

Operation Manual for the A7000 Series
Temperature Measurement: A7X18-X



CAUTIONS

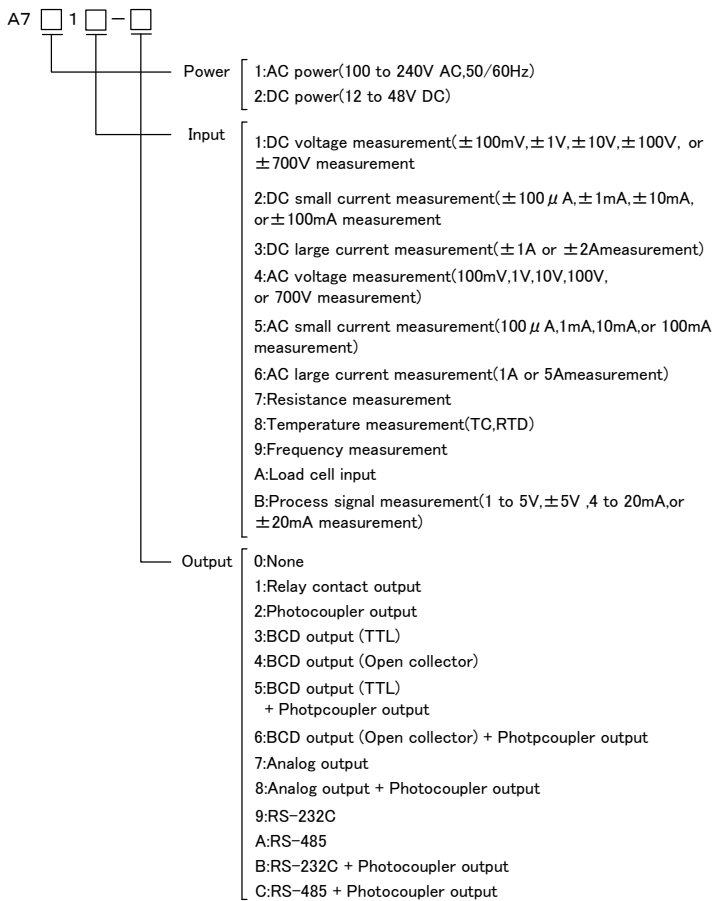
- (1) Application of voltage or current exceeding the maximum allowable value to the input section may damage the instrument.
- (2) Use the supply voltage in the allowable range. Using it out of this range may result in fire, electric shock, or an instrument failure.
- (3) Please note that the information 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

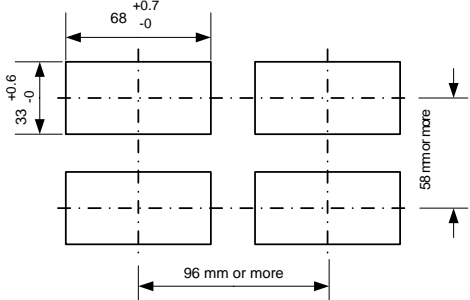
The type configuration of the A7000 series is as shown below. Check that there is no difference in the type or specifications between the product you ordered and the product you have received.



2. Mounting Method

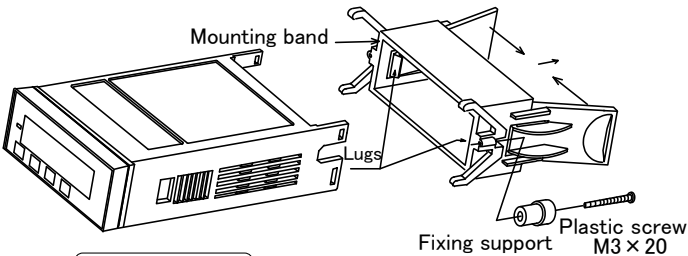
2.1. Panel Cutout Dimensions

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, contact your sales representative or our sales office.

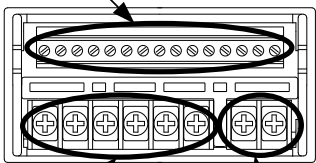


CAUTIONS

- (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.

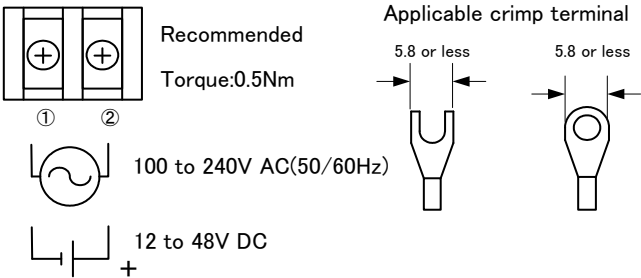
3. Description of Terminals and Connection

Output section (different configuration for BCD output)



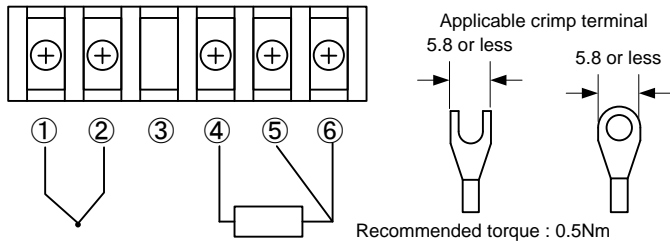
Input section Power section

3.1. Connecting Power



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

3.2. Connecting Input Signal



Terminal No.	Name	Description
1	TC HI	Thermocouple's positive leg connectuin terminal
2	TC LO	Thermocouple's negative leg connection terminal
3	NC	Connect nothing to this terminal.
4	RTD A	Resistance element conductor connection terminal
5	RTD B	Resistance element conductor connection terminal
6	RTD C	Connection terminal of a conductor resistance rejection wire

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

Burnout warning □ Thermocouple : "B.OUT" is displayed in case of a break in TC HI or TC LO
RTD : "OVER" is displayed in case of a break in RTD A or RTD B
"B.OUT" is displayed in case of a break in RTD C

Note : Analog output produced in the event of burnout becomes minimal during B.OUT display or becomes maximal during OVER display.

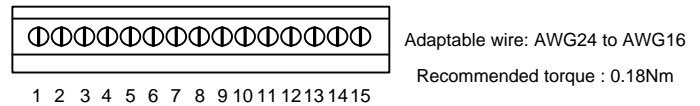
3.3. Connecting Various Output Signals

3.3.1. Relay Contact Output Unit



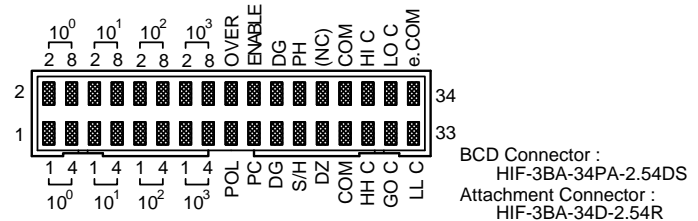
Term. No.	Name	Description
1	P.SEL1	Pattern Select terminals. Enabled when they have the same potential as, or are shorted with, terminal COM. * They are disabled unless pattern select is set up for terminal control using condition data.
2	P.SEL2	Pattern1 Pattern2 Pattern3 Pattern4 Pattern5 Pattern6 Pattern7 Pattern8
3	P.SEL3	P1 P2 P3 OFF OFF OFF ON OFF ON OFF ON OFF ON
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

3.3.2. Photocoupler Output Unit



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	Pattern1 Pattern2 Pattern3 Pattern4 Pattern5 Pattern6 Pattern7 Pattern8
3	P.SEL3	P1 P2 P3 OFF OFF OFF ON OFF ON OFF ON OFF ON
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

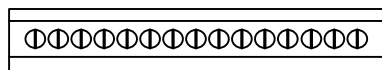
3.3.3. BCD Unit



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



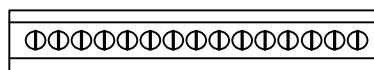
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Adaptable wire: AWG24 to AWG16
Recommended torque : 0.18Nm

Term. No.	Name	Description
1	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.

3.3.6. RS-485 Unit



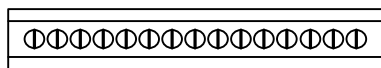
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Adaptable wire: AWG24 to AWG16
Recommended torque : 0.18Nm

Term. No.	Name	Description
1	(+)	Non-inverse output
2	(-)	Inverse output
3	SG	Common terminal for communications function
4	TERM	Terminating resistor terminal (200 Ω). When turning it ON, short it with terminal 5.
5	TERM	Terminating resistor terminal (200 Ω). 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.

3.3.5. RS-232C Unit



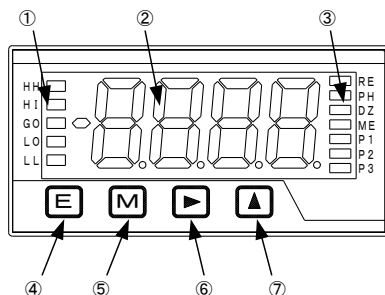
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Adaptable wire: AWG24 to AWG16
Recommended torque : 0.18Nm

Term. No.	Name	Description
1	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.

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.
④	Enter	P1 Pattern 1
		P2 Pattern 2
		P3 Pattern 3
		Pattern 4 Pattern 5 Pattern 6 Pattern 7 Pattern 8
⑤	Mode	Shifts the unit to the parameter setting mode.
⑥	Shift	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).
⑦	Increment	Used to change the objective digit during parameter settings or make DZ control in measurements (When pressed for a prolonged time).

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	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/green	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/green	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/green	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	green	1	red/green	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/green	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/green	Selects red or green for display color applied during LL judgment. * Only when CLR.T is in MANU.
BLNK (BLNK)	Display blank level	OFF	0	OFF/LV1/LV2/LV3/on	Selects display brightness. (Bright OFF ⇔ LV1 ⇔ LV2 ⇔ LV3 ⇔ ON Extinguished)
P.VH (PVH)	PH select	PH	0	PH/val/peak	Selects the type (peak hold, valley hold, or peak - valley hold) activated when the PH function is enabled.
DZ.BU (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.
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	LV1	3	LV0/LV1/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.
P.VH.T (PVH.T)	Peak hold type	A	0	A/B	Selects the action type of peak hold (A: real display, B: result display).
DZ.C (DZ.C)	Digital zero control	SW	0	SW/TERM	Selects the digital zero control method (SW: front panel keys, TERM: external control terminals).
PS.C (PS.C)	Pattern select control	SW	0	SW/TERM	Selects the pattern select control method (SW: front panel keys, TERM: external control terminals). * Only when external control is provided
BCD.L (BCD.L)	BCD output logic	NLo	0	NLo/PLo	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 19200/38400	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
DEL (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
rRnQ (RANG)	Input range	PA	1	PA/Pb/J/E/5/b PA/JPA/Pb/JPB	Selects the input range. *Note that the input terminal changes depending on the input range.
dLHc (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.)
RoUt (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
RoHc (AOHI)	Analog output HI	9999	1	-9999 ~ 9999	Sets the relationship between display and analog output. * Only when analog output is provided
RoLo (AOLO)	Analog output LO	0	1	-9999 ~ 9999	Sets the relationship between display and analog output. * Only when analog output is provided
Unct (UNIT)	Unit of temperature indication	c	1	c/F	Unit of temperature indication is set.

5.1.3. Comparator Data

Menu Display	Parameter Name	Initial Value	P.L.	Settable Range or Alternatives	Main Setting Target and Precautions
coNt (COM.T)	Comparison output	oPU	1	oPU/Err	Selects high and low judgments (O/U) or tolerance judgments (ERR) for comparison action type.
HH-5 (HH-S)	HH judgment value	5000	2	-9999 ~ 9999	Sets HH-side judgment value. * Only when COM.T is in O/U
HL-5 (HI-S)	HI judgment value	1000	2	-9999 ~ 9999	Sets HI-side judgment value. * Only when COM.T is in O/U
Lo-5 (LO-S)	LO judgment value	500	2	-9999 ~ 9999	Sets LO-side judgment value. * Only when COM.T is in O/U
LL-5 (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	500	2	000 ~ 1000	Sets tolerance 1. * Only when COM.T is in ERR
Err2 (ERR2)	Tolerance 2	1000	2	000 ~ 1000	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
HL-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	no	0	no/nc	Sets HH output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).
HL-L (HI-L)	HI logic	no	0	no/nc	Sets HI output logic (N.O: normally open, N.C: normally closed). * When power is OFF, output is always open (OFF).
Lo-L (GO-L)	GO logic	no	0	no/nc	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	no	0	no/nc	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	no	0	no/nc	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 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

Comparator data: A group of parameters relating to comparison output such as the comparison output operation type or judgment values

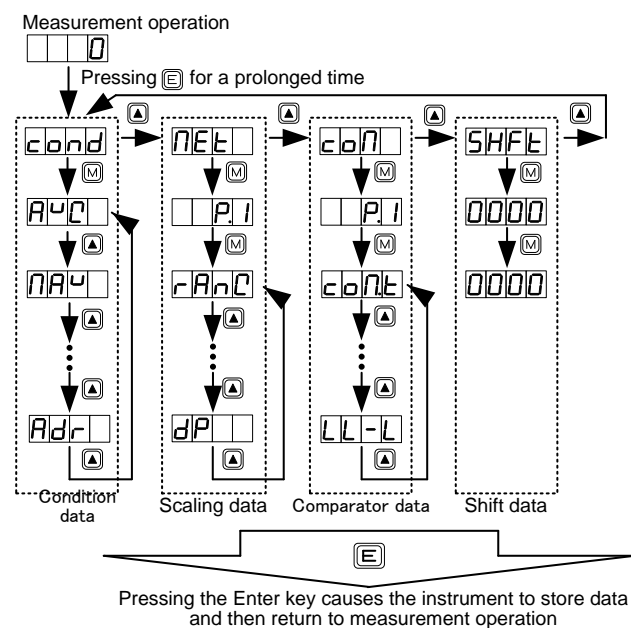
Shift data: A group of parameters relating to the function that forcibly shifts an indicated value

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.

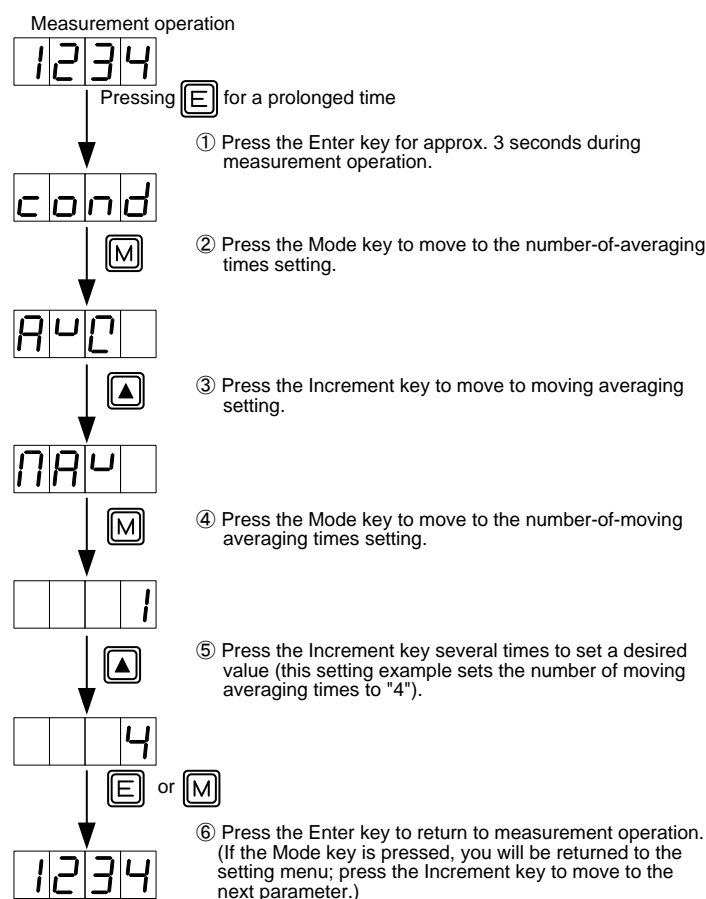
* At factory shipment, the protect level is set to LV1. (In this case, only settings relating to display color, scaling, or judgment values can be made).

5.4. Shifting to the Parameter Setting Mode



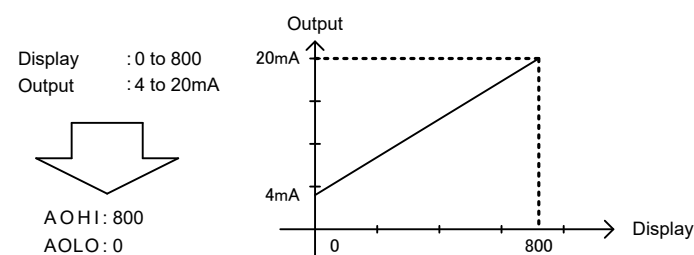
5.5. Condition Data Setting Procedure

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



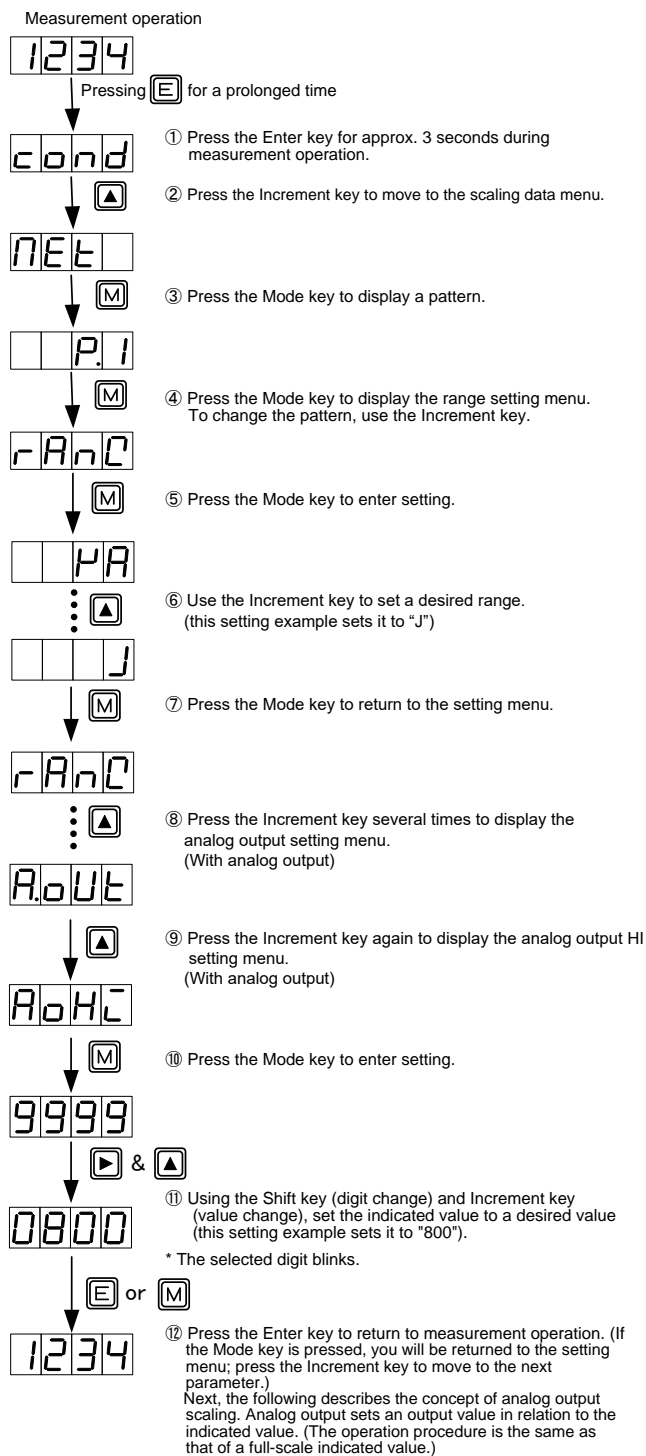
5.6. Scaling Data Setting Procedure

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



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

* 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.

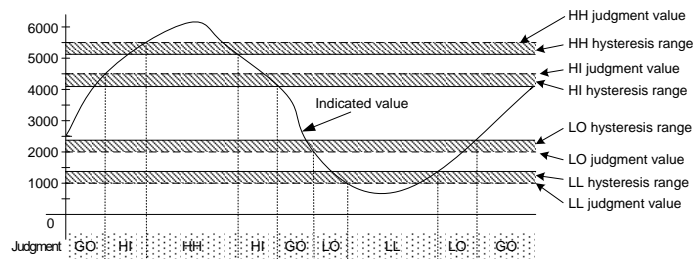


5.7. Comparator Data Setting Procedure

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

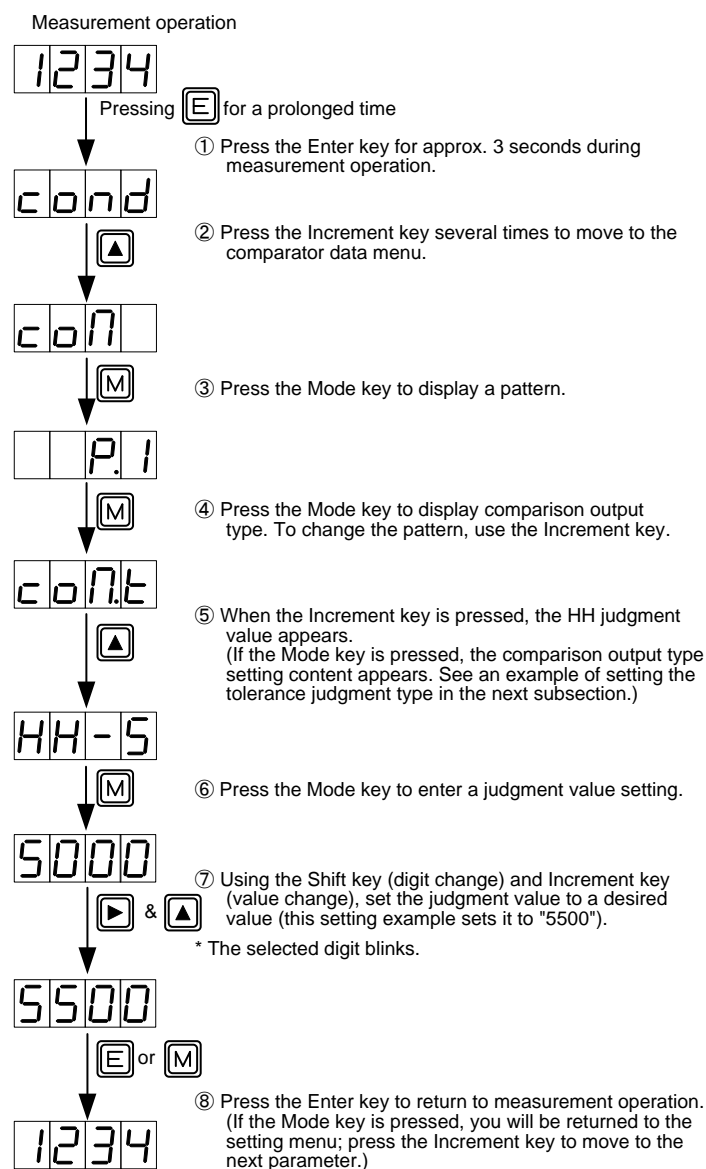
5.7.1. High and Low Judgment Type

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.

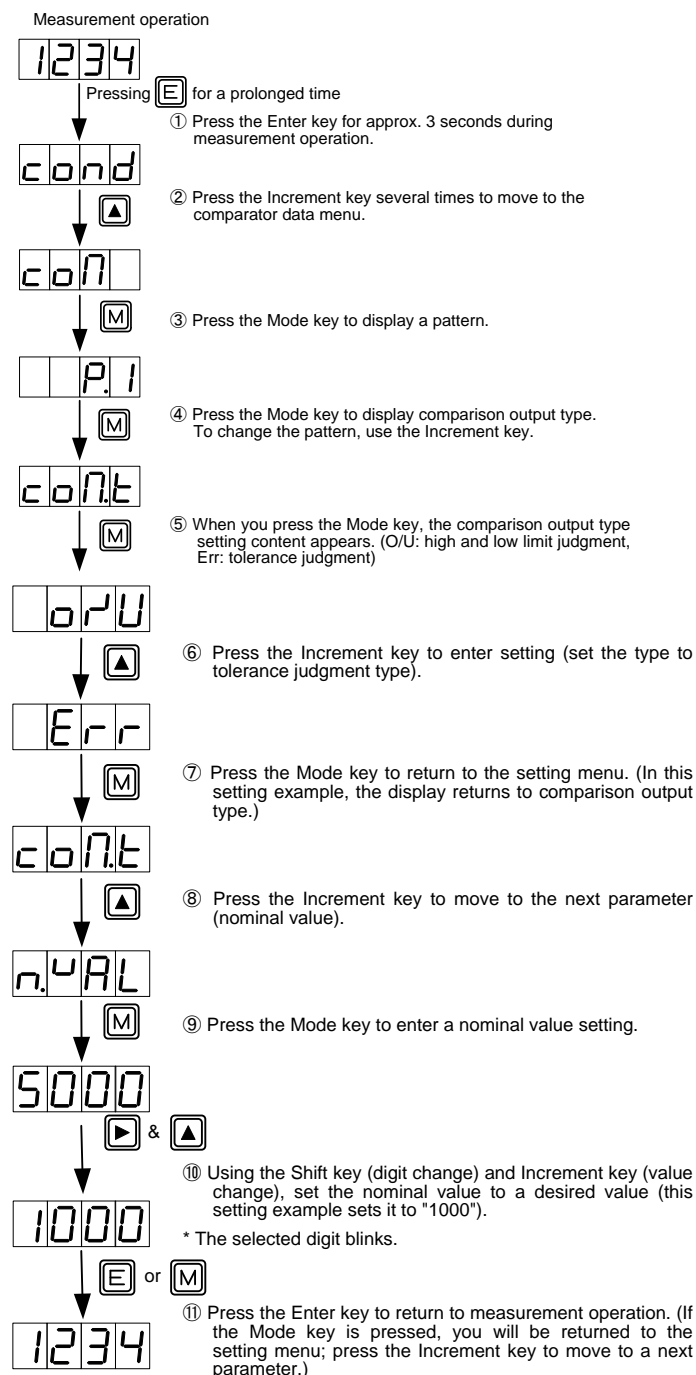
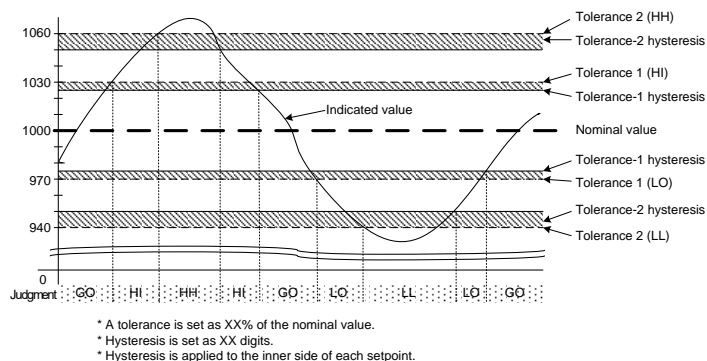
* The setting conditions are $(HH \text{ judgment value} - HH \text{ hysteresis}) > HI \text{ judgment value}$, $(HI \text{ judgment value} - HI \text{ hysteresis}) > (LO \text{ judgment value} + LO \text{ hysteresis})$, and $LO \text{ judgment value} > (LL \text{ judgment value} + LL \text{ hysteresis})$.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



5.7.2. Tolerance Judgment Type

The tolerance judgment type allows you to set a nominal value and its tolerances ($\pm XX\%$) 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.

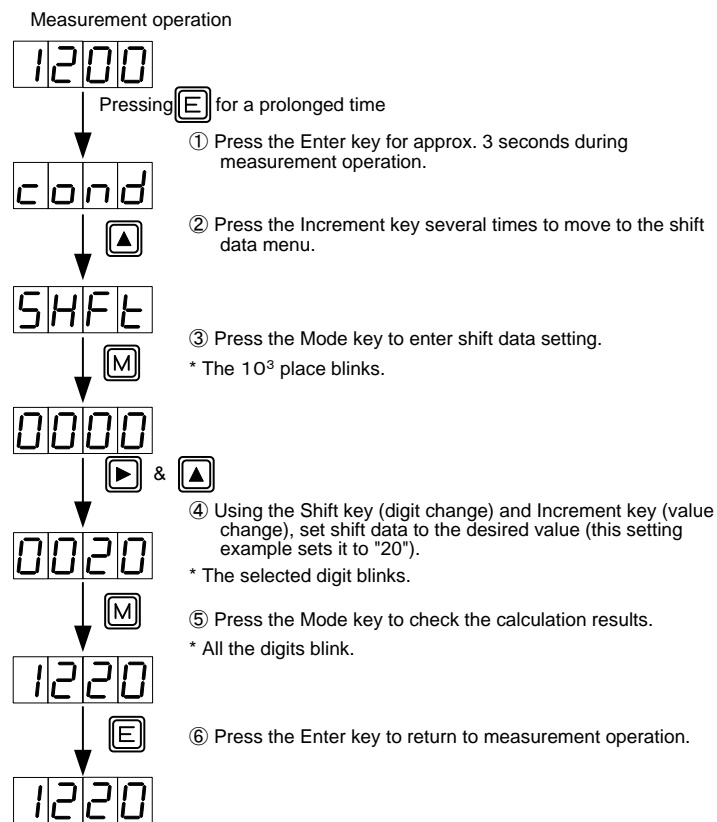
For example, if the nominal value is set to 1000 and tolerances 1 and 2 are set to 3% and 6% respectively, internal judgment values are 1060 for HH judgment value, 1030 for HI judgment value, 970 for LO judgment value, and 940 for LL judgment value.



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.

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



6. External Control Function

6.1. Each External Control Terminal

Internal circuit: pull-up at approx. 5 V (resistance value: approx. 10 k Ω)

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

Range	Sensor	Measurement range	Error (23°C ± 5°C, 35 to 85%)	Cold junction compensation error
KA	K	-50.0 to +199.9°C	± (0.5% of FS)	± 2°C
KB		-50 to +1200°C	± (0.2% of FS)	
J	J	-50 to +1000°C		
T	T	-50 to +400°C	± (0.6% of FS)	
S	S	0 to 1700°C	± (0.4% of FS)	
R	R	-10 to +1700°C		
B	B	100 to 1800°C		
PA	Pt100Ω	-100.0 to +199.9°C	± (0.15% of FS)	—
JPA	JPt100Ω			
PB	Pt100Ω	-100 to +600°C	± (0.3% of FS)	—
JPB	JPt100Ω			

Sampling speed : RTD: Approx. 10 times/sec max. (The sampling speed is half of the configured.)
TC: Approx. 5 times/sec max. (The sampling speed is quarter of the configured.)

Burnout warning—Thermocouple : "B.OUT" is displayed in case of a break in TC HI or TC LO
RTD : "OVER" is displayed in case of a break in RTD A or RTD B
"B.OUT" is displayed in case of a break in RTD C

Note : Analog output produced in the event of burnout becomes minimal during B.OUT display or becomes maximal during OVER display.

*The degree of accuracy of the cord B is applied to more than 500 °C.



CAUTION

- (1) "ERR1" may be indicated immediately after the power is turned on or immediately after the range is switched. This is not an abnormal occurrence, because it is caused by the zero-contact compensation circuit becoming temporarily unstable.
The product will automatically recover after several samplings.
- (2) If indications fluctuate heavily, decrease the sampling speed.

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 k Ω or more	$\pm(0.5\%$ of FS)	$\pm 50\text{mVpp}$
0 to 10 V	10 k Ω or more		
1 to 5 V	10 k Ω or more		
4 to 20 mA	550 Ω or less		$\pm 25\text{mVpp}$

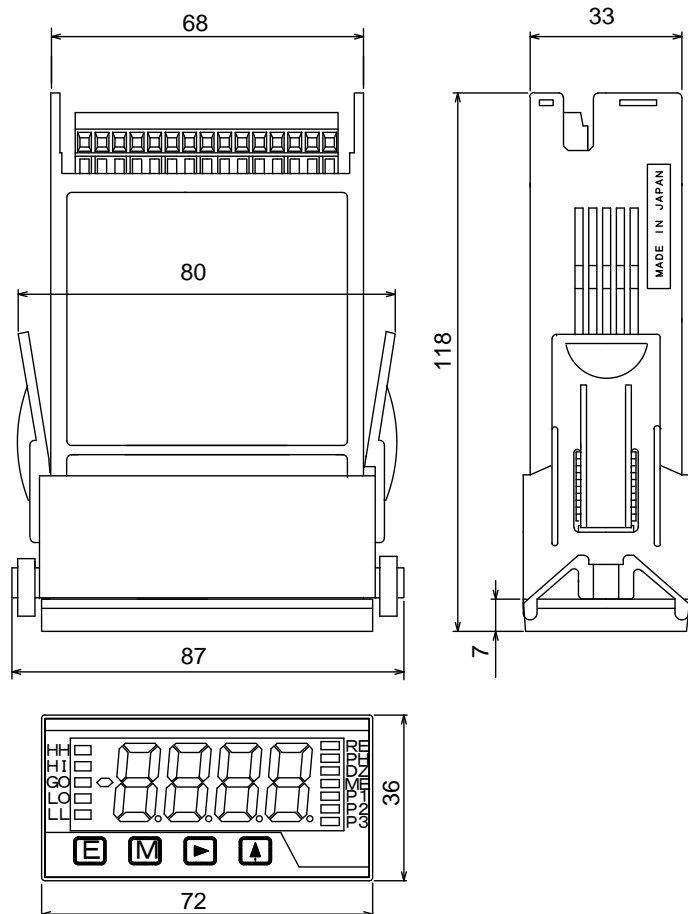
* A ripple of 4 to 20 mA is caused at a resistive load of 250 Ω and output of 20 mA.

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	

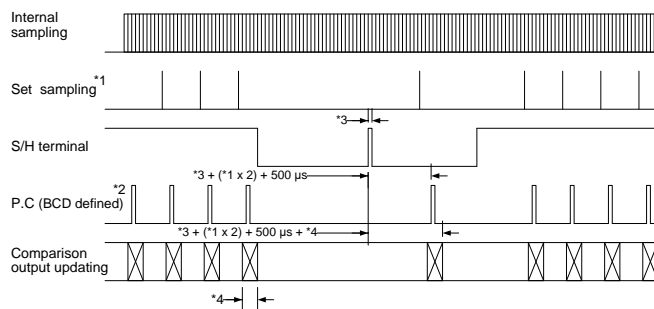
* For more information on the communications function such as the send/receive format and commands, see the separate A7000 Communications Function Operation Manual.

8.4. Outer Dimensions



9. Timing Chart

Start/hold type A



*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
50	20.833 times/sec	Approx. 48 ms
100	10.4165 times/sec	Approx. 96 ms
200	5.20825 times/sec	Approx. 192 ms
400	2.604125 times/sec	Approx. 384 ms
800	1.3020625 times/sec	Approx. 768 ms
1000	1.04165 times/sec	Approx. 960 ms
2000	0.520825 times/sec	Approx. 1.92 s
5000	0.20833 times/sec	Approx. 4.8 s

* RTD: The speed is half of the value in the table on the left.
* TC: The speed is quarter of the value in the table on the left.

*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
50	Approx. 14.4 ms
100	Approx. 30 ms
200	
400	
800	
1000	
2000	
5000	

*3 External start signal










An external start signal should be 500 μs to one period of set sampling.

*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
	Indicates that a signal exceeding the measurement range has been applied.
	Indicates that an input signal once exceeded the measurement range, but has returned to the measurable range with the peak hold function activated.
	Indicates that the unit is waiting for an A/D converter input or that power-ON delay time is valid.
	Indicates that the temperature measurement unit's Burnout (broken wire) alarm.
	Indicates that each judgment value of comparator data or the size of hysteresis parameters does not the conditions.
	The zero point of contact compensation circuit is an unstable state temporarily. It returns automatically by the sampling of several times.
	Indicates that digital limiter HI and digital limiter LO of scaling data have the same value.
	Indicates that analog output HI and analog output LO of scaling data have the same value.
	Linearize data error

10.2. Error Display in the Event of Problem in Memory

Display	Description
	Memory switch area, checksum error of main memory
	Calibration data area, checksum error of main memory
	Memory switch area, checksum error of sub-memory
	Calibration data area, checksum error of sub-memory
	Condition data area, checksum error Press the Mode key for a prolonged time to load the initial values.
	Scaling data area, checksum error (for each pattern) Press the Mode key for a prolonged time to load the initial values of each pattern.
	Comparator data area, checksum error (for each pattern) Press the Mode key for a prolonged time to load the initial values of each pattern.
	Calibration data area, checksum error (for each pattern) Press the Mode key for a prolonged time to load the initial values of each pattern.
	Shift data area, checksum error Press the Mode key for a prolonged time to load the initial values.
	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.)