

MAC3 Series

Digital controller Instruction Manual

Thank you for purchasing SHIMAX product. Please check that the product is the one you ordered.

Please operate after you read the instruction manual and fully understand it.

Notice

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

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Preface

This instruction manual is intended for those who will be involved in wiring, installation, operation and routine maintenance of the MAC3.

This manual describes the care, installation, wiring, function, and proper procedures regarding the operation of MAC3.

Keep this manual on hand while using this device. Please follow the provided guidance.

1. Matters regarding safety

For matters regarding safety, potential damage to equipment and/or facilities and additional instructions are indicated as follows:

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

〔△WARNING〕

* □This mark indicates hazardous conditions that could cause damage to equipment and/or facilities. Exercise extreme caution as indicated.

〔△CAUTION〕

* This mark indicates additional instructions and/or notes.

〔NOTE〕

〔△WARNING〕

MAC3 is designed for controlling temperature, humidity, and other physical subjects in general industrial facilities. It must not be used in any way that may adversely affect safety, health, or working conditions.

〔△CAUTION〕

To avoid damage to the connected equipment, facilities or the product itself due to a fault of this instrument, safety countermeasures must be taken before usage, such as proper installation of the fuse and the overheating protection device. No warranty, expressed or implied, is valid in the case of usage without having implemented proper safety countermeasures.

〔△CAUTION〕

● The △ mark on the plate affixed to the instrument:

On the terminal nameplate affixed to the case of your 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.

● The external power circuit connected to the power terminal of this instrument must have a means of turning off the power, such as a switch or breaker. Install the switch or breaker adjacent 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 off the power. Use a switch or breaker, which meets the requirements of IEC127.

● 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 breaker and the instrument and should be attached to the L side of the power terminal.

Fuse Rating: 250V AC 0.5A / medium lagged or lagged type.

Use a fuse which meets the requirements of IEC127

● Load voltage/current to be connected to the output terminal and the alarm terminal should be within the rated range. Otherwise, the temperature will rise and shorten the life of the product and/or result in problems with the product.

● Voltage/current that differs from input specification should not be connected to the input terminal. It may shorten the life of the product and/or result in problems with the product.

● Input, output of voltage pulse, and output of electric current are not insulated. Therefore, do not ground an adjusted power terminal when a ground sensor is employed.

● A signal wire's common mode voltage to ground (signal wires other than contact output including power supply and event) should be less than 30V rms, 42.4V peak, and 60 VDC .

● This instrument has basic insulation between the power supply and the secondary circuit. If accessible Safety Extra Low Voltage (SELV) circuits are to be connected to Signalinput/output terminals (Input, Output (SSR, Current, Voltage), DI, CT, Analog output, Communication, and other secondary circuit), ensure to provide a basic insulation between the SELV circuits and these terminals (For example, use transformer which has a basic insulation or higher degree of insulation). The basic insulation requires a clearance at least 1.5mm and a creepage of at least 3.0mm.

● All the wires for the interior distribution, except for communication and contact output (including power supply and event), should be less than 30m in length. When the wire's length is 30m or more, or in the case of outdoor wiring, the suitable measure against a lightning surge is required.

● EMC standard (IEC61326) classifies MAC3 into Class A apparatus. Electromagnetic interference may occur when MAC3 is used at a business district or in the home. Please use after taking sufficient measures.

2. Introduction

2-1. Check before use

Before using MAC3, please check the model code, the exterior appearance and accessories. Also, make sure that there are no errors, impairs and shortages.

Confirmation of model code: Check that the product you ordered is being delivered properly.

Check the model code of the main body case against the following code table.

Example of model code

MAC 3 A -	M	C	F -	E	C -	D	H	T	R	N
1	2	3	4	5	6	7	8	9	10	11

Item

1. Series MAC3A-:96×96mm size digital controller
MAC3B-:48×96mm size digital controller
2. Input M:multi, V:voltage, I:current
3. Control Output 1 C:contact, S:voltage pulse, I:current(4~20mA), V: Voltage(0~10V)
4. Power Supply F:90 - 264V AC, L:21.6 - 26.4V DC/AC
5. Event Output N:none, E:Event Output 1 · 2 (two points)
6. Control Output 2 · Event Output · Optional Selection of DI
N:none, C:contact, S:voltage pulse, I:current (4~20mA), V:- Voltage(0~10V)
E: Event Output 3(one point), D: external control input (DI4) one point
7. DI N:none, D: external control input (DI 1,2) two points
8. CT Input N: none, H: CT Input one points
9. Analog Output N: none, I: current (4~20mA), V: Voltage(0~5V)
10. Communication N: none, R: RS485
11. Program Function N: none, P: equipped

Example of model code

MAC 3 D -	M	C	F -	E	C -	D	H	T	N
1	2	3	4	5	6	7	8	9	

Items

1. Series MAC3C-: 72×72mm size digital controller
MAC3D-: 48×48mm size digital controller
2. Input M:multi, V: voltage, I:current
3. Control Output 1 C:contact, S:voltage pulse, I:current(4~20mA), V: Voltage(0~10V)
4. Power Supply F:90 - 264V AC, L:21.6 - 26.4V DC/AC
5. Event Output N:none, E:Event Output 1 · 2 (two points)
6. Control Output 2 · Event Output · Optional Selection of DI
N:none, C:contact, S:voltage pulse, I:current (4~20mA), V:- Voltage(0~10V)
E: Event Output 3(one point), D: external control input (DI4) one point
7. DI · CT Input N: none, D: external control input (DI1,2) two points, H:CT Input one points
8. Analog Output · Communication N: none, T: current (4~20mA), V: Voltage(0~5V) R: RS485
9. Program Function N: none, P: equipped

Check of accessories

Instruction manual: 1 set

〔NOTE〕 : Please contact our agencies or business offices if you have any problem.
We welcome any kind of inquiry such as defect of the product, shortage of accessory
and so on.

2-2. Caution for use

(1) Do not operate the front panel keys with hard or sharp objects.

Do not fail to touch keys lightly with a fingertip.

(2) Wipe gently with a dry rag and avoid using solvents such as thinner.

3. Installation and wiring

3-1. Installation site (environmental conditions)

〔△CAUTION〕

Do not use this product under the following conditions.

Otherwise, failure, damage and fire may occur.

- (1) Where flammable gas, corrosive gas, oil mist or dust generate or grow rife.
(2) Where the temperature is below -10°C or above 55°C.

(3) Where the humidity is over 90%RH or where condensation occurs.

(4) Where high vibration or impact occurs

(5) Where inductive interference may easily affect the operation.

Or, in the region of strong electric circuit area.

(6) Where waterdrops or direct sunlight exists.

(7) Where the altitude is above 2,000m.

〔NOTE〕 : The environmental conditions comply with the IEC664.

Installation category is II and the pollution degree is 2.

3-2. Mounting

(1) Machine the mounting hole by referring to the panel-cut illustration in Section 3-3.

(2) Applicable thickness of the mounting panel is 1.2 ~ 2.8mm.

(3) As this product provides mounting fixture, insert the product into the panel.

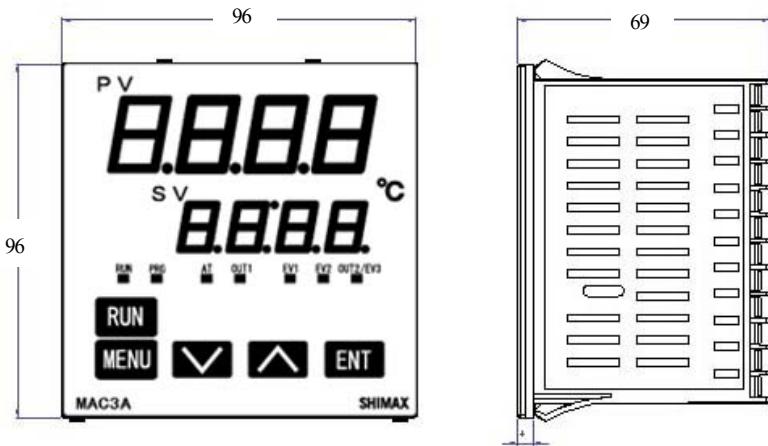
〔NOTE〕:MAC 3 is a panel set-up type.

Please use the product after setting up to the panel.

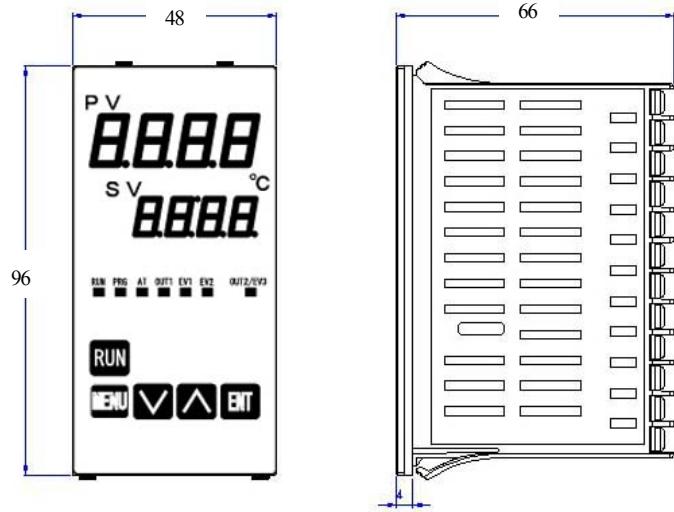
3-3. External dimension and panel cutout

MAC3 external dimensions (unit: mm)

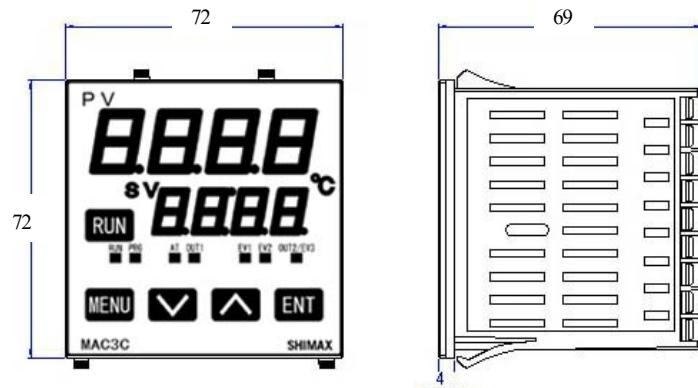
MAC 3A



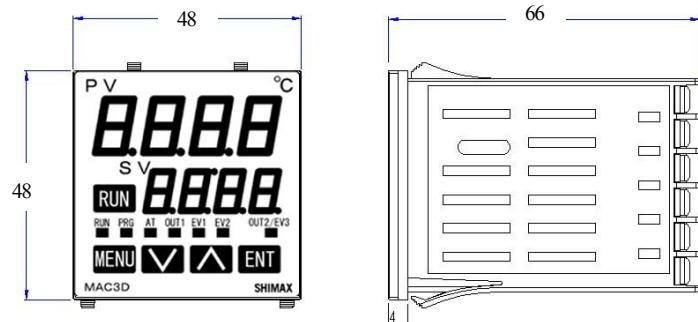
MAC 3B



MAC 3C

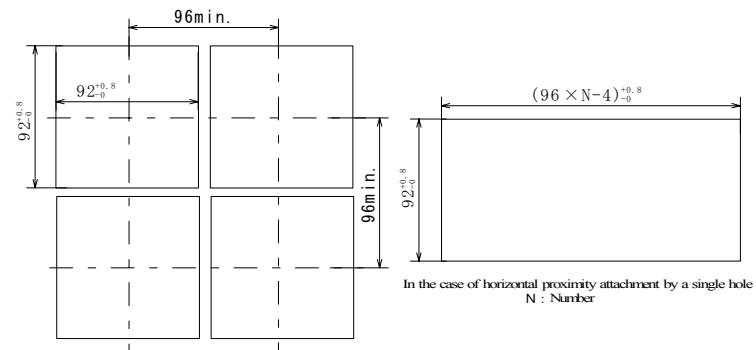


MAC 3D

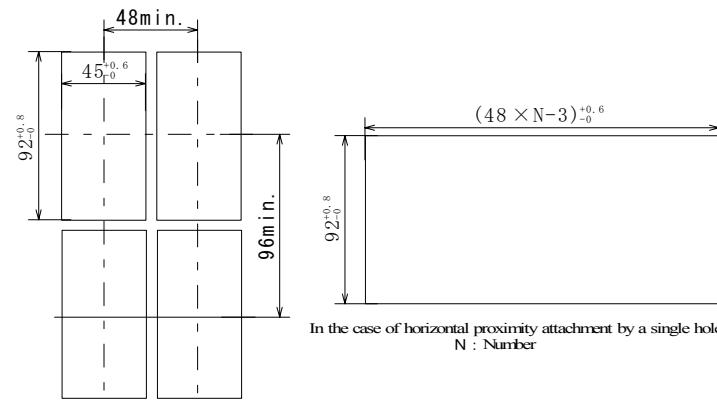


MAC3 panel cutout (unit: mm)

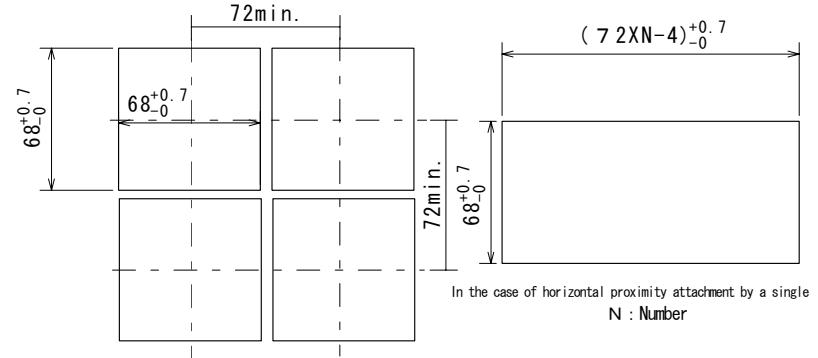
MAC3A (96×96 size)



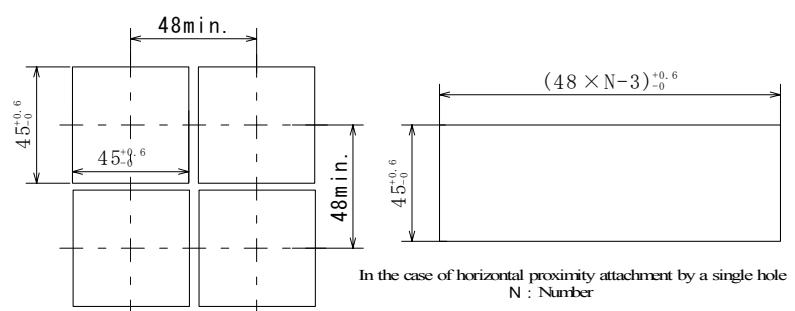
MAC3B 48×96 size



MAC3C 72×72 size



MAC3D 48×48 size



Note: Proximity attachment by a single hole is possible only in the case of horizontal direction.

When an apparatus that was attached in vertical direction is removed, a dedicated detachment tool is required.

3-4. Wiring

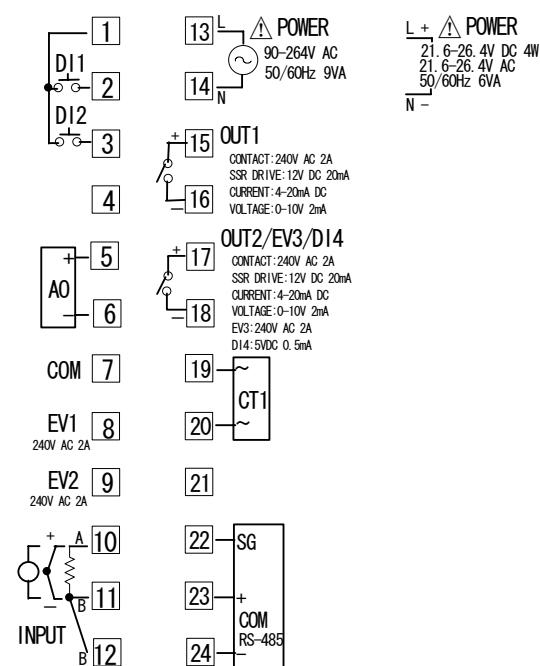
〔△ WARNING〕

- ◎Do not turn on electricity while wiring to avoid an electric shock.
- ◎Do not touch a terminal or live part while turning on electricity.

- (1) Make sure that wiring operation is properly done in line with a terminal wire diagram of section 3-5.
- (2) Choose a suitable compensation lead wire in the case of thermocouple input.
- (3) In the case of resistance bulb input, resistance value of each lead wire must be less than 5Ω and that of three lead wires must be equal.
- (4) Do not wires an input signal line inside of an electric wire pipe or a duct same with the high voltage line.
- (5) Shield wiring (single point grounding) is effective against static induction noise.
- (6) Wiring twisted at equal short intervals is effective against electromagnetic induction noise.

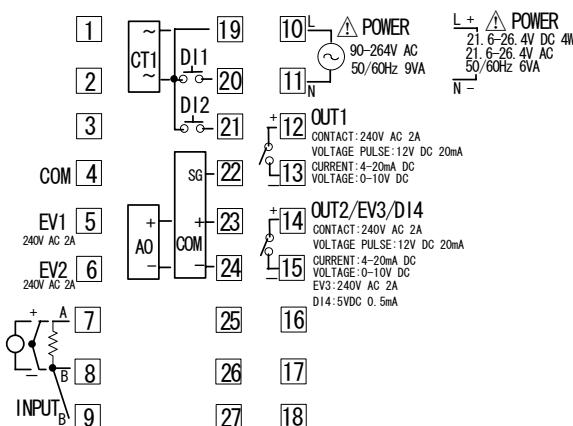
3-5. Terminal arrangement diagram

3-5. Terminal arrangement plan of MAC3A and MAC3B



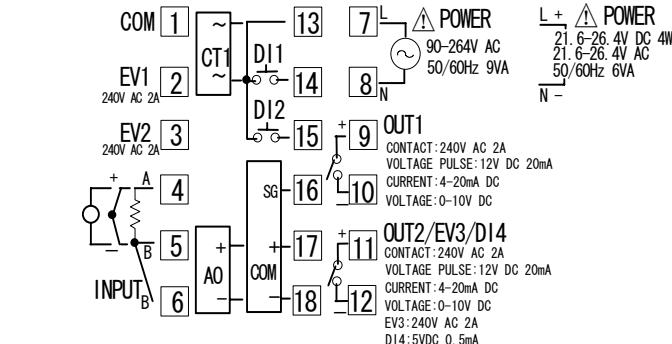
〔Note〕 : If input type is thermocouple or voltage, errors may occur when terminal 11 and terminal 12 terminal are short-circuited

Terminal arrangement plan of MAC3C



〔Note〕 : If input type is thermocouple or voltage, errors may occur when terminal 8 and terminal 9 terminal are short-circuited

Terminal arrangement plan of MAC3D



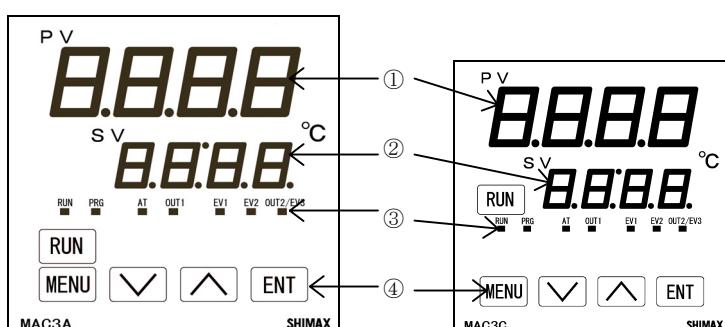
〔Note〕 : If input type is thermocouple or voltage, errors may occur when terminal 5 and terminal 6 terminal are short-circuited

4. Description of front panel

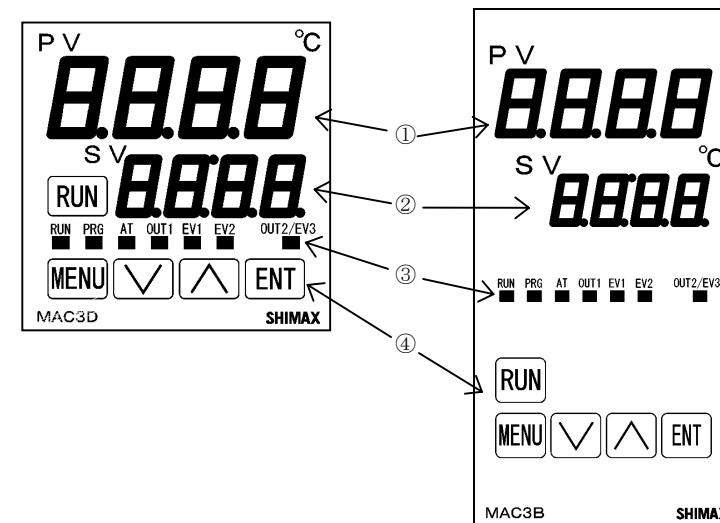
4-1. Names of front panel

MAC3A 96x96

MAC3C 72x72



MAC3D 48x48



4-2. Explanation of front panel section

① : Display of measured value (PV) (red)

Measured value (PV) and type of setting is displayed on each setting screen.

② : Display of target value (SV) (green)

Target value and set value are displayed on each setting screen.

③ : Monitor LED

(1) RUN monitor LED RUN (green)

If RUN is performed with RUN key, operation mode1 screen, external control input (DI), and communication, it lights up, and put out by standby (reset). It blinks, if a manual output is chosen in output monitoring screen or extermal control input (DI).

(2) Program functional monitor LED PRG (green)

Lights up at the time of program control's standby or flat part control. Puts out at the time of FIX control selection.

(3) Auto tuning operation monitor LED AT (green)

If AT is chosen in ON or external control input (DI), blinks during AT execution. Lights up when AT is on standby, and puts out with AT automatic termination or release.

(4) control out put 1 monitor LED OUT (green)

At the time of a contact or a voltage pulse output, the it lights up with ON and lights off with OFF. Lights off with 0% power output, and lights up with 100% power. And blinks in intermediate ratio.

(5) Event output monitors LED EV1 and EV2 (yellow)

Lights up when the allotted event output turns to ON.

(6) Control out put 2/event output 3 monitors LED OUT2/EV3 (yellow)

When control output 2 is chosen, it operates like control output 1 monitor LED does. When event output 3 is chosen, it operates like event output monitor LED does.

④ : Key-switch section

(1) □ (MENU)key

Press this key to move onto the next screen among the screens.

Press □(MENU) key for three seconds on the basic screen, then it jumps to the lead screen of Mode 1. Press □ key for three seconds on the lead screen of each Mode screens, then it jumps to the basic screen.

Press □ key for three seconds on the lead screen of FIX or PROG, then it jumps to the basic screen.

When a program control option is added, press □ (MENU) key for three seconds on the screen of operation mode 2, then it jumps to the screen of operation Mode 1.

(2) ▼ (DOWN)key

Press ▼ (DOWN) key one time, and the shown value decreases by one numerical value.

One time press of ▼ key decreases by one numerical value. By pressing the key continuously, the value as well consecutively decreases. A decimal point of the smallest digit blinks at this time. This shows that a setting change is in progress.

In PROG, used as a shift key between each step setting screens(Steps 1-25),lead screen.

Also used as a shift key between lead screen in each mode screens.

(3) ▲ (UP)key

Press ▲ (UP) key one time, and the shown value increases by one numerical value.

By pressing continuously, the value By pressing the key continuously, the value consecutively increases. A decimal point of the smallest digit blinks at this time. This shows that a setting change is in progress.

In PROG, used as a shift key between each step setting screens (Steps 1-25), lead screen.

Also used as a shift key between lead screen in each mode screens.

(4) ▶ (ENTRY/REGISTER)key

The setting data changed on each screen is determined (the decimal point of the minimum digit is also lighted off).

When a program control option is added, press ▶ (ENT) key for three seconds on the screen of operation mode 1, then it jumps to the screen of operation Mode 2.

Press ▶ key for 3 seconds on the output monitoring screen,then the shift between manual output and automatic output is carried out.

Press the key for 3 seconds on the basic screen, then it shifts to FIX or PROG head screen.

Push at FIX-PROG and each mode screens' lead screen, then shifts to setting screen.

(5) ▨ (RUN OPERATION/STOP)key

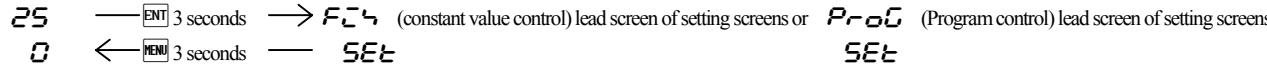
Push for 3 seconds at STBY (control stop), then FIX or PROG control starts.

Push for 3 seconds while FIX or PROG is in operation, then control is stopped.

5. Description of screens

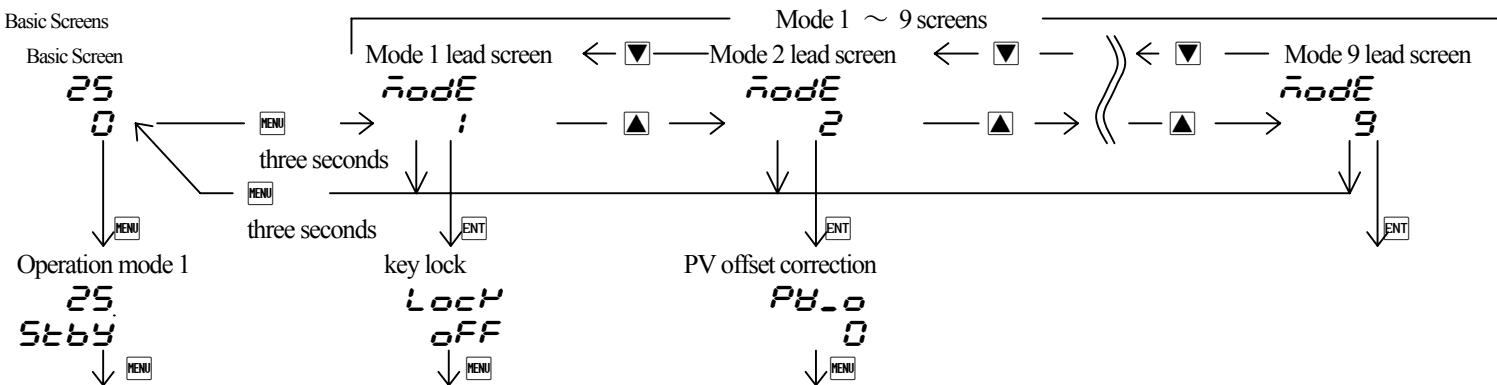
5-1. How to move to another screen

Basic Screen



Press the ENT key for 3 seconds on a basic screen, then it shifts to the lead screen of FC4 (constant value control) setting screens, or to the lead screen of ProG (program control) setting screens.

Press the MENU key for 3 seconds on FC4 or ProG the lead screen of setting screens, then it shifts to the basic screen. The shift is also possible when the program option is added and FC4 is chosen on the operation mode 2 screen. The shift is possible when the program option is added and ProG is chosen on the operation mode 2 screen.



Every time you press the MENU key on a basic screen, it shifts to each screen of the basic screens.

Press the MENU key for 3 seconds on a basic screen, then it shifts to the lead screen of mode 1 screens.

Press the ▲ key on the lead screen of mode 1 screens , then it further advances to mode 2, and mode 3. (Notes: If no corresponding option is found, the mode 4 - 9 is skipped)

Press the □ key on the lead screen of mode 1 screens , then it further advances to mode 9, and mode 8. (Notes: If no corresponding option is found, the mode 4 - 9 is skipped)

Press the MENU key for 3 seconds on the lead screen of mode 1 to 9 screens, then it shifts to the basic screen.

Press the ENT key on the lead screen of mode 1 to 9 screens, then it shifts to the first setting screen of each screens.

Press the MENU key on the the first setting screen of each screens, then it shifts to the next screen. Every time you press the MENU key, it shifts to the next setting screen.

5-2. Setting Method

To change settings, display an appropriate screen and change the setting (value or function) by pressing ▲ or □ key.

On the output monitor screen of basic screens, you can change the control output from "Automatic" to "manual" ,and save its change of setting. Display the output monitor screen, and then press ENT key for three seconds to shift from Automatic to Manual. Then by pressing ▲ or □ key, you can adjust to the desirable output value. In this case, no need to press ENT key in order to determine the change of setting.

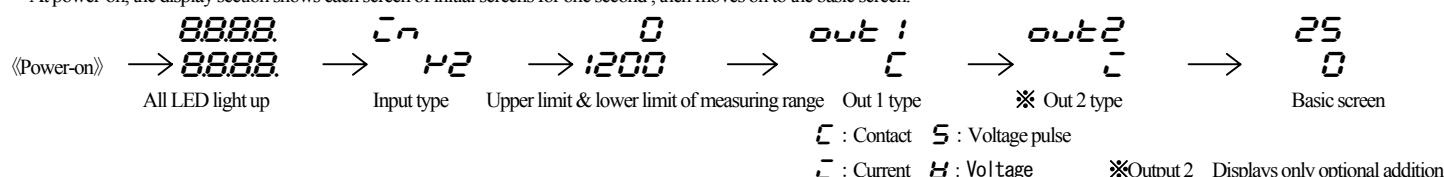
Press ENT key for three seconds as well to shift back to Automatic. Excluding when a keylock is OFF, Automatic↔Manual switchover does not work while STBY<RST> and AT are in operation.

In the case of two-output type, the switchover between automatic and manual is operable through output 1 and output 2. The setting is altered simultaneously.



5-3. Power-on and initial screen display

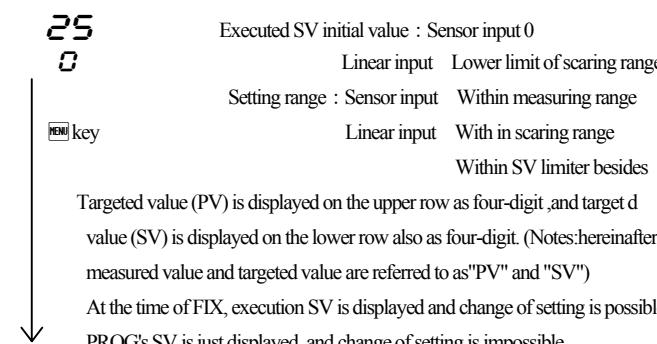
At power-on, the display section shows each screen of initial screens for one second , then moves on to the basic screen.



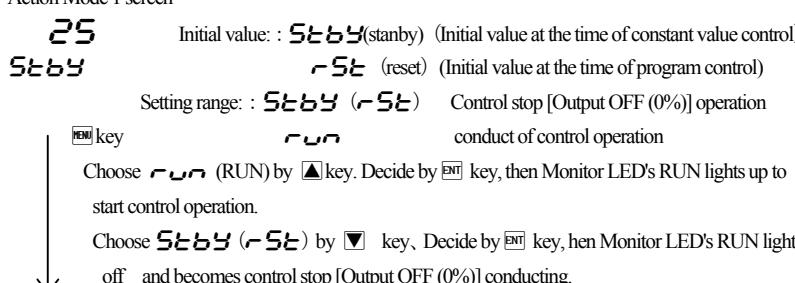
5-4. Explanation of each screen

(1) Basic Screens

Basic Screen



Action Mode 1 screen



Priority is given to DI when RUN is allotted to external control input. DI. Key operation cannot be performed unless allotment is canceled.

When measuring range, a unit, scaling, and output characteristics are changed it is initialized and Stby (rSt) is displayed.

Press ENT key for 3 seconds, then it shifts to Action mode2 screen,when the program control option is added on this screen, FIX (constant value control) ↔ PROG (program control) switchover is possible choose.

Choose a program,then Monitor LED's PRG lights up.

Action mode1 screen Action mode2 screen

25 ← ENT three seconds → 25

Stby ← MENU three seconds → FC4

(rSt) (ProG)

Press MENU key for 3 seconds on Action mode2 screen, then it returns to Action model screen.

Action mode2 screen is not displayed without a program option.

When PROG is allotted to DI, DI is given priority. Key operation cannot be performed unless allotment is canceled.

Press MENU key on Action mode1 screen, then it shifts to output 1 monitoring screen.

Output 1 monitoring screen

25 manual output setting range: 0.0-100.0% (within output limiter)
1000 At the time of automatic output, monitor display only.
 key Refer to Item 5-2 about automatic ⇔ manual switchover, and setting method at the time of manual operation.
A manual output is canceled when an operation mode is made into **Stby (rSt)**.
When a power source is interrupted and re-switched on, it returns to the condition just before intercepting.
When **Run** is allotted to DI, DI is given priority. Automatic ma ⇔ manual switchover is not performed with key operation, and only the output value at the time of manual operation can be changed.

Output 2 monitoring screen

25
1000 Contents are the same with that of an output 1.
 key Output 2 monitoring screen displays only when output 2 option is added.

CT1 current monitoring screen

25 Current display range: 0.0-55.0A
500 Displays at the time of CT input option addition, and the current value detected by CT sensor is displayed.
 key Current value is displayed.

CT2 current monitoring screen

25
300 Contents are the same with that of an CT 1.
 key

Monitoring screen of step's remaining time period

25
99:59 Displays while program is in operation if program option is added.
 key Step № in progress and remaining time are displayed by turns.
(In ∞ setting, step № and **0** are displayed by turns)
A remaining time and an elapsed time is switchable by pressing the **ENT** key for 3 seconds. (Switchover is interlocked with the number of times of next screen pattern.)
Decimal point of the minimum digit lights up in displaying elapsed time,
This screen is not displayed without a program option. Not displayed in the state of program RST and FIX neither.

Monitoring screen for the remaining repeating time of pattern

25
9999 Being displayed while program is in operation, when the program option is added,
On-going step № and the remaining repeating time of pattern are displayed by turns.
 key (In ∞ setting, step № and **0** are displayed by turns)
A remaining time and actually performed times are switchable by pressing the **ENT** key for 3 seconds. (Switchover is interlocked with front screen step time.)
The decimal point of the minimum digit lights up when actually performed times being displayed.
This screen is not displayed without a program option. Not displayed in the state of Program RST and FIX neither.

PID № monitoring screen

25
P2_ : Chosen PID № is displayed when FIX is in operation.
PID № chosen at each step and on-going step № are displayed by turns when PROG
 key is in operation.
PID № of output 1 is displayed in the first digital, and PID № of output 2 is displayed in the third digital. The third digital is shown as **_** when there is no output 2 option.
This screen is not displayed in the state of STBY (RST).

HOLD (temporary stopping) execution screen

HOLD Initial value: **OFF**
OFF Setting range: **OFF, on**
While HOLD is executed, on the basic screen, SV value and **HOLD** is displayed by turns.
If switched **on** while PROG is in operation, the operation temporary stops with as of then step time and SV value. While HOLD is in execution, SV value and **HOLD** is displayed by turns in basic screen.
HOLD is used in order to perform AT in the middle of an inclination step or to compensate the insufficient time of flat step.
Controls is performed with SV value at the time of stopping, while HOLD is in execution
HOLD is canceled if **OFF** is chosen while HOLD is in execution. The remaining time of

the step is performed based on a program.

SHP (skip) is unable to perform while HOLD is in execution.

When **HOLD** is allotted to DI, DI is given priority.

Execution and release of HOLD with key operation is unable to perform.

This screen is not displayed without a program option. Not displayed in the state of program

rSt and FIX neither.

SKIP (skip) execution screen

SHP Initial value: **OFF**
OFF Setting range: **OFF, on**
SKIP (skip) is the function that makes to end the on-going step compulsorily, and is to shift to the following step. The next step starts instantly, if performed.
When SKIP is continuously performed, about 1 second interval is required from execution to the next one.
Even if SKIP is allotted to DI, execution is able to perform with DI and key operation.
 key SKIP cannot be performed while HOLD is in operation.
This screen is not displayed without a program option. Not displayed in the state of program **rSt** and FIX neither.

AT (Auto Tuning) execution screen

AT Initial value: **OFF**
OFF Setting range: **OFF, on**
 key
AT is performed by ON selection, and canceled by OFF selection.
Not displayed at the time of STBY(RST), a manual output, and P(proportional band)=OFF.
Except in the setting of keylock OFF, AT is unable to perform in scale over.
(At the time of DI allotment, execution of AT by DI can be performed.)
Even in such a case, halfway release is performed on this screen.
Release of AT, STBY(RST), EV operating point, setting of keylock, and mode 5 ~ 9screen are operateable with key.
Except in the setting of AT normal end, execution of AT is canceled compulsorily at the time of STBY(RST) selection and AT release setup.

EV1 (event 1) operating-point setting screen

E81 Initial value: upper limit absolute value measuring range Scaling upper limit
1200 lower limit absolute value measuring range Scaling lower limit
 key
upper limit deviation **2000**
lower limit deviation **-4999**
within deviation **0**
outside deviation **2000**
CT1 or CT2 **00**
guarantee **0**
Setting range: upper limit absolute value within measuring range within scaling limit
lower limit absolute value within measuring range within scaling limit
upper limit deviation **-4999~2000** unit
lower limit deviation **-4999~2000** unit
within upper-lower limit deviation **0~2000** unit
outside upper-lower limit deviation **0~2000** unit
CT1 or CT2 **0~500A**

The operating point of the alarm type allotted to EV1 is set up.

No option, No display when **non, So, run, StP, P_E, End, Hold, ProG, d_Sl, and u_Sl** are allotted to EV1.

The operation mode of each deviation alarm is **run**.

Effective at the time of automatic output.

Each deviation alarm serves as PV's deviation to Execution SV.

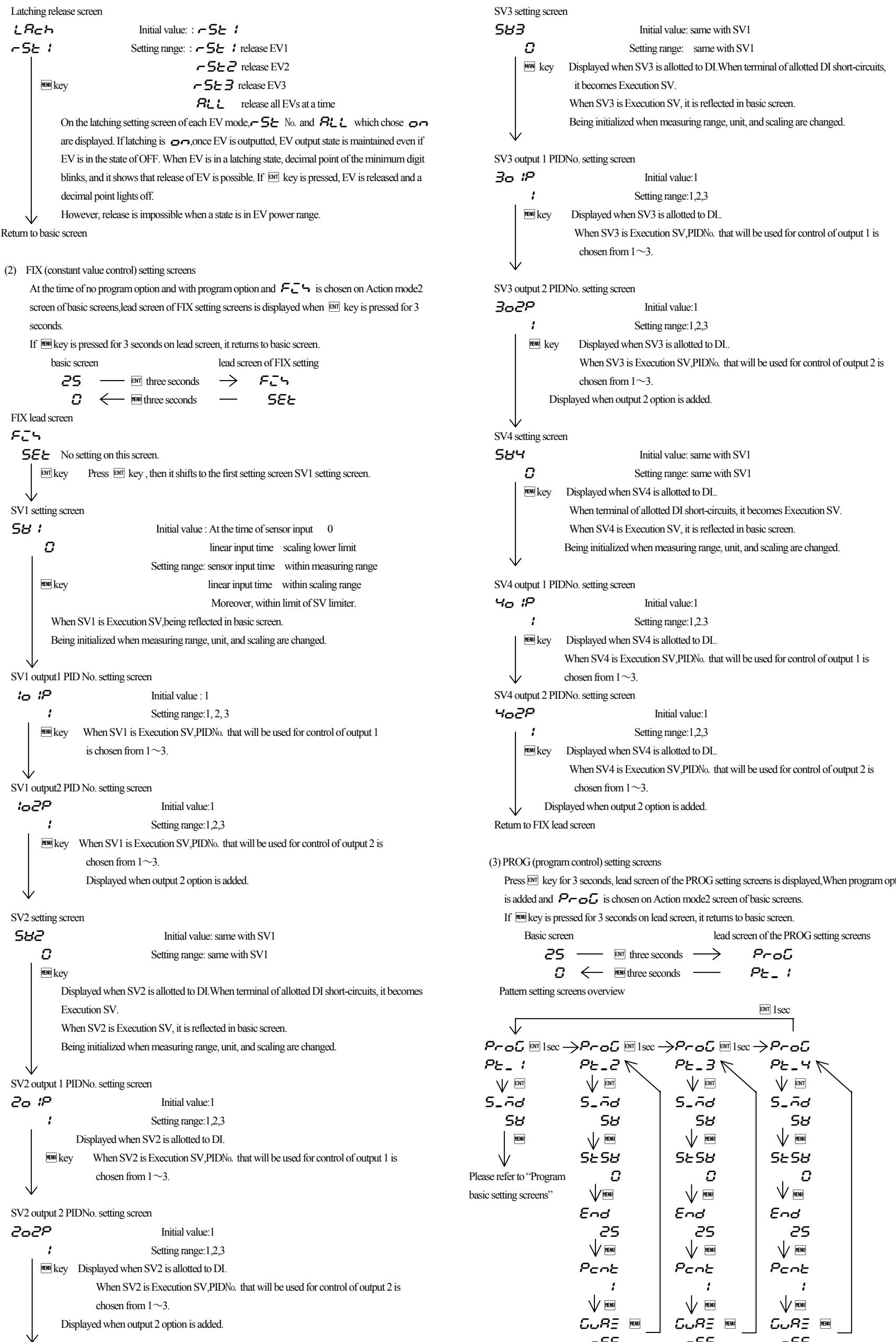
Event operation other than each deviation alarm is always effective.

EV2 (event 2) operating-point setting screen

E82
0 Initial value, setting range, contents are the same with EV1
 key

EV3 (event 3) operating-point setting screen

E83
0 Initial value, setting range, contents are the same with EV1
 key
When EV3 option is added, event 3 is displayed as the same contents with EV 1 and 2, irrespective of EV 1 and 2.



Program basic setting screens

Program basic setting screens Lead screen

ProG No setting on this screen

Pt_ : Press **▲** key to shift to step 1 lead screen.

Press **▼** key to shift to step 40 lead screen.

ENT key Press **ENT** key to shift to the first setting screen start mode setting screen.

Start mode setting screen

S_nd

Initial value: **PV** (PV)

ENT key

Setting range: **SV** (SV), **PV**

This setting screen can decide if the start set point of program control should be PV, or should be the start SV which is set on the next screen.

When PV is chosen, and when PV is closer to the set point of Step1 than start wasting SV, time is ommissible.

Start SV setting screen

St 58

ENT key

Initial value : At the type of sensor input 0

linear input type scaling lower limit

Setting range: sensor input type within measuring range

linear input type within scaling range

Moreover, within limit of SV limiter.

When SV is chosen on start mode setting screen, this screen's set value becomes start set point.

The basic screen SV display at the time of Program RST is the value set on this screen.

Termination step setting screen

End

ENT key

Initial value: 40

Setting range: 1~40(1ptn), 1~20(2ptn), 1~10(4ptn)

Number of execution Setting screen for repeating of program pattern

Pcnt

ENT key

Initial value: 1

Setting range: 1~9999 times, ∞

Guarantee soak zone setting screen

GurE

ENT key

Initial value : OFF

Setting range : OFF, 1 to 2000 unit

During program operation, the SV value on program step proceed to flat step from ramp step, the PV value some time delay from the SV value and the flat step become shorter than the step. This function avoid and assuring the time of flat step.

Time unit setting screen (Displayed only for the pattern 1 setting screen group)

t_Ur

ENT key

Initial value: **mm : ss** : **55**(minute:second)

mm : ss : **55**, **HH : mm**, **HHHH**

This decides if unit of the execution time set up at each step is minute: second, hour, minute, or hour.

Number of patterns setting screen (Displayed only for the pattern 1 setting screen group)

Ptn

ENT key

Initial value : 1

Setting range : 1, 2, 4

Set the number of patterns.

To program basic setting screens Lead screen

About PV start

In start mode, when PV is chosen, and when PV is closer to the set point of Step1 than start SV, wasting time is ommissible.

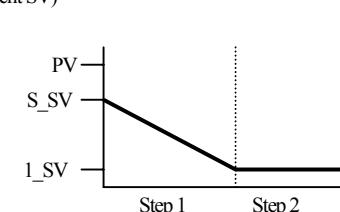
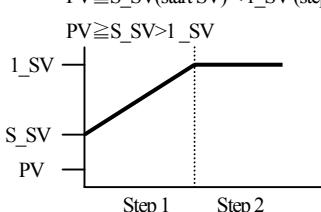
example : PV at the time of "RST is 30°C, Start SV is 0 °C, Step 1's attainment SV 100 °C, Execution time of Step1 is 60 minutes. Start at start SV, attainment time is 60 minutes.

When starts at PV, $100-30=70$ °C, therefore $60 \text{ minutes} \times 70\% = 42$ minutes = 18 minutes' shortening

However, depending on the spatial relationship between PV, Start SV, and attainment SV, it may become SV start or Step1 may be skipped.

(1) case of SV start

$PV \leq S_SV (\text{start SV}) < 1_SV (\text{step1 attainment SV})$

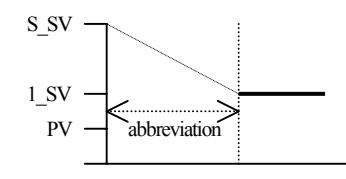
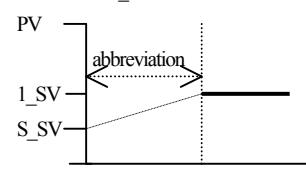


(2) When Step 1 is skipped and progresses to Step 2

$S_SV < 1_SV < PV$

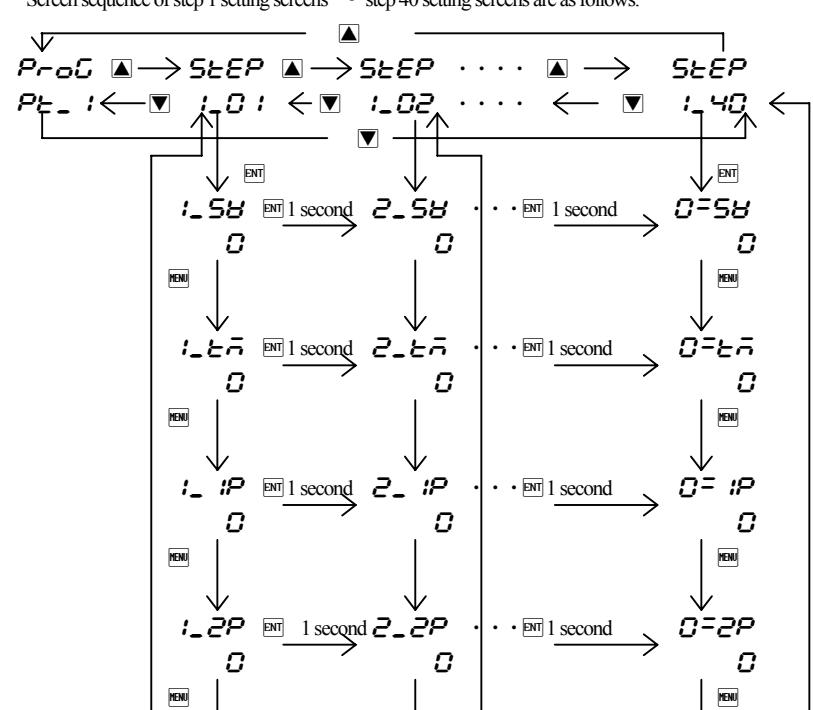
$S_SV > 1_SV > PV$

$PV = 1_SV$



Step 1 setting screens ~ Step 40 setting screens

Screen sequence of step 1 setting screens ~ step 40 setting screens are as follows.



In each step setting screen, next to number, **_** for Steps 1~9, **-** for 10~19, **=** for 20~29, **_** for 30~39, **=** for 40, are assigned to distinguish each of them.

(Example : Step1SV = **1-58**, step 12SV = **2-58** and step 23SV = **3-58**)

If the **ENT** key is pressed at each step lead screen, it shifts to SV setting screen of each step.

If the **ENT** key is pressed on SV setting screen, it shifts to execution time setting screen of each step.

After that, if **ENT** key is pressed, then it shifts to output 1PIDNo, output 2PIDNo, and lead screen.

Moreover, it is if **ENT** key is pushed for 1 second on each setting screen, it advances to the next Step No.'s same setting item screen. (**1_SV** → **2_SV** → ... → **0_SV** → **1_SV**)

Step 1 is explained, since all the setting content of each step are same.

Step1 SV setting screen

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

1-58

Initial value : At the time of sensor input 0

At the time of linear input scaling lower limit

Setting range : At the time of sensor input within measuring range

At the time of linear input scaling within the limits

Within limit of SV limiter, and yet

Attainment set value of Step 1 is set.

Being initialized when measuring range, unit, and scaling are changed.

(4) Mode 1 screens

Mode 1 lead screen

Node Press **ENT** key for 3 seconds on basic screen, then displayed

:

ENT key No setting on this screen. Press the **ENT** key, then it shifts to the first setting screen, keylock setting screen.

Keylock setting screen

LocK

OFF

ENT key

Initial value:**OFF**

Setting range:**OFF**, **I** to **S**

- 1 Only change of Execution SV (basic screen), Manual output value, and keylock is possible.
 - 2 Only change of Manual output value and keylock is possible.
 - 3 Only change of a keylock is possible.
 - 4 Only change of a keylock is possible. **RUN** key is invalid.
 - 5 **I** + Basic screens and FIX/PROG setting screens can be changed.
 - 6 **I** + Basic screens and step setting screens can be changed.
- The RUN key is invalid when the Keylock is set to 4 or when the super key lock is activated by DI. Everything else is valid.
- Key locks 5 and 6 can be used with Ver 1.37 or later.

SV limiter lower limit setting screen

SL

Initial value: measuring range lower limit

ENT key Setting range: measuring range lower limit value~measuring range upper limit value-1

Lower limit value of target value is set.

When upper limit value is smaller than lower limit value, the value compulsorily becomes lower limit value +1.

SV limiter upper limit value setting screen

SH

Initial value: measuring range upper limit

:200

Setting range:SV limiter lower limit value +1~ measuring range upper limit value

ENT key Setting upper limit value of target value is set.

Return to mode1 lead screen.

(5) Mode 2 screens

Mode 2 lead screen

Node Press **▲** key in mode3 lead screen, or press **▼** key in mode1 lead screen,

then being displayed.

ENT key There is no setting.

If **ENT** key is pressed, it shifts to the first setting screen PV offset correction screen.

PV offset correction (PV bias) setting screen

Ph_o

O

Initial value:0

Setting range: -500~500 unit

ENT key Used for correction of input errors such as sensor.

If offset correction is performed, control is also performed with the corrected value

PV gain correction setting screen

Ph_G

000

Initial value:0.00

Setting range: ±5.00%

ENT key Maximum input value is corrected within limit of ±5.00% of measuring range.

If corrected, inclination of spang changes in straight line which connects zero point and correction maximum value.

PV filter setting screen

Ph_F

O

Initial value:0

Setting range: 0 ~ 9999 seconds

ENT key When input change is violent or noise is overlapped, used in order to ease the influences.

In 0 second setting, filter does not function.

Measuring range setting screen

Range

H2

Initial value: multi **H2**, voltage **B1**, current **A1**

Setting range: Chosen from 5-5.measuring range code table.

Combination of input type and measuring range is set by code.

Temperature unit setting screen

Unit

C

Initial value:**C**

Setting range:**C**、**F**

ENT key The temperature unit at the time of a sensor input is set up from **C** (°C), **F** (°F). Not displayed when the linear input is chosen.

Input scaling lower limit value setting screen

Sc_L

Initial value:0.0

Setting range: -1999 ~ 9989 unit

ENT key

Scaling lower limit value at the time of linear input is set up.

Input scaling upper limit value setting screen

Sc_H

Initial value:100.0

Setting range: -1989 ~ 9999 unit

ENT key

Scaling upper limit value at the time of linear input is set up.

NOTE : Suppose that the difference between a lower limit value and upper limit value is 10 or less,or over 10,000. In this setting, upper limit value is compulsorily changed into that of +10 or ± 10000 count. Upper limit value cannot be set as lower limit value of +10 count or less,or that of over 10,000 count.

Input scaling Decimal point position Setting screen

dP

Initial value: the first place after decimal point (0.0)

Setting range: no decimal point 0~the third place after decimal point(0.000)

ENT key

Decimal point position of input scaling is set .

NOTE : The screen of input scaling serves as a monitor at the time of a sensor input.

Setting change cannot be performed.

Return to mode 2 lead screen.

(6) Mode 3 screens

Mode 3 lead screen

Node No setup

3

If **ENT** key is pressed, it shift s to the first setting screen, output 1 proportional band setting screen. In this screens, PID which can be used in output 1, 1 to 3 related Items and soft start of output 1, and proportional period output characteristics are set up.

Output 1 PID1 proportional-band (P) setting screen

1_P :

Initial value:3.0%

30

Setting range:OFF, 0.1 ~ 999.9%

ENT key

When performing auto tuning, no necessity for a setting basically.

If OFF is chosen, it becomes ON-OFF (two positions) operation.

Output 1 PID1 Integral time (I) setting screen

1_I :

Initial value: 120 seconds

120

Setting range: OFF, 1~6000 seconds

ENT key

When performing auto tuning, no necessity for a setting basically.

This screen is not displayed at the time of ON-OFF operation.

Becomes P operation or PD operation in I=OFF setting.

Output 1 PID1 Derivative time (D) setting screen

1_d :

Initial value: 30 second

30

Setting range: OFF, 1~3600 seconds

ENT key

When performing auto tuning, no necessity for a setting basically.

This screen is not displayed at the time of ON-OFF operation.

Becomes P operation or PI operation in D=OFF setting.

Output1 PID1 manual reset setting screen

1_r :

Initial value:0.0

00

Setting range: -50.0~50.0%

ENT key

The offset correction at the time of I=OFF (P operation,PD operation) is performed.

This screen is not displayed at the time of ON-OFF operation.

Output 1 PID1 differential-gap setting screen

1_dF :

Initial value: 5

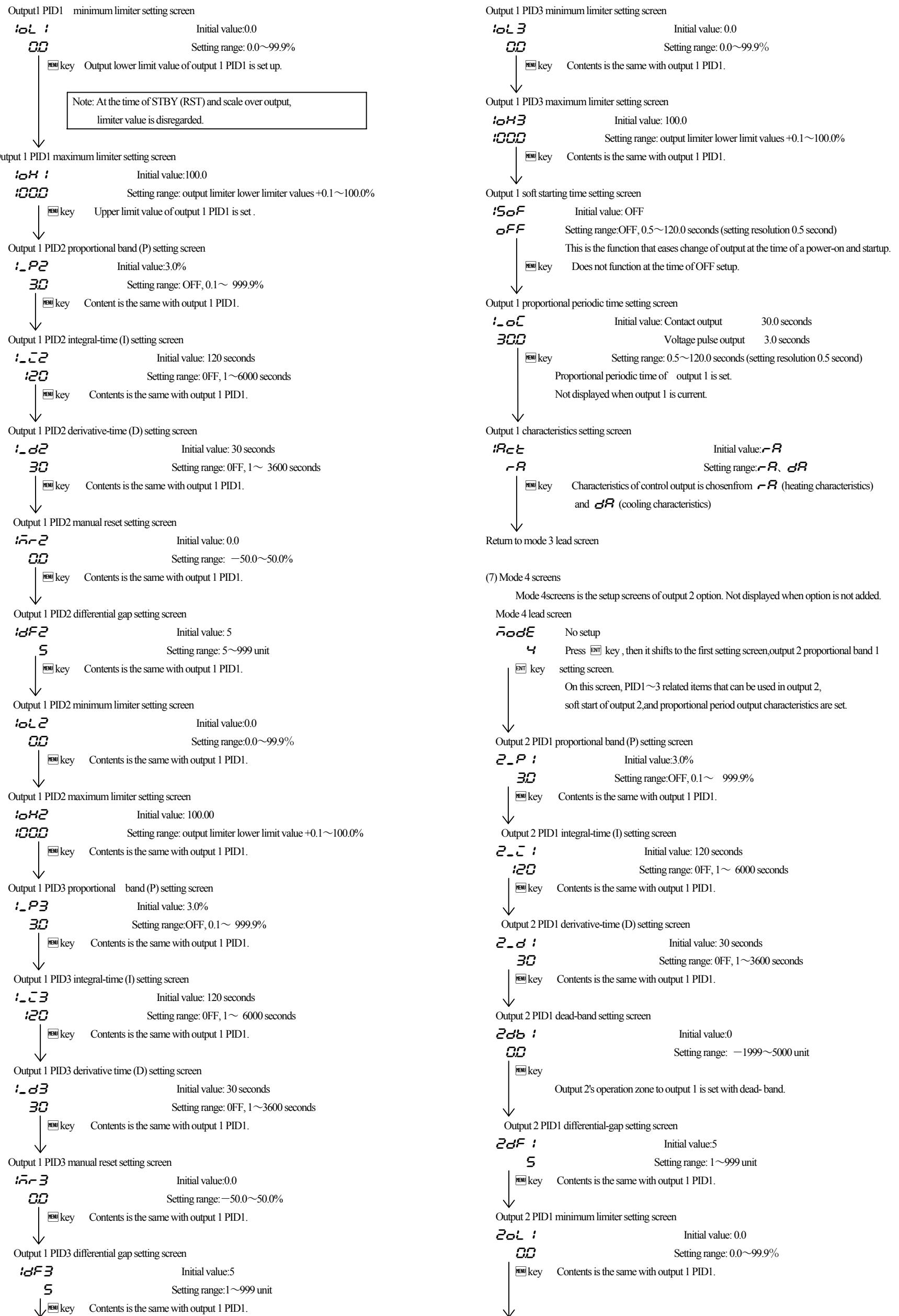
5

Setting range: 1 ~999 unit

ENT key

The differential gap at the time of ON-OFF operation is set.

Displayed at the time of P=OFF (ON-OFF operation) setup.



Output 2 PID1 maximum limiter setting screen
2oH1 Initial value:100.0
i000 Setting range: output limiter lower limit values +0.1~100.0 %
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID2 proportional-band (P) setting screen
2-P2 Initial value:3.0%
30 Setting range: OFF, 0.1~ 999.9%
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID2 integral-time (I) setting screen
2-L2 Initial value: 120 seconds
120 Setting range: OFF, 1~6000 seconds
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID2 derivative-time (D) setting screen
2-d2 Initial value: 30 seconds
30 Setting range: OFF, 1~3600 seconds
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID2 dead-band setting screen
2db2 Initial value:0.0
00 Setting range: -50.0~50.0%
↓ **[ENT]** key Contents are the same as output 2PID1 dead-band setting screen.

Output 2 PID2 differential-gap setting screen
2dF2 Initial value: 5
5 Setting range: 1~999 unit
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID2 minimum limiter setting screen
2oL2 Initial value: 0.0
00 Setting range: 0.0~99.9%
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID2 maximum limiter setting screen
2oH2 Initial value:100.0
i000 Setting range:output limiter lower limit values+0.1~100.0 %
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID3 proportional-band (P) setting screen
2-P3 Initial value:3.0%
30 Setting range:OFF, 0.1~999.9%
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID3 integral-time (I) setting screen
2-L3 Initial value: 120 seconds
120 Setting range: OFF, 1~6000 seconds
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID3 derivative-time (D) setting screen
2-d3 Initial value: 30 seconds
30 Setting range: OFF, 1~3600 second
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID3 dead-band setting screen
2db3 Initial value:0.0
00 Setting range: -50.0~50.0%
↓ **[ENT]** key Contents are the same as output 2 PID1 dead-band setting screen.

Output 2 PID3 differential-gap setting screen
2dF3 Initial value:5
5 Setting range: 1~999 unit
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID3 minimum limiter setting screen
2oL3 Initial value:0.0
00 Setting range: 0.0~99.9%
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 PID3 maximum limiter setting screen
2oH3 Initial value:100.0
i000 Setting range: output limiter lower limit values+0.1~100.0 %
↓ **[ENT]** key Contents is the same with output 1 PID1.

Output 2 soft starting time setting screen
2soF Initial value:OFF
oFF Setting range:OFF, 0.5~120.0 seconds (setting resolution 0.5 second)
↓ **[ENT]** key Contents is the same with output 1.

Output 2 proportional periodic-time setting screen
2-oC Initial value: Contact output 30.0 seconds
300 Voltage pulse output 3.0 seconds
↓ **[ENT]** key Setting range: 0.5~120.0 seconds (setting resolution 0.5 second)
Contents is the same with output 1.

Output 2 characteristics setting screen
2Rct Initial value:**dR**
rR Setting range:**rR, dR**
↓ **[ENT]** key Contents is the same with output 1.

Return to mode 4 lead screen.

(8) Mode 5 screens

Mode 5 screens is the setup screens of event option. Not displayed when option is not added.

Mode 5 lead screen

Mode No setup.
S Press **[ENT]** key , it shifts to the first setting screen, event 1 operation-mode setting screen.
↓ **[ENT]** key

Event 1 operation-mode setting screen

E_1-1 Initial value:**non**
non Setting range: Chosen from event type character table.

[ENT] key Change in measuring range, scaling, and unit make it initialize.

Event type allotted to event 1 is chosen from character table.

Event type character table

Character	Type	Character	Type
non	No allotment	cL2	Control loop alarm 2
HR	Upper limit absolute value alarm	StP	Step signal
LR	Lower limit absolute value alarm	P_E	Pattern termination signal
So	Scale over alarm	End	Program termination signal
Hd	Maximum deviation alarm	Hold	Hold signal
Ld	Minimum deviation alarm	ProG	Program signal
Cd	Within deviation alarm	u_SL	Up slope signal
od	Without deviation alarm	d_SL	Down slope signal
rUn	RUN signal	Gur	Gurantee signal
cL1	Control loop alarm 1		

※ Being initialized if measuring range, scaling, and unit are changed.

※ Deviation alarm is possible to output at the time of RUN+AUTO.

In other events, output is always possible.

Event 1 differential-gap setting screen

E_1-d Initial value:5unit
5 Setting range: 1~999 unit
↓ **[ENT]** key ON-OFF differential gap of event 1 is set.
Not displayed, when the event 1 mode are as follows.**non, So, rUn, StP, P_E, Hold, ProG, u_SL, d_SL**.
Change in measuring range, scaling, unit, and the event 1 mode make it initialize.

Event 1 standby operation setting screen

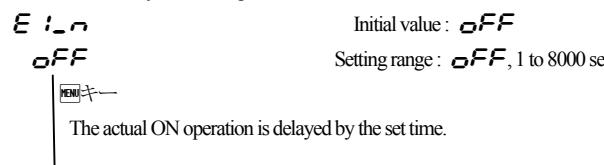
E_1-S oFF Initial value: : **oFF**
[ENT] key Setting range: : **oFF, 1, 2**
oFF : No standby operation, **1** : standby-operation only at the time of a power-on.
2 : Standby-operation in the following cases ;At the time of power-on.

When each alarm's operating point is changed,
When deviation alarm's SV is performed,
When RUN/STBY (RST) is switched,
When AUTO/MAN is switched.

Not displayed, when the event 1 mode are as follows. ;**non, So, rUn, StP, P_E, Hold, ProG, u_SL, d_SL**.
Change in measuring range, scaling, unit, and the event 1 mode make it initialize.

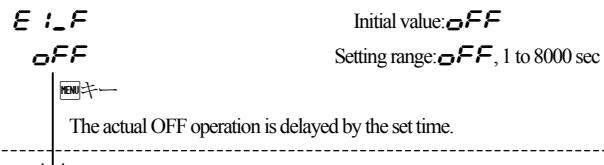
※This function available. from ver 1.38

Event 1 ON delay time setting screen



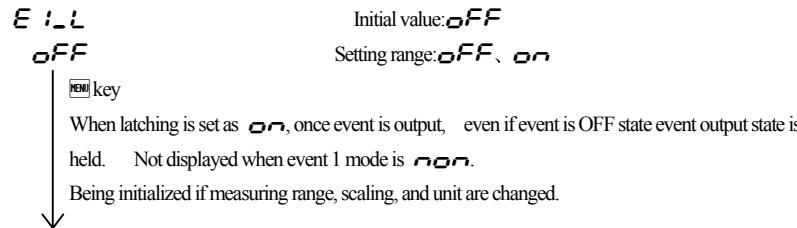
Initial value: **OFF**
Setting range: **OFF**, 1 to 8000 sec

Event 1 OFF delay time setting screen



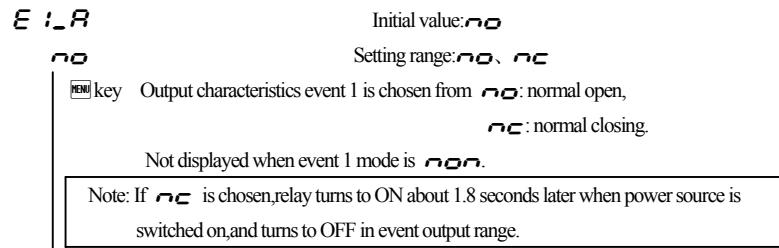
Initial value: **OFF**
Setting range: **OFF**, 1 to 8000 sec

Event 1 latching setting screen



Initial value: **OFF**
Setting range: **OFF**, **on**

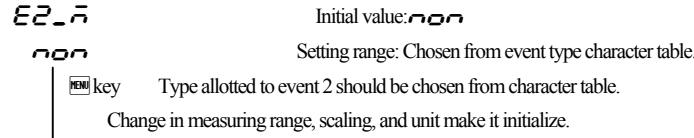
Event 1 output characteristics setting screen



Note: If **nc** is chosen, relay turns to ON about 1.8 seconds later when power source is switched on, and turns to OFF in event output range.

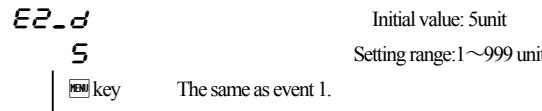
Initial value: **no**
Setting range: **no**, **nc**

Event 2 mode setting screen



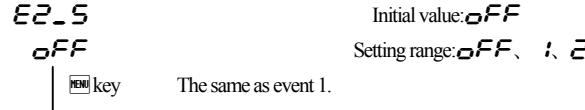
Initial value: **non**
Setting range: Chosen from event type character table.

Event 2 differential-gap setting screen



Initial value: **5unit**
Setting range: 1~999 unit

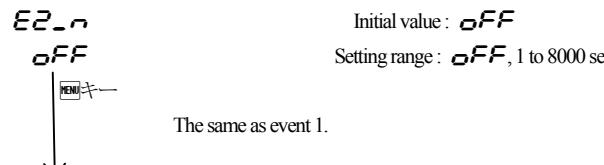
Event 2 standby operation setting screen



Initial value: **OFF**
Setting range: **OFF**, **1**, **2**

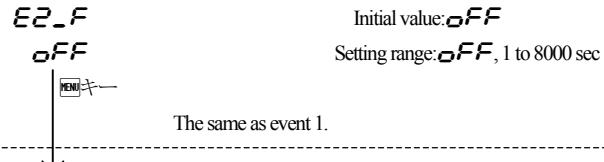
※This function available. from ver 1.38

Event 2 ON delay time setting screen



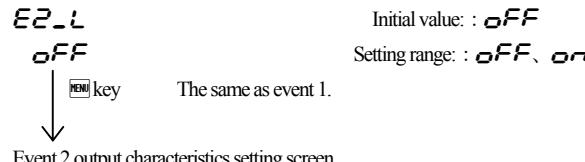
Initial value: **OFF**
Setting range: **OFF**, 1 to 8000 sec

Event 2 OFF delay time setting screen



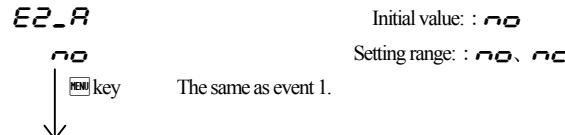
Initial value: **OFF**
Setting range: **OFF**, 1 to 8000 sec

Event 2 latching setting screen



Initial value: **OFF**
Setting range: **OFF**, **on**

Event 2 output characteristics setting screen



Initial value: **no**
Setting range: **no**, **nc**

Event 3 mode setting screen

Notes: Apart from event 1 and 2, event 3 is displayed when being added as additional option.

E3_n

Initial value: **non**

Setting range: Chosen from event type character table.

ENT key Type allotted to event 3 should be chosen from character table. Change in measuring range, scaling, and unit make it initialize.

The following screens are the same as for events 1 and 2.

ENT

Return to mode 5 lead screen

(9) Mode 6 screens

Mode 6 screens is the setup screens of external control input (DI) option.

Not displayed when option is not added.

DI input is a no-voltage contact or open collector

Mode 6 lead screen

node

No setup.

6

Press **ENT** key , it shifts to the first setting screen, DI1 mode setting screen.

ENT

In MAC 3D (48x48), when option of CT OUTPUT is added, DI 1~DI3 cannot be chosen and not displayed.

DI 1 mode setting screen

d1_n

Initial value: **non**

Setting range: chosen from DI operation character table

ENT

Choose DI operation that is allotted to DI 1 from character table.

DI 2 mode setting screen

d2_n

Initial value: **non**

Setting range: chosen from DI operation character table

ENT

Choose DI operation that is allotted to DI 2 from character table.

DI 3 mode setting screen

d3_n

Initial value: **non**

Setting range: chosen from DI operation character table.

ENT

Choose DI operation that is allotted to DI 3 from character table.

DI 4 mode setting screen

d4_n

Initial value: **non**

Notes: Apart from DI 1~3, DI 4 is displayed when being added as additional option.

Setting range: Chosen from DI operation character table.

ENT

Choose DI operation that is allotted to DI 4 from character table.

Return to mode 6 lead screen

DI operation character table and restrictions concerning DI

DI operation character table

DI character	Operation type	Input detection	Contents
non	No allotment		
S8_1	1st SV	level	With closed DI terminal Execution SV = 1st SV
S8_2	2nd SV	level	With closed DI terminal Execution SV = 2nd SV
S8_3	3rd SV	level	With closed DI terminal Execution SV = 3rd SV
S8_4	4th SV	level	With closed DI terminal Execution SV = 4th SV
run	control RUN	level	RUN with closed DI terminal, STBY with open one.
Prog	program	level	Program with closed DI terminal. Constant value with opened.
Run	manual input	level	Manual with closed DI terminal, auto with open one.
At	auto tuning	edge	AT-start with rise edge.
Hold	hold	level	Program's time stops temporarily.
skip	skip	edge	Shift to the next program's step.
Pt_1	Pattern 1	level	With closed DI terminal, Execution pattern = 1
Pt_2	Pattern 2	level	With closed DI terminal, Execution pattern = 2
Pt_3	Pattern 3	level	With closed DI terminal, Execution pattern = 3
Pt_4	Pattern 4	level	With closed DI terminal, Execution pattern = 4
L_5	latching release	edge	All latching are released by rise edg.
Lock	super key lock	level	Super keylock with closed DI terminal. Release with opened.

- When **58** to **584** are conducted during AT execution, they are performed at the time of AT termination.
- If each DI is assigned **58** to **584** or **Pt** to **Pt-4** and more than one DI is turned on at the same time, the one with the lowest number has priority.
- Rt** can be performed at the time of a RUN-automatic output.
- When **Rt** is allotted to, release in the middle of AT operation is carried out by off-key operation chosen in AT screen.
- While AT is performed, if STBY (RST) or a manual output is performed, AT is released.
- Even when a keylock is not OFF, conducting of DI is effective.
- The same operation other than **non** is impossible to allot to DI1-DI4 at a time.
- Operation allotted to DI takes priority over DI. Key operation cannot be performed.
- Execution of DI operation is possible to perform. But neither release of AT nor numerical change of SV and manual output is possible to perform.
- In DI input, 5VDC 0.5mA per point is impressed. Use endurable switch, transistor and so on.
- Wiring distance of DI should be less than **30m**.

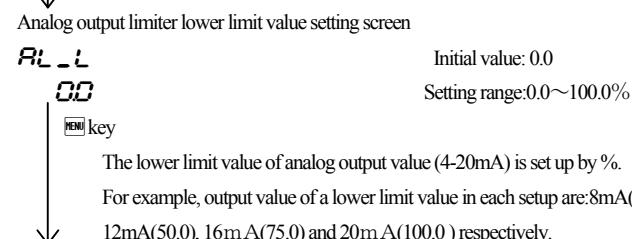
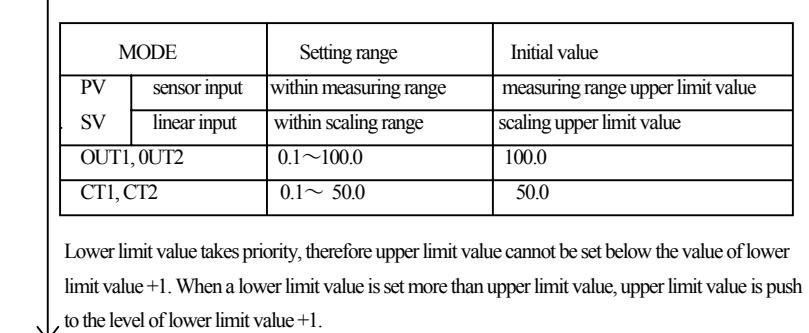
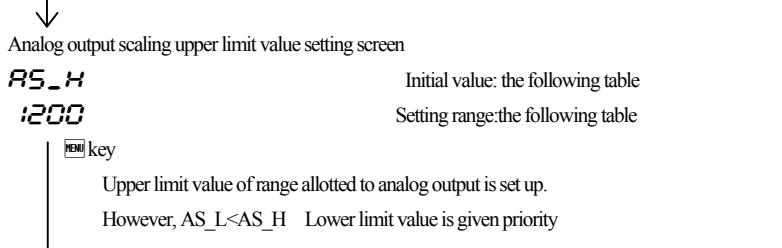
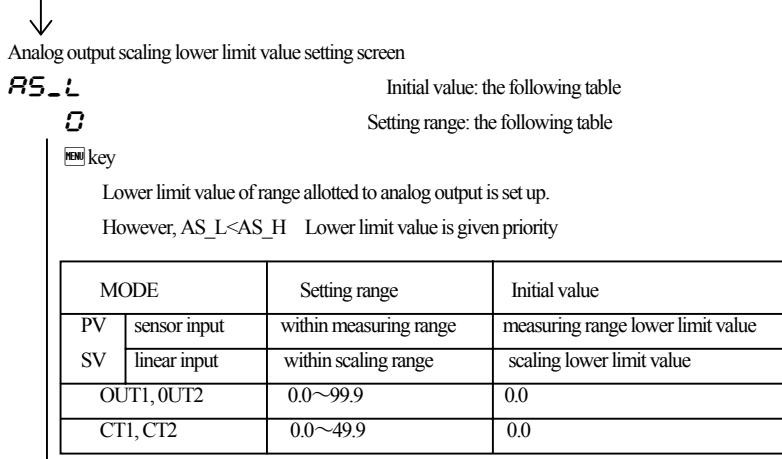
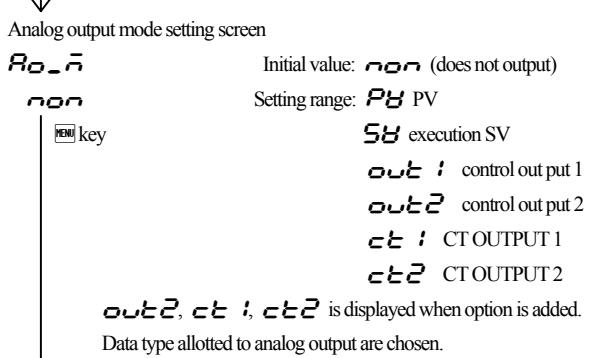
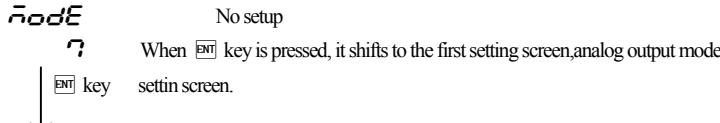
(10) Mode 7 screens

The Mode 7 screens is the setup screens of analog output option.

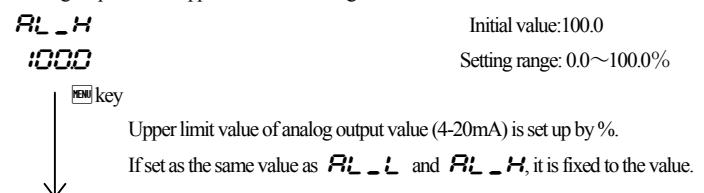
Not displayed when option is not added.

In MAC 3D (48x48), when communication option is added, it is impossible to choose and display.

Mode 7 lead screen



Analog output limiter upper limit value setting screen



Return to mode 7 lead screen

Note: An analog output limiter can be made into reverse scaling.

Example: Output range 0°C (4mA) ~ 1200°C (20mA) can be 0°C (20mA) ~ 1200°C (4mA). Set AL_L as 100% and AL_H as 0.0%.

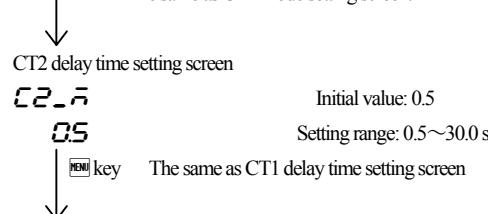
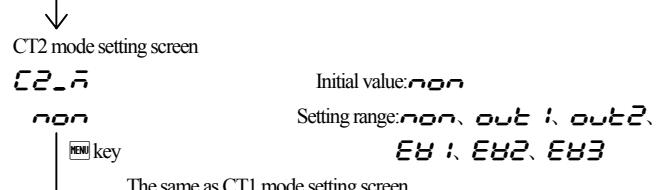
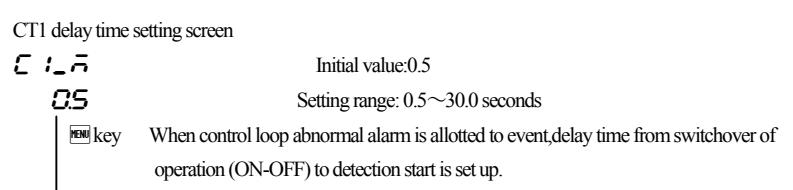
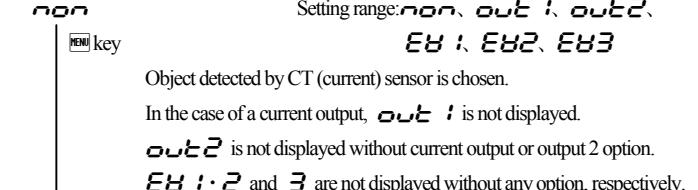
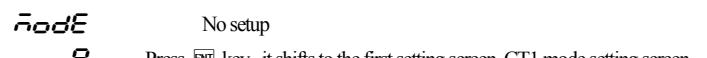
(11) Mode 8 screens

Mode 8 screens is the setup screens of CT OUTPUT option.

Not displayed when option is not added.

In MAC 3D (48x48), when DI 1~3 are added, it is impossible to choose and display.

Mode 8 lead screen



About control loop abnormal alarm

When the targeted output of a control loop abnormal alarm is ON, if current detected by CT is lower than the allotted event's operating point (Setting Value of a basic screens, event operating point setting screen) alarm output is issued as breaking alarm.

When the targeted output is OFF, if detected current is higher than the allotted event's operating point (short-circuit, earth fault, etc.)

(12) Mode 9 screens

Mode 9 screens is the setup screens of communication (RS-485) option.

Not displayed when it is not added. See the attached Communication Instruction Manual (in the appendix : "at the time of communication option added") about communication,

5-5. measuring range code table

Input type	code	Measuring Range	
		unit code C (°C)	unit code F (°F)
Thermo couple	R	R1	0 ~ 1700 0 ~ 3100
	K	R2	-199.9 ~ 400.0 -300 ~ 700
	K	R3	0 ~ 1200 0 ~ 2200
	K	R4	0.0 ~ 300.0 0 ~ 600
	J	J1	0 ~ 600 0 ~ 1100
	J	J2	0.0 ~ 600.0 0 ~ 1100
	T	T1	-199.9 ~ 200.0 -300 ~ 400
	E	E1	0 ~ 700 0 ~ 1300
	S	S1	0 ~ 1700 0 ~ 3100
	*5 U	U1	-199.9 ~ 200.0 -300 ~ 400
	N	N1	0 ~ 1300 0 ~ 2300
	*1 B	B1	0 ~ 1800 0 ~ 3300
	*3 Wre5-26	S-26	0 ~ 2300 0 ~ 4200
	*4 PL II	PL2	0 ~ 1300 0 ~ 2300
Resistance bulb Pt100	P1	-200 ~ 600	-300 ~ 1100
	P2	-100.0 ~ 200.0	-150.0 ~ 400.0
	*6 P3	0.0 ~ 100.0	0.0 ~ 200.0
	*6 P4	-50.0 ~ 50.0	-60.0 ~ 120.0
	P5	-100.0 ~ 300.0	-150.0 ~ 600.0
	P6	-200.0 ~ 300.0	-300 ~ 600
	P7	-199.9 ~ 600.0	-300 ~ 1100
	P8	0 ~ 250	0 ~ 500
	JP1	-200 ~ 500	-300 ~ 900
	JP2	-100.0 ~ 200.0	-150.0 ~ 400.0
	*6 JP3	0.0 ~ 100.0	0.0 ~ 200.0
	*6 JP4	-50.0 ~ 50.0	-60.0 ~ 120.0
	JP5	100.0 ~ 300.0	-150.0 ~ 600.0
	JP6	-200.0 ~ 300.0	-300 ~ 600
	JP7	-199.9 ~ 500.0	-300 ~ 900
	JP8	0 ~ 250	0 ~ 500
Nickel 120	N1	0 ~ 230	0 ~ 450
	Voltage (mV) *7 0 ~ 10	R1	
	0 ~ 100	R2	
	*7 -10 ~ 10	R3	
	0 ~ 20	R4	
	0 ~ 50	R5	
	Voltage(V)	1 ~ 5 R1	
		0 ~ 5 R2	
	-1 ~ 1 R3		
	0 ~ 1 R4		
Current(mA)	0 ~ 2 R5		
	0 ~ 10 R6		
	4 ~ 20 RA1		
	0 ~ 20 RA2		

Thermo couple B,R,S,K,E,J,T,N:JIS/IEC

Resistance bulb Pt100:JIS/IEC

JPt100: former JIS

*1 Thermo couple Accuracy is not guaranteed below B:400°C (752 °F).

*2 Thermo couple In K, T, U,accuracy is $\pm 0.5\%$ FS for 0 ~ -100°C (-148 °F) and $\pm 1.0\%$ FS if it is below -100°C

*3 Thermo couple Wre 5-26: Product of Hoskins Mfg. Co.

*4 Thermo couple P L II : Platinet

*5 Thermo couple U:DIN43710

*6 Resistance bulb Accuracy of Pt/JPt $\pm 50.0\%$ C, 0.0 ~ 100.0°C is $\pm 0.3\%$ FS.

*7 Voltage(mV) 0 ~ 10mV, Accuracy of 0 ~ 10mV is $\pm 0.3\%$ of input range.

* Setup of factory shipment is Multi input: Thermo couple **R2** 0-1200°C

Voltage input : 1-5V **R1** 0.0-100.0

Current input : 4-20mA **RA1** 0.0-100.0

6. Supplementary Explanation of Function

6-1. Auto return function

When there is no key operation 3 minutes or more, on the screen except for basic screen and each monitoring screen, screen automatically shifts to basic screen. (Auto return).

6-2. Output Soft Start Function

This is the function to increase the control output gradually with set-up time at the time of power-on, STBY → RUN, and normal return from scale over. This is effective for controlling the excessive current to loads, such as a heater.

1) Soft-start functions in the following conditions.

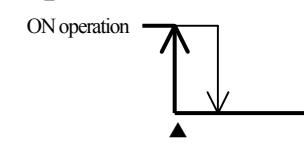
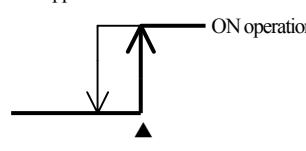
- At the time of the power-on in automatic operation, STBY(RST) → RUN, and normal return from scale over.
- Setup of proportional band (P) is other than OFF
- Soft starting time is not OFF

6-3. Event Selection Alarm Operation Figure

The figure of alarm operation figure allotted to event 1 ~ 3 is shown.

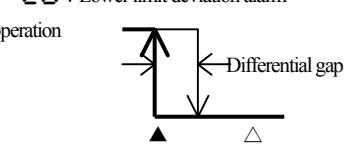
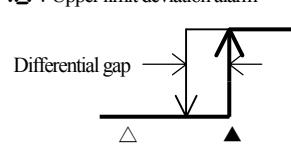
HR: Upper limit absolute value alarm

LR: Lower limit absolute value alarm



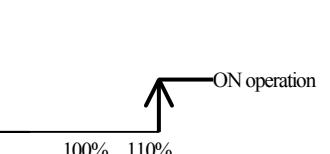
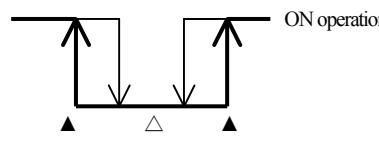
HD: Upper limit deviation alarm

LD: Lower limit deviation alarm

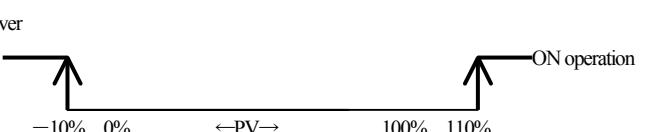


OD: Without deviation alarm

CD: Within deviation alarm



SO: Scale over



6-4. AT (Auto Tuning)

- If AT is performed by FIX (constant value control), AT monitor LED blinks and light is put out by termination or intermediate release.
- When auto tuning is ended in inclination step or chosen all PID(s), it is in standby state until one pattern is completed, then lights up, then puts out when one pattern is completed.
- When AT is not completed within 1 pattern, AT conducting is released when one pattern is completed.
- Even in inclination step, AT is performed if it is in HOLD state.
- AT at the time of 2 output specification is as follows.

At the time of heating / cooling operation and cooling / heating operation = OUT1, OUT2 common - PID value

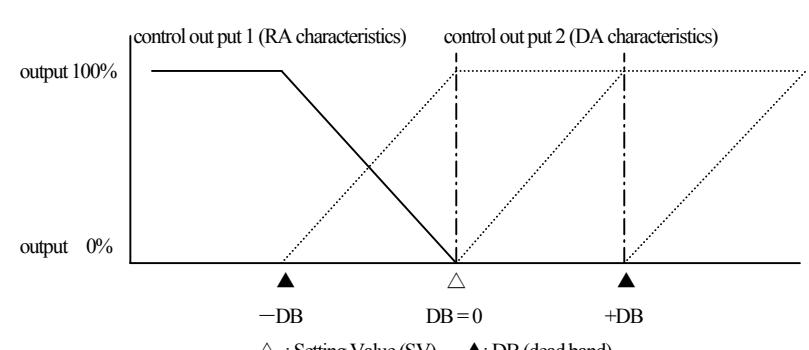
At the time of heating / heating operation and cooling / cooling operation, only OUT1 performs AT. OUT 2 output while performing AT is 0% or output limiter lower limit value.

6-5. 2 output-characteristics figure

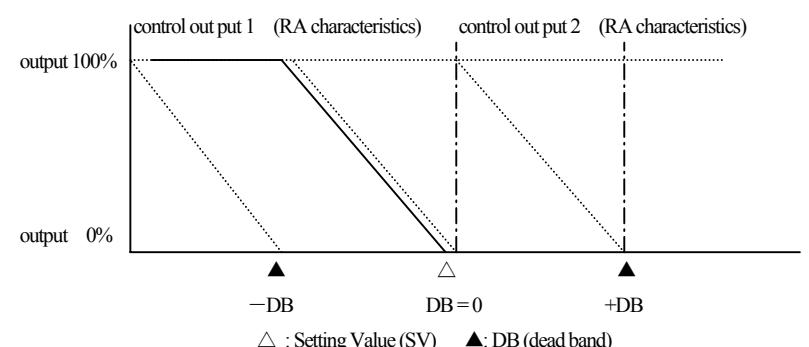
2-output characteristics is shown in the following figure.

◎ Conditions: P operation, manual reset (**RA**) -50.0%

1) OUT 1 RA (heating) • OUT 2 DA (cooling)



2) OUT 1RA (heating) • OUT 2 RA (heating)

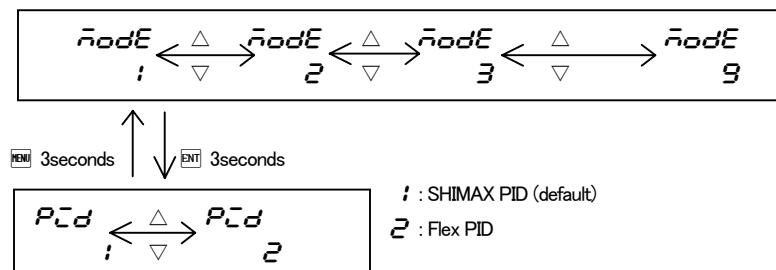


6-6 PID control method (Flex PID Method add from Ver 1.20)

MAC3 equipped with flex PID which can be suited SV (target value) change followingness as a disturbance in addition to the usual type SHIMAX PID which can be suited for a few target of a disturbance element (factory setting)

This is explanation a modification method of two types PID method both SHIMAX PID method and Flex PID method.

(1) Setting of PID method

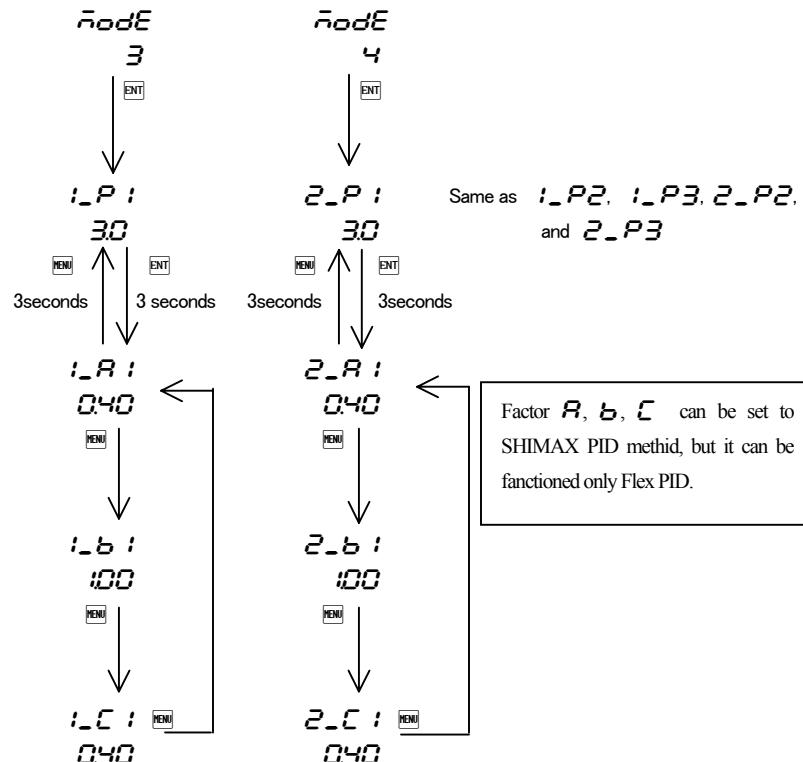


(2) About the factor used for Flex PID

There are a factor ζ for SV change followingness and a disturbance response factor R and b in addition to the SHIMAX PID method, P (proportional band), I (integration time) and D (derivative time) in flex PID, and it's possible to set from 1 to 3 at PID setting screen of output 1 and 2.

At PID setting screen it can be moved to R setting screen by pressing **ENT** key for 3seconds.

Move to b setting screen by pressing **ENT** key, move to ζ setting screen by pressing **ENT** key, move to R setting screen by pressing **ENT** key, move to PID setting screen by pressing **ENT** key 3 seconds at R setting screen.



(3) Adjustment of each Factor

Auto tuning function calculates standard PID for the turbulence response but best value is not necessarily obtained for all applications.

When the auto tuning function finished, it should be confirmed whether the auto tuning result is excellent by giving turbulence by intention while checking the control result.

The integration limitation coefficient is trimmed ζ as an adjustment of the overshoot and undershoots. When ζ is enlarged, it becomes easy for the overshoot and undershoot to go out though the restoration speed quickens.

ζ setting range : 0.00 to 1.00

Initial value : 0.4 (When the control characteristics of OUT1 and 2 are the same (RA&RA, or DA&DA))

0.8 (When the control characteristics of OUT1 and 2 are different (RA&DA, or DA&RA))

Adjustment of follow for Start up and SV change

The turbulence response and the SV change follow can be individually set by Flexible PID method in MAC3. It already set up the turbulence response, and now set it according to the purpose based on the table below.

R	b	Control method	Features	Remarks
1	1	I-PD (Measurements proportion differentiation early type)	For fixation control	1flexible PID control
1	0	ID-P (Measurements proportionally early type)	The kickback due to the change in the SV value is small, but the target value tracking ability is slightly inferior.	
0	1	IP-D (Measurements differentiation early type)	For lamp control	
0	0	PID (Deflection PID)	For target value follow valuing and cascade regulation	
Any	0	P-I-PD (P Flex type)	Turbulence response and target value follow	
Any	Any	PD-I-PD (PD Flex type)	Like 2 flexible PID control	

R, b Setting range : 0.00 to 1.00

Default value : FIX : $R = 0.40$ $b = 1.00$

PROG : $R = 0.20$ $b = 0.20$

R should be reduced when you want to improve the step response at the SV change and the start-up, R should be expanded when you wants to reduce the overshoot at the step responds and to reduce the output change.

b should be reduced when you want to improve the follow performance at the lamp control, b should be expanded When you wants to reduce the overshoot at the lamp ends and to reduce the output change

(4) Dual output control

- When using for heating & cooling:

If SV > PV when both output 1 and output 2 are left at 0%, assign heating to output 1. If SV < PV, assign cooling to output 1.

- In the following cases, depending on the load condition, the dead band (DB) setting may be temporarily ignored and the control output may operate.

- When the set values of proportional band (P) and derivative (D) of output 1 and output 2 are different.
- When the proportional period of output 1 and output 2 is different.

7. Trouble Shooting

7-1. Cause and Treatment of Main Defects

Contents of defects	Cause	Treatment
Error message display	Refer to cause and treatment of error display	Refer to cause and treatment of error display
PV display is not normal	Mismatch of instrument and input. Fault in the wiring.	Type code, check of specification. Check of wiring.
Display disappeared and does not operate	Power is not supplied. Abnormality of instrument.	Check of a power supply (voltage of terminal, switch, fuse, wiring).
Key operation impossible	Keylocked. Abnormality of instrument.	Release of keylock. Check of instrument, repair, exchange.

7-2. Cause and Treatment of Error Display

(1) Abnormality Display of Measurement Input

Error display	Contents	Cause		Treatment
HHHH (HHHH)	Scale over in upper limit	1.wire breaking of thermocouple input 2.wire breaking of resistance bulb input A 3.when input exceeds upper limit of measuring range by 10%		1.wire breaking check of thermocouple input wiring, replacement of thermocouple 2.check of resistance bulb A wiring, replacement of resistance bulb 3.check of input voltage value and current value, input transmitter and specification (matching of incoming signal and meter specification)
LLL (L L L L)	Scale over in lower limit	1.when input exceeds lower limit of measuring range by 10% 2.wire breaking of resistance bulb input B		1.polarity of input is reverse, check of wiring and an input transmitter 2.check of resistance bulb B wiring, replacement of resistance bulb
(B: Wiring of MAC3A, 3B's terminal No.11, Wiring of MAC 3C's terminal No.8, Wiring of MAC 3D's terminal No.5)				
b--- (B ---)	Breaking of resistance bulb input	1.wire breaking of b	1.check of resistance bulb wiring	
		(b: Wiring of MAC 3A, 3B's terminal No.12, Wiring of MAC 3C's terminal No.9, wiring of MAC 3D's terminal No.6)		
		2.multiple wire breaking combinations in A, B, b (A and B, A and b, B and b, all of ABB)	2.replacement of resistance bulb	
C JHH (C J HH)	Cold junction (CJ) temperature of thermocouple input is scale over in upper limit side	When ambient temperature of a meter exceeds 80°C	1.make Ambient temperature of meter within use environment condition temperature 2.Check the meter when ambient temperature is not over 80°C	
C JLL (C J LL)	Cold junction (CJ) temperature of thermocouple input is scale over in lower limit side	When ambient temperature of meter becomes less than -20°C	1.make Ambient temperature of meter within use environment condition temperature 2.Check the meter when ambient temperature is not less than -20°C	

8. Specification

Display

Display method	Digital display: MAC3A (96 x 96 size) PV red 7 segment LED	4 figure (height of character about 20mm)
	MAC3B(48x96 size)	SV green 7 segment LED 4 figure (character quantity about 13mm)
	MAC3C(72x72 size)	PV red 7 segment LED 4 figure (height of character about 12mm) SV green 7 segment LED 4 figures (height of character about 9 mm)
	MAC3D(48x48 size)	PV red 7 segment LED 4 figure (height of character about 16mm) SV green 7 segment LED 4 figures (height of character about 11mm) PV red 7 segment LED 4 figure (height of character about 12mm) SV green 7 segment LED 4 figures (height of character about 9mm)

Status display: RUN (green), PRG (green), AT (green), OUT 1(green)
EV1 (yellow), EV2 (yellow), OUT2 /EV3 (yellow)

Display accuracy : $\pm(0.25\%FS+1\text{digit})$ CJ errors not included, B thermo couple below 400°C is not guaranteed.
Display accuracy during EMC examination is $\pm 5\%FS$.

Accuracy maintenance range : $23 \pm 5^\circ\text{C}$

Display range : -10%-110% of measuring range, but Pt100's -200~600°C is -240~680°C

Display resolution : Changes with measuring range and scaling.

Input scaling : Possible at the time of voltage input and current input -1999 to 9999 (spang 10 to 10000 count, decimal point position no decimal point 0.1, 0.01, 0.001)

Setting

Setting system : By five front keys ()

SV setting range : Same with measuring range

Key lock : Communication and key setting (six levels), DI (one level)

Operations	Level	Lock Content
Communication & Key setting	OFF	No lock
	1	Possible to change Execution SV, manual output value, and a keylock level.
	2	Possible to change manual output value and keylock level.
	3	Possible to change keylock level.
	4	Possible to change keylock level. key is invalid.
	5	In addition to the contents of Level 1, Basic screens and FIX/PROG setting screens can be changed.
	6	In addition to the contents of Level 1, Basic screens and step setting screens can be changed.
DI Setting	Super Key Lock (Shift between screens prohibited. Fixed only to the basic screen.)	

The RUN key is invalid when the Keylock is set to 4 or when the super key lock is activated by DI. Everything else is valid.

SV setting limiter : Same with measuring range (lower limit < upper limit)

Unit setting : Settable at the time of sensor input °C, °F

Program function (option) (40step function add from ver1.30)

Number of pattern : 1, 2, and 4
 Maximum Number of steps : 40(1 pattern), 20(2 pattern), 10(4 pattern)
 PID selection : Each output has three kinds. PID1, PID2, and PID3.
 Time setting : 0 minute 0 second~99 minutes 59 seconds or 0 hour 0 minute~99 hours 59 minutes or 0.0 - 999.9 hours ,and ∞ (infinity)
 Time setup resolution : 1 second or 1 minute or 0.1 hour
 Time accuracy : $\pm (\text{Setup time} \times 0.005 + 0.25 \text{ second})$
 In a step Setting parameter : SV, time, PID№
 Number of repeats : 1 to 9999 times, and ∞
 Time signal : Possible to allot to Event (1 second for changeover, 3 seconds for pattern end, 3 seconds for program end)
 PV start function : With
 Guarantee soak function : With
 Time hold facility : Possible at front key, DI allotment, or communication
 Step skip : Possible at front key, DI allotment, or communication
 Power failure compensation : Without (setting contents being held. However, elapsed time, execution step, and number of execution are reset.)

Event 1 • 2 (option) : 2 sets

Output rating : Contact Normal open (1a) 240V AC 2A (resistance load) EV1 • EV2 and common

Kind of event : Refer to following table.

Function	Character	Note
No allotment	<i>noa</i>	
Upper limit absolute value Alarm	<i>uR</i>	
Lower limit absolute value alarm	<i>LR</i>	
Scale over alarm	<i>So</i>	HHHH, LLLL, B---- Operates, when displayed.
Upper limit deviation value Alarm	<i>u_d</i>	
Lower limit deviation value alarm	<i>l_d</i>	
Within deviation alarm	<i>cd</i>	
Without deviation alarm	<i>od</i>	
RUN signal	<i>r_u_n</i>	Operates during PROG and FIX in operation.
Control loop alarm (Heater breaking / loop)	<i>c_t_1</i> <i>c_t_2</i>	When contact/voltage pulse output is ON Breaking alarm, when it is below EV set. When contact/voltage pulse output is OFF Loop alarm, when it is more than EV set.
Step signal	<i>StP</i>	Operate for 1 second at the time of step switchover
Pattern end signal	<i>P_E</i>	Operate for 3 seconds at the time of pattern end
Program end signal	<i>E_nd</i>	For 3 seconds at the time of program end
Hold signal	<i>Hold</i>	Operates during time hold.
Program signal	<i>Prog</i>	Operates by program selection
Upslope signal	<i>u_SL</i>	Operates when the inclination of program control rises (including Hold status)
Downslope signal	<i>d_SL</i>	Operates when the inclination of program control descends (including Hold status)
Guarantee signal	<i>GuR</i>	Operates when approaches the targeted value exceeding the EV value.

Setting range : Upper limit absolute value alarm, Lower limit absolute value alarm within measuring range

Upper limit deviation alarm, Lower limit deviation alarm -1999 - 2000 unit

Within deviation alarm, without deviation alarm 0 - 2000unit

Control loop alarm 0.0-50.0A

Standby operation : OFF No standby operation

1 Only at the Time of Power-on, standby operation

2 At the Time of power switch on, each alarm operating point is changed, deviation alarm's execution SV is changed, and RUN/STBY (RST) is switched over standby operation, at the time of AUTO/MAN switchover

ON/OFF delay : OFF, 1 to 8000 second (This function available, from ver 1.38)

Latching : Alarm operation maintenance function(Release is done by key operation, DI, or power OFF.

In the case of release by DI and power OFF, all alarms are called off simultaneously)

Differential gap : 1 to 999 unit

Output characteristic : Choose from normal open (NO) or normal closing (NC).

If NC is chosen and power is turned on, relay becomes ON about 1.8 seconds and becomes OFF at event power range.

Event3 (Option) : Event3 is exclusive selection option of control out put 2 and DI4.

: Item and contents are same with event 1 and 2.

DI 1-2 (option)	: In MAC3C and MAC3D, exclusive selection option with CT1 input.																																																																										
Input rating	: 5V DC 0.5mA																																																																										
Allotment function	: Refer to following table.																																																																										
<table border="1"> <thead> <tr> <th>Character</th><th>Kinds of operation</th><th>Input detection</th><th>Contents</th></tr> </thead> <tbody> <tr><td>nOn</td><td>No allotment</td><td>level</td><td></td></tr> <tr><td>S8_1</td><td>1st SV</td><td>level</td><td>With closed DI terminal, Execution SV = 1st SV</td></tr> <tr><td>S8_2</td><td>2nd SV</td><td>level</td><td>With closed DI terminal, Execution SV = 2nd SV</td></tr> <tr><td>S8_3</td><td>3rd SV</td><td>level</td><td>With closed DI terminal, Execution SV = 3rd SV</td></tr> <tr><td>S8_4</td><td>4th SV</td><td>level</td><td>With closed DI terminal, Execution SV = 4th SV</td></tr> <tr><td>rUn</td><td>Control RUN</td><td>level</td><td>RUN with closed DI terminal. STBY(RST) with opened.</td></tr> <tr><td>ProG</td><td>Program</td><td>level</td><td>Program with closed DI terminal. Constant value with opened.</td></tr> <tr><td>mAu</td><td>Manual output</td><td>level</td><td>Manual with closed DI terminal. Auto with opened.</td></tr> <tr><td>At</td><td>Auto tuning</td><td>edge</td><td>AT starts with rise edge.</td></tr> <tr><td>Hold</td><td>Hold</td><td>level</td><td>Program time stops temporary.</td></tr> <tr><td>SkP</td><td>Skip</td><td>edge</td><td>Shifts to the following step of program.</td></tr> <tr><td>Pt_1</td><td>Pattern 1</td><td>level</td><td>With closed DI terminal, Execution pattern = 1</td></tr> <tr><td>Pt_2</td><td>Pattern 2</td><td>level</td><td>With closed DI terminal, Execution pattern = 2</td></tr> <tr><td>Pt_3</td><td>Pattern 3</td><td>level</td><td>With closed DI terminal, Execution pattern = 3</td></tr> <tr><td>Pt_4</td><td>Pattern 4</td><td>level</td><td>With closed DI terminal, Execution pattern = 4</td></tr> <tr><td>LsrS</td><td>Latching release</td><td>edge</td><td>With rise edge, all latchings released</td></tr> <tr><td>LocY</td><td>Super keylock</td><td>level</td><td>Super keylock with closed DI terminal. Release with opened.</td></tr> </tbody> </table>				Character	Kinds of operation	Input detection	Contents	nOn	No allotment	level		S8_1	1st SV	level	With closed DI terminal, Execution SV = 1st SV	S8_2	2nd SV	level	With closed DI terminal, Execution SV = 2nd SV	S8_3	3rd SV	level	With closed DI terminal, Execution SV = 3rd SV	S8_4	4th SV	level	With closed DI terminal, Execution SV = 4th SV	rUn	Control RUN	level	RUN with closed DI terminal. STBY(RST) with opened.	ProG	Program	level	Program with closed DI terminal. Constant value with opened.	mAu	Manual output	level	Manual with closed DI terminal. Auto with opened.	At	Auto tuning	edge	AT starts with rise edge.	Hold	Hold	level	Program time stops temporary.	SkP	Skip	edge	Shifts to the following step of program.	Pt_1	Pattern 1	level	With closed DI terminal, Execution pattern = 1	Pt_2	Pattern 2	level	With closed DI terminal, Execution pattern = 2	Pt_3	Pattern 3	level	With closed DI terminal, Execution pattern = 3	Pt_4	Pattern 4	level	With closed DI terminal, Execution pattern = 4	LsrS	Latching release	edge	With rise edge, all latchings released	LocY	Super keylock	level	Super keylock with closed DI terminal. Release with opened.
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Input minimum retention time : 0.25 second

Input of operation : Non-voltage contact or open collector

DI4 (option) : DI4 is exclusive selection option with control output 2, Event3

Number of input : One

: Item and contents are same with DI 1 and DI 2.

Communication function(option) : In MAC3C and MAC3D, exclusive selection option with Analog output function

Read attached communication instructions manual that detailed about communication function.

Communicative type : EIA standard RS-485

Communication system : Two-wire system half duplex multi-drops (bus) system

Synchro system : Asynchronous system

Communication distance : Maximum 500m (depend s on conditions)

Communication Speed : 1200, 2400, 4800, 9600, 19200 or 38400bps

Data format : Start 1bit, Stop 1~2 bits, Data length 7 or 8 bits, Parity without, odd number, even number

Master function : Chooses from SV, OUT1, OUT2 (1:n number of slaves maximum 31)

* When MAC3 is a master, slave address range must be continuation.

* When MAC3 is a master, bus connection with other host PCs is not allowed.

* Input range of master machine and slave machine should be equal, at the time of cascade control

Slave address : 1 to 255

Parameter preservation mode : Choose from RAM, MIX and EEPROM mode.

Error detection : None, Choose from ADD, complement of ADD +2, exclusive OR, CRC-16 and LRC

Flow control : none

Delay : 1 to 500ms (resolution 1ms)

Communication code : ASCII code or binary code

Protocol : SHIMAX Standard or MODBUS ACII, MODBUS RTU protocol

Termination resistance : 120Ω (external connection)

Number of connection : Maximum 32 sets (depends on conditions, host is included)

Analog output(AO) : In MAC3C and MAC3D, exclusive selection option with communication function

Output kind : Choose from PV, SV, OUT1, OUT2, CT1, and CT2.

Output rating : 4-20mA DC 300Ω or less, Display accuracy ±0.3% (accuracy maintenance range 23°C±5°C)

Load regulation±0.05%, Resolution approx 1/50,000

Scaling function : with (range depends on output type) analog output lower limit value < analog output upper limit value

Output limiter : 0.0 to 100.0% (reverse setting is possible)

CT 1 input : In MAC3C and MAC3D, exclusive selection option with DI1 + DI2.

Detection method : Current judging system by CT sensor

Detection range : 0.0 to 55.0A

Sampling period : 125ms

Detection accuracy : ±5%FS

Detection delay time : 0.5 to 30.0 seconds

Alarm output : Assigned to event

Detection Objects : Assigned to OUT1, OUT2, EV1, EV2, and EV3.

Alarm operating point

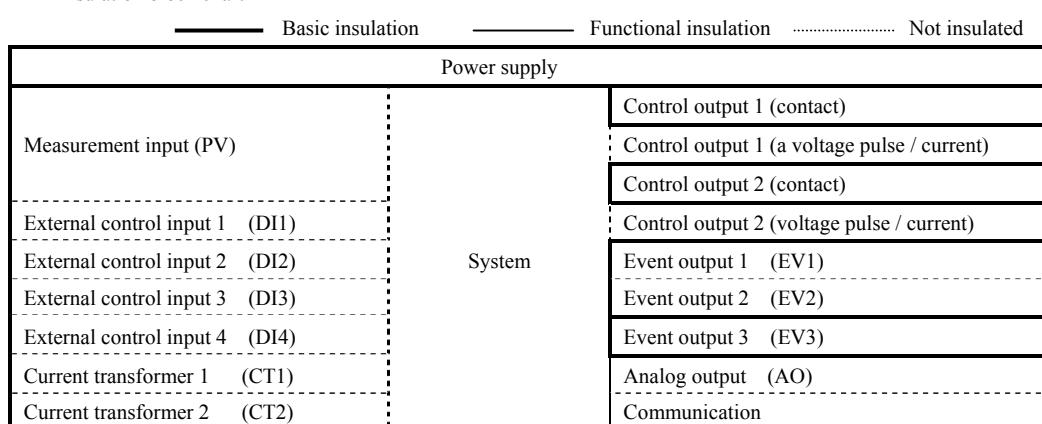
setting range : 0.0 to 50.0A

Recommended CT sensors : Products of U_RD co., CTL-6-L ,CTL-6-V, CTL-6-P-H, CTL-6-S-H, CTL-12L-8

General specification

Data save	: Nonvolatile memory (EEPROM)
Temporary dead time	: No influence within 0.02 second 100% dip
Use environmental condition	: Temperature: -10 to 55 °C
Humidity	: Below 90%RH (no dew condensation)
Height	: Altitude of 2000m or less
Category	: II
Contamination degree	: 2
Storage temperature Conditions	: -20 to 65 °C
Supply voltage	: 90 to 264V AC 50/60Hz or 21.6 to 26.4V AC (50/60Hz)/DC
Power consumption	: 90 to 264V AC maximum 9VA 21.6 to 26.4V AC maximum 6 VA 21.6 to 26.4V DC maximum 4W
Applicable standard	: EU CE marking directives compliant (EMC : Class A)
Oscillation	: IEC60068-2-6
Insulated class	: Class I apparatus
Input noise removal ratio	: Normal 50dB or higher
Impulse-proof noise	: Power-source Normal 100ns/1 μ s±1500V
Insulation resistance	: Between input/output terminal and power supply terminal 500V DC 20Ω or higher Between analog output or communication and other input/output terminals 500V DC 20Ω or higher
Withstand voltage	: Between input/output terminal and power supply terminal 1500V AC 1 minute or 1800V AC 1 second Between analog output or communication and other input/output terminals 500V AC 1 minute or 600V AC 1 second
Resistance to vibration	: Frequency 10~55~10Hz, amplitude 0.75mm (one side amplitude) • • 100m/S ² Direction 3 directions Sweep speed 1 octave/minute (about 5 minutes for both-way/cycle) Number of sweep 10 times
Case material	: PC or PPE
Case color	: Light gray
Outside dimension MAC3 A	: H96×W96×D69mm (depth in panel 65mm)
MAC3 B	: H96×W48×D66mm (depth in panel 62mm)
MAC3 C	: H72×W72×D69mm (depth in panel 65mm)
MAC3 D	: H48×W48×D66mm (depth in panel 62mm)
Thickness of applied panel	: 1.2-2.8mm
Size of attachment hole	MAC3A : H92×W92mm Attachment hole size of horizontal plural proximity attachment W(96×N-4) mm H92mm MAC3B : H92×W45mm N=number of equipment W(48×N-3) mm H92mm MAC3C : H68×W68mm W(72×N-4) mm H68mm MAC3D : H45×W45mm W(48×N-3) mm H45mm
Weight	MAC3A : About 220g MAC3B : About 160g MAC3C : About 150g MAC3D : About 120g
Isolation	: Except for input, system and contact, all control output are no-isolation Between event output EV1 and EV2 1 is not insulated Others are basic insulation or functional insulation. Refer to the following insulation block chart.

Insulation block chart



RoHS information

中华人民共和国中国电子行业标准 SJ/T11364-2014
People's Republic of China Electronic Industry Standard SJ/T 11364-2014

产品 / Product		MAC3/5/50 Series Digital Controller					
零件名称 / Part Name		有毒有害物质或元素 / Hazardous Substances					
		铅/Pb	汞/Hg	镉/Cd	六价铬/Cr ⁶⁺	多溴联苯/PBB	多溴二苯醚/PBDE
电路模块 / PCB Assembly	X	0	0	0	0	0	0
壳体 / Enclosure	0	0	0	0	0	0	0
包装 / Packaging	0	0	0	0	0	0	0
0	指明产品所有均质材料包含的有害物质要低于GB/T26572限定的要求 Indicates that said hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement of GB/T 26572.						
X	指明产品所用的至少一种均质材料包含的有害物质高于GB/T26572限定的要求 Indicates that said hazardous substance contained in at least one of the homogeneous materials used for this part is above the limit requirement of GB/T 26572.						



标识中央的数字表示适用于中华人民共和国销售的电子信息产品的“环保使用期限”。
本公司生产的产品的环保使用期限为10年。但是，此环保使用期限不是产品保证期限。

9. Program pattern setting table

Please copy and use this table according to need.

Start mode	SV, PV								
End step	1-40								
Number of pattern execution	1~9999, ∞								
Time unit: min.: sec., hour: min., or hour									
Output1 PID No.1									
P=	%								
I=	second								
D=	second								
Differential gap =									
Manual reset =	%								
Output limiter	OL= %								
	OH= %								
Output 1 PID No.2									
P=	%								
I=	second								
D=	second								
Differential gap =									
Manual reset =	%								
Output limiter	OL= %								
	OH= %								
Output 1 PID No.3									
P=	%								
I=	second								
D=	second								
Differential gap =									
Manual reset =	%								
Output limiter	OL= %								
	OH= %								
Output 2 PID No.1									
P=	%								
I=	second								
D=	second								
Differential gap =									
Manual reset =	%								
Output limiter	OL= %								
	OH= %								
Output 2 PID No.2									
P=	%								
I=	second								
D=	second								
Differential gap =									
Manual reset =	%								
Output limiter	OL= %								
	OH= %								
Output 2 PID No.3									
P=	%								
I=	second								
D=	second								
Differential gap =									
Manual reset =	%								
Output limiter	OL= %								
	OH= %								
Step No.									
SV (target setting value)									
Time									
Output 1 PID No.									
Output 2 PID No.									

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

SHIMAX CO., LTD.

190 Shimoniiyachi, Aza, Yotsuya, Daisen-shi, Akita 014-0102, Japan

URL <http://www.shimax.co.jp>

Phone: +81-187-86-3400 FAX. +81-187-62-6402

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