value.
uH (Valleyhold)..... Always displays the minimum measured value.
PuH (Peak valley hold).. Always displays (Maximum displayed value - Minimum displayed value).

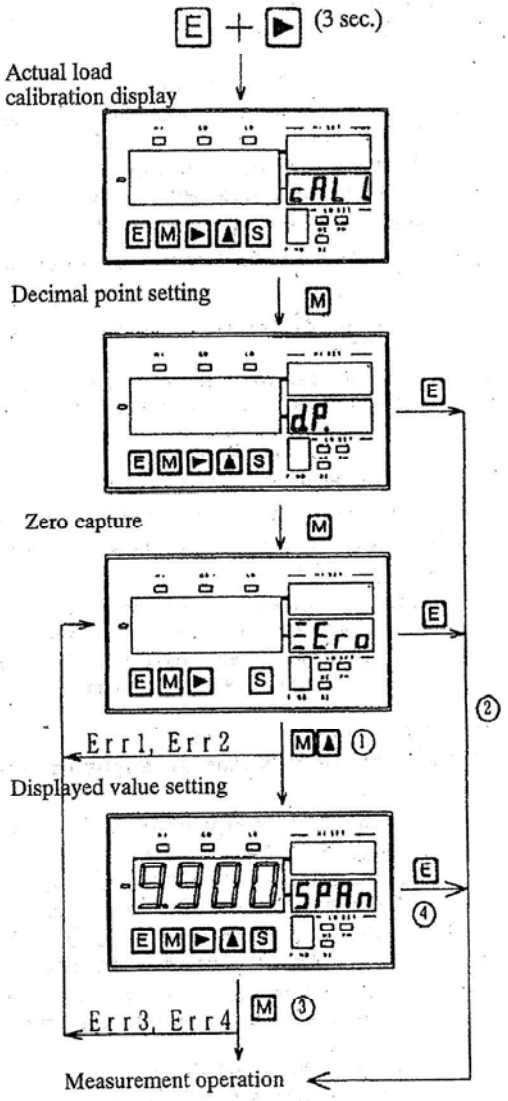
Note) If nCP (condition data setting) is set to oFF, the meter operates using the contents set in comparison 1.

2-4 Calibration

For this meter, two calibration methods are available: actual load calibration in which any actual load is applied to calibrate the meter and equivalent calibration in which sensor data is entered by key operation to calibrate the meter without applying any actual load. However, no calibration can be performed with Pro (condition data setting) set to 01 or 03.
No comparison operation is performed during the setting. The comparison output is turned "OFF." The BCD and analog outputs during the setting become "0000" and 0 mA (0 V), respectively. When returning to measurement operation after the setting is finished, the meter is reset in the same state as that where clear operation is performed.
(See Chapter 3, item 3-3-6 "Clear.")

2-4-1 Actual load calibration setting (CAL 1)

■ Ⓔ + ▶ (3 sec.):
Calibration setting (Measurement operation suspended)



■ Description of setting

: Decimal point setting
Set the position of the decimal point by the ▶ key.

: Zero value capturing
① Do not apply any load to the sensor.
After the input is stabilized, the "DZ" LED lights.
After the no-load input is stabilized, press the Ⓜ key.
Thus the data when the display shows "0" is captured.
When no zero calibration is performed, press the ▲ key to move to the next "SPAn" without capturing the zero calibration data.
② Press the Ⓔ key to return the meter to measurement operation without capturing the zero calibration data.

: Displayed value setting
③ Apply the actual load to the sensor.
Set the value displayed when the actual load is applied by the ▶ and ▲ keys. After the input is stabilized, the "DZ" LED lights.
Press the Ⓜ key to capture the value displayed when the actual load is applied.
④ When not changing the displayed value set, press the Ⓔ key to return the meter to measurement operation without changing the displayed value set.

Note 1)
After the input is stabilized, the "DZ" LED lights, but even if it does not light, the data is captured by pressing the Ⓜ key.

Note 2)
For Err1 to Err4, see page 16.

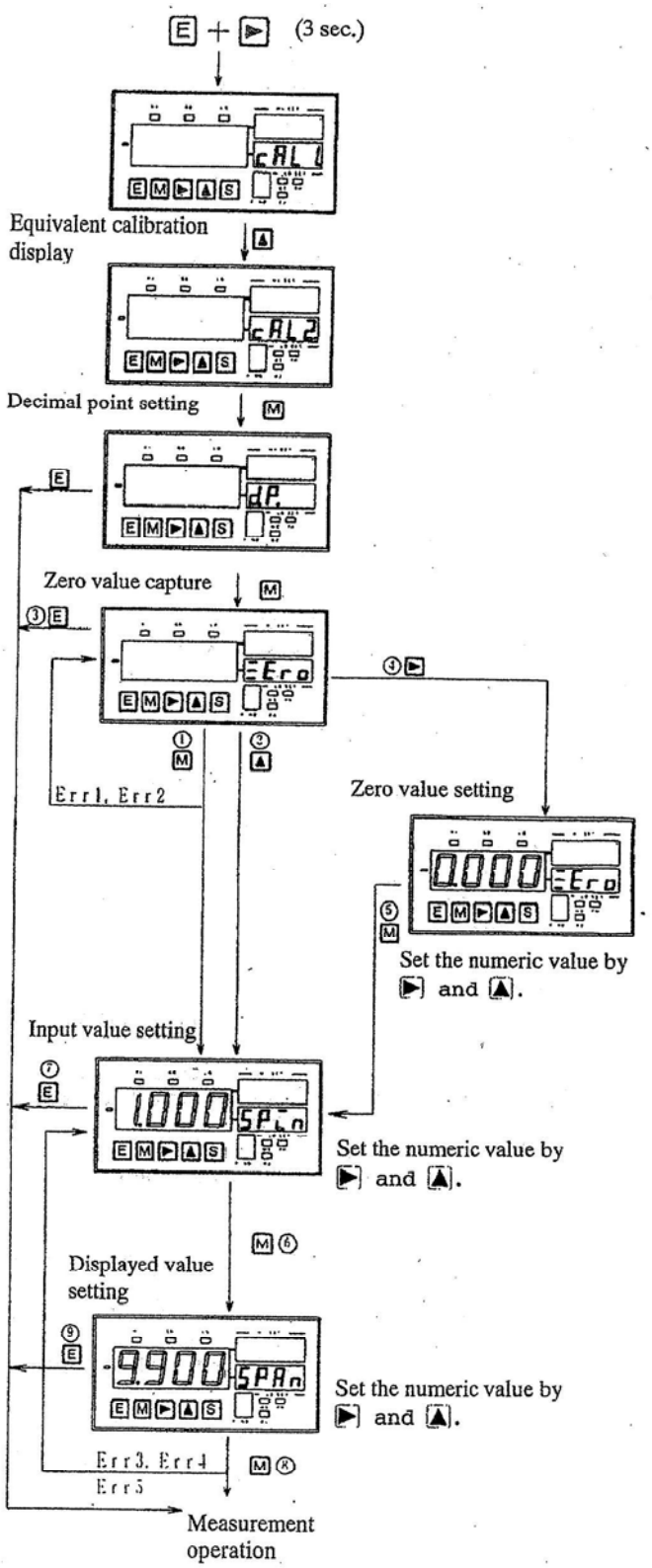
2-4-2 Equivalent calibration setting (cAL2)

■ Ⓔ + ▶ (3 sec.): Calibration setting (Measurement operation suspended)

■ Description of setting

Pressing Ⓔ + ▶ (3 sec.) displays cAL1 on the setting display unit of the LO side.

Next, press the ▶ key to display cAL2.



: Decimal point setting

Press the ▶ key to set the position of the decimal point.

: Zero point capturing

① Do not apply any load to the sensor.
If the input is stabilized, the "DZ" LED lights.
After the input is stabilized, press the Ⓜ key to capture the data when the display shows "0" and then move to the next SPLn.

② It no zero adjustment is performed, press the ▲ key to move to the next SPLn.

③ Press the Ⓔ key to return the meter to measurement operation.

④ When the sensor is not used, press the ▶ key to move to the zero value setting.

: Zero value setting

⑤ Set the sensor input value at which "0" needs to be displayed in steps of mV/V by the ▶ and ▲ keys.
Pressing the Ⓜ key stores the setpoint to move to the next SPLn.
Setting range: -0.300 to +2.000
If any setting out of the range is made, an error is displayed just when the Ⓜ key is pressed to return to the previous setpoint.

: Input value setting

⑥ Set the input value in steps of mV/V by the ▶ and ▲ keys.
Pressing the Ⓜ key stores the setting to move to the next SPAn.
Setting range: +1.000 to 3.000
If any setting out of the range is made, an error is displayed just when the Ⓜ key is pressed to return to the previous setting.

⑦ Pressing the Ⓔ key returns to measurement operation without capturing the input value.

: Displayed value setting

⑧ Set the displayed value when the input equal to the input value setting is accepted by the ▶ and ▲ keys.
Pressing the Ⓜ key makes each setting valid to return to measurement operation.
Setting range: 1 to 9999
If any setting out of the range is made, an error is displayed just when the Ⓜ key is pressed to return to the previous setting.

⑨ Pressing the Ⓔ key returns to measurement operation without capturing the displayed value set.

Note 1) After the input is stabilized, the DZ LED lights, but the data is captured even while the LED is turned off.

Note 2) The input range during calibration using the actual load is as follows.
When capturing zero value: Approx. -0.3 to +2.0 mV/V
When setting displayed value: Approx. 1.0 to 3.0 mV/V.

Note 3) If any error is found during the setting, either of the following messages is displayed.
Err 1: Input when capturing zero value is less than -0.3 mV/V.
Err 2: Input when capturing zero value is more than +2.0 mV/V.
When the input at no load exceeds the zero adjustment range, connect a fixed resistor to one side of the sensor bridge to correct the imbalance. However in this case, use the resistor with a high temperature coefficient as it directly affects the accuracy.
The following table applies to a resistance of 350Ω between the sensor terminals.
When connected between -SIG and -EXC.
(For reversing the polarity, connect the resistor between - SIG and +EXT.)

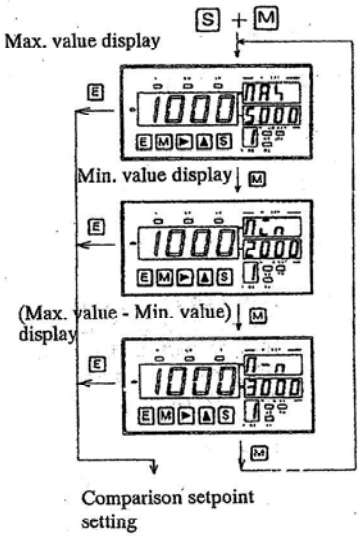
Input converted strain (mV/V)	-0.3	-0.5	-0.8	-1.0	-1.2	-1.4	-1.6	-1.8	-2.0	-2.5
Resistance (kΩ)	174	147	110	86.6	73.2	61.9	54.9	48.7	43.6	34.8

Err 3: Input when the displayed value is set or the setting equals to or is smaller than that when the zero value is captured.
Make the input when the displayed value is set (input value setting) larger than the input when the zero value is captured (setting when the zero value is captured).
Err 4: Input when the displayed value is set or the input value setting exceeds the gain adjustment range.
Make the inputs when the displayed value is set (or input value setting) smaller.
Err 5: Input when the displayed value is set or the input value setting is less than the minimum input sensitivity. Set SPin larger or set SPAn smaller.

Note 4) If the power is turned off during the setting, the data set becomes invalid.
Note 5) If the SPin value is set smaller, an error becomes larger. Therefore, set the value as large as possible.
Note 6) As this meter is so designed that the 4-wire sensor is used, an error may be included in equivalent calibration caused by wiring resistance if the cable becomes long.
Note 7) If it becomes impossible to exit from the error display, turn the power off once and then turn it on again. The meter operates at the setpoint before entering the setting.

2-5 Maximum/minimum value display and pattern change

1) Displaying the maximum or minimum value or the difference between the maximum and minimum values
For this meter, it is possible to display the maximum or minimum value, or the difference between the maximum and minimum values on the LO setting display unit. (A message is displayed on the HI setting display unit.)
Pressing the (S) + (M) keys on the comparison value display turns to the state of displaying the maximum value (MAX), the minimum value (MIN) or the difference between the maximum and minimum values (M-m).
In order to return to the comparison value display, press the (E) key.
If the power is turned off and then on again, the meter displays the comparison value.
The maximum value, the minimum value or the difference between the maximum and minimum values is selected by pressing the (M) key. These values are always stored for the result of measurement and also they are cleared by the (S) key (3 sec.) or on the CLR terminal.



Note) If the measured value overflows, all of the decimal points on the LO setting display unit flash.
This state is released by the data clear function.

2) Pattern change
A pattern change can be made by the front keys or on the terminal in the PSEL condition data setting.
When using the front keys, each time the (▶) + (▲) keys are pressed, the pattern can be changed from 3 + 4. When using the terminal, see Chapter 3, item 3-1-1 "Pattern select."

Note 1) No pattern can be changed by the front keys with the maximum or minimum value displayed. Press the (E) key to display the comparison value, and then change the pattern.
Note 2) First clear operation is performed by the (S) key or on the CLR terminal after the pattern is selected with MCP (condition data setting) set to ON, and then the pattern is selected.

2-6 EEPROM

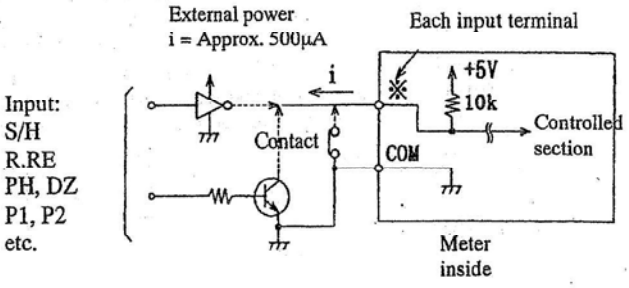
This meter has a built-in EEPROM which stores the comparison setpoint, calibration data, etc.
No. of data write times to EEPROM: 100,000 guaranteed
The EEPROM is re-written when any one of the following operations is performed.

- When the meter returns to measurement operation by the (E) key after the operation of comparison, calibration or condition data setting is performed,
- When the zero value is updated with b.UP (condition data setting) set to ON,
- When the calibration zero value is updated by the zero adjust function

3. How to use other functions

3-1 Control terminals

This meter is provided with control terminals for pattern select, peak hold, digital zero, relay reset, start/hold, comparison, clear and ENABLE for the BCD output specification.
Apply control signal input as dry contact input.
For transistor input, use open-collector output.
As current flowing through the contact is small, use the contact for extremely small current.
Input rating of each control terminal
Level "0" : 0 to less than 1.5V
Level "1" : 3.5 to 5 V
Input current: Less than - 0.5 mA



3-3-1 Pattern select

When changing the pattern on external terminals, connect the terminal in the table below to the COM terminal.

Upper screw terminal \ Pattern No.	P1	P2	p3	P4
⑨ [P.SEL0]	1	0	1	0
⑩ [P.SEL1]	1	1	0	0

*0 = Shorted
*1 = Opened

The setting of the comparison contents is as shown in the following table.

Setting item	Pattern 1 (P1)				Pattern 2 (P2)			
	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)
S - HI	1000	1000	1000	1000	1000	1000	1000	1000
S - LO	500	500	500	500	500	500	500	500
H - HI	0	—	—	—	0	—	—	—
H - LO	0	—	—	—	0	—	—	—
PVH	PH	PH	PH	PH	PH	PH	PH	PH

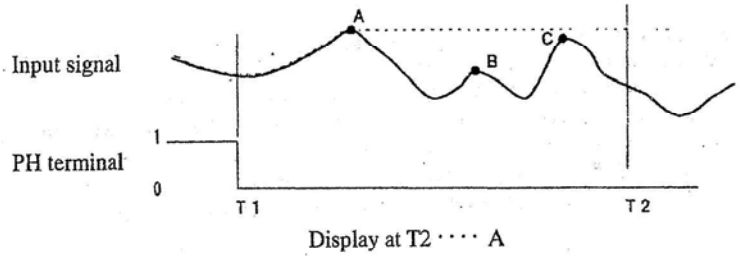
Setting item	Pattern 3 (P3)				Pattern 4 (P4)			
	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)	Comparison 1 (C1)	Comparison 2 (C2)	Comparison 3 (C3)	Comparison 4 (C4)
S - HI	1000	1000	1000	1000	1000	1000	1000	1000
S - LO	500	500	500	500	500	500	500	500
H - HI	0	—	—	—	0	—	—	—
H - LO	0	—	—	—	0	—	—	—
PVH	PH	PH	PH	PH	PH	PH	PH	PH

Note 1) Terminal control can be performed when the PSEL condition data setting is set to out.
Note 2) When the pattern is changed on external terminals, a data selection time of less than 25 ms is required after the pattern is changed.
Note 3) PVH can be independently set to each of comparisons 1 to 4, but the same type of PVH is set to patterns 1 to 4.

3-1-2 Peak hold

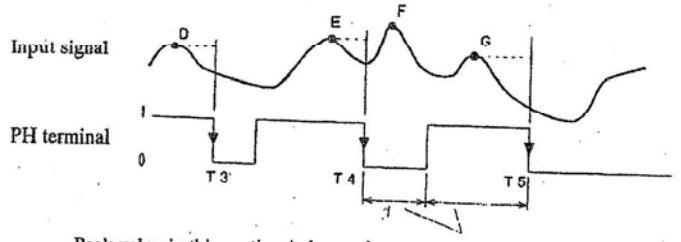
The monitor PH LED lights with the PH terminal shorted with the COM terminal or set to level "0", and the operation of peak hold (PH/peak value), valley hold (UH/valley value) or peak valley hold (PUH/difference between peak and valley) is performed using the contents selected by the comparison setting.
There are two types of peak hold: Type A and Type B. Either of these two types is selected by the condition data setting.
Type A is of the free-run type in which the peak hold functions is activated with the PH terminal shorted with the COM terminal or set to level "0". It is deactivated with the PH terminal opened or set to level "1".
Type B is of the one-shot type in which measurement continues while these terminals are opened. (No display is updated.) The peak hold value previously measured is displayed when the terminals are opened and then shorted again to output the result of comparison. No measurement is performed while the terminals are shorted.

● Peak hold Type A



Display at T2 ···· A

● Peak hold Type B



Peak value in this section is ignored. More than one-sampling time

Display at T3 ..... D
Display at T4 ..... E
Display at T5 ..... G

Note 1) Type B is operated only when nCP is set to oFF. AT on, the operation of Type A is always performed even if set to Type B.

Note 2) If overflow (o.L) occurs during peak hold measurement, OVER is displayed. If negative overflow (-o.L) occurs during valley hold measurement, MINUS OVER is displayed. If the input is within the display range hereafter, all of the decimal points flash.
If the PH terminal is released once, or clear operation is performed by the (S) key or on the CLR terminal, the OVER display is canceled.

For peak hold operation with nCP set to on, see Chapter 3, item 3-3 "SPC function".

3-1-3 Digital zero

The monitor DZ LED lights with the DZ terminal shorted with the COM terminal or set to level "0" and measurement is conducted with the value displayed just before set to "ZERO".
The display hereafter becomes as follows.

(Input value-Digital zero value) = Displayed value (Measured value)

This is not accepted during hold operation.
Therefore, conduct this setting in the free-run state.

Note 1) If digital ZERO and peak hold are simultaneously turned ON, the former has priority over the latter.

Note 2) The display range after the operation of digital ZERO is performed changes.
Example:
If the operation of digital ZERO is performed at a display of 5000, the upper display limit becomes 9999 - 5000 = 4999.

3-1-4 Relay reset

All of the comparison outputs are turned off with the R.RE terminal shorted with the COM terminal or set to level "0".
The comparison output display also goes off.
Can be controlled regardless of the start/hold state.

3-1-5 Start/hold (How to use Types A and B)

There are two types of start/hold: Type A and Type B. Either of these two types is selected by the condition data setting. Type A is of the free-run type in which the measured data or the result of comparison just before is held with the S/H terminal shorted with the COM terminal or set to level "0". Measurement re-starts with the S/H terminal opened or set to level "1".
Type B is of the one-shot type in which the measured data or the result of comparison is output only once with the S/H terminal changed like level "1" (opened) → level "0" (shorted).
See Chapter 6 "Timing chart."
For both Types A and B, the time until the result of measurement is output changes depending on the sampling speed.

Note) The operation of Type B is not performed with nCP (condition data) set to on.

3-1-6 Clear

Clear operation is performed as shown in the following with the CLR terminal shorted with the COM terminal or set to level "0".

- Clears the maximum or minimum value.
- Clears the peak or valley value.
- Re-tries the operation of initial peak removal from the beginning.
- Re-tries the operation of variation point hold from the beginning.
- Re-tries the timer operation of the SPC function.
- Turns the comparison output OFF.
- Re-tries the operation of the SPC function from the beginning.

Note 1) Clear operation is performed on the terminals with C-C (condition data) set to out. It is performed by the key ((S) + 3 sec.) with C-C set to in.

Note 2) As clear operation is one-shot operation, it is performed just when the CLR terminal opened from the COM terminal is shorted or the CLR terminal set to level "1" changes to level "0". Therefore, each of the above operations is performed even with the CLR terminal shorted with the COM terminal or set to level "0".

Each control function enters its function with the relevant terminal shorted with the COM terminal on the lower screw terminal board or set to level "0". It is deactivated when opened or set to level "1". (For Type B of start/hold, the terminal control level will be reversed.)

3-2 Initial peak removal function

This meter is provided with the initial peak removal function which makes invalid comparison with a rapidly changing input.

■ **Operation**

Sets the amount of variation X in the ELPu condition data setting. Sets the time T until comparison becomes valid after the initial peak is detected on ELPt.

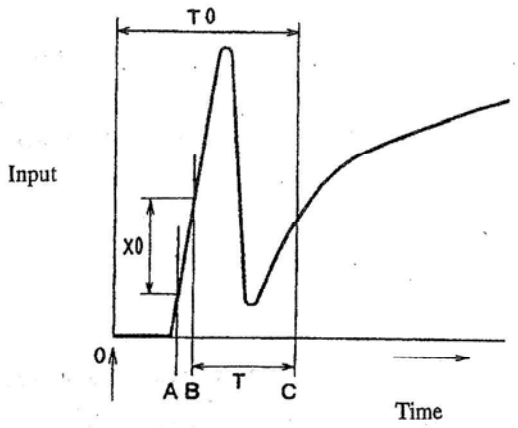
First, if CLEAR is executed by the ⑥ key or on the CLR terminal, measurement starts in the meter.

No operation of comparison is performed in the section T0. The measured values at A (previous time) and B (this time) are computed by sampling, and if the difference between them becomes more than X in the positive direction (if X0 > X in the Fig. at right), the initial peak is detected to start the internal timer.

The operation of peak removal is performed up to point C after CLEAR is executed. The operation up to point C after CLEAR is executed becomes as follows.

- No operation of comparison is performed with ncP set to oFF.
- No comparison terminal is accepted with oFF set to on.

In addition, no timer operation of comparison is performed with ELPu or ELPt set to "0".



CLEAR execution
B: Initial peak detection point
C: End point of initial peak removal operation
X0: The amount of variation in one sampling
T: Initial peak removal setting time
T0: Section of initial peak removal

Note) If it is not sure that there is an initial peak in the measurement signal, do not perform the operation of initial peak removal.

3-3 SPC function

This meter is provided with the SPC function (Section Point Compare) which can make the decision of comparison at any point. This function is useful for making the comparison of intermediate pressures.

It is activated with ncP (condition data setting) set to on.

There are two operation methods: method by terminal control (COMP C1 to C4) and that by timer setting (Ct1 to Ct4).

3-3-1 Operation by comparison terminals (C1 to C4) (Stroke Operation)

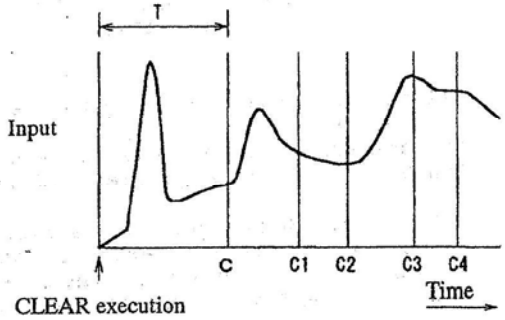
1) Operation in free-run state

If CLEAR is executed by the ⑥ key or on the CLR terminal, the result of comparison made previously and the hold state are released.

The result of comparison is output with each comparison terminal of 1 to 4 (C1 to C4) in external control terminals shorted with the COM terminal or set to level "0" (falling one-shot signal).

At this time, the terminal number operated is displayed on the pattern display unit, while the comparison setpoint corresponding to the terminal number is displayed on the HI/LO setting display units. The operation of comparison ends at comparison 4 and at this time the measured value display and the result of comparison are held. Hereafter, the terminals corresponding to comparisons 1 to 3 and timer operation are not accepted. See Chapter 6 "Timing chart".

Note 1) The Fig. shows the operation performed when the initial peak removal function is valid. Therefore, no comparison terminal is accepted in the section (T) between the point of CLEAR execution and point C.



C; End point of initial peak removal operation
C1 to C4: Point of comparison terminal operation

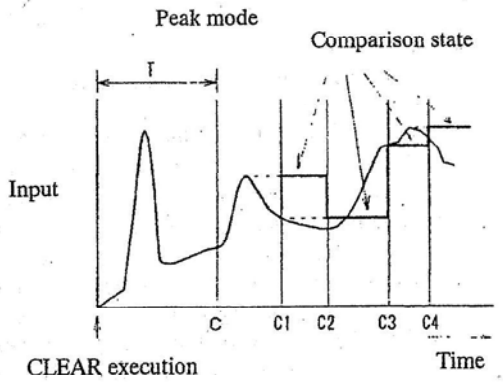
2) Peak hold operation

The "PH" LED on the display unit lights with the PH terminal shorted with the COM terminal or set to level "0" to start peak hold operation. If CLEAR is executed by the ⑥ key or on the CLR terminal, the result of comparison made previously and the hold state are released.

If any one of comparisons 1 to 4 is operated, the operation of comparison is performed by the peak mode (any one of peak, valley and peak valley) corresponding to the number selected by the measured value until the selection of comparison is made after CLEAR is input. Next, the measured value is cleared once and it is updated in peak hold mode set by any one of comparisons 1 to 4.

The main display until any one of comparisons 1 to 4 is operated after CLEAR is executed is the same as that in the free-run state. (The Fig. shows the section up to C1 after CLEAR is executed.)

The operation of comparison ends at comparison 4 and at this time the measured value display and the result of comparison are held. Hereafter, the terminals of comparisons 1 to 3 are not accepted.



C; End point of initial peak removal operation
C1 to C4: Point of comparison terminal operation

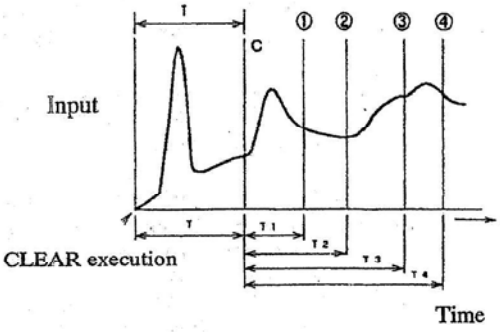
If the PH terminal is opened or set to level "1" with any one of comparisons 1 to 3 operated, the "PH" LED goes off and the main display is on normal display. If the PH terminal is shorted with the COM terminal or set to level "0" again, the main display is on normal display until any other comparison is executed next.

Note 1) The Fig. shows the operation when the initial peak removal function is valid. Therefore no comparison terminal is accepted in the section (T) between the point of CLEAR execution and point C.
In addition, no peak hold operation is performed in the section (T).

Note 2) The Fig. shows the operation performed when the peak hold mode of any one of comparison terminals 1 to 4 is at the peak.

3-3-2 Operation by timer setting

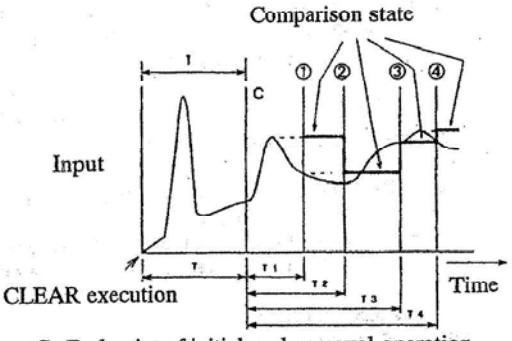
1) Operation in free-run state
Sets the time of operating any one of comparisons 1 to 4 by ct 1 to 4 (condition data setting).
First, if CLEAR is executed by the (S) key or on the CLR terminal the result of comparison made previously and the hold state are released to start counting the timer.
When the time set arrives, the result of comparison is output. At this time, the number of the timer activated is displayed on the pattern display unit while the comparison setpoint corresponding to that timer number is displayed on the HI/LO setting display units.
Each timer setpoint has no limit in its magnitude. However, when the timer corresponding to comparison 4 is activated, the measurement ends, and at this time the measured value display and the result of comparison are held. Hereafter, the operation of the timers 1 to 3 is not accepted.



C; End point of initial peak removal operation
C1 to C4: Point of comparison terminal operation

Note) The Fig. at right shows the operation when the initial peak removal function is valid. Therefore, no timer operation is accepted in the section (T) from the point of CLEAR execution to point C. The timer starts counting from point C.

2) Operation at peak hold
Sets the time of operating the comparison by any one of the ct 1 to 4 (condition data setting). The "PH" LED lights with the PH terminal shorted with the COM terminal or set to level "0" to start peak hold operation.
First, if CLEAR is executed by the (S) key or on the CLR terminal, the result of comparison made previously and the hold state are released to start counting the timer.
If the time set arrives, the operation of comparison is performed by using the peak value until the comparison timer starts after CLEAR is executed. (The type of peak hold becomes the mode set by the number of the timer activated.) Next the measured value is cleared once and it is updated in the mode set by any one of comparisons 1 to 4.



C; End point of initial peak removal operation
C1 to C4: Point of comparison terminal operation

The display on the main display unit until any one of comparisons 1 to 4 is operated after CLEAR is executed is the same as that in the free-run state. The operation of comparison ends at the timer corresponding to comparison 4 and at this time the measured value display and the result of comparison are held. Hereafter, no operation of the timers corresponding to comparisons 1 to 3 is performed.

Note 1) If the PH terminal is opened or set to level "1" with any one of comparisons 1 to 3 finished, the "PH" LED goes off and the display on the main display unit is in the free-run state. If the PH terminal is shorted with the COM terminal or set to level "0" again, the display on the main display unit continues the free-run state until any other comparison is executed next.

Note 2) The Fig. at upper right shows the operation when the initial peak removal function is valid. Therefore, no comparison terminal is accepted in the section (T) from the point of CLEAR execution to point C.

Note 3) The Fig. at upper right shows the operation when the peak hold mode of any one of comparisons 1 to 4 is at the peak.

Note 4) If the terminal is controlled first, the operation on the terminal has the highest priority.

3-3-3 Items common to operation on comparison terminals and by timer settings

1) Comparison operation

There is no operating order of comparisons 1 to 3, but each comparison is made only once from the start of measurement to the operation end of comparison 4.
If "GO" is output from the result of each of comparisons 1 to 3, it is output to the monitor but not to the output terminals. If "HI" or "LO" is output, it is also output to the output terminals.
If the comparison is made in each of comparisons 1 to 3, the result of comparison is held until the next comparison is made. The result of comparison 4 is displayed and also output if the result of "HI" or "LO" is produced in comparisons 1 to 3.

Example:

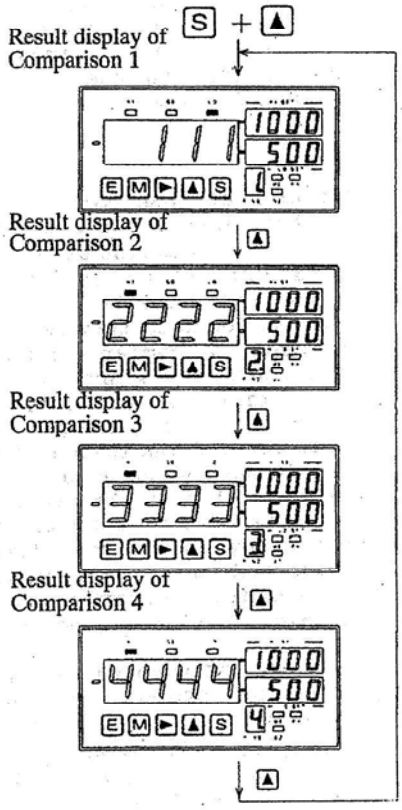
- When the result of comparisons 1 to 3 produces "GO" and the result of comparison 4 also produces "GO": Comparison output GO
- When the result of comparisons 1 to 3 produces "GO" and the result of comparison 4 produces "H" or "LO":
- When "HI" or "LO" exists in the result of comparisons 1 to 3 and the result of comparison 4 produces "GO": Comparison output HI and LO

If CLEAR is executed by the (S) key or on the CLR terminal with the operation of comparison performed, the result of comparison is released. At this time, the pattern number selected is displayed on the pattern number display unit. "- - - -" is displayed on the HI/LO comparison display units.

3-4 Comparison result check function

Pressing (S) + [▲] while the SPC function is activated can check the result of comparisons 1 to 4 until then. The pattern No. display unit shows the number of comparison; the main display unit shows the measured value when the comparison is made and the comparison display unit shows each of the setpoints of comparisons 1 to 4. Each time the [▲] key is pressed, the selection number changes. Pressing the (E) key returns to measurement operation.
The comparison output monitor lights the result of each comparison but at this time no comparison output changes. For the number in which no comparison is made, the main display unit shows "- - - -" and the comparison output monitor does not light. This function is activated even with nCP (condition data) set to oFF, but at this time the main display unit shows "- - - -" for comparisons 1 to 4.
If CLEAR is executed by the (S) key or on the CLR terminal, the result of comparison is cleared.

Note) This operation cannot be performed in the maximum or minimum value display state.



3-5 Zero adjust function

This function is used to update the zero value in the calibration setting without entering the calibration setting mode.

Zero adjustment can be performed by the [▲] key with the ZAd (condition data) set to On.
First enter the input at which the display becomes zero.
Next, press the [▲] key and as a result all of the decimal points on the main display unit flash. Under this condition keep pressing the [▲] key and thus the decimal points stop flashing about 3 sec. later. Thus the captured zero value is updated to start measurement.

Note 1) Releasing the [▲] key while the decimal points flash does not update the zero value.

Note 2) If the captured zero value is updated, the meter is reset in the same state as that where CLEAR is executed.

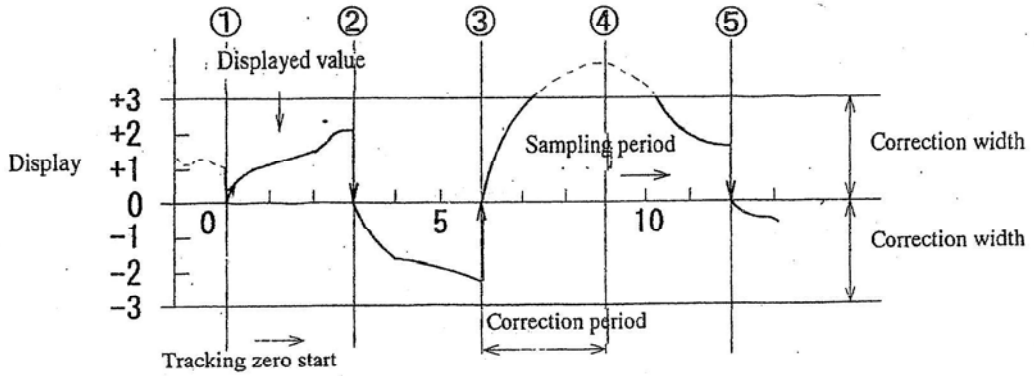
Note 3) An input error is checked under the same condition as the calibration setting.

Note 4) In order to prevent misoperation, it is recommended that usually ZAd be set to oFF.

Note 5) Note that if this operation is performed the captured zero value in the calibration setting is updated.

3-6 Tracking zero function

This function is used to digitally and automatically correct zero drift within the meter. This function is activated when the digital zero function is activated.



Example: Correction time (tr t) 3-sampling and correction width (tr U) 3-digit settings.

① The digital zero and tracking zero functions start being activated. As the display is within the correction width, it is zero.

②③ As the display is within 3 digits, it is corrected to be set to zero.

④ As the display is out of the correction value, it is not corrected.

⑤ As the display is within 3 digits again, it is set to zero.

Note) For peak, valley and peak valley hold, the display when corrected remains as is.

Note) No tracking zero value is backed up.

3-7 Analog output

As the analog output of this meter, an output of 0 to 10 V or 4 to 20 mA is obtained with its change within the displayed range. Its output range can be set at AoHi (AoHi/analog HI setpoint) or AoLo (AoLo/analog LO setpoint) for the scaling data setting. This setting is made by the ▶ and ▲ keys.

For AoHi and AoLo, there is no limit in their magnitude.

AoHi: Displayed value at an analog output of 10 V (20 mA)

AoLo: Displayed value at an analog output of 0 V (4 mA)

Example:

When obtaining an analog output of 10 V (20 mA) at a displayed value of 1000 and an analog output of 0 V (4 mA) at a displayed value of 100, make the setting as follows.

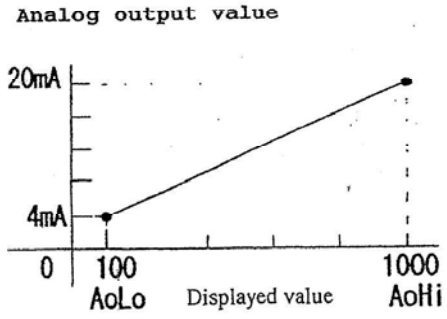
AoHi : 1000

AoLo : 0100

Setting range:

AoHi : -9999 to 9999

AoLo : -9999 to 9999



Note 1) When the displayed value becomes larger than the analog output setpoint, the output becomes more than 11 V for the 0 to 10 V output range and more than 21 mA for the 4 to 20 mA output range. For the o.L. display, the output becomes more than 11 V for the 0 to 10 V output range and more than 21 mA for the 4 to 20 mA output range.
In addition, for the -o.L. display, the output becomes 0 V (0 mA).

Note 2) Any analog signal out of the setting range is not correctly output.

Note 3) The output becomes 0 V (0 mA) while in the following operation.

- Condition data setting
- Comparison setting
- Calibration setting

4. Error message

Errors are displayed on the main display unit.

Details of display	Details of error	Remedy
dAt 1 The segment in the 10^0 digit lights. The decimal points in all digits flash.	Abnormal internal memory.	Turn the power on again. If not yet recovered, contact our sales agent or Asahi directly.
d. .E. . The decimal points in all digits flash.	Abnormal digital zero backup data.	No digital zero write operation is performed. See item "bUP condition data setting."
c.AL. The decimal points in all digits flash.	Abnormal calibration data.	Re-set the calibration data.
c.oAX. The decimal points in all digits flash. (X: Pattern No.)	Abnormal pattern data displayed on X.	Make the comparison of the abnormal pattern No. and re-set the hysteresis data.
c.ond. The decimal points in all digits flash.	Abnormal condition data.	Re-set the condition data.
9.9.9.1 The decimal points in all digits flash. (Figures vary depending on the condition.)	When the input and displayed values exceed the measuring range during peak hold operation.	Release the peak hold operation, once.
oL., -oL.	When the input and displayed values exceed the measuring range.	Use the meter within the specified measuring and display ranges.
uAIt	When the microcomputer waits for data input.	When the setting is changed with start/hold or peak hold turned ON, release each operation, once.

Caution:

If dAt 1, c.AL., c.oAX. or c.ond. is frequently displayed, it is considered that the meter is affected by noise. Therefore in this case, take the necessary measures for noise.

5. Specifications

■ General specifications

1. Operation method: Successive comparison method
2. Accuracy: ±(0.15% of FS + 1 digit) (at 23°C ± 5°C)
3. Sampling speed: 2000 times/sec
4. Display: 7 segment LEDs
   (Light emitting diode numeric elements)
   Height, 14.2 mm (red)
   Height of comparison setting display unit, 8 mm (green)
5. Temperature characteristic: ±(0.005% of rdg. + 0.5 digits)/°C
6. Polarity display: "—" is displayed when the result of computation is negative.
7. Overrange display:
   "o.L" or -o.L" is displayed for the input signal of exceeding the measuring range.
8. Zero display: Leading zero suppression
9. Monitor display: Peak hold (PH), digital zero (DZ) and digital zero backup (ME)
10. Applicable sensor: Various strain gauge type sensors (350Ω)
11. Sensor power supply: 5 VDC ± 10%, 60 mA or 10 VDC ± 10%, 30 mA
12. Zero point adjustment range: -0.3 to +2.0 mV/V
13. Gain adjustment range: 1.0 to 3.0 mV/V
14. Minimum input range: 0.5 μV/digit (At a sensor power supply voltage of 5 VDC)
    1.0 μV/digit (At a sensor power supply voltage of 10 VDC)
15. Maximum input voltage: 3.0 mV/V
16. Maximum display: 9999 (all 4 digits)
17. Decimal point: Settable to any position. (Selected by the front key)

■ External control

1. Hold: The S/H terminal shorted with the COM terminal or set to level "0"
2. Start: The S/H terminal opened from the COM terminal or set to level "1"
3. Digital zero:
   The displayed value just before the DZ terminal is shorted with the COM terminal or set to level "0" is set to "Zero" and this value is stored.
4. Peak hold / Valley hold / Peak valley hold: The PH terminal shorted with the COM terminal or set to level "0"
   The type of peak hold depends on the respective setting of comparison ① to comparison ④.
   (Selected by the front key.)
5. Pattern select: Four patterns can be freely set by combing the COM terminal with the P.SEL terminals 0 and 1.
6. Comparison terminals:
   The comparison terminal C1, C2, C3 or C4 shorted with the COM terminal or set to level "0"
7. CLEAR: The result of comparison released with the CLR terminal shorted with the COM terminal or set to level "0"
   Input rating of each control:
   Level "0"; 0 to 1.5 V
   Level "1"; 3.5 to 5 V
   Input current; Less than -2 mA

■ Comparison block

1. Control method: Computing method by microcomputer
2. Setting range: High/low limit setting including polarity; -9999 to 0 to +9999
3. Comparison operation: 1-point comparison by comparisons 1 to 4 or continuous comparison by comparison 1
4. Comparison condition:

Comparison condition	Comparison result
Measured value > High setpoint	HI
High setpoint ≧ Measured value ≧ Low measured value	GO
Low measured value > Measured value	LO

5. Comparison relay: Contact capacity; 120 VAC 0.5 A Resistive load
   28 VDC 1 A Resistive load
   Electrical life; More than 100,000 times
   Mechanical life; More than one-hundred million times
6. Photo-coupler output (NPN type): Voltage; 30 V max.
   Current; 20 mA max.
   Saturated output voltage; Less than 1.2 V at 20 mA
7. Hysteresis: Can be set from 1 to 999 digits (only for comparison 1) for each comparison setpoint.

■ Common specifications

1. Memory backup: EEPROM is used to store set data for about 10 years (No. of data write times: 100,000 guaranteed).
2. Operating temperature/humidity range: 0 to 50°C/35 to 85% RH (No condensing)
3. Storage temperature/humidity range: -10 to 70°C/Less than 60% RH.
4. Power: 100 VAC ±10% or 200 VAC ± 10% (50/60 Hz)
5. Power consumption: 7 VA (TYP) (At 100 VAC)
6. Dimensions: 96 (W) × 48 (H) × 144 (D) mm DIN size
7. Weight: Approx. 550 g

8. Dielectric strength:
   Between the input terminal and comparison output; For 1 min. at 500 VDC
   Between the input terminal and COM of each output (BCD: D.COM, ANALOG OUT: -, RS-232C: SG); For 1 min. at 500 VDC
   Between the power terminal and input terminal/case/comparison output; For 1 min. at 1500 VAC
   Between the power terminal and COM of each output (BCD: D.COM, ANALOG OUT: -, RS-232C: SG); For 1 min. at 1500 VAC (For the 100 VAC power specification); For 1 min. at 2100 VAC (For the 200 VAC power specification)
9. Insulation resistance: Between each terminal above; More than 100 MΩ at 500 VDC
10. Anti-noise characteristic:
    Power supply terminals, Normal/common mode ± 1500 V, Square wave of 1 ns (rise), noise with 500 ns
11. Accessories: Instruction manual
    Terminal cover

■ Input/output specifications

● BCD data output (Isolated from input)

◎ TTL

1. Measured data: Tri-state parallel BCD positive logic latch output
2. Polarity signal: Level "1" for minus display
3. OVER signal: Level "1" for OVER display
4. Printing command signal: Positive pulse in the fixed section each time measurement is finished. (Depending on the sampling speed)

* It is possible to change each signal described above to the negative logic.
Each signal described above: TTL level fan-out = 25 V CMOS compatible

◎ Open-collector (NPN type)

1. Measured data: Transistor turned "ON" for negative logic "1"
2. Polarity signal: Transistor turned "ON" for minus display
3. OVER signal: Transistor turned "ON" for OVER display
4. Printing command signal: Transistor turned "ON" in the fixed section each time measurement is finished. (Depending on the sampling speed)
5. Transistor output capacity: Voltage, 30 V max.
   Current, 15 mA max.
   Saturated output voltage, Less than 1.2 V at 15 mA

ENABLE input:
Output transistor turned "OFF" with the ENABLE terminal shorted with the D.COM terminal or set to level "0"
(For TTL, the data output is set to high-impedance state.)
Level "0"; 0 to 1.5 V
Level "1"; 3.5 to 5 V
Input current: Less than -0.5 mA

Note 1) The output becomes "0000" during the following operation.
- Condition data setting
- Comparison setting
- Calibration setting

Note 2) For the o.L. or -o.L. display, the value just before is output to set the OVER signal to level "1" or "ON."

● RS-232C (Isolated from input)

1. Electrical characteristic: Conforming to EIA RS-232C
2. Synchronizing method: Start-stop
3. Communication method: Full duplex
4. Transmission speed: 2400/4800/9600/19200 bps
5. Start bit: 1 bit
6. Data length: 7 bits
7. Error detection: Even parity
8. Stop bit: 2 bits
9. Delimiter: CR/LF
10. Character code: ASCII code
11. Transmission control procedure: Ignored process

● Analog output (Isolated from input)

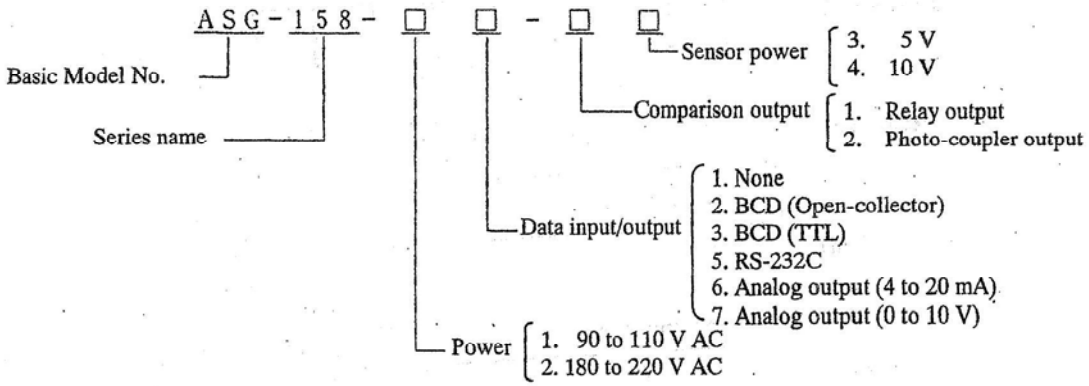
The display range to output the analog signal can be freely set.

1. Resolution: Equal to 14 bits
2. Temperature coefficient: ±200 ppm/°C
3. Output response: Less than 1.5ms+2(1/sampling speed)(0%～90%)

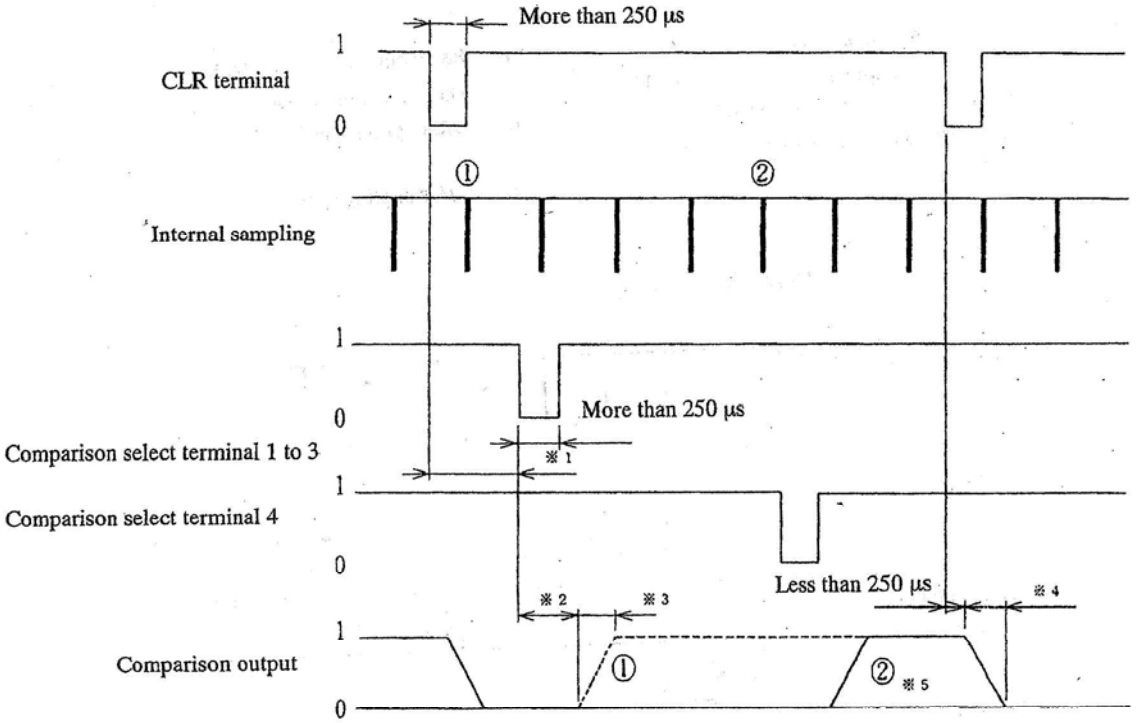
Output	Load resist.	Accuracy	Ripple
0 to 10 V	More than 10 kΩ	±0.5% of FS	50 mVP - P
4 to 20 mA	0 to 270 Ω	±0.5% of FS	25 mVP - P

Note 1: Accuracy: At (23°C ±5°C and 35 to 85% RH)
Note 2: Ripple in 4 to 20 mA: At 250Ω load and 20 mA

Model No. configuration



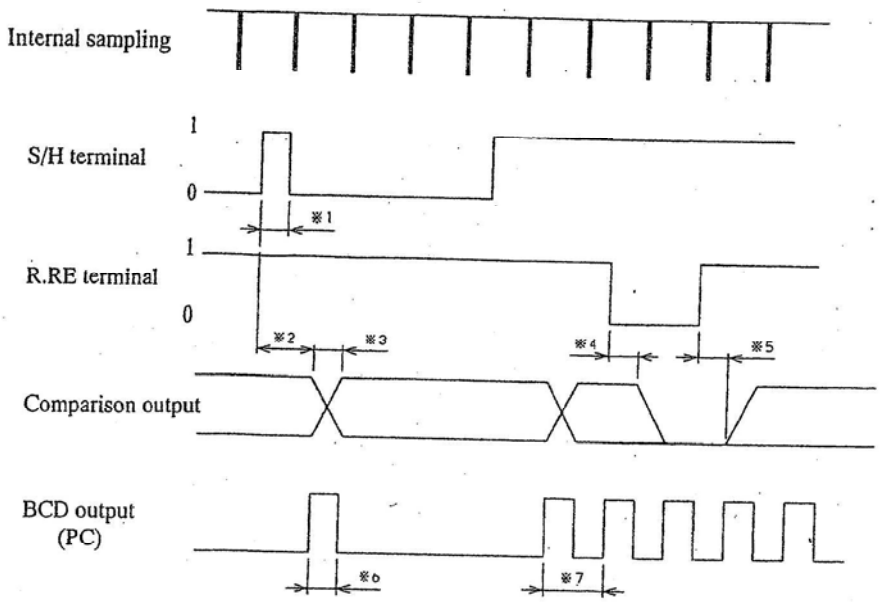
6. Timing chart



*1 (1/Sampling speed) + More than 250 µs
*2 (1/Sampling speed) + More than 250 µs
*3 Relay output 5 ms MAX
Photo-coupler output 100 µs

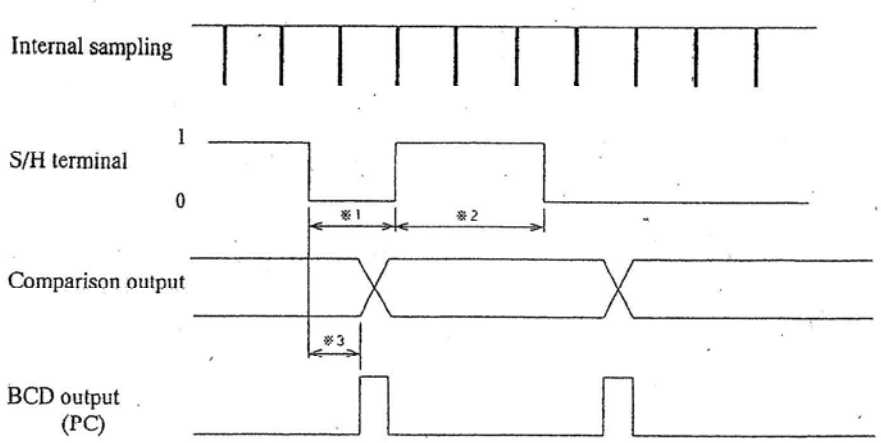
*4 Relay output 15 ms MAX
Photo-coupler output 100 µs
*5 No output changes when the result of decision is made by ①.

Start/hold, Type A



*1 More than 200 μs
*2 (1/1-sampling speed) + Within 300 μs
*3, 5 Relay output 5 ms MAX
Photo-coupler output 100 μs
*4 Relay output 15 ms MAX
Photo-coupler output 100 μs
*6 (1/Sampling speed × 2)
*7 (1/1-sampling speed)

Start/hold, Type B



*1 More than 200 μs
*2 (1/1-sampling speed) + More than 250 μs
*3 (1/1-sampling speed) + Within 300 μs

7. Warranty and after-sale service

1) Warranty

This meter is warranted for a period of one year form date of delivery. Any defect which occurs in this period and is undoubtedly causd by Watanbe'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 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 nearst Watanabe sales agent or Watanabe directly giving as much information on problem as possible.

watanabe
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ED-50091a

ＡＳＧ－１５８ ＳＥＲＩＥＳ
ＲＳ－２３２Ｃ ＩＮＳＴＲＵＣＴＩＯＮ ＭＡＮＵＡＬ

1. Outline

This instruction manual explains specifications and operation of the RS-232C interface to be built in it for the ASG-158 series digital strain gauge meter relay. RS-232C interface of the instrument, such as a personal computer by connecting to an external device, the measurement data capture and measurement parameters required to operate can be set.

2. Specifications (Conforming EIA RS-232C)

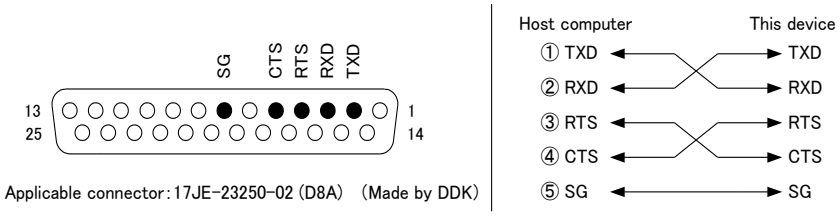
a) Synchronizing method : Start-stop
b) Communication method : Full duplex
c) Baud rate : 19200, 9600, 4800, 2400bps
d) Start bit : 1bit
e) Data length : 7bit
f) Error detection : Even parity
g) Stop bit : 2bit
h) Character code : ASCII code
i) Transmission control procedure : Non-procedure
j) Signal names used : TXD, RXD, CTS, RTS, SG only
k) Delimiter : CR/LF

3. Terminal connection

3-1 RS-232C

This device uses only 5 wires : send (TXD), receive (RXD), send request (RTS), send permit (CTS) and signal ground (SG), but does not use other control signals. In addition, RS-232C can be variously used from its standard. Therefore prior to its use, carefully refer to the relevant computer manual as the connector pin arrangement and control signal control method differ depending on the computer used.

■ RS-232C Input/output connector



4. Setting the baud rate

Press the ▲ switch while pressing the E switch to enter the condition data setting mode. Then press M switch until the display changes to "bAUd" (baud rate setting) in order. After "bAUd" is displayed, set the desired baud rate. After the setting is finished, press the E switch to return to measurement operation.

5. Checking operation

After the baud rate setting check operations by using the Windows Hyper Terminal or by loading the following program into the computer.

Sample program

```
100'
110'
120 CLS:CR$=CHR$(13)+CHR$(10)                    Creation of delimiter
130'
140 OPEN"COM:E73NN"AS#1                          Communication line opened
150'
160 PRINT:K$=""":A$=""                           Line feed and data clear
170 ENTRY of INPUT COMMAND";K$                   Command (data) enter
180'
190 PRINT #1,K$+CR$;                             Command (data) enter
200 CNT=0                                        Receive wait counter clear
210'
220 IF  CNT>3000 THEN PRNT " NO RESPONSE":GOTO 160   Jump to command entry when there is no response
230 IF LOC(1)<2 THEN CNT=CNT+1:GOTO 220          Presence or absence of received data
240 LINE INPUT #1,A$                             Capture of received data
250 FOR T=1 TO 200:NEXT                          Timing adjustment
260'
270 PRINT "(METER OUTPUT)=";A$                   Received data display
280 IF LOC(1)<2 THEN 160 ELSE 240                Returns to command entry
290'                                             When there is no received data.
300 END
```

Execution example

```
run
Is COMMAND ENTERED ?  DSP←
(METER OUTPUT) = _5000……DISPLAY is for 5000.

IS COMMAND ENTERED ?
```

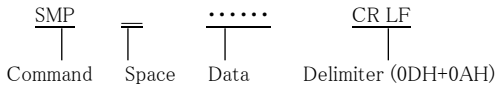
※The above operation check program is for N88BASIC of PC9801 made by NEC.
When using any other program, create a program equal to the above sample.
In addition, the operation can be checked by using this program, but the use of this sample program does not assures the use of the actual program.

6. Command

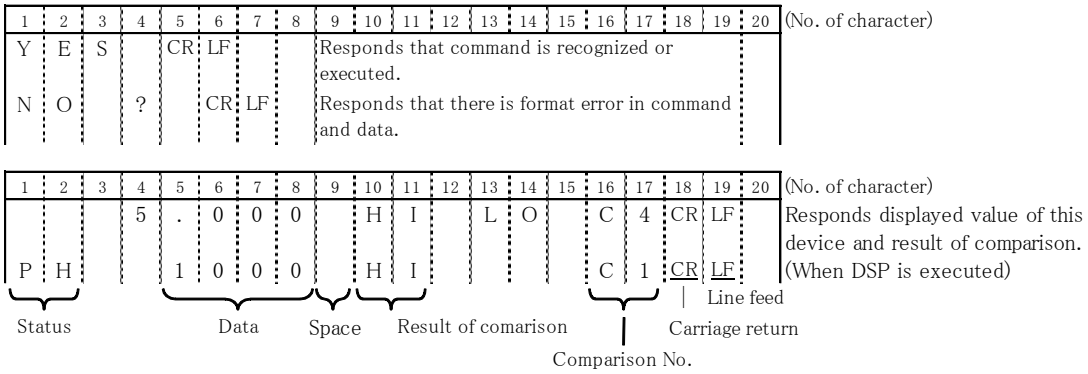
Commands other than CA1, CA2, and COM do not affect the measuring operation of the meter.

6-1 RS-232C command format and response format

1)Command (Host side)



6-2 Response



7. Command and formats

Description of function		Host side		Meter side	
No.	Function		文字長		文字長
7-2-2	Protect setting [W] Data is written to EEPROM when this command is executed.	PRO OF CR LF	6	YES CR LF The response from the instrument	4

No.	Function		Charact length		Charact length
7-1-1	RESULT OF OPERATION / RESULT OF COMPARISON / COMPARISON NO. RESPONSE Responds the result of operation, the result of comparison, the comparison No. and the condition of this device. No response while HOLD using the control terminal.	DSP CR LF	3	5.000 HI LO C4 CR LF When the result of decision corresponds to HI and LO after ending at comparison No.4. -50 GO C2 CR LF When the result of decision corresponds to GO and the display shows "-50" after comparison No.2 is executed. <= 9055 HI C1 CR LF When the result of decision corresponds to HI and the display overflows after comparison No.1 is executed. The numeric value shows the value just before the display overflows. PH 6000 HI C3 CR LF When the result of decision corresponds to HI after comparison No.3 is executed with the PH terminal set to "0" and comparison No.3 is in peak hold mode. In addition, if an overflow happens while in peak hold mode, "PH" is replaced with "<=".	17 17 17 17
7-2-1	PROTECT RESPONSE Responds the contents of this device.	PRO CR LF	3	PRO 01 CR LF PRO 02 CR LF PRO 03 CR LF PRO OFF CR LF Responds one of these depending on the condition of this device.	6 6 6 7
7-2-2	PROTECT SETTING [W] Inhibits a change in the comparison setting, condition data or calibration during measurement operation. 01 : Only the comparison setting can be made by the front switch. 02 : Only calibrasion can be changed by the front switch. 03 : No comparison setting, calibration or condition data can be changed by the front switch. OF : The comparison setting, calibration or c	PRO 01 CR LF PRO 02 CR LF PRO 03 CR LF PRO OF CR LF	6 6 6 6	YES CR LF	4

No.	Function	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Charact length	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Charact length
7-3-1	SAMPLING SPEED RESPONSE Responds the contents of this device.	S M P CR LF	3	S M P 1 0 0 0 CR LF	5～8
7-3-2	SAMPLING SPEED SETTING [W]	S M P x x x x CR LF	5～8	Y E S CR LF	4
		Setpoint / No.of sampling times (Times/sec.) / Setpoint / No.of sampling times (Times/sec.) 2000 / 2000 / 20 / 20 1000 / 1000 / 10 / 10 500 / 500 / 5 / 5 200 / 200 / 2 / 2 100 / 100 / 1 / 1 50 / 50			
7-4-1	START/HOLD TERMINAL RESPONSE Responds START/HOLD terminal state.	E S A CR LF	3	S T A R T CR LF H O L D CR LF Responds one of these depending on the condition of this device.	5 4
7-4-2	START/HOLD TYPE RESPONSE Responds the contents of this device.	S T T CR LF	3	S T T A CR LF S T T B CR LF	5 5
7-4-3	START/HOLD TYPE SETTING [W] Sets the START/HOLD type.	S T T A CR LF S T T B CR LF	5 5	Y E S CR LF Y E S CR LF	4 4
7-4-4	START DELAY RESPONSE Responds the contents of this device.	S T D CR LF	3	S T D x x x CR LF	5～7
7-4-5	START DELAY TIME SETTING [W]	S T D x x x CR LF Setting range 0～999ms	5～7	Y E S CR LF	4
7-5-1	RELAY RESET TERMINAL RESPONSE Responds relay reset terminal state.	E R A CR LF	3	O N CR LF O F F CR LF Responds one of these depending on the condition of this device.	2 3
7-5-2	COMPARISON OUTPUTS DELAY RESPONS Responds the contents of this device.	R L D CR LF	3	R L D x x x CR LF	5～7
7-5-3	COMPARISON OUTPUTS DELAY TIME SETTING [W]	R L D x x x CR LF Setting range 0～999ms	5～7	Y E S CR LF	4
7-6-1	DIGITAL ZERO TERMINAL RESPONSE Responds Digital zero terminal state.	E Z A CR LF	3	D Z R O N CR LF D Z R 1 0 0 0 CR LF D Z R O F F CR LF Outputs in series. Responds one of these depending on the condition of this device.	6 5～10 7
7-6-2	DIGITAL ZERO BACKUP RESPONSE Responds the contents of this device.	B D Z CR LF	3	O N CR LF O F F CR LF	2 3
7-6-3	DIGITAL ZERO BACKUP SETTING [W] Sets digital zero backup valid or invalid.	B D Z O N CR LF B D Z O F CR LF ON:Backup is made valid. OF:Backup is made invalid	6 6	Y E S CR LF Y E S CR LF	4 4
7-7-1	PEAK HOLD TERMINAL RESPONSE Responds Peak hold terminal state.	E P A CR LF	3	P V H O N CR LF P V H O F F CR LF Responds one of these depending on the condition of	6 7
7-7-2	PEAK HOLD TYPE RESPONSE Responds the contents of this device.	P V T CR LF	3	P V T A CR LF P V T B CR LF	5 5
7-7-3	PEAK HOLD TYPE SETTING [W] Sets peak hold type.	P V T A CR LF P V T B CR LF A:A type B:B type	5 5	Y E S CR LF Y E S CR LF	4 4
7-7-4	PEAK HOLD VALUE RESPONSE Responds peak hold value.	P V D CR LF	3	P H 5 0 0 0 CR LF V H - 1 0 0 0 CR LF P V H 6 0 0 0 CR LF Outputs in series. Each value is cleared when the PH terminal is set to "0" or CLEAR is executed by the CLR terminal or S switch.	6～9 6～9 6～9
7-8-1	TRACKING ZERO RESPONSE Responds tracking zero time and width	T R K CR LF	3	T R K O F F CR LF O N T = x x x W = x x CR LF Responds one of these depending on the condition of this device.	7 10～13
7-8-2	TRACKING ZERO SETTING [W] Sets trackong zero time.	T R K T = x x x CR LF Setting range 0～999	7～9	Y E S CR LF	4
	Sets trackong zero width.	T R K W = x x CR LF Setting range 1～99	7～8	Y E S CR LF	4
7-9-1	HYSTERESIS TYPE RESPONSE Responds hysteresis type state.	H Y S CR LF	3	H Y S A CR LF H Y S B CR LF H Y S C CR LF Responds one of these depending on the condition of this device.	5 5 5
7-9-2	HYSTERESIS TYPE SETTING [W] Sets hysteresis type.	H Y S A CR LF H Y S B CR LF H Y S C CR LF	5 5 5	Y E S CR LF Y E S CR LF Y E S CR LF	4 4 4
7-10-1	PATTERN SELECT RESPONSE Responds selected pattern No..	P S L CR LF	3	P S L x CR LF x:1～4	5
7-10-2	PATTERN SELECT CONTROL [W] Selects pattern No.	P S L x CR LF x:1～4 Can be set when "PSEL" is "IN" in condition data setting.	5	Y E S CR LF If the SPC function is valid, the pattern is changes when the next CLEAR is executed after the command is executed. If the SPC function is invalid, changed immediately after the command is executed.	4
7-11-1	FIXED ZERO RESPONSE Responds the contents of this device.	F I X CR LF	3	F I X O N CR LF F I X O F F CR LF Responds one of these depending on the condition of	6 7
7-11-2	FIXED ZERO CONTROL [W] Sets the 10^0 digit of the display.	F I X O N CR LF Forcibly sets the 10^0 digit to "0". F I X O F CR LF Releases fixed zero.	6 6	Y E S CR LF Y E S CR LF	4 4

No.	Function		Charact length		Charact length
7-12-1	INITIAL PEAK REMOVAL RESPONSE Responds the contents of this device.	ELP CR LF	3	ELPW=xxxx CR LF ELPT=xxxx CR LF Outputs in series.	6～9 6～9
7-12-2	INITIAL PEAK REMOVAL SETTING [W] Sets initial peak removal time and width.	ELPT xxxx CR LF Setting range 0～9999ms ELPW xxxx CR LF Setting range 0～9999	6～9 6～9	YES CR LF YES CR LF	4 4
7-13-1	SPC function response Responds the contents of this device.	MCP CR LF	3	MCP ON CR LF MCP OFF CR LF Responds one of these depending on the condition of	6 7
7-13-2	SPC FUNCTION SETTING [W]	MCP ON CR LF The SPC function is made valid. MCP OF CR LF The SPC function is made invalid.	6 6	YES CR LF YES CR LF	4 4
7-14-1	SPC FUNCTION TIMER RESPONSE Responds the contents of this device.	CTx CR LF	3	CTx yyyy CR LF x:1 to 4 y:0 to 9999	5～8
7-14-2	SPC FUNCTION TIMER SETTUNG [W] Sets time corresponding to each comparison No.	CTx yyyy CR LF x:1 to 4 y:0 to 9999	5～8	YES CR LF	4
7-15-1	MOVING AVERAGE RESPONSE Responds the contents of this device.	MAV CR LF	3	MAV OFF CR LF MAV xxx CR LF Responds one of these depending on the condition of	7 5～7
7-15-2	SETTING OF NO. OF MOVING AVERAGING TIMES [W]	MAV xxx CR LF	5～7	YES CR LF	4
7-16-1	MAXIMUM/MINIMUM VALUE RESPONSE	MAX CR LF	3	MAX 5.000 CR LF MIN −1.000 CR LF M−M 6.000 CR LF Outputs in series. MAX:Max. Value. MIN:Min. Value. M-M:Difference between max. and min. Values. Each value is cleared when CLEAR is executed by the CLR terminal or switch.	5～10 5～10 5～9
7-16-2	MAXIMUM/MINIMUM VALUE RESPONSE CLEAR Clears the maximum value, minimum value and the difference between the maximum and minimum values.	MCL xx CR LF MA:Max. Value clear MI:Min. Value clear MM:Clear of difference between max. and min. Values.	6	YES CR LF	4
7-17-1	CONDITION DATA RESPONSE Responds the condition data set by this device.	ALL CR LF	3	PRO OFF CR LF SMP 100 CR LF DCY 2.5 CR LF MCP OFF CR LF AENW 0 CR LF MAV OFF CR LF S−H A CR LF 0−H A CR LF STD 0 CR LF RLD 0 CR LF TRT 0 CR LF TRW 0 CR LF FIX OFF CR LF BLNK OFF CR LF PSEL OUT CR LF ELPW 0 CR LF ELPT 0 CR LF C−C OUT CR LF B.UP OFF CR LF BAUD 9600 CR LF The above responses are output in series.	6～7 5～8 5～8 6～7 6～9 6～7 5 5 5～7 5～7 6～8 6～7 6～7 8 7～8 6～9 6～9 6～7 7～8 8～9

Setting	No.of times	Setting	No.of times
0	OFF	32	32
2	2	64	64
4	4	128	128
8	8	256	256
16	16		

No.	Function		Charact length		Charact length
7-18-1	CALIBRATION DATA SETTING [W] (1)ACTUAL LOAD CALIBRATION Measurment operation is suspended while in actual load calibration. The display unit on this device shows "cAL 1".	C A 1 CR LF	3	Z E R O CR LF	4
		N CR LF Applying an input for display "0" and entering "N", this divice permorms the calibration of zero and go to the next SPAN.	1	E R R 1 CR LF Input less than −0.3mV/V	4
				E R R 2 CR LF Input more than +2.0mV/V After ERR1 or ERR 2 occors, also responds "ZERO" and returns to the calibration of zero.	4
		J CR LF If the calibration of ZERO is not necessary, enter "J" to skip the calibration and proceed to the next	1		
				N O ? CR LF If the input is not in a stable state, responds "No?" with capturing the input as data. After capturing, responds "SPAN xxxx".	4
				S P A N 9 9 0 0 CR LF Displays when ZERO input value is correct and "J" is entered. Responds the numerical value that has been set.	6〜10
	Note 1: When entering a numeric value, do not enter a decimal point.	5 0 0 0 CR LF Enter the displayed value for SPAN input. Setting range 1〜9999 Reading "5000" If you want to set.	4	S P A N 5 0 0 0 CR LF If a decimal point is set, the response will be up to 10 character	6〜10
		N CR LF Entering "N", performs the calibration of SPAN and returns to the mesurment oparation.	1	Y E S CR LF	4
				E R R 3 CR LF The input for the calibration of SPAN is under the gain adjust Please apply the input within the gain adjust range.	4
				E R R 4 CR LF The input for the calibration of SPAN is over the gain adjust range. Please apply the input within the gain adjust range.	4
				E R R 5 CR LF The ratio of the input and the displayed value for the SPAN is under minimum input sensitivity. Raise the level of input or enter a smaller displayed value for the SPAN input. After ERR3, ERR4 or ERR5 occors, also responds "ZERO" and returns to the calibration of zero.	4
	Note 2: When returned to the Mesurment state by "R" after an "ERRx" response, no data is changed.	R CR LF Entering "R" while the calibration, the calibration is canseled and returns to the		Y E S CR LF	4
7-18-2	(2)QUIVALENT CALIBRATION [W] Measurment operation is suspended while in equivalent calibration. The display unit on this device shows "cAL 2".	C A 2 CR LF	3	Z E R O CR LF	4
		N CR LF Applying an input for display "0" and entering "N", this divice permorms the calibration of zero and go to the next SPIN.	1	E R R 1 CR LF Input less than −0.3mV/V	4
				E R R 2 CR LF Input more than +2.0mV/V After ERR1 or ERR 2 occors, also responds "ZERO" and returns to the calibration of zero.	4
		J CR LF If the calibration of ZERO is not necessary, enter "J" to skip the calibration and proceed to the next	1		
				N O ? CR LF If the input is not in a stable state, responds "No?" with capturing the input as data. After capturing, responds "SPIN xxxx".	5
		S CR LF Entering "S" after ZERO response, proceeds to ZERO calibration setting. Enter the sensor input value of a four-digit numerical value correnponding to display"0".	1	Z I N 0 . 0 0 0 CR LF Responds the numerical value that has been set.	9
	Note 1: When entering a numeric value, do not enter a decimal points.	0 0 0 0 CR LF When setting the input to 0.1mV/V.	4	Z I N 0 . 1 0 0 CR LF	9
		− 0 3 0 0 CR LF When setting the input to −0.3mV/V.	5	Z I N − 0 . 3 0 0 CR LF If "−" polarity is set, the length is 10 character long.	10
		N CR LF Enables the setting of the ZERO calibration and proceeds to the next SPIN setting.	1	S P I N 2 . 0 0 0 CR LF Responds the numerical value that has been set.	10
	Note 1: When entering a numeric value, do not enter a decimal points.	3 0 0 0 CR LF Enter a sensor input value in a four-digit numeric value. Input range 1.0〜3.0mV/V When setting the input to 3.0mV/V.	4	S P I N 3 . 0 0 0 CR LF	10
		N CR LF	1	S P A N 9 9 0 0 CR LF	6〜10
		5 0 0 0 CR LF Enter the displayed value for SPAN input. Setting range 1〜9999 Reading "5000" If you want to set.	1〜4	S P A N 5 0 0 0 CR LF If a decimal point is set , the response will be up to 10 character long.	6〜10
		N CR LF Entering "N", performs the calibration of SPAN and returns to the measurment oparation.	1	Y E S CR LF	4
				E R R 3 CR LF The input for the calibration of SPAN is under the gain adjust Please apply the input within the gain adjust range.	4
				E R R 4 CR LF The input for the calibration of SPAN is over the gain adjust range. Please apply the input within the gain adjust range.	4
				E R R 5 CR LF The ratio of the input and the displayed value for the SPAN is under minimum input sensitivity. Raise the level of input or enter a smaller displayed value for the SPAN input. After ERR3, ERR4 or ERR5 occors, also responds "ZERO" and returns to the calibration of zero.	4
	Note 2: When returned to the Mesurment state by "R" after an "ERRx" response, no data is changed.	R CR LF Entering "R" while the calibration, the setting of SPAN is canseled and returns to the		Y E S CR LF	4

No.	Function	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15	Charact length	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20	Charact length
7-19-1	COMPARISON DATA SETTING [W] Measurement operation is suspended during the setting. The display umit no this device shows "coM". If "Pro" corresponds to "02" or "03" in the condition data setting., sending "COM" returns "NO ?" to disable the setting. Note 1: When entering a numeric value, do not enter a decimal points. Note 2: If communication is suspended, the device returns to measurement operation after a lapse of about 16 sec.	C O M CR LF x CR LF x:Enter pattern No. to be set. 1 to 4. N CR LF Entering "N" moves to the next item. 1 CR LF Enter the comparison No. to be set. 1 to 4 N CR LF N CR LF 1 0 0 CR LF When changing S-LO data to 100. N CR LF N CR LF H-HI or H-LO appears only at comparison No. C1. N CR LF Sets the peak hold type corresponding to each comparison No. PH:Peak hold VH:Valley hold PVH:Peak valley hold R CR LF Entering "R", returns to measurement	3 1 1 1 3 1 1 1 1	P - 1 CR LF P - x CR LF C - 1 CR LF C - 1 CR LF S - H I 5 0 0 0 CR LF S - L O 1 0 0 0 CR LF S - L O 1 0 0 CR LF If each of polarity "-" or a decimal point is set, the character length is 10. If both of polarity "-" and a decimal point are set, the character H - H I 0 CR LF H - L O 0 CR LF P V H P H CR LF Y E S CR LF	3 3 3 3 6～11 6～11 6～11 6～8 6～8 6～7 4
7-19-2	COMPARISON DATA RESPONSE Comparison data is checked. No data can be changed. The display unit of this device show coM. Note 1: If communication is suspended, the device returns to measurement operation after a lapse of about 16 sec.	C O * CR LF x CR LF x:Enters pattern No. to be checked. N CR LF x CR LF x:Enters pattern No. to be checked. 1 to 4 N CR LF N CR LF N CR LF N CR LF N CR LF R CR LF Entering "R" returns to measurement operation.	3 1 1 1 1 1 1 1 1 1	P - 1 CR LF P - x CR LF C - 1 CR LF C - x CR LF S - H I 5 0 0 0 CR LF S - L O 1 0 0 0 CR LF H - H I 0 CR LF H - L O 0 CR LF P V H P H CR LF Y E S CR LF	3 3 3 3 6～11 6～11 6～8 6～8 6～7 4
7-20-1	ERROR MESSAGE RESPONSE Normal			Y E S CR LF	4
7-20-2	Abnormal Format error Undefined command			N O ? CR LF	5
7-20-3	Abnormal memory in this device.			D A T A L O S T C O N D CR LF (Abnormal condition data) Recovery method : Reset the condition data by the switch in the device. D A T A L O S T C O M x CR LF (Abnormal comparison data) x:Destroyed pattern No. Recovery method : Reset the comparison data by the switch in the device. D A T A L O S T C A L CR LF (Abnormal calibration data) Recovery method : Reset the calibration data by the switch in the device. D A T A L O S T D . Z CR LF (When the DZ backup function is valid and the DZ memory value is abnormal.) Recovery method : Update the digital zero value. D A T A L O S T x CR LF (x:A～C) Recovery method : Turn the power on again. If not recovered yet. Contact your nearest Asahi sales agent or Asahi directly.	14 14 13 13 11

8. Hysteresis

8-1 Hysteresis

Hysteresis (dead band) with respect to the comparison setpoint can be classified into the following 3 types.
HI and LO Hysteresis values can be independently set.

A type	HI-HYS=(S-HI)-(H-HI) LO-HYS=(S-LO)+(H-LO)
B type	HI-HYS=(S-HI)+(H-HI) LO-HYS=(S-LO)+(H-LO)
C type	HI-HYS=(S-HI)-(H-HI) LO-HYS=(S-LO)-(H-LO)

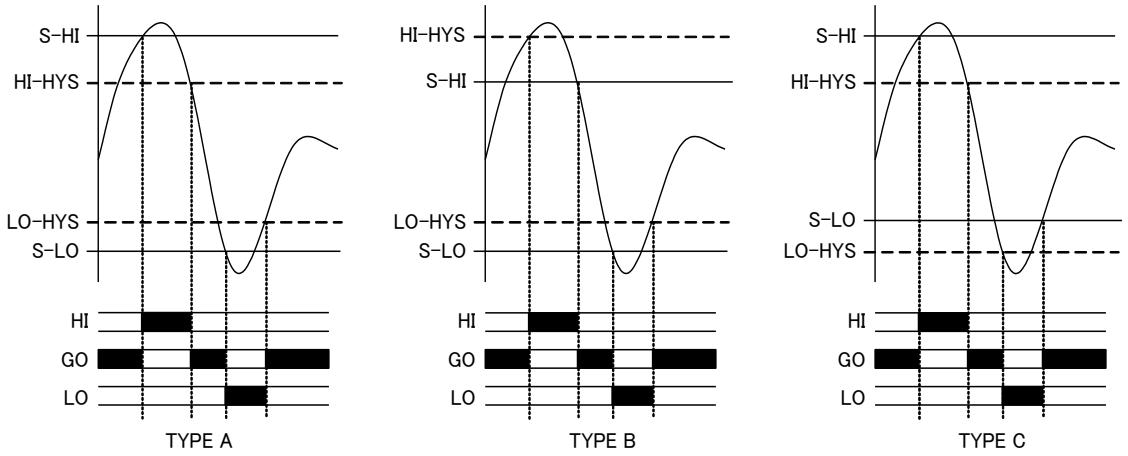
HI-HYS/LO-HYS : Comparison and hysteresis setpoint are arranged within the computer and are actually used for decision.
S-HI,S-LO : Comparison setpoint on the HI and LO sides.
H-HI,H-LO : Hysteresis setpoint on the HI and LO sides.

●Comparison setting condition

1) A type
(S-HI)≧(S-LO)+(H-LO)
(S-LO)≦(S-HI)−(H-HI)

2) B type
(S-HI)≧(S-LO)+(H-LO)
(S-LO)≦(S-HI)−(H-LO)

3) C type
(S-HI)≧(S-LO)+(H-HI)
(S-LO)≦(S-HI)−(H-HI)



Note : Hysteresis is activated only in comparison No.1.
Also it is activated only when the SPC function is invalid.

9. EEPROM

When the [W] command in the list of commands is executed, the setting is changed and the data is written to the EEPROM.
No. of data write times to EEPROM : 100,000 guaranteed.

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