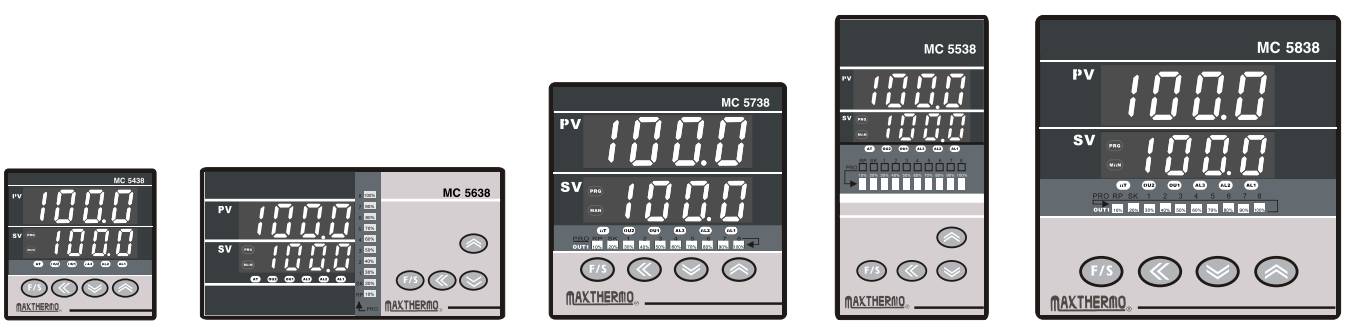
# MAXTHERMO-GITTA GROUP CORP
# MAXIMUM ELECTRONIC CO., LTD

## Temperature PID Controllers

## OPERATIONAL MANUAL

MAXTHERMO®

MC 5438 / MC 5538 / MC 5638
MC 5738 / MC 5838

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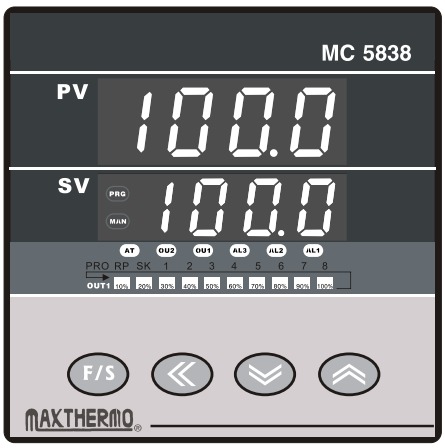



## Display unit & Indication lamps

| |
|---|
| **PV** =Measured value display |
| **SV** =Set value dispaly |
| AL1 =Alarm 1 output lamp |
| AL2 =Alarm 2 output lamp |
| AL3 =Alarm 3 output lamp |
| OU1 =Control output 1 lamp |
| OU2 =Control output 2 lamp |
| AT =Autotuning lamp |
| MAN =Manual mode lamp |
| 10% ~ 100% =Manipulated output value display |
| PRG = Programmable mode lamp |
| 1~8 = Segment-in-process display lamp |
| RP = Ramping mode lamp(programmable mode only) |
| SK = Soaking mode lamp (programmable mode only) |

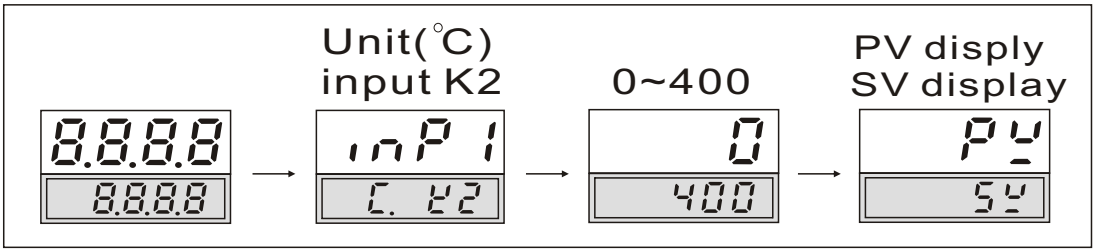
## Operation keys

| |
|---|
| F/S =Function & Set key |
| =Shift key |
| =Down key |
| =Up key |
| Press 3 sec while the SV is not flashing = Used for returning to initial window. |
| Press 3 sec while in level selection window= Used for calling up lock function. |
| Press 3 sec while in pv/sv initial window= Used for stopping output and SV window will display "HOLD", press 3 sec again to regain output. (This function is available only while OUTM is selected 1 or 2) |
| Press 3 sec while in pv/sv initial window= Used for calling up level selection. |
| Press 3 sec while in level selection window= Used for entering each level. |

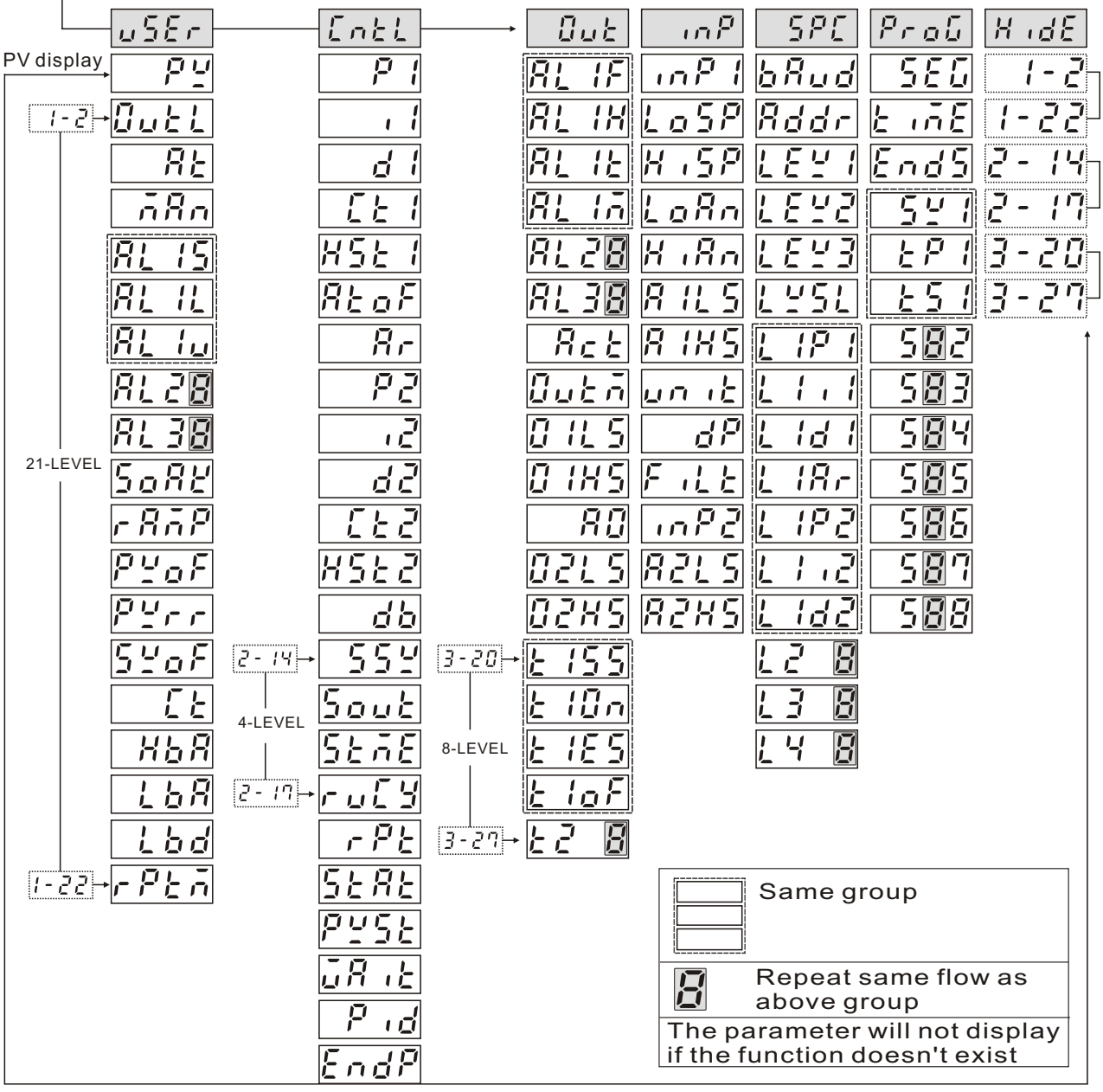
## Operation keys (programmable mode only)

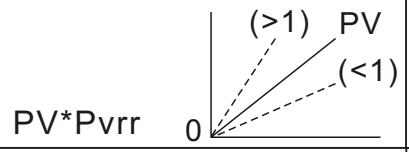
| These keys are only operated in PV/SV initial window. | |
|---|---|
| 3SEC Run | PRG lights,RP or SK flashes The executing segment lamp lights. |
| 3SEC Pause | PRG, RP and SK light The executing segment lamp lights. |
| + F/S Jump | Jump to the next segment, press first. |
| + F/S Stop | Turn off all lamps which used for programmable mode, press first. |
| Refer to arrow When PRG Lights(No PRG light in MC-5438 ). | |

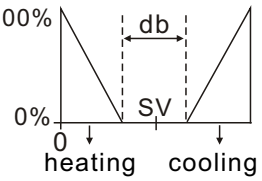
## Window checks display after turning on power




## LEVEL Parameter flow chart



| Parameter | | DESCRIPTION | RANGE | Initial value |
|---|---|---|---|---|
| PV | Pv | Process value | LoSP~HiSP | |
| SV | Sv | Set value | LoSP~HiSP | 0.0 |
| uSEr | ▼ | | | |
| OutL | OutL | Output percentage | 0.0~100.0% | 0.0 |
| At | At | Auto tuning | No / yes | no |
| Man | Man | Manual mode | Man1 =power failure memory<br>Man2 =no memory No=non | no |
| AL1S | AL1S | Alarm 1 set value | If ALIF set at 1 or 2, range=-200~200<br>If ALIF set at 3 or 4, range=Losp~Hisp<br>If ALIF set at 10, range=1-8 segment ending | 10.0 |
| AL1L | AL1L | Alarm 1 lower set value | 0~200 | 10.0 |
| AL1u | AL1u | Alarm 1 upper set value | 0~200 | 10.0 |
| AL2S AL3S | | AL2S / AL3S For operating functions same as the above descriptions | | |
| SoAK | SoAK | Perform only when AL1M set at 10 or 11 (Refer to explanation on page 7) | 0.00~99.59 (h.m) | 0.00 |
| rAmP | rAmP | Ramp<br>(Refer to explanation on page 7) | 0.0~200.0/m | 0.0 |
| PvoF | PvoF | Pv offset<br>(Refer to explanation on page 7) | -200~200 | 0.0 |
| Pvrr | Pvrr | Pv ratio<br>(Refer to explanation on page 7) | 0.001~9.999<br>  | 1.000 |
| SvoF | SvoF | Sv offset<br>(Refer to explanation on page 7) | -200~200 | 0.0 |
| Ct | Ct | Current transformer monitor<br>(Refer to explanation on page 7) | 0.0~100.0A | |
| HbA | HbA | Heater break alarm value<br>(Refer to explanation on page 8) | 0.1~100.0A | 0.1 |
| LbA | LbA | Control loop break alarm time<br>(Refer to explanation on page 8) | 0.1~200.0 min | 8.0 |
| Lbd | Lbd | LBA dead band<br>(Refer to explanation on page 8) | 0.0~200.0 | 0.0 |
| rPtn | rPtn | Repeat times monitor<br>Only use in program function<br>(Refer to explanation on page 8) | 1~1000 | |

| Parameter | | DESCRIPTION | RANGE | Initial value |
|---|---|---|---|---|
| CntL | ▼ | | | |
| P1 | P1 | Output 1 proportional band | 0.0~3000 | 30.0 |
| i1 | i1 | Output 1 integral time | 0~3600 sec | 240 |
| d1 | d1 | Output 1 derivative time | 0~900 sec | 60 |
| Ct1 | Ct1 | Output 1 cyclic time<br>(Refer to explanation on page 8) | 0~150 sec | 15 |
| HSt1 | HSt1 | Output 1 hysteresis | 0.0~200.0 | 0.0 |
| AtoF | AtoF | At offset<br>(Refer to explanation on page 8) | -200~200 | 0.0 |
| Ar | Ar | Anti-reset windup<br>(Refer to explanation on page 8) | 0~100.0% SV-P1 x Ar | 100.0 |
| P2 | P2 | Output 2 proportional band | 0.0~3000 | 30.0 |
| i2 | i2 | Output 2 integral time | 0~3600 sec | 240 |
| d2 | d2 | Output 2 derivative time | 0~900 sec | 60 |
| Ct2 | Ct2 | Output 2 cyclic time | 0~150 sec | 15 |
| HSt2 | HSt2 | Output 2 hysteresis | 0.0~ 200.0 | 0.0 |
| db | db | Dead band/overlap | -200.0~200.0<br>  | 0.0 |
| SSv | SSv | Soft start set value<br>(Refer to explanation on page 8) | 0.0~200.0 (see fig 2) | 120.0 |
| Sout | Sout | Soft start output percentage<br>(Refer to explanation on page 8) | 0.0~100.0% (see fig 2) | 30.0 |
| StmE | StmE | Soft start failed time<br>(Refer to explanation on page 8) | 0~10 min (see fig 2) | 10 |
| ruCy | ruCy | Motor valve cyclic time<br>(Refer to explanation on page 8) | 1~150 sec (see fig 3) | 5 |
| rPt | rPt | Program executing times<br>(Refer to explanation on page 8) | 1~1000 (see fig 4) | 1 |
| StAt | StAt | Start mode selection<br>use in program function only<br>(Refer to explanation on page 8) | CoLd = manual<br>rSET=start after power ON<br>Hot=<br>start from memory of power failure | CoLd |
| PvSt | PvSt | Start point selection<br>use in program function only | RSEt = start from 0<br>Pv = start from PV | rSEt |
| wAit | wAit | Wait value in program<br>(Refer to explanation on page 8) | 0.0~200.0 | 0.0 |
| Pid | Pid | PID/Level PID selection<br>(Refer to explanation on page 9) | Pid =Pid<br>Lpid =Level Pid | Pid |
| EndP | EndP | Selects control when program ended<br>(Refer to explanation on page 9) | Cont = Continue<br>StoP = One program only<br>(see fig 4) | StoP |

| Parameter | | DESCRIPTION | RANGE | Initial value |
|---|---|---|---|---|
| Out ▼ | | | | |
| AL1F | AL1F | Alarm 1 action function | 0~12 (see table 1) | 1 |
| AL1H | AL1H | Alarm 1 hysteresis | 0.0~200.0 | 0.0 |
| AL1t | AL1t | Alarm 1 in program mode on time | 0.00~99.59 (h . m) | 0.00 |
| AL1m | AL1m | Alarm 1 special mode selection | (see table 2) | 0 |
| For operating functions refer to the above descriptions<br>Different function see(1),(2),(3)<br>AL2F AL2F (1)AL2M Alarm 2 special mode selection (See Table 2 ) 0~7<br>AL3F AL3F (2)AL3F Alarm 3 action function (See Table 1 ) 0~11<br>(3)AL3M Alarm 3 special mode selection (see Table 2 ) 0~7 | | | | |
| Act | Act | Control action selection | CooL / HEAt | HEAt |
| Outm | Outm | Output mode selection<br>This parameter is skiped,<br>opening it needs to contact distributor (see table 3) | | 1 |
| O1LS | O1LS | Output 1 scale low | 0.0~100.0% | 17.6 |
| O1HS | O1HS | Output 1 scale high | 0.0~100.0% | 96.0 |
| AO | AO | Analog output selection | Pv=transmit PV<br>Sv=transmit SV<br>dEv=transmit (PV-SV)<br>Mv=transmit output percentage | Pv |
| O2LS | O2LS | Output 2 and transmission scale low | 0.0~100.0% | 17.6 |
| O2HS | O2HS | Output 2 and transmission scale high | 0.0~100.0% | 96 .0 |
| t1SS | t1SS | Time signal 1 start segment setting<br>Use in program function only<br>(Refer to explanation on page 9) | 1~8 | 1 |
| t1On | t1On | Time signal 1 on time setting<br>Use in program function only<br>(Refer to explanation on page 9) | 0.00~99.59 (h . m) | 0.01 |
| t1ES | t1ES | Time signal 1 end segment setting<br>Use in program function only<br>(Refer to explanation on page 9) | 1~8 | 1 |
| T1oF | T1oF | Time signal 1 off time setting<br>Use in program function only<br>(Refer to explanation on page 9) | 0.00~99.59 (h . m) | 0.01 |
| t2SS | t2SS | For operating functions refer to the above descriptions | | |

| Parameter | | DESCRIPTION | RANGE | Initial value |
|---|---|---|---|---|
| inP | ▼ | | | |
| inP1 | inP1 | Input 1 selection | (see table 4) | K2 |
| LoSP | LoSP | Low setting limit | LOSP~HISP | 0.0 |
| HiSP | HiSP | High setting limit | LOSP~HISP | 400.0 |
| LoAn | LoAn | Analog input range low | -1999~9999 | 0.0 |
| HiAn | HiAn | Analog input range high | -1999~9999 | 100.0 |
| A1LS | A1LS | Analog input 1 scale low | 0~FFFF | |
| A1HS | A1HS | Analog input 1 scale high | 0~FFFF | |
| unit | unit | Unit selection | °C /°F / non | °C |
| dP | dP | Decimal point | 0/0.0/0.00/0.000 | 0.0 |
| FiLt | FiLt | Digital filter (see fig 5) | 0.001~1.000 Non = no function Ct = use for heater break alarm rmSV= use for remote SV | 0.600 |
| inP2 | inP2 | Input 2 selection | | non |
| A2LS | A2LS | Analog input 2 scale low | 0~FFFF | |
| A2HS | A2HS | Analog input 2 scale high | 0~FFFF | |
| SPC | ▼ | | | |
| bAud | bAud | Baud rate | 2.4K / 4.8K / 9.6K 19.2K / 38.4K | 9.6K |
| Addr | Addr | Address | 0~31 | 0 |
| LEV1 | Lev1 | Set the range for level1 PID ( see fig 6 ) (act only when level PID is selected) | LoSP~HiSP | 400 |
| LEV2 | Lev2 | Set the range for level2 PID ( see fig 6 ) (act only when level PID is selected) | LoSP~HiSP | 400 |
| LEV3 | Lev3 | Set the range for level3 PID ( see fig 6 ) (act only when level PID is selected) | LoSP~HiSP | 400 |
| LvSL | LvSL | Watched PID level selection, the level is selected which will display below | 1~4 refer to explanation on page 9 | 1 |
| L1P1 | L1P1 | Output 1 proportional band for level 1 | 0.0~3000 | 30.0 |
| L1i1 | L1i1 | Output 1 integral time for level1 | 0~3600 sec | 240 |
| L1d1 | L1d1 | Output 1 derivative time for level1 | 0~900 sec | 60 |
| L1Ar | L1Ar | Anti-reset windup for level1 | 0.0~100.0% | 100.0 |
| L1P2 | L1P2 | Output 2 proportional band for level 1 | 0.0~3000 sec | 30.0 |
| L1i2 | L1i2 | Output 2 integral time for level1 | 0~3600 sec | 240 |
| L1d2 | L1d2 | Output 2 derivative time for level 1 | 0~900 | 60 |
| L2P ~ 4 | | The same as level 1 | | |

| Parameter | DESCRIPTION | RANGE | Initial value |
|---|---|---|---|
| ProG ▼ | | | |
| SEG SEG | Program segment monitor | 1~8 | |
| tiME TimE | Program countdown monitor | | |
| EndS EndS | Program segment end setting | 1~8 | 1 |
| SV1 Sv1 | Sv in segment 1 (see fig 7) | LoSP~HiSP | 100 |
| tP1 tP1 | Program time in segment 1 (see fig 7) | 0.00~99.59 (H.M) | 0.00 |
| tS1 tS1 | Soak time in segment 1 (see fig 7) | 0.00~99.59 (H.M) | 0.00 |
| SV2~8 | The same as segment 1 | | |
| HIdE ▼ | | | |
| 1-12~1-22 | Parameter shows with respect to this position | non~t2of | |
| 2-14~2-17 | Parameter shows with respect to this position | non~t2of | |
| 3-20~3-27 | Parameter shows with respect to this position | non~t2of | |

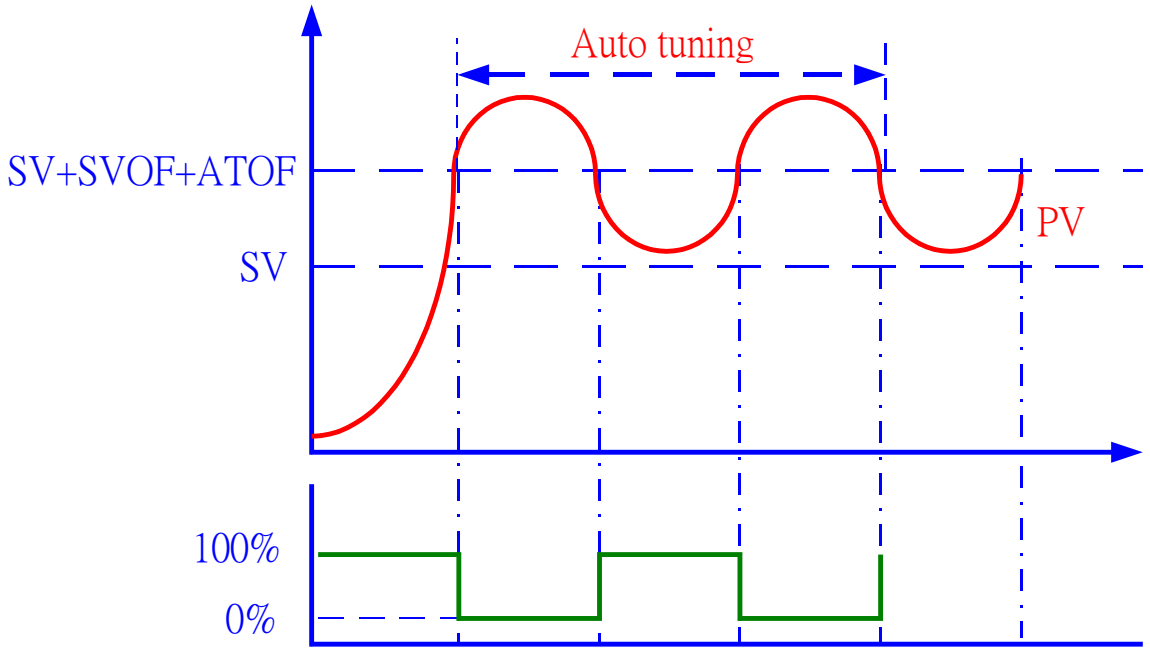
# PARAMETER EXPLANATIONS

| | |
|---|---|
| SoAK | It performs only when AL1M set at 10 or 11, and when the controller is without program function. If you set AL1M at 10, AL1 shift to soak function and contactor will be normal open; if you set AL1M at 11, then AL1 shift to soak function but the contactor is normal close. |
| rAmP | It is for setting PV to increased or decreased according to the set value when the controller is without program function. For example: If rAmP is set at 10 ,PV will increase 10°C per minute, but if PV is higher than SV,PV will decrease10°C per minute. |
| PvoF | When PV is not correct with SV, you can adjust this parameter with (+) or (-). |
| Pvrr | It's for adjusting PV be more accurate. The formulation is PV (now) = PV (pre) X Pvrr + PVOF. |
| SvoF | When SV is not correct with PV, you can adjust this parameter with (+) or (-). |
| Ct | It's for detecting current to see whether the heater is broken. Display value:0.0~100.0A. When you order CT function, a small C.T. is included. |

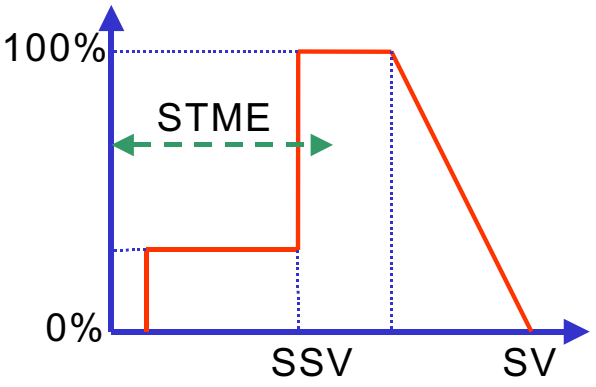
| | |
|---|---|
| HbA | Heater break alarm set value. Set value range: 0.1 ~100.0 A.<br>For Example:<br>a. When the current is low or off, but the control output is on, and CT<=HBA, it means the heater is broken, and the alarm will be on.<br>b. When the current is over or short-circuit, but control output is off, and CT>=HBA, the alarm is on.<br>(The CT and HBA parameter work only when you order the heater break alarm function). |
| LbA & Lbd | Parameters for loop break alarm.<br>For Example:<br>a. When OutL is 0.0% and LBA time is elapsed, PV should be below LBD ; if it is still within the LBD determination range, the alarm will be on.<br>b. When OutL is 100.0% and LBA time is elapsed, PV should be higher then LBD, if it is still within the LBD determination range, alarm will be on. (LBA and LBD works via software setting, no need to ordering extra components). |
| rPtm | It shows how many times the program runs at the moment.<br>This parameter works when your PID controller is with program function. |
| Ct1 | It's for setting ON-OFF cyclic time of output 1, normally it is set at 0 for 4~20mA output, 1 for SSR drive output, 15 for relay output. |
| Ar | It's a solution for preventing over-shooting.<br>This parameter makes the Integral delay. The setting range is from 0 to 100%; initial value 100% means integral will perform when PV reaches proportional band, but if you set Ar at 50%, it means the integral will perform when PV reaches 50% of proportional band. |
| SSV | It's for setting soft start range, when you do not want the heating system to go up too quick at the beginning, you may set SSV.<br>For Example:<br>If you want the temperature to go up slowly under 120°C, you may set SSV at 120. |
| Sout | It is for setting the output percentage under SSV ; if you want to the output to be 50%, you may set it at 50. |
| StmE | It is for setting soft start failure time. When the PID controller reaches the StmE time, but PV does not reach SSV, it means soft start fails, and then the Controller will revert to SV. |
| RuCy | It is for the setting motor valve cyclic time from close to open a time or from open to close. |
| rPt | It's for setting how many times the program process is executed. |
| StAt | It is for setting when the program procedure starts.<br>Cold is to start by manual, rSET is to start after power on.<br>Hot is to start from memory of power failure. |
| wAit | It is for setting the value, for which SV will wait PV if PV goes up slowly than SV. |

| | |
|---|---|
| Pid | In this parameter, you can choose the controller with one PID performing only or multiple level-PID (LPID) performing, if you choose LPID you can set 4 levels of different PID. |
| Endp | It is for setting when the program ends, to run for one time only or to be continued. |
| tiSS | It is for setting in which segment you want the time signal alarm to start (in program function).<br>For Example:<br>If you want it to alarm in segment 2, you may set it as 2 . |
| tiOn | It is for setting in what time you want the alarm to perform.<br>For Example:<br>If your segment 2 is set as 10 minutes and you want the controller to alarm at the 6$^{th}$ minute, you may set tiOn 6$^{th}$ in this case the alarm will perform in segment 2, and start from the 6$^{th}$ minute. |
| t1Es | It is for setting in which segment you want the time signal to end (in program function).<br>For Example:<br>If you want it to end in segment 5, you may set it as 5 . |
| T1oF | It is for selecting what time you want the alarm to end.<br>For Example:<br>If your segment 5 is set as 5 minutes and you want the alarm to end at 3$^{rd}$ minute, you may set T1oF as 3 in this case the alarm will end at the 3$^{rd}$ minute in segment 5. |
| LvsL | It is for selecting which level of PID you have set; then you can watch its PID value.<br>For Example:<br>If you set it as 3, you can watch L3P1, L3I1, L3d1 .....<br>But first you need to set the Pid parameter in CntL Level as Lpid, and Lev1 to Lev3 in SPC level. |

# Fig 1. PID Auto Tuning




# Fig 2. Soft Start




SSV

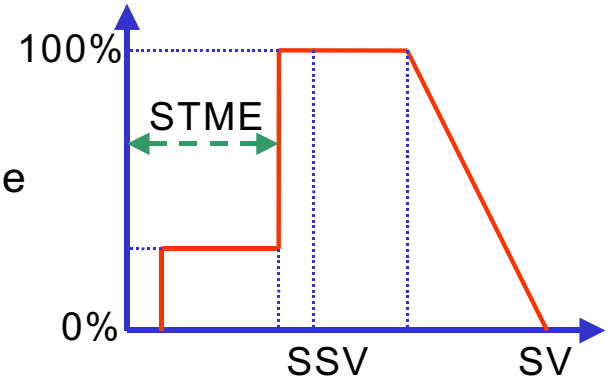
Soft start set value

SOUT

Soft start output percentage

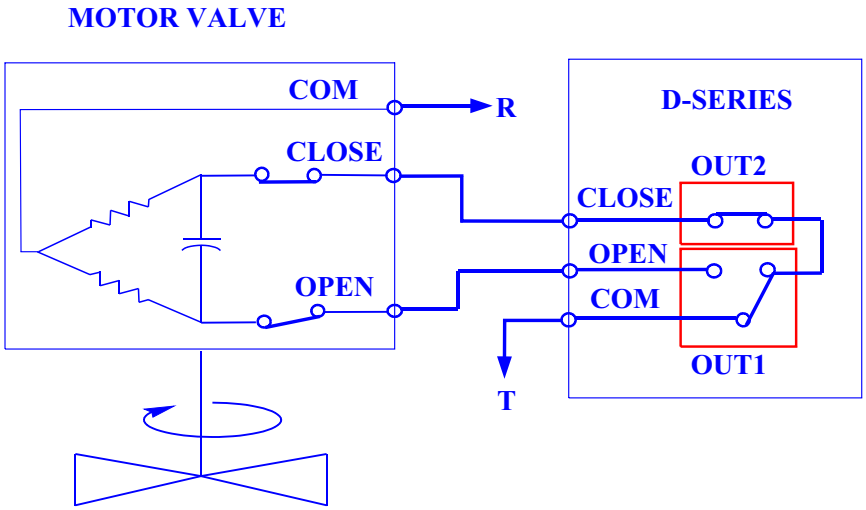
STME

Soft start failed time



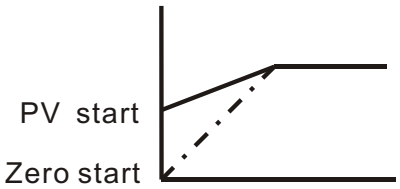
# Fig 3. Motor Valve Control

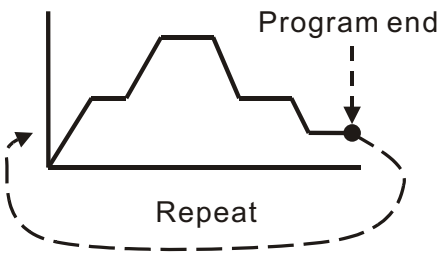
RUCY
Motor valve cyclic time



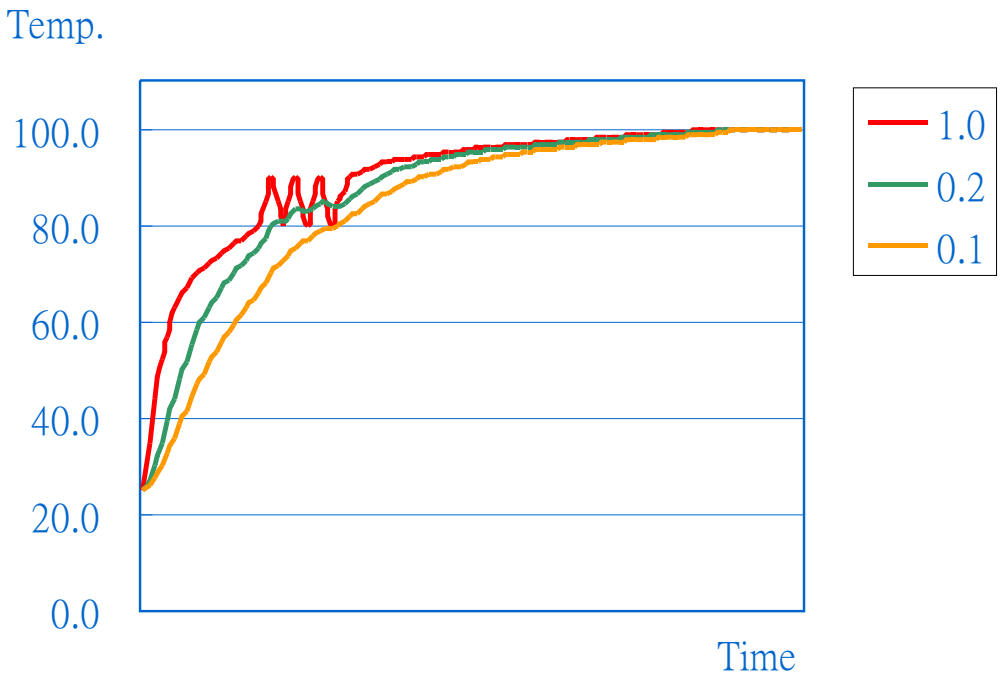

# Fig 4. Program Control (Con't)

| | |
|---|---|
| RPTM | Repeat times monitor |
| RPT | Program execution times setting |
| STAT | Start mode selection |
| PVST | Start point selection |
| WAIT | Wait zone |
| ENDP | Selects control when program ended |
| SEG | Program segment monitor |
| TIME | Program countdown monitor |
| ENDS | Program end segment setting |



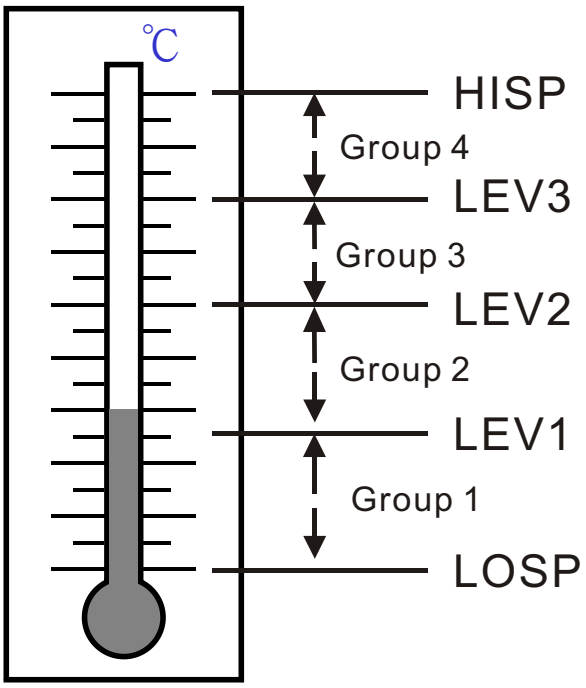



# Fig 5. Digital Filter(con't)

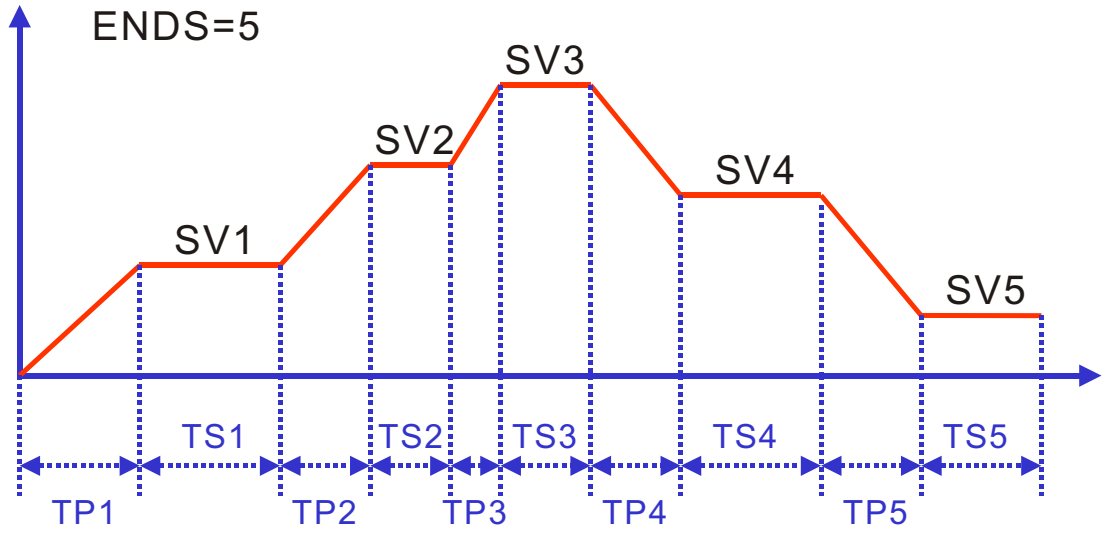



# Fig 6. Level PID

| PID | PID/level PID selection |
|---|---|
| LEV1 | Level 1 |
| LEV2 | Level 2 |
| LEV3 | Level 3 |
| LVSL | Levels selection |
| L1P1 | P1 for group 1 |
| L1I1 | I1 for group 1 |
| L1D1 | D1 for group 1 |
| L1AR | AR for group 1 |
| L1P2 | P2 for group 1 |
| L1I2 | I2 for group 1 |
| L1D2 | D2 for group 1 |



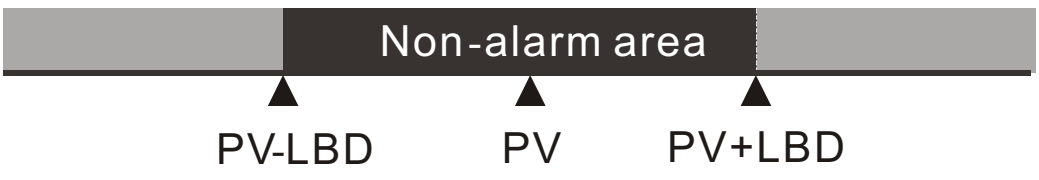
# Fig7. Program Control




# Fig8. Loop Break Alarm

OUTL=0.0%
LBA time elapsed
PV is still within
determination range

OUTL=100.0%
LBA time elapsed
PV is still within
determination range



# Fig 9. Heater Break Alarm

Low or No current flow

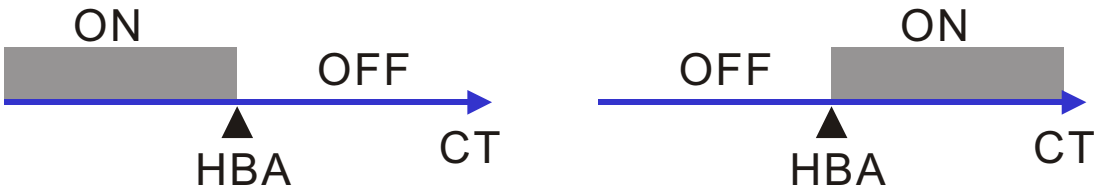
Control output is ON

CT <= HBA

Over current or short-circuit

Control output is OFF

CT >= HBA




# Fig 10. Segment Ending Alarm

AL1F

10

AL1S

1~8 segment

AL1T

0.00

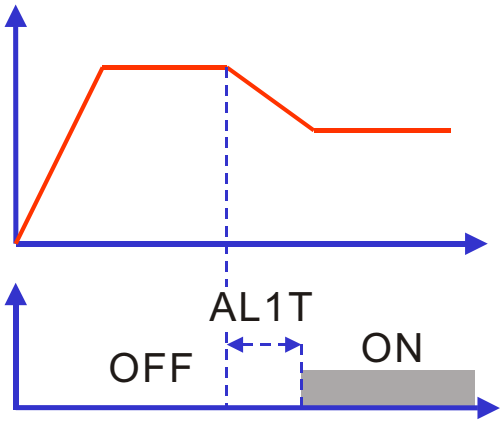
Flicker alarm

99.59

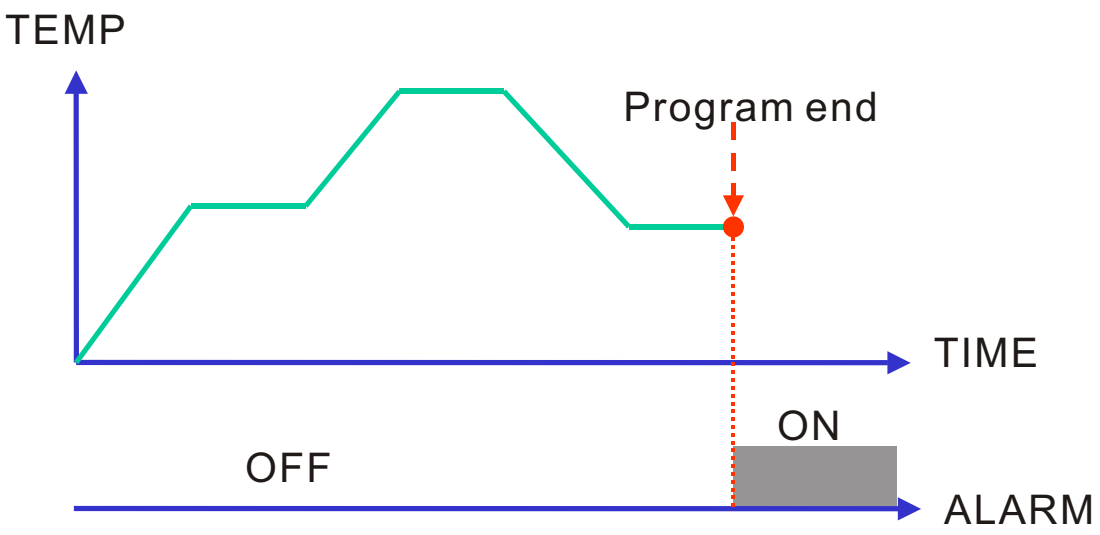
Continued alarm

Others

ON delay time



# Fig 11. Program Ending Alarm



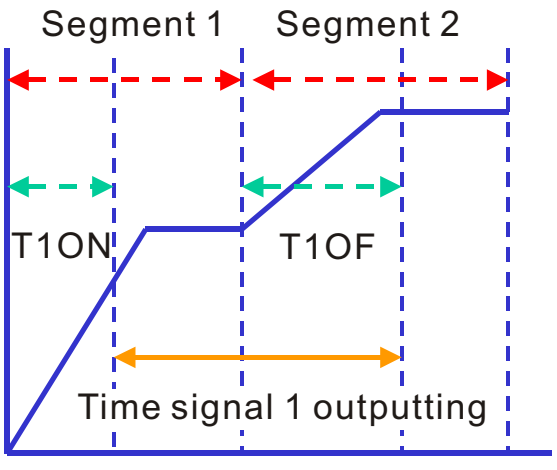

# Fig 12. Time Signal Alarm

T1SS
Time signal 1 start segment setting

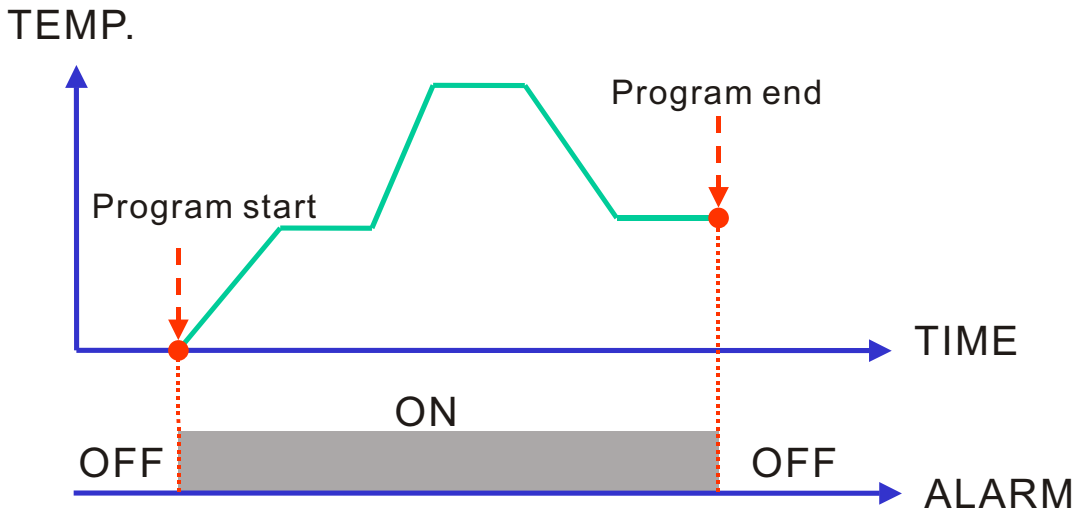
T1ON
Time signal 1 on time setting

T1ES
Time signal 1 end segment setting

T1OF
Time signal 1 off time setting



# Fig 13. Program Running Alarm




# Fig 14. Communication Protocol

**Interface**

RS-485
RS-232

**Baud rate**

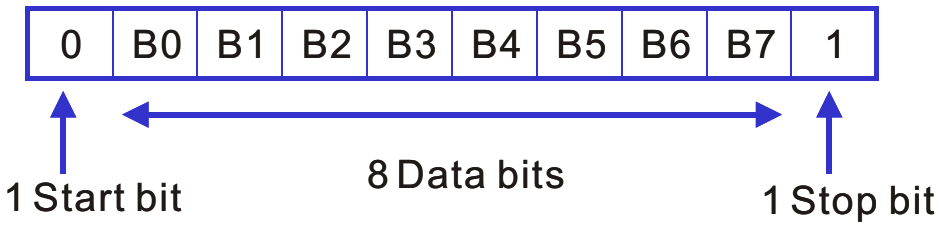
2400
4800
9600
19200
38400

**Data frame**

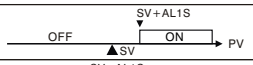
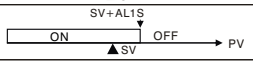
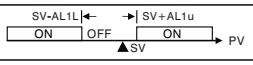
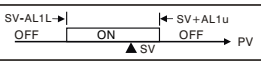
Data Bits=8
Parity = None
Start bit = 1
Stop bit = 1

**Data format**

ModBus Protocol RTU Mode



## Table1. Alarm Mode Selection (Used in ParameterAL1F,AL2F,AL3F)

| AL1F | AL2F | AL3F | Alarm function selection | |
|---|---|---|---|---|
| 0 | 0 | 0 | No alarm | |
| 1 | 1 | 1 | Deviation high alarm |   |
| 2 | 2 | 2 | Deviation low alarm |   |
| 3 | 3 | 3 | Absolute high alarm |   |
| 4 | 4 | 4 | Absolute low alarm |   |
| 5 | 5 | 5 | Deviation high/low alarm |   |
| 6 | 6 | 6 | Band alarm |   |
| 7 | 7 | 7 | System failure alarm (when error information happen) | |
| 8 | 8 | 8 | Loop break alarm | see fig 8 |
| 9 | 9 | 9 | Heater break alarm | see fig 9 |
| 10 | 10 | 10 | Segment ending alarm in program control | see fig 10 |
| 11 | 11 | 11 | Program ending alarm in program control | see fig 11 |
| 12 | 12 | | Time signal alarm | see fig 12 |
| 13 | 13 | | Program running alarm in program control | see fig 13 |

## Table 2. special alarm function selection (used in parameter AL1M, AL2M, AL3M )

| AL1M | AL2M | AL3M | Special alarm mode selection |
|---|---|---|---|
| 0 | 0 | 0 | Normal |
| 1 | 1 | 1 | Alarm with normal-close contact |
| 2 | 2 | 2 | Latch |
| 3 | 3 | 3 | Alarm with normal-close contact and latch |
| 4 | 4 | 4 | Alarm with inhibit |
| 5 | 5 | 5 | Alarm with inhibit and normal-close contact |
| 6 | 6 | 6 | Alarm with inhibit and latch |
| 7 | 7 | 7 | Alarm with inhibit , normal-close contact and latch |
| 8 | | | Alarm with on-delay timer |
| 9 | | | Alarm with on-delay timer but normal-close contact |
| 10 | | | Alarm with soaking timer |
| 11 | | | Alarm with soaking timer but normal-close contact |

## Table 3. output mode selection (use in Parameter OUTM)

| | |
|---|---|
| 0 | Non |
| 1 | Single output |
| 2 | Dual output |
| 3 | Motor value control output “a” contact |
| 4 | Motor value control output “b” contact |
| 5 | Single output with transmitter |
| 6 | Single output with soft start |
| 7 | Single output with transmitter and soft start |
| 8 | Program control |
| 9 | Program control with transmitter |

※ The standard mode is set at NO.1
For using No.2.3.4.5.7.9, you need to install extra hardware.
For using No.6 and 8, you need to contact distributors.

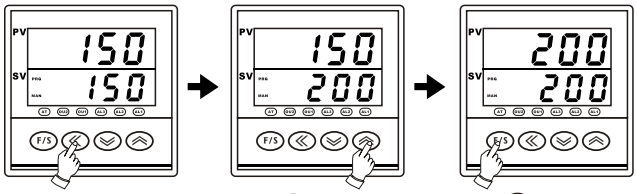
## Table 4. Input & temperature ranges selection (Used in parameter InP1)

| TYPE | °C | °F |
|---|---|---|
| K1 | 0~200 | 32~392 |
| K2 | 0~400 | 32~752 |
| K3 | 0~800 | 32~1472 |
| K4 | 0~1000 | 32~1832 |
| K5 | 0~1200 | 32~2192 |
| j1 | 0~200 | 32~392 |
| j2 | 0~400 | 32~752 |
| j3 | 0~800 | 32~1472 |
| j4 | 0~1000 | 32~1832 |
| j5 | 0~1200 | 32~2192 |
| t1 | -50~50 | -58~122 |
| t2 | -100~100 | -148~212 |
| t3 | -200~400 | -328~752 |
| r | 0~1700 | 32~3092 |
| E | 0~1000 | 32~1832 |
| S | 0~1700 | 32~3092 |
| b | 0~1800 | 32~3272 |
| n | -200~1300 | -328~2372 |
| Pt1 | -50~50 | -58~122 |
| Pt2 | 0~100 | 32~212 |
| Pt3 | 0~200 | 32~392 |
| Pt4 | 0~400 | 32~752 |
| Pt5 | -200~600 | -328~1112 |
| jPt | -200~500 | -328~932 |
| Lin | -1999~9999 | |

## Table 5.Error information

| Display | description |
|---|---|
| in1E | Input 1 error |
| AdCF | A/D converter failed |
| CJCE | Cold junction compensation failed |
| in2E | Input 2 error |
| PV Blinks | PV exceeds set Ranges |
| rAMF | Ram failed |
| intF | Interface failed |
| AutF | Auto tuning failed |

## A How to set "SV" example: SV set at 200 C°

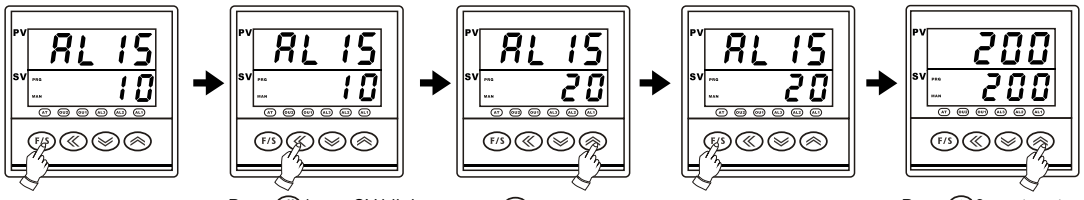



Press ≪ SV blinks
Press ≪ again to move digit

Press ≫ to increase or
Press ≪ to decrease
the value

Press F/S to enter SV setting

## B How to set " AL1S,AL2S,AL3S" example: alarm 1set at 20 C°




Press F/S 1 sec, PV shows
"AL1S"

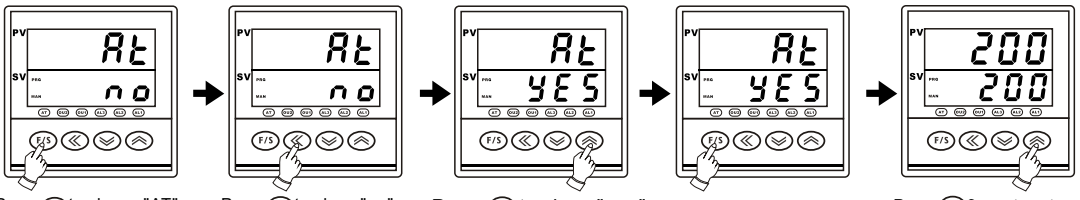
Press ≪ 1 sec, SV blinks
press ≪ again to
move digit

Press ≫ to increase or
Press ≪ to decrease the
value

Press F/S to enter AL1 setting

Press ≫ 3 sec to return to
PV/SV window

## C How to set "AT" (auto tuning)




Press F/S to shows "AT"
on PV window

Press ≪ to show "no"
flickering on SV window

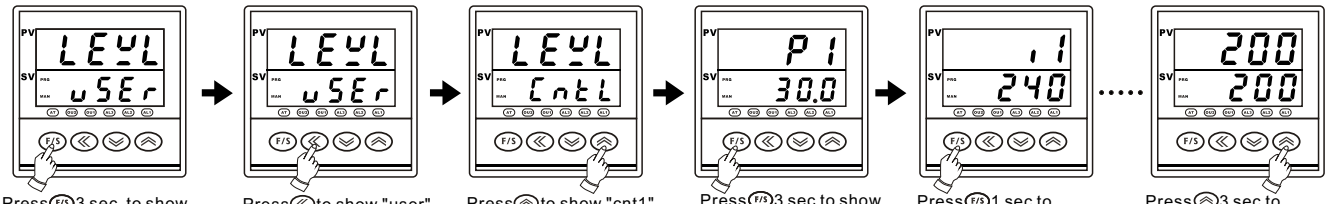
Press ≫ to show "yes"
on SV window

Press F/S to enter AT setting

Press ≫ 3 sec to return to
PV/SV window

## D How to enter different "level" for setting parameter

### (1) Enter "CntL" level




Press F/S 3 sec to show
"LEVL" on PV window
(under PV/SV initial window)

Press ≪ to show "user"
flickering on SV window
(under PV show "LEVL")

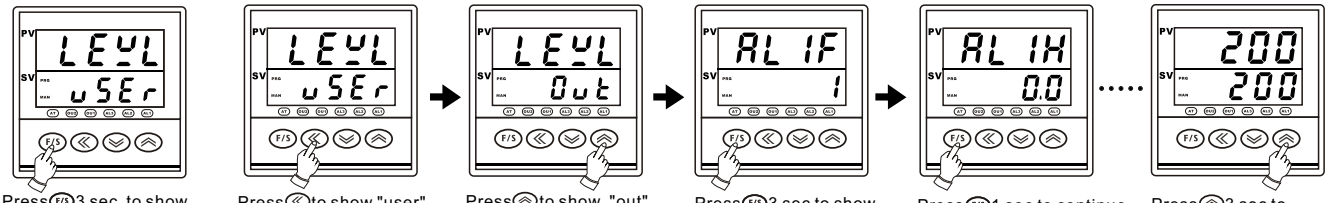
Press ≫ to show "cnt1"
on SV window then press
F/S to enter this level

Press F/S 3 sec to show
"P1" on PV window

Press F/S 1 sec to
continue other parameters
in this level

Press ≫ 3 sec to
return to PV/SV initial
window

### (2) Enter "Out" level




Press F/S 3 sec to show
"LEVL" on PV window
(under PV/SV initial window)

Press ≪ to show "user"
flickering on SV window
(under PV show"LEVL")

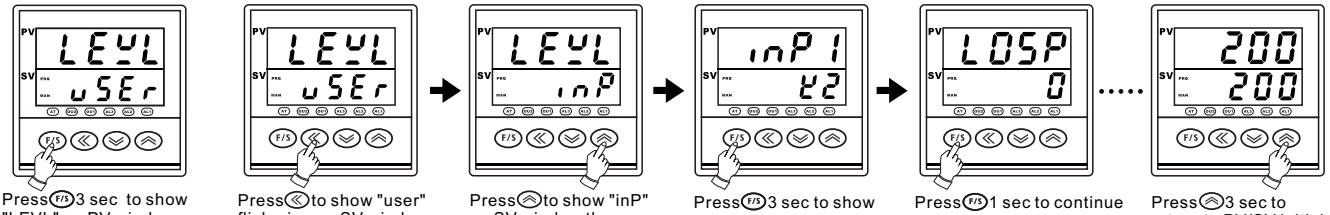
Press ≫ to show "out"
on SV window then
press F/S to enter this level

Press F/S 3 sec to show
"AL1F" on PV window

Press F/S 1 sec to continue
other parameters
in this level

Press ≫ 3 sec to
return to PV/SV initial
window

### (3) Enter "inP" level




Press F/S 3 sec to show
"LEVL" on PV window
(under PV/SV initial window)

Press ≪ to show "user"
flickering on SV window
(under PV show"LEVL")

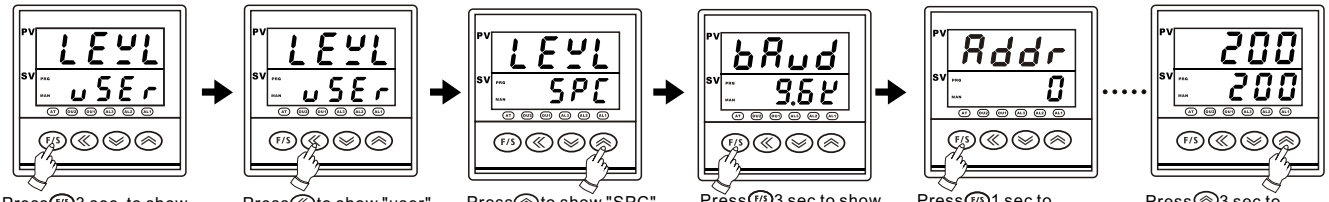
Press ≫ to show "inP"
on SV window then
press F/S to enter this level

Press F/S 3 sec to show
"inP1" on PV window

Press F/S 1 sec to continue
other parameters
in this level

Press ≫ 3 sec to
return to PV/SV initial
window

## (4)Enter "Spc" level




Press F/S 3 sec to show "LEVL" on PV window (under PV/SV initial window)

Press ≪ to show "user" flickering on SV window (under PV show "LEVL")

Press ≫ to show "SPC" on SV window then press F/S to enter this level

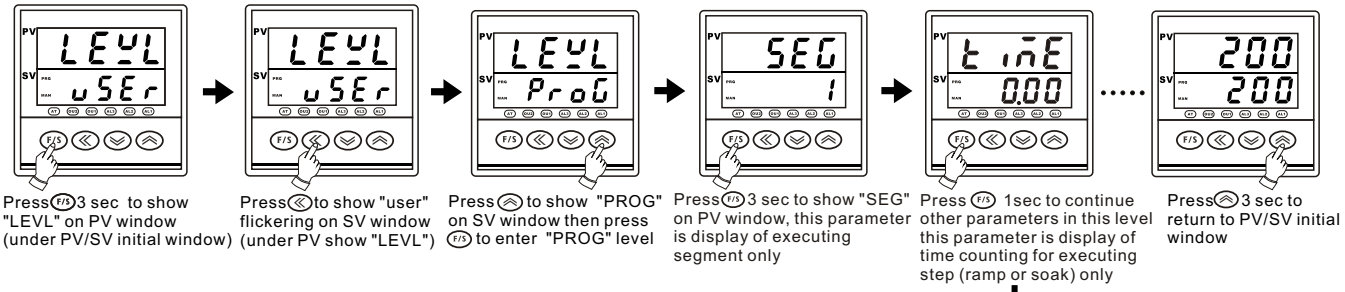
Press F/S 3 sec to show "baud" on PV window

Press F/S 1 sec to continue other parameters in this level

Press ≫ 3 sec to return to PV/SV initial window

## (5)Enter program level

* "OUTM" in "out" level must be selected at "8" or "9" (refer to fig 3)




Press F/S 3 sec to show "LEVL" on PV window (under PV/SV initial window)

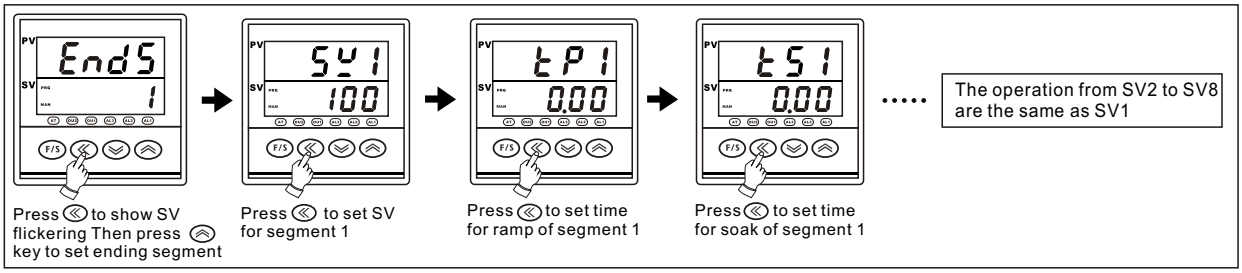
Press ≪ to show "user" flickering on SV window (under PV show "LEVL")

Press ≫ to show "PROG" on SV window then press F/S to enter "PROG" level

Press F/S 3 sec to show "SEG" on PV window, this parameter is display of executing segment only

Press F/S 1sec to continue other parameters in this level this parameter is display of time counting for executing step (ramp or soak) only

Press ≫ 3 sec to return to PV/SV initial window




Press ≪ to show SV flickering Then press ≫ key to set ending segment

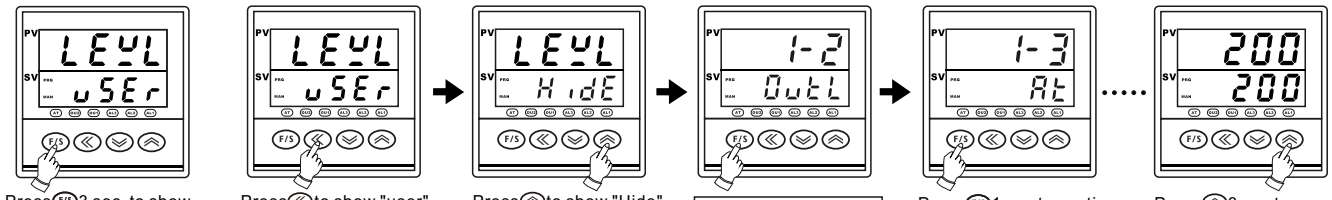
Press ≪ to set SV for segment 1

Press ≪ to set time for ramp of segment 1

Press ≪ to set time for soak of segment 1

## (6) Enter "Hide" level

In this level, the user can arrange parameter order or hiding from NO. 1-2 to 1-22, 2-14 to 2-17 and 3-20 to 3-27
( please refer to level parameter flow chart in page 1),but same parameter can not be arranged in 2 positions in the same time,
for example you want to arrange "OUTL" to 1-3 you need to cancel it in 1-2 first.When you want to cancel or hide it you need to select "non" on the "SV"




Press F/S 3 sec to show "LEVL" on PV window (under PV/SV initial window)

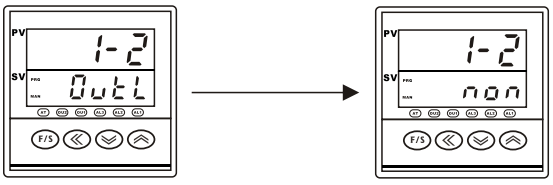
Press ≪ to show "user" flickering on SV window (under PV show"LEVL")

Press ≫ to show "Hide" on SV window then press F/S to enter this level

Press F/S 3 sec to show "1~2" on PV window

Press F/S 1 sec to continue other parameters in this level

Press ≫ 3 sec to return to PV/SV initial window

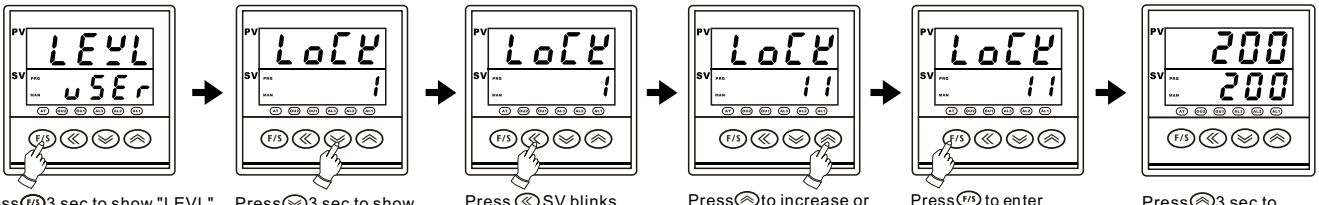



Press ≪ 1 sec to show "OUTL" flickering then press ≫ key to"non" for hiding and canceling or press ≫ key to select other parameters.

If you select "non" in 1-2 and press F/S to enter then 1-2 will not display anything but if you select other parameter in 1-2, it will display which parameter.

The operation in 1-2 to 1-22 , 2-14 to 2-17 and 3-20 to 3-27 all are the same.

## E How to set "LoCK" function




Press F/S 3 sec to show "LEVL" on PV window (under PV/SV initial window)

Press ≫ 3 sec to show "LOCK" on PV window

Press ≪ SV blinks

Press ≫ to increase or Press ≫ to decrease code number

Press F/S to enter "LOCK" setting

Press ≫ 3 sec to return to PV/SV initial window

Code number for Lock function

| | |
|---|---|
| 0 | all parameters are locked except PV |
| 1 0 1 | all parameters are locked except SV |
| 1 1 | open"USER" level and above |
| 2 2 | open"CNTL" level and above |
| 1 1 1 | open"OUT" level (Except OUTM )and above |
| 2 2 2 | open"I NP" level and above |
| 1 1 0 0 | open"SPC" level and above |
| 2 2 0 0 | open"PROG"level and above |
| 1 1 2 2 | open"HIDE" level and above |
| 1 2 3 4 | open"USER" and "PROG" level only |

P.S. Opening "PROG" level needs to contact distributor.

## F. How to modify input

This series controller provides free input for T/C and RTD,
it doesn't need to modify hardware except analog input.

1.Analog input hardware modification
(Refer to S1~S8 on PC board back)
S1 & S2 are shorted with COM. originally,
so it needs to open S1 or S1& S2 and to short some pads as drawing.

| INPUT | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 |
|---|---|---|---|---|---|---|---|---|
| TC/RTD | ○ | ○ | × | × | × | × | × | × |
| 0~20MA | × | ○ | × | × | ○ | × | × | × |
| 4~20MA | × | ○ | × | × | ○ | × | × | × |
| 0~100MV | × | × | ○ | × | × | ○ | × | × |
| 0~1V | × | × | × | ○ | × | ○ | × | × |
| 0~5V | × | × | × | × | × | ○ | × | ○ |
| 1~5V | × | × | × | × | × | ○ | ○ | × |
| 0~10V | × | × | × | × | × | ○ | × | ○ |

[○] short [×] open

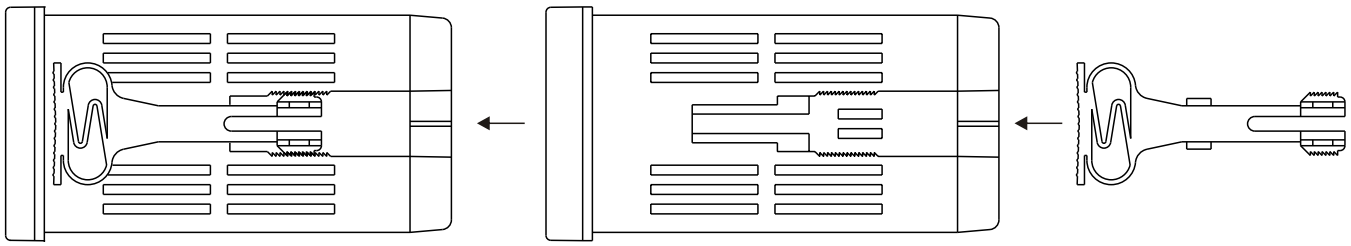
2.Analog input software modification
※Select "Lin" in "inpl" parameter
※Set "LoAn" in "inp" level to lowest range
※Set "HiAn" in "inp" level to highest range

3.Analog input calibration
※Enter "A1LS" parameter in "inp" level
※Provide signal for lowest range and wait for 3 sec then keep pressing key
※Enter "A1HS" parameter in "inp" level
※Provide signal for highest range and wait for 3 sec then keep pressing key
※Return to PV/SV initial window and provide signal for lowest range again then check if PV equals to LoAn
※Provide signal for highest range again then check if PV equals to HiAn
If it is not accuracy after calibrating, please repeat above procedure again

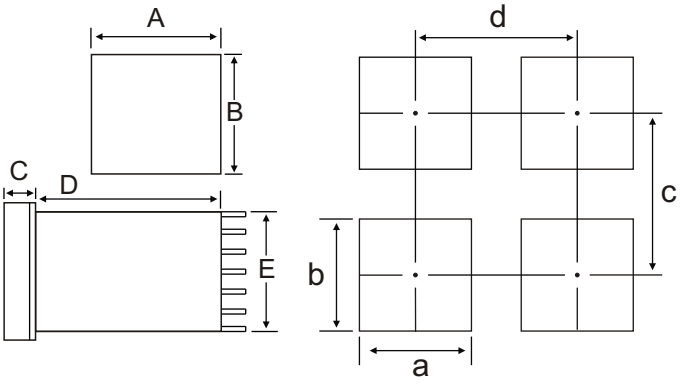
## G. Communication Protocol (see fig 14)

| PARA | INDEX | PARA | INDEX | PARA | INDEX | PARA | INDEX |
|---|---|---|---|---|---|---|---|
| LEvL | 00 | AL1F | 30 | L1i1 | 60 | Sv7 | 90 |
| LoCK | 01 | AL1H | 31 | L1d1 | 61 | tP7 | 91 |
| Sv | 02 | Al1t | 32 | L1Ar | 62 | tS7 | 92 |
| OutL | 03 | AL1m | 33 | L1P2 | 63 | Sv8 | 93 |
| At | 04 | AL2F | 34 | L1i2 | 64 | tP8 | 94 |
| mAn | 05 | AL2H | 35 | L1d2 | 65 | tS8 | 95 |
| AL1S | 06 | AL2t | 36 | L2P1 | 66 | 1-2 | 96 |
| AL1L | 07 | AL2m | 37 | L2i1 | 67 | 1-3 | 97 |
| AL1U | 08 | AL3F | 38 | L2d1 | 68 | 1-4 | 98 |
| AL2S | 09 | AL3H | 39 | L2Ar | 69 | 1-5 | 99 |
| AL2L | 0A | AL3t | 3A | L2P2 | 6A | 1-6 | 9A |
| AL2U | 0B | AL3m | 3B | L2i2 | 6B | 1-7 | 9B |
| AL3S | 0C | Act | 3C | L2d2 | 6C | 1-8 | 9C |
| AL3L | 0D | Outm | 3D | L3P1 | 6D | 1-9 | 9D |
| AL3U | 0E | O1LS | 3E | L3i1 | 6E | 1-10 | 9E |
| SOAK | 0F | O1HS | 3F | L3d1 | 6F | 1-11 | 9F |
| rAmP | 10 | AO | 40 | L3Ar | 70 | 1-12 | A0 |
| PvoF | 11 | O2LS | 41 | L3p2 | 71 | 1-13 | A1 |
| Pvrr | 12 | O2HS | 42 | L3i2 | 72 | 1-14 | A2 |
| SvoF | 13 | t1SS | 43 | L3d2 | 73 | 1-15 | A3 |
| Ct | 14 | t1On | 44 | L4P1 | 74 | 1-16 | A4 |
| HbA | 15 | t1ES | 45 | L4i1 | 75 | 1-17 | A5 |
| LbA | 16 | t1oF | 46 | L4d1 | 76 | 1-18 | A6 |
| Lbd | 17 | t2SS | 47 | L4Ar | 77 | 1-19 | A7 |
| rPtm | 18 | t2On | 48 | L4p2 | 78 | 1-20 | A8 |
| P1 | 19 | t2ES | 49 | L4i2 | 79 | 1-21 | A9 |
| i1 | 1A | t2oF | 4A | L4d2 | 7A | 1-22 | AA |
| d1 | 1B | inP1 | 4B | SEG | 7B | 2-14 | AB |
| Ct1 | 1C | LoSP | 4C | TimE | 7C | 2-15 | AC |
| HSt1 | 1D | HiSP | 4D | EndS | 7D | 2-16 | AD |
| AotF | 1E | LoAn | 4E | Sv1 | 7E | 2-17 | AE |
| Ar | 1F | HiAn | 4F | tP1 | 7F | 3-20 | AF |
| P2 | 20 | A1LS | 50 | tS1 | 80 | 3-21 | B0 |
| i2 | 21 | A1HS | 51 | Sv2 | 81 | 3-22 | B1 |
| d2 | 22 | unit | 52 | tP2 | 82 | 3-23 | B2 |
| Ct2 | 23 | dp | 53 | tS2 | 83 | 3-24 | B3 |
| HSt2 | 24 | FiLt | 54 | Sv3 | 84 | 3-25 | B4 |
| db | 25 | inP2 | 55 | tP3 | 85 | 3-26 | B5 |
| SSv | 26 | A2LS | 56 | tS3 | 86 | 3-27 | B6 |
| Sout | 27 | A2HS | 57 | Sv4 | 87 | | |
| StmE | 28 | | | tP4 | 88 | | |
| rUCy | 29 | bAud | 59 | tS4 | 89 | | |
| rPt | 2A | Addr | 5A | Sv5 | 8A | | |
| StAt | 2B | LEv1 | 5B | tP5 | 8B | | |
| PvSt | 2C | LEv2 | 5C | tS5 | 8C | | |
| wAit | 2D | Lev3 | 5D | Sv6 | 8D | | |
| Pid | 2E | LvSL | 5E | tP6 | 8E | | |
| EndP | 2F | L1P1 | 5F | tS6 | 8F | Pv | 100 |

# Mounting procedures

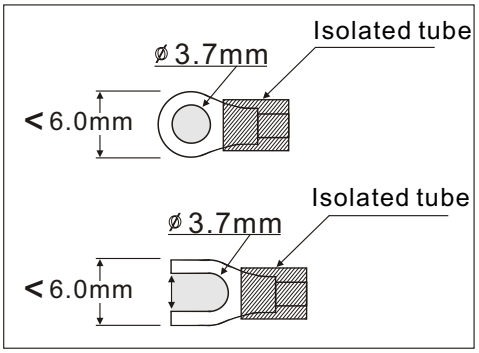


# Dimension

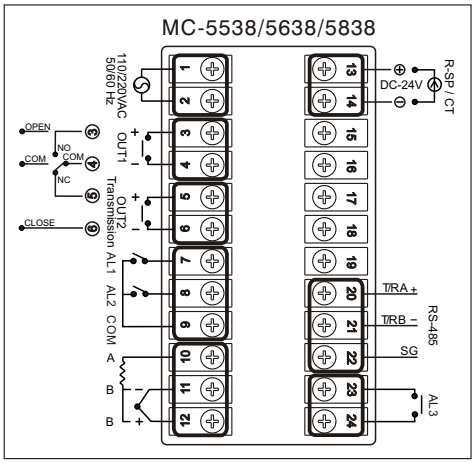


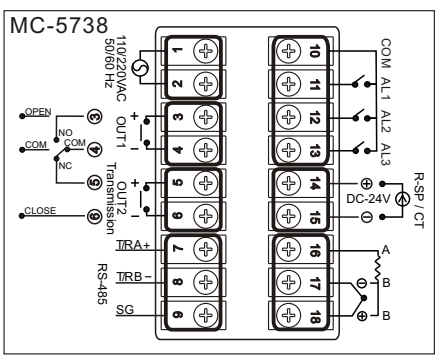

| Type | A | B | C | D | E | a | b | c | d |
|---|---|---|---|---|---|---|---|---|---|
| MC-5838 | 96 | 96 | 10.5 | 83 | 90 | $91^{+0.5}_{-0}$ | $91^{+0.5}_{-0}$ | 120 | 120 |
| MC-5738 | 72 | 72 | 10.5 | 83 | 67 | $68^{+0.5}_{-0}$ | $68^{+0.5}_{-0}$ | 100 | 100 |
| MC-5638 | 96 | 48 | 10.5 | 83 | 43 | $91^{+0.5}_{-0}$ | $46^{+0.5}_{-0}$ | 70 | 120 |
| MC-5538 | 48 | 96 | 10.5 | 83 | 90 | $46^{+0.5}_{-0}$ | $91^{+0.5}_{-0}$ | 120 | 70 |
| MC-5438 | 48 | 48 | 10.5 | 83 | 45 | $46^{+0.5}_{-0}$ | $46^{+0.5}_{-0}$ | 70 | 70 |

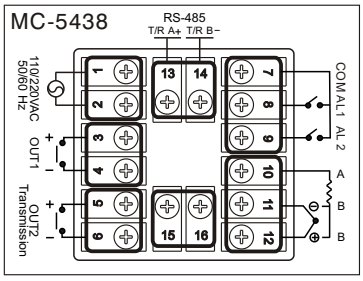
## Available terminal




# External terminal



## SPECIFICATIONS

| | | |
|---|---|---|
| PV Input | Typeof Input | TC (K,J,T,R,E,S,B,N) |
| | | RTD (Pt100, JPt100) |
| | | Linear(1-5V, 4-20mA) |
| | Input Sampling Time | 300 ms |
| Indication | PV/SV Indication | 4-digit |
| | Constant Value Storage System | Non-volatile memory ($E^2$PROM) |
| Control Mode | Proportional Band ( P ) | 0.0~3000 |
| | Integral Time ( I ) | 0~3600 |
| | Derivative Time ( D ) | 0~900 |
| | Cycle Time | 0~150 |
| | Dead Band | 0.0~200.0 |
| Output | Relay Output Relay | Contact, SPDT 3A/240VAC |
| | Voltage Output | Voltage Pulse |
| | Linear Output | 4~20mA, 1-5V , |
| | Motor Control Output | Open loop motor valve |
| Alarm | Channel | 3 Channels (Optional) |
| Communication | Type of Communication | RS-232, RS-485 |
| General Specifications | Power Supply Voltage & Frequency | AC 90~260V, 50/60Hz |
| | Power Consumption | <3.5VA |
| | Ambient Temperature | -10℃ ~ 55℃ |
| | Ambient Humidity | 0~80% RH |

## ORDERING INFORMATION

A B C D E F G

M C - 5438 - 1 0 1 - 0 0 0

**A:Type (Dimension)**

MC-5438 = 48x48mm ( DIN 1/16 ), MC-5538 = 48x96mm ( DIN 1/8 ),
MC-5638 = 96x48mm ( DIN 1/8 ), MC-5838 = 96x96mm ( DIN 1/4)),
MC-5738 = 72x72mm

**B:Output 1**

0=NONE
1=Relay,contact,SPDT 3A/240VAC
2=Volt,voltage pulse,20VDC/20MA
3=mA Current,4~20mA
4=Open loop motor valve control
A=0~5V
B=0~10V
C=1~5V
D=2~10V

**E:Transmission**

0=None
1=4~20mA (Adjustable)
2=0~20mA (Adjustable)
A=0~5V
B=0~10V
C=1~5V
D=2~10V

**C:Output 2**

0=NONE
1=Relay,contact,SPDT 3A/240VAC
2=Volt,voltage pulse,20VDC/20MA
3=mA Current,4~20mA
A=0~5V
B=0~10V
C=1~5V
D=2~10V

**F:Input 2**

0=None
1=4~20mA remote set point
2=0~20mA remote set point
3=CT for heater break alarm
A=0~5V remote set point
B=0~10V remote set point
C=1~5V remote set point
D=2~10V remote set point

**D:Alarm**

0 = NONE
1 = Alarm x 1
2 = Alarm x 2
3 = Alarm x 3

**G:Communication**

0 = None
1 = RS-232
2 = RS-485

※ C & E are used the same terminal so one function is available only but C & E & F one function is available only in MC-5438