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.

Contents

SHIMAX

MAC3 F-1 AE January, 2005

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 .

「⚠CAUTION」

● 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

MAC３A−	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)
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)
E-: Event Output 3(one point), D-: external control input (DI4) one point
7. DI N:none, D: external control input (DI 1,2,3) three points
8. CT Input N: none, H: CT Input two points
9. Analog Output N: none, I: current (4～20mA)
10. Communication N: none, R: RS485
11. Program Function N: none, P: equipped

Example of model code

MAC３D−	M	C	F−	E	C−	D	T	N
1	2	3	4	5	6	7	8	9

Items

1. Series 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)
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)
E-: Event Output 3(one point), D-: external control input (DI4) one point
7. DI・CT Input N: none, D: external control input (DI1,2,3) three points, H:CT Input two points
8. Analog Output・Communication N: none, T: current (4～20mA), 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□ or above 55□.
(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.

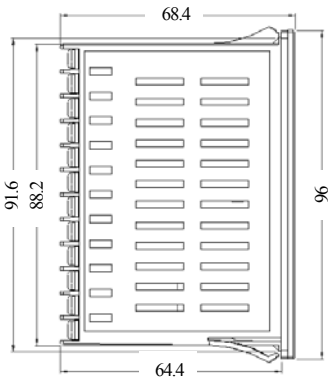
「NOTE」:MAC 3 is a panel set-up type.
Please use the product after setting up to the panel.

3-3. External dimension and panel cutout

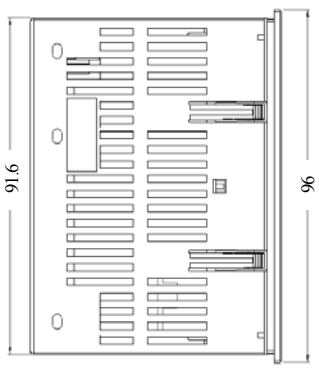
MAC3 external dimensions (unit: mm)

MAC3A (96×96 size)

profile

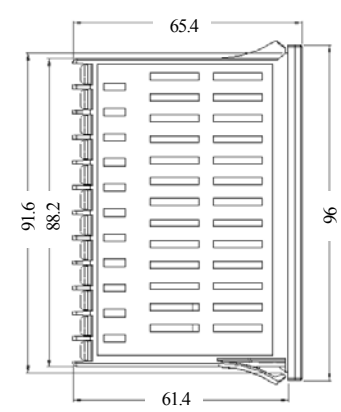


top View

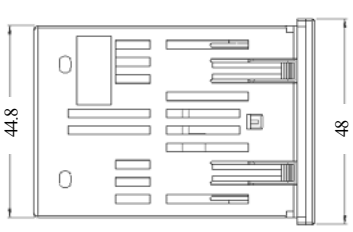


MAC3B (48×96 size)

profile

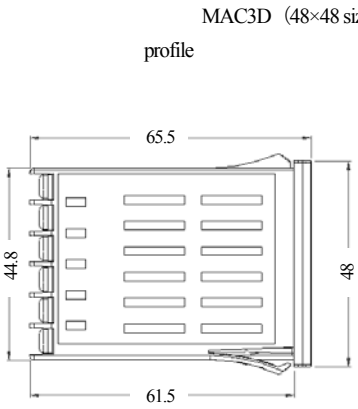


top View

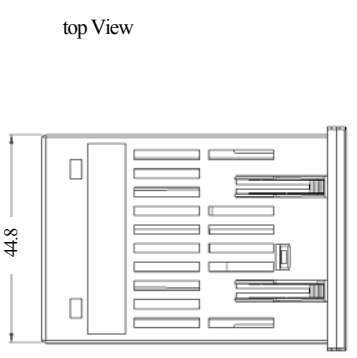


MAC3D (48×48 size)

profile

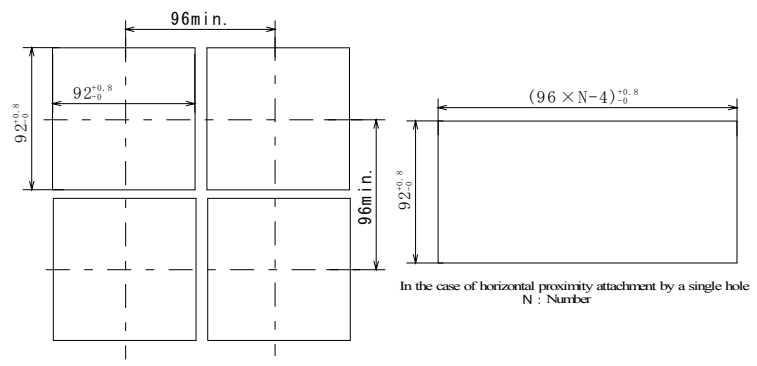


top View

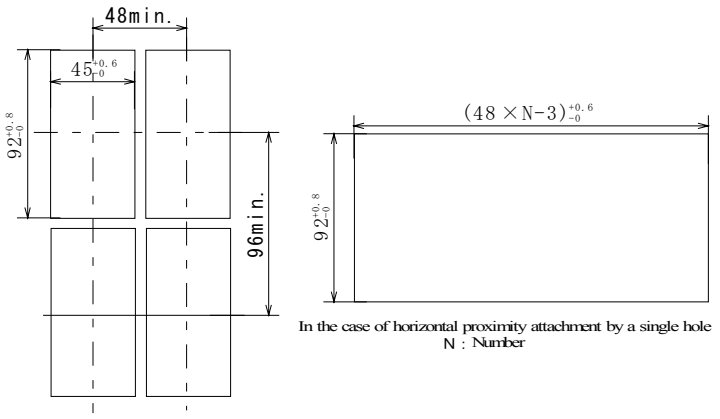


MAC3 panel cutout (unit: mm)

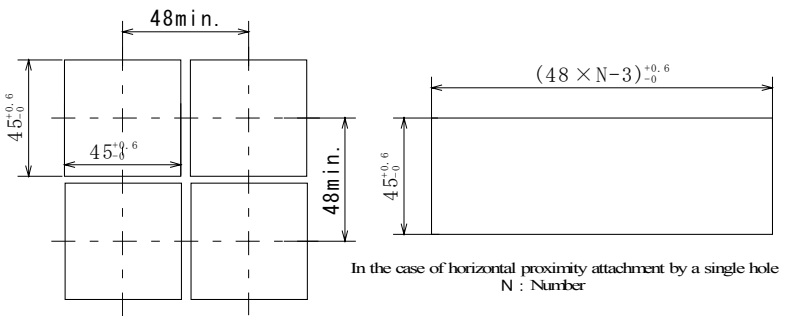
MAC3A (96×96 size)



MAC3B 48×96 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.

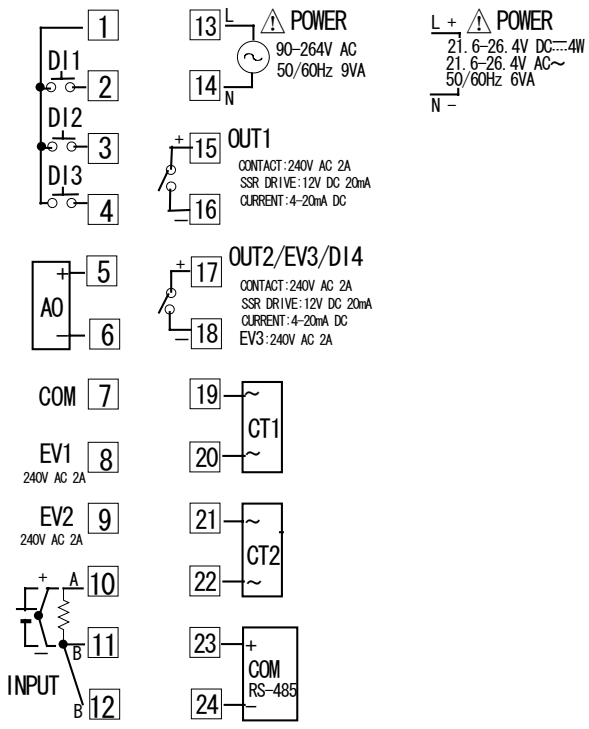
(4) Do not wires an input signal line inside of an electric wire pipe or a duct same with the high voltage line.

(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.

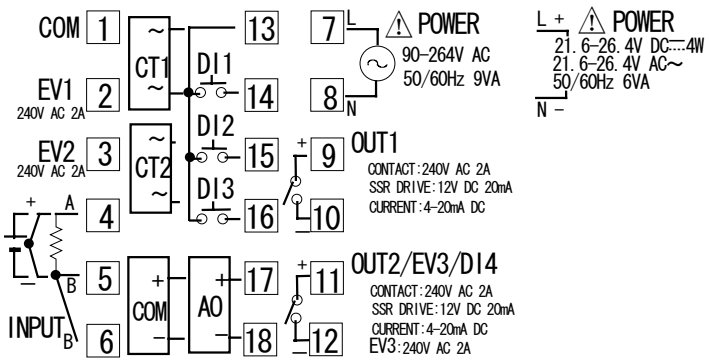
3-5. Terminal arrangement diagram

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 MAC3D

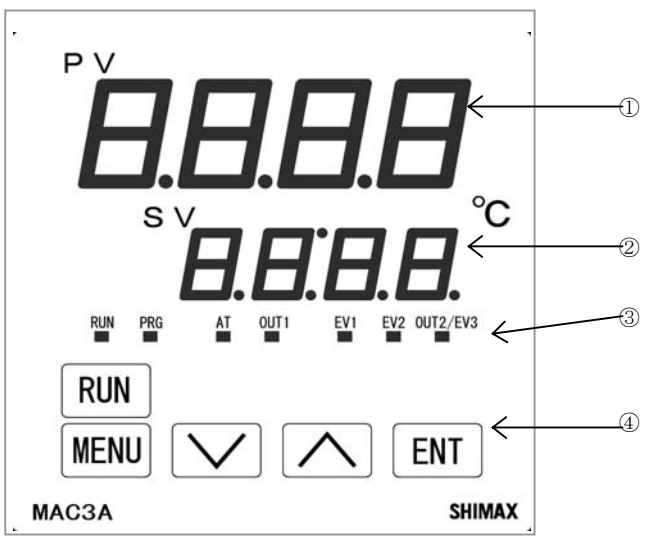


「Note」: If input type is thermocouple or voltage, errors may occur when terminal 5 and terminal 6 terminal are short-circuited

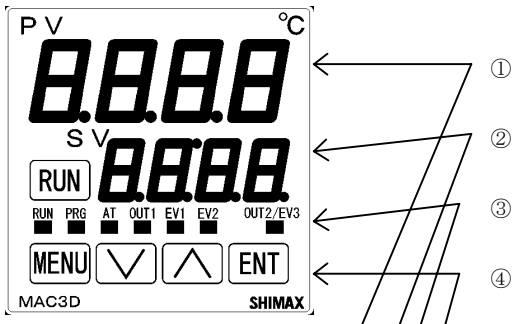
4. Description of front panel

4-1. Names of front panel.

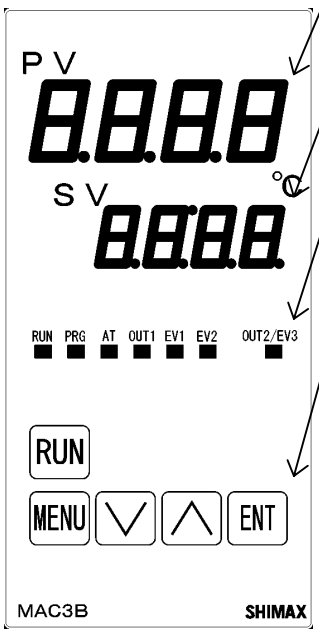
MAC3A 96× 96 size front



MAC3D 48×48 size front



MAC3B 48× 96 size front



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 external 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 (MENU)key

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

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

Press MENU 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(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) ENT (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 (ENT) key for three seconds on the screen of operation mode 1, then it jumps to the screen of operation Mode 2.

Press ENT 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 (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

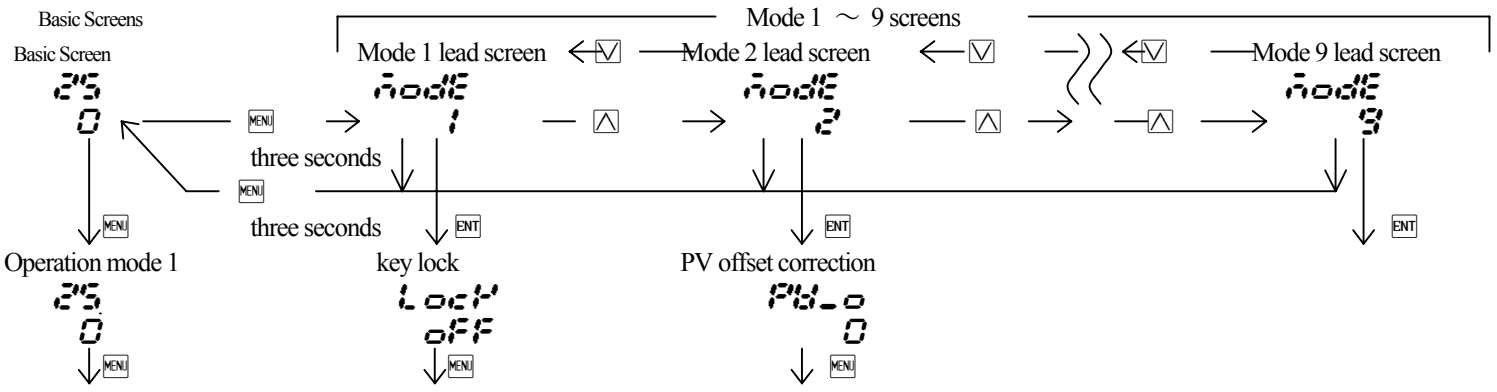
Basic Screen

25 0 ⟷ ENT 3 seconds / MENU 3 seconds → FIX (constant value control) lead screen of setting screens or → P-oG (Program control) lead screen of setting screens

SEt SEt

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

Press the MENU key for 3 seconds on FIX or P-oG 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 FIX is chosen on the operation mode 2 screen. The shift is possible when the program option is added and P-oG is chosen on the operation mode 2screen.



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～ 9 screens, then it shifts to the basic screen.

Press the ENT key on the lead screen of mode 1～ 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.

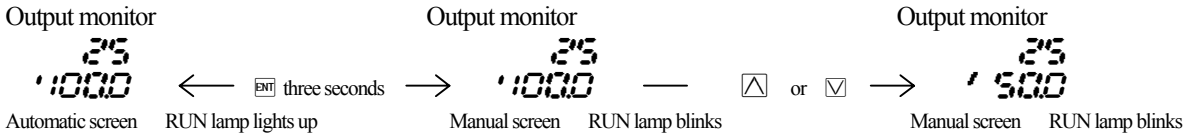
5-2. Setting Method

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.

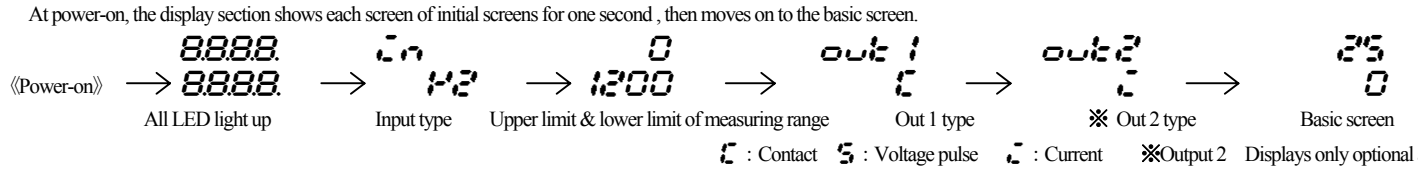
Press ENT key for three seconds as well to shift back to Automatic. Excluding when a keylock is OFF, Automatic⇔Manual switchover does not work while STBY<RST> and AT are in operation.

In the case of two-output type, the switchover between automatic and manual is operatable 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 scre

(1) Basic Screens

Basic Screen

25 0

Executed SV initial value：Sensor input 0

Linear input Lower limit of scaring range

Setting range：Sensor input Within measuring range

MENU key Linear input With in scaring range

Within SV limiter besides

Targeted value (PV) is displayed on the upper row as four-digit ,and target d value (SV) is displayed on the lower row also as four-digit. (Notes:hereinafter, measured value and targeted value are referred to as"PV" and "SV")

At the time of FIX, execution SV is displayed and change of setting is possible.

PROG's SV is just displayed ,and change of setting is impossible.

Action Mode 1 screen

25 Stby

Initial value: : Stby(stanby)（Initial value at the time of constant value control）

r-St（reset）(Initial value at the time of program control)

Setting range: : Stby（r-St） Control stop [Output OFF (0%)] operation

MENU key run conduct of control operation

Choose run (RUN) by △ key. Decide by ENT key, then Monitor LED's RUN lights up to start control operation.

Choose Stby（r-St）by ▽ key、Decide by ENT key, hen Monitor LED's RUN lights off and becomes control stop [Output OFF (0%)] conducting.

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 (r-St) 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 — ▲ ENT → 25

Stby ← MENU three seconds FIX ← ▼ ENT → P-oG

r-St ← MENU three seconds ———— PRG LED lights up

Press MENU key for 3 seconds on Action mode2 screen, then it returns to Action mode1 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
10.0.0 manual output setting range: :0.0-100.0% (within output limiter)

At the time of automatic output,monitor display only.

MENU 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 (r-St).

When a power source is intercepted and re-switched on, it returns to the condition just before intercepting.

When AMnu 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
10.0.0 Contents are the same with that of an output 1.

MENU key Output 2 monitoring screen displays only when output 2 option is added.

CT1 current monitoring-screen

25
50.0 Current display range: 0.0-55.0A

Displays at the time of CT input option addition, and the current value detected by CT sensor is displayed.

MENU key Current value is displayed.

CT2 current monitoring screen

25
30.0 Contents are the same with that of an output 1.

MENU key

Monitoring screen of step's remaining time period

25
99:59 Displays while program is in operation if program option is added.

MENU key Step № in progress and remaining time are displayed by turns.

(In ∞ setting, step № and oF 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.

MENU key (In ∞ setting, step № and oF 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
PId 1 Chosen PID № is displayed when FIX is in operation.

PID № chosen at each step and on-going step № are displayed by turns when PROG is in operation.

MENU key

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.

SHIP (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 r-St and FIX neither.

SKIP (skip) execution screen

SHIP 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.

MENU 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 r-St and FIX neither.

AT (Auto Tuning) execution screen

AT Initial value: : oFF
oFF Setting range: : oFF、on

MENU 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 th 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

EV 1 Initial value: upper limit absolute value measuring range Scaling upper limit
1200 lower limit absolute value measuring range Scaling lower limit
upper limit deviation 2000
MENU key lower limit deviation -1333
within deviation 0
outside deviation 2000
CT1 or CT2 0.0
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 -1333～2000 unit
lower limit deviation -1333～2000 unit
within upper-lower limit deviation 0～2000 unit
outside upper-lower limit deviation 0～2000 unit
CT1 or CT2 0～50.0 A

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

No option, No display when non, So, r-un, StP, P_E, End, HoLd, Pr-oG, d_SL , and u_SL are allotted to EV1.

The operation mode of each deviation alarm is r-un.

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

EV2
0 Initial value,setting range, contents are the same with EV1

MENU key

EV3 (event 3) operating-point setting screen

EV3
0 Initial value,setting range, contents are the same with EV1

MENU 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.

Latching release screen

LAtch Initial value: : rSt 1

rSt 1 Setting range: : rSt 1 release EV1

rSt2 release EV2

rSt 3 release EV3

ALL release all EVs at a time

MENU key

On the latching setting screen of each EV mode,rSt No. and ALL which chose on are displayed. If latching is on,once EV is outputted, EV output state is maintained even if EV is in the state of OFF. When EV is in a latching state, decimal point of the minimum digit blinks, and it shows that release of EV is possible. If ENT key is pressed, EV is released and a decimal point lights off.

However, release is impossible when a state is in EV power range.

Return to basic screen

(2) FIX (constant value control) setting screens

At the time of no program option and with program option and FIX is chosen on Action mode2 screen of basic screens,lead screen of FIX setting screens is displayed when ENT key is pressed for 3 seconds.

If MENU key is pressed for 3 seconds on lead screen, it returns to basic screen.

basic screen — ENT three seconds → lead screen of FIX setting

25 — ENT three seconds → FIX

0 ← MENU three seconds — SEt

FIX lead screen

FIX

SEt No setting on this screen.

ENT key Press ENT key , then it shifts to the first setting screen SV1 setting screen.

SV1 setting screen

Sb 1 Initial value : At the time of sensor input 0

0 linear input time scaling lower limit

Setting range: sensor input time within measuring range

MENU key linear input time within scaling range

Moreover, within limit of SV limiter.

When SV1 is Execution SV,being reflected in basic screen.

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

SV1 output1 PID No. setting screen

1o 1P Initial value : 1

1 Setting range:1, 2, 3

MENU key When SV1 is Execution SV,PIDNo. that will be used for control of output 1 is chosen from 1～3.

SV1 output2 PID No. setting screen

1o2P Initial value:1

1 Setting range:1,2,3

MENU key When SV1 is Execution SV,PIDNo. that will be used for control of output 2 is chosen from 1～3.

Displayed when output 2 option is added.

SV2 setting screen

Sb2 Initial value: same with SV1

0 Setting range: same with SV1

MENU key

Displayed when SV2 is allotted to DI.When terminal of allotted DI short-circuits, it becomes Execution SV.

When SV2 is Execution SV, it is reflected in basic screen.

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

SV2 output 1 PIDNo. setting screen

2o 1P Initial value:1

1 Setting range:1,2,3

Displayed when SV2 is allotted to DI.

MENU key When SV2 is Execution SV,PIDNo. that will be used for control of output 1 is chosen from 1～3.

SV2 output 2 PIDNo. setting screen

2o2P Initial value:1

1 Setting range:1,2,3

MENU key Displayed when SV2 is allotted to DI.

When SV2 is Execution SV,PIDNo. that will be used for control of output 2 is chosen from 1～3.

Displayed when output 2 option is added.

SV3 setting screen

Sb3 Initial value: same with SV1

0 Setting range: same with SV1

MAN key Displayed when SV3 is allotted to DI.When terminal of allotted DI short-circuits, it becomes Execution SV.

When SV3 is Execution SV, it is reflected in basic screen.

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

SV3 output 1 PIDNo. setting screen

3o 1P Initial value:1

1 Setting range:1,2,3

MENU key Displayed when SV3 is allotted to DI..

When SV3 is Execution SV,PIDNo. that will be used for control of output 1 is chosen from 1～3.

SV3 output 2 PIDNo. setting screen

3o2P Initial value:1

1 Setting range:1,2,3

MENU key Displayed when SV3 is allotted to DI..

When SV3 is Execution SV,PIDNo. that will be used for control of output 2 is chosen from 1～3.

Displayed when output 2 option is added.

SV4 setting screen

Sb4 Initial value: same with SV1

0 Setting range: same with SV1

MENU key Displayed when SV4 is allotted to DI..

When terminal of allotted DI short-circuits, it becomes Execution SV.

When SV4 is Execution SV, it is reflected in basic screen.

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

SV4 output 1 PIDNo. setting screen

4o 1P Initial value:1

1 Setting range:1,2.3

MENU key Displayed when SV4 is allotted to DI..

When SV4 is Execution SV,PIDNo. that will be used for control of output 1 is chosen from 1～3.

SV4 output 2 PIDNo. setting screen

4o2P Initial value:1

1 Setting range:1,2,3

MENU key Displayed when SV4 is allotted to DI..

When SV4 is Execution SV,PIDNo. that will be used for control of output 2 is chosen from 1～3.

Displayed when output 2 option is added.

Return to FIX lead screen

(3) PROG (program control) setting screens

Press ENT key for 3 seconds, lead screen of the PROG setting screens is displayed,When program option is added and Prog is chosen on Action mode2 screen of basic screens.

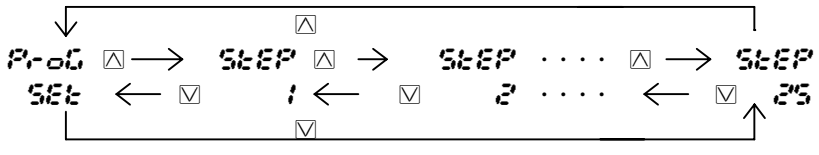
If MENU key is pressed for 3 seconds on lead screen, it returns to basic screen.

Basic screen — ENT three seconds → lead screen of the PROG setting screens

25 — ENT three seconds → Prog

0 ← MENU three seconds — SEt

With △, ▽ key, it is possible to shift between 2 (24), PROG and step No.1 ～ 25 lead screen.



Program basic setting screens

Program basic setting screens　Lead screen

PrOG
SEt　No setting on this screen

Press △ key to shift to step 1 lead screen.

Press ▽ key to shift to step 25 lead screen.

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

Start mode setting screen

S_md
SV　Initial value: PV (PV)

Setting range: SV (SV)、PV

MENU key　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 omissible.

Start SV setting screen

St SV
0　Initial value : At the type of sensor input　0

linear input type　scaling lower limit

Setting range: sensor input type　within measuring range

MENU key　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
9　Initial value: 9

Setting range: 1～25 step

MENU key　Pattern termination step №of program control is set.

Number of execution Setting screen for repeating of program pattern

Rpnt
1　Initial value:1

Setting range:1～9999 times、∞

MENU key　The number of execution of a program pattern is set.

Time unit setting screen

t_Un
hh:SS　Initial value:hh：SS(minute:second)

Setting range: hh：SS、HH：hh、HHHH

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

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 omissible.

「example」：PV at the time of "RST is 30℃, Start SV is 0 ℃, Step 1's　attainment SV 100 ℃,

Execution time of Step1 is 60 minutes

Start at start SV,attainment time is 60 minutes.

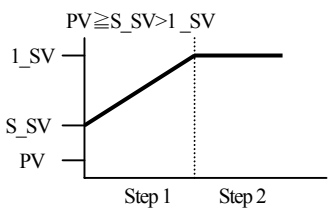
When starts at PV,　100-30=70℃ ,therefore　60 minutes x70%= 42 minutes = 18 minutes' shortening

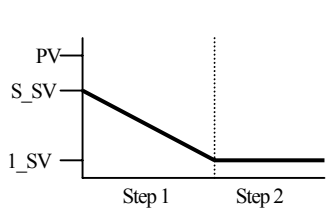
However, depending on the spatial relationship between PV, Start SV, and attainment SV, it may become SV start or Step1 may be skipped.

(1) case of SV start

PV≦S_SV(start SV) < 1_SV (step1 attainment SV)

PV≧S_SV>1 _SV



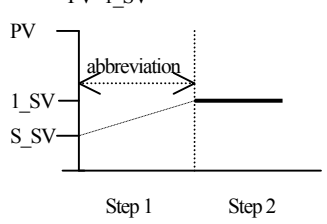


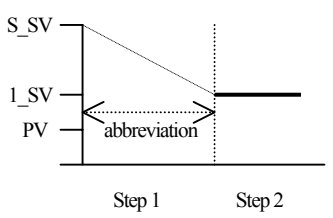
(2)When Step 1 is skipped and progresses to Step 2

S_SV < 1_SV < PV

S_SV > 1_SV > PV

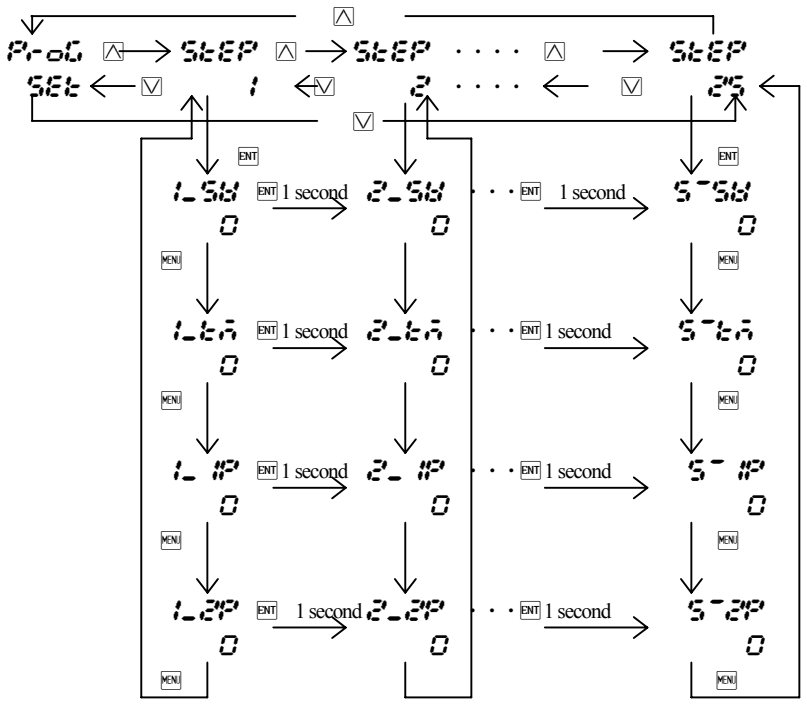
PV=1_SV





Step 1 setting screens～ Step 25 setting screens

Screen sequence of step 1 setting screens ～ step 25 setting screens are as follows.



In each step setting screen, next to number,_ for Steps 1～9 , - for 10～ 19 and ¯ for 20～ 25 are assained to distinguish each of them.

(Step　1 SV = 1_SV, step 11SV = 1-SV and step 21SV= 1¯SV)

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

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

After that, if MENU key key is pressed,then it shifts to output 1PID№, output 2PID№, and lead screen.

Moreover, it is if ENT key is pushed for 1 second on each setting screen,it advances to the next Step №'s same setting item screen.

(1_SV→2_SV・・・→5¯SV→1_SV)

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

Step1 SV setting screen

1_SV
0　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

MENU key　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.

Step 1 execution-time setting screen

1_tA
99:59　Initial value: 00:01

Setting range: 00:00 to 99:59 (minute: second, hour : minute)

0.1-999.9 (hour) and ∞(infinity)

MENU key　Execution time of Step 1 is set.

Step1 output1 PIDNo. setting screen

1_nP
1　Initial value:1

Setting range:1～3

PID№ used in Step1's control output 1 is chosen.

MENU key

Step1 output 2 PIDNo. setting screen

1_2P
1　Initial value:1

Setting range:1～3

MENU key　PID№ used in Step1's control output 2 is chosen.

Displayed when output 2 option is added.

To step1 lead screen

(4) Mode 1 screens

Mode 1 lead screen

Mode　Press MENU key for 3 seconds on basic screen, then displayed

1

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　Initial value:oFF

oFF　Setting range:oFF、1、2、3

MENU key

1 Only change of Execution SV (basic screen) and keylock is possible.

2 Only change of a keylock is possible.

3 Only change of a keylock is possible.

Notes: Even when keylock is set as 1 and 2, manual output value is possible to change.

SV limiter lower limit setting screen

SbL_L　Initial value: measuring range lower limit

0　Setting range: measuring range lower limit value~measuring range upper limit value－1

MENU key

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

SbL_H　Initial value: measuring range upper limit

1200　Setting range:SV limiter lower limit value +1~ measuring range upper limit value

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

Return to mode1 lead screen.

(5) Mode 2 screens

Mode 2 lead screen

Mode　Press ⋀ key in mode1 lead screen, or press ⋁ key in mode3 lead screen,

2　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

PbL_o　Initial value:0

0　Setting range:－500～500 unit

MENU 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

PbL_G　Initial value:0.00

0.00　Setting range: ±5.00%

MENU 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

PbL_F　Initial value:0

0　Setting range: 0 ～ 9999 seconds

MENU 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.

PV filter setting screen

rAnG　Initial value: multi Hi2, voltage 0 1, current 4A 1

H 1　Setting range: Chosen from 5-5.measuring range code table.

MENU key

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

Temperature unit setting screen

Unit　Initial value:c

c　Setting range:c、F

MENU key　The temperature unit at the time of a sensor input is set up from c (℃), F (℉).

Not displayed when the linear input is chosen.

Input scaling lower limit value setting screen

Sc_L　Initial value:0.0

0.0　Setting range: -1999 ～ 9989 unit

MENU 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

100.0　Setting range: －1989 ～ 9999 unit

MENU 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)

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

Decimal point position of input scaling is set .

MENU key

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

Mode　No setup

3　If ENT key is pressed, it shift s to the first setting screen, output 1 proportional band

ENT key　setting screen. In this screens, PID which can be used in output 1, 1～3 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 1　Initial value:3.0%

30　Setting range:OFF, 0.1 ～ 999.9%

MENU 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 1　Initial value: 120 seconds

120　Setting range: 0FF, 1～6000 seconds

MENU 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 1　Initial value: 30 second

30　Setting range: 0FF, 1～3600 seconds

MENU 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

rn- 1　Initial value:0.0

0.0　Setting range: －50.0～50.0%

MENU 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

HYS 1　Initial value: 5

5　Setting range: 1 ～999 unit

MENU key

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

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

Output1 PID1 minimum limiter setting screen

oL 1 Initial value:0.0

0.0 Setting range: 0.0～99.9%

MENU key Output lower limit value of output 1 PID1 is set up.

Note: At the time of STBY (RST) and scale over output, limiter value is disregarded.

Output 1 PID1 maximum limiter setting screen

oH 1 Initial value:100.0

100.0 Setting range: output limiter lower limiter values +0.1～100.0%

MENU key Upper limit value of output 1 PID1 is set .

Output 1 PID2 proportional band (P) setting screen

1_P2 Initial value:3.0%

3.0 Setting range: OFF, 0.1～ 999.9%

MENU key Content is the same with output 1 PID1.

Output 1 PID2 integral-time (I) setting screen

1_I2 Initial value: 120 seconds

120 Setting range: 0FF, 1～6000 seconds

MENU key Contents is the same with output 1 PID1.

Output 1 PID2 derivative-time (D) setting screen

1_d2 Initial value: 30 seconds

30 Setting range: 0FF, 1～ 3600 seconds

MENU key Contents is the same with output 1 PID1.

Output 1 PID2 manual reset setting screen

Mr-2 Initial value: 0.0

0.0 Setting range: －50.0～50.0%

MENU key Contents is the same with output 1 PID1.

Output 1 PID2 differential gap setting screen

dF2 Initial value: 5

5 Setting range: 5～999 unit

MENU key Contents is the same with output 1 PID1.

Output 1 PID2 minimum limiter setting screen

oL2 Initial value:0.0

0.0 Setting range:0.0～99.9%

MENU key Contents is the same with output 1 PID1.

Output 1 PID2 maximum limiter setting screen

oH2 Initial value: 100.00

100.0 Setting range: output limiter lower limit value +0.1～100.0%

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 proportional band (P) setting screen

1_P3 Initial value: 3.0%

3.0 Setting range:OFF, 0.1～ 999.9%

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 integral-time (I) setting screen

1_I3 Initial value: 120 seconds

120 Setting range: 0FF, 1～ 6000 seconds

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 derivative time (D) setting screen

1_d3 Initial value: 30 seconds

30 Setting range: 0FF, 1～3600 seconds

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 manual reset setting screen

Mr-3 Initial value:0.0

0.0 Setting range:－50.0～50.0%

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 differential gap setting screen

dF3 Initial value:5

5 Setting range:1～999 unit

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 minimum limiter setting screen

oL 3 Initial value: 0.0

0.0 Setting range: 0.0～99.9%

MENU key Contents is the same with output 1 PID1.

Output 1 PID3 maximum limiter setting screen

oH3 Initial value: 100.0

100.0 Setting range: output limiter lower limit values +0.1～100.0%

MENU key Contents is the same with output 1 PID1.

Output 1 soft starting time setting screen

SoF Initial value: OFF

oFF Setting range:OFF, 0.5～120.0 seconds (setting resolution 0.5 second)

This is the function that eases change of output at the time of a power-on and startup.

MENU key Does not function at the time of OFF setup.

Output 1 proportional periodic time setting screen

1_oC Initial value: Contact output 30.0 seconds

30.0 Voltage pulse output 3.0 seconds

MENU key Setting range: 0.5～120.0 seconds (setting resolution 0.5 second)

Proportional periodic time of output 1 is set.

Not displayed when output 1 is current.

Output 1 characteristics setting screen

rAct Initial value:-R

-R Setting range:-R、dR

MENU key Characteristics of control output is chosenfrom -R (heating characteristics) and dR (cooling characteristics)

Return to mode 3 lead screen

(7) Mode 4 screens

Mode 4screens is the setup screens of output 2 option. Not displayed when option is not added.

Mode 4 lead screen

Mode No setup

4 Press ENT key , then it shifts to the first setting screen,output 2 proportional band 1

ENT key setting screen.

On this screen, PID1～3 related items that can be used in output 2, soft start of output 2,and proportional period output characteristics are set.

Output 2 PID1 proportional band (P) setting screen

2_P1 Initial value:3.0%

3.0 Setting range:OFF, 0.1～ 999.9%

MENU key Contents is the same with output 1 PID1.

Output 2 PID1 integral-time (I) setting screen

2_I 1 Initial value: 120 seconds

120 Setting range: 0FF, 1～ 6000 seconds

MENU key Contents is the same with output 1 PID1.

Output 2 PID1 derivative-time (D) setting screen

2_d1 Initial value: 30 seconds

30 Setting range: 0FF, 1～3600 seconds

MENU key Contents is the same with output 1 PID1.

Output 2 PID1 dead-band setting screen

2db 1 Initial value:0

0.0 Setting range: －1999～5000 unit

MENU key

Output 2's operation zone to output 1 is set with dead- band.

Output 2 PID1 differential-gap setting screen

2dF 1 Initial value:5

5 Setting range: 1～999 unit

MENU key Contents is the same with output 1 PID1.

Output 2 PID1 minimum limiter setting screen

2oL 1 Initial value: 0.0

0.0 Setting range: 0.0～99.9%

MENU key Contents is the same with output 1 PID1.

Output 2 PID1 maximum limiter setting screen

2oH1 Initial value:100.0

1000 Setting range: output limiter lower limit values +0.1～100.0 %

MENU 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%

MENU key Contents is the same with output 1 PID1.

Output 2 PID2 integral-time (I) setting screen

2_I2 Initial value: 120 seconds

120 Setting range: 0FF, 1～6000 seconds

MENU 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: 0FF, 1～3600 seconds

MENU key Contents is the same with output 1 PID1.

Output 2 PID2 dead-band setting screen

2db2 Initial value:0.0

0.0 Setting range:－50.0～50.0%

MENU 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

MENU key Contents is the same with output 1 PID1.

Output 2 PID2 minimum limiter setting screen

2oL2 Initial value: 0.0

0.0 Setting range: 0.0～99.9%

MENU key Contents is the same with output 1 PID1.

Output 2 PID2 maximum limiter setting screen

2oH2 Initial value:100.0

1000 Setting range:output limiter lower limit values+0.1～100.0 %

MENU 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%

MENU key Contents is the same with output 1 PID1.

Output 2 PID3 integral-time (I) setting screen

2_I3 Initial value: 120 seconds

120 Setting range: 0FF, 1～6000 seconds

MENU 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: 0FF, 1～3600 second

MENU key Contents is the same with output 1 PID1.

Output 2 PID3 dead-band setting screen

2db3 Initial value:0.0

0.0 Setting range:－50.0～50.0%

MENU 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

MENU key Contents is the same with output 1 PID1.

Output 2 PID3 minimum limiter setting screen

2oL3 Initial value:0.0

0.0 Setting range: 0.0～99.9%

MENU key Contents is the same with output 1 PID1.

Output 2 PID3 maximum limiter setting screen

2oH3 Initial value:100.0

1000 Setting range: output limiter lower limit values+0.1～100.0%

MENU 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)

MENU key Contents is the same with output 1.

Output 2 proportional periodic-time setting screen

2_oC Initial value: Contact output 30.0 seconds

30.0 Voltage pulse output 3.0 seconds

MENU 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

2Act Initial value:dir

rA Setting range:rA、dir

MENU 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.

5 Press ENT key , it shifts to the first setting screen, event 1 operation-mode setting screen.

ENT key

Event 1 operation-mode setting screen

E1_A Initial value:non

non Setting range: Chosen from event type character table.

MENU key

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

Event type character table

Character	Type	Character	Type
non	No allotment	ct2	Control loop alarm 2
HA	Upper limit absolute value alarm	StP	Step signal
LA	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
Id	Within deviation alarm	u_SL	Up slope signal
od	Without deviation alarm	d_SL	Down slope siganal
run	RUN signal	GuA	Gurantee signal
ct1	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

E1_d Initial value:5unit

5 Setting range: 1～999 unit

MENU 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

E1_S oFF Initial value: : oFF

MENU 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.

Event 1 latching setting screen

E1L　　Initial value:oFF

oFF　　Setting range:oFF、on

MENU key

When latching is set as on, once event is output, even if event is OFF state event output state is held. Not displayed when event 1 mode is non.

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

Event 1 output characteristics setting screen

E1A　　Initial value:no

no　　Setting range:no、nc

MENU key Output characteristics event 1 is chosen from no: normal open,

nc: normal closing.

Not displayed when event 1 mode is non.

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.

Event 2 mode setting screen

E2Mo　　Initial value:non

LA　　Setting range: Chosen from event type character table.

MENU key Type allotted to event 2 should be chosen from character table.

Change in measuring range, scaling, unit, and the event 1 mode make it initialize.

Event 2 differential-gap setting screen

E2d　　Initial value: 5unit

5　　Setting range:1～999 unit

MENU key The same as event 1.

Event 2 standby operation setting screen

E2S　　Initial value:oFF

oFF　　Setting range:oFF、 1、2

MENU key The same as event 1.

Event 2 latching setting screen

E2L　　Initial value: : oFF

oFF　　Setting range: : oFF、on

MENU key The same as event 1.

Event 2 output characteristics setting screen

E2A　　Initial value: : no

no　　Setting range: : no、nc

MENU key The same as event 1.

Event 3 mode setting screen

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

E3Mo　　Initial value:non

LA　　Setting range: Chosen from event type character table.

MENU key Type allotted to event 2 should be chosen from character table.

Change in measuring range, scaling, unit, and the event 1 mode make it initialize.

Event 3 differential-gap setting screen

E3d　　Initial value: 5 unit

5　　Setting range: 1～999 unit

MENU key The same as event 1.

Event 3 standby operation setting screen

E3S　　Initial value:oFF

oFF　　Setting range:oFF、 1、2

MENU key The same as event 1.

Event 3 latching setting screen

E3L　　Initial value:oFF

oFF　　Setting range:oFF、on

MENU key The same as event 1.

Event 3 output characteristics setting screen

E3A　　Initial value:no

no　　Setting range:no、nc

MENU key The same as event 1.

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

Mode　　No setup.

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

ENT key

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

di1M　　Initial value:non

non　　Setting range: chosen from DI operation character table

MENU key

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

DI 2 mode setting screen

di2M　　Initial value:non

non　　Setting range: chosen from DI operation character table

MENU key

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

DI 3 mode setting screen

di3M　　Initial value:non

non　　Setting range: Chosen from DI operation character table.

MENU key

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

DI 4 mode setting screen

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

di4M　　Initial value: non

non　　Setting range: Chosen from DI operation character table.

MENU key

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		
Sv2	2nd SV	level	With closed DI terminal Execution SV = 2nd SV
Sv3	3rd SV	level	With closed DI terminal Execution SV = 3rd SV
Sv4	4th SV	level	With closed DI terminal Execution SV = 4th SV
run	control RUN	level	RUN with closed DI terminal, STBY with open one.
Pr-oG	program	level	Program with closed DI terminal. Constant value with opened.
MAn	manual inpu t	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.
SHCP	skip	edge	Shift to the next program's step.
L_rS	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 Sv2 ～ Sv4 are conducted during AT execution, they are performed at the time of AT termination.
- When Sv2 ～ Sv4 are allotted to to each DI, priority is given to 2-3-4 in order. AT can be performed at the time of a RUN-automatic output.
- When AT 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 isadded,it is impossible to choose and display.

Mode 7 lead screen

mode No setup

7 When ENT key is pressed, it shifts to the first setting screen,analog output mode

ENT key settin screen.

↓

Analog output mode setting screen

Ao_n Initial value: non (does not output)

non Setting range: PV PV

MEN key SV execution SV

out1 control out put 1

out2 control out put 2

ct1 CT OUTPUT 1

ct2 CT OUTPUT 2

out2, ct1, ct2 is displayed when option is added.

Data type allotted to analog output are chosen.

↓

Analog output scaling lower limit value setting screen

AS_L Initial value: the following table

0 Setting range: the following table

MEN key

Lower limit value of range allotted to analog output is set up.

However, AS_L<AS_H Lower limit value is given priority

MODE		Setting range	Initial value
PV	sensor input	within measuring range	measuring range lower limit value
SV	linear input	within scaling range	scaling lower limit value
OUT1, 0UT2		0.0～99.9	0.0
CT1, CT2		0.0～49.9	0.0

↓

Analog output scaling upper limit value setting screen

AS_H Initial value: the following table

1200 Setting range:the following table

MEN key

Upper limit value of range allotted to analog output is set up.

However, AS_L<AS_H Lower limit value is given priority

MODE		Setting range	Initial value
PV	sensor input	within measuring range	measuring range upper limit value
SV	linear input	within scaling range	scaling upper limit value
OUT1, 0UT2		0.1～100.0	100.0
CT1, CT2		0.1～ 50.0	50.0

Lower limit value takes priority, therefore upper limit value cannot be set below the value of lower limit value +1. When a lower limit value is set more than upper limit value, upper limit value is push to the level of lower limit value +1.

↓

Analog output limiter lower limit value setting screen

AL_L Initial value: 0.0

0.0 Setting range:0.0～100.0%

MEN key

The lower limit value of analog output value (4-20mA) is set up by %.

For example, output value of a lower limit value in each setup are:8mA(25.0),

12mA(50.0), 16mA(75.0) and 20mA(100.0) respectively.

↓

Analog output limiter upper limit value setting screen

AL_H Initial value:100.0

100.0 Setting range: 0.0～100.0%

MEN key

Upper limit value of analog output value (4-20mA) is set up by %.

If set as the same value as AL_L and AL_H, it is fixed to the value.

↓

Return to mode 7 lead screen

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

Example: Output range :0℃ (4mA)～ 1200℃ (20mA) can be 0℃ (20mA) ～ 1200℃ (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

mode No setup

8 Press ENT key , it shifts to the first setting screen, CT1 mode setting screen.

ENT key

↓

CT1_n Initial value:non

non Setting range:non、out1、out2、

MEN key EV1、EV2、EV3

Object detected by CT (current) sensor is chosen.

In the case of a current output, out1 is not displayed.

out2 is not displayed without current output or output 2 option.

EV1·2 and 3 are not displayed without any option, respectively.

↓

CT1 delay time setting screen

CT1_d Initial value:0.5

0.5 Setting range: 0.5～30.0 seconds

MEN key When control loop abnormal alarm is allotted to event,delay time from switchover of operation (ON-OFF) to detection start is set up.

↓

CT2 mode setting screen

CT2_n Initial value:non

non Setting range:non、out1、out2、

MEN key EV1、EV2、EV3

The same as CT1 mode setting screen.

↓

CT2 delay time setting screen

CT2_d Initial value: 0.5

0.5 Setting range: 0.5～30.0 seconds

MEN key The same as CT1 delay time setting screen

↓

Return to 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 9screens

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

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

5-5. measuring rangecode table

Input type			code	Measuring Range	
				unit code ℃ (℃)	unit code ℉ (℉)
MULTIINPUT	Thermo couple	R	r 1	0 ～1700	0 ～3100
		K	K 1	−199.9 ～400.0	−300 ～ 700
		K	K2	0 ～1200	0 ～2200
		K	K3	0.0 ～300.0	0 ～ 600
		J	J 1	0 ～ 600	0 ～1100
		T	t 1	−199.9 ～ 200.0	−300 ～ 400
		E	E 1	0 ～ 700	0 ～1300
		S	S 1	0 ～1700	0 ～3100
		*5 U	U 1	−199.9 ～ 200.0	−300 ～ 400
		N	n 1	0 ～1300	0 ～2300
		*1 B	b 1	0 ～1800	0 ～3300
		*3 Wre5-26	S-26	0 ～2300	0 ～4200
		*4 PLⅡ	PL2	0 ～1300	0 ～2300
	Resistance bulb Pt100		P 1	−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
			JP 1	−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
	Voltage (mV)	*7 0～ 10	A 1	Scaling range : −1999～9999 count Span : 10～10000 count Possible to change decimal point position (No Decimal point , 0.1, 0.01, 0.001)	
		0～100	A2		
		*7 −10～ 10	A3		
		0～ 20	A4		
		0～ 50	A5		
	Voltage(V)	1～ 5	b 1		
		0～ 5	b2		
		− 1～ 1	b3		
		0～ 1	b4		
		0～ 2	b5		
		0～ 10	b6		
	Current(mA)	4～ 20	AA 1		
		0～ 20	AA2		

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℃ (752 ℉).

*2 thermo couple In K, T, U,accuracy is±0.5%FS for 0～−100℃ (-148 ℉) and ±1.0%FS if it is below−100℃

*3 thermo couple Wre 5-26: Product of Hoskins Mfg. co.,

*4 thermo couple ＰＬⅡ： Platinel

*5 thermo couple U:DIN43710

*6 resistance bulb accuracy of Pt/JPt±50.0℃, 0.0～100.0℃ is ±0.3%FS.

*7 voltage(mV) 0～10mV，accuracy of 0～10mV is ±0.3% of input range.

* Setup of factory shipment is Multi input: thermo couple K2 0-1200℃

Voltage input :1-5V A 1 0.0-100.0

Current input : 4-20mA AA 1 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.

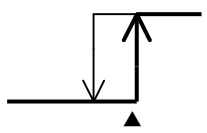
・Setup of proportional band (P) is other than OFF

・Soft starting time is not OFF

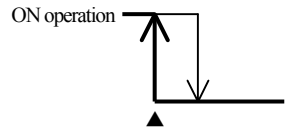
6-3. Event Selection Alarm Operation Figure

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

LA: Lower limit absolute value alarm

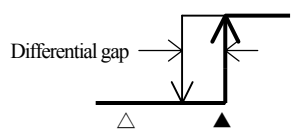


HA : Upper limit absolute value alarm

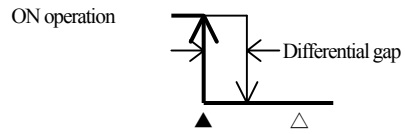


△: SV ▲: Alarm operating point setting value

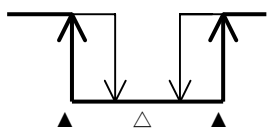
Hd : Upper limit deviation alarm



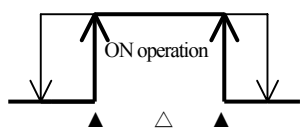
Ld : Lower limit deviation alarm



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

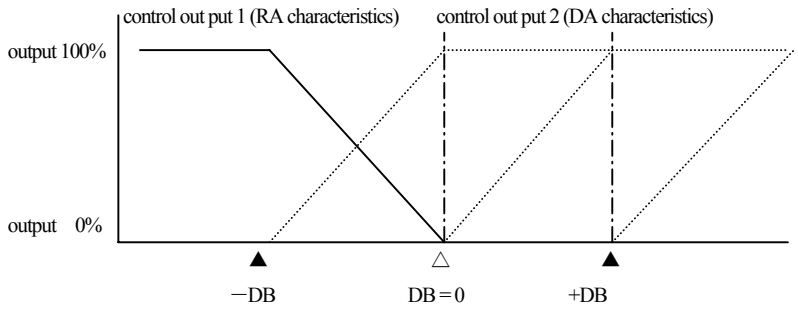
At the time of heating / heating operation and cooling / cooling operation, only OUT1 performs AT. OUT 2 output while performing AT is 0% or output limiter lower limit value.

6-5. 2 output-characteristics figure

2-output -characteristics is shown in the following figure.

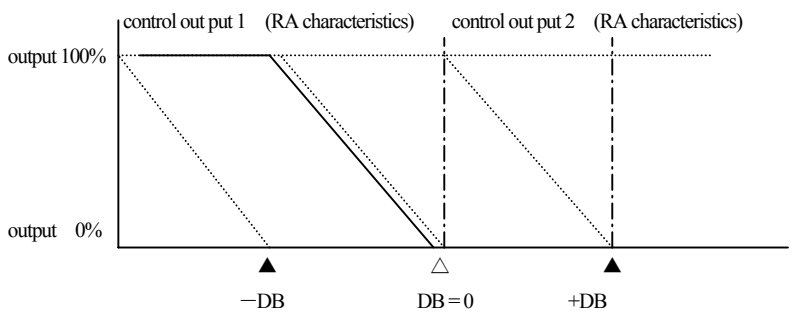
◎ Conditions: P operation, manual reset (rr-) −50.0%

1) OUT 1 RA (heating) ・OUT 2 DA (cooling) operation



△ : Setting Value (SV) ▲: DB (dead band)

2) OUT 1RA (heating)・ OUT 2 RA (heating)



△ : Setting Value (SV) ▲: DB (dead band)

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 bulbA 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)
LLLL (LLLL)	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 everse, 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 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 3D's terminal No.6	
		2.multiple wire breaking combinations in Abb (A and B, A and b, B and b, all of ABB)	2.replacement of resistance bulb
CJHH (CJHH)	Cold junction (CJ) temperature of thermocouple input is scale over in upper limit side	When ambient temperature of a meter exceeds 80℃	1.make Ambient temperature of meter within use environment condition temperature 2. Check the meter when ambient temperature is not over 80℃
CJLL (CJLL)	Cold junction (CJ) temperature of thermocouple input is scale over in lower limit side	When ambient temperature of meter becomes less than －20℃	1.make Ambient temperature of meter within use environment condition temperature 2. Check the meter when ambient temperature is not less than -20℃

8. Specification

Display

Display method　Digital display: MAC3A (96 x 96 size) PV red 7 segment LED　4 figure (height of character about 20mm)
SV green 7 segment LED　4 figure (character quantity about 13mm)
MAC3B(48x96 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 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　: ±(0.25%FS+1digit)CJ errors not included, B thermo couple below 400℃ is not guaranteed.
Display accuracy during EMC examination is ±5%FS.

Accuracy maintenance range　: 23±5℃

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

Display resolution　: Changes with measuring range and scaling.

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

Setting

Setting system　: By five front keys （ MENU,▽,△,ENT,RUN ）.

ＳＶSetting range　: Same with measuring range

Setting lock　: Communication and key seting (three levels), DI (one level)

Operations	Level	Lock Content
Communication & Key setting	OFF	No lock
	1	Execution SV and a manual numerical change are possible. And change of a keylock level is possible.
	2	Possible to change numerical value manually and keylock level.
	3	Possible to change keylock level.
DI Setting	Super Key Lock (Shift between screens prohibited. Fixed only to the basic screen.)	

＊Regardless of the setting lock by communication & key setting, the RUN key is always effective.
However, even RUN key is not received when super keylock by DI is performed.

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

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

Input

Multi input

Thermocouple input resistance　: 500Ω or more, external resistance tolerance level　100Ωor less

Influence of lead-wire　: 1.2μＶ／10Ω

Burnout　: Standard equipment (Up Scale only)

Measuring range　: Item 5-5. Refer to measuring range code table.

Compensation accuracy of reference junction　: ±1℃ (ambient temperature 18-28℃)　At the time of vertical plural proximity attachment ±2℃
±2℃（ambient temperature　0-50℃）　At the time of vertical plural proximity attachment ±3℃
Several minutes after power-on, accuracy is not guaranteed. Reaches the accuracy level within 5 minutes after power-on.

Tracking of a reference junction　: Below the ambient temperature of 0.5 ℃ / min, compensation accuracy of reference junction ±1℃

Resistance bulb stipulated current　resistance bulb　: Approx. 0.25mA

Lead wire resistance tolerance level　: 5Ω or less per wire (Resistance of three lines should be equal)

Influence of lead-wire resistance　: 5Ω or less per wire 0.2%FS
10Ω or less per wire 0.5%FS
20Ω or less per wire 1.0%FS

Measuring range　: Item 5-5. Refer to measuring range code table.

Voltage (mV) Input resistor　: 500kΩ or more

Input voltage range　: Item 5-5. Refer to measuring range code table.

Voltage input (V) Input resistor : 500kΩ or more

Input voltage range : Item 5-5. Refer to measuring range code table.

Current input (mA) reception

Resistance : 250Ω (built-in)

Input range : Item 5-5. Refer to measuring range code table.

Sampling period　: 0.25 second

PV filter　: 0 - 9999 second

PV offset compensation　: ±500 unit

PV gain correction　: ±5.00%PV filter

Control

Control system　: PID control with an auto tuning function or ON-OFF operation

Proportional band (P)　: OFF and 0.1 - 999.9% of measuring range (ON-OFF operation by OFF setting)

ON-OFF Differential-gap (DF)　: 1 - 999 unit

Integration Time (I)　: OFF, 1- 6000 seconds (PD operation by OFF setting)　} If both I and D are OFF, P operation.

Manual Reset (MR)　: ±50.0% (effective when set as I = OFF)

Output 2 dead band　:　-1999 - 5000 unit

Output limiter (OL, OH) : 0.0 - 100.0% (OL<OH) (set resolution 0.1)
Soft start : OFF, 0.5 - 120.0 seconds (set resolution 0.5)
Proportional period : 0.5 - 120.0 seconds (set resolution 0.5)
Control output characteristic : Output 1, output 2. Possible to choose either RA (heating) or DA (cooling).
Manual output : 0.0 - 100.0% (set resolution 0.1)

＊ Each parameter,(P, I, D, DF, MR, OL, and OH) of Outputs 1 and Outputs 2, belongs to 1～3 categories.

Control output 1

Contact : normal open (1a) 240V AC 2A (resistance load)
Voltage pulse (SSR drive) : 12V DC+1.0--1.5V MAX20mA
Current : 4 - 20mA DC load resistance 500Ω or less Display accuracyaccuracy±1% (accuracy maintenance range 23℃±5℃)
Load regulation ±0.2%, resolution approx. 1/12000

Control out put 2 (option) : Control out put 2 is exclusive option of event 3 and DI4.
Contact : normal open (1a) 240V AC 2A (resistance load)
Voltage pulse (SSR drive) : 12V DC+1.0--1.5V MAX20mA
Current : 4 - 20mA DC load resistance 500Ω or less ,display accuracy±1% (accuracy maintenance range 23℃±5℃)
Load regulation ±0.2%, resolution approx. 1/200

Program function (option)

Number of pattern : 1
Number of steps : Maximum 25
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 : ± (Setup time × 0.005 +0.25 second)
In a step Setting parameter : SV, time, PID№
Number of repeats : 1 - 9999 times, and ∞
Time signal : Possible to allot to Event (1 second for changeover, 3 seconds for patter end, 3 seconds for program end)
PV start function : With
Guarantee soak function : Without
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	non	
Upper limit absolute value Alarm	HA	
Lower limit absolute value alarm	LA	
Scale over alarm	So	HHHH, LLLL, B---- Operates, when displayed.
Upper limit deviation value Alarm	Hd	
Lower limit deviation value alarm	Ld	
Within deviation alarm	Cd	
Without deviation alarm	od	
RUN signal	run	Operates during PROG and FIX in operation.
Control loop alarm (Heater breaking / loop)	ct1	When contact/voltage pulse output is ON Breaking alarm, when it is below EV set.
	ct2	When contact/voltage pulse output is OFF Loop alarm, when it is more than EV set.
Step signal	StP	Operate for 1 second at the time of step switchover
Pattern end signal	P_E	Operate for 3 seconds at the time of pattern end
Program end signal	End	For 3 seconds at the time of program end
Hold signal	HoLd	Operates during time hold.
Program signal	Pro6	Operates by program selection
Upslope signal	u_SL	Operates when the inclination of program control rises (including Hold status)
Downslope signal	d_SL	Operates when the inclination of program control descends (including Hold status)
Guarantee signal	GuA	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
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 - 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 1-2-3 (option) : Set of 3 In MAC 3D, exclusive selection option with CT input .

Input rating : 5V DC 0.5mA

Allotment function : Refer to following table.

Character	Kinds of operation	Input detection	Contents
non	No allotment	level	
SV2	2nd SV	level	With closed DI terminal,Execution SV = 2nd SV
SV3	3rd SV	level	With closed DI terminal,Execution SV = 3rd SV
SV4	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.
MAn	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.
SKIP	Skip	edge	Shifts to the following step of program.
LS-S	Latching release	edge	With rise edge,all latchings released
Lock	Super keylock	level	Super keylock with closed DI terminal. Release with opened.

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, DI 2 and DI 3.

Communication function(option) : Output and an exclusive selection option for MAC 3D.
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 : 1-255

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

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

Flow control : none

Delay : 1 - 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 MAC 3D, 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℃±5℃)
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 - 100.0% (reverse setting is possible)

CT 1 ・CT2 input : In MAC 3D, exclusive selection option with DI・D2・D3

Detection method : Current judging system by CT sensor

Detection range : 0.0-55.0A

Sampling period : 125ms

Detection accuracy : ±5%FS

Detection delay time : 0.5 - 30.0 seconds

Alarm output : Assigned to event

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

Alarm operating point
setting range : 0.0-50.0A

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 : By nonvolatile memory (EEPROM)
Temporary dead time : no influence within 0.02 second 100% dip
Use environmental condition : Temperature: －10～55 ℃
Humidity : Below 90%RH (no dew condensation)
Hight : Altitude of 2000m or less
Category : Ⅱ
Contamination degree : 2
Storage temperature Conditions : －20～65 ℃
Supply voltage : 90-264V AC 50/60Hz or 21.6-26.4V AC (50/60Hz)/DC
Power consumption : 90-264V AC maximum 9VA 21.6-26.4V AC maximum 6 VA 21.6-26.4V DC maximum 4W
Applicable standard Safety : IEC1010-1 and EN61010-1:2001
EMC : EN61326-1:1997+Amendment1:1998+Amendment2:2001
(EMI: ClassA, EMS: AnnexA)
EN61000-3-2：2000 EN61000-3-3：1995＋Amendment 1：2001

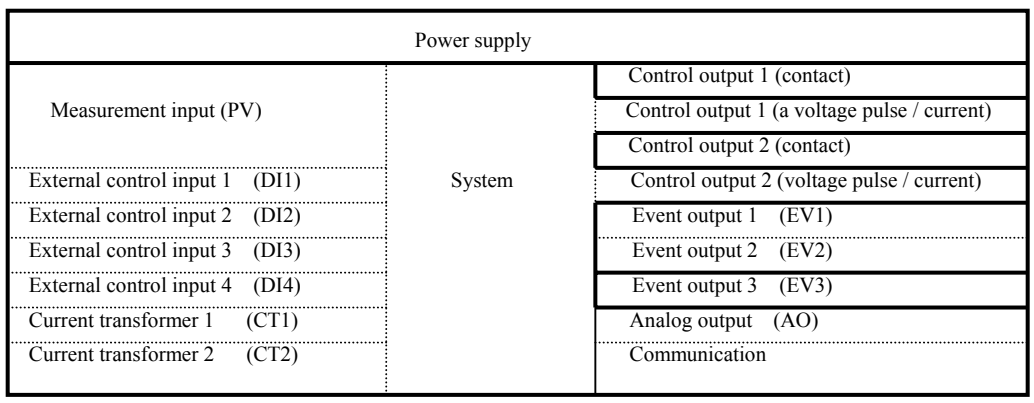
Oscillation : IEC60068-2-6/1995
Insulated class : Class I apparatus
Input noise removal ratio : Normal 50dB or higher
Impulse-proof noise : Power-source Normal 100ns/1 μ s±1500V

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 : PPO or PPE
Case color : Light gray (Mansel value 3.73B7.77/0.25)
Outside dimension MAC3 A : H96×W96×D69mm (depth in panel 65mm)
MAC3 B : H96×W48×D66mm (depth in panel 62mm)
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
MAC3D : H45×W45mm W(48×N-3) mm H45mm
Weight MAC3A : About 220g :
MAC3B : About 160g
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

Basic insulation　Functional insulation　Not insulated



9. Program pattern setting table Please copy and use this table according to need.

Start mode SV, PV		
End step 1-25		
Number of pattern execution 1～9999, ∞		
		100%
Time unit: min.: sec., hour: min., or hour		
Output1 PID No.1		
P= %		
I= second		90
D= second		
Differential gap =		
Manual reset = %		
Output limiter	OL= %	
	OH= %	80
Output 1 PID No.2		
P= %		
I= second		
D= second		
Differential gap =		70
Manual reset = %		
Output limiter	OL= %	
	OH= %	
Output 1 PID No.3		
P= %		60
I= second		
D= second		
Differential gap =		
Manual reset = %		
Output limiter	OL= %	50
	OH= %	
Output 2 PID No.1		
P= %		
I= second		
D= second		40
Differential gap =		
Manual reset = %		
Output limiter	OL= %	
	OH= %	
Output 2 PID No.2		30
P= %		
I= second		
D= second		
Differential gap =		
Manual reset = %		20
Output limiter	OL= %	
	OH= %	
Output 2 PID No.3		
P= %		
I= second		10
D= second		
Differential gap =		
Differential gap =		
Output limiter	OL= %	
	OH= %	
Step No.		
SV (target setting value)		
Time		
Output 1 PID No.		
Output 2 PID No.		

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