

# DIGITRONIK Digital Indicating Controller SDC10

## User's Manual

Thank you for purchasing the DIGITRONIK Digital Indicating Controller **SDC10**. This manual contains information for ensuring correct use of the DIGITRONIK Digital Indicating Controller **SDC10**. It also provides necessary information for installation, maintenance and troubleshooting. This manual should be read by those who design and maintain devices and operator control panels that use the DIGITRONIK Digital Indicating Controller **SDC10**. Be sure to keep this manual nearby for handy reference.

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## RESTRICTIONS ON USE

This product has been designed, developed and manufactured for general-purpose application in machinery and equipment.

Accordingly, when used in applications outlined below, special care should be taken to implement a fail-safe and/or redundant design concept as well as a periodic maintenance program.

- Safety devices for plant worker protection
- Start/stop control devices for transportation and material handling machines
- Aeronautical/aerospace machines
- Control devices for nuclear reactors

Never use this product in applications where human safety may be put at risk.

## REQUEST

Ensure that this User's Manual is handed over to the user before the product is used.

Copying or duplicating this User's Manual in part or in whole is forbidden. The information and specifications in this User's Manual are subject to change without notice.

Considerable effort has been made to ensure that this User's Manual is free from inaccuracies and omissions.

If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

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This manual uses the following symbols to ensure safe operation of this controller:



# WARNING

Warnings are indicated when mishandling the SDC10 might result in death or serious injury to the user.



# CAUTION

Cautions are indicated when mishandling the SDC10 might result in minor injury to the user, or only physical damage to the SDC10.



# WARNING



Note that incorrect wiring of the SDC10 can damage the SDC10 and lead to other hazards. Check that the SDC10 has been correctly wired before turning the power ON.



Before wiring, or removing/mounting the SDC10, be sure to turn the power OFF. Failure to do so might cause electric shock.














Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.



Do not disassemble the SDC10. Doing so might cause electric shock or faulty operation.

# CAUTION

	Do not operate the keys with a propelling pencil or sharp-tipped object. Doing so might cause faulty operation.
	<p>In addition to the standard ON/OFF and PID controls, the SDC10 is also equipped with self-tuning control which does not require setting control constants. Self-tuning control ensures stable control even during changes in SP values or during disturbances. This is achieved by monitoring and learning the characteristics of the control target to automatically output control constants.</p> <p>This function should be used according to the instructions given in the manual.</p>
	Use the SDC10 within the operating ranges recommended in the specifications (temperature, humidity, voltage, vibration, shock, mounting direction, atmosphere, etc.). Failure to do so might cause fire or faulty operation.
	Do not block ventilation holes. Doing so might cause fire or faulty operation.
	<p>Wire the SDC10 properly according to predetermined standards. Also wire the SDC10 using specified power leads according to recognized installation methods.</p> <p>Failure to do so might cause electric shock, fire or faulty operation.</p>
	<p>Do not allow lead clippings, chips or water to enter the controller case.</p> <p>Doing so might cause fire or faulty operation.</p>
	<p>Firmly tighten the terminal screws at the torque listed in the specifications.</p> <p>Insufficient tightening of terminal screws might cause electric shock or fire.</p>
	<p>Do not use unused terminals on the SDC10 as relay terminals.</p> <p>Doing so might cause electric shock, fire or faulty operation.</p>
	<p>We recommend attaching the terminal cover (sold separately) after wiring the SDC10.</p> <p>Failure to do so might cause electric shock, fire or faulty operation.</p>
	<p>Use the relays on the SDC10 within the service life listed in the specifications.</p> <p>Continued use of the relays after the recommended service life has expired might cause fire or faulty operation.</p>
	<p>Use Yamatake Corporation's SurgeNon if there is the risk of power surges caused by lightning.</p> <p>Failure to do so might cause fire or faulty operation.</p>

## SAFETY REQUIREMENTS



To reduce risk of electrical shock which could cause personal injury, follow all safety notices in this document.



This symbol warns the user of a potential shock hazard where hazardous live voltages may be accessible.

- \* If the controller is used in a manner not specified by Yamatake Corporation, the protection provided by the controller must be impaired.
- \* Do not replace any component (or part) not explicitly specified as replaceable by your supplier.
- \* All wiring must be in accordance with local norms and carried out by authorized and experienced personnel.
- \* A switch in the main power supply is required near the equipment.
- \* Provide delayed type (T) fuses having a rated power supply of 200mA and voltage of 250V for the mains power supply wiring of this AC power supply controller. (IEC 127)

### EQUIPMENT RATINGS

Supply voltage	100 to 240Vac (operating power voltage 85 to 264Vac)
Frequency	50/60Hz
Power consumption	7VA max.

### EQUIPMENT CONDITIONS

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Temperature:	0 to 50°C
Humidity:	10 to 90%RH (condensation not allowed)
Vibration:	2m/s <sup>2</sup> (10 to 60Hz)
Over-voltage category:	Category II (IEC60364-4-443, IEC60664-1)
Pollution degree:	2

### EQUIPMENT INSTALLATION

The controller must be mounted into a panel to limit operator access to the rear terminals. Make sure that the I/O common voltage and the grounding voltage excluding the power voltage are 33Vrms max., 46.7V (peak) max. and 70Vdc max.

### APPLICABLE STANDARDS

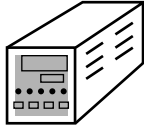
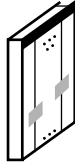
EN61010-1, EN50081-2, EN50082-2, EN61326



The CE supported model is the C10T type (panel type) only.

## Unpacking

When unpacking the product, check that you have received all the items that you ordered.

Name	Catalog No.	Q'ty	Remarks
Body 		1	See ■ <b>Model Selection Guide</b> on page 2.
Installation tool (C10T type only)	81446403-001	1	
User's Manual 	CP-UM-1703E	1	This manual
Engineering Unit seal		1	

The C10S type socket is optional.

After unpacking, handle the SDC10 and its accessories taking care to prevent damage or loss of parts.

Those using the communications function, should read the DIGITRONIK digital indicating controller User's Manual SDC10 "Communications Function Manual".

If an inconsistency is found or the package contents are not in order, immediately contact your dealer.

## Conventions Used in This Manual

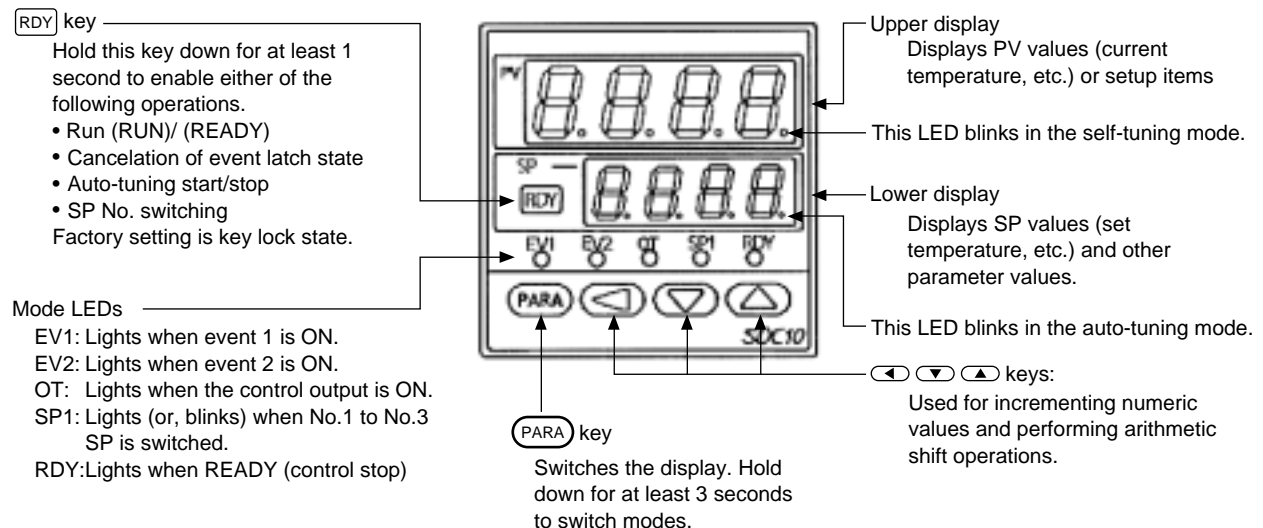
The following conventions are used in this manual.

### ! Handling Precautions

: Handling Precautions indicate items that the user should pay attention to when handling the SDC10.

 **Note** : Notes indicate useful information that the user might benefit by knowing.

# Chapter 1 NAMES & FUNCTIONS OF PARTS



# Chapter 2 STRUCTURE

## ■ Model Selection Guide

Basic Model No.	Mounting	Control Output	PV Input	Power Voltage	Option	Additional Processing	Specifications
C10	(Note 1)	T					Panel mounting
		S					Socket mounting
			0D				Relay output
			6D				Voltage pulse output (for SSR drive)
				T			Thermocouple input (K, J, E, T, R, DIN U, DIN L)
				R			RTD (Pt100/JPt100)
				L			DC voltage input (0 to 1Vdc, 0 to 5Vdc, 1 to 5Vdc)
					A		100 to 240Vac, 50/60Hz
					D		24Vdc (no polarity)
						00	None
						01	2 event outputs
				(Note 2)		02	2 event outputs 2 non-insulated external switch inputs 1 current transformer input
				(Note 2)		03	2 event outputs 2 insulated external switch inputs 1 current transformer input
				(Note 2)		05	2 event outputs RS-485 communications (CPL) 1 current transformer input
						00	No additional processing
					D0	Provision of Inspection Sheet	

(Note 1) A socket mounted model cannot be combined with 02, 03, 05 (option). The socket is sold as an option.

CE is not covered on socket mounted models.

(Note 2) The current transformer is sold as an option.

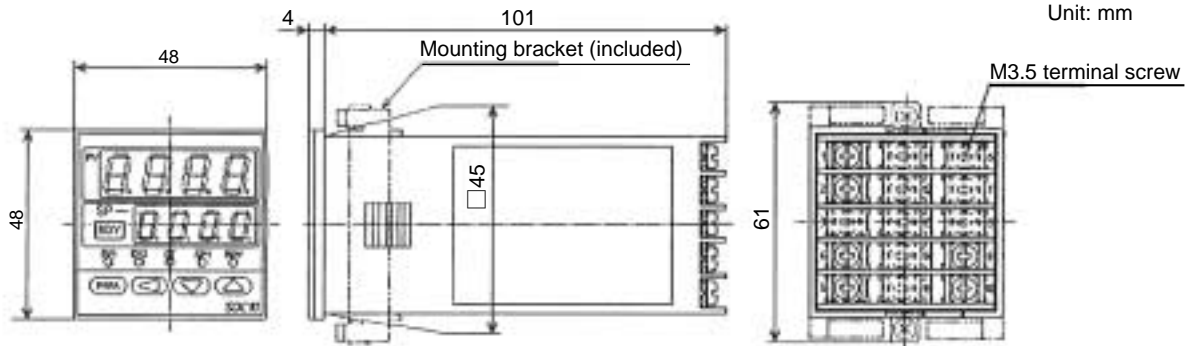
## ● Options

Name	Model No.
Current transformer	QN206A (5.8mm hole dia.)
	QN212A (12mm hole dia.)
Socket (C10S)	81446391-001
Mounting bracket	81446403-001
Hard cover	81446442-001
Soft cover	81446443-001
Terminal cover	81446464-001

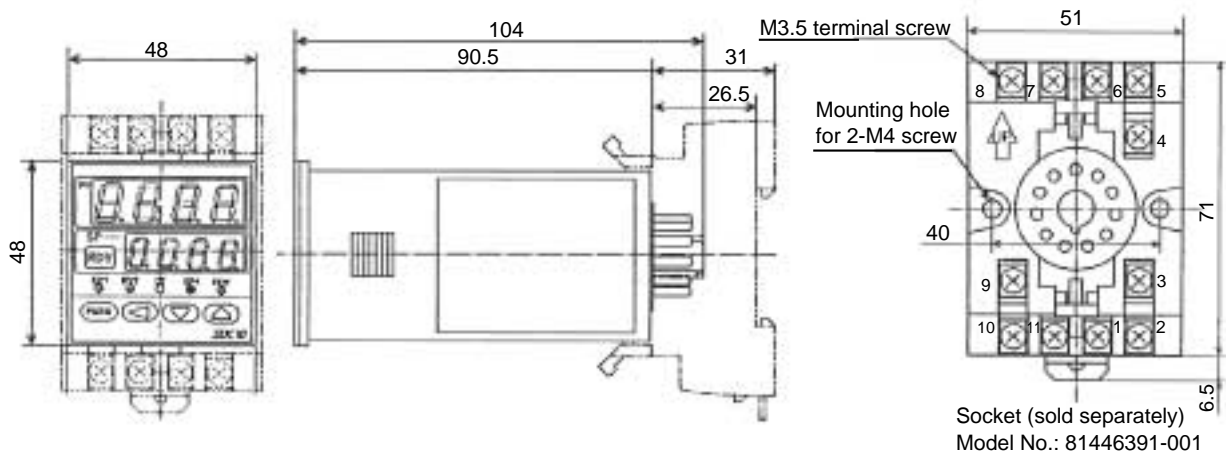
# Chapter 3 MOUNTING

## External Dimensions

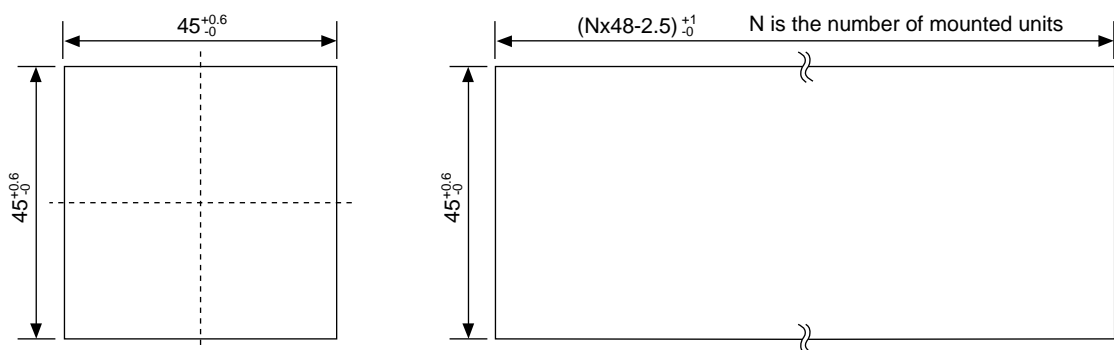
### ● C10T (panel mounted)



### ● C10S (with socket)



## Panel Cut-out Dimensions



## ! Handling Precautions

When three or more units are gang-mounted horizontally, the maximum allowable ambient temperature is 45°C.

## ■ Mounting Procedure

<b>⚠ CAUTION</b>	
<b>!</b>	Use the SDC10 within the operating ranges recommended in the specifications (temperature, humidity, voltage, shock, mounting direction, atmosphere, etc.). Failure to do so might cause fire or faulty operation.
<b>⊘</b>	Do not block ventilation holes. Doing so might cause fire or faulty operation.
<b>!</b>	Be sure to attach the terminal cover (sold separately) after wiring the SDC10. Failure to do so might cause electric shock, fire or faulty operation.

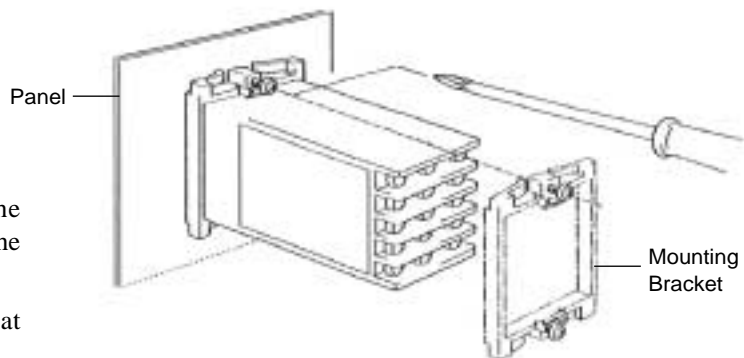
### **!** Handling Precautions

When three or more units are gang-mounted horizontally, the maximum allowable ambient temperature is 45°C.

#### ● C10T

- Required tools  
Phillips screwdriver

- ① Insert the controller into the opening on the front side of the panel.
- ② Attach the mounting bracket at the rear side of the panel.
- ③ Press the controller against the mounting bracket to make sure that the bracket claws enter the grooves of the controller.
- ④ Tighten the top and bottom screws. (When the screws touch the panel, turn the screws another half turn.)

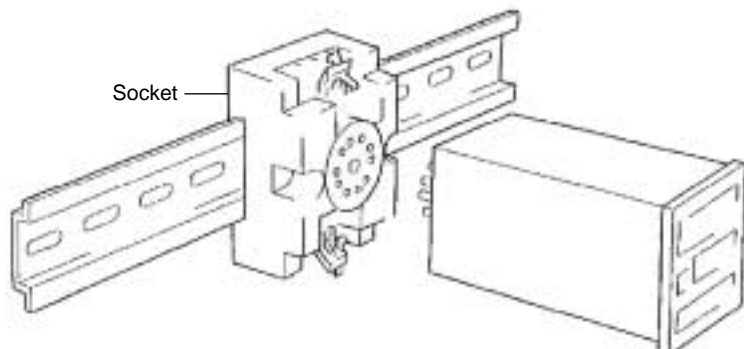


### **!** Handling Precautions

- Do not operate the keys with a propelling pencil or sharp tipped object. Be sure to mount this controller on a panel. Cover terminals to prevent electric shock. An optional terminal cover is provided. (model No.: 81446464-001)
- Do not overtighten the screws to prevent deformation of the front panel.

#### ● C10S

- ① Mount the socket in the panel using a DIN rail or screws.
- ② Wire the socket.
- ③ Insert the body of the controller into the socket.
- ④ Insert the clasps at the top and bottom of the socket into the holes of the controller body to firmly secure it to the socket.





## ■ Location

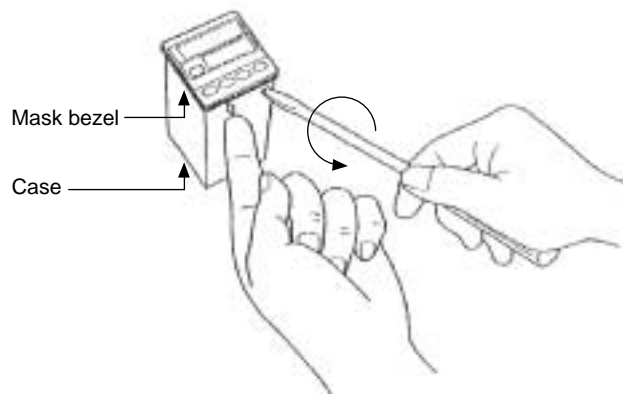
Do not install the controller in locations where it is:

- subject to extreme temperature and humidity
- subject to sulfuric or corrosive gases
- subject to dust or oil smoke
- subject to direct sunlight, or splashing by rain or water
- subject to mechanical vibrations and shock
- subject to high-voltage lines, welding machines and sources of electric noise
- less than 15 m from high-voltage ignition devices
- subject to electromagnetic fields
- subject to flammable liquids or vapor

## ■ Removing the SDC10T Case

The following instructions show how to remove the SDC10T body from the case. This has to be carried out only when the controller is to be replaced:

- Required tools  
Small standard screwdriver
- ① Press the claw on the lower left side of the mask bezel with your finger.
  - ② Insert the screwdriver into the groove between the mask bezel and the controller body.
  - ③ Press the claw while turning the screwdriver.
  - ④ Take hold of the front end of the body as it is forced out of the case and pull it out.

















## ! Handling Precautions

- Turn the power OFF before carrying out the above procedure.
- In the case of the socket model (C10S), internal components cannot be drawn out.

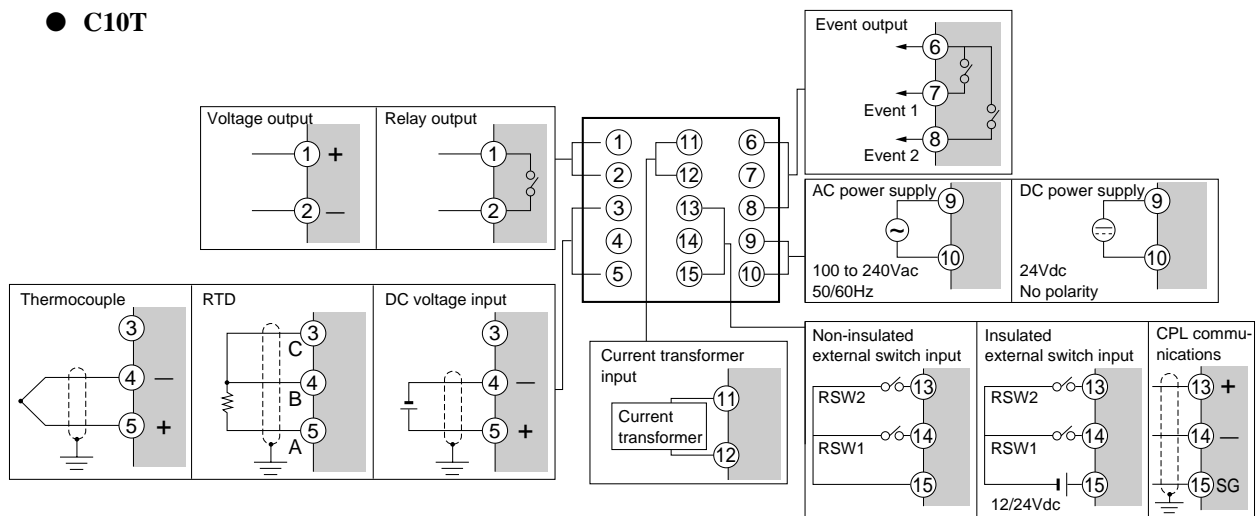
# Chapter 4 WIRING

## ■ Terminal Array and Wiring

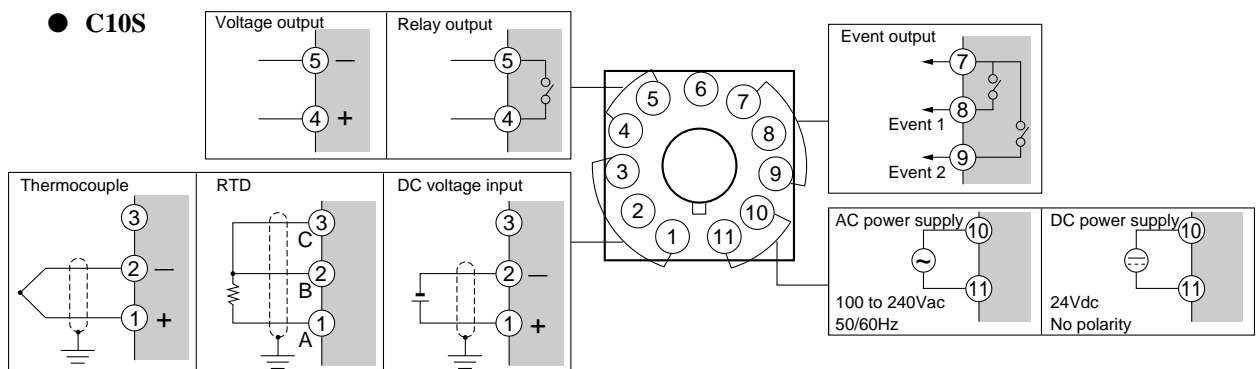
 <b>WARNING</b>	
	Before wiring, or removing/mounting the SDC10, be sure to turn the power OFF. Failure to do so might cause electric shock.
	Do not touch electrically charged parts such as the power terminals. Doing so might cause electric shock.

 <b>CAUTION</b>	
	Wire the SDC10 properly according to predetermined standards. Also wire the SDC10 using specified power leads according to recognized installation methods. Failure to do so might cause electric shock, fire or faulty operation.
	Do not allow lead clippings, chips or water to enter the controller case. Doing so might cause fire or faulty operation.
	Firmly tighten the terminal screws at the torque listed in the specifications. Insufficient tightening of terminal screws might cause electric shock or fire.
	Do not use unused terminals on the SDC10 as relay terminals. Doing so might cause electric shock, fire or faulty operation.
	We recommend attaching the terminal cover (sold separately) after wiring the SDC10. Failure to do so might cause electric shock, fire or faulty operation.
	Use the relays on the SDC10 within the service life listed in the specifications. Continued use of the relays after the recommended service life might cause fire or faulty operation.
	Use Yamatake Corporation's SurgeNon if there is the risk of power surges caused by lightning. Failure to do might cause fire or faulty operation.
	Make sure all wiring is correct. Incorrect wiring may damage connected equipment.
	The controller does not operate until six seconds after the power has been turned ON. Special arrangements must be made when the relay output from the controller is to be used as an interlock signal.
	When a ground type thermocouple must be used and an external switch input is required, PV readout error caused by sneak path current may occur. Select the insulated external switch input model (option code 03).

## ● C10T



## ● C10S

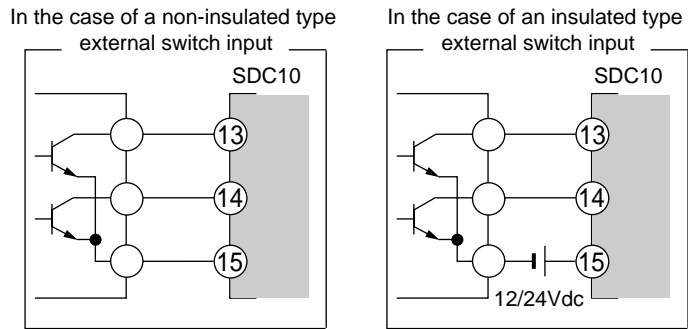


## ! Handling Precautions

- Check the model number of the controller and terminal numbers on the label on the side of the controller to prevent any wiring errors.
- Use crimped solderless wire connectors for M3.5 screws.
- I/O signal lines should be routed at least 50cm away from power lines. Also, do not route I/O leads through the same distribution box or ducts.
- Crimped solderless wire connectors must not contact other connectors.
- Do not use unused terminals as relay terminals.
- Two or more SDC10 series controllers can be connected in parallel by external switch input.
- The controller can be connected with the Yamatake Corporation SDC20/30/40 series in parallel by non-insulated external switch inputs.
- Before connecting in parallel to other equipment, first check the conditions of the other equipment.
- Non-insulated external switch inputs are non-voltage contact inputs. So, use external switch for small current.
- Pass a lead wire for carrying the heater current through a current transformer.  
Use the controller with the heater current within the specification range (allowable current). Otherwise, the controller may be damaged.
- The controller is designed not to function for six seconds after it is turned ON. This is to allow it to stabilize. The controller then enters the operation mode. However, warm up the controller to satisfy standard accuracy requirements. Warming up takes about 30 minutes.

- Current transformer input cannot be used for 3-phase motors and phase control.
- Devices and systems to be connected to this unit must have the basic insulation sufficient to withstand the maximum operating voltage levels of the power supply and input/output parts.
- Use power supply with reinforced insulation for DC model.

■ How to connect open collector output to external switch inputs



■ Noise Countermeasures

- Use power from a single-phase control power supply to reduce noise.
- Install an insulating transformer when power line noise is excessive and use a line filter.  
(model number of Yamatake Corporation line filter: 81446364-001)
- Use a CR filter to counteract fast-rising noise.  
(model number of Yamatake Corporation filter: 81446365-001)

! Handling Precautions

- When noise countermeasures have been taken, do not bundle primary and secondary cables together or route them through the same distribution box or ducts.

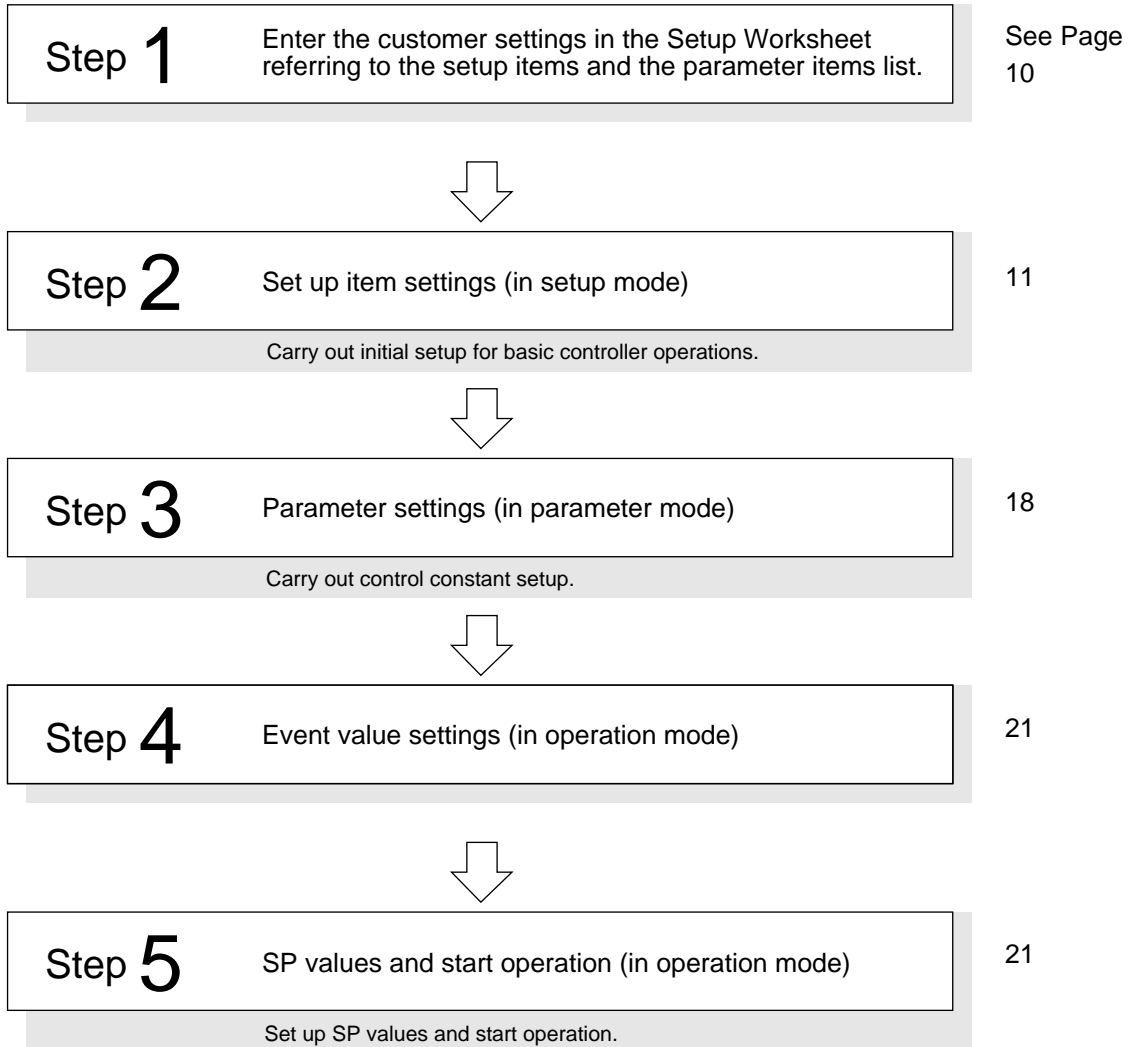
■ Meanings of Symbols in the Terminal Wiring Label

The following table shows the meanings of symbols in the terminal wiring label on the instrument top.

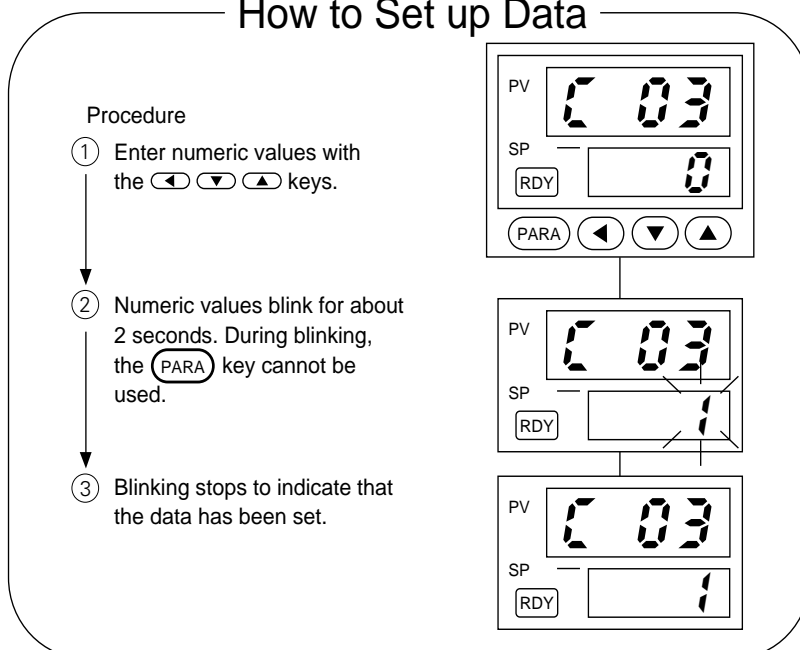
Symbol	Description
~	Alternating current
---	Direct current
⏏	Earth (ground) terminal
⚠	CAUTION, risk of electric shock
⚠	CAUTION

# Chapter 5 INITIAL SETTINGS

Set up the SDC10 according to the following procedure:

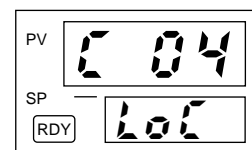


## How to Set up Data

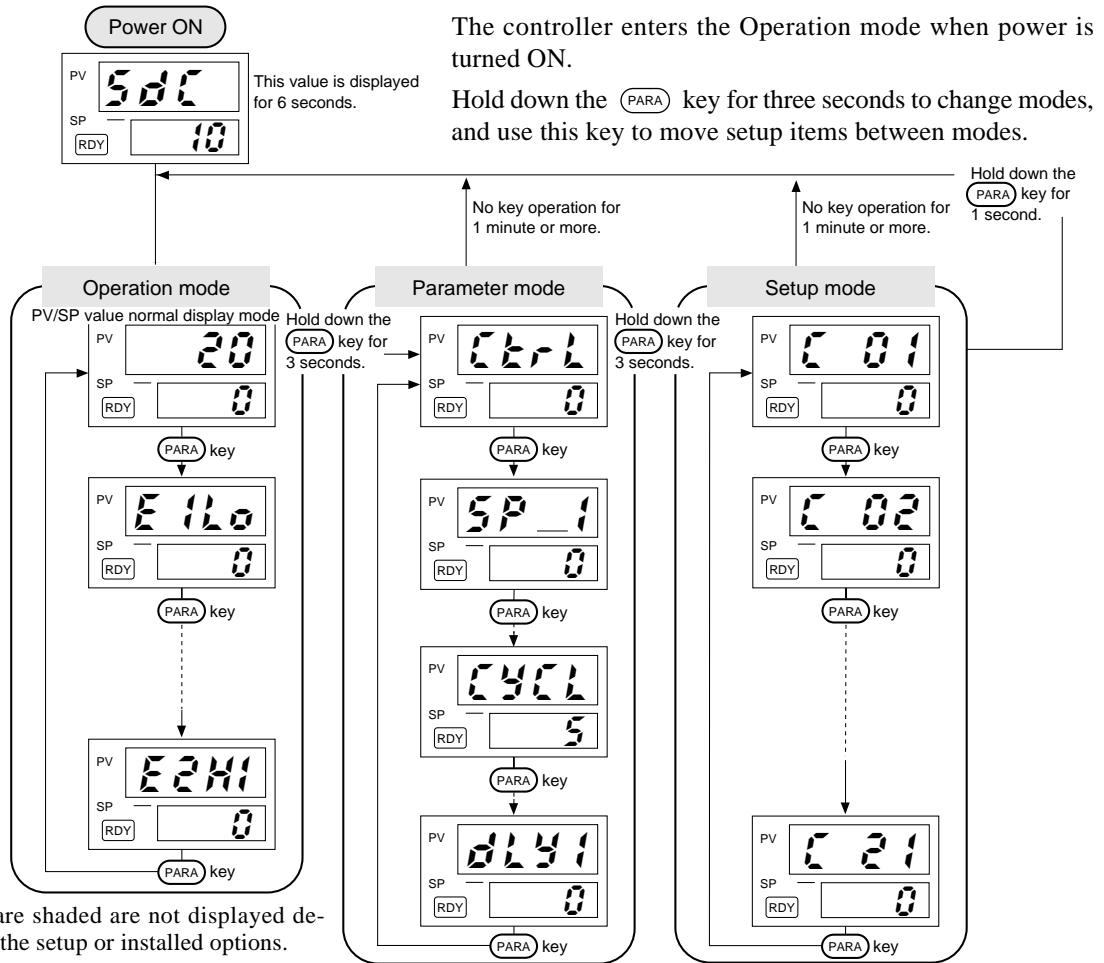


(Note)

“LoC” is displayed in the lower display for about 2 seconds to indicate that an incorrect key or data entry was made. Such entries are ignored.



## 5-1 Overall Operation Flow



Items that are shaded are not displayed depending on the setup or installed options.

### Operation Mode Display Order

- **Basic display state**
- **SP-0** : No. 0 SP value
- **SP-1** : No. 1 SP value
- **SP-2** : No. 2 SP value
- **SP-3** : No. 3 SP value
- **oVt** : Manipulated variable
- **ct** : Current value (CT)
- **t1** : Remaining timer 1 time
- **t2** : Remaining timer 2 time
- **E1Lo** : Event 1  
(E1) Lower limit
- **E1Hi** : Event 1  
Upper limit
- **E2Lo** : Event 2  
(E2) Lower limit
- **E2Hi** : Event 2  
Upper limit

### Parameter Mode Settings and Display Order

- **Ctrl** : Control method
- **At** : Auto-tuning
- **SP0** : No. 0 SP value
- **SP1** : No. 1 SP value
- **SP2** : No. 2 SP value
- **SP3** : No. 3 SP value
- **P** : Proportional band
- **I** : Reset time
- **d** : Rate time
- **oL** : Output limit low
- **oH** : Output limit high
- **rE** : Manual reset value
- **Sb** : Self-tuning startup width
- **dIFF** : Differential gap
- **CYCL** : Time-proportional cycle
- **Pb1R** : PV bias value
- **HYS1** : Event 1 hysteresis
- **dLY1** : Event 1 ON delay time
- **HYS2** : Event 2 hysteresis
- **dLY2** : Event 2 ON delay time
- **FlLt** : PV filter

### Setup Mode Settings and Display Order

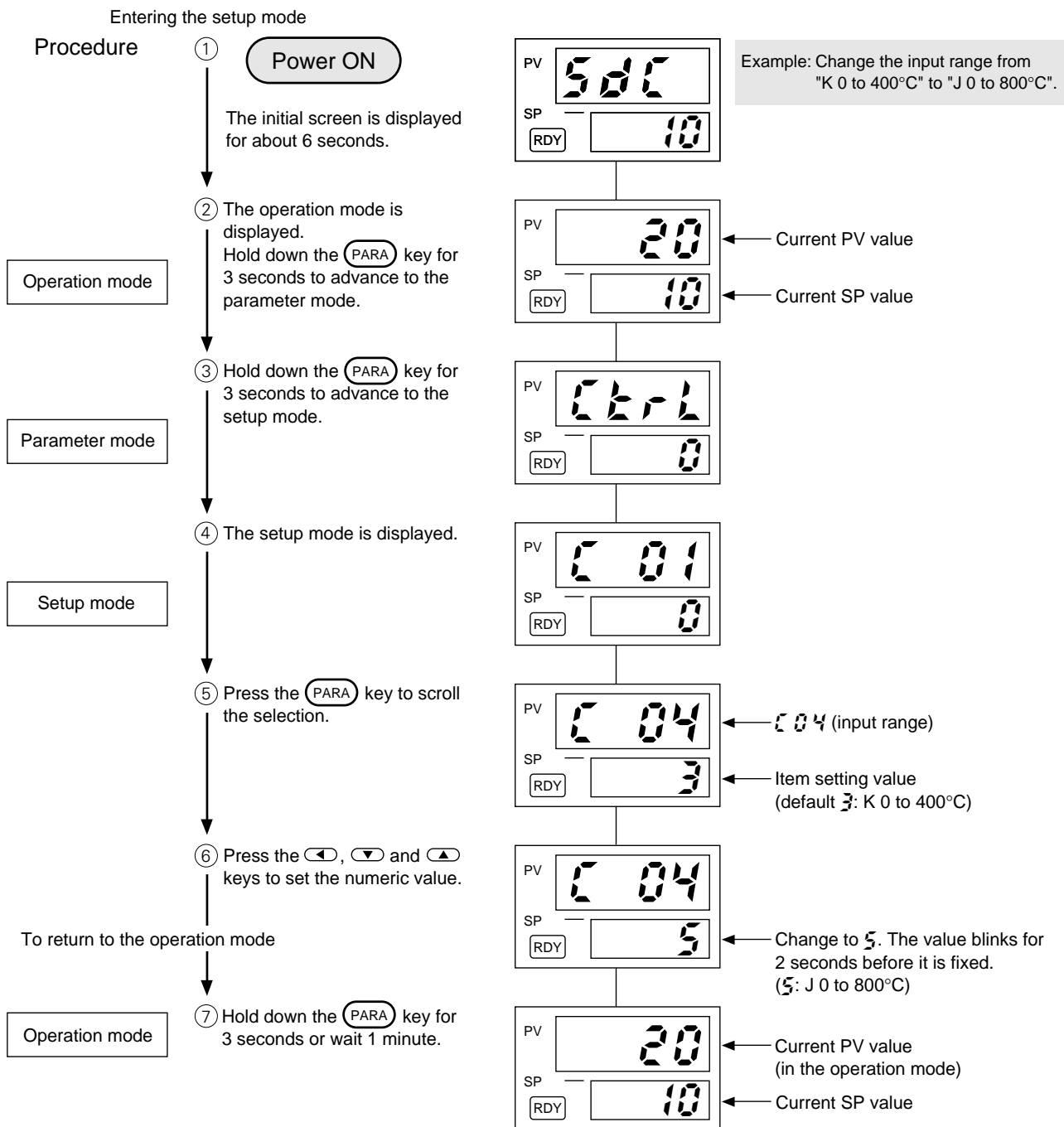
- **C01** : Key lock
- **C02** : Temperature unit
- **C03** : Direct/reverse operation
- **C04** : Input range
- **C05** : Decimal point position
- **C06** : PV range lower limit
- **C07** : PV range upper limit
- **C09** : Lower SP limit
- **C10** : Upper SP limit
- **C11** : Preset output value
- **C12** : Operation mode display
- **C13** : Number of SPs used
- **C14** : Event 1 type
- **C15** : Event 2 type
- **C16** : Event operation when READY
- **C17** : External switch input 1 type
- **C18** : External switch input 2 type
- **C21** : READY key settings
- **C22** : Communications address
- **C23** : Communications conditions
- **C24** : Cold junction compensation
- **C25** : Selection of time-proportional control operation

## 5-2 Setup Items

This section describes how to set the controller to the Operation mode after it is first mounted in instruments. Before this controller is first used, the input range, event operation type and other operating conditions matched to the desired instrument application must be set. This is referred to as “setup.”

If this controller is already mounted in instruments and the setup is already completed, proceed to the next chapter.

The following shows the initial settings in basic controller operation:



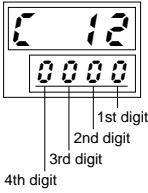
### ! Handling Precautions

The alarm code and blinking to indicate self-tuning or auto-tuning in progress are not displayed while moving to the setup mode.

## ● List of setup items

Function Prompt	Function	Selections and Setting Range	Factory Setting	Remarks
C01	Key lock	0: Key lock not engaged 1: Key lock engaged for items other than SP value, SP set selection, event value, <b>[RDY]</b> key and AT 2: Key lock engaged for items other than SP value, SP set selection and <b>[RDY]</b> key 3: Key lock engaged for all items	0	Key lock can be canceled anytime
C02	Temperature unit	0: °C 1: °F	0	
C03	Control output direction	0: Reverse operation (heat control) 1: Direct operation (cooling control)	0	
C04	Input type and range	Thermocouple input range 1: K 0 to 1200°C 0 to 2200°F 2: K 0 to 600°C 0 to 1100°F 3: K 0 to 400°C 0 to 700°F 4: K -200 to +400°C -300 to +700°F 5: J 0 to 800°C 0 to 1500°F 6: J -200 to +400°C -300 to +700°F 7: E 0 to 600°C 0 to 1100°F 8: T -200 to +400°C -300 to +700°F 9: DIN U -200 to +400°C -300 to +700°F 10: DIN L 0 to 800°C 0 to 1500°F 11: R 0 to 1600°C 0 to 3000°F 12: S 0 to 1600°C 0 to 3000°F	3	
		RTD input range 21: Pt100 -200 to +500°C -300 to +700°F 22: Pt100 0 to 200°C 0 to 300°F 23: Pt100 0.0 to 200.0°C 0.0 to 300.0°F 24: JPt100 -200 to +500°C -300 to +700°F 25: JPt100 0 to 200°C 0 to 300°F 26: JPt100 0.0 to 200.0°C 0.0 to 300.0°F 27: Pt100 -50 to +100°C -50 to +150°F 28: Pt100 -50.0 to +100.0°C -50.0 to +150.0°F 29: JPt100 -50 to +100°C -50 to +150°F 30: JPt100 -50.0 to +100.0°C -50.0 to +150.0°F	22	
		DC voltage input range 42: 1 to 5Vdc 43: 0 to 5Vdc 44: 0 to 1Vdc	43	
C05	Decimal point position	0: Decimal point not displayed (XXXX) 1: Decimal point No.1 display (XXX.X) 2: Decimal point No.2 display (XX.XX) 3: Decimal point No.3 display (X.XXX)	0	Displayed on DC voltage input models only
C06	PV range lower limit	-1999 to +9999	0	Displayed on DC voltage input models only
C07	PV range upper limit	-1999 to +9999	1000	Displayed on DC voltage input models only
C09	SP lower limit	Setting range : PV range lower limit to SP upper limit	Range Min.	
C10	SP upper limit	Setting range : SP lower limit to PV range upper limit	Range Max.	
C11	Manipulated variable when READY mode or Alarm occur	Setting range : 0 to 100% (no decimal point)	0	(Applied alarm code AL0 1, 02, 03, 70, 98)



Function Prompt	Function	Selections and Setting Range			Factory Setting	Remarks	
C12	Operation mode 	1st digit 0: Displays both SP and PV values 1: Displays SP value only 2: Displays PV value only 2nd digit 0: Does not display manipulated variable 1: Displays manipulated variable 3rd digit 0: Displays event settings or heater current value 1: Does not display event settings or heater current value 2: Does not display heater current only 4th digit 0: Displays time remaining of event timers/ Displays heater current and event setting with a resolution of 1A 1: Does not display time remaining of event timers/ Displays heater current and event setting with a resolution of 1A 2: Displays time remaining of event timers/ Displays heater current and event setting with a resolution of 0.1A 3: Does not display time remaining of event timers/ Displays heater current and event setting with a resolution of 0.1A				0000	
C13	Number of SPs used and display method	See page 14.					
C14	Event 1 operation type	See page 15.			0000	Displayed on event output model	
C15	Event 2 operation type	See page 15.			0000	Displayed on event output model	
C16	Event operation in READY mode	0: Operation continued in READY mode 1: Event output OFF in READY mode			0	Displayed on event output model	
C17	External switch input 1 operation type	Description	Operation when OFF	Operation when ON	0	Displayed on external switch input model.	
C18	External switch input 2 operation type	0: No operation 1: Switches between No.0 SP and No.1 SP 2: Switches between RUN and READY 3: Event 1 timer operation 4: Event 2 timer operation 5: Event 1 latch canceled 6: Event 2 latch canceled 7: Auto-tuning starts/stops	No.0 SP RUN Timer reset Timer reset Latch enabled Latch enabled Stopped	No.1 SP READY Timer activated Timer activated Latch canceled Latch canceled Started	0	All operation types are alternated. Do not set the same operation type No. to external inputs 1 and 2. (excluding 1: SP switching) When "1" (SP switching) is set for both C17 and C18, the four SP values can be switched.	
C21	[RDY] key setting	0: Disabled 1: Switches between RUN and READY 2: Event latch canceled 3: Auto-tuning start/stop 4: SP value switching (two to four SP values) Valid when the 1st digit of the number of SP sets C13 is "1" or more.			0	[RDY] key cannot be operated when same functions as external switch input have been set.	

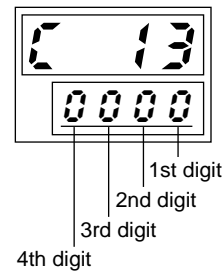
Function Prompt	Function	Selections and Setting Range	Factory Setting	Remarks
C22	Communications address	0 to 127	0	Displayed on communications model only Communications disabled when set to "0"
C23	Communications conditions	0: 9600bps, 8bits, even parity, 1 stop bit 1: 9600bps, 8bits, no parity, 2 stop bit 2: 4800bps, 8bits, even parity, 1 stop bits 3: 4800bps, 8bits, no parity, 2 stop bits	0	Displayed on communications model only
C24	Cold junction compensation	0: Yes 1: No	0	Thermocouple input model only
C25	Selection of time-proportional control operation	0: Priority given to controllability 1: Priority given to life of control target (only 1 ON/OFF operation within the time-proportional cycle)	0	If a large fluctuation of the manipulated variable occurs during the time-proportional cycle when this item is set to "0", control follows this fluctuation. For this reason, control may be turned ON and OFF several times within the cycle.

**C13 (number of SPs used and display method) Setting**

1st digit: Number of SPs used

This digit sets the number of SP values that are used.

Setting	Number of SPs Used
0	1
1	2
2	3
3	4



2nd digit: Display/change method

Setting	SP No. Display in Operation Mode	Change of SP Value during Selection (in Operation mode)	Display of Front Panel LED (SP1) *See SP1 Lighting Pattern Table.
0	OFF	Disabled	Pattern 1
1	ON	Disabled	Pattern 1
2	OFF	Enabled	Pattern 1
3	ON	Enabled	Pattern 1
4	OFF	Disabled	Pattern 2
5	ON	Disabled	Pattern 2
6	OFF	Enabled	Pattern 2
7	ON	Enabled	Pattern 2

- SP No. display in Operation mode  
This setting selects whether or not to display the SP No. (SP0 to SP3) in the Operation mode.
- Change of SP value during selection  
This setting selects whether or not to enable changing of the currently selected VP value.
- Display of front panel LED (SP1)  
This setting is for distinguishing which SP value is currently selected by the lit/blinking state of the front panel LED (SP1).

## Front Panel LED (SP1) Lighting Pattern

	Pattern 1	Pattern 2
No.0 SP Selected	Out	Out
No.1 SP Selected	Lit	Lit
No.2 SP Selected	Blinks twice	Lit
No.3 SP Selected	Blinks 3 times	Lit

## C14 and C15 settings

Digit settings: Enable/Disable

C14 and C15 Settings				Event Settings		Enable/Disable Related Settings	
4th digit	3rd digit	2nd digit	1st digit	E1 or E1 Low (E2) (E2 High)	E1 High (E2 High)	Hyster-esis	ON delay
Controller alarm 0: No 1: Yes	0: No 1: Standby 2: Latch 3: Standby and latch 4: Non 5: Standby at changing SP	0: Direct 1: Reverse	0: No	—	—	—	—
			1: PV upper limit alarm	-1999 to +9999	—	○	○
			2: PV lower limit alarm	-1999 to +9999	—	○	○
			3: PV upper and lower limit alarms	-1999 to +9999 (E2 High)	E1 Low to 9999 (E2 Low)	○	○
			4: Deviation upper limit alarm	-1999 to +9999	—	○	○
			5: Deviation lower limit alarm	-1999 to +9999	—	○	○
			6: Deviation upper and lower limit alarms	0 to 9999	0 to 9999	○	○
			7: Heater line break/overcurrent alarm	-1999 to E1 High (A) (E2 High)	E1 Low to 9999 (A) (E2 Low)	○	○
			8: Control device short-circuit alarm	-1999 to +9999 (A)	—	○	○
(See note)			9: Timer	1 to 9999 (s.)	—	x	x

- (Note)
- When the event operation type is set to timer, set digits 2, 3 and 4 to “0”.
  - When the controller fault alarm (4th digit) is set, the controller fault alarm operates directly at all times.

① Event operation type setting, direct/reverse operation

2nd Digit	1st Digit	Event	Description	Remarks
0	0	No		
0	1	PV upper limit alarm		
0	2	PV lower limit alarm		
0	3	PV upper and lower limit alarms		
0	4	Deviation upper limit alarm		
0	5	Deviation lower limit alarm		See note 1
0	6	Deviation upper and lower limit alarms		
0	7	Heater line break/overcurrent alarm		See note 2
0	8	Control device short-circuit alarm		See note 2
0	9	Timer		

Note 1 Set a negative value as the lower deviation limit (E1). If a positive value is set, a temperature higher than the SP value will be used as the operating point.  
Example: Enter “-10” to set an operating point of SP-10°C

Note 2 Heater line break/overcurrent and control device short-circuit alarm.

Models with a current transformer input detect heater line breaks, overcurrent conditions and control device short-circuit alarms by input from the current transformer.

- Heater line break/overcurrent alarm (operation type: 7)  
Heater line break: This alarm is activated when the current at control output ON is lower than the event setting (Ex Low). Set Ex High to “9999” to disable the overcurrent alarm.  
Overcurrent: This alarm is activated when the current is higher than the event setting (Ex High) when the control output is ON. Set Ex Low to “1999” to disable the heater line break alarm.
- Control device short-circuit alarm (operation type: 8)  
This alarm is activated when the current is higher than the event setting (Ex) when control output is OFF.



**Note**

- The current display (  $\bar{\bar{I}}$  ) in the operation mode indicates the current value when the control output is ON. This displayed current value is not updated when control output is OFF and for 300ms after control output changes to ON.

Detection of the current value is not updated for 300ms after the current output state changes.

- The following shows an example of how to set the event setting during detection of a line break.

Calculate the event setting using the heater current value at control output ON (monitor the displayed CT value) and heater current value at control output OFF (cannot be measured on the product) according to the following equation:

$$\text{Event setting} = \{(\text{heater current value at control output ON}) + (\text{heater current value at control output OFF})\} / 2$$

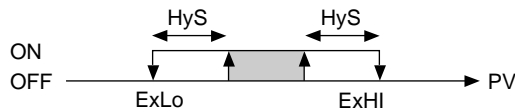
② Direct/reverse setting (C14 and C15 2nd digit setting)

The direct/reverse setting is used to reverse (invert an ON/OFF relationship) the operation of the event set on the 1st digit. (0: Direct, 1: Reverse)

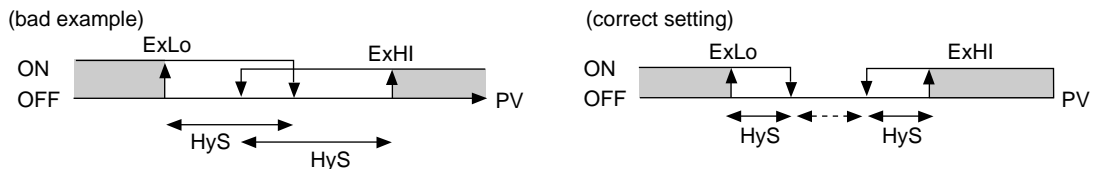
**!** Handling Precautions

- Direct operation of the PV upper limit alarm and deviation upper limit alarm is the same as the reverse limit of PV lower limit alarm and deviation lower limit alarm operation.

Example: Event operation type setting (1st digit): 3 (PV upper and lower limits)  
 Direct/reverse operation setting (2nd digit): 1 (reverse)



- When using the PV, deviation upper/lower limit and heater line break/overcurrent and control device short-circuit alarm, set HYS so that the OFF point is not lost.



- When using the heater line break/overcurrent and control short-circuit alarm, set the  $\leftarrow \cdots \rightarrow$  area to 3A or more.

③ Additional function settings (C14 and C15 3rd digit setting)

Standby and latch operations can be added as additional functions to an event operation type set on the 1st digit.

- Settings
- 0: No
  - 1: Standby
  - 2: Latch
  - 3: Standby and Latch
  - 4: Non
  - 5: Standby at changing SP



**Note**

- Standby
  - The standby function prevents an event from turning ON, even when the ON condition of that event is satisfied at controller power ON or when the READY mode changes to the RUN mode.
  - Event output is activated when an ON condition is satisfied after an OFF condition has been satisfied. The standby state occurs at power ON when the PV value is the shaded area.
- Latch
  - Once event output is ON, the latch function holds an event in the ON state even when an OFF condition is satisfied. Follow the procedure below to reset the latch state.

1. Set "Latch Cancel" to the external switch input to turn the external switch ON.
2. Reset the additional event setting function (by setting the 3rd digit on C14 and C15 to "0").
3. Turn the power OFF and back ON again.
4. Set "Latch Cancel" to the **[RDY]** key, and hold down the **[RDY]** key for at least one second.

**[!]** Handling Precautions

Latch Cancel by the **[RDY]** key is enabled for both events 1 and 2. External switch input is valid individually for events 1 and 2.

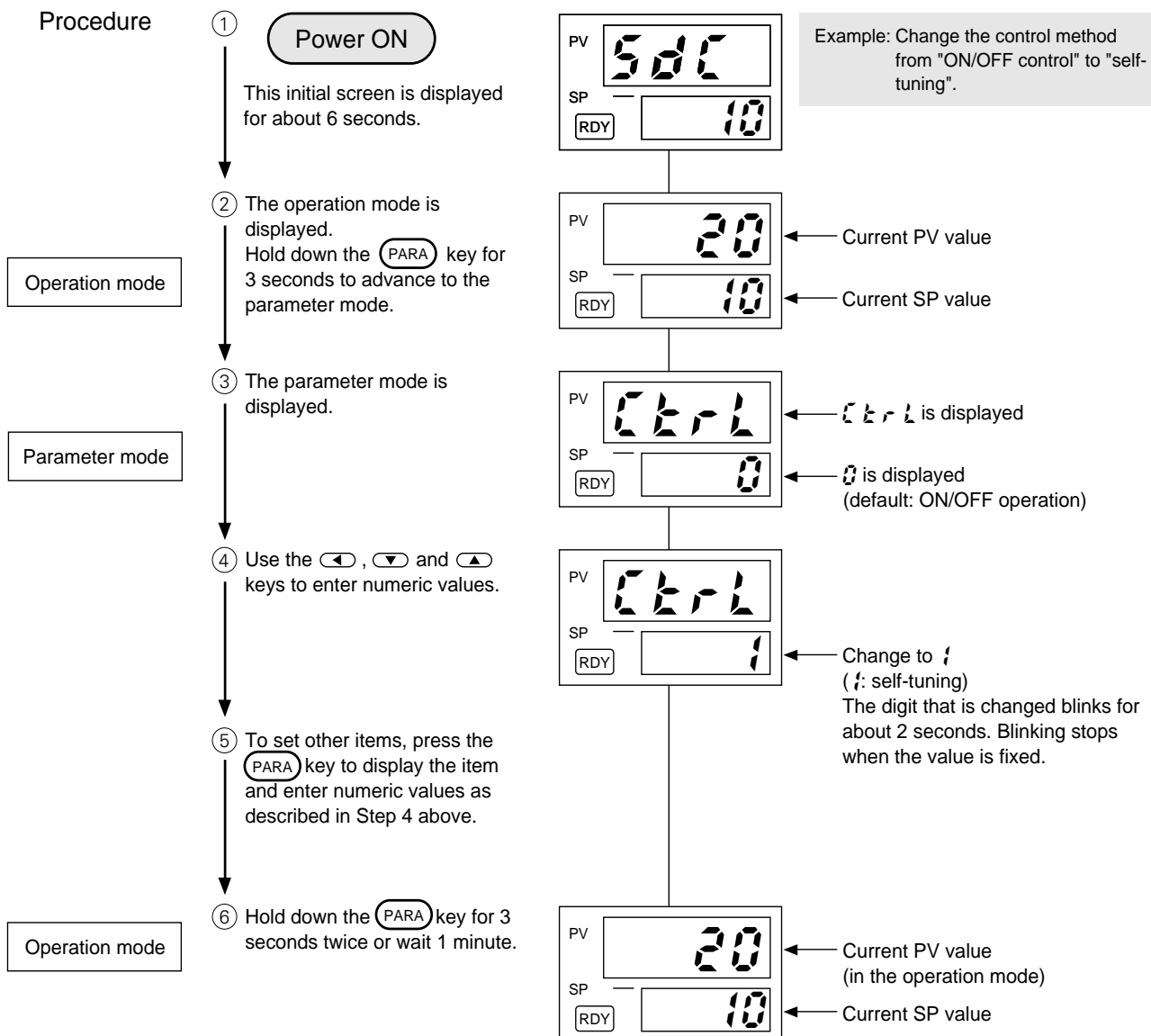
④ Controller alarm setting (C14 and C15 4th digit setting)

This function turns ON an event when a controller alarm code (AL01, AL02, AL03, AL70, AL97 and AL98) is generated regardless of the direct/reverse setting of the operation mode. OR logic can be set on the 1st digit of the event operation type.

Setting: 0: Disable  
1: Enable

### 5-3 Parameter Settings

Control parameter settings are shown below.



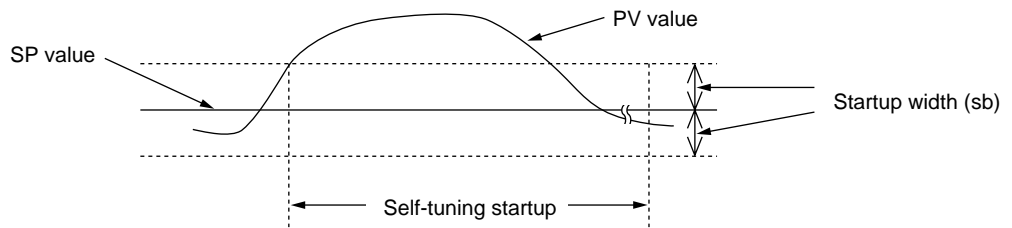
● List of parameters

Function Prompt	Function	Selections and Setting Range	Factory Setting	Remarks
$\zeta \tau \zeta$	Control method	0: ON/OFF control 1: Self-tuning 2: Control by PID fixed values	0	
$\mathcal{A} \tau$	Auto-tuning	0: Stop 1: Start	0	Displayed when $\zeta \tau \zeta$ (control method) is set to 1 or 2. Normally, setting is not required when $\zeta \tau \zeta$ (control method) is set to 1 (self-tuning).
$SP0$	No.0 SP value	Same as normal SP value or SP limit value range	0 (0.0)	
$SP1$	No.1 SP value		0 (0.0)	Displayed when 1st digit of $\zeta 1 \zeta$ is "1" to "3"
$SP2$	No.2 SP value		0 (0.0)	Displayed when 1st digit of $\zeta 1 \zeta$ is "2" or "3"
$SP3$	No.3 SP value		0 (0.0)	Displayed when 1st digit of $\zeta 1 \zeta$ is "3"
$P$	Proportional band	0.1 to 999.9%	5.0	
$i$	Reset time	0 to 3600 s	120	
$d$	Rate time	0 to 1200 s	30	
$oL$	Output limit low	0% to Output limit high	0	Displayed when $\zeta \tau \zeta = 1$ or $2$
$oH$	Output limit high	Output limit low to 100%	100	
$rE$	Manual reset value	0 to 100%	50	
$sb$	Self-tuning startup width/correction width setting	Thermocouple/RTD input: 0 to 5 (or 0.0 to 5.0) °C/°F	2 (or 2.0) °C/°F	
		DC voltage input 0.0 to 3.0% (%F.S.)	0.5% (%F.S.)	
$dIFF$	Differential gap	1 to 250 ( or 0.1 to 25.0)	5 (0.5)	$\zeta \tau \zeta = 0$
$\zeta Y \zeta L$	Time-proportional cycle	5 to 120 s (relay output) 1 to 120 s (voltage output)	10	Displayed when $\zeta \tau \zeta = 1$ or $2$
$Pb1R$	PV bias value	-1999 to +9999 (or -199.9 to +999.9)	0 (0.0)	
$HYS1$	Event 1 hysteresis	0 to 9999 (or 0.0 to 999.9)	5 (0.5)	Displayed on event output model and when value of 1st digit of event type setting ( $\zeta 14$ or $\zeta 15$ ) is 1 to 8
$dLY1$	Event 1 ON delay time	0 to 9999 s	0	
$HYS2$	Event 2 hysteresis	0 to 9999 (or 0.0 to 999.9)	5 (0.5)	
$dLY2$	Event 2 ON delay time	0 to 9999 s	0	
$FILT$	PV filter	0.0 to 20.0 s	0.0	

● **Self-tuning Startup Width Setting**

Any deviation width ( $sb$ ) for startup can be set as a startup condition of self-tuning. Startup width ( $sb$ ) is set in the parameter settings. Setting the startup width to “0” disables (self-tuning is started only when the SP value changes) self-tuning by deviation. The startup width ( $sb$ ) is set to “0” in the following applications:

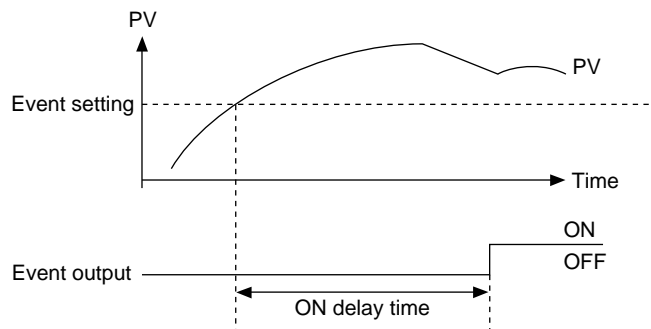
- In the case of interference control targets (e.g. instruments that are easily influenced by changes in the temperature of adjacent (up, down, left, right) zones
- In the case of control targets where disturbance is generated intermittently (e.g. packaging equipment)



**Note**

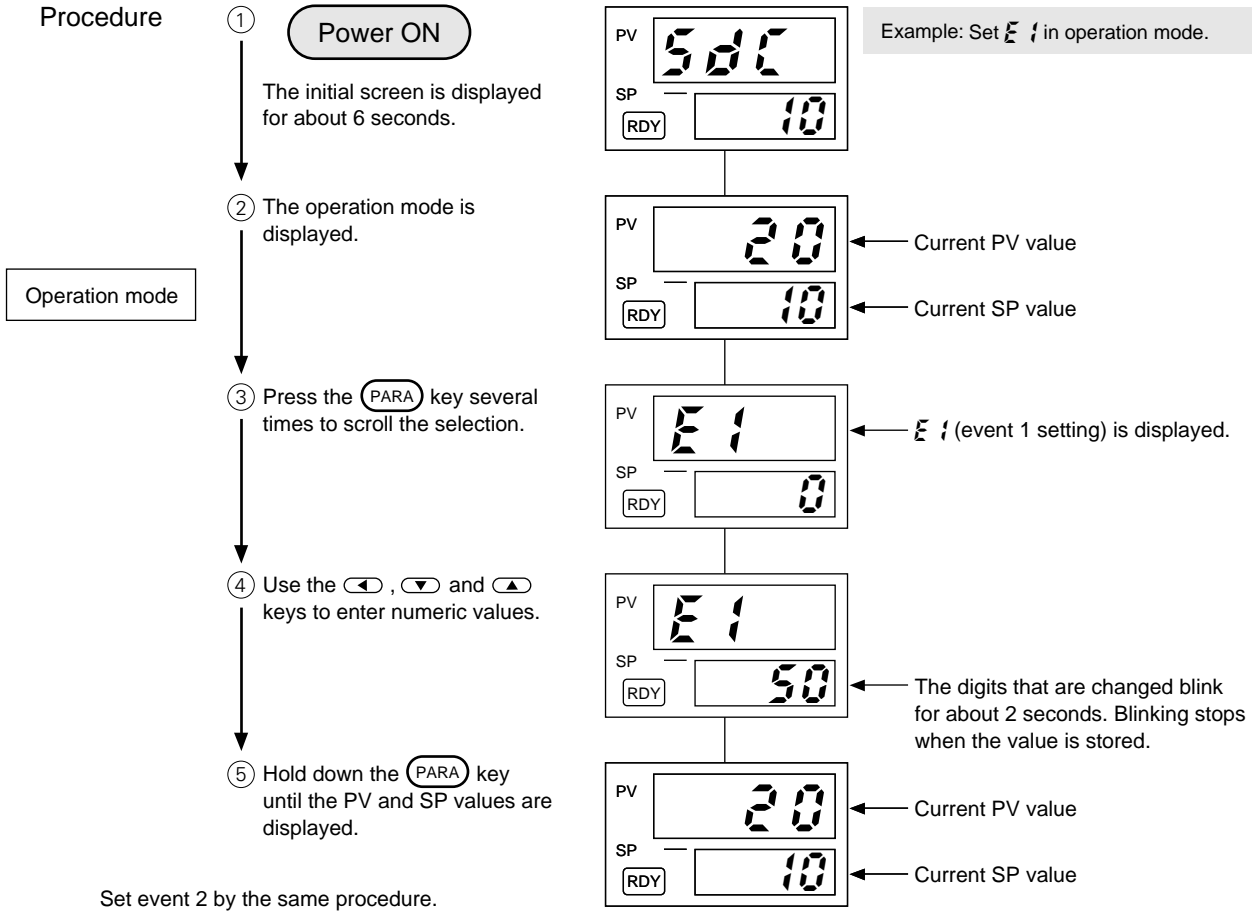
Event ON delay

An event operation whose condition (exceeding an upper temperature limit, for example) has been satisfied is not activated until a set time has elapsed.

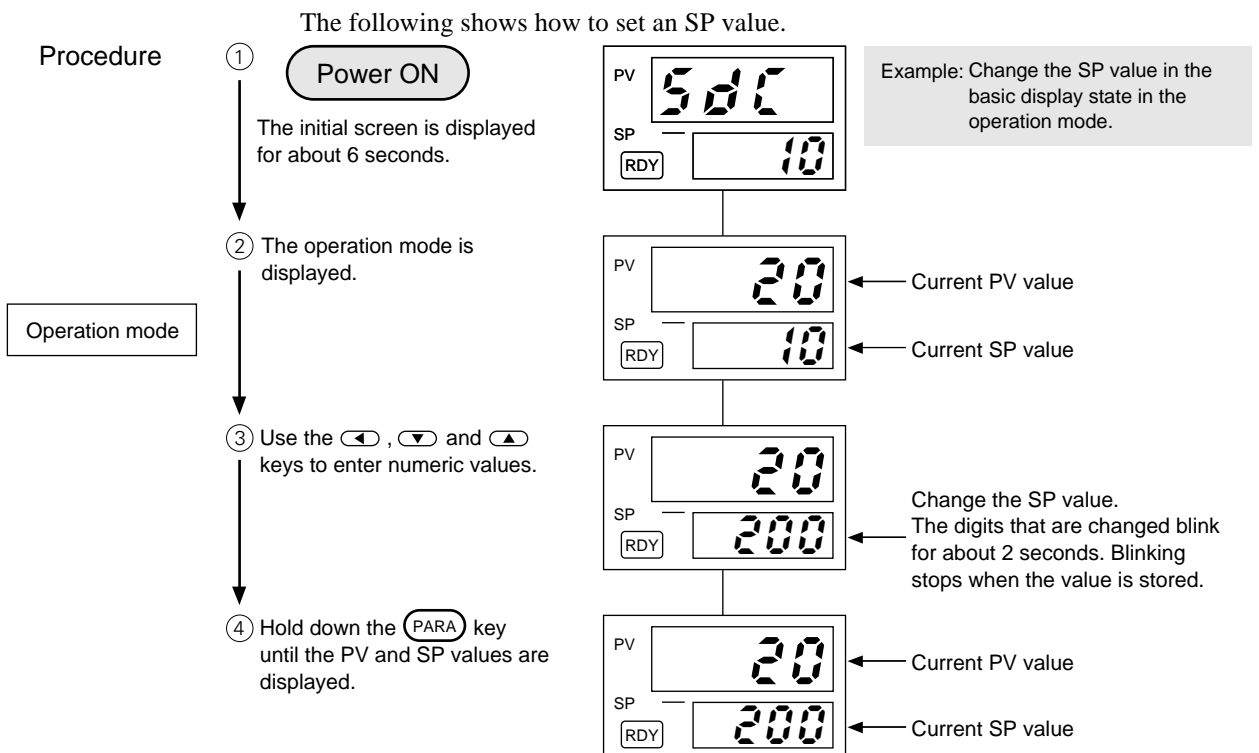




## 5-4 Event Settings (only with option installed)



## 5-5 SP Setting



■ List of Operation modes

Function Prompt	Function	Selections and Setting Range	Factory Setting	Remarks
Upper display: PV Lower display: SP	Normal display mode	SP: upper and lower SP limit Settings can be made in the 0.0 to 1.0 range	0	Upper display (PV): Displays 12 = XXX0, XXX2  Lower display (SP): Displays 12 = XXX0, XXX1
SP-0 SP-1 SP-2 SP-3	SP No. and SP value displayed			SP No. switched by ▲ ▼ keys.  (See note 1)
out	Manipulated variable displayed	Not settable	—	Displays 12 = XX1X ON/OFF control: "0.0" is displayed at OFF "100.0" is displayed at ON PID control: Values in 0.0 to 100.0 (%) range displayed
12	Current (Ct) displayed	Not settable	—	12 = X0XX is displayed on CT model Measurement range: 0 to 55 A Event operable range: 3 to 50 A Lights when control output is 300ms or more (See note 2).
t1	Timer event 1 remaining time displayed	Not settable	—	Displays 12 = 0XXX (See note 3)
t2	Timer event 2 remaining time displayed	Not settable	—	Displays 12 = 0XXX (See note 3)
E1 (E1Lo)	Event 1 (lower limit) setting	Depends on event 1 operation type See pages 10 to 12 for details	0	Displays 12 = X0XX Displays settings 12 = 1 to 9  E1: Sets either upper or lower limit. Displayed at event  E1Lo, E1Hi: Displayed at events requiring upper/lower limit setting
E1Hi	Event 1 (upper limit) setting		0	
E2 (E2Lo)	Event 2 (lower limit) setting	Depends on event 2 operation type See pages 10 to 12 for details	0	
E2Hi	Event 2 (upper limit) setting		0	

(Note 1) This value cannot be changed when SP switching by external switch input is selected.

(Note 2) This value blinks when control output is OFF or ON at 300ms or less. During blinking, the displayed CT value cannot be changed.

(Note 3) This value is displayed by timer events set in the event and by the operation type of the external switch input set to the timer start setting. As long as timer operation continues, the time elapsed after the occurrence of the event is displayed within the range 0 to -1999 seconds.

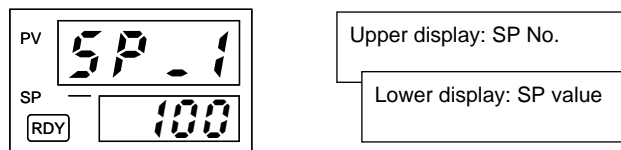
● How to Switch the SP Value

Up to four SP values can be switched by the following three methods:

- ① By SP No.
- ② By the **[RDY]** key
- ③ By external switch input

① By SP No.

If the value of the 2nd digit of setup item  $\zeta 13$  is set to an odd-number (1, 3, 5, 7), pressing the **[PARA]** key in the operation mode displays the SP Nos. “SP - 0” through to “SP - 3” on the upper display.



Pressing the **[▲]**, **[▼]** keys in this state changes the SP No. in the upper display, and switches the SP value.

The SP No. is not displayed if the value of the 2nd digit of setup item  $\zeta 13$  is set to an even-number (0, 2, 4, 6).

② By the **[RDY]** key

If the value of setup item  $\zeta 21$  is set to “4”, the SP value can be switched by the **[RDY]** key. Holding down the **[RDY]** key for at least two seconds switches the SP No.  $SP0 \rightarrow SP1 \rightarrow SP2 \rightarrow SP3 \rightarrow SP0$  and so forth.

③ By external switch input (optional function)

If the values of both setup items  $\zeta 17$  and  $\zeta 18$  are set to “1” (SP switching), the four SP values can be switched according to the ON/OFF states of the two external switch inputs.

	External Switch Input 1	External Switch Input 2		Selected SP
Set 1	OFF	OFF	→	No.0 SP
Set 2	ON	OFF	→	No.1 SP
Set 3	OFF	ON	→	No.2 SP
Set 4	ON	ON	→	No.3 SP

# Chapter 6 TUNING

## 6-1 Selecting the Control Method

The SDC10 is provided with three types of control method. Select the desired method according to the  $\xi \text{ } \xi \text{ } r \text{ } \xi$  (control method) setup in parameter items.

- 0. ON/OFF control
- 1. Self-tuning : This control method automatically changes control constants when SP is changed, or disturbance occurs.
- 2. Control by PID fixed values : Control follows fixed PID values set by auto-tuning or manual operation.

## 6-2 Self-tuning

The controller can be self-tuned by setting the control method to self-tuning ( $\xi \text{ } \xi \text{ } r \text{ } \xi = 1$ ).

Tuning is automatically started and control constants are changed by the following operation or when a change in state occurs in this state.

### ① Start by SP change

Start conditions:

- Initial start (\*1) SP change of  $\pm 10\%$ FS (\*2) or more
- 2nd start onwards SP change of  $\pm 5\%$ FS or more

\*1 “Initial start” refers to initial tuning after the  $\xi \text{ } \xi \text{ } r \text{ } \xi$  setting is set to 1.

\*2 “FS (full-scale)” refers to the width between the upper and lower temperatures set by range code (setup item C04).

Example:  $\pm 10\%$ FS when the range is  $-200$  to  $+400^\circ\text{C}$  becomes:  
 $600 (\text{ }^\circ\text{C}) \times 10 (\%) = 60 (\text{ }^\circ\text{C})$

### ② Start by generation of deviation

Startup conditions:

- When the difference between SP and PV is sb or more
- \* sb: Self-tuning startup width. This is set in the parameter items.

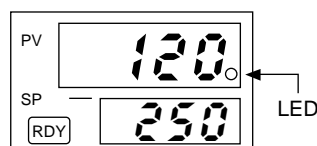
### ③ Start by power ON or mode change from READY to RUN

Start conditions:

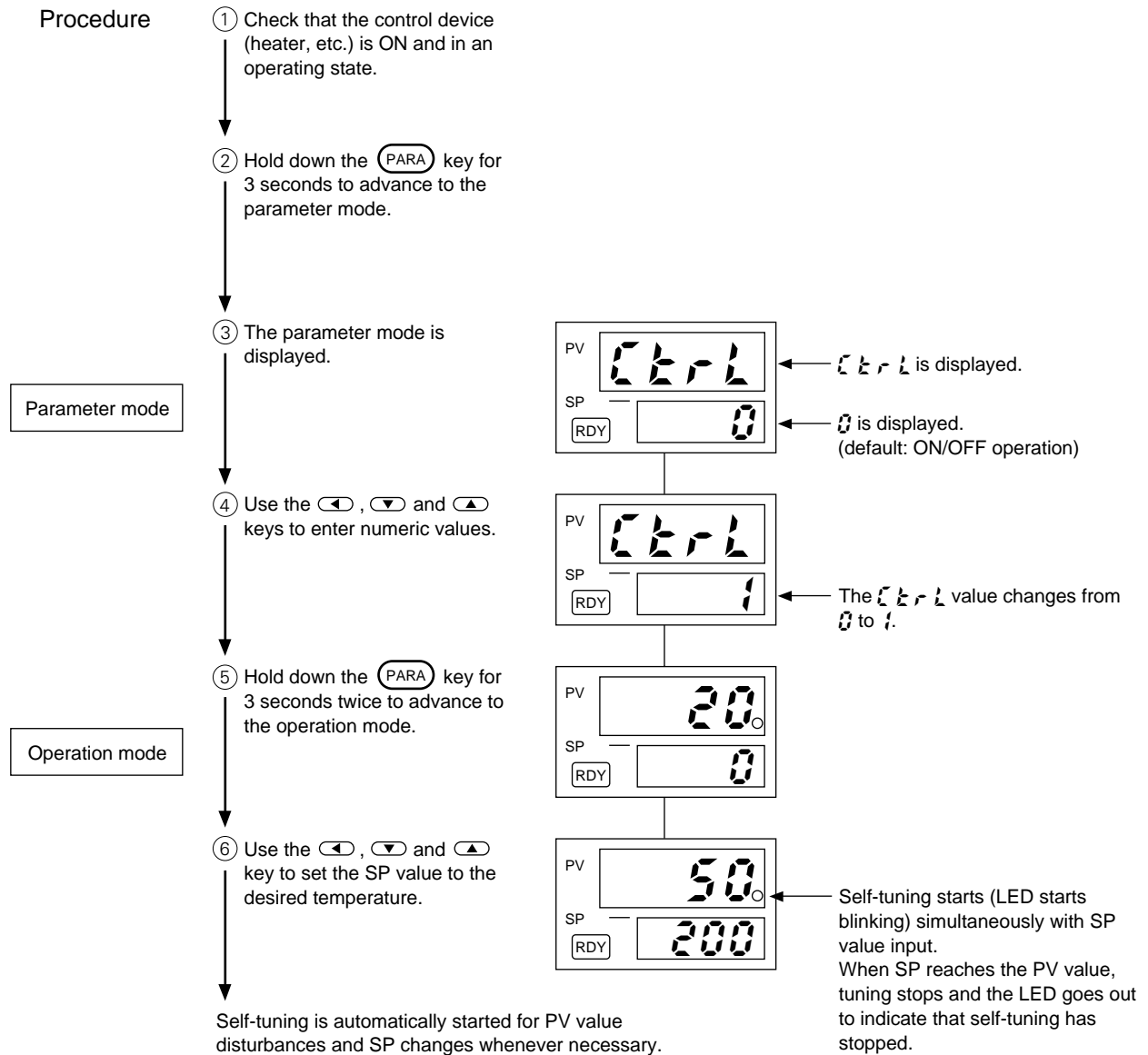
- When the power is turned ON with the difference between SP and PV at  $\pm sb$  or more, or the mode is changed from READY to RUN

### Self-tuning display

The lower right LED after the 1st digit in the upper display blinks when the self-tuning function is ON. The LED goes out when learning ends and control constants are stored.



### ● Startup method



### ● Stop method

Change **CtrL** from 1 to 2. This fixes the PID values. PID values can also be changed by key entry.

## 6-3 Cautions During Self-tuning

Observe the following when using the self-tuning function:

- Turn heaters or other control devices ON before turning the controller ON.
- To turn a control device OFF, set the controller to the READY mode. When turning a control device back ON again, set the controller to the RUN mode.
- When the power is turned OFF during self-tuning while the LED blinks, the control constants used during tuning are not stored in controller memory.

If any of the above mistakes have been made, unsuitable control constants are stored to memory, which may result in unexpected control. If this happens, follow the procedure below to reset the controller.

- Use auto-tuning.  
For details on how to use auto-tuning, see “6-4 Auto-tuning.”
- Reset the PID values, and resume self-tuning.
  - ① Set parameter item  $\zeta \xi r \underline{\quad}$  (control method) to “2”.
  - ② Reset the PID values to the factory settings ( $P = 5.0, I = 120, D = 30$ ).
  - ③ Set  $\zeta \xi r \underline{\quad}$  to “1”, and resume self-tuning.

**! Handling Precautions**

● In the Case of Interference Control Targets

Control targets may be located to the left or right (above or below), and response may slow down as a result of mutual tuning being adversely affected by respective changes in temperature.

If this happens, either use control by fixed PID values ( $\zeta \xi r \underline{\quad} = 2$ ), or set parameter item ( $\xi b$ ) to “0”.

● In the Case of Control Targets Where Disturbance Is Generated Intermittently

Tuning results are sometimes adversely influenced when tuning control targets where intermittent temperature drops occur (e.g. during sealing on packaging machines).

If this happens, either use control by fixed PID values ( $\zeta \xi r \underline{\quad} = 2$ ), or set parameter item ( $\xi b$ ) to “0”.

**6-4 Auto-tuning**

Use the auto-tuning function in the following instances:

- To automatically calculate PID constants by control by fixed PID value ( $\zeta \xi r \underline{\quad} = 2$ )
- When startup is slow in self-tuning control
- When response startup is slow in self-tuning control

The auto-tuning function can be used in either of self-tuning control ( $\zeta \xi r \underline{\quad} = 1$ ) or control by fixed PID values ( $\zeta \xi r \underline{\quad} = 2$ ).

● Procedure

- ① Hold the **PARA** key down for at least 3 seconds in the RUN mode and with the SP value set to enter the parameter setup mode.
- ② Press the **PARA** key with  $\zeta \xi r \underline{\quad}$  set to “1” or “2”.
- ③  $\mathcal{H} \xi$  (auto-tuning) is displayed. Set “1”.  
If “1” is already set, set to “0” then back to “1”.

Auto-tuning can also be stopped by using the external switch input function. To forcibly cancel auto-tuning midway, either set  $\mathcal{H} \xi$  to “0”, or set the controller to the READY mode.

**Auto-tuning indication**



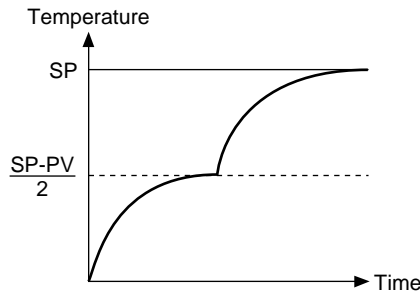
The lower right LED after the 1st digit in the lower display blinks when the auto-tuning function is ON. The LED goes out when tuning ends.

**! Handling Precautions**

- Auto-tuning does not function normally unless the control target is connected.
- The auto-tuning time from start to finish varies according to the control target.
- When auto-tuning is executed, control is suspended, and 0 to 100% output is repeated several times. If this hinders operation, manually set the PID values.
- Sometimes suitable PID values cannot be obtained according to the control target. If this happens, manually set the PID values.

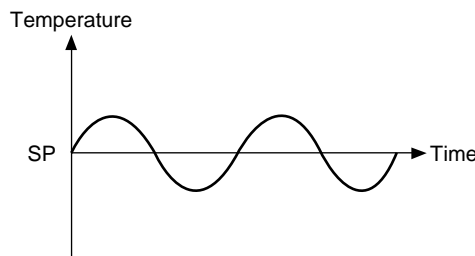
The following describes auto-tuning operation:

- ① Operation when the difference between SP and PV values is 10% FS or more and  $SP > PV$



At startup, operation stabilizes at a temperature of about  $(SP - PV)/2$   
 ↓  
 The temperature rises again and reaches SP.  
 ↓  
 Auto-tuning ends when stability is achieved.

- ② Operation when the difference between SP and PV values is 10% FS or less and  $SP < PV$



Cycling is repeated around the SP value.  
 ↓  
 Auto-tuning ends when stability is achieved.

**6-5 Control Troubleshooting**

Phenomenon		Remedy
Slow startup time	① ②	① Execute auto-tuning. ② Set $\zeta$ $\tau$ $L$ to "2", reset PID values to factory settings, and set $\zeta$ $\tau$ $L$ to "1" to execute self-tuning.
Slow response	① ②	
PV value fluctuates	① ② ③ ④	③ Reduce the value of time-proportional cycle ( $\zeta$ $\tau$ $L$ ).
Tuning does not end. PV value fluctuates with a 2°C or more error between SP and PV value.	① ② ③ ④	
Tuning does not end. PV value is stable but PV does not end.	⑤	④ Set the value of PV filter (parameter item) to "1.0" to "2.0".
Large overshoot	① ②	⑤ Operation ends though it takes a long time. The slower the response of the control target, the longer tuning takes.
Control signals repeatedly turn ON and OFF more than necessary.	④	

# Chapter 7 SPECIFICATIONS

Category	Item		Specifications																		
PV Inputs	Input type		Thermocouple: K, J, E, T, R, DIN U, DIN L RTD: Pt100, JPt100 DC voltage: 1 to 5 V, 0 to 5 V, 0 to 1 V																		
	Sampling cycle		500ms																		
	PV bias		-1999 to +9999 or -199.9 to +999.9																		
Indicators and Settings	Set points		1 or 2 to 4																		
	Setting indication range		Input range display: See page 12 for details																		
	Indication accuracy		±0.5%FS ±1 digit Negative thermocouple area: ±1%FS ±1 digit																		
	Temperature unit switching		°C/°F switchable																		
Control Outputs	Model number		0D		6D																
	Output		Relay contacts		Voltage pulse (for SSR drive)																
	Control action		ON/OFF, time-proportional		ON/OFF, time-proportional																
	Output rating		Contact type: SPST Contact rating: 250Vac, 3A, 30Vdc, 3A Life: Min. 100,000 operations (resistive load) Min. switching specification: 5V, 100mA		Voltage (open): 22.5Vdc ±15% Internal resistance: 1100Ω ±5% Leakage current (OFF): 100μA max.																
	Differential gap		1 to 9999 or 0.1 to 999.9																		
	Output direct/reverse switching		Switchable																		
	Additional Functions	Event	No. of points		2, SPST contacts, common shared Contact rating: 250Vac 1A, 30Vdc 1A (resistive load)																
Type			PV upper limit alarm, PV lower limit alarm, PV upper/lower limit alarms, deviation upper limit alarm, deviation lower limit alarm, deviation upper/lower limit alarms, heater line break/overcurrent, control device short-circuit, timer																		
Additional functions			Standby, latch, ON delay, controller alarm																		
Differential gap			0 to 9999 or 0.0 to 999.9																		
Life			Min. 100,000 operations (resistive load)																		
Min. switching specifications			5V, 10mA																		
Current transformer input			No. of points		1																
		Display range		AC 0 to 55A																	
		Guaranteed operating range		AC 3 to 50A																	
		Accuracy		±3A																	
		Recommended operating conditions		<table border="1"> <thead> <tr> <th>Measuring Current</th> <th>No. Current Thru Lines</th> <th>CT Value Display (ave.)</th> <th>Allowable Input Current</th> </tr> </thead> <tbody> <tr> <td>AC 3 to 15A</td> <td>3</td> <td>9 to 45A</td> <td>Max. AC 33A</td> </tr> <tr> <td>AC 5 to 23A</td> <td>2</td> <td>10 to 46A</td> <td>Max. AC 50A</td> </tr> <tr> <td>AC 9 to 50A</td> <td>1</td> <td>9 to 50A</td> <td>Max. AC 100A</td> </tr> </tbody> </table>			Measuring Current	No. Current Thru Lines	CT Value Display (ave.)	Allowable Input Current	AC 3 to 15A	3	9 to 45A	Max. AC 33A	AC 5 to 23A	2	10 to 46A	Max. AC 50A	AC 9 to 50A	1	9 to 50A
Measuring Current		No. Current Thru Lines	CT Value Display (ave.)	Allowable Input Current																	
AC 3 to 15A		3	9 to 45A	Max. AC 33A																	
AC 5 to 23A		2	10 to 46A	Max. AC 50A																	
AC 9 to 50A		1	9 to 50A	Max. AC 100A																	
External switch input	No. of points		2																		
	Function		SP switching, RUN/READY switching, event latch state cancel, timer event start/stop, auto-tuning start/stop																		
	Non-insulated type		Dry contact or open-collector <ul style="list-style-type: none"> <li>• Allowable ON contact resistance: Max. 250Ω</li> <li>• Allowable OFF contact resistance: Min. 100kΩ</li> <li>• Allowable ON residual voltage: Max. 1.0V</li> <li>• Terminal current voltage (open): 5Vdc</li> <li>• Terminal current (ON): Approx. 4mA</li> </ul>																		



Category	Item		Specifications
Additional Functions	External switch input	Insulated type	Wet contact or open-collector <ul style="list-style-type: none"> <li>• Input voltage range: 10 to 26.4Vdc</li> <li>• Allowable ON voltage: 10V min.</li> <li>• Allowable OFF voltage: 3.0V max.</li> <li>• Input impedance: Approx. 2200Ω</li> <li>• Terminal current (ON): Approx. 5mA (when 12Vdc is applied) Approx. 10mA (when 24Vdc is applied)</li> </ul>
General Specifications	Memory backup		Non-volatile semiconductor memory
	Rated power supply voltage		AC model: 100 to 240Vac, 50/60Hz DC model: 24Vdc (no polarity)
	Power consumption		AC model: 7VA Max. (under operating conditions) DC model: 7W Max. (under operating conditions)
	Insulation resistance		Across power terminal and secondary terminals: 500Vdc, 20MΩ or more
	Dielectric strength		AC model: Across power terminal and case: 1500Vac for 1 minute (See note) DC model: Across power terminal and case: 500Vac for 1 minute
	Rush current (power ON)		AC model: Max. 30A DC model: Max. 20A
	Mask material/color		ABS plastic/dark gray (equivalent to Munsell 5Y3.5/1)
	Case material/color		PC plastic/light gray (equivalent to Munsell 2.5Y7.5/1)
	Standard conditions		Ambient temperature: 23±2°C Ambient humidity: 60±5%RH Power voltage: AC model: 105Vac±1%, 50/60Hz±1Hz DC model: 24Vdc±5% Vibration resistance: 0m/s <sup>2</sup> Shock resistance: 0m/s <sup>2</sup> Mounting angle: Reference plane ±3°
	Operating conditions		Ambient temperature: 0 to 50°C (0 to 45°C when 3 or more units are gang-mounted horizontally) Ambient humidity: 10 to 90%RH (no condensation allowed) Power voltage: AC model: 85 to 264Vac, 50/60Hz±2Hz DC model: 21.6 to 26.4Vdc Vibration resistance: 0 to 2m/s <sup>2</sup> (10 to 60Hz, 2 hours in each X, Y, Z direction) Shock resistance: 0 to 10m/s <sup>2</sup> Mounting angle: Reference plane ±10° Altitude: Max. 2000 mm
	Shipping and storage conditions		Ambient temperature: -20 to +70°C Ambient humidity: 10 to 95%RH (no condensation allowed)
	Mass		200g max. (including installation bracket on panel mounted type) 300g max. (including socket on socket type)
Terminal screw tightening torque		0.78 to 0.98N•m	

(Note) The primary side and secondary side capacities are joined inside the controller. For this reason, when performing the withstand voltage test for the panel and controller's power supply, disconnect the wiring of grounded secondary side terminals and PV input terminals from those terminals. In some cases, the grounding / non-grounding type thermocouples and resistance bulb sensors are not guaranteed for the withstand voltage between the protecting tube and the inner sensor. Because of this, there will be a possible cause of failure if such a withstand voltage test is performed as it is.

● I/O isolation

The following table shows mutual isolation between I/O items. Items surrounded by solid lines are insulated from other signals. Items in dashed lines are not insulated:

Power supply	Digital circuit	Control output
PV input		Event output 1
External switch input 1		Event output 2
External switch input 2 *1		
Current transformer input		

\*1 Insulated external switch inputs (option code 3) are insulated from other signals.

# Chapter 8 ALARM CODES

When an error occurs, the following alarm codes are displayed in the upper display:

Alarm code	Error	Cause	Countermeasure
<i>AL01</i>	Abnormal PV input (see Note)	Sensor line break, incorrect wiring, incorrect range code setting	Check wiring or reset range code.
<i>AL02</i>	Abnormal PV input (see Note)	Sensor line break, incorrect wiring, incorrect range code setting	Check wiring or reset range code.
<i>AL03</i>	CJ failure	Terminal temperature compensation unit failure (thermocouple)	Replace unit.
	Abnormal PV input (see Note)	Sensor line break, incorrect wiring (RTD)	Check wiring.
<i>AL70</i>	Abnormal A/D conversion	Defective A/D converter	Replace unit.
<i>AL97</i>	Abnormal parameter	<ul style="list-style-type: none"> <li>• Power turned OFF during fixing of data</li> <li>• Data corrupted due to noise</li> </ul>	Reset data.
<i>AL98</i>	Abnormal adjustment data	Data corrupted due to noise	Replace unit.

An alarm code other than *AL97* causes the manipulated variable (control output value) to be set to 0% (OFF). Instrument operations other than manipulated variable are unaffected.

The *AL97* alarm code does not affect instrument operation.

(Note) • Display and operation when thermocouple input line break occurs

Abnormal State	Indication	Alarm Code
Sensor line break	Upscaled	<i>AL01</i>

• Display and operation when break occurs in resistance temperature detector input

Abnormal State	Indication	Alarm Code
Resistor line break	Upscaled or downscaled	<i>AL01</i>
Break in line A		or <i>AL02, AL03</i>
Break in line B	Downscaled	<i>AL02, AL03</i>
Break in line C	Upscaled or downscaled	<i>AL01, AL03</i>
Break in 2 lines or more		or <i>AL02, AL03</i>
B short-circuited	Downscaled	<i>AL02</i>
C short-circuited	Downscaled	<i>AL02</i>

• Display and operation when break occurs in DC voltage input

Abnormal State	Indication	Alarm Code
Line break	Upscaled	<i>AL01</i>

# Chapter 9 MAINTENANCE

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- **Cleaning**

Wipe off dirt on the controller using a soft, dry cloth.

- **Parts Replacement**

Only authorized personnel are allowed to replace parts.

- **Fuse Replacement (AC model only)**

Use only specified standard fuses when replacing fuses on the AC power supply wiring.

<b>Standard</b>	<b>IEC127</b>
Cutoff Speed	Delayed operation type
Rated Voltage	250V
Rated Current	200mA

# SDC10 Setup Work Sheet

		Model No.	C10
Person in charge		Drawn Up	

## ● Operation mode settings

Display	Item	Default	Customer settings	Memo
SP	SP value	0		
SP <input type="checkbox"/>	SP set selection	0		
E1 (E1Lo)	Event 1 (lower limit) setting	0		
E1Hi	Event 1 upper limit setting	0		
E2 (E2Lo)	Event 2 (lower limit) setting	0		
E2Hi	Event 2 upper limit setting	0		

See page 22 for information on operation settings.

## ● Parameter mode settings

Display	Item	Default	Customer settings	Memo
Ctrl	Control method	0		
At	Auto-tuning	0		
SP0	No.0 SP value	0		
SP1	No.1 SP value	0		
SP2	No.2 SP value	0		
SP3	No.3 SP value	0		
P	Proportional band	5.0	%	
I	Reset time	120	s	
d	Rate time	30	s	
oL	Output limit low	0	%	
oH	Output limit high	100	%	
rE	Manual reset	50	%	
Sb	Self-tuning startup width		%	
	Thermocouple, RTD	2	°C/°F	
	DC voltage	0.5	%FS	
dIFF	Differential gap	5 (0.5)		
CYCL	Time-proportional cycle	10	s	
PbIA	PV bias	0 (0.0)		
HYS1	Event 1 hysteresis	5 (0.5)		
dLY1	Event 1 ON delay time	0	s	
HYS2	Event 2 hysteresis	5 (0.5)		
dLY2	Event 2 ON delay time	0	s	
FLt	PV filter	0.0	s	

See page 19 for information on parameter settings.

● Setup mode items

Display	Item	Default	Customer settings	Memo
C01	Key lock	0		
C02	Temperature unit	0		
C03	Control output direction	0		
C04	Input range : thermocouple input	3		
	: RTD input	22		
	: DC voltage input	43		
C05	Decimal point position	0		
C06	PV range lower limit (DC voltage input)	0		
C07	PV range upper limit (DC voltage input)	1000		
C09	SP lower limit	Range Min.		
C10	SP upper limit	Range Max.		
C11	Manipulated variable when READY mode or Alarm occur	0		
C12	Operation mode	0000		
C13	Number of SPs used	0		
C14	Event 1 operation type	0000		
C15	Event 2 operation type	0000		
C16	Event operation in READY mode	0		
C17	External switch input 1 operation type	0		
C18	External switch input 2 operation type	0		
C21	RDY key setting	0		
C22	Communications address	0		
C23	Communications conditions	0		
C24	Cold junction compensation	0		
C25	Selection of time-proportional control operation	0		

See pages 12 to 14 for information on setup items.

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*This has been printed on recycled paper.* (02)

*Specifications are subject to change without notice.*

Printed in Japan.  
1st Edition: Issued in Nov., 1995  
12th Edition: Issued in July, 2004(B)