Digital Controller

FB400/FB900

Quick Operation Manual
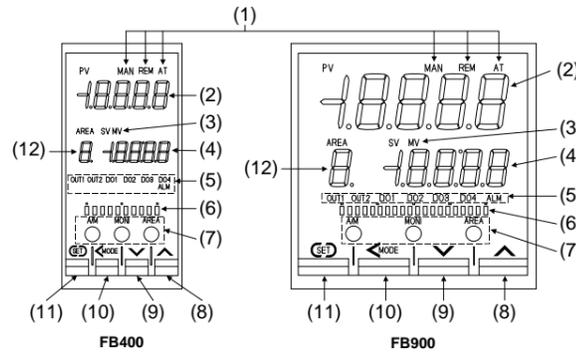
This manual describes the basic key operation and mode selection of the FB400/FB900. For detailed handling procedures and various function settings, please refer to the following separate manuals:
- FB400/FB900 Parameter List (IMR01W06-E□)
- FB400/FB900 Instruction Manual (IMR01W03-E□)
- FB100/FB400/FB900 Communication Instruction Manual (IMR01W04-E□)

📖 The above manuals can be download from our website:
URL: http://www.rkcinst.com/english/manual_load.htm

1. PARTS DESCRIPTION
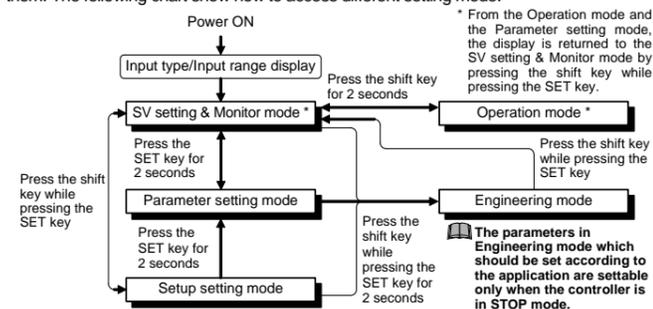

FB400   **FB900**

|		
(1)	Display lamps	Manual (MAN) mode lamp (green): Lights when operated in Manual mode. Remote (REM) mode lamp (green): Lights when Remote mode is activated. Autotuning (AT) lamp (green): Flashes when autotuning is activated.
(2)	Measured value (PV) display [green]	Display measured value (PV) or various parameter symbols.
(3)	Manipulated output (MV) lamp [green]	Lights when operated in Manual mode. In this case, the set value (SV) display shows the manipulated output value (MV).
(4)	Set value (SV) display [orange]	Displays set value (SV), manipulated output value (MV) or various parameter set values.
(5)	Output lamps [green] (OUT1 and OUT2) (DO1 to DO4)	Lights when the output corresponding to each lamp is ON.
	Alarm (ALM) lamp [red]	Lights when alarm (Event or heater break alarm [HBA]) is turned ON.
(6)	Bar graph display [green]	One of the values shown in the below can be selected for the bar graph. • Measured value (PV) • Set value (SV) • Deviation value • Manipulated output value (MV) • Current transformer (CT) input value
(7)	Direct keys	A/M (Auto/Manual transfer key) [Type 1, type 2] Switching the Auto/Manual control mode between Auto (PID control) mode and Manual mode.
	There are two types of direct key: Type 1 and Type2.	MONI (Monitoring key) [Type 1] Use to switch the monitor screen. Pressing the MONI key while any screen other than the SV setting & Monitor mode screen is being displayed returns to the Measured value (PV)/Set value (SV) monitor screen.
	They can be selected in Engineering mode.	AREA (Area key) [Type 1] Pressing the AREA key changes to memory area transfer screen.
		R/L (Remote/Local transfer key) [Type 2] Switching the Remote/Local control mode between Remote mode and Local mode.
		R/S (RUN/STOP transfer key) [Type 2] Switching the RUN/STOP mode between RUN and STOP status.
(8)	∧ Up key	Increase numerals.
(9)	∨ Down key	Decrease numerals.
(10)	◀MODE Shift key	Shift digits when settings are changed. Used to selection operation between modes.
(11)	SET key	Used for parameter calling up and set value registration.
(12)	Memory area display [orange]	Displays memory area number (1 to 8).

2. OPERATION MENU

2.1 Transfer to Each Mode

The controller has five different setting modes, and all settable parameters belongs to one of them. The following chart show how to access different setting mode.

📖 The parameters in Engineering mode which should be set according to the application are settable only when the controller is in STOP mode.

■ Input type and range display

This instrument immediately displays input type symbol and input range following power ON. Example: When sensor type is K thermocouple (−200 to +1372 ℃)
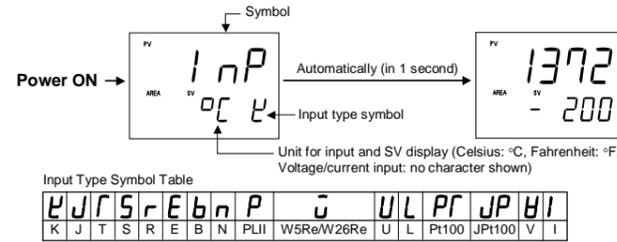

Input Type Symbol Table

K	J	T	S	R	E	B	N	PLII	W5Re/W26Re	U	L	Pt100	JPt100	V	I

2.2 Parameter Selection within Mode

### ■ SV setting & Monitor mode

It is possible to set SV which is a control target and also to monitor PV, SV, MV, etc. Pressing the MONI key enables the selection of monitor screens. Pressing the SET key enables the selection of setting screens. Use this mode during normal operation. The following flowchart is when the type of direct key corresponds to Type 1.
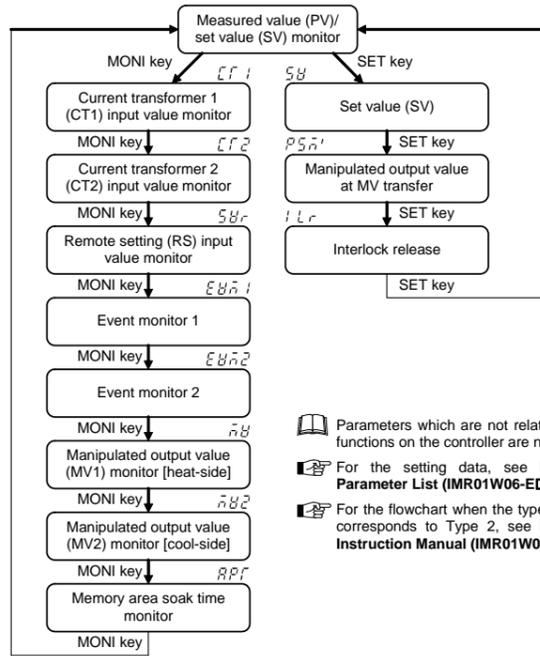
📖 Parameters which are not related to existing functions on the controller are not displayed.

☞ For the setting data, see **FB400/FB900 Parameter List (IMR01W06-E□)**.

☞ For the flowchart when the type of direct key corresponds to Type 2, see **FB400/FB900 Instruction Manual (IMR01W03-E□)**.

■ Parameter setting mode

It is possible to set any parameter relating to control. Up to 8 individual sets of SVs and parameters in Parameter setting mode can be stored and used in Multi-memory area function. For details on the parameters, see the **FB400/FB900 Parameter List (IMR01W06-E□)**.
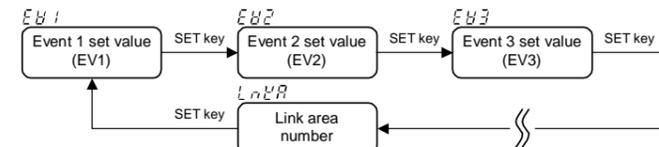
📖 Parameters which are not related to existing functions on the controller are not displayed.

■ Setup setting mode

It is possible to set a parameter not belonging to the memory area and also a setting lock level. For details on the parameters, see the **FB400/FB900 Parameter List (IMR01W06-E□)**.
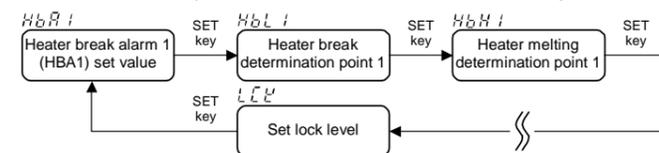
📖 Parameters which are not related to existing functions on the controller are not displayed.

■ Operation mode

The Operation mode is used to selects the operation modes (PID/AT, Auto/Manual mode, Remote/Local mode, RUN/STOP mode) of the instrument. In addition, the Startup tuning (ST) and Automatic temperature rise learning function can be set.
For details on the Operation mode, see the **FB400/FB900 Parameter List (IMR01W06-E□)**.
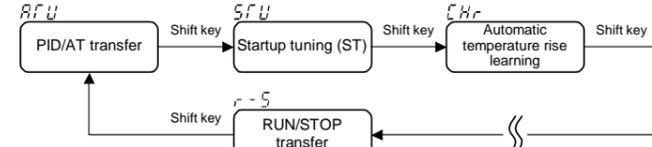
📖 The SET key as well as the SHIFT key enables the transfer of operation items.

📖 Transferring the operation mode immediately performs control in the mode transferred.

■ Engineering mode

⚠ **WARNING**

Parameters in the Engineering mode should be set according to the application before setting any parameter related to operation. Once the parameters in the Engineering mode are set correctly, no further changes need to be made to parameters for the same application under normal conditions. If they are changed unnecessarily, it may result in malfunction or failure of the instrument. RKC will not bear any responsibility for malfunction or failure as a result of improper changes in the Engineering mode.

The content relating to the specification of this product is set. Set meet application requirements. For details on the parameters, see the **FB400/FB900 Parameter List (IMR01W06-E□)**.

📖 Parameters in Engineering mode are settable only when the controller is in STOP mode. However, it is possible to check only the data even in RUN mode.
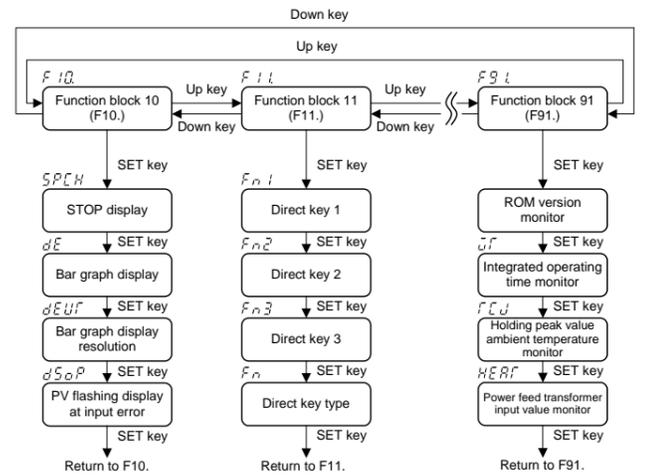

3. OPERATION

CAUTIONS

- All mounting and wiring must be completed before the power is turned on. If the input signal wiring is disconnected or short-circuited (RTD input only), the instrument determines that input error (burnout, etc.) has occurred.
  – Displays
  - Upscale: Thermocouple input *, RTD input (when input break), Voltage (low) input *
  - Downscale: Thermocouple input *, RTD input (when short-circuited), Voltage (low) input *, Voltage (high) input or Current input
  - For the voltage (high) or current input, the display becomes indefinite (display of about zero value).
    * For thermocouple input and voltage (low) input, it is possible to select upscale or downscale when burnout occurs. (Factory set value: Upscale)
  – Outputs
  - Control output: Output depending on the action at input error (high/low limit) [1]
(Factory set value: Manipulated output value at input error)
  - Event output: Output depending on the force ON of event action [1]
(Factory set value: Event output turned off at input error occurrence)
- 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 (Factory set value: hot start 1) [1] that existed prior to shut down.
- The event action is activated when the power is turned on or when transferred from STOP mode to RUN mode.
- The event re-hold action is activated when not only the SV is changed, but also the power is turned on or when transferred from STOP mode to RUN mode.

[1] Set in an engineering mode.

3.1 Procedure for Operation

Example: An example of performing operation with SV set to 200 ℃ and Event 1 set value [deviation high] set to 20 ℃ is shown in the following.
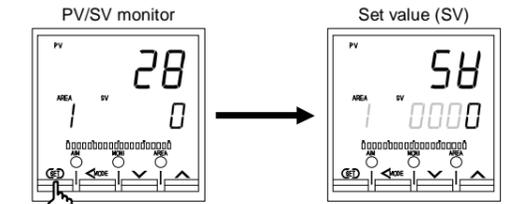
■ Operation procedure
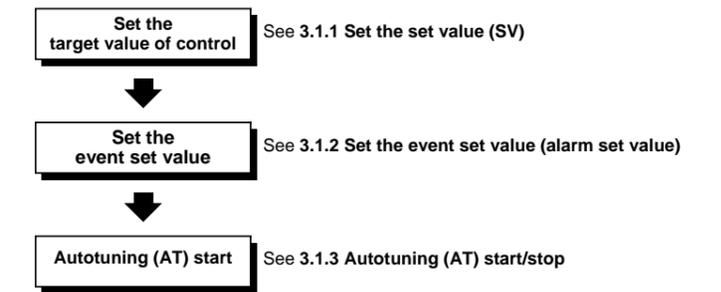
3.1.1 Set the set value (SV)

Example: Change the target value of the control to 200 ℃

1. Select the set value (SV) screen
   Press the SET key at PV/SV monitor screen until Set value (SV) screen is displayed.

2. Change the set value (SV)
   The high-lighted digit indicates which digit can be set.
   ① Press the shift key to high-light the hundreds digit.
   ② Press the UP key to change the number to 2.
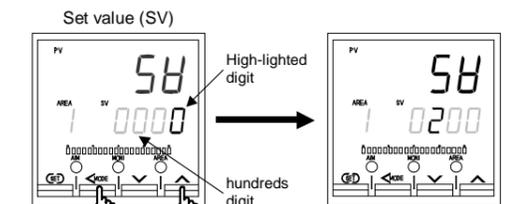
3. Store the set value (SV)
   Press the SET key to store the new set value (SV). The screen goes to the next parameter.
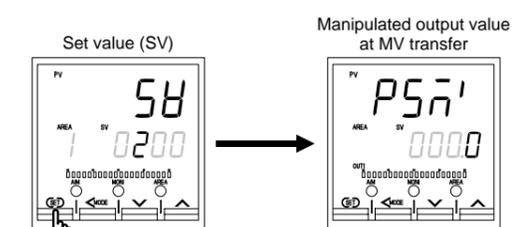
📖 When setting the set value (SV) after selecting the memory area number
   ① Press the shift key at Set value (SV) screen until the memory area display * is high-lighted.
   ② Select the memory area number which needs to be changed by pressing the UP or DOWN key.
   ③ Press the shift key until the SV display is high-lighted.
   ④ Change and then register the data by referring to steps "**2.**" and "**3.**" described above.
     * When the memory area display unit flashes, this indicates that the number now on display corresponds to any memory area number other than the control area.
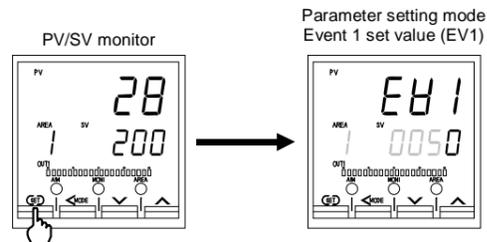
📖 After a new value is displayed on the display by using UP and DOWN keys, if no key operation is performed for more than 1 minute without pressing SET key, this instrument returns to the PV/SV monitor screen and the set value will not be changed.

📖 Follow the same setting procedure when also setting any parameter in SV setting & Monitor mode, Parameter setting mode, Setup setting mode, or Engineering mode.

### 3.1.2 Set the event set value (alarm set value)

Example: Change the event 1 set value (EV1) to 20 °C

1. Press the SET key for 2 seconds at PV/SV monitor screen until Parameter setting mode is displayed. Event 1 set value (EV1) is displayed first.

PV/SV monitor → Parameter setting mode / Event 1 set value (EV1)
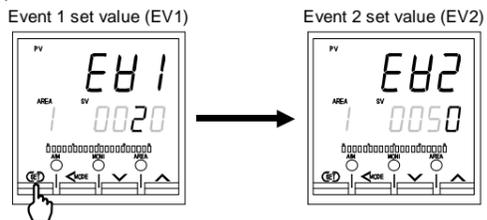
Event set value screen is not displayed when the event function is not available.

2. Press the Shift or DOWN keys to change the event 1 set value (EV1).

Event 1 set value (EV1)
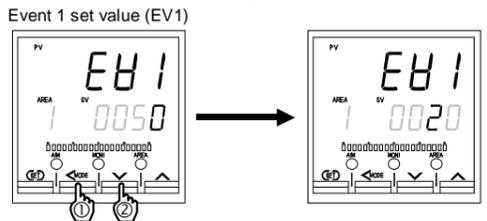
3. Press the SET key to store the new event 1 set value (EV1). The screen goes to the next parameter.

Event 1 set value (EV1) → Event 2 set value (EV2)

After a new value is displayed on the display by using UP and DOWN keys, if no key operation is performed for more than 1 minute without pressing SET key, this instrument returns to the PV/SV monitor screen and the set value will not be changed.

3.1.3 Autotuning (AT) start/stop

The autotuning (AT) automatically measures, computes and sets the optimum PID value.

■ Autotuning (AT) start

Start the autotuning (AT) when all following conditions are satisfied:
To start autotuning (AT), go to PID/AT transfer in Operation mode.

Operation mode state	PID control
	Auto mode and Local mode
	RUN mode
Input value state	The measured value (PV) is not underscale or overscale.
	Input error determination point (high) > Measured value (PV) > Input error determination point (low)
Output limiter setting	The output limiter high limit is be 0.1 % or higher and the output limiter low limit is 99.9 % or less.

When the cascade control is activated, the autotuning (AT) function cannot be turned on.

1. Press the Shift key for two seconds at PV/SV monitor screen until Operation mode is displayed. PID/AT transfer screen is displayed first.

PV/SV monitor → Operation mode / PID/AT transfer
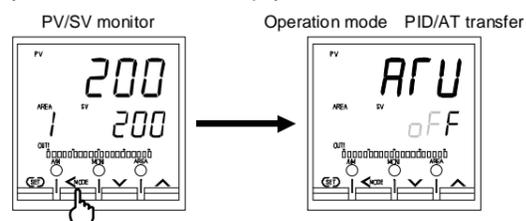
2. If set to "on" by pressing the UP key, the autotuning function (AT) starts. At this time, the AT lamp flashes.

Operation mode / PID/AT transfer

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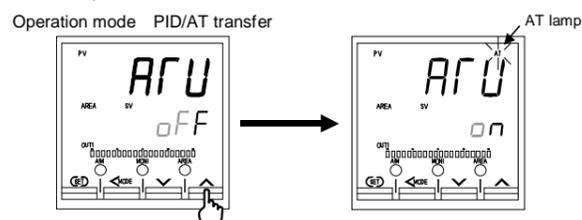
3. When the autotuning (AT) is finished, the control will automatically returns to PID control. At this time, the AT lamp turns off.

When canceling the autotuning function (AT), press the DOWN key to be set to "oFF."

■ Requirements for autotuning (AT) cancellation

The autotuning (AT) is canceled if any of the following conditions exist.

When the parameter is changed	When the temperature set value (SV) is changed.
	When the control area is changed.
	When the PV bias, the PV digital filter, or the PV ratio is changed.
When the Operation mode is transferred	When the Auto/Manual mode is changed to the Manual mode.
	When the Remote/Local mode is changed to the Remote mode.
	When the PID/AT transfer is changed to the PID control.
	When the RUN/STOP mode is changed to the STOP mode.
When the input value becomes abnormal	When the measured value (PV) goes to underscale or overscale.
	When the measured value (PV) goes to input error range. Measured value (PV) ≥ Input error determination point (high) or Input error determination point (low) ≥ Measured value (PV)
When the AT exceeded the execution time	When the AT does not end in two hours after AT started
Power failure	When the power failure of more than 20 ms occurs.
Instrument error	When the instrument is in the FAIL state.

If the autotuning (AT) is canceled, the controller immediately changes to PID control. The PID values will be the same as before autotuning (AT) was activated.
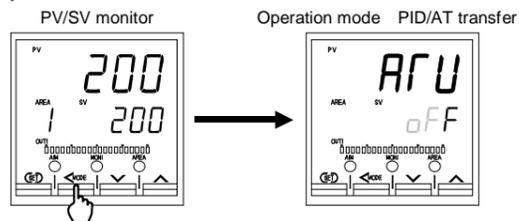
3.2 RUN/STOP Transfer

When the digital input RUN/STOP transfer function is used, it is impossible to transfer RUN/STOP through key operation if the contact (DI5) is not closed. (When DI5 opens: STOP mode is maintained.)

■ State of this instrument when set to STOP mode

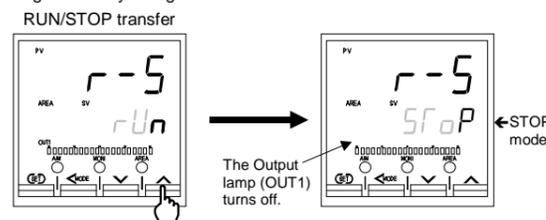| STOP display	Displays the STOP symbol on the SV or PV displays. (Factory set value: SV display)
Control output	Output depending on the Manipulated output value at STOP mode (Factory set value: −5.0 %)
Event output	Output depending on the Output state at STOP mode (Factory set value: OFF)
HBA output	
Transmission output	

1. Press the Shift key for two seconds at PV/SV monitor screen until Operation mode is displayed.

PV/SV monitor → Operation mode / PID/AT transfer

2. Press the Shift key several times until RUN/STOP transfer screen is displayed.

Operation mode / PID/AT transfer → RUN/STOP transfer (RUN mode)
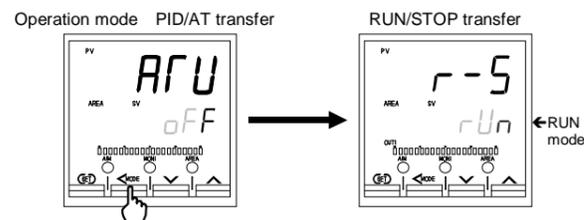
3. Pressing the UP key changes to STOP mode from RUN mode.

RUN/STOP transfer → (STOP mode) The Output lamp (OUT1) turns off.

Press the DOWN key when the RUN mode needs to be set.

3.3 Monitor Transfer

Pressing the MONI key enables the selection of only monitor screens in SV setting & Monitor mode. It is possible to check PV, SV and CT input values and also event conditions (alarm states, etc.).

PV/SV monitor ← PV / ← SV — MONI key → CT1 input value monitor ← Symbol / ← CT1 input value (current value)

MONI key ↓

MONI key ← CT2 input value monitor ← CT2 input value (current value)
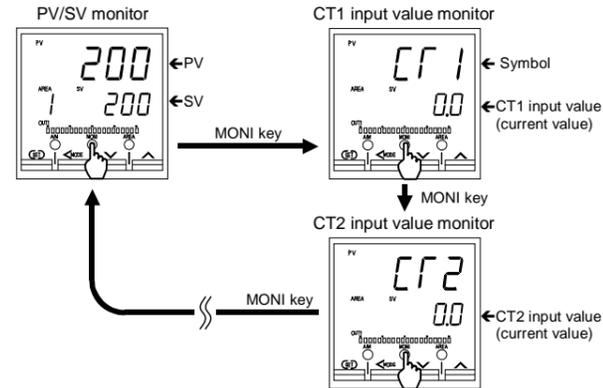
This diagram shows the operating procedure when the type of direct key corresponds to Type 1.
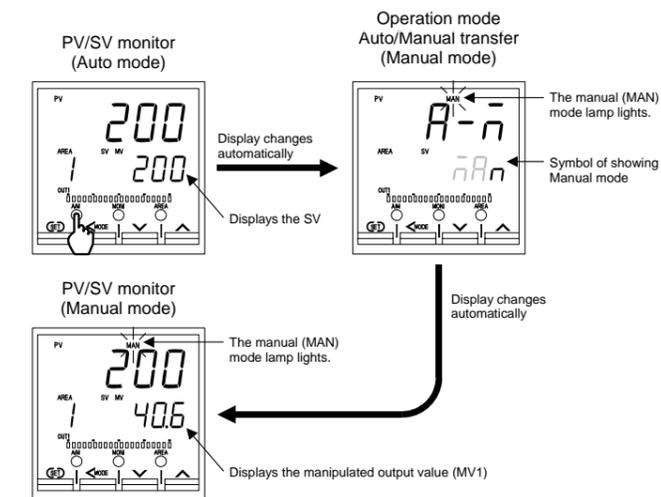
Monitor screens which are not related to existing functions on the controller are not displayed.

☞ For the types of monitor screen, see ■ SV setting & Monitor mode.

3.4 Setting Manipulated Output Value (MV) in Manual Mode

When the digital input Auto/Manual transfer function is used, it is impossible to transfer Auto/Manual through key operation if the contact is not closed. (When the contact opens: Manual mode is maintained.)

1. Even when this instrument is in any mode, pressing the A/M transfer key enables the transfer of Auto/Manual.
Pressing the A/M transfer key changes to the PV/SV monitor screen after the Auto/Manual transfer screen is displayed.

PV/SV monitor (Auto mode) — Displays the SV — Display changes automatically → Operation mode / Auto/Manual transfer (Manual mode) — The manual (MAN) mode lamp lights. / Symbol of showing Manual mode

PV/SV monitor (Manual mode) — The manual (MAN) mode lamp lights. / Displays the manipulated output value (MV1) — Display changes automatically

When in STOP mode, no manual (MAN) mode lamp turns on.

The manipulated output value when changed to the Manual mode from the Auto mode depending on the MV transfer function (MVTS) setting. The MV transfer function (MVTS) enables the selection of whether a balanceless and bumpless transfer is made or a previous manipulated output value is used.

2. When in manual mode, it is possible to set any manipulated output value (MV) on the PV/SV monitor screen. Set the manipulated output value (MV) by UP or DOWN keys.

PV/SV monitor (Manual mode) — The manual (MAN) mode lamp lights.
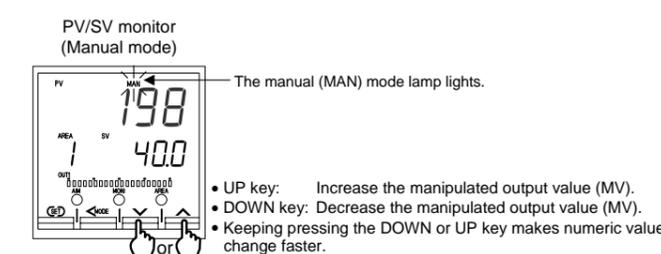
- UP key: Increase the manipulated output value (MV).
- DOWN key: Decrease the manipulated output value (MV).
- Keeping pressing the DOWN or UP key makes numeric value change faster.

3.5 Selecting Memory Area Used for Control

Example: When the control area is changed from 1 to 2

Even if this instrument is in any mode, pressing the AREA key changes to the Memory area transfer screen.

① Press the AREA key to change the screen to the Memory area transfer.
② Select any memory area number which needs to be changed by pressing the UP or DOWN key.
③ Press the SET key to store the new memory area number.

PV/SV monitor — AREA key → Memory area transfer

↓ UP key

PV/SV monitor ← SET key — Memory area transfer
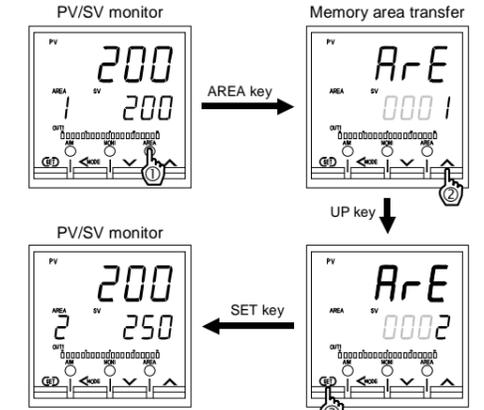
The AREA key can be used when the type of direct key corresponds to type 1.

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4. ERROR DISPLAYS

■ Display when input error occurs

Prior to replacing the sensor, always turn the power OFF or change to STOP with RUN/STOP transfer.

Display	Description	Action (Output)	Solution
PV [Flashing]	• PV exceeds the Input scale high/low. • PV exceeds the Input error determination point (high/low limit)	Action at input error: Output depending on the action at Input error (high/low limit)	Check input type, input range, sensor and sensor connection.
0000 [Flashing]	Over-scale PV is above the display range limit high (19999).	Event output: Output depending on the force ON of event action	
UUUU [Flashing]	Underscale PV is below the display range limit low (−19999).		

■ Self-diagnostic error

In an error is detected by the self-diagnostic function, the PV display shows "Err," and the SV display shows the error code. If two or more errors occur simultaneously, the total summation of these error codes is displayed.

Solution: 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.

PV display	SV display	Description	Control output	Digital output	Transmission output
Err	1	Adjusted data error			
	2	Back-up error			
	4	A/D conversion error			
	32	Custom data error	OFF	OFF	OFF
	128	Watchdog timer			
	256	Stack overflow			
	2048	Program error (busy)			