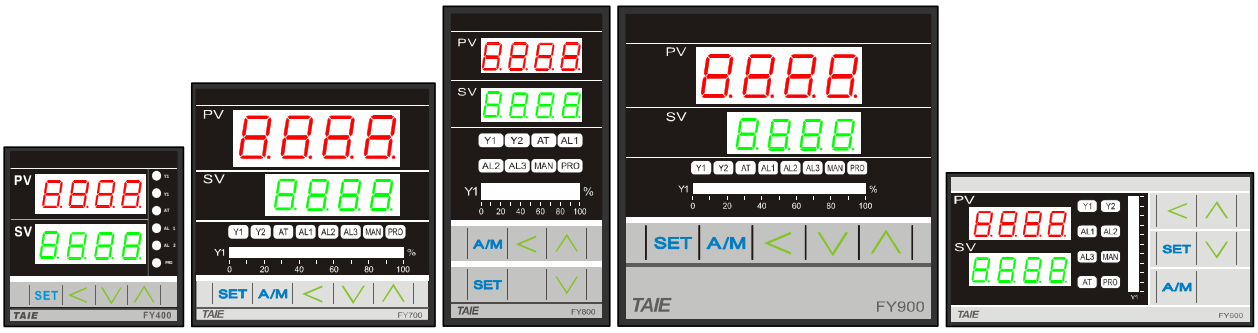
FY Series Digital PID Controller
Operation Manual



FY400 48x48 (DIN 1/16)

FY700 72x72

FY800 48x96 (DIN 1/8)

FY900 96x96 (DIN 1/4)

FY600 96x48 (DIN 1/8)

TAIE

2005.02

CONTENT

1 Notice before start- up …… Page 3
2 Specifications …… Page 4
3 Terminal arrangement
3.1 FY400 Terminals …… Page 6
3.2 FY600 Terminals …… Page 7
3.3 FY700 Terminals …… Page 8
3.4 FY800 Terminals …… Page 9
3.5 FY900 Terminals …… Page 10
4 External dimension and panel cutout …… Page 11
5 Parts description…… …… Page 12
6 Operations
6.1 Power On …….. Page 13
6.2 Change the Set Value (SV) …… Page 13
6.3 Change The Alarm Value…… Page 13
6.4 Autotuning (AT) ……..…… Page 14
6.5 Programmable RAMP / SOAK …….. Page 15
7 Operation levels
7.1 Levels diagram ……. Page 16
7.2 Lock function ……..……..…… Page 16
8 Parameters
8.1 Level 1 (User Level) …… Page 17
8.2 Level 2 (PID Level)
8.2.1 Level 2 parameters display / hiding condition…..……... Page 18
8.2.2 Description of parameters…… Page 19
8.3 Level 3 (Input Level) …… Page 20
8.4 Level 4 (SET Level)
8.4.1 How to hide parameters (Use SET1~SET7) …… Page 22
8.4.2 Special functions (Use SET8 / SET9 / SET0)……..… Page 23
8.4.3 Remote SV type selection…… Page 24
8.4.4 Output mode selection (Use OUTY) …… Page 24
8.5 Program Level
8.5.1 Description of parameters …… Page 25
8.5.2 Description of operation…… Page 26
9 Input type table …… Page 27
10 Alarm
10.1 Alarm time…… Page 29
10.2 SETA …… Page 29
10.3 Alarm mode …… Page 30

11 Error codes …… Page 31
12 Modify input type: TC, RTD …… Page 32
13 Modify input type: Linear Input (mA ,V)
13.1 Hardware …… Page 33
13.2 Calibration …… Page 34
14 Modify output type: Relay, SSR, 4~20mA …… Page 35
15 Modify output mode: OUT1/ALARM, OUT1/OUT2 …… Page 35
16 Applications
16.1 RAMP & SOAK …… Page 36
16.2 TTL Communication：SV output and RATE function…… Page 37
16.3 1ψ Phase angle control (By SCR module) …… Page 38
16.4 1ψPhase angle control (By TRIAC) …… Page 39
16.5 3ψPhase angle control (By DIODE/SCR module)…….. Page 40
16.6 1ψZero crossing control (By SCR Module) …… Page 41
16.7 1ψZero crossing control (By TRIAC) …… Page 42
16.8 3ψZero crossing control (By SCR module) …… Page 43
16.9 3ψZero crossing control (By TRIAC) …… Page 44
16.10 3 wires proportional motor valve control …… Page 45
16.11 Communication
16.11.1 Protocol …… Page 46
16.11.2 Wiring diagram …… Page 49

1. Notice before start-up

FY 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

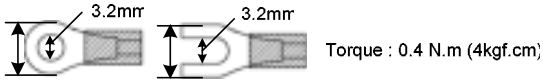
Please confirm the specification of controller is to totally with your requirement before using it, also read this manual in detail.

⚠ 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. (FY400 connecting with Pin 1 and 6, FY600/700/800/900 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 50 to 85% 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		FY400	FY600	FY700	FY800	FY900
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	TC	K,J,R,S,B,E,N,T,W,PL2,U,L				
	RTD	DPT100,JPT100,JPT50				
	mA dc	4~20mA ,0~20mA				
	mV / V dc	0~1V,0~5V,0~10V,1~5V,2~10V -10~10mV,0~10mV,0~20mV,0~50mV,10~50mV				
	Decimal point position	0000 , 000.0 , 00.00 , 0.000 Available for linear input (mA / mV / V)				
Output 1	Relay	SPST type	SPDT type	SPDT 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。				
Accuracy		0.2% + 1digit				
Sample time		250 ms				
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 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) 1500V AC for 1 minute between output terminal and case (ground)				
Operating temperature		0~50℃				
Humidity range		50~85%RH				
Weight		150g	225g	225g	225g	300g
Display Height		PV:7mm SV:7mm	PV:7mm SV:7mm	PV:14mm SV:10mm	PV:7mm SV:7mm	PV:14mm SV:10mm

● Optional Spec.

Model	FY400	FY600	FY700	FY800	FY900
Output 2	Available for all models.				
	For heating and cooling control use. Relay , SSR , 4~20mA , 0~20mA , 0~5V , 0~10V , 1~5V , 2~10V				
Alarm 2	Available for all models.				
	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 SPST type	Not available	Available SPST type	Available SPST type
	3A , 220V , electrical life:100,000 times or more (under rated load)				
Transmission	Available for all models.				
	4~20mA , 0~20mA , 0~1V , 0~5V , 0~10V , 1~5V , 2~10V				
Remote SV	Not available	Available	Available	Available	Available
	4~20mA, 0~20mA, 0~1V, 0~5V, 0~10V, 1~5V, 2~10V				
Communication	Available for all models.				
	RS232 , RS485 , TTL				
	Baud rate: 9600,4800,2400,1200,300,110 bps. Start bit : 1 bit, Stop bit : 1 bit , Odd parity.				
Waterproof /Dust proof	Available for all models.				
	IP66 (NEMA4)				

● Special control output

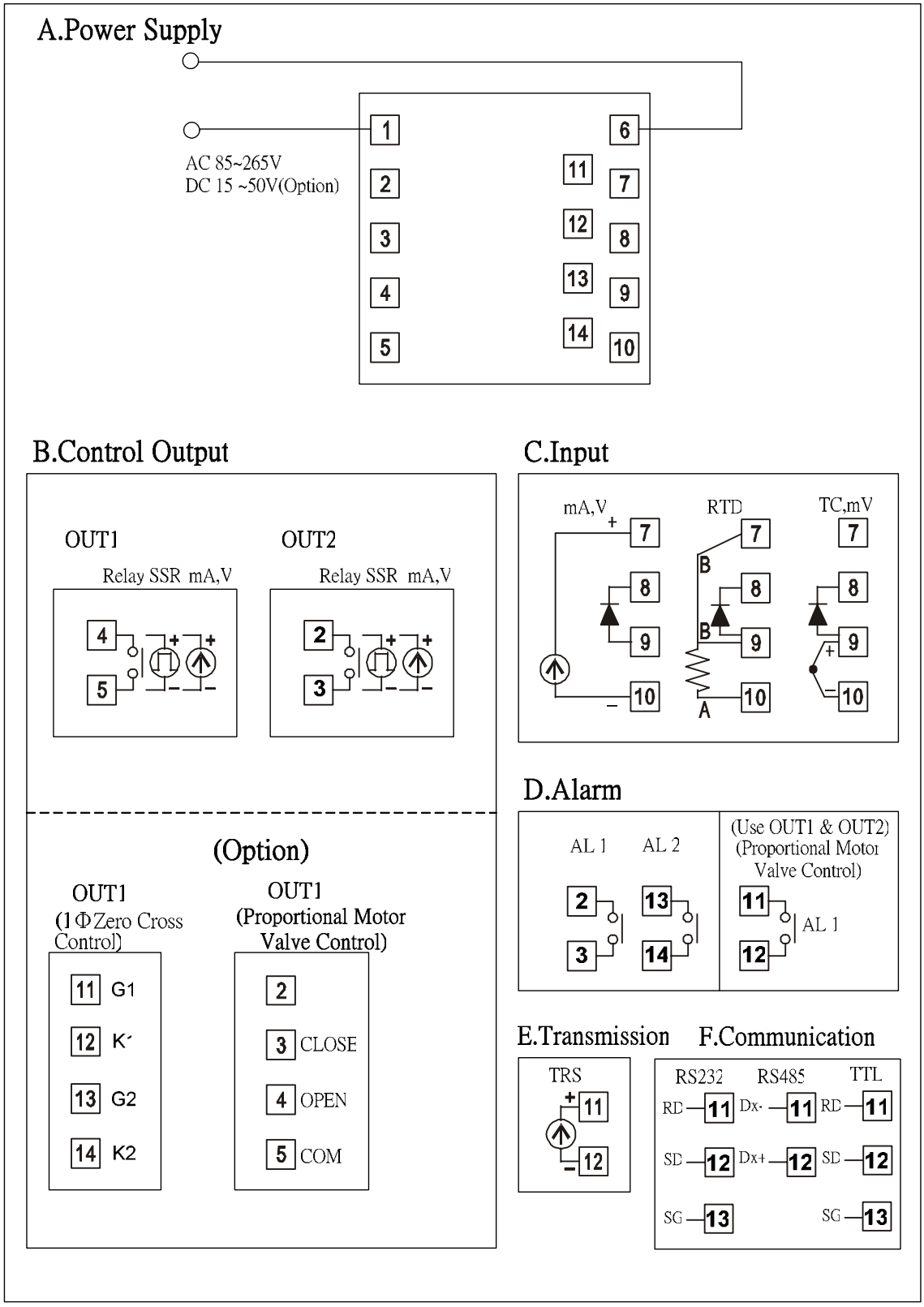
Model	FY400	FY600	FY700	FY800	FY900
1φ zero crossing control(1φSSR)	Available	Not available	Available	Not available	Available
3φ zero crossing control(3φSSR)	Not available				Available
Motor valve control	Available				
1φ phase angle control(1φSCR)	Not available	Available			
3φ phase angle control(3φSCR)	Not available				Available

● Programmable RAMP/SOAK

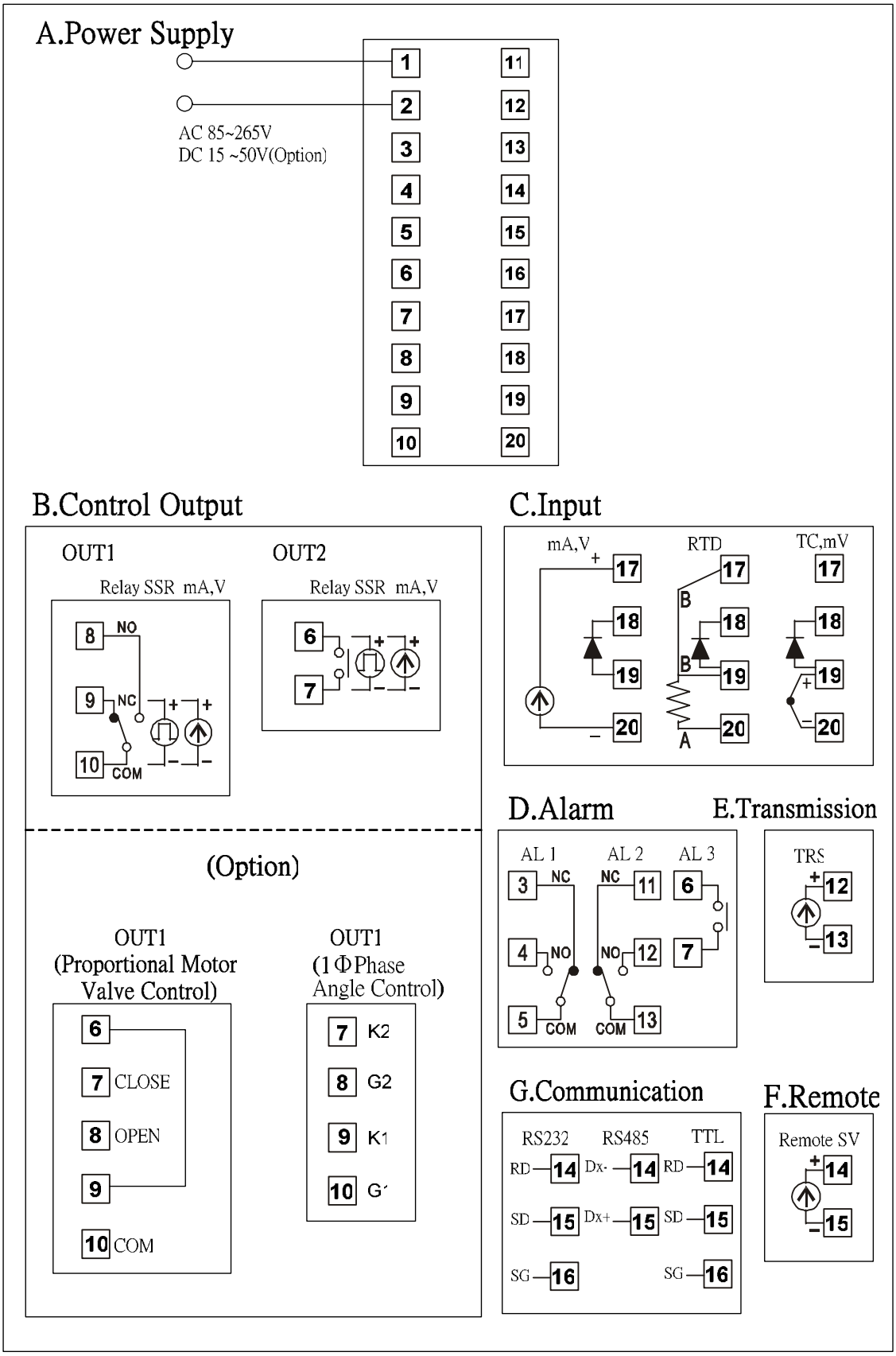
Model	PFY400	PFY600	PFY700	PFY800	PFY900
Programmable RAMP/SOAK	2 patterns with 8 segments each. The 2 patterns can be linked together as 16 segments use.				

3. Terminal arrangement

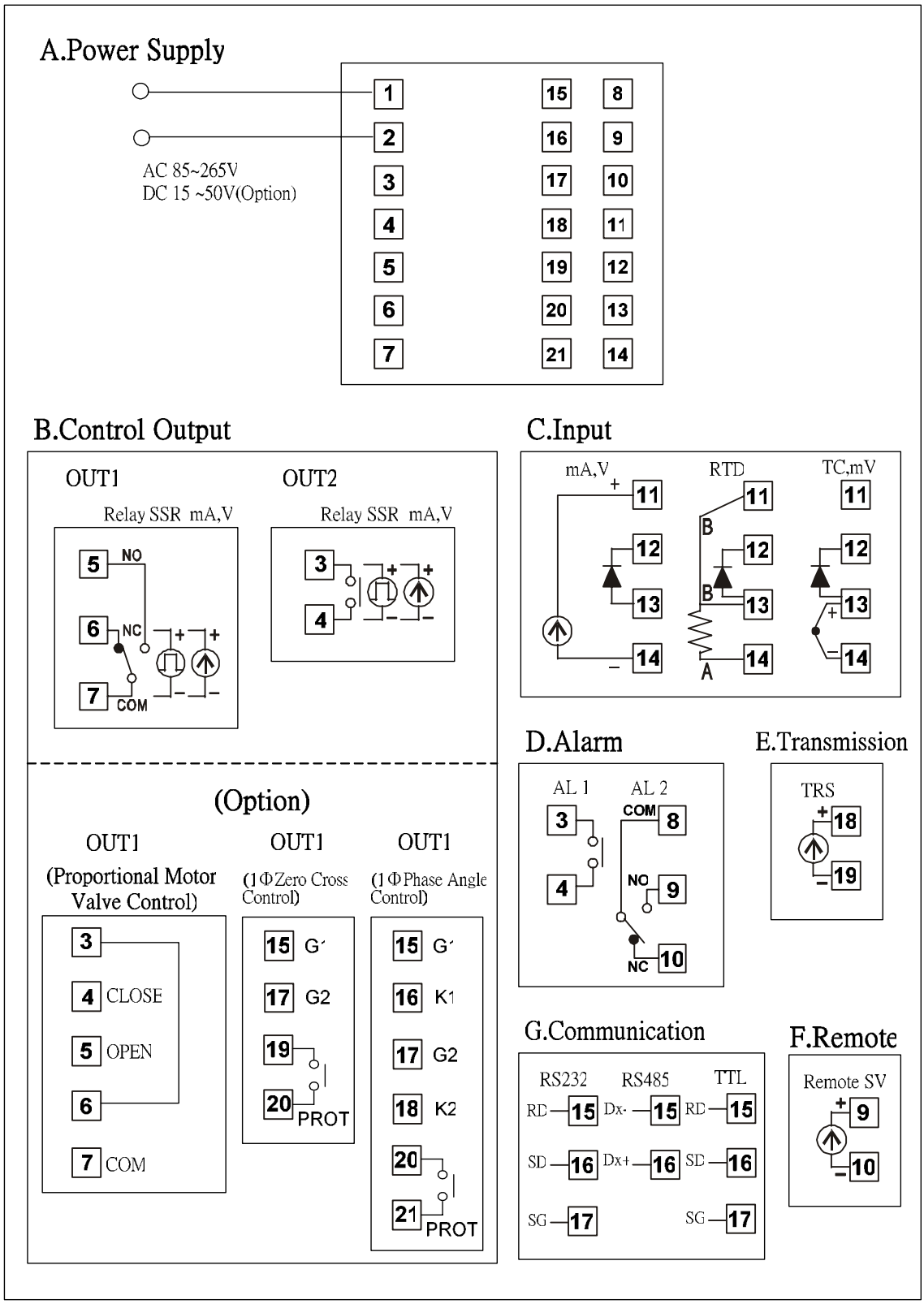
3.1 FY400 Terminals (48mm x 48mm , DIN 1/16)



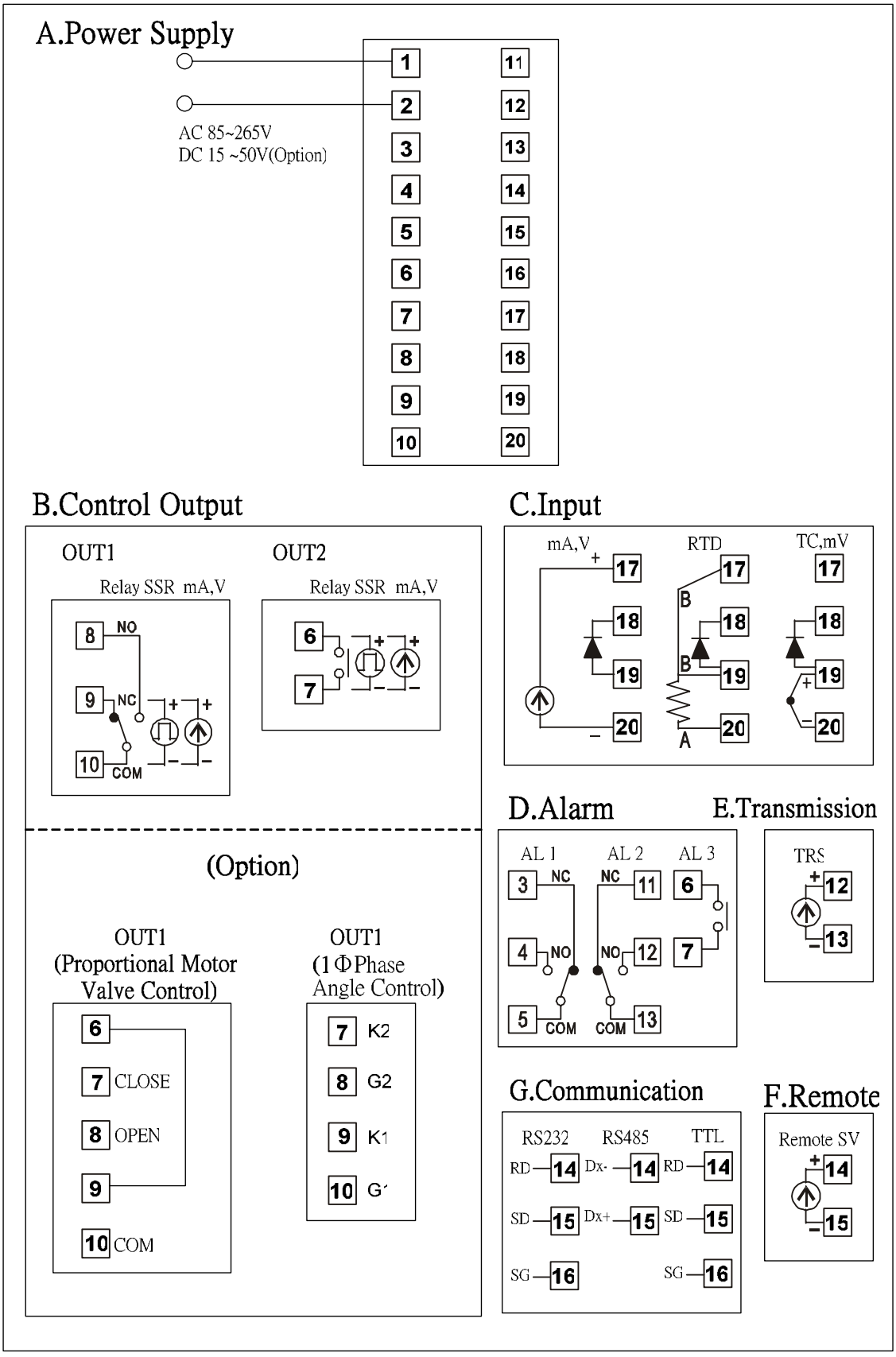
3.2 FY600 Terminals (96mm x 48mm , DIN 1/8)



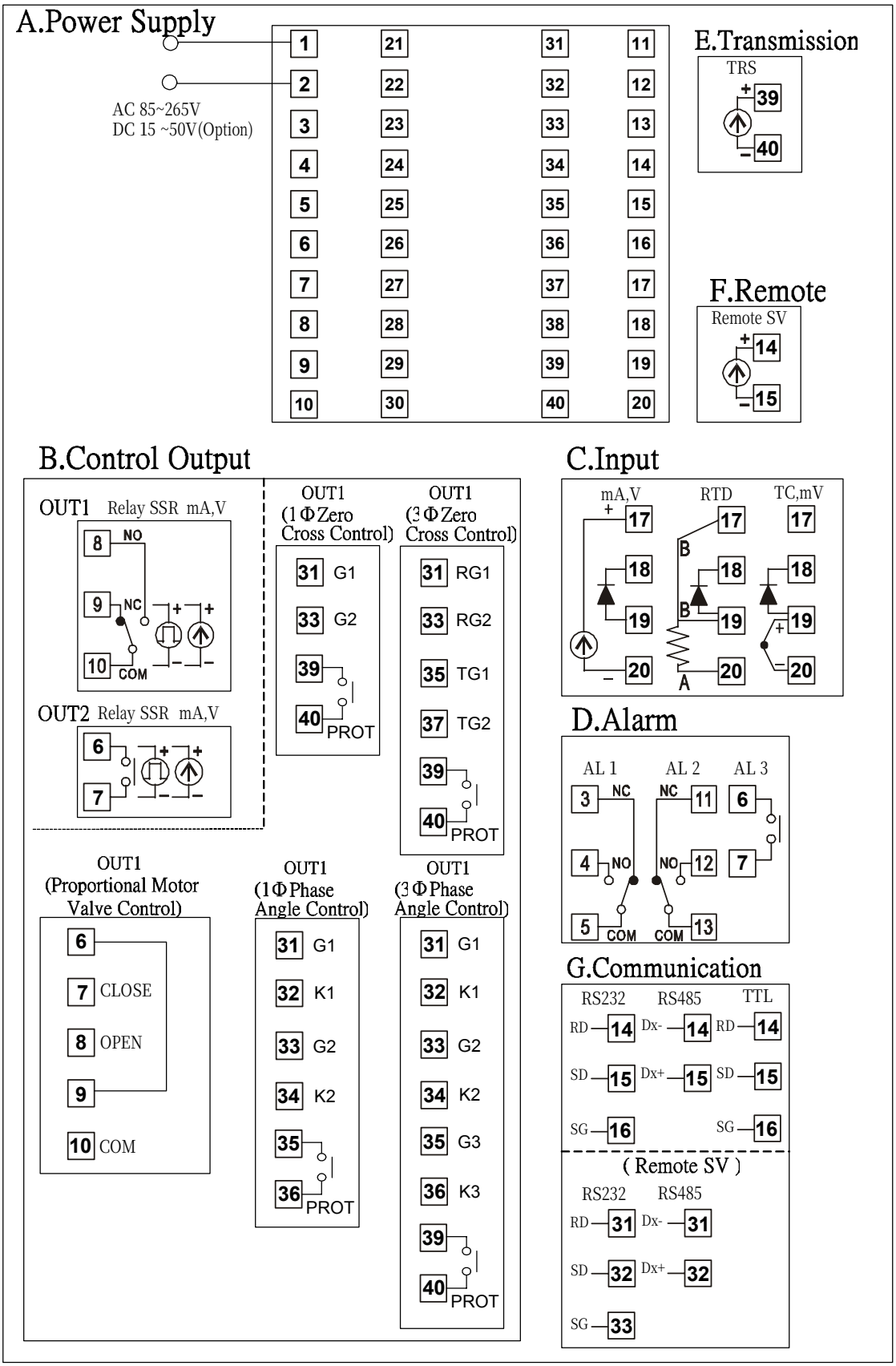
3.3 FY700 Terminals (72mm x 72mm)



3.4 FY800 Terminals (48mm x 96mm , DIN 1/8)

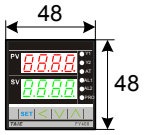


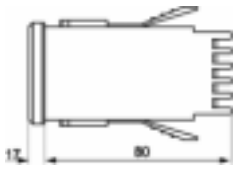
3.5 FY900 Terminals (96mm x 96mm , DIN 1/4)

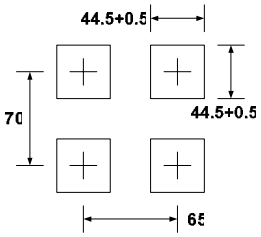


4. External dimension and panel cutout〈Unit：mm〉

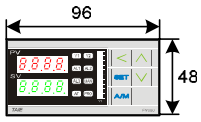
FY400

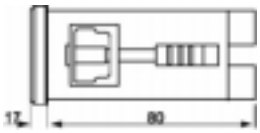


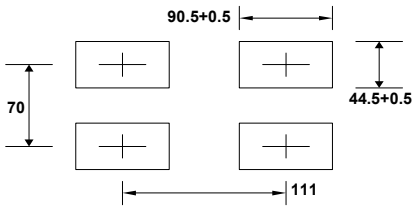




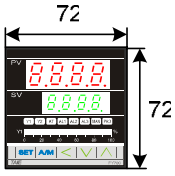
FY600

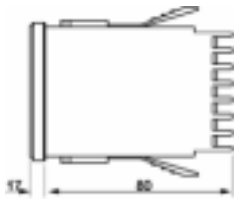


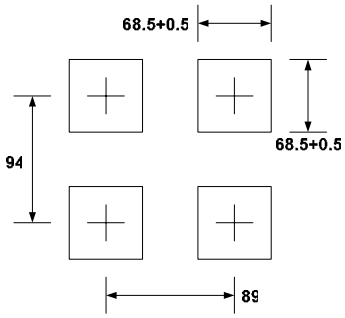




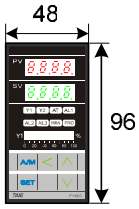
FY700

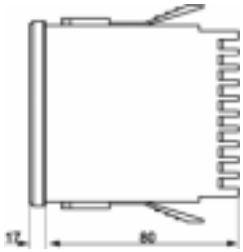


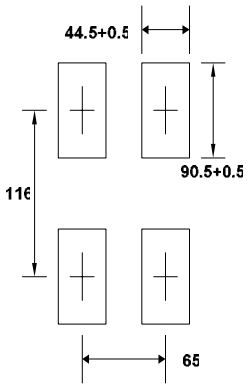




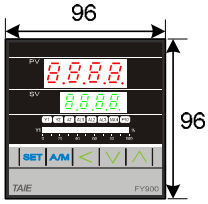
FY800

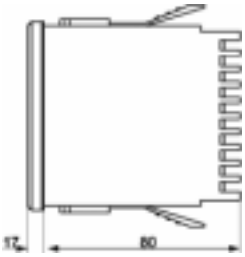


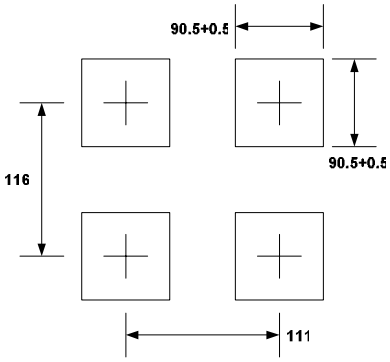




FY900

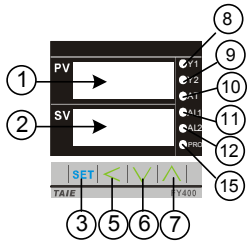




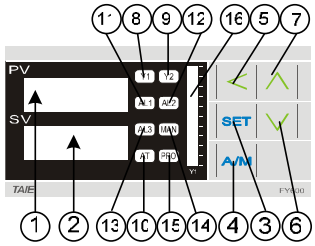


5. Parts description

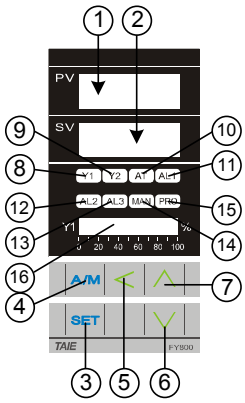
FY400



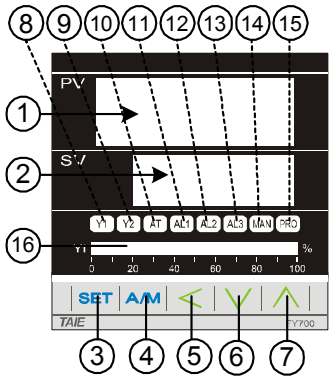
FY600



FY800



FY700 / FY900

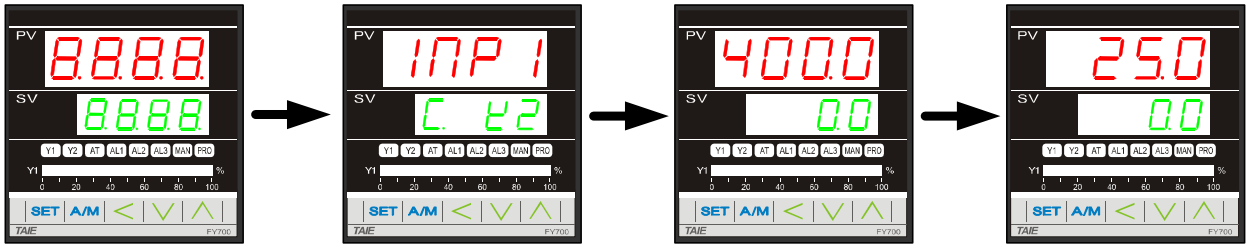


SYMBOL	NAME		FUNCTION
PV	①	Measured value (PV) display	Displays PV or various parameter symbols (Red)
SV	②	Set value (SV) display	Displays SV or various parameter set values (Green)
SET	③	Set key	Used for parameter calling up and set value registration
A/M	④	Auto/Manual key	Switches between Auto(PID) output mode and Manual output mode.
<	⑤	Shift key	Shift digits when settings are changed
∨	⑥	Down key **Program hold*	Decrease numbers (-1000,-100,-10,-1) ** Program hold* 〈*Programmable controller*〉
∧	⑦	Up key **Program run*	Decrease numbers (+1000,+100,+10,+1) ** 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 following::



All LED and 7 segment displays will be lighted

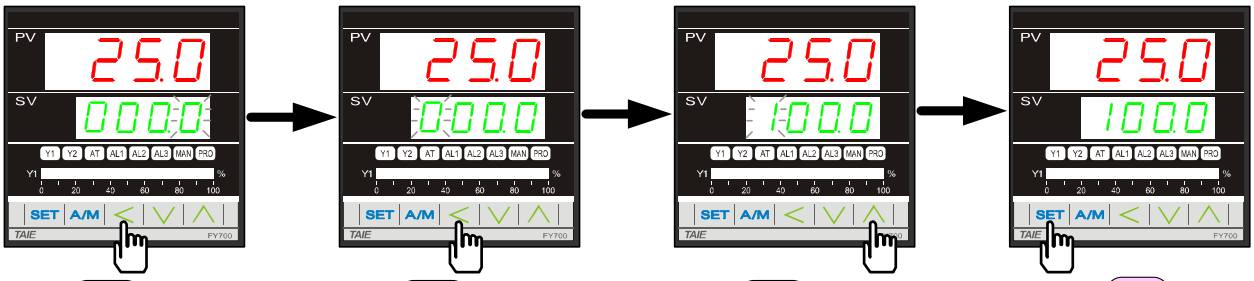
Display input type (K2)

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.

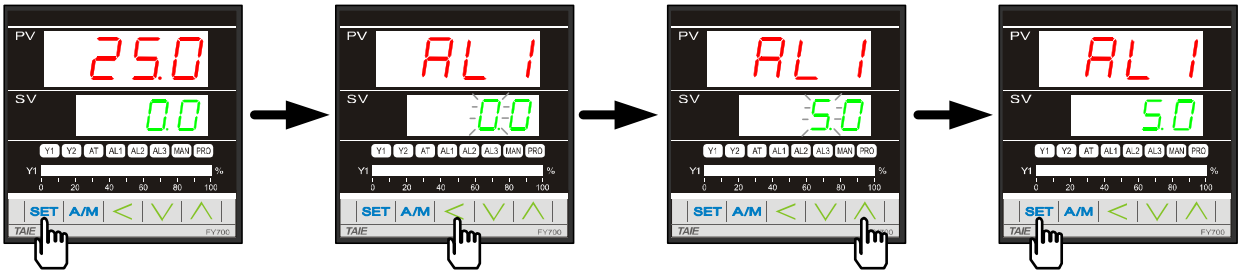
Press < key to select the hundreds digit.

Press ∧ key to change the number to 1

Press SET 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 SET key to display parameter AL1

Press < key to change AL1 value

Press ∧ key increase AL1 value

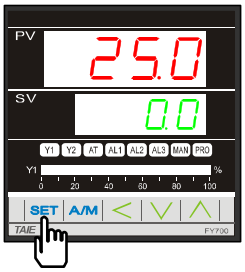
Press SET key store the new value of AL1

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

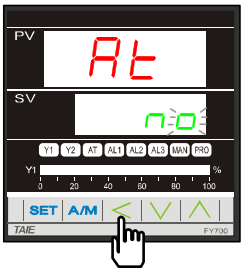
* To change alarm mode, press SET + < key 5 seconds to enter Level 3 (Input Level) and then change ALD1/ALD2/ALD3 value.

6.4 Autotuning (AT)

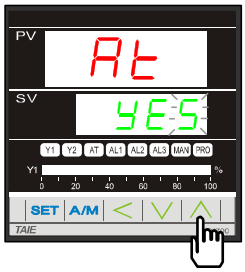
Use AT function to automatically calculate and set the optimize PID value for your system.



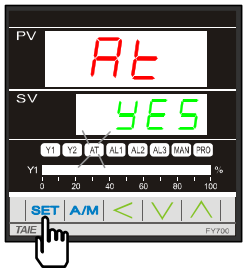
Press SET key
to display parameter AT.



Press < key
to change AT setting

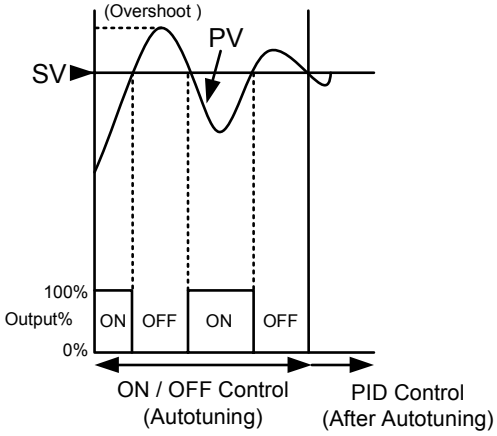


Press ∧ key
change AT to " YES "



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

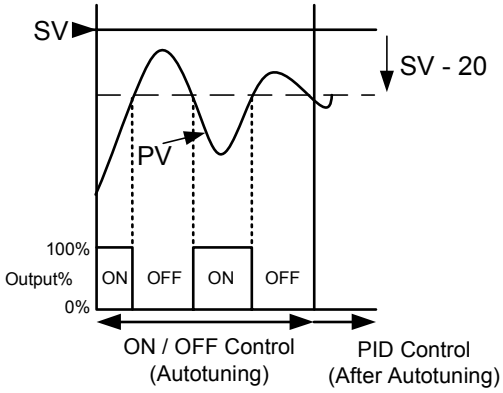
Autotuning
ATVL=0



Autotuning
ATVL=20

*Set ATVL to prevent overshoot occurred during autotuning process.

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



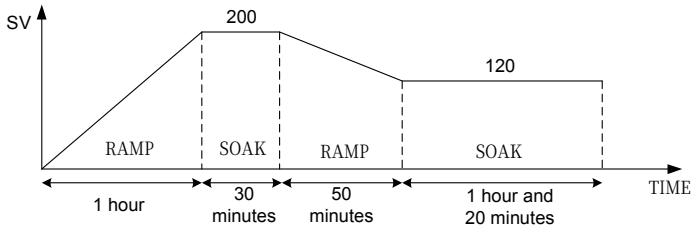
Autotuning failure

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)

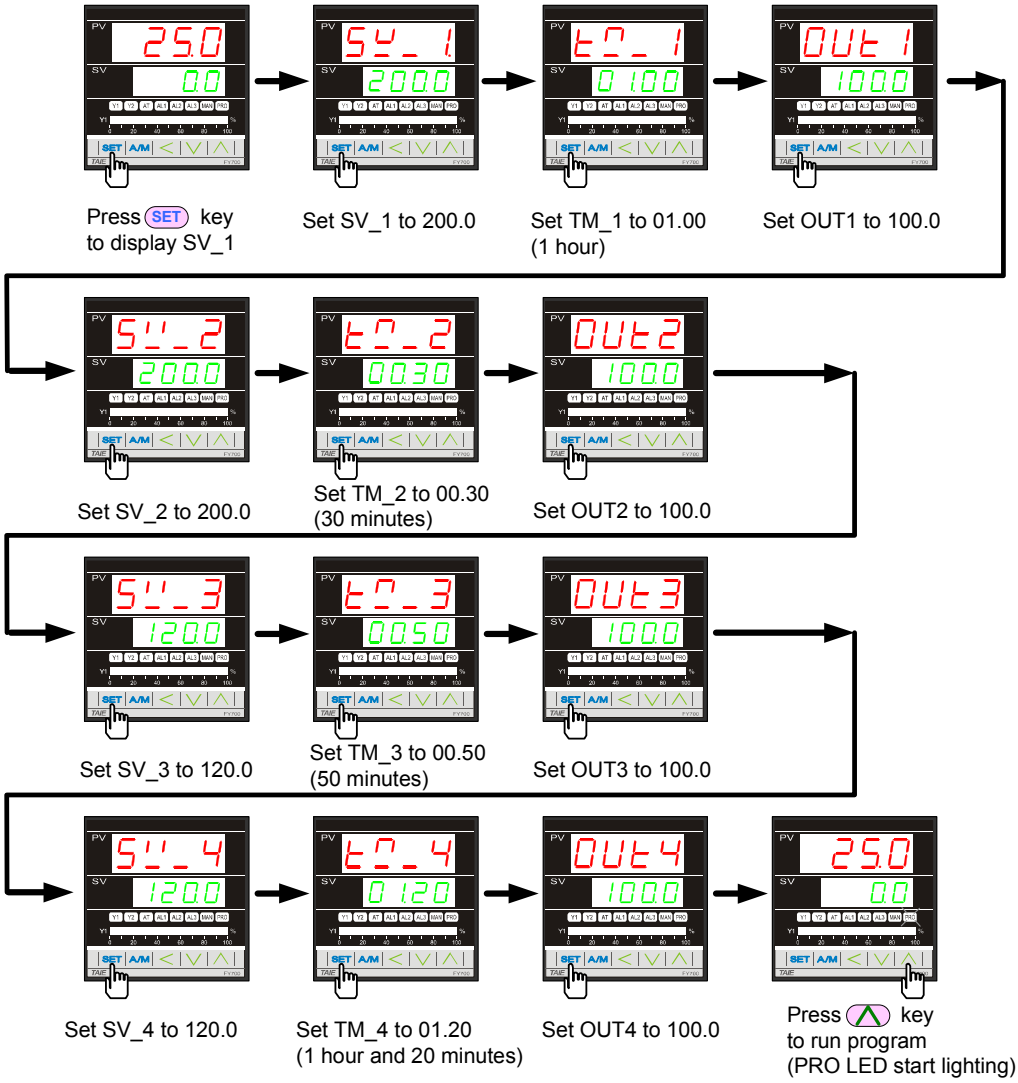
6.5 Programmable RAMP / SOAK (Only available for PFY model)

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

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

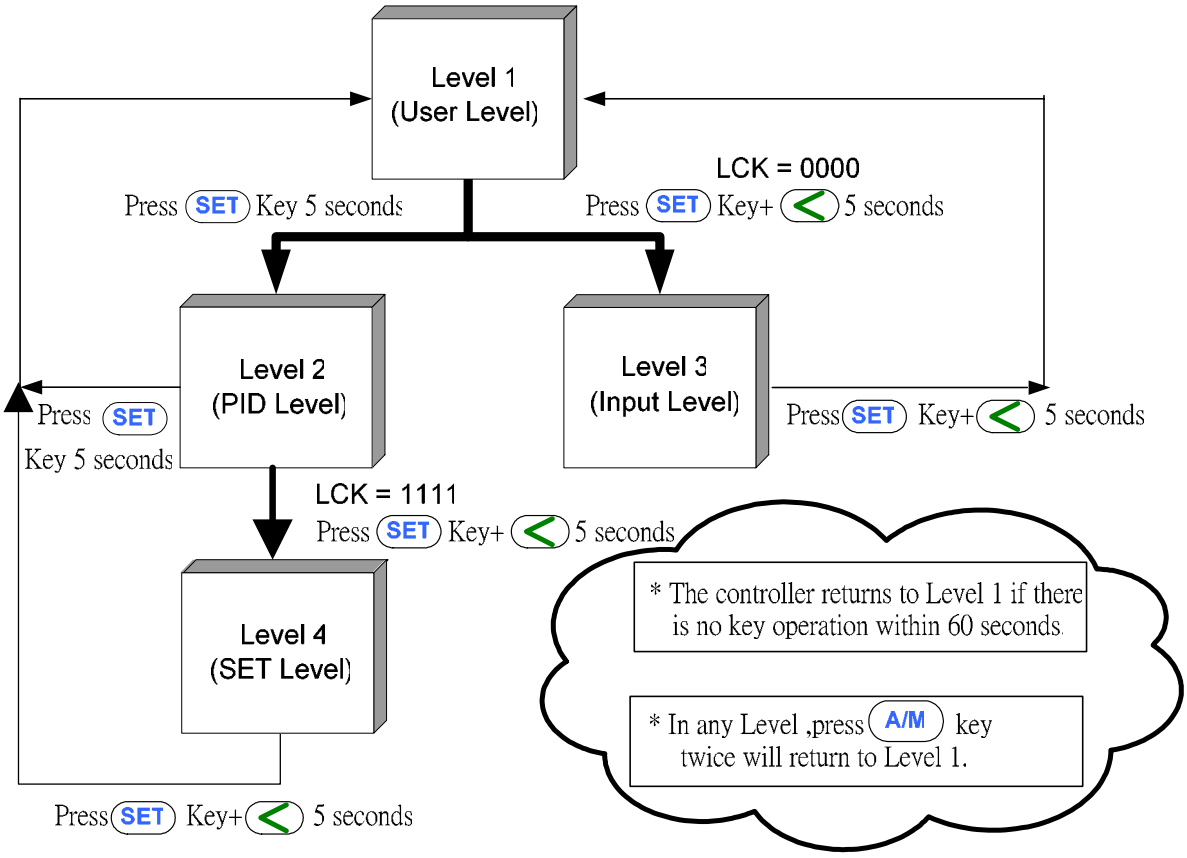


Please operate conroller as following steps:



7. Operation levels

7.1 Levels diagram



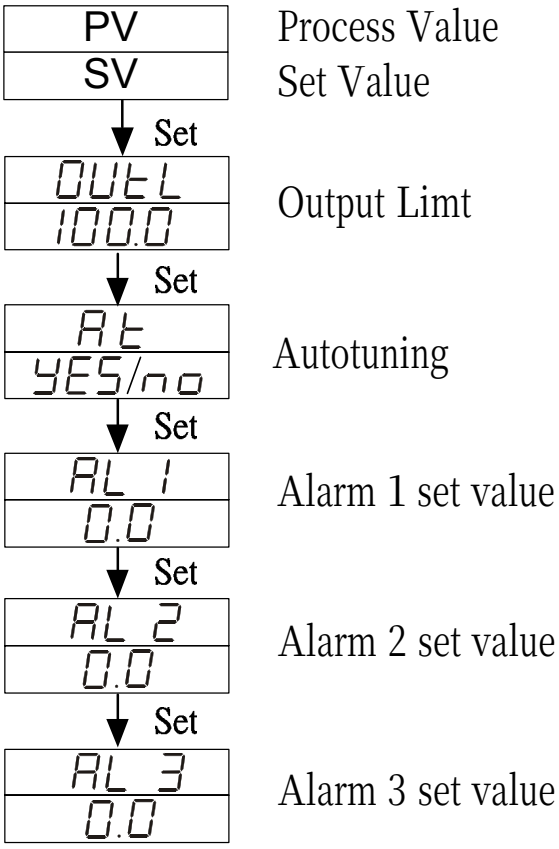
7.2 Lock function

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)



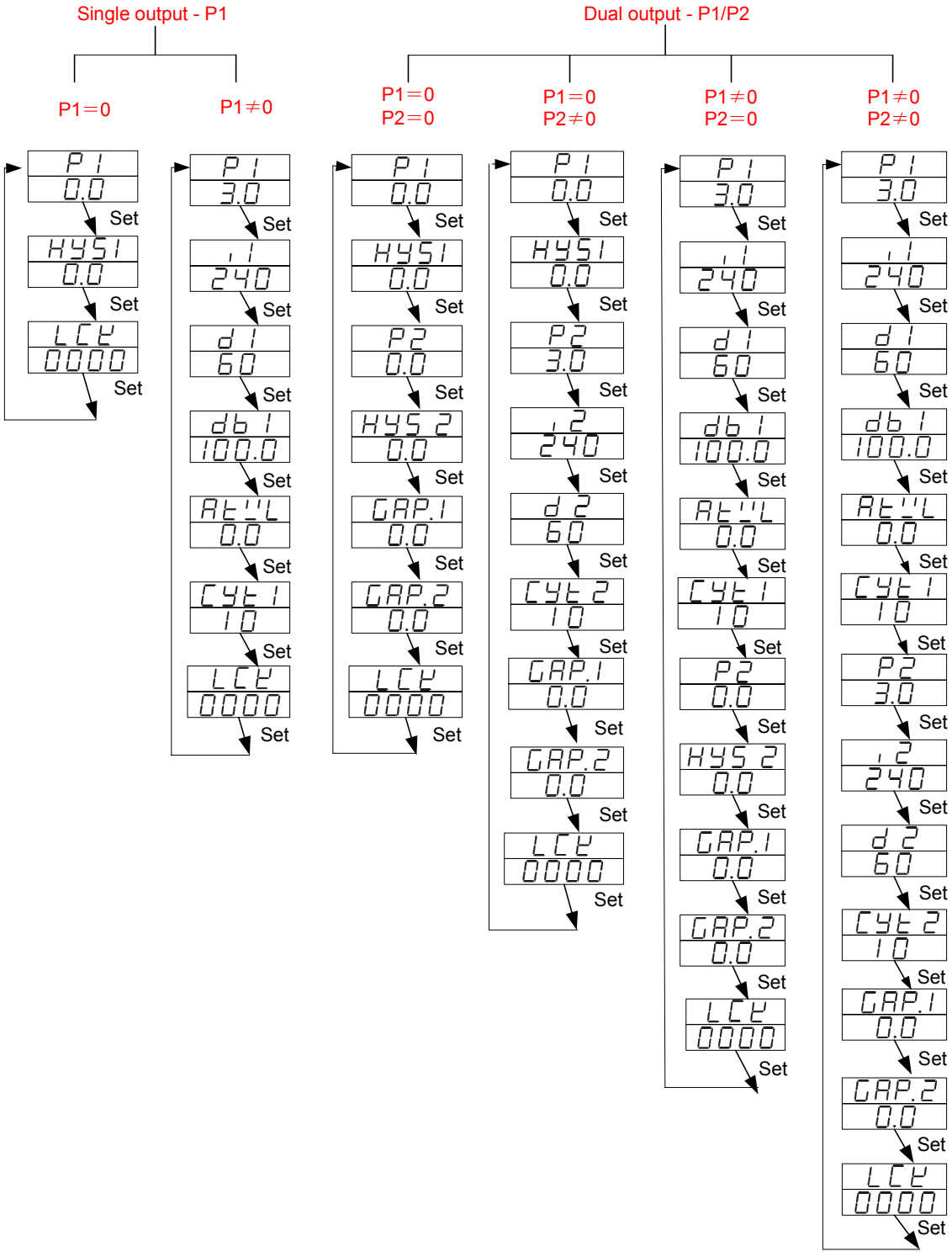
8.2 LEVEL 2 (PID Level)

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

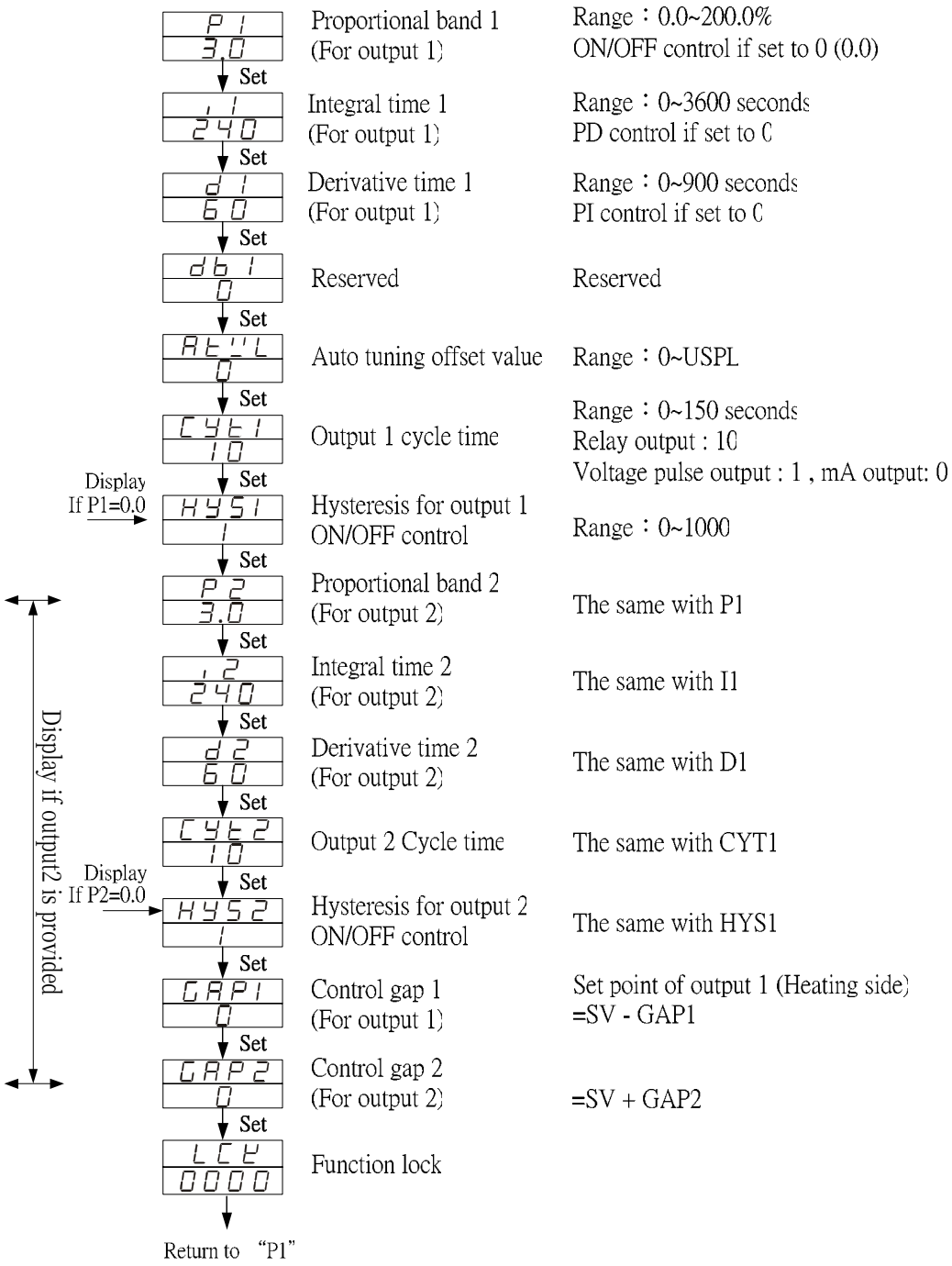
8.2.1 Level 2 parameters display / hiding condition

1. Press SET key 5 seconds to enter level 2.
2. Set LCK to “ 1111 ”.
3. Press SET key and ◁ key 5 seconds, to enter level 4 (Set level).
4. Set OUTY to “ 0 ” (Single output-P1) .

1. Press SET key 5 seconds to enter level 2.
2. Set LCK to “ 1111 ”.
3. Press SET key and ◁ key 5 seconds, to enter level 4 (Set level).
4. Set OUTY to “ 1 ” (Dual output - P1/P2) .



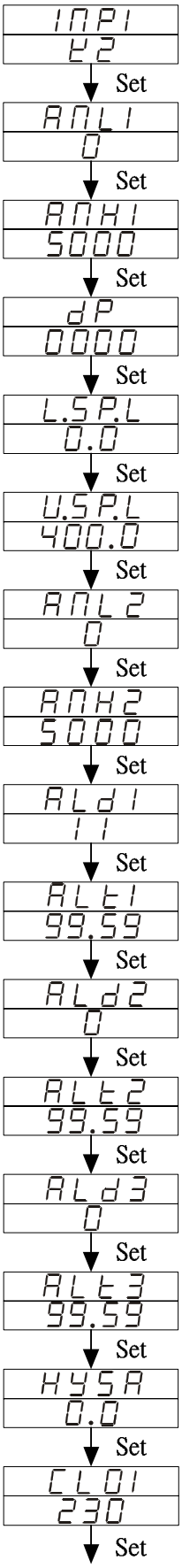
8.2.2 Description of parameters



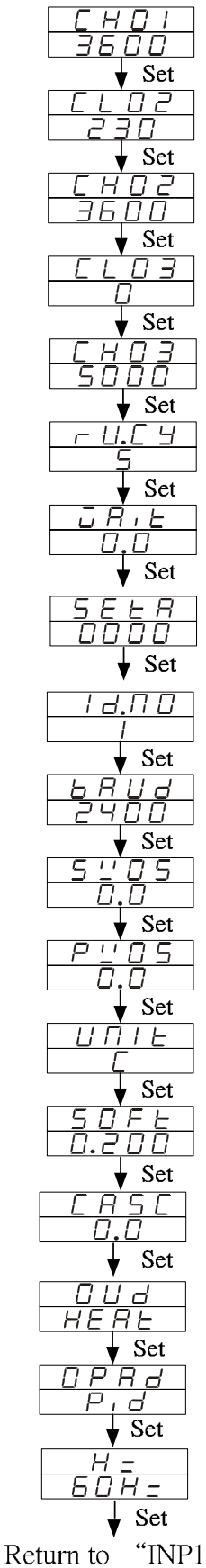
LCK	Levels entering available				Parameters which can be changed
	Level 1 (User)	Level 2 (PID)	Level 3 (Input)	Level 4 (SET)	
0000	◎	◎	◎	------	All parameters (default value)
1111	◎	◎	------	◎	All parameters
0100	◎	◎	------	------	All parameters except level 3
0110	◎	◎	------	------	Parameters in level 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 SET key + Shift(◁) key 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 Refer to “Alarm mode type”
Alarm time of AL1	Range：0~99 Min 59 Secs 0=Flicker Alarm，99:59=Continued Others=On delay time (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 high 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
Others=Wait value

ID number — Range：0 ~ 99

Baudrate — 110 / 300 / 1200 / 2400 / 4800 / 9600 bps

SV compensation — Range：-1000~1000

PV compensation — Range：-1000~1000

Unit of PV & SV — C(℃) / F(℉) / A(Analog)

Soft Filter

Reserved

Action mode — Heat / Cool

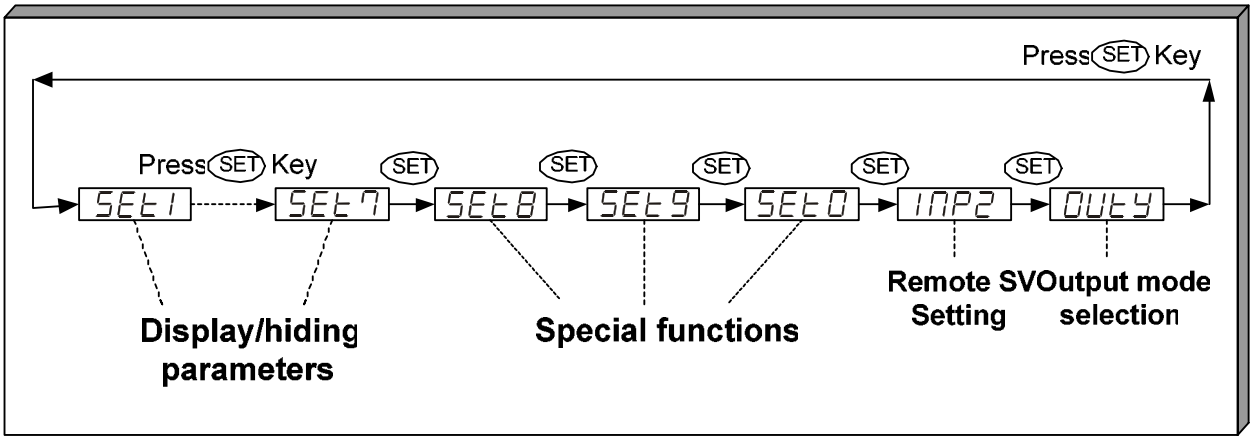
Control algorithm — PID / Fuzzy

Frequency — 50 / 60HZ

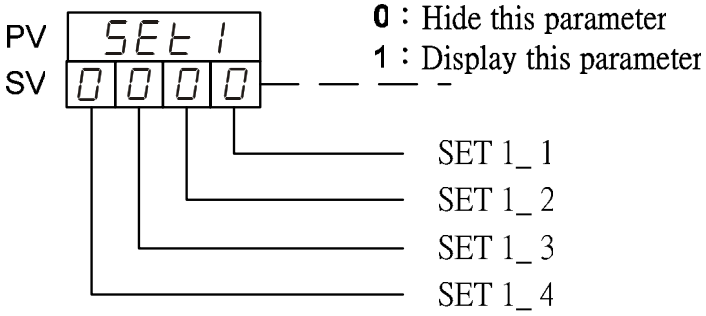
Return to “INP1”

8.4 Level 4 (SET level)

To enter level 4, set LCK to ”1111”and then press SET 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.CY,oAt,SETA	Level 3
1_ 4	AL 2	Level 1	5_ 4	Id.NO,bAUd	Level 3
2_ 1	AL 3	Level 1	6_ 1	SVOS	Level 3
2_ 2	ANL1,ANH1,dP	Level 3	6_ 2	PVOS	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	SOFT	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)

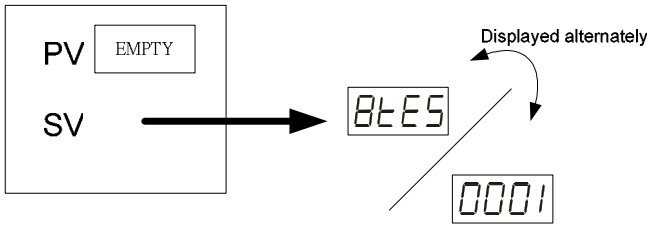
SET 8		Remark
8_ 1	0 : Program not repeat	Only available for programmable controller
	1 : Program repeat	
8_ 2	0 : No power failure option	
	1 : With power failure option	
8_ 3	0 : Program starts from 0	
	1 : Program starts from PV	
8_ 4	0 : Reserved (Don't change it)	

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。

※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

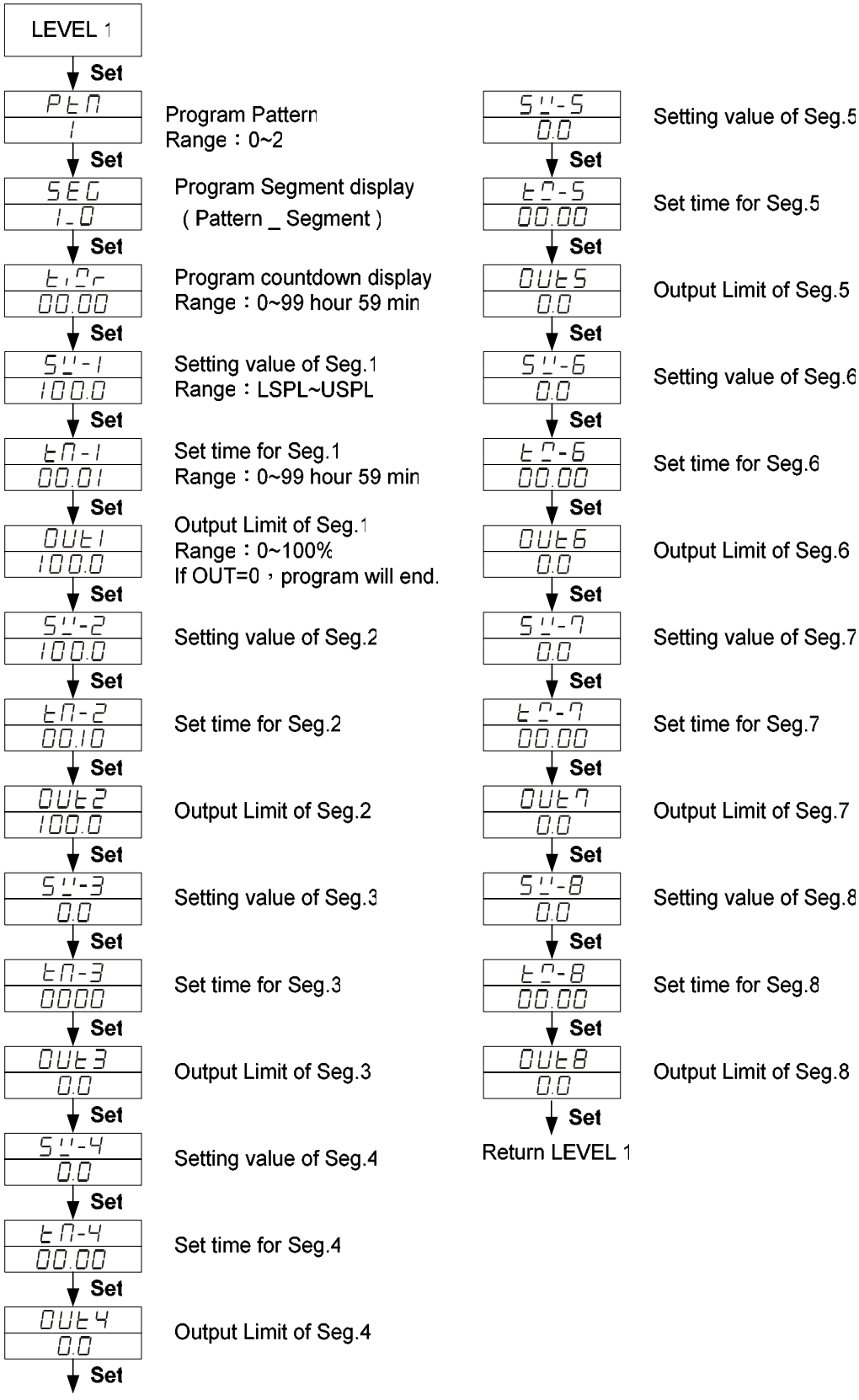
OUTY=3 3 wire proportional motor valve control

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.

   △ + **SET**(JUMP) ：Jump to previous segment.

   ▽ + **SET** (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.

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 ~ 1000℃ / 0 ~1832℉
N	n 1	0 ~ 1200℃ / 0 ~2192℉
	n 2	0 ~ 1300℃ / 0 ~2372℉
T	t 1	0.0 ~ 400.0℃ / 0.0 ~752.0℉
	t 2	0.0~ 200.0℃ / 0.0 ~392.0℉
	t 3	0.0 ~ 350.0℃ / 0.0 ~662.0℉
W	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”.

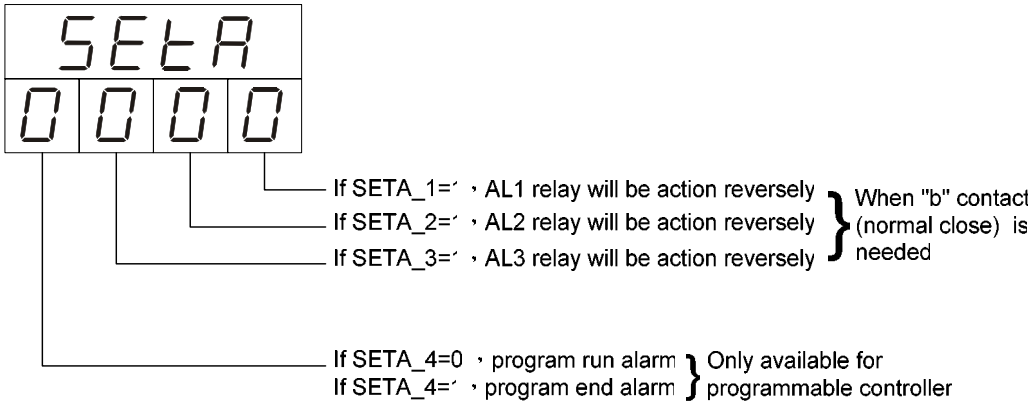
10. Alarm

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

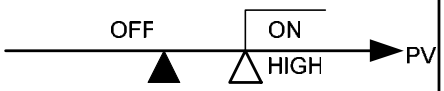
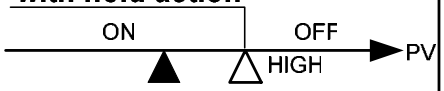
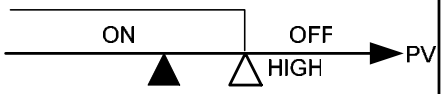
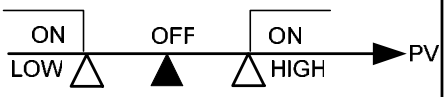
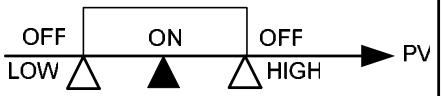
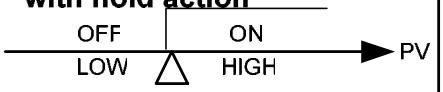
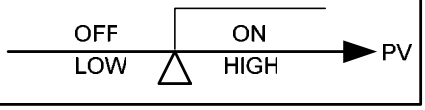
10.2 SETA

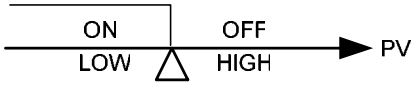
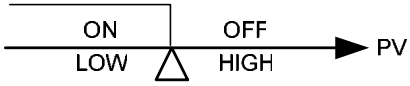
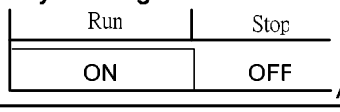
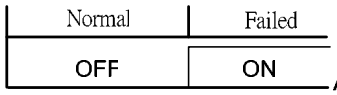
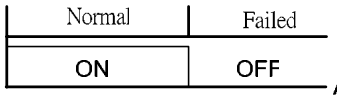
*SETA is in Level 3 (Input level)



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)** (1) ALD1~3 , set **07** (2) ALD1~3=Alarm Segment (3) ALT1~3 defines as follows: **0** =flicker alarm **99.59** =continued alarm **others** =alarm ON time
17	**Program Run alarm (Only for Programmable controller)** 
08	**System failed alarm* (ON)** 
18	**System failed alarm* (OFF)** 
09	**Soak Timer** When PV=SV(soak) , the timer begins to count. When timer is up , alarm relay will be activated. Timer range = 00H.00M ~ 99H.59M
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 following :

”UUU1” or “NNN1” or “CJCE”

11. Error codes

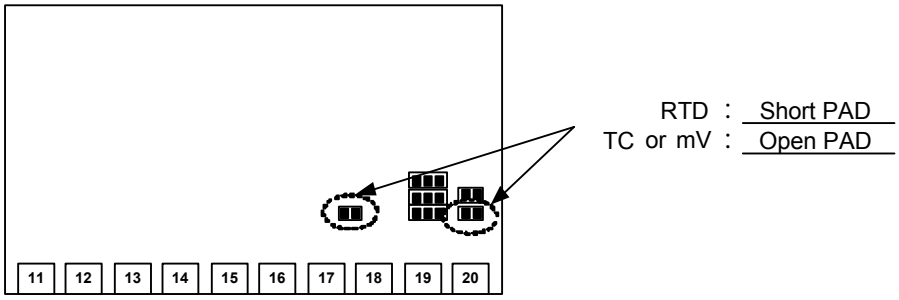
DISPLAY	DESCRIPTION
inIE	Open circuit of main control sensor.(INP1)
∗ AdCF	A/D convert failed.
∗ CJCE	Cold junction compensation failed.
in2E	Open circuit of sub control sensor.(Remote SV)
uuu1	PV exceeds USPL.
nnn1	PV under LSPL.
uuu2	Input signal of sub control exceeds the upper limit. (Remote SV)
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.

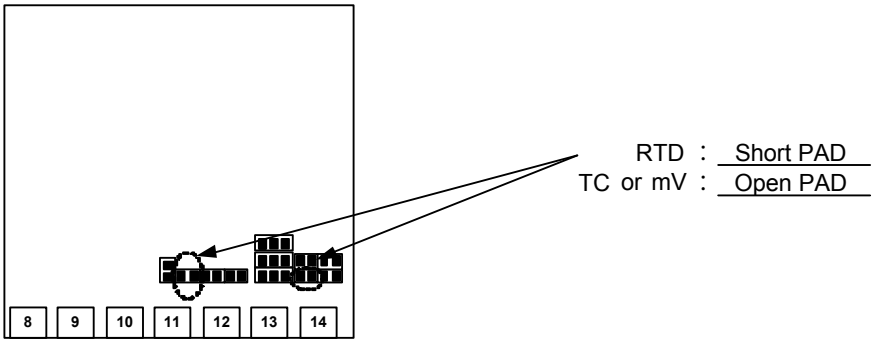
12. Modify input type ("TC" ⟷ "RTD")

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.

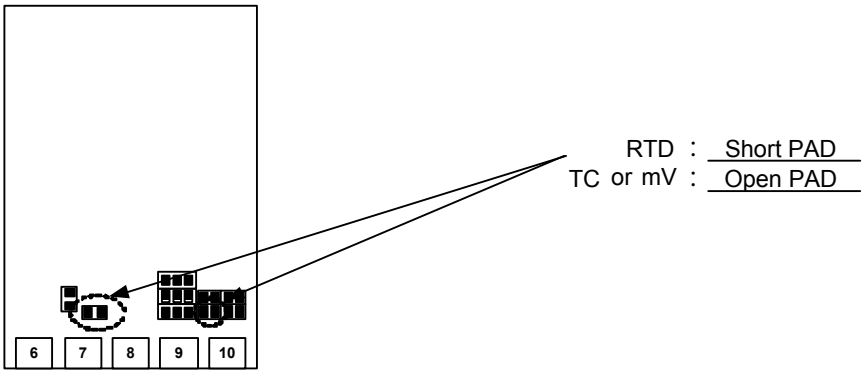
96X96, 48X96 , 96X48
(CPU Board)



72X72
(CPU Board)



48X48
(CPU Board)



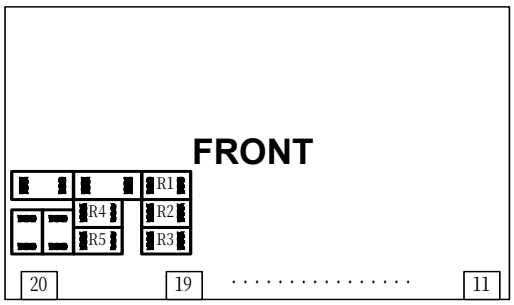
13. Modify input type：Linear Input (mA ,V)

13.1 Hardware：

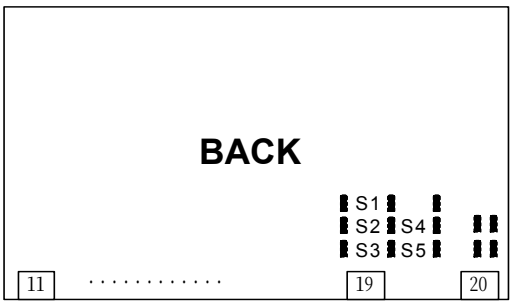
	96×96, 48×96, 96×48	72×72	48×48
INPUT (+)	PIN 17	PIN 11	PIN 7
INPUT (-)	PIN 20	PIN 14	PIN 10

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)

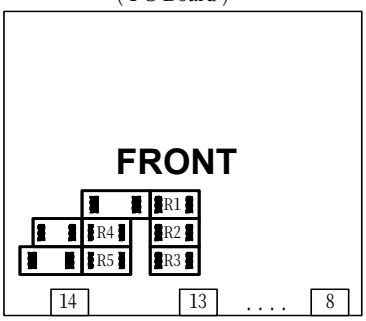
96x96, 48x96, 96x48
(PC Board)



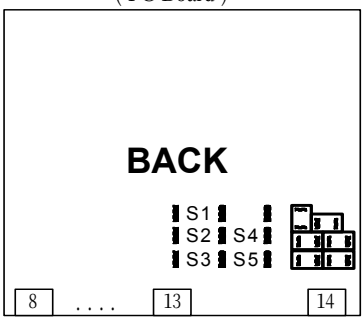
96x96, 48x96, 96x48
(PC Board)



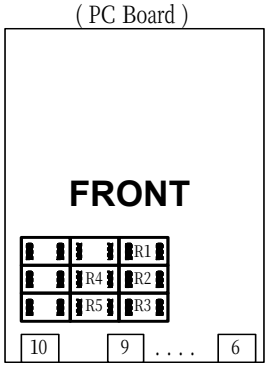
72x72
(PC Board)



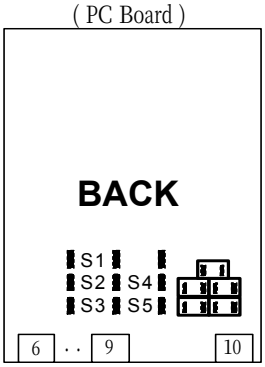
72x72
(PC Board)



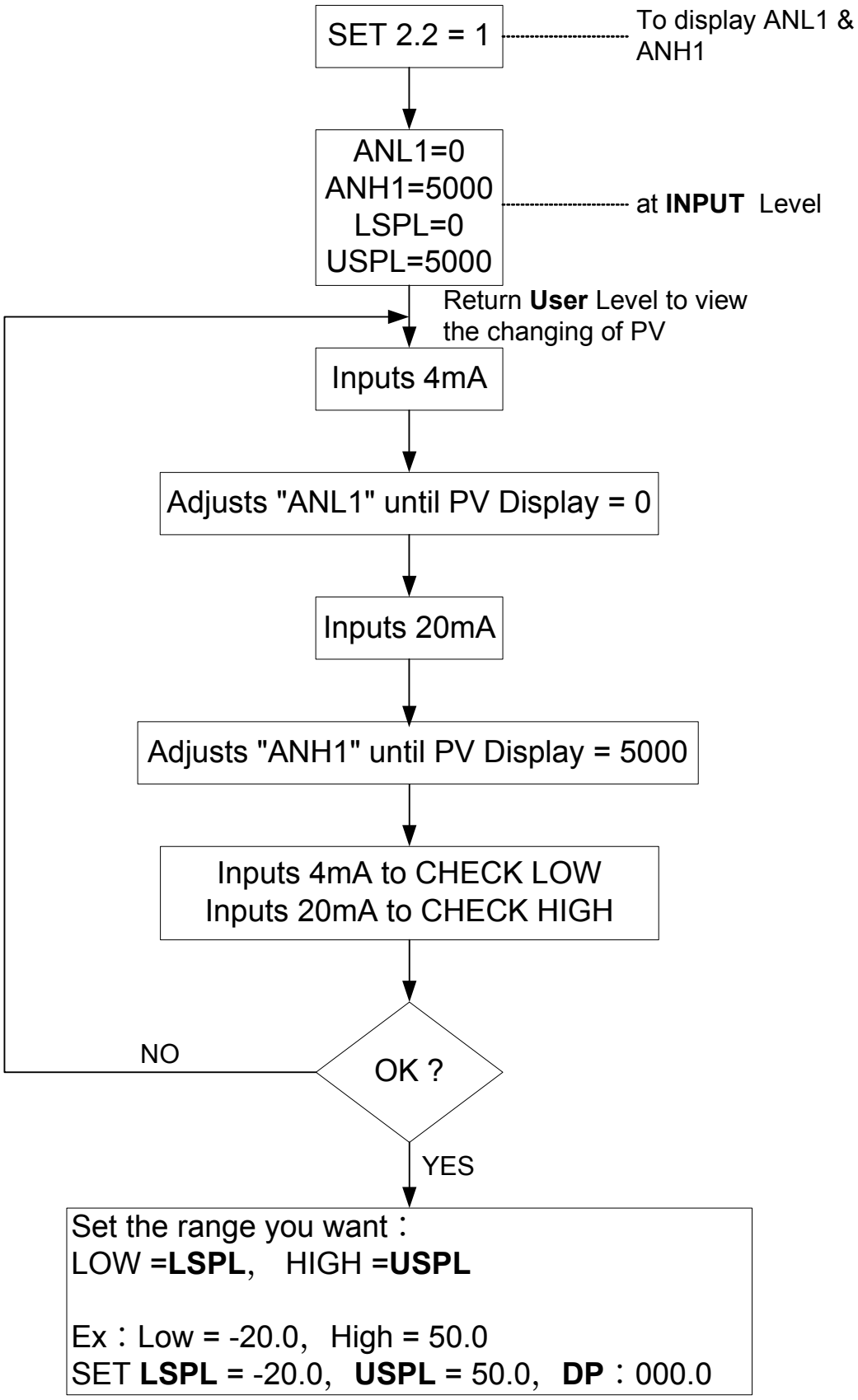
48x48
(PC Board)



48x48
(PC Board)



13.2 Calibration：



14. Modify output type: Relay, SSR, 4~20mA

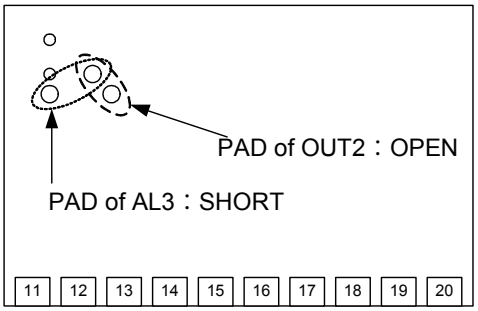
It just needs to change a module at the same position,
and modify parameter **CYT1** in LEVEL 2 .

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

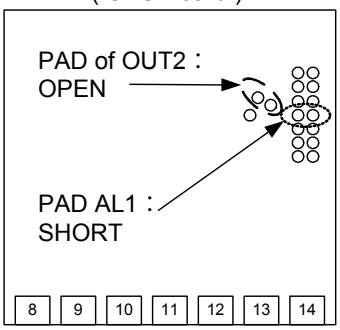
15. Modify output mode: OUT1/ALARM, OUT1/OUT2

OUT1 / ALARM

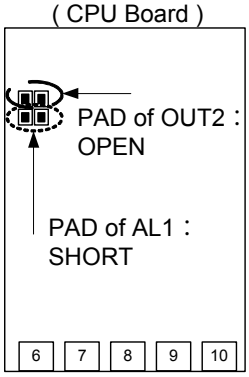
96X96, 48X96, 96X48
(CPU Board)



72X72
(CPU Board)

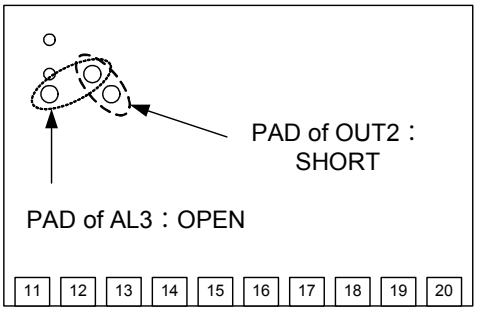


48X48
(CPU Board)

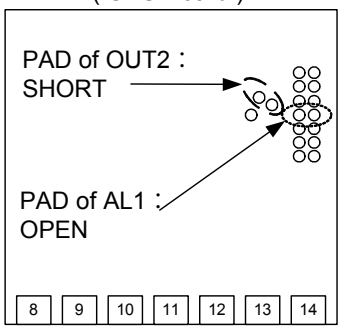


OUT1 /OUT2

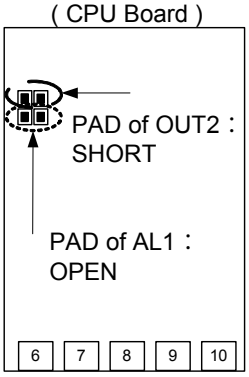
96X96, 48X96, 96X48
(CPU Board)



72X72
(CPU Board)



48X48
(CPU Board)



16. Applications

16.1 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.

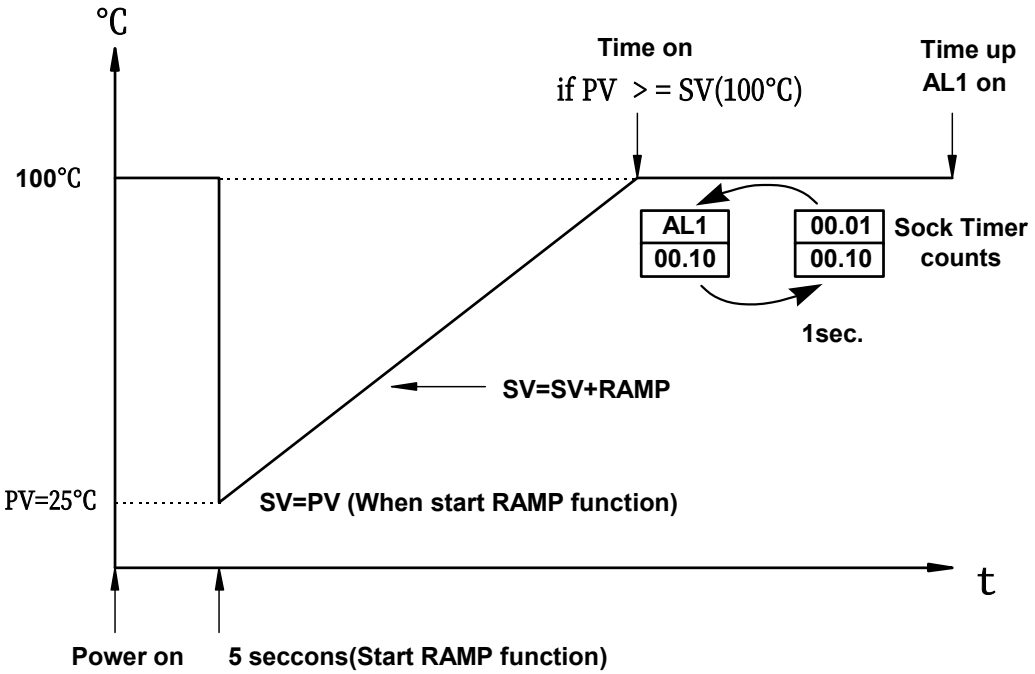
II. AL1 / AL2 will display as below:

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℃



16.2 TTL Communication：SV output and RATE function

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

Display AL3 ：SET2.1=1

Display ALD3：SET4.1=1

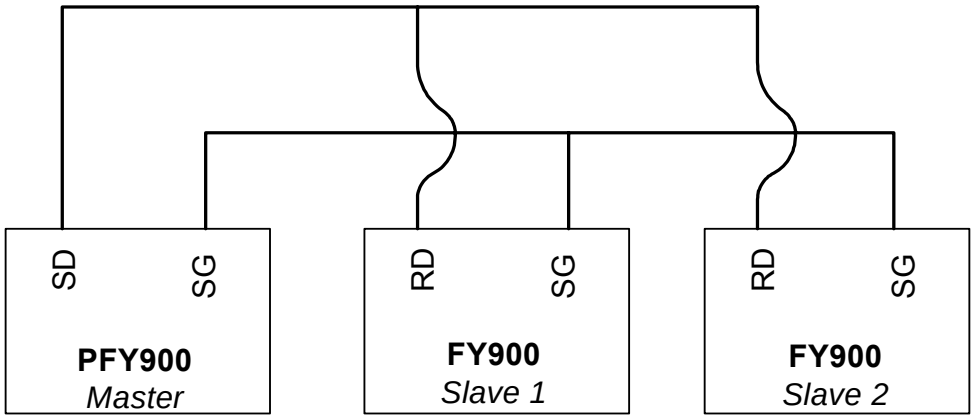
Display RATE(AL3 will be replaced) ：SET0.2=1

Set ALD3 to 0. (In Level 3)

Slave SV = (**RATE**÷9999)×master SV

- **Example：**

Connection Diagram

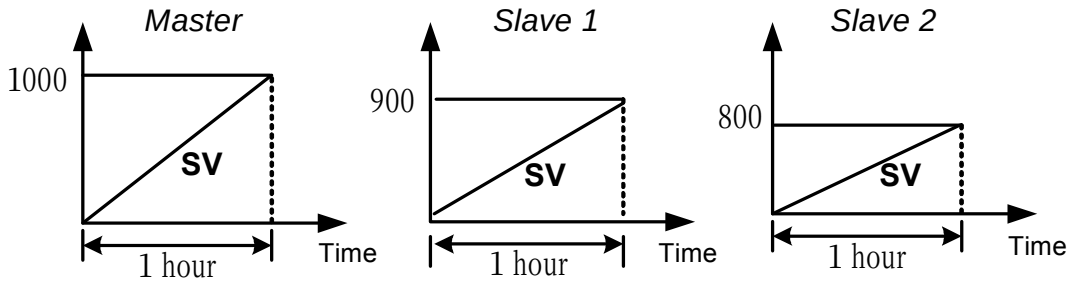


SV OUT (SET0.1=1)
IDNO=0 (SET5.4=1)
BAUD=2400(SET5.4=1)

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%

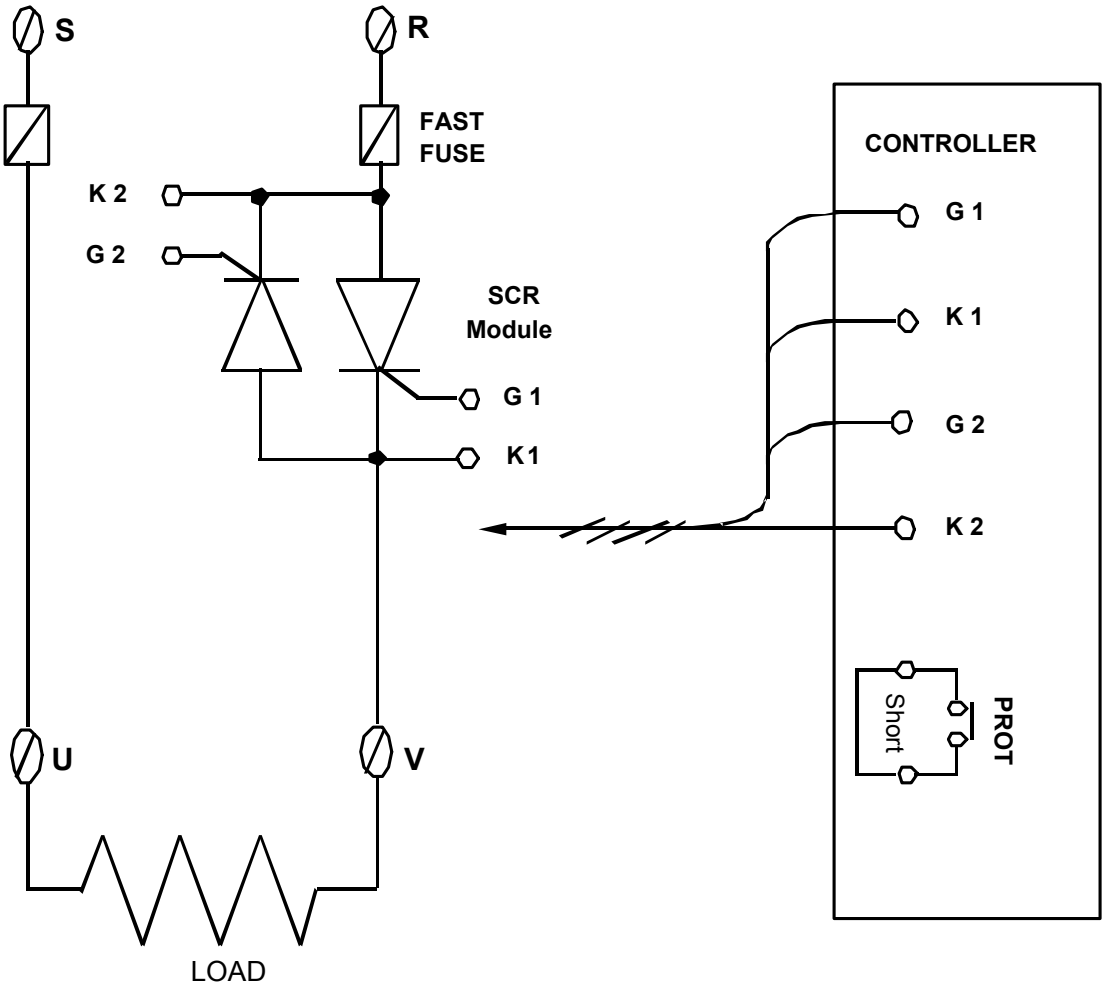
RATE = 9000
SV=900

RATE =8000
SV=800

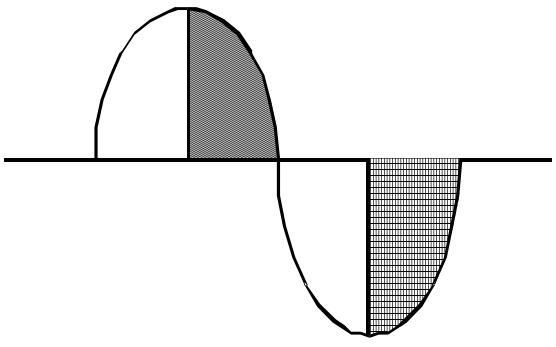
(Three controllers reach to the max value at the same time)

16.3 1ψ Phase angle control (By SCR module)

- Available Models：FY900 / PFY900，FY700 / PFY700
- OUT1: 1ψSCR
- Parameter setting： OUTY=4
  CLO1=0，CHO1=4500 if use for resistance load
  CLO1=0，CHO1=4000 if use for inductor load

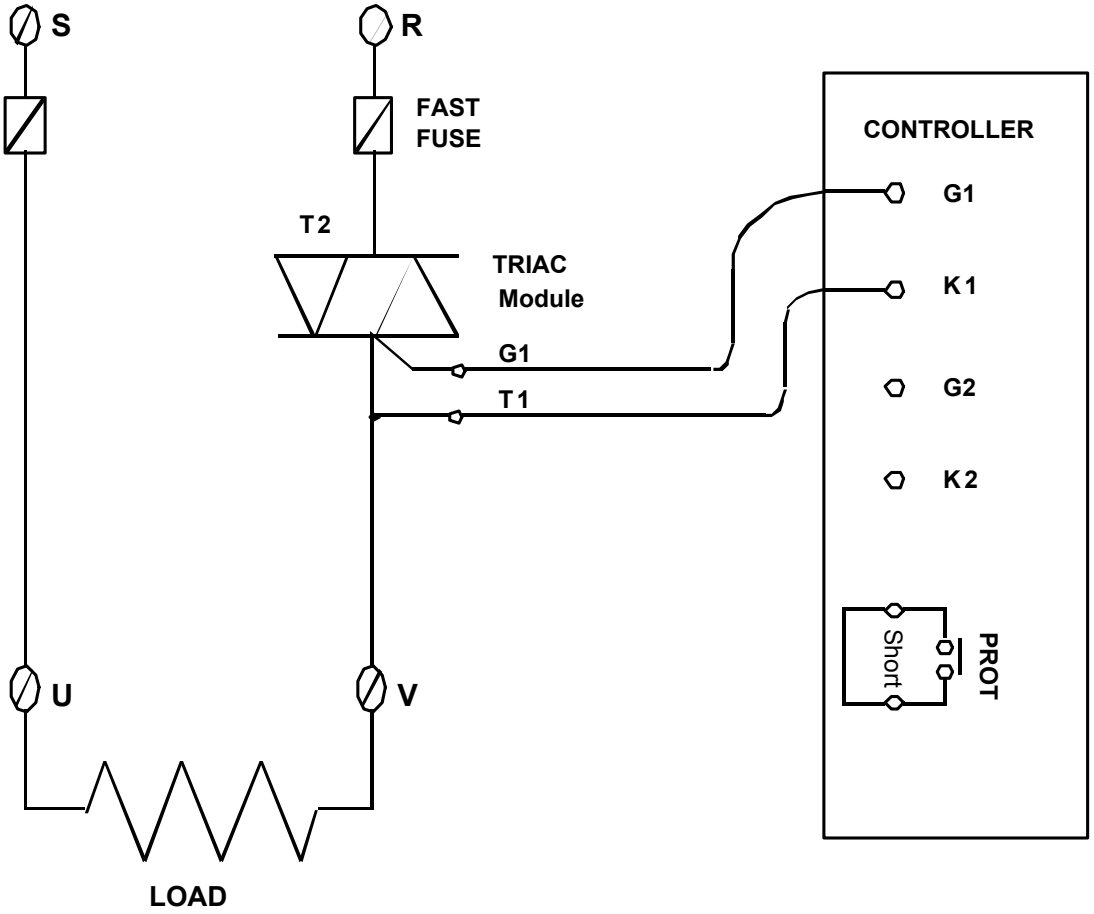


** Controller source phase must be same as load source phase

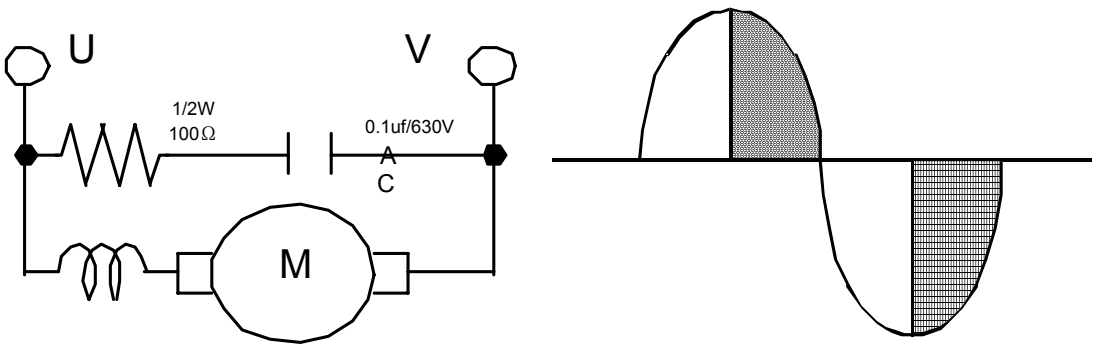


16.4 1ψ Phase angle control (By TRIAC)

- Available Models：FY900 / PFY900，FY700 / PFY700
- OUT1: 1ψSCR
- Parameter setting： OUTY=4
  CLO1=0，CHO1=4500 if use for resistance load
  CLO1=0，CHO1=4000 if use for inductor load

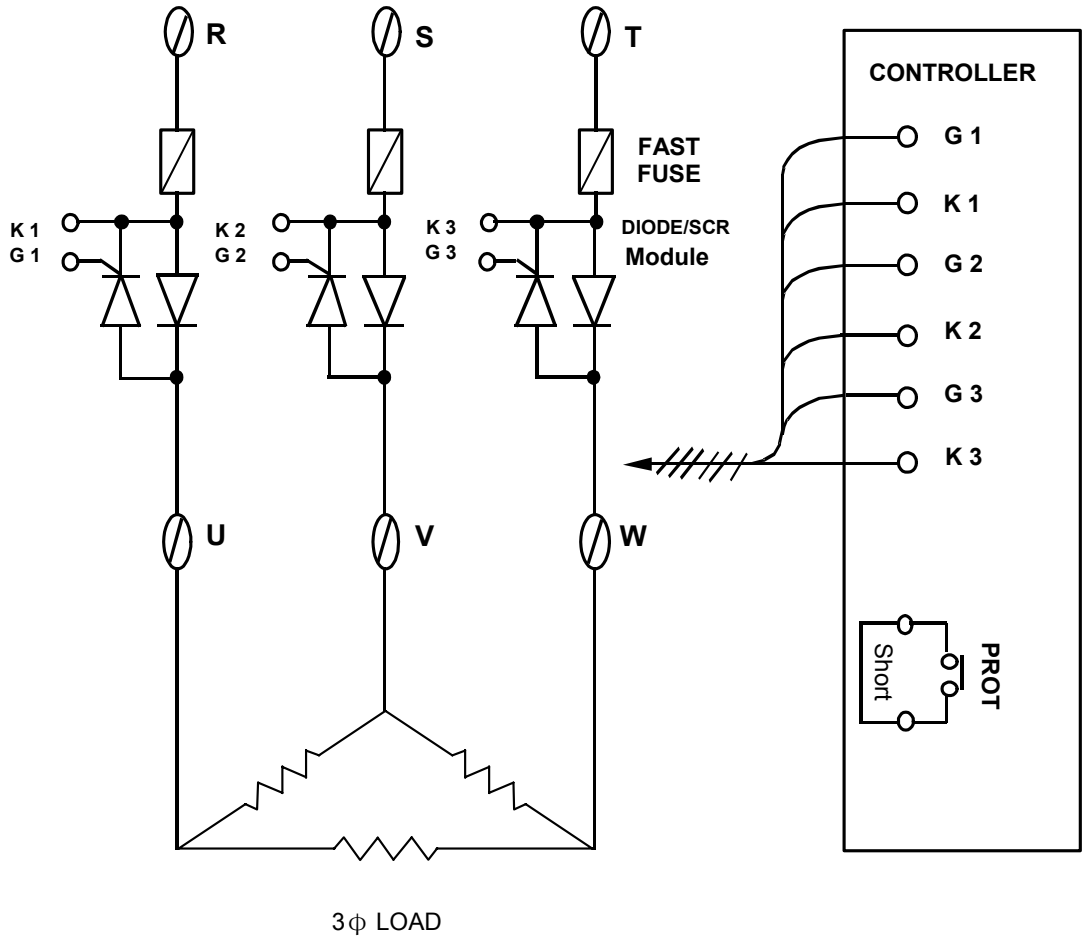


** Controller source phase must be same as load source phase



16.5 3ψ Phase angle control (By DIODE/SCR module)

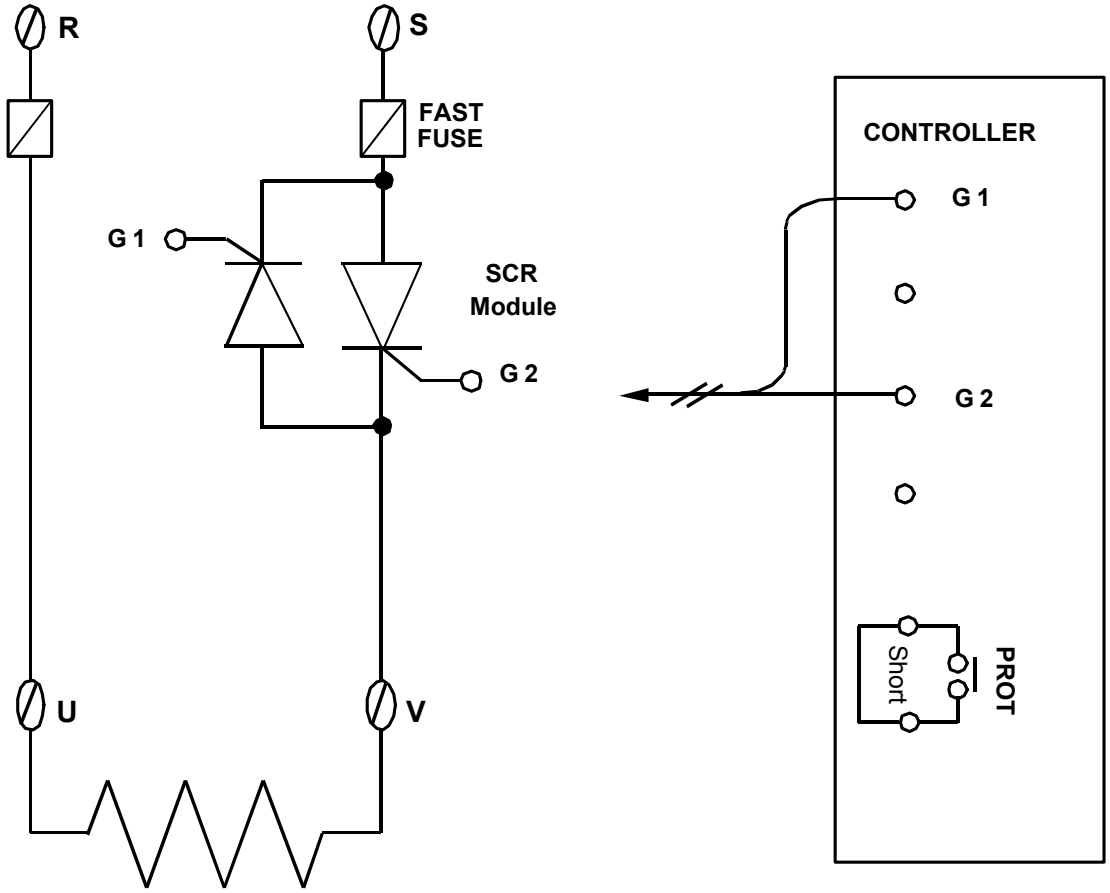
- Available Models：FY900 / PFY900
- OUT1: 3ψSCR
- Parameter setting： OUTY=5
  CLO1=0, CHO1=4500 only if use for resistance load
  CLO1=0, CHO1=4000 if use for inductor load

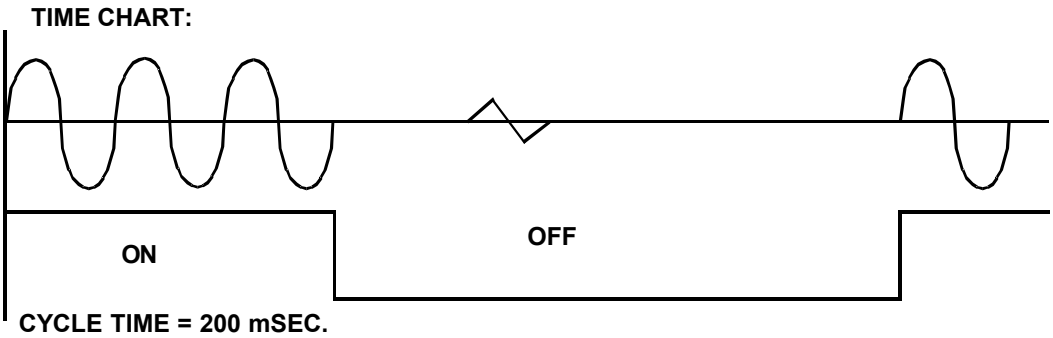


3φ LOAD

16.6 1ψZero crossing control (By SCR module)

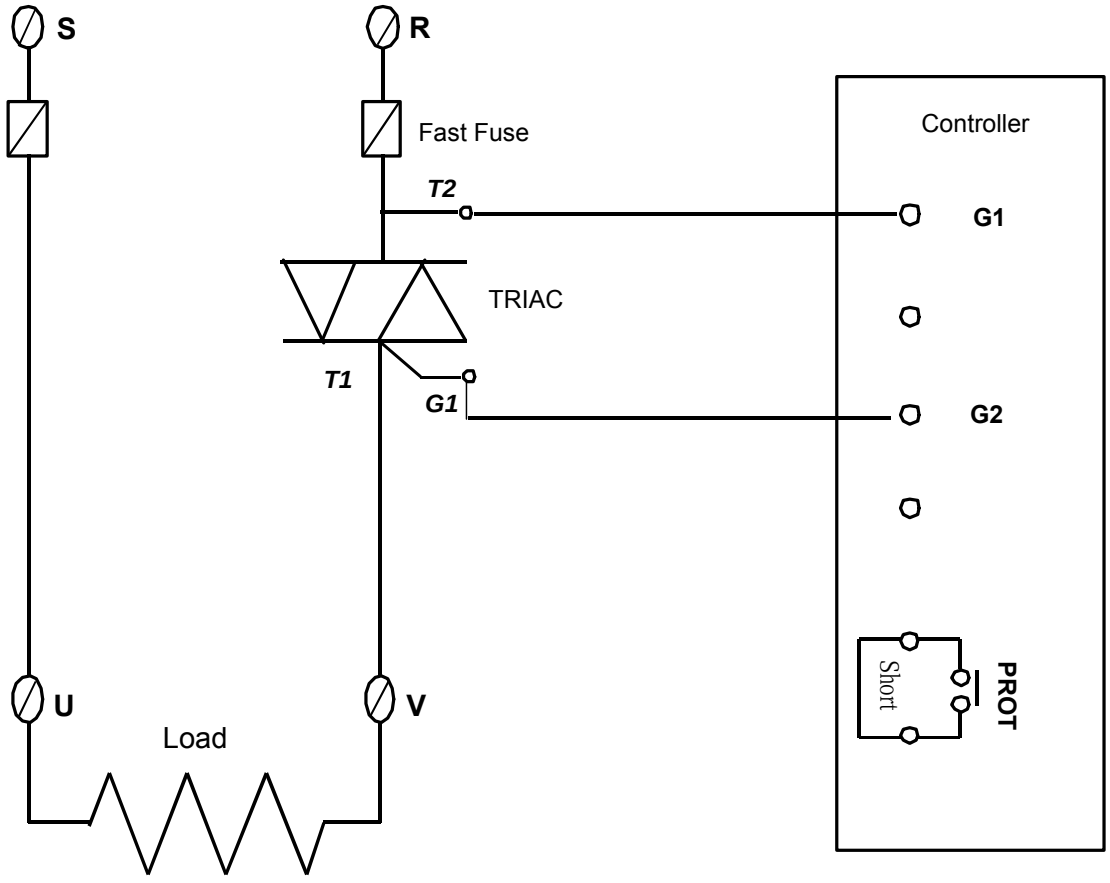
- Available Models： FY900 / PFY900, FY700 / PFY700
  FY400 / PFY400
- OUT1: 1ψSSR
- Parameter setting： OUTY=0
  CYT1=1





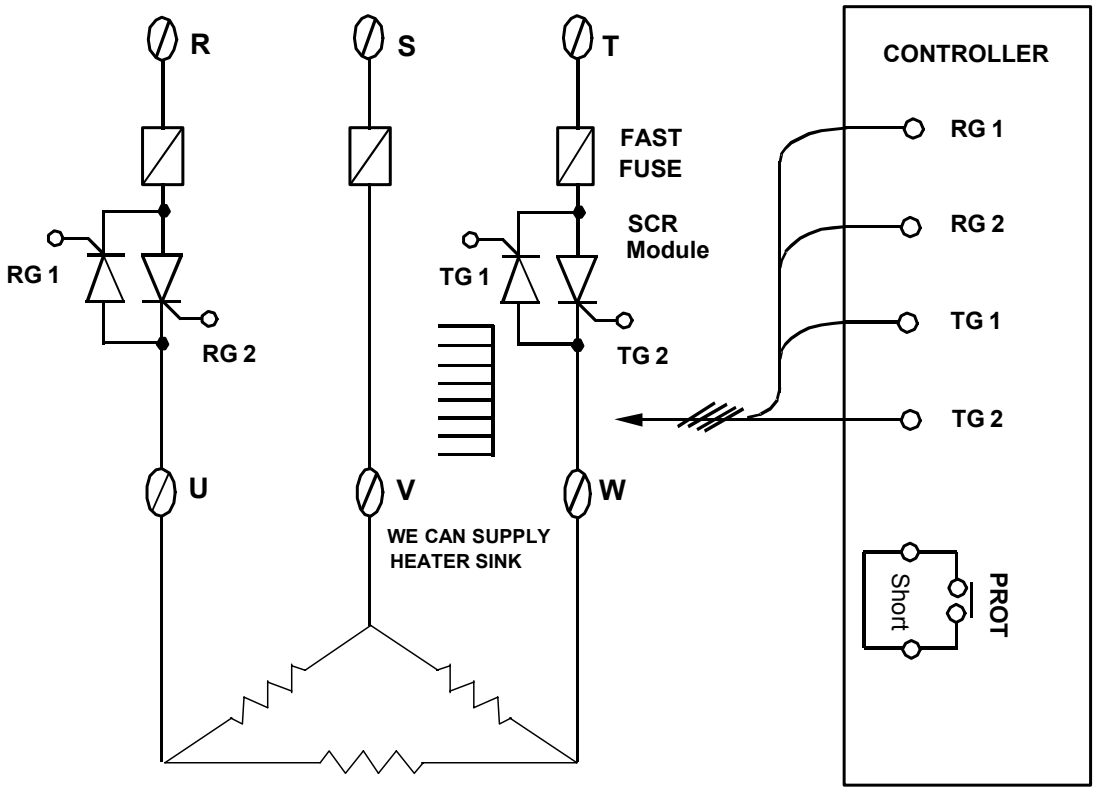
16.7 1ψZero crossing control (By TRIAC)

- Available Models： FY900 / PFY900, FY700 / PFY700
  FY400 / PFY400
- OUT1: 1ψSSR
- Data Change： OUTY=0
  CYT1=1

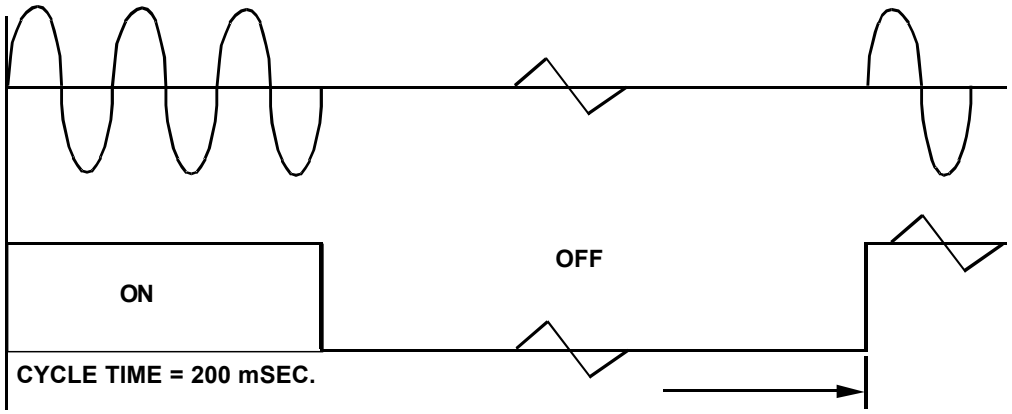


16.8 3ψZero crossing control (By SCR module)

- Available Models：FY900 / PFY900
- OUT1: 3ψSSR
- Data Change： OUTY=0
  CYT1=1

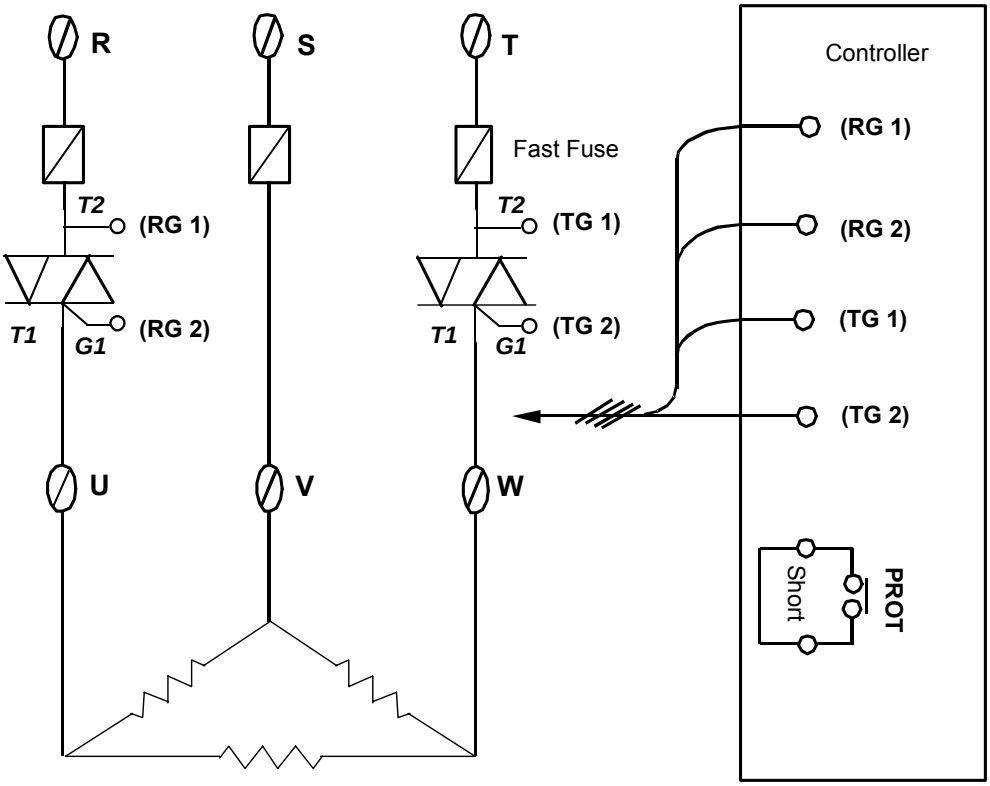


TIME CHART:



16.9 3ψZero crossing control (By TRIAC)

- Available Models：FY900 / PFY900
- OUT1: 3ψSSR
- Data Change： OUTY=0
  CYT1=1

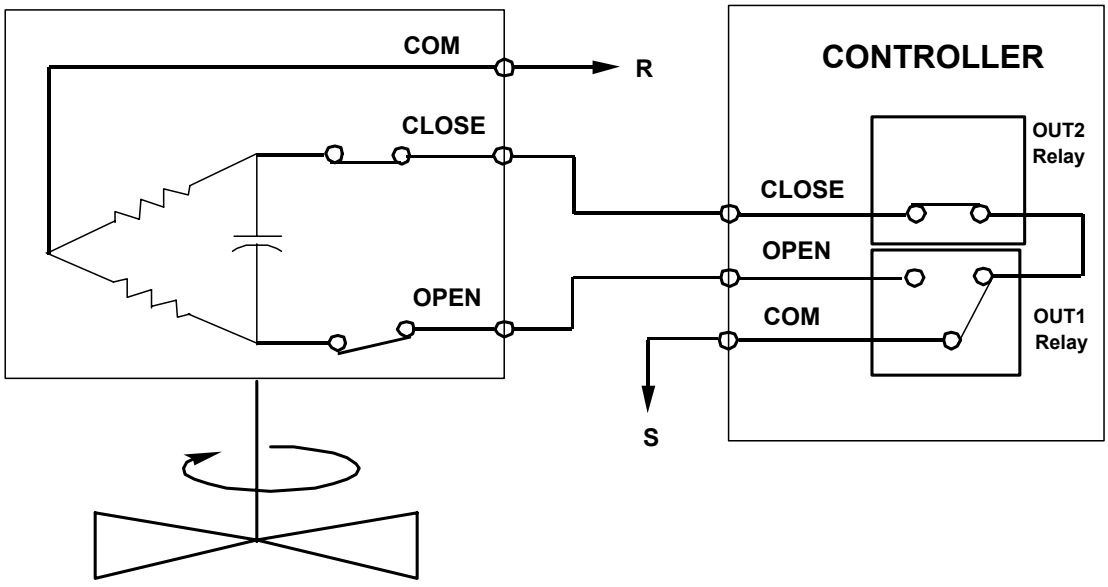


16.10 3 wires proportional motor valve control

- Available Models： FY900 / PFY900, FY700 / PFY700
  FY800 / PFY800, FY600 / PFY600
  FY400 / 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



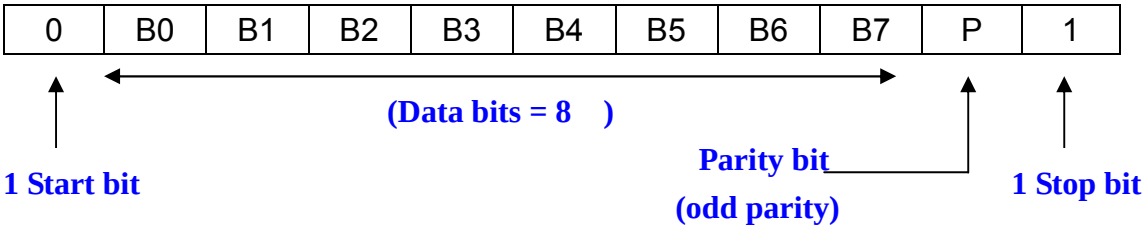
16.11 Communication

16.11.1 Protocol

- Interface RS-232 or RS-485 (by your order)
- Baud rate 110,300,1200,2400,4800,9600 bps
  ※Choose by setting parameter “BAUD” in controller.

- DATA FRAME

Data Bits ＝ 8，ODD Parity，1 Satrt bit，1 Stop bit



- DATA FORMAT

※Use “HEX” code data format

NAME	DESCRIPTION	LENGTH
CMD	Command	1 BYTE
XIDNO	The ID of controller	1 BYTE
CHNO	Reservation，don’t care	1 BYTE
XADDR	Address	1 BYTE
XDATA1	HIGH BYTE of DATA	1 BYTE
XDATA2	LOW BYTE of DATA	1 BYTE

7 Bytes

- **CMD** **R**(READ from controller)
  M(MODIFY the data in controller temporarily)
  ※After controller restarted，the modification will be disappear
  W(WRITE the data to controller)
  The HEX CODE of R、M、W are as below
  R:52H，M:4DH，W:57H。

- **XIDNO** Range：1(01 H)~100(63 H)
  ※Must be same as “IDNO“ of the controller

- **CHNO** Range：(00 H ~ FF H)

- **XADDR** **See Appendix(XADDR)**

- **XDATA 1** HIGH BYTE of DATA

- **XDATA 2** LOW BYTE of DATA

- **CHKSUM** CHECK SUM ＝ **CMD＋XIDNO＋CHNO＋XADDR ＋XDATA 1＋XDATA 2**

  EX：4DH + 01H + 00H +00H +03H +E8H = 01 **39**H

  Eliminate

  CHECK SUM ＝ **39**H

※If WRITE to controller，the Data Length is “7 Bytes” as below

CMD	XIDNO	CHNO	XADDR	XDATA 1	XDATA 2	CHKSUM

※If READ from controller，the Data Length is “8 Bytes” as below (Include Header：07H)

07H	CMD	XIDNO	CHNO	XADDR	XDATA 1	XDATA 2	CHKSUM

- **COMMUNICATION EXAMPLES**

■ Modify SV to ‘123.4’ (The ID of controller is ‘20’)

➔ CMD MODIFY(M)：4D H

➔ XIDNO20 (decimal) ＝ 14H(hex)

➔ CHNO 00H (Don’t care)

➔ XADDR 00 H (The XADDR of SV)

➔ XDATA1

& XDATA2 1234(decimal) = 04D2H(hex)

➔ CHKSUM 4DH + 14H + 00H +00H +04H +D2H = 01**37**H

The HEX CODE needed to be send to the controller is ‘4D14 0000 04D2 37’

■ Read ‘PV’ from controller (The ID of controller is ‘1’)

(CMD READ(R)：52 H

(XIDNO 1 (decimal) ＝ 01H(hex)

(CHNO 00H (Don’t care)

(XADDR 80 H (The XADDR of PV)

(XDATA1 & XDATA2 = 0000H

(CHKSUM 52H + 01H + 00H +80H +00H +00H = 00D3H

The HEX CODE needed to be send to the controller is ‘5201 0080 0000 D3’

（Wait about 100ms …）

Controller return：07 4D 00 00 00 xxyy zz

PV

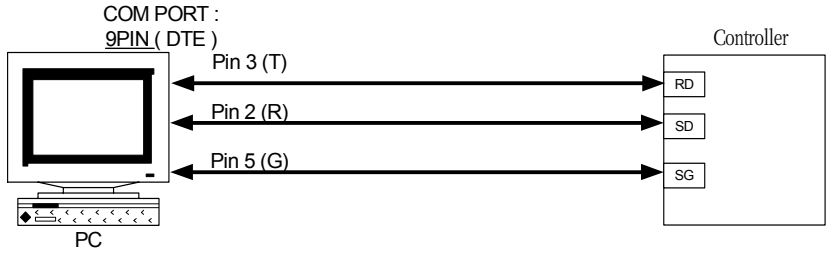
CHECK SUM=4DH + 00H + 00H + 00H + xxH +yyH(Not Include header 07H)

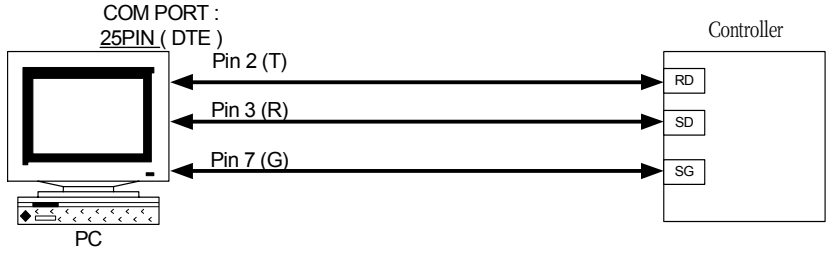
- **Appendix(XADDR)**

OPTION	XAADR	OPTION	XAADR	OPTION	XADDR	OPTION	XADDR
PV	80H	**OUT8**	20H	**D2**	42H	**UNIT**	64H
OUT%	A3H	**SV_12**	21H	**CYT2**	43H	**SOFT**	65H
SV	00H	**TM_12**	22H	**HYS2**	44H	**CASC**	66H
OUTL	01H	**OUT12**	23H	**GAP1**	45H	**OUD**	67H
AT	02H	**SV_22**	24H	**GAP2**	46H	**OPAD**	68H
AL1	03H	**TM_22**	25H	**LCK**	47H	**HZ**	69H
AL2	04H	**OUT22**	26H	**INP1**	48H	**SET1**	6AH
AL3	05H	**SV_32**	27H	**ANL1**	49H	**SET2**	6BH
PTN	06H	**TM_32**	28H	**ANH1**	4AH	**SET3**	6CH
SEG	07H	**OUT32**	29H	**DP**	4BH	**SET4**	6DH
TIMR	08H	**SV_42**	2AH	**LSPL**	4CH	**SET5**	6EH
SV_1	09H	**TM_42**	2BH	**USPL**	4DH	**SET6**	6FH
TM_1	0AH	**OUT42**	2CH	**ANL2**	4EH	**SET7**	70H
OUT1	0BH	**SV_52**	2DH	**ANH2**	4FH	**SET8**	71H
SV_2	0CH	**TM_52**	2EH	**ALD1**	50H	**SET9**	72H
TM_2	0DH	**OUT52**	2FH	**ALT1**	51H	**SET0**	73H
OUT2	0EH	**SV_62**	30H	**ALD2**	52H	**INP2**	74H
SV_3	0FH	**TM_62**	31H	**ALT2**	53H	**OUTY**	75H
TM_3	10H	**OUT62**	32H	**ALD3**	54H		
OUT3	11H	**SV_72**	33H	**ALT3**	55H		
SV_4	12H	**TM_72**	34H	**HYSA**	56H		
TM_4	13H	**OUT72**	35H	**CLO1**	57H		
OUT4	14H	**SV_82**	36H	**CHO1**	58H		
SV_5	15H	**TM_82**	37H	**CLO2**	59H		
TM_5	16H	**OUT82**	38H	**CHO2**	5AH		
OUT5	17H	**P1**	39H	**CLO3**	5BH		
SV_6	18H	**I1**	3AH	**CHO3**	5CH		
TM_6	19H	**D1**	3BH	**RUCY**	5DH		
OUT6	1AH	**DB1**	3CH	**WAIT**	5EH		
SV_7	1BH	**ATVL**	3DH	**SETA**	5FH		
TM_7	1CH	**CYT1**	3EH	**IDNO**	60H		
OUT7	1DH	**HYS1**	3FH	**BAUD**	61H		
SV_8	1EH	**P2**	40H	**SVOS**	62H		
TM_8	1FH	**I2**	41H	**PVOS**	63H		

16.11.2 Wiring diagram

RS232 Connection Diagram





NOTE:

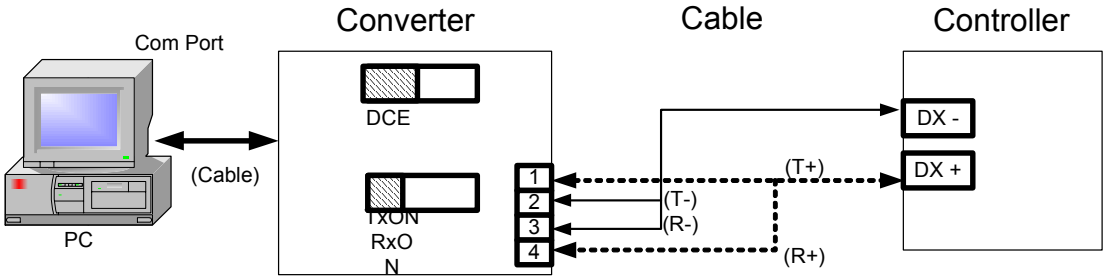
1.The length of cable be connected between controller and PC can't exceed 15 meter.

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 the "Protocol" file in CD.

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 the "Protocol" file in CD.