Operation Manual for the A7000 Series

DC Voltage Measurement: A7X11-X

DC Small Current Measurement: A7X12-X

DC Large Current Measurement: A7X13-X

⚠ CAUTIONS

(1) Application of voltage or current exceeding the maximum allowable value to the input section may damage the instrument.
(2) Use the supply voltage in the allowable range. Using it out of this range may result in fire, electric shock, or an instrument failure.
(3) Please note that the information contained in this manual is subject to change due to product improvements without notice.
(4) Every effort has been made to ensure accuracy in the presentation of this manual. However, should you have any questions or should any errors or omissions come to your attention, please contact your sales representative or our sales office directly.
(5) After reading, keep this manual nearby so that you can refer to it as needed.

1. Check before Use

Thank you for purchasing our A7000 series. The operator who uses the instrument should keep this manual on hand. When you receive the product, make sure that you have all the parts and that none have been damaged during transportation. If any part is damaged or missing, contact your sales representative or our sales office directly.

1.1. Type Configuration

The type configuration of the A7000 series is as shown below. Check that there is no difference in the type or specifications between the product you ordered and the product you have received.

A 7□1□–□

Power:
- 1 AC power (100 to 240 V AC, 50/60 Hz)
- 2 DC power (12 to 48 V DC)

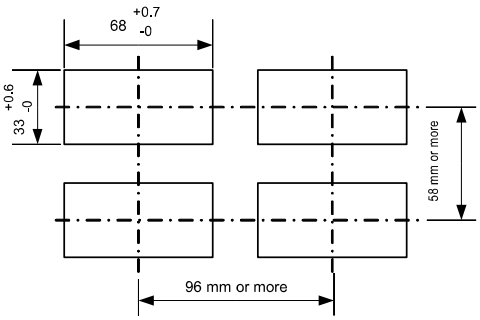
Input:
- 1 DC voltage measurement (±100 mV, ±1 V, ±10 V, ±100 V, or ±700 V measurement)
- 2 DC small current measurement (±100 μA, ±1 mA, ±10 mA, or ±100 mA measurement)
- 3 DC large current measurement (±1 A or ±2 A measurement)
- 4 AC voltage measurement (100 mV, 1 V, 10 V, 100 V, or 700 V measurement)
- 5 AC small current measurement (100 μA, 1 mA, 10 mA, or 100 mA measurement)
- 6 AC large current measurement (1 A or 5 A measurement)
- 7 Resistance measurement
- 8 Temperature measurement (TC, RTD)
- 9 Frequency measurement
- A Load cell input
- B Process signal measurement (1 to 5V, ±5 V, 4 to 20 mA, or ±20 mA measurement)

Output:
- 0 None
- 1 Relay contact output
- 2 Photocoupler output
- 3 BCD output (TTL)
- 4 BCD output (open collector)
- 5 BCD output (TTL) + photocoupler output
- 6 BCD output (open collector) + photocoupler output
- 7 Analog output
- 8 Analog output + photocoupler output
- 9 RS-232C
- A RS-485
- B RS-232C + photocoupler output
- C RS-485 + photocoupler output

2. Mounting Method

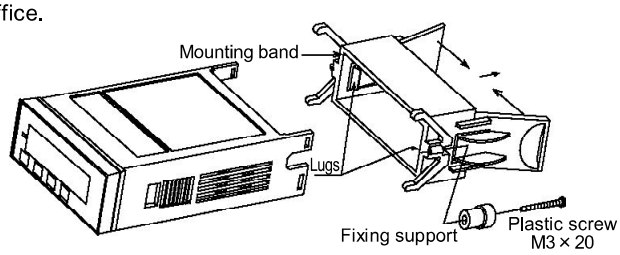
2.1. Panel Cutout Dimensions

For panel cutout made when mounting the A7000 series measuring unit, follow the figure below.



2.2. Panel Mounting Method

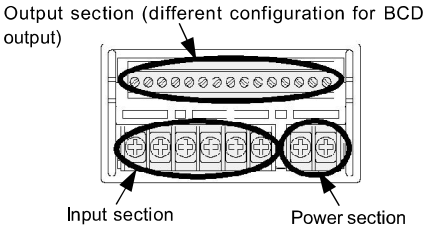
To mount the A7000 series measuring unit onto a panel, remove the mounting band from the main unit, fit the unit into the panel from the front of the panel, and fix it using the mounting band removed from the rear of the panel. If you wish to increase the strength of the mounting, attach fixing supports with screws as shown in the figure below. For fixing supports and screws, contact your sales representative or our sales office.



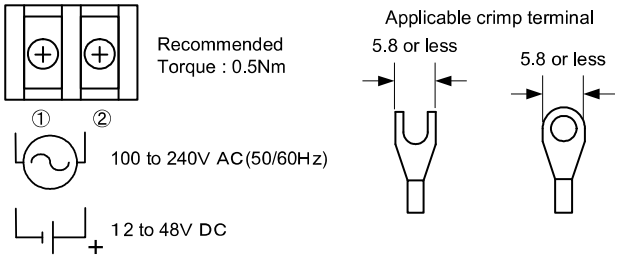
⚠ CAUTIONS

(1) Mount the instrument securely on a surface that will be able to bear its weight. Insufficient strength for mounting or incorrect mounting may result in the instrument falling and injuring personnel.
(2) The A7000 series has no power switch. Connecting power to the instrument makes the product immediately operable.
(3) If the instrument is installed inside equipment to heat radiation, etc., and ensure that the in-equipment temperature does not rise above 50°C.

3. Description of Terminals and Connection



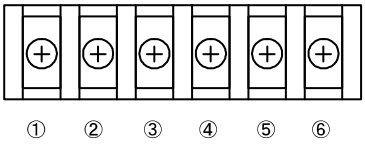
3.1. Connecting Power



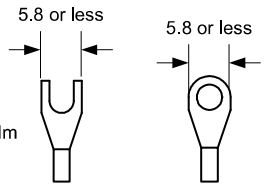
Terminal No.	Name	Description
1	Power	Power connection terminal. 0 V for DC driving
2	Power	Power connection terminal. + V for DC driving

3.2. Connecting Input Signal

3.2.1. DC Voltage Measuring Unit



Applicable crimp terminal

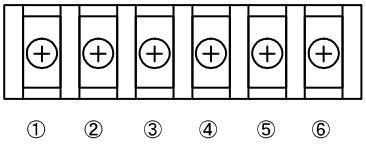


Recommended torque : 0.5Nm

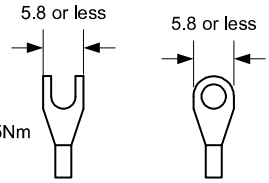
Terminal No.	Name	Description
1	15 HI	+ input terminal for 15 ranges (±700 V)
2	14 HI	+ input terminal for 14 ranges (±99.99 V)
3	13 HI	+ input terminal for 13 ranges (±9.999 V)
4	12 HI	+ input terminal for 12 ranges (±999.9 mV)
5	11 HI	+ input terminal for 11 ranges (±99.99 mV)
6	LO	- input terminal

* In the A7000 series, the range of use needs to be set using scaling data .
The unit is set to 15 ranges at factory shipment.

3.2.2. DC Small Current Measuring Unit



Applicable crimp terminal

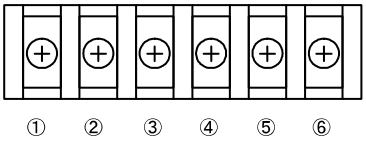


Recommended torque : 0.5Nm

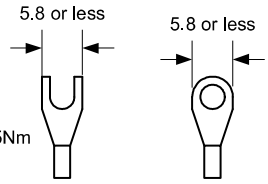
Terminal No.	Name	Description
1	24 HI	+ input terminal for 24 ranges (±99.99 mA)
2	23 HI	+ input terminal for 23 ranges (±9.999 mA)
3	22 HI	+ input terminal for 22 ranges (±999.9 μA)
4	21 HI	+ input terminal for 21 ranges (±99.99 μA)
5	LO	- input terminal
6	LO	- input terminal

* In the A7000 series, the range of use needs to be set using scaling data .
The unit is set to 24 ranges at factory shipment.

3.2.3. DC Large Current Measuring Unit



Applicable crimp terminal



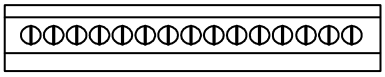
Recommended torque : 0.5Nm

Terminal No.	Name	Description
1	25 HI	+ input terminal for 25 ranges (±999.9 mA)
2	25 LO	- input terminal for 25 ranges (±999.9 mA)
3	NC	Connect nothing to this terminal.
4	26 HI	+ input terminal for 26 ranges (±2 A)
5	26 LO	- input terminal for 26 ranges (±2 A)
6	NC	Connect nothing to this terminal.

* In the A7000 series, the range of use needs to be set using scaling data .
The unit is set to 26 ranges at factory shipment.

3.3. Connecting Various Output Signals

3.3.1. Relay Contact Output Unit



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

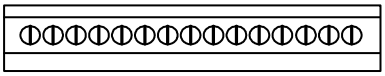
Adaptable wire: AWG24 to AWG16

Recommended torque : 0.18Nm

Term. No.	Name	Description
1	P.SEL1	Pattern Select terminals. Enabled when they have the same potential as, or are shorted with, terminal COM. * They are disabled unless pattern select is set up for terminal control using condition data.
2	P.SEL2	
3	P.SEL3	
4	S/H	Start/Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
5	PH	Peak Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
6	DZ	Digital Zero terminal. Enabled when it has the same potential as, or is shorted with, terminal COM. * This terminal is disabled unless digital zero is set up for terminal control using condition data.
7	COM	Common terminal for external control. (It has the same potential as input LO.)
8	HH a	The a-contact output terminal of HH output relay
9	c	COM terminal for HH and HI output relays
10	HI a	The a-contact output terminal of HI output relay
11	c	COM terminal of GO output relay
12	GO a	The a-contact output terminal of GO output relay
13	LO a	The a-contact output terminal of LO output relay
14	c	COM terminal for LO and LL output relays
15	LL a	The a-contact output terminal of LL output relay

	Pattern1	Pattern2	Pattern3	Pattern4	Pattern5	Pattern6	Pattern7	Pattern8
P1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
P2		OFF	ON			OFF	ON	
P3			OFF	OFF	ON	ON		

3.3.2. Photocoupler Output Unit



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

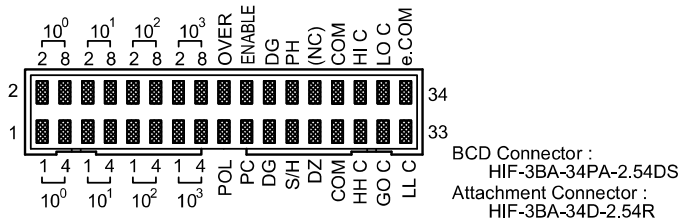
Adaptable wire: AWG24 to AWG16

Recommended torque : 0.18Nm

Term. No.	Name	Description
1	P.SEL1	Pattern Select terminals. Enabled when they have the same potential as, or are shorted with, terminal COM. * They are disabled unless pattern select is set up for terminal control using condition data.
2	P.SEL2	
3	P.SEL3	
4	S/H	Start/Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
5	PH	Peak Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
6	DZ	Digital Zero terminal. Enabled when it has the same potential as, or is shorted with, terminal COM. * This terminal is disabled unless digital zero is set up for terminal control using condition data.
7	COM	Common terminal for external control. (It has the same potential as input LO.)
8	HH c	Collector output terminal of HH output photocoupler
9	eCOM	Common emitter terminal for HH and HI output photocouplers
10	HI c	Collector output terminal of HI output photocoupler
11	eCOM	Emitter terminal of GO output photocoupler
12	GO c	Collector output terminal of GO output photocoupler
13	LO c	Collector output terminal of LO output photocoupler
14	eCOM	Common emitter terminal for LO and LL output photocouplers
15	LL c	Collector output terminal of LL output photocoupler

	Pattern1	Pattern2	Pattern3	Pattern4	Pattern5	Pattern6	Pattern7	Pattern8
P1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
P2		OFF	ON			OFF	ON	
P3			OFF	OFF	ON	ON		

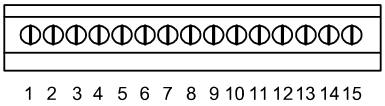
3.3.3. BCD Unit



Term. No.	Name	Description
1-4	10^0 1-8	Bit-1 to bit-8 outputs of BCD 10^0 digit
5-8	10^1 1-8	Bit-1 to bit-8 outputs of BCD 10^1 digit
9-12	10^2 1-8	Bit-1 to bit-8 outputs of BCD 10^2 digit
13-16	10^3 1-8	Bit-1 to bit-8 outputs of BCD 10^3 digit
17	POL	BCD polarity output
18	OVER	BCD overrange warning output
19	PC	BCD printout command output
20	ENABLE	BCD enable terminal. BCD output becomes high impedance or transistor is turned OFF when this terminal has the same potential as, or is shorted with, terminal DG.
21,22	DG	Common terminal for BCD outputs
23	S/H	Start/Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
24	PH	Peak Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
25	DZ	Digital Zero terminal. Enabled when it has the same potential as, or is shorted with, terminal COM. * This terminal is disabled unless digital zero is set up for terminal control using condition data.
26	NC	Connect nothing to this terminal.
27,28	COM	Common terminal for external control. (It has the same potential as input LO.)
29	HH c	Collector output terminal of HH output photocoupler
30	HI c	Collector output terminal of HI output photocoupler
31	GO c	Collector output terminal of GO output photocoupler
32	LO c	Collector output terminal of LO output photocoupler
33	LL c	Collector output terminal of LL output photocoupler
34	eCOM	Photocoupler's common emitter terminal

* For models A7X1X-3 and -4, terminals 29 to 34 are NC. Connect nothing to these terminals.

3.3.4. Analog Output Unit

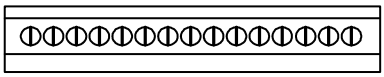


Adaptable wire: AWG24 to AWG16
Recommended torque : 0.18Nm

Term. No.	Name	Description
1	V.OUT	Voltage Output terminal (0 to 1 V, 0 to 10 V, 1 to 5 V)
2	A.OUT	Current Output terminal (4 to 20 mA)
3	AO.COM	Common terminal for analog outputs
4	S/H	Start/Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
5	PH	Peak Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
6	DZ	Digital Zero terminal. Enabled when it has the same potential as, or is shorted with, terminal COM. * This terminal is disabled unless digital zero is set up for terminal control using condition data.
7	COM	Common terminal for external control. (It has the same potential as input LO.)
8	HH c	Collector output terminal of HH output photocoupler
9	eCOM	Common emitter terminal for HH and HI output photocouplers
10	HI c	Collector output terminal of HI output photocoupler
11	eCOM	Emitter terminal of GO output photocoupler
12	GO c	Collector output terminal for GO output photocoupler
13	LO c	Collector output terminal of LO output photocoupler
14	eCOM	Common emitter terminal for LO and LL output photocouplers
15	LL c	Collector output terminal of LL output photocoupler

* For model A7X1X-7, terminals 8 to 15 are NC. Connect nothing to these terminals.

3.3.5. RS-232C Unit

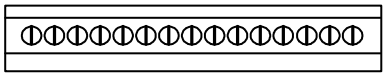


Adaptable wire: AWG24 to AWG16
Recommended torque : 0.18Nm

Term. No.	Name	Description
1	RXD	Receive terminal
2	TXD	Transmit terminal
3	SG	Common terminal for communications function
4	NC	Connect nothing to this terminal.
5	NC	Connect nothing to this terminal.
6	S/H	Start/Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
7	PH	Peak Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
8	NC	Connect nothing to this terminal.
9	COM	Common terminal for external control. (It has the same potential as input LO.)
10	HH c	Collector output terminal of HH output photocoupler
11	HI c	Collector output terminal of HI output photocoupler
12	GO c	Collector output terminal of GO output photocoupler
13	LO c	Collector output terminal of LO output photocoupler
14	LL c	Collector output terminal of LL output photocoupler
15	eCOM	Photocoupler's common emitter terminal

* For model A7X1X-9, terminals 10 to 15 are NC. Connect nothing to these terminals.

3.3.6. RS-485 Unit

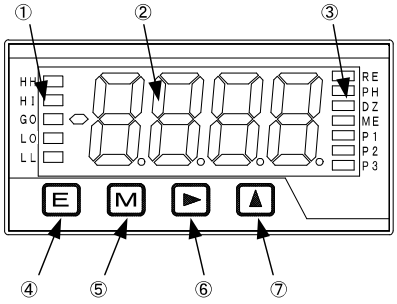


Adaptable wire: AWG24 to AWG16
Recommended torque : 0.18Nm

Term. No.	Name	Description
1	(+)	Non-inverse output
2	(-)	Inverse output
3	SG	Common terminal for communications function
4	TERM	Terminating resistor terminal (200Ω). When turning it ON, short it with terminal 5.
5	TERM	Terminating resistor terminal (200Ω). When turning it ON, short it with terminal 4.
6	S/H	Start/Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
7	PH	Peak Hold terminal. Enabled when it has the same potential as, or is shorted with, terminal COM.
8	NC	Connect nothing to this terminal.
9	COM	Common terminal for external control. (It has the same potential as input LO.)
10	HH c	Collector output terminal of HH output photocoupler
11	HI c	Collector output terminal of HI output photocoupler
12	GO c	Collector output terminal of GO output photocoupler
13	LO c	Collector output terminal of LO output photocoupler
14	LL c	Collector output terminal of LL output photocoupler
15	eCOM	Photocoupler's common emitter terminal

* For model A7X1X-A, terminals 10 to 15 are NC. Connect nothing to these terminals.

4. Part Names and their Functions



Location	Name	Main Functions								
①	Judgment Monitor	Indicates judgment results when the unit is used as a meter relay.								
②	Main Monitor	Displays measured values or menu names or information for setting up parameters.								
③	Function Monitor	RE	Lights up if the unit enters a remote control status using the communication function.							
		PH	Lights up if peak hold, valley hold, or peak - valley hold is activated.							
		DZ	Lights up if digital zero is activated.							
		ME	Lights up if digital zero backup is activated.							
		P1 P2 P3		Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 5	Pattern 6	Pattern 7	Pattern 8
			P1	OFF	ON	OFF	ON	OFF	ON	OFF	ON
			P2		OFF	ON			OFF	ON	
			P3			OFF	OFF	ON	ON		
④	Enter	Shifts the unit to the parameter setting mode.								
⑤	Mode	Shifts the unit to mode change during parameter settings or to max./min./ (max. min. value) display in measurements (When pressed for a prolonged time).								
⑥	Shift	Used to change the objective digit during parameter settings or make DZ control in measurements (When pressed for a prolonged time).								
⑦	Increment	Used to change a numerical value or content during parameter settings, make pattern select in measurement (When pressed for a prolonged time), or perform special operations.								

5. Setting Parameters

5.1. List of Parameters

5.1.1. Condition Data

Menu Display	Parameter Name	Initial Value	P.L.	Settable Range or Alternatives	Main Setting Target and Precautions
AvG (AVG)	Number of averaging times	50	0	1/2/4/8/10/20/50 / 100/200/400/800 / 1000/2000/5000	Selects the number of averaging times (sampling rate). Sampling rate is set as an averaged number of internal sampling times (1 sampling time: approx. 1 ms).
MAv (MAV)	Number of moving averaging times	1	0	1/2/4/8/16/32	Selects the number of moving averaging times. (Small filtering effect 1 (OFF) ⇔ 2 ⇔ 4 ⇔ 8 ⇔ 16 ⇔ 32 Large filtering effect)
S.wd (S.WD)	Step wide	1	0	1/2/5/10	Selects a display change width to limit variations in display. (If this parameter is set to "5," the least significant digit displays only "0" or "5.")
clr (CLR)	Display color	rEd	1	rEd/GrEn	Selects display color. * Only when no meter relay is available.
clr.t (CLR.T)	Display color type	AUto	1	AUto/MAnU	Selects either automatic setting (red for HI and LO and green for GO) or manual setting for display color type. * Only when a meter relay is available
HH.cL (HH.CL)	HH display color	rEd	1	rEd/GrEn	Selects red or green for display color applied during HH judgment. * Only when CLR.T is in MANU.
HI.cL (HI.CL)	HI display color	rEd	1	rEd/GrEn	Selects red or green for display color applied during HI judgment. * Only when CLR.T is in MANU.
GO.cL (GO.CL)	GO display color	GrEn	1	rEd/GrEn	Selects red or green for display color applied during GO judgment. * Only when CLR.T is in MANU.
LO.cL (LO.CL)	LO display color	rEd	1	rEd/GrEn	Selects red or green for display color applied during LO judgment. * Only when CLR.T is in MANU.
LL.cL (LL.CL)	LL display color	rEd	1	rEd/GrEn	Selects red or green for display color applied during LL judgment. * Only when CLR.T is in MANU.
bLnP (BLNK)	Display blank level	oFF	0	oFF/LV1/LV2/LV3/on	Selects display brightness. (Bright OFF ⇔ LV1 ⇔ LV2 ⇔ LV3 ⇔ ON Extinguished)
PvH (PVH)	PH select	PH	0	PH/VH/PvH	Selects the type (peak hold, valley hold, or peak - valley hold) activated when the PH function is enabled.
dZbU (DZ.BU)	DZ backup	oFF	0	oFF/on	Selects whether to backup the digital zero value when power is turned OFF.
PS (PS)	Pattern Select	1	0	1/2/4/8	Selects the number of patterns available for the pattern select function.
LInE (LINE)	Linearize	oFF	0	oFF/2/4/8/16	Selects the enable/disable of the linearize function and the number of correction points.
tr.t (TR.T)	Tracking zero correction time	000	0	000 ~ 999	Sets the enable/disable of the tracking zero function and correction time (setpoint/conversion rate). 。
tr.w (TR.W)	Tracking zero correction width	01	0	01 ~ 99	Sets the correction width of the tracking zero function. * Only when TR.T is a value other than 000.
P.on (P.ON)	Power-on delay time	0	0	0 ~ 9	Sets the time (setpoint x 1 sec.) taken from power ON to when measurement actually starts.
Pro (PRO)	Protect level	LV.1	3	LV0/LV.1/LV2/LV3	Selects the protect level for preventing erroneous operation (High LV3 ⇔ LV2 ⇔ LV1 ⇔ LV0 Low).
U-no. (U-NO.)	----	oFF	0	oFF/on	Use the unit with this parameter set to OFF.
S/Ht (S/H.T)	Start/hold type	A	0	A/b	Selects the action type of start/hold (A: free run, B: one shot).
S/H.d (S/H.D)	Start/hold delay time	0	0	0000 ~ 9999	Sets delay time (setpoint x approx. 1 ms) applied at start.
PvHt (PVH.T)	Peak hold type	A	0	A/b	Selects the action type of peak hold (A: real display, B: result display).
dZC (DZ.C)	Digital zero control	Su	0	Su/tErM	Selects the digital zero control method (SW: front panel keys, TERM: external control terminals).
PSC (PS.C)	Pattern select control	Su	0	Su/tErM	Selects the pattern select control method (SW: front panel keys, TERM: external control terminals). * Only when external control is provided
bcdL (BCD.L)	BCD output logic	nLoC	0	nLoC/PLoC	Selects the BCD output logic (N: negative logic, P: positive logic). * Only when BCD output is provided
bAUd (BAUD)	Baud rate	9600	1	2400/4800/9600 19.2k/38.4k	Selects the communication function's Baud rate. * Only when the communication function is provided
dAtA (DATA)	Data length	7	1	7/8	Selects the communication function data length. * Only when the communication function is provided
P.bit (P.BIT)	Parity bit	E	1	E/o/n	Selects the communication function parity bit. * Only when the communication function is provided
StP.b (STP.B)	Stop bit	2	1	1/2	Selects the communication function stop bit. * Only when the communication function is provided
t- (T-)	Delimiter	cr.LF	1	cr.LF/cr	Selects the communication function delimiter. * Only when the communication function is provided
Adr (ADR)	Address	01	1	01 ~ 99	Selects the RS-485 function's device ID. * Only when the RS-485 function is provided

5.1.2. Scaling Data

Menu Display	Parameter Name	Initial Value	P.L.	Settable Range or Alternatives	Main Setting Target and Precautions
rAnG (RANG)	Input range	15	1	11/12/13/14/15 (voltage)	Selects the input range. *Note that the input terminal changes depending on the input range.
		24	1	21/22/23/24 (small current)	
		26	1	25/26 (large current)	
FSc (FSC)	Full-scale indicated value	9999	2	-9999 ~ 9999	Sets the relationship between an input signal and indicated value. For the voltage measurement's 15 ranges, the full-scale input value becomes "9999" when an input is 700 V. For the large-current measurement's 26 ranges, the full-scale input value becomes "9999" when an input is 2 A.
FIn (FIN)	Full-scale input value	9999	2	-9999 ~ 9999	
oFS (OFS)	Offset indicated value	0	2	-9999 ~ 9999	
oIn (OIN)	Offset input value	0	2	-9999 ~ 9999	
dLHI (DLHI)	Digital limiter HI	9999	0	-9999 ~ 9999	Sets the high limit of the displayable range. (A value exceeding the digital limiter HI setpoint is not updated and is held at the set value.)
dLLo (DLLO)	Digital limiter LO	-9999	0	-9999 ~ 9999	Sets the low limit of the displayable range. (A value lower than the digital limiter LO setpoint is not updated and is held at the set value.)
AoUt (A.OUT)	Analog output type	0-1	1	0-1/0-10/1-5/4-20	Selects the analog output's output range. * Only when analog output is provided
AoHI (AOHI)	Analog output HI	9999	1	-9999 ~ 9999	Sets the relationship between display and analog output. * Only when analog output is provided
AoLo (AOLO)	Analog output LO	0	1	-9999 ~ 9999	
dP (DP)	Decimal point	....	2	Set to any digit	Sets the decimal-point display position.

5.1.3. Comparator Data

Menu Display	Parameter Name	Initial Value	P.L.	Settable Range or Alternatives	Main Setting Target and Precautions
coMt (COM.T)	Comparison output	orU	1	orU/Err	Selects high and low judgments (O/U) or tolerance judgments (ERR) for comparison action type.
HH-S (HH-S)	HH judgment value	5000	2	-9999 ~ 9999	Sets HH-side judgment value. * Only when COM.T is in O/U
HI-S (HI-S)	HI judgment value	1000	2	-9999 ~ 9999	Sets HI-side judgment value. * Only when COM.T is in O/U
Lo-S (LO-S)	LO judgment value	500	2	-9999 ~ 9999	Sets LO-side judgment value. * Only when COM.T is in O/U
LL-S (LL-S)	LL judgment value	0	2	-9999 ~ 9999	Sets LL-side judgment value. * Only when COM.T is in O/U
nVAL (N.VAL)	Nominal value	5000	2	-9999 ~ 9999	Sets the nominal value. * Only when COM.T is in ERR
Err1 (ERR1)	Tolerance 1	5.00	2	0.00 ~ 10.00	Sets tolerance 1. * Only when COM.T is in ERR
Err2 (ERR2)	Tolerance 2	10.00	2	0.00 ~ 10.00	Sets tolerance 2. * Only when COM.T is in ERR
HH-H (HH-H)	HH hysteresis	0	1	000 ~ 999	Sets HH-side hysteresis (applied to the inner side of a setpoint). * Only when COM.T is in O/U
HI-H (HI-H)	HI hysteresis	0	1	000 ~ 999	Sets HI-side hysteresis (applied to the inner side of a setpoint). * Only when COM.T is in O/U
Lo-H (LO-H)	LO hysteresis	0	1	000 ~ 999	Sets LO-side hysteresis (applied to the inner side of a setpoint). * Only when COM.T is in O/U
LL-H (LL-H)	LL hysteresis	0	1	000 ~ 999	Sets LL-side hysteresis (applied to the inner side of a setpoint). * Only when COM.T is in O/U
Er1H (ER1.H)	Tolerance-1 hysteresis	1	1	000 ~ 999	Sets tolerance-1 hysteresis (applied to the inner side of a setpoint). * Only when COM.T is in ERR
Er2H (ER2.H)	Tolerance-2 hysteresis	1	1	000 ~ 999	Sets tolerance-2 hysteresis (applied to the inner side of a setpoint). * Only when COM.T is in ERR
HH-L (HH-L)	HH logic	n.o	0	n.o/n.c	Sets HH output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).
HI-L (HI-L)	HI logic	n.o	0	n.o/n.c	Sets HI output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).
Go-L (GO-L)	GO logic	n.o	0	n.o/n.c	Sets GO output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).
Lo-L (LO-L)	LO logic	n.o	0	n.o/n.c	Sets LO output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).
LL-L (LL-L)	LL logic	n.o	0	n.o/n.c	Sets LL output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).

5.2. Display and Character Representation

0 1 2 3 4 5 6 7 8 9 - /
0 1 2 3 4 5 6 7 8 9 - /

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A b c d E F G H I J K L M n o P q r S t U v u w x y z

5.3. Parameter Types and Protect Levels

The A7000 series parameters are classified into the following groups depending on the main objective:

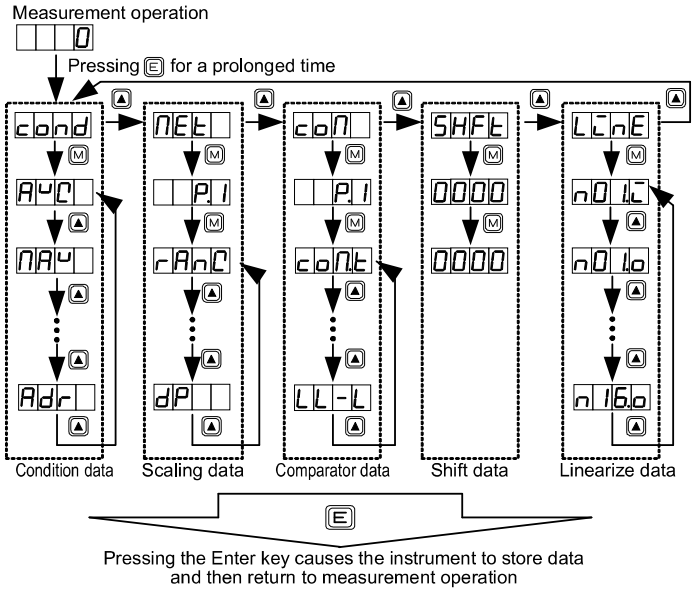
- Condition data: A group of parameters that set basic actions such as sampling rate and operation type of each control
- Scaling data: A group of parameters relating to measurements such as a measurement range and scaling
- Comparatordata: A group of parameters relating to comparison output such as the comparison output operation type or judgment values
- Shift data: A group of parameters relating to the function that forcibly shifts an indicated value
- Linearize data: A group of parameters relating to the function that corrects the linearity of an input value and indicated value

Each parameter has a protect level that has been set up. Setting the protect level of condition data allows the settable protect level of parameters to be limited. (For the settable protect level of each parameter, see P.L for the list of parameters in 5.1.)

For the protect levels, the higher the level value, the more the number of parameters whose setting is disabled increases. If the protect level is set to LV3, which is the highest level, all parameters are disabled from being set with the exception of protect level change.

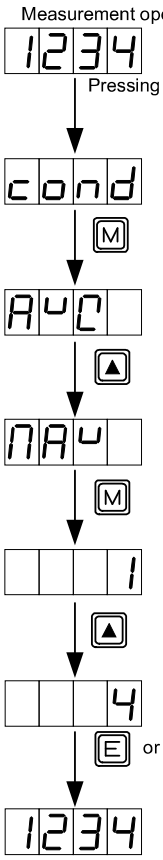
* At factory shipment, the protect level is set to LV1. (In this case, only settings relating to display color, scaling, or judgment values can be made).

5.4. Shifting to the Parameter Setting Mode



5.5. Condition Data Setting Procedure

This section describes an example of setting the number of moving averaging times as a typical example. Take the same steps for other parameters.

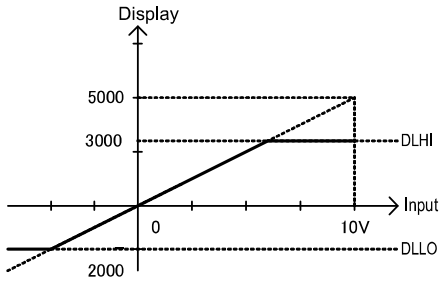


5.6. Scaling Data Setting Procedure

This section describes the concept of scaling data and an example of setting a full-scale indicated value as a typical example. Take the same steps for other parameters.

Input voltage : 0 to 10 V
Display : 0 to 5.000
(display range:-2.000 to 3.000)

RANG : 13
F S C : 5000
F I N : 9999
O F S : 0
O I N : 0
D L H I : 3000
D L L O : -2000
D E P : Lights up at the 10^3 place.

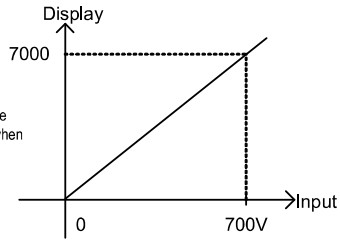


* The digital limiter is the function that limits an input value to the relevant set value even if a signal higher than or lower than the indicated value set to DLHI or DLLO respectively is input. The setting condition is DLHI > DLLO, and if this condition is not met, Err5 is caused, returning the display to DLHI.

Input voltage : 0 to 700 V
Display : 0 to 700.0

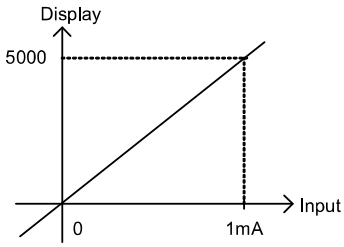
RANG : 15
F S C : 7000
F I N : 9999
O F S : 0
O I N : 0
D L H I : 9999
D L L O : -9999
D E P : Lights up at the 10^1 place.

* For 15 ranges, the full-scale input value (FIN) is "9999" when 700 V is input.



Input signal : 0 to 1 mA
Display : 0 to 5000

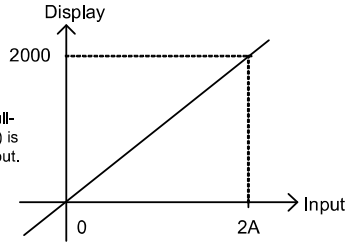
RANG : 22
F S C : 5000
F I N : 9999
O F S : 0
O I N : 0
D L H I : 9999
D L L O : -9999
D E P : None



Input signal : 0 to 2 A
Display : 0 to 2.000

RANG : 26
F S C : 2000
F I N : 9999
O F S : 0
O I N : 0
D L H I : 9999
D L L O : -9999
D E P : Lights up at the 10^3 place.

* For 26 ranges, the full-scale input value (FIN) is "9999" when 2 A is input.



Measurement operation

1234

Pressing E for a prolonged time

cond

① Press the Enter key for approx. 3 seconds during measurement operation.

▲

② Press the Increment key to move to the scaling data menu.

nEt

M

③ Press the Mode key to display a pattern.

P.1

M

④ Press the Mode key to display the range setting menu. To change the pattern, use the Increment key.

rAnC

▲

⑤ Press the Increment key to display the full-scale indicated value setting menu.

FSc

M

⑥ Press the Mode key to enter setting.

9999

▶ & ▲

⑦ Using the Shift key (digit change) and Increment key (value change), set the indicated value to a desired value (this setting example sets it to "8000").

8000

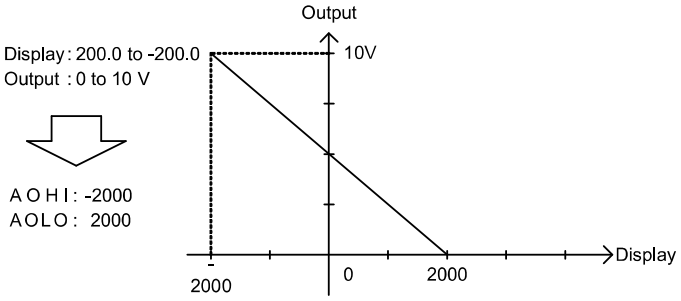
* The selected digit blinks.

E or M

⑧ Press the Enter key to return to measurement operation. (If the Mode key is pressed, you will be returned to the setting menu; press the Increment key to move to the next parameter.)
Next, the following describes the concept of analog output scaling. Analog output sets an output value in relation to the indicated value. (The operation procedure is the same as that of a full-scale indicated value.)

1234

Next, the following describes the concept of analog output scaling. Analog output sets an output value in relation to the indicated value. (The operation procedure is the same as that of a full-scale indicated value.)



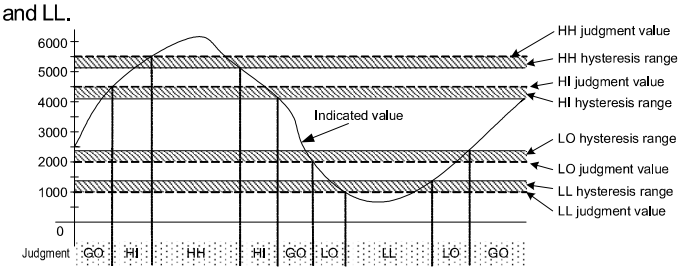
* If both AOHI and AOLO are set to the same value, Err6 is caused, returning the display to AOHI.

5.7. Comparator Data Setting Procedure

The A7000 can shoose comparison a vertical judgment or a tolerance judgment with the comparison output type of a comparator data setup.

5.7.1. High and Low Judgment Type

The high and low judgment type allows you to directly set judgment values in numerical values, which are checked against the indicated value for judgment. It allows setting of four stages of judgment points: HH, HI, LO, and LL.



* Hysteresis is applied to the inner side of each judgment setpoint.

* The setting conditions are (HH judgment value - HH hysteresis) > HI judgment value, (HI judgment value - HI hysteresis) > (LO judgment value + LO hysteresis), and LO judgment value > (LL judgment value + LL hysteresis). If any of these conditions is not met, Err0 is caused, returning the display to the HH judgment value setting.

Measurement operation

1234

Pressing E for a prolonged time

① Press the Enter key for approx. 3 seconds during measurement operation.

cond

▲

② Press the Increment key several times to move to the comparator data menu.

coM

M

③ Press the Mode key to display a pattern.

P.1

M

④ Press the Mode key to display comparison output type. To change the pattern, use the Increment key.

coM.t

▲

⑤ When the Increment key is pressed, the HH judgment value appears.
(If the Mode key is pressed, the comparison output type setting content appears. See an example of setting the tolerance judgment type in the next subsection.)

HH-S

M

⑥ Press the Mode key to enter a judgment value setting.

5000

▶ & ▲

⑦ Using the Shift key (digit change) and Increment key (value change), set the judgment value to a desired value (this setting example sets it to "5500").

* The selected digit blinks.

5500

E or M

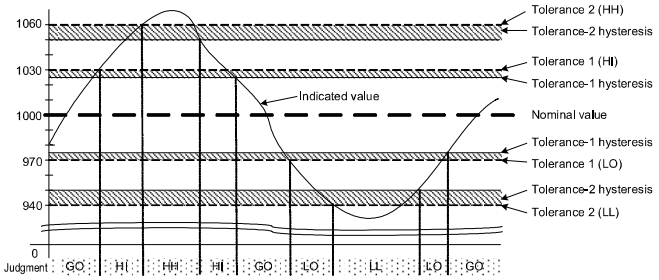
⑧ Press the Enter key to return to measurement operation. (If the Mode key is pressed, you will be returned to the setting menu; press the Increment key to move to the next parameter.)

1234

5.7.2. Tolerance Judgment Type

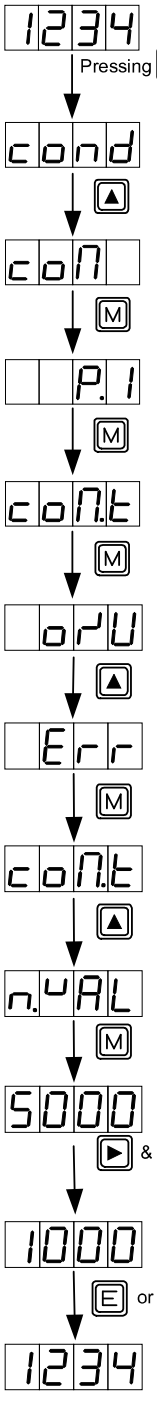
The tolerance judgment type allows you to set a nominal value and its tolerances (±XX%) to make judgment on the basis of the judgment values calculated from these values within the instrument. You can set one nominal value and two tolerance values.

For example, if the nominal value is set to 1000 and tolerances 1 and 2 are set to 3% and 6% respectively, internal judgment values are 1060 for HH judgment value, 1030 for HI judgment value, 970 for LO judgment value, and 940 for LL judgment value.



* A tolerance is set as XX% of the nominal value.
* Hysteresis is set as XX digits.
* Hysteresis is applied to the inner side of each setpoint.

Measurement operation



① Press the Enter key for approx. 3 seconds during measurement operation.

② Press the Increment key several times to move to the comparator data menu.

③ Press the Mode key to display a pattern.

④ Press the Mode key to display comparison output type. To change the pattern, use the Increment key.

⑤ When you press the Mode key, the comparison output type setting content appears. (O/U: high and low limit judgment, Err: tolerance judgment)

⑥ Press the Increment key to enter setting (set the type to tolerance judgment type).

⑦ Press the Mode key to return to the setting menu. (In this setting example, the display returns to comparison output type.)

⑧ Press the Increment key to move to the next parameter (nominal value).

⑨ Press the Mode key to enter a nominal value setting.

⑩ Using the Shift key (digit change) and Increment key (value change), set the nominal value to a desired value (this setting example sets it to "1000").

* The selected digit blinks.

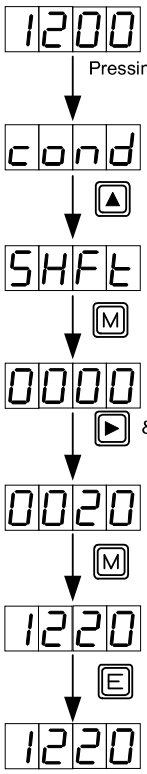
⑪ Press the Enter key to return to measurement operation. (If the Mode key is pressed, you will be returned to the setting menu; press the Increment key to move to a next parameter.)

5.8. Shift Data Setting Procedure

The shift function allows you to arbitrarily shift the display without changing the inclination of an input signal. A setting example below shows how to shift the indicated value by 20 digits.

<u>* The shift function is available (settable) when the condition data's protect level is "0."</u>

Measurement operation



① Press the Enter key for approx. 3 seconds during measurement operation.

② Press the Increment key several times to move to the shift data menu.

③ Press the Mode key to enter shift data setting.

* The 10^3 place blinks.

④ Using the Shift key (digit change) and Increment key (value change), set shift data to the desired value (this setting example sets it to "20").

* The selected digit blinks.

⑤ Press the Mode key to check the calculation results.

* All the digits blink.

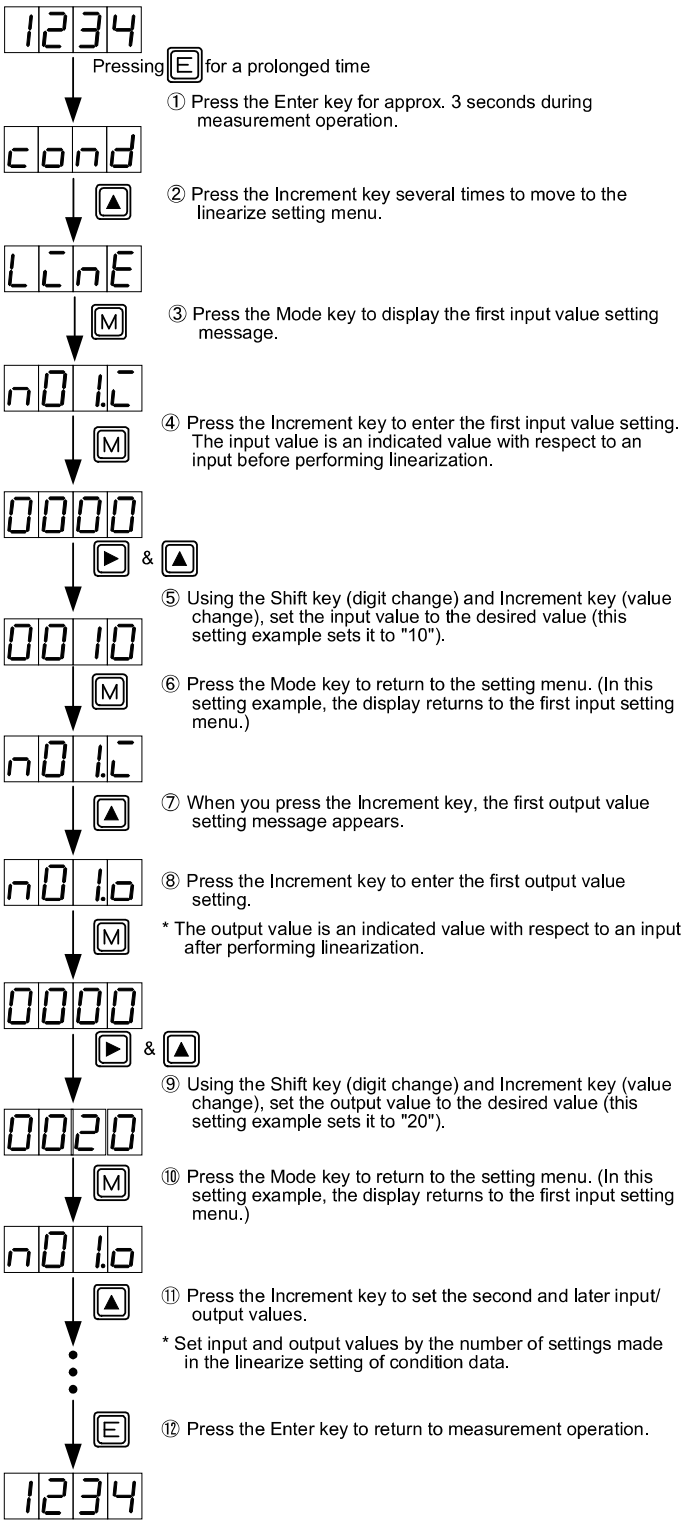
⑥ Press the Enter key to return to measurement operation.

5.9. Linearize Data Setting Procedure

The linearize function corrects the linear relationship between an input and the display at any point to change the inclination of the linear relationship. Linearize data is set using the input value (indicated value before correction) and output value (indicated value after correction) of any point.

* The linearize function is available only when you have selected any item other than OFF in linearize setting of condition data.

Measurement operation



* The setting conditions are N-1 < N-2 .... N-15 < N-16, and if these conditions are not met, Err7 occurs. In this case, make the setting again.

6. External Control Function

6.1. Each External Control Terminal

Internal circuit : pull-up at approx. 5 V (resistance value: approx. 10 kΩ)
Control signal HI level : 4.2 to 5 V with respect to terminal COM
Control signal LO level: 0 to 0.4 V with respect to terminal COM

Caution: The COM terminal of the external control circuit and the LO terminal of the input circuit have the same potential in terms of direct current.

6.2. Pattern Select Function

The pattern select function allows scaling data and comparator data to be stored in a maximum of eight patterns and lets you set any pattern for use. Pattern select control is achieved by terminal control and front panel key-based operation, depending on condition data setting. For terminal control, short circuiting the P.SEL1 to P.SEL3 terminals with the terminal COM, or making these terminals have the same potential, allows P-1 and up to P-8 to be switched. Also, for front panel key-based operation, pressing the Increment key for approx. 3 seconds allows a pattern to be switched.

Terminal Name	Pattern 1	Pattern 2	Pattern 3	Pattern 4	Pattern 5	Pattern 6	Pattern 7	Pattern 8
P.SEL1	Open	Shorted	Open	Shorted	Open	Shorted	Open	Shorted
P.SEL2		Open	Shorted			Open	Shorted	
P.SEL3			Open	Open	Shorted	Shorted		

* In default, front panel key-based operation is enabled. If you wish to perform terminal control, set it up using condition data.

6.3. Start/Hold Function

The start/hold function holds the display at any timing, which can be set in type A or type B using condition data. Type A is the free run mode, in which you short the S/H terminal with terminal COM or make these terminals have the same potential from the free-run status to hold the indicated value and comparison judgment value. Type B is the one-shot mode. In this mode, you short the S/H terminal with terminal COM or make these terminals have the same potential from a hold status to output the indicated value and comparison judgment value once. For this, see the timing chart below.

6.4. Peak Hold Function

The peak hold function holds one of the maximum values (peak hold), minimum values (valley hold), and maximum value - minimum value - (peak valley hold) and produces output in relation to it (switching of these values is set up using condition data). The peak hold function can be activated by shorting the PH terminal with the terminal COM or making these terminals have the same potential.

6.5. Digital Zero Function

The digital zero function regards display at any timing as zero and indicates varying width from this point on. This function can be activated or deactivated by terminal control or front panel key-based operation, which is selected according to the setting of condition data. For terminal control, the DZ and COM terminals are short-circuited or made to have the same potential to activate the digital zero function, causing the display of that time to be zero. For front panel key-based operation, press the Shift key for approx. 3 seconds to activate the function, causing the display of that time to be zero.

* In the default, front panel key-based operation is enabled. To perform terminal control, set it up using condition data.

7. Output Function

7.1. Comparison Output Function

The A7000 series allows four judgment values of HH, HI, LO, and LL to be set up with respect to the measured value (indicated value) and the judgment result to be output by relay contact output or photocoupler (when the comparison output unit has been installed). For the contact rating, etc., see the output specifications.

7.2. BCD Output Function

The A7000 series can output BCD signals with respect to the indicated value (when the BCD output unit has been installed). BCD output logic can be selected using condition data.

7.3. Analog Output Function

The A7000 series can output an analog signal with respect to the indicated value (when the analog output unit has been installed). There are four types of outputs: 0 to 1 V, 0 to 10 V, 1 to 5 V, and 4 to 20 mA, which can be selected using scaling data. Also, any scaling can be applied.

7.4. RS-232C Function

The A7000 series allows RS-232C function to be incorporated (when the RS-232C unit has been installed). For the RS-232C function, see the separate Communications Function Operation Manual.

7.5. RS-485 Function

The A7000 series allows RS-485 function to be incorporated (when the RS-485 unit has been installed). For the RS-485 function, see the separate Communications Function Operation Manual.

8. Specifications and Outer Dimensions

8.1. Input Specifications

●DC voltage measurements

Range	Measurement Range	Display	Error (23°C ±5°C, 35 to 85%)	Input Impedance	Max. Allowable Input
11	±99.99 mV	Offset:± 9999 Full scale: ± 9999	±(0.03% of rdg + 1 digit)	100 MΩ	±50 V
12	±999.9 mV				
13	±9.999 mV			Approx. 1 MΩ	±250 V
14	±99.99 V			Approx. 10 MΩ	
15	±700.0V		±(0.1% of rdg + 2 digits)		±700 V

Sampling rate: Approx. 1000 times/sec
* Error applies if the sampling rate is 20 times/sec or less.

●DC current measurements (small current)

Range	Measurement Range	Display	Error (23°C ±5°C, 35 to 85%)	Input Impedance	Max. Allowable Input
21	±99.99 μA	Offset:± 9999 Full scale: ± 9999	±(0.1% of rdg + 2 digits)	Approx. 100 Ω	±10 mA
22	±999.9 μA			Approx. 10 Ω	
23	±9.999 mA			Approx. 10 Ω	±50 mA
24	±99.99 mA			Approx. 1 Ω	±500 mA

Sampling rate: Approx. 1000 times/sec
* Error applies if the sampling rate is 20 times/sec or less.

●DC current measurements (large current)

Range	Measurement Range	Display	Error (23°C ±5°C, 35 to 85%)	Input Impedance	Max. Allowable Input
25	±999.9 mA	Offset:± 9999 Full scale: ± 9999	±(0.1% of rdg + 2 digits)	Approx. 0.1 Ω	±3A
26	±2.000 A			Approx. 0.1 Ω	

Sampling rate: Approx. 1000 times/sec
* Error applies if the sampling rate is 20 times/sec or less.

8.2. Common Specifications

Display: 7-segment LED display (character height: approx. 16 mm)
Polarity display: Automatically indicated when the calculation result is negative
Display range: -9999 to 9999
Overrange warning: "OVER" or "-OVER" indication in response to an input signal exceeding the display range
Decimal point: Settable to any digit position
Zero indication: Leading zero suppression
External control: P.SEL1 - 3, HOLD, PH, DZ (depending on output units)
Operating temperature and humidity ranges:
0 to 50 °C, 35 to 85% R.H (no condensation)
Storage temperature and humidity ranges:
-10 to 70 °C, 60% R.H or less
Power: AC power unit... 100 to 240 V AC ±10%,
DC power unit ... 12 to 48 V DC ±10%
Power consumption: 8 VA max. (AC power unit)
7 W max. (DC power unit)
Outer dimensions: 72 mm (W) x 36 mm (H) x 118 mm (D)
Weight: Approx. 160 g
Withstand voltage (AC power):
Power terminal to input terminal, COM, comparison output, BCD,
analog output, or RS communications terminal 1500 V AC for 1 minute
Withstand voltage (DC power):
Power terminal to input terminal, COM, comparison output, BCD,
analog output, or RS communications terminal 500 V DC for 1 minute
Withstand voltage (common):
Input terminal to comparison output, BCD, analog output, or RS- communications terminal 500 V DC for 1 minute
Case to each terminal 1500 V AC for 1 minute
Insulation resistance: 500 V DC at 100 MΩ or more between the noted terminals

8.3. Output Specifications

8.3.1. Comparison Output

Control method: Microcomputer-based calculation method
Judgment value setting range:
-9999 to 9999
Hysteresis: Settable in the range of 1 to 999 digits with respect to each judgment value
Comparison action: Depending on sampling rate
Setting conditions: High-high limit judgment value > high limit judgment value > low limit
judgment value > low-low limit judgment value
Comparison conditions:

Comparison Conditions	Judgment
ResultsIndicated value > high-high limit judgment value > high limit judgment value	HH, HI
High-high limit judgment value ≧ indicated value > high limit judgment value	HI
High limit judgment value ≧ indicated value ≧ low limit judgment value	GO
Low limit judgment value > indicated value ≧ low-low limit judgment value	LO
Low limit judgment value > low-low limit judgment value > indicated value	LO, LL

Comparator relay: Contact rating
125 V AC, 0.3 A (resistive load)
30 V DC, 1 A (resistive load)
Number of contacts
Relay contact x 5
Mechanical life
50 million times or more
Electrical life
100,000 times or more (resistive load)
Photocoupler output: Output rating
Sink current 50 mA max. Voltage applied: 30 V max.
Output saturation voltage 1.2 V or less at 50 mA
Output quantity
Photocoupler x 5

8.3.2. BCD Outputs

●TTL output
Measured data: Tri-state parallel BCD
Polarity signal: 1 level for negative indication
Excess signal: 1 level for excess indication
Printout command signal (PC):
Positive pulse output after completion of measurement (PC width depends on sampling)
Output logic: Switchable (PC logic not switchable)
Output signal: TTL level fan-out = 2, COMS compatible

●Open collector output (NPN type)
Measured data: Transistor ON when negative logic is logic 1
Polarity signal: Transistor ON for negative indication
Excess signal: Transistor ON for excess indication
Printout command signal (PC):
Transistor ON after completion of measurement (PC width depends on sampling)
Output logic: Switchable (PC logic not switchable)
Transistor output capacity:
Voltage 30 V max., Current 10 mA max.
Output saturation voltage 1.2 V or less at 10 mA

●Enable
Enable input: Shorting the ENABLE terminal with the DG terminal or making these terminals have the same potential causes BCD output to be high impedance (TTL) or transistor to be turned OFF.
Control signal HI level:
3.5 to 5 V with respect to DG terminal
Control signal LO level:
0 to 1.5 V with respect to DG terminal
Input current: -0.5 mA

8.3.3. Analog Output

Conversion method: PWM conversion
Resolution: 13 bits or equivalent
Scaling: Digital scaling
Response rate: Approx. 0.5 seconds

Output Type	Resistive Load	Accuracy	Ripple
0 to 1 V	10 kΩ or more	±(0.5% of FS)	±50mVpp
0 to 10 V	10 kΩ or more		
1 to 5 V	10 kΩ or more		
4 to 20 mA	550 Ω or less		±25mVpp

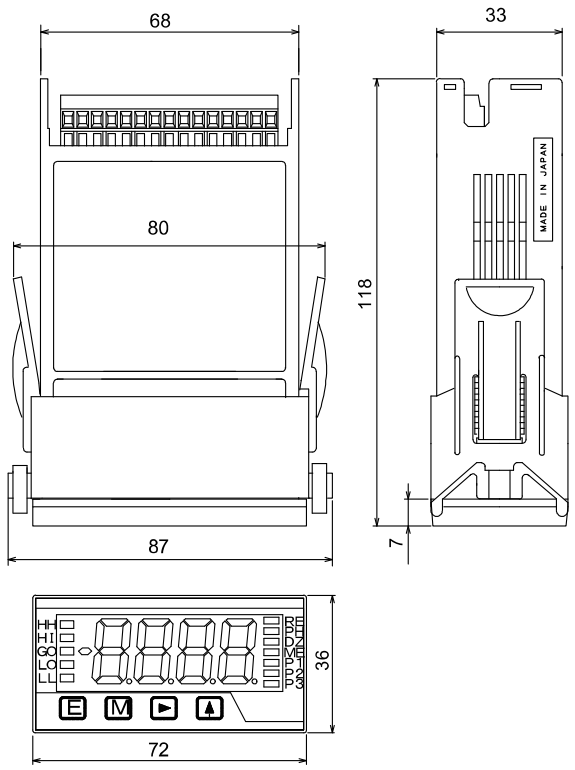
* A ripple of 4 to 20 mA is caused at a resistive load of 250 Ω and output of 20 mA.

8.3.4. Communication Function

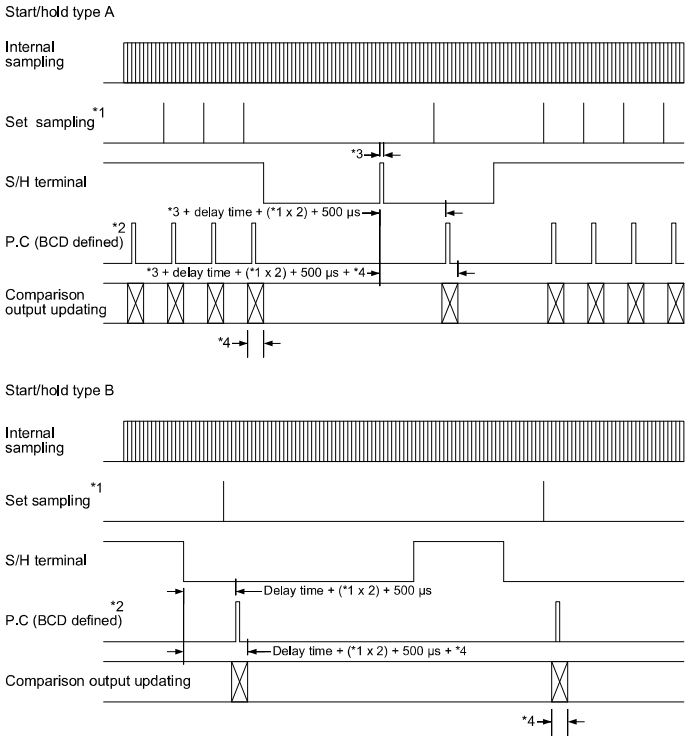
	RS-232C	RS-485
Synchronous System	Start-stop transmission system	
Communication System	Full duplex	Two-line semi-duplex (polling selecting system)
Transmission Rate	38400bps/19200bps/9600bps/4800bps/2400bps	
Start Bit	1bit	
Data Length	7 bits/8 bits	
Error Detection	Even parity/odd parity/none	
		BCC (block check character) checksum
Stop Bit	1 bit/2 bits	
Character Code	ASCII codes	
Data Communication Control Procedure	Non-procedural	
Signal Name in Use	TXD, RXD, SG	Non-inverse (+), inverse (-)
Number of Units Connected	1	A maximum of 31 meters
Line Length	15 m	500 m maximum
Delimiter	CR+LF/CR	

* For more information on the communications function such as the send/receive format and commands, see the separate A7000 Communications Function Operation Manual.

8.4. Outer Dimensions



9. Timing Chart



*1 Set sampling

This is the practical sampling rate of the A7000 series that is set using the AVG parameter of condition data (see the table below).

Set AVG Count	Set Sampling Rate	Set Sampling Period	Set AVG Count	Set Sampling Rate	Set Sampling Period
1	1041.65 times/sec	Approx. 960 µs	100	10.4165 times/sec	Approx. 96 ms
2	520.825 times/sec	Approx. 1.92 ms	200	5.20825 times/sec	Approx. 192 ms
4	260.4125 times/sec	Approx. 3.84 ms	400	2.604125 times/sec	Approx. 384 ms
8	130.20625 times/sec	Approx. 7.68 ms	800	1.3020625 times/sec	Approx. 768 ms
10	104.165 times/sec	Approx. 9.6 ms	1000	1.04165 times/sec	Approx. 960 ms
20	52.0825 times/sec	Approx. 19.2 ms	2000	0.520825 times/sec	Approx. 1.92 s
50	20.833 times/sec	Approx. 48 ms	5000	0.20833 times/sec	Approx. 4.8 s

*2 P.C signal output width

This differs depending on the set sampling and is as shown below:

Set AVG Count	P.C Output Width	Set AVG Count	P.C Output Width
1	Approx. 220 µs	100	Approx. 30 ms
2	Approx. 0.52 ms	200	
4	Approx. 1.15 ms	400	
8	Approx. 2.3 ms	800	
10	Approx. 2.9 ms	1000	
20	Approx. 5.8 ms	2000	
50	Approx. 14.4 ms	5000	

*3 External start signal

An external start signal should be 500 µs to one period of set sampling. You can set the delay time to external start using the start/hold delay time parameter of condition data.

*4 Comparison output delay time

Relay output: 10 ms maximum, photocoupler output: 200 µs maximum

10. Error Messages

10.1. Error Display during Measurement or Setting

Display	Description
oVEr -oVEr	Indicates that a signal exceeding the measurement range has been applied.
o.V.E.r. -o.V.E.r.	Indicates that an input signal once exceeded the measurement range, but has returned to the measurable range with the peak hold function activated.
uAIt	Indicates that the unit is waiting for an A/D converter input or that power-ON delay time is valid.
Err0	Indicates that each judgment value of comparator data or the size of hysteresis parameters does not meet the conditions.
Err4	Indicates that the full scale input value and offset input value of scaling data have the same value.
Err5	Indicates that digital limiter HI and digital limiter LO of scaling data have the same value.
Err6	Indicates that analog output HI and analog output LO of scaling data have the same value.
Err7	Linearize data error

10.2. Error Display in the Event of Problem in Memory

Display	Description
dAt0	Memory switch area, checksum error of main memory
dAt1	Calibration data area, checksum error of main memory
dAt2	Memory switch area, checksum error of sub-memory
dAt3	Calibration data area, checksum error of sub-memory
c.o.n.d.	Condition data area, checksum error Press the Mode key for a prolonged time to load the initial values.
n.E.t.1.	Scaling data area, checksum error (for each pattern) Press the Mode key for a prolonged time to load the initial values of each pattern.
c.o.n.1.	Comparator data area, checksum error (for each pattern) Press the Mode key for a prolonged time to load the initial values of each pattern.
c.A.L.1.	Calibration data area, checksum error (for each pattern) Press the Mode key for a prolonged time to load the initial values of each pattern.
S.H.F.t.	Shift data area, checksum error Press the Mode key for a prolonged time to load the initial values.
L.i.n.E.	Linearize data area, checksum error Press the Mode key for a prolonged time to load the initial values.

* Turning power ON with the Enter key and Mode key held down causes all the parameters to return to the initial values (defaults).

11. Warranty and After-sales Service

11.1. Warranty

The warranty period of the product is one year from the date of delivery. If a failure occurs during this period that is clearly judged to be caused by a defect ascribable to Watanabe Electric Industry, we will repair the failure or replace any defective parts without charge.

11.2. After-sales Service

The product has been manufactured, tested, and inspected with strict quality control management before shipment. Should the product break down, contact (send it to) your sales representative or our sales office directly. (In this case, write a detailed description of the problem and enclose it with the product.)

watanabe
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