

SB1 Quick Operation Manual

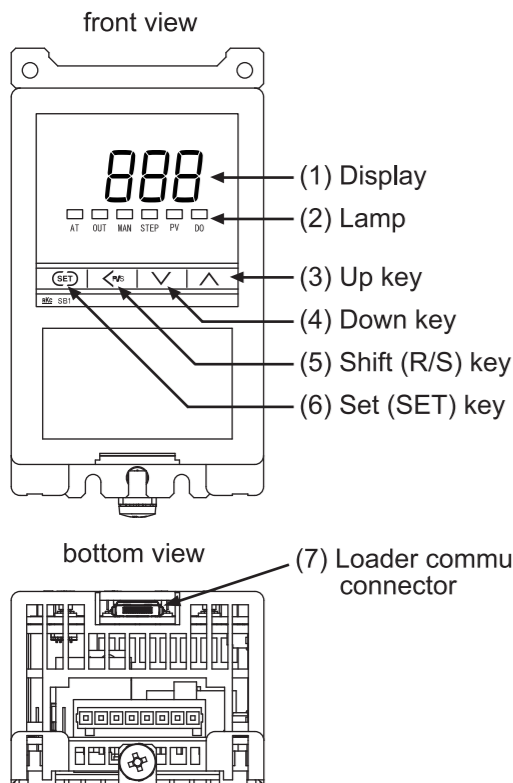
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IMR02M02-E1

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 SB1.

For functions, refer to **SB1 Instruction Manual (IMR02M04-E□)**. The manual can be downloaded from the official RKC website: http://www.rkcinst.co.jp/down_load.htm.

1. PARTS DESCRIPTION

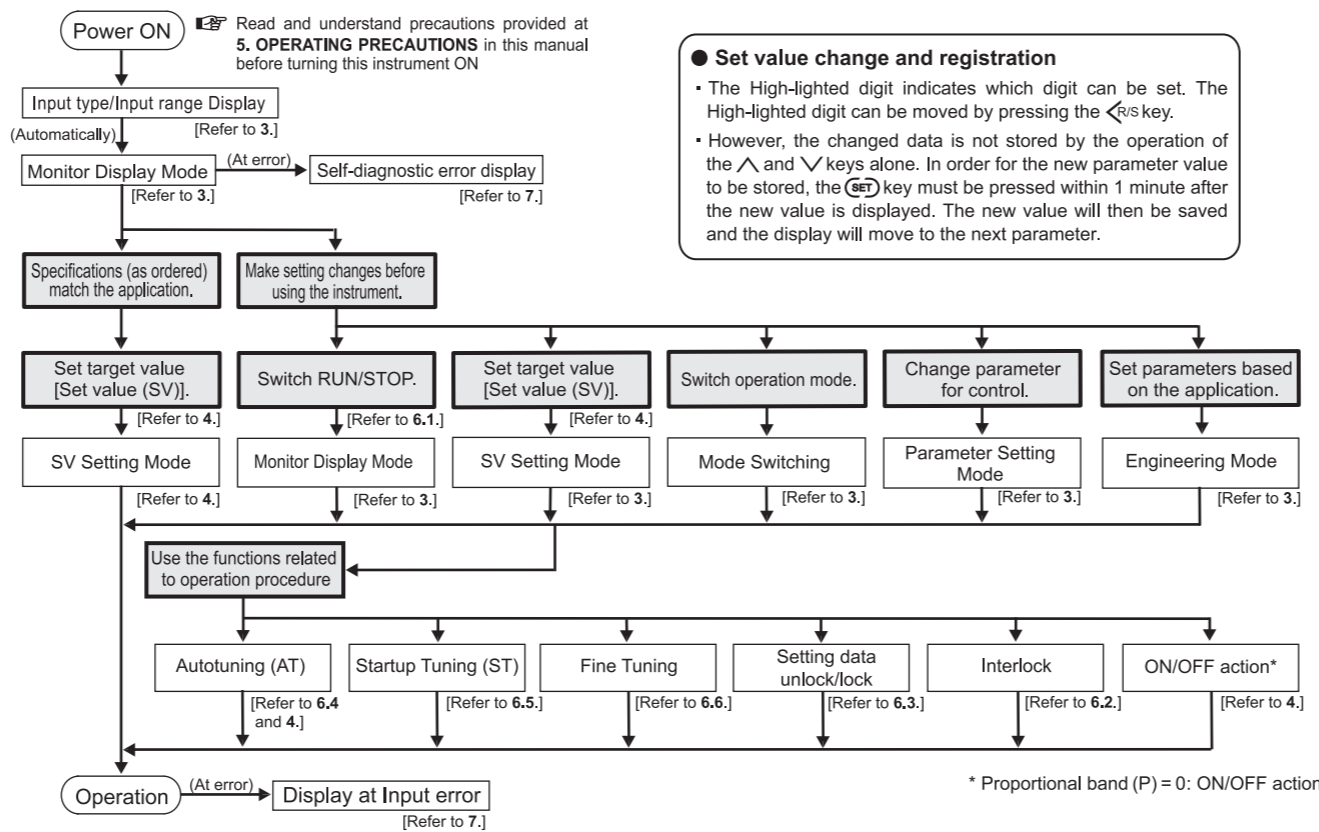


(1) Display	[Green]	Displays Measured value (PV), Set value (SV), Manipulated output value (MV) or various parameter symbols.
(2) AT lamp	[Green]	Flashes when Autotuning is activated. (After Autotuning is completed: AT lamp will go out) Light during Startup tuning (ST) execution.
Output lamp	[Green]	Lights when Output is turned on.
MAN mode lamp	[Green]	Lights when operated in Manual (MAN) mode.
PV lamp	[Green]	Light when the Measured value (PV) is displayed.
STEP lamp	[Green]	Lights when SV2 is selected for the Set value (SV).
DO (digital output) lamp	[Red]	Lights when the Event output is turned on.
(3) Up key ¹		Decrease numerals.
(4) Down key ¹		Increase numerals.
(5) Shift (R/S) key [Green]		Shift digits when settings are changed. Used to switch monitor items, RUN/STOP, and modes.
(6) Set (SET) key		Used for parameter calling up and set value registration.
(7) Loader 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 USB communication converter COM-K-1 (sold separately) ² . Our communication software ³ must be installed on the PC.

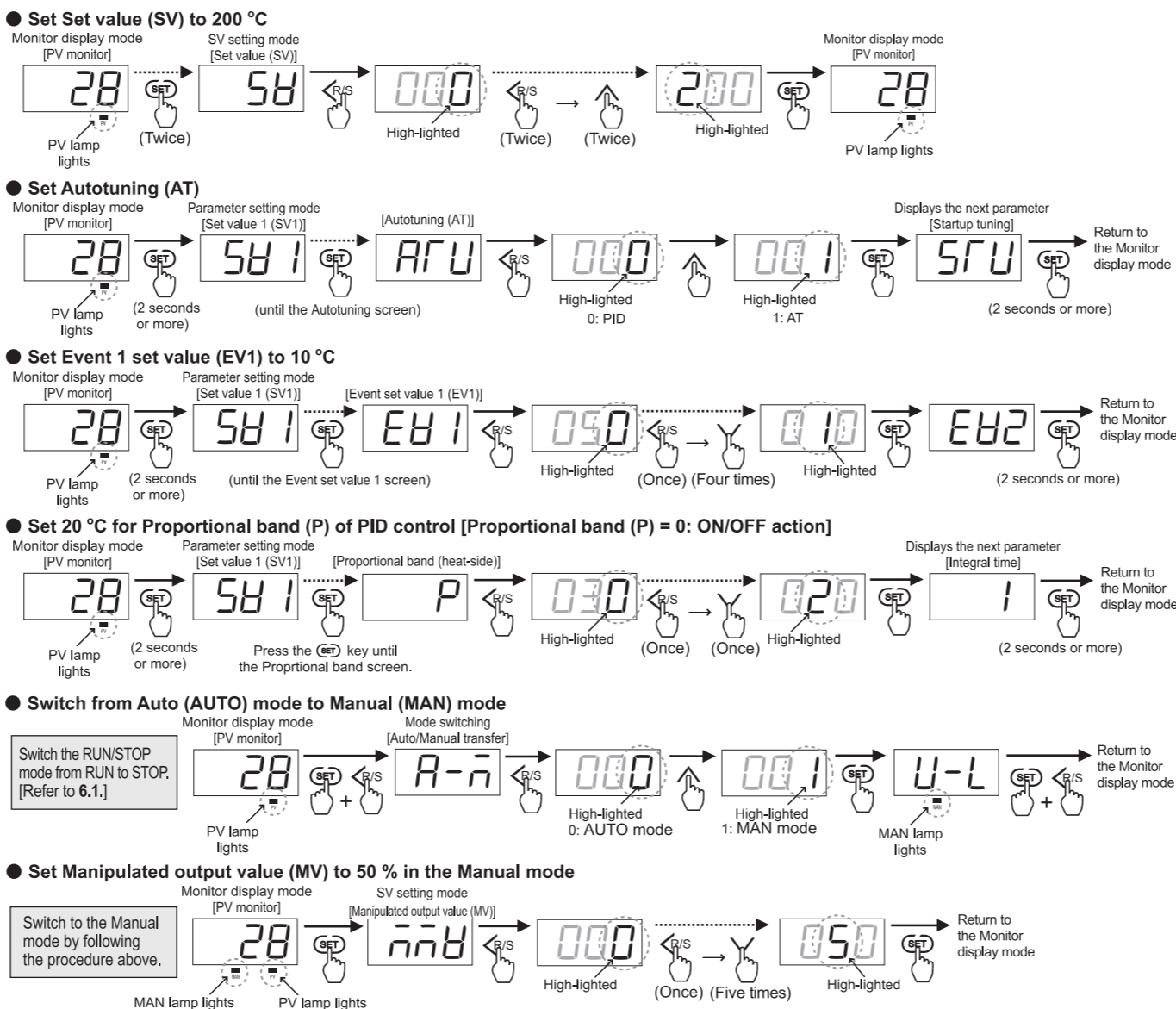
¹ Also used to switch items within Mode switching (AUTO/MAN, Set data lock, and Interlock release).
² For the COM-K, refer to COM-K Instruction Manual (IMR01Z01-E□).
³ Only available as a download from our website.

To avoid damage to the instrument, never use a sharp object to press keys.

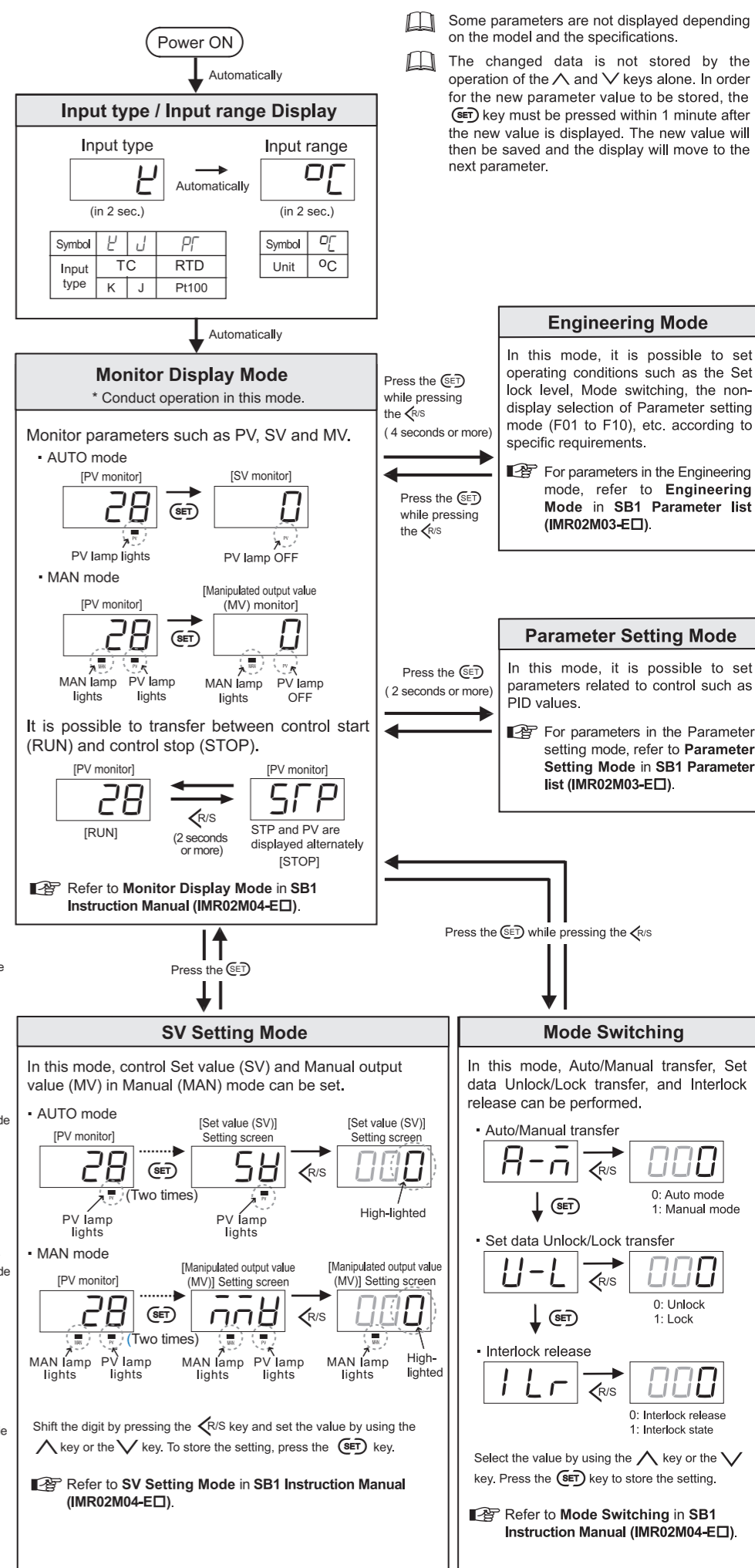
2. OPERATION FLOW



4. SETTING EXAMPLE



3. OPERATION MENU



5. OPERATING PRECAUTIONS

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
 - RTD input : Upscale (when input break), Downscale (when short-circuited)
 - <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.]])
- A power failure of 20 ms or less will not affect the control action. When a power failure of more than 20 ms occurs the instrument assumes that the power has been turned off. When power returns the controller will retain the conditions that existed prior to shut down.
 - * In case of AUTO mode:
 - Output changes from the Output limiter low with control calculation results.
 - In case of a Manual (MAN) mode:
 - Output status is defined as follows by the Bumpless mode setting in the Engineering mode.
 - In case of "0: without bumpless": Preset manual value is output.
 - In case of "1: with bumpless": 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 of 2. OPERATION FLOW** 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 simple key operation, or by setting 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."

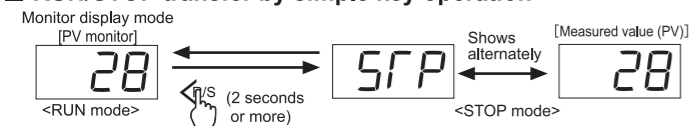
● State of this instrument when set to STOP mode

STOP display	Displays the STOP symbol "SFP" on the displays.
Control output	Output OFF
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

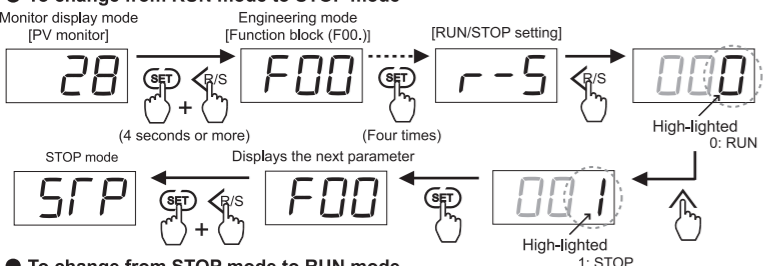
If the instrument is transferred to RUN mode from STOP mode, it performs the same operation (control RUN, event determination start-up) as the power-on.

■ RUN/STOP transfer by simple key operation

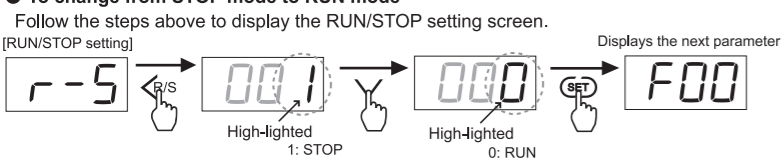


■ Performing RUN/STOP transfer in the "RUN/STOP setting"

● To change from RUN mode to STOP mode



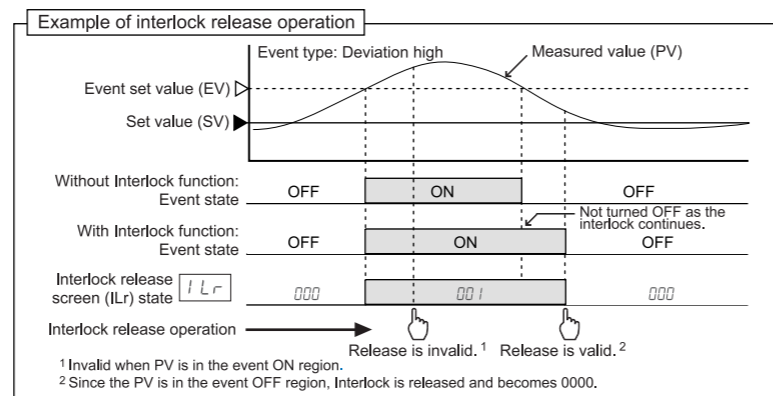
● To change from STOP mode to RUN mode



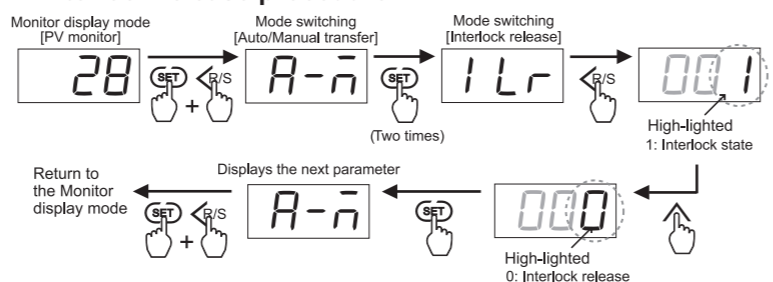
6.2 Interlock Release

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 the key operation.

To validate the Interlock function, it is necessary to set Event interlock (IL1) to "1: Used" in Engineering mode. (Factory shipment: Interlock function OFF)
Refer to SB1 Parameter list (IMR02M03-E0)



■ Interlock release procedure



6.3 Data Lock Function

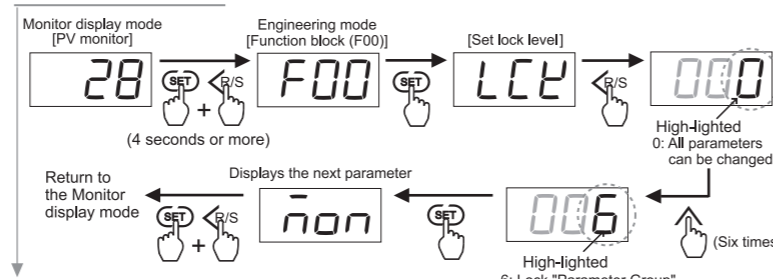
The Data lock function limits access of unauthorized personnel to the parameters and prevents parameter change by mistake. The setting of data lock is enabled in Set data Unlock/Lock of Mode switching. Set the parameters* that you wish to lock in the Set lock level of Engineering mode. *Only parameter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

To validate the Data lock function, settings are required in Set lock level (LCK) of Engineering mode. (Factory shipment: Data lock function OFF [All parameters can be changed])
Refer to SB1 Parameter List (IMR02CM03-E0).

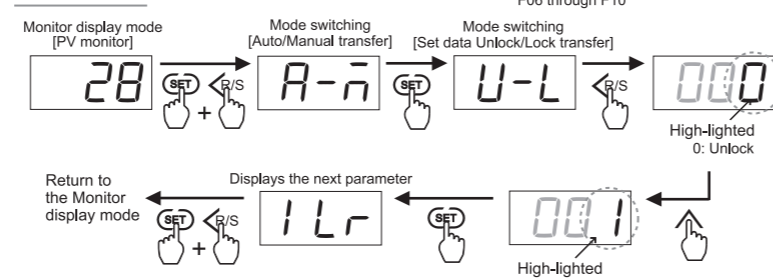
■ Data lock setting

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

1. Set the set lock level



2. Set the lock



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

6.4 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:

Operation state	PID control RUN
Parameter setting	Output limiter high $\geq 1\%$, Output limiter low $\leq 99\%$
Input value state	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.

Operation state	When the PID/AT transfer is changed to the PID control. When the RUN/STOP mode is changed to the STOP mode. When the Auto/Manual mode is changed to the Manual mode.
Parameter changing	When the Set value (SV) is changed. 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.
Power failure	When the power failure of more than 10 ms occurs.
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 or in stable control.

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

6.5 Startup Tuning (ST)

Startup tuning (ST) is a function which automatically computes and sets the PID values 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:

Operation state	PID control RUN
Parameter setting	ST is set to ON. (Execute once, Execute always) Output limiter high $\geq 1\%$, Output limiter low $\leq 99\%$
Input value state	The Measured value (PV) is not underscale or overscale. At ST at setting change, the Measured value (PV) shall be stabilized.
Output value state	At startup, output is changed and saturated at the Output limiter high or the Output limiter low.

■ 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.

Operation state	When the AT is activated. 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.
Instrument error	When the instrument is in the FAIL state.

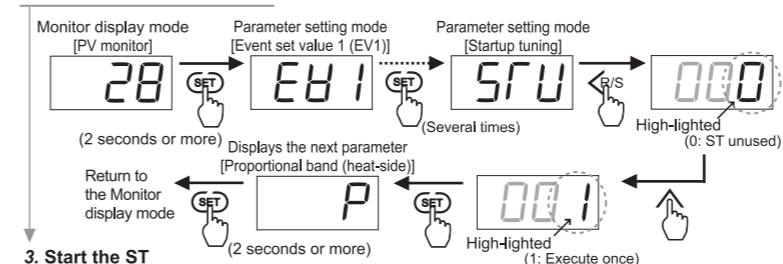
■ Startup tuning (ST) setting

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 transferred from STOP to RUN; or when the Set value (SV) is

2. Set the execution method



3. Start the ST

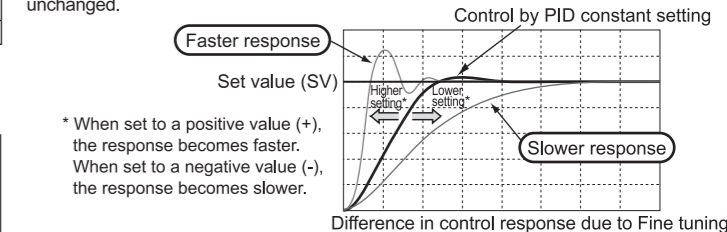
Turn off the power once and turn it on again. The ST will automatically start (During ST execution: AT lamp lights). When the calculation and setting of PID values is completed, setting of the ST screen will automatically change to "0." (ST is completed: AT lamp turns off)

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.

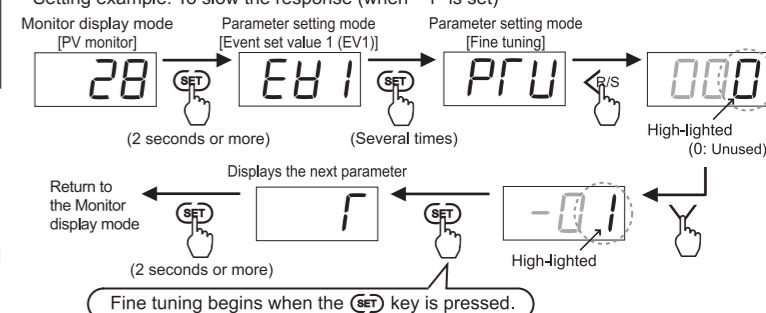
6.6 Fine Tuning

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.

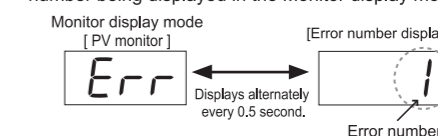
7. ERROR DISPLAY

■ 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 RUN/STOP transfer. Check input range, sensor and sensor connection.
000 [Flashing]	Over-scale: PV is above the display range limit high	
UUU [Flashing]	Underscale: PV is below the display range limit low	

■ Self-diagnostic error

When an error message displays, refer to the descriptions of the error based on the error number being displayed in the Monitor display mode.



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

Description	Action	Operation at error	Solution
1 Adjustment data error	Indication lamp: All lamp turns off [Except when FAIL is selected for the event (EV)]	Control output: OFF	Turn off the power at once.
2 Data back-up error		FAIL output: Contact open [When FAIL is selected for the event (EV)]	If an error occurs after the power is turned on again, please contact RKC sales office or the agent.
4 A/D conversion error*		All display is OFF	
Power supply voltage is abnormal			
Watchdog timer			
16 SB link error	Indication lamp: All lamp turns off [Except when FAIL is selected for the event (EV)]	Control output: Continue control/Stop control is settable. FAIL output: Contact open [When FAIL is selected for the event (EV)]	SB link error display goes off by removing the cause of the error.

* Including temperature compensation error

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