Digital Controller

FB100 Quick Operation Manual

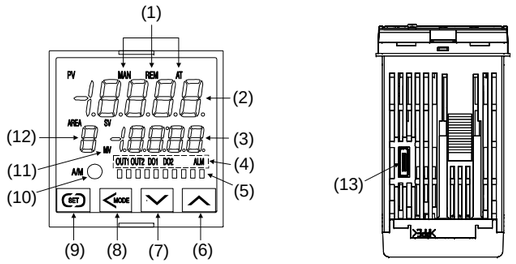
IMR01W13-E2

This manual describes the basic key operation and mode selection of the FB100.

For detailed handling procedures and various function settings, please refer to separate **FB100 Instruction Manual (IMR01W16-E□)**:

The manual can be downloaded from the official RKC website: http://www.rkcinst.com/english/manual_load.htm.

1. PARTS DESCRIPTION



Front view

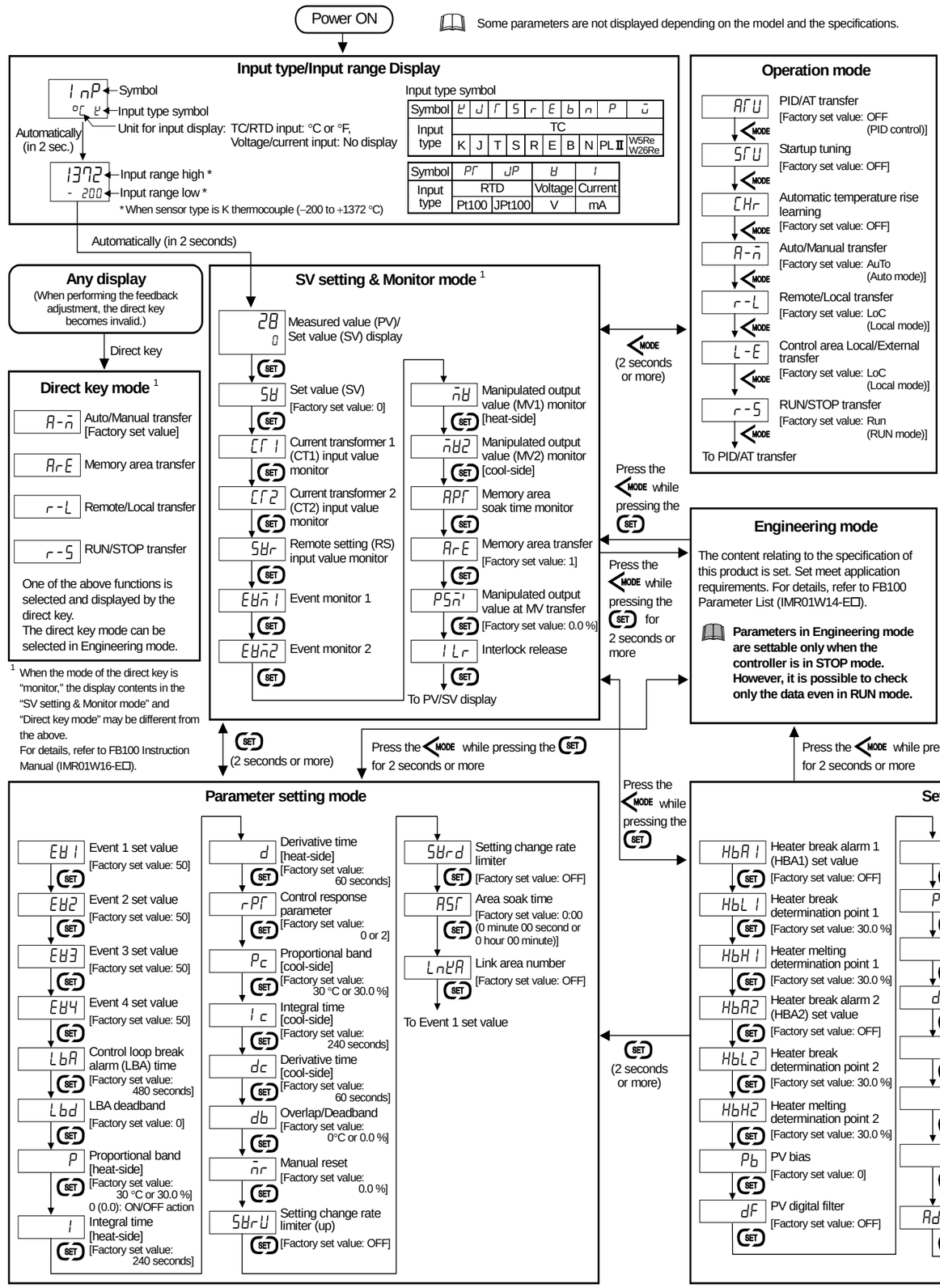
Bottom view

(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]	Displays measured value (PV) or various parameter symbols.
(3)	Set value (SV) display [orange]	Displays set value (SV), manipulated output value (MV) or various parameter set values.
(4)	Output lamps [green] (OUT1 and OUT2) (DO1 and DO2)	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.
(5)	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
(6)	∧ Up key	Increase numerals.
(7)	∨ Down key	Decrease numerals.
(8)	MODE Shift key	Shift digits when settings are changed. Used to selection operation between modes.
(9)	SET Set key	Used for parameter calling up and set value registration.
(10)	Direct key (Direct key type can be selected in Engineering mode.)	Each time the key is pressed, functions are changed among the following in sequence.
		A/M (Auto/Manual transfer) [Factory set value] Switching the Auto/Manual control mode between Auto (PID control) mode and Manual mode.
		MONI (Monitor) Use to switch the monitor screen. Pressing this 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.
		AREA (Memory area) Pressing this key changes to memory area transfer screen.
		R/L (Remote/Local transfer) Switching the Remote/Local control mode between Remote mode and Local mode.
		R/S (RUN/STOP transfer) Switching the RUN/STOP mode between RUN and STOP status.
(11)	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).
(12)	Memory area display [orange]	Displays memory area number (1 to 8).
(13)	Loader communication connector	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) [1]. Our communication software [2] must be installed on the PC.

[1] For the COM-K, refer to COM-K Instruction Manual (IMR01Z01-E□).

[2] Software name: PROTEM2, WinUCI-A, WinUCI-B for FB series or WinSCI (Only available as a download from our website.)

2. TRANSFER TO EACH MODE AND PARAMETER

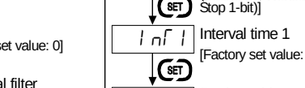


■ Set value change and registration

- The high-lighted digit indicates which digit can be set. Press MODE key to go to a different digit. Every time the MODE key is pressed, the high-lighted digit moves.
- The changed data cannot be registered only by the operation of the ∨ and ∧ keys. In order for the new parameter value to be stored, the SET key must be pressed within 1 minute after the new value is displayed. The new value will then be saved and the display will move to the next parameter.

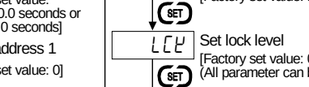
Example: Change the target value of the control to 200 °C

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

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. 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)

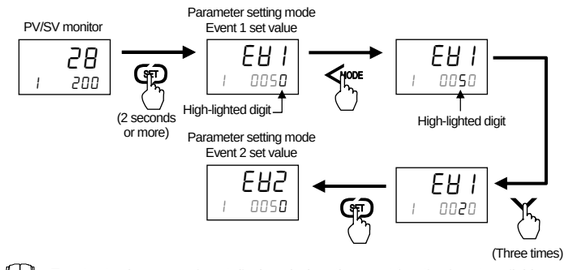
– Outputs
- Control output: Output depending on the action at input error (high/low limit) [1] (Factory set value: Manipulated output value at input error)
- Event output: Output depending on the force ON of event action [1] (Factory set value: Event output turned off at input error occurrence)

- 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 Set the Event Set Value (Alarm Set Value)

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



Event set value screen is not displayed when the event function is not available.

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

■ Event type and action

▲: Set value (SV) △: Event set value ☆: Event differential gap

Deviation action: If the deviation (PV – SV) reaches the event set value, event ON occurs.	
Deviation high	(Event set value is greater than 0.) OFF ☆ ON △ ▲ Low High PV (Event set value is less than 0.) OFF ☆ ON △ ▲ Low High PV
Deviation low	(Event set value is greater than 0.) ON ☆ OFF △ ▲ Low High PV (Event set value is less than 0.) ON ☆ △ OFF ▲ Low High PV
Deviation high/low	ON ☆ △ OFF ▲ ☆ △ ON Low High PV
Band	OFF ☆ △ ON ▲ ☆ △ OFF Low High PV

Input value action: When the PV reaches the event set value, event ON occurs.	
Process high	OFF ☆ △ ON ▲ Low High PV
Process low	ON ☆ △ OFF ▲ Low High PV

Set value action: When the SV reaches the event set value, event ON occurs.	
SV high	OFF ☆ △ ON ▲ Low High SV
SV low	ON ▲ ☆ △ OFF Low High SV

Manipulated output value action: When the MV reaches the event set value, event ON occurs.	
• MV high (MV1) [heat-side] • MV high (MV2) [cool-side]	OFF ☆ △ ON ▲ Low High MV
• MV low (MV1) [heat-side] • MV low (MV2) [cool-side]	ON ▲ ☆ △ OFF Low High MV

3.2 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 may be limited by the output limiter setting, the optimum PID values may not be calculated by AT.

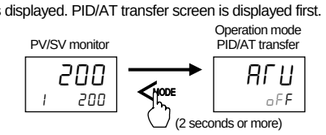
■ Requirements for autotuning (AT) start

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

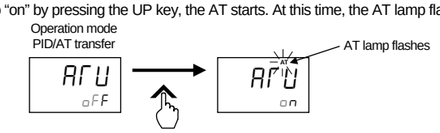
Operation mode state	PID control
	Auto mode and Local mode
	RUN mode
Input value state	The measured value (PV) is not underscale or over-scale.
	Input error determination point (high) > Measured value (PV) > Input error determination point (low)
Output limiter setting	The output limiter high limit is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

When the cascade control is activated, the AT cannot be turned on.

1. Press and hold the Shift key for 2 seconds at PV/SV monitor screen until Operation mode is displayed. PID/AT transfer screen is displayed first.



2. If set to "on" by pressing the UP key, the AT starts. At this time, the AT lamp flashes.



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

When canceling the AT, press the DOWN key to be set to "oFF."

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

■ 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 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.
Input value state	When the measured value (PV) goes to underscale or over-scale.
	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.

3.3 RUN/STOP Transfer

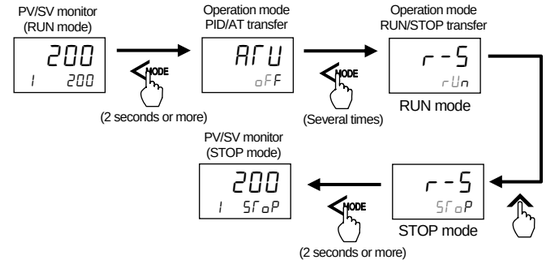
When the digital input RUN/STOP transfer function is used, it is impossible to transfer RUN/STOP through key operation if the contact is not closed. (When contact opens: STOP mode is maintained.)

■ 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	

■ Procedure of RUN/STOP transfer

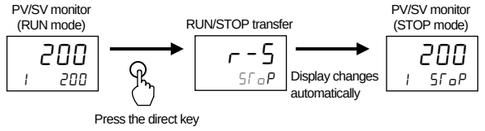
Changes RUN/STOP mode with the RUN/STOP transfer screen of the operation mode.



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

RUN/STOP transfer by the direct key is possible. When the direct key mode is "RUN/STOP transfer," the mode is switched between RUN and STOP alternately.

[Switching from RUN to STOP]



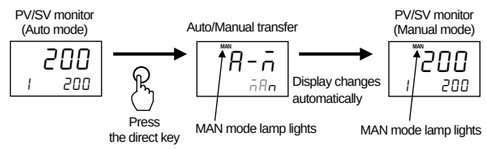
The direct key mode setting is configured in Engineering mode. For details, refer to FB100 Instruction Manual (IMR01W16-E□).

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. Transferred the Manual mode
Perform Auto/Manual transfer using the direct key.
(Factory set value of the direct key mode: Auto/Manual transfer)

[Switching from Auto mode to Manual mode]



Even the Auto/Manual transfer screen of the operation mode is switchable.

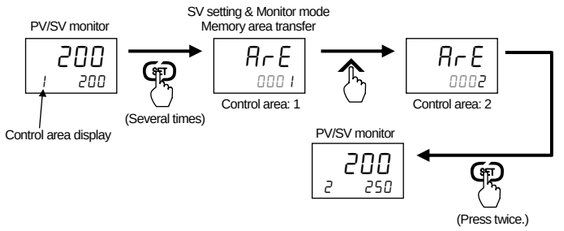
When in STOP mode, no manual (MAN) mode lamp turns on.

The manipulated output value when changed to the Manual mode from the Auto mode differs 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. Set the manipulated output value (MV)
Set the manipulated output value (MV) by UP or DOWN keys.
- 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



Memory area display is selected by the direct key. "Memory area transfer" display will be shown if the direct key is pressed when "Memory area transfer" is selected in the direct key mode.

When "External mode" is selected for Control area Local/External transfer, the display becomes as shown below and switching to the memory area cannot be performed via the front panel nor communication.

The direct key mode setting is configured in Engineering mode. For details, refer to FB100 Instruction Manual (IMR01W16-E□).

4. ERROR DISPLAYS

■ Display when input error occurs

Prior to replacing the sensor, always turn the power OFF or change to STOP mode 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) Event output: Output depending on the force ON of event action	Check input type, input range, sensor and sensor connection.
oooo [Flashing]	Over-scale PV is above the display range limit high (19999).		
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	OFF	OFF	OFF
	2	Back-up error			
	4	A/D conversion error			
	32	Custom data error			
	128	Watchdog timer			
	256	Stack overflow			
	2048	Program error (busy)			

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