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),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 1,2,3) 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 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 (DI1,2,3) 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.

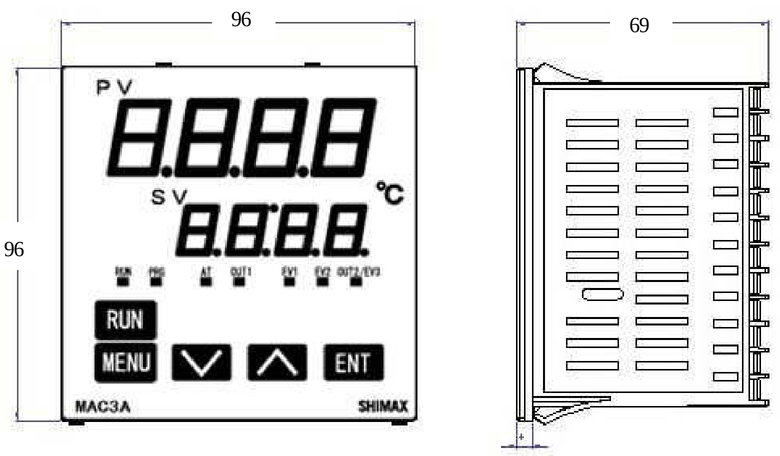
(2) Applicable thickness of the mounting panel is 1.2 ~ 2.8mm.

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

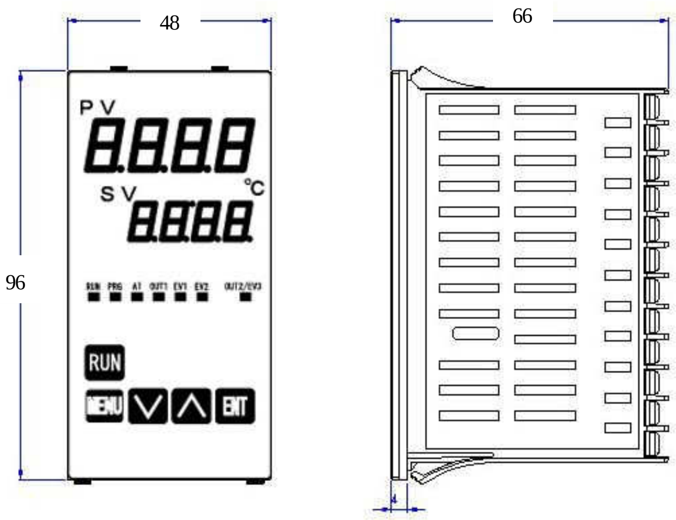
3-3. External dimension and panel cutout

MAC3 external dimensions (unit: mm)

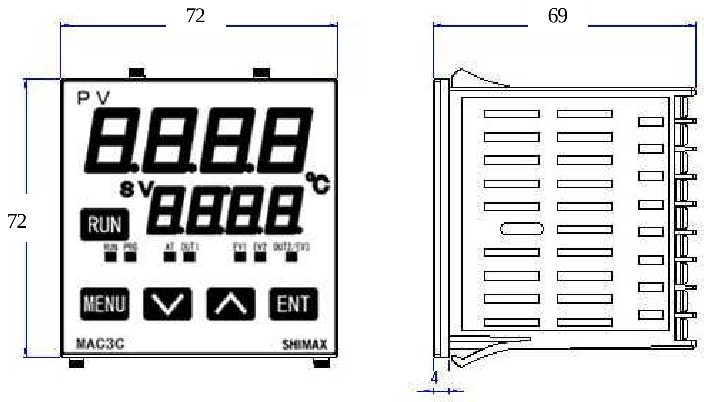
MAC３A



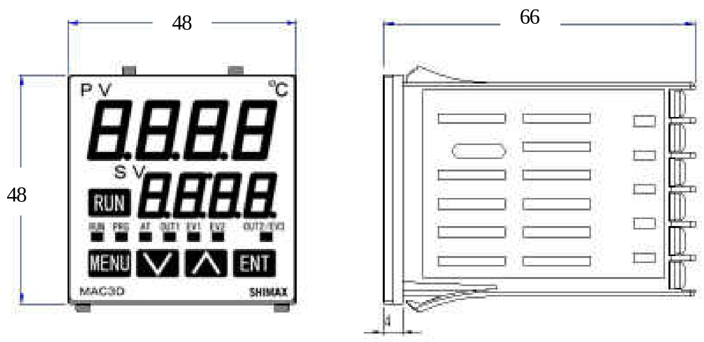
MAC３B



MAC３B

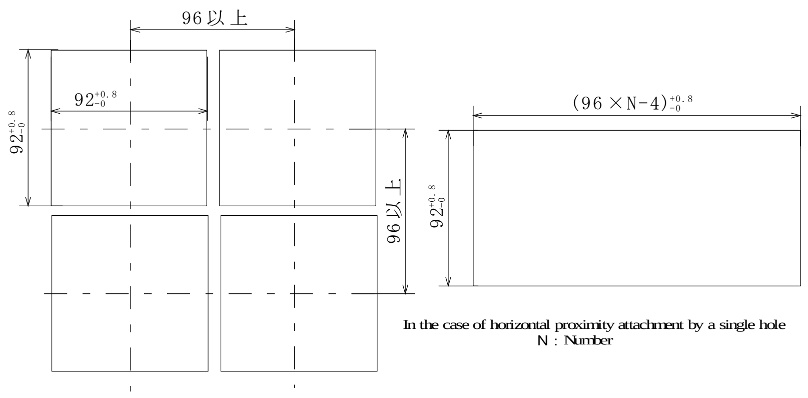


MAC３D

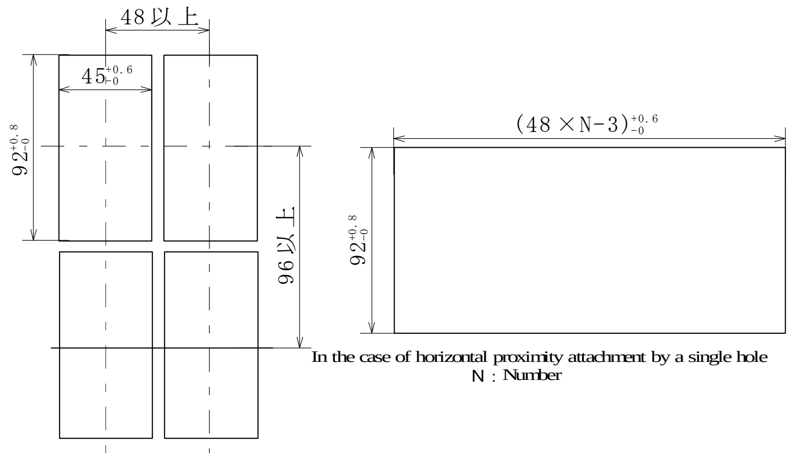


MAC3 panel cutout (unit: mm)

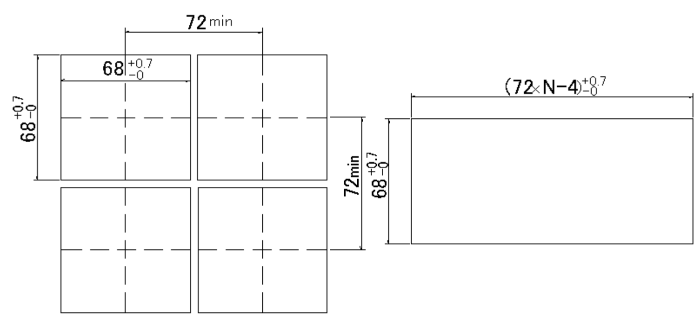
MAC3A 96×96size



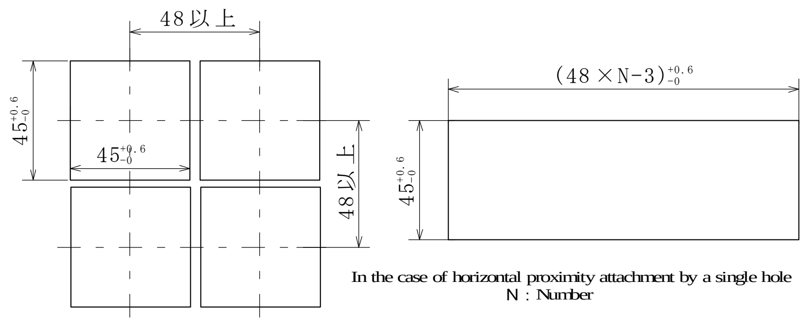
MAC3B 48×96size



MAC3C 72×72size



MAC3D 48×48size



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.

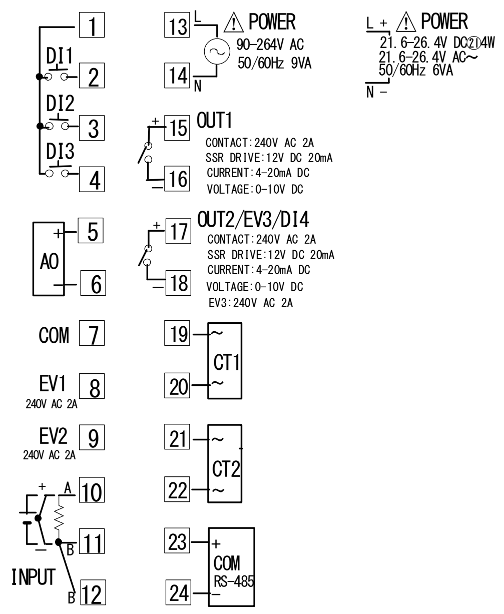
(4) Do not wires an input signal line inside of an electric wire pipe or a duct same with the high voltage line.

(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.

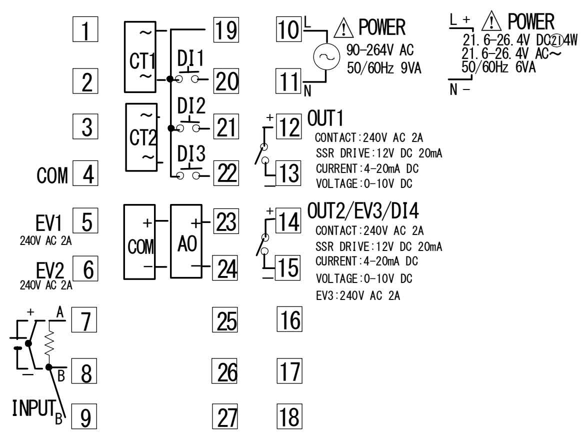
3－5. Terminal arrangement diagram

3-5. Terminal arrangement plan of MAC3A and MAC3B



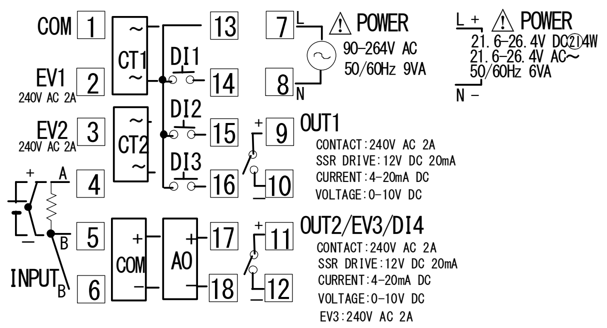
「Note」: If input type is thermocouple or voltage, errors may occur when terminal 11 and terminal 12 terminal are short-circuited

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

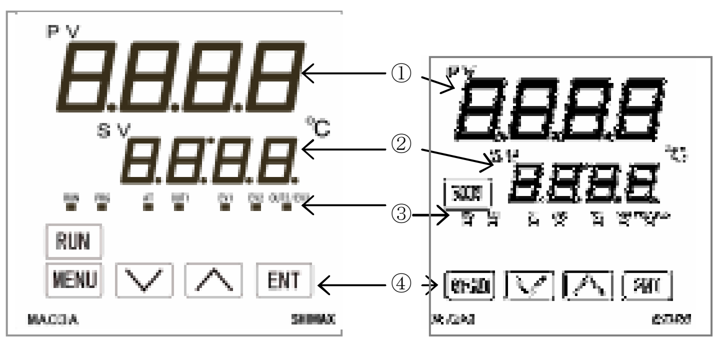


「Note」: If input type is thermocouple or voltage, errors may occur when terminal 5 and terminal 6 terminal are short-circuited

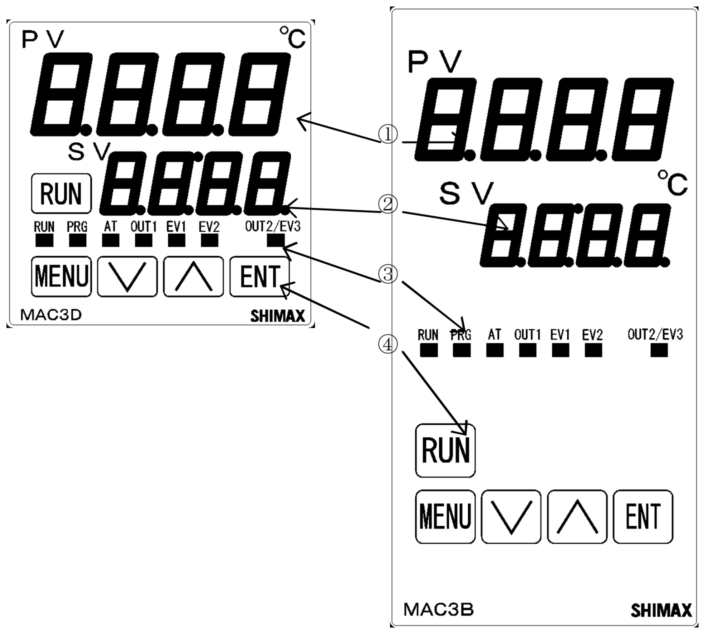
4. . Description of front panel

4－1. Names of front panel.

MAC3A 96×96size front　　MAC3C72×72size front



MAC3D 48×48size front　　MAC3B48×96 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 —— ENT 3 seconds ⟶ FCh (constant value control) lead screen of setting screens or PProG (Program control) lead screen of setting screens
0 ⟵ MNU 3 seconds—— SEt SEt

Press the ENT key for 3 seconds on a basic screen, then it shifts to the lead screen of FCh (constant value control) setting screens, or to the lead screen of ProG (program control) setting screens.
Press the MNU key for 3 seconds on FCh 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 FCh 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 2screen.

Basic Screens

Basic Screen	Mode 1 lead screen	Mode 2 lead screen	Mode 9 lead screen
25 / 0	modE / 1	modE / 2	modE / 9

Mode 1 ～ 9 screens

Basic Screen → MNU three seconds → Mode 1 lead screen; Mode 1 lead screen ← ▼ —— Mode 2 lead screen ← ▼ … ← ▼ —— Mode 9 lead screen; Mode 1 — ▲ → Mode 2 —— ▲ → … — ▲ → Mode 9; MNU three seconds → Basic Screen

Operation mode 1	key lock	PV offset correction
25 / 0	LocK / oFF	PV_o / 0

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

Output monitor		Output monitor		Output monitor
25 / 1 100.0	⟵ENT three seconds ⟶	25 / 1 100.0	—— ▲ or ▼ ⟶	25 / 1 50.0
Automatic screen RUN lamp lights up		Manual screen RUN lamp blinks		Manual screen RUN lamp blinks

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.

《Power-on》⟶						
	8.8.8.8. / 8.8.8.8.	In / K2 →	0 / 1200 →	out1 / C →	out2 / I →	25 / 0
	All LED light up	Input type	Upper limit & lower limit of measuring range	Out 1 type	※ Out 2 type	Basic screen

C : Contact S : Voltage pulse I : Current ※Output 2 Displays only optional addition.

5-4. Explanation of each scre

(1) Basic Screens

Basic Screen

25 Executed SV initial value : Sensor input 0
0 Linear input Lower limit of scaring range
Setting range : Sensor input Within measuring range
MNU 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 Initial value: : Stby(stanby) (Initial value at the time of constant value control)
Stby rSt (reset) (Initial value at the time of program control)
Setting range: : Stby(rSt) Control stop [Output OFF (0%)] operation
MNU 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(rSt) 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 (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 —— ▲ ENT → 25
Stby ← C. three seconds FCh ← ▼ ENT ProG
rSt ← C. three seconds PRG LED lights up

Press MNU 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 MNU 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)

100.0 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 (rSt).

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

When mAnu 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

100.0 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 Current display range: 0.0–55.0A

-50.0 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 No. in progress and remaining time are displayed by turns.

(In ∞ setting, step No. and dP 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 No. and the remaining repeating time of pattern are displayed by turns.

MENU key (In ∞ setting, step No. and dP 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 No. monitoring screen

25

P2_1 Chosen PID No. is displayed when FIX is in operation.

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

MENU key is in operation.

PID No. of output 1 is displayed in the first digital, and PID No. 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 H oLd 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.

SKIP (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

SKIP 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 rSt 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

EV1 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 -1999

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 -1999～2000 unit

lower limit deviation -1999～2000 unit

within upper-lower limit deviation 0～2000 unit

outside upper-lower limit deviation 0～2000 unit

CT1 or CT2 0～50.0A

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

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

LAch Initial value: rSt1

rSt1 Setting range: rSt1 release EV1

rSt2 release EV2

MENU key rSt3 release EV3

ALL release all EVs at a time

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 FCS 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 ENT key is pressed for 3 seconds on lead screen, it returns to basic screen.

basic screen lead screen of FIX setting

25 —— ENT three seconds → FCS

0 ← MENU three seconds —— SEt

FIX lead screen

FCS

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

SV1 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

1o1P 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

SV2 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

2o1P 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

SV3 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

3o1P 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

SV4 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

4o1P 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 lead screen of the PROG setting screens

25 —— ENT three seconds → ProG

0 ← MENU three seconds —— Pt_1

Press ENT Key for 1second it will move to Program pattern 2 screen, and Press ENT key 1second It will move to program pattern 1,2, 4,

The number of setting in the program pattern screen can be changed 1-4 to the number of program pattern.(1=pattern 1,2= pattern 1 & 2, 4= pattaern 1 to 4)

Only the pattern you did program pattern setting screen will be indicated.

ProG ENT 1second → ProG ENT 1second → ProG ENT 1second → ProG ENT 1second

Pt_1 Pt_2 Pt_3 Pt_4

S_nd S_nd S_nd S_nd

SV SV SV SV

MENU MENU MENU MENU

StSV StSV StSV

0 0 0

MENU MENU MENU

End End End

25 25 25

MENU MENU MENU

Pcnt Pcnt Pcnt

1 1 1

MENU MENU MENU

GuAr MENU GuAr MENU GuAr MENU

oFF oFF oFF

Please refer explanation of program sequence

Program basic setting screens

Program basic setting screens　Lead screen

ProG　No setting on this screen

SEt　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_ād　Initial value: PV (PV)

SV　Setting range: SV (SV)、PV(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

StSV　Initial value : At the type of sensor input　0

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　Initial value: 40

9　Setting range: 1～40 steps

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

Number of execution Setting screen for repeating of program pattern

Pcnt　Initial value:1

1　Setting range:1～9999 times、∞

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

Gurantee soak zone

GuAr　Initial value:OFF

oFF　Setting range:OFF,1～2000 Digits(Time unit belong to the Time unit setting screen)

MENU key　In case deviation of step SV of level step PV remains,the step does not move to the next step until PV reach to the SV.

Time unit setting screen

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

āā:SS　Setting range: āā:SS、HH:āā、HHH.H

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.

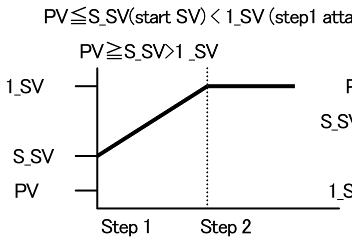
When starts at PV,　100−30=70℃ ,therefore　60 minutes x70%= 42 minutes = 18 minutes' shortening

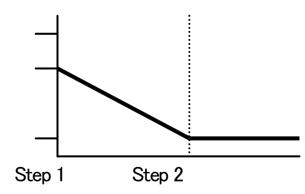
However, depending on the spatial relationship between PV, Start SV, and attainment SV, it may become SV start or Step1 may be skipped.

(1) case of SV start

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

PV≧S_SV>1_SV



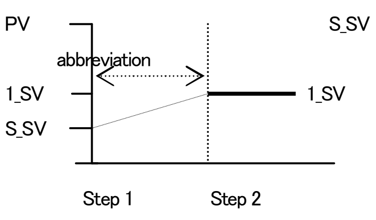


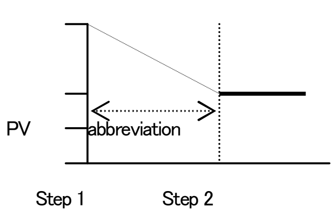
(2)When Step 1 is skipped and progresses to Step 2

S_SV < 1_SV < PV

S_SV > 1_SV > PV

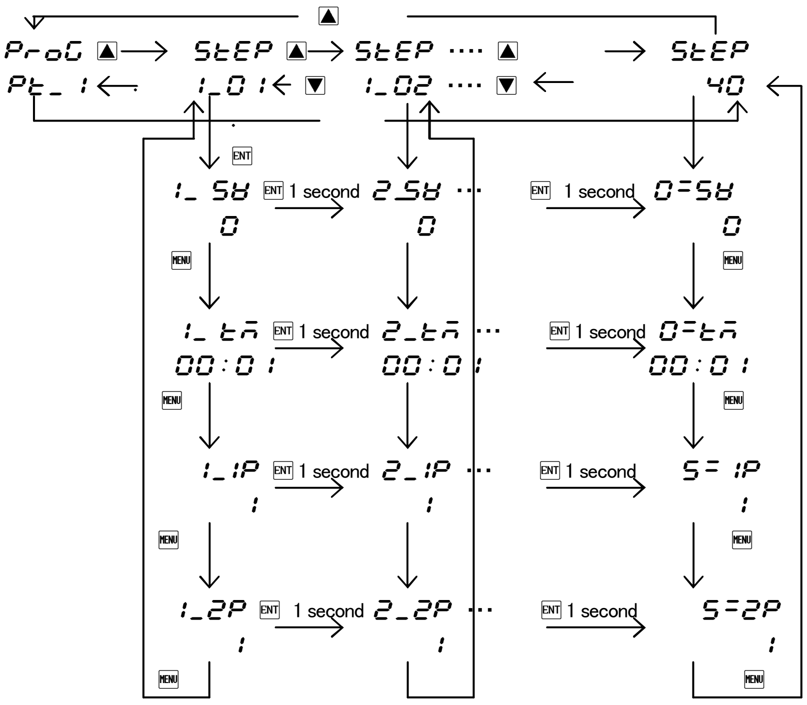
PV=1_SV





Step 1 setting screens～ Step 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 ‾ ,30 ～39　and 40 = are assained to distinguish each of them.

(Step　1 SV = 1_SV, step 12SV =2−SV , step 23SV=3‾SV , and step 34 4=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 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_SV　Initial value : At the time of sensor input　0

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_tā　Initial value: 00:01

99:59　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_1P　Initial value:1

1　Setting range:1～3

PIDNo. used in Step1's control output 1 is chosen.

MENU key

Step1 output 2 PIDNo. setting screen

1_2P　Initial value:1

1　Setting range:1～3

MENU key　PIDNo. 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、4

[MENU] key

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

2 Possible to change numerical value value manualy ,and key lock level

3 Only change of a keylock is possible.

4 Only change of a keylock is possible It can be locked [RUN] key

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

SV limiter lower limit setting screen

SV_L   Initial value: measuring range lower limit

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

[MENU] key   And bLK (SV display turn off)

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.

When you choose bLK pressing [▼] at lower limit value ,the SV display turn off at basic screen. But it will turn on at the setting screen.

SV limiter upper limit value setting screen

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

PV offset correction (PV bias) setting screen

PV_o   Initial value:0

o   S etting range:－500～500 Digits

[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

PV_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

PV_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.

Mesuring range setting screen

rAnG   Initial value: multi K2, voltage V1, current mA1

K1   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 digits

[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 digits

[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 shifts 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_P1   Initial value:3.0%

3.0   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_I1   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_d1   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

1mr1   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

1dF1   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

ioL 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

ioH 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

1mr2 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

1dF2 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

1oL2 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

1oH2 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

1mr3 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

1dF3 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

1oL3 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

1oH3 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

1SoF 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

1Act Initial value:rA

rA Setting range:rA、dA

MENU key Characteristics of control output is chosenfrom rA (heating characteristics)

and dA (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_P 1 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_d 1 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

100.0　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%

3.0　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 digits

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

100.0　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%

3.0　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 digits

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

100.0　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:dA

rA　Setting range:rA、dA

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_M　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:5Digits

5　Setting range: 1～999 Digits

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、U_SL.

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

Event 1 latching setting screen

E1_L Initial value: oFF

oFF Setting range: oFF、on

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

E1_A Initial value: no

no Setting range: no、nc

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

E2_m Initial value: non

LA Setting range: Chosen from event type character table.

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

E2_d Initial value: 5digit

5 Setting range: 1～999 digit

key The same as event 1.

Event 2 standby operation setting screen

E2·S Initial value: oFF

oFF Setting range: oFF、1、2

key The same as event 1.

Event 2 latching setting screen

E2_L Initial value:: oFF

oFF Setting range:: oFF、on

key The same as event 1.

Event 2 output characteristics setting screen

E2·A Initial value:: no

no Setting range:: no、nc

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.

E3_m Initial value: non

LA Setting range: Chosen from event type character table.

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

E3_d Initial value: 5 digit

5 Setting range: 1～999 digit

key The same as event 1.

Event 3 standby operation setting screen

E3_S Initial value: oFF

oFF Setting range: oFF、1、2

key The same as event 1.

Event 3 latching setting screen

E3_L Initial value: oFF

oFF Setting range: oFF、on

key The same as event 1.

Event 3 output characteristics setting screen

E3_A Initial value: no

no Setting range: no、nc

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

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

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

d1_m Initial value: non

non Setting range: chosen from DI operation character table

key

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

DI 2 mode setting screen

d2_m Initial value: non

non Setting range: chosen from DI operation character table

key

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

DI 3 mode setting screen

d3_m Initial value: non

non Setting range: Chosen from DI operation character table.

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.

d4_m Initial value: non

non Setting range: Chosen from DI operation character table.

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		
SB1	2st SV	level	With closed DI terminal Execution SV = 1st SV
SB2	2nd SV	level	With closed DI terminal Execution SV = 2nd SV
SB3	3rd SV	level	With closed DI terminal Execution SV = 3rd SV
SB4	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.
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.
SKiP	skip	edge	Shift to the next program's step.
Pt_1	Pattern 1	level	Choose pattern 1 with close DI rerminal
Pt_2	Pattern 2	level	Choose pattern 2 with close DI rerminal
Pt_3	Pattern 3	level	Choose pattern 3 with close DI rerminal
Pt_4	Pattern 4	level	Choose pattern 4 with close DI rerminal
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 SB2 ～ SB4, are conducted during AT execution, they are performed at the time of AT termination.

*When SB1 ～ SB4, are allotted to to each DI, priority is given to 1-2-3-4, 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
7 When ENT key is pressed, it shifts to the first setting screen,analog output mode

ENT key setting screen.

Analog output mode setting screen

Ao_m Initial value: non (does not output)
non Setting range: PV PV

MENU key
SV execution SV
out 1 control out put 1
out 2 control out put 2
ct 1 CT OUTPUT 1
ct 2 CT OUTPUT 2

out2, ct 1, 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

MENU 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

MENU 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%

MENU 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%

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

ENT key

C1_m Initial value:non
non Setting range:non、out 1、out2、EV1、EV2、EV3

MENU key

Object detected by CT (current) sensor is chosen.

In the case of a current output, out 1 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

C1_m Initial value:0.5
0.5 Setting range: 0.5～30.0 seconds

MENU 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

C2_m Initial value:non
non Setting range:non、out 1、out2、EV1、EV2、EV3

MENU key

The same as CT1 mode setting screen.

CT2 delay time setting screen

C2_m Initial value: 0.5
0.5 Setting range: 0.5～30.0 seconds

MENU 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	Measureing Range Unit Code c (℃)	Unit Code F (℉)
Multi Input	Thermo Couple	R	r1	0 ～1700	0 ～3100
		K	K1	-199.9～ 400.0	-300 ～ 700
		K	K2	0 ～1200	0 ～2200
		K	K3	0.0～ 300.0	0 ～ 600
		K	K4	0.0～ 800.0	0 ～1500
		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
		*5U	U1	-199.9～ 200.0	-300 ～ 400
		N	n1	0 ～1300	0 ～2300
		*1B	b1	0 ～1800	0 ～3300
		*3Wre5-26	S-26	0 ～2300	0 ～4200
		*4PLⅡ	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	-199.9～ 300.0	-300 ～ 600
			P7	-199.9～ 600.0	-300 ～1100
			P8	0 ～ 230	0 ～ 450
			JP1	-200 ～ 500	-300 ～ 900
		*6	JP2	-100.0～ 200.0	-150.0～ 400.0
		*6	JP3	0.0～ 100.0	0.0～ 200.0
			JP4	-50.0～ 50.0	-60.0～ 120.0
			JP5	-100.0～ 300.0	-150.0～ 600.0
			JP6	-199.9～ 300.0	-300 ～ 600
			JP7	-199.9～ 500.0	-300 ～ 900
			JP8	0 ～ 230	0 ～ 450
	Volatage(mV)*7	0～ 10	m1	Scaling Range :-1999～9999 Digit Span :10～10000Digit Change of decimal point's position is possible （no decimal pont、0.1, 0.01, 0.001）	
		0～100	m2		
		*7-10～ 10	m3		
		0～ 20	m4		
		0～ 50	m5		
Voltage(V)		1～ 5	V1		
		0～ 5	V2		
		-1～ 1	V3		
		0～ 1	V4		
		0～ 2	V5		
		0～ 10	V6		
Current(mA)		4～ 20	mA1		
		0～ 20	mA2		

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 PL Ⅱ: 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 V1 0.0-100.0

Current input : 4-20mA mA1 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.

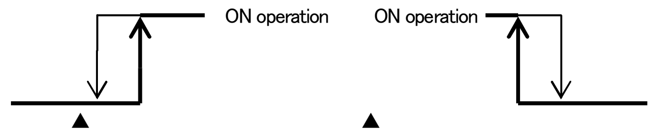
1) Soft- start functions in the following conditions.

- 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

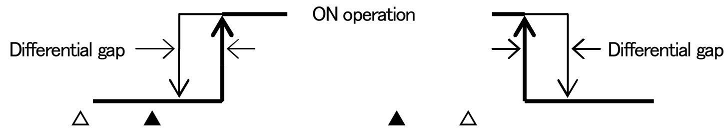
The figure of alarm operation figure allotted to event 1～3 is shown.

LA: Lower limit absolute value alarm HA: Upper limit absolute value alarm

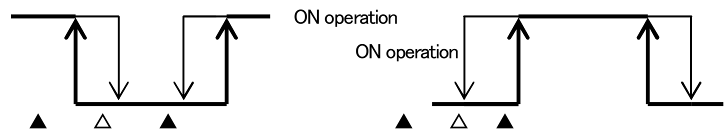


△: SV ▲: Alarm operating point setting value

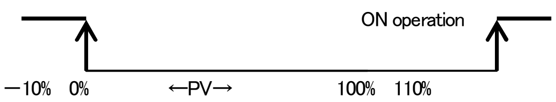
Hd: Upper limit deviation alarm Ld: Lower limit deviation alarm



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.

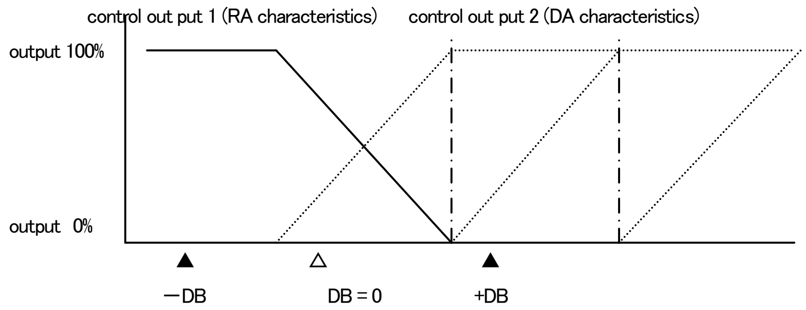
OUT 2 output while performing AT is 0% or output limiter lower limit value.

6-5. 2 output-characteristics figure

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

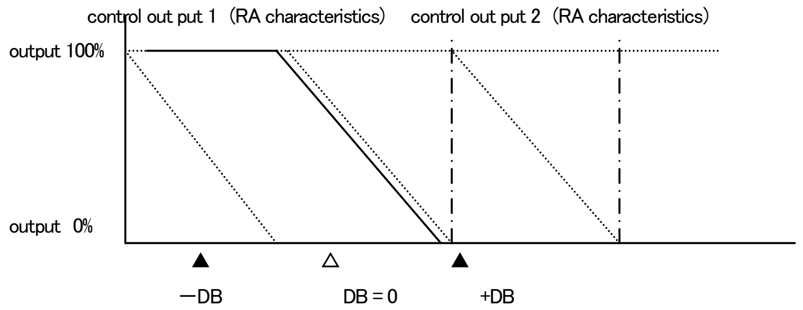
◎ Conditions: P operation, manual reset (mr) －50.0%

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



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

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



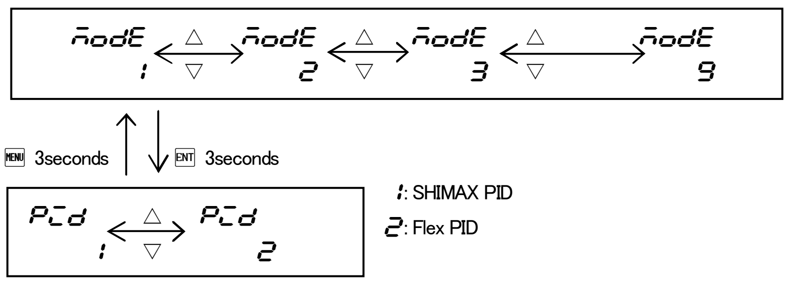
△ : Setting Value (SV) ▲: DB (dead band)

6-6 PID control methid(Flex PID Method add from Ver 1. .2)

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 sewtting)

This is explainaton a modification method of two tyoes PID method both SHIMAX PID methid and Flex PID method.

(1)Setting of PID method

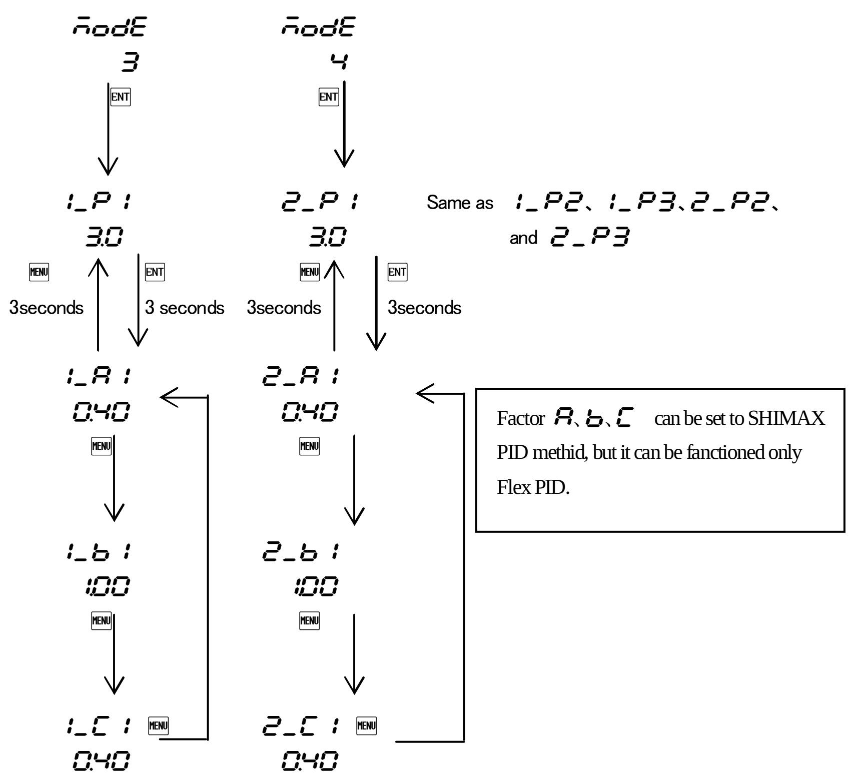


Press ENT key 3seconds at each setting lead screen from Mode 1 to Mode 9 , it move to the screen that can be shoosen both SHIMAX PID or Flex PID.

(2) About the factor used for Flex PID.(Add from ver 1. 2*)

There are a factor C for SV change followingness and a disturbance response factor A 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 A setting screen by pressing ENT key for 3seconds.
Move to b setting screen by pressing MENU key, move to C setting screen by pressing MENU key, move to A setting screen by pressing MENU key, move to PID setting screen by pressing MENU key 3 seconds at A 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 C as an adjustment of the overshoot and undershoots. When C is enlarged, it becomes easy for the overshoot and undershoot to go out though the restoration speed quickens.

C setting range=0.00～1.00　　C Default Value(Value of Output1 0.4 as same Output 1 &2)
(0.8 As Reverse-characteristic Output 1& 2)

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.

A	b	Control method	Features
1	1	I－PD(Measurements proportion differentiation early type)	For fixation control
1	0	ID－P(Measurements proportionally early type)	The kickback by the SV value change is ir target value follow are a little inferior. For ramp control
0	1	IP－D(Measurements differentiation early type)	
0	0	PID(Deflection PID)	For target value follow valuing and cascade re
A	0	P－I－PD(P2 flexi type)	Turbulence response and target value follow

Ab setting range＝0. 00～1. 00　　Default value(FIX: A＝0. 40 b＝1. 00)
(PRG: A＝0. 20 b＝0. 20)

A should be reduced when you want to improve the step response at the SV change and the start-up, A 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

7. Touble 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* *B: Wiring of MAC3A, 3B's terminal No.11, Wiring of MAC 3D's terminal No.5	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− − − (B−−−)	Breaking of resistance bulb input	1.wire breaking of b* *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)	1.check of resistance bulb wiring 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)
MAC3C(72 x72 size) PV red 7 segment LED 4 figure (height of character about 16mm)
SV green 7 segment LED 4 figures (height of character about 16 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.
	4	Only change of a keylock is possible It can be locked RUN key
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 : 500Ω or more, external resistance tolerance level 100Ω or less input resistance

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, Flex PID 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)(40step fuinction add from Ver 1.3*)

Number of pattern : Choosen from pattern 1,2,4 Add from Ver 1.3*

Number of steps : Maximum 40steps When choose pattenn 1,20steps of each steps when choose pattern 2,10steps of each steps when choose pattern 4.

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 : With Off or 1-2000unit(add from Ver 1. 2*)

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	Id	
Without deviation alarm	od	
RUN signal	run	Operates during PROG and FIX in operation.
Control loop alarm	ct1	When contact/voltage pulse output is ON Breaking alarm, when it is below EV set.
(Heater breaking / loop)	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	ProG	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.

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.
ProG	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.
SKIP	skip	edge	Shift to the next program's step.
Pt_1	Pattern 1	level	Choose pattern 1 with close DI rerminal
Pt_2	Pattern 2	level	Choose pattern 2 with close DI rerminal
Pt_3	Pattern 3	level	Choose pattern 3 with close DI rerminal
Pt_4	Pattern 4	level	Choose pattern 4 with close DI rerminal
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.

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 (dependson 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)

CT1・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/1μs±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)

MAC3C : H72×W72×D62mm (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

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 160g

MAC3D : About 120g

Isolation : Except for input, system and contact, all control output are no-isolation

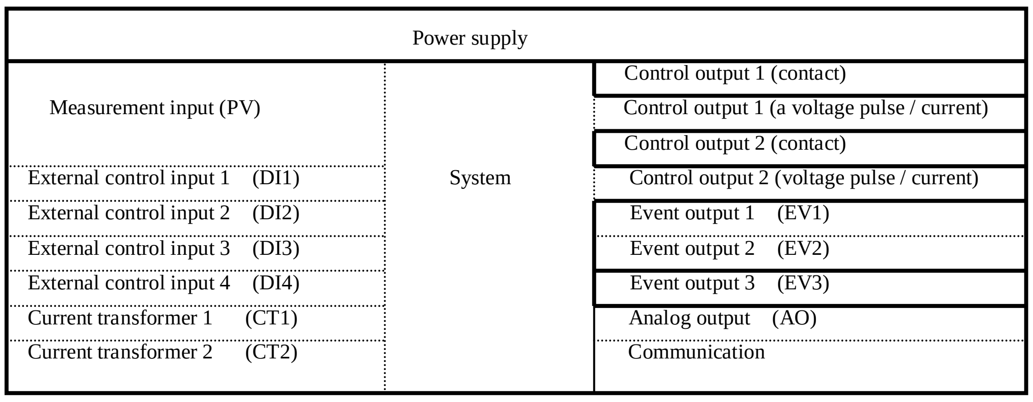
Between event output EV1 and EV2 1 is not insulated

Others are basic insulation or functional insulation.

Refer to the following insulation block chart.

Insulation block chart

Basic I nsulation 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.											

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

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