Digital Indicator (4-channel Type)

AF110 Quick Instruction Manual

 IMR02K01-E3

Thank you for purchasing this RKC product. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference.

This manual describes the mounting, wiring, parts description, basic key operations and specifications.
For detailed handling procedures, various function settings and parameters, please refer to the following separate manual:

- AF110 Instruction Manual (IMR02K02-E□): Separate
  (Download free or purchase hard copy)

These manual can be downloaded from our website:
URL: http://www.rkcinst.com/english/manual_load.htm

■ Accessories check

AF110 Quick Instruction Manual (IMR02K01-E3) 1
Mounting brackets (KCA100-526) 1

■ Safety precautions

WARNING

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- RKC is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

CAUTION

- This product is intended for use with industrial machines, test and measuring equipment. (It is not designed for use with medical equipment and nuclear energy.)
- This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.
- Be sure to provide an appropriate surge control circuit respectively for the following:
  – If input/output or signal lines within the building are longer than 30 meters.
  – If input/output or signal lines leave the building, regardless the length.
- This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.
- All precautions described in this manual should be taken to avoid damage to the instrument or equipment.
- All wiring must be in accordance with local codes and regulations.
- To prevent instrument damage or failure, protect the power line and the input/output lines from high currents with a protection device such as fuse, circuit breaker, etc.
- Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.
- For proper operation of this instrument, provide adequate ventilation for heat dispensation.
- Do not connect wires to unused terminals as this will interfere with proper operation of the instrument.
- Turn off the power supply before cleaning the instrument.
- Do not use a volatile solvent such as paint thinner to clean the instrument. Deformation or discoloration will occur. Use a soft, dry cloth to remove stains from the instrument.
- To avoid damage to instrument display, do not rub with an abrasive material or push front panel with a hard object.
- When high alarm with hold action is used for Alarm function, alarm does not turn on while hold action is in operation. Take measures to prevent overheating which may occur if the control device fails.

NOTICE

- This manual assumes that the reader has a fundamental knowledge of the principles of electricity, process control, computer technology and communications.
- The figures, diagrams and numeric values used in this manual are only for purpose of illustration.
- RKC is not responsible for any damage or injury that is caused as a result of using this instrument, instrument failure or indirect damage.
- RKC is not responsible for any damage and/or injury resulting from the use of instruments made by imitating this instrument.
- Periodic maintenance is required for safe and proper operation of this instrument. Some components have a limited service life, or characteristics that change over time.
- Every effort has been made to ensure accuracy of all information contained herein. RKC makes no warranty expressed or implied, with respect to the accuracy of the information. The information in this manual is subject to change without prior notice.
- No portion of this document may be reprinted, modified, copied, transmitted, digitized, stored, processed or retrieved through any mechanical, electronic, optical or other means without prior written approval from RKC.

1. MOUNTING

WARNING

To prevent electric shock or instrument failure, always turn off the power before mounting or removing the instrument.

1.1 Mounting Cautions

(1) This instrument is intended to be used under the following environmental conditions. **(IEC61010-1)** [OVERVOLTAGE CATEGORY II, POLLUTION DEGREE 2]

(2) Use this instrument within the following environment conditions:
- Allowable ambient temperature: 0 to 40°C
- Allowable ambient humidity: 10 to 90 %RH
  (Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3kPa)

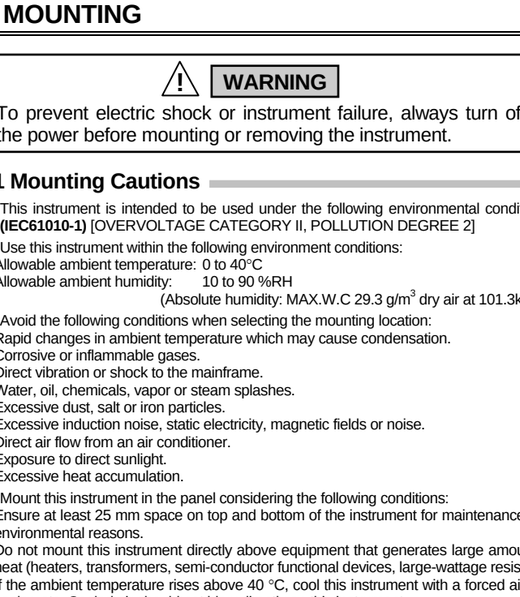
(3) Avoid the following conditions when selecting the mounting location:
- Rapid changes in ambient temperature which may cause condensation.
- Corrosive or inflammable gases.
- Direct vibration or shock to the mainframe.
- Water, oil, chemicals, vapor or steam splashes.
- Excessive dust, salt or iron particles.
- Excessive induction noise, static electricity, magnetic fields or noise.
- Direct air flow from an air conditioner.
- Exposure to direct sunlight.
- Excessive heat accumulation.

(4) Mount this instrument in the panel considering the following conditions:
- Ensure at least 25 mm space on top and bottom of the instrument for maintenance and environmental reasons.
- Do not mount this instrument directly above equipment that generates large amount of heat (heaters, transformers, semi-conductor functional devices, large-wattage resistors.)
- If the ambient temperature rises above 40 °C, cool this instrument with a forced air fan, cooler, etc. Cooled air should not blow directly on this instrument.
- In order to improve safety and the immunity to withstand noise, mount this instrument as far away as possible from high voltage equipment, power lines, and rotating machinery.
  High voltage equipment: Do not mount within the same panel.
  Power lines: Separate at least 200 mm.
  Rotating machinery: Separate as far as possible.

(5) If this instrument is permanently connected to equipment, it is important to include a switch or circuit-breaker into the installation. This should be in close proximity to the equipment and within easy reach of the operator. It should be marked as the disconnecting device for the equipment.

1.2 Dimensions

(Unit: mm)



Mounting panel thickness: 1 to 10 mm
(When mounting multiple AF110s close together, the panel strength should be checked to ensure proper support.)

*1 Case rubber packing (optional) [Waterproof/Dustproof (specify when ordering)]
*2 To keep the instrument as waterproof as possible, make sure that the panel surface has no burr or distortion where the hole is to be cut out.
*3 When the AF110 is mounted closely protection will be compromised and they will not meet IP66 standards.

The display cannot be seen from the outside of the view angle. The view angle of AF110 is 40° to the upper side, and 30° to the lower side from the center of the display vertically.

The front of the instrument conforms to **IP66** [Specify when ordering] when mounted on the panel. For effective Waterproof/Dustproof, the rubber packing must be securely placed between instrument and panel without any gap. If rubber packing is damaged, please contact RKC sales office or the agent.

1.3 Procedures of Mounting and Removing

■ Mounting procedures

1. Prepare the panel cutout as specified in **1.2 Dimensions**.
2. Insert the AF110 through the panel cutout.
3. Insert the mounting bracket into the mounting from the rear of the AF110 (Fig. 2.1).
4. Push the mounting bracket forward until the frame is firmly secured to the panel (Fig. 2.2).

Fig. 2.1

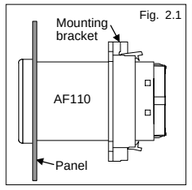
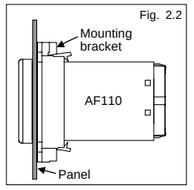
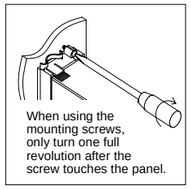


Fig. 2.2





■ Removal procedures

1. Turn the power OFF.
2. Remove the wiring.
3. Pull the mounting bracket (②) while releasing the hooks upward or downward (①) to remove the mounting bracket. (Fig. 2.3)
4. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument (Fig. 2.4).

Fig. 2.3

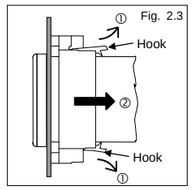
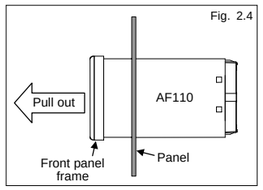


Fig. 2.4



It is possible to pull the AF110 out with the front panel frame while releasing the hooks upward or downward.

2. WIRING

WARNING

To prevent electric shock or instrument failure, do not turn on the power until all wiring is completed. Make sure that the wiring is correct before applying power to the instrument.

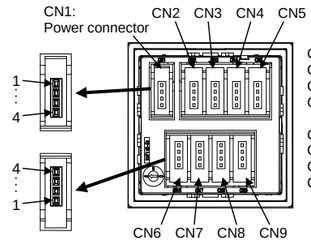
2.1 Wiring Cautions

- To avoid noise induction, keep communication signal wire away from instrument power line, load lines and power lines of other electric equipment.
- If there is electrical noise in the vicinity of the instrument that could affect operation, use a noise filter.
  – Shorten the distance between the twisted power supply wire pitches to achieve the most effective noise reduction.
  – Always install the noise filter on a grounded panel. Minimize the wiring distance between the noise filter output and the instrument power supply terminals to achieve the most effective noise reduction.
  – Do not connect fuses or switches to the noise filter output wiring as this will reduce the effectiveness of the noise filter.
- About 6 seconds are required as preparation time for output every time the instrument is turned on. Use a delay relay when the output line is used for an external interlock circuit.
- Power supply wiring must be twisted and have a low voltage drop.
- For an instrument with 24 V power supply, supply power from a SELV circuit.
- A suitable power supply should be considered in end-use equipment. The power supply must be in compliance with a limited-energy circuits (maximum available current of 8 A).
- This instrument is not provided with a power supply switch or fuse. Therefore, a fuse and power supply switch are required, install close to the instrument.
  Recommended fuse rating: Rated current: 0.5 A
  Fuse type: Time-lag fuse
  (Approved fuse according IEC 60127-2 and/or UL 248-14 and min. interrupting rating 8 A at 24 V DC)
- All wiring must be in accordance with local codes and regulations.

2.2 Connecting Cautions

- Connect connectors correctly in the right position. If it is forcibly pushed in with pins in the wrong positions, the pins may be bent resulting in instrument failure.
- When connecting or disconnecting the connectors, do not force it too far to right and left or up and down, but move it on the straight. Otherwise, the connector pins may be bent, causing instrument failure.
- When disconnecting a connector, hold it by the connector itself. Disconnecting connectors by yanking on their cables can cause breakdowns.
- To prevent malfunction, never touch the contact section of a connector with bare hands or with hands soiled with oil or the like.

2.3 Connector Configuration

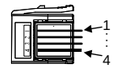


CN2: Sensor input 1 connector
CN3: Sensor input 2 connector
CN4: Sensor input 3 connector
CN5: Sensor input 4 connector

CN6: Alarm output DO1/DO2 connector
CN7: Alarm output DO3/DO4 connector
CN8: Alarm output DO5/DO6 connector
CN9: Alarm output DO7/DO8 connector

The plug and cable must be provided by the customer.
Recommended plug (e-CON compliant plug):
Mini-Clamp Plug, Wiremount (Positions: 4)
3M product or equivalent
[Applicable cable size: 0.14 to 0.50 mm^2 (AWG No. 22 to 26)]
Connector used (e-CON compliant socket):
Mini-Clamp Socket, Boardmount, Straight Solder Tails
Single row style: 37204-62A3-004PL, 4 row style: 37216-62M3-004PL
3M product or equivalent

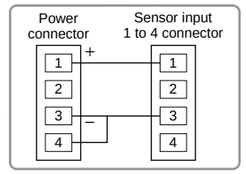
■ Power connector (CN1)



Pin No.	CN1
1	+
2	NC
3	24 V DC −
4	*

* Pin Nos. 3 and 4 are shorted in the instrument inside.

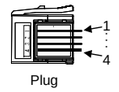
Be sure to wire the power correctly and use the correct polarity.
Power connector and Sensor input connector from 1 to 4 are connected in the instrument inside.
Damage to the instrument and sensor will result from reversing polarity.



The Power connector (CN1) is half covered with a sticker to prevent misinsertion. Remove the sticker when connecting the plug for power supply.

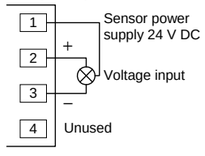
■ Sensor input connector (CN2 to CN5: Sensor input 1 to 4)

● Voltage input



Pin No.	CN2	CN3	CN4	CN5
1	Sensor power supply 24 V DC	Sensor power supply 24 V DC	Sensor power supply 24 V DC	Sensor power supply 24 V DC
2	+ IN1 (CH1) −	+ IN2 (CH2) −	+ IN3 (CH3) −	+ IN4 (CH4) −
3				
4	Unused	Unused	Unused	Unused

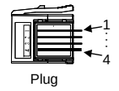
Wiring example:



Measured input value may not display properly when using sensor power supply at voltage input because of the electric power consumption of sensor or wiring impedance.
Conduct Auto-zero to adjust the zero point to display the measured input value properly.

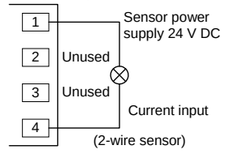
For the Auto-zero, refer to the **AF110 Instruction Manual (IMR02K02-E□)**.

● Current input

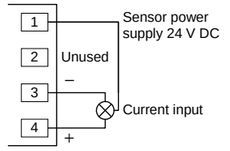


Pin No.	CN2	CN3	CN4	CN5
1	Sensor power supply 24 V DC	Sensor power supply 24 V DC	Sensor power supply 24 V DC	Sensor power supply 24 V DC
2	Unused	Unused	Unused	Unused
3	− IN1 (CH1)	− IN2 (CH2)	− IN3 (CH3)	− IN4 (CH4)
4	+	+	+	+

Wiring example 1:

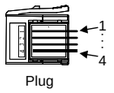


Wiring example 2:



■ Alarm output connector (CN6 to CN9: DO1 to DO8)

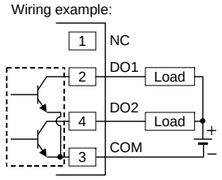
Open collector output



Plug

Pin No.	CN6	CN7	CN8	CN9
1	NC	NC	NC	NC
2	DO1	DO3	DO5	DO7
3	COM	COM	COM	COM
4	DO2	DO4	DO6	DO8

Wiring example:



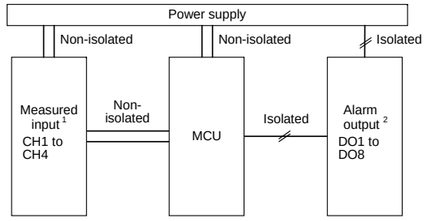
Output assignment (Fixed):

Input	CH1	CH2	CH3	CH4
Output	DO1 (ALM1) DO2 (ALM2) [CN6]	DO3 (ALM1) DO4 (ALM2) [CN7]	DO5 (ALM1) DO6 (ALM2) [CN8]	DO7 (ALM1) DO8 (ALM2) [CN9]

ALM1: Alarm 1 output ALM2: Alarm 2 output

■ Isolations of input and output

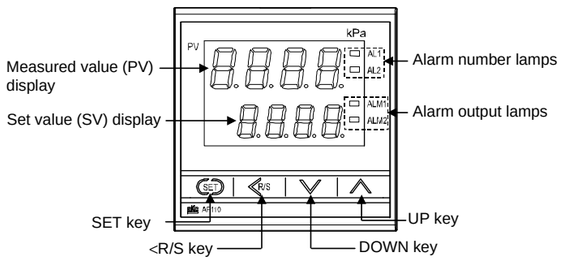
For isolated device input/output blocks, refer to the following:



[1] Measured inputs (CH1 to CH4) are not mutually isolated.

[2] Alarm outputs (DO1 to DO8) are not mutually isolated.

3. PARTS DESCRIPTION

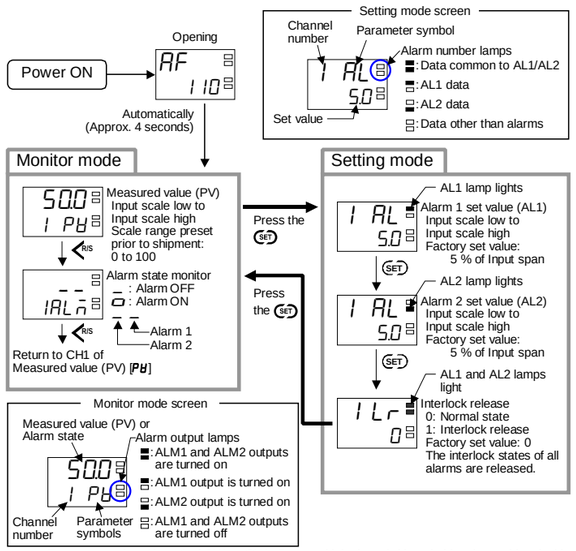


Measured value (PV) display [Green]	For monitor	Displays Measured value (PV) and alarm state.
	For data setting	Displays channel number and various parameter symbols of setting items.
Set value (SV) display [Orange]	For monitor	Displays channel number and parameter symbols of monitor items.
	For data setting	Displays various parameters' set values.
Alarm number lamps [Green] AL1, AL2	The lamp corresponding to the currently used alarm number (AL1 or AL2) lights. AL1: Alarm 1 AL2: Alarm 2	
Alarm output lamps [Orange] ALM1, ALM2	Lights when alarm output is turned on. (Logical *OR* of all channels) ALM1: Alarm 1 output ALM1: Alarm 2 output	
UP key	Use to increase a numerical value. Use to change to the next channel. Holding down the UP key rapidly advances the value.	
DOWN key	Use to decrease a numerical value. Use to change back to the previous channel. Holding down the DOWN key rapidly advances the value.	
<R/S key (Shift key)	Use to start changing settings. Use to move to a different digit when changing a setting. Used to switch monitor items and modes.	
SET key	Used for parameter calling up and set value registration.	

To avoid damage to the instrument, never use a sharp object to press keys.

4. OPERATION

Display returns to the Measured value (PV) monitor screen if no key operation is performed within 1 minute or when going back to the Monitor mode from the other modes.



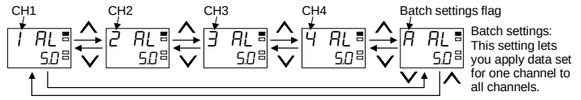
Factory set value: Alarm 1 of CH1 to CH4: Process high alarm (without hold action and interlock)
Alarm 2 of CH1 to CH4: Process low alarm (without hold action and interlock)

For the parameters of Engineering mode and Initial setting mode, refer to the **AF110 Instruction Manual (IMR02K02-E□)**.

■ Channel selection

Pressing the ∧ or ∨ key enables channel selection. When the ∧ key or ∨ key is pressed repeatedly in the Setting mode parameters (only data for each channel), the Batch settings flag (*R*) will appear after the last channel (CH4).

Example: Alarm 1 set value (AL1)

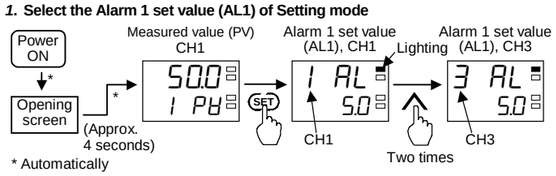


■ Changing data settings

- To store a new value for the parameter, always press the SET key.
- After a new value is displayed on the display by using ∧ and ∨ keys, if no key operation is performed for more than 20 seconds without pressing SET key, the value being set is canceled and the previous value is restored.

Example: Changing the CH 3 Alarm 1 set value (AL1) to 25.0 kPa.

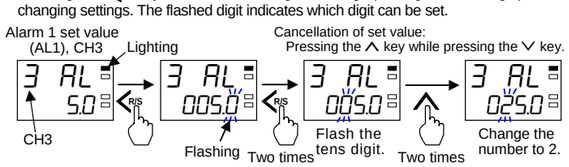
***1.* Select the Alarm 1 set value (AL1) of Setting mode**



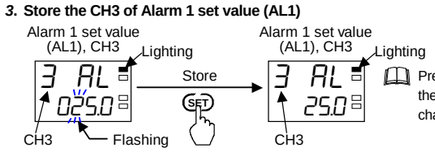
* Automatically

***2.* Change the CH3 of Alarm 1 set value (AL1) to 25.0 kPa**

Pressing the R/S key to flash the least significant digit (first digit from the right) and start changing settings. The flashed digit indicates which digit can be set.



***3.* Store the CH3 of Alarm 1 set value (AL1)**



Press the SET key to go to the next parameter of channel 1.

Other data can also be set by the same procedures as described in steps ***1*** to ***3***.

5. ERROR DISPLAYS

■ Display when input error occurs

Prior to replacing the sensor, always turn OFF the power.

Display	Description	Event output	Solution
PV [Flashing]	PV exceeds the Input scale high/low.	Output depending on the alarm action	Check input type, input range, sensor and sensor connection.
▫▫▫▫ [Flashing]	Over-scale • PV is above the Input scale high + (5 % of Input span). • PV is above the +9999		
▫▫▫▫ [Flashing]	Underscale • PV is below the Input scale low – (5 % of Input span) • PV is below the –1999		

■ Self-diagnostic error

In an error is detected by the self-diagnostic function, the PV display shows "Err," and the SV display shows the error code. If two or more errors occur simultaneously, the total summation of these error codes is displayed.

Solution: Turn off the power once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.

SV display	Description	Display	Output action
1	Adjustment data error	Display: Error display (Err and error number)	Alarm output: OFF
2	Back-up error		
4	A/D conversion error		
8	EEPROM error		
All display is OFF	Power supply voltage is abnormal	Display: All display is OFF	
	Watchdog timer		

6. SPECIFICATIONS

■ Input

Measured Input (PV)

Input type and range:

Input type		Input impedance
Voltage input	0 to 5 V DC	Approx. 1 MΩ
	0 to 10 V DC	
	1 to 5 V DC	
Current input	0 to 20 mA DC	Approx. 50 Ω
	4 to 20 mA DC	

Range (Input span): –1999 to +9999 (No decimal place) [The input decimal point position is selectable to decimal three places]
Scaling by Input scale low and Input scale high is possible.
(Factory set value: 0.0 to 100.0)
Decimal point position: No decimal place, One decimal place, Two decimal places, Three decimal places
Number of input: 4 points
Sampling cycle: 1 second
Action at input beak: Downscale or indicates the value near 0
Measured input correction:
- PV bias: –Input span to +Input span (within –1999 to+9999)
- First order lag digital filter: 0 to 100 seconds (0: OFF)
- Auto-zero (zero-point adjustment): Adjust the zero point of the Measured value (PV). Auto-zero is used to automatically set the PV bias (Pb) so that the Measured value (PV) will be 0.

■ Output

Alarm output (DO1 to DO8)

Number of output: 8 points (2 points/Input channel, Fixed)
Output type: Open collector output
Output method: Sink type
Allowable load current: 100 mA
Load voltage: 30 V DC or less
Minimum load current: 0.1 mA
ON voltage: 2 V or less (at maximum load current)
Leakage current at OFF: 0.1 mA or less

Sensor power supply 24 V

Output voltage: 24 V±10% DC
Allowable load current: 200 mA (total of 4 channels)

■ Performance (at the ambient temperature 23 ± 2 °C and the mounting angle ± 3 °)

Measured input accuracy

Accuracy: ±(0.2 % of input span+1 digit)
Noise rejection: Normal mode: 60 dB or more (50/60Hz)
Common mode:120 dB or more (50/60Hz)
Input resolution: 20000 or more

Influence

Influence ambient temperature (0 to 40 °C):
Voltage/Current inputs: ±0.01 %/°C of span
Influence of physical orientation (± 90° all orientations):
Voltage/Current inputs: Less than ±0.2 % of span
Input error is added to the accuracy.

■ Functions

Alarm function

Number of alarms: Up to 8 points (2 points/Input channel, Fixed)
Alarm type: Process high, Process low
Alarm setting range Input scale low to Input scale high
Additional function: Hold action, Interlock, Energized/De-energized
Delay timer: 0 to 600 seconds
Differential gap: 0 to Input span (9999 or less)
Output method: Assignable to digital output (DO1 to DO8)
Output assignment (Fixed):

Input	CH1	CH2	CH3	CH4
Output	DO1 (ALM1) DO2 (ALM2)	DO3 (ALM1) DO4 (ALM2)	DO5 (ALM1) DO6 (ALM2)	DO7 (ALM1) DO8 (ALM2)

ALM1: Alarm 1 output ALM2: Alarm 2 output

■ General specifications

Power supply voltage: 21.6 to 26.4 V DC [Including power supply voltage variation] (Rating 24 V DC)
Power consumption: Instrument: Maximum 65 mA (at 24 V DC)
Rush current: 11 A or less
Sensor power supply: Maximum 200 mA (total of 4 channels)
Allowable ambient temperature: 0 to 40 °C
Allowable ambient humidity: 10 to 90 %RH
(Absolute humidity: MAX.W.C 29.3 g/m^3 dry air at 101.3kPa)
Insulation resistance: Between measuring terminal and grounding: 20 MΩ or more at 500 V DC
Between power supply terminal and grounding: 20 MΩ or more at 500 V DC
When grounding is not provided: Between panels
Withstand voltage:

Time: 1 min	①	②	③
① Grounding terminal			
② Power terminal	1500 V AC		
③ Measured input terminals	1000 V AC		
④ Alarm output terminal (Open collector output)	1000 V AC	750 V AC	750 V AC

Power failure: A power failure of 25 ms or less will not affect the control action.
Memory backup: Backed up by non-volatile memory
Number of writing: 1,000,000 times
Depending on storage and operating conditions.
Data storage period: Approx. 10 years
Mounting and structure: Mounting method: Panel-mounted
Mounting orientation: ± 90 °
Case color: Black basic tone
Front panel material: PC [Flame retardancy: UL94 V-2]
Panel sheet material: PET [Flame retardancy: UL VTM-2]
Mounting bracket material: POM [Flame retardancy: UL94 HB]
Weight: Approx. 100 g

■ Standard (Pending)

Safety standards: UL: UL61010-1
cUL: CAN/CSA-C22.2 No.61010-1
CE marking: LVD: EN61010-1
OVERVOLTAGE CATEGORYII,
POLLUTION DEGREE 2
EMC: EN61326-1
RCM: EN55011
Panel sealing: IP66 (IEC60529)
[Front panel (if specified in the model code)]

7. MODEL CODE

■ Suffix code

AF110- 4 □ -3 ∗ 8D /□
(1) (2) (3) (4) (5)

(1) Type
4: 4-channel type

(2) Input type (common to all channels)
4: Voltage input (0 to 5 V DC)
5: Voltage input (0 to 10 V DC)
6: Voltage input (1 to 5 V DC)
7: Current input (0 to 20 mA DC)
8: Current input (4 to 20 mA DC)

Programmable range
–1999 to +9999 [The decimal point position is selectable]
(Factory set value: 0.0 to 100.0)

(3) Power supply voltage
3: 24 V DC

(4) Alarm output (DO1 to DO8)
8D: 8 points (2 points/Input channel, Fixed)
[Open collector output]

(5) Waterproof/Dustproof
No code: None
1: Waterproof/Dustproof (IP66)

RKC RKC INSTRUMENT INC. The first edition: OCT. 2009 [IMQ01]
The third edition: NOV. 2015 [IMQ00]
HEADQUARTERS: 16-6, KUGAHARA 5-CHOME, OHTA-KU TOKYO 146-8515 JAPAN
PHONE: 03-3751-9799 (+81 3 3751 9799) E-mail: info@rkcinst.co.jp
FAX: 03-3751-8585 (+81 3 3751 8585)
NOV. 2015