

MR13 Series Digital Controller

Instruction Manual

Thank you for purchasing the Shimaden MR13 digital controller.
Please check that the delivered product is the correct item you ordered. Please do not begin operating this product until you have read this instruction manual thoroughly and understand its contents.

"Notice"

Please ensure that this instruction manual is given to the final user of the instrument.

Preface

This instruction manual is meant for those who will be involved in the wiring, installation and routine maintenance of the MR13 series. This manual describes the care, installation, wiring, function, and operation of the MR13 series. Keep this manual at the work site during operation of the MR13 series.

You should always follow the guidance provided herein. For matters regarding safety, potential damage to equipment and/or facilities, additional instructions and notes are indicated by the following headings.

⚠ WARNING

Exercise extreme caution as indicated. This heading indicates hazardous conditions that could cause injury or death of personnel.

⚠ CAUTION

Exercise extreme caution as indicated. This heading indicates hazardous conditions that can cause damage to equipment and/or facilities.

NOTE

This heading indicates additional instructions and/or notes.

The mark \perp designates a protective conductor terminal. Make sure to properly ground it.

Matters Regarding Safety

⚠ WARNING

The MR13 series controllers are control instruments designed for industrial use to control temperature, humidity and other physical values. You must not employ this series for the control of any device potentially having a serious effect on human life without employing adequate and effective safety measures. We assume no responsibility for any accident arising from the use of this product without first taking effective safety measures.

⚠ WARNING

- The instrument should be installed, for example, in a control panel to prevent its terminal portion from accidental contact with a human body during its operation.
- The instrument should not be pulled out from its case. Never place your hand or an electric conductor inside it as such act may cause an electric shock resulting in serious injury or death.
- Make sure to ground the protective conductor (earth) terminal prior to using the instrument.

⚠ CAUTION

In the event a potential failure of the instrument could cause damage to the connected equipment, facilities or products, safety measures such as installing a fuse or an overheating protection device must be taken prior to the use of the instrument. We assume no responsibility for any accident which may occur as a result of not employing appropriate safety measures

⚠ CAUTION

- The \perp mark on the plate affixed to the instrument: On the terminal nameplate affixed to the case of the instrument, the \perp mark has been printed. This is to warn you of the risk of electric shock which may result if the charger is touched while it is energized.
- In the external power circuit to be connected to the power terminal of the instrument, a switch or a breaker as means to turn power off must be installed. Such a switch or a breaker should be fixed adjacently to the instrument so that it can be operated with ease, and with an indication that it is a means to turn power off. Use a switch or a breaker which meets the requirements of IEC60947.
- Fuse: Since the instrument does not have a built-in fuse, make sure to install a fuse in the power circuit to be connected to the power terminal. The fuse should be positioned between the switch or the breaker and the instrument and be attached to the L side of the power terminal.
Fuse rating/type: 250V AC 0.5 A/medium lagged or lagged type. Use a fuse which meets IEC60127 requirements.
- In the wiring operation, make sure to fasten terminal connections.
- Power voltage and frequency must be within their rated ranges.
- Voltage/current of a load to be connected to the output terminal and the alarm terminal should be within a rated range. If it goes out of the range, a rise in temperature will reduce the product life and/or result in problems with the product.
The output terminal should be connected with a device which meets IEC61010 requirements.
- Voltage/current out of its specified range should not be applied to the input terminal. It may reduce the product life and/or result in problems with the product.
For the rated voltage/current, refer to "6. Specifications."
In case input is of voltage (mV or V) or current (4-20 mA), the input terminal should be connected with a device which meets IEC61010 requirements.
- The MR13 series controller is provided with a draft hole.
Take care to prevent metal or other foreign matter from entering into it. Failure to do so may cause problems with the instrument or even fire
- Do not block the draft hole and maintain it free from dust and dirt. A rise in temperature or insulation failure may result in a shortening of the product life and/or problems with the instrument. For spaces required to be kept in its installation, see "2-3. Drawings showing external dimensions and panel cutout."
- It should be noted that repeated tolerance tests against voltage, noise, surge, etc. may lead to deterioration of the instrument.
- Users are prohibited from modifying the instrument and using it in an anomalous way.
- When employing the instrument, you are requested to observe matters to be attended to as described in the instruction manual concerning safe and correct operation of the instrument in order to use it safely while maintaining its reliability

Note: It takes 30 minutes to display the correct temperature after applying power to the digital controller. (Therefore, turn the power on more than 30 minutes prior to the operation.)

Contents

	page
1. Introduction	
1-1. Check before use	2
1-2. Matters to be attended to in use	2
2. Installation and wiring	
2-1. Installation site (environmental conditions)	2
2-2. Mounting	2
2-3. Drawings showing external dimensions and panel cutout	2
2-4. Wiring	3
2-5. Terminal arrangement	3
2-6. Terminal arrangement table	3
3. Front panel	
3-1. Drawing and names of parts	3
3-2. Description of front panel	3
4. Screens	
4-1. Power on and initial screen display	4
4-2. Key sequence	4
4-3. Screen configuration	8
4-4. How to change screens	8
4-5. Channel switching on each screen	8
4-6. Data change on each screen	8
4-7. Group 0 screens	8
4-8. Group 1 screens	9
5. Supplement	
5-1. Measuring range code table	10
5-2. Event type code table	10
5-3. Error messages	10
6. Specifications	11

1. Introduction

1-1. Check before use

This product has been fully checked for quality assurance prior to shipment. Nevertheless, you are requested to make sure that there is no error, damage or absence of delivered items by confirming the model codes and checking the external view of the product and the number of accessories.

Confirmation of model codes:

Check the model codes stuck to the case of the product to ascertain if the respective codes designate what was specified when you ordered the product, referring to the following code table:

MR13-□□□□□□□
① ② ③ ④ ⑤ ⑥ ⑦ ⑧

Item	Code and Description
① Series	MR13
② Input	1: Thermocouple 2: R.T.D. 3: Voltage (mV) 4: Current (4-20mA) 6: Voltage (V)
③ Output	Y1: Contact I1: Current P1: SSR drive voltage V1: Voltage
④ Program	N: Without P: With
⑤ EV	0: Without 1: With
⑥ REM/DI	00: Without 04: 4-20mA DC 05: 1-5V DC 06: 0-10V DC 51:DI
⑦ A-OUT/COM	00: Without 03: 0-10mV DC 04: 4-20mA DC 06: 0-10V DC 15: RS-485 17: RS-232C
⑧ Remarks	00: Without 1: With

Checking Accessories:

This instruction manual 1 copy
Unit decal 1 sheet

Note: Contact our representative or sales office concerning any problem with the product.

1-2. Matters to be attended to in use

- (1) Do not operate keys of the front panel with hard or sharp objects or motions. Lightly touch the keys with finger tips for operation.
- (2) Avoid solvents such as thinner for cleaning; wipe gently with a dry cloth.

2. Installation and wiring

2-1. Installation site (environmental conditions)

Indoors

Location without direct sunlight

Location with no dew condensation

⚠ CAUTION

The instrument should not be installed in those places as listed below. Its use in any of such places may cause trouble or damage or an outbreak of fire.

- (1) Where flammable gas, corrosive gas, oil mist and particles that can deteriorate insulation are generated or are abundant.
- (2) Where the temperature is below -10°C or above 50°C .
- (3) Where the relative humidity is above 90%RH or below dew point.
- (4) Where highly intense vibration or impact is generated or transferred.
- (5) Near high voltage power lines or where inductive interference can affect the operation of the instrument.
- (6) Dew drops or direct exposure to sunlight.
- (7) Where the elevation is in excess of 2,000 m.
- (8) Outdoors.
- (9) Supply voltage fluctuation not to exceed 10% of the Nominal supply voltage.

Note: The environmental conditions belong to IEC60664 installation category II and the degree of pollution is rated as 2 under this standard.

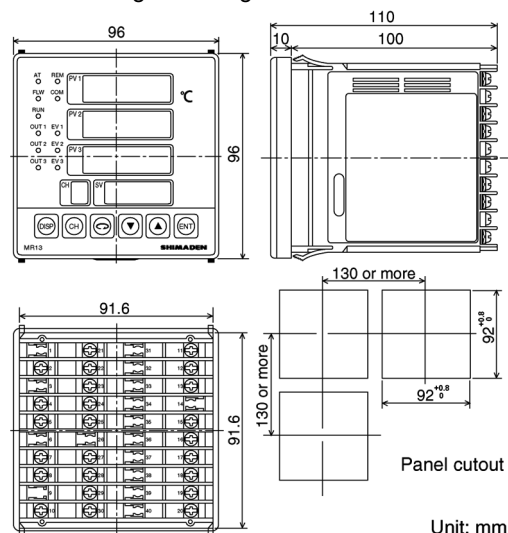
2-2. Mounting

⚠ CAUTION

For safety's sake and to maintain the proper functioning of the product, you should not draw it out from its case. If it is necessary to draw out the instrument, contact our office in your neighborhood

- (1) Machine the mounting hole by referring to panel cutout in Section 2-3.
- (2) Applicable thickness of the mounting panel is from 1.0 to 3.5 mm.
- (3) As this product has fixing pawls, just insert it from the front of panel for installation.

2-3. Drawings showing external dimensions and panel cutout

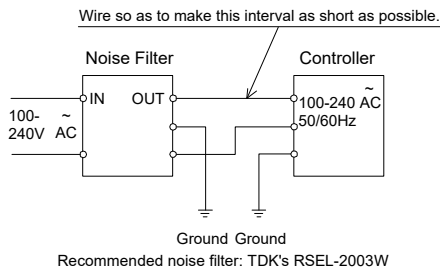


2-4. Wiring

⚠ WARNING

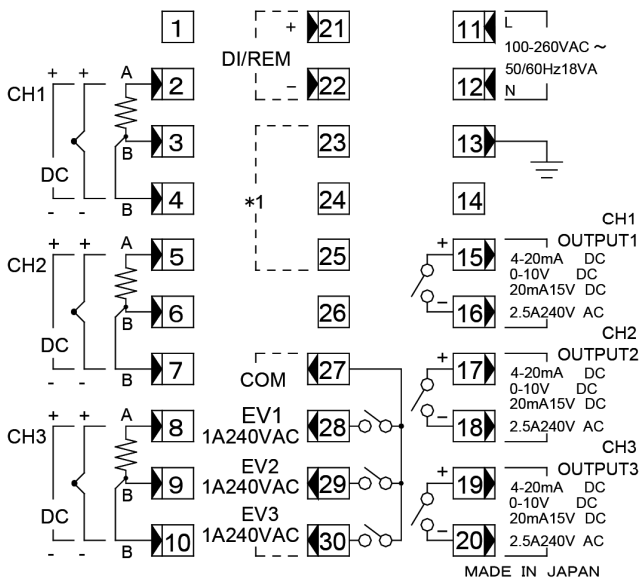
- The product must be disconnected from its power source during wiring operation so as to prevent electric shock.
- The protective conductor (earth) terminal \perp must be grounded prior to use. Otherwise, electric shock may result.
- Do not touch the wired terminals and charged devices while power is on.

- (1) Wiring operation should be done as indicated in the terminal arrangement in section 2-5. Double check that no wrong connection is made.
- (2) Crimp terminal should accommodate the M3.5 screw and should have a width of less than 7mm.
- (3) For thermocouple input, select the compensation wire suitable for the thermocouple type.
- (4) For R.T.D. input, leads should be less than 5Ω each in resistance and three leads should have the same resistance.
- (5) Input signal line should be conducted safely apart from high voltage power line.
- (6) Shield wiring (single point grounding) is effective for static induction noise.
- (7) Short interval twisted pair wire for input signal is effective for electromagnetic induction noise.
- (8) For power line, use wire or cable which is 1 mm^2 or more in sectional area and of which performance is equal to or higher than that of 600V vinyl insulated wire.
- (9) Earth grounding should be performed with earth resistance less than 100Ω and with wire thicker than 2 mm^2 .
- (10) Noise filter: If you think the instrument is susceptible to power noise, use noise filter to avoid malfunctioning. Install noise filter in grounded panel and wire it so that interval between the noise filter output and the power terminal of the instrument can be as short as possible.



2-5. Terminal arrangement

*1 SPECIFICATION	TERMINAL		
	23	24	25
A-output	+	-	-
RS-232C	SG	SD	RD
RS-485	SG	+	-



2-6. Terminal arrangement table

Name of terminal and description		Terminal number
Power terminal	100-260V AC±10% 50/60Hz 18VA	11-12
Protective conductor terminal	\perp	13
Input terminal 1	R.T.D.: A, Thermocouple, voltage, current: +	2
	R.T.D.: B	3
	R.T.D.: B, Thermocouple, voltage, current: -	4
Input terminal 2	R.T.D.: A, Thermocouple, voltage, current: +	5
	R.T.D.: B	6
	R.T.D.: B, Thermocouple, voltage, current: -	7
Input terminal 3	R.T.D.: A, Thermocouple, voltage, current: +	8
	R.T.D.: B	9
	R.T.D.: B, Thermocouple, voltage, current: -	10
Output terminal 1	Contact: COM, SSR drive voltage, voltage, current: +	15
	Contact: NO, SSR drive voltage, voltage, current: -	16
Output terminal 2	Contact: NO, SSR drive voltage, voltage, current: -	17
	Contact: COM, SSR drive voltage, voltage, current: +	18
Output terminal 3	Contact: NO, SSR drive voltage, voltage, current: -	19
	Contact: COM, SSR drive voltage, voltage, current: +	20
Remote input terminal (option)	+	21
	-	22
DI input terminal (option)	Contact: COM	21
	Contact: NO	22
Analog output terminal (option)	+	23
	-	24
Communication (option)	RS-232C: SG	23
	RS-485: SG	24
	SD	24
	RD	25
Event output terminal (option)	Contact: COM	27
	Contact: NO (EV1)	28
	Contact: NO (EV2)	29
	Contact: NO (EV3)	30

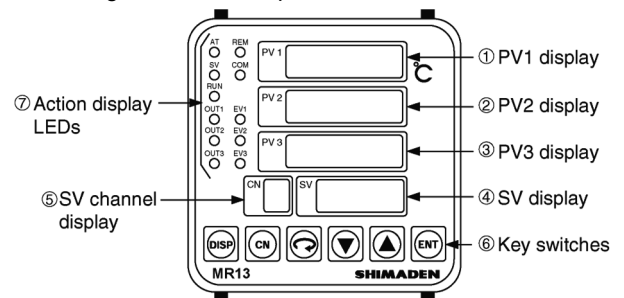
Note : In MR13, the same terminals are used for remote input and DI input. Confirm which is the function added to your instrument before use.

: In MR13, the same terminals are used for analog output and communication. Confirm which is the function added to your instrument before use.

: For thermocouple, voltage and current input, connection between B and B terminals will result in measurement error.

3. Front panel

3-1. Drawing and names of parts



3-2. Description of front panel

- ① PV1 display (green)
 - (1) Displays current measured value (PV1) on the mode 0 basic screen.
 - (2) Displays parameter type on each parameter screen.
- ② PV2 display (green)
 - (1) Displays current measured value (PV2) on the mode 0 basic screen.
- ③ PV3 display (green)
 - (1) Displays current measured value (PV3) on the mode 0 basic screen.
- ④ SV display (orange)
 - (1) Displays target set value on the mode 0 basic screen.
 - (2) Displays selected item and set value on each parameter screen.
- ⑤ SV channel display (orange)
 - (1) Displays SV channel on the mode 0 basic screen.
 - (2) Displays the channel of SV display on each parameter screen.

⑥ Key switches

(1) [DISP] (Disp) key

- Press on initial screens of mode 1 and 2 screen groups to move to the mode 0 basic screen.
- Press on any screen of the mode 0, 1 or 2 screen group to move to initial screen of that screen group.

(2) [CH] (channel) key

- Use for channel switching.
- Press on the 0-3 program setting screen in the program mode to move to the mode 2 screen group.

(3) [ENT] (parameter) key

- Press on any screen of the 0, 1, and 2 screen groups to move to the next screen.
- Keep pressing for 3 seconds on the basic screen of the mode 0 screen group to move to the keylock setting screen of the mode 1 screen group.

(4) [▼] (down) key

- Press on any screen to flash the point of the least digit and to decrease or back increment data.

(5) [▲] (up) key

- Press on any screen to flash the point of the least digit and to increase or increment data.

(6) [ENT] (entry/registration) key

- Press on any screen of the mode 0, 1 and 2 screen group to fix the data changed by the [▼], [▲] keys (also to extinguish flashing of the point).

⑦ Action display LEDs

(1) AT (auto tuning) monitor LED (green)

- Selection of ON by [▼], [▲] keys. Lights during AT stand-by and flashes during AT execution.

(2) FLW (follow SV) monitor LED (green)

- Lights when the setting to follow SV is ON and goes out when it is OFF.

(3) RUN (run) monitor LED (green)

- Lights while program is in execution and goes out when it stops.

(4) OUT1 (channel 1 output) monitor LED (green)

- For contact or SSR drive voltage output, lights when output turns ON and goes out when output turns OFF.
- For current or voltage output, brightness rises and falls in proportion to increase and decrease of output.

(5) OUT2 (channel 2 output) monitor LED (green)

- For contact or SSR drive voltage output, lights when output turns ON and goes out when output turns OFF.
- For current or voltage output, brightness rises and falls in proportion to increase and decrease of output.

(6) OUT3 (channel 3 output) monitor LED (green)

- For contact or SSR drive voltage output, lights when output turns ON and goes out when output turns OFF.
- For current or voltage output, brightness rises and falls in proportion to increase and decrease of output.

(7) REM (remote) monitor LED (green)

- Lights when remote channel number is set at 1, 2 or 3, and goes out when OFF is selected.

(8) COM (communication) monitor LED (green)

- Lights when COM is set for communication mode, and goes out when LOC is set.

(9) EVT1 (event) monitor LED (orange)

- Lights while Event 1 is in action.

(10) EVT2 (event) monitor LED (orange)

- Lights while Event 2 is in action.

(11) EVT3 (event) monitor LED (orange)

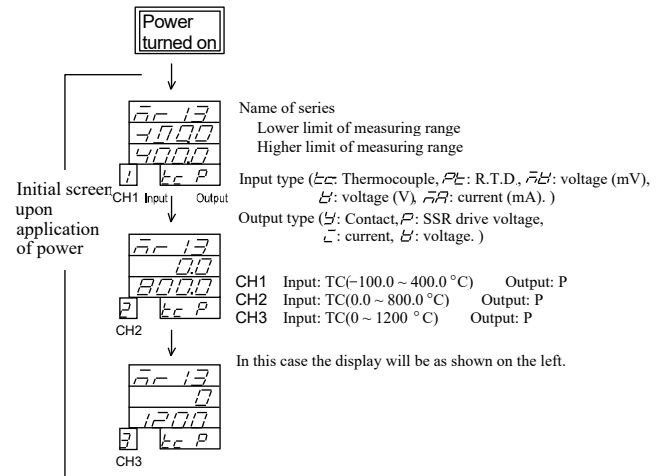
- Lights while Event 3 is in action.

4. Screens

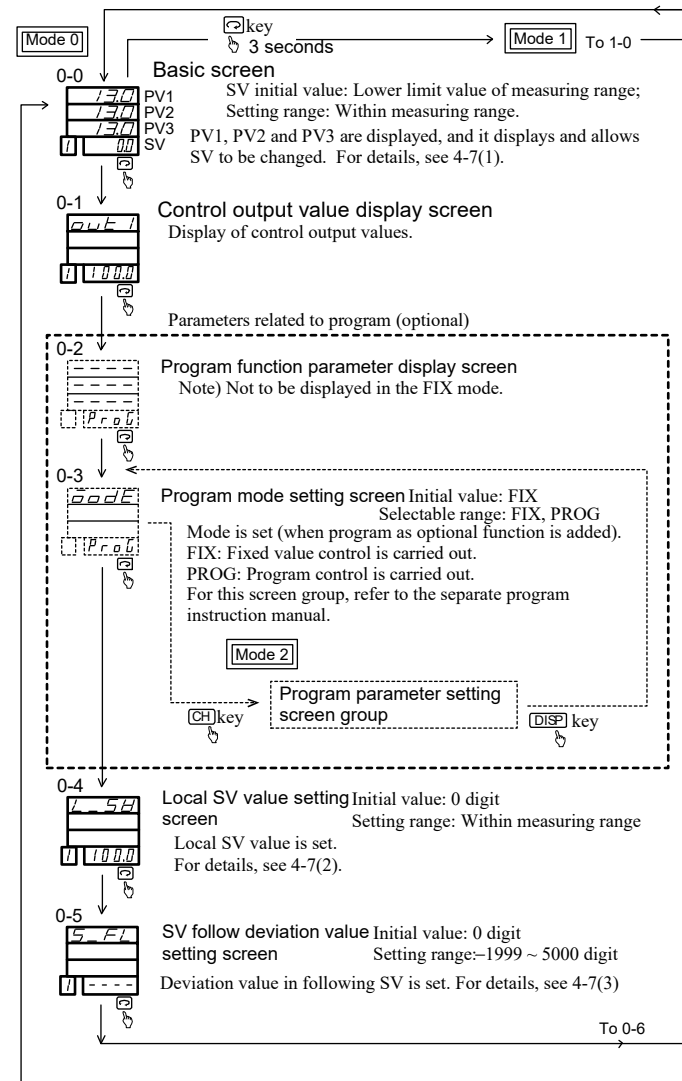
4-1. Power on and initial screen display

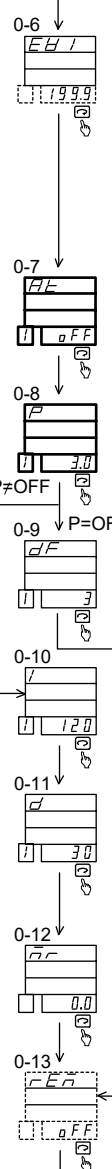
Upon applying power, the initial screens upon application of power as shown below are displayed successively, each for about 1.5 seconds, until the basic screen of mode 0 appears on display.

Continuous operation



4-2. Key sequence





Event set value setting screen
 Initial value: Refer to the table below;
 Setting range: Refer to the table below.

	Initial value	Setting range
EV1	1999 digit	0 ~ 1999 digit
EV2	-1999 digit	0 ~ -1999 digit
EV3	Higher limit value of measuring range	Within measuring range.

Set EV1~3 event set values.
 For details, see 4-7(4) and 5-2.

AT control execution screen Initial value: OFF
 Selectable range: ON, OFF

Selection of ON puts AT in execution and selection of OFF stops AT. For details, see 4-7(5).

Proportional band setting screen Initial value: 3.0%
 Setting range: OFF, 0.1 ~ 999.9%

Percentage of change in control output to measuring range is set. The amount of control output changes in proportion to difference between PV and SV values. Selection of OFF starts ON-OFF action.

Hysteresis setting screen Initial value: 3
 Selectable range: 1 ~ 999 digit

Hysteresis in ON-OFF action is set. This screen is displayed only when P=OFF.

Integral time setting screen Initial value: 120 seconds
 Setting range: OFF, 1 ~ 6000 seconds

This is the function to correct offset caused by proportional action. This screen is not displayed when P=OFF.

Derivative time setting screen Initial value: 30 seconds
 Setting range: OFF, 1 ~ 3600 seconds

In anticipation of a change in control output, this function enhances control stability by suppressing overshoot due to integration. This screen is not displayed when P=OFF.

Manual reset value setting screen Initial value: 0.0%
 Setting range: -50.0 ~ 50.0%

Offset is corrected by increasing/decreasing manual reset value. This screen is not displayed when P=OFF.

Remote input display screen
 Remote input value is shown on the SV display. (In case remote is not assigned, OFF is shown.) The CH display shows CH No. to which remote is assigned.

Note 1: The following shows screen frames on the respective screens:

- Screens always displayed by key operation and some other means.
- Screens shown when appropriate options are added or selected.
- Screens shown or skipped depending on I/O types or set control actions.

Note 2: When CH display is shaded:

- : Allows channel to be changed by [CH] key and parameter of each channel to be set. CH key serves to move to the mode 2 screen group, however, when it is pressed on the 0-3 program mode setting screen.
- : CH key serves to switch event output channel.

Note 3: On each screen of the mode 1 screen group, pressing [Left] key while [Right] key is being pressed causes backward movement. (It causes movement in opposite direction to what is caused by pressing [Right] key.)

[Mode 1] [DISP] key

Keylock mode setting screen Initial value: OFF
 Selectable Range: OFF, 1,2,3
 On locked screen, you are unable to change data.
 Note: This keylock mode setting screen is not locked by selection of any lock No..

Lock No	Range to be locked
OFF	Unlock (All data are allowed to be changed.)
1	Keylock of mode 1
2	Keylock of all screens except basic screens
3	Keylock of all screens

Event channel assignment setting screen
 Initial value: E1CH 1 E2CH 2 E3CH 3
 Setting range: 1, 2, 3
 EV1, EV2 and EV3 are respectively assigned to channels as desired.

Event type setting screen Initial value: E1_m 1 E2_m 2 E3_m 5
 Setting range: OFF, 1 ~ 10
 Events are assigned respectively to EV1, EV2 and EV3 by using event codes shown in 5-2. event type code table.

Event action hysteresis setting screen Initial value: 5 digit
 Setting range: 1 ~ 999 digit
 Event action hysteresis is set. This screen is not displayed in case event types 7 ~ 10 are set.

Event standby action selecting screen Initial value: 1
 Selectable range: 1 ~ 4

This is the action that even when PV value is within event range upon turning power on, event output is kept on standby and event is output only when PV value re-enters event range after it gets out of the event range once.

- 1: Alarm action without standby
- 2: Alarm action with standby (when power on and RST→RUN)
- 3: Alarm action with standby (when power on, RST→RUN, and SV is changed)
- 4: Control action without standby

For details, see 4-8(1). This screen is not displayed when Event types 7 ~ 10 are set.

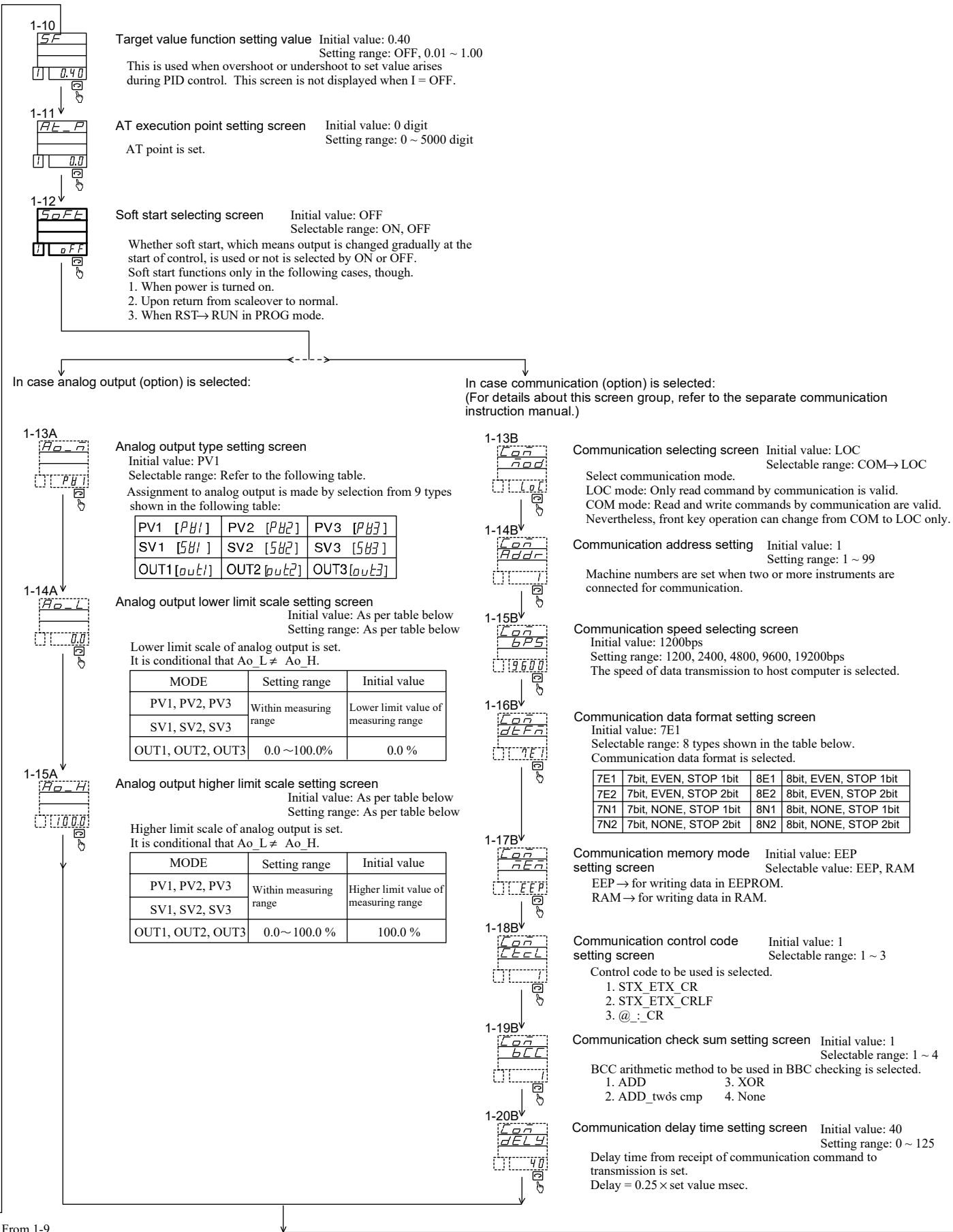
Event action delay time setting Initial value: OFF
 Setting range: OFF, 1 ~ 9999 seconds
 Delay time in event action is set. For details, see 4-8(2). This screen is not displayed when Event types 7 ~ 10 are set.

Output characteristic selecting screen
 Initial value: RA (heating);
 Selectable range: RA (heating), DA (cooling)
 Control action characteristic of control output is selected.
 RA: The more output decreases the higher PV value than SV value (heating control).
 DA: The more output decreases the higher SV value than PV value (cooling control).

Proportional cycle setting screen
 Initial value:
 Contact output 30.0 seconds
 SSR drive voltage 3.0 seconds
 Setting range: 0.5 ~ 120.0 seconds
 Proportional cycle time is set. This screen is not displayed for voltage and current output. The screen is not displayed when P=OFF, either.

Lower output limit setting screen
 Initial value: 0.0%
 Setting range: 0.0 ~ 99.9% on condition that o_L < o_H, though.
 Lower limit value of control output is set. Lower limit value becomes invalid in ON-OFF action with P=OFF for contact and SSR output.

Higher output limit setting screen
 Initial value: 100.0%
 Setting range: 0.1 ~ 100.0% on condition that o_L < o_H, though.
 Higher limit value of control output is set. Lower limit value becomes invalid in ON-OFF action with P=OFF for contact and SSR output.



From 1-9

In case DI input option is selected:

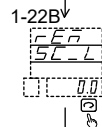
In case remote input option is selected: OFF is set.



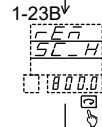
DI input type setting screen
 Initial value: non
 Selectable range: non, FLW, run, HLd, Adv
 Type of action in response to DI input is set. For details, see 4-8(3).
 [non] No processing
 [FLW] SV follow action (level input)
 [run] Program running action (edge input)
 [HLd] Program holding action (level input)
 [Adv] Program advance action (edge input)



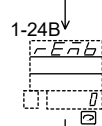
Remote channel No. setting screen
 Initial value: OFF
 Selectable range: OFF, 1 ~ 3
 Channel number to be used for remote input is set. However, the number of the channel which has been set to ON for SV deviation follow action is unable to be set. CH1 setting is not possible in the program mode, either.



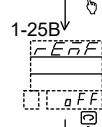
Remote scale lower limit value setting screen
 Initial value: Lower limit value of measuring range
 Setting range: Within measuring range
 Lower limit value of SV measuring range for remote input is set.
 Note: REM SC_L ≠ REM SC_H.



Remote scale higher limit value setting screen
 Initial value: Higher limit value of measuring range
 Setting range: Within measuring range
 Higher limit value of SV measuring range for remote input is set.
 Note: REM SC_L ≠ REM SC_H.



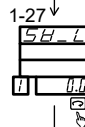
Remote bias setting screen
 Initial value: 0 digit
 Selectable value: -1999 ~ 5000 digit
 Remote bias value is set.



Remote filter setting screen
 Initial value: 0 second
 Setting range: 0-100 seconds
 Remote filter is set.



SV deviation follow action
 Initial value: CH2 OFF CH3 OFF
 Setting range: ON, OFF
 Upon selection of ON, SV of CH2 or CH3 follows SV of CH1. (Only CH2 and CH3 are selectable.) For details, see 4-8(4).



SV limiter lower limit value setting screen
 Initial value: Lower limit of measuring range
 Setting range: Within measuring range
 Lower limit value of SV limiter is set. Note: SV_L < SV_H.



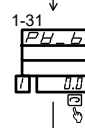
SV limiter higher limit value setting screen
 Initial value: Higher limit of measuring range
 Setting range: Within measuring range
 Higher limit value of SV limiter is set. Note: SV_L < SV_H.



PV display selecting screen
 Initial value: CH2 OFF, CH3 OFF
 Setting range: ON, OFF
 Whether PV value of CH2 or CH3 is to be displayed or not is selected. (Only CH2 and CH3 can be set.)



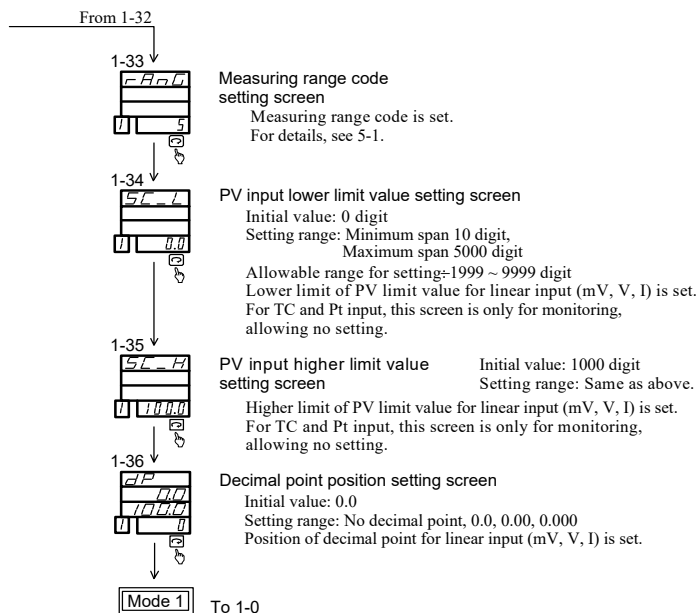
PV follow action setting
 Initial value: CH2 ON, CH3 ON
 Setting range: ON, OFF
 Upon selection of ON, PV of CH2 or CH3 follows PV of CH1. (Only CH2 and CH3 can be set.) For details, see 4-8(5).



PV bias setting screen
 Initial value: 0 digit
 Setting value: -1999 ~ 1999 digit
 PV bias value is set. If PV bias value of CH2 or CH3 is changed while PV follow action is going on, it will not work.



PV filter setting screen
 Initial value: 0 second
 Setting range: 0 ~ 100 seconds
 PV filter value is set. If PV filter value of CH2 or CH3 is changed while PV follow action is going on, it will not work.



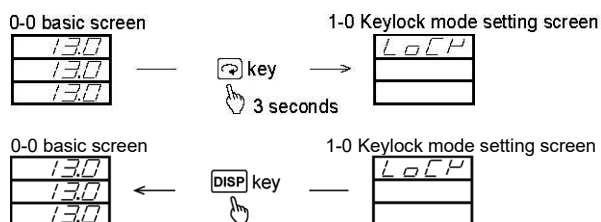
4-3. Screen configuration

In the MR13 controller, the screen configuration comprises screen groups and screens arranged correspondingly to the frequency of use in their operation.

- (1) Mode 0 screen group
It is made of screens of relatively high frequency in use for operation, i.e., the basic screen (for setting target value and confirming current measured value), the auto tuning action control screen, the event value setting screen and so forth.
- (2) Mode 1 screen group
It is made up of screens of less frequency in use than mode 0 screengroup, i.e., screens for setting values to be changed as required by input conditions or control capability, a screen for locking items not to be changed, and so on.
- (3) Mode 2 screen group (when optional program function is added)
It is made up of program-function-related setting and control screens. In case program option is not added or not in the program mode, you cannot get into the mode 2 screen group.

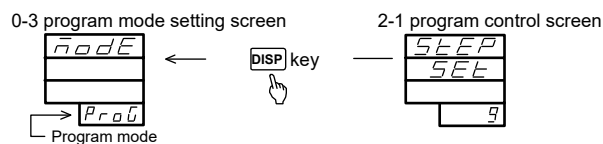
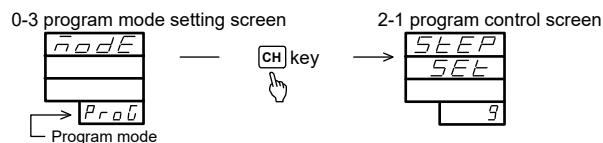
4-4. How to change screens

- (1) How to move between mode 0 and mode 1 screen groups
 - Pressing key on the basic screen of the mode 0 screen group for 3 seconds calls the keylock mode setting screen of mode 1 group onto display.
 - Pressing key on the keylock mode setting screen of the mode 1 screen group calls the basic screen of the mode 0 screen group onto display.



Note: In the above, the mark means that the key above the mark is pressed. Hereinafter this mark is used in the same way.

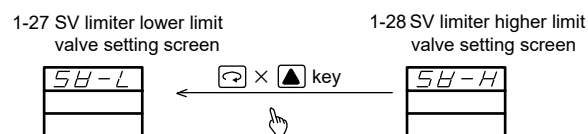
- (2) How to move between mode 0 and mode 2 screen groups (in case program option is added)
 - By pressing key on the 0-3 program mode setting screen, you can move to the mode 2 screen group (only when program mode is set).
 - Pressing key on any of the mode 2 screen group calls the 0-3 program mode setting screen onto display.



- (3) How to move from screen to screen in each screen group
 - Every time key is pressed once, you can move from screen to screen



- (4) How to move from screen to previous screen in mode 1 screen group (this applies only to mode 1 screen group)
 - Pressing key while key is being pressed, you can move from the current screen to a previous screen.



Note: In the above, × key means that key is pressed while key is being pressed. Hereinafter this representation is used in the same way.

4-5. Channel switching on each screen

Press key for channel switching. Every time this key is pressed, the channel is changed from CH1 to CH2, to CH3, to CH1 ...

4-6. Data change on each screen

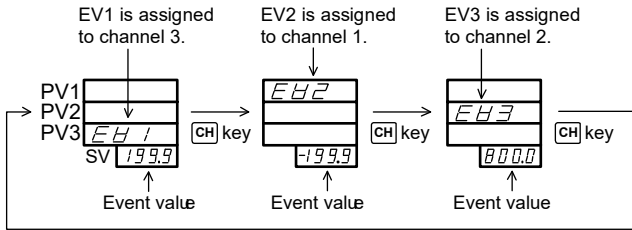
Press or key to change data on each screen. Press key to register changed data. Once data is registered, decimal point on the lower right side of screen, which has been flashing, goes out.

4-7. Group 0 screens

- (1) 0-0 basic screen
 - On the basic screen, local SV value of each channel can be set.
 - In SV follow action, SV1 is local SV value, SV2 and SV3 serve as SV follow deviation value setting screens. However, when SV follow deviation value is changed on the SV2 or SV3 display screen and changed value is registered by means of key, the display turns to SV in execution (SV follow deviation value + SV1).
 - SV1 is unable to be changed in the program mode.
 - Remotely assigned SV is unable to be changed.
- (2) 0-4 local SV value setting screen
 - SV1 can be changed even in the program mode but the change is not reflected in the program mode.
 - SV can be changed even when remote has been assigned but the change is not reflected in remote action.
- (3) 0-5 SV follow deviation setting screen
 - Deviation value of SV2 or SV3 from SV1 in SV follow action is set.
 - In the following cases, SV follow deviation value of appropriate channel is unable to be set:
 - a) In instrument specified for thermocouple (TC) or R.T.D. (Pt) input: Measuring range code of CH1 is different from that of CH2 or CH3.
 - b) In instrument specified for voltage (V, mV) or current (mA) input: Any one of measuring range code, lower limit value of PV input, higher limit value of PV input and position of decimal point of CH2 or CH3 is different from corresponding set value of CH1.
 - c) In case that channel is set as remote channel.

- (4) 0-6 Event set value setting screen (including event-output-related screens)
 On this screen, unlike on other screens, **[CH]** key switches event output. PV display is so arranged that one can see which event output is assigned to which channel.

Example: EV1, EV2 and EV3 are assigned respectively to channel 3, channel 1 and channel 2.

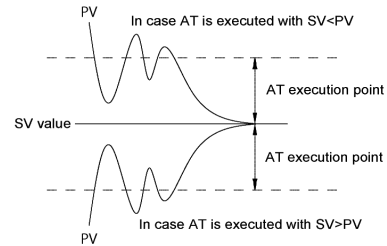


- (5) 0-7 AT control execution screen
- If channel falls in any of the following cases, AT is unable to be executed.
 - 1) In case remote assignment is made (including channel which follows remote channel).
 - 2) In case $\square FF$ is set for proportional band, i.e., P=OFF (in ON/OFF action).
 - 3) In case lock No. 2 or 3 is selected on the keylock mode setting screen.
 - 4) In case PV value (measured value) is in the state of scale-over.
 - 5) In channel 1 in the state of reset (rst) in the program mode. (For details see the Instruction Manual on Program Functions.)
 - In channel which falls in any of the following cases while AT is in execution, AT is forced to be released.
 - 1) In case output value remains at 0% or 100% continuously for 200 or more minutes.
 - 2) In case power supply is interrupted, due to power failure or some other reason.
 - 3) In case PV value (measured value) is in the state of scaleover.
 - If you put AT in execution (by selecting $\square \square$ on the selecting screen) again which AT is in execution, AT action already in execution is continued.
 - The following items can be set while AT is in execution: 0-6 event set value setting, 1-0 keylock mode setting and 1-29 PV display selection.

4-8. Group 1 screens

- (1) 1-4 Event standby action selecting screen
- When event output is used as alarm, select "1" - "3".
 - When event output is used as control output, set "4". In the case of scaleover on the event set value side, event output turns OFF.
 - When "2" is selected for standby action, standby action functions in the following cases:
 - 1) When power is tuned on.
 - 2) When program turns from RST to RUN or RST to FIX.
 - When "3" is selected for standby action, standby action functions in the following cases:
 - 1) When power is tuned on.
 - 2) When program turns from RST to RUN or RST to FIX.
 - 3) In case event set value is deviation value and SV is changed (except during remote input).
 - If you change standby action to "1" or "4", the standby action is released.
 - Even when "2" or "3" is set for standby action, standby action becomes invalid if PV value gets out of the event action ON range, for example, when power is turned on.
- (2) 1-5 Event delay time setting screen
- If factor to execute event ON action disappears within a time set as delay time, event will not be output and measurement of delay time is cleared.
 In case factor to execute event ON action occurs and delay time is changed within set time for delay time, time since the occurrence of the fact (total time) should be set.

- (3) 1-11 AT execution point setting screen
- For the purpose of avoiding hunting due to a limit cycle with a set SV AT execution, a virtual SV value (AT execution point) is set for AT to run at a point away from the actual SV value.



- Note 1: For AT execution point, an absolute value of difference between SV value and virtual SV value is to be input.
- Note 2: When 0 is set for AT execution point, SV value serves as the AT point.
- Note 3: When PV value is in the AT execution point area, SV value serves as the AT point.
- (4) 1-21A DI input type setting screen
- When DI input type is assigned, DI input operation becomes valid, i.e., key operation becomes invalid. (Priority is given to DI.)
- Note 1: When $[FL\bar{L}]$ is assigned, DI input operation should be started after parameter of channel in which SV deviation follow action is carried out is turned ON. DI in-put operation does not work if it remains OFF.
- Note 2: Action in response to DI input will be maintained even when DI input assignment has been released except in the case in which SV follow action has been assigned.

- (5) 1-26 SV deviation follow action setting screen
- SV2 and SV3 are made to follow SV1, by using SV follow deviation value.
 - In the following cases, SV deviation follow action of appropriate channel is unable to be turned ON
 - a) In instrument specified for thermocouple (TC) or R.T.D. (Pt) input: Measuring range code of CH1 is different from that of CH2 or CH3.
 - b) In instrument specified for voltage (V, mV) or current (mA) input: Any one of 4 items, i.e., measuring range code, lower limit value of PV input, higher limit value of PV input and position of decimal point of CH2 or CH3 is different from corresponding set value of CH1.
 - c) Common to all instruments: In case remote has been assigned.
 - During SV deviation follow action, measuring range code, PV input lower limit value, PV input higher limit value and position of decimal point in the channel in which the action is going on are unable to be changed.
- (6) 1-30 PV follow deviation action setting screen
- PV2 and PV3 are made to follow PV1, with deviation = 0.
 - In the following cases, PV deviation follow action of appropriate channel is unable to be turned ON.
 - a) Instrument specified for thermocouple (TC) or R.T.D. (Pt) input: Measuring range code of CH1 is different from that of CH2 or CH3.
 - b) In instrument specified for voltage (V, mV) or current (mA) input: Any one of 4 items, i.e., measuring range code, lower limit value of PV input, higher limit value of PV input and position of decimal point of CH2 or CH3 is different from corresponding set value of CH1.
 - During PV deviation follow action, measuring range code, PV input lower limit value, PV input higher limit value and position of decimal point in the channel in which the action is going on are unable to be changed.

5. Supplement

5-1. Measuring range code table

Input type	Code	Measure range	Code	Measure range		
Thermocouple	*1 B	01 0 - 1800 °C	15	0 - 3300 °F		
	R	02 0 - 1700 °C	16	0 - 3100 °F		
	S	03 0 - 1700 °C	17	0 - 3100 °F		
	K	04	-100.0 - 400.0°C	18	-150 - 750 °F	
		05	0.0 - 800.0°C	19	0 - 1500 °F	
		06	0 - 1200 °C	20	0 - 2200 °F	
	E	07 0 - 700 °C	21	0 - 1300 °F		
	J	08 0 - 600 °C	22	0 - 1100 °F		
	*2 T	09 -199.9 - 200.0°C	23	-300 - 400 °F		
	N	10 0 - 1300 °C	24	0 - 2300 °F		
	*3 PLII	11 0 - 1300 °C	25	0 - 2300 °F		
	C(WRe5-26)	12 0 - 2300 °C	26	0 - 4200 °F		
	*4 U	13 *2 -199.9 - 200.0°C	27	-300 - 400 °F		
	*4 L	14 0 - 600 °C	28	0 - 1100 °F		
R.T.D.	Pt100 (New) JIS/IEC	31	-200 - 600 °C	47	-300 - 1100 °F	
		32	-100.0 - 100.0°C	48	150.0 - 200.0°F	
		33	-100.0 - 300.0°C	49	-150 - 600 °F	
		34	-50.0 - 50.0°C	50	-50.0 - 120.0°F	
		35 *5	0.0 - 50.0°C	51	0.0 - 120.0°F	
		36	0.0 - 100.0°C	52	0.0 - 200.0°F	
		37	0.0 - 200.0°C	53	0.0 - 400.0°F	
		38	0.0 - 500.0°C	54	0 - 1000 °F	
		39	-200 - 500 °C	55	-300 - 900 °F	
	JPt100 (Old) JIS	40	-100.0 - 100.0°C	56	-150.0 - 200.0°F	
		41	-100.0 - 300.0°C	57	-150 - 600 °F	
		42	-50.0 - 50.0°C	58	-50.0 - 120.0°F	
		43 *5	0.0 - 50.0°C	59	0.0 - 120.0°F	
		44	0.0 - 100.0°C	60	0.0 - 200.0°F	
		45	0.0 - 200.0°C	61	0.0 - 400.0°F	
		46	0.0 - 500.0°C	62	0 - 900 °F	
		mV	-10 - 10	71	Depending on scaling function, you may set measuring range at any value within the following range: Scaling range: -1999 - 9999 digit Span: 10 - 5000 digit Note: Lower limit value < Higher limit value	
			0 - 10	72		
0 - 20	73					
0 - 50	74					
10 - 50	75					
0 - 100	76					
V	-1 - 1	81				
	0 - 1	82				
	0 - 2	83				
	0 - 5	84				
	1 - 5	85				
	0 - 10	86				
mA	0 - 20	94				
	4 - 20	95				

*1 Thermocouple B: Temperature above 400°C or below 750 °F is excluded from accuracy assurance.

*2 Thermocouple T, U: Accuracy of temperature between -199.9 and -100.0°C is $\pm (0.5\% FS + 1 \text{ digit})$

*3 Thermocouple PL II: Platinel

*4 Thermocouple U, L: DIN 43710

(Thermocouple B, R, S, K, E, J, T, N: JIS/IEC)

*5 R.T.D.: 0.0-50.0°C Accuracy is $\pm (0.6\% FS + 1 \text{ digit})$

Note: The following table shows factory-set measuring range codes:

Input	Standard/rating	Code	Measure range (range)
1. Thermocouple	JIS K	05	0.0 - 800.0°C
2. R.T.D.	JIS Pt100	37	0.0 - 200.0°C
3. Voltage	0 - 10mV DC	72	0.0 - 100.0
4. Current	4 - 20mA DC	95	0.0 - 100.0
5. Voltage	0 - 10V DC	86	0.0 - 100.0

Note : In case Measure code / range is altered ,such related valaes as SV , Event action point , PID valves are initialized. And also in case Channel / code is alrered for Event output or Remote input or Analog output , related valves are initialized.

5-2. Event type code table

Code	Event type	Setting rage of event set value	Initial value of event set value
OFF	Not assigned		
1	Higher limit deviation value	0 - 1999 digit	1999 digit
2	Lower limit deviation value	0 - -1999 digit	-1999 digit
3	Out of higher/ lower limit ranges	0 - 1999 digit	1999 digit
4	Within higher/ lower limit ranges	0 - 1999 digit	1999 digit
5	Higher limit absolute value	Within measuring range	Higher limit value of measuring range
6	Lower limit absolute value	Within measuring range	Lower limit value of measuring range
7	Scale-over	In the case of scale-over, EV output is continued.	
8	Program RUN	EV output is continued while program is in execution.	
9	Program END	EV output is produced for about 1 second upon termination of program.	
10	Program STEP	EV output is produced for about 1 second upon switching steps.	

Note: The above codes from 8 to 10 are selectable only when program option is added.

5-3. Error messages

If a problem with this instrument occurs, one of the following error messages will be displayed:

(1) Problem with measured input (to be displayed on the PV value display)

HHHH Breaking of thermocouple, breaking of R.T.D. A, and when PV exceeds higher limit of measuring range by about 10%.

LLLL When PV value falls to about 10% below lower limit of measuring range due to inverted polarity of input wiring or some other reason.

CJHH Cold junction (CJ) defect to higher side for thermocouple input.

CJLL Cold junction (CJ) defect to lower side for thermocouple input.

b--- Breaking of B (lower) or multiple break of A, B and B in R.T.D.input.

l--- Breaking of B (middle) in R.T.D. input.

(2) Problem with remote input (to be displayed on the SV value display)

rEHH When remote input value falls below lower limit of remote scale (+110%FS).

rELL When remote input value exceeds higher limit of remote scale (-10%FS).

Note: In the event you feel that something is out of order inside the instrument, please contact our representative or sales office.

6. Specifications

(1) Display

- LED display : PV display 7-segment LED
green 4 digits 3 channels to be displayed individually.
SV display 7-segment LED
orange 4 digits
CH display 7-segment LED
orange 1 digit
- Action display LED : Control output display: 3 - OUT1, OUT2, OUT3
Auto tuning: 1 - AT
Follow type SV display: 1 - FLW
Program RUN: 1 - RUN
Event output display: 3 - EV1, EV2, EV3
Remote input display: 1 - REM
Communication display: 1 - COM
- Display accuracy : $\pm(0.3\%FS + 1 \text{ digit})$ Standard accuracy
- Temperature range in which accuracy is maintained : $23^{\circ}\text{C} \pm 5^{\circ}\text{C}$
- Display resolution : Depends on measuring range
(0.001, 0.01, 0.1, 1)
- Sampling cycle : 0.5 seconds
- Measured value display range : -10% to 110% of measuring range

(2) Setting

- Setting : By 6 front key operation
- Setting range : Same as measuring range
- Higher/lower limit setting limiter : Higher and lower limits to be set separately; free within measuring range
(Lower limit < higher limit)
- Follow type SV setting : SV of CH2 or CH3 can be set to follow CH1 (deviation setting) (on condition that measuring range of CH2 or CH3 is the same as that of CH1.)

(3) Input

- Input type has to be the same for 3 channels (measuring range can be selected individually, though).
- Thermocouple : B, R, S, K, E, J, T, N, PL II, C(WRe5-26), {L, U (DIN43710)}
(Multiple input, multiple range. Refer to measuring range code table.)
External resistance : 100 Ω maximum
Input impedance : 500k Ω minimum
Burnout : Standard feature (up scale)
Cold junction temperature compensation
Accuracy : $\pm 2.0^{\circ}\text{C}$ (5 - 45 $^{\circ}\text{C}$)
- R.T.D. : JIS Pt100/JPt100 3-wire type
(Multiple range. Refer to measuring range code table.)
Amperage : About 0.25 mA
Lead wire tolerable Resistance : 5 Ω maximum/wire
- Voltage : $\pm 10, 0 - 10, 0 - 20, 0 - 50, 10 - 50, 0 - 100 \text{ mV DC}$, or $\pm 1, 0 - 1, 0 - 2, 0 - 5, 1 - 5, 0 - 10 \text{V DC}$
(Multiple input, programmable range. alarm Refer to measuring range code table.)
- Current : 4 - 20, 0 - 20mA DC
(Multiple input, programmable range. Refer to measuring range code table.)
Receiving impedance: 250 Ω
- Sampling cycle : 0.5 seconds
- PV bias : ± 1999 digit
- PV filter : OFF, 0 - 100 seconds
- Follow type PV input : PV input of CH2 or CH3 can be set to follow CH1 (deviation setting) (on condition that measuring range of CH2 or CH3 is the same as that of CH1.)

- Isolation : Insulated between input and various outputs (not insulated between input and system, remote input and DI input)
- (4) Control
 - Control mode : Expert PID control with auto tuning function
Proportional band (P): OFF, 0.1 - 999.9%FS (OFF=ON/OFF action)
 - Integral time (I) : OFF, 1 - 6000s (OFF=P, PD action with manual reset)
 - Derivative time (D) : OFF, 1 - 3600s (OFF=P, PI action)
 - Manual reset : $\pm 50.0\%$
 - ON/OFF hysteresis : 1 - 999 digit
 - Proportional cycle : 0.5 - 120.0 seconds
(0.5 sec. is unit for setting.)
 - Control output characteristics : RA/DA selectable (set to RA when shipped)
 - Output limiter : Higher limit, lower limit 0.0 - 100.0%
(lower limit < Higher limit)
 - Soft start : OFF, ON (Fixed to 10 sec.; Valid when power is turned on, RTS→RUN, and when returned from scaleover.)
- (5) Control output/rating
 - Output specification has to be the same for 3 channels.
 - Contact output (Y) : 1a 240V AC 2.5A/resistive load
 - Current output (I) : 4 - 20mA, 0 - 10mA DC
/load resistance 600 Ω maximum.
 - SSR drive voltage output (P) : 15V $\pm 3\text{V DC}$
/Load current 20mA maximum
 - Voltage output (V) : 0 - 10V DC
/Load current 2mA maximum
 - Operation output updating cycle : 0.5 second
 - Isolation : Insulated between control output and system and input
(not insulated between control output I, P or V and analog output)
- (6) Event output (optional)
 - Number of outputs : 3 -EV1, EV2, EV3 (Selectable from CH1, CH2 and CH3, individual setting, individual output)
 - Output rating : Contact output 1a (common) 240VAC / 1A (resistive load)
 - Setting : Individual setting
0) OFF: Not assigned
1) DEV: Higher limit deviation value
2) DEV: Lower limit deviation value alarm
3) DEV: Higher/lower limit value alarm in case SV is out of measuring range
4) DEV: Higher/lower limit value alarm in case SV is within measuring range
5) PV: Higher limit absolute value alarm
6) PV: Lower limit absolute value alarm
7) SO: ON upon scaleover
8) RUN: ON during program RUN
9) END: ON for 1 sec. upon
10) STEP: ON for 1 sec. upon termination of program step
 - Hysteresis : 1 - 999 digit
(when DEV or PV has been selected)
 - Standby action : Selectable
(when DEV or PV has been selected)
 - Action delay time : OFF, 1 - 9999 seconds
(when DEV or PV has been selected)
 - Isolation : Insulated between alarm output and various inputs/outputs and system
- (7) Remote setting (optional, selectable between this and DI)
 - Setting signal : 1 - 5V, 0 - 10V, 4 - 20mA
 - Setting range : Same as measuring range
 - Accuracy of setting : $\pm(0.3\%SF + 1)$ digit
 - Channel for setting : Selectable from CH1, CH2 and CH3

- Remote scaling : Within measuring range (inverted scaling possible)
- Remote bias : -1999 - 5000 digit
- Remote filter : OFF, 1 - 100 seconds
- Sampling time : 0.5 second
- Isolation : Insulated between remote input and various outputs, not insulated from system and various inputs)

(8) External control input (DI)

- (optional, selectable between this and remote setting)
- Number of input point: 1
- Input rating : No-voltage contact, open collector input (about 5V/0.4mA DC impress)
- Action type : NON, FLW (follow type SV), RUN, HLD and ADV
- Isolation : Insulated between DI input and various outputs (not insulated from system and various inputs)

(9) Program (optional)

- Registrable pattern : 1 pattern
- Number of steps : 9 maximum
- Program setting range
 - Level : same as measuring range
 - Time : 1 - 9999 seconds/step
 - Ramp : To be set automatically according to level and time
- Number of executions: 9999 maximum
- PID output limiter : To be set selectively from 3 types
- External control input : DI/no-voltage 1 point (RUN/RST, HLD, ADV)
- Action status output : RUN, END and STEP to be selectively output to event output
- CH2 and CH3 in SV follow setting : Program to be executed by making CH2 or CH3 deviation-follow to pattern set in CH1 in SV follow setting. Not in SV follow setting, program is executed in FIX mode.
- Additional functions : Temporary suspension (HLD), carry forward (ADV), PV start

(10) Analog output

- (optional, selectable between this and communication)
- Number of output : 1
- Output types : Select CH1_PV, CH2_PV, CH3_PV, CH1_SV, CH2_SV, CH3_SV, CH1_OUT, CH2_OUT and CH3_OUT
- Output rating : 0 - 10mV DC/Output impedance 10Ω
0 - 10V DC/Load current 1mA maximum
4 - 20mA/Load resistance 300Ω maximum
- Output accuracy : ±0.3%FS (to displayed value)
- Output resolution : About 1/8000
- Output updating cycle : 0.5 seconds
- Output scaling : Within measuring range (inverted scaling possible)
- Isolation : Insulated between analog output and various inputs and system (not insulated between analog output and control outputs I, P and V)

(11) Communication

- (optional, selectable between this and analog output)
- Communication type : RS-232C, RS-485
- Communication system : Half duplex start-stop synchronous system
- Communication speed: 1200, 2400, 4800, 9600, 19200bps
- Data format : 7 bits, 8 bits, no parity, even parity selectable
- Action type : NON, FLW (follow type SV), RUN,
- Communication address : 1 - 99
- Communication code : ASCII code
- Communication Protocol : Shimaden standard protocol
- Others : Control code selectable, BCC check arithmetic system selectable
- Isolation : Insulated between communication signal and system/input/output

(12) Others

- Data storage : By non-volatile memory (EEPROM)
- Ambient temperate/humidity ranges for use: -10 - +50°C/below 90% RH (on condition that there is no dew condensation)
- Temperature for storage : Between-20 and 65 °C
- Power voltage : 100V - 260V AC ±10% (50/60 Hz)
- Power consumption : 18VA maximum
- Input noise removal ratio : Normal mode 45 dB minimum (50/60 Hz)
Common mode 140 dB minimum (50/60 Hz)
- Insulation resistance : Between input/output terminals and power terminal 500V DC 20MΩ minimum
Between power terminal and protective conductor terminal 500V DC 20MΩ minimum
- Dielectric strength : 1 minute at 2300V AC between input/output terminals and power terminal
1 minute at 1500V AC between power terminal and protective conductor terminal
- Protective structure : IP66 equivalent, (Panel thickness : 1.2-3.2mm)
- Material : PPE resin molding (equivalent to UL94V-1)
- External dimensions : 96 × 96 × 110 mm (Inside depth of panel: 100 mm)
- Mounting : Push-in panel (one-touch mount)
- Panel cutout size : H92 × W92 mm
- Weight : About 420 g

产品中有毒有害物质或元素的名称及含量

部件名称	有毒有害物质或元素					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr (VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印制电路板	×	○	○	○	○	○
电子元器件	×	○	○	○	○	○
接线端子	○	○	○	○	○	○
外壳	○	○	○	○	○	○

○: 表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006 标准规定的限量要求以下。
×: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006 标准规定的限量要求。

The contents of this manual are subject to change without notice.

Temperature and Humidity Control Specialists
SHIMADEN CO., LTD.

Head Office: 2-30-10 Kitamachi, Nerima-Ku, Tokyo 179-0081 Japan
Phone: +81-3-3931-7891 Fax: +81-3-3931-3089
E-MAIL: exp-dept@shimaden.co.jp URL: http://www.shimaden.co.jp

PRINTED IN JAPAN