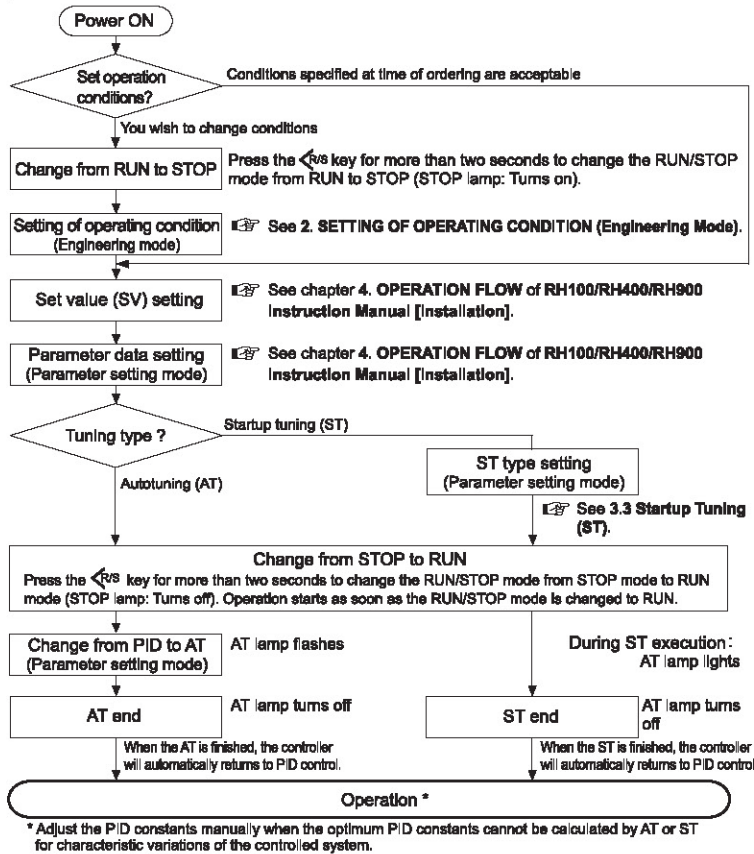


This manual describes the operation functions and operation condition settings that are configured in engineering mode of the RH100/RH400/RH900. In order to achieve maximum performance and ensure proper operation of your new instrument, carefully read all the instructions in this manual. Please place this manual in a convenient location for easy reference. For installation, wiring, and basic key operations, see the separate RH100/RH400/RH900 Instruction Manual [Installation] (IMR02C04-EC).

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

1. HANDLING PROCEDURE TO OPERATION

After installation and wiring, follow the procedure below to configure settings required for operation.



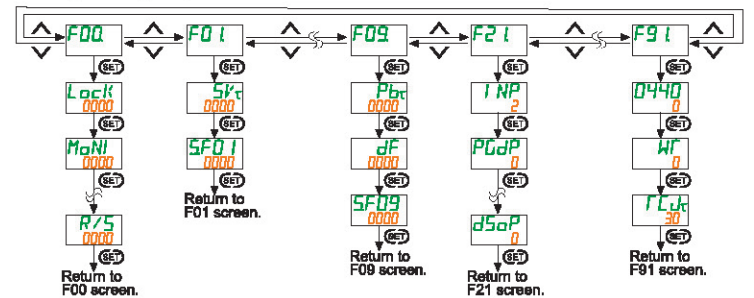
2. SETTING OF OPERATING CONDITION (Engineering Mode)

WARNING

Parameters in the engineering mode (F21 to F52) 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.

Setting items are classified into groups (function block: F□□) within the engineering mode. Set to meet application requirements.

F00: Non-display screen settings (monitor display mode, mode switching), set lock level settings for the setting data lock function, and RUN/STOP switching in engineering mode can be selected.
F01 to F09: The parameter setting screen that is displayed in parameter setting mode can be hidden.
F21 to F91: Settings related to the specifications of this product can be selected. (However, to display F21 and after, F00 settings are required.)



2.1 Restricting Access to Engineering Mode

The relationships between engineering mode, set data unlock/lock, and RUN/STOP are shown below.

●: Can be displayed and changed		○: Can be displayed		●: Cannot be displayed or changed	
Set data unlock/lock transfer	Engineering mode	RUN/STOP		RUN/STOP (STOP lamp lights)	
Unlock	F00	○	○	○	○
	F01 to F09 *	○	○	○	○
	F21 to F91	○	○	○ (Excluding F91)	○
Lock (Lamp lights)	F00	○	○	○	○
	F01 to F09 *	○	○	○	○
	F21 to F91	●	●	●	●

* Some setting items in parameter setting mode are the same as the items in F01 to F09. When the set value of one of these items is changed, the set value of the corresponding item in the other mode also changes. However, with respect to parameters that can be changed in the locked state, this applies only to F□□ parameters that are not locked in the set lock level setting.

2.2 List of Engineering Mode Parameters

To change to the engineering mode, press the ↵ key for more than four seconds while pressing the SET key in the monitor display mode.

Display	Name	Data range	Factory set value
F00	Function block 00	This is first parameter symbol of function block 00.	
Lock 0000	Set lock level	0 to 10	0
	0 All parameters can be changed	6 Lock "Parameter Group" F06 through F09	
	1 Lock "Parameter Group" F01 through F09	7 Lock "Parameter Group" F01 through F09	
	2 Lock "Parameter Group" F02 through F09	8 Lock "Parameter Group" F08 through F09	
	3 Lock "Parameter Group" F03 through F09	9 Lock "Parameter Group" F09	
	4 Lock "Parameter Group" F04 through F09	10 The setting is not used.	
MoNI 0000	Monitor selection (no display)	0: Display all 4: Manipulated output value (MV) monitor [no display]	0
Mode 0000	Mode selection (no display)	0: Display all 2: Set data unlock/lock transfer [no display] 4: Interlock release [no display] 8: Disable RUN/STOP key operation 128: Displays F21 and after	0
	Set the value of the item that you wish to hide. If there are multiple items that you wish to hide, set the sum of the values of the items.		
	Setting example: When "130" is set, "Set data unlock/lock transfer" can be hidden and "Displays F21 and after" is possible.		
R/S 0000	RUN/STOP setting	0: RUN 1: STOP (STOP lamp lights)	0
F01	Function block 01	This is first parameter symbol of function block 01.	
SV 0000	Set value (SV)	Setting limiter (low) to Setting limiter (high)	0
SF01 0000	F01 block selection (no display)	0: Display 1: No display	0
F04	Function block 04	This is first parameter symbol of function block 04.	
AL 1 0050	Alarm set value (ALM1)	<Displayed when alarm code A to T, V or W is selected.> Deviation action: -Input span to +Input span Input value or set value action: Same as input range	50 (50.0)
AL 1 0050	Alarm set value (ALM1) [high]	<Displayed when alarm code U, X, Y or Z is selected.> -Input span to +Input span	50 (50.0)
AL 1 1 0050	Alarm set value (ALM1) [low]		-50 (-50.0)
SF04 0000	F04 block selection (no display)	0: Display 1: No display	0
F05	Function block 05	This is first parameter symbol of function block 05.	
AT 0000	Autotuning (AT)	0: PID control 1: Autotuning (AT)	0
ST 0000	Startup tuning (ST)	0: ST unused 1: Execute once 2: Execute always	0
SF05 0000	F05 block selection (no display)	0: Display 1: No display	0
F06	Function block 06	This is first parameter symbol of function block 06.	
P 0030	Proportional band	1 (0.1) to Input span (Unit: °C) [Resolution of 0.1 °C: Within 999.9 °C] 0 (0.0): ON/OFF action	30 (30.0)
I 0240	Integral time	1 to 3600 seconds (0: PD action)	240
D 0060	Derivative time	1 to 3600 seconds (0: PI action)	60
ARW 0 100	Anti-reset windup (ARW)	1 to 100 % of proportional band (0: Integral action is always OFF)	100
PTU 0000	Fine tuning setting	-3 to +3 (0: Unused)	0
SF06 0000	F06 block selection (no display)	0: Display 1: No display	0
F07	Function block 07	This is first parameter symbol of function block 07.	
LbA 0480	Control loop break alarm (LBA) time	0 to 7200 seconds (0: Unused) [Displayed when alarm code "2" is selected.]	480
LbA 0000	LBA deadband (LBD)	0 to Input span [Displayed when alarm code "2" is selected.]	0
SF07 0000	F07 block selection (no display)	0: Display 1: No display	0

Display	Name	Data range	Factory set value
F08	Function block 08	This is first parameter symbol of function block 08.	
I 0020	Proportional cycle time	0 to 100 seconds (0: Setting below 1 second is possible for "Time setting of proportional cycle time" in the engineering mode F51) [Displayed when OUT1 code M, V or T is selected.]	Relay contact output: 20 Voltage pulse output: This output: 2
MT 0000	Minimum ON/OFF time of proportioning cycle	0 to 1000 ms [Displayed when OUT1 code M, V or T is selected.]	0
oLH 1050	Output limiter (high)	Output limiter (low) to 105.0 %	105.0
oLL 050	Output limiter (low)	-5.0 % to Output limiter (high)* * Output limiter (high) > Output limiter (low)	-5.0
SF08 0000	F08 block selection (no display)	0: Display 1: No display	0
F09	Function block 09	This is first parameter symbol of function block 09.	
Pb 0000	PV bias	-1999 (-199.9) to +9999 (+999.9) °C	0 (0.0)
dF 0000	PV digital filter	0 to 100 seconds (0: Unused)	0
SF09 0000	F09 block selection (no display)	0: Display 1: No display	0
F21	Function block 21	This is first parameter symbol of function block 21.	
INP 2	Input type	0 to 16 [See table 1.]	Depends on model code
PGdP 0	Decimal point position	0: No decimal place 1: One decimal place	Depends on model code
bA 0	Burnout direction	0: Upscale 1: Downscale Valid only when the TC input is selected.	0
PGSH 1312	Input scale high	Input scale low to Maximum value of the selected input range	Maximum value of the selected input range
PGSL 200	Input scale low	Minimum value of the selected input range to Input scale high	Minimum value of the selected input range
SLH 1312	Setting limiter (high)	Setting limiter (low) to Input scale high	Input scale high
SLL 200	Setting limiter (low)	Input scale low to Setting limiter (high)	Input scale low
dSp 0	PV flashing display at input error	0: Flashing 1: Non-flashing display	0
F30	Function block 30	This is first parameter symbol of function block 30.	
SS 0	Output status at STOP mode	0: Alarm action OFF 1: Alarm action continued	0
SPCH 1	STOP display selection	0: STOP on PV display + STOP lamp (green) lights 1: STOP on SV display + STOP lamp (green) lights 2: STOP lamp (green) lights	1
F41	Function block 41	This is first parameter symbol of function block 41.	
AS 1	Alarm type	0 to 13 [See table 2.]	Depends on model code
AHo 1	Alarm hold action	0: OFF 1: Hold action ON (When power turned on; when transferred from STOP to RUN) (When power turned on; when transferred from STOP to RUN; SV changed)	Depends on model code
AH 2	Alarm differential gap	0 to Input span	2 (2.0)
Abo 1	Alarm output state at input burnout	0: Alarm output is not forcibly turned ON when the burnout function is activated. 1: ON at overscale; no action at underscale 2: ON at underscale; no action at overscale 3: ON at overscale or underscale 4: OFF at overscale or underscale	0
ExC 1	Energized/De-energized of alarm output	0: Energized 1: De-energized	0
ALT 1	Alarm delay timer	0 to 600 seconds	0
AIL 1	Alarm Interlock	0: Unused (Interlock function OFF) 1: Used	0
F51	Function block 51	This is first parameter symbol of function block 51.	
a 1	Direct/Reverse action	0: Direct action 1: Reverse action	Depends on model code
oHH 1	ON/OFF action differential gap (upper)	0 (0.0) to 100 (100.0) °C	1 (1.0)
oHL 1	ON/OFF action differential gap (lower)	0 (0.0) to 100 (100.0) °C	1 (1.0)
oBg 0	Control output at burnout	0: Result of control computation 1: Low output limiter value (Output OFF)	0
dFP 0	Derivative action	0: Measured value derivative 1: Deviation derivative	0
FT 2	Time setting of proportional cycle time	0: 0.1 second (fixed) 1: 0.25 second (fixed) 2: 0.5 second (fixed) When proportional cycle time is set to 0 second in the parameter setting mode, this setting item becomes valid for the proportional cycle time.	2
F52	Function block 52	This is first parameter symbol of function block 52.	
ATC 0	AT cycles	0: 1.5 cycles 1: 2.5 cycles	0
ATG 10	AT differential gap time	0 to 50 seconds	10
SFS 0	ST start condition	0: Activate the ST function when the power is turned on; when transferred from STOP to RUN; or when the set value (SV) is changed. 1: Activate the ST function when the power is turned on; or when transferred from STOP to RUN. 2: Activate the ST function when the set value (SV) is changed.	0
F91	Function block 91	This is first parameter symbol of function block 91.	
0440 0	ROM version monitor	Display the version of loaded software.	

Display	Name	Data range	Factory set value
W 0	Integrated operating time monitor	0 to 9999 hours	
TC 30	Holding peak value ambient temperature monitor	-10 to +100 °C	

Table 1: Input type

Set value	input type		Range code	Set value	input type		Range code
0	K	-199.9 to +400.0 °C	K43	9	R	0 to 1769 °C	R02
1	K	0.0 to 800.0 °C	K08, K10	10	E	0 to 1000 °C	E01, E02
2	K	-200 to +1372 °C	K01 to K06, K41	11	B	0 to 1820 °C	B01, B02
3	J	-199.9 to +300.0 °C	J07	12	N	0 to 1300 °C	N01, N02
4	J	-200 to +1200 °C	J01 to J06, J15	13	PL II	0 to 1390 °C	A01, A02
5	T	-199.9 to +300.0 °C	T02, T03, T05	14	W	0 to 2320 °C	W01, W02
6	T	0.0 to +400.0 °C	T06	15	PT100	-199.9 to +649.0 °C	D01 to D10
8	S	0 to 1769 °C	S02	16	JPT100	-199.9 to +649.0 °C	P01 to P10

Do not set to any number which is not described in the input type table above. This may cause malfunctioning. The input type can be changed.

Table 2: Alarm type [▲: Set value (SV) △: Alarm set value ★: Alarm differential gap]

Set value	Alarm type code	Action
0	N	None
1	A	Deviation high
1	E	Deviation high with hold action *
1	Q	Deviation high with re-hold action *
2	B	Deviation low
2	F	Deviation low with hold action *
2	R	Deviation low with re-hold action *
3	C	Deviation high/low
3	G	Deviation high/low with hold action *
3	T	Deviation high/low with re-hold action *
5	X	Deviation high/low (High/Low individual setting)
5	Y	Deviation high/low with hold action (High/Low individual setting) *
5	Z	Deviation high/low with re-hold action (High/Low individual setting) *
4	D	Band
6	U	Band (High/Low individual setting)
8	H	Process high
9	K	Process high with hold action *
10	J	Process low
10	L	Process low with hold action *
7	V	SV high
8	W	SV low
11	2	Control loop break alarm (LBA) **
13	3	FAIL
12	4	Monitor during RUN

* Hold action and re-hold action must be set in "Alarm hold action (AHo1)."
** Precautions for LBA setting:
• The LBA function cannot be activated when AT function is turned on.
• Normally the LBA time of parameter setting mode should be set to approximately twice the integral time.
• If LBA setting time does not match the controlled object requirements, the LBA setting time should be lengthened. If setting time is not correct, the LBA will malfunction by turning on or off at inappropriate times or not turning on at all.

2.3 Precaution Against Parameter Change

When one of the following parameter items is changed, the set values of related parameters are initialized or is automatically converted according to the new setting. Reset the settings to the values that you wish to use.

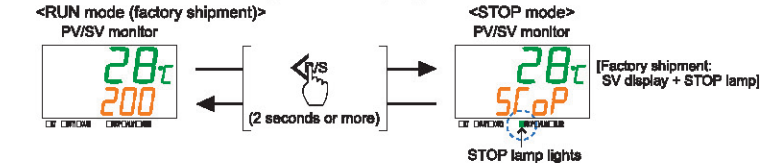
Changed parameter items	INP	PGdP	PGSH	PGSL	SLH	SLL	AS1	oLH	oLL
Initialized or automatically converted items	●	●	●	●	●	●	●	●	●
Decimal point position (PGdP)	●	○	○	○	○	○	○	○	○
Input scale high (PGSH)	●	○	○	○	○	○	○	○	○
Input scale low (PGSL)	●	○	○	○	○	○	○	○	○
Setting limiter (high) (SLH)	●	○	○	○	○	○	○	○	○
Setting limiter (low) (SLL)	●	○	○	○	○	○	○	○	○
Set value (SV)	●	○	○	○	○	○	○	○	○
ON/OFF action differential gap (upper) (oHH)	●	○	○	○	○	○	○	○	○
ON/OFF action differential gap (lower) (oHL)	●	○	○	○	○	○	○	○	○
Proportional band (P)	●	○	○	○	○	○	○	○	○
Integral time (I)	●	○	○	○	○	○	○	○	○
Derivative time (D)	●	○	○	○	○	○	○	○	○
Anti-reset windup (ARW)	●	○	○	○	○	○	○	○	○
Fine tuning setting (PTU)	●	○	○	○	○	○	○	○	○
PV bias (Pb)	●	○	○	○	○	○	○	○	○
PV digital filter (dF)	●	○	○	○	○	○	○	○	○
Control loop break alarm (LBA) time	●	○	○	○	○	○	○	○	○
LBA deadband (LBD)	●	○	○	○	○	○	○	○	○
Alarm set value (AL1, AL1')	●	○	○	○	○	○	○	○	○
Alarm differential gap (AH1)	●	○	○	○	○	○	○	○	○
Alarm hold action (AHo1)	●	○	○	○	○	○	○	○	○
Alarm delay timer (ALT1)	●	○	○	○	○	○	○	○	○
Output limiter (high) (oLH)	●	○	○	○	○	○	○	○	○
Output limiter (low) (oLL)	●	○	○	○	○	○	○	○	○

For cautions and basic procedures prior to operation, see the **RH100/RH400/RH900 Instruction Manual [Installation] (IMR02C04-E□)**. Functions related to operation are explained below.

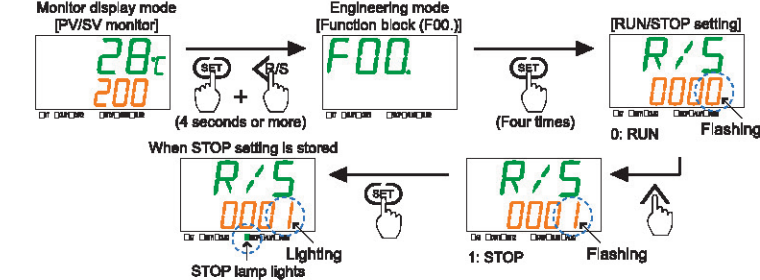
It is possible to transfer between control start (RUN) and control stop (STOP). RUN/STOP transfer can be performed by key operation, or by using the "RUN/STOP setting" in engineering mode. These two methods are linked together. For example, if the keys are used to transfer from RUN to STOP, the setting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

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: Below the low output limiter value
Alarm output	Output depending on the "Output status 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.

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



 The front keys can be used for RUN/STOP transfer in all modes (monitor display mode, parameter setting mode, mode switching) except engineering mode. To perform RUN/STOP transfer in engineering mode, use the "RUN/STOP setting" screen in function block F00.



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



The AT function automatically measures, computes and sets the optimum PID values. The AT can be used for PID control (Direct action/Reverse action).

- 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.

Operation state	PID control
Parameter setting	RUN
Input value state	Output limiter (high) $\geq 0.1\%$, Output limiter (low) $\leq 99.9\%$
	The measured value (PV) is not underscale or overscale.

Operation state	When the PID/AT transfer is changed to the PID control.
	When the RUN/STOP mode is changed to the STOP 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 20 ms occurs.
Instrument error	When the instrument is in the FAIL state.

The autotuning function can start from any state after power on, during a rise in temperature or in stable control. For the operation procedure, see RH100/RH400/RH900 Instruction Manual [Installation] (IMR02C04-E□).

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

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.

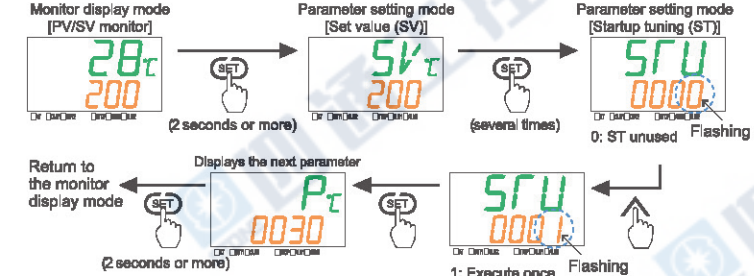
As simple autotuning, the PID values can be found in a short time without disturbing controllability for controlled systems with slow response at power ON.

- 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 may be limited by the output limiter setting, the optimum PID values may not be calculated by ST.

Operation state	PID control RUN
Parameter setting	ST is set to ON. (Execute once, Execute always) Output limiter (high) $\geq 0.1\%$, Output limiter (low) $\leq 99.9\%$
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 value (high) or the output limiter value (low).

Operation state	When the AT is activated. When the RUN/STOP mode is changed to the STOP mode.
Parameter changing	When ST is set to "0 (ST unused)." 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.

- 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 changed.)
 See 2. SETTING OF OPERATING CONDITION (Engineering Mode).

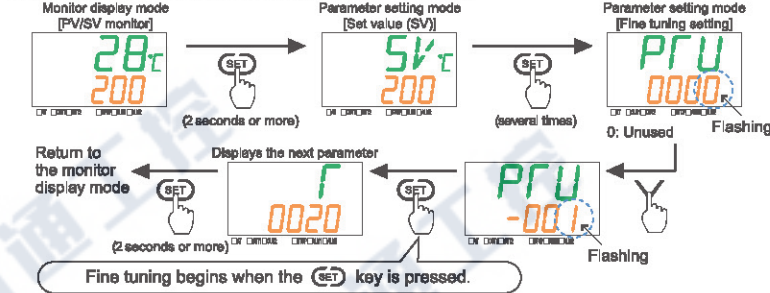
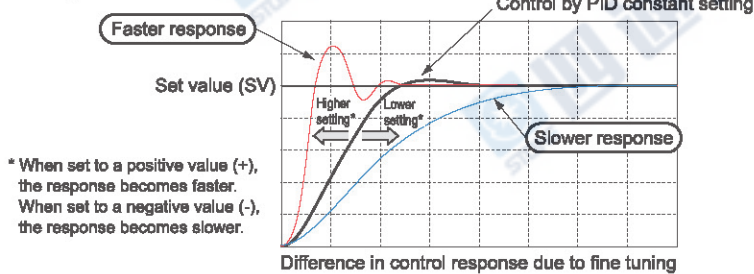


Turn off the power once and turn it on again. The ST will automatically start (During ST execution: AT lamp lights). When the calculation and setting of PID values is completed, setting of the ST screen will automatically change to "0." (ST is completed: AT lamp turns off)

 When ST was interrupted, the setting does not change to "0: ST unused." ST starts when the restart conditions are satisfied.

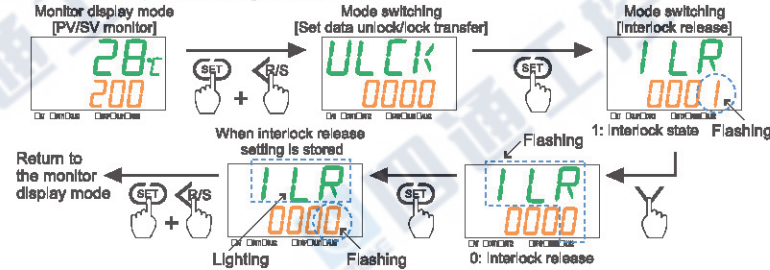
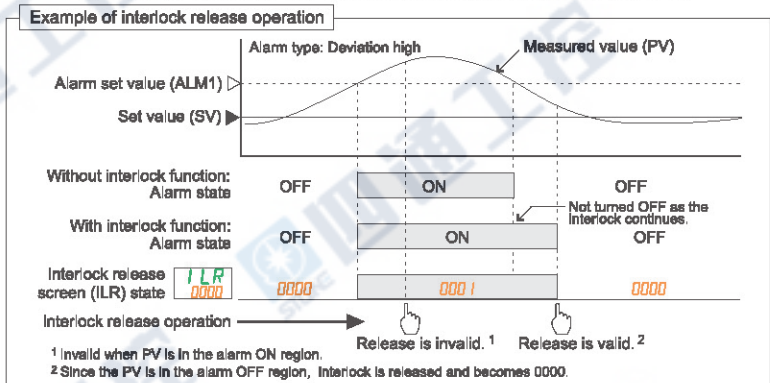
 If ST ends normally, the LBA time is automatically set twice as large as the integral time.

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.



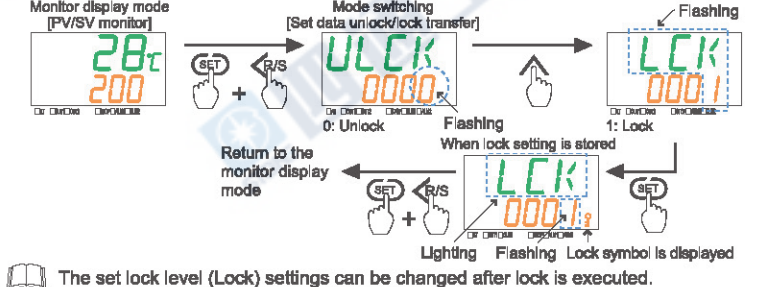
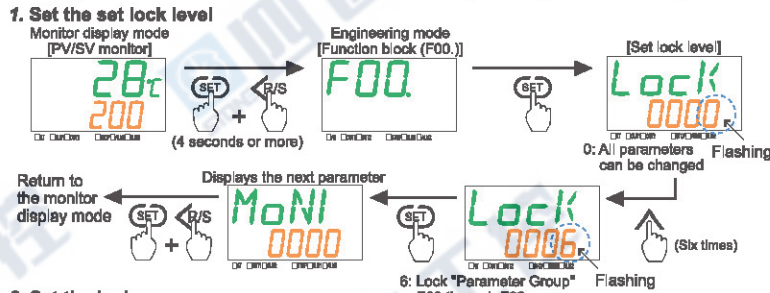
 If the set value of fine tuning is returned to "0: Unused," fine tuning correction will no longer be applied to control.

The alarm interlock action holds the alarm state even if the measured value (PV) is out of the alarm zone after it enters the alarm zone once. The interlock release can be made by the key operation.



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



Display or non-display can be selected for the screens of parameter setting mode, monitor display mode, and mode switching (factory shipment: Display all). These settings are selected in engineering mode.

