INSTRUCTION MANUAL

Programmable Controller **PCB1**

No. PCB11JE5 2022.05

For detailed usage and options, refer to the full Instruction Manual for the PCB1. Please download the full Instruction Manual from Shinko website.
https://shinko-technos.co.jp/e/ ▶ Support & Downloads ▶ Downloads ▶ Manuals

Thank you for purchasing our PCB1, Programmable Controller. This manual contains instructions for the mounting, functions, operations and notes when operating the PCB1. To ensure safe and correct use, thoroughly read and understand this manual before using this inst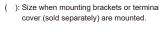rument. To prevent accidents arising from the misuse of this instrument, please ensure the operator receives this manual.

Safety Precautions (Be sure to read these precautions before using our products.)

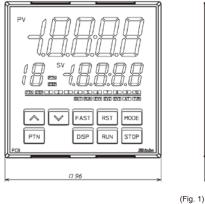The safety precautions are classified into 2 categories: "Warning" and "Caution".
⚠ **Warning**: Procedures which may lead to dangerous conditions and cause death or serious injury, if not carried out properly.
⚠ **Caution**: Procedures which may lead to dangerous conditions and cause superficial to medium injury or physical damage or may degrade or damage the product, if not carried out properly.

⚠ Warning

- To prevent an electrical shock or fire, only Shinko or other qualified service personnel may handle the inner assembly.
- To prevent an electrical shock, fire or damage to the instrument, parts replacement may only be undertaken by Shinko or other qualified service personnel.

⚠ Safety Precautions

- To ensure safe and correct use, thoroughly read and understand this manual before using this instrument.
- This instrument is intended to be used for industrial machinery, machine tools and measuring equipment. Verify correct usage after purpose-of-use consultation with our agency or main office. (Never use this instrument for medical purposes with which human lives are involved.)
- External protection devices such as protective equipment against excessive temperature rise, etc. must be installed, as malfunction of this product could result in serious damage to the system or injury to personnel. Proper periodic maintenance is also required.
- This instrument must be used under the conditions and environment described in this manual.
  Shinko Technos Co., Ltd. does not accept liability for any injury, loss of life or damage occurring due to the instrument being used under conditions not otherwise stated in this manual.

⚠ Installation Precautions

[This instrument is intended to be used under the following environmental conditions (IEC61010-1)]: Overvoltage category Ⅱ, Pollution degree 2

Ensure the mounting location corresponds to the following conditions:
- A minimum of dust, and an absence of corrosive gases
- No flammable, explosive gases
- No mechanical vibrations or shocks
- No exposure to direct sunlight, an ambient temperature of -10 to 55℃ (14 to 131℉)
- An ambient non-condensing humidity of 35 to 85 %RH (Non-condensing)
- No large capacity electromagnetic switches or cables through which large current is flowing
- No water, oil or chemicals or the vapors of these substances can come into direct contact with the unit
- Please note that the ambient temperature of this unit – not the ambient temperature of the control panel – must not exceed 55℃ (131℉) if mounted through the face of a control panel, otherwise the life of electronic components (especially electrolytic capacitors) may be shortened.

⚠ Caution with Respect to Export Trade Control Ordinance

To avoid this instrument from being used as a component in, or as being utilized in the manufacture of weapons of mass destruction (i.e. military applications, military equipment, etc.), please investigate the end users and the final use of this instrument. In the case of resale, ensure that this instrument is not illegally exported.

Specifications

Power supply voltage	100 to 240 V AC 50/60 Hz, Allowable fluctuation: 85 to 264 V AC 24 V AC/DC 50/60 Hz, Allowable fluctuation: 20 to 28 V AC/DC
Base accuracy (At ambient temperature 23℃, for a single unit mounting)	Thermocouple: Within ±0.2% of each input span ±1 digit However, R, S inputs, 0 to 200℃(32 to 392℉): Within ±6℃(12℉) B input, 0 to 300℃ (32 to 572℉): Accuracy is not guaranteed. K, J, E, T, N inputs, Less than 0℃ (32℉): Within ±0.4% of input span ±1 digit RTD: Within ±0.1% of each input span ±1 digit Direct current, DC voltage inputs: Within ±0.2% of each input span ±1 digit
Effect of ambient temperature	Within 50 ppm/℃ of each input span
Input sampling period	125 ms
Time accuracy	Within ±0.5% of setting time
Power consumption	100 to 240 V AC: Approx.8 VA max.(11 VA max. if max. options are added) 24 V AC: Approx. 5 VA max. (8 VA max. if max. options are added) 24 V DC: Approx. 5 W max. (8 W max. if max. options are added)
Ambient temperature	-10 to 55℃ (However, no icing, non-condensing)
Ambient humidity	35 to 85 %RH (However, non-condensing)
Altitude	2,000 m or less
Weight	Approx. 220 g
Accessories	Mounting bracket: 1 set Instruction manual excerpt: 1 copy

Control output OUT1	Relay contact: 1a, Control capacity, 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load cosΦ=0.4), Electric life: 100,000 cycles, Minimum applicable load: 10 mA 5 V DC Non-contact voltage for SSR drive): 12 V DC±15%, Max. 40 mA (short circuit protected) Direct current: 4 to 20 mA DC (Resolution: 12000), Load resistance: Max. 550 Ω
Event output EV□	Relay contact: 1a, Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load cosΦ=0.4) Electric life: 100,000 cycles, Minimum applicable load: 10 mA 5 V DC
Control output OUT2 [EV2(DR), DS, DA, EV3D□ options]	Relay contact: 1a, Control capacity: 3 A 250 V AC (resistive load) 1 A 250 V AC (inductive load cosΦ=0.4) Electric life: 100,000 cycles, Minimum applicable load: 10 mA 5 V DC (If EV2 option is ordered, and 020 is selected in [Event Output EV2 allocation]) Non-contact voltage for SSR drive): 12 V DC±15%, Max. 40 mA (short circuit protected) Direct current: 4 to 20 mA DC (Resolution: 12000), Load resistance: Max. 550 Ω
Transmission output (EIT option)	Output: 4 to 20 mA DC (Resolution: 12000), Load resistance: Max. 550 Ω Output accuracy: Within ±0.3% of transmission output span Response time: 400 ms + input sampling period (0%→90%)
Insulated power output (P24 option)	Output voltage: 24±3 V DC (When load current is 30 mA DC) Ripple voltage: Within 200 mV DC (When load current is 30 mA DC) Max. load current: 30 mA DC

Dimensions (Scale: mm)

(Fig. 1)

Panel Cutout (Scale: mm)

(Fig. 2)

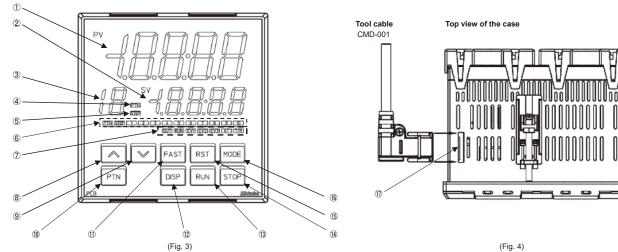### ⚠ Caution

If horizontal close mounting is used for the unit, IP66 specification (Drip-proof/Dust-proof) may be compromised, and all warranties will be invalidated.
The torque for the mounting bracket screws should be 0.1 N•m.

Horizontal close mounting
n: Number of mounted units

Names and Functions

(Fig. 3) (Fig. 4)

Tool cable CMD-001   Top view of the case

Displays, Indicators
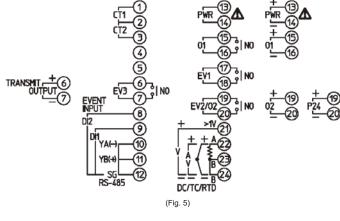
①	PV Display (Red)	Indicates process variable (PV) in RUN mode. Indicates setting characters in Setting mode. Flashes during Wait action or Holding in program control.
②	SV Display (Green)	Indicates desired value (SV), Output manipulated value (MV), or Remaining time (TIME) in RUN mode. Retains display indication at power OFF. Indicates the set values in setting mode.
③	PTN/STEP Display (Orange)	Indicates the pattern number or step number. Each time the DISP key is pressed, the PTN/STEP Display (③), and the PTN/STEP indicator (⑥) alternately indicate the pattern number and step number. Flashes during Wait action, or when the step number is indicated. If 'SV digital reception' is selected in [Communication protocol], is indicated.
④	PTN Indicator (Orange)	Lights up when the pattern number is indicated on the PTN/STEP Display.
⑤	STEP Indicator (Orange)	Lights up when the step number is indicated on the PTN/STEP Display.
⑥	PTN/STEP Indicator (Green)	LED for the pattern number or step number lights up. If the PTN/STEP Display (③) indicates the pattern number, the PTN/STEP indicator (⑥) lights up its step number. If the PTN/STEP Display indicates the step number, the PTN/STEP indicator lights up its pattern number. Each time the DISP key is pressed, the PTN/STEP indicator and the PTN/STEP Display alternately indicate the pattern number and step number.

Action Indicators

⑦	OUT (Green)	Lights up when control output OUT1 is ON. For direct current output type, flashes corresponding to the MV in 125 ms cycles.
	RUN (Orange)	Lights up during program control RUN. Flashes during Program control HOLD or Fixed value control.
	EV1 (Red)	Lights up when Event output EV1 is ON.

	EV2 (Red)	Lights up when Event output EV2 [(EV2, EV3(DR) options] is ON. Lights up when control output OUT2 (Cooling output (EV2, DS, DA or EV3D□ option)] is ON. For direct current output type (DA, EV3DA options), flashes corresponding to the MV in 125 ms cycles.
	EV3 (Red)	Lights up when Event output EV3 (EV3D□, EI options) is ON.
	AT (Orange)	Flashes while AT is performing.
	T/R (Orange)	Lights up during serial communication (C5W, C5 options) TX (transmitting) output.

Keys, Connector

⑧	UP key	In setting mode, increases the numerical value. By pressing for approx. 1 second during program control, time progress pauses, and control continues with the SV at that time (Holding function).
⑨	DOWN key	In setting mode, decreases the numerical value.
⑩	PTN key (Pattern key)	During program control stop (in standby), selects program pattern number to perform or to set. By pressing during program control, moves to Monitor mode. In Monitor mode, switches the Monitor mode.
⑪	FAST key	In setting mode, makes the numeric value change faster. During program control, makes step time progress 60 times faster.
⑫	DISP key (Display key)	During RUN mode, the PTN/STEP display and PTN/STEP indicator alternately indicate the pattern number and step number. In setting mode, registers the set value, and moves back to the previous mode.
⑬	RUN key	Performs program control, or cancels Holding while program control is held. By pressing for approx. 1 second during program control, stops performing step, and proceeds to the next step (Advance function).
⑭	STOP key	Stops program control by pressing for approx. 1 sec during program control, or cancels pattern end output.
⑮	RST(Reset) key	In setting mode, registers the set value, and moves to RUN mode.
⑯	MODE key	In setting mode, registers the set value, and moves to the next item.
⑰	Tool cable connector	By connecting the Tool cable (CMD-001, sold separately), the following operations can be conducted on an external computer, using the Console software SWM-PCB101M. • Reading and setting of step SV, step time, PID and various set values • Reading of PV and action status • Function change

Terminal Arrangement

⚠ Caution

Do not pull or bend the lead wire on the terminal side when wiring or after wiring, as it could cause malfunction. Use a solderless terminal with an insulation sleeve in which an M3 screw fits. The torque for the terminal screws should be 0.63 N•m.

(Fig. 5)

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PWR	Power supply voltage 100 to 240 V AC or 24V AC/DC (For 24 V DC, ensure polarity is correct.)
O1	Control output OUT1
EV1	Event output EV1
EV2	Event output EV2 [EV2, EV3(DR) options]
O2	Control output OUT2 [EV2, DS, DA, EV3D□ options]
P24	Insulated power output 24 V DC (P24 option)
TC	Thermocouple input
RTD	RTD input
DC	Direct current, DC voltage input
CT1	CT input 1 (C5W, EIW, W options)
CT2	CT input 2 (C5W, EIW, W options)
RS-485	Serial communication RS-485 (C5W, C5 options)
EVENT INPUT	Event input DI1 (C5W, EIW, EIT, C5, EI options) Event input DI2 (C5W, EIW, EIT, C5, EI options)
EV3	Event output EV3 (EV3D□, EI options)
TRANSMIT OUTPUT	Transmission output (EIT option)
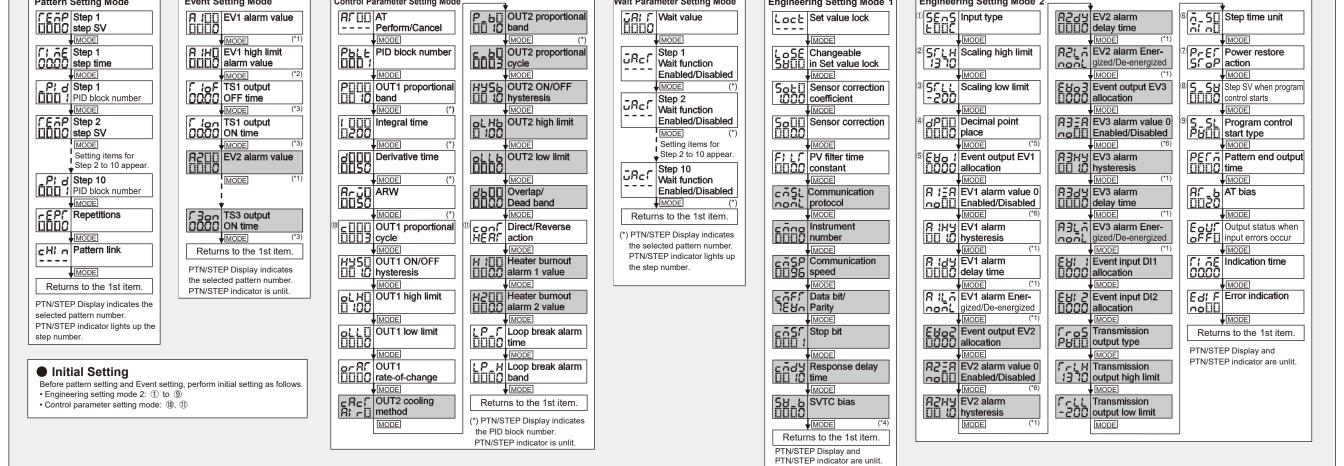
PCB1 Key Operation Flowchart

● About Setting Item

⌐E⌐P / Step 1 SV	Upper left: PV Display: Indicates setting characters. Lower left: SV Display: Indicates factory default. Right side: Indicates setting items.
A₂⌐⌐ / EV2 alarm value	Shaded setting items are optional, and appear only when the options are ordered.

- (*1) Available when 001 (High limit) to 012 (H/L limits with standby independent) are selected in [Event output EV□ allocation].
- (*2) Available when 004 (H/L limits independent), 006 (H/L limit range independent) or 012 (H/L limits with standby independent) is selected in [Event output EV□ allocation].
- (*3) Available when 015 (Time signal output) is selected in [Event output EV□ allocation].
- (*4) Available when SV digital reception (Shinko protocol) is selected in [Communication protocol].
- (*5) Available when direct current or DC voltage input is selected in [Input type].
- (*6) Available when 001(High limit) to 012 (H/L limits with standby independent) – except [007 (Process high) and 008 (Process low)] – are selected in [Event output EV□ allocation].

● Key Operation

- Use ∧ and ∨ for settings, and register the settings with MODE or DISP.
- MODE: Moves to the next item, illustrated by an arrow.
- DISP: Moves back to the previous item (Opposite to MODE).
- MODE (3 sec): Press MODE for approx. 3 seconds.
- ∧+MODE: Press ∧ and MODE (in that order) together.
- ∧+∨ (3 sec): Press ∧ and ∨ (in that order) together for 3 seconds.
- ∧+∨+MODE (3 sec): Press ∧, ∨ and MODE (in that order) together for 3 seconds.
- ∧+∨+MODE (3 sec): Press ∧, ∨ and MODE (in that order) together for 3 seconds.
- ∧+∨+STOP (3 sec): Press ∧, ∨ and STOP (in that order) together for 3 seconds.
- RST: Returns to RUN mode from any setting items.

POWER ON

If no□□ (Data clear No) is selected: If MODE is pressed, the unit returns to RUN mode.
If YES□ (Data clear Yes) is selected: If MODE is pressed, the unit automatically returns to RUN mode after data clear.

RUN Mode
Program control Stop (in standby) ⇄ Program control RUN

(*) Select a pattern with PTN, and press RUN, Program control for the pattern will be performed.

Monitor Mode (Enabled during program control)

[PV] MV Indication [PV] Remaining time

Setting Mode

Pattern Setting Mode
- Step 1 step SV
- Step 1 step time
- Step 1 PID block number
- Step 2 step SV
- Setting items for Step 2 to 10 appear.
- Step 10 PID block number
- Repetitions
- Pattern link
- Returns to the 1st item.

Event Setting Mode
- EV1 alarm value
- EV1 high limit alarm value (*1)
- TS1 output OFF time (*2)
- TS1 output ON time (*3)
- EV2 alarm value (*3)
- TS3 output ON time (*1)
- Returns to the 1st item. (*3)

Control Parameter Setting Mode
- AT Perform/Cancel
- PID block number
- OUT1 proportional band
- Integral time
- Derivative time
- ARW
- OUT1 proportional cycle
- OUT1 ON/OFF hysteresis
- OUT1 high limit
- OUT1 low limit
- OUT1 rate-of-change
- OUT2 cooling method

- OUT2 proportional band (*)
- OUT2 proportional cycle (*)
- OUT2 ON/OFF hysteresis (*)
- OUT2 high limit (*)
- OUT2 low limit (*)
- Overlap/Dead band (*)
- Direct/Reverse action (*)
- Heater burnout alarm 1 value
- Heater burnout alarm 2 value
- Loop break alarm time
- Loop break alarm band
- Returns to the 1st item.

Wait Parameter Setting Mode
- Wait value
- Step 1 Wait function Enabled/Disabled
- Step 2 Wait function Enabled/Disabled
- Setting items for Step 2 to 10 appear.
- Step 10 Wait function Enabled/Disabled
- Returns to the 1st item.

Engineering Setting Mode 1
- Set value lock
- Changeable in Set value lock
- Sensor correction coefficient
- Sensor correction
- PV filter time constant
- Communication protocol
- Instrument number
- Communication speed
- Data bit/ Parity
- Stop bit
- Response delay time
- SVTC bias (*4)
- Returns to the 1st item.

Engineering Setting Mode 2
- Input type
- Scaling high limit
- Scaling low limit
- Decimal point place
- Event output EV1 allocation
- EV1 alarm value 0 Enabled/Disabled
- EV1 alarm hysteresis (*1)
- EV1 alarm delay time (*1)
- EV1 alarm Ener-gized/De-energized (*1)
- Event output EV2 allocation
- EV2 alarm value 0 Enabled/Disabled (*6)
- EV2 alarm hysteresis (*1)

- EV2 alarm delay time (*1)
- EV2 alarm Ener-gized/De-energized (*1)
- Event output EV3 allocation
- EV3 alarm value 0 Enabled/Disabled (*6)
- EV3 alarm hysteresis (*1)
- EV3 alarm delay time (*1)
- EV3 alarm Ener-gized/De-energized (*1)
- Event input DI1 allocation
- Event input DI2 allocation
- Transmission output type
- Transmission output high limit
- Transmission output low limit

- Step time unit
- Power restore action
- Step SV when program control starts
- Program control start type
- Pattern end output time
- AT bias
- Output status when input errors occur
- Indication time
- Error indication
- Returns to the 1st item.

● Initial Setting
Before pattern setting and Event setting, perform initial setting as follows.
• Engineering setting mode 2: ① to ⑨
• Control parameter setting mode: ⑩, ⑪

Pattern link		Lock 5		Stop bit		R	32 to 3200 ℉	3 digits after decimal point
Pattern link Disabled		Changeable in Set value lock		1 bit		S	32 to 3200 ℉	Heating/Cooling control output
Pattern link Enabled		Step SV + Step time		2 bits		E	32 to 3308 ℉	Available only for Event output EV2 to EV3 allocation
AT Perform / Cancel		Step SV + Step time + EV□ alarm value		Input type		N	-328 to 1472 ℉	No event
AT Cancel		Communication protocol		K	-200.0 to 1370 ℃	T	-328.0 to 752.0 ℉	EV1 to EV3 alarm value 0 Enabled / Disabled
AT Perform		Shinko protocol		K	-200.0 to 400.0 ℃	N	-328 to 2372 ℉	EV1 to EV3 alarm Energized / De-energized
OUT2 cooling method		SV digital transmission (Shinko protocol)		J	-200 to 1000 ℃	PL-II	32 to 2534 ℉	Energized
Air cooling		SV digital reception (Shinko protocol)		R	0 to 1760 ℃	C(W/Re5-26)	32 to 4199 ℉	De-energized
Oil cooling		Modbus ASCII mode		S	0 to 1760 ℃	Pt100	-328.0 to 1562.0 ℉	Event input DI1, DI2 allocation
Water cooling		Modbus RTU mode		E	0 to 1820 ℃	JPt100	-328.0 to 1562.0 ℉	No event
Direct / Reverse action		Communication speed		T	-200.0 to 400.0 ℃	Pt100	-328 to 932 ℉	Pattern number selection
Reverse control action		9600 bps		N	-200 to 1300 ℃	JPt100	-328 to 932 ℉	Direct / Reverse action
Direct control action		19200 bps		PL-II	0 to 1390 ℃	4 - 20 mA	-2000 to 10000	Program control RUN / STOP
Step 1 to 10 Wait function Enabled / Disabled		38400 bps		C(W/Re5-26)	0 to 2315 ℃	0 - 20 mA	-2000 to 10000	Program control Holding / Not holding
Disabled		Data bit / Parity		Pt100	-200.0 to 850.0 ℃	0 - 1 V	-2000 to 10000	Program control Advance function
Enabled		8 bits / No parity		JPt100	-200.0 to 500.0 ℃	0 - 5 V	-2000 to 10000	Heater burnout alarm output
Set value lock		7 bits / No parity		Pt100	-200 to 850 ℃	1 - 5 V	-2000 to 10000	Loop break alarm output
Unlock		8 bits / Even		JPt100	-200 to 500 ℃	0 - 10 V	-2000 to 10000	Time signal output
Lock 1		7 bits / Even		K	-328 to 2498 ℉	Decimal point place		Output during AT
Lock 2		8 bits / Odd		J	-328.0 to 1832.0 ℉	No decimal point		Output by communication command
Lock 3		7 bits / Odd		R	32 to 3200 ℉	1 digit after decimal point		Pattern end output
Lock 4				J	-328 to 1832 ℉	2 digits after decimal point		RUN output

Power restore action	
Stops after power is restored	
Continues after power is restored	
Suspends after power is restored	
Program control start type	
P-RUN start	
PVR start	
SV start	
Output status when input errors occur	
Output OFF	
Output ON	
Error indication	
Disabled	
Enabled	
Transmission output type	
PV transmission	
SV transmission	
MV transmission	
Step time unit	
Hours : Minutes	
Minutes : Seconds	