MAC50 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

MAC50 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 MAC50.

This manual describes the care, installation, wiring, function, and proper procedures regarding the operation of MAC50

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**」

MAC50 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 MAC50 into Class A apparatus. Electromagnetic interference may occur when MAC50 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 MAC50, 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

MAC50A－	M	C	F－	E	C－	D	H	T	R
1	2	3	4	5	6	7	8	9	10

Item

1. Series MAC50A-:96×96mm size digital controller
   MAC50B-: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

Example of model code

MAC50D－	M	C	F－	E	C－	D	T
1	2	3	4	5	6	7	8

Items

1. Series MAC50C:72×72mm size digital controller
   MAC50D-: 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

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.

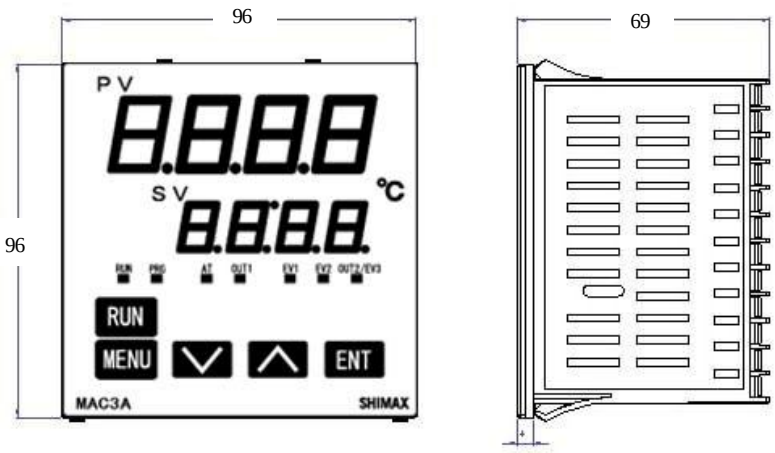
(2) Applicable thickness of the mounting panel is 1.2 ~ 2.8mm.

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

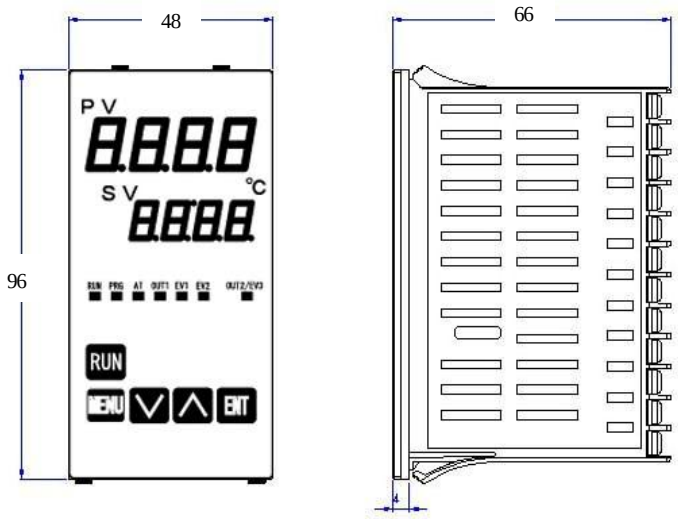
3-3. External dimension and panel cutout

MAC50 external dimensions (unit: mm)

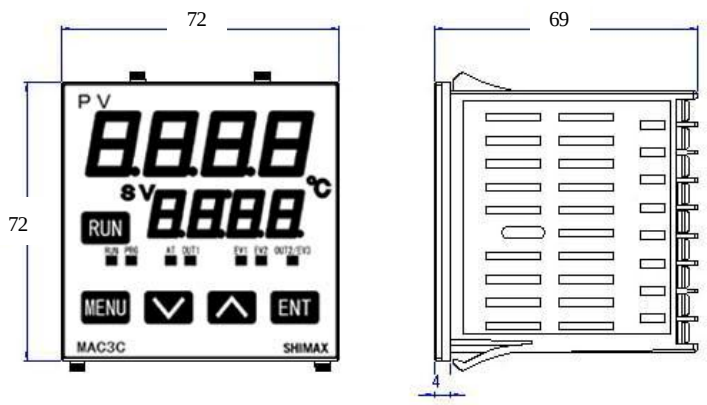
MAC50A



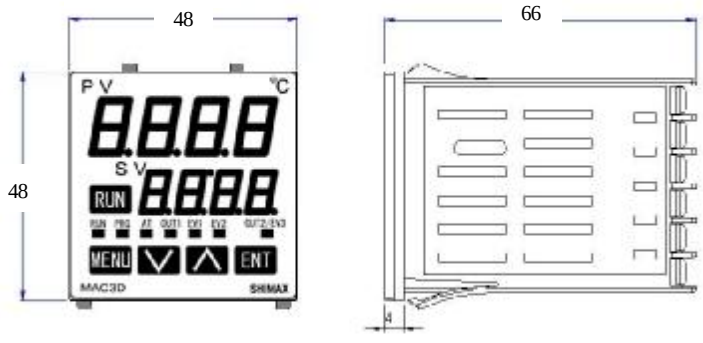
MAC50B



MAC50B

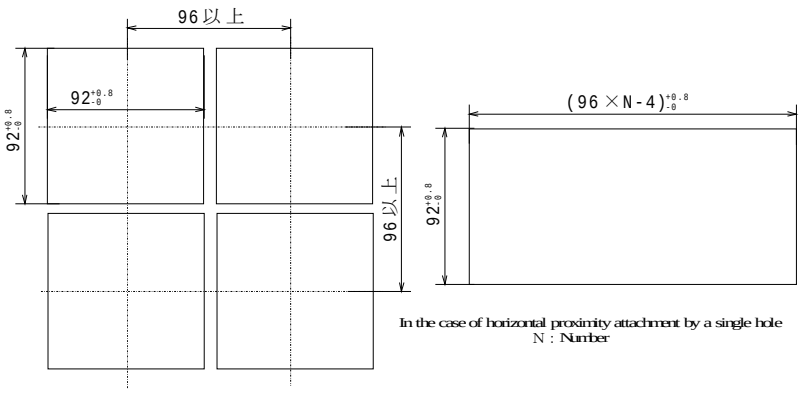


MAC50D



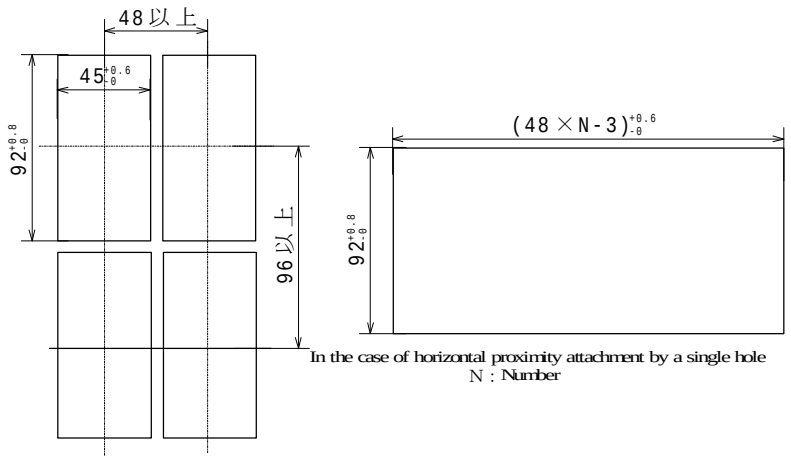
MAC50 panel cutout (unit: mm)

MAC50A 96×96size



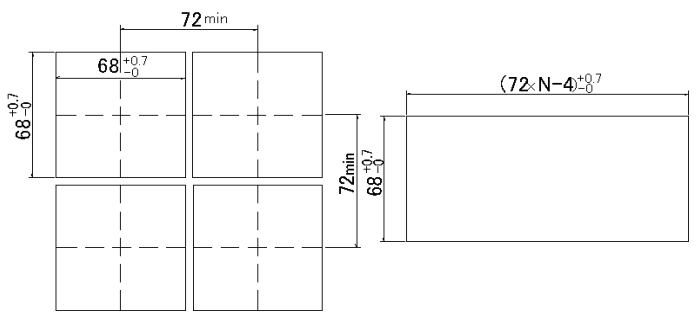
In the case of horizontal proximity attachment by a single hole
N : Number

MAC50B 48×96size

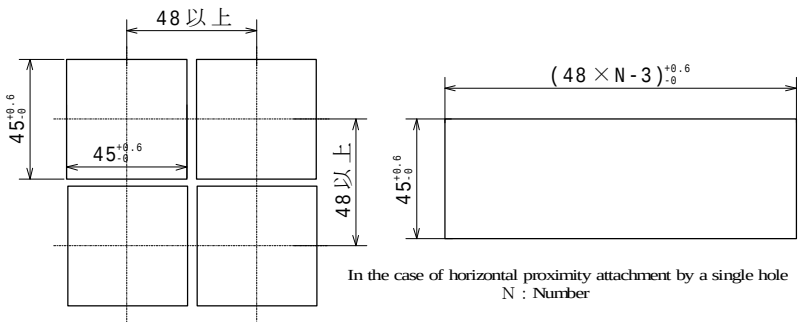


In the case of horizontal proximity attachment by a single hole
N : Number

MAC50C 72×72size



MAC50D 48×48size



In the case of horizontal proximity attachment by a single hole
N : Number

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.

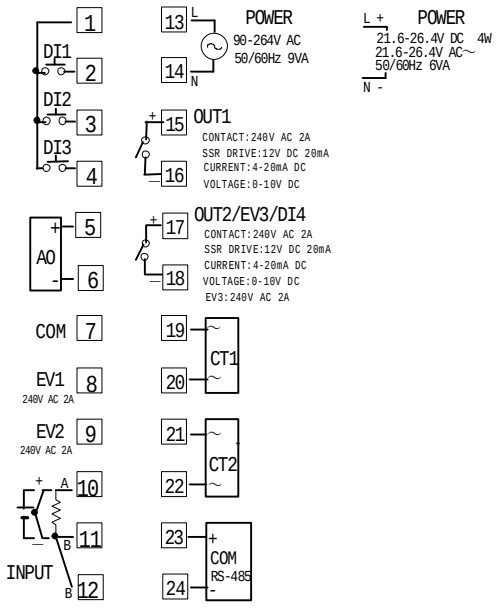
(4) Do not wires an input signal line inside of an electric wire pipe or a duct same with the high voltage line.

(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.

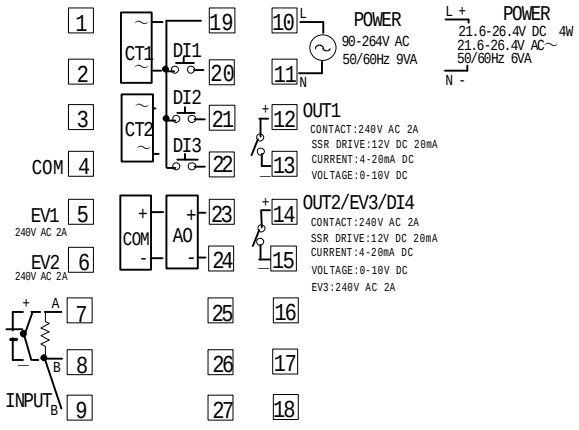
3－5. Terminal arrangement diagram

3-5. Terminal arrangement plan of MAC50A and MAC50B



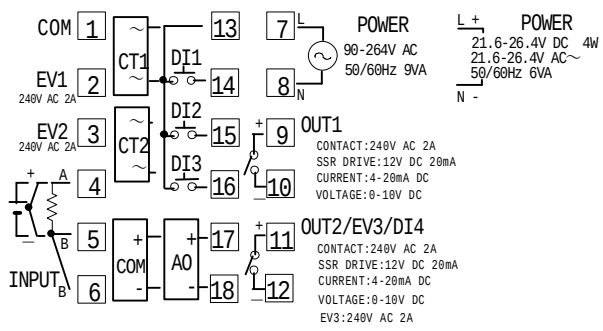
「Note」: If input type is thermocouple or voltage, errors may occur when terminal 11 and terminal 12 terminal are short-circuited

Terminal arrangement plan of MAC50C



「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 MAC50D



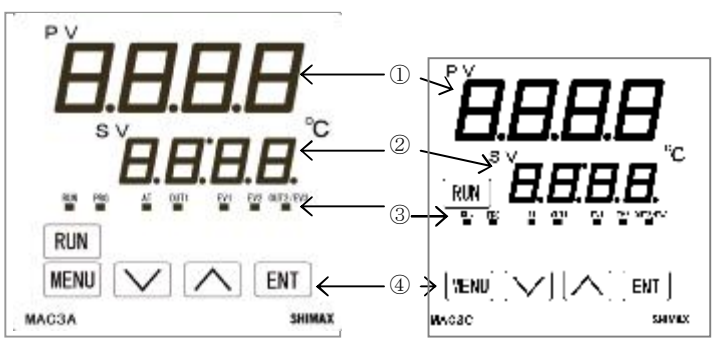
「Note」: If input type is thermocouple or voltage, errors may occur when terminal 5 and terminal 6 terminal are short-circuited

4. . Description of front panel

4－1. Names of front panel.

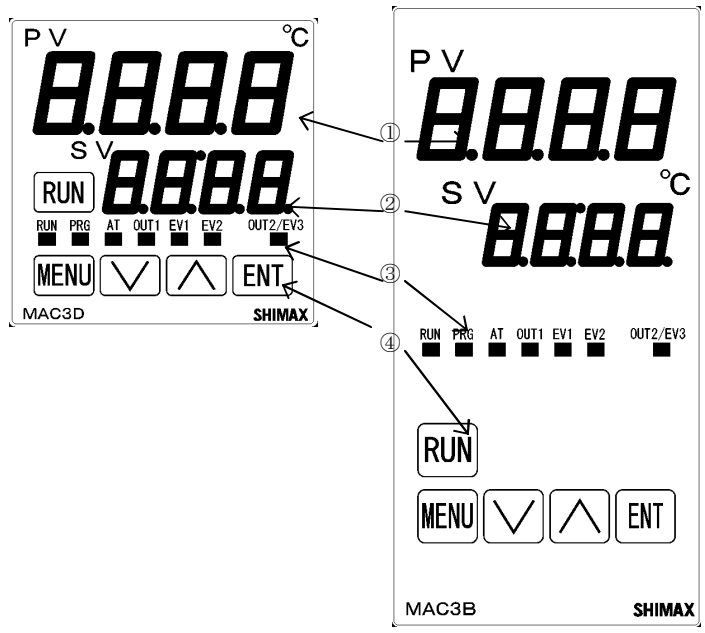
MAC50A 96×96size front

MAC50C72×72size front



MAC50D 48×48size front

MAC50B48×96 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) 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.

(3) 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.

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

Lights up when the allotted event output turns to ON.

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

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

④ : Key-switch section

(1) (MENU)key

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

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

Press key for three seconds on the lead screen , then it jumps to the basic screen..

(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.

(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.

(4) (ENTRY/REGISTER)key

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

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

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

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

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

(5) (RUN OPERATION/STOP)key

Push for 3 seconds at STBY (control stop), then FIX control starts.
Push for 3 seconds while FIX is in operation, then control is stopped.

5. Description of screens

5-1. How to move to another screen

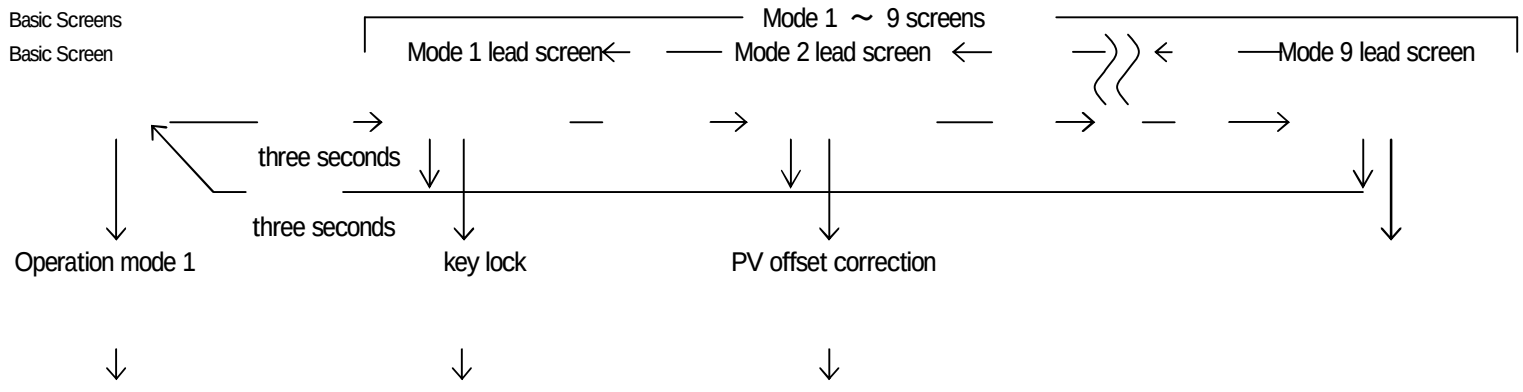
Basic Screen

3 seconds → (constant value control) lead screen of setting screen

← 3 seconds

Press the key for 3 seconds on a basic screen, then it shifts to the lead screen of (constant value control) setting screens。

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



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

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

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

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

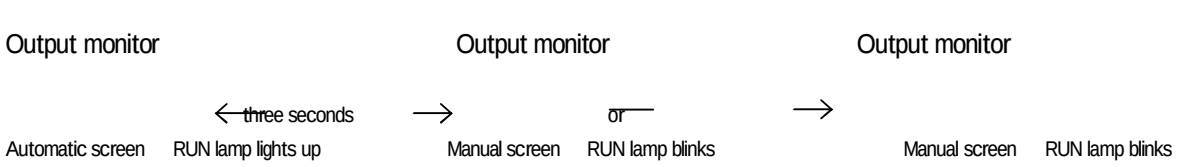
5-2. Setting Method

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 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 key in order to determine the change of setting.

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

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



5-3. Power-on and initial screen display

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

《Power-on》→ All LED light up → Input type → Upper limit & lower limit of measuring range → Out 1 type → ※ Out 2 type → Basic screen

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

5-4. Explanation of each scre

(1) Basic Screens

Basic Screen

Executed SV initial value : Sensor input 0

Linear input Lower limit of scaring range

Setting range : Sensor input Within measuring range

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.

Action Mode 1 screen

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

（reset）(Initial value at the time of program control)

Setting range: : （ ） Control stop [Output OFF (0%)] operation

key conduct of control operation

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

Choose （ ）by key、Decide by 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 （ ） is displayed.

Press key for 3 seconds, then it shifts to Action mode2 screen

Action mode1 screen Action mode2 screen

→ three seconds → →

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

Output 1 monitoring screen

manual output setting range: :0.0-100.0% (within output limiter)

At the time of automatic output,monitor display only.

key Refer to Item 5-2 about automatic ⇔ manual switchover,and setting method at the time of manual operation.

A manual output is canceled when an operation mode is made into ( ).

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

When 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

Contents are the same with that of an output 1.

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

↓

CT1 current monitoring-screen

Current display range: 0.0-55.0A

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

key Current value is displayed.

↓

CT2 current monitoring screen

Contents are the same with that of an output 1.

key

↓

AT (Auto Tuning) execution screen

Initial value: :

Setting range: : 、

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

Initial value: upper limit absolute value measuring range Scaling upper limit

lower limit absolute value measuring range Scaling lower limit

upper limit deviation

key lower limit deviation

within deviation

outside deviation

CT1 or CT2

guarantee

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 ～ unit

lower limit deviation ～ unit

within upper-lower limit deviation ～ unit

outside upper-lower limit deviation ～ unit

CT1 or CT2 ～ A

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

No option, No display when , , , are allotted to EV1.

The operation mode of each deviation alarm is .

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

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

key

↓

EV3 (event 3) operating-point setting screen

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

key

↓

When EV3 option is added, event 3 is displayed as the same contents with EV 1 and 2, irrespective of EV 1 and 2.

↓

Latching release screen

Initial value: :

Setting range: : release EV1

release EV2

key release EV3

release all EVs at a time

On the latching setting screen of each EV mode, No. and which chose are displayed. If latching is ,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 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 is chosen on Action mode2 screen of basic screens,lead screen of FIX setting screens is displayed when key is pressed for 3 seconds.

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

basic screen lead screen of FIX setting

—— three seconds →

← three seconds ——

FIX lead screen

No setting on this screen.

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

↓

SV1 setting screen

Initial value : At the time of sensor input 0

linear input time scaling lower limit

Setting range: sensor input time within measuring range

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

Initial value : 1

Setting range:1, 2, 3

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

Initial value:1

Setting range:1,2,3

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

Initial value: same with SV1

Setting range: same with SV1

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

Initial value:1
Setting range:1,2,3
Displayed when SV2 is allotted to DI.
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
Initial value:1
Setting range:1,2,3
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
Initial value: same with SV1
Setting range: same with SV1
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
Initial value:1
Setting range:1,2,3
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
Initial value:1
Setting range:1,2,3
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
Initial value: same with SV1
Setting range: same with SV1
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
Initial value:1
Setting range:1,2.3
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
Initial value:1
Setting range:1,2,3
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

(4) Mode 1 screens

Mode 1 lead screen
Press key for 3 seconds on basic screen, then displayed
key No setting on this screen. Press the key, then it shifts to the first setting screen, keylock setting screen.

Keylock setting screen
Initial value:
Setting range: 、、、、
key
Only change of Execution SV (basic screen) and keylock is possible.
Possible to change numerical value value manualy ,and key lock level
Only change of a keylock is possible.
Only change of a keylock is possible It can be locked key

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

SV limiter lower limit setting screen
Initial value: measuring range lower limit
Setting range: measuring range lower limit value~measuring range upper limit value－1
key And (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 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
Initial value: measuring range upper limit
Setting range:SV limiter lower limit value +1~ measuring range upper limit value
key Setting upper limit value of target value is set.

Return to mode1 lead screen.

(5) Mode 2 screens

Mode 2 lead screen
Press key in mode1 lead screen, or press key in mode3 lead screen, then being displayed.
key If key is pressed, it shifts to the first setting screen PV offset correction screen.

PV offset correction (PV bias) setting screen
Initial value:0
S etting range:－500～500 Digits
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
Initial value:0.00
Setting range: ±5.00%
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
Initial value:0
Setting range: 0 ～ 9999 seconds
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
Initial value: multi , voltage , current
Setting range: Chosen from 5-5.measuring range code table.
key
Combination of input type and measuring range is set by code.

Temperature unit setting screen
Initial value:
Setting range: 、
key The temperature unit at the time of a sensor input is set up from (℃) , ( ).
Not displayed when the linear input is chosen.

Input scaling lower limit value setting screen
Initial value:0.0
Setting range: -1999 ～ 9989 digits
key Scaling lower limit value at the time of linear input is set up.

Input scaling upper limit value setting screen
Initial value:100.0
Setting range: －1989 ～ 9999 digits
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

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

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

Decimal point position of input scaling is set .

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

No setup

If key is pressed, it shifts to the first setting screen, output 1 proportional band

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

Initial value:3.0%

Setting range:OFF, 0.1 ～ 999.9%

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

Initial value: 120 seconds

Setting range: 0FF, 1～6000 seconds

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

Initial value: 30 second

Setting range: 0FF, 1～3600 seconds

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

Initial value:0.0

Setting range: －50.0～50.0%

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

Initial value: 5

Setting range: 1 ～999 unit

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

Initial value:0.0

Setting range: 0.0～99.9%

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

Initial value:100.0

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

key Upper limit value of output 1 PID1 is set .

Output 1 PID2 proportional band (P) setting screen

Initial value:3.0%

Setting range: OFF, 0.1～ 999.9%

key Content is the same with output 1 PID1.

Output 1 PID2 integral-time (I) setting screen

Initial value: 120 seconds

Setting range: 0FF, 1～6000 seconds

key Contents is the same with output 1 PID1.

Output 1 PID2 derivative-time (D) setting screen

Initial value: 30 seconds

Setting range: 0FF, 1～ 3600 seconds

key Contents is the same with output 1 PID1.

Output 1 PID2 manual reset setting screen

Initial value: 0.0

Setting range: －50.0～50.0%

key Contents is the same with output 1 PID1.

Output 1 PID2 differential gap setting screen

Initial value: 5

Setting range: 5～999 unit

key Contents is the same with output 1 PID1.

Output 1 PID2 minimum limiter setting screen

Initial value:0.0

Setting range:0.0～99.9%

key Contents is the same with output 1 PID1.

Output 1 PID2 maximum limiter setting screen

Initial value: 100.00

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

key Contents is the same with output 1 PID1.

Output 1 PID3 proportional band (P) setting screen

Initial value: 3.0%

Setting range:OFF, 0.1～ 999.9%

key Contents is the same with output 1 PID1.

Output 1 PID3 integral-time (I) setting screen

Initial value: 120 seconds

Setting range: 0FF, 1～ 6000 seconds

key Contents is the same with output 1 PID1.

Output 1 PID3 derivative time (D) setting screen

Initial value: 30 seconds

Setting range: 0FF, 1～3600 seconds

key Contents is the same with output 1 PID1.

Output 1 PID3 manual reset setting screen

Initial value:0.0

Setting range:－50.0～50.0%

key Contents is the same with output 1 PID1.

Output 1 PID3 differential gap setting screen

Initial value:5

Setting range:1～999 unit

key Contents is the same with output 1 PID1.

Output 1 PID3 minimum limiter setting screen

Initial value: 0.0

Setting range: 0.0～99.9%

key Contents is the same with output 1 PID1.

Output 1 PID3 maximum limiter setting screen

Initial value: 100.0

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

key Contents is the same with output 1 PID1.

Output 1 soft starting time setting screen

Initial value: 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.

key Does not function at the time of OFF setup.

Output 1 proportional periodic time setting screen

Initial value: Contact output 30.0 seconds

Voltage pulse output 3.0 seconds

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

Initial value:

Setting range: 、

key Characteristics of control output is chosenfrom (heating characteristics)

and (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

No setup

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

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

Initial value:3.0%

Setting range:OFF, 0.1～ 999.9%

key Contents is the same with output 1 PID1.

↓

Output 2 PID1 integral-time (I) setting screen

Initial value: 120 seconds

Setting range: 0FF, 1～ 6000 seconds

key Contents is the same with output 1 PID1.

↓

Output 2 PID1 derivative-time (D) setting screen

Initial value: 30 seconds

Setting range: 0FF, 1～3600 seconds

key Contents is the same with output 1 PID1.

↓

Output 2 PID1 dead-band setting screen

Initial value:0

Setting range: －1999～5000 unit

key

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

↓

Output 2 PID1 differential-gap setting screen

Initial value:5

Setting range: 1～999 unit

key Contents is the same with output 1 PID1.

↓

Output 2 PID1 minimum limiter setting screen

Initial value: 0.0

Setting range: 0.0～99.9%

key Contents is the same with output 1 PID1.

↓

Output 2 PID1 maximum limiter setting screen

Initial value:100.0

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

key Contents is the same with output 1 PID1.

↓

Output 2 PID2 proportional-band (P) setting screen

Initial value:3.0%

Setting range: OFF, 0.1～ 999.9%

key Contents is the same with output 1 PID1.

↓

Output 2 PID2 integral-time (I) setting screen

Initial value: 120 seconds

Setting range: 0FF, 1～6000 seconds

key Contents is the same with output 1 PID1.

↓

Output 2 PID2 derivative-time (D) setting screen

Initial value: 30 seconds

Setting range: 0FF, 1～3600 seconds

key Contents is the same with output 1 PID1.

↓

Output 2 PID2 dead-band setting screen

Initial value:0.0

Setting range:－50.0～50.0%

key Contents are the same as output 2PID1 dead-band setting screen.

↓

Output 2 PID2 differential-gap setting screen

Initial value: 5

Setting range: 1～999 digits

key Contents is the same with output 1 PID1.

↓

Output 2 PID2 minimum limiter setting screen

Initial value: 0.0

Setting range: 0.0～99.9%

key Contents is the same with output 1 PID1.

↓

Output 2 PID2 maximum limiter setting screen

Initial value:100.0

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

key Contents is the same with output 1 PID1.

↓

Output 2 PID3 proportional-band (P) setting screen

Initial value:3.0%

Setting range:OFF, 0.1～999.9%

key Contents is the same with output 1 PID1.

↓

Output 2 PID3 integral-time (I) setting screen

Initial value: 120 seconds

Setting range: 0FF, 1～6000 seconds

key Contents is the same with output 1 PID1.

↓

Output 2 PID3 derivative-time (D) setting screen

Initial value: 30 seconds

Setting range: 0FF, 1～3600 second

key Contents is the same with output 1 PID1.

↓

Output 2 PID3 dead-band setting screen

Initial value:0.0

Setting range:－50.0～50.0%

key Contents are the same as output 2 PID1 dead-band setting screen.

↓

Output 2 PID3 differential-gap setting screen

Initial value:5

Setting range: 1～999 digits

key Contents is the same with output 1 PID1.

↓

Output 2 PID3 minimum limiter setting screen

Initial value:0.0

Setting range: 0.0～99.9%

key Contents is the same with output 1 PID1.

↓

Output 2 PID3 maximum limiter setting screen

Initial value:100.0

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

key Contents is the same with output 1 PID1.

↓

Output 2 soft starting time setting screen

Initial value:OFF

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

key Contents is the same with output 1.

↓

Output 2 proportional periodic-time setting screen

Initial value: Contact output 30.0 seconds

Voltage pulse output 3.0 seconds

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

Initial value:

Setting range: 、

↓ 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

No setup.

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

key

Event 1 operation-mode setting screen

Initial value:

Setting range: Chosen from event type character table.

↓ key

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

Event type character table

Character	Type
	No allotment
	Upper limit absolute value alarm
	Lower limit absolute value alarm
	Scale over alarm
	Maximum deviation alarm
	Minimum deviation alarm
	Within deviation alarm
	Without deviation alarm
	RUN signal
	Control loop alarm 1
	Control loop alarm 2

※ 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

Initial value:5Digits

Setting range: 1～999 Digits

↓ key ON-OFF differential gap of event 1 is set .

Not displayed, when the event 1 mode are as follows. 、 、 、are

Al

lotted.

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

Event 1 standby operation setting screen

Initial value: :

↓ key Setting range: : 、 、

: No standby operation、 : standby-operation only at the time of a power-on.

: 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. ; 、 、 、

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

↓ Event 1 latching setting screen

Initial value:

Setting range: 、

↓ key

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

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

Event 1 output characteristics setting screen

Initial value:

Setting range: 、

↓ key Output characteristics event 1 is chosen from : normal open,

: normal closing.

Not displayed when event 1 mode is .

Note: If 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

Initial value:

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

Initial value: 5digit

Setting range:1～999 digit

↓ key The same as event 1.

Event 2 standby operation setting screen

Initial value:

Setting range: 、 、

↓ key The same as event 1.

Event 2 latching setting screen

Initial value: :

Setting range: : 、

↓ key The same as event 1.

Event 2 output characteristics setting screen

Initial value: :

Setting range: : 、

↓ 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.

Initial value:

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

Initial value: 5 digit

Setting range: 1～999 digit

↓ key The same as event 1.

Event 3 standby operation setting screen

Initial value:

Setting range: 、 、

↓ key The same as event 1.

Event 3 latching setting screen

Initial value:

Setting range: 、

↓ key The same as event 1.

Event 3 output characteristics setting screen

Initial value:

Setting range: 、

↓ 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

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

↓ key

In MAC50D (48x48), when option of CT OUTPUT is added,

DI 1~DI3 cannot be chosen and not displayed.

DI 1 mode setting screen

Initial value:

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

Initial value:

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

Initial value:

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.

Initial value:

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
	No allotment		
	2st SV	level	With closed DI terminal Execution SV = 1st SV
	2nd SV	level	With closed DI terminal Execution SV = 2nd SV
	3rd SV	level	With closed DI terminal Execution SV = 3rd SV
	4th SV	level	With closed DI terminal Execution SV = 4th SV
	control RUN	level	RUN with closed DI terminal, STBY with open one.
	manual inpu t	level	Manual with closed DI terminal,auto with open one.
	auto tuning	edge	AT-start with rise edge.
	latching release	edge	All latching are released by rise edg.
	super key lock	level	Super keylock with closed DI terminal. Release with opened.

*When ～ are conducted during AT execution, they are performed at the time of AT termination.

*When ～ are allotted to to each DI, priority is given to - - - in order.

* can be performed at the time of a RUN-automatic output.

*When 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 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 MAC50D (48x48),when communication option isadded,it is impossible to choose and display.

Mode 7 lead screen

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

key setting screen.

↓

Analog output mode setting screen

Initial value: (does not output)

Setting range: PV

key execution SV

control out put 1

control out put 2

CT OUTPUT 1

CT OUTPUT 2

, , is displayed when option is added.

Data type allotted to analog output are chosen.

↓

Analog output scaling lower limit value setting screen

Initial value: the following table

Setting range: the following table

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

Initial value: the following table

Setting range:the following table

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

Initial value: 0.0

Setting range:0.0～100.0%

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

Initial value:100.0

Setting range: 0.0～100.0%

key

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

↓ If set as the same value as and , 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 MAC50D (48x48),when DI 1～3 are added,it is impossible to choose and display.

Mode 8 lead screen

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

key

↓

Initial value:

Setting range: 、 、 、

key 、 、

Object detected by CT (current) sensor is chosen.

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

is not displayed without current output or output 2 option.

and are not displayed without any option, respectively.

↓

CT1 delay time setting screen

Initial value:0.5

Setting range: 0.5～30.0 seconds

↓ 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

Initial value:

Setting range: 、 、 、

↓ key 、 、

The same as CT1 mode setting screen.

CT2 delay time setting screen

Initial value: 0.5

Setting range: 0.5～30.0 seconds

↓ 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 (℃)	Unit Code ( )
Multi Input	Thermo Couple	R		0 ～1700	0 ～3100
		K		-199.9～ 400.0	-300 ～ 700
		K		0 ～1200	0 ～2200
		K		0.0～ 300.0	0 ～ 600
		K		0.0～ 800.0	0 ～1500
		J		0 ～ 600	0 ～1100
		J		0.0～ 600.0	0 ～1100
		T		-199.9～ 200.0	-300 ～ 400
		E		0 ～ 700	0 ～1300
		S		0 ～1700	0 ～3100
		*5U		-199.9～ 200.0	-300 ～ 400
		N		0 ～1300	0 ～2300
		*1B		0 ～1800	0 ～3300
		*3Wre5-26		0 ～2300	0 ～4200
		*4PLⅡ		0 ～1300	0 ～2300
	Resistance Bulb Pt100			-200 ～ 600	-300 ～1100
				-100.0～ 200.0	-150.0～ 400.0
		*6		0.0～ 100.0	0.0～ 200.0
		*6		-50.0～ 50.0	-60.0～ 120.0
				-100.0～ 300.0	-150.0～ 600.0
				-199.9～ 300.0	-300 ～ 600
				-199.9～ 600.0	-300 ～1100
				0 ～ 250	0 ～ 500
		*6		-200 ～ 500	-300 ～ 900
		*6		-100.0～ 200.0	-150.0～ 400.0
				0.0～ 100.0	0.0～ 200.0
				-50.0～ 50.0	-60.0～ 120.0
				-100.0～ 300.0	-150.0～ 600.0
				-199.9～ 300.0	-300 ～ 600
				-199.9～ 500.0	-300 ～ 900
				0 ～ 250	0 ～ 500
	Volatage(mV)*7	0～ 10		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			
		*7-10～ 10			
		0～ 20			
		0～ 50			
	Voltage(V)	1～ 5			
		0～ 5			
		-1～ 1			
		0～ 1			
		0～ 2			
		0～ 10			
	Current(mA)	4～ 20			
		0～ 20			

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

resistance bulb Pt100:JIS/IEC

JPt100: former JIS

*1 thermo couple Accuracy is not guaranteed below B:400℃ (752).

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

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

*4 thermo couple PLⅡ: Platinel

*5 thermo couple U:DIN43710

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

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

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

Voltage input :1-5V 0.0-100.0

Current input : 4-20mA 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.

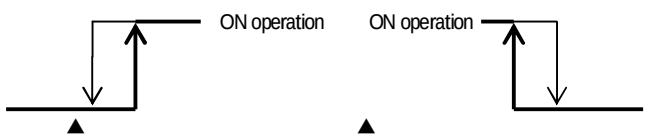
・Setup of proportional band (P) is other than OFF

・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.

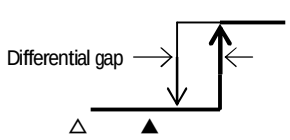
: Lower limit absolute value alarm



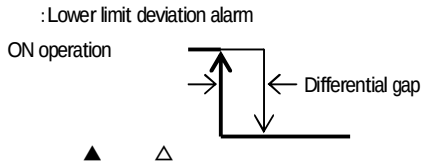
△: SV ▲: Alarm operating point setting value

: Upper limit absolute value alarm

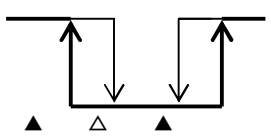
: Upper limit deviation alarm



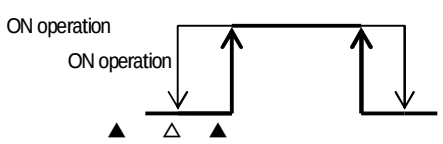
: Lower limit deviation alarm



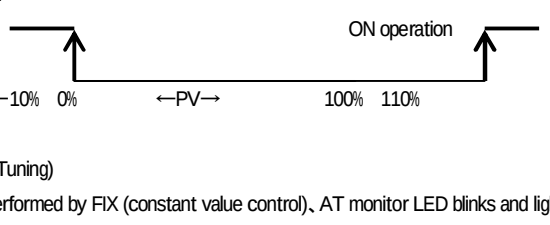
: Without deviation alarm



: Within deviation alarm



: 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.

・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.

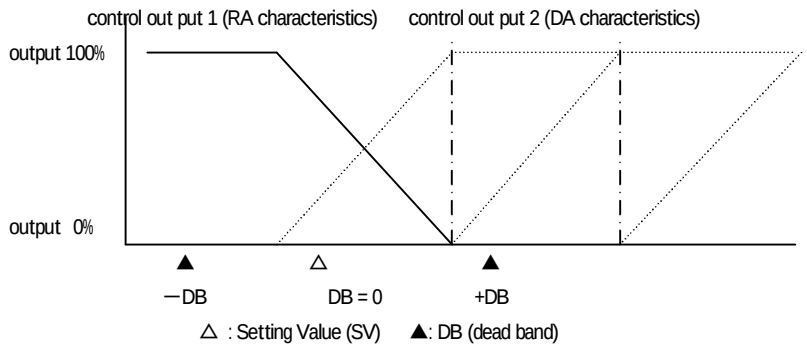
OUT 2 output while performing AT is 0% or output limiter lower limit value.

6-5. 2 output-characteristics figure

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

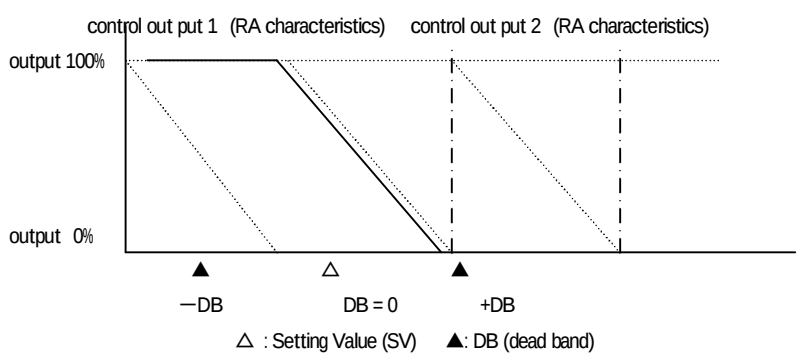
◎ Conditions: P operation, manual reset ( ) −50.0%

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)

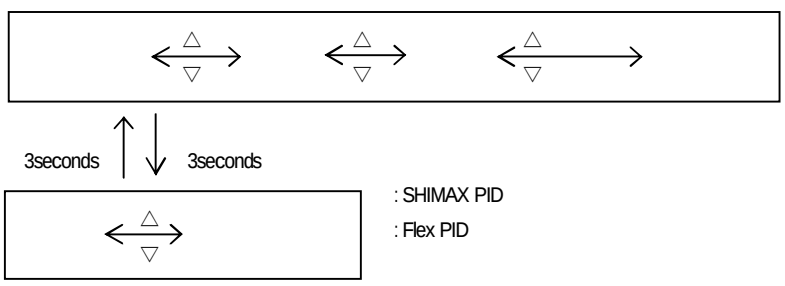
6-6 PID control methid

(Flex PID Method add from Ver 1. .2)

MAC50 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

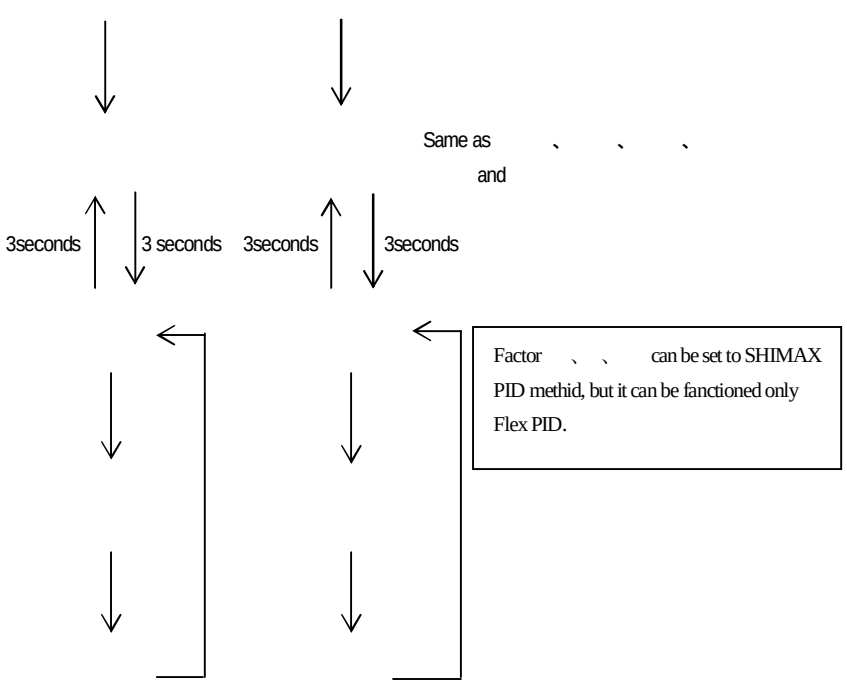


Press key 3seconds at each setting lead screen from Mode 1 to Mode 9 , it move to the screen that can be shoosen both SHIMAX PID or Flex PID.

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

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

setting range=0.00～1.00 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 MAC50.It already set up the turbulence response, and now set it according to the purpose based on the table below.

		Control method	Features	Remarks
1	1	I－P D (Measurements proportion differentiation early type)	For fixation control	1 flexible PID control
1	0	ID－P (Measurements proportionally early type)	The kickback by the SV value change is inferior and a no bur and the 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 regulation	
	0	P－I－PD (P2 flexi type)	Turbulence response and target value follow	like2flexible PID control

setting range＝0. 00～1. 00 Default value (FIX: ＝0. 40 ＝1. 00)

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

should be reduced when you want to improve the follow performance at the lamp control, 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)	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)	Scale over in lower limit	1.when input exceeds lower limit of measuring range by 10% 2.wire breaking of resistance bulb input B*	1.polarity of input is everse, check of wiring and an input transmitter 2.check of resistance bulb B wiring,replacement of resistance bulb
		*B: Wiring of MAC50A, 3B's terminal No.11, Wiring of MAC50D's terminal No.5	
(B---)	Breaking of resistance bulb input	1.wire breaking of b*	1.check of resistance bulb wiring
		*b: Wiring of MAC50A, 3B's terminal No.12,wiring of MAC50D's terminal No.6	
		2.multiple wire breaking combinations in Abb (A and B, A and b, B and b, all of ABB)	2.replacement of resistance bulb
(CJHH)	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)	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: MAC50A (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)
MAC50B(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)
MAC50C(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)
MAC50D (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 (, ,).

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 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 key is always effective.
However, even 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 100Ωor 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)

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

} If both I and D are OFF, P operation.

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

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		
Upper limit absolute value Alarm		
Lower limit absolute value alarm		
Scale over alarm		HHHH, LLLL, B---- Operates, when displayed.
Upper limit deviation value Alarm		
Lower limit deviation value alarm		
Within deviation alarm		
Without deviation alarm		
RUN signal		Operates during PROG and FIX in operation.
Control loop alarm		When contact/voltage pulse output is ON Breaking alarm, when it is below EV set.
(Heater breaking / loop)		When contact/voltage pulse output is OFF Loop alarm, when it is more than EV set.

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 MAC50D, 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
	No allotment		
	2nd SV	level	With closed DI terminal Execution SV = 2nd SV
	3rd SV	level	With closed DI terminal Execution SV = 3rd SV
	4th SV	level	With closed DI terminal Execution SV = 4th SV
	control RUN	level	RUN with closed DI terminal, STBY with open one.
	manual inpu t	level	Manual with closed DI terminal,auto with open one.
	auto tuning	edge	AT-start with rise edge.
	latching release	edge	All latching are released by rise edg.
	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 MAC50D.

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 MAC50 is a master, slave address range must be continuation.

※ When MAC50 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 MAC50D, 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 MAC50D, 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 MAC50 A : H96×W96×D69mm (depth in panel 65mm)

MAC50 B : H96×W48×D66mm (depth in panel 62mm)

MAC50C : H72×W72×D62mm (depth in panel 62mm)

MAC50 D : H48×W48×D66mm (depth in panel 62mm)

Thickness of applied panel : 1.2-2.8mm

Size of attachment hole

MAC50A	: H92×W92mm	Attachment hole size of horizontal plural proximity attachment	W(96×N-4) mm	H92mm
MAC50B	: H92×W45mm	N=number of equipment	W(48×N-3) mm	H92mm
MAC50C	: H68×W68mm		W(72×N-4) mm	H68mm
MAC50D	: H45×W45mm		W(48×N-3) mm	H45mm

Weight MAC50A : About 220g :

MAC50B : About 160g

MAC50C : About 160g

MAC50D : 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 .....

Power supply		
Measurement input (PV)	System	Control output 1 (contact)
		Control output 1 (a voltage pulse / current)
		Control output 2 (contact)
External control input 1 (DI1)		Control output 2 (voltage pulse / current)
External control input 2 (DI2)		Event output 1 (EV1)
External control input 3 (DI3)		Event output 2 (EV2)
External control input 4 (DI4)		Event output 3 (EV3)
Current transformer 1 (CT1)		Analog output (AO)
Current transformer 2 (CT2)		Communication

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

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