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.

CE

"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 ⏚ designates a protective conductor terminal. Make sure to properly ground it.

Matters Regarding Safety

⚠ WARNING

The MR13 series controllers are designed for controlling temperature, humidity and other physical subjects. It must not be used in any way that may adversely affect the safety, health or working conditions of those who come into contact with the effects of its usage. When used, adequate and effective safety countermeasures must be provided at all times. No warranty, express or implied, is valid in the case of using this product without proper safety countermeasures.

⚠ WARNING

- In using this product, be certain to house it, for example, in a control panel so that the terminals cannot come into contact with personnel.
- Do not take this instrument out of the case or put your hand or any conductor inside the case. Such conduct may lead to an accident which endangers life or causes serious injury due to electric shock.
- Do not fail to ground the protective conductor terminal in use.

⚠ CAUTION

To avoid damage to the connected equipment, facilities, other products or the like due to a fault of the product, safety countermeasures must be taken before use, such as proper installation of the fuse and the overheating protection device. No warranty, express or implied, is valid in the case of using this product without proper safety countermeasures.

⚠ CAUTION

- The ⚠ mark on the plate affixed to the instrument:
  On the terminal nameplate affixed to the case of the instrument, the ⚠ mark is printed. This is to warn you of the risk of electrical shock which may result if the charger is touched while it is energized.
- A means to allow the power to be turned off, such as a switch or a breaker, should be installed in the extended power circuit to be connected to the power terminal of the instrument. Fix the switch or the breaker adjacently to the instrument in a position which allows it to be operated with ease, and with an indication that it is a means of turning the power off. The switch or the breaker should meet the requirements of IEC947.
- Fuse: Since the instrument does not have a built-in fuse, do not forget 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: 250V AC 1.0A/ time-lag (T), low-breaking capacity (L).
  Use a fuse which meets the requirements of IEC127.
- When wiring is done, ensure that terminal connections are reliably tightened.
- Power voltage and frequency to be used should be within the rated ranges.
- Voltage/current of a load to be connected to the output terminal and the alarm terminal should be within a rated range. Otherwise, the temperature will rise and reduce the life of the product and/or result in problems with the product. For the rated voltage/current, see 6. Specifications. The output terminal should be connected with a device which meets the requirements of IEC1010.
- A voltage/current different from that of the input specification should not be applied to the input terminal. It may reduce the life of the product and/or result in problems with the product. For the rated voltage/current, see 6. Specifications. For voltage (mV or V) or current (4 ~ 20mA) input, the input terminal should be connected with a device which meets the requirements of IEC1010.
- The MR13 series controller is provided with a draft hole for heat discharge. Take care to prevent the entrance of metal or other foreign matter. Failure to do so may result in problems with the product and may even result in fire.
- Do not block the draft hole or allow dust or the like to adhere. A rise in temperature or insulation failure may result in shortening of the life of the product and/or problems with the product. For spaces between installed instruments, refer to 2-3. External Dimensions and Panel Cutout.

SHIMADEN CO.,LTD.
MR13F-1DE
Apr. 2001

- 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 or using it incorrectly.
- For safe and proper use of this product, you are requested to stick to the matters to be attended to described in this instruction manual.

Contents

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 ②③-④⑤⑥⑦⑧

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: 0-10V DC 05: 4-20mA DC 06: 1-5V DC 07: 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)

⚠ CAUTION

Do not try to operate the instrument in any of the following sites. If tried, it may lead to problems with or damage to it, or even to 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.

Note: The environmental conditions belong to the installation category II of IEC 664 and the degree of pollution is 2.

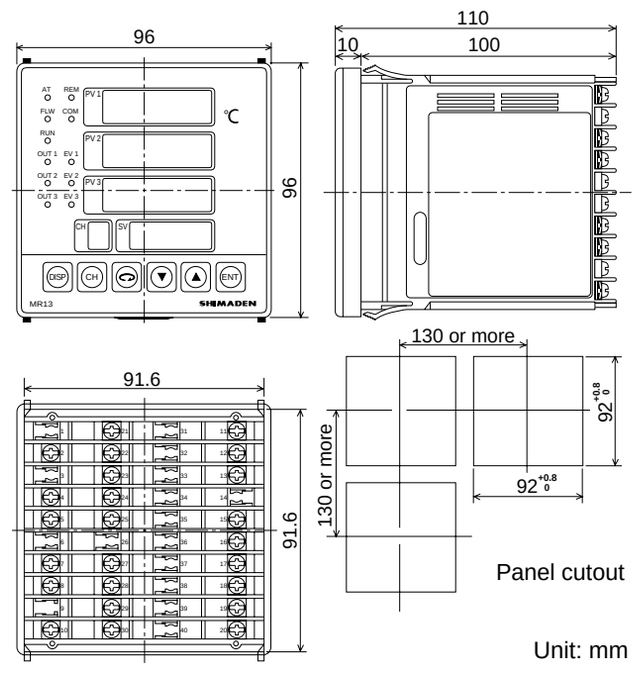
2-2. Mounting

⚠ CAUTION

For safety's sake and to maintain the function at a proper level, the instrument must not be drawn out of the case. If the need to draw out the case arises for replacement or repair, please contact our sales office.

(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. External dimensions and panel cutout



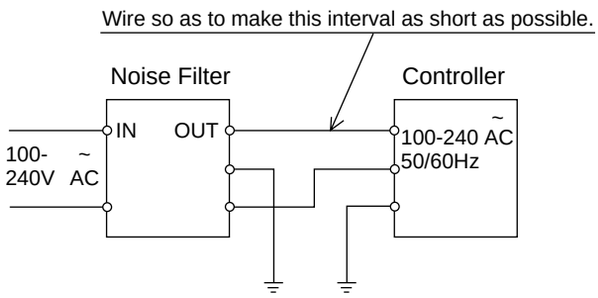
Unit: mm

2-4. Wiring

⚠ WARNING

- Make sure to turn the power off before starting wiring operation to prevent electric shock.
- Be certain that the protective conductor terminal (⏚) is properly grounded. Otherwise, a serious electric shock may result.
- Avoid touching the wired terminals and charged devices while power is on.

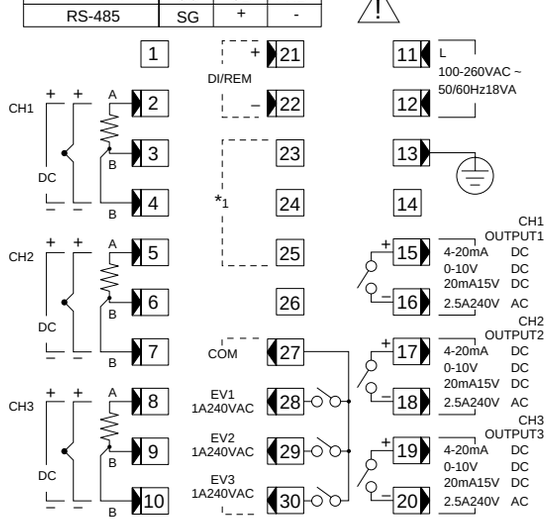
(1) Wiring operation should be done as indicated in the terminal arrangement in section 2-5. Double check that no wrong connection is made.
(2) Crimp terminal should accommodate the M3.5 screw and should have a width of less than 7mm.
(3) For thermocouple input, select the compensation wire suitable 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 mm² 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 mm² .
(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.



Recommended noise filter: TDK's ZMB2203-13

2-5. Terminal arrangement

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



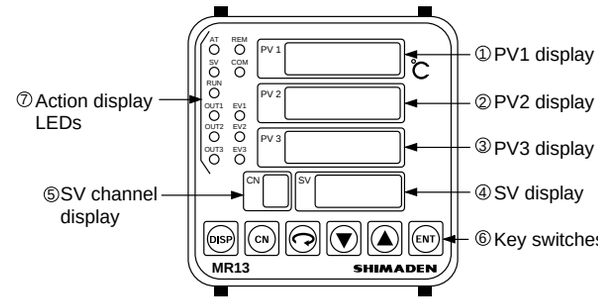
2-6. Terminal arrangement table

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

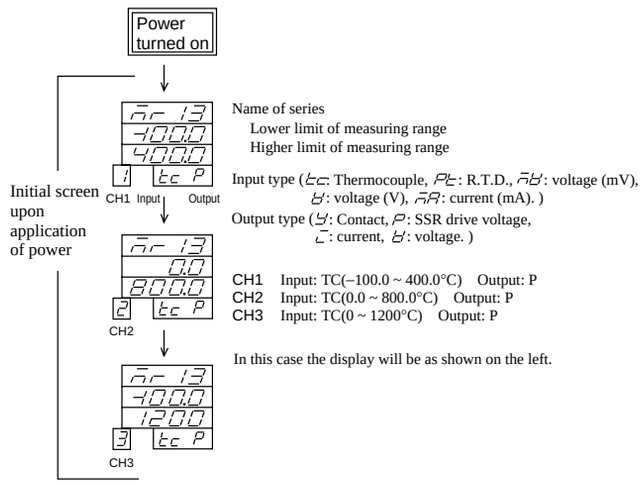
⑥ Key switches
(1) DISP (Disp) key
• Press on initial screens of mode 1 and 2 screen groups to move to the mode 0 basic screen.
• Press on any screen of the mode 0, 1 or 2 screen group to move to initial screen of that screen group.
(2) CH (channel) key
• Use for channel switching.
• Press on the 0-3 program setting screen in the program mode to move to the mode 2 screen group.
(3) (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.

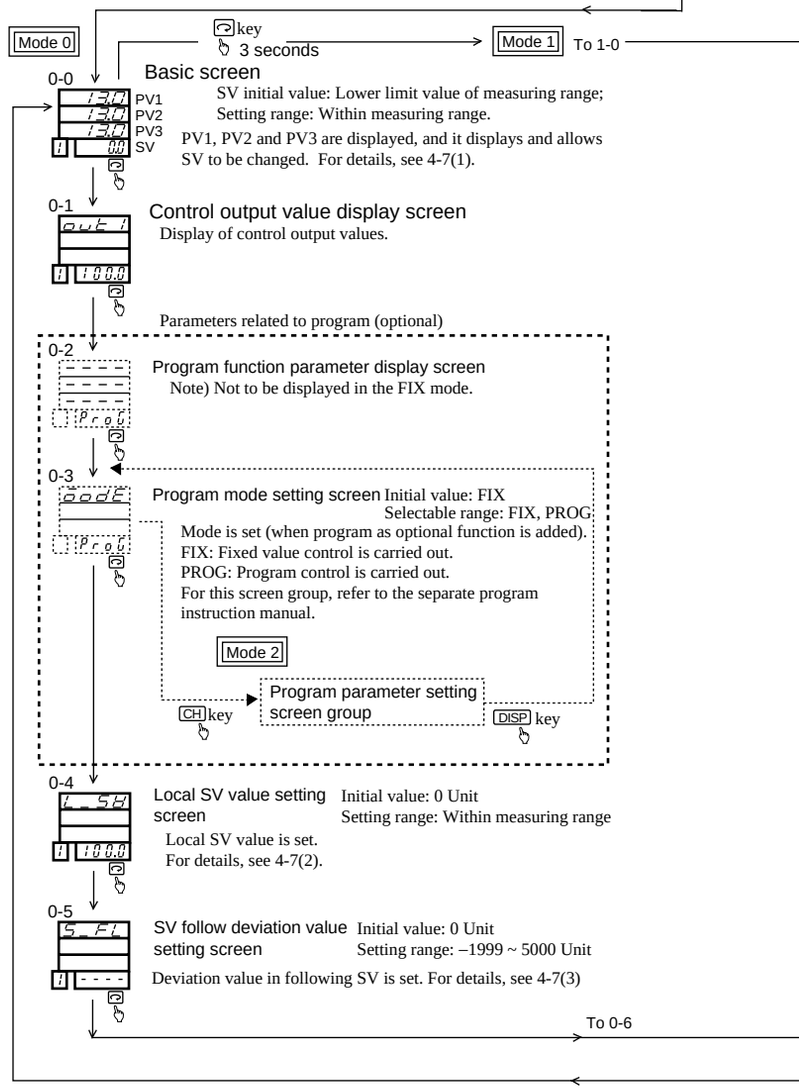
4. Screens

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.



4-2. Key sequence



To 0-0

Mode 1

DISP key

0-6

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 Unit	0 ~ 1999 Unit
EV2	–1999 Unit	0 ~ –1999 Unit
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.

0-7

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

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

0-8

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.

P≠OFF

P=OFF

0-9

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

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

0-10

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.

0-11

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.

0-12

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.

0-13

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 ▲ key while ↺ key is being pressed causes backward movement.
(It causes movement in opposite direction to what is caused by pressing ↺ key.)

1-0

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

1-1

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.

1-2

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, EV 2 and EV 3 by using event codes shown in 5-2. event type code table.

1-3

Event action hysteresis setting screen — Initial value: 5 Unit
Setting range: 1 ~ 999 Unit

Event action hysteresis is set.
This screen is not displayed in case event types 7 ~ 10 are set.

1-4

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.

1-5

Event action delay time setting — Initial value: 0 second
Setting range: 0 ~ 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.

1-6

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).

1-7

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.

1-8

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.

1-9

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.

To 1-10

To 1-21

1-10

Target value function setting value Initial value: 0.40
Setting range: OFF, 0.01 ~ 1.00

This is used when overshoot or undershoot to set value arises during PID control. This screen is not displayed when I=OFF.

1-11

AT execution point setting screen Initial value: 0 Unit
Setting range: 0 ~ 5000 Unit

AT point is set.

1-12

Soft start selecting screen Initial value: OFF
Selectable range: ON, OFF

Whether soft start, which means output is changed gradually at the start of control, is used or not is selected by ON or OFF.
Soft start functions only in the following cases, though.
1. When power is turned on.
2. Upon return from scaleover to normal.
3. When RST→ RUN in PROG mode.

In case analog output (option) is selected:

1-13A

Analog output type setting screen
Initial value: PV1
Selectable range: Refer to the following table.

Assignment to analog output is made by selection from 9 types shown in the following table:

PV1 [Pv1]	PV2 [Pv2]	PV3 [Pv3]
SV1 [Sv1]	SV2 [Sv2]	SV3 [Sv3]
OUT1 [out1]	OUT2 [out2]	OUT3 [out3]

1-14A

Analog output lower limit scale setting screen
Initial value: As per table below
Setting range: As per table below

Lower limit scale of analog output is set.
It is conditional that Ao_L≠Ao_H.

MODE	Setting range	Initial value
PV1, PV2, PV3	Within measuring range	Lower limit value of measuring range
SV1, SV2, SV3		
OUT1, OUT2, OUT3	0.0 ~100.0%	0.0%

1-15A

Analog output higher limit scale setting screen
Initial value: As per table below
Setting range: As per table below

Higher limit scale of analog output is set.
It is conditional that Ao_L≠Ao_H.

MODE	Setting range	Initial value
PV1, PV2, PV3	Within measuring range	Higher limit value of measuring range
SV1, SV2, SV3		
OUT1, OUT2, OUT3	0.0~100.0%	100.0%

In case communication (option) is selected:
(For details about this screen group, refer to the separate communication instruction manual.)

1-13B

Communication selecting screen Initial value: LOC
Selectable range: COM→ LOC

Select communication mode.
LOC mode: Only read command by communication is valid.
COM mode: Read and write commands by communication are valid.
Nevertheless, front key operation can change from COM to LOC only.

1-14B

Communication address setting Initial value: 1
Setting range: 1 ~ 99

Machine numbers are set when two or more instruments are connected for communication.

1-15B

Communication speed selecting screen
Initial value: 1200bps
Setting range: 1200, 2400, 4800, 9600, 19200bps
The speed of data transmission to host computer is selected.

1-16B

Communication data format setting screen
Initial value: 7E1
Selectable range: 8 types shown in the table below.
Communication data format is selected.

7E1	7bit, EVEN, STOP 1bit	8E1	8bit, EVEN, STOP 1bit
7E2	7bit, EVEN, STOP 2bit	8E2	8bit, EVEN, STOP 2bit
7N1	7bit, NONE, STOP 1bit	8N1	8bit, NONE, STOP 1bit
7N2	7bit, NONE, STOP 2bit	8N2	8bit, NONE, STOP 2bit

1-17B

Communication memory mode setting screen Initial value: EEP
Selectable value: EEP, RAM

EEP → for writing data in EEPROM.
RAM → for writing data in RAM.

1-18B

Communication control code setting screen Initial value: 1
Selectable range: 1 ~ 3

Control code to be used is selected.
1. STX_ETX_CR
2. STX_ETX_CRLF
3. @_:_CR

1-19B

Communication check sum setting screen Initial value: 1
Selectable range: 1 ~ 4

BCC arithmetic method to be used in BBC checking is selected.
1. ADD 3. XOR
2. ADD_two's cmp 4. None

1-20B

Communication delay time setting screen Initial value: 40
Setting range: 0 ~ 125

Delay time from receipt of communication command to transmission is set.
Delay=0.25 × set value msec.

From 1-9

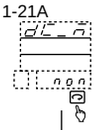
From 1-20

To 1-33

In case DI input option is selected:

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

1-21A

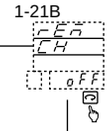


DI input type setting screen Initial value: non
Selectable range: non, FLW, run
HLd, AdV

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)

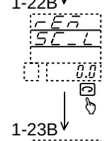
1-21B



Remote channel No. setting screen Initial value: OFF
Selectable range: OFF, 1 ~ 3

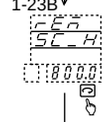
Channel number to be used for remote input is set.
However, the number of the channel which has been set to ON for SV deviation follow action is unable to be set.
CH1 setting is not possible in the program mode, either.

1-22B



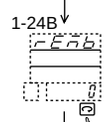
Remote scale lower limit value setting screen
Initial value: Lower limit value of measuring range
Setting range: Within measuring range
Lower limit value of SV measuring range for remote input is set.
Note: REM SC_L ≠ REM SC_H.

1-23B



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.

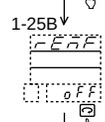
1-24B



Remote bias setting screen Initial value: 0 Unit
Selectable value: −1999 ~ 5000 Unit

Remote bias value is set.

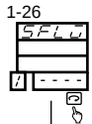
1-25B



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

Remote filter is set.

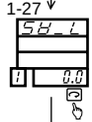
1-26



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).

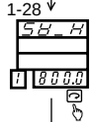
1-27



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.

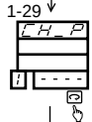
1-28



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.

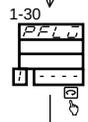
1-29



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.)

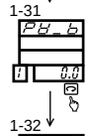
1-30



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).

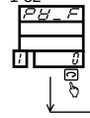
1-31



PV bias setting screen Initial value: 0 Unit
Setting value: −1999 ~ 1999 Unit

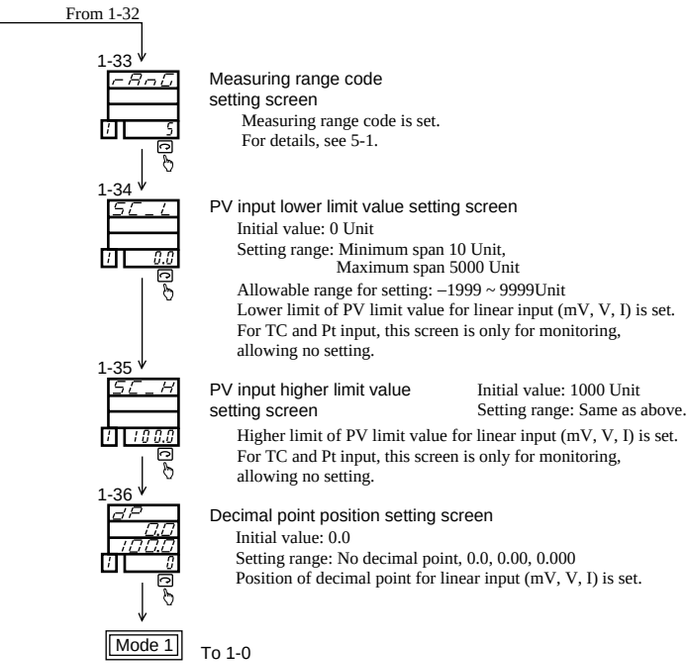
PV bias value is set. If PV bias value of CH2 or CH3 is changed while PV follow action is going on, it will not work.

1-32



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.

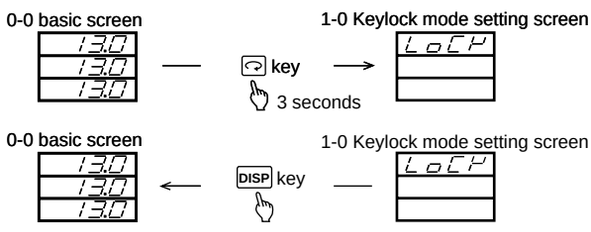
(1) Mode 0 screen group
It is made of screens of relatively high frequency in use for operation, i.e., the basic screen (for setting target value and confirming current measured value), the auto tuning action control screen, the event value setting screen and so forth.

(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.

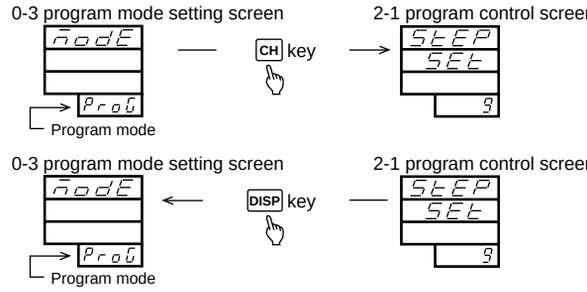
4-4. How to change screens

(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 DISP 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.

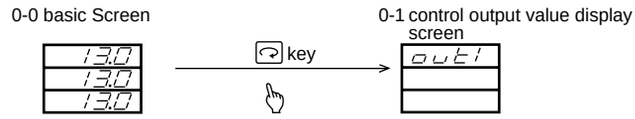


Note: In the above, the mark ☝ means that the key above the mark is pressed. Hereinafter this mark is used in the same way.

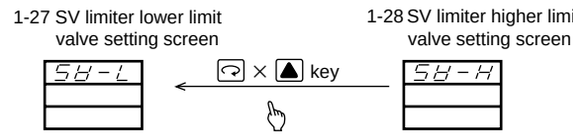
(2) How to move between mode 0 and mode 2 screen groups (in case program option is added)
- By pressing CH key on the 0-3 program mode setting screen, you can move to the mode 2 screen group (only when program mode is set).
  Pressing DISP key on any of the mode 2 screen group calls the 0-3 program mode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

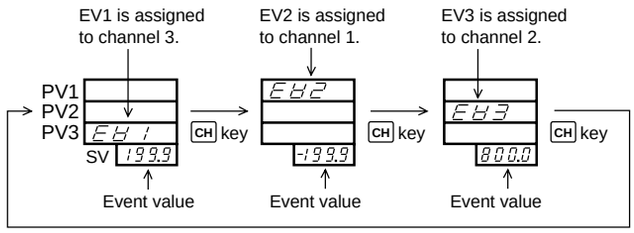
(2) 0-4 local SV value setting screen
- SV1 can be changed even in the program mode but the change is not reflected in the program mode.
- SV can be changed even when remote has been assigned but the change is not reflected in remote action.

(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 EV 3 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 OFF 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 on 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) 1-21A 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 [FLG] 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.

(4) 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.

(5) 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
	PLII	11	0 ~1300 °C	25	0 ~2300 °F
	WRe5-26	12	0 ~2300 °C	26	0 ~4200 °F
	*2 U	13	-199.9 ~ 200.0 °C	27	-300 ~ 400 °F
	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	*3 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
	JPt100 (Old) JIS	39	-200 ~ 500 °C	55	-300 ~ 900 °F
		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	*3 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 count Span: 10~5000 count **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 ± 0.5% FS.
*3 R.T.D.: Accuracy is ± 0.3°C (± 0.8 °F).

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

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 Unit	1999 Unit
2	Lower limit deviation value	0 ~ –1999 Unit	–1999 Unit
3	Out of higher/ lower limit ranges	0 ~ 1999 Unit	1999 Unit
4	Within higher/ lower limit ranges	0 ~ 1999 Unit	1999 Unit
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.	

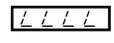
Note: The above codes from 8 to 10 are selectable only when program option is added.

5-3. Error messages

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

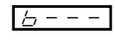
(1) Problem with measured input (to be displayed on the PV value display)


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

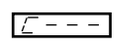

When PV value falls to about 10% below lower limit of measuring range due to inverted polarity of input wiring or some other reason.


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

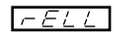

Cold junction (CJ) defect to lower side for thermocouple input.


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

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


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


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


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: ± (0.3%FS + 1 digit) Standard accuracy
- Temperature range in which accuracy is maintained: 23°C ± 5°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, WRe5-26, {L, U (DIN43710)} (Multiple input, multiple range. Refer to measuring range code table.)
  - External resistance: 100Ω maximum
  - Input impedance: 500kΩ minimum
  - Burnout: Standard feature (up scale)
  - Cold junction temperature compensation accuracy: ± 2.0 °C (5~45 °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: 5Ω maximum/wire
- Voltage: ± 10, 0~10, 0~20, 0~50, 10~50, 0~100 mV DC, or ± 1, 0~1, 0~2, 0~5, 1~5, 0~10V DC (Multiple input, programmable range. Refer to measuring range code table.)
- Current: 4~20, 0~20mA DC (Multiple input, programmable range. Refer to measuring range code table.) Receiving impedance: 250Ω
- Sampling cycle: 0.5 seconds
- PV bias: ± 1999 units
- PV filter: 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: ± 50.0%
  - ON/OFF hysteresis: 1~999 units
- 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 600Ω maximum.
- SSR drive voltage output (P): 15V ± 3V 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) 240V AC / 1A (resistive load)
- Setting: Individual setting
  0) NON: Not assigned
  1) DEV: Higher limit deviation value alarm
  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 termination of program
  10) STEP: ON for 1 sec. upon termination of program step
- Hysteresis: 1~999 units (when DEV or PV has been selected)
- Standby action: Selectable (when DEV or PV has been selected)
- Action delay time: 0~9999 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: ± (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 units
- Remote filter: 0~100 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:
- 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:
- 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: 99 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
- 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 60 dB minimum (50/60 Hz)
  Common mode 140 dB minimum (50/60 Hz)
- Applicable standards: Safety: IEC1010-1 and EN61010-1
  EMC: EN61326
- Insulation resistance: Between input/output terminals and power terminal 500V DC 20MΩ minimum
  Between input/output terminals and protective conductor terminal 500V DC 20MΩ minimum
- Dielectric strength: 1 minute at 2300V AC between input/output terminals and power terminal (inductive current 5mA)
  1 minute at 2300V AC between power terminal and protective conductor terminal (inductive current 5mA)
- Protective structure: Only front panel has simple dust-proof and drip-proof structure
- Material: PPO 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

Temperature and Humidity Control Specialists

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