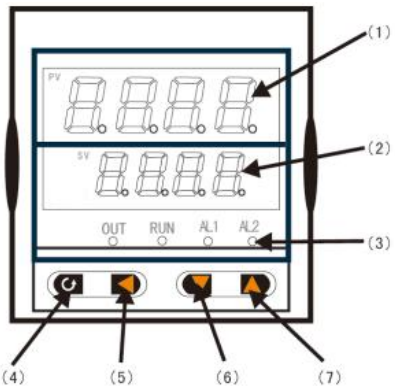
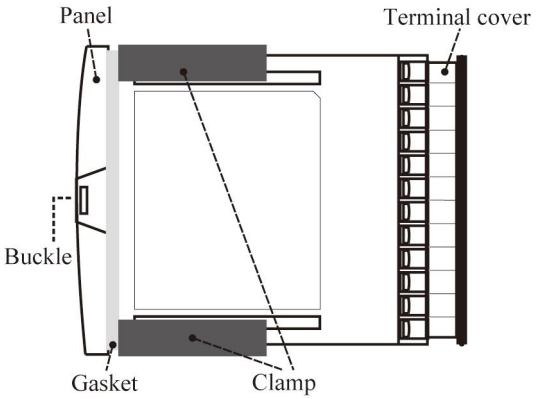
SUP-1300 Easy Fuzzy PID Regulator

Introduction

SUP-1300 series easy fuzzy PID regulator adopts fuzzy PID formula for easy operation with measurement precision of 0.3%; 7 types of dimensions available, 33 types of signal input available; applicable to measurement of industrial process quantifiers including temperature, pressure, flow, liquid level, and humidity etc. Combined with all kinds of executors, it's capable of PID regulation and control to electric heating appliances, electromagnetic and electric control valve. Supporting 2-way alarm, 1-way control output or RS485 communication interface adopting standard MODBUS protocol, 1-way DC24V feed output; photoelectric isolation between input, output and power end; 100-240V AC/DC or 20-29V DC switch power supply; standard snap-in installation; operating temperature: 0-50℃, relative humidity: 5-85% RH without coagulation.

1. Profile of Display Panel





(1) PV Display (measured value)

(2) SV Display

Display parameters like input type in measurement mode;

Display setting value in parameters setting mode;

(3) Primary alarm (AL1) and secondary alarm indication lamp, running lamp (RUN) and output lamp (OUT);

(4) Confirmation

(5) Shift

(6) Decrease

(7) Increase

How to get the core out of shell:

The core of instrument can be taken out from the shell. Push buckles on both sides of the front panel aside, and push the front panel to separate core and shell. For installation, put the core into the shell and lock it with buckles to meet protection standard.

2. Model Selection

SUP-1300□-□-□/□/□ ( ) -□- ( )

① ② ③ ④ ⑤ ⑥ ⑦

① Specification		② Input graduation	
Code	Width×height×depth	No.	Graduation (measurement range)
A	160x80x110mm (horizontal)	00	Thermocouple B (400~1800℃)
B	80x160x110mm (vertical)	01	Thermocouple S (0~1600℃)
C	96x96x110mm (square)	02	Thermocouple K (0~1300℃)

D	96x48x110mm (horizontal)
E	48x96x110mm (vertical)
F	72x72x110mm (square)
H	48x48x110mm (square)
③ Control output (OUT)	
Code	Output type (load resistance RL)
0	4-20mA (RL≤600Ω)
1	1-5V (RL≥250KΩ)
2	0-10mA (RL≤1.2KΩ)
3	0-5V (RL≥250KΩ)
4	0-20mA (RL≤600Ω)
5	0-10V(RL≥4KΩ)
K1	Relay contact output
K3	Single-phase silicon controlled rectifier zero passage triggering pulse output
K4	Solid state relay driven voltage output
D1	RS-485 communication interface (Modbus)
④ Limits for alarm (relay contact output)	
Code	Limits for alarm
X	No output
1	1-limit alarm
2	2-limit alarm
⑤ Feed output	
Code	Feed output (output voltage)
X	No output
P	1-way feed output
	For example, "P(24)" means feed output 24V
⑥ Power supply	
Code	Voltage range
A	AC/DC100~240 (AC/50-60Hz)
D	DC 20~29
⑦Remarks	
N/A, omissible	

03	Thermocouple E graduation (0~1000℃)
04	Thermocouple T graduation (-200.0~400.0℃)
05	Thermocouple J graduation (0~1200℃)
06	Thermocouple R graduation (0~1600℃)
07	Thermocouple N graduation (0~1300℃)
08	Thermocouple F2 graduation (700~2000℃)
09	Thermocouple Wre3-25 graduation (0~2300℃)
10	Thermocouple Wre5-26 graduation (0~2300℃)
11	Thermal resistance Cu50 (-50.0~150.0℃)
12	Thermal resistance Cu53 (-50.0~150.0℃)
13	Thermal resistancecu100 (-50.0~150.0℃)
14	Thermal resistancept100 (-200.0~650.0℃)
15	Thermal resistanceba1 (-200.0~600.0℃)
16	Thermal resistanceba2 (-200.0~600.0℃)
17	Linear resistance0~500Ω (-1999~9999)
18	Remote transmission resistance 0~350Ω (-1999~9999)
19	Remote transmission resistance 30~350Ω (-1999~9999)
20	0~20mv (-1999~9999)
21	0~40mv (-1999~9999)
22	0~100mv (-1999~9999)
23	Reserved internally
24	Reserved internally
25	0~20ma (-1999~9999)
26	0~10mA (-1999~9999)
27	4~20mA (-1999~9999)
28	0~5V (-1999~9999)
29	1~5V (-1999~9999)
30	Reserved internally
31	0~10V (-1999~9999)
32	0~10mA (extraction) (-1999~9999)
33	4~20mA (extraction) (-1999~9999)
34	0~5V (extraction) (-1999~9999)
35	1~5V (extraction) (-1999~9999)
55	Full switch

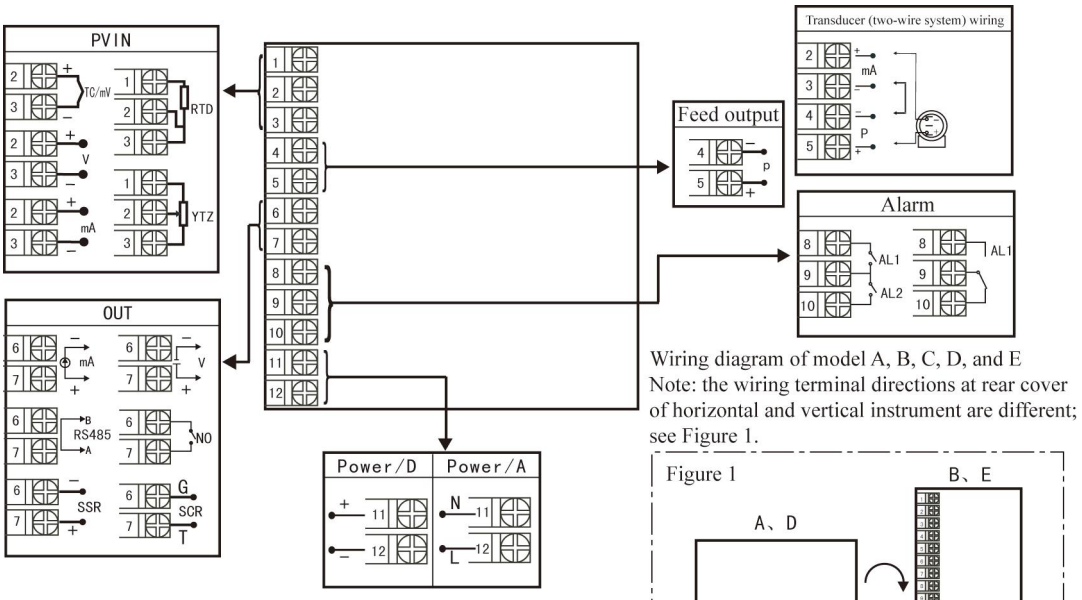
Notes:

Contact capacity of 1st relay (with normally open/closed contact): 3A 220VAC/5A 30VOC (resistive load)

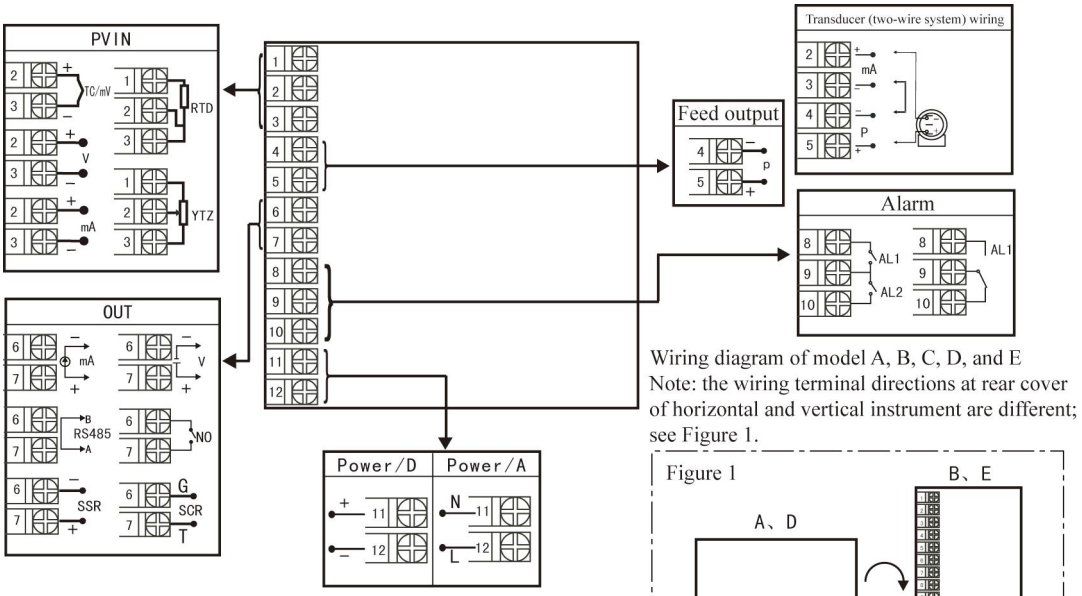
Contact capacity of 2nd relay (only one normally open contact): 3A 220VAC/5A 30VOC (resistive load)

Contact capacity of relay for instrument of Model H: 0.6A 220VAC/0.6A 30VOC (resistive load)

3. Wiring

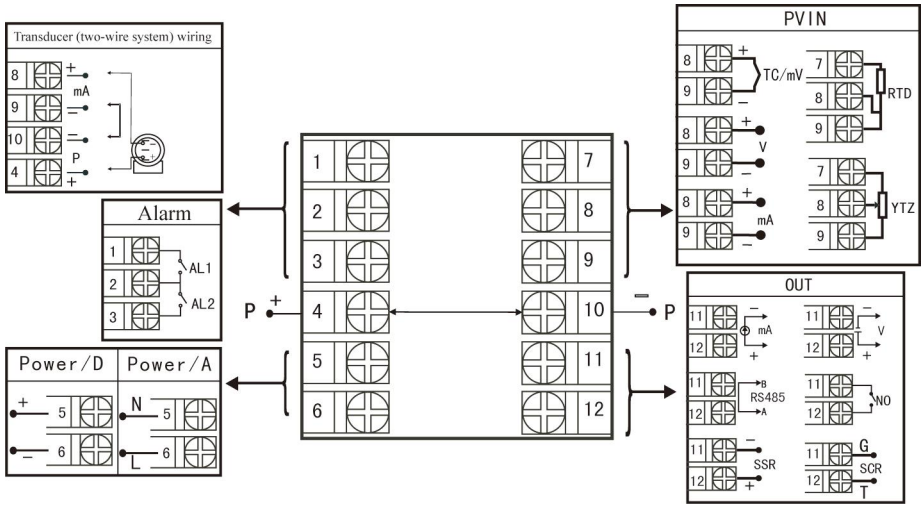


Wiring diagram of model A, B, C, D, and E
Note: the wiring terminal directions at rear cover of horizontal and vertical instrument are different; see Figure 1.



Wiring diagram of model A, B, C, D, and E
Note: the wiring terminal directions at rear cover of horizontal and vertical instrument are different; see Figure 1.

Wiring diagram of model F



Wiring diagram of model H

Note: in the above diagram, if one group of terminals has different functions, only one of them may be available. Take RS485 for example, communication and transducing output are on the same group of OUT terminals, so only one of them may be selected. If both functions are required, the control output can only select switching value output with wiring terminal of AL2.

See figure below for short circuit ring corresponding to input signal of Model A, B, C, D, E, and H.

	JP1	JP2
Thermal resistance input Thermocouple input	 mV/R/mA V	 mV/R mA
DC current input	 mV/R/mA V	 mV/R mA
DC voltage input	 mV/R/mA V	

4. Operation

After power-on self-test, the instrument will enter operating mode automatically. Press for parameters setting.

(1) Press and hold for reset;

(2) In any other menu, press and hold for 5 seconds to go back to measurement menu;

(3) In measurement mode, press and hold first and then press and hold for manual/automatic switch, and RIN lamp will be on;

★ Back to operating mode

(1) Manual return: in parameters setting mode, hold for 5 seconds to return to real-time measurement mode;

(2) Automatic return: in parameters setting mode, inaction for 60 seconds will bring the instrument back to real-time measurement mode.

4.1 L1 Parameters Setting

In the operating mode, press , PV will display LOC and SV will display parameter symbol: press increase/decrease key for setting.

See table below for L1 parameters (matching functions of the ordered model; there will not be parameters for functions not available):

Parameter	Symbol	Name	Setting Range (Value)	Description	Preset value
LoC	LoC	Parameter lock	LoC=00 LoC≠00.132 LoC=132	No lock (valid for change of L1 parameters) Lock (valid for change of L1 parameters) No lock (valid for change of L1 and L2 parameters)	00
AL1	AL1	Primary alarm value	-1999-9999	Setting value for primary alarm	50 or 50.0
AL2	AL2	Secondary alarm value	-1999-9999	Setting value for secondary alarm	50 or 50.0
Auto	Auto	Automatic calculation	Auto=OFF Auto=ON	Off-manual setting of PID parameters On-automatic calculation	OFF

AH1	AH1	Return difference of primary alarm	0-9999	Return difference value of primary alarm	02 or 2.0
AH2	AH2	Return difference of secondary alarm	0-9999	Return difference value of secondary alarm	02 or 2.0
AHSu	AHSu	Step control of return difference value	0-9999	Step control of return difference value (taking control target value as alarm value)	05
SdiS	SdiS	SV display screen content in measurement mode	SdiS=0 SdiS=1 SdiS=2 SdiS=3 SdiS=4 SdiS=6 SdiS=7	Input graduation Primary alarm value Secondary alarm value Control target value Control output percentage ℃ No content	0
P	P	Proportional band	0-9999	Setting value of proportional band (the smaller P value, the slower of system response; step control when P=0)	500
I	I	Integration time	0-9999(×0.5S)	Setting value of program integration time for releasing residual difference generated by proportional control; the smaller I value, more effective the integration; when set as (9999), the integration effect would be OFF.	400
d	D	Differentiation time	0-9999(×0.5S)	Setting value of program differentiation time; the smaller D value, the weaker of differentiation effect; when set as 0, the differentiation effect: OFF; used for predicting output change to prevent disturbance and promote control stableness.	100
T	T	PID regulation calculation cycle	1-160(×0.5S)	PID regulation calculation cycle	8
SF	SF	Output inhibition parameter	0-100	Output inhibition parameter (the larger, the stronger of inhibition).	0

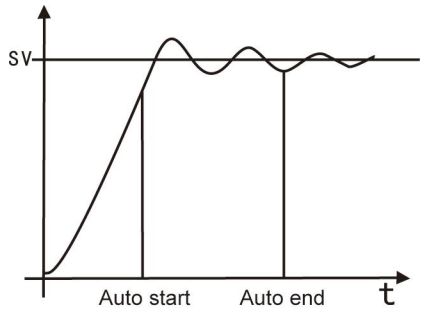
4.2 Setting of Control Target Value SU

In the operating mode, press and hold for 5 seconds, it will enter interface for setting of control target value SU:

Parameter	Symbol	Name	Range	Description	Preset value
SU	SV	Control target value	Full range	Setting value of control target value	50 or 50.0

4.3 PID Parameters and Self-tuning

At system commissioning, self-tuning may be used to find the best PID parameters conveniently to promote tuning quality. After setting of control target value SV, it will enter L1 parameters setting interface in measurement mode; set AUTO=On, then press for confirmation and return to the measurement mode; the instrument will start self-tuning. As seen in figure below, when AUTO starts, AUTO blinks on SV; when measured PV value reaches SV setting value, it will automatically cause disturbance to the system twice to three times. PID parameter will be calculated automatically based on super oscillation extent and cycle. Upon completion of AUTO tuning, SV will display target value, and the system



can be used normally. (Generally, self-tuning is only required once or twice for normal system)

Note: in case of power failure or reset at self-tuning, the instrument will be controlled subject to setting value before self-tuning.

During self-tuning, other operations will be forbidden.

Upon completion of self-tuning, parameter setting value may be adjusted manually after self-tuning based on actual conditions for optimal control effect.

When converting to AUTO mode after manual modification of setting value, PID follow-up effect cannot be reached until holding for reset.

4.4 L2 Parameters Setting

In the operating mode, press , PV will display LOC and SV will display parameter symbol: press increase/decrease key for setting. Loc=132 and hold to enter L2 parameters interface.

See table below for L2 parameters (matching functions of the ordered model; there will not be parameters for functions not available):

Parameter	Symbol	Name	Setting Range (Value)	Description	Preset value
Pn	Pn	Input graduation	0~35	Set input graduation type (see L2 Parameters Pn Lookup Table)	4-20
dP	Dp	Decimal point	dp=0 dp=1 dp=2 dp=3	No decimal point Ten decimal places (XXX.X) One hundred decimal places (XX.XX) One thousand decimal places (X.XXX)	0
AL1	ALM1	Primary alarm mode	ALM1=0 ALM1=1 ALM1=2 ALM1=3 ALM1=4 ALM1=5	No alarm Lower-limit alarm Upper-limit alarm Lower deviation alarm Upper deviation alarm Alarm within the deviation	2
AL2	ALM2	Secondary alarm mode	ALM2=0 ALM2=1 ALM2=2 ALM2=3 ALM2=4 ALM2=5	No alarm Lower-limit alarm Upper-limit alarm Lower deviation alarm Upper deviation alarm Alarm within the deviation	1
PIdn	PIDM	Control mode	PIDM= PID PIDM=bit	PID control output Step control (taking control target value as alarm value)	PID
Addr	Addr	Equipment code	0-250	Setting of equipment code of the instrument in communication	1
bAUd	bAud	Baud rate	1200 2400 4800 9600	Baud rate:1200bps Baud rate:2400bps Baud rate:4800bps Baud rate:9600bps	9600
FK	FK	Filter coefficient	0-4	To prevent flopping of displayed value	0
Pb	PB	Display input zero shift	Full range	Set and display shift of input zero	0
PK	PK	Display input	0-1.999 times	Set and display amplification scale of	1.000

		range scale		input range			
PI dL	PIDL	PID control output lower limit	Full range	Set lower limit of control output			0
PI dH	PIDH	PID control output upper limit	Full range	Set upper limit of control output			1000
PL	PL	Lower limit of measurement range	Full range	Set lower limit of measurement range of input signal			0
PH	PH	Upper limit of measurement range	Full range	Set upper limit of measurement range of input signal			1000
CuE	Cut	Small measuring signal cutting	0.000-1.000	This function only works for voltage/current extraction signal; when input signal<lower limit of input signal+(upper limit of input signal-lower limit of input signal>+set percentage, the instrument displays lower limit of measurement range.			0.000
out	Out	Transducing output type	Signal type	Parameter symbol	Signal type	Parameter symbol	4-20
			0-20mA	20mA	0-5V	0-5V	
			0-10mA	10mA	1-5V	1-5V	
			4-20mA	4-20	No output	0mA	
r-Pb	T-Pb	Zero correction at cold junction	Full range	Set zero correction value at cold junction			0
r-PE	T-Pk	Gain correction at cold junction	0-1.999 times	Set gain correction value at cold junction			1.000
SuH	SuH	Set upper limit of control target value	Full range	Set upper limit of control target value setting			0
nodE	Mode	PID action mode	Mode=0 Mode=1	Positive action Negative action			1

L2 Parameters Pn Lookup Table

Code	Signal Type	Parameter Symbol	Range Scope
0	Thermocouple B	T--B	400-1800℃
1	Thermocouple S	T--S	0-1600℃
2	Thermocouple K	T--K	0-1300℃
3	Thermocouple E	T--E	0-1000℃

4	Thermocouple T	T--T	-200.0-400.0℃
5	Thermocouple J	T--J	0-1200℃
6	Thermocouple R	T--R	0-1600℃
7	Thermocouple N	T--N	0-1300℃
8	F2 graduation	T-F2	700-2000℃
9	Wre3-25 graduation	T-L3	0-2300℃
10	Wre5-26 graduation	T-L5	0-2300℃
11	Thermal resistance Cu50	Cu50	-50.0-150.0℃
12	Thermal resistance Cu53	Cu53	-50.0-150.0℃
13	Thermal resistance Cu100	C100	-50.0-150.0℃
14	Thermal resistance Pt100	P100	-200.0-650.0℃
15	Thermal resistance BA1	BA1	-200.0-600.0℃
16	Thermal resistance BA2	BA2	-200.0-600.0℃
17	0-500Ω linear resistance	R0.5K	0-500Ωlinear resistance
18	0-350Ω remote transmission resistance	0350	Full range
19	30-350Ω remote transmission resistance	3350	Full range
20	0-20mV	20MV	Full range
21	0-40mV	40MV	Full range
22	0-100mV	100MV	Full range

25	0-20mV	20MV	Full range
26	0-10mV	10MV	Full range
27	4-20mV	4-20	Full range
28	0-5V	0-5V	Full range
29	1-5V	1-5V	Full range
31	0-10V	10V	Full range
32	0-10mA extraction	1.0MA	Full range
33	4-20mA extraction	4.-20	Full range
34	0-5V extraction	0.-5V	Full range
35	1-5V extraction	1.-5V	Full range
55	Full switch		

Note: how to fast switch graduation: change L2 parameter Pn; move decimal place to 1000 or 100, press increase/decrease key to switch first place and last place of graduation; when the decimal point is at 10, switch graduation at unit of ten; when the decimal point is at unit place, switch graduation at unit of one.

5. Digital Communication

Digital communication allows communication between the instrument and PC/PC network. MODBUS RTU protocol has been adopted. Please visit www.modbus.org for information about the protocol. It's not suggested to non-separated interface board, as it may cause disturbance or influence communication for earth potential difference. Shielded twisted pair shall be used as the lead.

* Refer to "Instrument Communication Manual" for specific parameters.

This Operation Instruction will be subject to any change without notice.