

INSTRUCTION MANUAL

AM-215B

DIGITAL METER RELAY

Thank you for selecting another fine *watanabe* product. Please check the description given on the rating label of this unit to make sure that it meets your specifications and be sure to read this instruction manual before using the product.

This manual outlines the operation, connection and adjustment procedures of this product.

The unit has been manufactured and inspected according to our strict quality control standard. If you should find a defect including damage incurred during transportation, contact us or the dealer where you purchased it immediately.

PACKAGE INCLUDES

- Digital meter relay ... 1
- Attachment band ... 1
- Instruction manual ... 1
- Unit seal ... 1

*For details of models and specifications, please check section 7 of this document download the specification sheet from our website, and then check it.

1. PRECAUTIONS

1.1 Conformity with CE directive

- Compliance with EN standards:
 - EN61326-1 EMS: Industrial environments; EMI: Class A
 - The wiring length should be not more than 30 m.
 - EN50581
- *Input range "14" is outside CE directive conformity.

1.2 Conformity with UL certification

- This equipment is compliant with UL certification.
- UL certification number : E247481
- This equipment is compliant with Pollution Degree 2 environment.
- Please connect the power supply, input, and each output of this equipment with a circuit protected from hazardous voltage by reinforced or double insulation.
- Please use this equipment at an altitude of up to 2000 m.
- *No UL certification when there is no UL mark, or input range "14".
- *If this equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

1.3 Protective structure

- Protective structure : IP65 (Front in the case of attached panel).
- Directive number : JIS C 0920(IP65 is not applicable authentication on UL certification).

1.4 Installation

- This equipment is designed for indoor use.
- Please install the main body in a location where the ambient temperature is within -10 to 55°C.
- Please install the main body in a location where relative humidity is 35 to 85%RH (no freezing or condensation).
- When the equipment is to be installed in a location where there is excessive dust or metal particles, house it in a dust-proof cabinet, which has a heat radiation function.
- Avoid exposing the equipment to vibration and impact, which may cause malfunction.
- Please do not block ventilation openings of the main body.

1.5 Wiring

- Be sure to keep the wiring of the power line, input signal line and output signal line away from any noise source, relay driving line and high-frequency line.
- Though the terminals, INPUT LO/ EXC 0V/ COM, are the equipotential, please wiring separately.
- Avoid clamping these lines together with a noise-superimposed line or putting them together in the same duct.
- Don't any wiring at NC terminal. (Don't use as a relay terminal.)

1.6 Others

- This equipment can be operated as soon as the power supply is turned ON. However, for optimum performance, allow 30 minutes of energizing time.

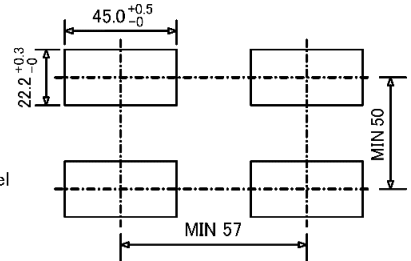
2. DIMENSIONS

2.1 Panel cut dimensions

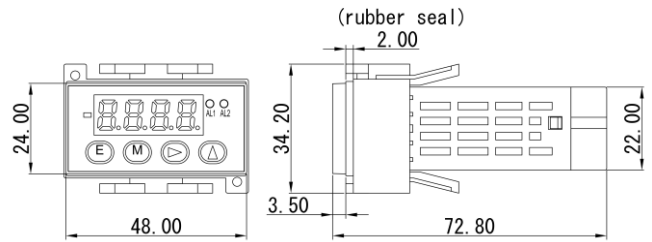
To install the AM-215B series, Panel cut dimensions are as Shown by the figure below.

*When installing this equipment alone, please separate it from the other equipment or wall by 12.2 mm on the left and right and 28 mm above and below.

*Recommended panel thickness: 1 to 8mm

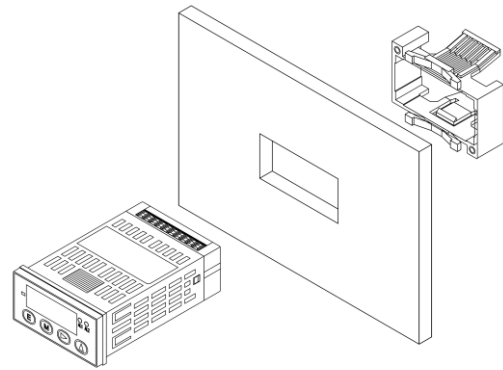


2.2 Outline dimensions

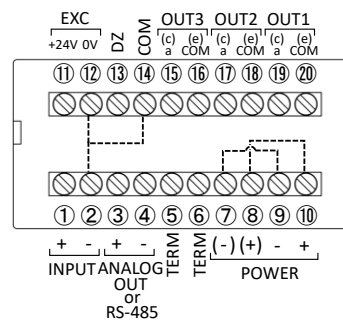


3. PANEL ATTACHMENT PROCEDURE

After removing the attachment bands from the main unit, insert the unit through the front of the panel, and fasten it from the rear side of the panel using the attachment band.



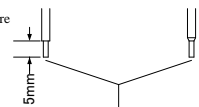
4. DESCRIPTION OF TERMINALS AND CONNECTION PROCEDURE



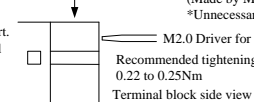
----- Short internally

*⑦,⑧ are terminals for crossover wiring. It is connected to ⑨,⑩ inside the product. (See the left figure)

Connection with electric wire
Thickness: AWG26 to 16
Cover stripping dimension: 5mm



*Precautions when using stranded wire
Please don't solder to the conductor part. It leads to lower drawing strength and disconnection.
Connection with ferrule terminals is recommended.



Connection with ferrule terminal
Recommended model① : AI 0.5-6WH-3200687 (Made by PHOENIX CONTACT)
*1mm cut after crimping conductive part for 6mm product
Recommended model② : MFL50-5WH (Made by MISUMI)
*Unnecessary for conductive part cutting

M2.0 Driver for minus
Recommended tightening torque: 0.22 to 0.25Nm
Terminal block side view

①② : Input signals

- Make the input signal lines as short as possible. Keep them away from other signal lines.
- If there is a lot of external noise, use a two-wire shielded cable and form a single connection between the outer sheath and the LO side at the signal source.
- When high frequency noise is superimposed on the input signal, please use a low-pass filter for input. However, the response time is delayed by the time constant, please note depending on usage conditions.

③④ : Output terminals

- An analog output (4 to 20 mA or 0 to 10 V) or an RS485 interface can be selected.
- *It becomes NC when there is no option output.

⑤⑥ : Terminal resistance

- Shorting 5 and 6 terminals to be enable the resistance (200Ω).
- *Only at RS485 output (It becomes NC at analog output)

⑦⑧⑨⑩ : POWER (Power terminals)

- A power source is connected to a power source terminal. The AM-215B does not have a power switch. The power is turned ON as soon as the power source is connected.
- ⑦,⑧ are terminals for crossover wiring. It is connected to ⑨,⑩ inside the product.

⑪⑫ : EXC (sensor power)

- Can be used as a sensor power (DC24V 25mA Max.).

⑬⑭ : DZ(Digital zero)

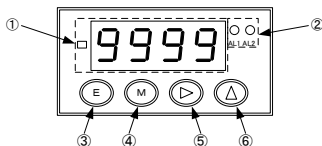
- The previously displayed value is set to zero. After this setting, measurement is performed based on this “zero” point for display. When the b.uP is OFF, turning the power OFF will cancel this setting.
- *The DZ terminal is enabled by short-circuiting it with the COM terminal or setting it to level “0”. It is disabled by open-circuiting it or setting it to level “1”.
- Level “0”: 0 to 1.5 V Level “1”: 3.5 to 5 V
- Input current: -0.5 mA or below

⑮~⑳ : HI、GO、LO(Comparative output terminals)

- Relay output (a : a-contact specification , COM : Common terminal)
Contact capacity: 24 V DC/1 A (resistive load)
- Photocoupler output (c : Collector , e : Emitter)
Output capacity: Voltage: 30 V Max., Current: 50 mA Max.
The maximum output saturation voltage is 1.2 V at 50 mA.
- *Please use power supply, input and output within the range of the rated capacity.

5. PARAMETER SETTING

5.1 Name and function of each part



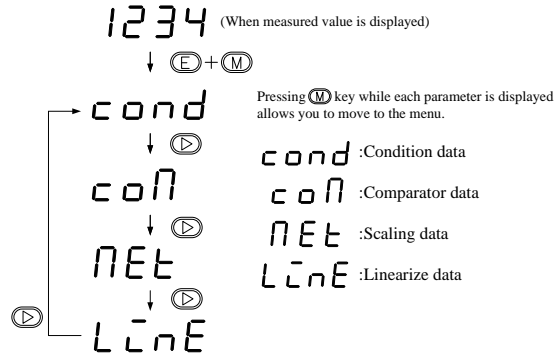
- ① Main display : Display of menu and contents at measurement value and parameter setting.
 - ② Judgment display : Display judgment result (arbitrarily set by comparator data).
 - ③ Enter switch : Transition from measurement state to parameter setting state (Enter + Mode).
 - ④ Mode switch : Move change items when setting parameters.
Transition to shift data setting state (Mode + Right for 3 seconds).
ON/OFF control with digital zero by switch (Mode + Upper for 3 seconds).
 - ⑤ Right switch : Transition of digits at parameter setting.
Transition to shift data setting state (Mode + Right for 3 seconds).
 - ⑥ Upper switch : Numerical selection and content selection at parameter setting.
ON/OFF control with digital zero by switch (Mode + Upper for 3 seconds).
- *All parameters can be initialized by turning on the power while pressing (E) (M) (D) (A) all. Please be aware that the factory contents will also be initialized and will be the initial value. For the initial value, please refer to “setting condition data” and after.

5.2 Parameter group

The parameters of the AM-215B fall into the five categories below.

This manual does not explain the settings of the shift data and the linearize data. They are explained in a different manual. If that manual is needed, please contact our dealer or office.

Condition data	Basic operation of the meter such as sampling speed and parameters related to each function
Comparator data	Parameters related to comparison output
Scaling data	Parameters related to input signal, display value, decimal point etc.
Shift data	Parameters related to the function for forcibly shifting display value
Linearize data	Parameters related to linearity correction of the output signal with respect to the input signal



When (M) key is pushed in the state of each menu name or there is no key operation during 1 second, it will shift to contents selection of a parameter. Moreover, when there is no key operation during 8 seconds at the time of selection of the contents of a parameter, it returns to menu name.

- (D) Digit shift
- (E) Back to measurement operation
- (A) Numerical value or option change
- (Grey box) Default value

5.3 Condition data setting

<p>cond</p> <p>↓ (M)</p> <p>P.L (Protect level)</p> <p>↓ (M)</p> <p>Ave (Average frequency)</p> <p>↓ (M)</p> <p>MAV (Moving-average calculation frequency)</p> <p>↓ (M)</p> <p>LPF (Low pass filter)</p> <p>↓ (M)</p> <p>Sud (Step wide)</p> <p>↓ (M)</p> <p>blnF (Display blanking)</p> <p>↓ (M)</p> <p>dLte (Digital limiter type)</p> <p>↓ (M)</p> <p>BAUD (Baud rate)</p> <p>↓ (M)</p> <p>DATA (Data length)</p> <p>↓ (M)</p> <p>P.bct (Parity bit)</p> <p>↓ (M)</p> <p>S.bct (Stop bit)</p> <p>↓ (M)</p> <p>t- (Delimiter)</p> <p>↓ (M)</p> <p>Adr (Equipment ID)</p> <p>↓ (M)</p> <p>b. UP (DZ Backup)</p> <p>↓ (M)</p> <p>LcNE (Linearize)</p> <p>↓ (M)</p> <p>tr t (TZ Correction tome)</p> <p>↓ (M)</p> <p>tr u (TZ Correction width)</p> <p>↓ (M)</p> <p>Pon (Delay time the power is turned ON)</p> <p>↓ (M)</p>		<p>The contents of parameters</p> <table border="1"> <tr> <td>PLD</td> <td>All parameters are displayed</td> <td>PL2</td> <td>Only comparator data are displayed</td> </tr> <tr> <td>PL1</td> <td>Comparator and scaling data are displayed</td> <td>PL3</td> <td>Only PL parameters are displayed</td> </tr> <tr> <td>1</td> <td>Once (25 times/sec)</td> <td>20</td> <td>50 times (1.25 times/sec)</td> </tr> <tr> <td>2</td> <td>Twice (12.5 times/sec)</td> <td>40</td> <td>40 times (0.63 times/sec)</td> </tr> <tr> <td>4</td> <td>4 times (6.25 times/sec)</td> <td>80</td> <td>80 times (0.31 times/sec)</td> </tr> <tr> <td>8</td> <td>8 times (3.125 times/sec)</td> <td>100</td> <td>100times(0.25 times/sec)</td> </tr> <tr> <td>10</td> <td>10 times (2.5 times/sec)</td> <td>200</td> 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5.4 Comparator data setting

com

↓ (M)

Menu name The contents of parameters

com.t (Comparative output type)	H.L.L HI-LO judgment operation (HI/GO/LO comparative output) H.H.H HH judgment operation (HH/HI/GO comparative output) L.L.L LL judgment operation (GO/LO/LL comparative output)
S-H (Judged value 1)	-9999 ~ 9999 Judged value 1 is set (setting varies depending on the COM.T setting) *The default value is 1000. *It is set to S-HH at the time of HHHG selection. *It is set to S-Lo at the time of GLLL selection.
S-Lo (Judged value 2)	-9999 ~ 9999 Judged value 2 is set (setting varies depending on the COM.T setting) *The default value is 500. *It is set to S-H at the time of HHHG selection. *It is set to S-LL at the time of GLLL selection.
H-H (Hysteresis 1)	0 ~ 999 Hysteresis 1 is set (setting varies depending on the COM.T setting) *The default value is 0. *It is set to H-HH at the time of HHHG selection. *It is set to H-Lo at the time of GLLL selection.
H-Lo (Hysteresis 2)	0 ~ 999 Hysteresis 2 is set (setting varies depending on the COM.T setting) *The default value is 0. *It is set to H-H at the time of HHHG selection. *It is set to H-LL at the time of GLLL selection.
L-H (Output 1 logic)	no Normally open nc Normally closed *It is set to L-HH at the time of HHHG selection. *It is set to L-Lo at the time of GLLL selection. *Output terminal is out 3.
L-Lo (Output 2 logic)	no Normally open nc Normally closed *It is set to L-H at the time of HHHG selection. *It is set to L-Lo at the time of HHHG selection. *Output terminal is out 2.
L-Lo (Output 3 logic)	no Normally open nc Normally closed *It is set to L-Lo at the time of HHHG selection. *It is set to L-LL at the time of HHHG selection. *Output terminal is out 1.
AL1 (AL1 lighting selection)	HH AL1 is turned on by HH Lo AL1 is turned on by LO H AL1 is turned on by HI LL AL1 is turned on by LL C AL1 is turned on by GO
AL2 (AL2 lighting selection)	HH AL2 is turned on by HH Lo AL2 is turned on by LO H AL2 is turned on by HI LL AL2 is turned on by LL C AL2 is turned on by GO *The parameter of AL1 and AL2 is set to GO with both sides immediately after changing comparative output type parameter.

- Comparative operation type
In the AM-215B, use the comparator data to select one type of comparative operation from the three types below:

HI / GO / LO mode

Comparator condition	Output		
	OUT1	OUT2	OUT3
Measurement value > HI limit value	O F F	O F F	O N
LO limit value ≤ Measurement value ≤ HI limit value	O F F	O N	O F F
LO limit value > Measurement value	O N	O F F	O F F

HH / HI / GO mode

Comparator condition	Output		
	OUT1	OUT2	OUT3
Measurement value > HH limit value	O F F	O N	O N
Measurement value > HI limit value	O F F	O N	O F F
HI limit value ≥ Measurement value	O N	O F F	O F F

GO / LO / LL mode

Comparator condition	Output		
	OUT1	OUT2	OUT3
Measurement value ≥ LO limit value	O F F	O F F	O N
LO limit value > Measurement value	O F F	O N	O F F
LL limit value > Measurement value	O N	O N	O F F

5.5 Scaling Data Setting

net

↓ (M)

Menu name The contents of parameters

FSc (Full scale display value)	-9999 ~ 9999 The value to be displayed at the time of FIN signal input is set *The default value is 9999.
FIn (Full scale input value)	-9999 ~ 9999 11 to 14 range -5000 ~ 5000 1V range -2000 ~ 2000 2A range *The default value is 9999(11-14 range), and 5,000 (1V range), 20.00 (2A range). In case 1V range setting, FIN setting will operate as 5,000 when setting is greater than 5,000, and operates as -5,000 when setting is less than -5,000. In case 2A range setting, FIN setting will operate as 20.00 when setting is greater than 20.00, and operates as -20.00 when setting is less than -20.00.
oFS (Offset display value)	-9999 ~ 9999 The value to be displayed at the time of OIN signal input is set *The default value is 0.
oIn (Offset input value)	-9999 ~ 9999 11 to 14 range -5000 ~ 5000 1V range -2000 ~ 2000 2A range *The default value is 0(11-14 range), and 1,000 (1V range), 4.00 (2A range). In case 1V range setting, OIN setting will operate as 5,000 when setting is greater than 5,000, and operates as -5,000 when setting is less than -5,000. In case 2A range setting, OIN setting will operate as 20.00 when setting is greater than 20.00, and operates as -20.00 when setting is less than -20.00.
dLH (Digital limiter HI value)	-9999 ~ 9999 The upper limit value of displayable range is set *The default value is 9999.
dLL (Digital limiter LO value)	-9999 ~ 9999 The lower limit value of displayable range is set *The default value is -9999.
AOH (Analog output HI value)	-9999 ~ 9999 Display value to output full scale value of analog output *The default value is 9999. *This menu is displayed only the option output form 6 or 7.
AOL (Analog output LO value)	-9999 ~ 9999 Display value to output offset value of analog output *The default value is 0. *This menu is displayed only the option output form 6 or 7.
dEP (Decimal point)	Each digit Decimal point lighting position *The default is off (all decimal points lit on setting) *Set up by (▶) key.

- Displayed value setting

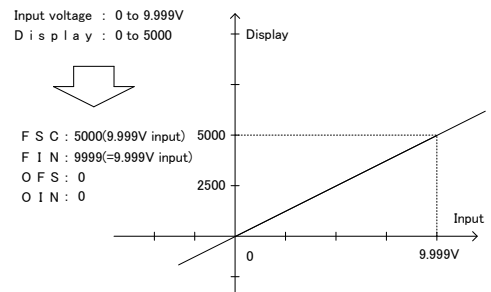
The concept of the scaling data and an example setting of a full-scale value are presented below:

Displayed value = (a × X) + b

a = (Displayed full-scale value - Displayed offset value) / (Input full-scale value - Input offset value)

b = Displayed offset value - (Input offset value × a)

X: Input value; a: Gain; b: Offset

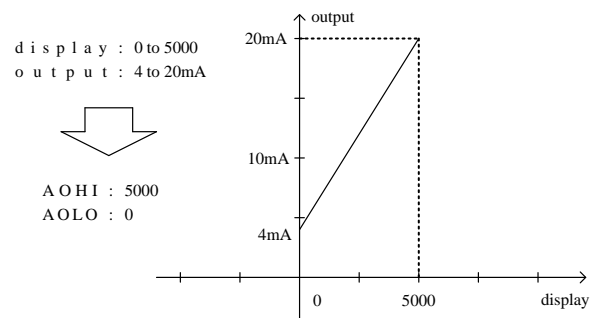


- Analog output setting

The range of displayed values of the AM-215B's analog output can be arbitrarily set, such that it corresponds to the range of 4 to 20 mA or 0 to 10 V. Analog output scaling sets a displayed value to the analog output HI that corresponds to 20 mA or 10 V. Likewise, it sets a displayed value to the analog output LO that corresponds to 4 mA or 0 V.

The scaling concept of analog output is presented below.

AOH : Display value when analog output is 20mA (10V).
AOL : Display value when analog output is 4mA (0V).



6. ERROR MESSAGES

The error message of AM-215B and the solution at the time of an error are as follow.

Error Display	Details	Recovery Response
	When an input or displayed value is out of the measured value range	Use the relay so that input and displayed values are in the measured value range.
	When the micro-computer is waiting for data input	Make sure that the averaging frequency is not set too high.
	Error in the internal memory of the relay	Turn the power of the relay OFF and turn it ON again. If the relay still does not recover, contact our dealer or office.
	Condition data error	Reset the condition data. * Change at least one of the data in a parameter and cycle through all of the other parameters.
	Comparator data error	Reset the comparator data. * Change at least one of the data in a parameter and cycle through all of the other parameters.
	Scaling data error	Reset the scaling data. * Change at least one of the data in a parameter and cycle through all of the other parameters.
	Linearize data error	Reset the linearize data. * Change at least one of the data in a parameter and cycle through all of the other parameters.
	Shift data error	Reset the shift data.
	Digital zero value backup data error	Perform a writing operation for the digital zero value.

7. SPECIFICATIONS

7.1 Model composition

AM-215B - ① - ② - ③ - ④ - ⑤ - ⑥ - ⑦ - ⑧ - ⑨

Basic model	Series name	Input range	Output	Comparative output	Scaling	Setting change	Special specification	UL compatible	Test report	Suffix code	Description
AM	215B	11									Basic model
		12									Series name
		13									±99.99mV
		14									±999.9mV
		1V									±9.999V
		2A									1 to 5V
			X								4 to 20mA
			4								None
			6								RS-485
			7								Analog output (4 to 20mA)
				R							Analog output (0 to 10V)
				P							Relay contact output
					X						Photocoupler output
					S						Standard
						X					With display scaling setting
						S					Standard
							X				With setting change
							S				Standard
								X			With special specification
									X		Without UL mark
										U	With UL mark
										X	Without test report
										T	With test report
											Standard
											White front seat

7.2 General specifications

Measurement function	: Select either DC voltage or DC current (single range)
Input circuit	: Single ended
Operation type	: Successive approximation method
Sampling speed	: Maximum 25 times/second
Display	: Red 7-segment LED display (character height: approximately 8 mm)
Polarity display	: "-" is displayed when the operation result is negative
Out-of-range warning	: "oL" or "-oL" is displayed when input signal is out of display range
Maximum display	: ±9999 (full 4 digits)
Decimal point	: Can be set at any position using the switch of front-panel
Zero display	: Leading zero suppress
Backup	: Settings are held in EEPROM (guaranteed for 100,000 writes)
Operating temperature and humidity ranges	: -10 to 55°C, 35 to 85% RH (no condensation)
Storage temperature and humidity ranges	: -20 to 70°C, 60% or lower RH (no condensation)
Supply voltage	: DC 24 V ±20%
Rated power	: 3.0 W
Inrush current	: Approximately 5 A / 400 usec
External dimensions	: 48mm(W) × 24mm(H) × 72.8mm(D) ※Including screw terminal
Weight	: Approximately 70 g
Withstand voltage	: DC 500 V for one minute across power terminals/input terminals and each output terminal DC 500 V for one minute across input terminals/each output terminal AC 1500 V for one minute across case/power terminals, input terminals, and each output terminal
Insulating resistance	: 100 MΩ or higher with DC 500 V across the terminals listed above
Standard accessories	: Operating manual, Fitting band, Unit seal
Conformity standard	: EN61326-1 EN50581 *Input range "14" (±99.99V) is outside CE directive conformity
UL certification number	: E247481 *No UL certification when there is no UL mark, or input range "14"
Protective structure	: IP65 : JIS C 0920 (IP65 is not applicable authentication on UL certification)

7.3 Input specifications

DC voltage measurements

Range	Measurement range	Display	Input impedance	Maximum allowed input
11	±99.99mV	Offset ±9999 Full scale ±9999	100 MΩ or more	±50V
12	±999.9mV		100 MΩ or more	±50V
13	±9.999V		Approx. 1 MΩ	±50V
14	±99.99V		Approx. 1 MΩ	±250V
1V	1 to 5 V		Approx. 1 MΩ	±50V

Accuracy: ±(0.03% of rdg + 2 digits) (at 23°C ± 5°C)

DC current measurements

Range	Measurement range	Display	Input impedance	Maximum allowed input
2A	4 to 20mA	Offset ±9999 Full scale ±9999	Approx. 50Ω	±50 mA

Accuracy: ±(0.03% of rdg + 2 digits) (at 23°C ± 5°C)

*This accuracy is for (FSC - OFS) / (FIN - OIN) ≤ 1

7.4 External control unit

Digital zero : Digital Zero is turned ON when the DZ terminal and COM terminal are shorted or "0" level.
Digital Zero is turned OFF when the DZ terminal and COM terminal are open or "1" level.
"0" level : 0 to 1.5 V "1" level : 3.5 to 5 V

7.5 External power supply unit

Output voltage : DC 24 V ±5%
Maximum load : 25mA

7.6 Option output specification

Output function	: DC 4 to 20 mA or DC 0 to 10V												
Output specifications	: <table border="1"> <thead> <tr> <th>Mode</th> <th>Load Resistance</th> <th>Accuracy</th> <th>Ripple</th> </tr> </thead> <tbody> <tr> <td>4 to 20 mA</td> <td>0 to 510 Ω</td> <td>±(0.2 % of FS)</td> <td>25mVp-p max.</td> </tr> <tr> <td>0 to 10 V</td> <td>5kΩ or more</td> <td>±(0.2 % of FS)</td> <td>50mVp-p max.</td> </tr> </tbody> </table>	Mode	Load Resistance	Accuracy	Ripple	4 to 20 mA	0 to 510 Ω	±(0.2 % of FS)	25mVp-p max.	0 to 10 V	5kΩ or more	±(0.2 % of FS)	50mVp-p max.
Mode	Load Resistance	Accuracy	Ripple										
4 to 20 mA	0 to 510 Ω	±(0.2 % of FS)	25mVp-p max.										
0 to 10 V	5kΩ or more	±(0.2 % of FS)	50mVp-p max.										

Response speed : about 100ms (about 200ms for low pass filter "ON")

7.7 Comparative output specification

Comparator unit

Control method : Microcomputer computation
Setting range : -9999 to +9999
Comparator operation : Depends on sampling speed.
Comparator conditions : AL1 and AL2 judging monitor can be turned on at the time of arbitrary judgment results.

HI / GO / LO mode

Comparator condition	Output		
	OUT1	OUT2	OUT3
Measurement value > HI limit value	OFF	OFF	ON
LO limit value ≤ Measurement value ≤ HI limit value	OFF	ON	OFF
LO limit value > Measurement value	ON	OFF	OFF

HH / HI / GO mode

Comparator condition	Output		
	OUT1	OUT2	OUT3
Measurement value > HH limit value	OFF	ON	ON
Measurement value > HI limit value	OFF	ON	OFF
HI limit value ≥ Measurement value	ON	OFF	OFF

GO / LO / LL mode

Comparator condition	Output		
	OUT1	OUT2	OUT3
Measurement value ≥ LO limit value	OFF	OFF	ON
LO limit value > Measurement value	OFF	ON	OFF
LL limit value > Measurement value	ON	ON	OFF

Setting condition : HI / GO / LO mode HI limit value > LO limit value
HH / HI / GO mode HH limit value > HI limit value
GO / LO / LL mode LO limit value > LL limit value

Hysteresis : For each comparator all limit value can be set as 0 to 999 digits.

Relay output unit

Output ratings : DC 24 V, 1 A (resistance load)
Mechanical life : 5 million times
Electrical life : 100 thousand times

Photocoupler output

Output ratings : Max.30V 50mA
Output saturation voltage : 1.2V Max. at 50mA

8. WARRANTY AND AFTER-SALES SERVICE

8.1 Warranty

The warranty lasts one year from the date of delivery. If an equipment failure which is considered to be clearly at the fault of Watanabe occurs during this period, we will repair the equipment at no charge.

8.2 After-sales service

This product was manufactured, tested, and inspected according to rigorous quality control procedures before it was shipped from the factory. If an equipment failure should occur, please contact your dealer or Watanabe(send the product to us). (Along with the failed product, please include a description with as much information as possible.)