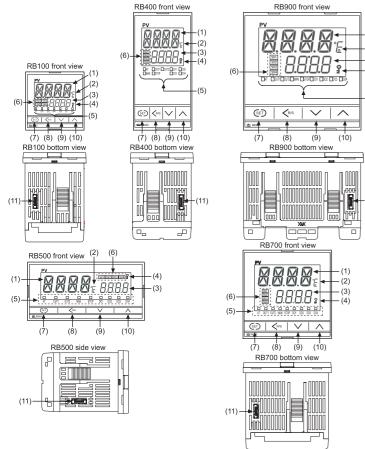
RB series (RB100|400|500|700|900)

Quick Operation Manual

In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place the manual in a convenient location for easy reference. This manual describes the parts description and basic key operations of the RB100/400/500/700/900.

For functions, refer to RB series Instruction Manual (IMR02C15-ED). The manual can be downloaded from the official RKC website http://www.rkcinst.com/english/manual_load.htm

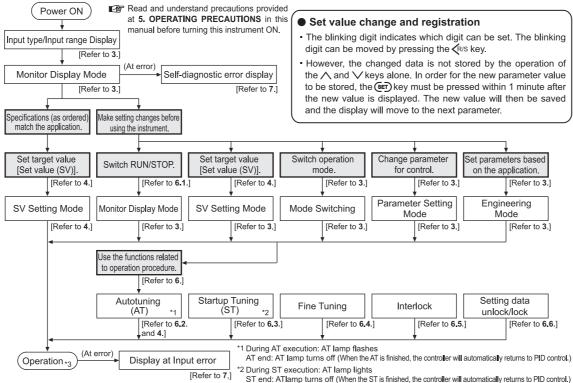
1. PARTS DESCRIPTION



(1)	Measured value (PV) display [Green]	Displays Measured value (PV) or various parameter symbols.		
(2)	Unit display [Green]	Displays the temperature units (°C or °F) of displayed data and the units (%) of the Manipulated output value (MV).		
(3)	Set value (SV) display [Orange]	Displays Set value (SV), Manipulated output value (MV) or various parameter set values.		
(4)	Set lock display[Orange]	Lights when the settings are locked.		
(After Autotuning is completed: A		Flashes when Autotuning is activated. (After Autotuning is completed: AT lamp will go out) Light during Startup tuning (ST) execution.		
	Output lamp [Green]	OUT1: Lights when Output 1 is turned on. OUT2: Lights when Output 2 is turned on. Lamp indication becomes as follows for Current output and Voltage output. For an output of less than 0 %: Extinguished For an output of more than 0 %: Lit		
	MAN mode lamp [Green]	Lights when operated in Manual (MAN) mode.		
	STOP lamp [Green]	Lights when control is stopped (STOP). Blinks when control is stopped (STOP) by the Timer function.		
	DO (digital output) lamp [Orange]	Lights when the Event (DO1 to DO4) output corresponding to each lamp is ON.		
(6)	STEP set value lamp [Orange]	When the step SV function or the Timer function is used, the lamp corresponding to the currently used Set value (SV1 to SV4) lights.		
(7)	Set (SET) key	Used for parameter calling up and set value registration.		
(8)	Shift key Shift digits when settings are changed. Used to switch monitor items, RUN/STOP, and modes.			
(9)	Down key 1	Decrease numerals.		
	Up key ¹	Increase numerals.		
(11)	onader communication connector Standard equipment) Setting and monitoring on a personal computer (PC) is possible if the controller is connected with our cable to a PC via our US communication converter COM-K-1 (sold separately) ² . Our communication software ³ must be installed on the PC.			

- ¹ Also used to switch items within Mode switching (AUTO/MAN, Set data lock, and Interlock release).
- ² For the COM-K, refer to COM-K Instruction Manual (IMR01Z01-E□). 3 Only available as a download from our website.
- To avoid damage to the instrument, never use a sharp object to press keys.

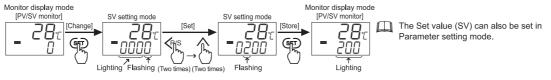
2. OPERATION FLOW



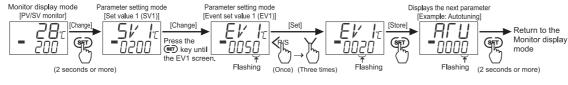
*3 Adjust the PID constants manually when the optimum PID constants cannot be calculated by AT or ST for characteristic variations of the controlled system.

4. SETTING EXAMPLE



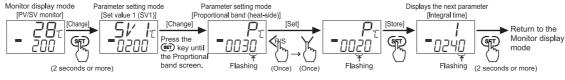


Set Event 1 set value (EV1) to 20 °C

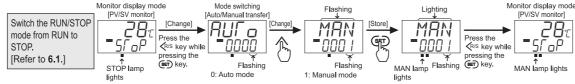


Set Autotuning (AT) Monitor display mode Displays the next parameter Parameter setting mode Parameter setting mode [PV/SV monitor] [Set value 1 (SV1)] [Autotuning (AT)] [Startup tuning] [Change] Press the - <u>- 0000</u> Monitor display Start the AT by mode pressing the (SET) key Flashing Flashing (2 seco AT lamp flashes

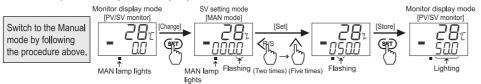
Set 20 °C for Proportional band (P) of PID control



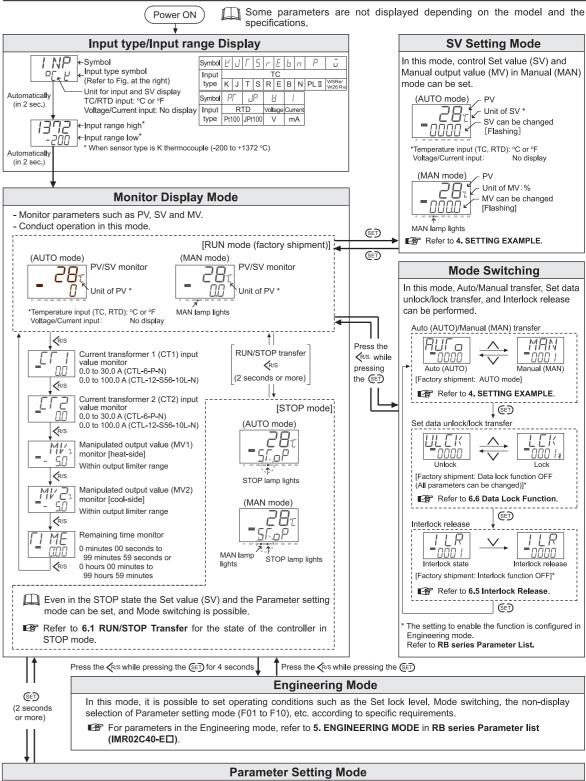
Switch from Auto (AUTO) mode to Manual (MAN) mode

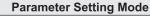


Set Manipulated output value (MV) to 50 % in the Manual mode



3. OPERATION MENU



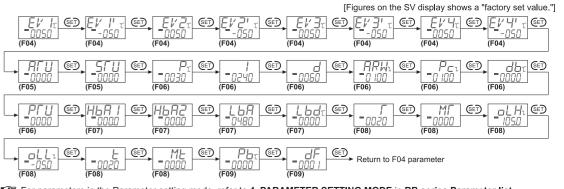


Change parameters related to control such as PID values.

F04 to F09 indicate group numbers used in Non-display of block and Set lock level in Engineering mode.

Parameters in F01 to F03 as well as F10 are not displayed with the factory default setting.

Some parameters are not displayed depending on the model and the specifications



For parameters in the Parameter setting mode, refer to 4. PARAMETER SETTING MODE in RB series Parameter list

5. OPERATING PRECAUTIONS

Read and understand the following precautions before starting operation

CAUTIONS

- There is no power switch on this instrument, so the instrument starts operation immediately following initial power ON (Factory set value: RUN).
- If the input signal wiring is disconnected or short-circuited (RTD input only), the instrument determines that input error (burnout, etc.) has occurred <Burnout direction>

Thermocouple input*: Upscale or Downscale

RTD input Upscale (when input break), Downscale (when short-circuited) Voltage input, current input:

Downscale or Indicate the value near 0 Burnout direction can be selected by Engineering mode. (Factory set value: Upscale

<Output at burnout>

Control output: According to the contents set by Control output at burnout (Factory set value: 0 [Result of control computation])

Event output: According to the contents set by Event output action at input burnout

(Factory set value: 0 [The Event output is not forcibly turned ON

when the Burnout function is activated.])

Heat/Cool PID control: Output is 0 %

 A power failure of 20 ms^{*1} or less will not affect the control action. When a power failure of more than 20 ms*1 occurs the instrument assumes that the power has been turned off. When power returns the controller will retain the conditions that existed prior to shuf

*1 10 ms in case of RB100 with 24 V AC/DC power supply.
*2 In case of AUTO mode:

Output changes from the Output limiter low with control calculation results. In case of a Manual (MAN) mod

Output status is defined as follows by the Bumpless mode setting in the Engineering mode.

In case of "0: without bumpless" In case of "1: with bumpless" Preset manual value is output. PID control: Output limiter low is output

- The Event hold action is activated when the power is turned on or when transferred from STOP mode to RUN mode. (Event type with hold action)
- The Event re-hold action is activated when not only the SV is changed, but also when power is turned on or when transferred from STOP mode to RUN mode. (Event type with re-hold action)

6. FUNCTIONS RELATED TO OPERATION

Refer to • Set value change and registration for basic data setting in this manual. Functions related to operation are explained below.

6.1 RUN/STOP Transfer

It is possible to transfer between control start (RUN) and control stop (STOP). RUN/STOP transfer can be performed by key operation, or by using the "RUN/STOP setting" in Engineering mode. These two methods are linked together. For example, if the keys are used to transfer from RUN to STOP, the setting of "RUN/STOP setting" in Engineering mode will also change to "STOP.

State of this instrument when set to STOP mode

STOP display	STOP lamp lights (Green). Displays the STOP symbol "STOP" on the SV or PV displays. [Factory shipment: SV display + STOP lamp]		
Control output	When the time-proportional control output: Output OFF When the continuous control output: Output of -5 %		
Event output	Output depending on the "Output action at STOP mode" [Factory shipment: Output OFF (Contact open)]		
Autotuning (AT)	AT canceled (The PID constants are not updated)		
Parameters	The Set value (SV) and Parameter setting mode can be set, and mode switching can be operated.		

State of this instrument when set to RUN mode

If the instrument is transferred to RUN mode from STOP mode, it performs the same operation (control RUN, event determination start-up) as the power-on.

■ RUN/STOP transfer by front key operation

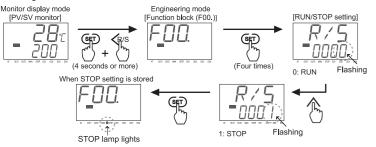
<RUN mode (factory shipment)>

"STOP" character in the STOP mode:					
	Character	STOP lamp	Key operation or communication ¹	Digital input (DI) 1,3	Timer function ²
	<i>YSTP</i>	Lighting	STOP	RUN	
	d5FP	Lighting	RUN	STOP	
	SroP	Lighting	STOP	STOP	
	rsrp	Flashing	RUN	RUN	STOP
	Communication, Digital input (DI): Optional function Factory shipment: Timer function is unused				

3 When no Digital input (DI) is supplied: Only 5 Por 5 P is displayed.

■ Performing RUN/STOP transfer in the "RUN/STOP setting"

■ To change from RUN mode to STOP mode



● To change from STOP mode to RUN mode

- 1. Follow the steps above to display the RUN/STOP setting screen
- 2. Changed to STOP from RUN.



6.2 Autotuning (AT) Start/Stop

The AT function automatically measures, computes and sets the optimum PID values.

Caution for using the Autotuning (AT)

- When a temperature change (UP and/or Down) is 1 °C or less per minute during AT, AT may not be finished normally. In that case, adjust the PID values manually. Manual setting of PID values may also be necessary if the set value is around the ambient temperature or is close to the maximum temperature achieved by the load.
- If the manipulated output value may be limited by the output limiter setting, the optimum PID values may not be calculated by AT.

■ Requirements for Autotuning (AT) start

Start the AT when all following conditions are satisfied:

[PID control		
RUN		
Output limiter high ≥ 0.1 %, Output limiter low ≤ 99.9 %		
[Heat/Cool control type: Output limiter high (heat-side) ≥ 0.1 %, Output limiter high ccool-side) ≥ 0.1 %]		
The Measured value (PV) is not underscale or overscale.		

■ Requirements for Autotuning (AT) cancellation

If the AT is canceled according to any of the following conditions, the controller immediately changes to PID control. The PID values will be the same as before AT was activated.

	When the PID/AT transfer is changed to the PID control.	
Operation state	When the RUN/STOP mode is changed to the STOP mode.	
	When the Auto/Manual mode is changed to the Manual mode.	
	When the Set value (SV) is changed.	
Parameter changing	When the PV bias or the PV digital filter is changed.	
	When the Output limiter value is changed.	
Input value state	When the Measured value (PV) goes to underscale or overscale.	
AT execution time	When the AT does not end in 9 hours after AT started.	
	When the power failure of more than 20 ms occurs.	
Power failure	(10 ms or more for RB100 with 24V AC/DC power supply.)	
Instrument error	When the instrument is in the FAIL state.	

■ Autotuning (AT) Start/Stop operation

The Autotuning function can start from any state after power on, during a rise in temperature

If AT ends normally, the LBA time is automatically set twice as large as the Integral time.

6.3 Startup Tuning (ST)

Startup tuning (ST) is a function which automatically computes and sets the PID values (Proportional band: heat-side only) from the response characteristics of the controlled system at power ON, transfer from STOP to RUN, and Set value (SV) change.

As simple autotuning, the PID values can be found in a short time without disturbing controllability for controlled systems with slow response at power ON.

Caution for using the Startup tuning (ST)

- For ST at power ON or transfer from STOP to RUN, always set the heater power to ON simultaneously with the start of tuning or before the start of tuning
- Start ST in the state in which the temperature differential of the Measured value (PV) and Set value (SV) at the start of ST is twice the proportional band, or greater
- When the manipulated output value may be limited by the output limiter setting, the optimum PID values may not be calculated by ST.

■ Requirements for Startup tuning (ST) start

Start the ST when all following conditions are satisfied

0	PID control	
Operation state	RUN	
	ST is set to ON. (Execute once, Execute always)	
Parameter setting	Output limiter high \geq 0.1 %, Output limiter low \leq 99.9 % [Heat/Cool control type: Output limiter high (heat-side) \geq 0.1 %]	
	The Measured value (PV) is not underscale or overscale.	
Input value state	At ST at setting change, the Measured value (PV) shall be stabilized.	
	Set value (SV) > Measured value (PV) [Heat/Cool PID control]	
Output value state	At startup, output is changed and saturated at the Output limiter high or the Output limiter low [Heat/Cool control type: Output limiter high (heat-side)].	

■ Requirements for Startup tuning (ST) cancellation

If the ST is canceled according to any of the following conditions, the controller immediately

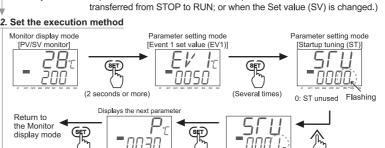
changes to PID control. The PID values will be the same as before ST was activated.			
	When the AT is activated.		
Operation state	When the RUN/STOP mode is changed to the STOP mode.		
	When the Auto/Manual mode is changed to the Manual mode.		
	When ST is set to "0 (ST unused)."		
Parameter changing	When the PV bias or the PV digital filter is changed.		
	When the Output limiter value is changed.		
Input value state	When the Measured value (PV) goes to underscale or overscale.		
ST execution time	When the ST does not end in hundred minutes after ST started		
Power failure	When the power failure of more than 20 ms occurs. (10 ms or more for RB100 with 24V AC/DC power supply.)		
Instrument error	When the instrument is in the FAIL state.		

■ Startup tuning (ST) setting

Setting example: When executing ST only 1 time at power ON

1. Check the start condition

First, make sure that "when the power is turned on" is selected in the ST start condition in Function block F52 of Engineering mode. Factory set value: 0 (Activate the ST function when the power is turned on; when



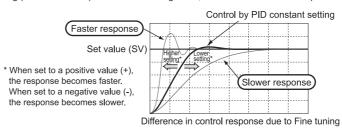
3. Start the ST

Turn off the power once and turn it on again. The ST will automatically start (During ST execution: AT lamp lights). When the calculation and setting of PID values is completed, setting of the ST screen will automatically change to "0." (ST is completed: AT lamp turns off)

- When ST was interrupted, the setting does not change to "0: ST unused." ST starts when the restart conditions are satisfied.
- If ST ends normally, the LBA time is automatically set twice as large as the Integral time.

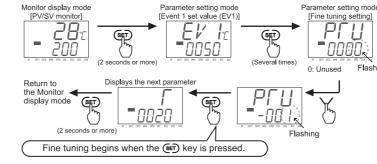
6.4 Fine Tuning

The Fine tuning function allows you to change the response of the set PID constant control. The control response can be made "faster" or "slower" by simply changing the Fine tuning setting (6 levels: -3 to +3) in Parameter setting mode; the PID constant can be kept unchanged.



■ Fine tuning setting

Setting example: To slow the response (when "-1" is set)

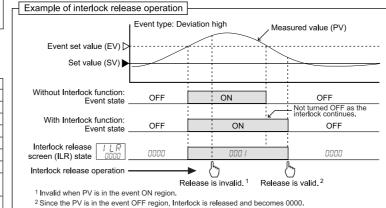


If the set value of Fine tuning is returned to "0: Unused," Fine tuning correction will no longer be applied to control.

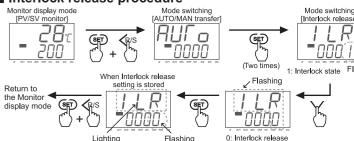
6.5 Interlock Release

The Event interlock action holds the event state even if the Measured value (PV) is out of the event zone after it enters the event zone once. The Interlock release can be made by

To validate the Interlock function, it is necessary to set Event interlock (EIL) to '1: Used" in Engineering mode, (Factory shipment: Interlock function OFF) Refer to RB series Parameter List (IMR02C40-E□).



■ Interlock release procedure



6.6 Data Lock Function

The Data lock function limits access of unauthorized personnel to the parameters and prevents parameter change by mistake. The setting of data lock is enabled in Set data unlock/lock of Mode switching. Set the parameters* that you wish to lock in the Set lock level *Only parameter of Parameter setting mode

To validate the Data lock function, settings are required in Set lock level (Lock) of Engineering mode (Factory shipment: Data lock function OFF [All parameters can be changed])

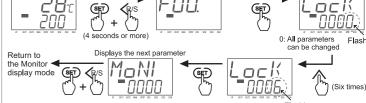
Refer to RB series Parameter List (IMR02C40-E□).

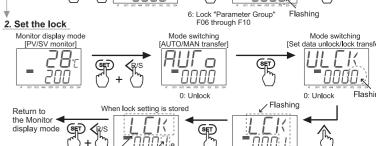
■ Data lock setting Setting example

Locking parameters from "Parameter Group" F06 through F10 in Parameter setting mode

[Set lock level]

Set the set lock level





Flashing Lock symbol is displayed

The Set lock level (Lock) settings can be changed after lock is executed.

7. ERROR DISPLAY

Display when input error occurs

Display	Description	Solution	
Measured value (PV) [Flashing]	PV is outside of input range.	Prior to replacing the sensor, always turn the power OFF or change to STOP with	
[Flashing]	Over-scale: PV is above the display range limit high	RUN/STOP transfer. Check input range, sensor and sensor connection.	
[Flashing]	Underscale: PV is below the display range limit low		

■ Self-diagnostic error

If two or more errors occur simultaneously, the total summation of these error codes is displayed.

Description	Action	Operation at error	Solution	
Adjustment data error Flashing Data back-up error Flashing Data back-up error A/D conversion error *	Indication lamp: All lamp turns off	Control output: Time-proportional control output: OFF Continuous control output: Output of -5 % Transmission output: Output of -5 % FAIL output: Contact open	Turn off the power at once. If an error occurs after the power is turned on again, please contact RKC sales office or the agent.	
Power supply voltage is abnormal	All display is OFF	[When FAIL is selected for the event (EV)]		
Watchdog timer				
* Including temperature compensation error				

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