Laboratory Equipment Manufacturer
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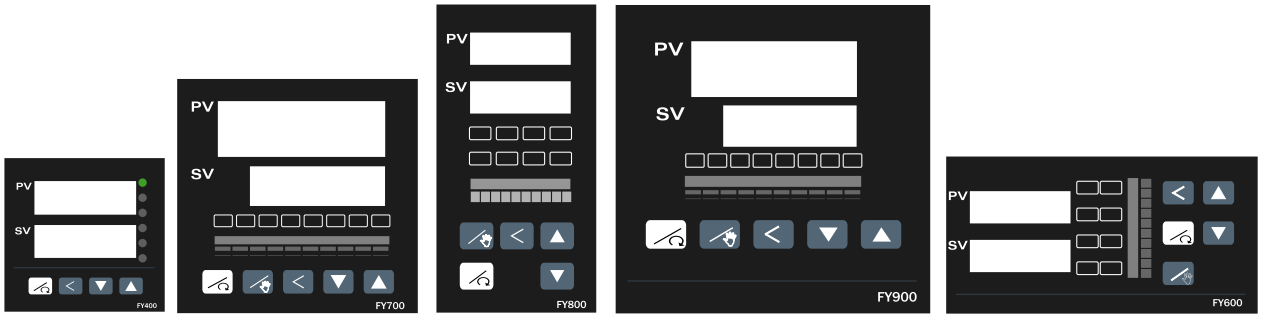
# PFY-Series Digital PID Controller
# Operation Manual




| PFY400 | PFY700 | PFY800 | PFY900 | PFY600 |
|---|---|---|---|---|
| 48x48 | 72X72 | 48X96 | 96X96 | 96X48 |
| (DIN 1/16) | (DIN 3/16) | (DIN 1/8) | (DIN 1/4) | (DIN 1/8) |

PLEASE READ THIS MANUAL CAREFULLY BEFORE OPERATION

Hagavish st. Israel 58817 Tel: 972 3 5595252, Fax: 972 3 5594529 mrc@mrclab.com ,

MRC.VER.01-5.13

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# 1. Notice before start-up

PFY series controller has got the CE approvals as below:

LDV： D/N EN61010-1

EMC： EN 55 022 1994 /A1：1995/ A2：1997

EN 61 000-3-2： 1995 / -3-3： 1995

EN 61 000-4-2： 1995 / -4-3： 1996 / -4-5： 1995 / -4-6

1996 / -4-8： 1993 / -4-11：1996/ EN 50 204： 1995

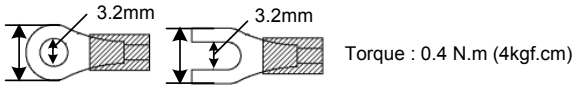
Please confirm the specification of controller is to totally with your requirement before using it, also read this manual in detail.

## ⚠ Danger

1. Danger! Electric Shock!
   DON'T touch AC power wiring terminals when controller has been powered!
   Keep the power off until all of the wirings are completed!

## ⚠ Warning

1. Please confirm the AC power wiring to controller is correct, otherwise it would be caused aggravated damage on controller. ( PFY400 connecting with Pin 1 and 6, PFY600/700/800/900 with Pin 1 and 2).
2. Be sure to use the rated power supply (AC85~265V or DC24V), otherwise it would be caused aggravated damage on controller.
3. Please confirm wires are connected with correct terminal (Input, Output).
4. Use M3 screw-compatible crimp-on terminals with an insulation sleeve, as shown below




5. Avoid installing controller in following spaces:
   I. A place where the ambient temperature may reach beyond the range from 0 to 50℃
   II. A place where the ambient humidity may reach beyond the range from 20 to 90% RH.
   III. A place where the controller likely to come into contact with water, oil, chemicals, steam and vapor.
   IV. A place where the controller is subject to interface with static electricity, magnetism and noise.
6. For thermocouple (TC) input, use shield compensating lead wire.
7. For RTD input, use shield wires which have low resistance and no resistance difference between the 3 wires.

# 1. Specifications

- **Standard spec.**

| Model | | PFY400 | PFY600 | PFY700 | PFY800 | PFY900 |
|---|---|---|---|---|---|---|
| Dimension | | 48X48mm | 96X48mm | 72X72mm | 48X96mm | 96X96mm |
| Supply voltage | | AC 85~265V，DC 15~50V (Option) | | | | |
| Frequency | | 50 / 60 HZ | | | | |
| Power consumption | | approx 3VA | approx 4VA | approx 3VA | approx 4VA | approx 4VA |
| Input | Accuracy | 0.2 % FS ± 1digit | | | | |
| | Sample time | 250ms | | | | |
| | TC | K , J , R , S , B , E , N , T , W5Re/W26Re , PLII , U , L | | | | |
| | RTD | PT100,JPT100,JPT50 | | | | |
| | mA dc | 4~20mA ,0~20mA | | | | |
| | mV / V dc | 0~1V,0~5V,0~10V,1~5V,2~10V<br>-10~10mV,0~10mV,0~20mV,0~50mV,10~50mV | | | | |
| | Decimal point position | 0000 , 000.0 , 00.00 , 0.000<br>Available for linear input (mA / mV / V) | | | | |
| Output 1 | Relay | SPST type | SPDT type | SPST type | SPDT type | SPDT type |
| | | 3A , 220V , electrical life:100,000 times or more (under rated load) | | | | |
| | Voltage pulse | For SSR drive. ON : 24V , OFF : 0V , max load current : 20mA | | | | |
| | mA dc | 4~20mA, 0~20mA. Maximum load resistance:560 Ω | | | | |
| | Voltage dc | 0~5V , 0~10V , 1~5V , 2~10V . Max load current:20mA | | | | |
| Alarm 1 | | 3A , 220V , electrical life:100,000 times or more (under rated load) | | | | |
| Control algorithm | | PID，PI，PD，P，ON / OFF(P=0)，FUZZY。 | | | | |
| PID range | | P: 0.0 ~ 200.0 %，I: 0~3600s，D: 0~900s | | | | |
| Isolation | | Output terminals(control output , alarm , transmission) and input terminals are isolated separately | | | | |
| Isolated resistance | | 10MΩ or more between input and case (ground) at DC 500 V<br>10MΩ or more between output and case (ground) at DC 500 V | | | | |
| Dielectric strength | | 1000V AC for 1 minute between input terminal and case (ground)<br>1500V AC for 1 minute between output terminal and case (ground) | | | | |
| Operating temperature | | 0~50℃ | | | | |
| Humidity range | | 20~90%RH | | | | |
| Weight | | 150g | 225g | 225g | 225g | 300g |
| Display Height | | PV:7mm<br>SV:7mm | PV:7mm<br>SV:7mm | PV:14mm<br>SV:10mm | PV:7mm<br>SV:7mm | PV:14mm<br>SV:10mm |

## ● Optional Spec.

| Model | PFY400 | PFY600 | PFY700 | PFY800 | PFY900 |
|---|---|---|---|---|---|
| Output 2 | For heating and cooling control use.<br>Relay , SSR , 4~20mA , 0~20mA , 0~5V , 0~10V , 1~5V , 2~10V | | | | |
| Alarm 2 | SPST type | SPDT type | SPST type | SPDT type | SPDT type |
| | 3A , 220V , electrical life:100,000 times or more (under rated load) | | | | |
| Alarm 3 | Not available | Available | Available | Available | Available |
| | | SPST type | SPST type | SPST type | SPST type |
| | 3A , 220V , electrical life:100,000 times or more (under rated load) | | | | |
| Heater Break Alarm (HBA) | Display range of heater current : 0.0~99.9A , Accuracy : 1%FS | | | | |
| | Included CT : SC-80-T | | | | |
| | Alarm relay : AL1 | | | | |
| Transmission | Available for PV or SV transmission | | | | |
| | 4~20mA , 0~20mA , 0~1V , 0~5V , 0~10V , 1~5V , 2~10V | | | | |
| Remote SV | 4~20mA , 0~20mA , 0~1V , 0~5V , 0~10V , 1~5V , 2~10V | | | | |
| Communication | Protocol : MODBUS RTU , MODBUS ASCII , TAIE | | | | |
| | RS232 , RS485 , TTL | | | | |
| | Baud rate: 2400 , 4800 , 9600 , 19200 , 38400 bps.<br>Data bits : 8 , Stop bit : 1 or 2bit , Odd or Even parity. | | | | |
| Water/Dust proof | IP65 | | | | |

## ● Special control output (OUT1)

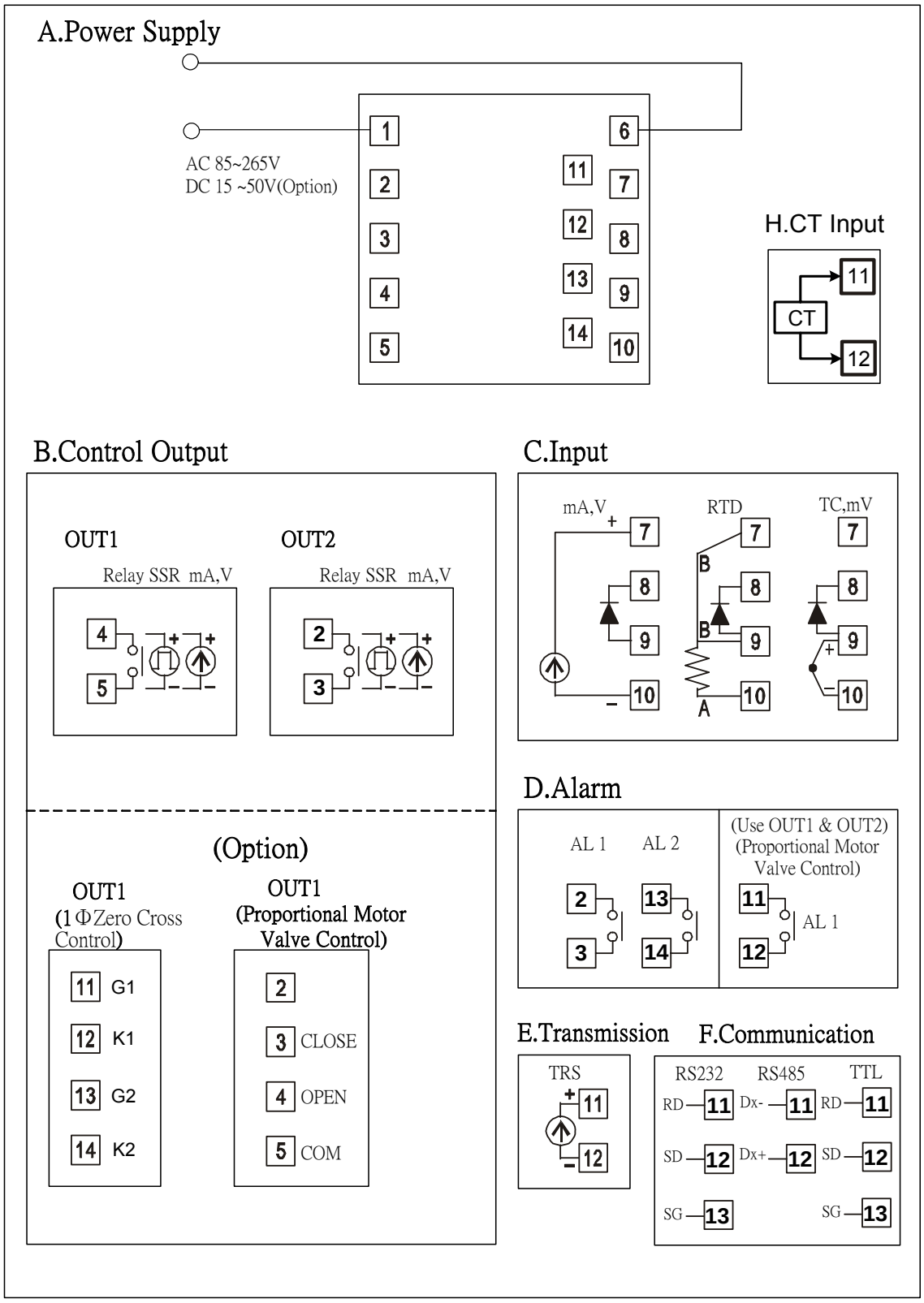
| Model | PFY400 | PFY600 | PFY700 | PFY800 | PFY900 |
|---|---|---|---|---|---|
| 1φ zero crossing control(1φSSR) | Available | Not available | Available | Not available | Available |
| 3φ zero crossing control(3φSSR) | Not available | | | | Available |
| Motor valve control | Available | | | | |
| 1φ phase angle control(1φSCR) | Not available | Available | | | |
| 3φ phase angle control(3φSCR) | Not available | | | | Available |

## ● Programmable RAMP/SOAK

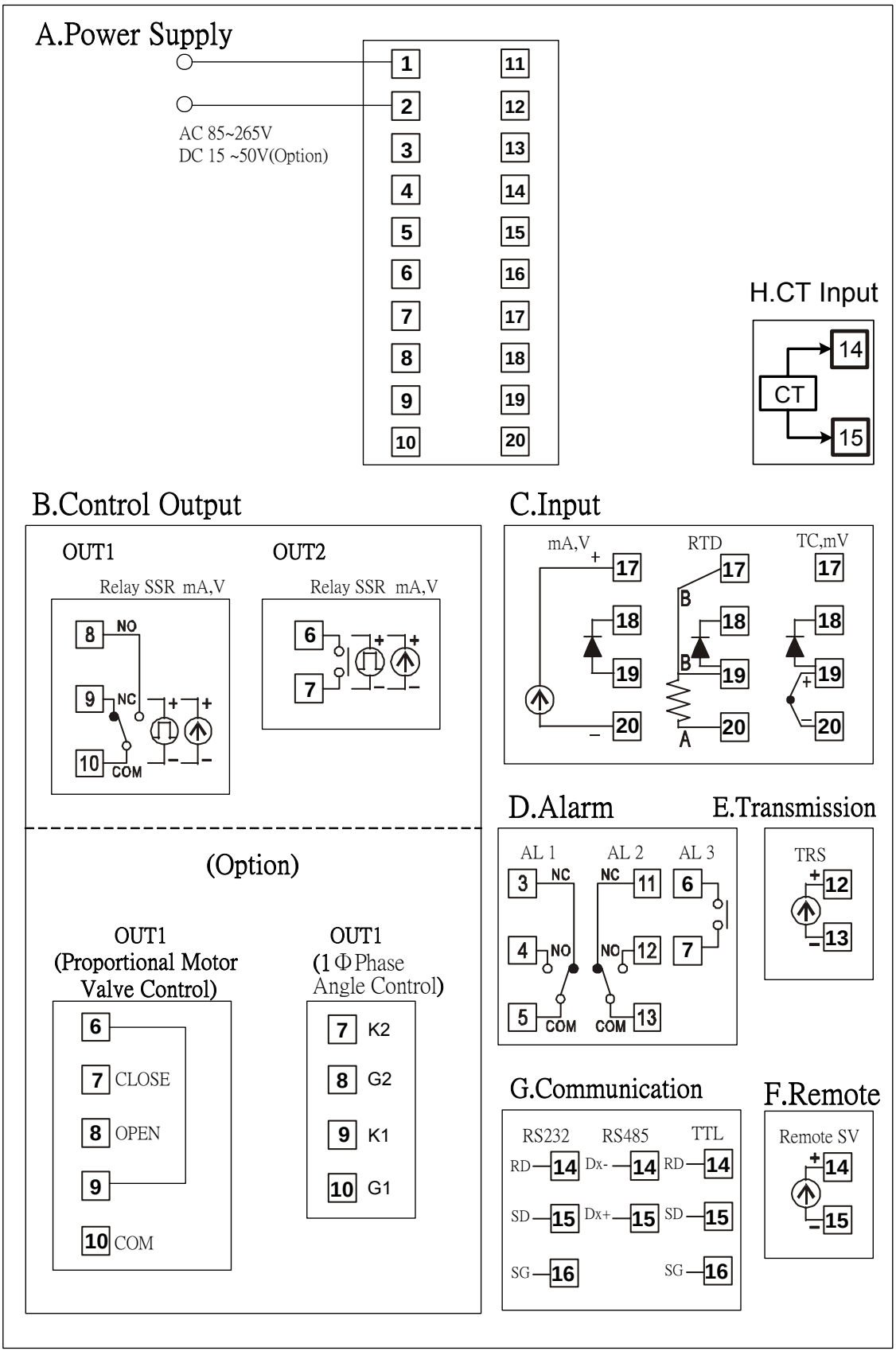
| Model | PFY400 | PFY600 | PFY700 | PFY800 | PFY900 |
|---|---|---|---|---|---|
| Programmable RAMP/SOAK | 2 patterns with 8 segments each.<br>The 2 patterns can be linked together as 16 segments use. | | | | |

# 3. Terminal arrangement

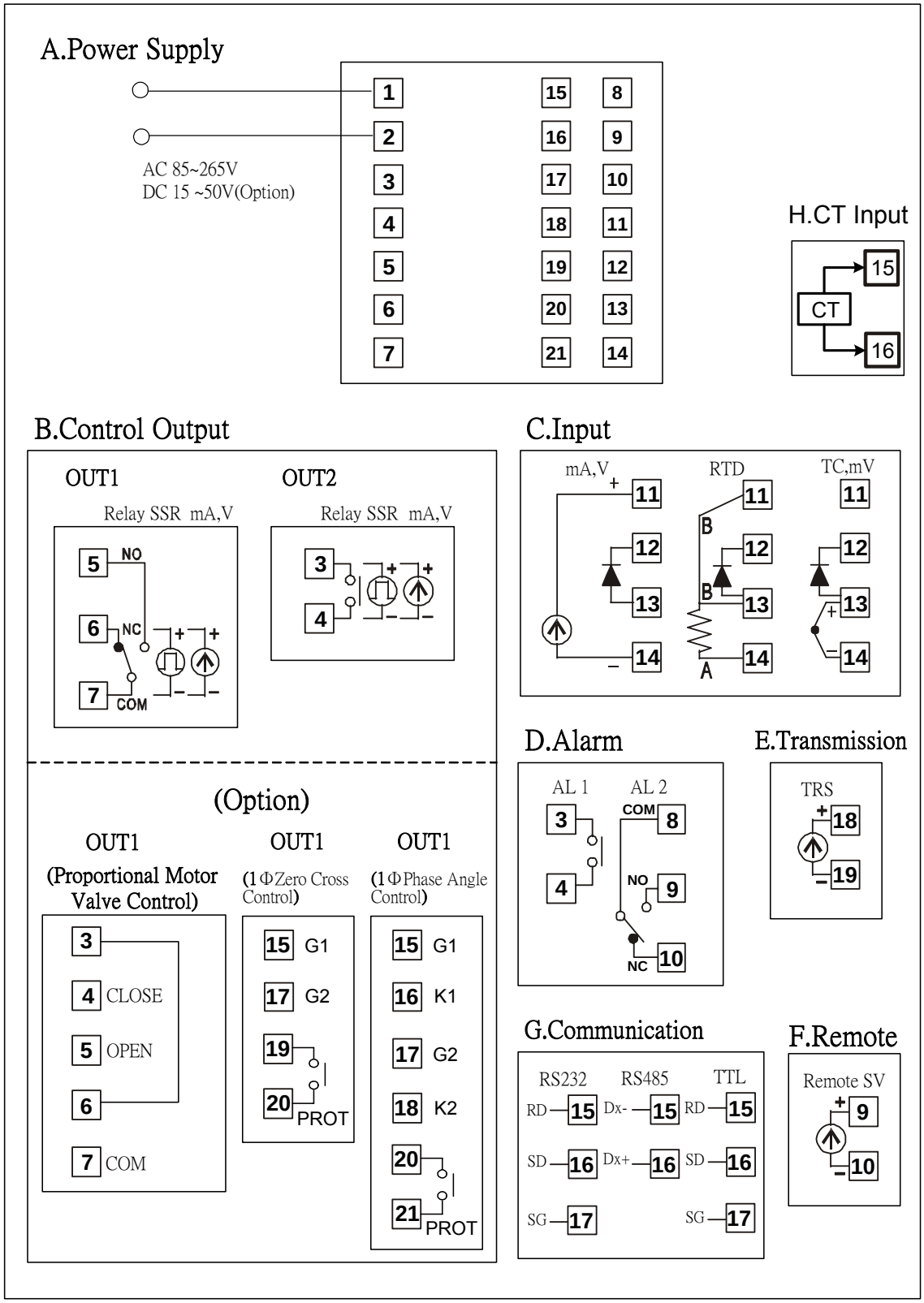
## 3.1 PFY400 Terminals ( 48mm x 48mm , DIN 1/16 )



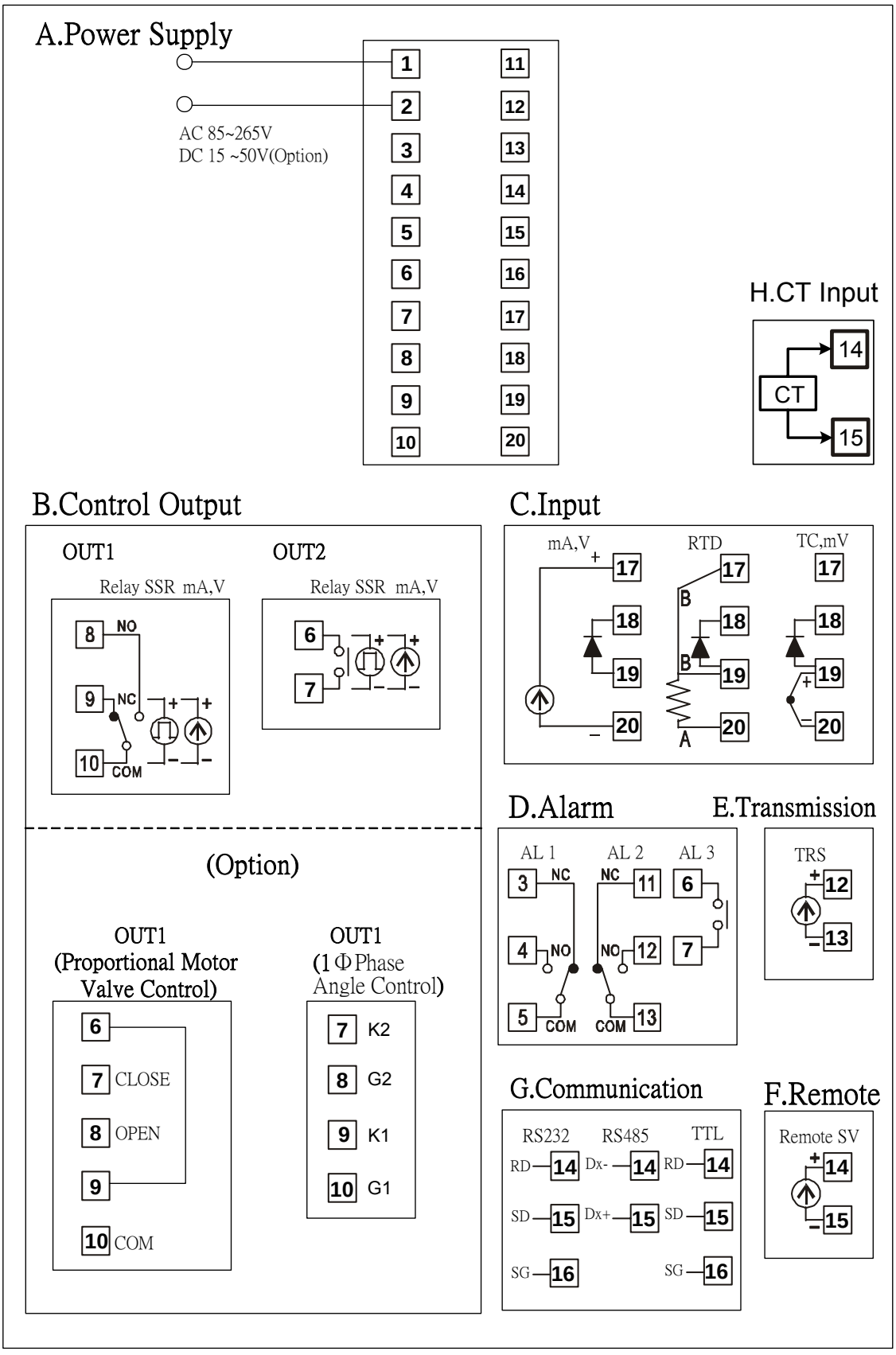
## 3.2 PFY600 Terminals ( 96mm x 48mm , DIN 1/8 )



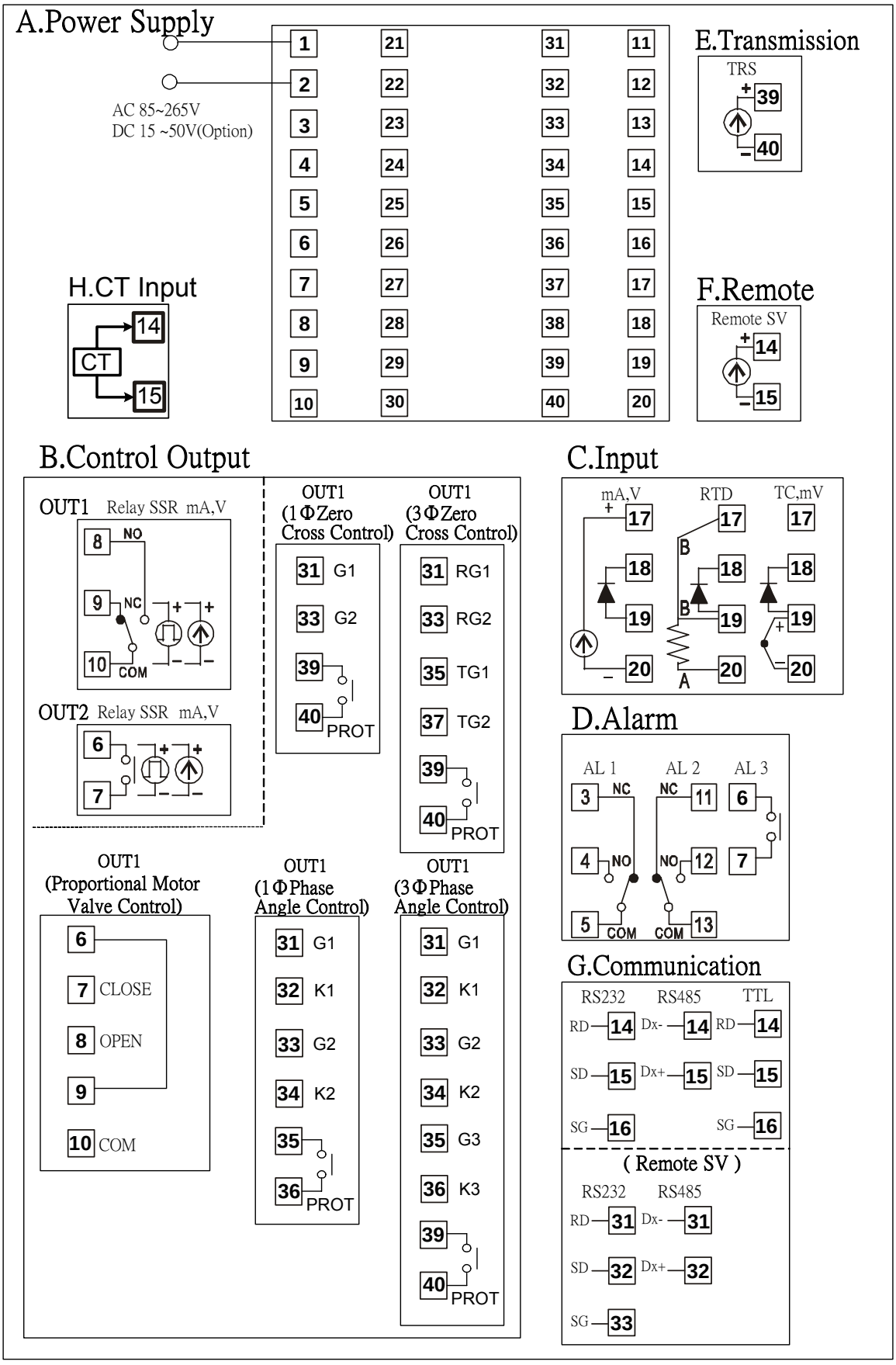
## 3.3 PFY700 Terminals ( 72mm x 72mm)



## 3.4 PFY800 Terminals ( 48mm x 96mm , DIN 1/8 )

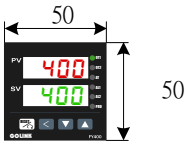


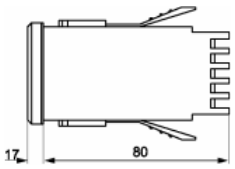
## 3.5 PFY900 Terminals ( 96mm x 96mm , DIN 1/4 )

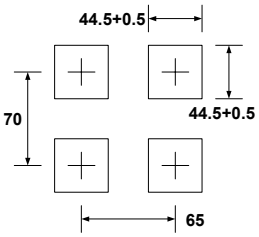


# 4. External dimension and panel cutout〈Unit：mm〉

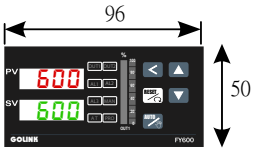
**PFY400**

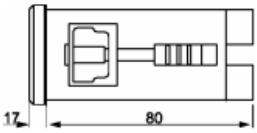


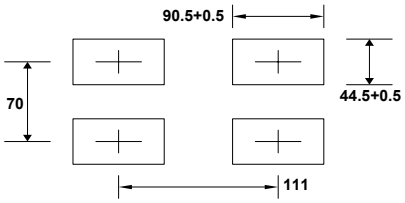



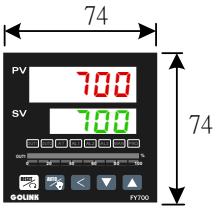

**PFY600**

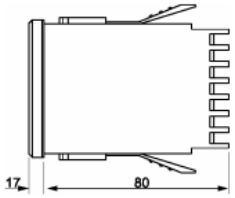


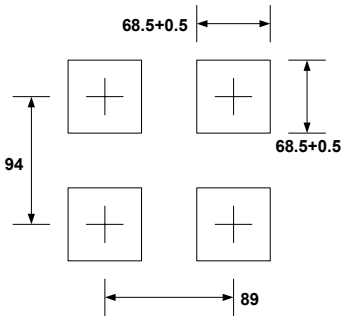



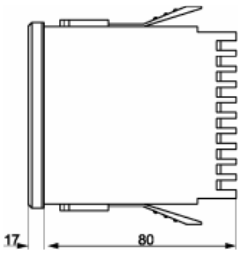

**PFY700**

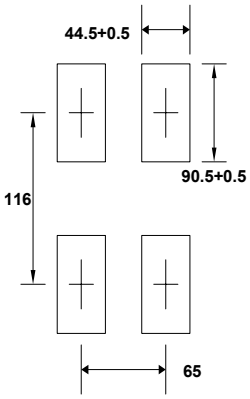


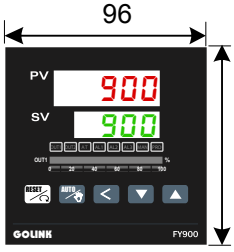



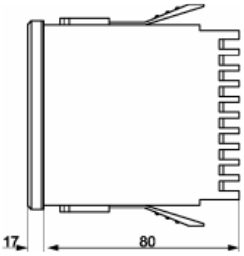

**PFY800**

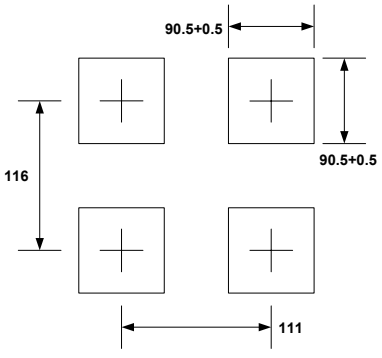



**PFY900**

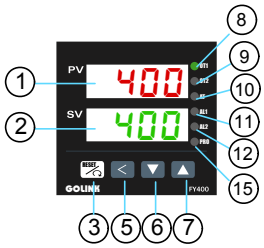


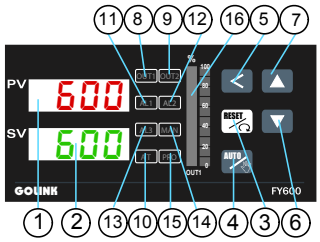



# 5. Parts description

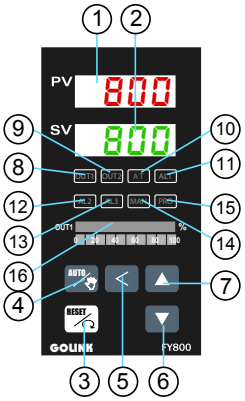
PFY400



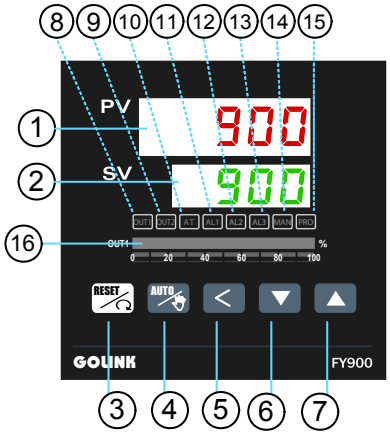

PFY600




PFY800




PFY700 / PFY900

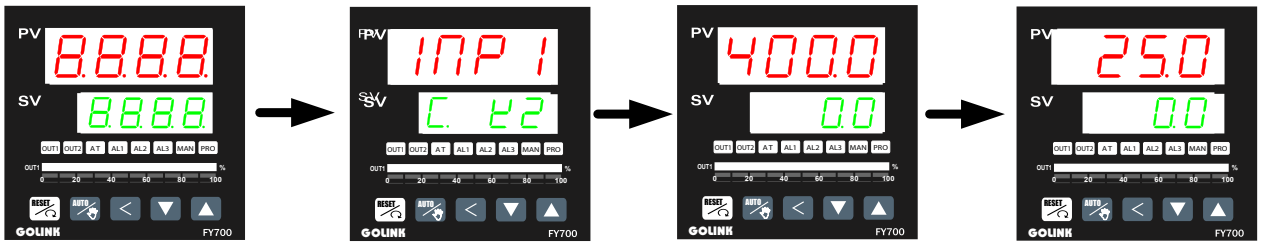



| SYMBOL | NAME | | FUNCTION |
|---|---|---|---|
| **PV** | ① | Measured value (PV) display | Displays PV or various parameter symbols (Red) |
| **SV** | ② | Set value (SV) display | Displays SV or various parameter set values (Green) |
| RESET | ③ | Set key | Used for parameter calling up and set value registration |
| AUTO | ④ | Auto/Manual key | Switches between Auto(PID) output mode and Manual output mode. |
| < | ⑤ | Shift key | Shift digits when settings are changed |
| ▼ | ⑥ | Down key<br>**Program hold* | Decrease numbers (-1000,-100,-10,-1)<br>* *Program hold*〈*Programmable controller*〉 |
| ▲ | ⑦ | Up key<br>**Program run* | Decrease numbers (+1000,+100,+10,+1)<br>* *Program run*〈*Programmable controller*〉 |
| **OUT1** | ⑧ | OUT1 lamp | Lights when OUT1 is activated (Green) |
| **OUT2** | ⑨ | OUT2 lamp | Lights when OUT2 is activated (Green)。 |
| **AT** | ⑩ | Auto tuning lamp | Lights when Auto tuning is activated (Orange) |
| **AL1** | ⑪ | Alarm 1 lamp | Lights when Alarm 1 is activated (Red) |
| **AL2** | ⑫ | Alarm 2 lamp | Lights when Alarm 2 is activated (Red) |
| **AL3** | ⑬ | Alarm 3 lamp | Lights when Alarm 3 is activated (Red) |
| **MAN** | ⑭ | Manual output lamp | Lights when manual output is activated (Orange) |
| **PRO** | ⑮ | **Program running lamp* | **Flashes when program is running*〈*Programmable controller*〉。 |
| **OUT1%** | ⑯ | OUT% bar-graph display | Output% is displayed on 10-dot LED. |

# 6. Operations

## 6.1 Power On

Controller will display as below



displays will be lighted

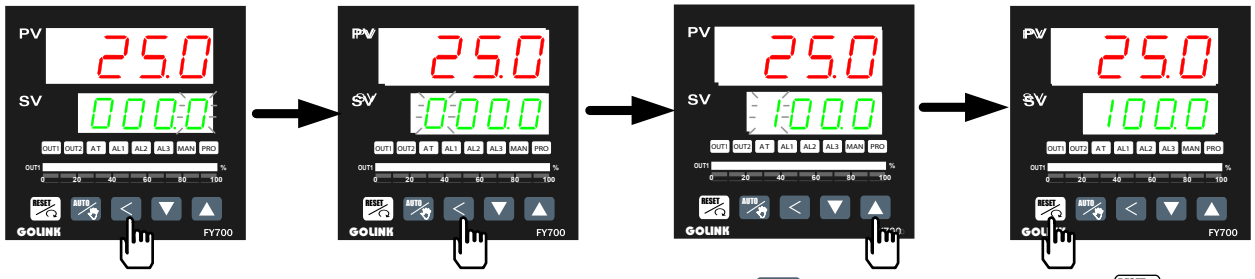
Display input type (K2)

Display range (0.0~400.0)

Ready for use

## 6.2 Change the Set Value (SV)

Change SV from 0.0 to 100.0



Press < key. The SV number started to flash. The flashing digit indicates which digit can be set.

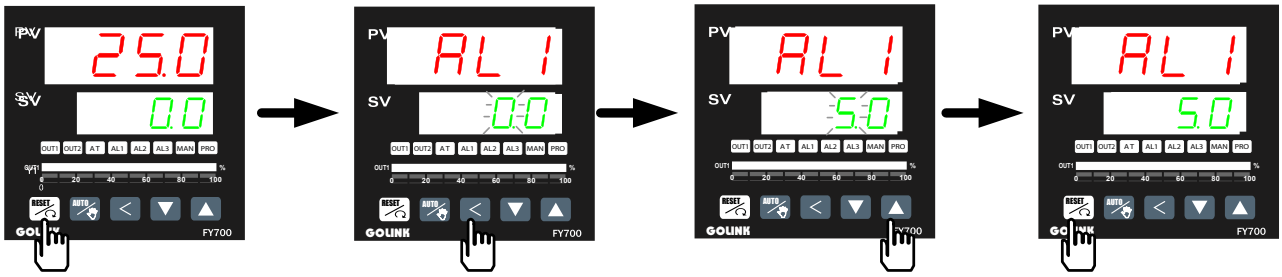
Press < key to select the hundreds digit.

Press ▲ key to change the number to 1

Press RESET key to store the new set value.

## 6.3 Change the Alarm Value

Change AL1 value to “5.0” (AL1 active, if PV exceeds SV over 5.0)



Press RESET key to display parameter AL1

Press < key to change AL1 value

Press ▲ key increase AL1 value

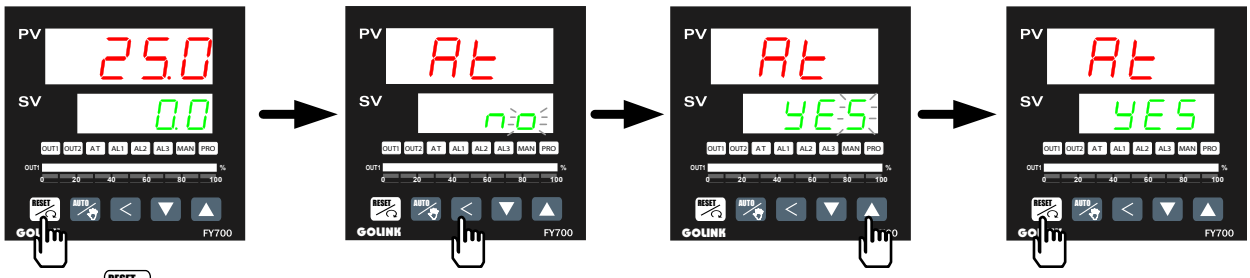
Press RESET key store the new value of AL1

* The are total 16 alarm mode types, please referred with “alarm mode” in page 30

* To change alarm mode, press RESET + < key 5 seconds to enter Level 3 (Input Level) and then change ALD1/ALD2/ALD3 value.

## 6.4 Autotuning (AT)

Use AT function to automatically calculate and set the optimize PID value for your system.



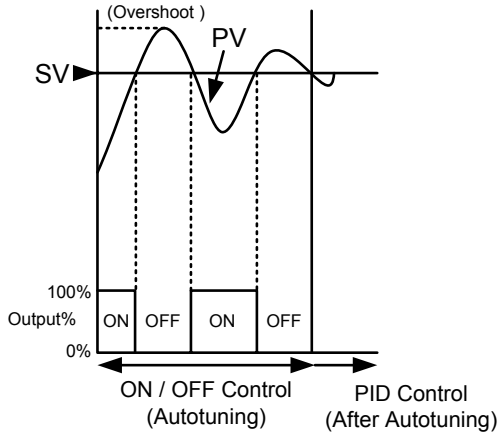

Press RESET key to display parameter AT.

Press < key to change AT setting

Press ▲ key change AT to "YES"

Press RESET key Start auto tuning (AT lamp will be lighted on)

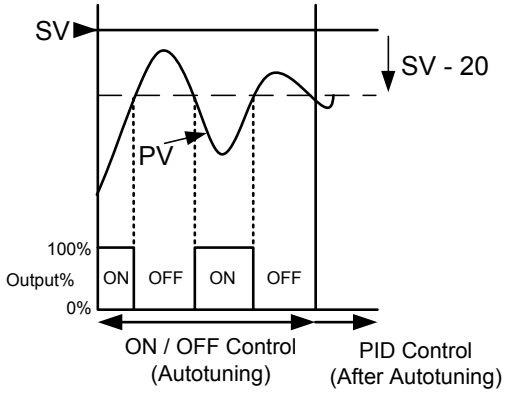
Autotuning
**ATVL=0**




Autotuning
**ATVL=20**

*Set ATVL to prevent overshoot occurred during autotuning process.

To set ATVL ,press RESET key 5 seconds to enter Level 2 (PID Level) and then change the value.




Autotuning failure

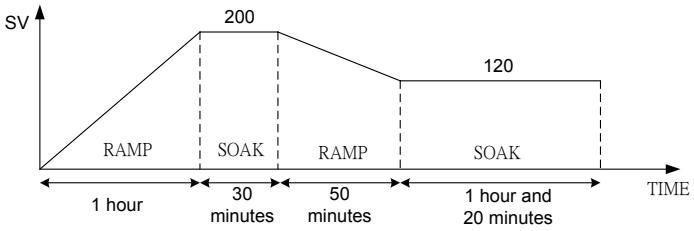
Possible cause 1： ATVL is too big. (If not sure，set ATVL=0)

Possible cause 2：Calculation time is too long.
(Set PID parameter manually)

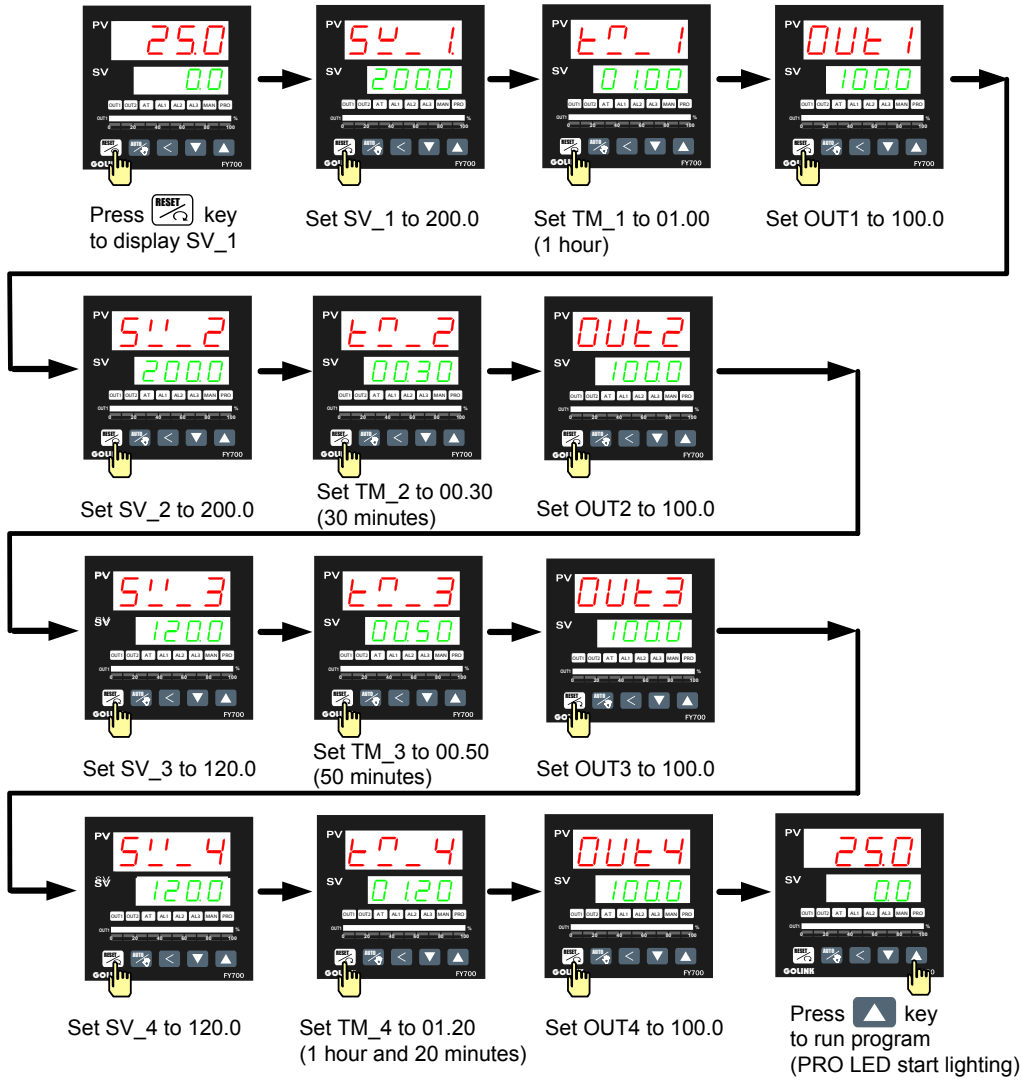
## 6.5 Programmable RAMP / SOAK (Only available for PFY model)

*For detail of the programmable instruction, please refer with page 25.

Assume the temperature profile is as below (use total 4 segments )

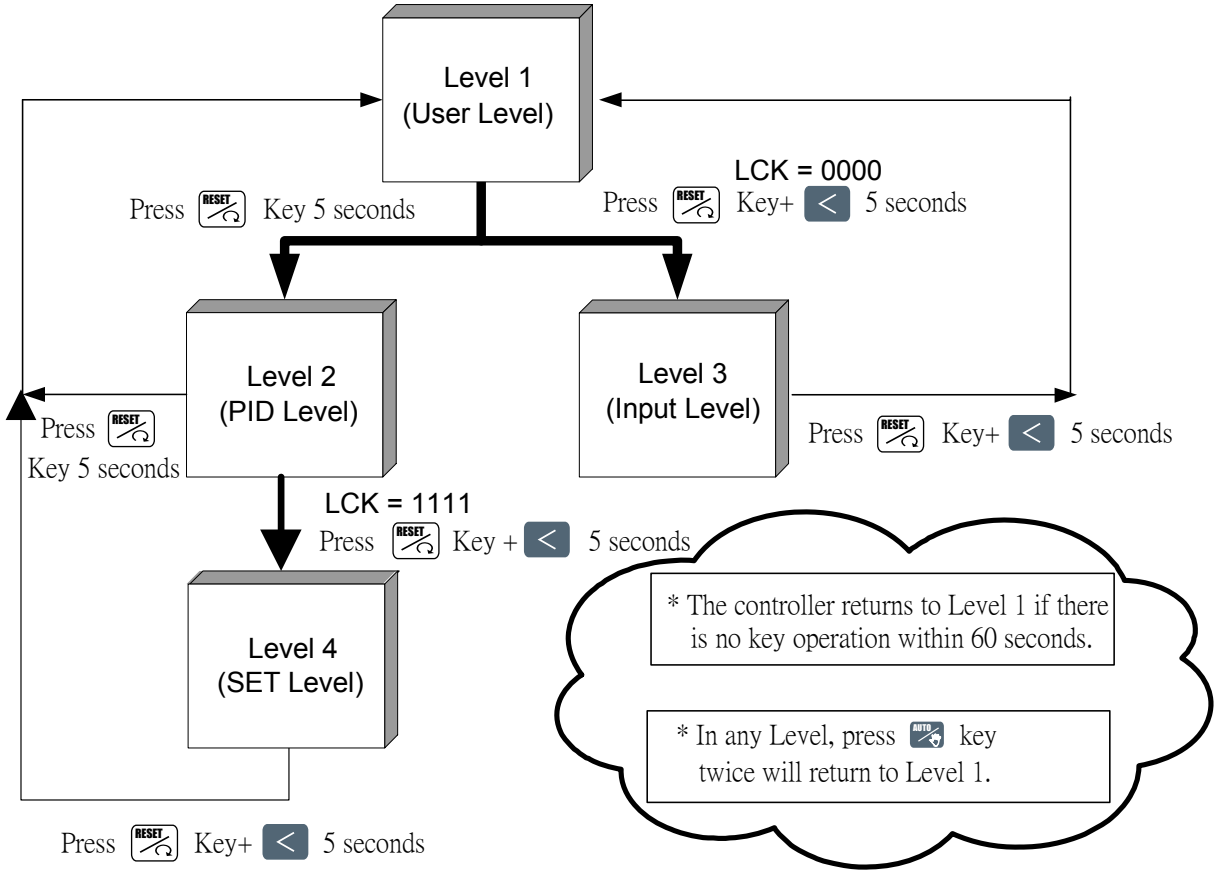



Please operate conroller as following steps:



# 7. Operation levels

## 7.1 Levels diagram



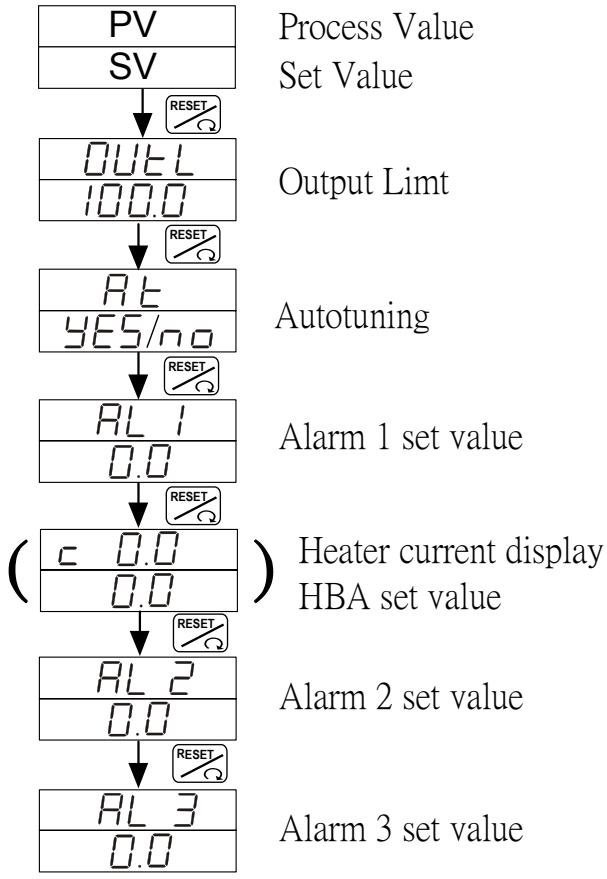

## 7.2 Lock function

To use lock function, please set parameter “LCK” in level 2.

| LCK | Levels entering available | | | | Parameters which can be changed |
|---|---|---|---|---|---|
| | Level 1 (User) | Level 2 (PID) | Level 3 (Input) | Level 4 (SET) | |
| 0000 | ◎ | ◎ | ◎ | ------ | All parameters (Factory set value) |
| 1111 | ◎ | ◎ | ------ | ◎ | All parameters |
| 0100 | ◎ | ◎ | ------ | ------ | All parameters except level 3 |
| 0110 | ◎ | ◎ | ------ | ------ | Parameters in level 1 |
| 0001 | ◎ | ◎ | ------ | ------ | “SV” and “LCK” |
| 0101 | ◎ | ◎ | ------ | ------ | Only “LCK” |

# 8. Parameters

## 8.1 Level 1 (User Level)



## 8.2 LEVEL 2 (PID Level)

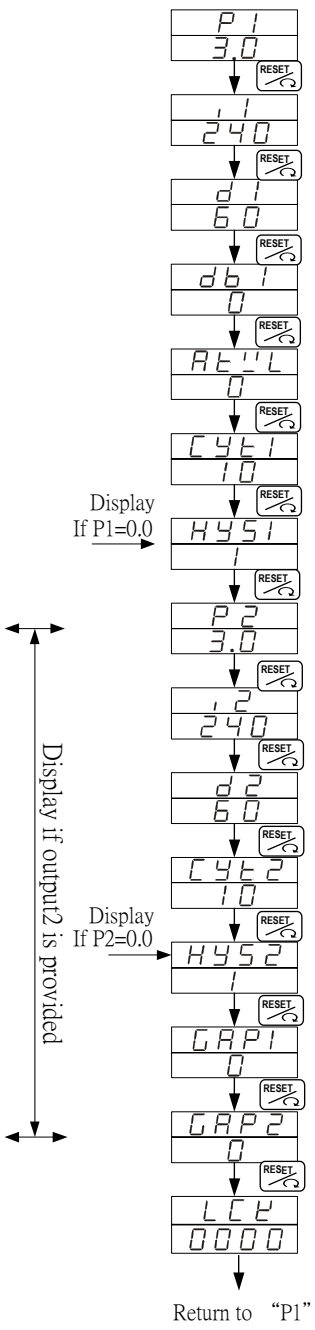
To enter level 2, press SET key 5 seconds in level 1

### 8.2.1 Level 2 parameters display / hiding condition

1. Press RESET key 5 seconds to enter level 2.
2. Set LCK to "1111".
3. Press RESET key and < key 5 seconds, to enter level 4 (Set level).
4. Set OUTY to "0" (Single output-P1) .

1. Press RESET key 5 seconds to enter level 2.
2. Set LCK to "1111".
3. Press RESET key and < key 5 seconds, to enter level 4 (Set level).
4. Set OUTY to "1" (Dual output - P1/P2) .

### 8.2.2 Description of parameters

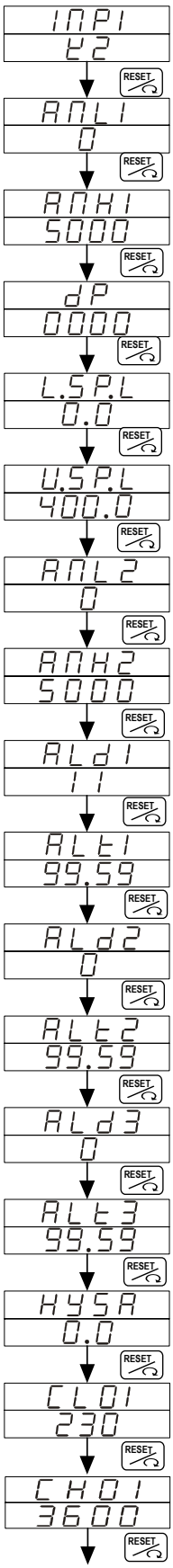



| | |
|---|---|
| Proportional band 1 (For output 1) | Range：0.0~200.0%<br>ON/OFF control if set to 0 (0.0) |
| Integral time 1 (For output 1) | Range：0~3600 seconds<br>PD control if set to 0 |
| Derivative time 1 (For output 1) | Range：0~900 seconds<br>PI control if set to 0 |
| Reserved | Reserved |
| Auto tuning offset value | Range：0~USPL |
| Output 1 cycle time | Range：0~150 seconds<br>Relay output : 10<br>Voltage pulse output : 1 , mA output: 0 |
| Hysteresis for output 1 ON/OFF control | Range：0~1000 |
| Proportional band 2 (For output 2) | The same with P1 |
| Integral time 2 (For output 2) | The same with I1 |
| Derivative time 2 (For output 2) | The same with D1 |
| Output 2 Cycle time | The same with CYT1 |
| Hysteresis for output 2 ON/OFF control | The same with HYS1 |
| Control gap 1 (For output 1) | Set point of output 1 (Heating side)<br>=SV - GAP1 |
| Control gap 2 (For output 2) | =SV + GAP2 |
| Function lock | |

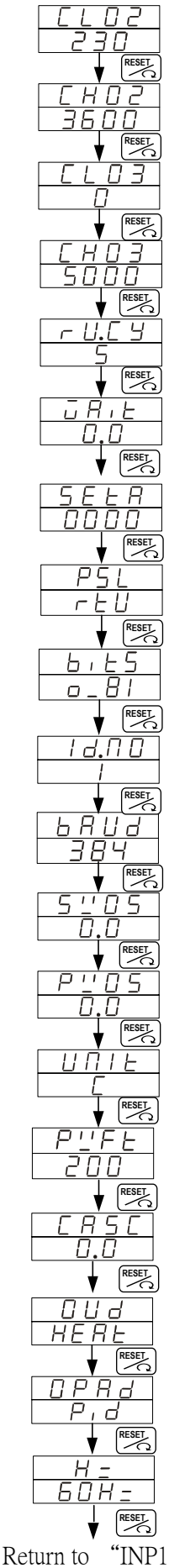
| LCK | Levels entering available | | | | Parameters which can be changed |
|---|---|---|---|---|---|
| | Level 1 (User) | Level 2 (PID) | Level 3 (Input) | Level 4 (SET) | |
| 0000 | ◎ | ◎ | ◎ | ------ | All parameters (default value) |
| 1111 | ◎ | ◎ | ------ | ◎ | All parameters |
| 0100 | ◎ | ◎ | ------ | ------ | All parameters except level 3 |
| 0110 | ◎ | ◎ | ------ | ------ | Parameters in level 1 |
| 0001 | ◎ | ◎ | ------ | ------ | “SV” and “LCK” |
| 0101 | ◎ | ◎ | ------ | ------ | Only “LCK” |

## 8.3 LEVEL 3 (Input Level)

To enter level 3 , set LCK to ”0000”and then press RESET key + Shift < keys for 5 seconds.




| | |
|---|---|
| Input type selection | |
| Analog input low limit calibration (Used for mA and V input) | Range：-1999 ~ 9999 |
| Analog input high limit calibration (Used for mA and V input) | Range：0 ~ 9999 |
| Decimal point position (Available for mA and V input) | 0000，000.0，00.00，0.000 |
| Lower Set-Point Limit | Scaling Low Limit |
| Upper Set-Point Limit | Scaling High Limit |
| Remote input low limit calibration | Range：-1999 ~ 9999 |
| Remote input high limit calibration | Range：0 ~ 9999 |
| Alarm mode of AL1 | Range:00~19<br>Refer to “Alarm mode type” |
| Alarm time of AL1 | Range：0~99 Min 59 Secs<br>0=Flicker Alarm，99:59=Continued<br>Others=On delay time<br>(If ALD=07 , ALT means alarm on time) |
| Alarm mode of AL2 | The same with ALD1 |
| Alarm time of AL2 | The same with ALT1 |
| Alarm mode of AL3 | The same with ALD1 |
| Alarm time of AL3 | The same with ALT1 |
| Hysteresis of all Alarm | Range：0~1000 |
| Output 1 low limit calibration (Used for mA and V output) | Range：0 ~ 9999 |
| Output 1 low limit calibration (Used for mA and V output) | Range：0 ~ 9999 |

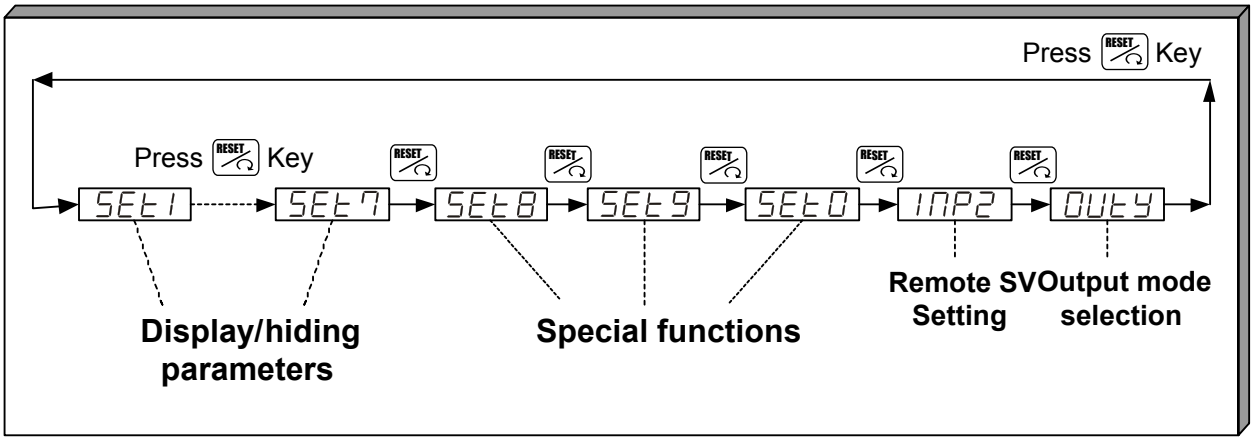



| | |
|---|---|
| Output 2 low limit calibration (Used for mA and V output) | The same with CLO1 |
| Output 2 high limit calibration (Used for mA and V output) | The same with CHO1 |
| Retransmission low limit calibration | The same with CLO1 |
| Retransmission high limit calibration | The same with CHO1 |
| Full run time of proportional motor ( Used for proportional motor valve control output) | Range：5~200 seconds |
| Used for programmable controller to wait continued operation | 0=Not wait<br>Others=Wait value |
| Communication Protocol Selection | MODBUS RTU /<br>MODBUS ASCII /<br>TAIE |
| Communication Bits Configuration | O_81 /O_82/E_81/<br>E_82 |
| ID number | Range：0 ~ 255 |
| Baudrate | 2400 / 4800 / 9600 /<br>19200 / 38400 bps |
| SV compensation | Range：-1000~1000 |
| PV compensation | Range：-100.0~500.0 |
| Unit of PV & SV | C(℃) / F(℉) / A(Analog) |
| PV Filter | PV will responese faster if<br>PVFT is smaller. |
| Reserved | |
| Control mode | Heat / Cool |
| Control algorithm | PID / Fuzzy |
| Frequency | 50 / 60HZ |

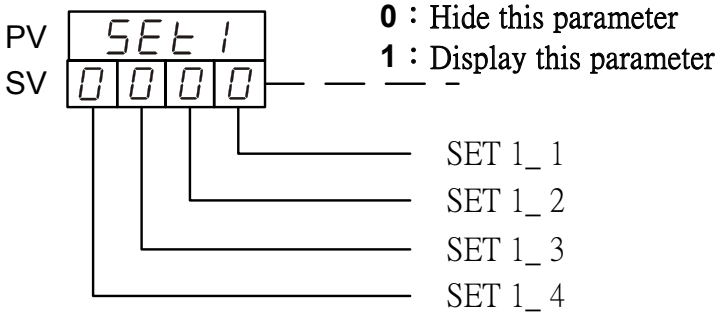
Return to “INP1”

## 8.4 Level 4 (SET level)

To enter level 4, set LCK to ”1111”and then press RESET key + Shift < key 5 seconds.




### 8.4.1 How to hide parameters (Use SET1~SET7)




*For the description of Level 1 parameters, please refer with page 17.

*For the description of Level 3 parameters, please refer with page 20.

| SET | Display / hiding | Level | SET | Display / hiding | Level |
|---|---|---|---|---|---|
| 1_ 1 | OUtL | Level 1 | 5_ 1 | CLO2,CHO2 | Level 3 |
| 1_ 2 | At | Level 1 | 5_ 2 | CLO3,CHO3 | Level 3 |
| 1_ 3 | AL 1 | Level 1 | 5_ 3 | r U.Cy,SAt,SEtA | Level 3 |
| 1_ 4 | AL 2 | Level 1 | 5_ 4 | PSL,bitS,Id.NO,bAUd | Level 3 |
| 2_ 1 | AL 3 | Level 1 | 6_ 1 | SUOS | Level 3 |
| 2_ 2 | ANL1,ANH1,dP | Level 3 | 6_ 2 | PUOS | Level 3 |
| 2_ 3 | L.SP.L,U.SP.L | Level 3 | 6_ 3 | UNIt | Level 3 |
| 2_ 4 | ANL2,ANH2 | Level 3 | 6_ 4 | PUFt | Level 3 |
| 3_ 1 | ALd1 | Level 3 | 7_ 1 | CASC | Level 3 |
| 3_ 2 | ALt1 | Level 3 | 7_ 2 | OUd | Level 3 |
| 3_ 3 | ALd2 | Level 3 | 7_ 3 | OPAd | Level 3 |
| 3_ 4 | ALt2 | Level 3 | 7_ 4 | H - | Level 3 |
| 4_ 1 | ALd3 | Level 3 | | | |
| 4_ 2 | ALt3 | Level 3 | | | |
| 4_ 3 | HYSA | Level 3 | | | |
| 4_ 4 | CLO1,CHO1 | Level 3 | | | |

### 8.4.2 Special functions (Use SET8 / SET9 / SET0)

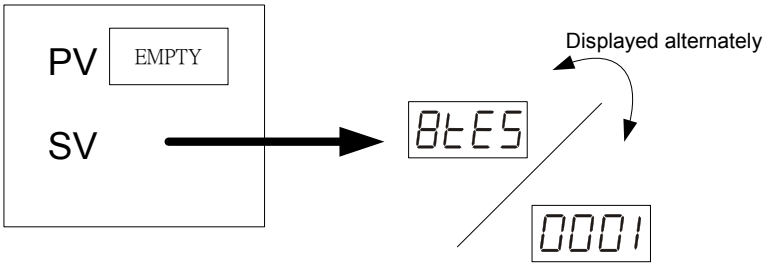
| SET 8 | | Remark |
|---|---|---|
| 8_ 1 | 0 : Program not repeat | Only available for programmable controller |
| | 1 : Program repeat | |
| 8_ 2 | 0 : No power failure option | |
| | 1 : With power failure option | |
| 8_ 3 | 0 : Program starts from 0 | |
| | 1 : Program starts from PV | |
| 8_ 4 | 0 : Reserved (Don't change it) | |

| SET 9 | | Remark |
|---|---|---|
| 9_ 1 | 0 : Reserved (Don't change it) | |
| 9_ 2 | 0 : Timer Unit = "Hour : Minute" | Only available for programmable controller |
| | 1 : Timer Unit = "Minute : Second" | |
| 9_ 3 | 0 : Disable transmission | Used for transmission output |
| | 1 : SV Transmission | |
| 9_ 4 | 0 : Disable transmission | |
| | 1 : PV Transmission | |

| SET 0 | | Remark |
|---|---|---|
| 0_ 1 | 0 : TTL Communication (Slave) | Used for TTL communication |
| | 1 : TTL Communication (Master) | |
| 0_ 2 | 0 : Hide parameter "RATE" | |
| | 1 : Display parameter "RATE" | AL3 will be replaced by "RATE" |
| 0_ 3 | 0 : Disable Remote SV function | Used for Remote SV function |
| | 1 : Enable Remote SV function | |
| 0_ 4 | 0 : use output relay "b" contact when motor valve closed | Used for 3 wire proportional motor valve control |
| | 1 : use output relay "a" contact when motor valve closed | |

Please don't operate **SET 8_4**，otherwise the controller's process will be in confusion.

If SET8.4 is set to “1”, the controller will enter into “Single Display” mode, the PV LED will not display any values. The SV LED will display both the parameter value and the setting value alternately as shown in the diagram below.




To rectify the problem please press the SHIFT KEY < and change the setting value to “0000”.

### 8.4. 3 Remote SV type selection

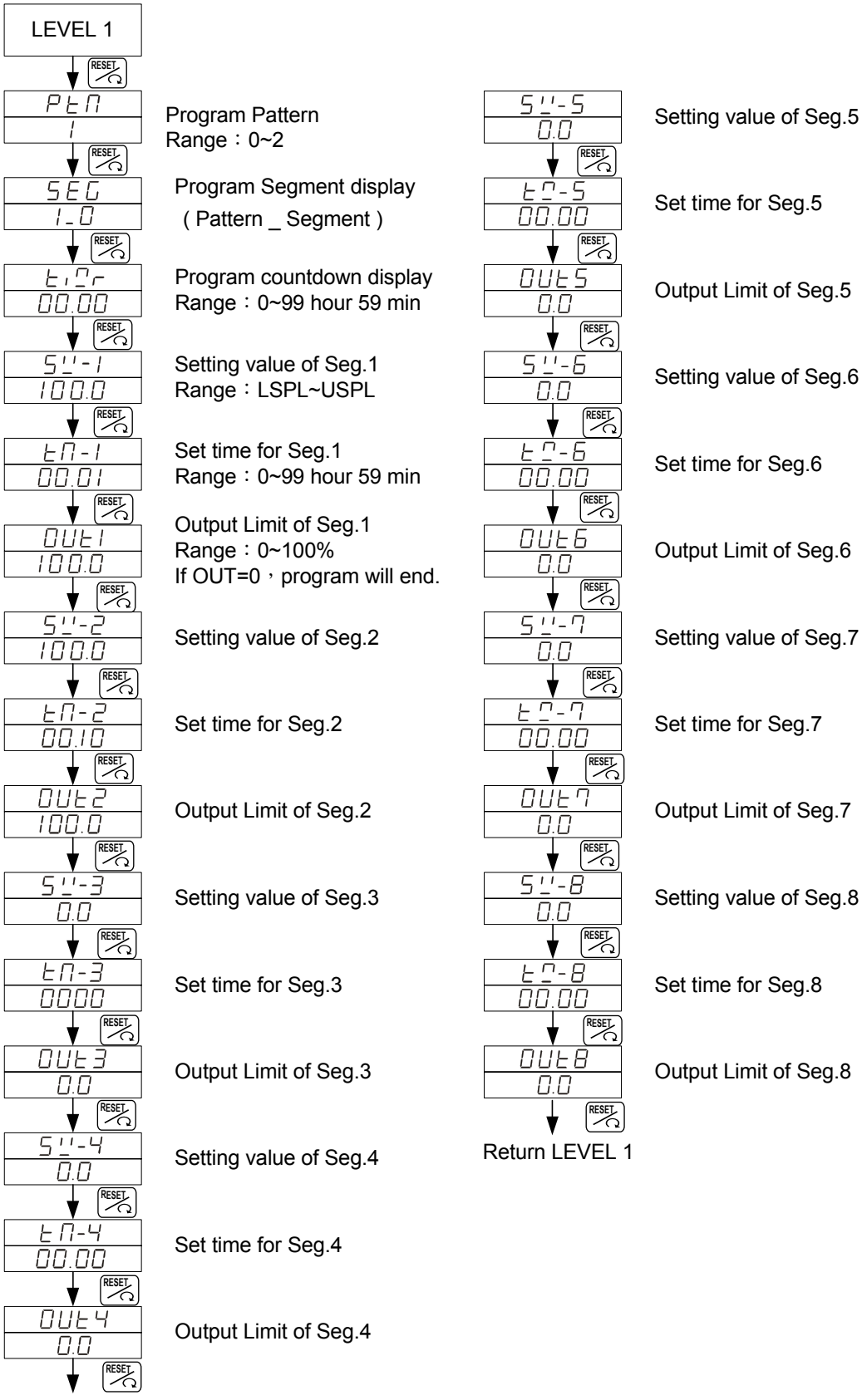
INP2=0 None
INP2=1 10~50mV / 4~20mA / 1~5V / 2~10V
INP2=2 0~50mV / 0~20mA / 0~5V / 0~10V
INP2=4 CT input
※Remote SV function is not available for programmable controller

### 8.4. 4 Output mode selection (Use OUTY)

OUTY=0 Single output (OUT1)
OUTY=1 Dual output (OUT1 / OUT2)
OUTY=2 Reserved
OUTY=3 3 wire proportional motor valve control
OUTY=4 1ψPhase angle control (1ψSCR)
OUTY=5 3ψPhase angle control (3ψSCR)

## 8.5 Program Level (Only displayed in programmable controller)

### 8.5.1 Description of parameters



### 8.5.2 Description of operation

1. There are 2 patterns can be used，each pattern contains 8 segments.
2. Terminologies

   **Pattern** ：A program consists of some steps.

   **Ramp status**：The status with changing SV.

   **Soak status** ：The status with fixed SV.
3. Operating

   I. "KEY" function (no changing parameter)

   ▲ (RUN) ：Start program procedure，**PRO** LED in panel start flicking.

   ▼ (HOLD) ：Suspend program procedure，**PRO** LED in panel will stop flicker but still light on.

   ▲ + RESET(JUMP) ：Jump to previous segment.

   ▼ + RESET (RESET)：Reset program procedure，**PRO** LED in panel will off.

   II. Alarm Function：

   **ALD1** = “07”(Segment end alarm)，

   **AL1** = “2”(It means when segment 2 end, AL1 will act)

   **ALT1** =“00:10”(Relay on time is 10 seconds).

   ＊ In this case，when program proceeds to segment 2 end，the relay of AL1 will be on 10 seconds.

   III. END function：

   The Controller doesn’t have END order, so if program procedure is less than 8 segments, please set the last segment’s OUT to “0”. Program will end in this segment. Otherwise，it will proceed 8 or 16 segments.

   IV. Linking Function：

   **PTN**=1 proceed pattern 1，contains 8 segments.

   **PTN**=2 proceed pattern 2，contains 8 segments.

   **PTN**=0 linking proceed pattern 1 and 2 totally 16 segments.

   (Please set PTN1 and PTN2 at first，and then set PTN to 0)

   V. Other function(＊refer to LEVEL 4)

   SET 8_1=1 Program repeats.

   SET 8_2=0 No power failure function.

   SET 8_2=1 Enable power failure function.

   (When power shut down and on again，the controller will start from the segment which is near PV)

   SET 8_3=0 Program starts from 0.

   SET 8_3=1 Program starts from PV.

   SET 9_2=0 Timer Unit = “Hour : Minute”

   SET 9_2=1 Timer Unit = “Minute : Second”

## 9. Input type table (INP1 selection)

| TYPE | CODE | RANGE |
|---|---|---|
| K | K 1 | 0.0 ~ 200.0℃ / 0.0 ~392.0℉ |
| | K 2 | 0.0 ~ 400.0℃ / 0.0 ~752.0℉ |
| | K 3 | 0 ~ 600℃ / 0 ~1112℉ |
| | K 4 | 0 ~ 800℃ / 0 ~1472℉ |
| | K 5 | 0 ~ 1000℃ / 0 ~1832℉ |
| | K 6 | 0 ~ 1200℃ / 0 ~2192℉ |
| J | J 1 | 0.0 ~ 200.0℃ / 0.0 ~392.0℉ |
| | J 2 | 0.0 ~ 400.0℃ / 0.0 ~752.0℉ |
| | J 3 | 0 ~ 600℃ / 0 ~1112℉ |
| | J 4 | 0 ~ 800℃ / 0 ~1472℉ |
| | J 5 | 0 ~ 1000℃ / 0 ~1832℉ |
| | J 6 | 0 ~ 1200℃ / 0 ~2192℉ |
| R | r 1 | 0 ~ 1600℃ / 0 ~2912℉ |
| | r 2 | 0 ~ 1769℃ / 0 ~3216℉ |
| S | S 1 | 0 ~ 1600℃ / 0 ~2912℉ |
| | S 2 | 0 ~ 1769℃ / 0 ~3216℉ |
| B | b 1 | 0 ~ 1820℃ / 0 ~3308℉ |
| E | E 1 | 0 ~ 800℃ / 0 ~1472℉ |
| | E 2 | 0 ~ 900℃ / 0 ~1652℉ |
| N | n 1 | 0 ~ 1200℃ / 0 ~2192℉ |
| | n 2 | 0 ~ 1300℃ / 0 ~2372℉ |
| T | t 1 | -199.9 ~ 400.0℃ /-199.9 ~752.0℉ |
| | t 2 | -199.9 ~ 200.0℃ / -199.9 ~392.0℉ |
| | t 3 | 0.0 ~ 350.0℃ / 0.0 ~662.0℉ |
| W5Re/W26Re | U 1 | 0 ~ 2000℃ / 0 ~3632℉ |
| | U 2 | 0 ~ 2320℃ / 0 ~4208℉ |
| PLⅡ | PL 1 | 0 ~ 1300℃ / 0 ~2372℉ |
| | PL 2 | 0 ~ 1390℃ / 0 ~2534℉ |
| U | U 1 | -199.9 ~ 600.0℃ / -199.9 ~999.9℉ |
| | U 2 | -199.9 ~ 200.0℃ / -199.9 ~392.0℉ |
| | U 3 | 0.0 ~ 400.0℃ / 0.0 ~752.0℉ |
| L | L 1 | 0 ~ 400℃ / 0 ~752℉ |
| | L 2 | 0 ~ 800℃ / 0 ~1472℉ |

| TYPE | CODE | RANGE |
|---|---|---|
| **JIS PT100** | JP1 | -199.9 ~ 600.0℃ / -199.9 ~999.9℉ |
| | JP2 | -199.9 ~ 400.0℃ / -199.9 ~752.0℉ |
| | JP3 | -199.9 ~ 200.0℃ / -199.9 ~392.0℉ |
| | JP4 | 0 ~ 200℃ / 0 ~392℉ |
| | JP5 | 0 ~ 400℃ / 0 ~752℉ |
| | JP6 | 0 ~ 600℃ / 0 ~1112℉ |
| **DIN PT100** | dP1 | -199.9 ~ 600.0℃ / -199.9 ~999.9℉ |
| | dP2 | -199.9 ~ 400.0℃ / -199.9 ~752.0℉ |
| | dP3 | -199.9 ~ 200.0℃ / -199.9 ~392.0℉ |
| | dP4 | 0 ~ 200℃ / 0 ~392℉ |
| | dP5 | 0 ~ 400℃ / 0 ~752℉ |
| | dP6 | 0 ~ 600℃ / 0 ~1112℉ |
| **JIS PT50** | dP.1 | -199.9 ~ 600.0℃ / -199.9 ~999.9℉ |
| | dP.2 | -199.9 ~ 400.0℃ / -199.9 ~752.0℉ |
| | dP.3 | -199.9 ~ 200.0℃ / -199.9 ~392.0℉ |
| | dP.4 | 0 ~ 200℃ / 0 ~392℉ |
| | dP.5 | 0 ~ 400℃ / 0 ~752℉ |
| | dP.6 | 0 ~ 600℃ / 0 ~1112℉ |
| **AN1** | AN1 | -10 ~ 10mV / -1999~9999 |
| **AN2** | AN2 | 0 ~ 10mV / -1999~9999 |
| **AN3** | AN3 | 0 ~ 20mV / -1999~9999 |
| **AN4** | AN4 | 0 ~ 50mV / -1999~9999 |
| **AN5** | AN5 | 10 ~ 50mV /-1999~9999 |

＊The initial setting in factory is “K2”.

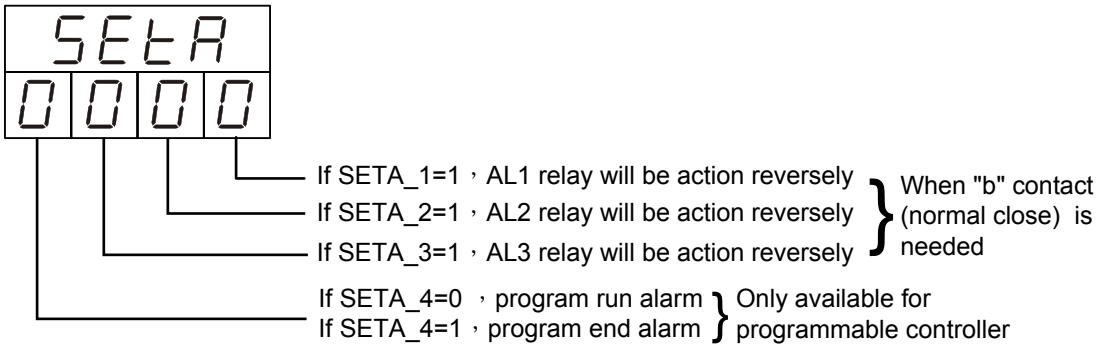
# 10. Alarm

## 10.1 Alarm time (ALT1/ALT2/ALT3)

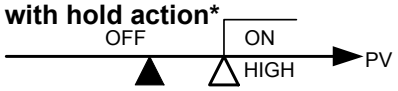
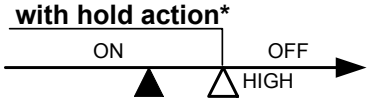
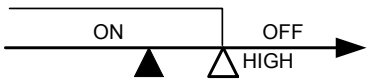
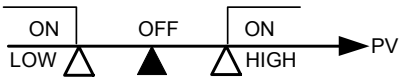
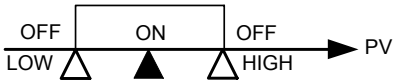
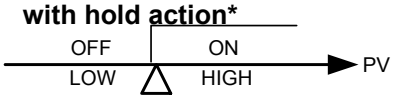
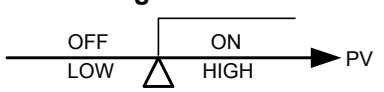
| | |
|---|---|
| ALT1=0 | Flicker alarm |
| ALT1=99.59 | Continued alarm |
| ALT1=00.01 ~ 99.58 | Alarm on delay time |

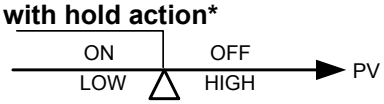
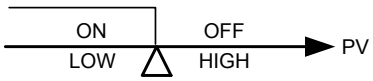
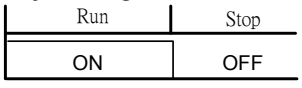
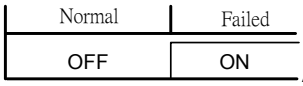
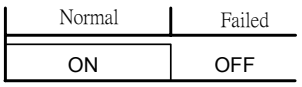
## 10.2 SETA

*SETA is in Level 3 (Input level)




## 10.3 Alarm mode (ALD1 / ALD2 / ALD3) ( ▲:SV △:Alarm set value)

| | |
|---|---|
| 01 | **Deviation high alarm with hold action***   |
| 11 | **Deviation high alarm** |
| 02 | **Deviation low alarm with hold action***   |
| 12 | **Deviation low alarm**   |
| 03 | **Deviation high/low alarm with hold action*** |
| 13 | **Deviation high/low alarm**   |
| 04 / 14 | **Band alarm**   |
| 05 | **Process high alarm with hold action***   |
| 15 | **Process high alarm**   |

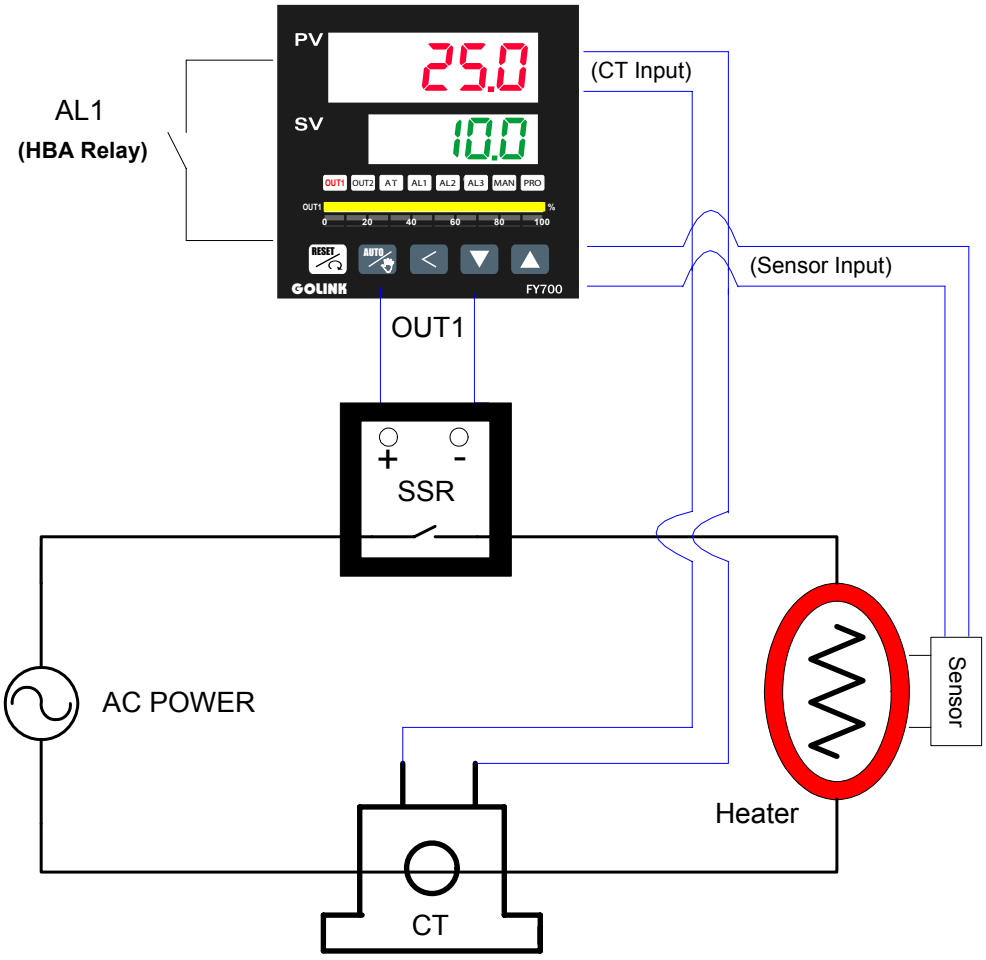
| | |
|---|---|
| 06 | **Process low alarm with hold action***   |
| 16 | **Process low alarm**   |
| 07 | **Segment End alarm (Only for Programmable controller)**<br>(1) ALD1~3 , set **07**<br>(2) ALD1~3=Alarm Segment<br>(3) ALT1~3 defines as follows:<br>**0** =flicker alarm<br>**99.59** =continued alarm<br>**others** =alarm ON time |
| 17 | **Program Run alarm (Only for Programmable controller)**   |
| 08 | **System failed alarm* (ON)**   |
| 18 | **System failed alarm* (OFF)**   |
| 09 | **Heater Break Alarm** (HBA)<br>Please refer with HBA function description in page 31. |
| 00 / 10 | **No alarm** |

***Hold action:**
When Hold action is ON, the alarm action is suppressed at start-up until the measured value (PV) enters the non-alarm range.

***System failed:**
It means that the controller display error message with one of the parameter symbol “UUU1” or “NNN1” or “CJCE”

# 11. Heater Break Alarm (HBA)

## 11.1 HBA Wiring Example

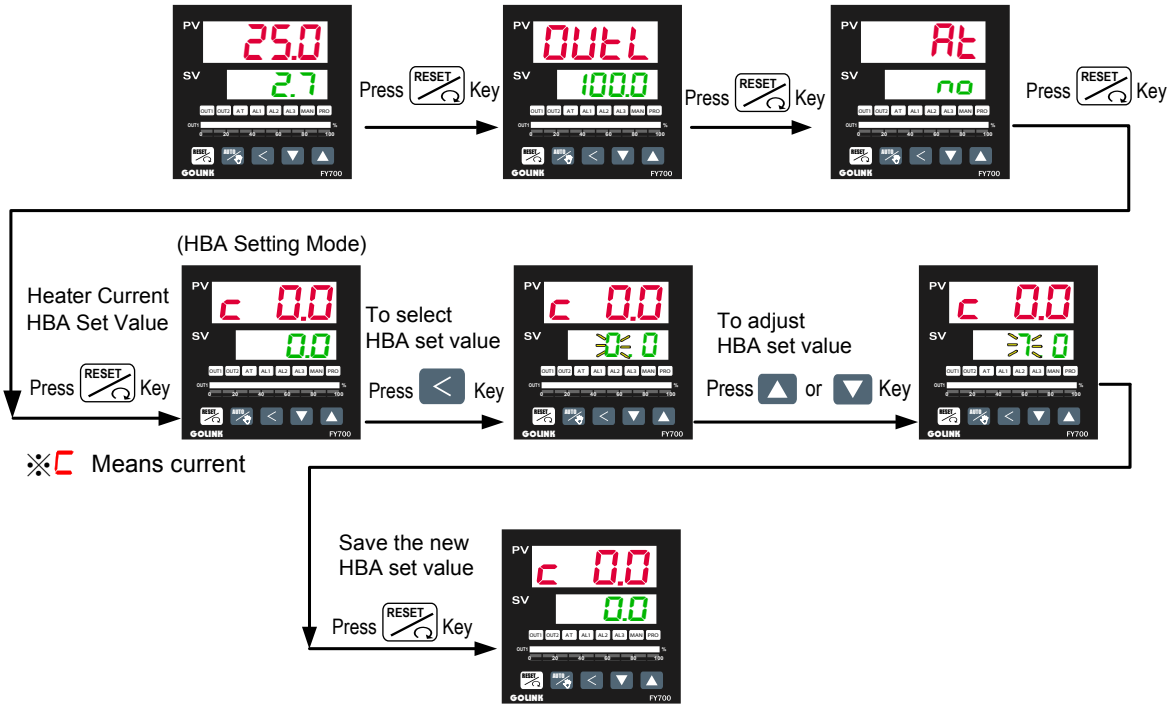



## 11.2 HBA Function Description

HBA function detects the AC current flowing through the heater by a Current Transformer (CT), and compares the CT input value and HBA set value. When OUT1 is ON and CT input value is less than HBA set value during 5 seconds , AL1 is activated. Otherwise, AL1 is not activated.

The AC current flowing through heater can also be monitored in HBA setting mode.

## 11.3 HBA setting procedure




## 11.4 Parameters for HBA function

| Name | Value | Operation Level |
|---|---|---|
| AL1 | HBA Set Value | Level 1 |
| ALD1 | 9 | Level 3 |
| SET0 | 0100 | Level 4 |
| INP2 | 4 | Level 4 |

- How to enter Level 3：Set parameter “LCK”to 0000 in Level 2 , and then press both the RESET key + < key for 5 seconds to enter the operation Level 3.
- How to enter Level 4：Set the parameter “LCK” to be “1111” in Level 2 , and press both the RESET key + < key for 5 sec. to enter the operation Level 4.

## 11.5 Activated conditions of HBA

1. OUT1 is ON
2. Heater current is less the HBA set value
3. Condition1 and 2 are continued for more than 5 seconds

AL1 will be activated, if condition 1 & 2 & 3 are all “true”.

## 11.6 Remarks

- Available output(OUT1) type for HBA
  - I. Relay
  - II. Voltage pulse (SSR drive)
- Since the HBA function uses AL1 as alarm relay, pls set temperature alarms by the AL2 or AL3.

# 12. Error codes

| DISPLAY | DESCRIPTION |
|---|---|
| inIE | Open circuit of main control sensor.(INP1) |
| ∗ AdCF | A/D convert failed. |
| ∗ CJCE | Cold junction compensation failed. |
| in2E | Open circuit of sub control sensor.(Remote SV) |
| uuu1 | PV exceeds USPL. |
| nnn1 | PV under LSPL. |
| uuu2 | Input signal of sub control exceeds the upper limit. (Remote SV) |
| nnn2 | Input signal of sub control under the lower limit. (Remote SV) |
| ∗ RAMF | RAM failed. |
| inEF | Interface failed. |
| AUEF | Auto tuning failed. |

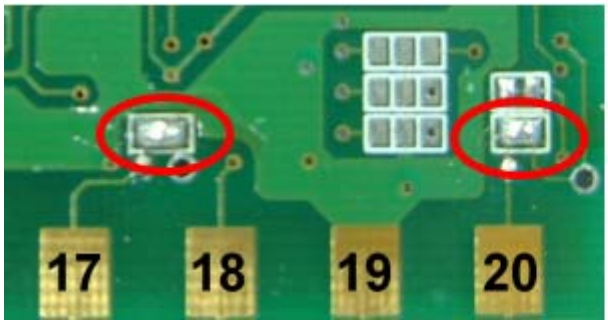
**NOTE**：If the "∗" marked error comes up，the controller needs to be repaired. Please send it to the nearest sales office or retail dealer.

## 13. Modify input type ("TC" ⇄ "RTD")

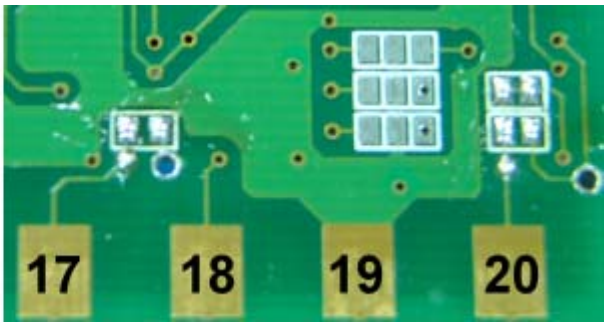
If the controller needs to modify input type from **TC** or **mV** to **RTD** , please make PAD short on the back side of PC board as following diagram and change input selection(INP1). On the contrary , modify from **RTD** to **TC** or **mV** , make PAD open.

96x96,48x96,96x48(mm)

RTD : Short pads

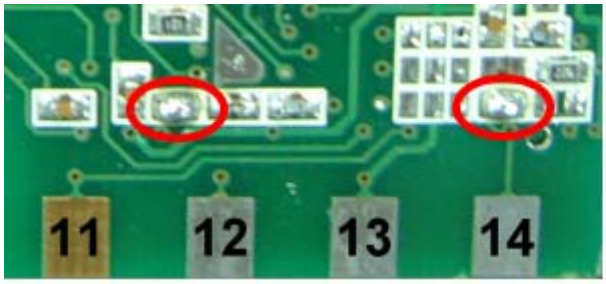



TC or mV : Open pads

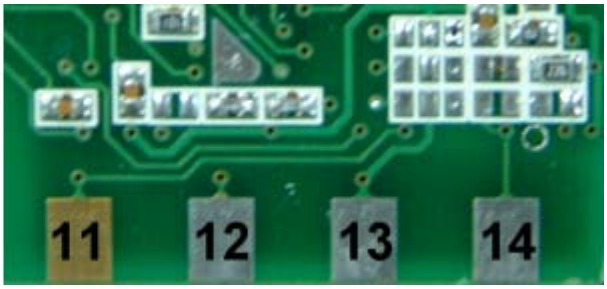



72x72(mm)

RTD : Short pads

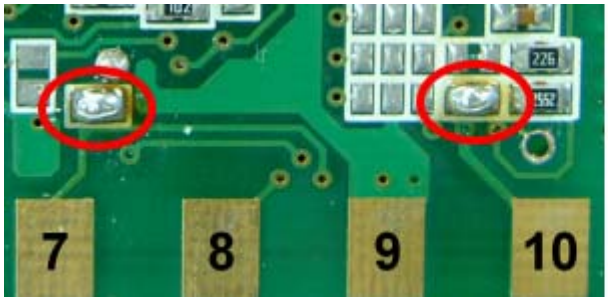



TC or mV : Open pads

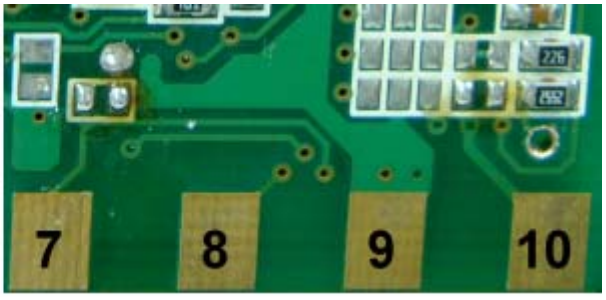



48x48(mm)

RTD : Short pads




TC or mV : Open pads



# 14. Modify input type : Linear Input (mA ,V)

## 14.1 Hardware：

| | 96×96，48×96，96×48 | 72×72 | 48×48 |
|---|---|---|---|
| **INPUT ( + )** | PIN 17 | PIN 11 | PIN 7 |
| **INPUT ( - )** | PIN 20 | PIN 14 | PIN 10 |

**0~20mA** (INP1=AN4)：(R3 use 100Ω，R5 use 2.4Ω， S3＆S5 SHORT)

**4~20mA** (INP1=AN5)：(R3 use 100Ω，R5 use 2.4Ω， S3＆S5 SHORT)

**0 ~ 1V** (INP1=AN4)：(R1 use 2KΩ，R4 use 100Ω，S1＆S4 SHORT)

**0 ~ 5V** (INP1=AN4)：(R2 use 10KΩ，R4 use 100Ω，S2＆S4 SHORT)

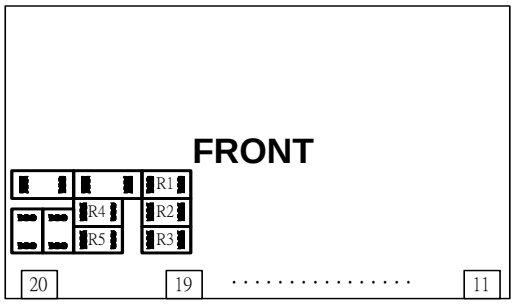
**1 ~ 5V** (INP1=AN5)：(R2 use 10KΩ，R4 use 100Ω，S2＆S4 SHORT)

**0 ~ 10V** (INP1=AN4)：(R3 use 22KΩ，R4 use 100Ω，S3＆S4 SHORT)

**2 ~ 10V** (INP1=AN5)：(R3 use 22KΩ，R4 use 100Ω，S3＆S4 SHORT)

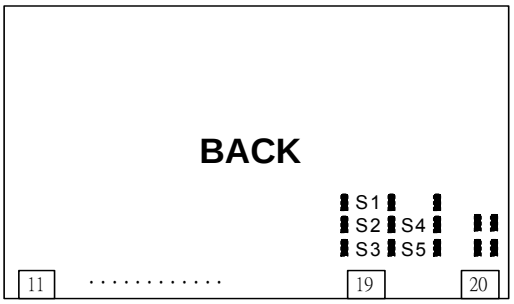
96×96，48×96，96×48

( PC Board )



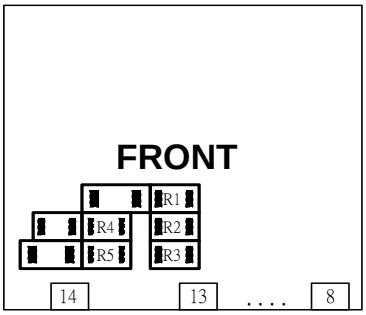

96×96，48×96，96×48

( PC Board )



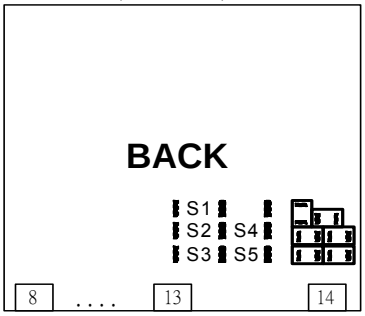

72×72

( PC Board )



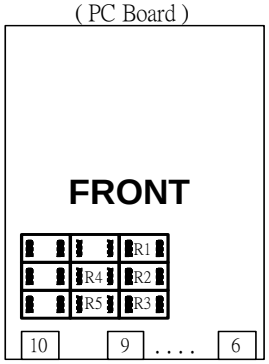

72×72

( PC Board )



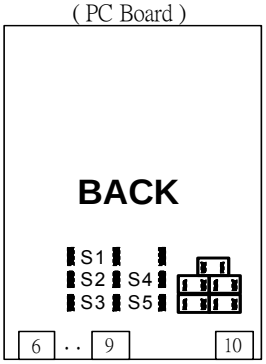

48×48

( PC Board )

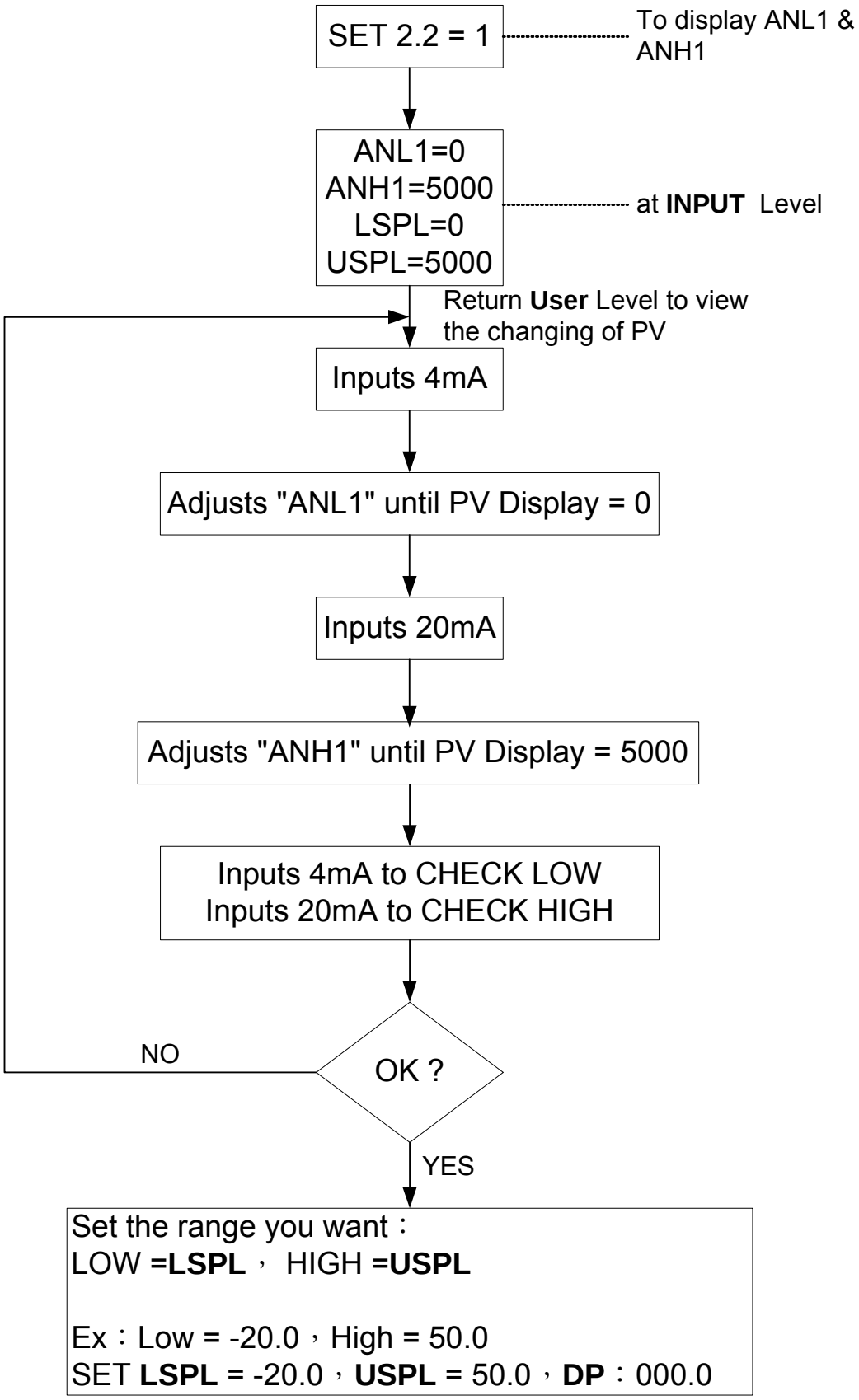



48×48

( PC Board )



## 14.2 Calibration：



# 15. Modify input type : Linear Input (mA ,V)

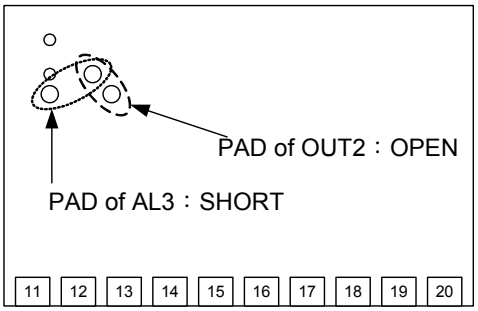
It just needs to change a module at the same position，
and modify parameter **CYT1** in LEVEL 2 .

➔Relay: CYT1=10, Voltage pulse: CYT1=1, 4~20mA:CYT1=0

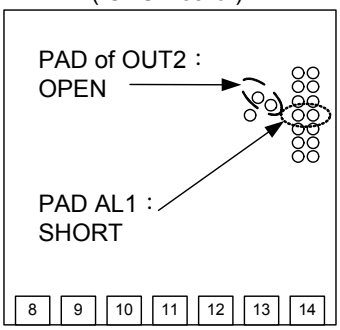
# 16. Modify output mode: OUT1/ALARM, OUT1/OUT2

## OUT1 / ALARM

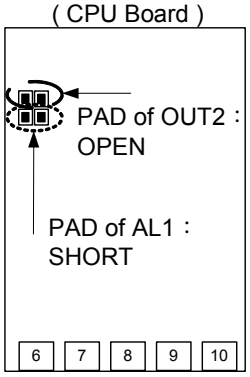
96x96，48x96，96x48
( CPU Board )




72x72
( CPU Board )

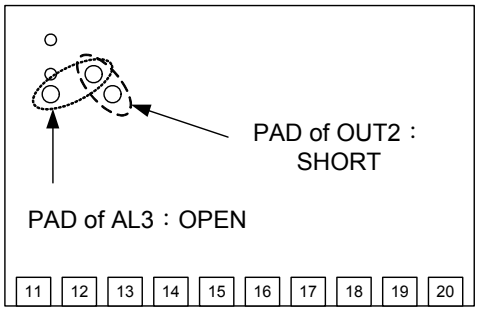



48x48
( CPU Board )

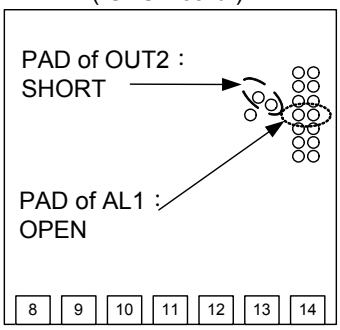



## OUT1 /OUT2

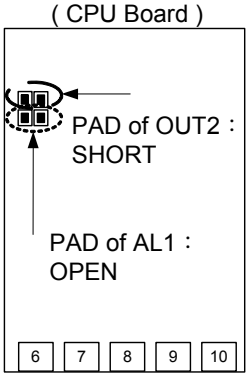
96x96，48x96，96x48
( CPU Board )




72x72
( CPU Board )




48x48
( CPU Board )



# 17. Applications

## 17.1 RAMP & SOAK

- **RAMP：**

I. SET2.1=1➔To display AL3

II. SET4.1=1➔To display ALD3

III. ALD3=9➔Open RAMP option

IV. Then, AL3 will not display. It was replaced by RAMP.

| RAMP |
| --- |
| 0 0.0 0 |

Range：00.00 ~ 99.99(℃/ min)
(If RAMP is not used，please set ALD3 to 0)

- **SOAK**：

I. ALD1 / ALD2=19 ➔ To use Sock Timer.

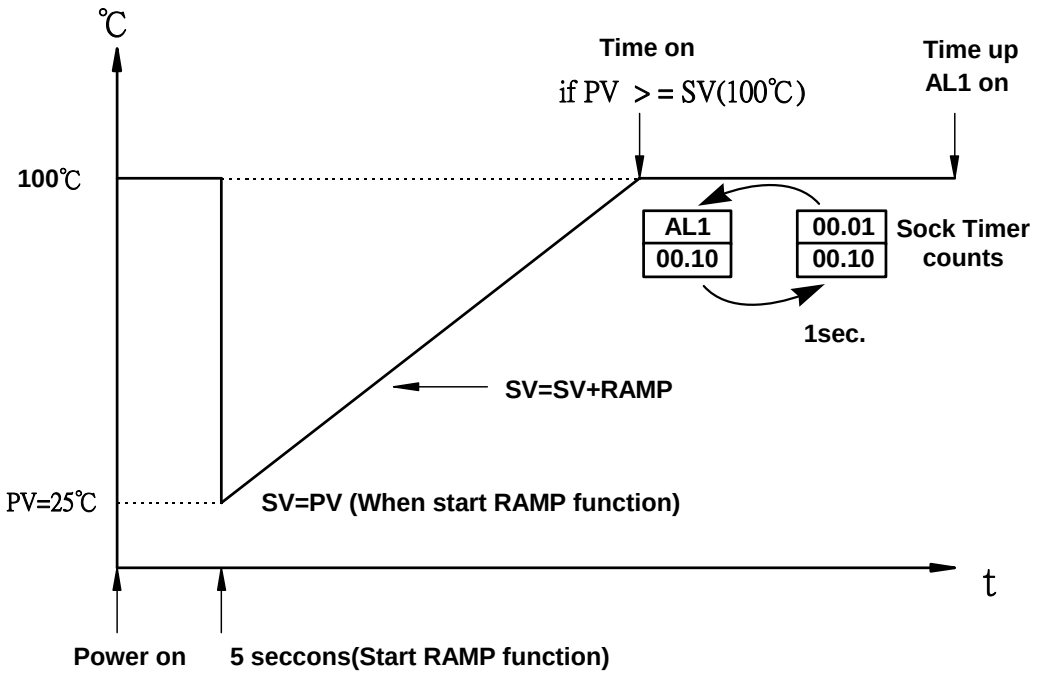
II. AL1 / AL2 will display as below:

| AL1 |
| --- |
| 0 0 . 0 0 |

Range：00.00 ~ 99.59(Hour.Minute)

- **Example：**

SV=100℃，RAMP=10.00 (℃/min)，AL1=00.10 min，PV=25℃



## 17.2 TTL Communication：SV output and RATE function

- **Open RATE function (use for slave controller)**

Display AL3 ：SET2.1=1

Display ALD3：SET4.1=1

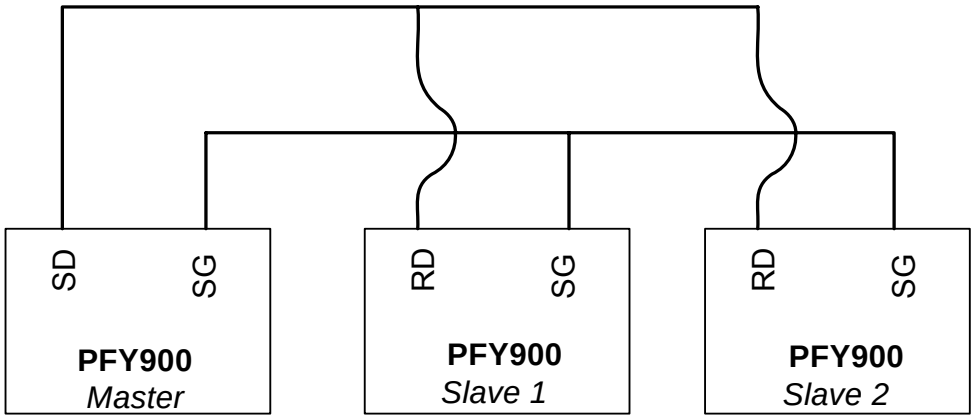
Display RATE(AL3 will be replaced) ：SET0.2=1

Set ALD3 to 0. (In Level 3)

Slave SV = (**RATE**÷9999)×master SV

- **Example：**

**Connection Diagram**

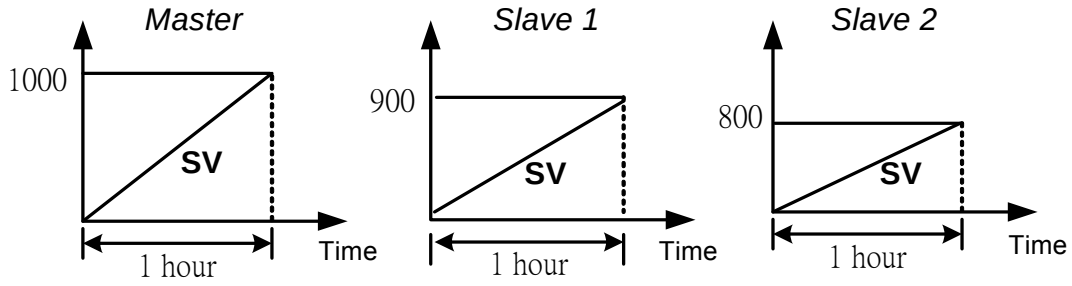



**SV OUT** (SET0.1=1)
**IDNO=0** (SET5.4=1)
**BAUD=2400**(SET5.4=1)

**IDNO=1** (SET5.4=1)
**BAUD=2400**
(SET5.4=1)
open RATE function

**IDNO=1** (SET5.4=1)
**BAUD=2400**
(SET5.4=1)
open RATE function

**Time Chart**




**SV_1=1000**
**TM_1=01:00**
**OUT_1=100%**

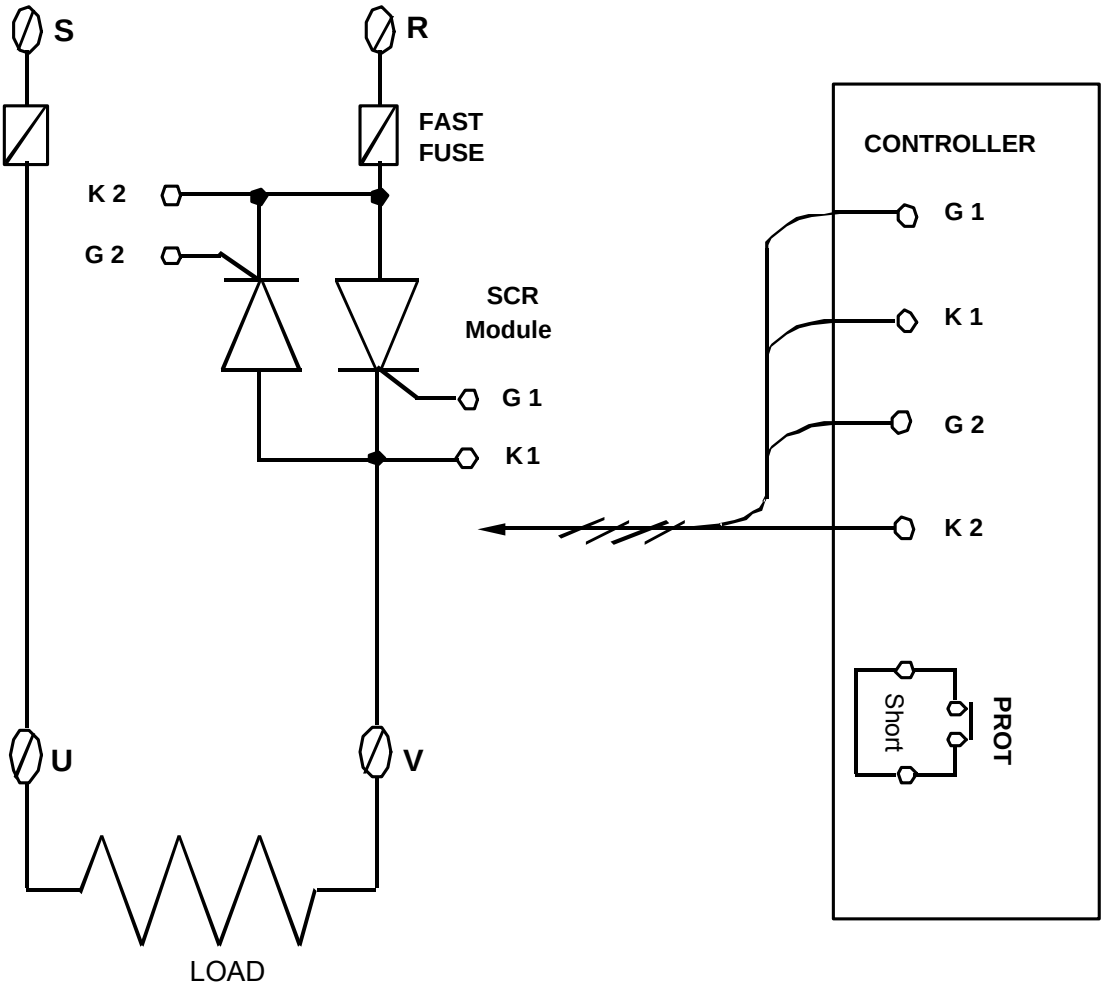
**RATE = 9000**
**SV=900**

**RATE =8000**
**SV=800**

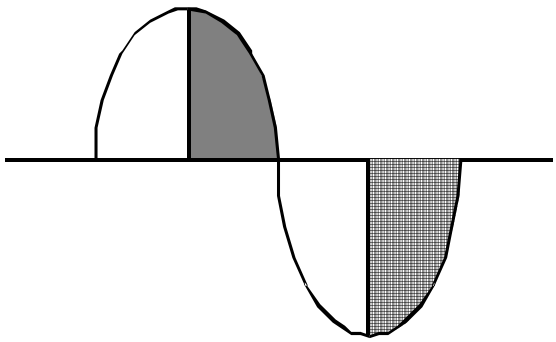
( Three controllers reach to the max value at the same time )

## 17.3 1$\phi$ Phase angle control (By SCR module)

- Available Models：PFY900 ， PFY700
- OUT1: 1$\phi$ SCR
- Parameter setting： OUTY=4
  CLO1=0，CHO1=4500 if use for resistance load
  CLO1=0，CHO1=4000 if use for inductor load

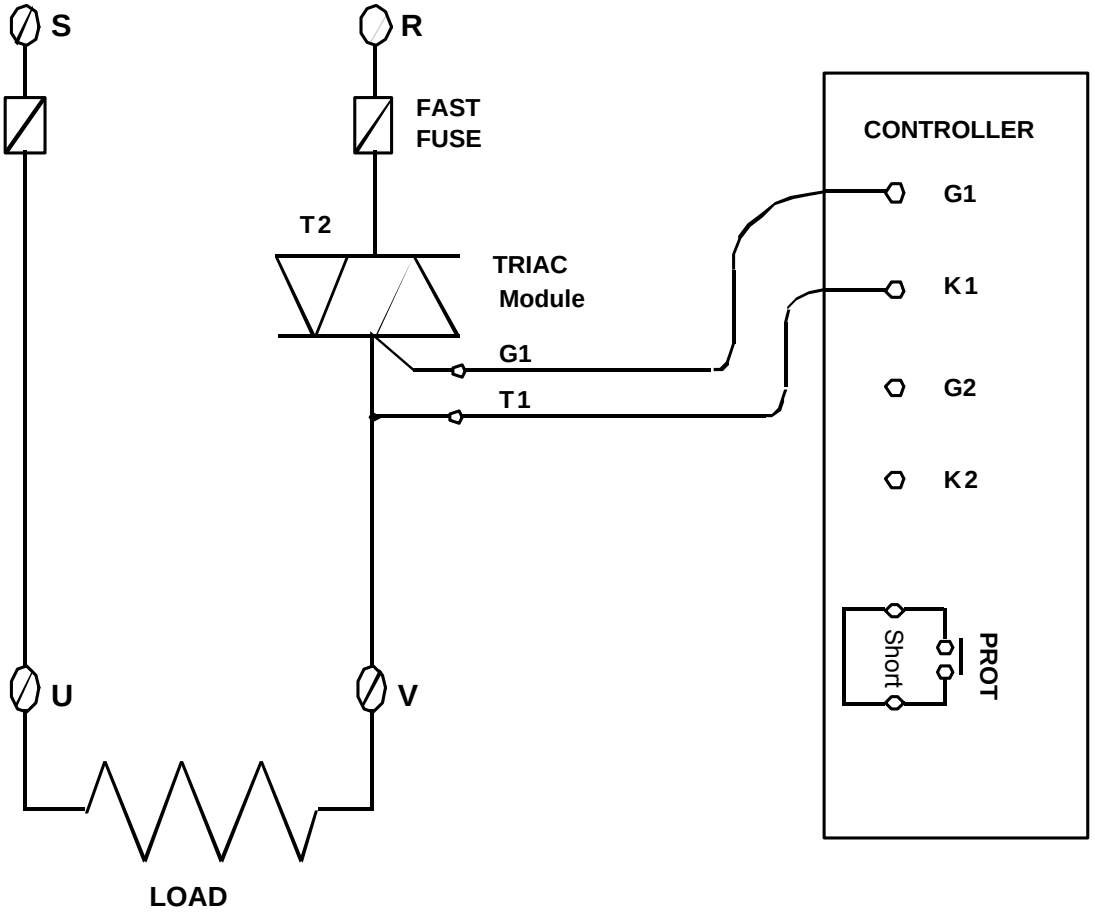



** Controller source phase must be same as load source phase

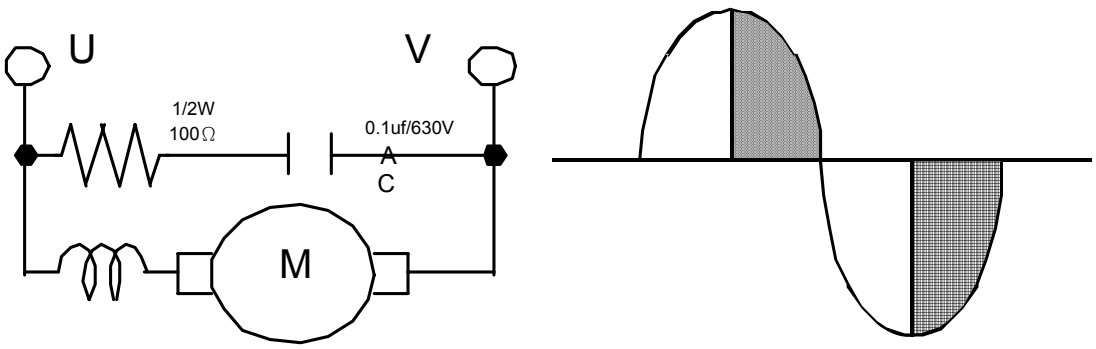


## 17.4 1$\phi$ Phase angle control (By TRIAC)

- Available Models： PFY900， PFY700
- OUT1: 1$\phi$ SCR
- Parameter setting： OUTY=4
  CLO1=0，CHO1=4500 if use for resistance load
  CLO1=0，CHO1=4000 if use for inductor load

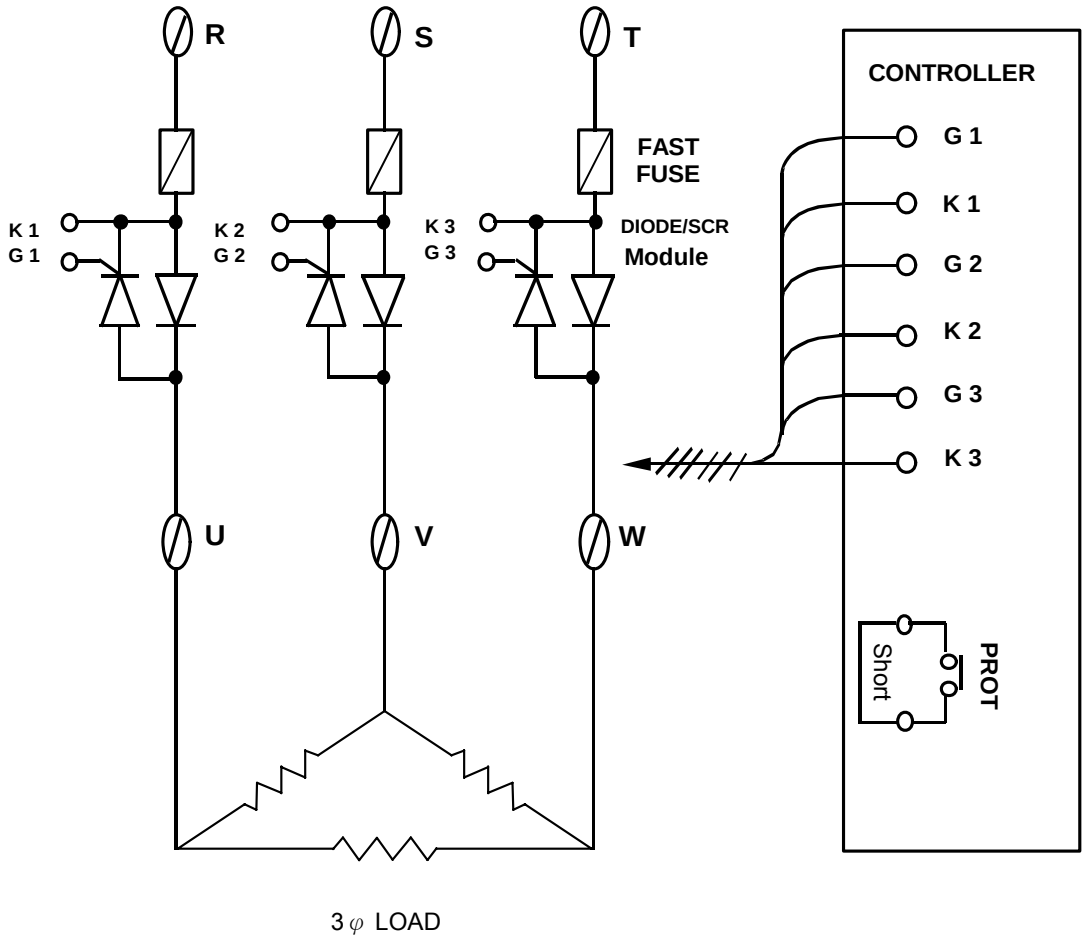



** Controller source phase must be same as load source phase



## 17.5 3$\phi$ Phase angle control (By DIODE/SCR module)

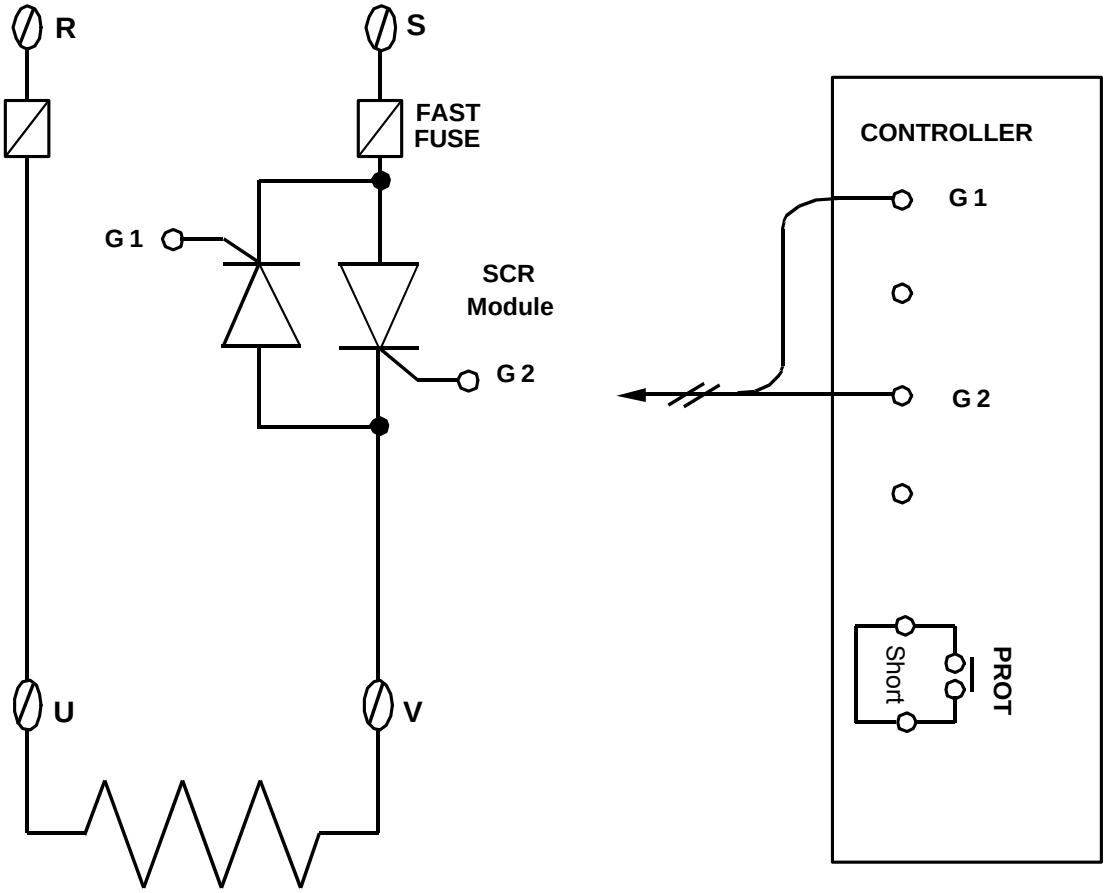
- Available Models：PFY900
- OUT1: 3$\phi$ SCR
- Parameter setting： OUTY=5
  CLO1=0，CHO1=4500 only if use for resistance load
  CLO1=0，CHO1=4000 if use for inductor load

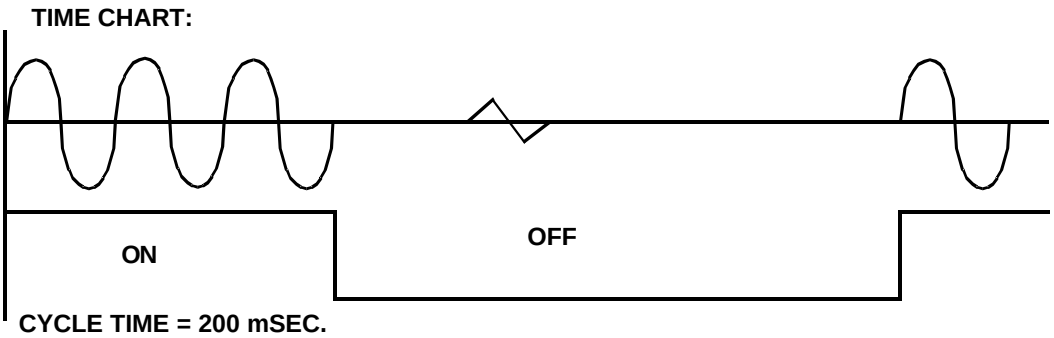



3$\varphi$ LOAD

## 17.6 1$\phi$ Zero crossing control (By SCR module)

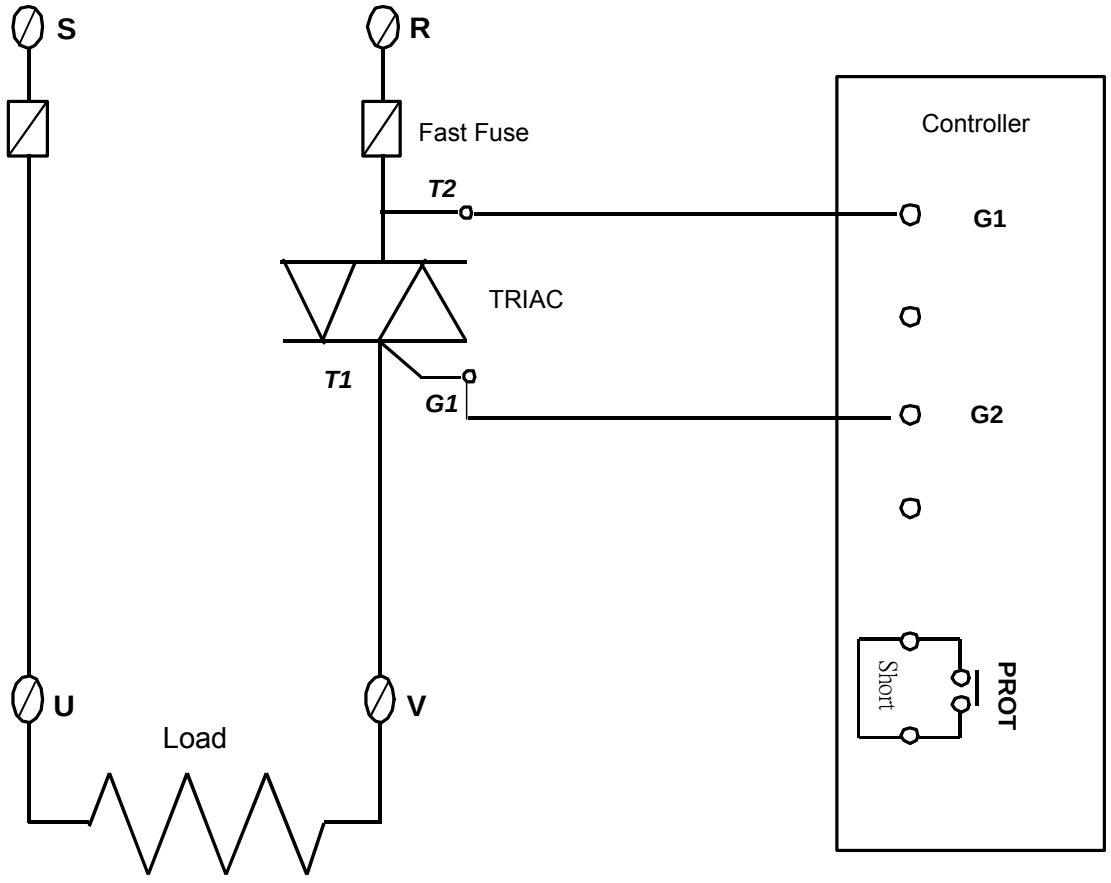
- Available Models： PFY900， PFY700
  PFY400
- OUT1: 1$\phi$ SSR
- Parameter setting： OUTY=0
  CYT1=1



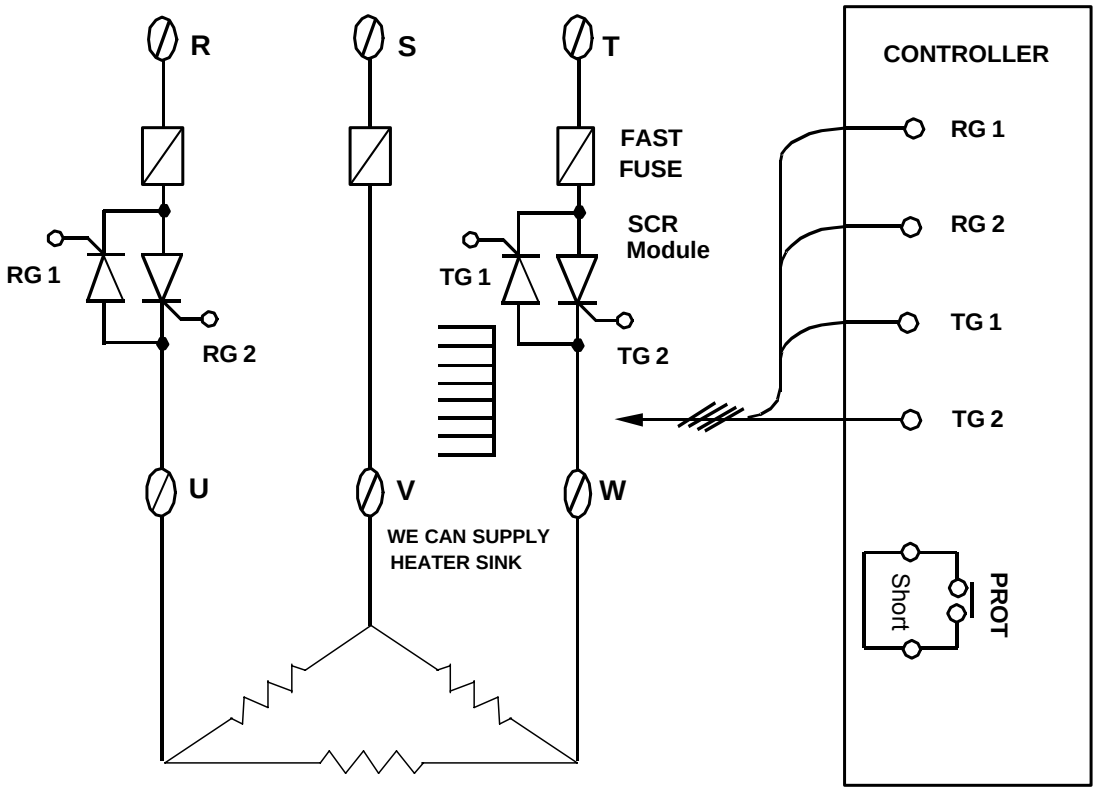
## 17.7 1$\phi$ Zero crossing control (By TRIAC)

- Available Models： PFY900， PFY700
  PFY400
- OUT1: 1$\phi$ SSR
- Data Change： OUTY=0
  CYT1=1

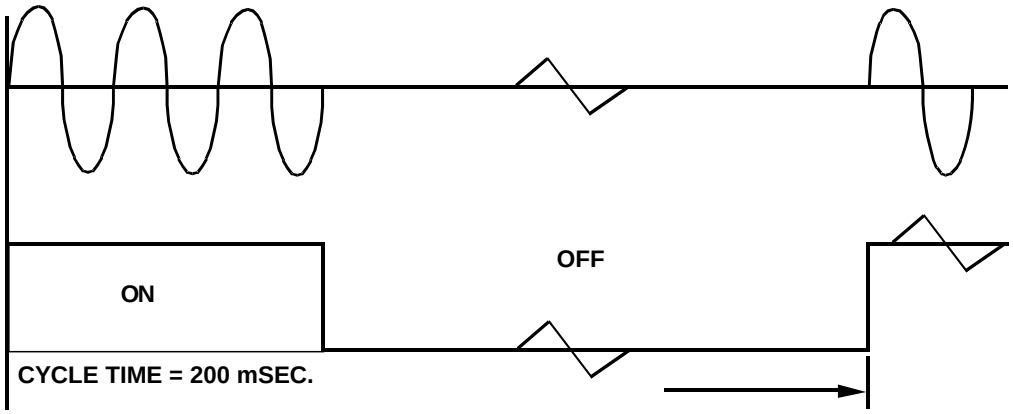


## 17.8 3$\phi$ Zero crossing control (By SCR module)

- Available Models：PFY900
- OUT1: 3$\phi$ SSR
- Data Change： OUTY=0
  CYT1=1

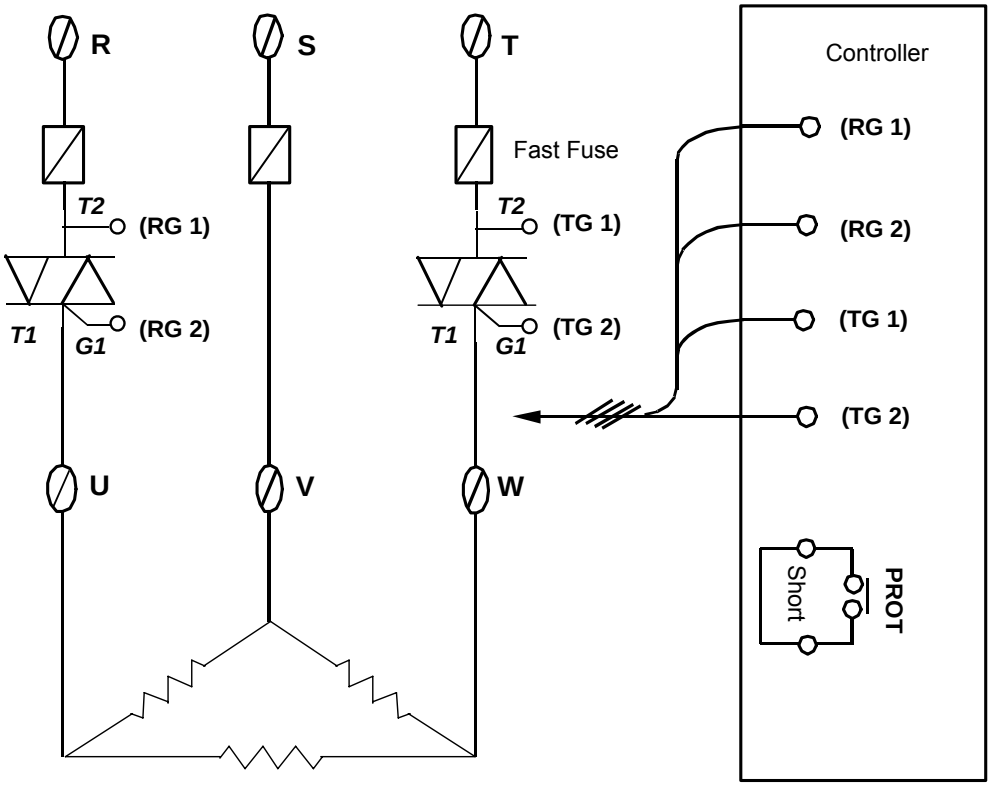



**TIME CHART:**



## 17.9 3$\phi$ Zero crossing control (By TRIAC)

- Available Models： PFY900
- OUT1: 3$\phi$ SSR
- Data Change： OUTY=0
  CYT1=1

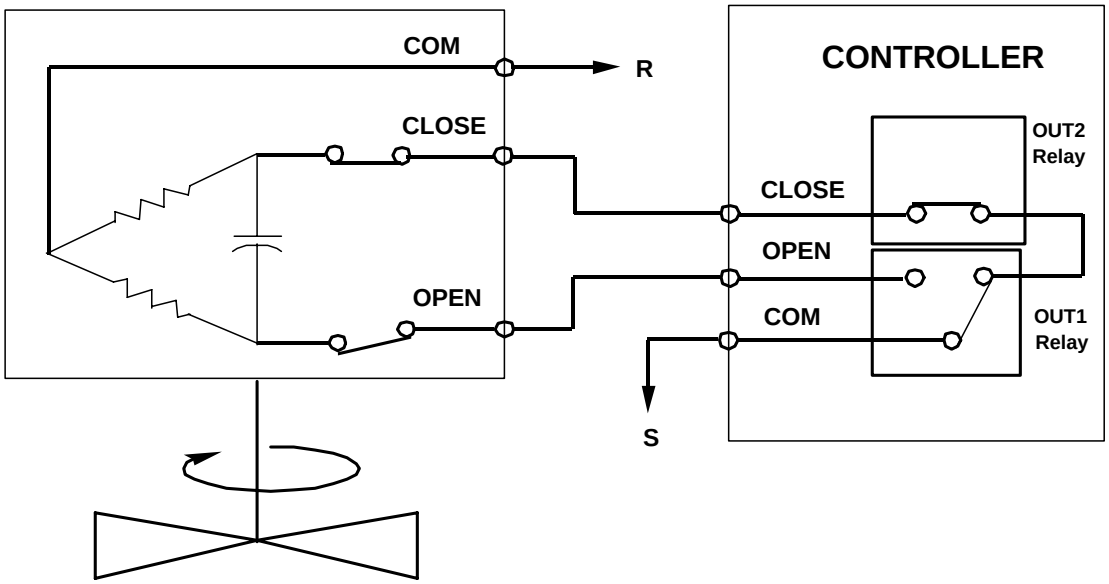


## 17.10 3 wires proportional motor valve control

- Available Models： PFY900， PFY700
  PFY800，PFY600
  PFY400
- Data Change： OUTY=3
  CYT1=1 ~ 100sec.
  (Manufacturing default setting “5” seconds.)
  RUCY=5 ~ 200 seconds.

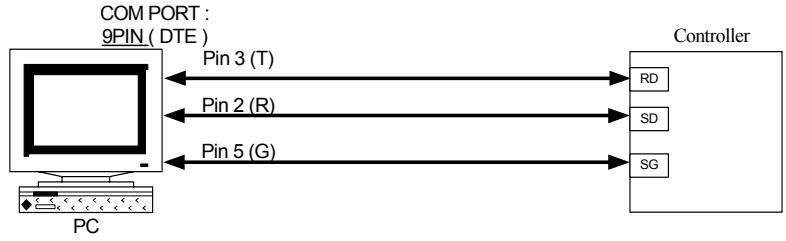
1. CYT1 is the cycle time of Open / Close
2. RUCY is the 0 ~ 100% running time of motor valve

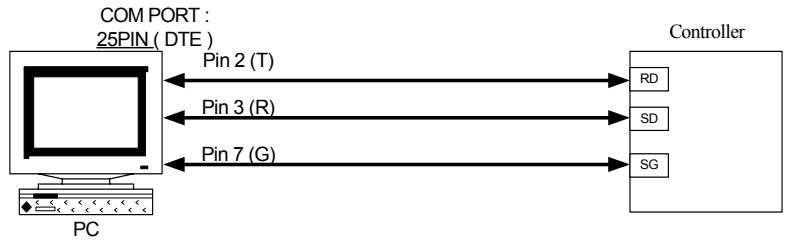
**MOTOR VALVE**



## 17.11 Wiring diagram of PC communication

### RS232 Connection Diagram




**NOTE:**

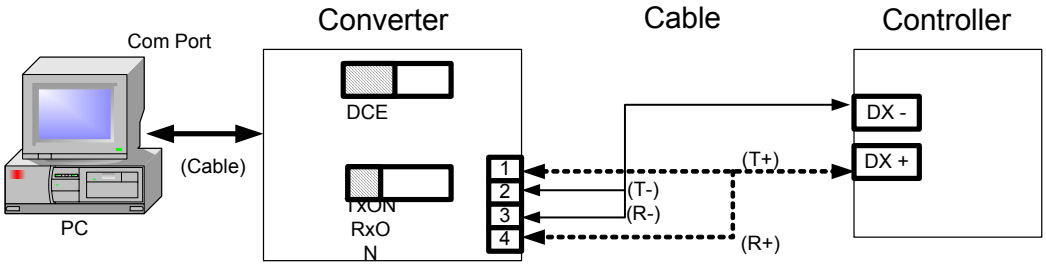
1.The length of cable be connected between controller and PC can't exceed 15 meter.

2.One Com Port can only be connected to one controller.
If more than one controller is connected to one Com Port，communication will be failed.

3.Ensure that the controller's IDNO and BAUD settings are the same with PC software's settings.

4.For the software communication format please refer to communication manual.

### RS485 Connection Diagram




**NOTE:**
1.The length of cable be connected between Converter and Controller can't exceed 1.2 KM.
Suggestion:choose "Shielded Cable".

2.One Com Port can be connected up to a maximum of 30 Controllers.

3.Ensure that the Controller's IDNO and BAUD settings are the same with PC software's settings.

4.For the software communication format ,please refer to communication manual.