# Catalog and User manual

MAU90 Series PID Controller




## 3 Years Warranty !!

## 1:General Features:

- Dual display,4 digits,7 segments LED display
- TC/RTD/Analog input
- NPID,APID,Autotune,ON-OFF control mode
  artificial intelligence fuzzy logic PID control algorithem
- 0.25%F.S measuring accuracy
- Bar graphic display indication for 1/4 DIN and 1/8 DIN(optional)
- $^0$C/$^0$F display selectable
- Alarm standby function
- 0.01 maximum resolution, even for K/J/PT100 input
- Fast sampling rate at 250ms
- 100~240Vac, 24VDC/AC source, lighting strike proof
- 60 seconds protection against 380Vac in case user
  connect the controller to 380Vac power supply
- Very small temperature drift,<0.03%FS/$^0$C
- Modbus RS-485 communication, PV/SV re-transmission
  24VDC auxiliary power supply available on request
- Ultra low power consumption less than < 3W
- Ultra high brightness LED, excellent readability under direct sunlight
  two options on the display color, red+yellow, and white+green, two options
- Very small temperature drift,<0.03%FS/$^0$C
- Operates at extremely wide ambient range, -30℃~75℃ degree
- Excellent performance, very limited overshoot and undershoot
- CE and ROHs compatible

## 2:Ordering Information

MAU90-1-2-3-4-5-6-7

### 1:Size of the controller

| | |
|---|---|
| 05 | 48mm*48mm, panel cutout(45mm*45mm), depth(78mm) |
| 06 | 48mm*96mm, panel cutout(44mm*92mm), depth(92mm) |
| 06B | 48mm*96mm, panel cutout(44mm*92mm), depth(68mm) |
| 16 | 48mm*96mm, panel cutout(44mm*92mm), depth(92mm), with Bar graphic display |
| 16B | 48mm*96mm, panel cutout(44mm*92mm), depth(68mm), with Bar graphic display |
| 07 | 72mm*72mm, panel cutout(68mm*68mm),depth(92mm) |
| 17 | 72mm*72mm, panel cutout(68mm*68mm),depth(92mm) with bar graphic display |
| 08 | 96mm*48mm, panel cutout(92mm*44mm),depth(92mm) |
| 08B | 96mm*48mm, panel cutout(92mm*44mm),depth(68mm) |
| 18 | 96mm*48mm, panel cutout(92mm*44mm),depth(92mm),with bar graphic display |
| 18B | 96mm*48mm,panel cutout(92mm*44mm),depth(68mm),with bar graphic display |
| 09 | 96mm*96mm, panel cutout(92mm*92mm),depth(92mm) |
| 09B | 96mm*96mm, panel cutout(92mm*92mm),depth(68mm) |
| 19 | 96mm*96mm, panel cutout(92mm*92mm),depth(92mm), with bar graphic display |
| 19B | 96mm*96mm, panel cutout(92mm*92mm),depth(68mm),with bar graphic display |

### 2:Input(MIO)

| | |
|---|---|
| 1 | TC/RTD/Analog(need 250 ohm resistor for 4-20mA input) |
| 2 | TC/RTD/Analog input(with 24VDC auxiliary power supply) |

### 3:Output(OUTP)

| | |
|---|---|
| 1 | Relay output(NO+NC), 5A 250Vac relay |
| 2 | SSR Drive, 12VDC/50mA voltage pulse |
| 3 | 4-20mA output |
| 4 | Single phase thyristor zero-crossing trigger output |
| 5 | Single phase thyristor phase-shift trigger output |
| 6 | Three phase thyristor zero-crossing trigger output |
| 7 | 0-10VDC output |

### 4:Alarm output(ALM)

| | |
|---|---|
| 0 | without alarm output |
| 1 | 1 alarm with 1 Relay output(NO+NC), 5A 250Vac relay |
| 2 | 2 alarms with 2 relay output(NO), 2A, 250Vac |
| 3 | 1 alarm with 1 SSR Drive output 12Vdc/50mA |
| 4 | 2 alarms with 2 SSR Drive output 12Vdc/50mA |

### 5:Auxiliary output(AUX)

| | |
|---|---|
| 0 | without auxiliary output |
| 1 | 1 Relay output(NO+NC), 5A 250Vac relay as alarm or auxiliary output such as cooling |
| 2 | 2 Relay output(NO) as 2 separate alarms |
| 3 | 1 SSR Drive output as alarm or auxiliary output such as cooling |
| 4 | 2 SSR Drive output as 2 separate alarms |
| 5 | 4-20mA output as cooling output |
| 6 | 0-10Vdc output as cooling output |

### 6:Communication

| | |
|---|---|
| 0 | without communication |
| 1 | AI-BUS RS-485 communication |
| 3 | Modbus RS-485 communication |

### 7:Power supply

| | |
|---|---|
| A | 100-240Vac 50/60HZ |
| D | 24VDC/AC |

Ordering example : MAU90-16B-2-1-2-1-3-A

1 2 3 4 5 6 7

Main model number: MAU90
1>>Size: 16B, 48mm*96mm, short length 68mm version, with bar graphic display
2>>Input: Universal input with 24VDC auxiliary power supply,24VDC can be used for transmitters, such as temperature transmitter or pressure transmitter
3>>Output: Relay output (NO+NC)
4>>Alarm: 2 alarms, with 2 relay( NO open)
5>>Auxiliary output: 1 relay , this can be configures as alarm or cooling output configurable via menu
6>>Communication: With Modbus RS-485 communicatiom
7>> Source: 100-240Vac 50/60hz

## 2.1 Unique Feature

### 2.1.1 modular design

This controller has a unique modular design,5 slots are distributed inside the controller on the PCB board, different modular with different functions can be inserted to respective slots to enable the controller for different features. this provide great flexibility for distributor in meeting different demands from end users while keep their stock level as low as possible to save cost. customer can keep some of basic model and keep some modular, such as Modbus RS-485 module, 24VDC auxiliary power supply module, 2 alarm module, 4-20mA module etc. whenever a specific demands comes in from end user, respective module can be quickly installed and therefore a swift delivery can be made, various modules as below, below is a link to our youtube channel to help you have a better understanding on the concept

https://www.youtube.com/shorts/KNZLmxQPPjk


Relay output module, NO+NC relay
Ordering code: L0


Modbus RS-485 module
Ordering code: S7


2 alarm module, NO for both relay
for size 48mm*96mm, 96mm*48mm and 96mm*96mm, two modules can be installed, so you will have maximum 4 alarms
Ordering code:L5


24VDC auxiliary module
Some of application need 24VDC auxiliary power for the transmitters
Ordering code:V24


Analog input with 24VDC auxiliary power supply, a 250 ohm resistor needs to be parralled connected to input terminals if this modular is not installed, with this modular, 4-20mA can be connected to controller directly
ordering code:I1/I2


AI-BUS RS-485 module
Ordering code: S1


4-20mA output modular
Ordering code: X3-420


0-10Vdc output modular
Ordering code: X3-010


Single phase thyristor zero-crossing trigger output
Ordering code: K1


Single-phase thyristor phase-shift trigger output module
Ordering code: K5


Three phase thyristor zero-crossing trigger output
Ordering code: K3

### 2.1.2 Touch button

This controller adapts a touch button, this has a lot of advantages over traditional push buttons, the button does not wear out overtime, provides a better user experience while configuring the controller, below is a link from our youtube channel for further elaboration of this point.

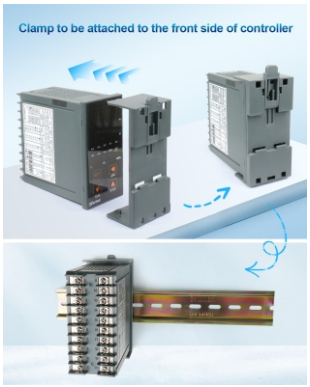
https://www.youtube.com/watch?v=atJ4xpybt3g&list=PL1CSF0YGSEQxqkkwhudDWUyOju9GJNuq7&index=3

### 2.1.3 High IP rating

This controller has a fully sealed housing for greater protection, for size 48mm*96mm and 96mm*96mm, a rubber gasket can be attached to the inside and outside of controller, the controller will be IP67, protection against water splash

### 2.1.4 Din Rail clamps for 48mm*96mm vertical version


DIN rail clamps available for 48mm*96mm size, this is a perfect solution for customer who need DIN rail mount controller,
one set of clamps has two PCS of clamps, clamp to be attached to back of the controller

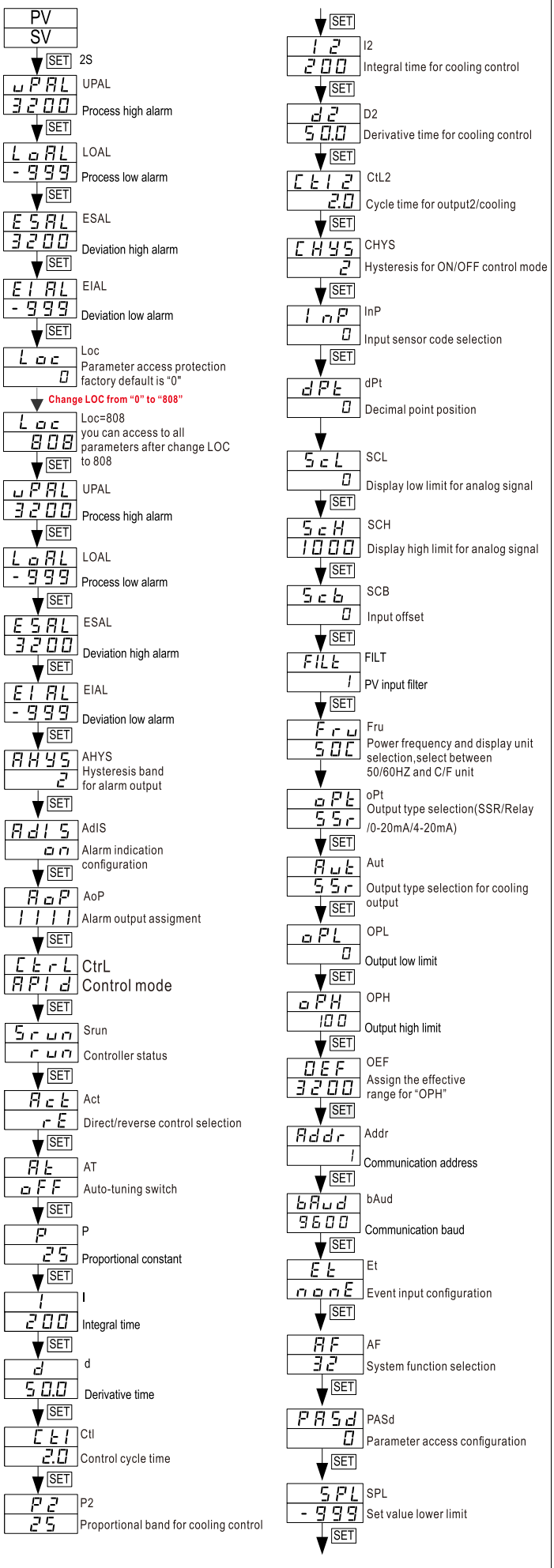



clamp to be attached to the front of the controller


One set of clamps has two pcs, one to be attached to the back and one to be attached to the front of the controller

## 3:Parameter Setting

Press SET key for more than 2 seconds, and then tap on the SET key, you will see below parameters one bye one.




**EP1-EP8**

### 3.1 List of system parameters

Table 1

| Code | Description | Setting Range | Initial Setting | Remarks |
|---|---|---|---|---|
| uPAL | process high alarm | -999~3200 | 3200 | See. 3.1.1 for details |
| LoAL | process low alarm | -999~3200 | -999 | |
| ESAL | deviation high alarm | -999~3200 | 3200 | |
| EIAL | deviation low alarm | -999~3200 | -999 | |
| AHYS | alarm hysteresis band | 0~200 | 2 | |
| AdIS | alarm indication | ON/OFF | ON | |
| AoP | alarm output assigment | 0~6666 | 3333 | |
| CtrL | control mode | OnoF,APID,nPID,PoP,SoP | APID | See. 3.1.2 for details |
| Srun | controller status | run,Stop,Hold | run | See. 3.1.3 for details |
| Act | direct/reverse control selection | rE,dr,rEbA,drbA | rE | See. 3.1.4 for details |
| AT | auto-tuning | OFF,on,FOFF | OFF | See. 3.1.5 for details |
| P | proportional band | 0~3200 °C/°F | 25 | See. 3.1.6 for details |
| I | integral time | 1~9999 Secs | 200 | |
| d | derivative time | 0~3200 Secs | 50.0 | |
| Ctl | control cycle time | 0.2~300.0 Secs | 2.0 | See. 3.1.7 |
| P2 | proportional band for cooling | 0~3200 °C/°F | 25 | See. 3.1.8 |
| I2 | Integral time for cooling control | 1~9999 Secs | 200 | |
| d2 | derivative time for cooling control | 0~3200 Secs | 50.0 | |
| Ctl2 | control cycle time for cooling | 0.2~300.0 Secs | 2.0 | See. 3.1.9 |
| CHYS | hysteresis for ON/OFF control | 0~2000 | 2 | See. 3.1.10 |
| InP | Input sensor code | 0~37 | 0 | See. 3.1.11 |
| dPt | decimal point | 0/0.0/0.00/0.000 | 0 | See. 3.1.12 |
| ScL | lower limit for analog input | -999~3200 | 0 | See. 3.1.13 |
| ScH | higher limit for analog input | -999~3200 | 1000 | |
| Scb | input offset | -999~4000 | 0 | See. 3.1.14 |
| FILt | Filter strength | 0~40 | 1 | |
| Fru | power frequency and C/F display selection | 50C/50F/60C/60F | 50C | See. 3.1.15 |
| oPt | output type | SSr/rELy/0-20/4-20/PHA1 | anyone of them | See. 3.1.16 |
| Aut | cooling output type | SSr/rELy/0-20/4-20 | anyone of them | See. 3.1.17 |
| oPL | output lower limit | -110~+110% | 0 | See. 3.1.18 |
| oPH | output higher limit | 0~+110% | 100 | |
| OEF | OPH effective range | -999~3200 | 3200 | |
| Addr | address | 0~80 | 1 | See. 3.1.19 |
| bAud | baud rate | 0~19200 | 9600 | See. 3.1.20 |
| Et | event input | nonE,ruSt,SP.1.2, PId2,Eact | nonE | See. 3.1.21 |
| AF | system function | 0~255 | 32 | See. 3.1.22 |
| PASd | access protection | 0~9999 | 0 | See. 3.1.23 |
| SPL | Setting value lower limit | -999~3200 | -999 | See. 3.1.24 |

| | | | | |
|---|---|---|---|---|
| SPH | Setting value higher limit | -999~3200 | 3200 | See. 3.1.24 |
| SP 1 | Set value 1 | -999~3200 | 0 | See. 3.1.25 |
| SP 2 | Set value 2 | -999~3200 | 0 | |
| EP1~EP8 | Field parameters | EP1=UPAL EP3=ESAL EP2=LOAL EP4=EIAL | N/A | See. 3.1.26 |

### 3.1.1 Alarm parameters

**UPAL**
-Absolute temperature value high alarm, if PV > UPAL , then alarm on.
If PV < UPAL-AHYS, alarm off. set UPAL=3200 will deactive the alarm. AHYS is alarm hysteresis

**LoAL**
-Absolute temperature value low alarm, if PV < UPAL , then alarm on.
If PV > UPAL+AHYS, alarm off. set LoAL=-999 will deactive the alarm.
AHYS is alarm hysteresis

**ESAL**
-Deviation high alarm, when PV-SV > ESAL, alarm on, when PV-SV < ESAL-AHYS, alarm off, set ESAL=3200 will deactive the alarm.

**EIAL**
-Deviation high alarm, when PV-SV > ESAL, alarm on, when PV-SV < ESAL-AHYS, alarm off, set ESAL=3200 will deactive the alarm

**AHYS**
-Deviation high alarm, when PV-SV > ESAL, alarm on, when PV-SV < ESAL-AHYS, alarm off, set ESAL=3200 will deactive the alarm

**AdIS**
When alarm is triggered, the alarm indicator will light up. at the same time,The lower display could display the alarm code "UPAL,LOAL, ESAL, EIAL" and setting value alternately, this is a visual warning for the operator to know that the alarm is triggered,if you put AdIS as "off" then the lower window won't display the alarm code when alarm is on, if you put AdIS as "on" then the lower window will display the alarm
code when alarm is triggered

**AOP**
Assign relays to different alarm, AL1 and AL2 refers to the two relays that are installed inside of the controller for alarm purpose, please do not confuse the relays with alarm parameter UPAL,LOALESAL,EIAL, The parameter AOP(alarm output defenition) allows user to select which relay to be triggered when the alarm set condition is met, You can set multiple alarms to active one relay(either AL1, AL2, AU1 or AU2) but you can't activate both relays with just one alarm. below is the format of the AOP value, the AOP value consist of a 4 digits number, like 4321. the numbers on the unit position defines which relay will be triggered when "UPAL" alarm is on, the numbers on the ten's position defines which relay will be triggered when "LoAL" alarm is on, the numbers on the hundred's position defines which relay will be triggered when "ESAL" alarm is on, the numbers on the thousand's position defines which alarm will be triggered when "ELAL" alarm is on.

$$AOP=\frac{4}{EIAL}\ \frac{3}{ESAL}\ \frac{2}{LoAL}\ \frac{1}{UPAL}$$

The range of the AOP is 0-4, 0 means no relay will be triggered even if alarm condition is met, 1 means AL1 relay will be triggered, 2 means AL2 relay will be triggered, 3 means AU1 relay will be triggered, 4 means AU2 relay will be triggered take "4321" as an example, it means that the AL1 relay will be triggered when UPAL alarm is ON, AL2 relay will be triggered when LOAL alarm is on, AU1 relay will be triggered when ESAL alarm is on, AU2 relay will be triggered when EIAL alarm is on. if you put AOP=3333, means all 4 different alarms when trigger the same relay which is AU1 relay.

### 3.1.2 Control mode(CtrL)

This controller incorporates 5 different control modes, the parameter code are OnoF, APID, nPID, PoP, SoP.
**OnoF**: ON/OFF control mode, for simple application which accuracy is not that critical
**APID**: Artifical intelligence PID control mode
**nPID**: Standard PID control mode
**PoP**: The controller will retransmit the PV value as analog output to feed to recorder or other device, this works if the main output is analog output
**SoP**:The controller will retransmit the SV value as analog output to feed to recorder or other device. this works if the main output is analog output

### 3.1.3 Controller status(Srun)

This parameters defines the controller status, available with 3 options, run, Stop ,Hold.
**Run**, controller at running mode
**StoP**, controller stop operating.

### 3.1.4 Direct/reverse or heating/cooling mode selection(Act)

This parameter available with 4 options, rE,dr, rEbA, drbA. these parameters are used to define the control action, whether you need heating or cooling control mode.
**rE**: reverse control mode, for heating application
**dr**: direct control mode, for cooling application
**rEbA**: reverse control mode with alarm suppression, unnecessary absolute low limit and deviation low limit alarm will be suppressed.
**drbA**: direct control mode with alarm suppression, unnecessary absolute high limit and deviation high alarm will be suppressed.

### 3.1.5 Auto-tuning switch(AT)

This parameter is auto-tuning switch parameter, OFF, on, FOFF
**OFF**: auto-tuning off
**on**: auto-tuning on
**FOFF**: auto-tuning off, and you can not activate the auto-tuning from the front panel

### 3.1.6 P.I.D values and PID control mode

Please note that this controller has two PID control mode, APID and nPID, nPID is a normal conventional PID control mode, it's similar to PID control mode from other controllers on the markets, APID is a unique fuzzy logic enhanced PID control with advance algorithm

In most cases the fuzzy logic enhanced PID control is very adaptive and may work well without changing the initial PID parameters. If not, users may need to use auto-tune function to let the controller determine the parameters automatically. If the auto tuning results are not satisfactory, you can manually fine-tune the PID constants for improved performance. Or you can try to modify the initial PID values and perform auto tune again. Sometimes the controller will get the better parameters.

(1)Proportinal constant "P"
Please note that the P constant is not defined as proportional band as in the traditional model under **APID** control mode, its unit is not in degrees. A larger constant results in larger and quicker action, which is the opposite of the traditional proportional band valve. it also functions in the entire control range rather than a limited band.
If you are controlling a very fast response system (>1°C/°F/second) that fuzzy logic is not quick enough to adjust, set the control mode as nPID will change the controller to the traditional PID system with a moderate gain for the P.
(2) Integral time "I"
Integral action is used to eliminate offset. Larger values lead to slower action. Increase the integral time when temperature fluctuates regularly (system oscillating). Decrease it if the controller is taking too long to eliminate the temperature offset. When I = 0, the system becomes a PD controller.

(3) Derivative time "D"
Derivative action can be used to minimize the temperature overshoot by responding to its rate of change. The larger the number, the faster the action.

### 3.1.7 Control cycle time for reverse/heating action

**CtL**: Control cycle time for reverse/heating action, for SSR, analog and phase angled output, the range will 1.0~3.0 seconds. for relay output, the value will be greater than 3 seconds, the most optimal value will be calculated via auto-tuning process(This is a big difference between our PID and other PID on the markets, most of PID on the markets , the cycle time are predetermined, but for our PID, the control cycle time will be calculated via auto-tuning process, this will increase the control accuracy dramatically)
Under ON/OFF control mode, the Ctl will be used to define the ON delay time. this is very useful for some of application with the compressor involved. they need this feature to protect the compressor.

### 3.1.8 P.I.D values for cooling control action

**P2**,**I2**,**d2** defines the P,I,D values for cooling control action, it is similar to the PID values which had been elaborated in 3.1.6.

### 3.1.9 Control cycle time for cooling control action

**Ctl2**, This parameter defines the control cycle time for cooling control action, it is similar to the parmater which had been elaborated in 3.1.7.

### 3.1.10 Hysteresis for ON/OFF control mode

**CHYS**, This parameters is used to remove the frequent ON/OFF action of the relay around the set point in an ON/OFF control situation. for reverse/heating control, the relay will release if PV>SV, and relay will pull-in when PV<SV-CHYS, for direct/cooling control application, the relay will release when PV<SV, and relay will pull-in when PV<SV+CHYS.

### 3.1.11 Input sensor code InP

**InP**, Please see table 2 for acceptable sensor type and its range

Table 2. code for InP input and its range.

| InP code | Input sensor type | Display range (° C) | Display range (° F) |
|---|---|---|---|
| 0 | K (thermocouple) | -50~+1300 | -58~2372 |
| 1 | S (thermocouple) | -50~+1700 | -58~3092 |
| 2 | R(thermocouple) | 0~1700 | 32~3092 |
| 3 | T (thermocouple) | -200~350 | -328~662 |
| 4 | E (thermocouple) | 0~800 | 32~1472 |
| 5 | J (thermocouple) | 0~1000 | 32~1832 |
| 6 | B (thermocouple) | 0~1800 | 32~3272 |
| 7 | N (thermocouple) | 0~1300 | 32~2372 |
| 8 | WRe(3/25)(thermocouple) | 0~2300 | 32~4172 |
| 9 | WRe(5/26)(thermocouple) | 0~2300 | 32~4172 |
| 10 | Special input | N/A | N/A |
| 12 | Radiant high temperature sensor | N/A | N/A |
| 17 | K, with 2 decimal point | 0~300.00 | 32~572.00 |
| 18 | J, with 2 decimal point | 0~300.00 | 32~572.00 |
| 20 | Cu50 | -50~+150 | 58~302 |
| 21 | Pt100 | -200~800 | -328~1472 |
| 22 | Pt100(-100~+300.00) | -100~+300.00 | -148~+572.00 |
| 15 | 4-20mA(specify when order) | -9990~32000 **defined** by user with SCL and SCH | |
| 16 | 0-20mA(specify when order) | | |
| 25 | 0~75mV | | |
| 26 | 0~80Ω | | |
| 27 | 0~400Ω | | |
| 28 | 0~20mV | | |
| 29 | 0~100 mV | | |
| 30 | 0~60 mV | | |
| 31 | 0~500mV | | |
| 32 | 100~500mV | | |
| 33 | 1~5V<br>4~20mA (w/ 250Ω Resistor) | | |
| 34 | 0~5V | | |
| 35 | 0~10V | | |
| 36 | 2~10V | | |
| 37 | 0~20V | | |

### 3.1.12. Decimal point setting (dPt)

The parameter dPT defines how many decimal point you will see for PV and SV value, the display format can be 0, 000.0 ,00.00 , 0.000. see table 4 for details

**1) Thermocouple and RTD**

For thermocouples and RTD sensors, dPt can be set to 0 or 0.0 or 0.00

when dPt=0, temperature display resolution is 1°C/F

when dPt=000.0, temperature display resolution is 0.1°C/F, the temperature will be displayed at the resolution for 0.1°C for input below 1000°C,display will be 1°C for input over 1000°C

For some of application where customer need 2 decimal points even when the input is K,J,PT100, in this case, the InP can be set as "17" "18" "22", and set "dPt" as 00.00, the display resolution will be 00.01°C/F

**2) Linear input(Voltage, current, or resistance input, InP=25~37)**

For other linear input signal, dPt can be set to all display format

Table 3. dPt parameter setting

| dPt value | 0000 | 000.0 | 00.00 | 0.000 |
|---|---|---|---|---|
| Display format | 0000 | 000.0 | 00.00 | 0.000 |

### 3.1.13 Limiting the control range, "SCL" and "SCH"

When you set InP=15,16, 25~37, the input will be analog inputs, parameter "SCL" and "SCH" are used for scaling display, "SCL" is the value to be displayed when the signal is at its low limit of the linear input, "SCH" is the value to be displayed when the signal is at its high limit of the linear input. for example, for 4-20mA signal,"SCL" corresponds to the value when signal is 4mA, and "SCH" corresponds to the value when signal is 20mA.

### 3.1.14 Input offset "Scb" and input filter strength "FILt"

Input offset Scb is used to add an offset value to compensate the sensor error or simply to shift the reading. for example, if the controller displays 2°C when probe is in ice/water mixture, setting Scb=-2, will shift the temperature reading to 0°C

If measurement input fluctuates due to noise, then a digital filter can be used to smooth the input. "FILt" may be configured in the range of 0 to 40. Stronger filtering increases the stability of the readout display, but causes more delay in the response to change in temperature. FILt = 0 disables the filter.

### 3.1.15 Frequency of power supply and display unit

These parameters have 4 options, "**50C**" "**50F**" "**60C**" "**60F**". 50 means the power supply is 50HZ AC source, C means the display will be in Celcius, 60 means the source is 60HZ AC source, F means the display will be in Fahrenheit ,to have a most optimal anti-inteference effect, make sure to choose the frequency according to your source, for instance, a typical north America source,the supply will be 110V 60HZ and display in Fahrenheit, in this case, user should chose 60F. for a domestic user in china, the setting will be 50C, 50HZ in Celcius unit.

### 3.1.16. Output definition "oPt"

These parameter defines the output type, options are "**SSr**", "**rELy**" "**0-20**", "**4-20**" "**PHA1**" These parameters are not applicable for this model

### 3.1.17. Output definition for cooling action "Aut"

This parameter is not applicable for this model

### 3.1.18 Output range limits "oPL" and "OEF" "oPH"

oPL and oPH allows you set the output range low and high limit. oPL is a useful feature for a system that needs to have a minimum amount of power as long as the controller is powered. For example, if oPL=20, the controller will maintain a minimum of 20% power output even when input sensor failed.

OEF assign the effective range of the output high limit function. makes the OPH function relevant to the process value, if the PV< OEF, the output high limit function kicks in, when PV>OEF, the output high limit function will be disengaged. this is very useful for some of application where the maximum power has to be under certain degree when the temperature less than certain value. for example, if you put OEF=300°C, and OPH=20%, when PV<300°C, the maximum output will be 20% ,when PV increase and eventually greater than 300°C, the maximum output will be no longer 20%, the limits will be 100%. the actual output will be determined by the controller itself.

### 3.1.19 Device address "Addr"

This controller available with RS-485 option, one may integrate this controller to a communication system, this parameters defines the address of the controller. the

### 3.1.20 Communication speed baud rate "bAud"

This parameter defines the communication speed between controller and other device such as PLC. the options are 1200bps,2400bps,4800bps,9600bps,19200 bps.

### 3.1.21 Even input configuration "Et"

Controller with event input function as an option, this parameter makes sense if you order controller with event input function. it has several options "**nonE**" "**ruSt**" "**SP1.2**" "**Pid2**" "**EACt**"

**nonE**: event input function disabled, this is factory default value

**ruSt**: this parameter only applicable for ramp and soak controller

**SP1.2**:a remote switch can be used to switch the SV between SV1 and SV2

**Pid2**:This controller can have up to two groups of PID values, P,I,D and Ctl as the First group of PID values, P2,I2,d2 and Ctl2 as second group of PID values, release the switch will assign the First group of PID values to the control process, which means P.I.D and Ctl kicks in, if the switch pull-in, second group of PID values, P2,I2, d2 will kick-in.

**EACt**: If this parameter is assigned to "Et", a remote switch be used to switch the control mode between heating/cooling mode, release the switch will put the controller on heating mode with P, I, D , CtL parameters kick-in, pull-in the switch will put the controller on cooling mode with the P2,I2,D2 Ctl2 kick-in. the "Act" will be altered automatically.

**3.1.22 "AF" system function configuration**

Parameter "AF" is used to some of advanced system functions of this controller, below is the details on how to calculate the AF value based on below formula.

**AF**= A x 1+ B x 2+ C x 4 +D x 8 + E x 16+ F x 32 + G x 64 + H x 128

**A**=0, ESAL and EIAL will be deviation alarm, **A**=1, ESAL and EIAL will be absolute alarm, if you put A=1, then the controller will have 2 group of absolute high limit alarm and 2 group of absolute low limit alarm.
B=0, Hysteresis for alarm and ON/OFF control will be unilateral hysteresis, if B=1. the hysteresis for will be bilateral hysteresis.
C=0, Bar graphics shows the output value, C=1, bar graphics shows the PV value
D=0, Password for engineering parameters is "808", D=1, password for engineering parameters is "PASd" you can assign any password to have a greater protection against unauthorized access.
E=0, UPAL and LOAL will be absolute high and absolute low alarm, if E=1, UPAL and LOAL will be switched to deviation high and deviation low alarm, together with ESAL and EIAL, the controller could have 2 groups deviation high alarm and 2 groups of deviation low alarm.
F=0, Ultra precision control mode, the actual control resolution is 10 times higher than the display, for analog input, the maximum display is 3200, F=1, conventional control accuracy, set F=1 if the display will exceed 3200.
G=0, The absolute high alarm will be triggered if temperature sensor break apart
G=1, The absolute high alarm won't be triggered if temperature sensor break apart.
If you put AF=160, the communication protocol will be RS-485 mode.

**3.1.23 "PASd" engineer parameter access configuration**

When PASd=0~255, or AF.D=0, you put LOC=808 will enable the user to access entire engineer parameters.
If PASd set to value between 256~9999 and AF.D=1, the engineering parameters can't access without input the password assigned under PASd, for example, if you set PASd=2687, to access to engineer parameters, user have to key-in password 2687 to access the engineer parameters.

**3.1.24 "SPL" and "SPH" setting value low limit and high limit**

SPL is setting value low limit, SPH is the setting value high limit, for example, if you put SPL=0 and SPH=400, the setting value will be from 0~400.

**3.1.25 "SP1" and "SP2" dual setting value.**

Controller can also be used as a standard PID controller, in this case, two setting values can be assigned to the same controller, when Et=SP1.2, a remote switch can be used to switch the setting value between SP1 and SP2, for example, if SP1= 100, SP2=400, at some point, user might want to use the controller with the setting value at SP1(100), in this case, you can switch the SV back and forth between SP1 and SP2. this parameter only works for panel mount version of MAU90

**3.1.26 "EP1~EP8" field parameters and access protection parameter "Loc"**

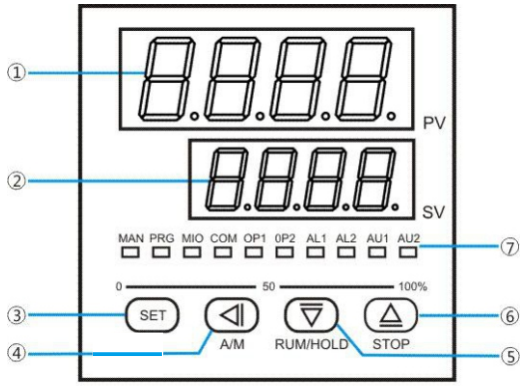
By assigning system parameters as Field Parameters (EP1 ~ EP8), you can select which parameter can be displayed or changed when controller is locked. Up to 8 parameters can be assigned as Field Parameter. The Field Parameter can be any parameter listed in Table 2 except Field parameters themselves and the Loc parameter.
By setting Loc to different values, different access privilege can be granted to user, if Loc=0, user can access and configure parameters under field parameter EP1~EP8 ,all shortcut and setting value, step time duration are configurable.
Loc=1, user can access and configure parameters under field parameter EP1~EP8 ,all shortcut and setting value, step time duration are configurable, but user can not Run, Stop, Pause, execute auto-tuning on the controller.
Loc=2, user can not access to the field parameter list, but user can Run,Stop,Pause, and execute the auto-tuning on the controller.
Loc=3, user can access and configure parameter under field parameter list, all short cut operation is disabled.
Loc=4~255, All parameters are locked expect the Loc parameter itself.

To prevent the parameters and the program being changed accidently, you can completely or partially lock the parameters and the program after the initial setup. the configuration privilege is determined by "Loc", please refer to the table 5 for the privilege levels.

Table 4. "Loc" value and the configuration privilege level

| Loc value | Privilege | EP1 - 8 Adjustment | Program Adjustment | Step Selection |
|---|---|---|---|---|
| 0 | limited | Yes | Yes | Yes |
| 1 | | Yes | No | Yes |
| 2 | | Yes | No | No |
| 3 and up | | No | No | No |
| 808 (Default) | unlimited | Yes | Yes | Yes |
| PAsd | unlimited | Yes | Yes | Yes |

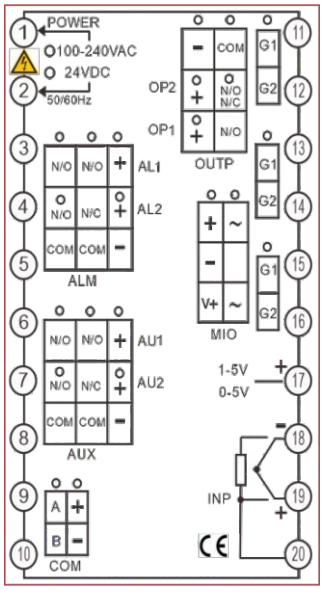
## 4:Front panel and display



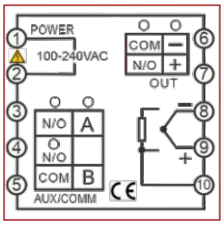

① Upper display
② Lower display
③ Set key
④ Shift key(Auto/manual transfer key)
⑤ Decrease key
⑥ Increase key
⑦ 10 LED indicators, MAN indicator off means auto control mode MAN on means manual control mode, PRG means ramp and soak control mode, MIO, OP1,OP2,AL1,AL2,AU1,AU2, indicates respective function,COM indicates the communication status

Right after power on, the controller goes to PV/SV display mode if the lower display shows "orAL" and flashes, means over range or input code has not been configured correctly the output will be put to "0" if this happens

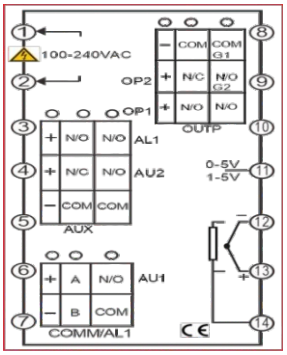
## 5:Wiring diagram




1): Thermocouple and signal less than 500mV goes to terminal 19 and 18, 19 positive, 18 negative
2): 0-5V and 1-5V goes to 17 and 18, 17+, 18-
3): Jump a 250 ohm resistor to terminal 17 and 18 for 4-20mA input, or you can choose an input modular with 24VDC, then 4-20mA goes to terminal 14 and 15
4)RTD goes to terminal 18, 19, 20
5)Communication goes to terminal 9 and 10
6)alarm or auxiliary output goes to terminal 3,4,5 and 6,7,8
7)Analog output goes to terminal 13 and 11, SSR drive output goes to terminal 13 and 11




For size 48mm*48mm. the number of terminals are limited
1)Input goes to terminal 8,9,10
2)output goes to terminal 6 and 7
3)Communication or alarm goes to terminal 3,4,5
4)Power supply goes to terminal 1 and 2




1): Thermocouple and signal less than 500mV goes to terminal 12 and 13, 12 positive, 13 negative
2): 0-5V and 1-5V goes to 11 and 12, 11+, 12-
3): Jump a 250 ohm resistor to terminal 11 and 12 for 4-20mA input,
4)RTD goes to terminal 12, 13, 14
5)Communication or alarm goes to terminal 6 and 7
6)alarm or auxiliary output goes to terminal 3,4,5