CONTROLLER

1-channel
Temperature Controller
with Built-in SSR

SB1 Series

(Actual size)

CE, UL, c-UL

G RoHS compliant

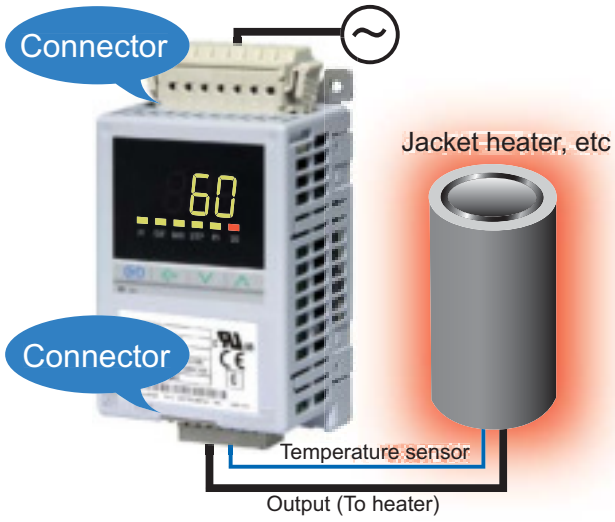
RKC INSTRUMENT INC.

SSR and controller integrated into a compact temperature control box.

SB1 Series

Capable of direct connection to the load.

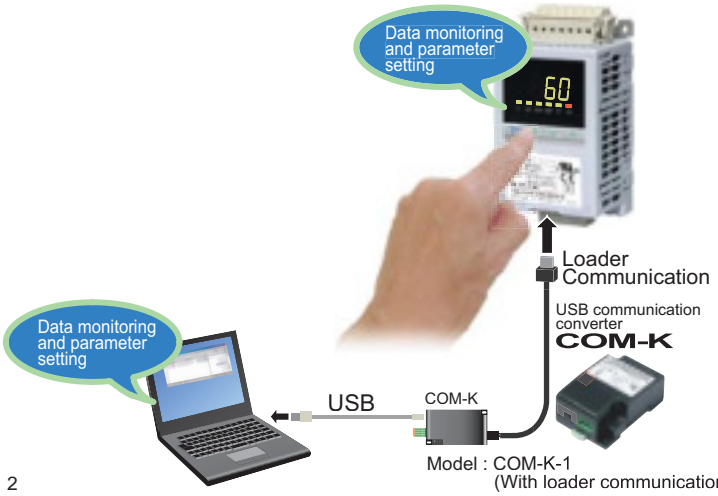
Temperature control can be easily assembled and started by connecting a heater line and temperature sensors to the SB1. Wiring is handled with connectors to reduce wiring time.



(*) Permissible load capacity may be less than 7A depending on the ambient temperature of the installation location.

Data can be viewed on site by using the display and operation keys or controlled remotely via loader communication port.

The SB1 has a display, setting keys and loader communication port on the front panel.

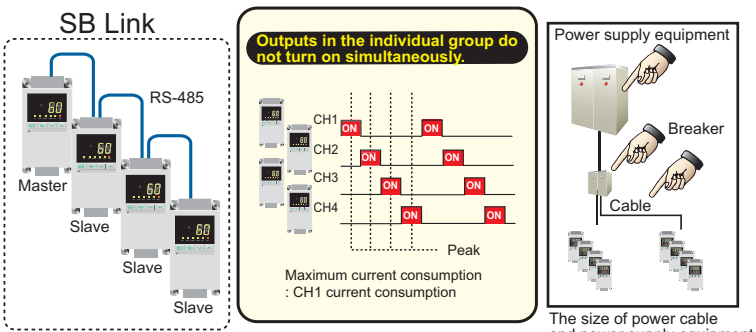


Power saving by SB Link

Peak current suppression (SB Link)

When SB1 controllers are divided into groups (max. 4 pcs per group) with the output limiter, the controllers in the same group will not turn on simultaneously.
Saves energy by limiting the control output around the normal load factor.

* SB Link cannot be used simultaneously with a host communication.

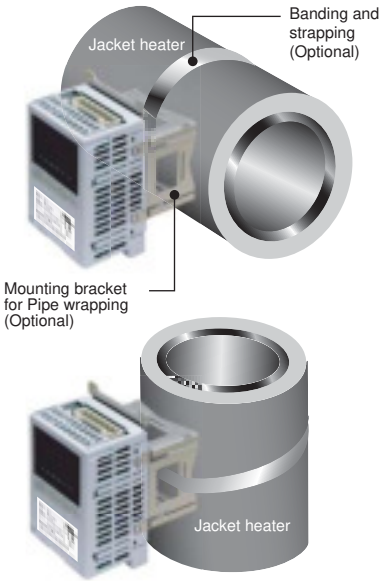


The size of power cable and power supply equipment can be minimized.

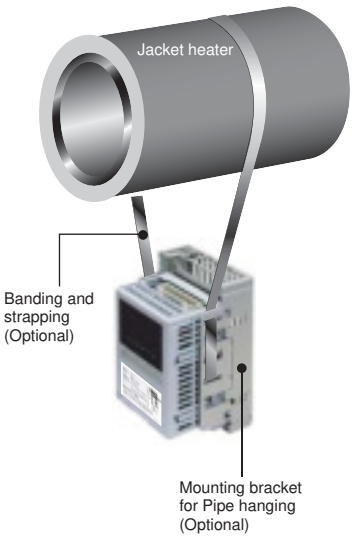
Can be installed in a small space or onto a pipe.

The SB1 can be supplied with pipe wrapping type, pipe hanging type, DIN-rail mounting type, or panel mounting type. Proper mounting can be attained according to the pipe configuration.

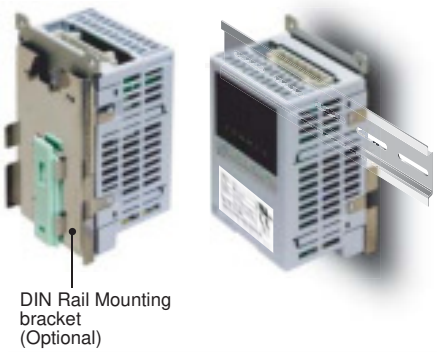
Pipe wrapping type



Pipe hanging type



DIN rail mounting type

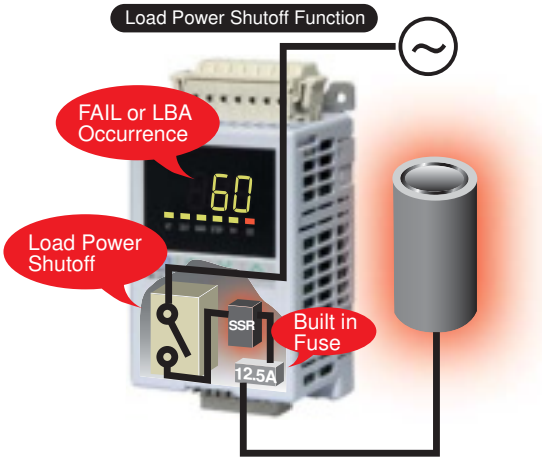


Panel mounting type

Safety design

< Load Power Shutoff Function + Fuse >

This function disconnects internal load power with an internal relay.
A fuse is incorporated inside the SB1 to protect the instrument from a load short-circuit.

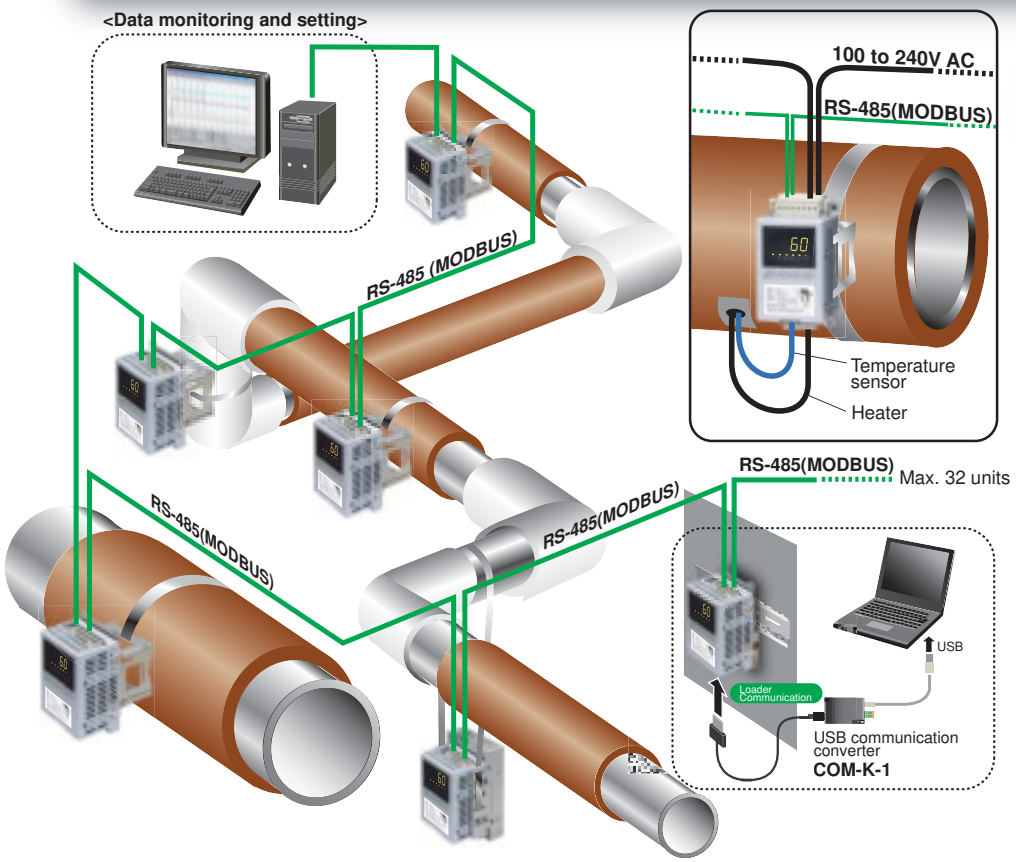


* Internal fuse must be replaced by an authorized personnel.

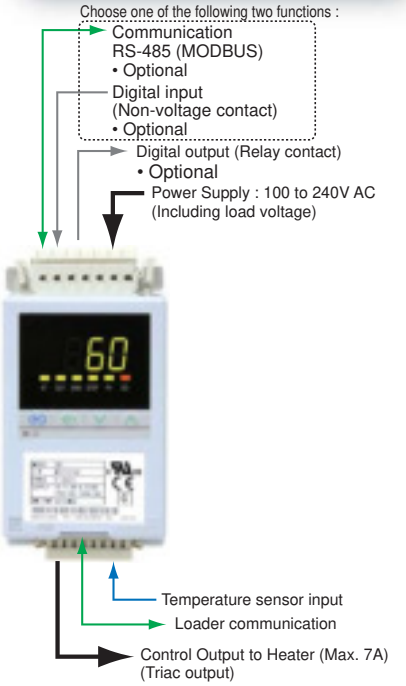
Action of the load power shutoff function can be selected from the following:

1. Works at the time of FAIL.
2. Works at the time of FAIL or LBA.
3. Works at the time of FAIL or LBA. (status retained)

Installation and wiring example



Input/Output Configuration



SPECIFICATIONS

Input

Measured input	Thermocouple input K, J (JIS/IEC) : 0 to 800°C, 0 to 999°F RTD input Pt100 (JIS/IEC) : 0 to 400°C, 0 to 800°F • 1/0.1°C(°F) display can be selectable on only communication data. • Universal input
Accuracy	Thermocouple input 0°C or more, Less than 500°C : ± (1.5°C [2.7°F] + 1 digit) 500°C or more : ± (0.3% of Reading + 1 digit) RTD input 0°C or more, Less than 200°C : ± (0.6°C [1.1°F] + 1 digit) 200°C or more : ± (0.3% of Reading + 1 digit)
Cold-junction temperature compensation error	±1°C [1.8°F] (23°C±2°C [73°F±3.6°F]) ±2°C [3.6°F] (-10 to 60°C [14 to 140°F])
Sampling time	0.25sec
Influence of external resistance	0.25μV/Ω (Thermocouple input)
Influence of lead resistance	0.02% of reading/Ω (RTD input) • Maximum 10Ω per wire
Input impedance	1MΩ or more
PV bias	-199 to 999°C [°F]
Input digital filter	0 to 100 sec. (OFF when 0 is set.)

Control

Control method	PID control (With autotuning) • P, PI, PD, ON/OFF control selectable
Setting range	a) Proportional band : 1 to span (°C,°F) (ON/OFF control when P = 0) • Differential gap at ON/OFF control : 0 to 100 (°C,°F) b) Integral time : 1 to 999 sec (PD control when I = 0) c) Derivative time : 1 to 999 sec (PI control when D = 0) d) Anti-Reset Windup(ARW) : 1 to 100% of heat side proportional band (Integral action is OFF when ARW = 0) e) Output limiter : -5 to +105% (High/Low individual setting) f) Proportional cycle time : 1 to 100 seconds
Additional function	Startup tuning, Fine tuning, Measured value derivative/Deviation derivative selection Manual control

Control output

Output type

Triac output (control output)
Output method: AC output (Zero-cross method)
Allowable load current: 7 A (Ambient temperature 40°C or less)
Set the surface temperature to the following degree if the allowable load current exceeds 3A:
• Front side: 80°C or less
• Metal at the back side: 100°C or less
Load voltage: 100 to 240 V AC (Same as the power supply voltage)
Minimum load current: 50 mA
ON voltage: 1.5 V or less (at maximum load current)

Load Power Shutoff Function

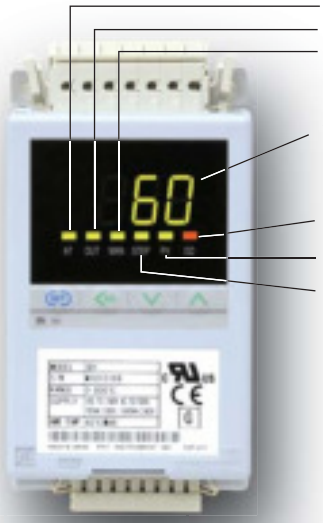
The relay for Load power shutoff opens at the occurrence of instrument abnormality (FAIL) or Control loop break alarm (LBA). (Shut off the internal load power line. [L side of the power])
[Selectable action]
• Relay for Load power shutoff opens at FAIL (Restores when FAIL is resolved.)
• Relay for Load power shutoff opens at FAIL or LBA (FAIL state or LBA state remains *)
• Relay for Load power shutoff opens at FAIL or LBA
(Returns to the normal state when FAIL state or LBA state recovers.)

Peak current suppression function

When a group of controllers (up to 4 units) is connected by SB link, use the Peak current suppression function by setting Output limiter high to prevent all outputs from turning ON at the same time

Setting

SV limiter	Scaling low to scaling high (High/Low individual setting
Ramp-to-setpoint	1 to span per Time (Time : 1 minute/1 hour (Selectable) Up/Down individual setting
Setting data lock	Lock level : 1 to 10 level (0 : No lock)
SV step function	Number of SV : 2 points (SV1/SV2)



Event (Alarm)

Number of events	2 points
Event type	Process high, Process low, Deviation high, Deviation low, Deviation high/low*1, Band, Set value high, Set value low, LBA (Control loop break alarm), RUN status monitor FAIL, Output of the communication monitoring result, *1: Two types of alarm settings are field-selectable. 1. Independent high and low settings. 2. Common high/low setting
Delay timer	0 to 600 sec
Other functions	a) Interlock (latch) function is configurable b) Hold/Re-hold action c) Energized/Re-energized action is configurable.

Digital output (DO) (Optional)

Number of output	1 point
Output	Relay contact output, Form a contact, 250V AC 1A, 30V DC 0.5A (Resistive load) • Electric life : 150,000 cycles or more
Function	Event (Alarm) output

Digital Input (DI) (Optional) • Not available with Communication

Number of input	1 point
Input method	Non-voltage contact input
Function	SV1/SV2 selection, STOP/RUN, Auto/Manual, Alarm interlock reset, • Selectable

Communications (Optional) • Not available with Digital Input (DI)

Communication method	RS-485
Communication speed	2400bps, 4800bps, 9600bps, 19200bps
Protocol	a) ANSI X3.28 sub-category 2.5A4 (RKC standard) b) MODBUS-RTU
Bit format	a) RKC standard protocol Start bit : 1, Data bit : 7 or 8, Parity bit : 1 (odd or even) or none, Stop bit : 1 or 2 b) MODBUS protocol Start bit : 1, Data bit : 8 Parity bit : 1 (odd or even) or none, Stop bit : 1 or 2
Maximum connection	31 units
Terminating resistor	External installation is necessary (120Ω 1/2W)
Buffer mode	Correspond (Mode in which writing to EEPROM is not performed for setting changes)

Inter-controller Communication (SB Link) (Optional)

• Not available with Digital Input (DI)

Function	Peak current suppression function When a group of controllers (up to 4 units) is connected by SB link, use the Peak current suppression function by setting Output limiter high to prevent all outputs from turning ON at the same time
Communication method	RS-485
Communication speed	19200bps
Protocol	MODBUS-RTU
Bit format	Start bit: 1, Data bit: 8, Parity bit: None, Stop bit: 1
Maximum connections:	4 controllers (Address setting range: 0 to 3 *) * Address No. 0 is for Master controller.

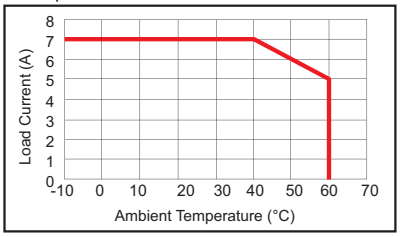
Loader communication

Protocol	ANSI X3.28 sub-category 2.5A4 (RKC standard)
Communication speed	9600bps
Bit format	Start bit : 1, Data bit : 8, Parity bit : none, Stop bit : 1
Maximum connection	1 unit (Address : 0)
Connection method	COM-K loader cable (equivalent to W-BV-01-1500)

General Specifications

Supply voltage	90 to 264V AC (50/60Hz) Rating : 100 to 240V AC
Power consumption (When a load is disconnected)	4.0 VA max. (at 100 V AC) Rush current: 5.6 A or less 6.7 VA max. (at 240 V AC) Rush current: 13.3 A or less
Power consumption (When a load is connected) [Ambient temperature: 40°C]	705 VA max. (When connecting a load equivalent to 7A at 100 V AC) Rush current: 5.6 A or less 1690 VA max. (When connecting a load equivalent to 7A at 240 V AC) Rush current: 13.3 A or less
Ambient temperature	-10 to 60°C (14 to 140°F)
Ambient humidity	5 to 95%RH (Non condensing) • Absolute humidity : MAX.W.C29.3g/m3 dry air at 101.3kPa
Weight	Approx. 130g (Instrument only)
Safety standards	UL: UL61010-1, cUL: CAN/CSA-C22.2 No. 61010-1
CE marking	LVD: EN61010-1 OVERVOLTAGE CATEGORYII, POLLUTION DEGREE 2 EMC: EN61326-1

● Temperature characteristics of load current



CAUTION

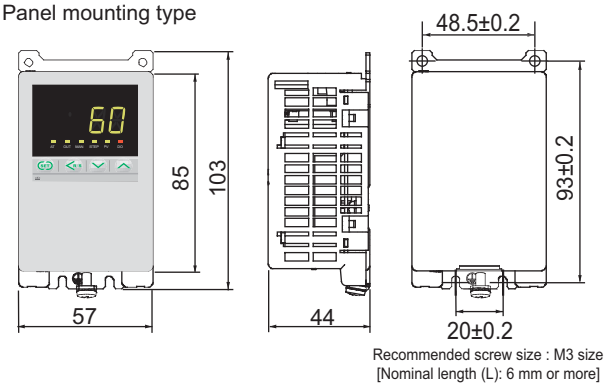
Temperature of the Installation position (surface of a jacket heater) : -10 to +100°C.

External Dimensions

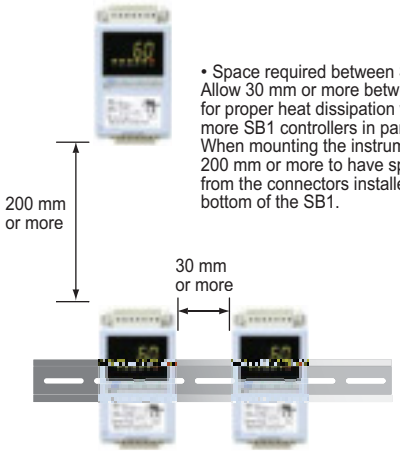
Unit : mm

(Panel mounting hole dimensions)

Panel mounting type

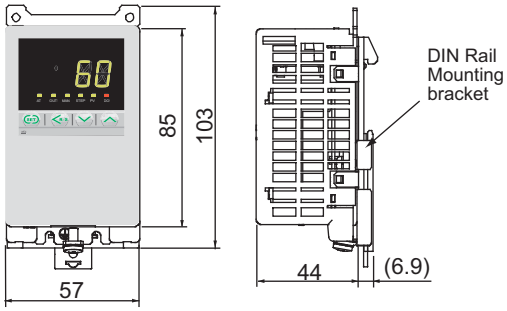


Recommended screw size : M3 size
[Nominal length (L): 6 mm or more]

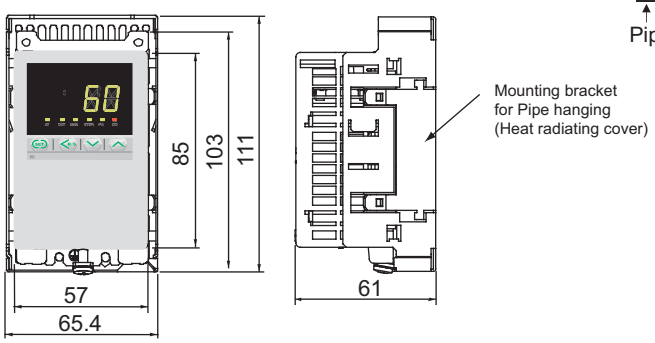


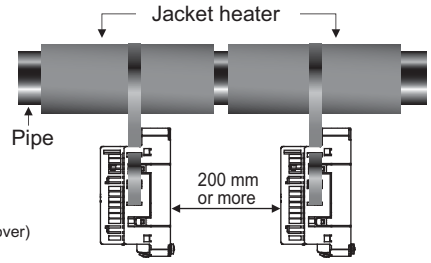
• Space required between SB1
Allow 30 mm or more between the instruments for proper heat dissipation when mounting two or more SB1 controllers in parallel.
When mounting the instruments vertically, allow 200 mm or more to have space for wiring to or from the connectors installed on the top and the bottom of the SB1.

DIN rail mounting type

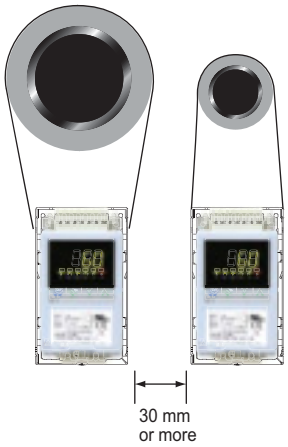


Pipe hanging type

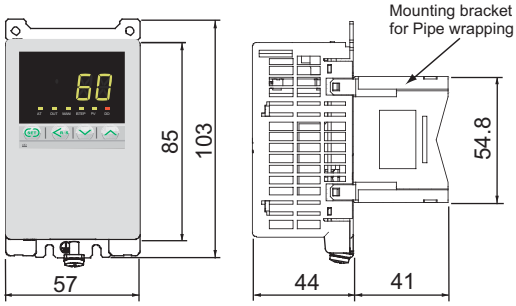


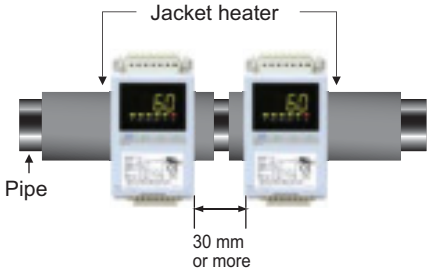


For pipe hanging type, allow sufficient space (200 mm or more) between the instruments for heat dissipation.

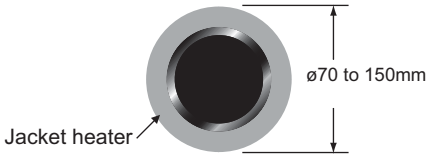


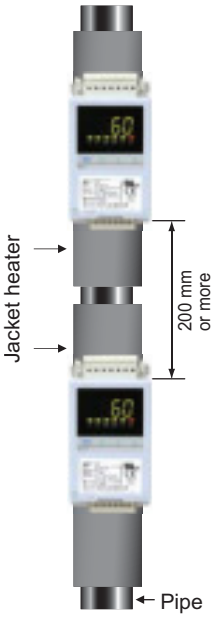
Pipe wrapping type





Recommended pipe size
(when a jacket heater is mounted)





Model and Suffix Code

		Temperature Controller with Built-in SSR **SB1** F □□□-T-4∗□□□□-□□□	Code
		Hardware coding only ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ / Quick start code ⑨ ⑩ ⑪	
①	Control Method	PID control with AT (Reverse action)	**F**
②	Input and range	See Input range Code Table	□□□
③	Control output (OUT)	Triac output	**T**
④	Power supply	100 to 240V AC	**4**
⑤	Digital output (DO)	Not supplied	**N**
		Digital output : 1 point	**1**
⑥	Communication/ Digital input (DI)	Not supplied	**N**
		Digital input : 1 point	**D**
		RS-485 (ANSI/RKC standard protocol)	**5**
		RS-485 (MODBUS protocol)	**6**
⑦	Mounting method	Without mounting bracket (Panel mounting)	**N**
		With mounting bracket (Sold separately)	**1**
⑧	Quick start code	No quick start code (Default setting)	**N**
		Specify quick start code (Event, Digital output type)	**1**
⑨	Event 1 (Alarm 1) type	No quick start code (Default setting)	No Code
		See Alarm Code Table	□
⑩	Event 2 (Alarm 2) type	No quick start code (Default setting)	No Code
		See Alarm Code Table	□
⑪	Digital output assignment	No quick start code (Default setting)	No Code
		Event 1	**1**
		Event 2	**2**
		Logical OR of Event 1 and Event 2	**3**
		Logical AND of Event 1 and Event 2 4	**4**

● Input range Code Table (Universal input)

Thermocouple Input

Input	Range	Code	Input	Range	Code
K	0 to 800°C	K04	J	0 to 800°C	J04
	0 to 999°F	KB1		0 to 999°F	JA8

RTD Input

Input	Range	Code
Pt100	0 to 400°C	D17
	0 to 800°F	DB4

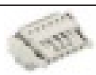
• 1/0.1°C(°F) display can be selectable on only communication data.

● Event Code Table (Programmable)

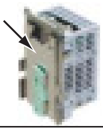
Code	Event Type
N	No event
A	Deviation High
B	Deviation Low
C	Deviation High/Low (Common high/low setting)
D	Band (Common high/low setting)
E	Deviation High with Hold
F	Deviation Low with Hold
G	Deviation High/Low with Hold (Common high/low setting)
H	Process High
J	Process Low
K	Process High with Hold
L	Process Low with Hold
Q	Deviation High with Alarm Re-hold
R	Deviation Low with Alarm Re-hold
T	Deviation High/Low with Re-Hold (Common high/low setting)
U	Band (Individual high and low settings)
V	Set value High
W	Set value Low
X	Deviation High/Low (Individual high and low settings)
Y	Deviation High/Low with Alarm Hold (Individual high and low settings)
Z	Deviation High/Low with Alarm Re-Hold (Individual high and low settings)
2	Loop break alarm
3	FAIL
4	RUN status
5	Output of the communication monitoring result

Mounting type Accessories

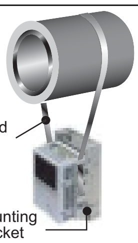
Panel mounting Type

SB1/Accesory	Model Code
SB1	SB1F□□□-T-4∗□□Ⓝ□-□□□
Connector (upper-side)	SB1P-C02 
Connector (lower-side)	SB1P-C01 

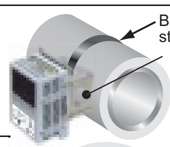
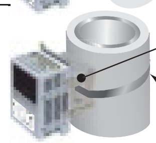
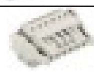
DIN rail mounting Type

SB1/Accesory	Model Code
SB1	SB1F□□□-T-4∗□□①□-□□□
DIN rail mounting bracket	SB1P-M03 
Connector (upper-side)	SB1P-C02 
Connector (lower-side)	SB1P-C01 

Pipe hanging Type

SB1/Accesory	Model Code
SB1	SB1F□□□-T-4∗□□①□-□□□
Mounting bracket for Pipe hanging	SB1P-M02 
Banding and strapping	SB1P-B02
Connector (upper-side)	SB1P-C02 
Connector (lower-side)	SB1P-C01 

Pipe wrapping Type

SB1/Accesory	Model Code
SB1	SB1F□□□-T-4∗□□①□-□□□
Mounting bracket for Pipe wrapping	SB1P-M01 
Banding and strapping	SB1P-B01 
Connector (upper-side)	SB1P-C02 
Connector (lower-side)	SB1P-C01 

Accessories (Sold Separately)

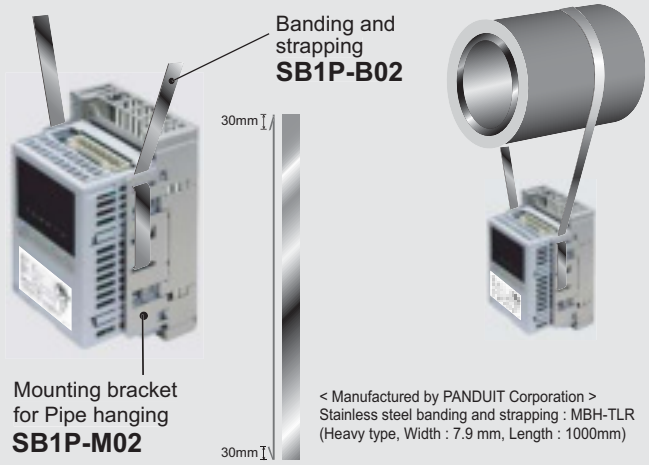
Mounting bracket

• Mounting brackets are not necessary when using panel mounting type.

DIN rail mounting Type

DIN rail mounting bracket
SB1P-M03

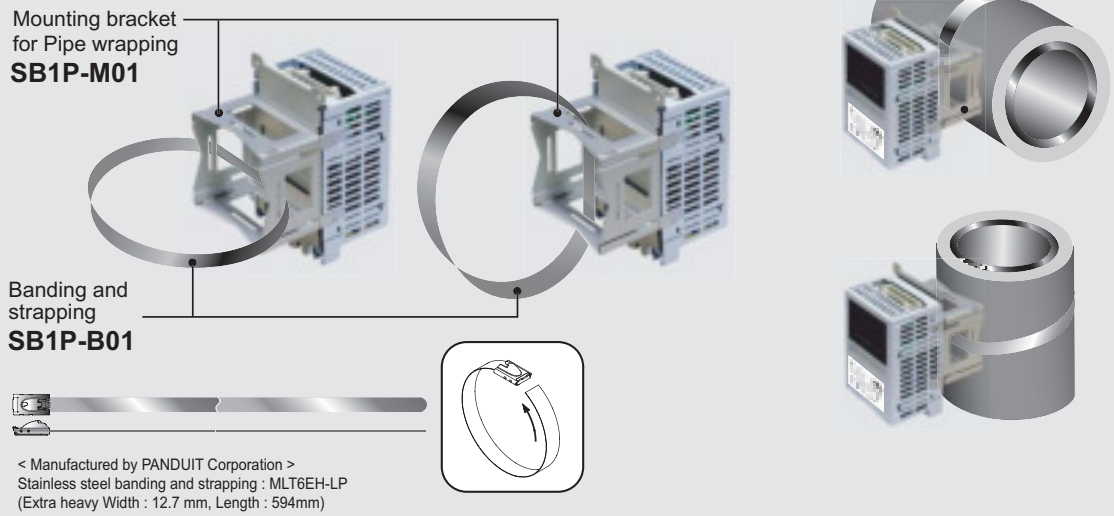
Pipe hanging Type



Mounting bracket for Pipe hanging
SB1P-M02

< Manufactured by PANDUIT Corporation >
Stainless steel banding and strapping : MBH-TLR
(Heavy type, Width : 7.9 mm, Length : 1000mm)

Pipe wrapping Type



< Manufactured by PANDUIT Corporation >
Stainless steel banding and strapping : MLT6EH-LP
(Extra heavy Width : 12.7 mm, Length : 594mm)

Connector and Tool for cable wiring

Connector

Power supply/ Event input/output/ Communication connector
SB1P-C02
• Manufactured by WAGO Corporation: 721-2107/037-000

Measured input/Control output connector
SB1P-C01
• Manufactured by WAGO Corporation: 734-108/037-000

Wiring tool

Tool for SB1P-C02
SB1P-C13
• Manufactured by WAGO Corporation: 210-720 Partially isolated shaft Type 2

Tool for SB1P-C01
SB1P-C11
• Manufactured by WAGO Corporation: 210-719 Partially Isolated shaft Type 1

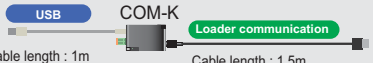
or
SB1P-C12
• Manufactured by WAGO Corporation: 734-230 Push button for connectors (Connector operating lever)

• A small screwdriver can be used for wiring.

USB communication converter (Loader Communication)

Model Code : USB communication converter (COM-K)

Specifications	Model and Suffix code	
	COM-K-	□
Loader communication cable	Without loader communication cable	N
	With loader communication cable	1



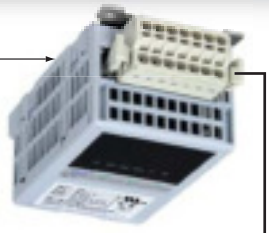
Cable length : 1m
(COM-K standard accessory)

Cable length : 1.5m
(optional, specify in the model code when ordering

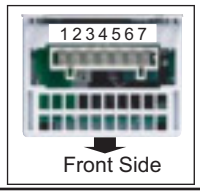
Model Code for cable only
W-BV-01-1500

Connector Configuration

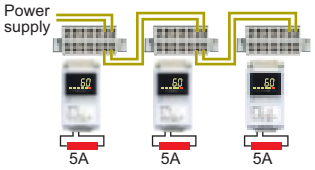
Upper side



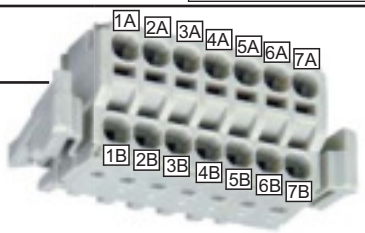
Power supply/Event input/output/ Communication connector (CN1)



Caution Maximum allowable current (power supply part) is 15 A.

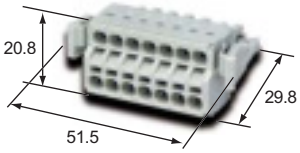


(Total current : Maximum 15A)



Connector (Sold Separately)

Model Code : SB1P-C02



• Manufactured by WAGO Corporation: 721-2107/037-000

Pin No.	1A 1B	2A 2B	3A 3B	4A 4B	5A 5B	6A 6B	7A 7B
Description	SG	T/R(A)	T/R(B) RS-485 Communication (Option)	NO Relay contact		L N Note 100 to 240V AC	
	DI Non-Voltage contact Digital input (DI) (Option)			Digital output (DO) (Option)		Power supply	

● Recommended cable
Compatible cable diameter : 12 AWG (2.5 mm^2)
Stripping length: 9 to 10 mm

• The pins of the same number at line A and line B of the Plug are connected internally.
• Communication and Digital input (Event input) cannot be selected at the same time.

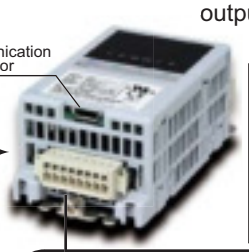
● Wiring tool (Sold Separately)

Model Code : SB1P-C13

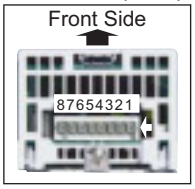
• Manufactured by WAGO Corporation: 210-720
Partially isolated shaft Type 2
• A small screwdriver can be used for wiring.

Lower side

Loader communication connector

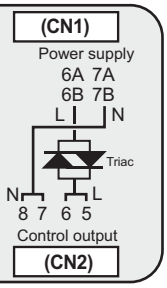


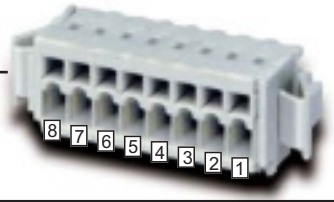
Measured input/Control output connector (CN2)



Note

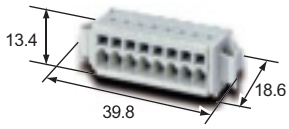
The pin No. 7 (N) of the Power supply terminal and the pin No. 7 and No. 8 of the Control output terminal are connected internally.





Connector (Sold Separately)

Model Code : SB1P-C01



• Manufactured by WAGO Corporation: 734-108/037-000

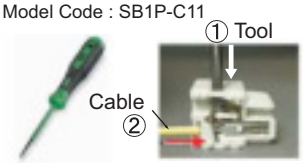
Pin No.	8	7	6	5	4	3	2	1
Description	Note N Triac AC output L Heater					(1) B B A (2)		
	Control output (OUT) SSR (Triac)					Measured input (1) Thermocouple (2) RTD		

● Recommended cable
Compatible cable diameter : 14 AWG (1.5 mm^2)
Stripping length: 6 to 7mm

• The pin No. 5 and No.6, the pin No. 7 and No. 8 are connected internally.

● Wiring tool (Sold Separately)

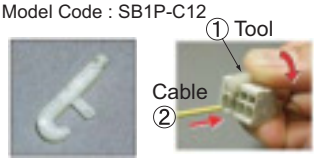
Model Code : SB1P-C11



• Manufactured by WAGO Corporation: 210-719
Partially Isolated shaft Type 1
• A small screwdriver can be used for wiring.

or

Model Code : SB1P-C12



• Manufactured by WAGO Corporation: 734-230
Push button for connectors
(Connector operating lever)

Safety Warning

- Before operating this product, read the instruction manual carefully to avoid incorrect operation.
- This product is intended for use with industrial machines, test and measuring equipment. It is not designed for use with medical equipment.
- If it is possible that an accident may occur as a result of the failure of the product or some other abnormality, an appropriate independent protection device must be installed.

Caution for the export trade

All transactions must comply with laws, regulations, and treaties.

Caution : Avoid imitated products

Imitation of RKC products are appearing in the marketplace. RKC will not warrant such products nor bear the responsibility for any damage and/or accident caused by their use and urge caution when making your purchase.

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