User's Manual
FU2E V3

FU series Digital PID Temperature Controllers Process Controllers

1 Notice

Please confirm the specification of controllers is tally with your request before using, and refer to this user manual in detail.

⚠ Danger

1. Danger ! Electric Shock !
   Don't touch AC power wiring terminal when controllers power on to avoid electric shock !
   Keep the power off when controllers wiring !

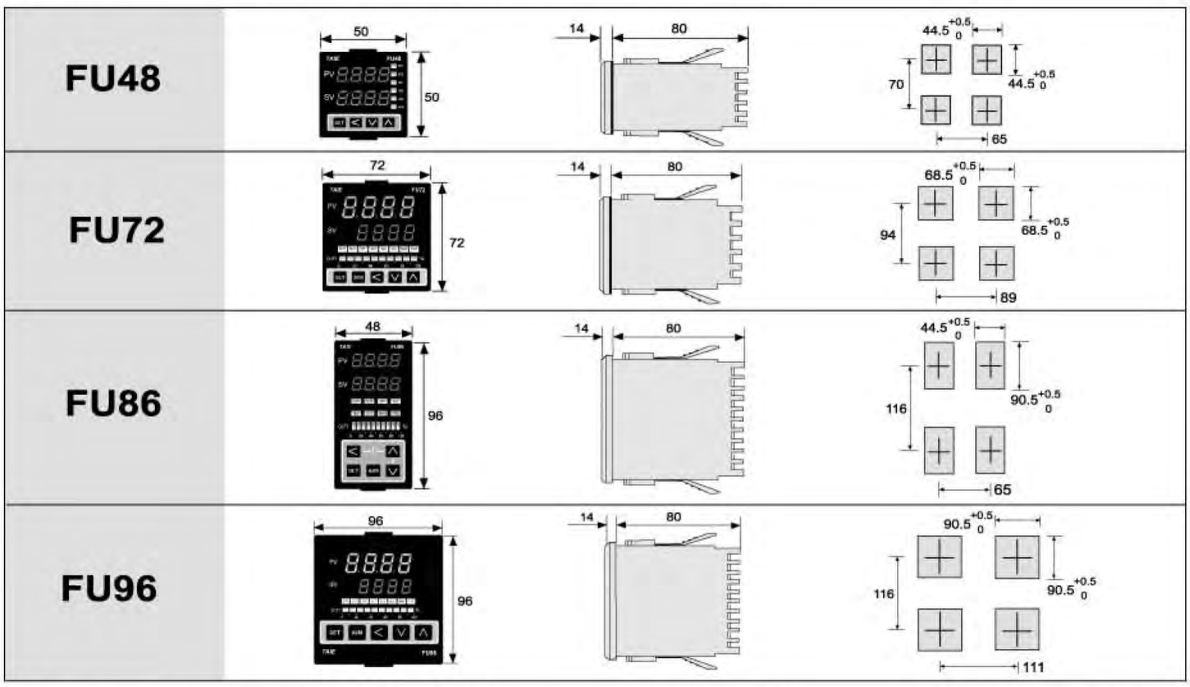
⚠ Warning

1. Please confirm the AC power wiring to controller is correct, otherwise it will be caused serious damage on controller.
   (FU48 connecting with Pin 1 and 6,FU72/86/96 with Pin 1 and 2).
2. Be sure to use the rated power supply(AC85~265V or DC24V),otherwise it will be caused serious damage on controller.
3. Please confirm all wring is connected with correct terminals (Input, Output and Alarm)
4. Use M3 screw-compatible crimp-on terminals with an insulation sleeve, as shown below

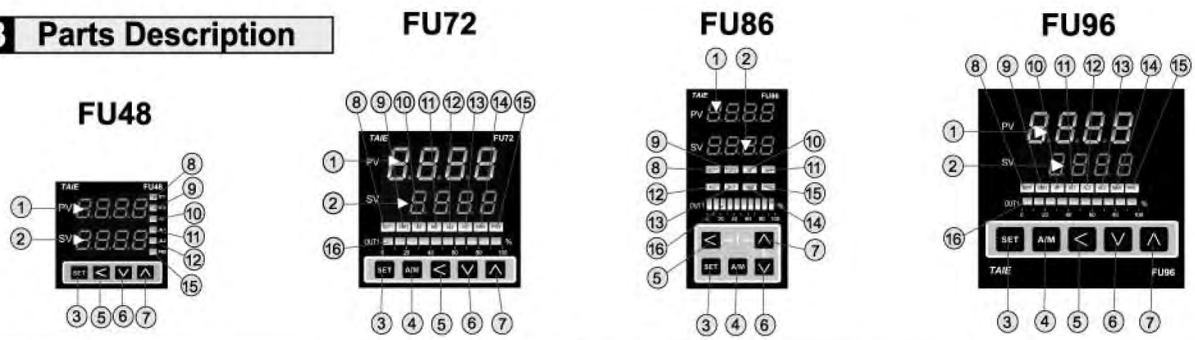
Torque : 0.4 N.m (4kgf.cm)

5. Avoid to install controller in the following sites:
   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 renge from 50 to 85% RH.
   III. A place where the controller likely contact with water, oil, chemicals, steam or 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 with low resistance and the same materials among 3 wires.

2 External Dimension and Panel Cutout 〈 Unit : mm 〉



3 Parts Description

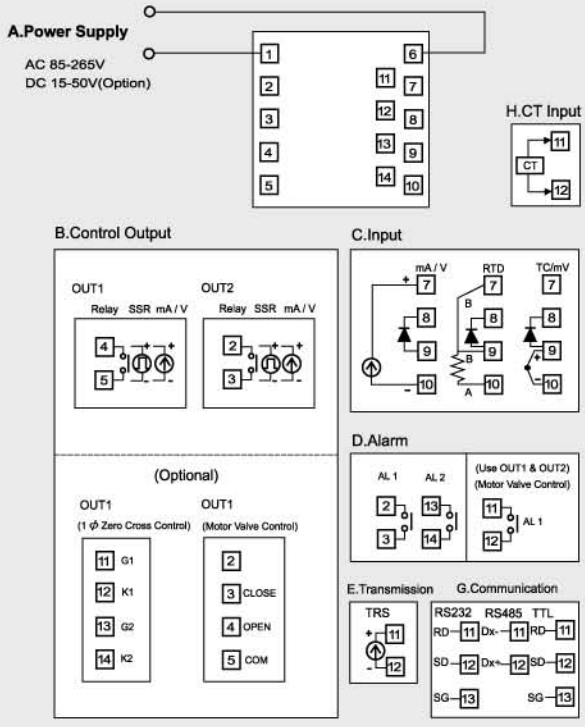


SYMBOL		NAME	FUNCTION
PV	①	Measured value (PV)display	Displays PV or various parameter symbols(Red)
SV	②	Setting value (SV)display	Displays SV or various parameter set values(Green)
SET	③	Set Key	Used for parameter calling up and set value registration
A/M	④	Auto/Manual key	Switches between Auto(PID) output mode and Manual output
<	⑤	Shift Key	Shift digits when settings are changed
V	⑥	Down Key (*Program Hold)	Decrease numbers (*Only for programmable controller)
∧	⑦	Up Key (*Program Run)	Increase numbers (*Only for programmable controller)

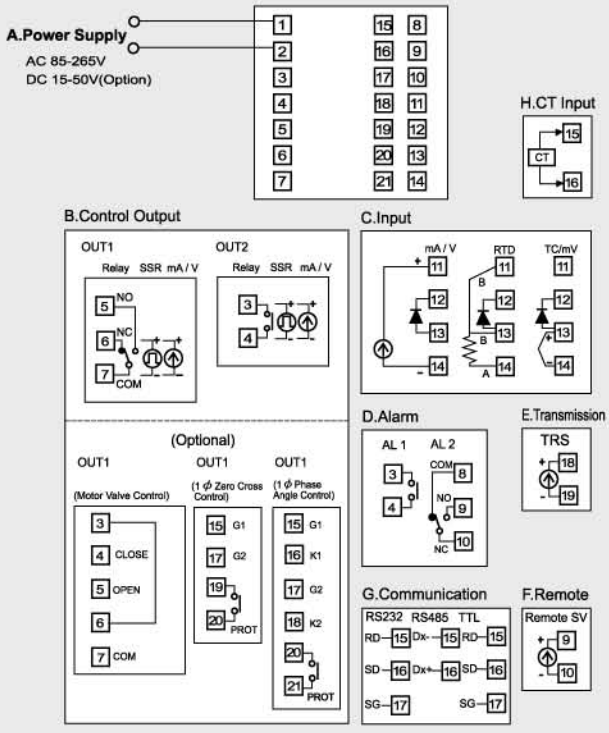
SYMBOL		NAME	FUNCTION
OUT1	⑧	OUT1 lamp	Lights when OUT 1 is on(Orange)
OUT2	⑨	OUT2 lamp	Lights when OUT 2 is on(Orange)
AT	⑩	Autotuning lamp	Lights when Autotuning is activated(Orange)
AL1	⑪	Alarm 1 lamp	Lights when Alarm 1 is activated(Orange)
AL2	⑫	Alarm 2 lamp	Lights when Alarm 2 is activated(Orange)
AL3	⑬	Alarm 3 lamp	Lights when Alarm 3 is activated(Orange)
MAN	⑭	Manual output lamp	Lights when manual output is activated(Orange)
PRO	⑮	*Program Running lamp	*Flashes when program running (Only for programmable controller)
OUT1%	⑯	Output1% Bar-Graph display	Output 1% is displayed on 10-dot LEDs (Green)

4 Terminal Arrangement

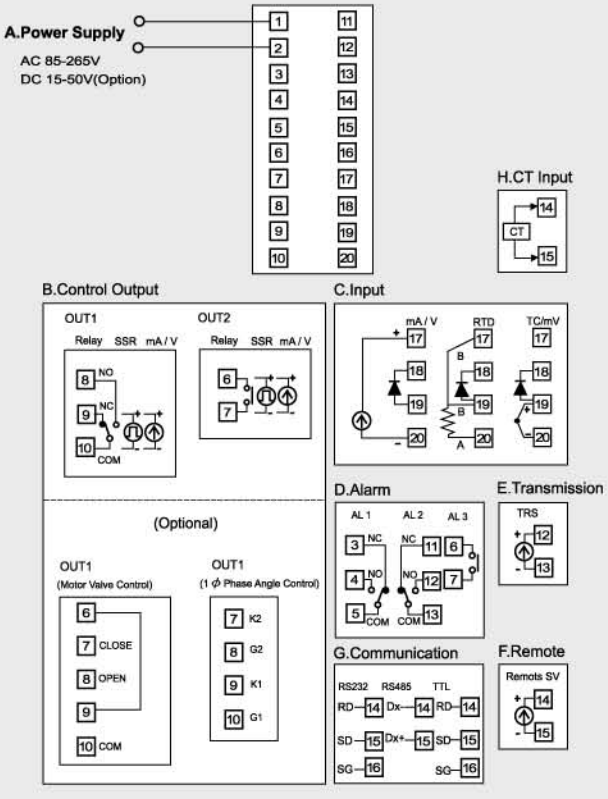
FU48



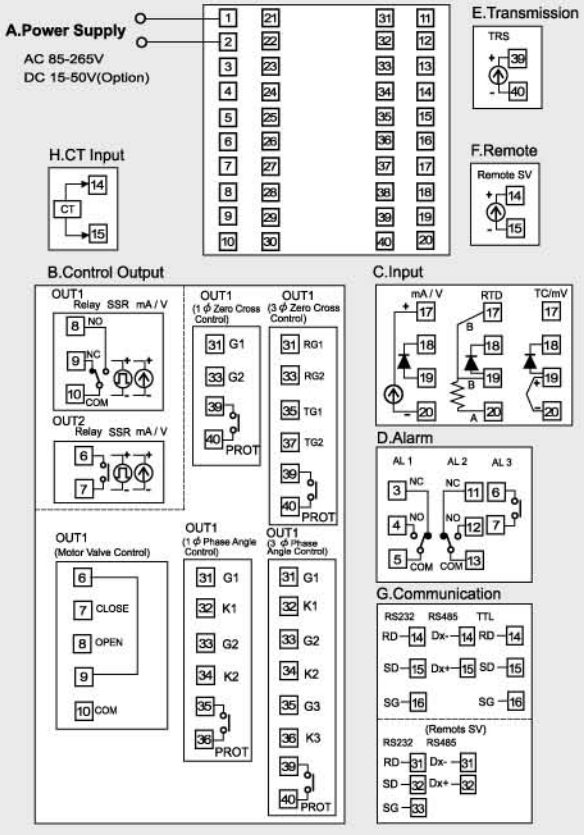
FU72



FU86



FU96



5 Operations

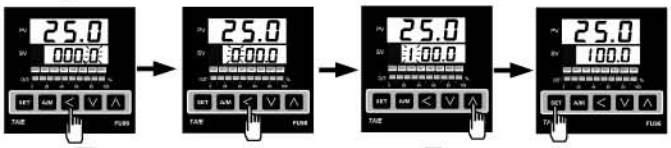
1.Power ON:

Controller wiil display as following

Light all LEDs and all 7 segment displays | Display series type | Display input type | Display range (0.0 ~ 400.0) | Ready for use

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.

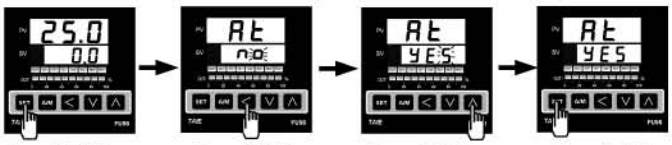
Press ＜ Key
To select the hundreds digit.

Press ∧ Key
To change the number to 1.

Press (SET) Key
To store the new set value.

3.Auto Tuning (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.

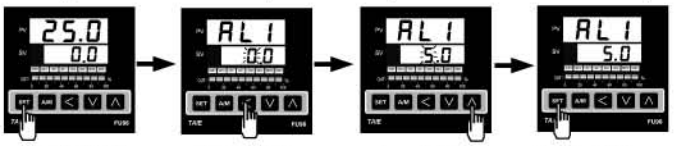
Press ∧ Key
Change AT to " YES "

Press (SET) Key
Start Autotuning process
(AT lamp will be lighted on)

AT light on，Auto Tuning started.
AT light off，Auto Tuning finished.

4.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

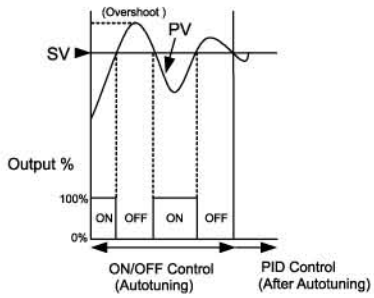
Press (SET) Key
Store the new value of AL1

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

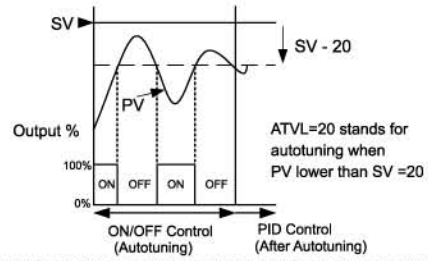
Autotuning (AT)

*Set ATVL to prevent overshoot occurred during autotuning process.
To set ATVL ,press (SET) key for 3 seconds to enter Level 2 (PID Level) and then change the value.

Factory Default **Autotuning ATVL=0**



(Ex.) **Autotuning ATVL=20**



7 Error Displays

Show status	Explanation	Remedy
in IE	IN1E : Input 1 Error	Check whether input loop is opened or wiring incorrect.
CJCE	CJCE :Cold Junction Compensation Failed	Check the compensation diode outside controller.
uuu 1	UUU1 : PV is above USPL	Check whether the input value is correct or not.
nnn 1	NNN1 : PV is below LSPL	Check whether the input value is correct or not.
AdCF	ADCF :A/D Convert Failed	Controller needs to be repaired.
rAMF	RAMF :RAM Failed	Controller needs to be repaired.

6 Alarm mode type

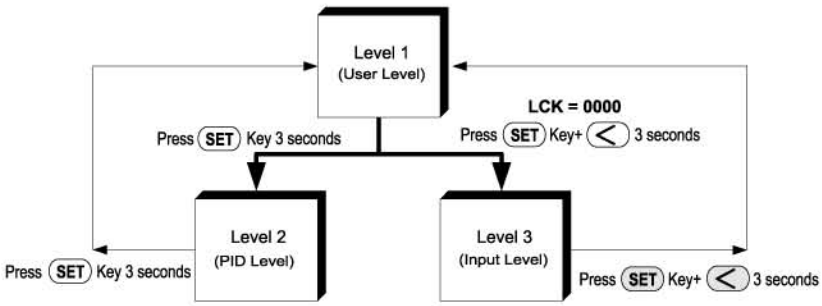
▲:SV △: Alarm set value

01	Deviation high alarm with hold action*
11	Deviation high alarm
02	Deviation high 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)ALD1~3 defines as follows: = 0 = flicker alarm = 99.59 = continued alarm = others = alarm ON Delay time
17	Program Run alarm (Only for Programmable controller) Run / Stop ON / OFF AL
08	System failed alarm*(ON) Normal / Failed OFF / ON AL
18	System failed alarm*(OFF) Normal / Failed ON / OFF AL
09	Heater Break Alarm (HBA)
00 10	No alarm

8 Levels Explanation

Levels Diagram

1. When the power is on, it will stay at Level 1(User Level) automatically.
2. The controller returns to Level 1 if there is no key operation within 60 seconds.
3. In any Level, press (A/M) key twice will return to Level 1.
   (FU48 don't have (A/M) key)



Level 1 (User Level)

Process Value / Set Value	P.V / S.V
Output Limt	OUtL 1000
Autotuning	At YES/no
Alarm 1 set value	AL 1 0.0
Alarm 2 set value	AL 2 0.0
Alarm 3 set value	AL 3 0.0

Return to "P.V"

Display If P1=0

Duel Output display when it has heating or cooling

Display If P2=0

Level 2 (PID Level)

P 1 3.0	Proportional band 1 (For output 1)	Range : 0.0~200.0% ON/OFF control if set to 0 (0.0)
I 1 240	Integral time 1 (For output 1)	Range : 0~3600 seconds PD control if set to 0
d 1 60	Derivative time 1 (For output 1)	Range : 0~900 seconds PI control if set to 0
db1 0	Dead-band time	Don't care
AtVL 0	Auto tuning offset value	Range : 0~USPL
CYt1 10	Output 1 cycle time	Range : 0~150 seconds Relay output :10 Voltage pulse output : 1 , mA output :0
HYS1 1	Hysteresis for output 1 ON/OFF control	Range : 0~1000 PV > (SV+HYSI), OFF PV ≦ (SV-HYS1), ON
P 2 3.0	Proportional band 2 (For output 2)	The same with P1
I 2 240	Integral time 2 (For output 2)	The same with I1
d 2 60	Derivative time 2 (For output 2)	The same with D1
CYt2 10	Output 2 Cycle time	The same with CYT1
HYS2 1	Hysteresis for output 2 ON/OFF control	The same with HYS1
GAP1 0	Control gap 1 (For output 1)	Set point of output 1 (Heating side) =SV - GAP1 (Set when it has duel display)
GAP2 0	Control gap 2 (For output 2)	Set point of output 2 (Cooling side) =SV + GAP2 (Set when it has duel display)
LCK 0000	Function lock	

Return to "P 1"

LCK	Levels entering available			Parameters can be changed or not
	Level 1 (User Level)	Level 2 (PID Level)	Level 3 (Input Level)	
0000	Yes	Yes	Yes	All parameters (Factory set value)
1111	Yes	Yes	No	All parameters
0100	Yes	Yes	No	All parameters except Level 3
0110	Yes	Yes	No	Parameters in Level 1
0001	Yes	Yes	No	SV" and "LCK"
0101	Yes	Yes	No	Only "LCK"

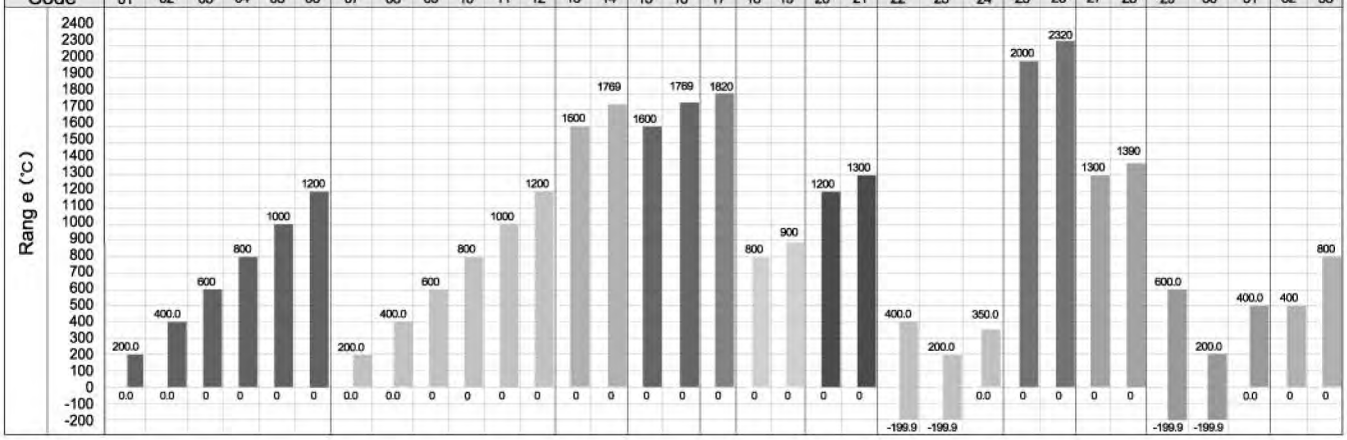
Level 3 (Input Level)

Input parameter	INP1 t2	Input type selection	
	ANL1 0	Analog input low limit calibration (Used for mA and V input)	Range : -1999 ~ 9999
	ANH1 5000	Analog input high limit calibration (Used for mA and V input)	Range : 0 ~ 9999
	dP 0000	Decimal point position (Available for mA and V input)	0000 , 000.0 , 00.00 , 0.000
	L.SP.L 0.0	Lower Set-Point Limit	Scaling Low Limit
	U.SP.L 400.0	Upper Set-Point Limit	Scaling High Limit
	ANL2 0	Remote input low limit calibration	Range : -1999 ~ 9999
	ANH2 5000	Remote input high limit calibration	Range : 0 ~ 9999
Alarm parameter	ALd1 11	Alarm mode of AL1	Range:00~18 Refer to "Alarm mode type"
	ALt1 99.59	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)
	ALd2 0	Alarm mode of AL2	The same with ALd1
	ALt2 99.59	Alarm time of AL2	The same with ALt1
	ALd3 0	Alarm mode of AL3	The same with ALD1
	ALt3 99.59	Alarm time of AL3	The same with ALT1
	HYSA 0.0	Hysteresis of all Alarm	Range : 0~1000
Linear signal adjust	CLO1 230	Output 1 low limit calibration (Used for mA and V output)	Range : 0 ~ 9999
	CHO1 3600	Output 1 high limit calibration (Used for mA and V output)	Range : 0 ~ 9999
	CLO2 230	Output 2 low limit calibration (Used for mA and V output)	The same with CLO1
	CHO2 3600	Output 2 high limit calibration (Used for mA and V output)	The same with CHO1
	CLO3 0	Retransmission low limit calibration	The same with CLO1
	CHO3 5000	Retransmission high limit calibration	The same with CHO1
Particular parameter	rU.CY 5	Full run time of proportional motor (Used for proportional motor valve control output)	Range: 5~200 seconds
	oA.t 0.0	Used for programmable controller to wait continued operation	0=Not wait Others=Wait value
Communication parameter	SEtA 0000	Alarm forward / inverse action setting can force the use of a-contact into b-contact	Level 4 setting please ask distributor
	PSL rtU	Communication Protocol Selection	MODBUS RTU / MODBUS ASCII / TAIE
	bit5 o_81	Communication Bits Configuration	O_81 / O_82 / E_81 / E_82
	Id.NO 1	ID number	Range : 0 ~ 255
	bAUd 384	Baudrate	2400 / 4800 / 9600 / 19200 / 38400 bps
SV.PV parameter	SV.OS 0.0	SV compensation	Range : -1000~1000
	PV.OS 0.0	PV compensation	Range : -100.0~500.0
	UNIt C	Unit of PV & SV	C(℃) / F(℉) / A(Analog)
	PV.Ft 200	PV Filter	PV will responese faster if PVFT is smaller.
	CASC 0.0	Reserved	
Control way	OUd HEAt	Action mode	Heat / Cool
	OPAd P.d	Control algorithm	PID / Fuzzy
	Hz 60Hz	Frequency	50 / 60HZ

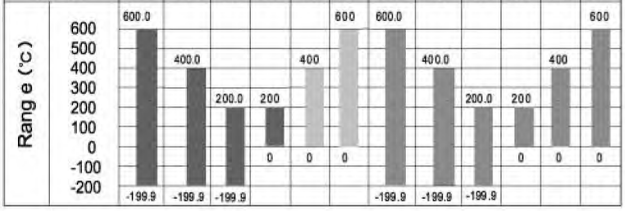
Return to "INP1"

9 Input Types

Type	T C (Thermocouple)																												
	K						J						R		S		B	E		N		T			W		PLII		U			L	
Code	K1	K2	K3	K4	K5	K6	J1	J2	J3	J4	J5	J6	R1	R2	S1	S2	B1	E1	E2	N1	N2	T1	T2	T3	W1	W2	PL1	PL2	U1	U2	U3	L1	L2
	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33



Type	R T D											
	JPT 100						PT 100					
	JP1	JP2	JP3	JP4	JP5	JP6	DP1	DP2	DP3	DP4	DP5	DP6
Code	41	42	43	44	45	46	47	48	49	50	51	52



Type	DC LINEAR					
	AN1				AN2	AN3
Code	61	62	63	64	71	76
Input Range	-10~10mV	-2~2V	-5~5V	-10~10V	0~10mV	0~20mV
Set Range	Four kinds	-1999~9999	-199.9~999.9	-19.99~99.99	-1.999~9.999	

Type	DC LINEAR										
	AN4							AN5			
Code	81	82	83	84	85	86	87	91	92	93	94
Input Range	0~50mV	0~20mA	0~1V	0~5V	0~10V	0~5KΩ	0~2V	10~50mV	4~20mA	1~5V	2~10V
Set Range	Four kinds of choices:			-1999~9999		-199.9~999.9		-19.99~99.99		-1.999~9.999	

10 Combination of options and models

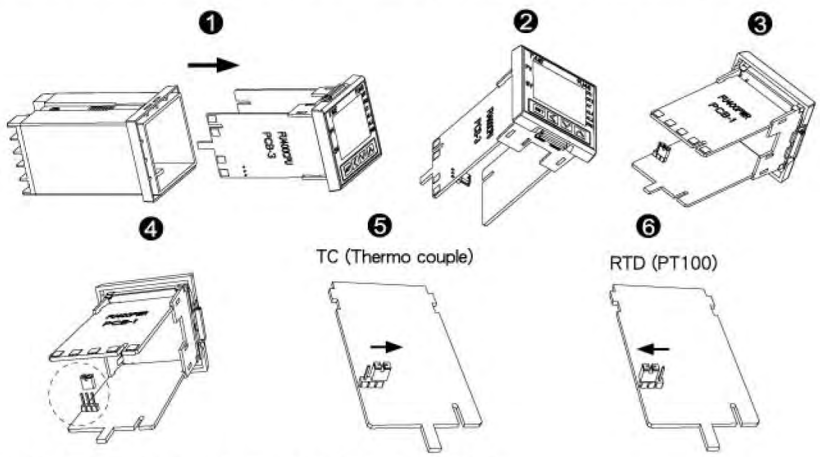
Options / Model	RAMP/SOAK PROGRAM	Output 1					Output2	Alarm2	Alarm3	HBA	Transmission	Remote SV	Communication	DC 24V Power
		1φSCR_Z	3φSCR_Z	Motor valve control	1φSCR_P	3φSCR_P								
FU48	○	○	–	○	–	–	○	○	–	○	○	○	○	○
FU72	○	○	–	○	○	–	○	○	○	○	○	○	○	○
FU86	○	–	–	○	○	–	○	○	○	○	○	○	○	○
FU96	○	○	○	○	○	○	○	○	○	○	○	○	○	○

○ Available – Not available

* Remote SV function is not availadle,if HBA Function has been specified.

11 Input Type Change of TC ↔ RTD

1.Take out the main body from outer case: adjust the jumper to the correct place



2.Start power after setting jumper to the correct place

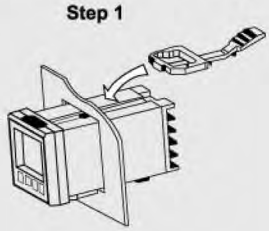
3.Amend the input type from the front membrane to enter in Level 3 to set.

* 4.Please be sure to cut off power and start again after amending input type so that the new parameters could be effective.

5.To change input type of TC or RTD is available but linear input is unavailable. Please ask our local distributor for help.

To mount panel easily

Step 1



Step 2

To push the clamp of special structure design without using screw to the end can be smoothly fixed on the panel.

12 Model & Suffix codes

Model	Output1	Output2	Alarm	TRS	Remote SV	Commu-nication	Input Type	Power	Water/Dust Proof
FU48	1	0	1	0	0	0	02	A	N

Model

(STANDARD)

FU48	48x48mm
FU72	72x72mm
FU86	48x96mm
FU96	96x96mm

(RAMP/SOAK Programmable)

PFU48	48x48mm
PFU72	72x72mm
PFU86	48x96mm
PFU96	96x96mm

Output1 / Output2

0	None
1	Relay
2	Voltage Pulse (SSR Drive)
3	4~20mA
4	0~20mA
A	0~5V
B	0~10V
C	1~5V
D	2~10V
5	1 ϕ SCR zero cross control
6	3 ϕ SCR zero cross control
7	Motor valve control
8	1 ϕ SCR phase angle control
9	3 ϕ SCR phase angle control

Alarm

0	None
1	1 Set
2	2 Sets
3	3 Sets
A	HBA*
B	HBA+AL2
C	HBA+AL2+AL3

TRS / Remote SV

0	None
1	4~20mA
2	0~20mA
A	0~5V
B	0~10V
C	1~5V
D	2~10V

Communication

0	None
3	TTL
A	RS232_MODBUS
B	RS485_MODBUS

Input Type: See Input Codes

Power

A	AC 85~265V
D	DC 24V

Water/Dust Proof

N	None
W	IP65

1. ■■■■ : Block means optional functions with additional charge
2. Factory set value K2, code 02
3. TC Input(K. J.R.S.B.E.N.T.W.PLII.U.L...)setting, can be changed to any types by user
4. RTD(JPT 100, PT100)setting, can be changed to any type by user
5. TC, RTD, LINEAR can be changed each other but need to change the parts of hardware. For more details, please contact local agents.
6. HBA : Heater Break Alarm (HBA must use AL1 as alarm relay)

13 Specifications

Standard Spec.

Model	FU48	FU72	FU86	FU96
Dimension	48X48mm	72X72mm	48X96mm	96X96mm
Supply voltage	AC 85~265V			
Frequency	50/60 HZ			
Power Consumption	approx 3VA	approx 3VA	approx 4VA	approx 4VA
Memory	Non-volatile memory E^2PROM			
Input	Accuracy : 0.2%FS,Sample time : 250ms			
TC	K , J , R , S , B , E , N , T , W5Re/W26Re , PL2 , U , L			
RTD	PT100 , JPT100			
mA dc	4~20mA , 0~20mA			
Voltage dc	0~1V , 0~5V , 0~10V , 1~5V , 2~10V -10~10mV , 0~10mV , 0~20mV , 0~50mV , 10~50mV			
DP Position	0000 , 000.0 , 00.00 , 0.000 (available for mA or Voltage dc input) According to the input type, ℃/℉ can be displayed to one decimal			
Output 1	Main control output to HEAT mode or COOL mode			
Relay	SPST type	SPDT type	SPDT type	SPDT type
Voltage Pulse	8A , 240V, electrical life : 100,000 times or more(under the rated load).			
mA dc	For SSR drive. ON:24V , OFF:0V , maximum load current:20mA.			
Voltage dc	DC 4~20mA , 0~20mA ◦ maximum load resistance: 560Ω.			
	DC 0~5V , 0~10V , 1~5V , 2~10V ◦ maximum load current : 20mA.			
Alarm 1	SPST type	SPST type	SPDT type	SPST type
	8A , 240V , electrical life : 100,000 times or more(under the rated load).			
Control algorithms	PID , P , PI , PD , ON/OFF(P=0) , FUZZY			
PID range	P : 0~200% , I : 0~3600 Secs , D : 0~900 Secs			
Isolation	Output terminal (control output , alarm ,transmission) and Input terminal are isolated separately.			
Isolated resistance	10M Ω or more between input terminals and case(ground) at DC 500V 10M Ω or more between output terminals and case(ground) at DC 500V			
Dielectric strength	1000V AC for 1 minute between input terminals and case(ground) 1500V AC for 1 minute between output terminals and case(ground)			
Operating temperature	0~65℃			
Humidity range	0~50℃ / 20~90% RH			
Weight (approx)	approx150g	approx225g	approx225g	approx300g
LED Display(PAT.)	PV:8mm SV:8mm	PV:14mm SV:10mm	PV:8mm SV:8mm	PV:14mm SV:10mm

Optional Spec.

RAMP/SOAK Program	2 Patterns with 8 segments each . can be linked together as 16 segments use			
Output 2	For heating and cooling control use *Acctron mode is opposite with Output 1			
Relay	SPST type	SPST type	SPST type	SPST type
Voltage Pulse	For SSR drive. ON:24V , OFF:0V , maximum load current:20mA.			
mA dc	DC 4~20mA , 0~20mA ◦ maximum load resistance :560Ω.			
Voltage dc	DC 0~5V , 0~10V ,1~5V ,2~10V ◦ maximum load current : 20mA .			
Alarm 2	SPST type	SPDT type	SPDT type	SPDT type
Alarm 3	——	SPST type	SPST type	SPST type
Heater Break Alarm (HBA)	Display Range of Heater Current:0.0~99.9A , Accuracy : 1%FS Included CT :SC-80-T (5.8mm dia , 0.0~80.0A) or SC-100-T(12mm dia , 0.0~99.9A) Alarm Relay : AL1			
Transmission	Available for PV or SV transmission			
mA dc	DC 4~20mA , 0~20mA ◦ maximum load resistance :560Ω.			
Voltage dc	DC 0~5V , 0~10V ,1~5V ,2~10V ◦ maximum load current : 20mA .			
Remote SV Input	4~20mA , 0~20mA , 0~5V , 0~10V , 1~5V , 2~10V are available.			
Communication	Protocol : MODBUS RTU , MODBUS ASCII , TAIE Interface : RS485 ,RS232, TTL Baudrate : 38400, 19200 , 9600 , 4800 , 2400 bps 8 bit , Start bit : 1 bit , Parity : Odd or Even , Stop bit : 1 or 2 bit			
WaterProof/DustProof	IP65			