Shimaden, Temperature and Humidity Control Specialists

°C
%RH
SHIMADEN

Series FP23A

SHIMADEN DIGITAL CONTROLLER

CE approved

PRODUCT FEATURE

- ☐ *2-channel controller (Basic type: 1-channel controller)*
- ☐ *Independent 2-loop / Internal Cascade / 2-input operation control*
- ☐ *High accuracy ± (0.1% FS + 1 digit)*
- ☐ *High Sampling Cycle 0.1 sec.*
- ☐ *High resolution 1/ 1000 °C display achieved*
  **Only for R.T.D. input (scale: 0.000–30.000 °C)*
- ☐ *Programmable Max. 400steps (400 steps x 1 pattern to 20 steps x 20 patterns)*
- ☐ *Auto-Tuning PID / Expert PID*
- ☐ *Max. 10 Zone PID control available*
- ☐ *Independent Multi -Input*
- ☐ *User Friendly Operation (Menu Driven: 4 Lines LCD Display)*
- ☐ *Easy Setting & Maintenance via Infrared COM port on the front panel*
- ☐ *Interface RS-232C/RS-485 (MODBUS / Shimaden)*
- ☐ *The front dust/splash-proof IP66*
- ☐ *Universal Power Supply (100–240V AC ±10%)*
- ☐ *Sensor power supply*

COPING WITH ADVANCED PROCESS CONTROL

Temperature˚C, Pressure MPa, Flowrate m³/s, etc.

Two types of programs can be executed at the same time.

High-performance programmable controller

FP23A Series

Number of program patterns:

Max. 20 Patterns

Number of program steps:

Max. 400 Steps

High Accuracy:

± (0.1% FS+1 digit)

High Speed Sampling Cycle: 100 msec.

(100 msec. even at 2-loop specification)

Dual Universal-Input

Thermocouple
R.T.D.
DC voltage
DC current

All of them are acceptable.

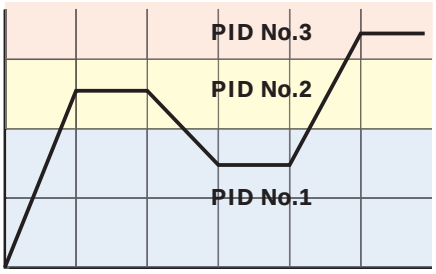
* Individual setting is allowed for each channel at 2-loop specification.

* Current input is executed through externally attached shunt resistor with 250 Ω

Multiple PID

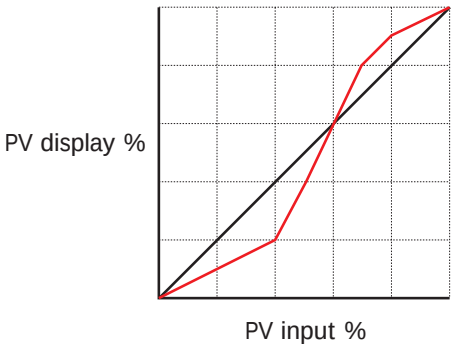
- Selectable from 10 PID Nos. for each step
- Control by zone PID is also available (Max. 10 zones).

PID No. 3 Zone value
PID No. 2 Zone value
PID No. 1 Zone value



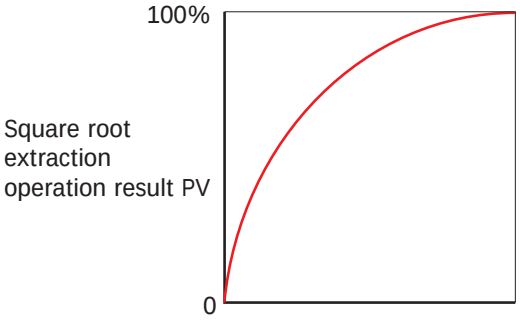
linearization approximation

Linearising nonlinear signal input Number of approximation point: Max. 11



Square root extraction operation functions

Linearisation of signals with square characteristic such as flow rate



EASY READABILITY AND USABILITY ARE RADICALLY PURSUED.

Excellent visibility thanks to the large LED with 5 digits x 2 lines and LCD with 128 x 32 dots

■PV Display Panel

- Measured value (PV) display
- CH2PV is indicated when CH2 lamp is illuminated.
- Error message display

■SV Display Panel

- Target value (SV) display
- CH2SV is indicated when CH2 lamp is illuminated.
- CH2PV is indicated when PV2 lamp is illuminated.
- Error message display

■LCD Display Panel

- Pattern / Step No. display
- Output display (numerical value and bar graph)
- Channel display
- Various setting parameters display

■Status Lamp Display Panel

RUN:	Program on standby: Flashing Program in execution: ON
HLD:	Program suspended: ON
MAN:	Manual operation (MAN) in execution: Flashing
FIX:	During FIX mode: ON
EV1~3:	Event output being on: ON
DO1~5:	External control output being on: ON
EXT:	When start pattern No. by DI is selected: ON
COM:	In communication mode: ON
AT:	Auto tuning in execution: Flashing
OUT 1, 2:	Control output monitor lamp

■Key Switch Display Panel

DISP	: Return to the basic screen : Switching to display mode
GRP	: Go to screen group
SCRN	: Go to any screen within the group
	: Selection of editing and setting parameters
	: Increase/decrease of numeric value and scaling factor
ENT	: Registration of numeric value and/or data
STEP	: Switching of step No.
PTN	: Switching of pattern No.

EASY PARAMETER SETTING THANKS TO THE INTERACTIVE MODE THROUGH 4 LINE LCD DISPLAY

DISPLAY MODE CORRESPONDING TO EACH SPECIFICATION

◆ Independent 2-loop control

- CH1...PV
- CH2...PV
- CH1...PTN No. STEP No. SV
- CH2...PTN No. STEP No. SV

◆ 2-input operation control

- Operation result **PV**
- **SV**
- Input 1
- Input 2

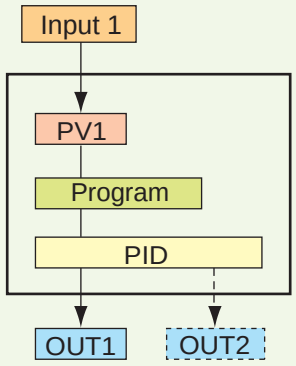
◆ Positioning proportional control (servo output)

- **PV**
- **SV**
- Opening

COPING WITH MULTIFARIOUS APPLICATIONS

1 Loop / 2 Loop Control

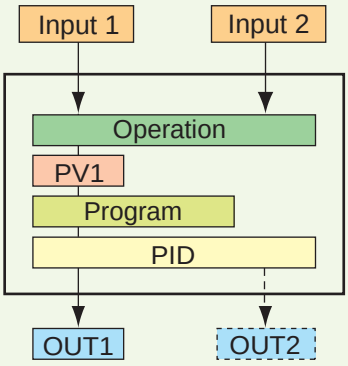
1-input control



* 1 output (for heating/cooling control) may also be provided.

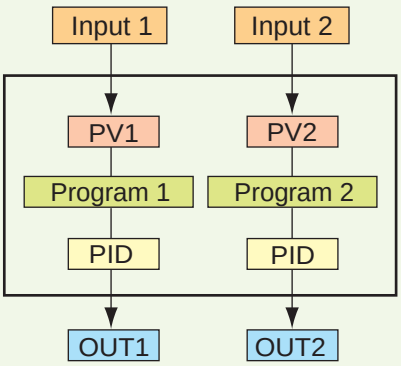
2-input operation control

(max. value, min. value, deviation value, average value)



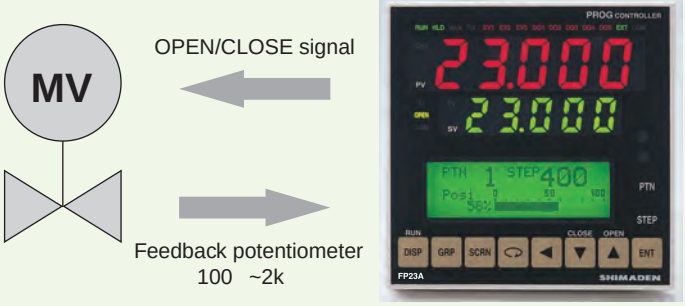
* 2 outputs (for heating/cooling control) may also be provided.

Independent 2-loop control

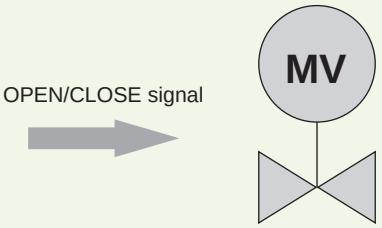


Servo Output Specification (Control motor/motor valve control)

With feedback potentiometer



Without feedback potentiometer



* Proportional control may be executed both with and without feedback potentiometer.

Easily Connectable with External Equipment such as PLC thanks to Abundant Number of Input/Output Points

- **External Control Input (DI): Max. 10**

  Execution/stop of program control
  Stop of program control
  Suspension of program control
  Postponement of program step
  FIX mode
  Manual control operation
  Logical operation input
  Selection of start pattern No.

- **Event Output: 3**
  External Control Output: Max. 13

  27 alarm actions, various status output and logical operation output

- **Sensor power supply**

  24V DC

- **Analog Output: Max. 2**

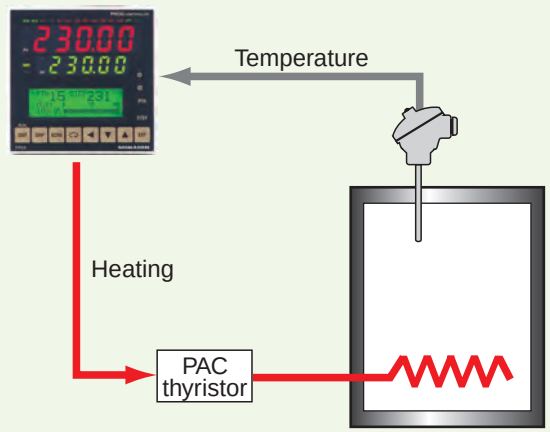
  Externally output PV, SV, deviation value, output value, limit value for each channel by means of analog signal

- **Communication function**

  Both Shimaden standard protocol and MODBUS (RTU/ASCII) communication protocol are equipped.

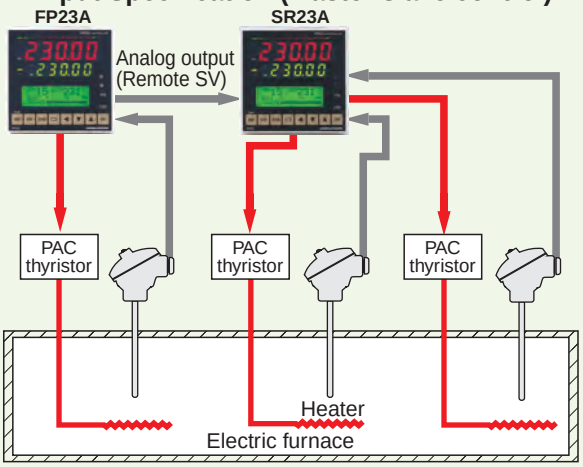
Heating Control

1-input Specification



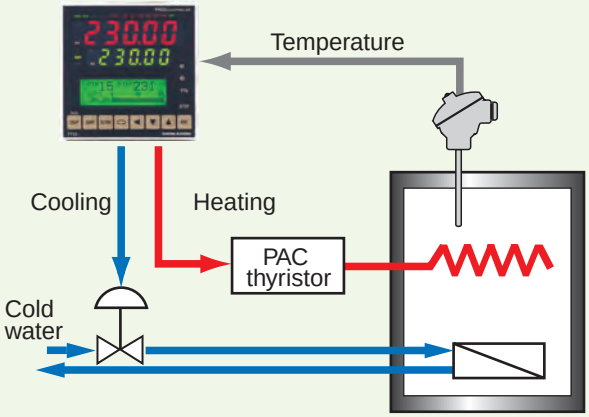
3-Zone Program Temperature Control of Electric Furnace

1-input Specification (Master-slave control)



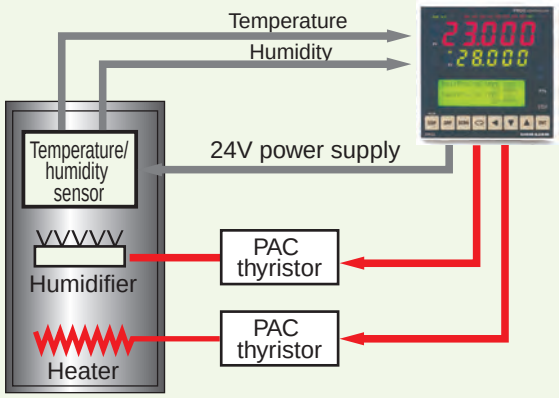
Heating/Cooling Control

1-input Specification



Constant-temperature/constant-humidity control

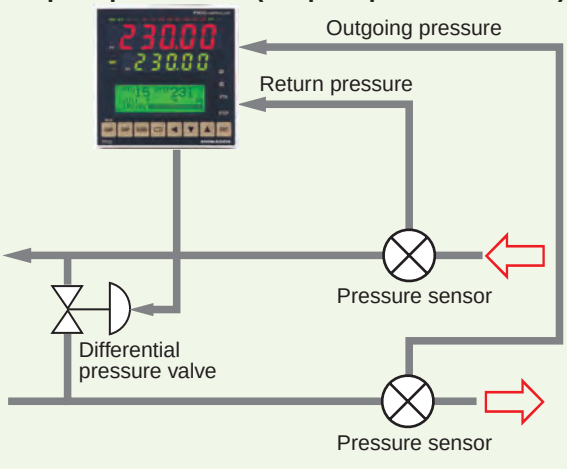
2-input Specification (Independent 2-loop control)



* Cooling (dehumidifying) may be achievable by using event output as well.

Differential Pressure Control

2-input Specification (2-input operation control)



Widely Coping with Various Usages

- **Semiconductor manufacturing equipment**
- **Electrical/electronic parts/components manufacturing-related equipment**
- **Various industrial furnaces**
- **Vacuum heating furnaces**
- **Environmental test equipment**
- **Food processing machines**
- **Plastic processing/molding machines**
- **Sterilization/pasteurization equipment for pharmaceuticals**

SPECIFICATIONS

■ Display

- LED display
  - Measured value (PV): 7-segment red LED 5 digits, height of characters 16 mm
  - Set value (SV): 7-segment green LED 5 digits, height of characters 11 mm
- LCD display: PTN No., STP No., Graph Pattern, control output value, various parameter displays
  128 x 32 dot matrix liquid crystal display with yellow-green LED backlight
- Action display lamps: 19 action statuses display. Lights on or blinks depending on the status

RUN	Green	Lights when control is executed, brinks when program execution is waiting
HLD	Green	Lights when program operation is stopped temporarily, brinks when it is stopped by input error
MAN	Green	Lights when manual control is in operation
FIX	Green	Lights when FIX (fixed value control) mode
EV1 to EV3	Orange	Lights when event output is ON
DO1 to DO5	Orange	Lights when DO output is ON
COM	Green	Lights when the communication mode is ON
EXT	Green	Lights when start pattern external switching is assigned
AT	Green	Lights when auto tuning is in standby, brinks when it is being executed
CH2	Green	Lights when CH2 PV and SV are displayed (in 2-loop)
PV	Green	Lights when CH1 PV and CH2 SV (7-segment LED in LED display) are displayed (in 2-loop)

■ For basic functions other than MS

OUT1	Green	Control Output 1
OUT2	Green	Control Output 2

■ For basic function MS

OPEN	Green	Lights when open output is ON
CLOSE	Green	Lights when close output is ON

- Display accuracy: ±(0.1% + 1digit) of measuring range (See Measuring Range Code Table for individual ranges.)
  - TC input: ±(0.1% FS + 1°C)
  - Pt input: ±(0.1% FS + 0.1°C)
  - mV, V input: ±(0.1% FS + 1 digit)
  - mA input: Depends on accuracy of externally attached resistor (When ±0.1%FS accuracy is required, specify when ordering)
- Temperature range for maintaining display accuracy
  23°C±5°C
- Display resolution: 0.0001, 0.001, 0.01, 0.1, 1 (differs depending on measuring range)
- Sampling cycle: 0.1 seconds (100 msec)

■ Setting

- Local setting: By 10 front panel key switches
- SV setting range: Same as measuring range (within setting limiter)
- Higher/lower setting limiter: Any value in measuring range (lower limit value < higher limit value)

■ Input

- Universal-input, multi-range: Thermocouple input, RTD input, voltage input (mV, V), current input (mA)
- Thermocouple (TC)
  - Input type: B, R, S, K, E, J, T, N, PLII, PR40-20, C (WRe 5-26), U (DIN 43710), L (DIN 43710), AuFe-Cr.
    For details, see Measuring Range Code Table.
  - Display range: ±10% of measuring range
    Note: However, it will not go lower than -273.15°C.
  - Allowable range of external resistance: 100Ω max.
  - Input resistance: Approx. 500 kΩ
  - Cold junction compensation: Selectable between internal and external cold junction compensation
  - Internal cold junction compensation accuracy: ±1°C (in range of 18 to 28°C)
  - Burnout functions: Standard feature (up scale)
- RTD input type: JIS Pt100 /JPt100 3-wire type. For details, see Measuring Range Code Table.
  - Display range: ±10% of measuring range (not lower than -273.15°C)
  - Lead wire tolerance: 10Ω max. per wire
  - Amperage: Approx. 1.1mA
- Voltage input (mV, V) type: -10 to 10, 0 to 10, 0 to 20, 0 to 50, 10 to 50, 0 to 100, -100 to 100 mV
  -1 to 1, 0 to 1, 0 to 2, 0 to 5, 1 to 5, 0 to 10, -10 to 10 V
  Universal-input, programmable scaling For details, see Measuring Range Code Table.
  - Input resistance: Approx. 500 kΩ
- Current input (mA) type: 4 to 20, 0 to 20 mA: universal-input and programmable scaling For details, see Measuring Range Code Table.
  - Receiving resistance: 250Ω by external resistor
- Common functions
  - Sampling cycle: 0.1 seconds (100 msec)
  - PV bias: ±10000 digit
  - PV slope: Input value x 0.500 to 1.500
  - PV filter: OFF, 1 to 100 seconds

● Input operation	Possible with voltage or current input
Square root extraction operation	Low cut range 0.0 to 5.0% FS
Linearizer approximation	Number of input points: 11
● Isolation	Insulated between input and DI input, or input and various outputs. Not insulated between input and the system, or input and CT input.

■ Control

■ For basic functions other than MS

● Control output	1-output specification, 2-output specification In the case of independent 2-channel control (CH1, CH2) specification, control output 2 is the output on CH2 side.
● Control system (common to Control Output 1 and 2)	
	Expert PID control with auto tuning function
Multi-PID	By PID Nos.01 to 10 (10 types) Individual PID set on each step and FIX SV
Zone PID	Selectable between individual PID and zone PID (max. 10 zones)
Proportional band (P)	OFF, 0.1 to 999.9% (OFF: ON-OFF action)
Integral time (I)	OFF, 1 to 6000 seconds (OFF: P or PD control)
Derivative time (D)	OFF, 1 to 3600 seconds (OFF: P or PI control)
Set value function	OFF, 0.01 to 1.00
Manual reset (MR)	-50.0 to 50.0% (available when I = OFF)
Dead band (DB)	-19999 to 20000 digit (Control Output 2 in 1-loop/2-out specification)
Hysteresis (DF)	1 to 9999 digit (at ON-OFF action, available when P = OFF)
Proportional cycle	1 to 120 seconds (at contact or SSR drive voltage output)
● Hysteresis Mode	Select from the 3 modes below Center mode, SV OFF mode, SV ONmode
● Control output type/rating (common to Control Outputs 1 and 2)	
Y:	Contact 1c, contact rating 240 V AC/2.5A resistive load, 1A inductive load
I:	Current 4 to 20 mA DC/load resistance 600Ω max.
P:	SSR drive voltage 12 V±1.5 V DC/load current 30 mA max.
V:	Voltage 0 to 10 V DC/load current 2 mA max.
Output accuracy	±0.5% FS (5 to 100% output/within accuracy maintaining temperature range)
Resolution	Approx. 1/14000 (during current or voltage output)
● Operation/output update cycle	0.1 seconds (100 msec)
● Control output characteristics	Reverse (for heating)/Direct (for cooling), Control Outputs 1 and 2 set individually (heating/cooling, 2-stage heating/2-stage cooling selectable in 1-loop, 2-output specification)
● Higher/lower output limiter setting range	
	Higher limit/lower limit (set individually for each PID No.) 0.0 to 100.0% (lower limit < higher limit)
● Output rate-of-change	OFF, 0.1 to 100.0%/seconds (set individually for control outputs limiter 1 and 2)
● Control output at error	0.0 to 100.0% (set individually for Control Outputs 1 and 2)
● Control output at standby	0.0 to 100.0% (set individually for Control Outputs 1 and 2)
● Manual control	
Auto/manual switching	Balanceless/bumpless action (simultaneous for Control Outputs 1 and 2)
Output setting range	0.0 to 100.0% set individually for Control Output 1 and 2
Setting resolution	0.1%
● Isolation	Insulated between Control Output and the system. Not insulated between Control Outputs.

■ For basic function MS

● Control system	Expert PID control with auto tuning function
Multi-PID	By PID Nos.01 to 10 (10 types) Individual PID set on each step and FIX SV
Zone PID	Selectable between individual PID and zone PID (max. 10 zones)
Proportional band (P)	OFF, 0.1 to 999.9% (OFF: ON-OFF action)
Integral time (I)	OFF, 1 to 6000 seconds (OFF: P or PD control)
Derivative time (D)	OFF, 1 to 3600 seconds (OFF: P or PI control)
Set value function	OFF, 0.01 to 1.00
Manual reset (MR)	-50.0 to 50.0% (available when I = OFF)
● Hysteresis Mode	Select from the 3 modes below Center mode, SV OFF mode, SV ONmode
● Operation/output update cycle	0.1 seconds (100 msec)
● Control output characteristics	Reverse (for heating)/Direct (for cooling)
● Higher/lower output limiter setting range	
	Higher limit/lower limit (set individually for each PID No.)
Setting range	0.0 to 100.0% (lower limit < higher limit)
● Output rate-of-change limiter	OFF, 0.1 to 100.0%/seconds
● Control output	Output for servo actuator drive Support for both feedback potentiometer with/without
● Control output type/rating	R: Contact output, rating 240V AC 2A Y: Contact output, rating 240V AC 2A, built-in CR absorber
● Output update cycle	50msec
● Control output at error	Stop, Preset (0 to 100%) (with feedback potentiometer) Stop, Close, Open (without feedback potentiometer)

- Control output at reset: Stop, Preset (0 to 100%) (with feedback potentiometer)
  Stop, Close, Open (without feedback potentiometer)
- Output at potentiometer error: Stop, Close, Open (with feedback potentiometer)
- Manual control: Auto/manual switching
  Balanceless/bumpless transfers (with feedback potentiometer)
  Manual output: Open/Close output
- Positioning: With percentage, as numerically and bar graph on LCD.
  Display resolution: 1%
  Display range: -10 to 110%
- Positioning ZERO/SPAN adjustment
  Supports automatic adjustment, manual adjustment available
- Dead Band (DB): 0.2 to 10.0% of input signal
- Hysteresis (DF): 25% of the DB
  When DB is equal to or lower than 1.2%, fixed to 0.3%.
- Feedback potentiometer: 100 to 2kΩ/3 wire system
- Isolation: Insulated between between Servo Output and various I/O, or Servo Output and the system.

■ Program Function

- Number of patterns: Max. 20 patterns
- Number of steps: Max. 400 steps
- Step time: 0 minutes 0 seconds to 99 minutes 59 seconds or 0 hours 0 minutes to 99 hours 59 minutes
- Pattern execution counts: Repeatable to 9999 times max.
- Step loop count: Repeatable to 9999 times max.
- Pattern link setting: Connectable to 20 patterns max.
  Executable to 9999 times max.
- Link execution setting: Repeatable to 9999 times max.
- Program settings: By front panel keys or communication
  Level: Same as measuring range
  Time (1): 0 to 99 hours 59 minutes/step
  Time (2): 0 to 99 minutes 59 seconds/step
  Ramp settings: Automatic computation by setting time and level
  Ascend, descend, ramp control
  Timer: Sets the delay time for start of program operation
  00 hours 00 minutes to 99 hours 59 minutes
- Setting resolution: Level: 0.1 or 1 (varies according to measuring range)
  Time: 1 minute or 1 second
- Advance function: Program moves to next step during operation.
- Hold function: Progress of program time is stopped temporarily during operation.
- Time signal setting
  Number of registrations: Max. 8 points per pattern. (TS1 to TS8) Assigned to event output or DO
  Time (1): 0 to 99 hours 59 minutes
  Time (2): 0 to 99 minutes 59 seconds
  Resolution: 1 minute or 1 second
- Guarantee soak zone: When the program moves from a ramp step to a flat step, the program does not move to the next step if the PV value is not in the set zone range or is not more than the preset time.
  Setting resolution: 0 to 9999 digit
  Time (1): 0 to 99 hours 59 minutes
  Time (2): 0 to 99 minutes 59 seconds

■ Event Output

- Number of outputs: Total 3; EV1 to EV3
- Output rating: 240 V AC/1.0A resistive load common to contact outputs (normally open contacts)
- Output update cycle: 0.1 seconds (100 msec)
- Setting/selection: Individual setting (individual output), selectable from the following 27 types (to designate output)
  In the case of independent 2-channel control (CH1, CH2) specification, assignment will be done to eigher CH1 or CH2.
- Output types

1) None	No action (no assignment)
2) DEV Hi	Higher limit deviation alarm
3) DEV Low	Lower limit deviation alarm
4) DEV Out	Outside higher/lower limit deviation alarm
5) DEV In	Inside higher/lower limit deviation alarm
6) PV Hi	PV higher limit alarm
7) PV Low	PV lower limit alarm
8) SO	ON at scale over
9) FIX	ON in FIX mode
10) AT	ON during execution of auto tuning
11) MAN	ON during manual control
12) LOGIC	ON during logic operation output
13) RUN	ON during control execution
14) HLD	ON during program hold
15) GUA	ON during guarantee soak
16) STEP	ON during step move
17) PRG. END	ON at program end
18) TS1	ON during time signal 1
|	
25) TS8	ON during time signal 8
26) Direct	ON during direct output by communication

Direct cannot be set for event, but for DO.

■ For basic functions other than MS

27) HBA	ON during Heater Break alarm action
28) HLA	ON during Heater Loop alarm action

■ For basic function MS

27) Posi.H	Positioning higher limit absolute value
28) Posi.L	Positioning lower limit absolute value
29) POT.ER	Feedback potentiometer error
	Direct cannot be set for events, but for DOs.
	Posi. H, Posi. L, and POT. ER can be assigned only when the controller is used with feedback potentiometer.

- Setting range

DEV Hi, Low	-25000 to 25000 digit
DEV Out, In	0 to 25000 digit
PV Hi, Low	Within measuring range
Posi. H, L	0 to 100%
Hysteresis	1 to 9999 digit (DEV, PV, SV)
	1 to 50% (When Posi is selected)
Action delay time	OFF, 1 to 9999 digit (when DEV, PV, SV or Posi is selected)
Standby action	Selectable from 4 types (when DEV, PV, SV or Posi is selected)
OFF	No standby action
1	At power ON, or at RST -> RUN
2	At power ON, at RST -> RUN, or at execution SV is changed
3	At input error (SO), when action is OFF
Output characteristics switching	Selectable between normally open and normally closed.

- Isolation: Insulated between event output and various I/O, or event output and the system.

■ External Control Output (DO)

- Number of outputs: 13 points in total; standard 5 and 8 optional.

DO1 to DO3	Darlington output 3 points.
DO4 to DO5	Open collector output 2 points.
DO6 to DO13	Open collector output 8 points. (optional)

- Output rating: Open collector output 24 V DC/8mA max., ON voltage 0.8V max.
  Darlington output 24 V DC/50mA max., ON voltage 1.5V max.
- Output update cycle: 0.1 seconds (100 msec)
- Setting/selection: Individual setting (individual output), selectable.
  In the case of independent 2-channel control (CH1, CH2) specification, assignment will be done to eigher CH1 or CH2.
  Details are the same as those for event outputs. (However, LOGIC can be assigned to only DO1 to DO5. Direct can be assigned to only DO6 to DO13 with communication option. Posi.H, Posi.L, and POT.ER can be assigned only when the controller is used with feedback potentiometer.)
  Details of setting range, hysteresis, action delay time and stand by action are the same as those for event outputs.
- Output characteristics switching: Normal open and normal close selectable.
- Isolation: Insulated between DO and various I/O, or DO and the system.
  Not insulated between DOs.

■ External Control Input (DI)

- Number of inputs: 10 points in total; standard 4 and 6 optional.
  DI1 to DI4 4 points.
  DI5 to DI10 6 points (optional)
- Input rating: Non-voltage contact or open collector.
  - Input specifications: Photocoupler input 5 V DC, voltage application 2.5 mA max. per 1 input.
  - Input holding time: 0.1 seconds (100 msec) min.
- Setting/selection: Individual setting (individual input), selectable from 12 types
  In the case of independent 2-channel control (CH1, CH2) specification,
  assignment will be done to eigher CH1 or CH2 or both.
  - Input types:

1) None	No action (no assignment)
2) RUN/RST	Switching of Run/Reset (when ON: Run execution)
3) RST	Forced Reset (when ON: Reset state)
4) HLD	Control suspension/restart (when ON: suspension state)
5) ADV	Execute advance (when ON: execute advance)
6) FIX	Switching of FIX mode/Program mode (when ON: FIX mode)
7) MAN	Switching of control output between auto/manual (when ON: manual)
8) LOGIC	Logic operation input [exclusive port] (when ON: input ON)
9) PTN2bit	Selection of start pattern No. by DI input (selectable from 3 patterns)
10) PTN3bit	Selection of start pattern No. by DI input (selectable from 7 patterns)
11) PTN4bit	Selection of start pattern No. by DI input (selectable from 15 patterns)
12) PTN5bit	Selection of start pattern No. by DI input (selectable from 20 patterns)
13) PTN5BCD	Selection of start pattern No. by DI input (selectable from 19 patterns)
14) Preset 1 to 3	Preset No. switching by DI2 to DI4.

  Insulated between DI and various I/O, or DI and the system
- Isolation: Not insulated between DIs.

■ Logic Operation Functions

- Number of logic: Assignable to 8 points in total: EV1 to EV3 3 points, DO1 to DO5 5 points
  DO4 and DO5 are exclusively for timer and counter operation.
- Logic operation inputs: In the case of independent 2-channel control (CH1, CH2) specification,
  TS1 to TS8 (CH1), TS1 to TS8 (CH2), and DI1 to DI10, can be assigned individually to source 1 and 2
- Input logic conversion: Input logic conversion possible individually on source 1 and 2 (EV1 to EV3, DO1 to DO3 output)

1) BUF	By external control input logic
2) INV	Inversion of external control input logic
3) FF	Flip-flop logic operation of external control input

  (When a time signal is assigned to a source, flip-flop cannot be set.)
- Logic operation (1): Logic operation output by source 1 and 2 (EV1 to EV3, DO1 to DO3 output)

1) AND	Output by logical product
2) OR	Output by logical sum
3) XOR	Output by exclusive OR

- Logic operation (2): Logic operation Output by source 1 (DO4, DO5 output)

1) Timer operation	OFF, 1 to 5000 seconds
2) Counter operation	OFF, 1 to 5000 counts

■ 2-input Specification

- Input types: Input 1 and Input 2, individual selection, individual setting, universal input, multi range
  Thermocouple input, R.T.D. input, voltage input (mV, V), current input (mA)
- Input and control specifications: Specifications to be decided by combinations of input and control output.
  - 1-loop control specification: 1) 2-input operation (PV1, PV2) and 1-output

MAX	Max. value input of PV1 and PV2, 1-output/2-output control specification
MIN	Min. value input of PV1 and PV2, 1-output/2-output control specification
AVE	Average value input of PV1 and PV2, 1-output/2-output control specification
DEV	Deviation value input of PV1 - PV2, 1-output/2-output control specification
PV	Taking PV value of PV1

    2) 2-input operation (PV1, PV2) and 2-output
  - 2-loop control specification: 1) Independent 2-channel control specification
- Isolation: Insulated between Input 2 and DI input, or input and various outputs. Not insulated between Input 1 (standard input) and Input 2, input and the system, input and remote input, or input and CT input

■ Heater Break Alarm (option)

● Alarm action	HBA alarm ON when control output is ON and heater break is detected
	HLA alarm ON when control output is OFF and heater loop error is detected
Alarm detection	HBA is detected at heater current ≦ setting current value, when control output is ON
	HLA is detected at heater current ≧ setting current value, when control output is OFF
	Hysteresis at heater Break or loop error detection 0.2 A
● Current detection	Heater current detection by external CT (supplied CT for exclusive use/single phase)
Current detection selection	Selectable from Control Output 1 or Control Output 2 only when control output is Y or P
Sampling cycle	0.2 seconds (200 msec)
Minimum action confirmation time	0.2 seconds (200 msec) or longer (regardless of whether control output is ON or OFF)
● Current setting	Heater break, heater loop alarm set individually
Setting range	OFF, 0.1 to 50.0 A (OFF = suspension of alarm action)
Setting resolution	0.1 A
● Current display	0.0 to 55.0 A
Display accuracy	3% FS (sine wave 50 Hz)
Sampling cycle	0.2 seconds (200 msec)
Minimum action confirmation time	0.2 seconds (200 msec) or longer (regardless of whether control output is ON or OFF)
● Output	Assigned to EVENT, DO output
Output hold	Selectable between Lock mode and Real mode
● Isolation	Insulated between CT input and DI input, or CT input and various outputs.
	Not insulated between CT input and sensor input, or CT input and the system.

■ Analog Output (option)

● Number of Outputs	Maximum 2, A_o1, A_o2 individual setting, individual output
	Only A_o1 when sensor power supply (optional) is selected
	In the case of independent 2-channel control (CH1, CH2) specification, assignment will be done to eigher CH1 or CH2.
● Output types	Selectable from 9 types
	PV, SV, DEV, OUT1, CH2_PV, CH2_SV, CH2_DEV, OUT2 Posi
Output rating	Individual selection (individual output)
	0 to 10 mV DC/output resistance 10Ω
	0 to 10 V DC/load current 2 mA max.
	4 to 20mA DC/load resistance 300Ω max.
● Output accuracy	±0.1% FS (of indicated value)
● Output resolution	Approx. 1/14000
● Output update cycle	0.1 second (100 msec)
● Output scaling	PV, SV, CH2_PV, CH2_SV: within measuring range
	DEV, CH2_DEV: within -100.0 to 100.0%;
	OUT1, OUT2 within 0.0 to 100.0%; reverse scaling possible
● Isolation	Insulated between analog outputs and various I/O or analog outputs and the system.
	Not insulated between analog outputs (A_o1 and A_o2)

■ Sensor Power Supply (option)

● Number of outputs	1
	Output from Analog Output 2 (A_o2) terminal
	When the sensor power supply (SPS) is selected, Analog Output 2 (A_o2) is unusable.
● Output rating	24 V DC/25 mA max.
● Isolation	Insulated between SPS and various I/O, SPS and analog output 1, or SPS and the system.

■ Communication (option)

● Communication type	RS-232C, RS-485	
● Communication system	RS-232C	3-line half-duplex system
	RS-485	2-line half-duplex multidrop (bus) system
● Communication distance	RS-232C	15 m max.
	RS-485	500 m max. (depending on connection conditions)
● Number of connectable devices	RS-232C	1
	RS-485	32 (including the host, differs depending on connection conditions)
● Synchronization system	Start-stop synchronization	
● Communication speed	2400, 4800, 9600, 19200 bps	
● Communication (device) address	1 to 98	
● Communication delay time	1 to 50 msec	
● Communication memory mode	EEP, RAM, r_E	
● Communication mode type	COM1 or COM2	
● Communication protocol (1)	SHIMADEN protocol	
Data length	7 bit, 8bit	
Parity	EVEN, ODD, NONE	
Stop bit	1bit, 2bit	
Control code	STX_ETX_CR, STX_ETX_CRLF, @_: _CR	
Checksum (BCC)	ADD, ADD_two's cmp, XOR, None	
Communication code	ASCII	
● Communication protocol (2)	MODBUS ASCII mode	
Data length	7 bit (fixed)t	
Parity	EVEN, ODD, NONE	
Stop bit	1bit, 2bit	
Control code	CRLF	
Error check	LRC check	
Function code	03H and 06H (Hex) supported	
	1) 03H	Read data
	2) 06H	Write data
● Communication protocol (3)	MODBUS RTU mode	
Data length	8 bit (fixed)	
Parity	EVEN, ODD, NONE	
Stop bit	1bit, 2bit	
Control code	None	
Error check	CRC 16	
Function code	03H and 06H (Hex) supported	
	1) 03H	Read data
	2) 06H	Write data

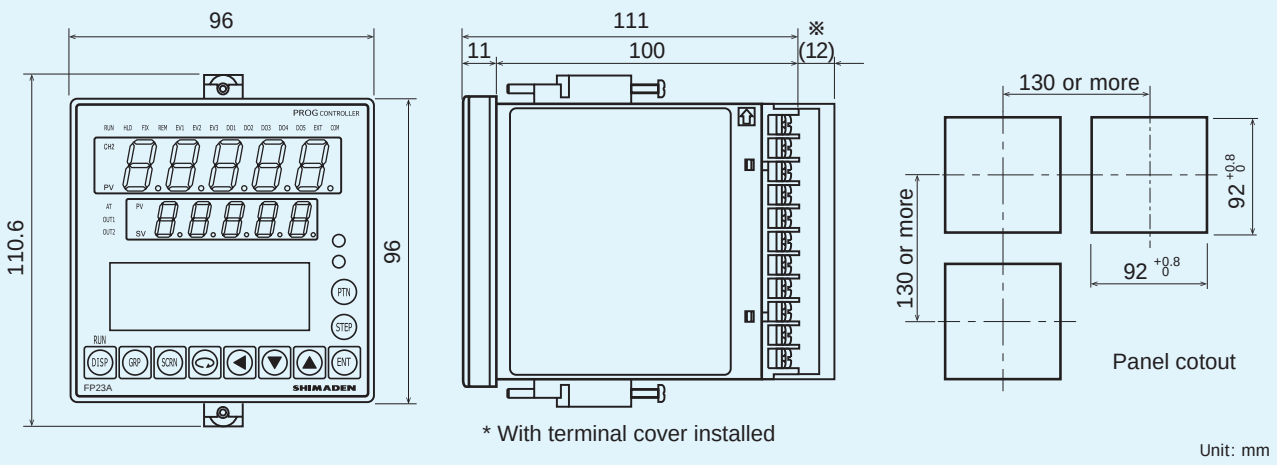
■ Infrared Communication

● Communication system	Direct communication is possible with a PC through the infrared communication adapter (sold separately)
● Number of connectable devices	1
● Infrared communication specification	
Synchronization system	Start-stop synchronization
Communication speed	9600 bps
Data format	7E1 (7 bits, even parity, 1 stop bit)
Control code	STX_ETX_CR
Checksum (BCC)	ADD
Communication code	ASCII
● Communication protocol	SHIMADEN protocol (extended)

■ General Specifications

● Data storage	Non-volatile memory (EEPROM)	
● Operating environment conditions		
Temperature	-10 to 50°C	
Humidity	90% RH max. (no dew condensation)	
Elevation	2000 m above sea level or lower	
Overvoltage category	II	
Pollution degree	2 (IEC60664)	
● Storage temperature	-20 to 65°C	
● Power voltage	100 to 240 V AC ±10% (50/60 Hz)	
● Power consumption	Max. 16 VA	
● Input noise removal ratio	Normal mode	40 dB min. (50/60 Hz)
	Common mode	120 dB min. (50/60 Hz)
● Applicable standards	Safety	IEC61010-1 and EN61010-1 EN IEC 61010-2-030
	EMC	EN61326-1
● Insulation resistance	Across I/O terminals and power terminals: 500 V DC 20MΩ min. Across power terminals and ground terminals: 500 V DC 20MΩ min.	
● Dielectric strength	Across I/O terminals and power terminals: 2300 V AC for 1 minute Across power terminals and ground terminals: 1500 V AC for 1 minute	
● Protective structure	Front operating panel only is dust-proof and drip-proof. (equivalent to IP66)	
● Case material	PC resin molding (equivalent to UL94V-1)	
● External dimensions	(H x W x D) 96 x 96 x 111 mm (panel depth: 100 mm)	
● Mounting	Imbedded in panel (using mounting fixtures)	
● Thickness of usable panel	1.0 to 8.0 mm	
● Size of panel cutout	92 (H) x 92 (W) mm	
● Weight	600 g max.	

EXTERNAL DIMENSIONS/PANEL CUTOUT



1-input Specification

- **1-output control**
- **2-output control (Heat & Cool/Heat & Heat/Cool & Cool)**

ORDERING INFORMATION

ITEM	CODE	SPECIFICATIONS		
SERIES	FP23A-	96 x 96 DIN size, high-performance digital controller EV 1 to 3 (3 points), DI 1 to 4 (4 points), DO 1 to 5 (5points)		
BASIC FUNCTIONS	SS	Multi input, 1-input/1-output control		
	SD	Multi input, 1-input/2-output control		
CONTROL OUTPUT 1	Y	Contact 1c, contact rating: 240V AC 2.5A/resistive load, 1A/inductive load		
	I	Current 4 to 20mA DC, Load resistance: max. 600Ω		
	P	SSR drive voltage output 12V±1.5V DC, Load current: max. 30mA		
	V	Voltage 0 to 10V DC, Load current: max. 2mA		
CONTROL OUTPUT 2 (Select N- for basic function SS.)	N-	None		
	Y-	Contact 1c, contact rating: 240V AC 2.5A/resistive load, 1A/inductive load		
	I-	Current 4 to 20mA DC, Load resistance: max. 600Ω		
	P-	SSR drive voltage output 12V±1.5V DC, Load current: max. 30mA		
	V-	Voltage 0 to 10V DC, Load current: max. 2mA		
HEATER BREAK ALARM (FOR SINGLE-PHASE) *1	00	None		
	31	Heater break alarm* (heater current 30A with CT)	Selectable only when Control Output 1 or 2 is Y or P	
	32	Heater break alarm* (heater current 50A with CT)		
ANALOG OUTPUT 1	0	None		
	3	0 to 10mV DC, Output resistance: 10Ω		
	4	4 to 20mA DC, Load resistance: max. 300Ω		
	6	0 to 10V DC, Load current: max. 2mA		
ANALOG OUTPUT 2 or SENSOR POWER SUPPLY	0	None		
	3	0 to 10mV DC, Output resistance: 10Ω		
	4	4 to 20mA DC, Load resistance: max. 300Ω		
	6	0 to 10V DC, Load current: max. 2mA		
	8	Sensor power supply 24V DC 25mA		
ADDITIONAL EXTERNAL OUTPUT CONTROL SIGNAL (DI/DO) *2	0	None		
	1	DI 5 to 10 (6 points), DO 6 to 9 (4 points)		
	2	DI 5 to 10 (6 points), DO 6 to 13 (8 points)		
COMMUNICATION FUNCTION	0	None		
	5	RS-485	Shimaden standard protocol / MODBUS (RTU/ASCII) communication protocol	
	7	RS-232C		
REMARKS	0	Without		
	9	With		

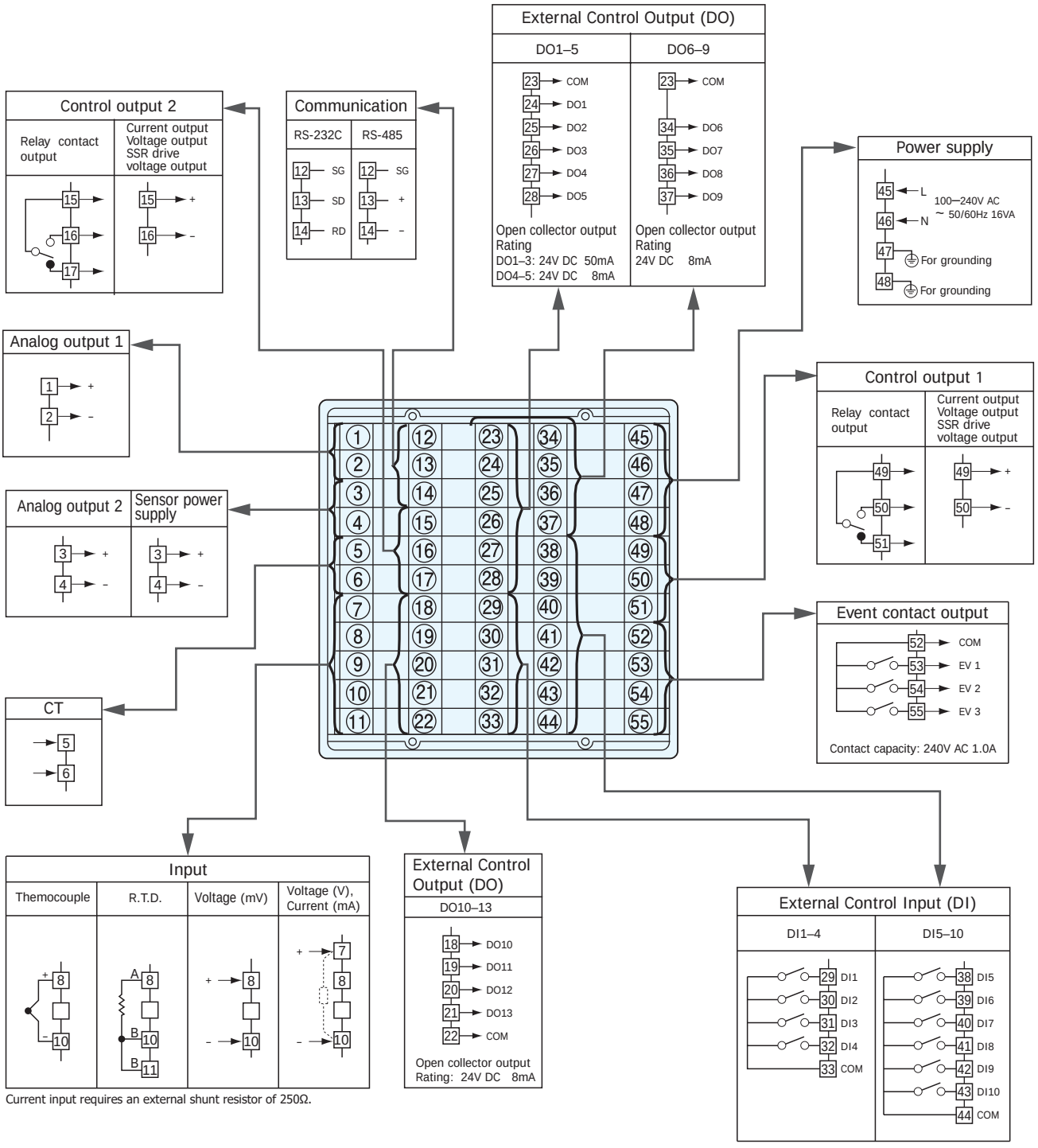
*1 When switching the SV No. by DI, 10 points of DI (CODE 1 or 2) are required.

*2 Ten DI points (code 1 or 2) are required for switching the SV No. by DI.

Optional Accessories

Name	Model	Description
Shunt Resistor	QCS002	 250Ω, external input resistance at current input

TERMINAL ARRANGEMENT



Current input requires an external shunt resistor of 250Ω.

Crimp-type terminals fit M3 screws.

2-input Specification

- 2-input/2-output control (independent 2-loop control)
- Internal cascade control *Output for control is output to Control Output 2.
- 2-input operation/1-output control (1-loop control by max. value, min. value, average value, deviation value operation)
- 2-input operation/2-output control (1-loop heat & cool/heat & heat/cool & cool control by max. value, min. value, average value, deviation value operation)

ORDERING INFORMATION

ITEM	CORD	SPECIFICATIONS
SERIES	FP23A-	96 x 96 DIN size, high-performance digital controller EV 1 to 3 (3 points), DI 1 to 4 (4 points), DO 1 to 5 (5points)
BASIC FUNCTIONS *2, *3	DL	Multi input, independent 2-loop control
	DS	Multi input, 2-input operation/1-output control *2
	DD	Multi input, 2-input operation/2-output control
CONTROL OUTPUT 1 *1	Y	Contact 1c, contact rating: 240V AC 2.5A/resistive load, 1A/inductive load
	I	Current 4 to 20mA DC, Load resistance: max. 600Ω
	P	SSR drive voltage output 12V±1.5V DC, Load current: max. 30mA
	V	Voltage 0 to 10V DC, Load current: max. 2mA
CONTROL OUTPUT 2	Y-	Contact 1c, contact rating: 240V AC 2.5A/resistive load, 1A/inductive load
	I-	Current 4 to 20mA DC, Load resistance: max. 600Ω
	P-	SSR drive voltage output 12V±1.5V DC, Load current: max. 30mA
	V-	Voltage 0 to 10V DC, Load current: max. 2mA
HEATER BREAK ALARM (FOR SINGLE-PHASE) *4	00	None
	31	Heater break alarm (heater current 30A with CT) — Selectable only when Control Output 1 or 2 is Y or P
	32	Heater break alarm (heater current 50A with CT) — Selectable only when Control Output 1 or 2 is Y or P
ANALOG OUTPUT 1	0	None
	3	0 to 10mV DC, Output resistance: 10Ω
	4	4 to 20mA DC, Load resistance: max. 300Ω
	6	0 to 10V DC, Load current: max. 2mA
ANALOG OUTPUT 2/ SENSOR POWER SUPPLY	0	None
	3	0 to 10mV DC, Output resistance: 10Ω
	4	4 to 20mA DC, Load resistance: max. 300Ω
	6	0 to 10V DC, Load current: max. 2mA
	8	Sensor power supply 24V DC 25mA
ADDITIONAL EXTERNAL OUTPUT CONTROL SIGNAL (DI/DO) *5	0	None
	1	DI 5 to 10 (6 points), DO 6 to 9 (4 points)
COMMUNICATION FUNCTION	0	None
	5	RS-485 — Shimaden standard protocol/ MODBUS (RTU/ASCII) communication protocol
	7	RS-232C — Shimaden standard protocol/ MODBUS (RTU/ASCII) communication protocol
REMARKS	0	Without
	9	With

*1 Independent 2-loop control, internal cascade control, 2-input operation/1-output control and 2-input operation/2-output control are all supported in the 2-input specification. This controller is shipped with the function selected at BASIC FUNCTION set.

*2 In an internal cascade control specification, slave output for control is output to Control Output 2. Select the same specification as Control Output 2 for Control Output 1.

*3 In a 2-input operation/1-output control specification, the output for control is output to Control Output 1. Select the same specification as Control Output 1 for Control Output 2.

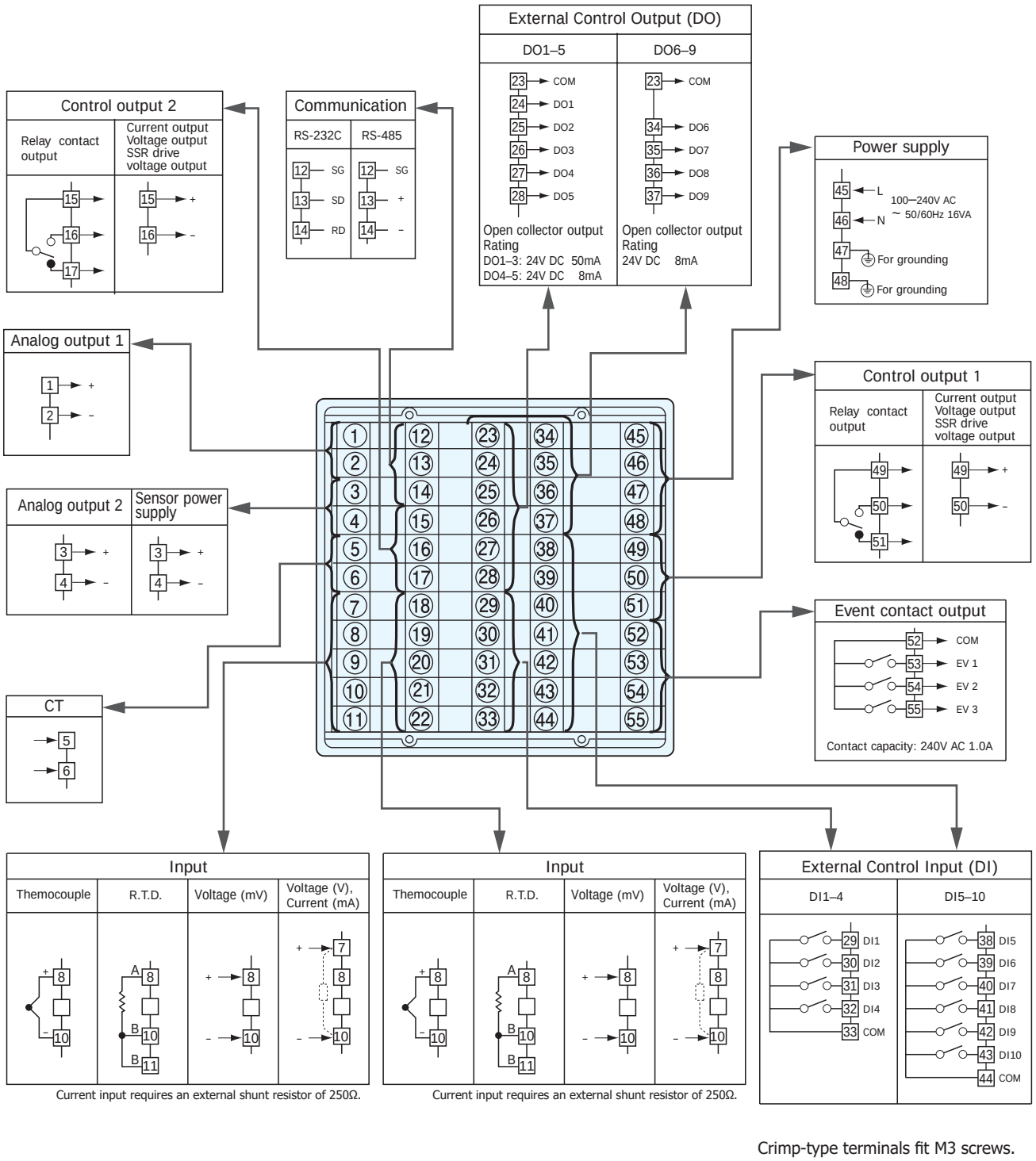
*4 In a 2-output specification, the heater break alarm is used by either of Control Output 1 or 2.

*5 When switching the SV No. by DI, 10 points of DI (CODE 1) are required.

Optional Accessories

Name	Model	Description
Shunt Resistor	QCS002	 250Ω, external input resistance at current input

TERMINAL ARRANGEMENT



Crimp-type terminals fit M3 screws.

Servo output Specification

- **Control motor position proportional control**

ORDERING INFORMATION

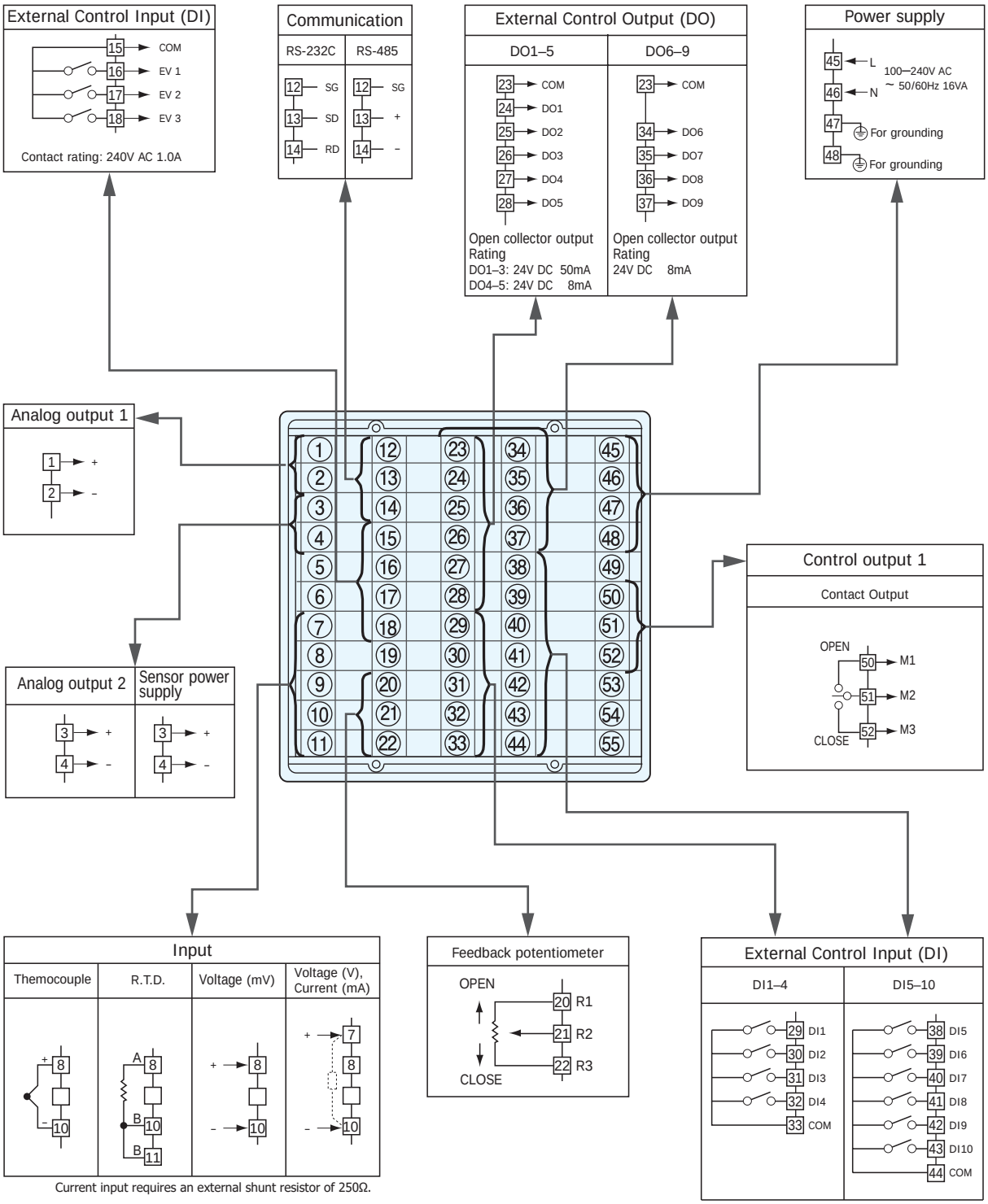
ITEM	CORD	SPECIFICATIONS		
SERIES	FP23A-	96 x 96 DIN size, high-performance digital controller EV 1 to 3 (3 points), DI 1 to 4 (4 points), DO 1 to 5 (5points)		
BASIC FUNCTIONS	MS	Multi input, 1-input Servo output		
CONTROL OUTPUT 1 *1	Y	Contact, rating: 240V AC 2A, CR absorber built-in		
	R	Contact, rating: 240V AC 2A		
CONTROL OUTPUT 2	N-	None		
HEATER BREAK ALARM (FOR SINGLE-PHASE)	00	None		
ANALOG OUTPUT 1	0	None		
	3	0 to 10mV DC Output resistance: 10Ω		
	4	4 to 20mA DC Load resistance : max.300Ω		
	6	0 to 10V DC Load current : max. 2mA		
ANALOG OUTPUT 2/SENSOR POWER SUPPLY	0	None		
	3	0 to 10mV DC Output resistance: 10Ω		
	4	4 to 20mA DC Load resistance : max.300Ω		
	6	0 to 10V DC Load current : max.2 mA .		
	8	Sensor power supply 24 V DC 25mA		
ADDITIONAL EXTERNAL OUTPUT CONTROL SIGNAL (DI/DO) *2	0	None		
	1	DI 5 to 10 (6 points), DO 6 to 9 (4 points)		
COMMUNICATION FUNCTION	0	None		
	5	RS-485	Shimaden standard protocol/	
	7	RS-232C	MODBUS (RTU/ASCII) communication protocol	
REMARKS	0	Without		
	9	With		

*1 Y : This must be selected when directly controlling the motor.
R : This must be selected when controlling the motor through auxiliary relay, PLC or the like.
*2 When switching the SV No. by DI, 10 points of DI (CODE 1) are required.

Optional Accessories

Name	Model	Description
Shunt Resistor	QCS002	 250Ω, external input resistance at current input

TERMINAL ARRANGEMENT



Crimp-type terminals fit M3 screws.

EXTERNAL DIMENSIONS/PANEL CUTOUT

Input Type		Sensor Type			Cord	Symbol	Measuring range (°C)	Measuring range (°F)
Multi input	Thermocouple	B		*1	01	B	0.0 – 1800.0 °C	0 – 3300 °F
		R		*2	02	R	0.0 – 1700.0 °C	0 – 3100 °F
		S		*2	03	S	0.0 – 1700.0 °C	0 – 3100 °F
		K		*3	04	K	-100.0 – 400.0 °C	-150.0 – 750.0 °F
		K			05	K	0.0 – 400.0 °C	0.0 – 750.0 °F
		K			06	K	0.0 – 800.0 °C	0.0 – 1500.0 °F
		K			07	K	0.0 – 1370.0 °C	0.0 – 2500.0 °F
		K		*3	08	K	-200.0 – 200.0 °C	-300.0 – 400.0 °F
		E			09	E	0.0 – 700.0 °C	0.0 – 1300.0 °F
		J			10	J	0.0 – 600.0 °C	0.0 – 1100.0 °F
		T		*3	11	T	-200.0 – 200.0 °C	-300.0 – 400.0 °F
		N		*2	12	N	0.0 – 1300.0 °C	0.0 – 2300.0 °F
		PL II		*4	13	PL II	0.0 – 1300.0 °C	0.0 – 2300.0 °F
		PR 40-20		*5	14	PR 40-20	0.0 – 1800.0 °C	0 – 3300 °F
		C (WRe 5-26)			15	C	0.0 – 2300.0 °C	0 – 4200 °F
		U		*3	16	U	-200.0 – 200.0 °C	-300.0 – 400.0 °F
		L			17	L	0.0 – 600.0 °C	0.0 – 1100.0 °F
		Kelvin	K	*6	18	K	10.0 – 350.0 K	10.0 – 350.0 K
			AuFe-Cr	*7	19	AuFe-Cr	0.0 – 350.0 K	0.0 – 350.0 K
	RTD *9	Pt100		*8	31	Pt 1	-200.0 – 600.0 °C	-300.0 – 1100.0 °F
					32	Pt 2	-100.00 – 100.00 °C	-150.0 – 200.0 °F
					33	Pt 3	-100.0 – 300.0 °C	-150.0 – 600.0 °F
					34	Pt 4	-60.00 – 40.00 °C	-80.00 – 100.00 °F
					35	Pt 5	-50.00 – 50.00 °C	-60.00 – 120.00 °F
					36	Pt 6	-40.00 – 60.00 °C	-40.00 – 140.00 °F
					37	Pt 7	-20.00 – 80.00 °C	0.00 – 180.00 °F
					38	Pt 8 *6	0.000 – 30.000 °C	0.00 – 80.00 °F
					39	Pt 9	0.00 – 50.00 °C	0.00 – 120.00 °F
					40	Pt 10	0.00 – 100.00 °C	0.00 – 200.00 °F
					41	Pt 11	0.00 – 200.00 °C	0.0 – 400.0 °F
					42	Pt 12 *7	0.00 – 300.00 °C	0.0 – 600.0 °F
					43	Pt 13	0.0 – 300.0 °C	0.0 – 600.0 °F
					44	Pt 14	0.0 – 500.0 °C	0.0 – 1000.0 °F
		JPt100			45	JPt 1	-200.0 – 500.00 °C	-300.0 – 900.0 °F
					46	JPt 2	-100.00 – 100.00 °C	-150.0 – 200.0 °F
					47	JPt 3	-100.0 – 300.0 °C	-150.0 – 600.0 °F
					48	JPt 4	-60.00 – 40.00 °C	-80.00 – 100.00 °F
					49	JPt 5	-50.00 – 50.00 °C	-60.00 – 120.00 °F
					50	JPt 6	-40.00 – 60.00 °C	-40.00 – 140.00 °F
					51	JPt 7	-20.00 – 80.00 °C	0.00 – 180.00 °F
					52	JPt 8 *6	0.000 – 30.000 °C	0.00 – 80.00 °F
					53	JPt 9	0.00 – 50.00 °C	0.00 – 120.00 °F
					54	JPt 10	0.00 – 100.00 °C	0.00 – 200.00 °F
					55	JPt 11	0.00 – 200.00 °C	0.0 – 400.0 °F
					56	JPt 12 *7	0.00 – 300.00 °C	0.0 – 600.0 °F
					57	JPt 13	0.0 – 300.0 °C	0.0 – 600.0 °F
					58	JPt 14	0.0 – 500.0 °C	0.0 – 900.0 °F
	Voltage (mV)	−10– 10mV			71	−10– 10mV		
		0– 10mV			72	0– 10mV		
		0– 20mV			73	0– 20mV		
		0– 50mV			74	0– 50mV		
		10– 50mV			75	10– 50mV		
		0– 100mV			76	0– 100mV		
		−100– 100mV			77	−100– 100mV		
	Voltage (V)	−1– 1V			81	−1– 1V		
		0– 1V			82	0– 1V		
		0– 2V			83	0– 2V		
		0– 5V			84	0– 5V		
		1– 5V			85	1– 5V		
		0– 10V			86	0– 10V		
		−10– 10V			87	−10– 10V		

Initial value : 0.0 to 100.0

Measuring range may be arbitrarily set within following range by scaling function.

Scaling range: -19999 to 30000 digit
Span: 10 to 30000 digit
Lower limit value < Higher limit value
Decimal alignment: None, decimal positions: 1, 2, 3 or 4

If using at 0 to 20 mA, select code 84 (0 to 5 V); if using 4 to 20 mA, select code 85 (1 to 5 V) and attach a separate sold shunting resistor QCS002 (250 Ω) between the input terminals.

Note: Minimal decimal is selectable.

Note:

*1. Thermocouple B: accuracy is not guaranteed at 400°C/750° F or below.
Accuracy at 400 to 800°C (750 to 1472°F) is ±(0.2% FS + 1 digit).

*2. Thermocouple R, S, N: accuracy of indicated values below 200°C and 392°F is ±(0.2% FS+ 1 digits).

*3. Thermocouple K, T, U: accuracy at -100°C and -148°F or below is ±(0.5% FS + 1 digit).
Accuracy at -100 to 0°C (-148 to 32°F) is ±(0.2% FS + 1 digit).

*4 Thermocouple PLII: accuracy is ±(0.2% FS + 1 digit).

*5. Thermocouple PR40-20: accuracy at 400°C and 752°F or below is ±(0.5% FS + 1 digit).
Accuracy at 400 to 800°C (752 to 1472°F) is ±(0.3% FS + 1 digit).

*6. Thermocouple K (Kelvin) accuracy temperature range

Temperature range	
Below 30.0K	±(0.8%FS+16K +1 digit)
30.0K or more-Below 70.0K	±(0.4%FS+5.6K+1 digit)
70.0K or more-Below 170.0K	±(0.3%FS+2.4K+1 digit)
170.0K or more-Below 270.0K	±(0.2%FS+1.2K+1 digit)
270.0K or more	±(0.1%FS+0.8K+1 digit)

*7. Thermocouple gold-iron/chromel (AuFe-Cr) (Kelvin) accuracy temperature range

Temperature range	
Below 30.0K	±(0.3%FS+2.4K+1 digit)
30.0K or more-Below 70.0K	±(0.2%FS+1.2K+1 digit)
70.0K or more-Below 170.0K	±(0.1%FS+1.0K+1 digit)
170.0K or more-Below 280.0K	±(0.1%FS+0.8K+1 digit)
280.0K or more	±(0.2%FS+0.8K+1 digit)

*8. If lower than -240 °C in all ranges of the resistance temperature detector, underscale is displayed.

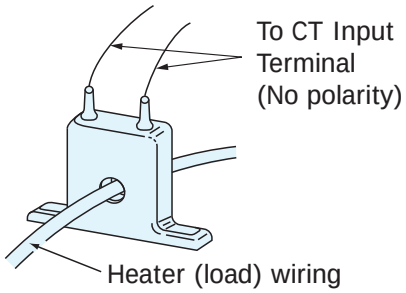
Note: If higher limit exceeds 32000 digit, scaleover is displayed.

Note: Unless otherwise specified, the measuring range will be set as follows when shipped from the factory:

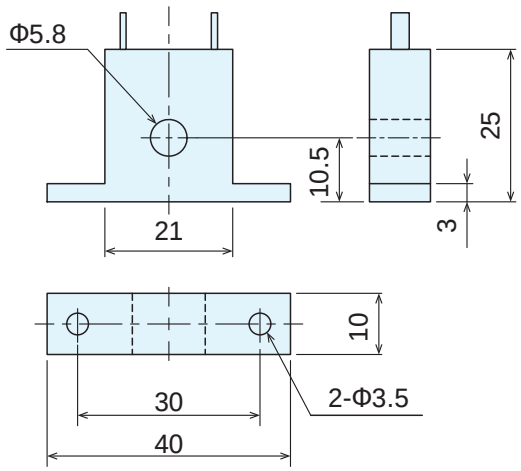
Input	Standard/rating	Measuring range
Thermocouple	JIS K	0.0 to 800.0 °C

CURRENT TRANSFORMER (CT) FOR HEATER BREAK ALARM

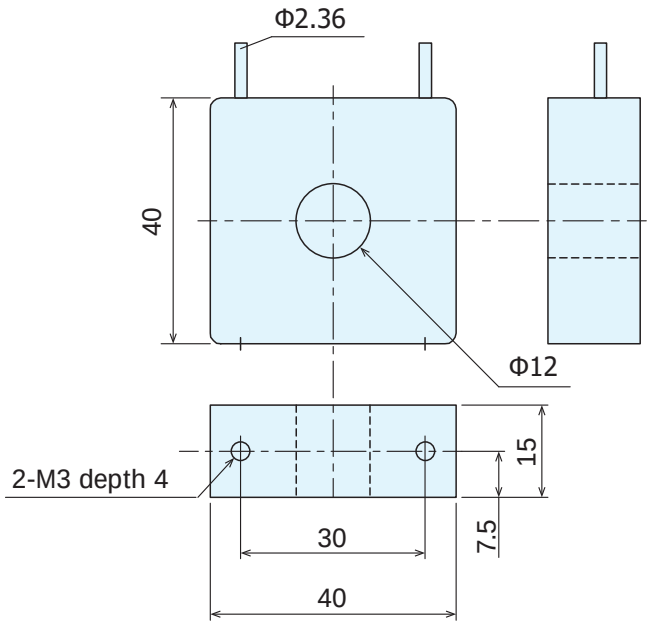
● CT-wiring example



■ QCC01 for 0–30 A



■ QCC02 for 0–50 A



Unit: mm

■ **Avoid using it for control of devices upon which human life is dependent.**

WARNING

* Be sure to follow the instruction manual when operating this device.
* This device is designed for industrial use to control temperature, humidity and other physical values. Avoid using it for control of devices upon which human life is dependent.
* If the possibility of loss or damage to your system or property as a result of failure of any parts of the process exists, proper safety measures must be made before the instrument is put into use so as to prevent the occurrence of trouble.

Head Office & Saitama Factory
ISO 9001/ISO14001 Certification Obtained

Temperature and Humidity Control Specialists
SHIMADEN CO., LTD.
Head Office: 2-30-10 Kitamachi, Nerima-ku, Tokyo 179-0081 Japan
Phone: +81-3-3931-7891 Fax: +81-3-3931-3089
E-MAIL: exp-dept@shimaden.co.jp URL: https://www.shimaden.co.jp