

SHIMADEN

SR25

Microprocessor-based Multi-setting Controller

Instruction Manual

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Thank you for having purchased our SR25 microprocessor-based controller.
We suggest you confirm that the instrument in your possession is to your specifications.
The code for the instrument type is shown on the outer case. In order to use all the functions of this instrument, we recommend that you read this instruction manual carefully.

* Please make sure that this instruction manual is passed onto the final user.

1. Code of Instrument Type

Composition of Code

1 2 3 4 5 6 7 8 9

Example of Code Selection :

1 2 3 4 5 6 7 8 9
SR25- 1 I- N- 1 06 00 0 0

- Codes for Ordering -

CODE			SPECIFICATIONS	
SR25-			MPU-Based PID Auto-Tuning Controller, DIN 96 x 96mm	
INPUT	1		Thermocouples, User-selectable inputs and ranges	
	2		R.T.D. (Pt100), User-selectable ranges	
	3		DC Voltage, User-selectable 0~10, 10~50, 0~20, 0~50, 0~100, -10~10mV linear inputs and ranges	
	4		DC Current, User-selectable 4~20, 0~20mA linear inputs and ranges	
	6		DC Voltage, User-selectable 0~1, 1~5, -1~1, 0~2, 0~5, 0~10V linear inputs and ranges	
CONTROL OUTPUT 1	Y-		Contact: PB Cycle 1~200 seconds variable, Capacity: 240V AC 2.5A/Resistive load, 1A/Inductive load	
	I-		Current: 4~20mA DC, Load resistance: 600 max. (Factory set = RA)	
	P-		SSR Voltage: PB Cycle 1~200 seconds variable, Output rating: 15V DC/20mA max.	
	V-		Voltage: 0~10V DC, Maximum load current: 2mA max. (Factory set = RA)	
CONTROL OUTPUT 2 (HEAT/COOL CONTROL)	N-		None (Select one output model)	
	Y-		Contact: PB Cycle 1~200 seconds variable, Capacity: 240V AC 2.5A/Resistive load, 1A/Inductive load	
	I-		Current: 4~20mA DC, Load resistance: 600 max. (DA)	
	P-		SSR Voltage: PB Cycle 1~200 seconds variable, Output rating: 15V DC/20mA max.	
EVENT CONTACT OUTPUT	0		None (DO1 DO2, Open collector)	
	1		Contact Output (SPST) EV1~EV3/Capacity = 240V AC, 2.5A/Resistive load	
REMOTE INPUT	06		0~10V DC, Input resistance: 500k Ω min.	Non-Isolated Input
	04		4~20mA DC, Receiving resistance: 250 Ω	
	05		1~5V DC, Input resistance: 500k Ω min.	
	14		4~20mA DC, receiving resistance: 250 Ω	Isolated Input
	15		1~5V DC, Input resistance: 500k Ω min.	
	16		0~10V DC, Input resistance: 500k Ω min.	
ANALOG OUTPUT (TRANSMISSION)	00		None	
	11		1-Output, Voltage: 0~10mV DC/Output resistance: 10 Ω	
	14		1-Output, Current: 4~20mA DC/Load resistance: 500 Ω max.	
	16		1-Output, Voltage: 0~10V DC/max. load current: 2mA max.	
	23		2-Output, Voltage: 0~10mV DC/Output resistance: 10 Ω	
	24		2-Output, Current: 4~20mA DC/Load resistance: 500 Ω max.	
INTERFACE FUNCTION	26		2-Output, Voltage: 0~10V DC/max. load current: 2mA max.	
	0		None	
	6		RS-422A	
EXTERNAL INPUT & OUTPUT PLUG CORD	7		RS-232C	
	0		None	
REMARKS	1		24-pin plug with 1m cord	
	0		Without	
	9		With (Please consult before ordering.)	

Note: In the case of 2 retransmission analog outputs, the output signals must be of the same type.

2. Inputs and Selectable Range

Input	Type	Code Input	JIS ANSI	DIN	OTHERS	°C	°F
THERMOCOUPLES	T	IN 8	○	○		-199.9 ~ 200.0	-300 ~ 400
	J	IN 7	○	○		0 ~ 600.0	0 ~ 1100
	E	IN 6	○	○		0 ~ 700.0	0 ~ 1300
	K	IN 3	○	○		-100.0 ~ 400.0	-150 ~ 750
	K	IN 4	○	○		0 ~ 800.0	0 ~ 1500
	K	IN 5	○	○		0 ~ 1200	0 ~ 2200
	N	IN 9			○	0 ~ 1300	0 ~ 2300
	PLH	IN 10			○	0 ~ 1300	0 ~ 2300
	R	IN 1	○	○		0 ~ 1700	0 ~ 3100
	S	IN 2	○	○		0 ~ 1700	0 ~ 3100
	B*1	IN 0	○	○		0 ~ 1800	0 ~ 3300
	PR40-20	IN 11			○	0 ~ 1800	0 ~ 3300
	WRe5-26	IN 12			○	0 ~ 2300	0 ~ 4200
	※3 U (DIN 43710)	IN 13		○		-199.9 ~ 200.0	-300 ~ 400
	※3 L (DIN 43710)	IN 14		○		0 ~ 600.0	0 ~ 1100
R. T. D. (Pt100)	Pt100	IN 31	○	○		-199.9 ~ 600.0	-300 ~ 1100
	Pt100	IN 32	○	○		-100.0 ~ 100.0	-150.0 ~ 200.0
	Pt100	IN 33	○	○		-100.0 ~ 300.0	-150.0 ~ 600.0
	Pt100	IN 34	○	○		-40.0 ~ 60.0	-40.0 ~ 140.0
	Pt100 *2	IN 35	○	○		0.00 ~ 50.00	0 ~ 120.0
	Pt100	IN 36	○	○		0 ~ 100.0	0 ~ 200.0
	Pt100	IN 37	○	○		0 ~ 200.0	0 ~ 400.0
	Pt100	IN 38				0 ~ 500.0	0 ~ 1000

*1 Effective range: 400-1800°C (750-3300°F)

Thermocouple and R. T. D. Pt100

*2 Not our standard accuracy

*3 Thermocouples U and L: DIN: 43710

- User-Programmable Ranges -

DC voltage and current inputs.

For DC voltage and current inputs, user-programmable scaling is available with scaling range of -1999 ~ 9999 digits.

Code of Input	3-Voltage(mV)	4-Current(mA)	6-Voltage(V)
IN 22	-10 ~ 10 mV		-1 ~ 1V
IN 23	0 ~ 10 mV		0 ~ 1V
IN 24	0 ~ 20 mV		0 ~ 2V
IN 25	0 ~ 50 mV	0 ~ 20 mA	0 ~ 5V
IN 26	10 ~ 50 mV	4 ~ 20 mA	1 ~ 5V
IN 27	0 ~ 100 mV		0 ~ 10V

- Standard Controls -

Although identical types of inputs and the ranges of SR25 can be selected, the instrument is delivered in the following form. The instrument is normally supplied with the following range setting. Other ranges may be specified.

Standard Range (Factory-set when shipping)

Input	Standard	Range
1 Thermocouple	JIS (K)	0~800.0 °C
2 R.T.D.	JIS (Pt100)	0~200.0 °C
3 DC Voltage	0~10mV	0~100.0%
4 DC Current	4~20mA	0~100.0%
6 DC Voltage	0~10V	0~100.0%

3. Installation, Mounting and Connection

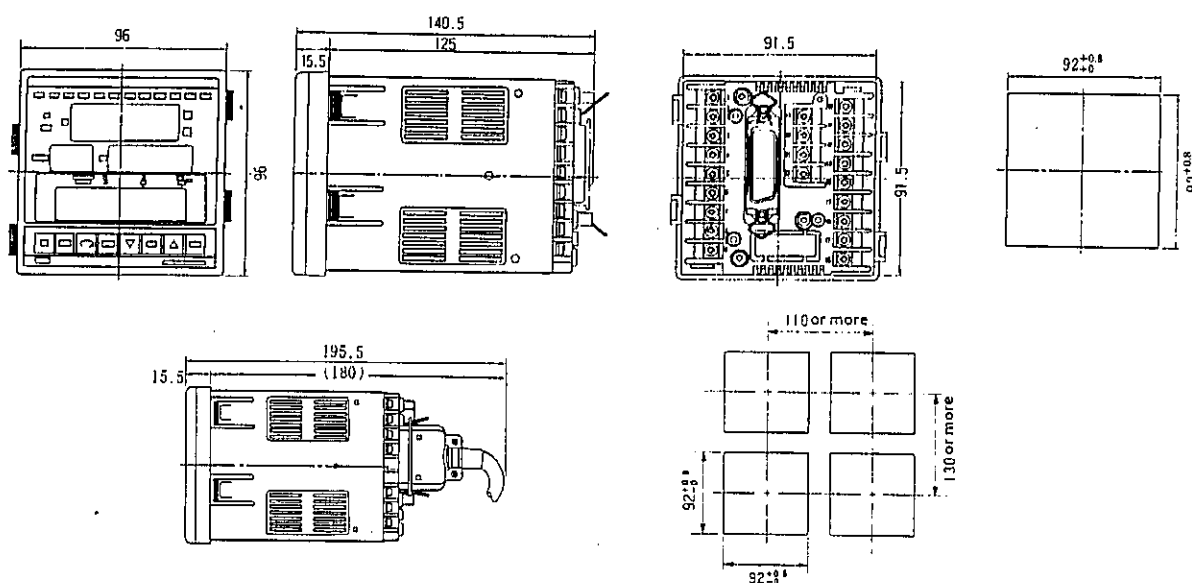
- INSTALLATION -

The following conditions are required:

- 1) There is no inflammable or corrosive gas, soot or dust to impair insulation, in the place of installation.
- 2) The ambient temperature is between -10°C and +50°C.
- 3) The instrument is not subjected to shocks and strong vibrations.
- 4) There is no strong electric or magnetic interference.
- 5) There is no exposure to direct sunlight or drops of water.

- MOUNTING -

Cut out hole in the panel in accordance with the following cutout drawings. Then mount the instrument by pressing it firmly, but carefully, through the cut out hole from the front of the panel. (Panel Thickness : 1~3.5mm)

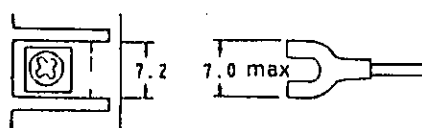


Unit: mm

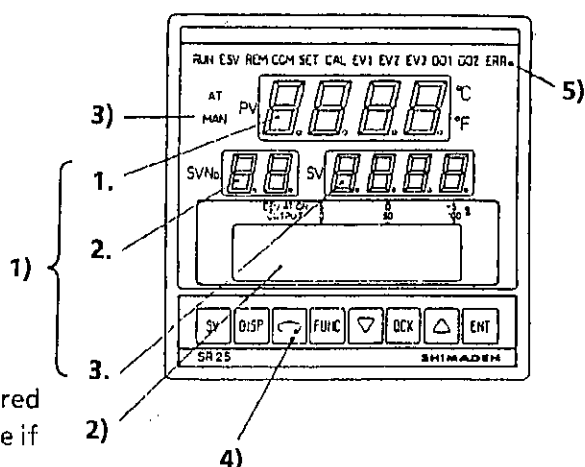
When mounting side by side, the minimum space between instruments should be 110mm. When mounting one above another, the minimum space between them should be 130mm.

- WIRING -

- 1) The MEASUREMENT and CONTROL signals being weak, it is appropriate to use shielded cable for connections, in order to prevent electrical noise and interference. (Shielding to be grounded at one point.)
- 2) Avoid laying power cables with those for instrumentation.
- 3) Connect the instrument according to the wiring diagram attached to the top of the instrument. Recheck the wiring upon completion.
- 4) Use a suitable terminal for the M3.5 terminal screw. The size of the terminal must be less than 7.0mm.



4. Front Panel Information (Names and Functions)



1) LED Display

1. PV Display

Indicates the measured value or the message if overscaled.

2. SV No. Display

Indicates the selected SV No. In the case of REMOTE mode, interface or RAMPING, specific messages are displayed.

3. SV Display

Indicates the SV (Set Value) selected.

2) LCD Screen

1. Deviation Display

Indicates the difference (deviation) between PV and SV in a bar graph. The covered range is $\pm 5\%FS$, and is displayed by bars (0.2%/bar).

2. Output Display

Indicates the value of output signal(s) in a bar graph. The covered range is 0~100%, represented in bars (2%/bar).

3. Parameter Display

Shows all the necessary supporting data, parameters and programming. (16 alpha-numerical $\times$ 2 lines)

4) Keyboard on Front Panel

1. SV (Selection of SV No.)

Selection and display of SV in local mode and display in remote mode.

2. DISP (Display)

Selection of level (with ∇ or Δ) and exit from a display group. Routine for getting out of the first group of a level when you come from another group.

3. ∇ (Parameter setting)

Progressing within groups of screens, entrance to a group (two presses), and change of level (with DISP).

4. FUNC (Function)

To move "cursor" and ">" (prompt).

5. Δ (Up) ∇ (Down)

For raising or lowering the values of parameters and for moving from one group to another.

6. QCK (Quick Parameter Setting)

Quick slide of the cursor (prompt) from 1 rank to the left (rapid raising and lowering of gross values).

7. ENT (Enter)

Registering of parameter values or input data. Confirmation of a completed screen. Enter into a group of parameters.

5) Monitor Lamps

1. RUN

Lit during ramp control

2. ESV

Lights when EXT is selected.

3. REM

Indicates that the displayed SV comes from external setting (REMOTE).

4. COM

Lit during communication between the instrument and a PC through the interface RS232C or RS422.

5. SET

Indicates the setting of a parameter. The light goes out when ENT is pressed.

6. CAL

Reserved for factory adjustment.

7. EV1

Lit while output terminal EV1 is on.

8. EV2

Lit while output terminal EV2 is on.

9. EV3

Lit while output terminal EV3 is on.

10. DO1

Lit while output terminal DO1 is on.

11. DO2

Lit while output terminal DO2 is on.

12. ERR

Indicates malfunctioning. For example, "Input signal out of range".

13. °C °F

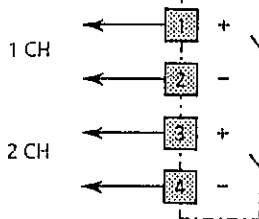
Shows the unit selected (°C, °F or blank).

5. Connection of Terminals

Analog Output (Option)

Voltage: 0~10mV = Output resistance 10Ω
0~10V = Load current 2mA max.

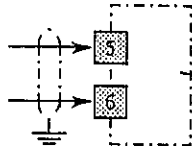
Current: 4~20mA = Load resistance: 500Ω max.



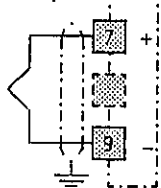
Remote (external value-setting)

Voltage: 0~10V = resistance 500KΩ min.
1~5V = resistance 500KΩ min.

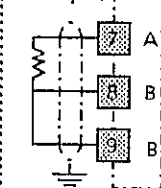
Current: 4~20mA = Load resistance: 250Ω



TC Input

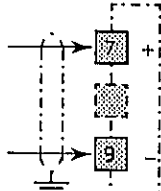


RTD Input



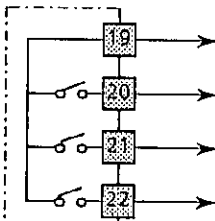
Voltage / Current Input

Voltage: Input resistance 500KΩ min.
Current: Receiving impedance 250Ω min.

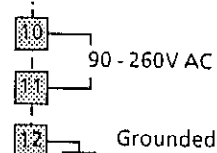


Contact Output (option)

Contact capacity: 240V AC,
2.5A resistive load
1A inductive load



Power Supply

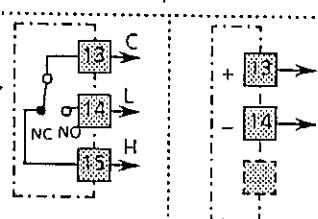


Control output

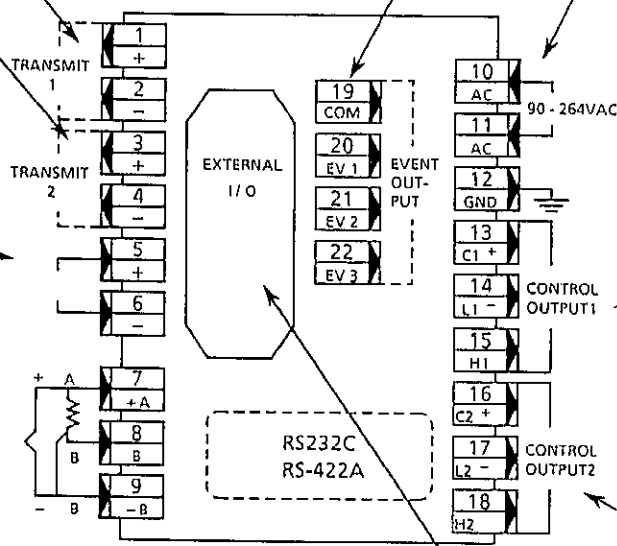
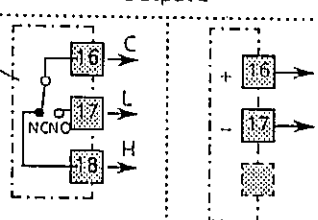
Contacts: 240V AC
2.5A resistive load
1A inductive load

Voltage: 0~10V = load current 2mA maximum
15VDC 20mA max.
Current: 4~20mA = load resistance 600Ω maximum

Output 1

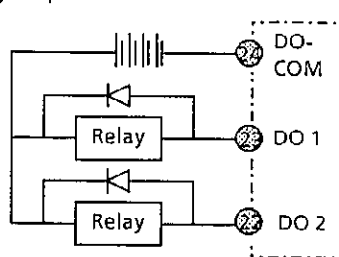


Output 2



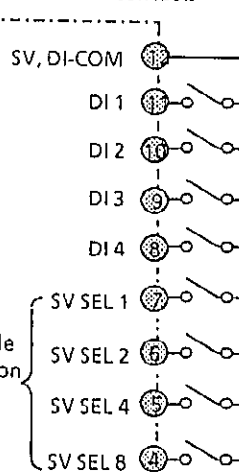
External Contact Input / Output (24-pin)

Example of set-up of relay by output



Open collector output
Max current: 50mA
Max voltage: 24V DC

Input pins Operation by external contacts



Binary code for selection of SV1 to SV10

6. 24-pin Plug Control/Operation: Inputs by Remote Control

(The plug is provided with the instrument.)

Operation from a remote place is possible by means of external non-voltage contact, and enables selection of SV No. as well as external control.

1) Selection for SV Nos.

Therefore, one can select SV Nos. from a remote place by using a switch.

SV No. Pin No.	1	2	3	4	5	6	7	8	9	10
No. 12 COM										
No. 7 SEL 1	●		●		●		●		●	
No. 6 SEL 2		●	●			●	●			●
No. 5 SEL 4				●	●	●	●			
No. 4 SEL 8								●	●	●

● Contact closed.

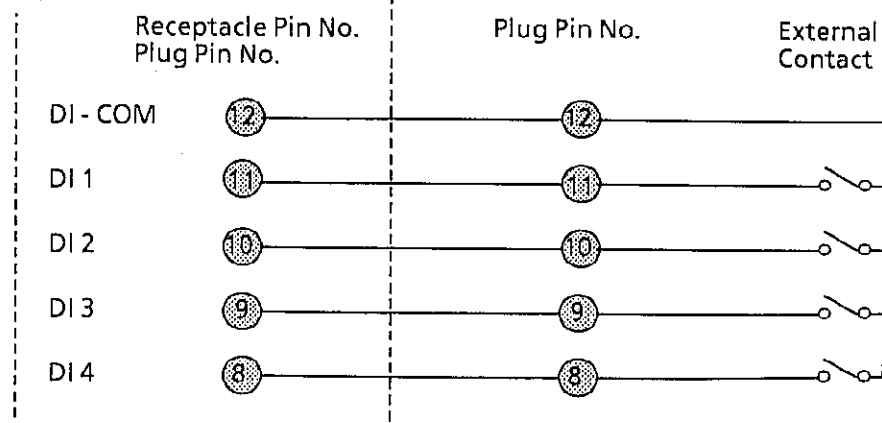
For further details, please refer to page 49.

2) External Control Input

Functions can be selected from the following 7 kinds. Then, they are assigned to 4 pins: 11(DI 1), 10(DI 2), 9(DI 3) and 8(DI 4).

- | | | |
|---------------|---------------------------------|---|
| 1. NOP | Inoperative | |
| 2. REM/LOC | Setting selection Local/Remote | Contact closed for Remote (REM) |
| 3. MAN/AUTO | Control selection Manual/Auto | Contact closed for Manual (MAN) |
| 4. AT-EXECUTE | Auto-tuning execution | Immediate on closing for Auto-tuning (AT)
(See P35.) |
| 5. DA/RA | Action selection Direct/Reverse | Contact closed for Direct (DA) |
| 6. STBY/EXEC | Suspension of control | Contact closed for Stand-by (STBY) |
| 7. STOP/RUN | Stop/Run ramp control | Contact closed for Stop (STOP) |

Connection



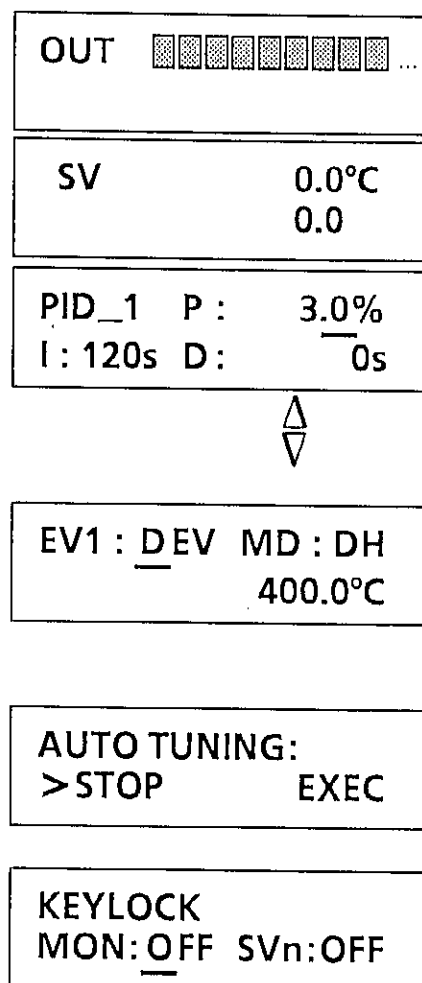
See page 49 for detail of the 24-pin plug.

7. Keyboard Operation

HINT: By pressing the DISP key twice, you can return straight to the top of group A "Output Screen A".

7-1. How to Scan Different Screens

- 1) When power is applied, the first screen of Group A - Level 1 appears (output signals by bar graphs). For successive scanning of all the screens of the group, press the  key.
- 2) To move to the next group, Group B - Level 1 (points of setting SV), press the DISP and  keys. A search for different screens of the group is possible, as described in 1).
- 3) To move from one group to another in the same level, press the  key as often as required. However, if a parameter has just been set in a group, the DISP key has to be pressed to get out of the group. Then press the  key to move to the next group.
When you go round the groups of the same level, pressing the key allows you to return to the preceding group.
When the first screen of the group you have selected appears, press the ENT (or ) key, if you want entry to the parameters there. After confirmation of your setting in a group, you can move from one screen to another by means of the  key and carry out entry or modification of the parameters there.
- 4) To move from Level 1 to Level 2, press the DISP and then the  key. The screen at the head of Level 2 - Group A appears (Auto-Tuning in/out of action). Apart from moving from this screen, departure from any screen of Level 1 is possible by the above sequence of the keys.
- 5) To move from Level 2 to Level 3, press the DISP and then the  key. The screen at the head of Level 3 - Group A appears (locking function of the keyboard). Apart from getting out of this screen, departure from any screen of Level 2 is possible by the above sequence of the keys.
- 6) To return from Level 3 to Level 1, follow the same steps as above.
Whichever level, group or screen is displayed, you can always return to the initial screen (Level 1 - Group 1) by pressing the DISP key twice or thrice.
- 7) All the sequences of the keys and steps described for Level 1 apply to Levels 2 and 3.



Summary

- Getting out of a group : Press the DISP key.
- Moving from one group to another : Press the  key to move to the next group, and the  key for moving to the preceding group. Note: After a Level change, Group A of that Level is displayed. In order to move from this point to the next group, you are forced to press the DISP key (getting out of a group).
- Moving into a group: Press the ENT or  key.
- Moving between screens in a group : Press the  key.
- Moving from one level to another : Press the DISP and then the  key.
- Returning to the initial screen: Press the DISP key twice or three times.

7-2. How to Register and Alter Parameters

- 1) To begin with, obtain the screen on which you want to work.
(If you are not sure how to operate, reread Paragraph 7-1.)
- 2) As soon as you start working on a parameter, the monitor lamp SET is lit. It will not go off until your setting is registered by pressing the ENT key. If many different items need to be altered on the screen, you can enter your various inputs by pressing the ENT key just once, thus registering the whole screen. If you get out of a screen on which you set parameters while the ENT monitor lamp is still on, modifications will not be registered.

- 3) To modify or register figures or numbers, move the cursor "-" to those to be modified by using the FUNC key. Next, increase by the Δ key or decrease by the ∇ key the figures under the cursor. After confirming that there is no mistake, press the ENT key to register the input (validation).

An increase or decrease by use of the Δ and ∇ keys automatically moves the decimal point. If you use the QCK (Quick) key, however, you can move the cursor directly under the figures of tens, hundreds, etc., and thus input numbers far quicker.

- 4) To modify or register conditions, descriptions, i.e. ON/OFF or ST-BY/EXEC.

With the cursor "-": Move the cursor by using the FUNC key and have conditions, items, etc. displayed by the Δ and ∇ keys. Then, register what you have selected with the ENT key.

With the cursor ">": Using the FUNC key, move the cursor to the selected condition, description or order, and register it by means of the ENT key.

PID_1	P :	3.0%
I ; 120s	D :	0s

KEYLOCK	
MON:OFF	SVn:OFF

CONTROL	
> ST - BY	EXEC

Note: Selection of SV (Set Value)

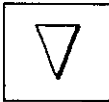
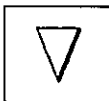
- Select the desired SV No. through the SV key. Then, press the ENT key. Immediately you are in control fixed around the selected point of setting (SV).
- If you have parametrized ramp control (Level 1 - Group E and Level 2 - Group G), select the desired SV No. with the SV key. Then, press the ENT key. Immediately you have ramp control (ascending or descending) up to the selected set value.

8. Procedure of Investigation and Parameter Setting

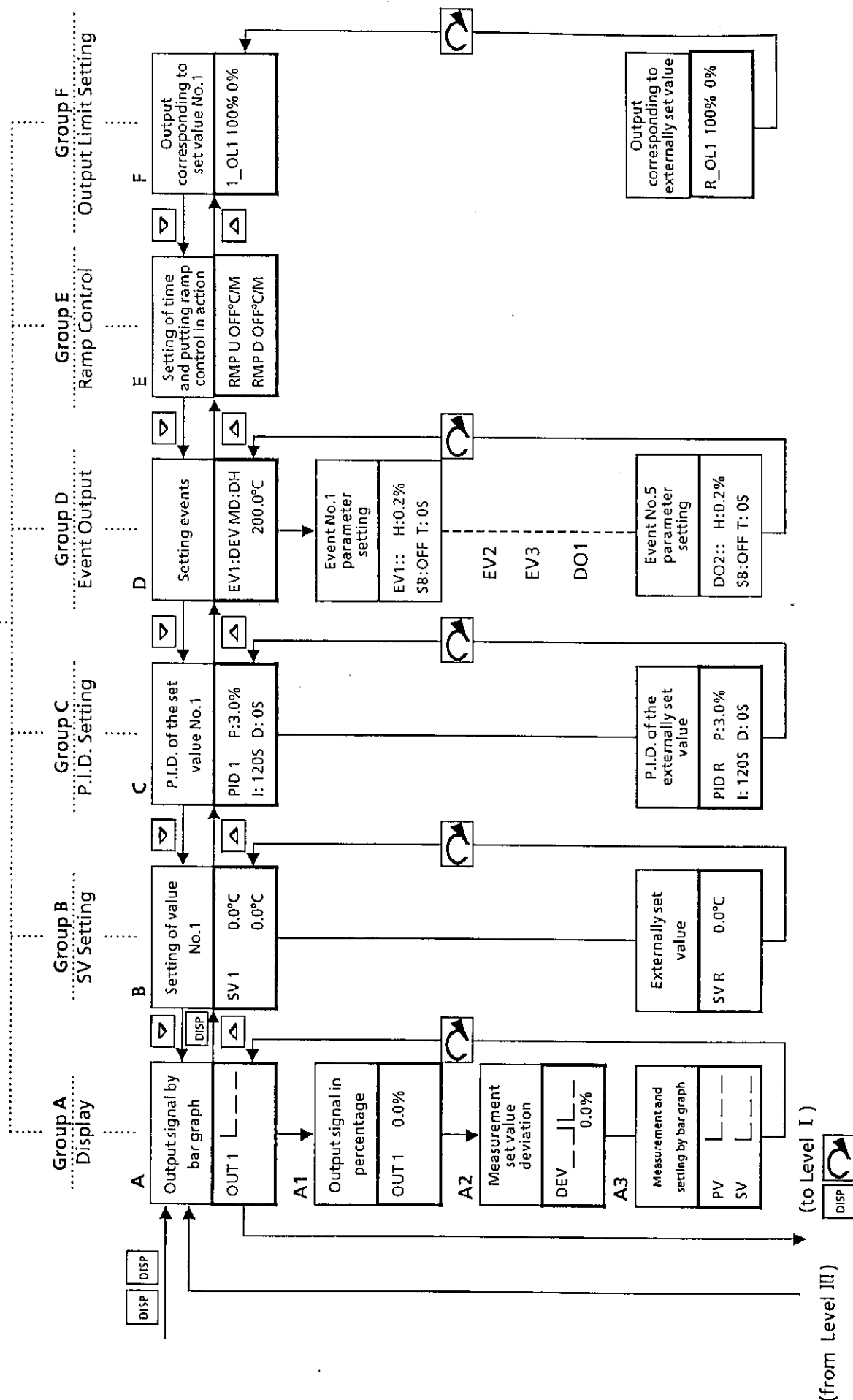
The parameter memory of the SR25 has 3 separate levels, within which the groups of the parameters are accessible.

The levels and groups, and the procedures for using them are described in the following 3 pages.

Summary of Key Functions

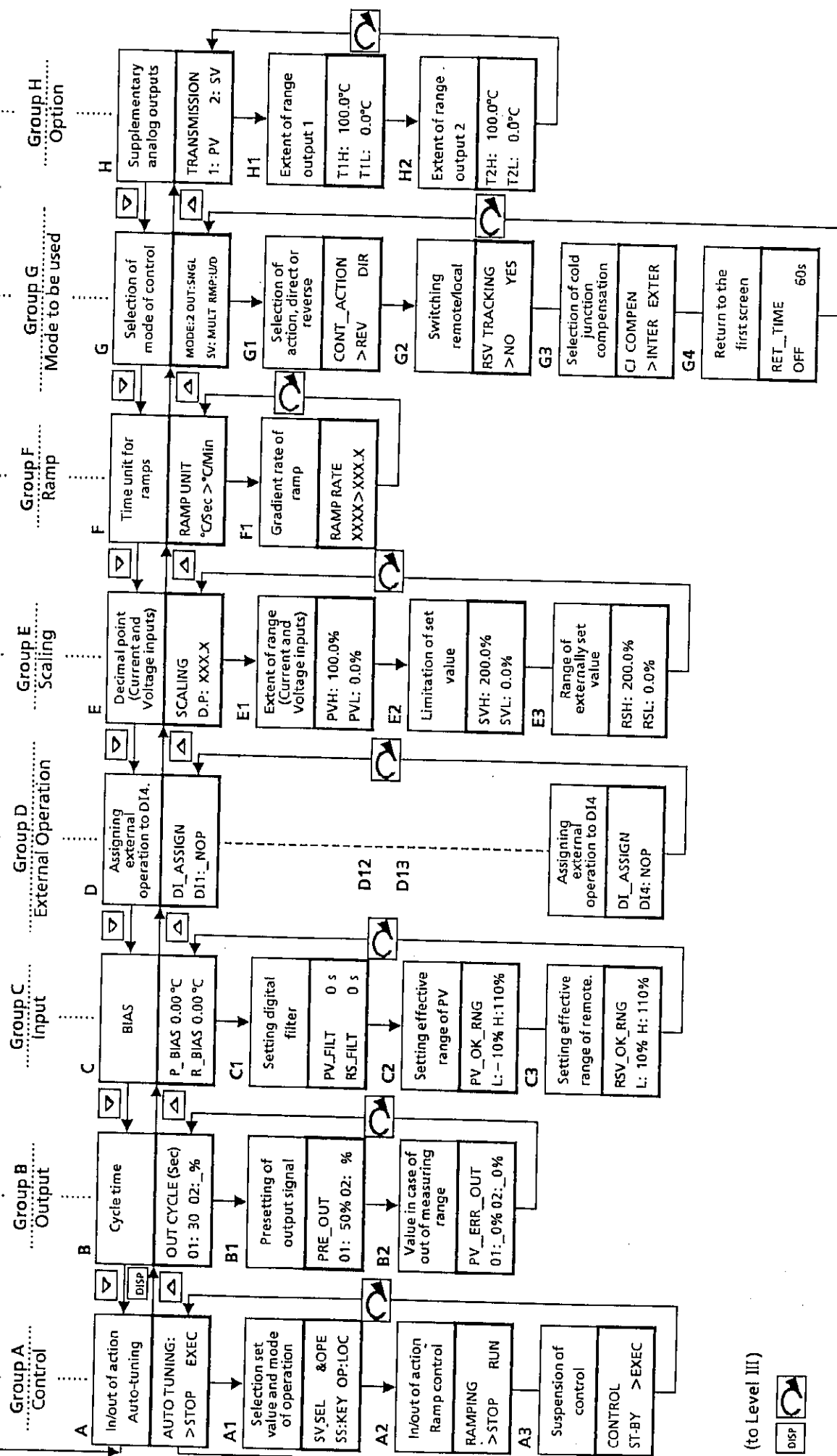
SV	Selection of different SV	QCK	Sliding of the cursor 1 rank to the left (quick rise of large numbers).
DISP	 Moving from one level of parameters to another level.		
ENT	or  Entry into a group of parameters.		
FUNC	or  /  ENT		For entry or changing parameters within a group.
	For moving around within a group.	 / 	Moving from one group to another.
DISP	Used for changing levels.		

LEVEL I



(from Level I)

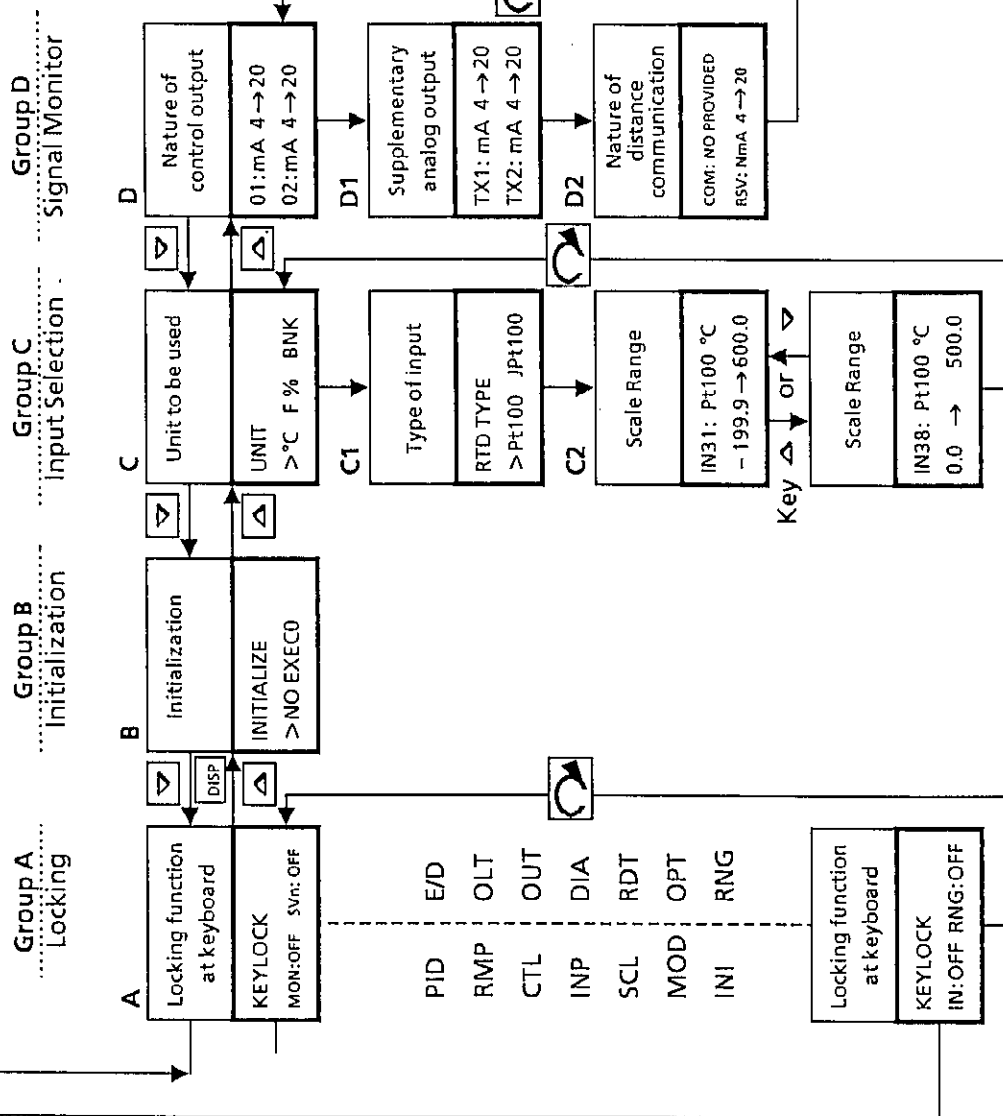
LEVEL II



DISP
(to Level I)

LEVEL III

(from Level II)



9. Basic Operation

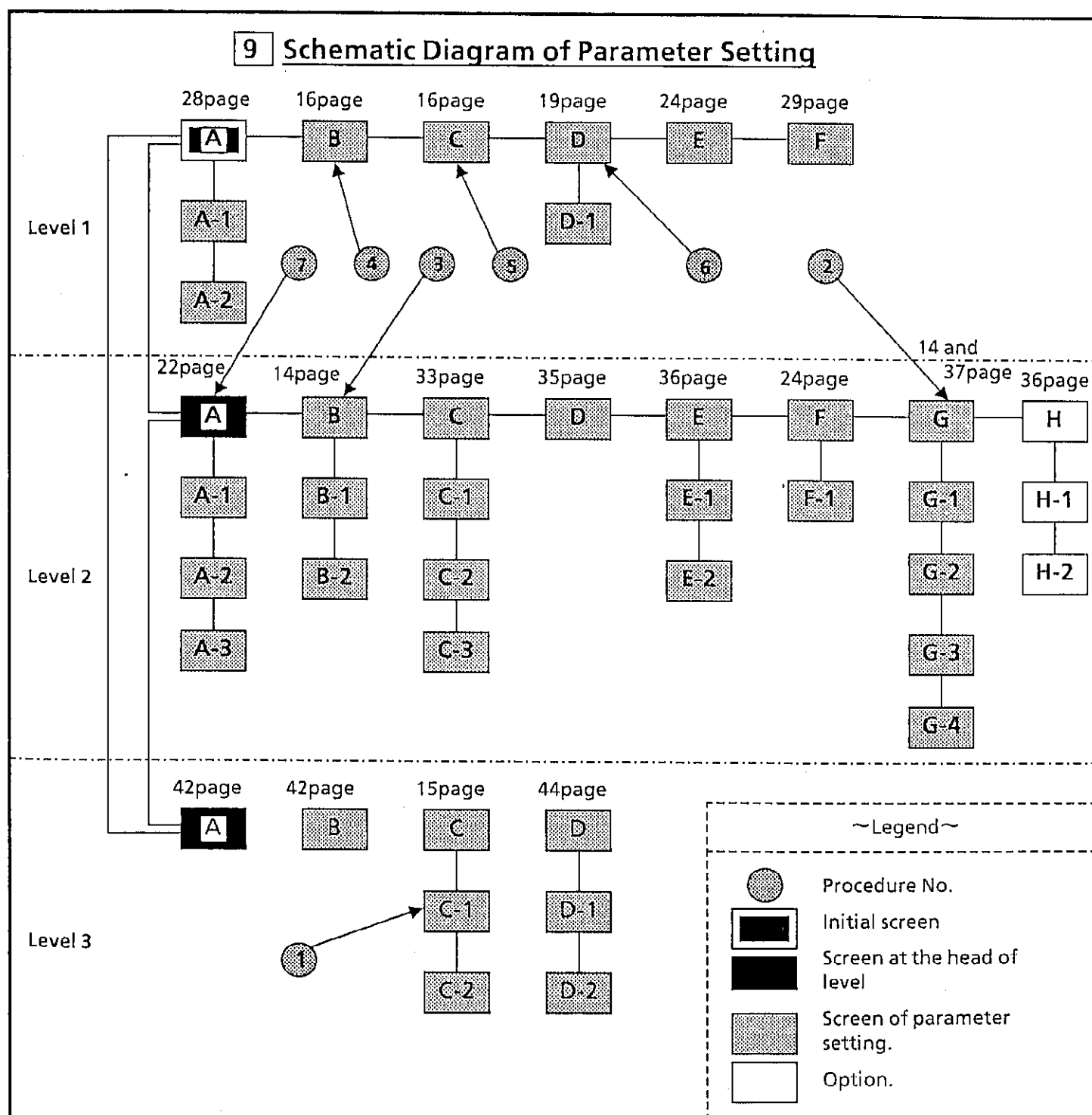
The basic operation procedures are shown by Nos. ① to ⑦ in the following schematic diagram of parameter setting.

In some cases, the factory-set initial values can be used. But if any changes are to be made follow the procedure in the order indicated.

- Procedure 1: Initial setting Nos.1 to 3
 Procedure 2: Basic setting for operation Nos.4 to 6
 Procedure 3: Other basic setting for operation No.7

The procedures will be described in detail later. If you want to carry out a parameter setting other than the basic operation, follow the operating steps in the preceding pages.

9 Schematic Diagram of Parameter Setting



*** INITIAL SETTING ***

9- ① . Selection of Engineering Unit, RTD Type and Measuring Range (Level 3 - Group C)

1) Selection of Engineering Unit

Initial Setting

The instrument is set to °C.

In the case of thermocouple and RTD inputs a selection between °C and °F causes the selected unit on the measurement indicator to light red.

In the case of linear inputs (voltage, current), you can select °C, °F, % or BNK. If BNK(blank) is selected, no unit is indicated. If % is selected, this unit is shown on the LCD screen.

UNIT			
>	°C	°F	% BNK

Procedure for Physical Unit Selection

To move to Level 3, press the DISP and  keys. Move out of Group A (screen KEYLOCK "locking") of this level by pressing the DISP key. Move to Group C by means of the  key. Now, the "Unit" screen is displayed. Move into it with ENT and select a unit with the FUNC key. Push "ENT".

2) Selection of RTD Type (Pt100/JPt100)

This selection is applicable only to inputs by a resistance thermometer. In the case of inputs by a thermocouple or linear inputs, this screen is not displayed.

Initial Setting for RTD Type

WARNING!!

Remarks: The instrument may be delivered with the initial setting of Pt100 (DIN) or JPt100 (Japanese old standard). Therefore, be sure to check this setting.

RTD TYPE	
>Pt100	JPt100

Procedure for RTD Type Selection

You remain in Group C. To move to the next screen, press the  key. The above screen is shown. Select your standard by means of the FUNC and ENT keys.

3) Selection of Measuring Range

Initial Setting

RTD : IN37
Thermocouple : IN04
Linear : IN26

IN 37	:	PT100°C
0.0	-	200.0

For values corresponding to codes of inputs (IN), see page 2 "Inputs and Selectable Ranges".

Procedure for Selection of Range

The screen at the beginning of the procedure is "UNIT" for thermocouple inputs and linear inputs, and "RTD TYPE" for resistance temperature detector inputs. Call the first screen of the range with the  key. You can scan all the other screens of ranges by using the  and  keys. Make your selection and confirm it with ENT.

Note: It should be remembered that when you change the unit or measuring range, all the data are initialized in the same manner as you carry out the function "INITIALIZE-EXEC 1" of Level 3 - Group B (page 42).

9- ② . Selection of Mode of Control (Level 2 - Group G)

There are 4 modes available.

Number of Output(s)	Number of Settings	Mode	Ramping
1 Output (Single)	SV: SNGL SV1, SVR	Mode 0	Impossible
	SV: MULT SV1-SV10, SVR	Mode 2	Possible
2 Outputs (Dual)	SV: SNGL SV1,SVR	Mode 1	Impossible
	SV: MULT SV1-SV10,SVR	Mode 3	Possible

- In case of a 1 output instrument, selection between modes 0 and 2 is possible.
- In case of a 2 output instrument, any of the modes 0, 1, 2 and 3 can be selected.

Initial Setting

1 Output instrument: Mode 2

2 Output instrument: Mode 3

If the initial parameter setting does not suit you, follow the Mode Selection procedure to select the desired mode.

MODE:3 OUT: DUAL SV: MULT RMP: U/D

Procedure of Selection of Mode

Move to Level II by the DISP and  keys. The screen "AUTO-TUNING STOP EXEC" is displayed. Move up to the screen "Selection of Control Mode" (Level 2 - Group G) by pressing the DISP key, and then the Δ key as often as required. Get into Group G by pressing the ENT (or ) key. Then, select the mode which meets your requirements by means of the Δ and ∇ keys. Next, register it with the ENT key.

9- ③ . Setting of Proportional Cycle Times (Level 2 - Group B)

Applicable only to contact outputs and outputs for thyristor driving.

Initial Setting

Setting: 1 to 200 seconds

Initial setting: 30 seconds (also for 2 outputs)

In the case of "1 output", the setting for "2 outputs" is not possible and the indication remains at 02: ...

In the case of voltage or current outputs, the setting of "1 output" or "2 outputs" is not possible and indication remains at 01: ... 02: ...

OUT CYCLE (sec) 01: 30 02:

Procedure for Proportional Cycle Time Setting

Move out of Group G (where we were before) by using the DISP key, and go to Group B by using the Δ and ∇ keys until the above screen is displayed. Move into the group by pressing the ENT (or ) key. Carry out the entry of your values by using the Δ and ∇ keys with ENT. To move from one output to another, press the FUNC key. (The whole screen can be made valid when the ENT key is pressed only once.)

*** BASIC SETTING FOR OPERATING THE INSTRUMENT ***

Now it is appropriate to register the value of SV or maximum 11 SV (including SV__R "REMOTE") as well as 11 values of the corresponding PID

9- ④ . Set Values Setting (Level 1 - Group B)

Initial Setting

Initial values for all : 0.0°C

Note 1: The values of the SV1 to SV10 and SV__R are always restricted by the following values:

- 1) SVH and SVL for thermocouple and RTD inputs (higher and lower limits of set values).
- 2) PVH and PVL for mV, V, mA inputs (higher and lower limits of measuring ranges).
- 3) RSH and RSL for externally set values (higher and lower limit of REMOTE).

SV_1	0.0°C
[E]	0.0

Note 2:

- 1) The value [E] is displayed only for the SV in action.
- 2) The indicated value SV__R has no role other than monitoring and can not be modified.
- 3) During AUTO-TUNING (AT), no changes can be made.

Procedure for SV Registration

To return to the initial screen, press DISP twice. Next, make access to Group B by using the DISP key and then the Δ key. Get into the group by means of ENT and select an SV No. with the $\curvearrowright$ or SV key. (When pressed continuously, this key moves SV fast forward). Assign a value to the SV through the QCK, Δ and ∇ keys. Effectuate this value with the ENT key. In accordance with the MODES in use, two cases present themselves:

1) Mode 0 or 1

Only SV1 and SV__R are accessible. Ramp control is ineffective. The screen of the SV in action appears first. When the $\curvearrowright$ or SV key is pressed, the other SV available is displayed.

2) Mode 2 or 3

All SV are accessible. The ramp control is usable. The screen of the SV in action appears first. Moving out of one SV to the next in numerical order is done through the $\curvearrowright$ key or SV.

9- ⑤ . PID Setting (Level 1 - Group C)

The setting of the parameters PID can be entered directly by the instrument if you use the AUTO-TUNING function (Level 2 - Group A).

Initial Setting

Initial values for all the 11 PID corresponding to the 11 SV:

P = 3.0%

I = 120 s

D = 0 s

PID_1	P:3.0%
1: 120s	D:0s

Modes of control which can be used :

1st output: PID, PI, PD, P, ON/OFF

2nd output: P, ON/OFF

Procedure for Setting of PID

Move out of Group B with the DISP key, then go up to group C with the Δ key. Move into this group with the ENT (or $\curvearrowright$) key. Now you can set parameters P, I and D using the QCK (to move cursor to the left, thus enabling parameters to be set faster), Δ and ∇ keys, and the FUNC key for advancing from one parameter to another. Next, press the ENT key.

1) GENERAL

Like the screens of SV setting, the screens of PID setting are decided by the selected mode. Of course it is possible to set as many parameters of PID as those of SV.

```
SV_1... ..P. I. D_1
SV_2... ..P. I. D_2
.....
SV_10... ..P. I. D_10
SV_R ... ..P. I. D_R
```

- * In Mode 0 or 1, only the PID_1 and PID_R screens are available for parameter setting.
- * In Mode 2 or 3, all the screens from PID_1 to PID_10 and PID_R are accessible for parameter setting.
- * In Modes 1 and 3, i.e., modes of 2 outputs, a supplementary screen for the second output is displayed with its parameters.

K2, H and DB.

Initial Values:

K2: 1.0 (coefficient of proportional band)

DB: 0.0% (dead band)

P.I.D_1	K2:	1.0
	DB:	0.0%

When K2 = 0.0 (ON/OFF), a parameter of Hysteresis can be set.

Initial Value:

H: 0.1%

P.I.D_1	K2:	ON/OFF
H:0.1%	DB:	0.0%

2) Proportional Band P

Range of setting: 0.1 to 999.9% FS. When P is set at 0, you are made to move into ON/OFF.

P is a parameter expressed in % of the full scale (FS), and makes the Control output change between 0 and 100 % in proportion to the measurement (PV)/set value (SV) deviation, the CONTROL OUTPUT between 0 and 100%.

- * Setting the instrument to change ON/OFF control

After bringing the cursor to position P, display the value of the setting as 0 by using the ∇ key and press the ENT key. The display for P then indicates "ON/OFF", thus indicating that you are in ON/OFF control. In ON/OFF, a new parameter is displayed. This is H, hysteresis. Its setting zone is from 0.1% to 9.9% of FS.

3) Integral Time Setting I

Range of setting: 1 to 6000 seconds

* Setting I at 0

After making sure that the cursor is accurately on I, return its value to 0 with the QCK and ∇ keys. Then the word OFF is displayed instead of the value. Press ENT. You are now in PD control. A new parameter is displayed. It is R, initial value is 50.0%.

* Manual Resetting R. (Proportional band deviation)

Range of setting: 0.0 (OFF) to 99.9% of FS.

This parameter makes it possible to correct an eventual deviation between PV and SV during the control without integration time (I = OFF).

PID_1	P:	3.0%
R:50.0%	D:	9s

* Normally, during control P(PD), $PV = SV$ and the control output is equal to 50.0% (the midpoint of the band). There is no deviation.

* Correction of deviation: It is possible to correct a deviation by working on the value of the parameter of reset R:

$R > 50.0\%$ for a deviation $PV < SV$

$R < 50.0\%$ for a deviation $PV > SV$

* Return to the initial value of I. This can be done simply by returning the cursor to the parameter R (manual reset) and changing its value to OFF (just below 0) by using the QCK and ∇ keys, and entering with ENT. The initial value of 120s is then displayed.

4) Delivative Time Setting D

Range of setting: OFF, 0-3600 sec.

* Deletion of Delivative (Control P and PI)

After making sure that the cursor is accurately on D, return its value to OFF (just below 0) by means of the QCK and ∇ keys. Then, press the ENT key.

PID_3	P:	3.0%
I: 120s	D:	OFF

* Parameter D and Auto-tuning

If the parameter D has been positioned on OFF, the Auto-tuning function has no effect on this and it remains on OFF. If this parameter is returned to the value 0, Auto-tuning will calculate a new time of differentiation D.

9- . Setting of Event Parameters (EV, DO) (Level 1 - Group D)

The function "Event Output" allows selection and output on terminals and/or DIN plug of events as per the following: PV, SV, DEV, AT, RUN, REM, and MAN.

Groups of Events:

1. EV1 to EV3: Contact output (at option)
2. DO1 to DO2: Open collector output to DIN plug (external control/operation) (standard) (For characteristics, see page 51).

INITIAL SETTING

Initial values of event outputs

① Designation of event output	② Type	③ MD	④ Set Point	⑤ H	⑥ SB	⑦ T
EV1	DEV	DH	4000	0.2%	OFF	0 sec
EV2	DEV	DL	-4000	0.2%	OFF	0 sec
EV3	ERR					
DO1	AT					
DO2	REM					

①	②	③
EV1:	DEV	MD: DH
		400.0°C
	④	⑤
EV1:	:	H: 0.2%
SB: OFF	T:	0s
⑥	⑦	

* Enter the parameters in numerical order, 1, 2, 3, 4.....
The setting is common to all SV's.

Procedure of Parameter Setting of Event Outputs

Move out of Group C with the DISP key. Move up to Group D using the Δ key. Move into this group with the ENT key (or $\curvearrowright$ key). Set values with the Δ or ∇ key and enter your parameters by ENT. Advance from one parameter to another by using the FUNC key. Call the next event by the $\curvearrowright$ key and set parameters in the same manner as above.

1) Types of Events

Eight types of events are available for selection. A maximum of 5 can be output (2 outputs on the DIN plug; DO1 and DO2,3 optional outputs on terminals : EV1 to EV3).

Type of Event	Setting Range	Hysteresis	Alarm	Time Delay Setting
DEV	+/- 4000	0.1 to 9.9% (individual setting)	deviation	0~9999 seconds
PV	-1999~ + 1999 within the measuring range		absolute	
SV			absolute	
AT	AUTO-TUNING is executed		Output = 'ON'	Not Available
RUN	RAMP CONTROL is executed		Output = 'ON'	
ERR	PV, RSV is scale over		Output = 'ON'	
REM	REMOTE MODE is executed		Output = 'ON'	
MAN	MANUAL MODE is executed		Output = 'ON'	

* Explanation of functions of 8 EVENT OUTPUTS

DEV: Deviation alarm. The corresponding output is activated when the deviation between the measurement and the set value (PV and SV) reaches the entered value.

PV: Absolute alarm. (No relation to one or more SV.) The corresponding output is activated when the measurement (PV) reaches the entered value.

SV: Absolute alarm. The corresponding output is activated when the set value (SV) reaches the entered value.

AT: The corresponding output remains active during Auto-tuning of the PID values (AUTO-TUNING).
 RUN: The corresponding output remains active during the whole period of execution of a ramp.
 ERR: The corresponding output is activated as soon as the MEASUREMENT or EXTERNALLY SET VALUE "REMOTE" (RSV) is out of range.
 REM: The output is activated when you are in the EXTERNAL SETTING "REMOTE" mode.
 MAN: The output is activated during MANUAL OPERATION and remains active as long as you are in this mode.
 When an event is displayed and its output is activated, the LED display EV1, EV2, EV3, DO1 or DO2 is lit.

* Selection of DEV, PV and SV

If you select these events, the supplementary parameters are necessary as follows:

- ③ Mode of action (MD)
- ④ Set Point
- ⑤ Hysteresis (H)
- ⑥ Stand-by (SB)
- ⑦ Time Delay Setting (T)

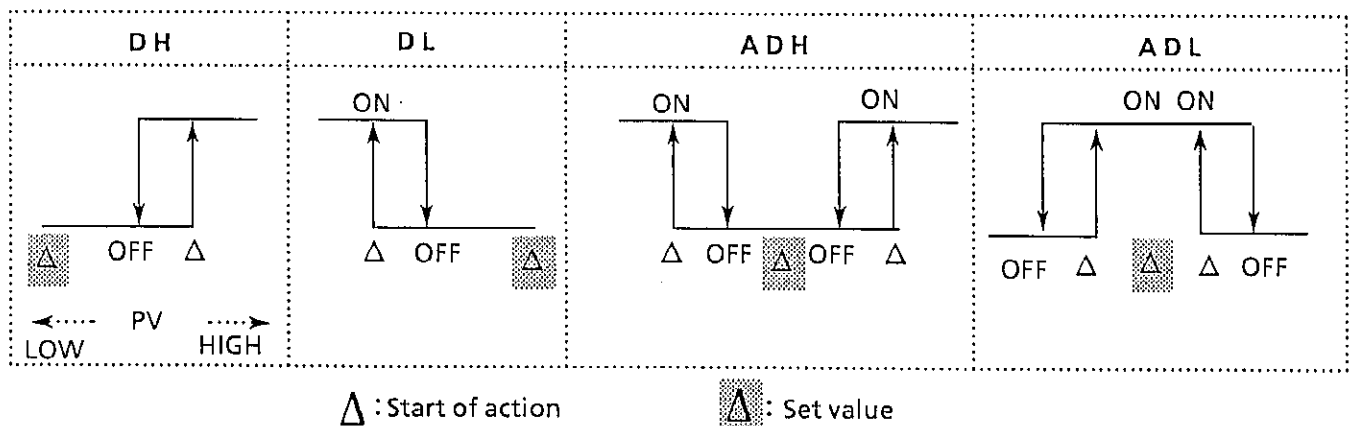
* Selection of AT, RUN, ERR, REM and MAN

Where only events (states), are monitored, parameters ③ to ⑦ are not used.

2) Modes of Action ③ (MD)

* DEV (Deviation alarm)

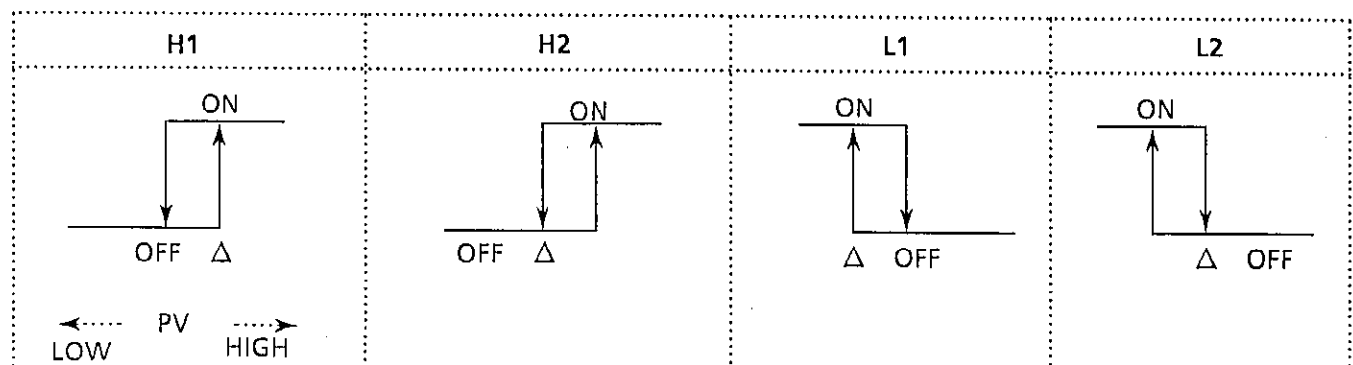
According to the required work to be done, the DH, DL, ADH and ADL modes can be selected.



* PV (Absolute alarm of measurement) and SV (Absolute alarm of set value)

According to the work required to be done, the HI, H2, L1 and L2 modes can be selected.

Δ : Start of action



3) Setting of Set Point

If the event selected is DEV, PV or SV, a set point is required.

EVENT TYPE	MODE OF ACTION	RANGE OF SETTING
DEV	DH DL	- / + 4000
DEV	ADH ADL	0 to 4000
PV , SV	H1, H2, L1, L2	Within range

4) Hysteresis (H)

This parameter assures that an output is stable without too frequent contact operation.

Range of setting : 0.1 to 9.9% of FS

Initial value : 0.2% of FS

5) Stand-By (SB)

This parameter cancels operation of the event (DEV, PV, SV) until the first time PV = SV.

ON : Stand-by

OFF: Non Stand-by (initial setting)

- * If ABSOLUTE VALUE , VALUE OF DEVIATION or TYPE OF EVENT is modified, the parameter "STAND-BY" is re-initialized to OFF (non-stand-by), the T and H values are retained.

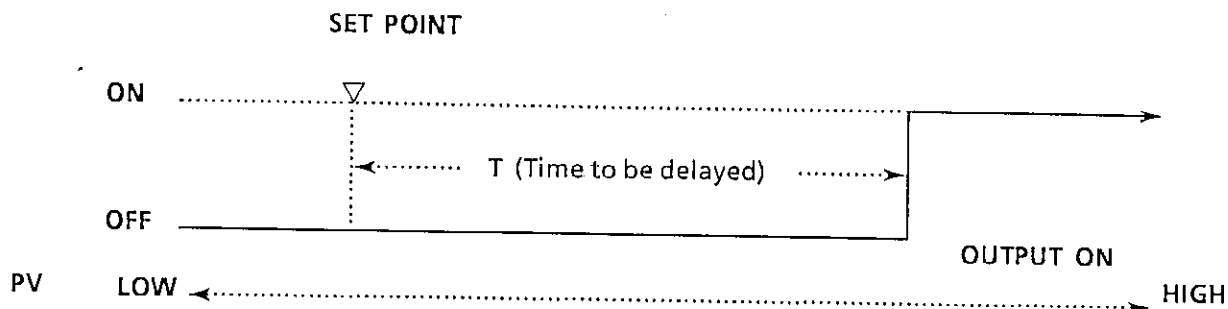
6) Time Delay (T)

Setting of time of event outputs to be delayed.

This Time Delay enables blocking of the activated event output during a time T.

Range of Setting: 0 to 9999 sec.

Initial value: 0 sec.



- * Event must be continuous, otherwise timing is reset.
- * If $T = 0$, there will be no time delay.
- * If during the course of time delaying, you want to change the time T, only a new time shorter than the time set previously is possible. If the new time is longer than the original time, the latter will be executed.

*** OTHER BASIC SETTINGS TO PUT THE INSTRUMENT IN OPERATION ***

Once the settings described in paragraphs 9-1 to 9-6 have been completed, you can start controlling. If you are directly operating the instrument, you can begin with AUTO-TUNING. When AUTO-TUNING (AT) screen is selected, it is possible for you to start and stop auto-tuning. AUTO-TUNING automatically enters the calculated PID parameters in accordance with an SV and the inertia of your system. During this phase, the AT lamp is lit on the LED monitor. This lamp goes out when auto-tuning is completed.

9- Operating of Auto-Tuning (Level 2 - Group A)

Initial Setting

Initial selection: STOP

AUTO - TUNING : > STOP EXEC
--

How to Select Auto-tuning

Move from the initial screen to the auto-tuning screen (Level 2 - Group A__Control) by means of the DISP and  keys. Then, select EXEC or STOP with the FUNC key and enter your selection with ENT.

This selection can also be operated by remote control.

(See assignment of DI on page 35.)

A) Conditions Required for Execution of Auto-Tuning

(Keyboard mode as well as remote control mode)

1. Do not be in Ramp Control.
2. Do not be in Manual operation.
3. Do not be in ON/OFF Control (P = 0 at PID Setting).
4. Error lamp must be off. If ERR is detected during auto-tuning, it will be interrupted immediately.
5. Do not be in ST-BY mode (suspension of control.) (See Level 2 - Group A-3.)

B) Stopping of AUTO-TUNING during Execution

1. When error is detected.
2. Power failure
3. Time between 2 changes of state of control output ("ON", "OFF") exceeds 2 hours i.e., process value changes very slowly.

Important Remarks

If AUTO-TUNING has been assigned to one of the external control DI's (Level 2 - Group D), it is impossible to start AUTO-TUNING from the keyboard.

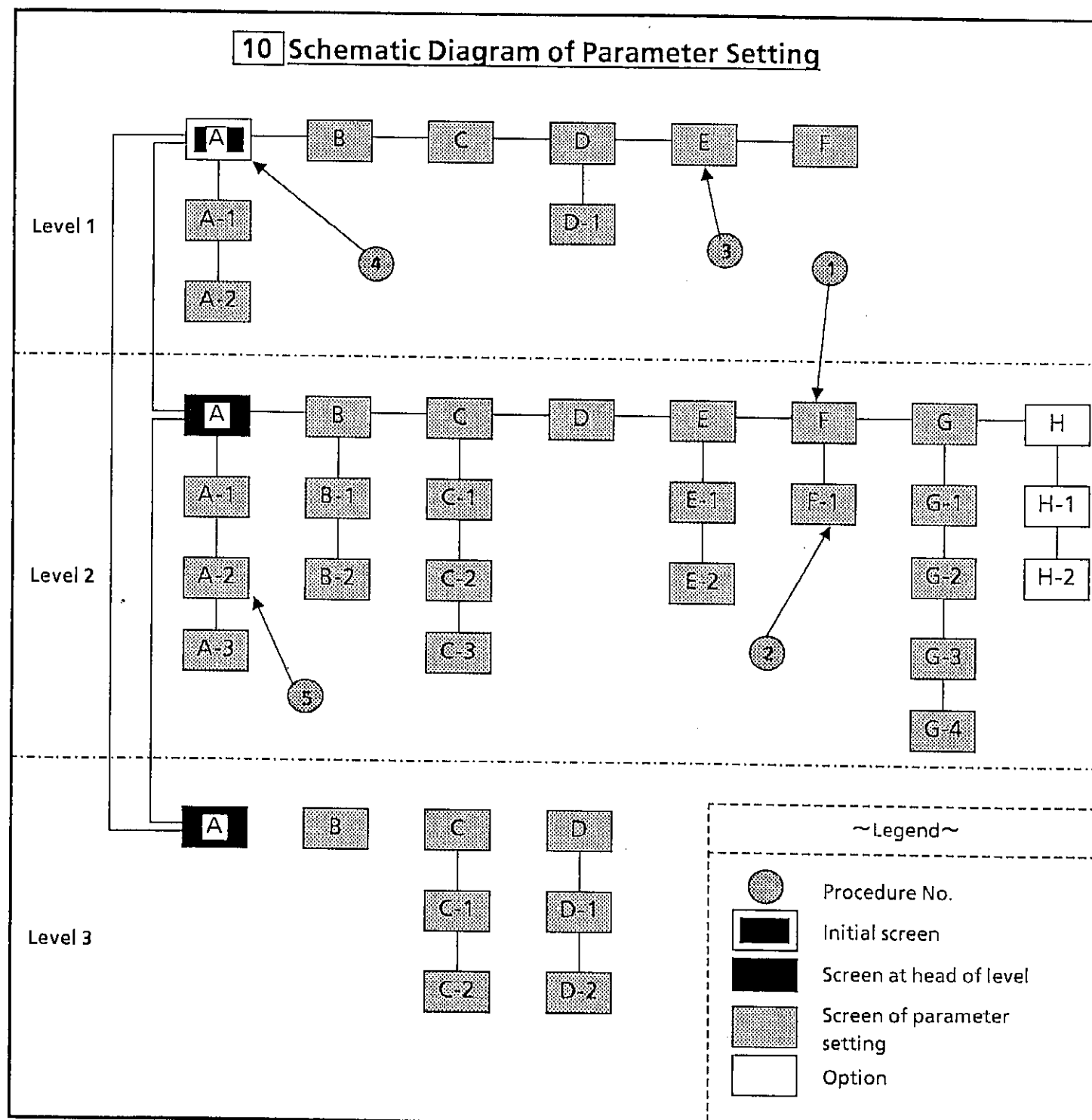
You must then remove AUTO-TUNING from External Control (DI) if you want to carry out AUTO-TUNING solely by the keyboard.

10. Ramp Control

This function allows progressive advance of SV by creating a ramp.

Ramp Control is possible only when Mode 2 or 3 is selected (Level 2 - Group G).

For setting of the parameters of Ramp Control, refer to the block diagrams of screen identification and parameter setting (pages 8, 9, 10 and 11) and the following parameter block diagram.



10- ①. Selection of Unit of Time for Ramping (Level 2 - Group F)

This screen enables selection of the unit of time for ramping in seconds(sec) or minutes(min).

Initial Setting

Initial selection : °C/Min

RAMP UNIT
>°C/Sec °C/Min

Procedure of Selection of the Unit of Time

Quit the initial screen, go to Level 2 - Group A by means of the DISP and  keys. Move out of this group with the DISP key. Go up to the screen RAMP UNIT (select time unit) by pressing the  key as often as required. Move into this group (Group F) by means of the ENT or  key. Select a unit with the FUNC key, and enter it with ENT.

10- ②. Selection of Ramp Rate (Level 2 - Group F - Screen F1)

On this screen, select ramp rate from 1 (XXXX) or 1 / 10 (XXX.X) per minute or second.

Initial Setting

Initial selection: XXX.X

RAMP RATE
XXXX >XXX.X

Procedure for Selection of Rate

After getting out of the preceding screen, go to screen F1 (RAMP RATE) by using the  key. Select one of the two indications with the FUNC key and enter it with ENT.

10- ③. Ramp Setting (Level 1 - Group E)

INITIAL SETTING

RMP __U: Ramp Up

RMP __D: Ramp Down

Initial value: OFF

RMP_U OFF °C/M
RMP_D OFF °C/M

Procedure of Ramp Setting

Return to the initial screen by pressing the DISP key twice or three times. Press the DISP key to get out of this screen. Go up to Group E with the  and  keys. Then, get into this group with the ENT (or ) key. Leave it "OFF" or make a value appear with the QCK,  and  keys. To advance from one parameter to another, use the FUNC key. Enter your selection with the ENT key.

1) Possible Setting for Thermocouples and RTD's Pt100

Range of setting: OFF, 1 to 9999 or 0.1 to 999.9

Unit and Ramp Rate (See Paragraphs 10-1 and 10-2)

U/M (XXXX or XXX.X/Min)

U/S (XXXX or XXX.X/Sec)

2) Possible Setting for Inputs in mA, V and mV

Range of setting:

OFF, 1 – 9999 or 0.1 – 999.9 (PV = XXXX)

0.1 – 999.9 or 0.01 – 99.99 (PV = XXX.X)

0.01 – 99.99 or 0.001 – 9.999 (PV = XX.XX)

0.001 – 9.999 or 0.0001 – 0.9999 (PV = X.XXX)

Unit and rate of gradient (See paragraphs 10-1 and 10-2):

U/M (XXXX or XXX.X/Min)

U/S (XXXX or XXX.X/Sec)

3) General Remarks

- * Different values can be set between RMP__U and RMP__D, except those concerning selection of unit and rate of gradient.
- * In ramp control, selection between RMP__U and RMP__P is made automatically by the instrument depending on whether the newly set value (SV) is > or < than the previous value.
Setting RMP__U and RMP__D for each of multi-SV is not possible.
- * The values assigned to RMP__U and RMP__D are common to ALL the set values.
- * Even in the course of ramping, RMP__U and RMP__D can be changed. If changed, the operation employs the newly changed values.
- * If RMP__U and RMP__D are entered as OFF, all ramp control becomes ineffective. An SV change will cause an immediate move from the set value to a new one.

4) Conditions Required for Execution of Ramp Control

(Applicable to remote control mode as well as keyboard mode)

1. Not in AUTO-TUNING mode.
2. In Mode 2 or 3 (MULTI-SV)
3. If the ramp has to be operated by external setting (REMOTE: RSV) and/or by one of the 10 set values, "TRACKING OF SET VALUE" must be on "NO". (Level 2 - Group G - Screen G2 RSV TRACKING)
4. The setting of ramps RMP__U and RMP__D is not on OFF.
5. Not in manual operation (MAN lamp lit).
6. Not in stand-by condition (Level 2 - Group A-Screen A3)
7. During Ramping, changing the value of the SV IN OPERATION always causes the Ramping to stop and an immediate move to this new value.

10-④. Putting Ramp Control in Action

Parameters of ramp control are set and executed as indicated in the preceding paragraphs.

Call the initial screen (Level 1 - Group A) by pressing the DISP key twice or three times. Select an SV No. by means of the SV key. The SV No. thus selected flashes until you press ENT to start the ramp control. The LED lamp "RUN" is lit to signal that ramp control is on.

Now, by pressing the DISP key, you can indicate on the SV No. display the direction of the ramp in the process of execution. UP means an upward ramp and DN a downward ramp. On the SV displays, you can see the value of SV changing.

When the ramp control is completed, the lamp RUN as well as the SV No. goes out. The value of SV attained is now displayed.

Note: While ramp control is executed, it is impossible to change modes.

10- . Operation of Ramp Control (Level 2 - Group A - Screen A2)

Ramp Control can be suspended or restarted during its execution.

Initial Setting

Initial Selection: Stop

RAMPING

> STOP

RUN

Procedure of Ramp Control Operation

Go to Level 2 - Group A (AUTO-TUNING) by using the DISP and  keys. The level change brings you automatically into the first GROUP. Then, you can press the  key twice to advance to screen A2.

1) Suspension (Temporary Stop) of Ramp Control

On screen A2, select the STOP position with the FUNC key, and enter it with the ENT key. The ramping is now stopped temporarily. To confirm : the lamp RUN flashes, the direction of ramp has disappeared, and the setting remains on the same value.

2) Restart of Ramp Control

On the same screen select RUN this time with the FUNC key, and enter with ENT. The ramp control resumes immediately. To confirm: the lamp RUN stays lit, the direction of ramp is displayed, and the setting has been changed to a new value.

* The initial selection is "STOP", but when ramp control is started, it goes to RUN automatically.

Note:

To STOP ramping IN THE MIDDLE and move directly to a new setting, go to the next screen A3.

Then, select optional "CONTROL ST-BY" (suspension) with FUNC and enter with ENT. The ramp control is stopped. To confirm: the lamp RUN, the direction of ramp, the flashing of the measurement value have gone out, and the setting remains at the same value.

Now select option EXEC by using the FUNC key and enter it with ENT. The setting will now move directly to the value to be attained, and the instrument is shifted to fixed control around this point of setting. (The lamp RUN remains out as we are no longer in ramp control.)

11. Display of All Groups and First Screens

The setting and displays of the SR25 are divided into 3 LEVELS. In each level, there are GROUPS classified from A to H (maximum). And in the GROUPS, NUMBERED SCREENS allow you to make access to parameters.

SCREEN A is at the head of each LEVEL.

SCREENS A to H (maximum) are the screens at the head of the group. Those which follow in the same group, for example, A is called A1, A2.

All the information which has not been given so far will now be discussed in the following order.

DISPLAY OF GROUPS AND PARAMETERS OF FIRST SCREENS

G R O U P		1st S C R E E N	P A G E
No.	FUNCTION	WORDS	
LEVEL 1			
A	DISPLAY	Output signal (s) by bar graph	28
B	SV SETTING	Setting of SV's	16
C	PID SETTING	Setting of PID	16~18
D	EVENT OUTPUT	Event setting	18~21
E	RAMP CONTROL	Time setting and putting ramp control in action	23~26
F	OUTPUT LIMIT SETTING	Setting of output limit	29 & 30
LEVEL 2			
A	CONTROL	Operation of Auto-Tuning	22
B	OUTPUT	Setting of cycle time	14
C	INPUT	PV offset (BIAS Setting)	33 & 34
D	EXTERNAL OPERATION	Assignment of external operation to DI	35
E	SCALING	Position of decimal point	36 & 37
F	RAMP	Units of time for ramps	24~26
G	MODE TO BE USED	Selection of Mode of Control	14 & 37
H	OPTION	Supplementary analog outputs	40 & 41
LEVEL 3			
A	LOCKING	Locking function of keyboard	42
B	INITIALIZATION	Initialization	42
C	INPUT SELECTION	Unit and range to be used	15
D	SIGNAL MONITOR	Supplementary analog outputs or communications	44

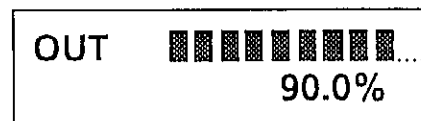
12. Parameters of Level 1

12-1. Initial Screen, Deviation Display, Measurement (PV), Set Value (SV) - (Level 1 - Group A)

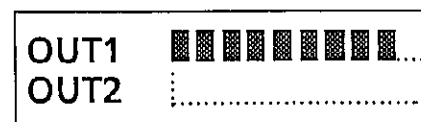
In this group of display screens, we will find:

1) Initial Screen Display of Control Output Signals

With "1 output", the same screen displays by bar graph the value of the control output signal. The value of this signal is repeated in % under the bar graph.



With "2 outputs", the first screen displays by bar graph the value of the 2 control signal outputs. In the screen following it, the value of the 2 signals is repeated in %.

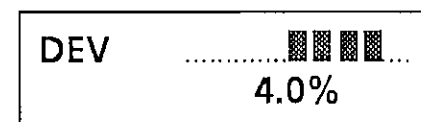


4 to 5 seconds after voltage is applied to the instrument, the first screen appears. From that moment, regardless of the level or the group in which you find yourself, you will return to this initial screen by pressing the DISP key twice or 3 times.

In ramp control, by pressing the DISP key, the direction of ramp is shown on the SV No. display and the progress of the SV of ramp on the SV display. (For further details, refer to paragraph 10-4 "Putting Ramp Control in Action".)

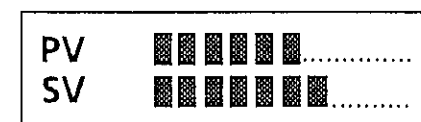
2) Measurement/Set Value Deviation Display

To move out of the initial screen and into the screen of deviation, press the key. The value of deviation between the MEASUREMENT (PV) and the set value (SV) in action is expressed in % of the full range. A bar graph also shows this deviation between -5% and + 5% of the full range on both sides of the SET VALUE (SV).



3) Measurement (PV) and Set Value (SV) Display

Move out of the deviation screen and go to the PV/SV screen by pressing the key. It shows the MEASUREMENT (PV) and the SET VALUE (SV) in the form of two BAR GRAPHS (0-100% of full range).



12-2. Change to Manual Operation

You can not move to manual control unless you have right in front of you the screen indicating in % the value of the control output signal. Thus, in the case of "1 OUTPUT" this is the first screen, but in the case of "2 OUTPUTS" it is the screen following the initial one.

When you have the right screen, just press FUNC and ENT. The lamp MAN lights. You can now change the value of control output(s) by using the FUNC key to proceed from one output to the other ("2 OUTPUTS"), and the Δ and ∇ keys to increase or decrease the value of the output. The extent of setting of the signal is confined within the limits of parameter setting in LEVEL 1 - GROUP F for a precise SV.

CAUTION:

It is not possible to change to manual operation in the following cases:

When AUTO-TUNING is executed LEVEL 2 - GROUP A

When RAMP CONTROL is executed LEVEL 2 - GROUP A-2

When STAND-BY is selected LEVEL 2 - GROUP A-3

AUTO -TUNING: STOP >EXEC		
---	--	--

RAMPING STOP >RUN		
--	--	--

CONTROL >ST-BY EXEC		
--	--	--

REMARK: During manual operation, it is possible to change SV.

To return to automatic control, press the FUNC and ENT keys. The lamp MAN goes out.

12-3. Setting Limits of Control Output (Level 1 - Group F)

The value of CONTROL OUTPUT SIGNAL can be restricted by HIGHER and LOWER LIMITS, for each SV No.

INITIAL SETTING

1) Higher Limit

Initial value: 100% of the full range

Extent of setting: $\text{LOWER LIMIT} < \text{HIGHER LIMIT} < \text{OR} = 105\% \text{ OF FULL RANGE}$

The HIGHER LIMIT can never be smaller than the lower limit.

2) Lower Limit

Initial value: 0% or the full range

Extent of setting: $-5\% \text{ of THE FULL RANGE} < \text{OR} = \text{LOWER LIMIT} < \text{HIGHER LIMIT}$

The LOWER LIMIT can never be larger than the higher limit.

Procedure for Setting Limit

Press the DISP key to get out of Group A. Then go to GROUP F (OUTPUT LIMIT) by using the  key. Get into this group with the ENT (or ) key. Move to the correct parameter by using the FUNC key and change the values by means of the QCK,  and  keys. Enter them by pressing the ENT key.

MODE 0 AND MODE 2 "1 OUTPUT"

R_OLT	100%	0%
1_OLT	100%	0%

HIGHER LIMIT

LOWER LIMIT

MODE 1 AND MODE 3 "2 OUTPUT"

R_OL1	100%	0%
R_OL2	100%	0%

HIGHER LIMIT

LOWER LIMIT

TABLE OF ORDER OF APPEARANCE OF LIMIT SETTING

No. of SV (Set value)	1 OUTPUT		2 OUTPUTS	
	MODE 0	MODE 2	MODE 1	MODE 3
SV_R	R_OLT	R_OLT	R_OL1 R_OL2	R_OL1 R_OL2
SV_1	1_OLT	1_OLT	1_OL1 1_OL2	1_OL1 1_OL2
SV_2		2_OLT		2_OL1 2_OL2
SV_10		10_OLT		10_OL1 10_OL2

13. Parameters of Level 2

13-1. Setting Parameters of Auto-tuning (Level 2 - Group A)

INITIAL SETTING

Initial selection : STOP

AUTO -TUNING:
>STOP EXEC

PROCEDURE OF SETTING AUTO-TUNING

To move out of the initial screen, call the screen of AUTO-TUNING at the head of LEVEL 2 by pressing the DISP and  keys. You can now make your selection by using the FUNC key and enter it with the ENT key. For detailed information, see Paragraph 9-7 (page 22).

13-2. Mode of Selection of Setting and Mode of Operation (Level 2 - Group A-1)

This screen allows you:

- 1) by the MODE OF SELECTION OF SETTING, to determine whether the call of different SV is made at the instrument keyboard level or at a distance through the connector of EXTERNAL CONTROL/OPERATION.
- 2) by the OPERATING MODE, to determine whether parameter setting and modifications of data are made at the instrument keyboard level or in the COMMUNICATION mode by the INTERFACES RS-232C or RS-422A.

INITIAL SETTING

The MODE OF SELECTION OF SETTING SV__SEL is positioned on:

SS: KEY, that is, on the keyboard.

The MODE OF OPERATION OPE is set at :OP : LOC, that is, local.

Accordingly, if you use the instrument only with the keyboard, you have no modifications to change.

SV_SEL & OPE
SS:KEY OP : LOC

PROCEDURE OF MODE OF SELECTION

To reach the screen of MODE OF SELECTION OF SETTING and MODE OF OPERATION from the preceding screen, press the  key. Next, make your selection by using the FUNC,  and  keys and enter with the ENT KEY.

1) Mode of Selection of Setting SV__SEL

You have a choice between selecting the SET VALUE No. at the level of the keyboard or through the connector of EXTERNAL CONTROL/OPERATION.

SS: KEY: In this case, the SV No. is selected on the keyboard of the instrument.

SS: EXT: The lamp ESV lights up and selection of the SV No. is entered by external contacts (via the connector of EXTERNAL CONTROL/OPERATION). Any value of SV No. out of the range 1 to 10 is considered as 1.

13-3. Selection between STAND-BY (Suspension) and Normal Control (Level 2 - Group A-3)

When the control is in the STAND-BY state, the output signal is blocked until, for example, a system which has just been set in motion becomes stable. Then, it is possible to start control.

This can be used also for blocking the control when, after assigning "DI", you want to confirm that the DI does not disturb the system at the moment of switching.

INITIAL SETTING.

Initial selection is: EXEC

CONTROL ST-BY > EXEC

PROCEDURE OF SELECTION

Move out of the preceding screen and go to the screen of selection of STAND-BY or EXECUTION of control by pressing the  key twice. Select one of the two options with the ENT key. To confirm:

- ST-BY ... The control output signal moves to 0% and control is no longer in action. The MEASUREMENT indication flashes.
- EXEC Control resumes, based on the setting entered.

13-4. Setting of Output Cycle Time (Level 2 - Group B)

INITIAL SETTING.

Initial value: 30 sec.

OUT CYCLE (Sec)
01 : 30 02 :

PROCEDURE FOR SETTING CYCLE TIME

Move out of the previous GROUP by pressing the DISP key. Go to GROUP B with the  key. Move into this GROUP by using the ENT key. As the screen sought is at the head of this GROUP, you can now enter desired values by using the FUNC, QCK,  and  keys. Then, enter them with the ENT key.

For a more detailed description of the time of cycle, see page 14.

13-5. Initial Presetting of Output Signal Value (Level 2 - Group B-1)

By presetting the value of the output signal, it is possible to give it a value at the starting point which will be taken when power is applied to the instrument. This value can be set in a range from -5% to + 105% independently from one calculated by PID actions. Thereafter, the normal control resumes its role.

INITIAL SETTING.

The initial value: 50%

Setting Range: - 5 to + 105%

PRE_OUT
01 : 50 % 02 : _%

PROCEDURE FOR PRESETTING INITIAL VALUE

In getting out of the previous screen, just press the  key to reach the screen of presetting. Obtain the desired value displayed by using the QCK,  and  keys, and enter it with the ENT key.

In PID and PI Mode

- Setting of PRE __ OUT < 50% for a heater having a high capacity enables you to avoid exceeding current limits on start up.
- Setting of PRE __ OUT > 50% for a heater having a low capacity enables you to reach your set value at a higher speed.

Note: PRE __ OUT 02 is not usable.

13-6. Setting of Output Value in Case of Out-of-Range of Measurement (Level 2 - Group B-2)

When the measurement (PV) gets out of the range, i.e. error, the CONTROL OUTPUT signal is brought back to a SAFETY value (mostly 0%). This screen allows you to register the SAFETY VALUE you have selected.

INITIAL SETTING.

Initial value: 0%

Setting Range: - 5 to + 105%

PV_ERR_OUT

01 : 0% 02 : _%

PROCEDURE OF SETTING SAFETY VALUE

To move out of the preceding screen, call the screen "Value in case of Out-of-Measurement-Range" by using the  key, set a value by using the QCK, Δ and ∇ keys, and enter with ENT.

13-7. Setting of PV and Remote BIAS (Level 2 - Group C)

This function is provided to compensate the error in Measured Value (PV) and Remote Value (REM).
(This function is for sensor compensation.)

INITIAL SETTING.

RTD AND THERMOCOUPLE INPUTS

Initial value: 0.00°C

Setting Range: - 99.99 to 99.99°C / °F

LINEAR INPUTS

Initial value: 0.00 U (U = unit of temperature)

Setting Range:

Format of measurement	[	XXXX	- 999.9 to 999.9 U
		XXX.X	- 99.99 to 99.99 U
		XX.XX	- 9.999 to 9.999 U
		X.XXX	- 0.9999 to 0.9999 U

P_BIAS 0.00°C

R_BIAS 0.00°C

PROCEDURE FOR ALIGNMENT OF MEASUREMENT DEVIATION

Move out of GROUP C, first get out of the preceding group by using the DISP key. Next, press the Δ and ENT (or ) keys to get into GROUP C. You are now in front of the screen you seek. Then, by using the QCK, Δ and ∇ keys, enter the desired value. You can select from PV or REM by means of the FUNC key. The value is entered with the ENT key.

13-8. Setting of Digital Filter (Level 2 - Group C-1)

This setting allows, if necessary, a suppression of the noise of analog signals of MEASUREMENT and REMOTE inputs.

INITIAL SETTING.

Initial value: 0s (This means that there is no filtering.)

Setting Range: 0 to 100s

PV_FILT 0 s

RS_FILT 0 s

PROCEDURE FOR SETTING OF FILTERING

From the preceding screen, just press the  key and you are in the right screen. Use the FUNC key to select PV FILT or RS FILT and enter the designated value by using the QCK, Δ and ∇ keys, then, enter with the ENT key.

13-9. Setting of Effective Range of PV Measurement (Level 2 - Group C-2)

With this setting, you can adjust the MEASURING range by a certain proportion. When this range is exceeded upward or downward, the ERR lamp lights up and, if you have assigned the error ERR to an output of event (DO.. or EV..), the corresponding output will be activated.

INITIAL SETTING.

Initial value: L = - 10% H = 110%

Setting range: L = 0 to - 10% of full scale
H = 100 to 110% of full scale

PV_O.K_RNG

L: - 10% H: 110%

PROCEDURE FOR SETTING EFFECTIVE RANGE OF MEASUREMENT

Move out of the previous screen, press the  key to make the screen of "PV_O.K_RNG / L: - 10% H: 110%" appear. Set the values by using the QCK  and  keys, change items with the FUNC key and enter them with the ENT key.

13-10. Setting of Effective Range of REMOTE (Level 2 - Group C-3)

With this setting, you can adjust the range of the external setting (REMOTE) by a certain proportion. If you are in REM (SV No. = RE) and you have assigned the error ERR to an output of events (DO..or EV..), when the higher or lower limit of this range is exceeded, the ERR lamp lights up. Further, if you have assigned the error to an event output, the corresponding output will be activated.

INITIAL SETTING.

Initial value: L = - 10% H = 110%

Setting Range: L = 0 to - 10% of full scale
H = 100 to 110% of full scale

RSV_O.K_RNG

L: - 10% H: 110%

PROCEDURE FOR SETTING EFFECTIVE RANGE OF REMOTE

Move out of the previous screen, press the  key to make the screen of "RSV_O.K_RNG / L: - 10% H: 110%" appear. Set the values by using the QCK,  and  keys, change items with the FUNC key and enter them with the ENT key.

13-11. Assignment of Inputs of Remote Control (Level 2 - Group D)

It is possible to assign 4 inputs DI1 to DI4 (DI = Digital Input) (located on the external CONTROL/OPERATION CONNECTOR) selected from the 7 operations shown in the following table.

MODE OF OPERATION	FUNCTION	INHIBITION	TYPE OF SIGNAL
NOP	NO OPERATION		STATE OF CONTACT
MANual	MANUAL OPERATION	AT, RUN, STBY	STATE OF CONTACT
REMOte SV	EXTERNAL SETTING	AT	STATE OF CONTACT
Auto-tuning	AUTO-SETTING	MAN, STBY	* Immediate on closing
Stand-By	SUSPENSION OF CONTROL		STATE OF CONTACT
Direct-Act	DIRECT ACTION	AT, RUN	STATE OF CONTACT
STOP	STOP RAMP CONTROL		STATE OF CONTACT

The event STAND-BY blocks the functioning of the operation regardless of whether it is in external operation or at the keyboard. If an operation is assigned to a DI, the corresponding operation at the keyboard will not function because the ASSIGNMENT TO A "DI" TAKES PRIORITY.

- * All modes of operation require continuous closing of contact. Auto-tuning is started immediately on closing of contact and continue in operation even if contact is opened. Further re-closing of the contact will stop auto-tuning.

INITIAL SETTING.

Initial value: NOP for DI1 to DI4

**DI_ASSIGN
DI1 :NOP**

PROCEDURE FOR ASSIGNING DI'S

To move from GROUP C, where we were before, to GROUP D, get out of the group by pressing DISP and then Δ to proceed to the first screen of GROUP D which assigns DI1. Move into the group with the ENT (or $\curvearrowright$) key and assign to DI1 a function (operation) by means of the Δ and ∇ keys. Enter your selection with the ENT key. To set the other DI's, proceed to their screens by using the $\curvearrowright$ key and repeat the steps mentioned above for DI1.

FUNCTIONING OF OUTSIDE OPERATIONS

NAME OF OPERATION	ROLE OF OPERATION	ACTION OF CONTACT OF DI	
		OPEN	CLOSE
NOP	NO OPERATION		
REM / LOC	EXTERNAL / LOCAL SETTING	LOCAL	EXTERNAL
MAN / AUTO	MANUAL / AUTO CONTROL	AUTO	MANUAL
DA / RA	DIRECT / REVERSE ACTION	REVERSE	DIRECT
STBY / EXEC	YES / NO SUSPENSION OF CONTROL	NO	YES
STOP / RUN	RUN / STOP RAMP CONTROL	RUN	STOP
AT-EXECUTE	EXE / STOP AUTO-TUNING	Refer to the * above.	

13-12. Calibration of Range for Voltage/Current Inputs (Level 2 - Group E)

In the case of linear inputs, there are two selections possible:

- 1) Position of decimal point of your range
- 2) Extent of your actual measuring range

INITIAL SETTING.

1) Position of Decimal Point

Initial place: XXX.X

Possible selection: XXXX to X.XXX

2) Setting of Extent of Range

Initial setting: PVH = 100.0% PVL = 0.0%

(The unit % is the factory-set parameter. If you change the unit to be used, for example °C, °C will appear on the screen in place of %.)

Setting range: -1999 to +9999

SCALING

D.P:

XXX.X

PVH:

100.0%

PVL:

0.0%

PROCEDURE OF CALIBRATION OF RANGE

1) Position of Decimal Point

Move out of the previous group by pressing the DISP key. Next, go to GROUP E by using the Δ key. The screen at the head of this group is that for calibration of measurement for voltage/current inputs. Get into this group by the ENT (or $\curvearrowright$) key and select the position of decimal point by using the ∇ and Δ keys. Enter it with the ENT key.

2) Selection of Extent of Range

The screen following the above screen is that of setting the extent of range, so just press the $\curvearrowright$ key. Enter the high and low values by using the QCK, Δ and ∇ keys and FUNC key for moving from one parameter to another. Enter your selection with the ENT key.

13-13. Limitation of Set Value (SV) (Level 2 - Group E-1)

For thermocouple and RTD input type, it is possible to provide limits to set values to restrict them. (The screen shown below is at the head of the group.)

INITIAL SETTING

Initial values: SVH = 100% of full scale, SVL = 0% of full scale

Setting range: Within measuring range

SVH:

400.0°C

SVL:

0.0°C

PROCEDURE FOR LIMITING SET VALUES

Get into GROUP E as described in paragraph 13-12 (Restart from GROUP D since the screen of LIMITATION OF SV is at the head of GROUP E in the case of inputs by thermocouple and RTD). Enter the higher and lower values by using the QCK, Δ and ∇ keys and FUNC key for moving from one parameter to another. Enter your selection with the ENT key.

13-14. Limitation of Remote Signal (External Setting) (Level 2 - Group E-2)

To provide a higher and lower limit to an externally set value (REMOte). This serves as a frame to confine the set value.

INITIAL SETTING

Initial values: RSH: 100% of full scale, RSL = 0% of full scale

RSH :	400.0%
RSL :	0.0%

PROCEDURE OF LIMITING REMOTE SIGNAL

1) Linear Inputs

Previously we were in the screen of SETTING OF EXTENT OF RANGE (See paragraph. 13-12). To reach the screen sought press the  key. Enter the higher and lower values by using the QCK,  and  keys and FUNC key for moving from one parameter to another. Enter your selection with the ENT key.

* The unit on the screen is the one selected at the beginning.

2) Thermocouple and RTD Inputs

Start from the screen LIMITATION OF SET VALUE (SV) (See Para 13-13) and reach the screen sought by pressing the  key. Then, enter the higher and lower values by using QCK,  and  keys and FUNC key for moving from one parameter to another. Enter your selection with the ENT key.

Note: If the ERR lamp lights up in EXTERNAL SETTING (SV No. = rE), it shows that the setting has exceeded one of the values designated for the extent of range (SCREEN RSV __ O.K __ RNG.LEVEL 2 - GROUP C).

13-15. Selection of Mode of Control (Level 2 - Group G)

This is just a reminder. For detailed description, see paragraph 9-1 on page 14.

INITIAL SETTING

Initial selection: Mode 2 for 1 output instrument
Mode 3 for 2 output instrument

MODE : 3	OUT:DUAL
SV :MULT	RMP:U/D

PROCEDURE FOR SELECTION OF MODE

Get out of the group where we were before by means of the DISP key. For access to GROUP G, press  twice and get into it by using the ENT (or  key). The screen MODE OF CONTROL is at the head of GROUP G. Select mode by using the  and  keys. Enter it with the ENT key.

13-16. Selection of Direct/Reverse Action (Level 2 - Group G-1)

In this screen you can decide whether the action of control output signal is DIRECT or REVERSE.

INITIAL SETTING

Initial Selection: REVERSE (REV)

Possible Selection: DIRECT = DIR

REVERSE = REV

CONT_ACTION

>REV

DIR

PROCEDURE OF SELECTION OF DIRECT/REVERSE ACTION

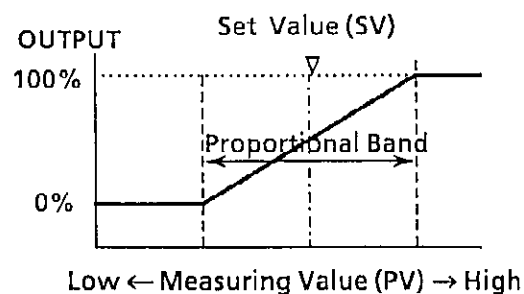
To get out of the preceding screen, press the  key and you are in the screen required. Then select the mode of action by the FUNC key and enter with the ENT key.

EXPLANATION OF ACTION

DIR: Direct Action

The measurement and the control output signal progress in the same direction. If the PV increases (relatively to the set value), the output signal increases. This mode of action is generally used for CONTROL OF COOLING.

Output, Set value (SV), Proportional band, Low ← measurement → high.



REV: Reverse Action

The measurement and the control output signal progress in opposite directions. If the PV increases (relatively to the set value), the output signal decreases. This mode is generally used for CONTROL OF HEATING.

Note:

- A change in the direction of action during AUTO-TUNING or ramp control is impossible.
- If the SR25 has contact output, the direction of action to be used does not affect the connection of output terminals:

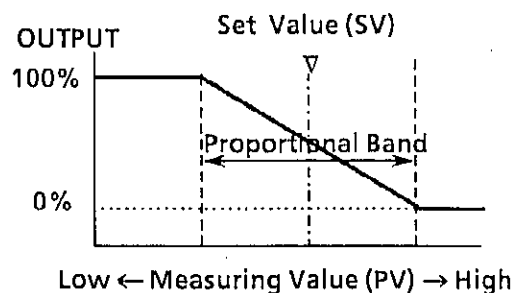
C1 (13), L1 (14) for the output 1

C2 (16), L2 (17) for the output 2

- In the 2 output instrument, if the direction of action of one output is changed, the direction of the other output will also be changed.

REV to output 1 → DIR to output 2

DIR to output 1 → REV to output 2



13-17. Tracking of External Setting (REMOte) (Level 2 - Group G-2)

This function allows a set value to be remotely set against a set value number.

CAUTION: (In keyboard mode - SS/KEY - Level 2 - Group A-1)

The selection between REM and LOC is possible by assignment of DI (page 30), but the switching from REMote to local through a DI as an intermediary allows a change only to SV No. 1. (To move a selected SV No. is impossible.)

INITIAL SETTING

Initial Selection: NO

RSV TRACKING	
>NO	YES

PROCEDURE OF TRACKING EXTERNAL SETTING

To move out of the preceding screen, press the ENT key and you are in the screen required. Select the mode of action by the FUNC key and enter it with the ENT key.

TYPE OF ACTION

1. Commands using the keyboard (Level 2 - Group A-1 on KEY. See p.27)
2. Commands using DI (remote set value) as intermediary (See Page 35) and remote operation of SV (Level 2 - Group A-1).

From DI's, by REM/LOC switching, you can move from the externally set value to a selected SV (and also by remote operation).

13-18. Compensation of Cold Junction (Level 2 - Group G-3)

This function allows you to decide whether the compensation of cold junction is made at instrument or externally. (This screen is available only for T / C input)

INITIAL SETTING

Initial selection: INTER

Possible Selection: INTER - Internal EXTER - External

C. J_COMPEN.	
>INTER	EXTER

PROCEDURE OF SELECTION OF COMPENSATION

To move out of the preceding screen press the  key and you are in the screen required. Make your selection by using the FUNC key and enter it with ENT.

13-19. Setting Time of Return to Initial Screen (Level 2 - Group G-4)

You can set a time at the end of which the initial screen reappears if no key is pressed. This return can even be neutralized.

INITIAL SETTING

Initial value: OFF

Possible Setting:

RET_TIME	
OFF	60s

ON: The displayed value represents the time period in seconds to elapse between the last key operation and the return to the INITIAL screen.

Period can be set from: 10 to 125 seconds

If ON is selected the initial period is 60 seconds.

OFF: Even if a value is displayed, the instrument will not return to the initial screen unless you press the DISP key twice or 3 times.

PROCEDURE OF SETTING TIME OF RETURN TO INITIAL SCREEN

To move out of the previous screen, press the  key and you will reach the screen required. By pressing the  or  key you can move from ON ↔ OFF. Select ON and set the time by using the FUNC key and enter a value by means of the ,  and QCK keys. Enter your selection with the ENT key.

13-20. Assignment of Supplementary Analog Outputs (Level 2 - Group H)

This screen is only for supplementary analog outputs, copied from measurements, set values or output signals. The communication of computer type is not referred to in this paragraph since it has its own manual.

INITIAL SETTING

Initial selection: 1 Supplementary output: 1 : PV (Measurement)
2 Supplementary outputs: 1 : PV 2 : SV (Set value)

Possible selection: Measuring value PV
Local set value SV
Deviation DEV
Remote set value RSV
Control output 1 OUT1
Control output 2 OUT2

TRANSMISSION	
1 : PV	2 : SV

PROCEDURE OF ASSIGNING SUPPLEMENTARY ANALOG OUTPUT

To move out of the previous screen and enter GROUP H, first leave GROUP G by pressing the DISP key. Proceed to the required screen at the head of Group H by the  key. Press the ENT (or  key. Possible options can be scanned by the  and  keys. In case of two supplementary outputs, use the FUNC key to move from one to the other. Enter it with ENT.

13-21. Limitation of Supplementary Analog Outputs (Level 2 - Group H-1 and 2)

It is possible to limit the extent of range of outputs of the 6 types shown in the preceding paragraph. The following explanation is applicable to all points on the next screen H-2.

INITIAL SETTING

There are always maximum limits of the extent of range.

Example: PV = 0-500°C → If selected PV T1H = 500°C, T1L = 0°C

All the ranges can be limited T1H (higher limit) > T1L (lower limit).

T1H :	500.0 °C
T1L :	0.0 °C

PROCEDURE OF LIMITING SUPPLEMENTARY ANALOG OUTPUTS

To move out of the previous screen press the  key which takes you to the screen sought. Enter new values by the Δ , ∇ and QCK keys and use the FUNC key to move from one limit to the other.

Enter them with the ENT key.

T2H :	500.0 °C
T2L :	0.0 °C

TYPE	EXTENT OF SETTING	INITIAL VALUE
MEASUREMENT (PV)	HIGHER AND LOWER LIMITS OF MEASURING RANGE	H: HIGHER LIMIT L: LOWER LIMIT
SET VALUE (SV)	HIGHER AND LOWER LIMITS OF MEASURING RANGE	H: HIGHER LIMIT L: LOWER LIMIT
DEVIATION (DEV)	- / + 100%	H: 100% L: 0%
REMOTE (RSV)	HIGHER AND LOWER LIMITS OF MEASURING RANGE	H: HIGHER LIMIT L: LOWER LIMIT
CONTROL OUTPUT 1 (OUT 1)	0 TO 100%	H: 100% L: 0%
CONTROL OUTPUT 2 (OUT 2)	0 TO 100%	H: 100% L: 0%

14. Parameters concerning Level 3

14-1. Locking of Screen (Level 3 - Group A)

The locking of screens is possible to avoid accidental inputs of data.

INITIAL SETTING

Initial selection: OFF

A locked screen is marked with an asterisk on the upper left corner.

Possible selection:

ON: The parameters of the locked screen can not be modified.

OFF: The parameters of the locked screen can be modified.

KEYLOCK
MON : OFF SVn: OFF

*

TYPES OF GROUPS CAPABLE OF BEING LOCKED

GROUPS		GROUPS	
MON	: Display	SVn	: Setting of values
PID	: Setting of PID	E/D	: Outputs of events
RMP	: Ramp control	OLT	: Limits of control outputs
CTL	: Control	OUT	: Control output
INP	: Inputs	DIA	: Assignment of DI
SCL	: Limits of ranges	RDT	: Parameters of ramps
MOD	: Modes	OPT	: Options
INI	: Initialization	RNG	: Units and ranges

PROCEDURE OF LOCKING OF SCREENS

To move out of the previous group press the DISP key and move to LEVEL 3 by pressing the DISP and  keys. We are now in Group A and the screen required (No need to press ENT because we are in a group at the head). Use the  and  keys to move ON to OFF and the FUNC key to move from one item to another on the same screen. For scanning all the locked screens of this group make use of the  key. Enter your selection by the ENT key.

14-2. Initialization (Level 3 - Group B)

The SR25 has two ways of returning to the initial values. The initial values are different depending on the type of initialization (See table on the next page).

INITIAL SETTING

Initial selection: NO

Possible selection: EXEC with the value 0 (EXEC 0)
EXEC with the value 1 (EXEC 1)

INITIALIZE
>NO EXEC0

PROCEDURE OF INITIALIZATION

To move out of the previous group press the DISP key. Then, go to the next group i.e. GROUP B by using the  key. Get into this group by pressing the ENT (or ) key and make use of the FUNC key to select one or the other option. If you select EXEC, choose your type of initialization, 0 or 1, by using the  and  keys. Enter your selection with the ENT key.

TABLE OF TWO TYPES OF INITIALIZATION

PARAMETERS	0	1
AUTO / MAN	AUTO	AUTO
SV (Value)	Lower limit	Lower limit
No. of SV in action	1	1
P.I.D.	----	Initial value
EV / DO (Event outputs)	----	Initial value
OUT LIMIT	----	Initial value
SV SEL (SV Selection mode)	----	KEY
OPE (Interactive mode)	----	LOC
RAMP	STOP	STOP
OUT CYCLE	----	30 s
PRE-OUT	----	50 %
PV BIAS	0	0
RS BIAS	0	0
PV FILT	----	0
RS FILT	----	0
PV ERR OUT	0	0
PV O.K. RNG	Initial value	Initial value
DI ASSIGN	----	NOP
PV SCALING	Initial value	Initial value
SV LIMIT	Initial value	Initial value
RAMP UNIT	----	U / Min
RAMP RATE	----	1 / 10
MODE	----	2(3)
CONT ACTION	----	REV
REM -> LOCAL	----	DIR
CJC1 (Cold junction compensation)	----	INT
RET TIME	----	OFF - 60
KEYLOCK	----	OFF
UNIT TC / RTD	----	°C
UNIT LIN	----	%
Pt TYPE	----	IEC
TRANS KIND	----	PV - SV
TX SCALING	----	0 to 100% FS
MN	----	0
ZPS	----	1200
DATA / PARI	----	7 / E

14-3. Display of Type of Control Outputs (Level 3 - -Group D)

The screens of this group are for monitoring purposes. Hence, you can not intervene in the displayed parameters.

PROCEDURE TO MOVE TO MONITOR SCREENS

First, move out of GROUP B where you were before by pressing the DISP key and proceed to GROUP D by pressing the  key twice. Move into this group by using the ENT (or ) key. When  is pressed, ALL THE SCREENS OF THIS GROUP are displayed.

01 : mA 4 --> 20
02 : RELAY

Example:

Output 1: 4 - 20mA

Output 2: relay

14-4. Display of Types of Supplementary Analog Outputs (Level 3 - Group D-1)

PROCEDURE TO MAKE ACCESS

To move out of the previous screen, press .

TX1 : mV 0 --> 10
TX2 : NO PROVIDED

Example:

1st output→ 0 - 10 mV

2nd output: Not provided

14-5. Nature of Remote Communication (Level 3 - Group D-2)

This screen is for communication through interface RS232C or RS422A and for REMOTE (external setting).

PROCEDURE TO MAKE ACCESS

To move out of the previous screen, press .

COM : NO PROVIDED
RSV : N V 0 --> 10

Example:

Interface: Not provided

Remote: RSV→ 0 - 10 V

15. Control with 2 Outputs (Heating/Cooling)

A controller of this type is called HEATING/COOLING as it has an output for heating (RA - Reverse Action) as well as for cooling (DA - Direct Action). Accordingly, heating or humidification and cooling or dehumidification are included in the same process of control.

In the SR25 control outputs are assigned as follows:

- Control output No. 1: Heating or humidification: Control by PID, Auto-Tuning
- Control output No. 2: Cooling or dehumidification: Proportional control

SETTING IN HEATING/COOLING CONTROL

- Selection of modes
- Setting of the coefficient of proportional band (K2) ※ If K2 = ON/OFF, setting of hysteresis (H) is required.
- Setting of the dead band (DB)

15-1. Selection of Modes (Level 2 - Group G)

For proceeding to HEATING/COOLING CONTROL, it is compulsory to be in mode 1 or 3 (Dual = 2 outputs).
For initial setting and procedure, see page 14.

15-2. Setting of Coefficient of Proportional Band (Level 1 - Group C)

The screen of setting coefficient K2 follows the screen of setting PID for the control output No. 1 (corresponding to the same No. of SV).

INITIAL SETTING

Initial value: K2 = 1.0

Setting Range: 0.0 = ON/OFF, 0.1 to 10.0

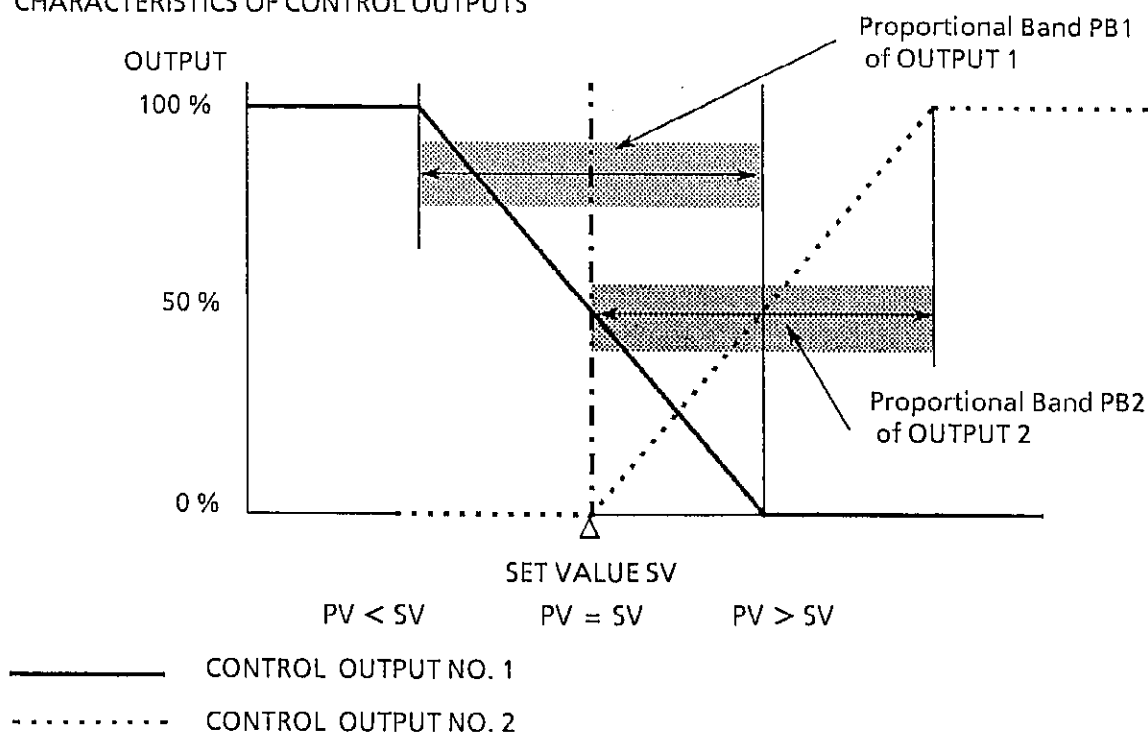
PROCEDURE OF SETTING OF COEFFICIENT OF PROPORTIONAL BAND FOR OUTPUT 2

Move out of the initial screen and proceed to GROUP C by the sequence of DISP, Δ , ∇ and ENT (or $\curvearrowright$) keys. When $\curvearrowright$ is pressed the screen of K2 appears. Set the value by using Δ , ∇ and QCK. Enter it with the ENT key. This process is the same for all the SV's.

PID_1	P :	3.0%
	I :	120s
	D :	0s

PID_1	K2 :	1.0
	DB :	0.0%

CHARACTERISTICS OF CONTROL OUTPUTS



Explanation and Setting of Value of K2

The PROPORTIONAL BAND of OUTPUT 2 is expressed by:

$$PB2 = 1/K2 \times \text{PROPORTIONAL BAND (\%) OF OUTPUT 1}$$

$$PB2 = 1/K2 \times PB1$$

Note: When PB1 = ON/OFF, PB2 is calculated with an arbitrary value of 10%.

Example:

Assuming that the proportional band of OUTPUT 1 is 10% and the coefficient of proportional band K2 takes values of 0.1, 1.0 and 10.0 successively, then the proportional band PB2 of OUTPUT 2 will take in its turn the following values:

$$K2 = 0.1, \quad PB2 = PB1 / K2 = 10.0 / 0.1 = 100\%$$

$$K2 = 1.0, \quad PB2 = PB1 / K2 = 10.0 / 1.0 = 10\%$$

$$K2 = 10.0, \quad PB2 = PB1 / K2 = 10.0 / 10.0 = 1\%$$

Output 2 Parameter in ON/OFF

Output 2 can be put in ON/OFF control. In this case a new parameter of hysteresis appears which can be set. For moving into ON/OFF, set K2 to 0.

INITIAL SETTING

Initial value: H: 0.1%

Setting Range: 0.1 to 9.9% of full scale

PID_1	K2: 1.0
	DB: 0.0%



PROCEDURE OF SETTING HYSTERESIS OF OUTPUT 2

Bring the value of K2 to 0.0 by pressing the ∇ key and enter it with the ENT key. K2 shows "ON/OFF" in place of a value, and the hysteresis is shown in the lower line.

PID_1	K2 : ON/OFF
H: 0.1%	DB : 0.0%

15-3. Setting of Dead Band (DB)

Using the heating/cooling control may require the use of a dead band. When very stable and prompt control of temperature is required, the use of dead band is discouraged while it is recommended for slow and less precise control in which one wants to realize energy saving.

INITIAL SETTING

Initial value: DB: 0.0%

Scope of setting: -50.0 to 50.0%

PID_1	K2: 1.0
	DB: 0.0%

PROCEDURE OF SETTING DEAD BAND

By using the FUNC key, proceed to the parameter DB, which can be set by the Δ , ∇ and QCK keys. Enter it by the ENT key.

EXPLANATION OF ROLE OF DEAD BAND

-Dead Band in Control

Using dead band produces an energy saving effect.

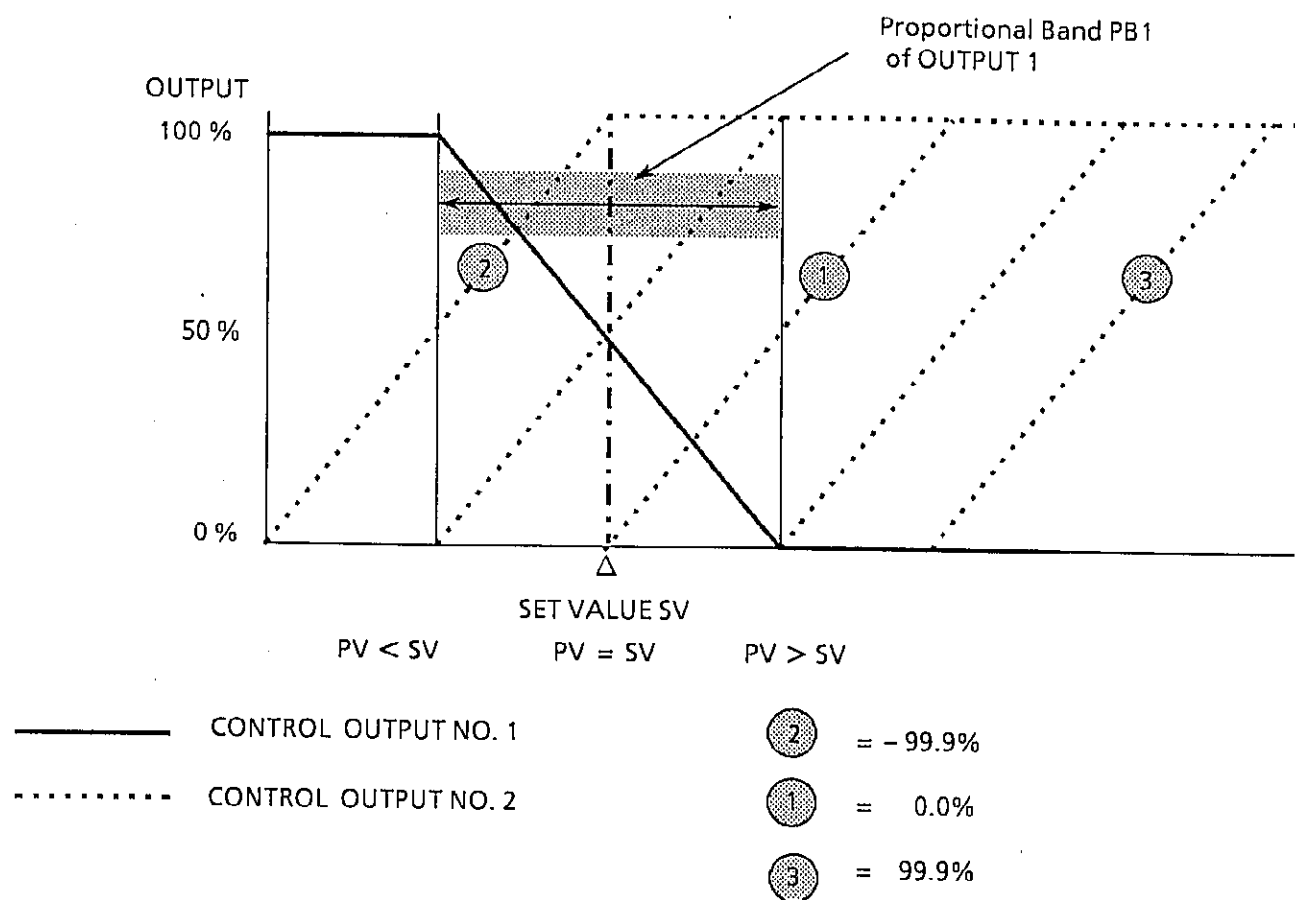
-Overlapped Control

Overlapping of the two control OUTPUTS (OUTPUTS 1 and 2 activated simultaneously) will be more energy consuming but it will give closer control.

-Use of Auto-Tuning

If auto-tuning is executed in the "2 outputs" mode, the PID value of the "1 outputs" side will change depending on the results of auto-tuning, however, the values of K2 and DB of the "2 outputs" side will be the same as those before auto-tuning execution.

CHARACTERISTICS OF OUTPUT WITH DEAD BAND



16. Explanation of Terms and Functions

MULTI-SV

In mode 2 or 3, it is possible to show up to 10 different set values of which the Nos. are selected by using the SV key. These set values can be switched with RSV (Externally set values→REMOTE). On the screens of SV, the set value in action is indicated by the presence of [E] to the left of the set value.

MULTI-PID

To each No. of SV's the values of P., I., D can be set. In accordance with these values, P, PD, PI, PID and ON/OFF control is possible. Manual reset control is available for the P control and PD control.

OUTPUTS OF EVENTS

The 8 events are as follows: PV (absolute value), SV (absolute value), DEV (value of deviation), AT (auto-tuning), REM (external setting), RUN (ramp control), MAN (manual control) and ERR. They are generated as DO1 and DO2 (standard version) on the connector of external control/operation (outputs to open collector) and as EV1, EV2, EV3, (option) on terminals (contacts of relays). In total the SR25 can use 5 outputs of events, selected from the above-mentioned eight.

LIMITS OF CONTROL OUTPUTS

The higher and lower limits enable maximum and minimum values of control outputs to be fixed. The control outputs can not take values other than those between the maximum and the minimum.

AUTO-TUNING

The parameters of PID. The optimum is calculated automatically during auto-tuning by the method called "cycle limit". At the end of calculation, the instrument is placed under control with the calculated parameters. It is possible to change the value found, manually.

PRE-SETTING OF OUTPUTS (PRE-OUT)

It is possible to preset the value of control output signal when power is first applied or control is resumed after a suspension (Stand-by).

VALUE IN CASE OF OUT-OF-RANGE MEASUREMENT (BURNOUT)

If a measurement exceeds the normal range, it is alarmed by ERR (ERROR = out of the measuring range) and the output is brought to a safe value (approximately 0%). This value can be set from -5 to 105%.

OFFSET ADJUSTMENT OF SENSOR (PV BIAS)

This is the function to correct deviation of measurement (PV). For example, this deviation may be produced by a drift of a thermocouple output caused by its deterioration.

SETTING OF DIGITAL FILTER

The circuits of input of measurement (PV) and of externally set value (RSV) are provided with a digital filter which is programmable to constant of time (time-lag filter).

EXTENT OF RANGE (PROGRAMMABLE SCALING)

In the case of linear inputs, the extent of range can be defined between -1999 and + 9999 and the position of decimal point between XXXX and X.XXX. For thermocouples and RTD inputs, the extent of set values as well as externally set values can be restricted by higher and lower limits.

SETTING FOR RAMP CONTROL (in multi-SV mode)

This setting allows the SR25 to carry out ramp control.

17. Parts for Connection to SR25

Plug for External Control/Operation

This is a miniature 24-pin FEMALE DIN plug on the instrument. The male connector is provided in the instrument package.

ARRANGEMENT OF PINS

OUTPUTS*	NO. OF PIN	NO. OF PIN	INPUTS**
DO - COM	24	12	DI, SV - COM
DO 1	23	11	DI 1
DO 2	22	10	DI 2
	21	9	DI 3
	20	8	DI 4
	19	7	SV SEL1 BIN CODE
	18	6	SV SEL 2
	17	5	SV SEL 4
	16	4	SV SEL 8
	15	3	
	14	2	
	13	1	

* Open collector outputs

** Unpolarized, external contact inputs

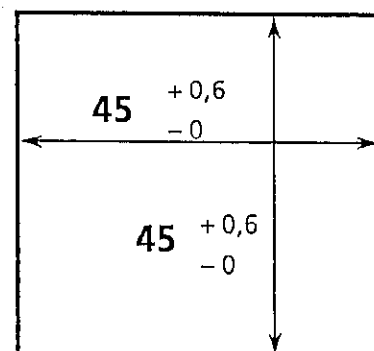
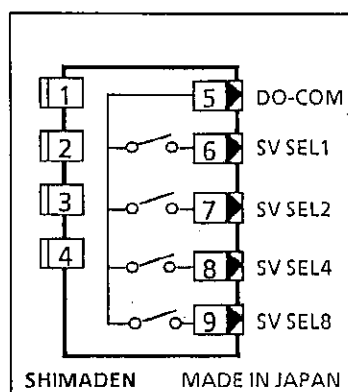
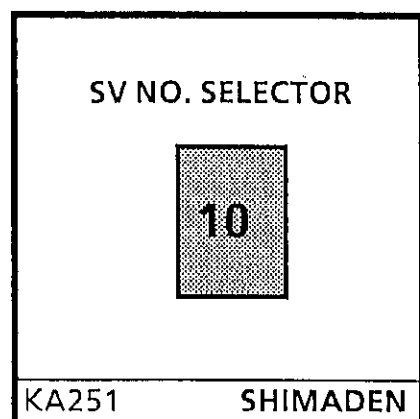
Cable for Connection to Plug DIN and External Contacts

Shield cable, with 14 marked wires, can be provided as an option to the instrument. It is equipped with a male connector DIN miniature at one end and wires with fork terminals at the other end. Its standard length is 1 metre.

External Selector of SV No.

This is a 10-position switch for selection of SV No. remotely.

(Reference No. KA251) Sizes: 48 × 48 × 100mm



Cut in mm

18. Complete Technical Specifications

DISPLAY

Digital Display	7-segment LED
	PV (Process Value = Measurement) = displayed in red, 14.3mm in height
	SV (Set Value) = displayed in green, 10.0mm in height
	SV No. = displayed in green, 10.0mm in height
LCD Display:	16 Alpha-Numerical x 2 lines (with back light)
Tolerance:	- / + 0.1% - / + 1 digit (standard precision at 23°C - / + 5°C)
Resolution:	Depends on the range: 0.001, 0.01, 0.1, 1
Sampling Cycle:	0.1 second
°C / °F Indication:	Selectable by key

PARAMETER SETTING

Local:	By 8 keys on the front
	Extent of setting identical to the extent of measurement
	Multi-SV - 10 SV's can be entered.
	Selection of SV by keys and/or external contacts (BIN Code)
	Limits of set value - higher and lower limits can be set independently.
	PV Bias = - / + 99.99 °C / °F for thermocouple and RTD Pt100
	- / + 9999 x 1/10 unit for voltage and current
External Setting (Remote):	By external analog signal, Non-Isolation: Standard 0 ~ 10VDC
	Isolation: Option
	Extent of setting identical to the measuring range
	Tolerance = - / + 0.1% of full scale - / + 1 digit
	Setting signal: 0 ~ 10V and 1 ~ 5V = Input resistance: 500K Ω
	4 ~ 20mA = receiving resistance: 250 Ω
	RSV Bias = - / + 99.99 °C / °F for thermocouple and RTD Pt100
	- / + 9999 x 1/10 unit for voltage and current
Local/Remote:	Can be selected by keys and/or external signal. In selection of Control mode, externally set value is introduced without bump to local setting (tracking of set value without irregularity).

INPUTS

Thermocouple: (User-selectable)	T, J, E, K, R, N, PLII, S, B, PR40-20, WRe5-26, U&L (DIN43710)
	External resistance = 100 Ω maximum
	Impedance of input = 500 Ω minimum
	Burnout = Standard feature (Up-scale)
R.T.D.:	Pt100-JIS/DIN
	Lead Wire Tolerable Range = 5 Ω maximum/wire
	Amperage = 1mA
DC Voltage: (User-selectable)	0 ~ 10mV, 10 ~ 50mV, -10 ~ 10mV, 0 ~ 20mV, 0 ~ 50mV, 0 ~ 100mV, 0 ~ 1V, 1 ~ 5V, -1 ~ 1V, 0 ~ 2V, 0 ~ 5V, 0 ~ 10V = .
	Programmable range
	Impedance of input = 500K Ω minimum
DC Current: (User-selectable)	4 ~ 20mA and 0 ~ 20mA = . Programmable ranges
	Receiving impedance = 200 Ω
PV filter:	Setting possible from 0 to 100 seconds
Noise Ratio	In normal mode = 60dB minimum (50/60 Hz)
	In common mode = 140dB minimum (50/60 Hz)

CONTROL OUTPUTS

Modes of control:	1 - PID auto-tuning 2 - PID auto-tuning (heating) + proportioning (cooling)
Control output 1:	Proportional band (PB) = 0, 0.1 ~ 999.9% FS (PB = 0 → ON/OFF) Integral time (IT) = 0 ~ 6000s (Mode PD at IT = 0). Manual reset available Derivative time (DT) = 0 ~ 3600s (Mode PI at DT = 0) Proportional cycle = 1 ~ 200s (only relay and thyristor outputs) Hysteresis (ON/OFF) = 0.1 ~ 9.9% FS (relay and thyristor)
Control output 2: (2 control output type)	Proportional band (PB) = 0.1 ~ 10.0 × PB (Control output 1) % Dead band = SV + (0 ~ - / + 0.5) × PB (Control output 1) %
PID Values:	PID's are set independently for 10 SV's and RSV's
Types of Outputs:	(Applicable to 1 output and 2 outputs) Contact = 240VAC, 2.5A/resistive load, 1A/inductive load Voltage = 0 ~ 10VDC, load current 2mA maximum Current = 4 ~ 20mADC, load resistance 600 Ω maximum SSR voltage = 15VDC/20 mADC maximum
High / Low Output Limit:	Individually high / low setting, can be set independently for SV1-SV10 and RSV (remote) Setting range = - 5 ~ 105% (low limit < high limit)
Manual Operation:	Setting range = - 5 ~ 105% Indication of output signal = digital in %, Resolution: 0.1% Auto/manual selection Balanceless bumpless (This does not exist for output 2)
Ramp Control:	Increment and decrement Input/Setting range = Thermocouple and RTD: 1 ~ 9999 or 0.1 ~ 999.9 °C / (°F) min (s) Current and voltage = 1 ~ 9999 × 1 or × 1/10 unit/min (s)

EVENT OUTPUT (ALARM/STATUS)

Standard:	2 outputs (DO1 and DO2), Open collector 24VDC, 50mA maximum
Option:	3 outputs (EV1 to EV3), Contact output & 240VAC/Capacity, 2.5A/Resistive load

* Up to 5 outputs are available including option.

Setting/Output:	Individual setting/Individual output
Inhibit / Non-inhibit:	Can be selected by the keys on the front panel

TYPE OF EVENT	SETTING RANGE	HYSTERESIS	ALARM	TIME DELAY SETTING
PV	- 1999~9999 to within the measurement range	0,1~9,9% individual setting	Absolute	0~9999sec
SV			Absolute	
DEV			- / + 4000	
AT	Auto-tuning is executed		Output = "ON"	Not Available
ERR	PV, RSV is scale over		Output = "ON"	
RUN	Ramp control is executed		Output = "ON"	
REM	Remote mode		Output = "ON"	
MAN	Manual mode		Output = "ON"	

EXTERNAL SWITCH INPUTS

Type of input: Selection of SV No., REM, MAN, AT, DA/RA, RUN, STBY and NOP.
Input Nos.: 4 points, Multi (SV) selection / BIN code
Input Rating: Non-voltage Contact

OPTIONS

Remote setting signal isolation: ... In option
Event outputs: 2 in standard (DO1 and DO2), and 3 in option (EV1 to EV3)
Supplementary analog outputs: ... To select from PV, SV, RSV, OUT1, and OUT2, scaling available
Output signals = 0~10mVDC = , output resistance: 10 Ω (1 or 2 outputs)
0~10VDC = , maximum load: 2mA (1 or 2 outputs)
4~20mADC = , load resistance: 500 Ω max. (1 or 2 outputs)
Accuracy/resolution: - / + 0.1% FS/0.01% maximum

FUNCTION OF COMMUNICATION

Designation: RS-232C or RS-422A
Half duplex asynchronous type with start/stop bits
Speed: Selectable 1200, 2400 and 4800 bps
Word: 7 bits + 1 bit of parity or 8 bits (without parity)
Address: 0~31
Code: ASCII (on 8 bits)

GENERAL SPECIFICATIONS

Memory protection: Non-volatile memory
Ambient temperature: - 10~50°C
Ambient humidity: 90% RH max.
Line voltage: 90~264V AC, 50/60Hz
Consumption: Approximately 17VA
Insulation resistance: 500V DC 20M Ω between input terminal and power supply terminal
500V DC 20M Ω between power supply terminal and ground terminal
External dimensions: 96(H) $\times$ 96(W) $\times$ 140(D) (panel depth 125mm)
Panel Thickness: 1.0 ~ 3.5 mm
Panel cutout: 92 $\times$ 92mm (+ 0.8 / -0 mm)
Installation: Push in panel (no mounting hardware necessary)
Weight: Approximately 750 g

19. Registered Parameter Sheets

(These sheets are used by the operator to record set values)

SV, PID OUTPUT LIMITS

ITEMS	INITIAL VALUE	USER'S VALUE ASSIGNED TO DIFFERENT SV'S										SETTING RANGE
		1	2	3	4	5	6	7	8	9	10	
SV	0											* -1999 ~ 9999
P.I.D	P											P = ON/OFF, 0.1 ~ 999.9 %
	I											I = OFF, 1 ~ 6000 sec
	D											D = OFF, 0 ~ 3600 sec
P = 0, ON / OF	H											H = 0.1 ~ 9.9 % FS
I = 0	R											R = 0.0 ~ 99.9 % FS
OUTPUT LIMIT	HIGHER											L.LIM < H.LIM ≤ 105 %
	LOWER											- 5 % ≤ L.LIM < H.LIM
2 OUTPUTS (OPTION)	K2											K2 = ON / OFF, 0.1 ~ 10.0
	DB											DB = ~ 50.0 ~ 50.0
K2 = 0, ON / OFF	H											H = 0.1 ~ 9.9 % FS

NOTE : * For RTD and thermocouple, the decimal point is automatically fixed in accordance with the selected range.
For voltage and current input, see the positioning of decimal point on page 36.

MODES

ITEMS	INITIAL VALUES	USER'S VALUES	POSSIBLE SELECTION
Mode "1 Output"	MODE 2		MODE 0 or 2
Mode "2 Outputs"	MODE 3		MODE 0 to 3
Direction of Control Action	REVERSE		DIR or REV
Remote Tracking	NO		YES or NO
Cold Junction Compensation	INTERNAL		INTERNAL or EXTERNAL
Return to Initial Screen	OFF (60s)		OFF or ON (10-125sec)

INPUTS

ITEMS		INITIAL VALUES	USER'S VALUES	SETTING RANGE
Bias (Measurement Deviation)	TC, RTD, REM	0.00°C		- 99.9 ~ 99.99°C
	mV, mA, V	0.00 U _{IC}		- 0.9999 ~ 999.9 U _※
Digital Filter PV		0 S		0 ~ 100sec
Digital Filter REM		0 S		0 ~ 100sec
Effective Range of Measurement PV	Higher Limit	110% FS		100 ~ 110% FS
	Lower Limit	- 10% FS		0 ~ - 10% FS
Effective Range of External Setting REM	Higher Limit	110% FS		100 ~ 110% FS
	Lower Limit	- 10% FS		0 ~ - 10% FS

※ u: unit

OUTPUTS

ITEMS	INITIAL VALUES	USER'S VALUES	SETTING RANGE
Proportional Cycle (SSR, Contact)	30 sec		1~200sec
Output Value in PRE __ OUT	50%		- 5 ~ 105%
PV_ERR_OUT	0%		- 5 ~ 105%

EXTENT OF RANGE

ITEMS		INITIAL VALUES	USER'S VALUES	SETTING RANGE
Decimal Point (Linear Inputs)		XXX.X		XXXX ~ XXX.X
Measuring Range PV (Linear Inputs)	PVH	100.0 %		-1999 ~ 9999
	PVL	0.0 %		
Limits of Set Values (TC and RTD Inputs)	SVH	Maximum Range		In the Range
	SVL	Minimum Range		
Limits of REMOTE (Linear Inputs)	PSH	100.0 %		In the Range
	PSL	0 %		
Limits of REMOTE (TC and RTD Inputs)	PSH	Maximum Range		Within SV Limits
	PSL	Minimum Range		

RAMP CONTROL

ITEMS		INITIAL VALUES	USER'S VALUES	SETTING RANGE
Unit of RAMP Time [U : unit]		U / Min		U / Min OR U / sec
Rate of Gradient		XX.XX		XXX.X or XX.XX
Gradient	Increment (RMP__U)	OFF		TC, RTD: OFF, 1 ~ 9999 or 0.1 ~ 999.9
	Decrement (RMP__D)	OFF		
		mV, mA, V : OFF or 1 ~ 9999 0.1 ~ 999.9 PV = XXXX 0.1 ~ 999.9 0.01 ~ 99.99 PV = XXX.X 0.01 ~ 99.99 0.001 ~ 9.999 PV = XX.XX 0.001 ~ 9.999 0.000 ~ 0.9999 PV = X.XXX		

EVENTS (EV, DO)

EVENT NO.5.	ITEMS	INITIAL VALUES	USER'S VALUES	SETTING RANGE
EV 1	TYPE	DEV		<u>TYPE :</u> DEV, PV, SV AT, RUN, ERR REM, MAN <u>ACTION MODE :</u> DEV : DH, DL, ADH, ADL PV, SV : H1, L1, H2, L2 <u>VALUE :</u> DEV : -/+ 4000 PV, SV : - 1999 ~ 9999 <u>HYSTERESIS : (H)</u> 0.1 ~ 9.9% FS STAND-BY : (SB) ON : STAND-BY OFF : NON STAND-BY <u>TIME DELAY : (T)</u> 0 ~ 9999 sec
	Action Mode	DH		
	Value	4000		
	H	0.2 %		
	SB	OFF		
	T	0 sec		
EV 2	TYPE	DEV		
	Action Mode	DL		
	Value	-4000		
	H	0.2 %		
	SB	OFF		
	T	0 sec		
EV 3	TYPE	ERR		
	Action Mode			
	Value			
	H			
	SB			
	T			
DO 1	TYPE	AT		
	Action Mode			
	Value			
	H			
	SB			
	T			
DO 2	TYPE	REM		
	Action Mode			
	Value			
	H			
	SB			
	T			

ASSIGNMENT OF DI's

ITEMS	INITIAL VALUES	USER'S VALUES	SETTING RANGE
DI 1	NOP		NOP, MAN, REM, AUTO, ST-BY, DIA, STOP
DI 2	NOP		
DI 3	NOP		
DI 4	NOP		

LOCKING OF SCREENS

ITEMS	INITIAL VALUES	USER'S VALUES	SETTING RANGE
MON : Display (Level I Group A)	OFF		ON: Access to the parameters of the screen is not possible. SCREEN LOCKED OFF: The parameters of the screen are accessible and they can be modified. SCREEN NOT LOCKED
SVn : Set Value (Level I Group B)	OFF		
PID : PID Setting (Level I Group C)	OFF		
E/D : Event Output (Level I Group D)	OFF		
RMP : Ramp Control (Level I Group E)	OFF		
OLT : Output Limits (Level I Group F)	OFF		
CTL : Control (Level II Group A)	OFF		
OUT : Output Signals (Level II Group B)	OFF		
INP : Inputs (Level II Group C)	OFF		
DIA : Assignment of DI's (Level II Group D)	OFF		
SCL : Scaling (Level II Group E)	OFF		
RDT : Definition of Ramps (Level II Group F)	OFF		
MOD : Modes (Level II Group G)	OFF		
OPT : Options (Level II Group H)	OFF		
INI : Initialization (Level III Group B)	OFF		
RNG : Input Selection (Level III Group C)	OFF		

OPTIONS

ITEMS		INITIAL VALUES	USER'S VALUES	SETTING RANGE
Supplementary Analog Outputs	1 CH	PV		PV, SV, DEV, RSV OUT1, OUT2
	2 CH	SV		
Range for PV, SV, RSV	H	Maximum Range		Within the maximum and minimum limits displayed.
	L	Minimum Range		
Range for DEV	H	100%		— / + 100%
	L	0%		
Range for OUT1, OUT2	H	100%		0 to 100%
	L	0%		

Codes for Out-of Range Indication on Measurement Display (Red LED) (ERR)

** By Output of Range

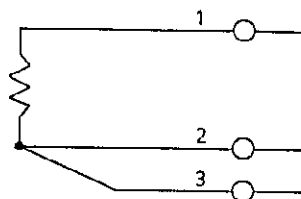
PV < - 10 % FS	L.L. - -
110 % FS < PV	H.H. - -

** Thermocouple Fault

Thermocouple line cut	H.H. - -	(1)
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** RTD Fault

Line 1 cut (1)	H.H. - -	(1)
Line 1 cut (2)	b. - - -	(2)
Line 1 cut (3) 1-2, 1-3, 2-3, 1-2-3	C. - - -	(2)



CONTROL OUTPUT IN CASE OF SENSOR OUT OF ORDER

(1) 0% in reverse action and 100% in direct action.

(2) 0% regardless of the direction of action.

Temperature and Humidity Control Specialists

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