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Digital PID

Temperature/Process Controllers

FU Series

Integrated Mold、
Technology Leadership
High Light LED New feelings

Best comparison of price and function

Programmable | Fuzzy | Autotuning | MODBUS

CE RoHS Pb compliant Match to RoHs System

Patent No. : ZL200820301949.5 、M347604

Digital PIDTemperature Controllers / Process Controllers

BEST CHOICE FOR PROCESS AND TEMPERATURE CONTROL

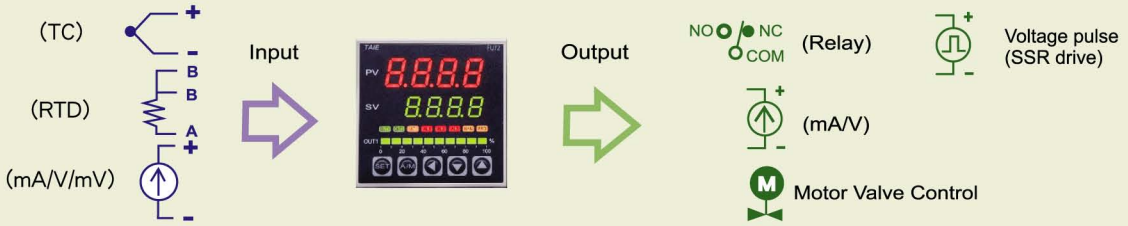
Application:Control temperature , humidity , pressure , flow and PH.

FU series controllers are microprocessor based controllers.Which have been designed with high accuracy input , various ouput selection , useful options and good reliability at a competitive price.
FU series use "PID+FUZZY" algorithm to implement excellent control.
The output status is displayed on the built in "Bar-Graph" display.
FU series also provide "Programmable RAMP/SOAK" function and has 2 patterns by 8 segments, to elevate or decrease temperature.
FU series support MODBUS protocol. Communication with HMI is more convenient.

Available in 4 sizes,the models and sizes are as below:
FU48:48X48mm (DIN 1/16)　　FU86:48X96mm (DIN 1/8)
FU72:72X72mm (DIN 3/16)　　FU96:96X96mm (DIN 1/4)

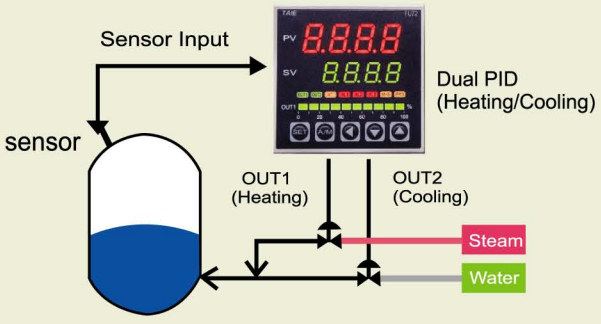
Multi-Option of input & output

◎ Completely correspond to any kinds of input signal like Thermo couple, RTD PT100, and DC4~20mA. 0~5V.etc.
◎ Satisfy any requests for output mode like DC4~20mA, 0~5V Voltage, Current & the relay output of capacity 8A
◎ It provides with 3 features of Controller, Signal converter and Alarm monitor. It can be changed the signal of mV, V, RTD to the output of Voltage & Current 4~20mA instead of the signal converter.
◎ Separately design for signal circuit and power circuit on PC board, effectively restrain the external interference of electric wave.



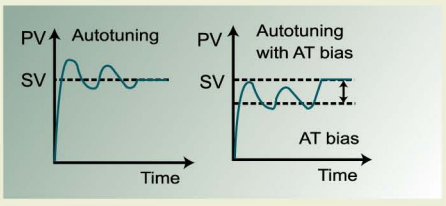
Optimize function

Heating and Cooling Control



PID autotuning control

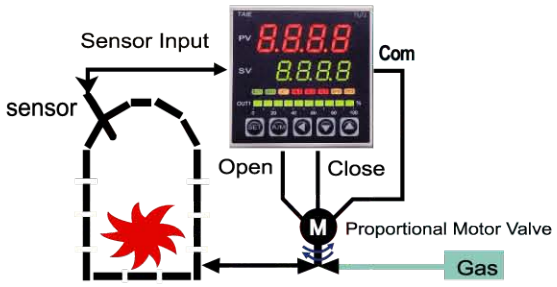
It will make to calculate optimize PID value.



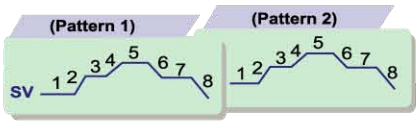
When autotuning acts ,it will make PV hunting 1~2 cycle to calculate optimize PID value. To protect user's device , **FU** series controller can perform PV hunting below SV by setting AT bias value(ATVL) .

Special Function Design

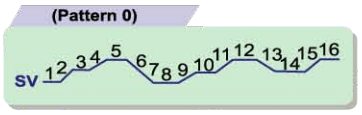
Motor Valve Control



Ramp/Soak Program

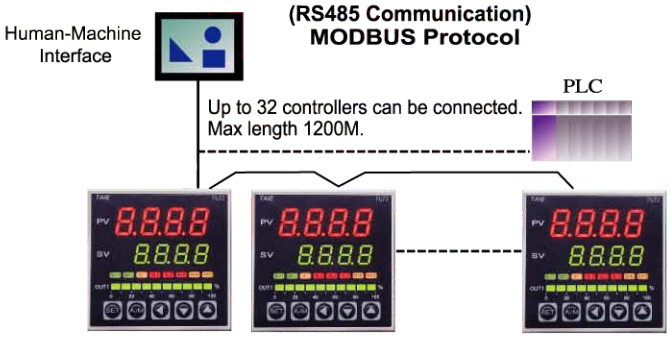


There are 2 patterns by 8 segments can be used in ramp/soak program.



There are 2 patterns can be linked together as16 segments in ramp/soak program.

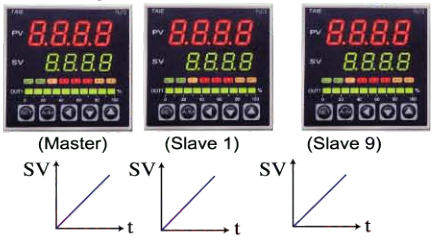
RS-485 Communication



TTL Communication

(TTL Communication)

Up to 10 controllers can be connected.
Max length 1M.



The SV value of slave controllers will be remoted by master controller,and reached to max value at the same time

Operations

1.Power ON: Controller will display as the following

Light all LEDs and all 7 segment displays | 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.

Alarm Types

Alarm types list as below:

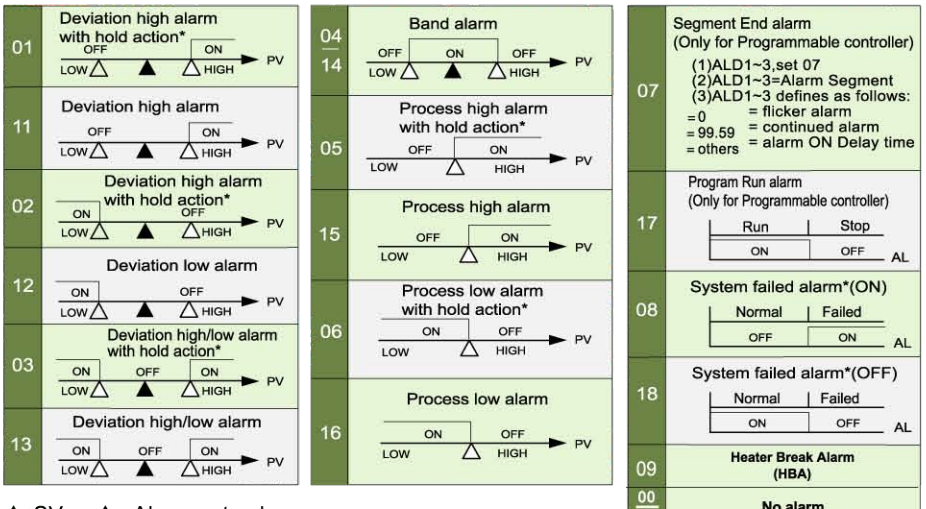
Deviation
- Deviation High Alarm
- Deviation Low Alarm
- Deviation High/Low Alarm
- Band Alarm

System
- System Failed Alarm
- System Normal Alarm

PV
- PV High Alarm
- PV Low Alarm

Program
- Program Run Alarm
- Program End Alarm
- Segment End Alarm

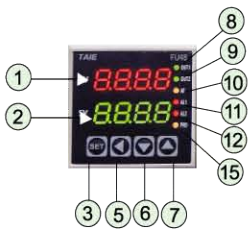
5.Alarm mode type (Referenced for ALD1/ALD2/ALD3)



▲:SV △: Alarm set value

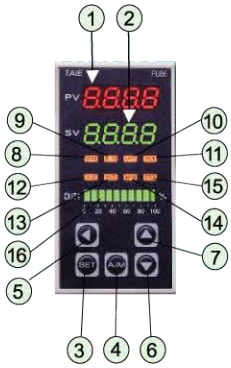
Parts Description

FU48



FU72

FU86



FU96

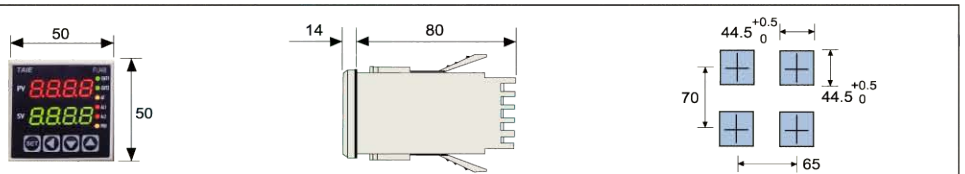
SYMBOL	NAME		FUNCTION
PV	①	Measured value (PV)display	Displays PV or various parameter symbols(Red)
SV	②	Setting value (SV)display	Displays SV or various parameter values(Green)
SET	③	Set Key	Used for parameter calling up and set value registration
A/M	④	Auto/Manual key	Switches between Auto(PID) output mode and Manual output
＜	⑤	Shift Key	Shift digits when settings are changed
∨	⑥	Down Key	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
OUT2	⑨	OUT2 lamp	Lights when OUT 2 is on
AT	⑩	Autotuning lamp	Lights when Autotuning is activated
AL1	⑪	Alarm 1 lamp	Lights when Alarm 1 is activated
AL2	⑫	Alarm 2 lamp	Lights when Alarm 2 is activated
AL3	⑬	Alarm 3 lamp	Lights when Alarm 3 is activated
MAN	⑭	Manual output lamp	Lights when manual output is activated
PRO	⑮	*Program Running lamp	*Flashes when program running (Only for programmable controller)
OUT1%	⑯	Output 1% Bar-Graph display	Output 1% is displayed on 10-dot LEDs

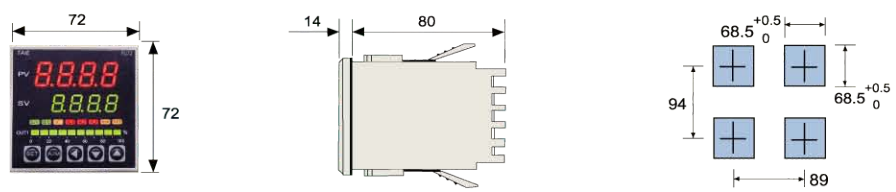
Unit : mm

External Dimension

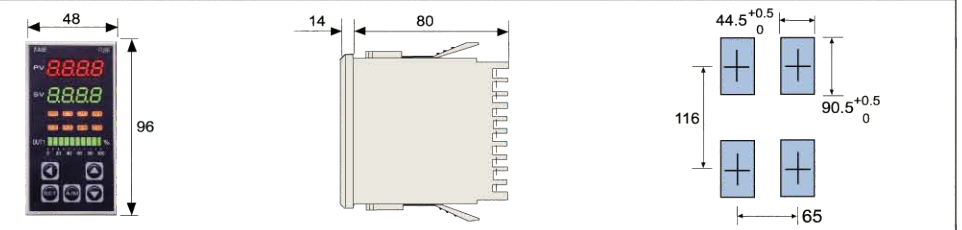
FU48



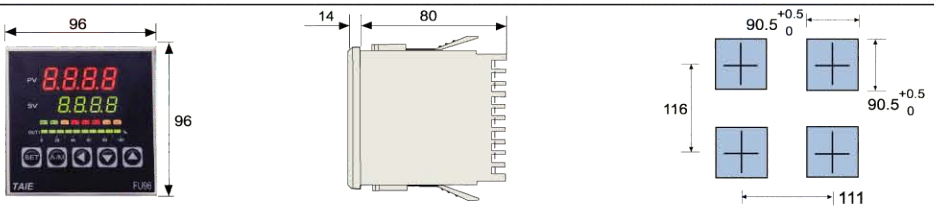
FU72



FU86

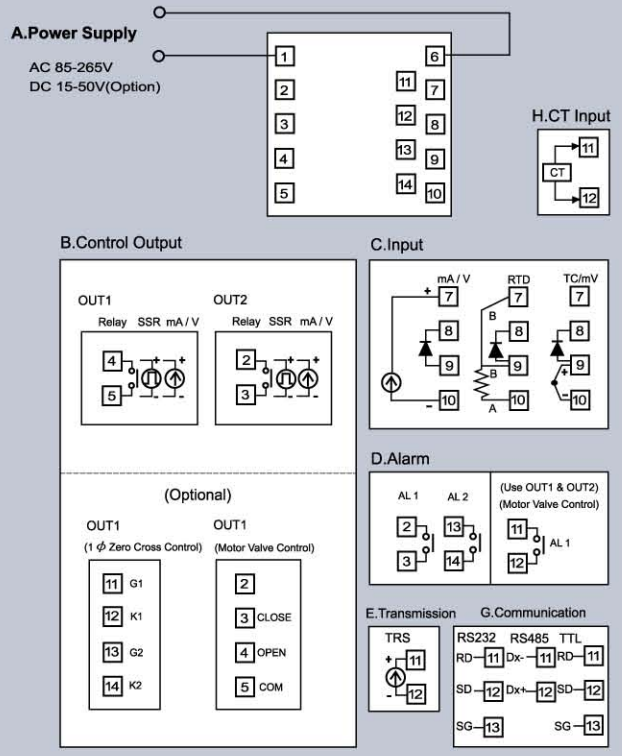


FU96

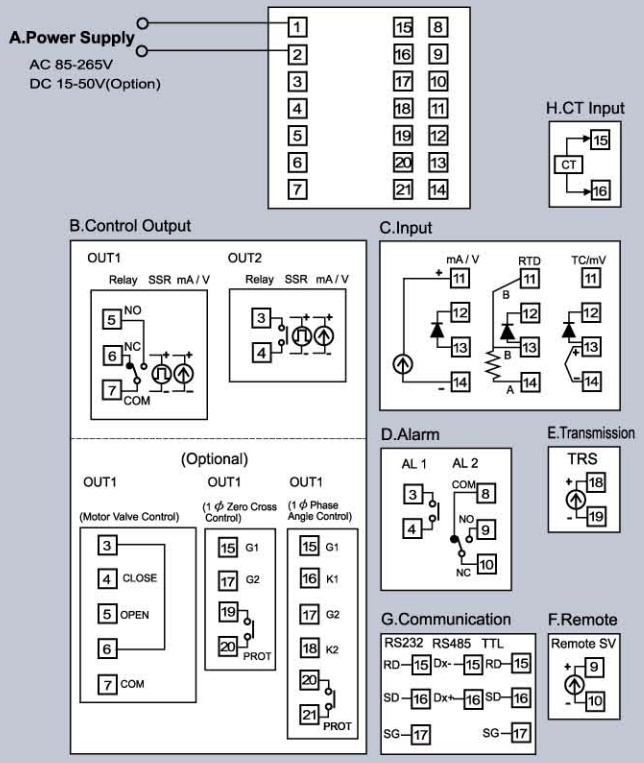


Terminal Arrangement

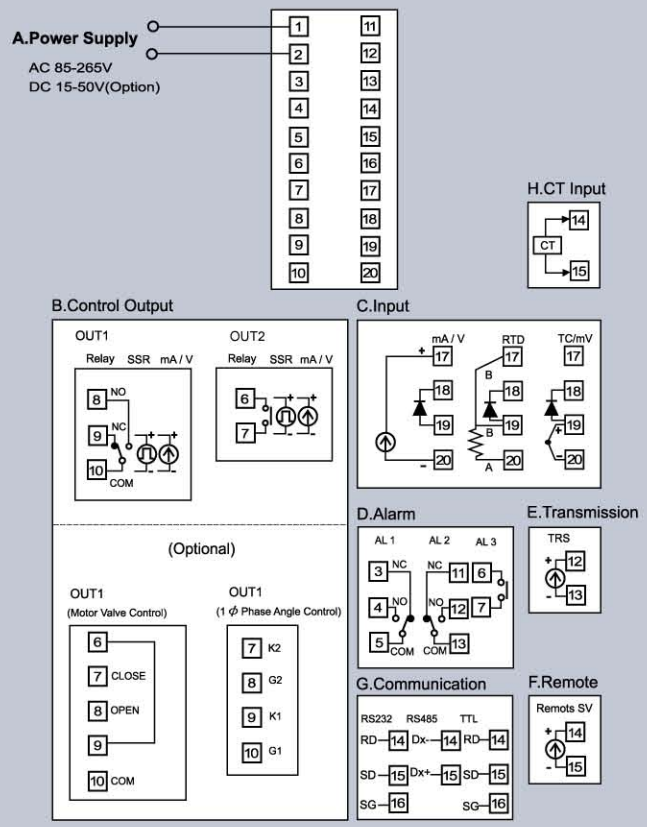
FU48



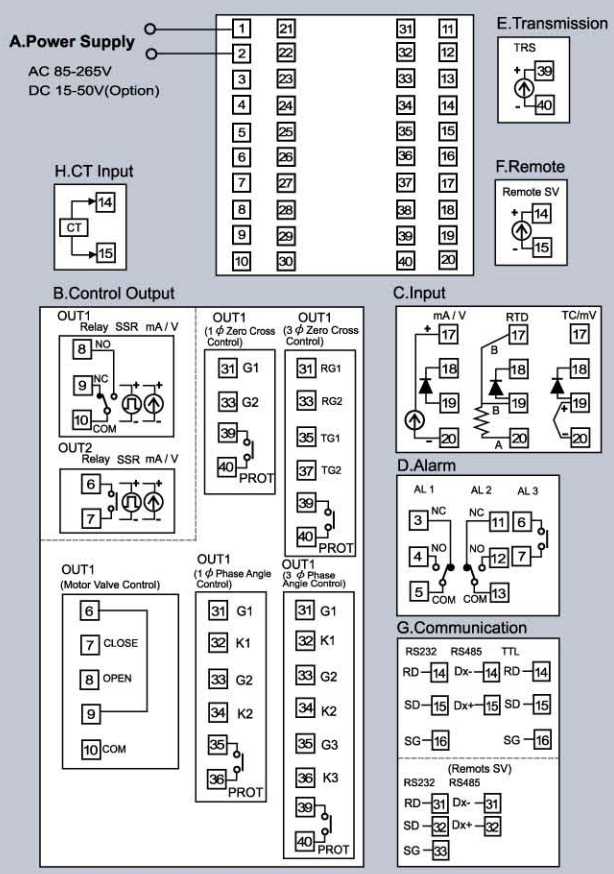
FU72



FU86



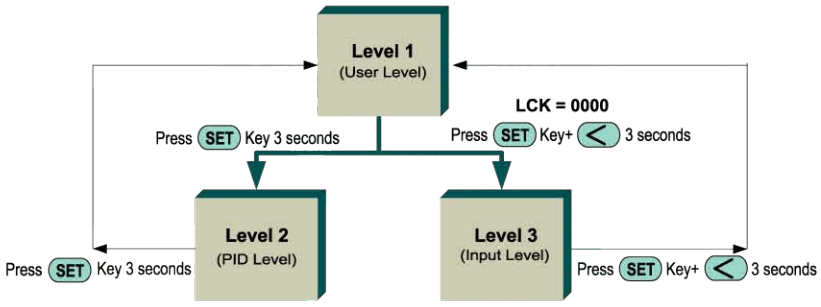
FU96



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 / SetValue	PV / SV
Output Limt	OUtL 100.0
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 "PV"

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	FU don't have this function
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	

Display If P1=0

Duel Output display when it has heating or cooling

Display If P2=0

Return to "P I"

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 except Level 3
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

INPt tYP2	Input type selection	
ANLt 0	Analog input low limit calibration (Used for mA and V input)	Range : -1999 ~ 9999
ANHt 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	(FU don't have this function)
ANH2 5000	Remote input high limit calibration	(FU don't have this function)

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	(FU48 don't have AL3)
ALt3 99.59	Alarm time of AL3	(FU48 don't have AL3)
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	(FU don't have this function)
CHO3 5000	Retransmission high limit calibration	(FU don't have this function)

Particular parameter

rU.CY 5	Full run time of proportional motor (Used for proportional motor valve control output)	Range : 5~200 seconds
bAit 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
bitS 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(°F) / A(Analog)
PVFt 200	PV Filter	PV will responese faster if PVFT is smaller.
CASC 0.0	Reserved	FU don't use it

Control way

OUd HEAt	Action mode	Heat / Cool
OPAd P.d	Control algorithm	PID / Fuzzy
H= 60H=	Frequency	50 / 60HZ

Return to "INPt"

Specifications

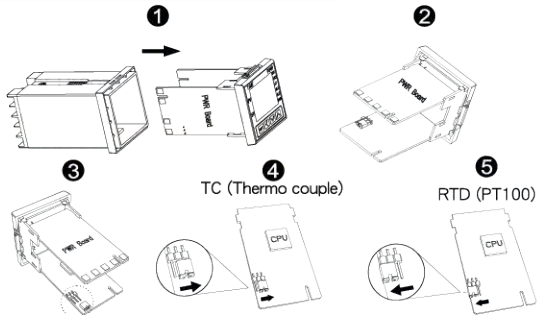
Standard Spec.

Model	FU48	FU72	FU86	FU96
Dimension	48X48mm	72X72mm	48X96mm	96X96mm
Supply voltage	AC 85～265V / DC 24V (option)			
Frequency	50/60 HZ			
Power Consumption	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	DC 4～20mA , 0～20mA			
Voltage dc	DC 0～1V , 0～5V , 0～10V , 1～5V , 2～10V DC -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 Voltage dc	For SSR drive. ON:24V , OFF:0V , maximum load current: DC 20mA.			
Alarm 1	DC 4～20mA , 0～20mA ◦ maximum load resistance: 560Ω. DC 0～5V , 0～10V , 1～5V , 2～10V ◦ maximum load current : DC 20mA.			
	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	approx 225g	approx 225g	approx300g
LED Display(PAT.)	high light technology, Red/Green/Orange with in one Module			

Optional Spec.

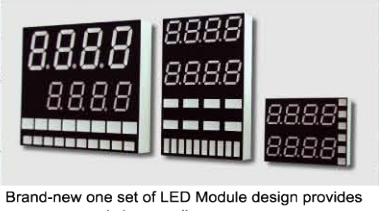
RAMP/SOAK Program	2 Patterns with 8 segments each . The 2 patterns can be linked together as 16 segments use			
Output 2	For heating and cooling control use			
Relay	SPST type	SPST type	SPST type	SPST type
Voltage Pulse	For SSR drive. ON:24V , OFF:0V , maximum load current: DC 20mA.			
mA dc	DC 4~20mA , 0~20mA .Maximum load resistance:560 Ω			
Voltage dc	DC 0~5V , 0~10V ,1~5V ,2~10V. Maximum load current: DC 20mA.			
Alarm 2	SPST type	SPDT type	SPDT type	SPDT type
Alarm 3	None	SPST type	SPST type	SPST type
Heat 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 : 560 Ω			
Voltage dc	DC 0~5V,0~10V,1~5V,2~10V. Maximum load current : DC 20mA.			
Remote SV	DC 4~20mA , 0~20mA , 0~5V , 0~10V , 1~5V , 2~10V are available			
Communication	Protocol : MODBUS RTU,MODBUS ASCII, TAIE			
	Interface : RS232 , RS485 , TTL			
	Baudrate : 38400, 19200 , 9600 , 4800 , 2400 bps.			
	8 bit , Start bit : 1 bit , Parity : Odd or Even , Stop bit : 1 or 2 bit			
Water Proof	IP65			

Input Type Change of TC◄►RTD



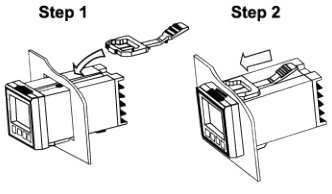
1.Take out the main body from outer case: adjust the jumper to the correct place
2.Start power after setting jumper to the correct place
3.Amend the input type from the front membrane to enter in Level 3 to set.
4.Please be sure to cut off power and start again after amending input type so that the new 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.

New High Light LED Module Display



Brand-new one set of LED Module design provides more easy and clear reading.

To mount panel easily



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

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

(STANDARD)

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

(RAMP/SOAK Programmable)

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

Output1

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	1φ SCR zero cross control
6	3φ SCR zero cross control
7	Motor valve control
8	1φ SCR phase angle control
9	3φ SCR phase angle control

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

Alarm

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

TRS

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

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)

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.

Input Type

TC (Thermocouple)

Type	K						J						R		S		B	E		N		T			W		PLII		U			L	
Code	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
Range (°C)	200.0	400.0	600	800	1000	1200	200.0	400.0	600	800	1000	1200	1600	1769	1600	1769	1820	800	900	1200	1300	400.0	200.0	350.0	2000	2320	1300	1390	600.0	200.0	400.0	400	800
	0.0	0.0	0	0	0	0	0.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	-199.9	-199.9	0.0	0	0	0	0	-199.9	-199.9	0.0	0	0

RTD

Type	JPT 100						PT 100					
Code	JP1	JP2	JP3	JP4	JP5	JP6	DP1	DP2	DP3	DP4	DP5	DP6
	41	42	43	44	45	46	47	48	49	50	51	52
Range (°C)	600.0	400.0	200.0	200	400	600	600.0	400.0	200.0	200	400	600
	-199.9	-199.9	-199.9	0	0	0	-199.9	-199.9	-199.9	0	0	0

DC LINEAR

Type	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	

DC LINEAR

Type	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										

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