Digital Controller

FB100 Installation Manual

All Rights Reserved, Copyright © 2008, RKC INSTRUMENT INC.   **IMR01W12-E5**

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 handling precautions, mounting, wiring and specifications only. For the basic operations, refer to FB100 Quick Operation Manual (IMR01W13-E☐). For detailed handling procedures and various function settings, please refer to the following separate manuals:

- FB100 Instruction Manual (IMR01W16-E☐)
- FB100/FB400/FB900 Communication Instruction Manual (IMR01W04-E☐)

📖 These manuals can be downloaded from the official RKC website:
URL: http://www.rkcinst.com/english/manual_load.htm

■ Product Check

■ Optional (Sold separately)

■ 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.
- This instrument is protected from electric shock by reinforced insulation. Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.
- 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.
- Tighten each terminal screw to the specified torque found in the manual 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/re-hold action is used for Event 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.
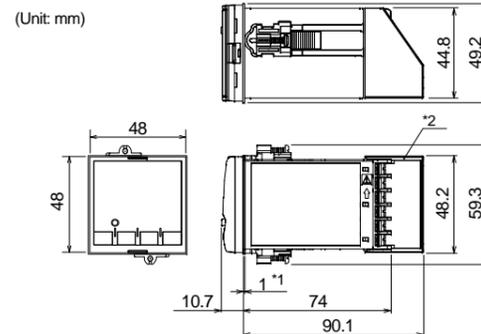
1. MOUNTING

⚠ **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: –10 to +50 °C
- Allowable ambient humidity: 5 to 95 %RH
  (Absolute humidity: MAX. W. C 29.3 g/m³ dry air at 101.3 kPa)
- Installation environment conditions: Indoor use
  Altitude up to 2000 m

(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:
- Provide adequate ventilation space so that heat does not build up.
- 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 50 °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.
- Mount this instrument in the horizontal direction for panel. If you did installation except a horizontal direction, this causes malfunction.

(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.
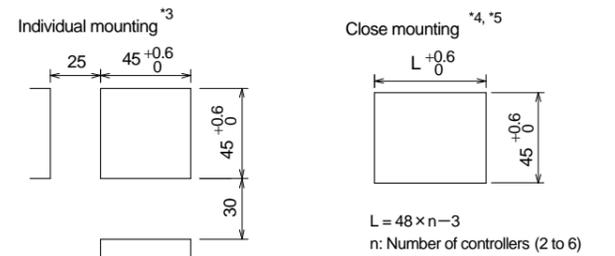
1.2 Dimensions

(Unit: mm)

*1 Case rubber packing
*2 Terminal cover KCA100-517 (optional) [sold separately]

● Panel cutout

(Unit: mm)

Individual mounting *3

Close mounting *4, *5

L = 48 × n − 3
n: Number of controllers (2 to 6)

Panel thickness: 1 to 10 mm
(When mounting multiple FB100s close together, the panel strength should be checked to ensure proper support.)

*3 When cutting out each mounting hole through a panel for individual mounting, observe that there is no bur or distortion along the panel cutout surface, or there is no bend on the panel surface. If so, the water resistant characteristics may worsen.

*4 Remove the case rubber packing. Because of closely mounting the FB100s, protection will be compromised and not meet IP66 (NEMA 4X) by close mounting.

*5 When controllers are closely mounted, ambient temperature must not exceed 50 °C.

1.3 Procedures of Mounting and Removing

■ Mounting procedures

1. Prepare the panel cutout as specified in **1.2 Dimensions**.
2. Insert the instrument through the panel cutout.
3. Insert the mounting bracket into the mounting groove of the instrument. (Fig. 1)
4. Push the mounting bracket forward until the bracket is firmly secured to the panel. (Fig. 2)
5. Only turn one full revolution after the screw touches the panel. (Fig. 3)
6. The other mounting bracket should be installed the same way described in **3**. to **5**.

📖 The front of the instrument conforms to **IP66 (NEMA 4X)** when mounted on the panel. For effective waterproof/dustproof, the gasket must be securely placed between instrument and panel without any gap. If gasket is damaged, please contact RKC sales office or the agent.

Fig. 1

Fig. 2

Fig. 3

■ Removing procedures

1. Turn the power OFF.
2. Remove the wiring.
3. Loosen the screw of the mounting bracket. (Fig. 4)
4. Lift the latch of the mounting bracket (①), then pull the mounting bracket (②) to remove it from the case. (Fig. 4)
5. The other mounting bracket should be removed in the same way as described in **3**. and **4**.
6. Pull out the instrument from the mounting cutout while holding the front panel frame of this instrument. (Fig. 5)

Fig. 4

Loosen the screw

Fig. 5

Panel

Pull out

Front panel frame

📖 Use long-nose pliers to remove mounting brackets from the instrument that is installed in a narrow place or installed tightly in a vertical position.
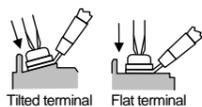
2. WIRING

⚠ **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

- For thermocouple input, use the appropriate compensation wire.
- For RTD input, use low resistance lead wire with no difference in resistance between the three lead wires.
- To avoid noise induction, keep input 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 five seconds are required as preparation time for contact 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 furnished with a power supply switch or fuse. Therefore, if a fuse or power supply switch is required, install close to the instrument.
  Recommended fuse rating: Rated voltage 250 V, Rated current 1 A
  Fuse type: Time-lag fuse
- Use the solderless terminal appropriate to the screw size.
  Screw size:
  M3 × 7 (with 5.8 × 5.8 square washer)
  Recommended tightening torque:
  0.4 N·m (4 kgf·cm)
  Applicable wire:
  Solid/twisted wire of 0.25 to 1.65 mm²
  Specified dimension: Refer to Fig. 6
  Specified solderless terminals:
  Manufactured by J.S.T MFG CO., LTD.
  Circular terminal with isolation V1.25–MS3
  (M3 screw, width 5.5 mm,
  hole diameter 3.2 mm)
- Make sure that the any wiring such as solderless terminal is not in contact with the adjoining terminals.
- Up to two solderless terminal lugs can be connected to one terminal screw, then refer to figure 7.
  However, in this case, reinforced insulation cannot be used.

Fig. 6

φ5.5 MAX
φ3.2 MIN
φ5.0
5.6 mm
9.0 mm

Fig. 7: Image of how to bend each solderless terminal lug

Top view
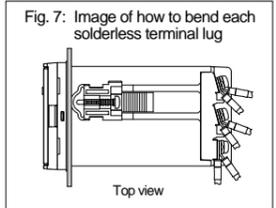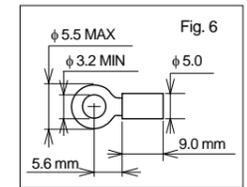
📖 When tightening a screw of the instrument, make sure to fit the screwdriver properly into the screw head mounted tilted or flat as shown in the right figure. Tightening the screw with excessive torque may damage the screw thread.

Tilted terminal   Flat terminal

📖 If solderless terminal lugs other than those in not recommended dimensions are used, terminal screws may not be tightened. In such a case, bend each solderless terminal lug in advance and then conduct wiring. If the terminal screw is forcibly tightened, it may be damaged.

📖 When two solderless terminal lugs are connected to one terminal screw, terminal cover cannot be used.

📖 For isolated device input/output blocks, refer to the following:
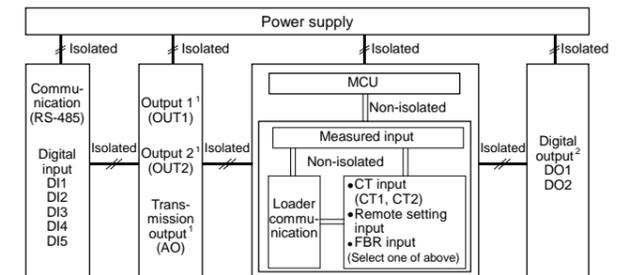
[1] Outputs are isolated if output 1 (OUT1) or output 2 (OUT2) is "relay contact output" or "triac trigger output." If both outputs are "relay contact output" or " triac trigger output," outputs are not isolated.

[2] Digital outputs (relay contact output type only) are not mutually isolated.

2.2 Terminal Configuration

Power supply

AC L	AC L	DC +
100-240 V	24 V	24 V
N	N	—

Relay contact (2)
COM 7
DO2 NO 8
DO1 NO 9

Output 2 [a]

Relay contact (1): OUT2 NO
Triac: OUT2 Triac

Output 1 [a]

Relay contact (1): OUT1 NO
Triac: OUT1 Triac

Voltage pulse/Voltage/Current: OUT2 +/−
Open collector: OUT2
Voltage pulse/Voltage/Current: OUT1 +/−
Open collector: OUT1

Measured input

Thermocouple	RTD	Voltage/Current
+ 11 TC − 12	A 10 RTD B 11 B 12	IN 11 12

Optional function

Optional: A — Digital input [b] (DI1 to DI5)
Dry contact input: COM 13, DI1 14, DI2 15, DI3 16, DI4 17, DI5 18
Remote setting input: Voltage/Current IN 17, 18

Optional: B [c] — Digital input [b] (DI1, DI2)
Dry contact input: COM (−) 13, DI1 14, DI2 15
FBR input: O 16, W 17, C 18

Optional: C — Digital input [b] (DI1, DI2)
Dry contact input: COM (−) 13, DI1 14, DI2 15
CT input: COM 16, CT1 17, CT2 18

Optional: D — Digital input [b] (DI1, DI2)
Dry contact input: COM (−) 13, DI1 14, DI2 15
Digital input [b] (DI1 to DI3): COM (−) 16, DI1 17, DI2 18, DI3

Optional: E [d] — Communication
SG 13, RS-485 T/R (A) 14 [Communication 1], T/R (B) 15
Digital input [b] (DI1): Dry contact input COM (−) 16, DI1
CT input: COM 17, CT1 18

Optional: F [d] — Communication
SG 13, RS-485 T/R (A) 14 [Communication 1], T/R (B) 15
Digital input [b] (DI1): Dry contact input COM (−) 16, DI1
CT input: COM 17, CT1 18

Optional: G — Communication
SG 13, RS-485 T/R (A) 14 [Communication 1], T/R (B) 15
SG 16, RS-485 T/R (A) 17 [Communication 2], T/R (B) 18

Optional: H — Communication
SG 13, RS-485 T/R (A) 14 [Communication 1], T/R (B) 15
CT input: COM 16, CT1 17, CT2 18

Optional: J [d] — Communication
SG 13, RS-485 T/R (A) 14 [Communication 1], T/R (B) 15
Digital input [b] (DI1): Dry contact input COM (−) 16, DI1
Remote setting input: Voltage/Current IN 17, 18

Optional: 3, 4, 5, 6, 7, 8 — Digital input [b] (DI1)
Dry contact input: COM (−) 13, DI1 14
Transmission output: Voltage/Current AO 17, 18

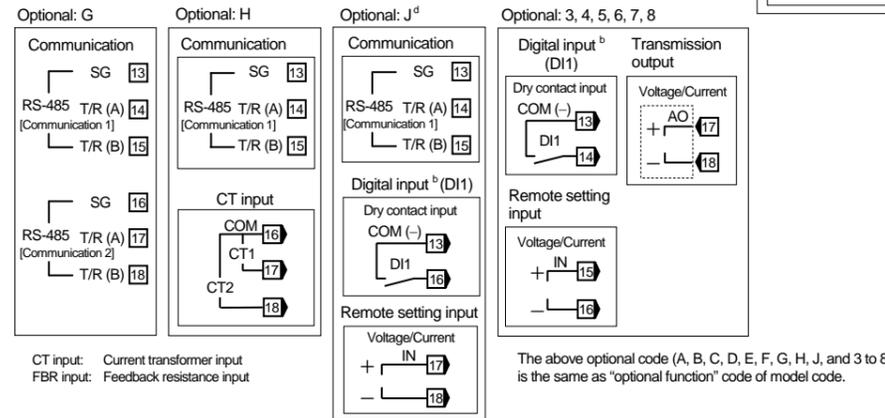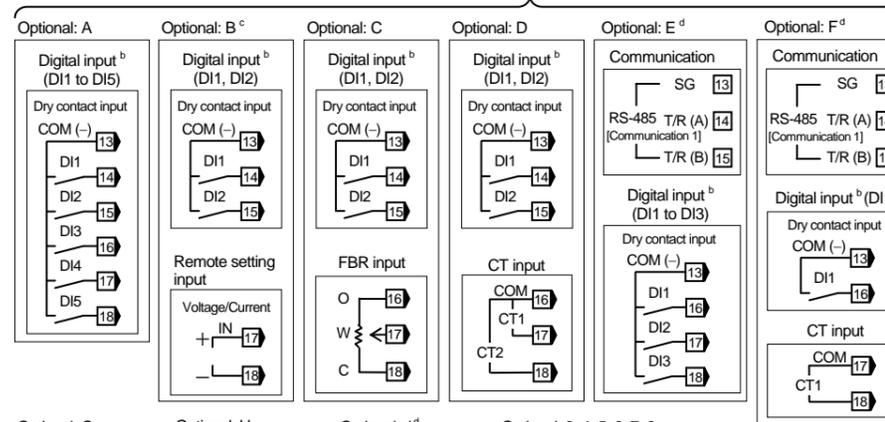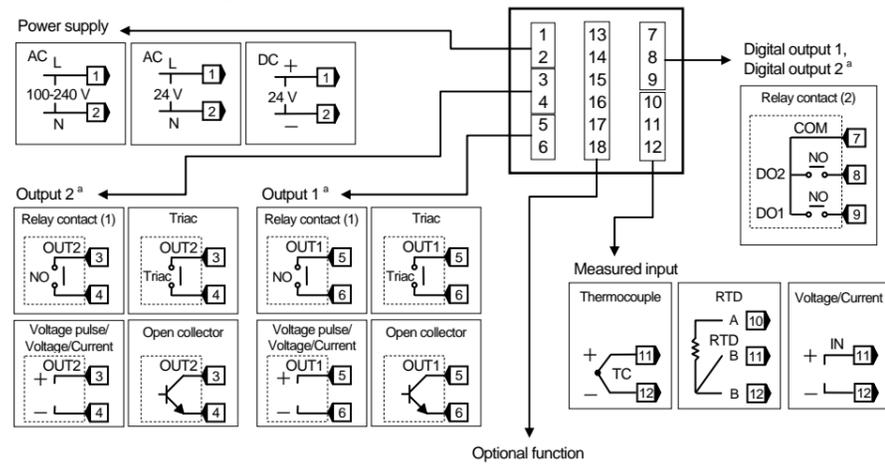CT input: Current transformer input
FBR input: Feedback resistance input

The above optional code (A, B, C, D, E, F, G, H, J, and 3 to 8) is the same as "optional function" code of model code.

[a] Output assignment
Output 1 (OUT1) and Output 2 (OUT2):
Control output or Digital output can be allocated to OUT1 and OUT2.
For Heat/Cool PID control, OUT1 corresponds to the heat-side output and OUT2 corresponds to the cool-side output.
For Position proportioning PID control, OUT1 corresponds to the open-side output and OUT2 corresponds to the close-side output.
Digital output 1 (DO1) and Digital output 2 (DO2):
Output of the Event function can be allocated to DO1 and DO2.
• The following two methods of setting the output assignments are available:
Specify when ordering (Initial setting code)
Setting for Output assignment (Engineering Mode)

Table 1: Output type

	OUT1 OUT2	DO1 DO2	AO
Relay contact output (1)	○		
Relay contact output (2)		○	
Voltage pulse output	○		
Current output	○		○
Voltage output 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC	○		○
Voltage output 0 to 1 V DC			○
Triac output	○		
Open collector output	○		

(○: Indicates that an output specification is supported.)

[b] Digital input (DI1 to DI5) can be changed by the Digital input (DI) assignment in the Engineering Mode.
[c] In the case of optional B, terminal No. 16 is unused, but be connected with SG inside.
[d] In the case of optional E, F and J, the COM (−) of the Digital input shares terminal No. 13 with SG of the communication.

Table 2: Input type and Measured range

Input type	Measured range	Input type	Measured range
K	−200.0 to +400.0 °C	W5Re/W26Re	0 to 2300 °C
	−200.0 to +800.0 °C		0 to 4200 °F
	−200 to +1372 °C	U	−200.0 to +400.0 °C
	−328.0 to +400.0 °F		0.0 to 600.0 °C
	−250.0 to +800.0 °F		32.0 to 1112.0 °F
	−328 to +2502 °F	L	0.0 to 900.0 °C
	0.0 to 400.0 °C		32.0 to 1652.0 °F
J	−200.0 to +400.0 °C	Pt100	−100.00 to +100.00 °C
	−200.0 to +800.0 °C		−200.0 to +850.0 °C
	−200.0 to +800.0 °C		−199.99 to +199.99 °F
	−200 to +1200 °C		−328.0 to +1562.0 °F
	−200.0 to +400.0 °F		−100.00 to +100.00 °C
	−328.0 to +1200.0 °F		−200.0 to +640.0 °C
	−328 to +2192 °F		−199.99 to +199.99 °F
T	−200.0 to +400.0 °C	JPt100	−328.0 to +1184.0 °F
	−328.0 to +752.0 °F		±1 V
S, R	−50 to +1768 °C		0 to 5 V
	−58 to +3214 °F		1 to 5 V
E	−200.0 to +400.0 °C		0 to 10 V
	−200 to +1000 °C		0 to 1 V
	−328.0 to +1292.0 °F		0 to 100 mV
	−328 to +1832 °F		0 to 10 mV
B	0 to 1800 °C		±100 mV
	0 to 3272 °F		±10 mV
N	0 to 1300 °C		0 to 20 mA
	0 to 2372 °F		4 to 20 mA
PLII	0 to 1390 °C		Programmable range (−19999 to +19999)
	0 to 2534 °F		

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3. SPECIFICATIONS

Measured input
Number of input: 1 point
Input type and range: Refer to Table 2.
Sampling cycle: 100 ms±0.3 %
(50 ms±5 % or 250 ms±0.3 % is selectable)
Influence of external resistance:
Approx. 0.2 μV/Ω
(Converted depending on TC types)
Influence of input lead: Approx. 0.01 %/Ω of PV (RTD input)
10 Ω or less per wire
Input impedance: TC input: 1 MΩ or more
Voltage (low) input: 1 MΩ or more
Voltage (high) input: Approx. 1 MΩ
Current input: Approx. 50 Ω
Sensor current: Approx. 250 μA (RTD input)
Action at input break:
TC input, Voltage (low) input:
Upscale or Downscale
RTD input: Upscale
Voltage (high) input, Current input:
Downscale (Indicates the value 0)
Action at input short circuit: Downscale (RTD input)
Input correction:
PV bias: −Input span to +Input span
PV ratio: 0.500 to 1.500
First order lag digital filter: 0.0 to 100.0 seconds (0.0: OFF)
Low level cutoff: 0.00 to 25.00 %/of input span
Cold-junction temperature compensation error (TC input):
Within ±1.0 °C
Within ±1.5 °C (range of −10 to +50 °C)

Remote setting (RS) input [Optional]
Number of input: 1 point (Not isolated from measured input)
Input type:
Voltage (low) input: 0 to 10 mV DC, 0 to 100 mV DC, 0 to 1 V DC
Voltage (high) input: 0 to 5 V DC, 1 to 5 V DC, 0 to 10 V DC
Current input: 0 to 20 mA DC, 4 to 20 mA DC
Sampling cycle: Twice of the measured input sampling cycle
Input impedance:
Voltage (low) input: 1 MΩ or more
Voltage (high) input: Approx. 1 MΩ
Current input: Approx. 50 Ω
Action at input break: Downscale (Indicates the value 0)
Input correction:
RS bias: −Input span to +Input span
RS ratio: 0.001 to 9.999
RS digital filter (first order lag): 0.0 to 100.0 seconds (0.0: OFF)
Allowable input voltage: Voltage (low) input: Within ±3.5 V
Voltage (high) input: Within ±12 V

Current transformer (CT) input [Optional]
Number of inputs: 2 points max.
CT type: CTL-6-P-N or CTL-12-S56-10L-N (Sold separately)
Input range: CTL-6-P-N: 0.0 to 30.0 A
CTL -12-S56-10L-N: 0.0 to 100.0 A
Automatic power frequency detection:
Power frequency can be set by automatic detection. No frequency may be able to be detected if at a CT value of less than 0.5 A.
Sampling cycle: Twice of the measured input sampling cycle

Feedback resistance (FBR) input [Optional]
Number of input: 1 point
Permissible resistance range:
100 Ω to 10 kΩ (Standard: 135 Ω)
Input range: 0.0 to 100.0 %
(for adjustment span of open and close)
Sampling cycle: Twice of the measured input sampling cycle
Action at FBR break: Upscale

Digital input (DI) [Optional]
Number of inputs: 5 points max. (DI1 to DI5)
Input method: Dry contact input
Open state: 500 kΩ or more
Close state: 10 Ω or less
Contact current: 5 mA or less
Voltage at open: Approx. 5 V DC
Capture judgment time: 200 ms

Output
Number of outputs: 5 points max.
(OUT1, OUT2, DO1, DO2, AO [optional])
Output type: Refer to Table 1.
• Relay contact output (1)
Contact type: 1a contact
Contact rating (Resistive load):
250 V AC 3 A / 30 V DC 1 A
Electrical life: 100,000 times or more (Rated load)
(Switching: 10 times/min)
Mechanical life: 20 million times or more
(Switching: 300 times/min)
• Relay contact output (2)
Contact type: 1a contact
Contact rating (Resistive load):
250 V AC 1 A / 30 V DC 1 A
Electrical life: 300,000 times or more (Rated load)
(Switching: 10 times/min)
Mechanical life: 20 million times or more
(Switching: 300 times/min)
• Voltage pulse output
Output voltage: 0/12 V DC (Rating)
ON voltage: 11 to 13 V
OFF voltage: 0.2 V or less
Allowable load resistance: 600 Ω or more

• Current output
Output current (Rating): 4 to 20 mA DC, 0 to 20 mA DC
Output range: 1 to 21 mA DC, 0 to 21 mA DC
Allowable load resistance: 600 Ω or less
Output impedance: 1 MΩ or more
• Voltage output
Output voltage (Rating): 0 to 10 V DC, 0 to 5 V DC, 1 to 5 V DC, 0 to 1 V DC
Output range: −0.5 to +10.5 V DC, −0.25 to +5.25 V DC, 0.8 to 5.2 V DC, −0.05 to +1.05 V DC
Allowable load resistance: 1 kΩ or more
Output impedance: 0.1 Ω or less
• Triac output
Output method: AC output (Zero-cross method)
Allowable load current: 0.5 A (Ambient temperature 40 °C or less)
Ambient temperature 50 °C: 0.3 A
Load voltage: 75 to 250 V AC
Minimum load current: 30 mA
ON voltage: 1.6 V or less (at maximum load current)
• Open collector output
Output type: Sink type
Allowable load current: 100 mA
Load voltage: 30 V DC or less
Minimum load current: 0.5 mA
ON voltage: 2 V or less (at maximum load current)
Leakage current at OFF: 0.1 mA or less

Communication [Optional]
Interface: Based on RS-485, EIA standard
Multi-drop connection is available.
Protocol:
• RKC communication (ANSI X3.28-1976 subcategories 2.5 and A4)
• Modbus-RTU
Termination resistor: Externally connected
(Example: 120 Ω 1/2 W)

General specifications
Power supply voltage:
• 100 to 240 V AC type:
90 to 264 V AC [Including power supply voltage variation], 50/60 Hz (Rating 100 to 240 V AC)
Frequency variation: 50 Hz±10 %, 60 Hz±10 %
• 24 V AC type:
21.6 to 26.4 V AC [Including power supply voltage variation], 50/60 Hz (Rating 24 V AC)
Frequency variation: 50 Hz±10 %, 60 Hz±10 %
• 24 V DC type:
21.6 to 26.4 V DC [Including power supply voltage variation] (Rating 24 V DC)
Power consumption (at maximum load):
• 100 to 240 V AC type:
5.4 VA max. (at 100 V AC), 8.1 VA max. (at 240 V AC)
• 24 V AC type:
5.3 VA max. (at 24 V AC)
• 24 V DC type:
142 mA max. (at 24 V DC)
• Rush current: 12 A or less
Allowable ambient temperature: −10 to +50 °C
Allowable ambient humidity: 5 to 95 %RH
(Absolute humidity: MAX.W.C 29.3 g/m³ dry air at 101.3 kPa)
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
Between power supply and measuring terminals:
20 MΩ or more at 500 V DC
When grounding is not provided: Between panels
Withstand voltage:

Time: 1 min.	①	②	③	④	⑤
① Grounding terminal					
② Power terminal	1500 V AC				
③ Measured input terminal	1500 V AC	2300 V AC			
④ Output terminal (Relay contact, Triac)	1500 V AC	2300 V AC	2300 V AC		
⑤ Output terminal (Voltage, Current)	1500 V AC	2300 V AC	1500 V AC		
⑥ Communication, digital input (DI) terminals	1500 V AC	2300 V AC	510 V AC	2300 V AC	1000 V AC

Transportation and Storage environment conditions:
• Shock: Height 800 mm or less
• Temperature: −25 to +55 °C (at storage), −40 to +70 °C (at transport)
• Humidity: 5 to 100 %RH (Non condensing)
Installation environment conditions:
Indoor use
Altitude up to 2000 m
Weight: Approx. 150 g

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4. MODEL CODE

■ Suffix code

FB100 -□□ - □ ∗ □/□□ -□ □□□/Y
(1) (2) (3) (4) (5) (6) (7) (8) (9)

∗ : Indicates a specification code to be optional specified. If this section is blank, this means that no code is described on the nameplate.

(1) Output 1 (OUT1), (2) Output 2 (OUT2)
N: None (OUT2 only)
M: Relay contact output
V: Voltage pulse output
4: Voltage output (0 to 5 V DC)
5: Voltage output (0 to 10 V DC)
6: Voltage output (1 to 5 V DC)
7: Current output (0 to 20 mA DC)
8: Current output (4 to 20 mA DC)
T: Triac output
D: Open collector output

(3) Power supply voltage
3: 24 V AC/DC
4: 100 to 240 V AC

(4) Optional function
N: None
A: Digital input (5 points)
B: Digital input (2 points) + Remote setting input
C: Digital input (2 points) + Feedback resistance input
D: Digital input (2 points) + CT input (2 points)
E: Digital input (3 points) + Communication (1 point)
F: Digital input (1 point) + Communication (1 point) + CT input (1 point)
G: Communication (2 points)
H: Communication (1 point) + CT input (2 points)
J: Digital input (1 point) + Communication (1 point) + Remote setting input
3: Digital input (1 point) + Remote setting input + Transmission output [Voltage output (0 to 1 V DC)]
4: Digital input (1 point) + Remote setting input + Transmission output [Voltage output (0 to 5 V DC)]
5: Digital input (1 point) + Remote setting input + Transmission output [Voltage output (0 to 10 V DC)]
6: Digital input (1 point) + Remote setting input + Transmission output [Voltage output (1 to 5 V DC)]
7: Digital input (1 point) + Remote setting input + Transmission output [Current output (0 to 20 mA DC)]
8: Digital input (1 point) + Remote setting input + Transmission output [Current output (4 to 20 mA DC)]

(5) Case color
N: White
A: Black

(6) Quick start code
N: No quick start code (Configured to factory set value) *
1: Specify quick start code 1
2: Specify quick start code 1 and 2
* Factory set value: Refer to the Parameter list (IMR01W14-E□).

(7) Control Method [Quick start code 1]
No code: Quick start code 1 is not specified
F: PID control with AT (Reverse action)
D: PID control with AT (Direct action)
G: Heat/Cool PID control with AT
A: Heat/Cool PID control with AT (for Extruder [air cooling])
W: Heat/Cool PID control with AT (for Extruder [water cooling])
Z: Position proportioning PID control without FBR (Reverse action)
C: Position proportioning PID control without FBR (Direct action)

(8) Measured input and Range [Quick start code 1]
No code: Quick start code 1 is not specified
□□□: Refer to Range code table.

(9) Instrument specification
Y: Version symbol

■ Quick start code 2 (Initial setting code)

□□ □□□ - □□□□ - □□
(1) (2) (3) (4)(5)(6)(7) (8)(9)

(1) Output assignments (OUT1, OUT2, DO1 and DO2)
01 to 15: Refer to Output assignments table.

(2) Digital input assignments (DI1 to DI5)
01 to 26: Refer to Digital input assignments table.

(3) Remote setting input
N: None
1: Voltage input (0 to 10 mV DC)
2: Voltage input (0 to 100 mV DC)
3: Voltage input (0 to 1 V DC)
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)

(4) Event function 1 (EV1), (5) Event function 2 (EV2), (6) Event function 3 (EV3), (7) Event function 4 (EV4)
N: None
A: Deviation high
B: Deviation low
C: Deviation high/low
D: Band
E: Deviation high [1]
F: Deviation low [1]
G: Deviation high/low [1]
H: Process high
J: Process low
K: Process high [1]
L: Process low [1]
Q: Deviation high [2]
R: Deviation low [2]
T: Deviation high/low [2]
V: SV high
W: SV low
1: MV high
2: MV low
3: Cooling MV high
4: Cooling MV low
5: Control loop break alarm (LBA) [3]
[1] With Hold action
[2] With Re-hold action
[3] Can be selected only for Event 4 (EV4).

(8) CT type
N: CT1 (None), CT2 (None)
P: CT1 (CTL-6-P-N), CT2 (None)
S: CT1 (CTL-12-S56-10L-N), CT2 (None)
T: CT1 (CTL-6-P-N), CT2 (CTL-6-P-N)
U: CT1 (CTL-12-S56-10L-N), CT2 (CTL-12-S56-10L-N)

(9) Communication 1 protocol
N: None
1: RKC communication (ANSI X3.28-1976)
2: Modbus
A: Intercontroller communication *
* In the case of optional E, F, H and J, this code is selectable.
In the case of optional G, factory set value of Communication 2 protocol becomes Intercontroller communication.

● **Output assignments table**

Code	OUT1	OUT2	DO1	DO2	Code	OUT1	OUT2	DO1	DO2
01	MV1	MV2	EV1	EV2	09	MV1	HBA	EV1	EV4
02	MV1	MV2	EV1	EV4	10	MV1	HBA	EV4	EV1
03	MV1	MV2	EV4	EV1	11	MV1	HBA	EV4	FAIL
04	MV1	MV2	EV4	FAIL	12	MV1	FAIL	EV1	EV2
05	MV1	MV2	FAIL	HBA	13	MV1	FAIL	EV1	EV4
06	MV1	MV2	FAIL	EV4	14	MV1	EV1	EV4	EV3
07	MV1	HBA	EV1	EV2	15	MV1	EV1	EV4	EV2
08	MV1	HBA	EV4	EV2					

MV1: Control output 1, MV2: Control output 2, EV1 to EV4: Event output 1 to Event output 4
HBA: Heater break alarm, FAIL: Fail output (De-energized only), EV1 to EV4: Event output 1 to Event output 4
− For Position proportioning PID control, regardless of the above selection, OUT1 becomes the open-side output, and OUT2 becomes the close-side output.
− HBA output becomes OR when two CT input is available.

● **Digital input assignments table**

Code	DI1	DI2	DI3	DI4	DI5	Selectable optional function
01						Unused
02	Memory area transfer (1 to 8)			M-SET	R/S	
03	Memory area transfer (1 to 8)			M-SET	Unused	
04	Memory area transfer (1 to 8)			M-SET	A/M	
05	Memory area transfer (1 to 8)			M-SET	ILR	A
06	Memory area transfer (1 to 8)			R/S	Unused	
07	Memory area transfer (1 to 8)			R/S	A/M	
08	Memory area transfer (1 to 8)			R/S	ILR	
09	Memory area transfer (1 to 8)			Unused	A/M	
10	Memory area transfer (1 to 8)			Unused	ILR	
11	Memory area transfer (1 to 8)			A/M	ILR	
12	Memory area transfer (1 to 8)					
13	R/S	R/L*	A/M			A and E
14	R/S	R/L*	ILR			
15	R/S	A/M	ILR			
16	R/L*	R/L*				
17	R/S	A/M				
18	R/S	ILR				A, B, C, D and E
19	R/S	ILR				
20	R/L*	ILR				
21	R/L*	ILR				
22	A/M	R/S				
23	R/S					
24	R/L*					A, B, C, D, E, F, J, 3, 4, 5, 6, 7 and 8
25	A/M					
26	ILR					

M-SET: Memory area set
Select a new memory area number by using DI1, DI2, and DI3. From open status, close the contact between DI4 (M-SET) and the common terminal to make the memory area number effective in the controller.
R/S: RUN/STOP transfer
R/L: Remote/Local transfer
A/M: Auto/Manual transfer
ILR: Interlock release
* In the case of the optional function A, C and D without Remote setting input and Communication, the Remote/Local transfer functions are invalid.

Range code table
[Thermocouple (TC) input, RTD input]

Type	Code	Measured range	Code	Measured range
K	K35	−200.0 to +400.0 °C	KC4	−328.0 to +400.0 °F
	K40	−200.0 to +800.0 °C	KC6	−250.0 to +800.0 °F
	K41	−200 to +1372 °C	KC5	−328 to +2502 °F
	K09	0.0 to 400.0 °C	KA4	0.0 to 400.0 °F
	K10	0.0 to 800.0 °C	KA1	0 to 800 °F
	K14	0 to 1300 °C	KA2	0 to 1600 °F
	K02	0.0 to 400.0 °C		
	K04	0 to 800 °C		
J	J27	−200.0 to +400.0 °C	JC6	−328.0 to +1200.0 °F
	J32	−200.0 to +800.0 °C	JC7	−328.0 to +700.0 °F
	J15	−200 to +1200 °C	JB9	−328 to +2192 °F
	J08	0.0 to 400.0 °C	JB6	0.0 to 800.0 °F
	J09	0.0 to 800.0 °C	JA1	0 to 800 °F
	J02	0 to 400 °C	JA2	0 to 1600 °F
	J04	0 to 800 °C		
T	T19	−200.0 to +400.0 °C	TC2	−328.0 to +752.0 °F
E	E21	−200.0 to +700.0 °C	EA9	−328.0 to +1292.0 °F
	E06	−200 to +1000 °C	EB1	−328 to +1832 °F
S	S06	−50 to +1768 °C	SA7	−58 to +3214 °F
R	R07	−50 to +1768 °C	RA7	−58 to +3214 °F
B	B03	0 to 1800 °C	BB2	0 to 3272 °F
N	N02	0 to 1300 °C	NA7	0 to 2372 °F
PLII	A02	0 to 1390 °C	A2A	0 to 2534 °F
W5Re/W26Re	W03	0 to 2300 °C	WA2	0 to 4200 °F
U	U04	0.0 to 600.0 °C	UB2	32.0 to 1112.0 °F
L	L04	0.0 to 900.0 °C	LA9	32.0 to 1652.0 °F
Pt100	D21	−100.00 to +100.00 °C	DD1	−199.99 to +199.99 °F
	D34	−100.0 to +100.00 °C	DC6	−199.99 to +199.99 °F
	D35	−200.0 to +850.0 °C	DC8	−328.0 to +1562.0 °F
JPt100	P29	−100.00 to +100.00 °C	PC8	−199.99 to +199.99 °F
	P30	−200.0 to +640.0 °C	PC9	−328.0 to +1184.0 °F
			PD1	−200.0 to +200.0 °F

[Voltage input, Current input]

Type	Code	Measured range
0 to 10 mV DC	101	
0 to 100 mV DC	201	
0 to 1 V DC	301	
0 to 5 V DC	401	Programmable range
0 to 10 V DC	501	(−19999 to +19999
1 to 5 V DC	601	Factory set value: 0.0 to 100.0)
0 to 20 mA DC	701	
4 to 20 mA DC	801	
−100 to +100 mV DC	901	
−1 to +1 V DC	902	
−10 to +10 mV DC	903	

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