

AR18 Series Digital Controller Instruction Manual

Thank you for purchasing a Shimaden product. After making sure the product fits the desired description, you should carefully read the instructions and get a good understanding of the contents before attempting to operate the digital controller.

Request

The instruction manual should be kept in a handy place where the end user can refer to it when necessary.

Preface

This instruction manual describes precautions, mounting, wiring, functions and operating procedures when handling the AR18 Series. Keep the manual handy when dealing with AR18 Series Digital Controller. Be sure to observe all precautions and adhere to the procedures provided in the manual.

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1. Safety precautions

Be sure to read the instruction manual before attempting to install, operate, maintain or inspect the digital controller. You should become familiar with the controller, safety information and other important matters before attempting to use the controller.

The labels for safety precautions in instruction manual are divided into “warning” and “caution.”

The symbol  indicates a protective conductor terminal. Be sure to provide grounding.



WARNING


The AR18 Series digital controllers are control instruments designed for industrial use to control temperature, humidity and other physical amounts. You should either take appropriate safety measures or avoid using for control that could have a serious effect on human life. The manufacturer shall not be liable for an accident that results if used without taking appropriate safety measures.

- The digital controller should be used so the terminal elements in the control box, etc., are not touched by human beings.
- Do not remove the controller from its case, or insert your fingers or electric conductors inside the case. Doing so could result in electric shock accident involving death or serious injury.



CAUTION

If there is danger of damage to any peripheral device or equipment due to failure of the controller, you should take appropriate safety measures such as mounting a fuse or overheating prevention device. The manufacturer shall not be liable for an accident that results if used without taking appropriate safety measures.

- Alert mark  on controller name plate

An alert mark is printed on the terminal element name plate applied to the controller case.

The mark indicates you could get shocked if you touch the terminal element while conducting electricity.

- Provide a switch or breaker as a means of cutting off power for external power circuit connected to the power terminal of the controller. Mount a switch or breaker near the controller where the operator can get to it easily and label it as an electrical breaker for the controller.
Use a switch or breaker that conforms to the requirements of IEC60947.
- Fuses
The controller does not have a built-in fuse. Be sure to mount a fuse on the power circuit connected to the power terminal. Provide a fuse between the switch or breaker and the controller. Mount on the L side of the power terminal.
Fuse rating/characteristics: 250 V AC, 0.5 A, medium or slow blowing
Use a fuse that conforms to the requirements of IEC60127.
- Voltage/current of load connected to the output terminal and alarm terminal should be within the rating.
Using voltage/current that exceeds the rating could shorten the life of the controller by raising the temperature, and could result in controller failure. For rating, see “9. Specifications.”
Connect equipment that conforms to the requirements of IEC61010 to the output terminal.
- Do not apply voltage/current other than rated input to the input terminal. Doing so could shorten the life of the product or result in controller failure.
For rating, see “9. Specifications.”
If the input is voltage or current, connect equipment that conforms to the requirements of IEC61010 to the input terminal. Draft holes are provided in the controller for heat to escape from. Do not allow foreign matter such as metal to get into the holes.
Doing so could result in controller failure or fire.
- Do not allow the draft holes to become clogged with dust, etc.
Doing so could shorten the life of the product due to temperature rise or insulation deterioration, and could result in controller failure or fire.
For space between controllers, see “3-3. External dimensions and panel cutout.”
- Repeating endurance tests such as dielectric strength, noise resistance and surge resistance could negatively affect the controller.
- The user should absolutely not modify or use the controller other than the way it was intended.
- It takes 30 minutes to display the correct temperature after applying power to the digital controller. (Therefore, turn the power on more than 30 minutes prior to the operation.)
- To ensure safety and maintain the functions of this device, do not disassemble this device. If this device must be disassembled for replacement or repair, contact your dealer.

2. Introduction

2-1. Preliminary check

The controller has undergone sufficient quality control inspections, but you should check the specification code, inspect the controller and make sure you have all the accessories to make sure nothing is missing or damaged.

Compare the specification code on the case with the following to make sure it is the product you ordered.

2-1-1. Specification code check

| Item | Code | Specifications |
|--|--------|--|
| 1. Series | AR18 - | DIN 96 x 96 digital controller |
| 2. Measured values | 1 | Equipped with indicator (red) 4 digits Character size 14.3 mm |
| | 0 | Not equipped with indicator |
| 3. Input | □□□ | See Measuring Range Codes. |
| 4. Control mode | 1 | One setting, two-position type DF: 0.1 – 9.9% FS (Control output 2 cannot be selected) |
| | 2 | Two setting, two-position type DF: 0.1 – 9.9% FS (alarm output cannot be selected) |
| | 3 | Three-position type DF: 0.2% FS DB: 1 – 99% FS (Control output is Y–N fixed) |
| 5. Control output 1 To select three-position, select "Y." | Y - | Contact 1c 240 V AC 5A / resistive load 2A / inductive load |
| | P - | SSR drive voltage output / 12 V±1.5 V DC (max. load current 30 mA) *1 |
| 6. Control output 2 To select one-setting, two-position type, select "N." To select two-setting, two-position type, select "Y" or "P." To select three-position type, select "N." | N | Not equipped |
| | Y | Contact 1c 240 V AC 5A / resistive load 2A / inductive load |
| | P | SSR drive voltage output / 12 V±1.5 V DC (max. load current 30 mA) *1 |
| 7. Alarm output (optional) To select two-setting, two-position type, select "0." | 0 | Not equipped |
| | 1 | Higher and lower limit deviation 2 points, no standby action Contact 1a 240 V AC 2A / resistive load Hysteresis: 0.2% FS fixed |
| | 2 | Higher and lower limit deviation 2 points, standby action Contact 1a 240 V AC 2A / resistive load Hysteresis: 0.2% FS fixed |
| 8. Analog output (optional) | 0 | None |
| | 3 | Voltage 0 – 10 mV DC, output resistance 10Ω |
| | 4 | Current 4 – 20 mA DC, load resistance 300Ω max. |
| | 6 | Voltage 0 – 10 V DC, load current 2 mA max. |
| | | Output type: measured value Output range: same as measuring range (fixed) *2 |
| 9. Front panel | J | Japanese |
| 10. Remarks | 0 | Without |
| | 9 | With |

【 Supplementary explanation: The table below indicates the summary of the specifications of "4. Control mode," "5. Control output 1" and "6. Control output 2" which are shown on the above table. 】

| Item | Code | Specifications |
|---------------------|------|---|
| 4. Control mode | 1Y-N | One-setting, two-position type DF: 0.1 – 9.9%FS (contact output) |
| | 1P-N | One-setting, two-position type DF: 0.1 – 9.9%FS (SSR drive voltage output) |
| | 2Y-Y | Two-setting, two-position type DF: 0.1 – 9.9%FS (contact output + contact output) |
| 5. Control output 1 | 2Y-P | Two-setting, two-position type DF: 0.1 – 9.9%FS (contact output + SSR drive voltage output) |
| 6. Control output 2 | 2P-Y | Two-setting, two-position type DF: 0.1 – 9.9%FS (SSR drive voltage output + contact output) |
| | 2P-P | Two-setting, two-position type DF: 0.1 – 9.9%FS (SSR drive voltage output + SSR drive voltage output) |
| | 3Y-N | Three-position type DF: 0.2%FS DB: 1 – 99%FS (contact output) |

*1: For SSR drive voltage output, "heating action only."

*2: Specification for lower limit value/ higher limit value within measuring range is possible (specify when ordering).

■ Terminal cover (Sold separately)

| Type | Mounting method |
|----------|--|
| For AR18 | QCR007 One-touch mount (1 set contains 2 covers) |

2-1-2. Accessories check

Unit seal: 1

Instruction manual: 1



CAUTION

In the event you want to inquire about a product defect, missing accessory or other matter, please contact your nearest Shimaden dealer.

2-2. Notes on use

Do not operate the front panel keys with hard or pointed objects. Always press the keys lightly with the tips of your fingers.

To clean, wipe lightly with a dry cloth. Do not use solvents such as thinner.

3. Installation and wiring

3-1. Installation site (environmental conditions)

Ambient conditions for operations

The controller is designed to be used under the following conditions. Observe the following environmental conditions when using:

- ① Must be used indoors
- ② Max. elevation: 2,000 m
- ③ Ambient temperature: -10 to 50°C
- ④ Ambient humidity: Max. 90%RH, no dew condensation
- ⑤ Transient over voltage category: II
- ⑥ Pollution class: 2 (IEC 60664)



CAUTION

Do not use the controller in the following locations.

Doing so could lead to controller failure, damage or fire.

- * Places exposed to flammable or corrosive gases, oil mist, or excessive dust that could cause insulation to deteriorate.
- * Places subject to vibration or impact
- * Places near strong electric circuit or places subject to inductive interference
- * Places exposed to water dripping or direct sunlight
- * Places where the controller is struck directly by air from heater or air conditioner

3-2. Mounting

- ① Cut a hole for mounting the controller in the panel by referring to the External dimensions and panel cutout in section 3-3.
- ② The panel thickness should be 1.0 – 4.0 mm.
- ③ The controller is provided with tabs for mounting. Insert as is from the front surface of the panel.
- ④ AR18 Series controller is designed for mounting on the panel. Be sure to mount on the panel.
- ⑤ Operate the product with attached gasket.
Use genuine parts for replacement.
- ⑥ If mounted in series, provide ventilation so ambient temperature does not exceed 50°C.

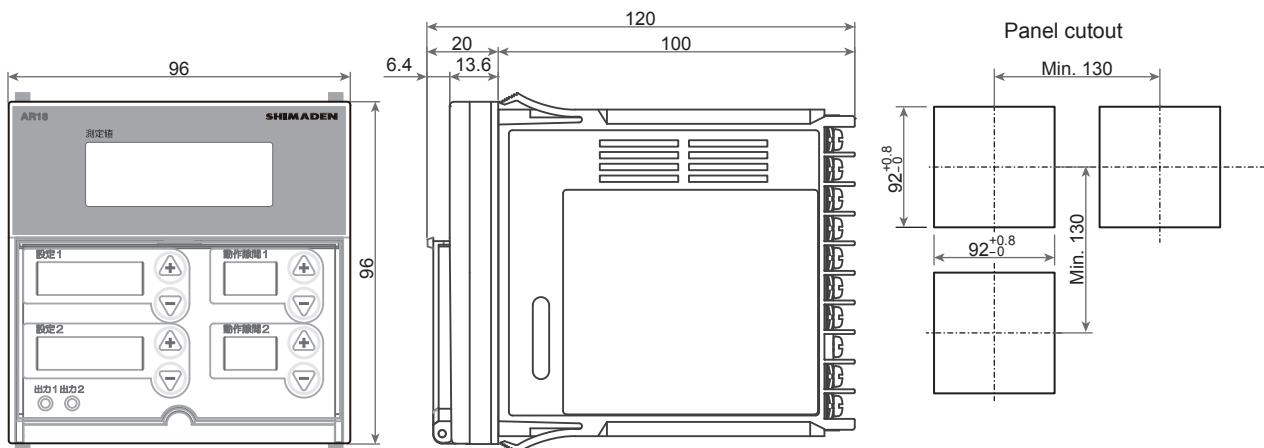


CAUTION

In order to maintain safety and function, do not remove the case from the controller.

If the case has to be removed for replacement/repair, contact your nearest Shimaden dealer.

3-3. External dimensions and panel cutout



Unit: mm

3-4. Wiring



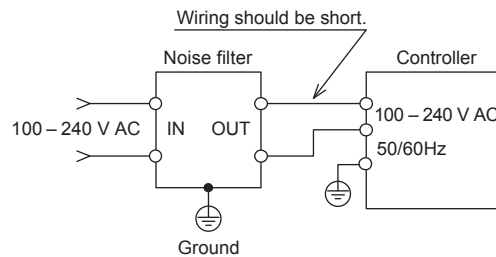
WARNING

- Be sure to turn off power before wiring. Failure to do so could result in electrical shock.
- After wiring, do not touch terminal elements or other charged parts while conducting electricity. Failure to do so could result in electrical shock.

Take the following precautions when wiring:

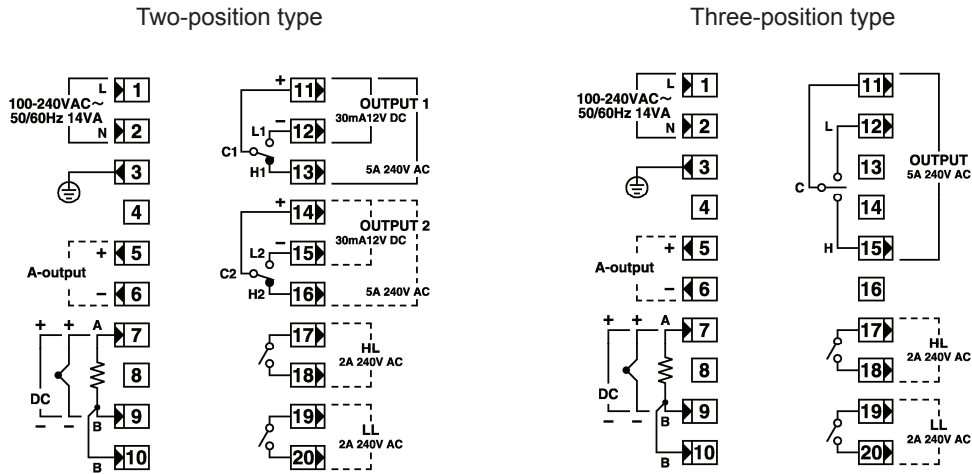
- ① Wire in accordance with the terminal layout of section 3-5 and terminal arrangement table of section 3-6. After wiring, check and make sure the wiring is correct.
- ② Crimp-type terminals fit M3.5 screws. Use crimp-type terminals that are no wider than 7mm.
- ③ For thermocouple input, use a compensating conductor that matches the type of thermocouple.
- ④ For R.T.D. input, resistance for lead wires should be a maximum of 5Ω per wire. All 3 wires should have the same resistance.
- ⑤ Input signal wires must not be accommodated with a high-voltage power circuit in the same conduit or duct.
- ⑥ Using shielded wiring (single point grounding) is effective for static induction noise.
- ⑦ Making input wiring short and twisting at regular intervals is effective for electromagnetic induction noise.
- ⑧ For power supply, use wiring or cable with sectional area of at least 1 mm^2 that offers the same performance as 600 V vinyl insulated wiring.
- ⑨ Securely fasten the terminal element screw. Fastening torque: $1.1\text{ N}\cdot\text{m}$ ($11\text{ kgf}\cdot\text{cm}$)
- ⑩ If the controller appears to be easily affected by power supply noise, use a noise filter to prevent malfunctioning. Mount the noise filter on the grounded panel and make the wire connection between the noise filter output and power line terminals of the controller as short as possible.

Recommended noise filter: TDK RSEL-2003W



3-5. Terminal layout

Wire in accordance with the following terminal layout and terminal arrangement table.



3-6. Terminal arrangement table

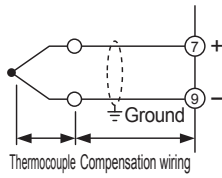
| Name of terminal | Description | Terminal No. | |
|--|---------------------------------|-------------------|---------------------|
| | | Two-position type | Three-position type |
| Power supply | 100 – 240 V AC L | 1 | 1 |
| | 100 – 240 V AC N | 2 | 2 |
| Input | Thermocouple/voltage/current: + | 7 | 7 |
| | Thermocouple/voltage/current: – | 9 | 9 |
| | R.T.D.: A | 7 | 7 |
| | R.T.D.: B | 9 | 9 |
| Control output 1 | R.T.D.: B | 10 | 10 |
| | Contact: NO | 11-12 | |
| | Contact: NC | 11-13 | |
| | Contact: NO | | 11-12 |
| Control output 2 (Two-setting type) | Contact: NO | | 11-15 |
| | SSR drive voltage + | 11 | |
| | SSR drive voltage – | 12 | |
| | Contact: NO | 14-15 | |
| Alarm output (optional) | Contact: NC | 14-16 | |
| | SSR drive voltage + | 14 | |
| | SSR drive voltage – | 15 | |
| | Contact: C | 17 | 17 |
| Analog output (optional) | Contact: HL | 18 | 18 |
| | Contact: C | 19 | 19 |
| | Contact: LL | 20 | 20 |
| Protective conductor terminal | Voltage/current: + | 5 | 5 |
| | Voltage/current: – | 6 | 6 |
| | Ground terminal \oplus | 3 | 3 |

3-7. Wiring

3-7-1. Input circuit

The input circuit handles weak electrical signals. Wire separate of the motor and operation circuits. If wiring together cannot be avoided, make a single contact using shielded wire.

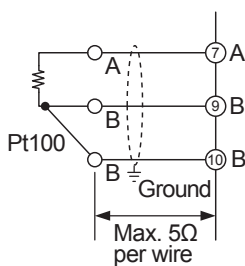
1) Thermocouple input



Be sure to wire the thermocouple with thermocouple compensation lead wire. Arrange for the total resistance of thermocouple and compensation wiring to be at least 100Ω.

- Reference -
- Type of thermocouple and color of compensation wiring
- T = brown, J = yellow, E = purple, K = blue, S = black, R = black, B = gray

2) R.T.D. input



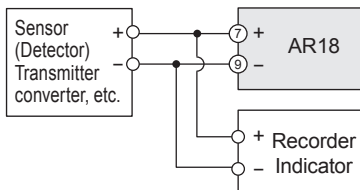
Use 3-wire type for R.T.D. wiring, and use the same wiring material so the resistance value is the same.

The resistance value per wire should not exceed 5Ω. If connected along the way, take proper measures so contact resistance does not increase.

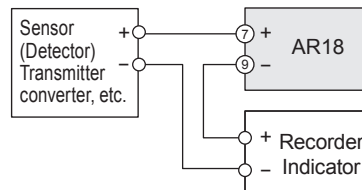
- Reference -
- Wiring material and target max. distance
- Twisted wire 0.5 mm² / approx. 100 m
- 0.75 mm² / approx. 150 m

3) Voltage / current input

■ Voltage input

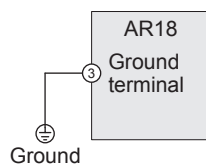


■ Current input



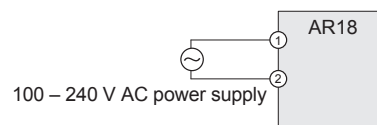
3-7-2. Grounding

To ensure safety and minimize the effect of noise, be sure to ground the ground terminal.



3-7-3. Power circuit

100 – 240 V AC can be used for the power circuit. Wire as shown in the following figure.



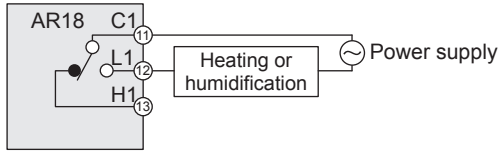
3-7-4. Control output circuit

The control output circuit conducts contact output / SSR drive voltage. The respective wiring methods differ. Wire while referring to the following figure.

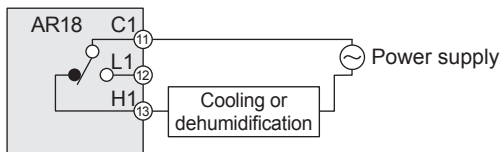
① One-setting, two-position type

■ Contact output form

* Heating or humidification wiring

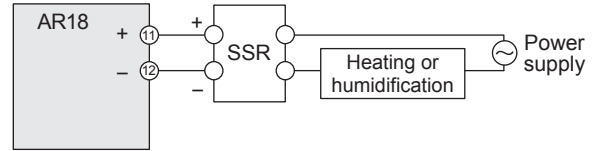


* Cooling or humidification

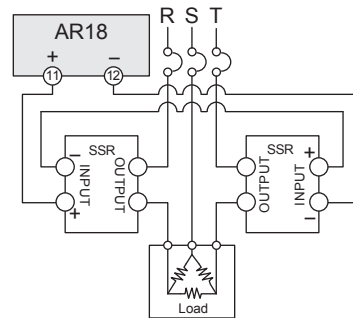


■ SSR drive voltage output form

* 1 SSR contact

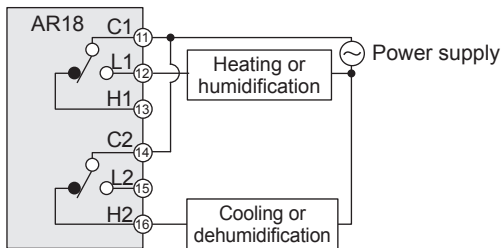


* Using 3-phase circuit

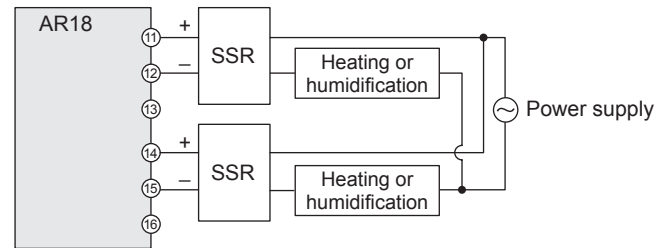


② Two-setting, two-position type

■ Contact output form

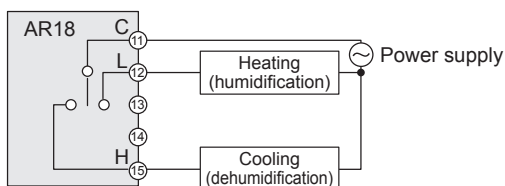


■ SSR drive voltage output form

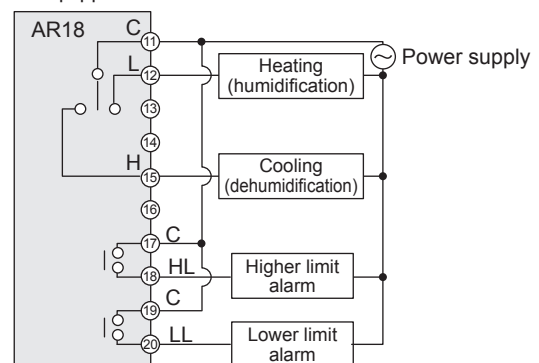


③ Three-position type

Three-position control is implemented by providing a dead band (DB) for heating/cooling or humidifying/dehumidifying. Higher and lower limit action is adjusted symmetrically focusing on the setting point by dead band (DB).



* If equipped with alarm

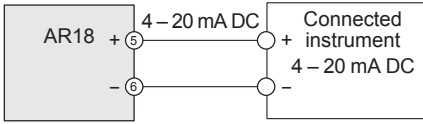


3-7-5. Analog output circuit (optional)

Analog output includes “voltage output form” and “current output form.” Wire while referring to the following explanatory diagram.

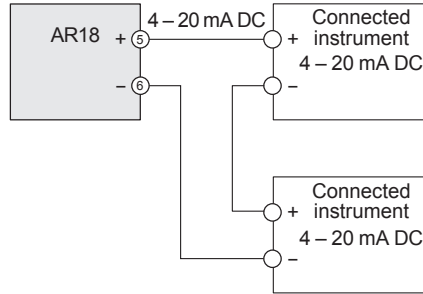
■ Current output

* If current input form instrument is connected
(load resistance 300Ω max.)



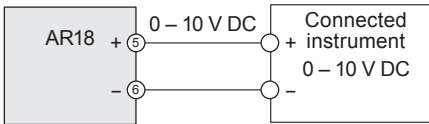
Note: If 1 – 5 V input form instrument is connected, mount an external 250Ω resistor (at least 1/4 W).

* If 2 loads are connected
(load resistance 300Ω max.)

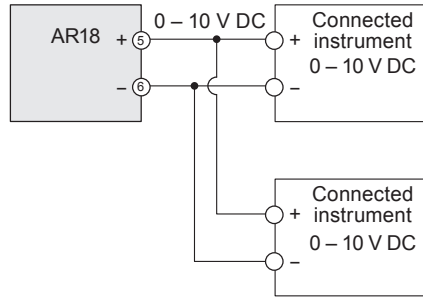


■ Voltage output

* If 1 load is connected



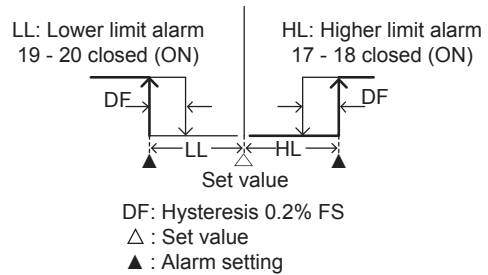
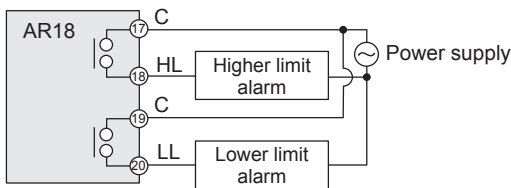
* If 2 loads are connected



3-7-6. Alarm output circuit (optional)

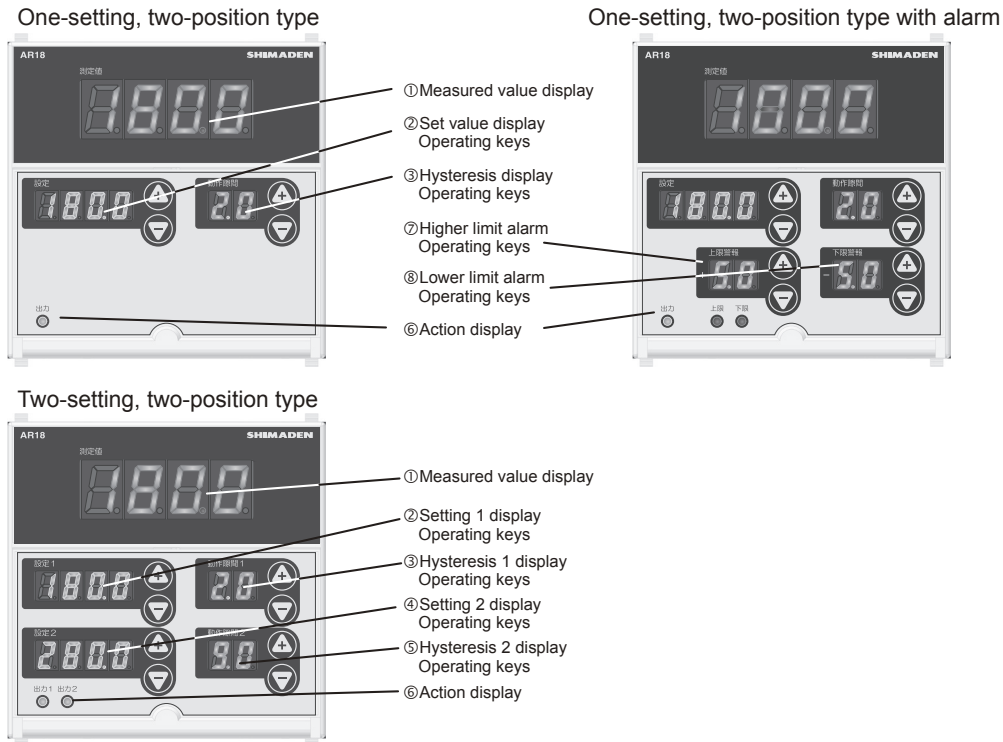
Separate higher/lower limit setting/output is possible.

* Higher/lower limit alarm wiring



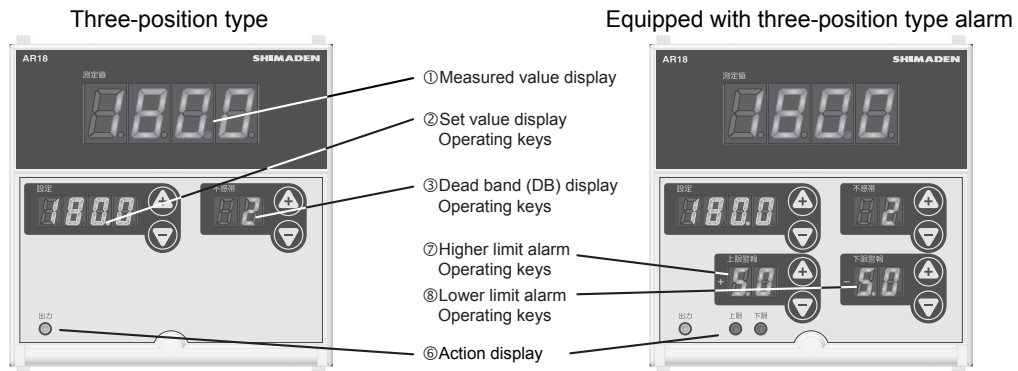
4. Names and functions of parts on front panel

4-1. Two-position type



| Name | Function | |
|---|--|---|
| ① Measured value display | Measured value display (red LED) * Displays current measured value. | If equipped with measured value display, lights continuously when power is conducted. |
| ② Set value display (setting 1 display) | Setting 1 set value display (green LED) * Sets/displays target set values (SV). Value is incremented by ▲ key. Value is decremented by ▼ key. | Lit constantly when conducting power Same for setting range / measuring range |
| ③ Hysteresis display (hysteresis display 1 display) | Setting 1 hysteresis value display (orange LED) * Sets/displays hysteresis. Value is incremented by ▲ key. Value is decremented by ▼ key. | Lamp goes off 8 seconds after setting is complete. Setting range: 0.1 – 9.9 FS |
| ④ Setting 2 display | Setting 2 set value display (green LED) * Sets/displays target set values (SV). Value is incremented by ▲ key. Value is decremented by ▼ key. | Lit constantly when conducting power Same for setting range / measuring range |
| ⑤ Hysteresis 2 display | Setting 2 hysteresis value display (orange LED) * Sets/displays hysteresis. Value is incremented by ▲ key. Value is decremented by ▼ key. | Lamp goes off 8 seconds after setting is complete. Setting range: 0.1 – 9.9 FS |
| ⑥ Action display | Output 1 / output 2 set value display (green LED) * Contact output form Lights when terminals 11 - 12 and 14 - 15 are shorted. * SSR drive voltage output form Lights when control output 1/2 is output. Higher limit alarm / lower limit alarm display (red LED) * Lights for higher limit alarm / lower limit alarm. | |
| ⑦ Higher limit alarm | Higher limit alarm display (orange LED) * Sets/displays higher limit alarm. Value is incremented by ▲ key. Value is decremented by ▼ key. * Alarm set value lights for higher limit alarm (orange LED). | Lamp goes off 8 seconds after setting is complete. Setting range Without decimal point 0 – 99, no With decimal point 0.0 – 99, no (Note that decimal points cannot be set for readings of 10 or higher.) Does not function if “no” is set. |
| ⑧ Lower limit alarm | Lower limit alarm display (orange LED) * Sets/displays lower limit alarm. Value is incremented by ▲ key. Value is decremented by ▼ key. * Alarm set value lights for lower limit alarm (orange LED). | Lamp goes off 8 seconds after setting is complete. Setting range Without decimal point no, -99 – 0 With decimal point no, -99 – 0.0 (Note that decimal points cannot be set for readings of -10 or lower.) Does not function if “no” is set. |

4-2. Three-position type



| Name | Function | |
|--------------------------|---|---|
| ① Measured value display | Measured value display (red LED) * Displays current measured value. | If equipped with measured value display, lights continuously when power is conducted. |
| ② Set value display | Set value display (green LED) * Sets/displays target set values (SV). Value is incremented by ▲ key. Value is decremented by ▼ key. | Lit constantly when conducting power. Same for setting range / measuring range |
| ③ Dead band (DB) display | Dead band (DB) display (orange LED) * Sets/displays dead band (DB). Value is incremented by ▲ key. Value is decremented by ▼ key. | Lamp goes off 8 seconds after setting is complete. Setting range: 1 – 99% FS |
| ⑥ Action display | Output action display Lights when terminals 11 - 12 are shorted. (green LED) Lights when terminals 11 - 15 are shorted. (red LED) Higher limit alarm / lower limit alarm display (red LED) * Lights for higher limit alarm / lower limit alarm. | |
| ⑦ Higher limit alarm | Higher limit alarm display (orange LED) * Sets/displays higher limit alarm. Value is incremented by ▲ key. Value is decremented by ▼ key. * Alarm set value lights for higher limit alarm (orange LED). | Lamp goes off 8 seconds after setting is complete. Setting range Without decimal point 0 – 99, no With decimal point 0.0 – 99, no (Note that decimal points cannot be set for readings of 10 or higher.) Does not function if “no” is set. |
| ⑧ Lower limit alarm | Lower limit alarm display (orange LED) * Sets/displays lower limit alarm. Value is incremented by ▲ key. Value is decremented by ▼ key. * Alarm set value lights for lower limit alarm (orange LED). | Lamp goes off 8 seconds after setting is complete. Setting range Without decimal point no, -99 – 0 With decimal point no, -99 – 0.0 (Note that decimal points cannot be set for readings of -10 or lower.) Does not function if “no” is set. |

5. Action

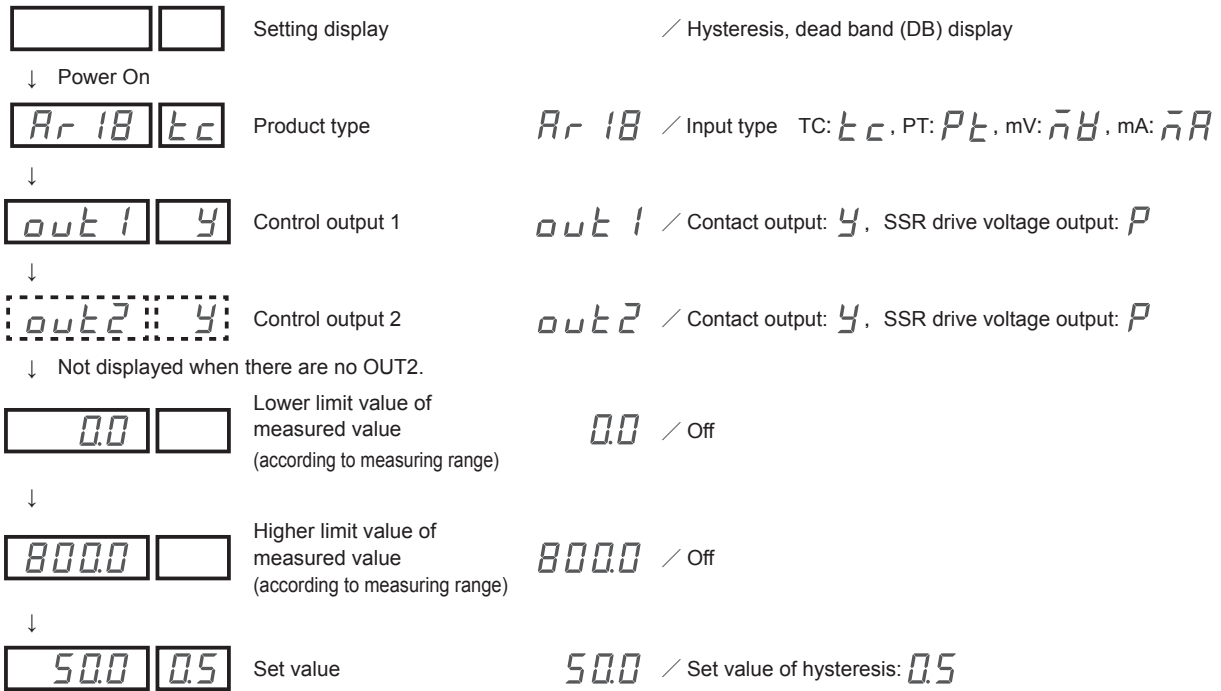
Make sure the wiring is correct before turning on the power. Incorrect wiring could result in burnout.

5-1. Display when power is applied

Check the initial message when power is applied to see if the product specifications are as desired.

When power is applied, the initial screen when power is applied is displayed for each screen for about 1 second as shown in the following figure.

The following figure shows one-setting, two-position type, input measuring range code 005 (0.0 – 800.0°C)

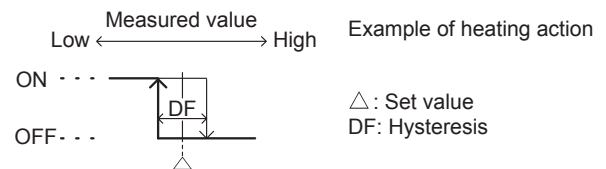


5-2. Hysteresis, dead band (DB)

ON/OFF control setting value for this series is set in advance. When temperature reaches the set value, control output becomes OFF. When output becomes OFF, temperature goes down, and then it becomes ON again. This action is repeated at a certain position. Hysteresis is provided for switching output ON/OFF to stabilize action.

Two-position type

With the two-position type, hysteresis (DF) is set to the desired value within the range of 0.1 – 9.9% FS.

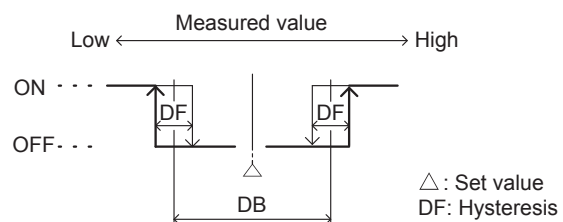


Three-position type

Three-position includes dead band (DB) setting.

The narrower dead band (DB) is, the less amplitude there is for heating and cooling and discrepancy with set point is reduced. It is therefore frequently used for heating and cooling. Set to the optimal value while observing action. Set dead band (DB) to the desired value within the range of 1 – 99% FS.

Hysteresis (DF) is fixed to 0.2% FS.



5-3. Operation

5-3-1. Setting set points

Set value is set by ▲ and ▼ keys. Pressing ▲ or ▼ key makes the first decimal point flash and changes the value of the set value. If there is no key input operation for 3 seconds, update operation is finished and the first decimal point stops flashing. The values changed by the ▲ and ▼ keys are applied to operation immediately.



Set value to 30.0 with the ▲ key. (First decimal point flashes.)



No key operation for 3 seconds. Setting changed to 30.0 and update operation finished. (first decimal point stops flashing)

5-3-2. Display off

When setting is complete, the hysteresis, dead band (DB), alarm higher limit and alarm lower limit displays darken and go off. The example shows the case where hysteresis is changed from 0.0 to 1.0.



Set value to 1.0 with the ▲ key. (First decimal point flashes.)



No key input for 3 seconds (First decimal point goes off.)



Setting is changed to 1.0 and update operation is finished.



Display darkens for 5 seconds.



Display goes off.

6. Explanation of functions

6-1. Control output

*Control output characteristics

In the case of contact output, connect either heating or cooling action as given in the following table.

Only heating is applicable in the case of SSR drive voltage output.

| Two-position type | | | Three-position type | |
|-------------------|-------|-------|---------------------|-------|
| Action | OUT1 | OUT2 | Action | OUT |
| Heating | 11-12 | 14-15 | Heating | 11-12 |
| Cooling | 11-13 | 14-16 | Cooling | 11-15 |

Heating: Terminal to be shorted if measured value is lower than set value.
Cooling: Terminal to be shorted if measured value is higher than set value.

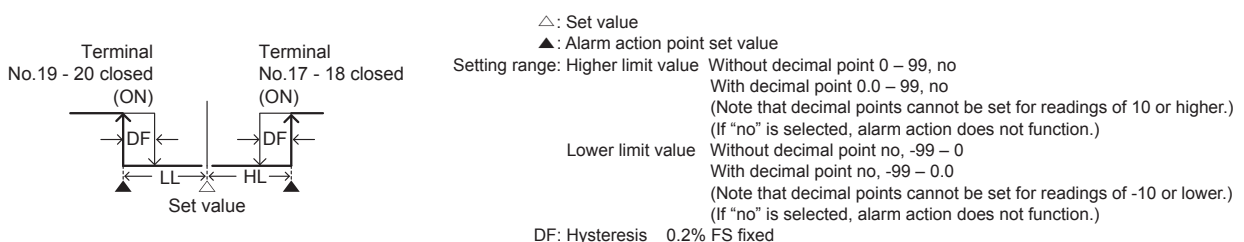
6-2. Alarm action

Sets alarm action points for deviation of measured values from target set values.

In the case of input measuring range code 005 (K, 0.0 – 800.0°C), for example, to trigger an alarm when measured value is 201.0°C or higher and the target set value (SV) is 200.0°C, the higher limit alarm is set to 1.0°C (unit).

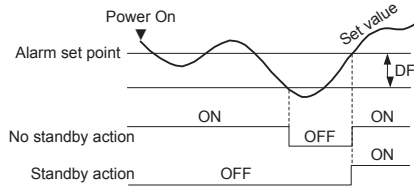
Or to trigger an alarm when measured value is 198.0°C or less when target set value is 200.0°C, the lower limit alarm is set to 2.0°C (unit). Alarm action point acts in accordance with target set values (SV).

If alarm action is ON, alarm value (orange) and action display (alarm higher limit and alarm lower limit) LED (red) lights.



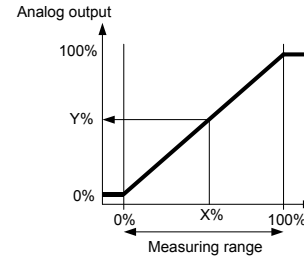
6-3. Standby action

Standby action is a system whereby, when power is applied, if measured value is in the alarm range, the device stands by without giving the alarm, and once it gets out of the alarm range, the alarm is given when it enters the alarm range again. Operates by conventional operation after standby action is canceled.



6-4. Analog output

Analog output is a function output by converting measured output to DC current signal according to 0 – 100% of measuring range. Types of analog output include current output 4 – 20 mA DC, voltage output 0 – 10 V DC or 0 – 10 mV DC.



7. Causes and remedy of trouble and errors

7-1. Causes and remedy of trouble

| Trouble information | Cause | Remedy |
|---|---|--|
| * Error message is displayed. | ① See “Causes and remedy of errors.” ② Something is wrong with the instrument. | ① See “Causes and remedy of errors.” ② Inspect, repair or replace the instrument. |
| * Something is wrong with display contents of measured value. | ① Specified measuring range code does not match input sensor / input signal. ② Erroneous wiring to input terminals of sensor. ③ Something is wrong with the instrument. | ① Check if set measuring range code of product code matches input signal. ② Check wiring to sensor input terminals. ③ Inspect, repair or replace the instrument. |
| * Front panel display goes off and does not function. | ① Problem with power supply and/or wiring connection. ② Something is wrong with the instrument. | ① Inspect power supply / wiring connections and check wiring. ② Inspect, repair or replace the instrument. |
| * Keys do not work. | ① Something is wrong with the instrument. | ① Inspect, repair or replace the instrument. |
| * ON-OFF action of control output is too fast. | ① On-Off hysteresis is too narrow. | ① Widen On-Off hysteresis range. |

7-2. Causes and remedy of error display

| Screen display | Description | Cause | Remedy |
|----------------|--|---|--|
| HHHH (HHHH) | Higher limit scaleover | ① Break in thermocouple input wiring. ② Break in R.T.D. input A wiring. ③ Measured input value exceeded higher limit of measuring range by 10%. | ① Check thermocouple input wiring for possible break. If there is nothing wrong with wiring, replace thermocouple. ② Check R.T.D. input A terminal wiring for possible break. If there is nothing wrong with wiring, replace R.T.D. ③ For voltage or current input, check the measurement signal transmission unit. Check if input signal is within measuring range. |
| LLLL (LLLL) | Lower limit scaleover | Measured input value fell below lower limit of measuring range by 10%. | Check for measured input wiring for reverse polarity or possible break. Check if input signal is within measuring range. |
| b--- (b--- | Break in R.T.D. input wiring | ① Break in B wiring ② Multiple break in ABB wiring | Check R.T.D. input ABB terminal wiring for possible break. If there is nothing wrong with wiring, replace R.T.D. |
| CJHH (CJHH) | Higher limit scaleover of cold junction (CJ) of thermocouple input | Ambient temperature has exceeded 80°C. | ① Raise ambient temperature to the level provided in the environment conditions for the controller. ② If ambient temperature has not exceeded 80°C, inspect the controller. |
| CJLL (CJLL) | Lower limit scaleover of cold junction (CJ) of thermocouple input | Ambient temperature has fallen to -20°C and/or below. | ① Raise ambient temperature to the level provided in the environment conditions for the controller. ② If ambient temperature is above -20°C, inspect the controller. |

If action differs from that for which the controller was designed and the controller is thought to be faulty, please read the instruction manual and inspect once more. If the product trouble is not resolved or you have questions, please contact your nearest Shimaden dealer.

8. Measuring Range Codes

| Input type | | Code | Measuring range | Code | Measuring range | Higher/lower limit alarm setting range |
|--------------|--------------|----------------|---------------------------|----------------|-------------------|--|
| Thermocouple | B | 001 * 1 | 0 – 1800 °C | 101 * 1 | 0 – 3300 °F | |
| | R | 002 | 0 – 1700 °C | 102 | 0 – 3100 °F | |
| | S | 003 | 0 – 1700 °C | 103 | 0 – 3100 °F | |
| | K | 004 * 2 | -199.9 – 400.0 °C | 104 * 2 | -300 – 750 °F | |
| | | 005 | 0.0 – 800.0 °C | 105 | 0 – 1500 °F | |
| | | 006 | 0 – 1200 °C | 106 | 0 – 2200 °F | |
| | E | 007 | 0 – 700 °C | 107 | 0 – 1300 °F | |
| | J | 008 | 0 – 600 °C | 108 | 0 – 1100 °F | |
| | T | 009 * 2 | -199.9 – 200.0 °C | 109 * 2 | -300 – 400 °F | |
| | N | 010 | 0 – 1300 °C | 110 | 0 – 2300 °F | |
| | PLII * 3 | 011 | 0 – 1300 °C | 111 | 0 – 2300 °F | |
| | C(WRe5 - 26) | 012 | 0 – 2300 °C | 112 | 0 – 4200 °F | |
| | U *4 | 013 * 2 | -199.9 – 200.0 °C | 113 * 2 | -300 – 400 °F | |
| | L *4 | 014 | 0 – 600 °C | 114 | 0 – 1100 °F | |
| Kelvin | K | 015 * 5 | 10.0 – 350.0 K | | | Higher limit alarm Without decimal point: 0 – 99, no With decimal point: 0.0 – 99, no (Note that decimal points cannot be set for readings of 10 or higher.) |
| | AuFe - Cr | 016 * 6 | 0.0 – 350.0 K | | | |
| | K | 017 * 5 | 10 – 350 K | | | |
| | AuFe - Cr | 018 * 6 | 0 – 350 K | | | |
| R.T.D. | Pt100 | 030 | -100.0 – 350.0 °C | 130 | -150.0 – 600.0 °F | Lower limit alarm Without decimal point: no, -99 – 0 With decimal point: no, -99 – 0.0 (Note that decimal points cannot be set for readings of -10 or lower.) |
| | | 031 | -200 – 600 °C | 131 | -300 – 1100 °F | |
| | | 032 | -100.0 – 100.0 °C | 132 | -150.0 – 200.0 °F | |
| | | 033 | -50.0 – 50.0 °C | 133 | -50.0 – 120.0 °F | |
| | | 034 | 0.0 – 200.0 °C | 134 | 0.0 – 400 °F | |
| | JPt100 | 035 | -200 – 500 °C | 135 | -300 – 1000 °F | |
| | | 036 | -100.0 – 100.0 °C | 136 | -150.0 – 200.0 °F | |
| | | 037 | -50.0 – 50.0 °C | 137 | -50.0 – 120.0 °F | |
| | | 038 | 0.0 – 200.0 °C | 138 | 0.0 – 400.0 °F | |
| | Pt100 | 039 | -100.0 – 350.0 °C | 139 | -150.0 – 600.0 °F | |
| | | 040 | -199.9 – 550.0 °C | 140 | -300 – 1000 °F | |
| | | 041 | 0.0 – 350.0 °C | 141 | 0.0 – 650.0 °F | |
| | JPt100 | 042 | 0.0 – 550.0 °C | 142 | 0 – 1000 °F | |
| | | 045 | -199.9 – 500.0 °C | 145 | -300 – 1000 °F | |
| 046 | | 0.0 – 350.0 °C | 146 | 0.0 – 650.0 °F | | |
| | 047 | 0.0 – 500.0 °C | 147 | 0 – 1000 °F | | |
| Voltage (mV) | -10 – 10mV | 071 | 0.0 – 100.0 (fixed) *7 | | | |
| | 0 – 10mV | 072 | | | | |
| | 0 – 20mV | 073 | | | | |
| | 0 – 50mV | 074 | | | | |
| | 10 – 50mV | 075 | | | | |
| | 0 – 100mV | 076 | | | | |
| Voltage (V) | -1 – 1V | 081 | | | | |
| | 0 – 1V | 082 | | | | |
| | 0 – 2V | 083 | | | | |
| | 0 – 5V | 084 | | | | |
| | 1 – 5V | 085 | | | | |
| | 0 – 10V | 086 | | | | |
| Current (mA) | 0 – 20mA | 091 | | | | |
| | 4 – 20mA | 092 | | | | |

Thermocouple B, R, S, K, E, J, T, N: JIS/IEC

R.T.D. Pt100: JIS/IEC JPt100

* 1 Thermocouple B: Accuracy guarantee not applicable to 400°C (752°F) and/or below.

* 2 Thermocouple K, T, U: Accuracy of those readings -100.0°C and/or below is ±0.7% FS.

* 3 Thermocouple PLII: Platinel

* 4 Thermocouple U, L: DIN 43710

* 5 Thermocouple K (Kelvin) accuracy

* 6 Thermocouple Metal-chromel (AuFe-Cr) (Kelvin) accuracy

10.0 – 30.0K ±(2.0%FS + 40 °C+1digit)

0.0 – 30.0K ±(0.7%FS + 6 °C+1digit)

30.0 – 70.0K ±(1.0%FS + 14 °C+1digit)

30.0 – 70.0K ±(0.5%FS + 3 °C+1digit)

70.0 – 170.0K ±(0.7%FS + 6 °C+1digit)

70.0 – 170.0K ±(0.3%FS + 2.4 °C+1digit)

170.0 – 270.0K ±(0.5%FS + 3 °C+1digit)

170.0 – 280.0K ±(0.3%FS + 2 °C+1digit)

270.0 – 350.0K ±(0.3%FS + 2 °C+1digit)

280.0 – 350.0K ±(0.5%FS + 2 °C+1digit)

Note: Measuring range is set to one of those given above as specified by the customer.

* 7 For an exception from the standard option, please select the remark 9.

Specification is possible under the following conditions (specify when ordering).

Range : -1999 – 9999 digit Lower limit value < higher limit value

Span : 10 – 10000 digit



Position of decimal point : none, 0.1

9. Specifications

■ Display

- Digital display : Measured value / red LED 4 digits, character height approx. 14.3 mm
Setting 1, 2 / green LED 4 digits, character height approx. 8 mm
Other (higher limit, lower limit alarm, hysteresis 1, 2, dead band (DB) / orange LED 2 digits, character height approx. 8 mm
- Status display : Output 1, 2 / green
For three-position type, green/red 2-color lamp, dead band (DB) off
- Display accuracy : higher limit, lower limit alarm / red
: $\pm (0.25\%FS + 1 \text{ digit})$
Does not include cold junction temperature compensation accuracy of thermocouple input
For details on accuracy, see "8. Measuring Range Codes."
- Range for maintaining display accuracy : $23^{\circ}C \pm 5^{\circ}C$ (18 – 28°C)
- Display resolution : Differs according to measuring range (0.1, 1)
- Measured value display range : -10 – 110% of measuring range
However, Pt -200 – 600°C range is -240 – 680°C.
JPt -200 – 500°C range is -240 – 570°C.
- Display update cycle : 0.25 seconds
- Input scaling : 0 – 100.0 (linear input) standard

■ Setting

- Setting method : By operation of 4 or 8 front keys  
- Setting range : Same as measuring range

■ Input

- Input type : Selection by measuring range code (TC, Pt, mV, V, mA)
- Thermocouple : B, R, S, K, E, J, T, N, PL II, C(WRe5-26), (U, L (DIN43710) Metal-chromel (AuFe-Cr)
: Min. input resistance 500kΩ
: Max. external resistance tolerance: 100Ω
: Burnout function: Standard equipment (up scale)
: Cold junction compensation accuracy (CJ error) $\pm 2^{\circ}C$ (within ambient temperature 5 – 45°C)
- R.T.D. : Pt100 / JPt100 3-wire type
: Amperage 0.25 mA
: Lead wire tolerable resistance 5Ω max. per wire (resistance for all wires must be equal)
- Voltage : mV : -10 – 10, 0 – 10, 0 – 20, 0 – 50, 10 – 50, 0 – 100 mV DC
: V : -1 – 1, 0 – 1, 0 – 2, 0 – 5, 1 – 5, 0 – 10 V DC
: Input resistance 500kΩ min.
- Current : mA : 0 – 20, 4 – 20 mA DC
: Input resistance approx. 250Ω
- Sampling cycle : 0.25 seconds
- Isolation : No insulation between input and system; all others insulated

■ Control

- Control mode : One-setting, two-position type control, two-setting, two-position type control, three-position type control
- Control output type/rating : Contact / 1c 240 V AC, 5A (resistive load), 2A (inductive load)
: SSR drive voltage / 12V \pm 1.5 V DC (max. load current 30 mA)
- No. of control output points : Output 1
: Output 2
- Hysteresis (DF) : Two-position type 0.1 – 9.9% FS
: Three-position type 0.2% FS fixed
- Action dead band (DB) (three-position type) : 1 – 99% FS
- Control output characteristics : RA (reverse characteristics) only
Relay output: Realized by NC terminal for cooling

- Isolation : Contact output insulated for all
: No insulation between SSR drive voltage and analog output; all others insulated

■ Alarm output (optional)

- Number of output points : 2 (HL, LL)
- Type : HL higher limit alarm
: LL Lower limit alarm
- Setting range : Higher limit alarm Without decimal point 0 – 99, no
: With decimal point 0.0 – 99, no
(Note that decimal points cannot be set for readings of 10 or higher.)
Lower limit alarm Without decimal point no, -99 – 0
: With decimal point no, -99 – 0.0
(Note that decimal points cannot be set for readings of -10 or lower.)
- Action : ON-OFF action
- Hysteresis : 0.2% FS fixed
- Standby action : Standby action / no standby action
- Output type/rating : Contact 1a / 240 V AC, 2A (resistive load)
- Output updating cycle : 0.25 seconds
- Isolation : Insulated for all
- Selection conditions : Cannot be selected for two-setting, two-position type

■ Analog output (optional)

- Number of output points : 1
- Output type : Measured value
- Output range : Same as measuring range (fixed)
Specification for lower limit value/higher limit value within measuring range is possible (specify when ordering).
- Output specifications/rating : Current 4 – 20 mA DC / max. load resistance 300Ω
Voltage 0 – 10 V DC / max. load current 2 mA
Voltage 0 – 10 mV DC, output resistance 10Ω
- Output accuracy : $\pm 0.3\%FS$ (for display value)
- Output resolution : Approx. 0.008% (1/13,000)
- Output updating cycle : 0.25 seconds
- Isolation : No insulation with control output P

■ General specifications

- Data storage : Non-volatile memory (EEPROM)
- Operating environment conditions : Temperature -10–50°C
: Humidity 90%RH max. (no dew condensation)
: Elevation 2000 m above sea level or lower.
: Over voltage Category II
: Pollution degree 2 (IEC 60664)
- Storage temperature : -20 – 65°C
- Supply voltage : 100 – 240 V AC \pm 10% 50/60 Hz
- Power consumption : Max. 14 VA for 100 – 240 V AC
- Input/noise removal ratio : Normal mode min. 50 dB (50/60 Hz)
: Common mode min. 130dB (50/60 Hz)
- Insulation resistance : Between input/output terminals and power terminal 500 V DC, 20 MΩ or above;
: Between input/output terminals and ground terminal 500V DC, 20MΩ or above
- Dielectric strength : Between input/output terminals and power terminal 2300 V AC, 1 minute
: Between power terminal and ground terminal 1500V AC, 1 minute
- Material of case : PPE resin (flame resistance UL94V-0)
- External dimensions : H96 x W96 x D120 mm (100 mm inside panel)
- Protective structure : Only front panel has dust-proof and dripproof structure equivalent to IP66. (Panel thickness :1.2–3.2mm)
- Mounting : Push-in panel (one-touch mount)
- Panel thickness : 1.0 – 4.0 mm
- Panel cutout : H92 x W92 mm
- Weight : Approx. 340 g

The contents of this manual are subject to change without notice.

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