

■ Preface

Thank you for purchasing our product. Before you start to operate the product, please read the following precautions at first, and use the product safely and carefully.

This Instruction Manual aims to summarize the Instruction Manual (Detailed version). For detailed contents, please refer to the product's original instruction manual (Detailed version) which can be downloaded for free from our website <https://www.shimaden.co.jp>.

Documents/Application software available for download are as follows.

- \*FP23A series digital controller instruction manual (Detailed version)
- \*Parameter setup tool "Parameter Assistant SR23 FP23"

■ Operating environment

OS: Windows 10

Windows 10 is a registered trademark of Microsoft Corporation in the United States and other countries.

The FP23A series has 6 basic functions (SS: 1-input/1-output control, SD: 1-input/2-output control, DL: Independent 2 channel control, DS: 2-input, 1-output control, DD: 2-input/2-output control, MS: Servo output).

■ Checking accessories

Make sure that your product package has all of the following items

■ Standard accessories

- (1) Instruction Manual (A3 size paper x2)
- (2) Mounting fixture (w/ 2 screws)
- (3) Terminal cover
- (4) Unit decal

■ Optional accessories

- (1) Current transformer (CT) for heater break alarm (when the heater break alarm option is selected)
- (2) Termination resistor (when the RS-485 communication option is selected)

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■ Safety Precautions



Warning

The FP23A Series Digital Controllers is control instruments designed for industrial use to control temperature, humidity and other physical values. It must not be used in any way that may adversely affect the safety, health or working conditions of those who come into contact with the effects of its use. When used, adequate and effective safety countermeasures must be provided at all times by the user.

No warranty, express or implied, is valid in the case of use resulting in an accident without having taken the proper safety countermeasures.

- Before you start to use this device, install it in a control panel or the like and avoid touching the terminals.
- Do not open this device's case, and touch the boards or inside of the case with your hands or a conductor. The user should never repair or modify this device. Doing so might cause an accident that may result in death or serious bodily injury from electric shock.



Caution

To avoid damage to connected peripheral devices, facilities or the product itself due to malfunction of this device, safety countermeasures such as proper installation of the fuse or installation of overheating protection must be taken before use. No warranty, express or implied, is valid in the case of use resulting in an accident without having taken the proper safety countermeasures.

- The warning mark on the plate affixed on the casing of this device warns you not to touch charged parts while this device is powered ON. Doing so might cause an electric shock.
- A means for turning the power OFF such as switch or a breaker must be installed on the external power circuit connected to the power terminal on this device. Fasten the switch or breaker at a position where it can be easily operated by the operator, and indicate that it is a means for powering this device OFF.
- This device does not have a built-in fuse. Install a fuse that conforms to the following rating in the power circuit connected to the power terminal.

**Fuse rating/characteristics: 250 VAC 1.0A/medium lagged or lagged type**

- When wiring this device, tighten the terminal connections firmly.
- Use the device with the power voltage and frequency within their rated ranges.
- Do not apply a voltage or current outside of the input rating to the input terminal. Doing so might shorten the service life of this device or cause it to malfunction.
- The voltage and current of the load connected to the output terminal should be within the rated range. Exceeding this range may cause the temperature to rise which might shorten the service life of this device or cause it to malfunction.
- This device is provided with ventilation holes for heat to escape. Prevent metal objects or other foreign matter from entering these ventilation holes as this may cause this device to malfunction. Do not block these ventilation holes or allow dirt and dust to stick to these holes. Temperature buildup or insulation failure might shorten the service life of this device or cause it to malfunction.
- Repeated tolerance tests on voltage, noise, surge, etc. may cause this device to deteriorate.
- Never remodel this device or use it in a prohibited manner.
- To ensure safe and proper use of this device, and to maintain its reliability, observe the precautions described in this manual.
- Do not operate the keys on the front panel of this device with a hard or sharp-tipped object. Be sure to operate the keys with your fingertips.
- When cleaning this device, do not use paint thinner or other solvents. Wipe gently with a soft, dry cloth.
- It takes approximately 30 minutes to display the correct temperature after applying power to this device. (Therefore, turn the power on more than 30 minutes prior to the operation.)
- To ensure safety and maintain the functions of this device, do not disassemble this device. If this device must be disassembled for replacement or repair, contact your dealer.
- Only the instruments mounted on the front of the panel facing outward are of protection class of IP66. Do not use in any environment where water or solids in excess of IEC60529 may get inside or when the device is not facing the front.
- Be sure to install this product with the attached gasket. Failure to do so could result in electric shock. After wiring, do not touch terminal elements or other charged parts. Failure to do so could result in electric shock.

■ Precautions for Installation Site



Caution

Do not use this device in the following sites. Doing so might result in malfunction or damage to this device and in some cases may result in electrical shock or fire.

- Locations that are filled with or generate inflammable gas, corrosive gas, dirt and dust, smoke, etc.
- Locations that are subject to water droplets, direct sunlight or strong radiated heat from other equipment
- Locations where the ambient temperature falls below -10°C or rises above 50°C
- Locations where dew condensation forms and the humidity reaches 90% or more
- Near equipment that generates high-frequency noise
- Near heavy current circuits or locations likely to be subject to inductive interference
- Locations subject to strong vibration and impact
- Locations exceeding an elevation of 2000 m
- Outdoor

■ Precautions for Wiring



Caution

- To prevent electric shock, always turn off and disconnect this device from the power supply before starting wiring.
- Do not touch wired terminals or charged parts with your hands while the power is supplied.

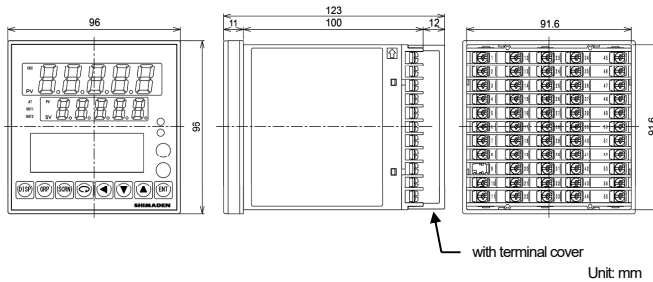
Pay attention to the following points when performing wiring:

- Check that the wiring is free from mistakes according to "Rear Terminal Arrangement Diagram."
- Use crimped terminals that accommodate an M3 screw and that have a width of 6.2 mm or less.
- For thermocouple input, use a compensation wire compatible with the type of thermocouple.
- For RTD input, the resistance of a single lead wire must be 10Ω or less and the three wires must have the same resistance.
- The input signal lead must not be passed along the same conduit or duct as that for high-voltage power lines.
- Shield wiring (single point grounding) is effective against static induction noise.
- Short interval twisted pair wiring is effective against electromagnetic induction noise.
- When wiring (minimum 1 mm<sup>2</sup> cross-sectional area) of 600 V grade PVC insulated wire or equivalent wire having the same rating.
- For wiring the ground, ground the ground terminal with the earth resistance at less than 100Ω and with wire 2 mm<sup>2</sup> or thicker.
- Two earth terminals are provided, each connected internally. One is for the ground connection, and the other is for connecting the shield of the signal lead. Do not use the earth terminals for crossover wiring of the power system ground lead.
- If this device is considered as being susceptible to noise caused by the power supply, attach a noise filter to prevent abnormal functioning. Install a noise filter onto a grounded panel, and make the wire connecting the noise filter output and the power supply terminal on this controller as short as possible.
- Counter measure against lightning surge will be required for signal line over 30m.

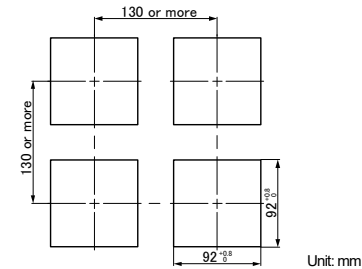
Termination resistor  
(When the RS-485 communication option is selected)



External Dimensions



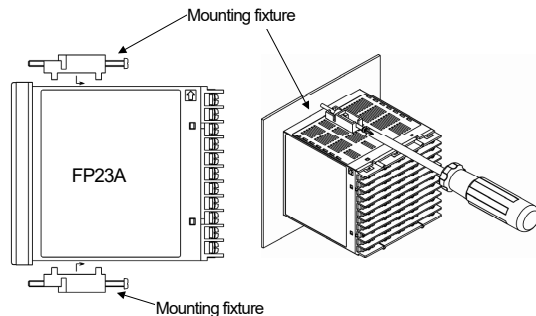
Panel Cutout Dimensions



Mounting

Follow the procedure below to mount this device on a panel.

- Drill mounting holes referring to the panel cutout dimensions described in the previous section.  
The applicable thickness of the mounting panel is 1.0 to 8.0 mm.
- Press this device into the panel from the front of the panel.
- Insert the mounting fixtures at the top and bottom of this device, and tighten the screws from behind to fasten the device in place.
- Over-tightening the screws may deform or damage the device housing. Take care not to tighten the screws too tight.
- After completing wiring after installation, attach the terminal cover.



Rear Terminal Arrangement Diagram

1	12	23	34	45
2	13	24	35	46
3	14	25	36	47
4	15	26	37	48
5	16	27	38	49
6	17	28	39	50
7	18	29	40	51
8	19	30	41	52
9	20	31	42	53
10	21	32	43	54
11	22	33	44	55

Description

Terminal No.	Symbol	Description
1	+	Analog Output 1 (OP)
2	-	Analog Output 2 (OP)
3	+	Sensor Power Supply (OP)
4	-	Heater break alarm CT input (OP)
5	+	PV input 1 V, mA mV, TC, RTD
6	-	
7	+	
8	+A	
9	N.C.	
10	-B	PV input 2 mV, TC, RTD, V, mA RTD
11	B	
45	L	
46	N	Power Supply
47		Protective grounding (internal shorting across terminals)
49	COM+	Control Output 1 M1 Open Control Output M2 COM M3 Close
50	NO-	
51	NC	
52	COM	Event Output EV1 to 3
53	EV1	
54	EV2	
55	EV3	External Control Output DO1 to 5 Darlington open collector Open collector
23	COM	
24	DO1	
25	DO2	
26	DO3	
27	DO4	
28	DO5	
29	DI1	External control input DI1 to 4
30	DI2	
31	DI3	
32	DI4	
33	COM	

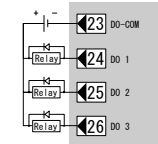
Terminal No.	Symbol	Description	
34	DO6	External control output DO6 to 9 (OP)	
35	DO7		
36	DO8		
37	DO9		
38	DI5		External control Input DI5 to 10 (OP)
39	DI6		
40	DI7		
41	DI8		
42	DI9		
43	DI10	Communication (OP)	
44	COM		
12	SG		
13	SD+		
14	RD-	Control Output 2 COM+ Event Output EV1 to 3 NO- EV2 NC EV3	
15	COM+		
16	NO-		
17	NC		
18		PV input 2 V, mA mV, TC, RTD RTD	
19	+A		
20	NC		
21	-B		
22	B	External Control Output DO10 to 13 (OP)	
18	DO10		
19	DO11		
20	DO12		
21	DO13		
22	COM		
20	R1	Feedback potentiometer input	
21	R2		
22	R3		

- ① Applies to 1-input specification only
- ② Applies to 2-input specification only
- SA Applies to servo output only
- SA Does not apply to servo output

Wiring Example of Open Collector Output

The following is an example of wiring open collector output for external control output terminals (DO).

Open collector output (for connecting to relays)



DO1 to DO3 Darlington open collector output  
Output rating 24 V DC 50 mA max.

DO terminals other than DO1 to DO3

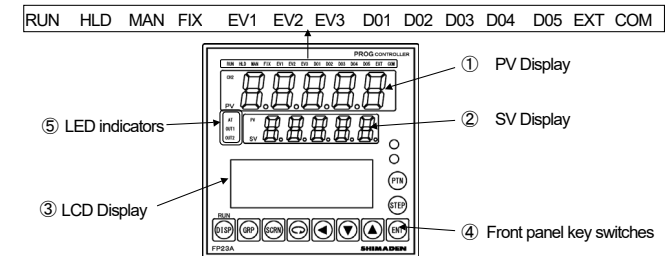
All the terminals other than DO1 to DO3 are open collector output terminals (24 V DC 8 mA max.). Note that the output ratings differ from that of DO1 to DO3.

Note for 1-input specification, DO10 to DO13 terminals (option)

The DO-COM terminal (terminal No. 22) for external control output DO10 to DO13 (optional) is internally connected to DO-COM terminal No. 23. However, for DO10 to DO13, using the No. 22 DO-COM terminal is recommended.

Note that the DO10 to DO13 terminals are open collector output as described above.

Names and Functions of Parts on Front Panel



The front view is an example of the basic function SS. (Differs from the basic function MS.)

If the instrument is independent 2-channel control or internal cascade control (2-loop specification), it has three kinds of display mode. The display mode can be switched to another by pressing the **DISP** key on the front panel. Except for the above specifications (1-input specification, 2-input operation specification, servo specification), only one display mode is available.

① PV Display

For independent 2-channel control (2-loop) in 2-input specification

- Display mode 1: Displays the current measured value (PV) or error messages of CH1.
- Display mode 2: Displays the current measured value (PV) or error messages of CH2.
- Display mode 3: Displays the current measured value (PV) or error messages of CH1.

For other than the above controllers

Displays the current measured value (PV) or error messages.

② SV Display

For independent 2-channel control (2-loop) in 2-input specification

- Display mode 1: Displays the target set value (SV) or error messages of CH1.
- Display mode 2: Displays the target set value (SV) or error messages of CH2.
- Display mode 3: Displays the current measured value (PV) or error messages of CH2.

For other than the above controllers

Displays the target set value (SV) or error messages.

Note

- When it is under Display mode 1, CH1 PV value is shown on the PV display, and CH1 SV value is shown on the SV display. For 1-loop specification, the display information is the same as the Display mode 1.
- Display mode 2 or 3 is used only for 2-loop specification (independent 2-channel controller and internal cascading controller).
- When it is under Display mode 2 (when CH2 lamp lights), CH2 PV value is shown on the PV display, and CH2 SV value is shown on the SV display. When it is under Display mode 3 (when PV lamp lights), CH1 PV value is shown on the PV display, and CH2 PV value is shown on the SV display.

⑤ LED indicators

Note that for independent 2-channel control and internal cascade control (2-loop) in 2-input specification, each RUN, HLD, MAN, FIX, EXT, AT lamp shows different channel information depending on the Display mode.

For independent 2-channel control and internal cascade control (2-loop)

- Display mode 1: Displays the action status of CH1.
- Display mode 2: Displays the action status of CH2.
- Display mode 3: Displays the action status of CH1.

For other than the above controllers

Displays the action status.

Status lamps

RUN	green	Lights during program execution.
HLD	green	Lights when the program is paused. Blinks when the pause has caused by an input error.
MAN	green	Blinks when control output is set to manual operation (MAN).
FIX	green	Lights in the FIX mode.
EV1	orange	Lights during EV1 action.
EV2	orange	Lights during EV2 action.
EV3	orange	Lights during EV3 action.
DO1	orange	Lights during DO1 action.
DO2	orange	Lights during DO2 action.
DO3	orange	Lights during DO3 action.
DO4	orange	Lights during DO4 action.
DO5	orange	Lights during DO5 action.
EXT	green	Lights when start pattern No. selection (PTN 2bit, PTN 3bit, PTN 4bit, PTN 5bit, PTN 5BCD) are set to DI5 to DI8.
COM	green	Lights during communication (COM) mode.
AT	green	Blinks during execution of auto tuning, and lights during standby.

SA	OUT1	green	When control output is current or voltage output, the brightness of this lamp changes according to fluctuation of Control Output 1, and during contact or SSR drive voltage output, this lamp lights when Control Output 1 is ON and goes Out when Control Output 1 is OFF.
	OUT2	green	When control output is current or voltage output, the brightness of this lamp changes according to fluctuation of Control Output 2, and during contact or SSR drive voltage output, this lamp lights when Control Output 2 is ON and goes Out when Control Output 2 is OFF.

SA	OPEN	green	Lights when open output is ON, and goes out when it is OFF.
	CLOSE	green	Lights when close output is ON, and goes out when close it is OFF.

Monitor lamps ②

CH2	green	Lights when display mode is 2. PV/SV values are displayed on PV/SV of CH2.
PV	green	Lights when display mode is 3. PV value is displayed on PV of CH1 display and PV of CH2 is displayed at SV display.

Error Messages

LED Display	Cause and countermeasure	
E-roñ	ROM error	The error codes on the left are displayed on the PV display. If any of the messages are displayed, repair or replacement is required. Immediately turn the power OFF, and contact your dealer.
E-rAñ	RAM error	
E-EEP	EEPROM error	
E-Rd1	Input 1 A/D error	
E-Rd2	Input 2 A/D error ②	
E-SPc	Hardware error	
Sc_LL	The PV value exceeded the measuring range lower limit (-10%FS).	When a PV input-related abnormality is detected during execution of control on this device, the error codes on the left are displayed on the PV display. If any of the messages are displayed, repair or replacement is required. Immediately turn the power OFF, and contact your dealer.
Sc_HH	The PV value exceeded the measuring range higher limit (+110%FS), RTD-A burnout, or thermocouple burnout.	
b----	One or two RTD-B burnout, or all leads of the RTDs burnout. Action of this device in this case is PV moving excessively towards the higher limit.	
CJ_LL	Cold junction compensation (-20°C) is at the lower limit. (thermocouple input)	If abnormal temperature of cold junction temperature compensation device is detected, it is displayed in the PV display. Check that the operating environment temperature is within ratings and if it is within specifications, contact your dealer.
CJ_HH	Cold junction compensation (+80°C) is at the higher limit. (thermocouple input)	
LCD Display	Cause and countermeasure	
HB_HH	The heater current exceeds 55.0 A. SA	When a heater current abnormality is detected during execution of control on this device, this error code is displayed on the LCD. Repair or replacement is required. Immediately turn the power OFF, and contact your dealer.
ERROR	Feedback potentiometer error SA	When a feedback is installed, and a burnout of feedback resistor R2 is detected, the message is displayed "Posi" field on LCD screen. Repair or replacement is required. Immediately turn the power OFF, and contact your dealer.

③ LCD display (21 characters x 4 lines)

Pattern/step No. display

Displays the pattern/step No. in the Program mode. In the FIX mode, "F" is displayed at the PTN field and "- -" is displayed at the STEP field. "- -" at the STEP field goes out during control execution (RUN) in the FIX mode.

Output (OUT) display

Displays the control output value by a numerical value and a bar graph as a percentage (%).

Channel (CH1/CH2) display

Displays the current channel for the data as one of the parameter values (2-loop specification only).

IN1/IN2 PV display

Displays the PV values of INPUT 1/INPUT 2 (2-input specification only).

CH1/CH2 actions display

Displays the actions of the channel that is not displayed on LED indicators. (2-loop specification only).

Program monitor display

Displays the program status monitor.

Remaining step time display

Displays the remaining step time during program operation.

Pattern graph display

Displays the pattern (step) graph during program operation.

Screen title display

Displays the screen group title in the respective screen group top screen.

Setup parameter display

Parameters can be selected and displayed by front key operation.

For 2-loop, the following "CH1" information is displayed under Display mode 1 or 3, and the following "CH2" information is displayed under Display mode 2.

④ Front panel key switches

DISP	Displays the basic screen. Switches the Display mode.
GRP	Changes the screen group or returns to the screen group top screen.
SCRN	Switches the parameter display screen in a screen group.
↺	Selects the parameter to set up or change. The parameter to be changed is indicated by the cursor (▶).
◀	Moves the digit in set numerical values.
▼	Decrements parameters and numerical values during setup.
▲	Increments parameters and numerical values during setup.
ENT	Registers data or parameter numerical values.
STEP	At a reset, increments the start step No. in the basic screen. (ENT) must be pressed to register.)
PTN	At a reset, increments the start pattern No. in the basic screen. (ENT) must be pressed to register.)

The following key combination operations are available in screens from 0-0.

ENT + DISP	Switching of Run/Reset
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The following key combination operations are available in screens from 0-1 to 0-7.

ENT + PTN	Hold (HLD) operation
ENT + STEP	Advance (ADV) operation

LCD Flow Chart

