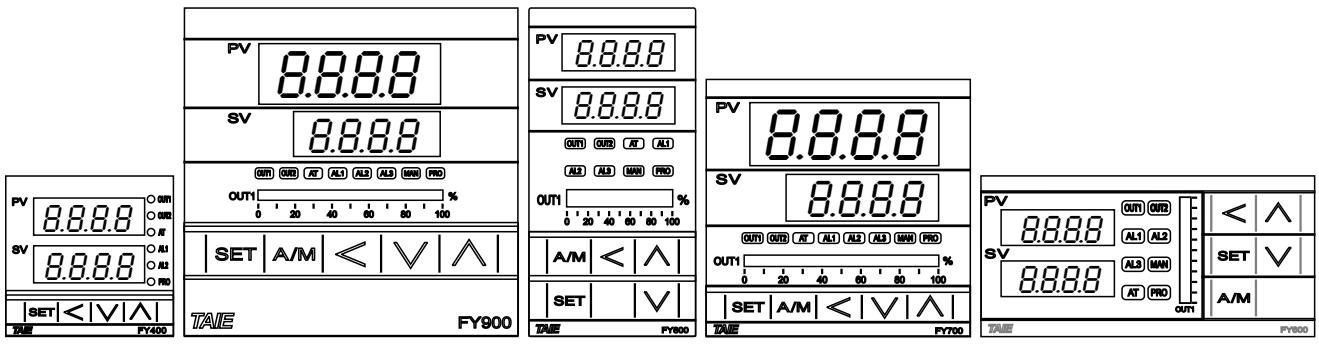
Digital Temperature Controller

FY400/600/700/800/900

FA230/231

Operation Manual



Ver 1.6

台灣儀控股份有限公司
TAIWAN INSTRUMENT & CONTROL CO., LTD

Preface

Thank you for purchasing the TAIE FY/FA series digital temperature controllers.

This User's Manual contains instructions for mounting, functions, operations and notes when operating the FY/FA series digital temperature controllers.

To prevent accidents arising from the misuse of this controller, please ensure the operator receives this manual.

Notes

- This instrument should be used in accordance with the specifications described in the manual. If it is not used according to the specifications, it may malfunction or cause a fire.
- Be sure to follow the warnings, cautions and notices. If they are not observed, serious injury or malfunction may occur.
- The contents of this instruction manual are subject to change without notice.
- Care has been taken to ensure that the contents of this instruction manual are correct, but if there are any doubts, mistakes or questions, please inform our company.
- Measures must be taken to ensure that the operator cannot touch power terminals or other high voltage sections.
- Any unauthorized transfer or copying of this document, in part or in whole, is prohibited.
- TAIWAN INSTRUMENT & CONTROL Co., Ltd. is not liable for any damage or secondary damage(s) incurred as a result of using this product, including any indirect damage.

⚠ **WARNING** : This mark indicates precautions that must be taken if there is danger of electric shock, fire, etc., which could result in loss of life or injury.

⚠ **CAUTION** : This mark indicates that if these precautions and operating procedures are not taken, damage to the instrument may result.

⚠ WARNING

- An external protection device must be installed if failure of this instrument could result in damage to the instrument, equipment or injury to personnel.
- All wiring must be completed before power is turned on to prevent electric shock, fire or damage to instrument and equipment.
- This instrument must be used in accordance with the specifications to prevent fire or damage to instrument and equipment.
- This instrument is not intended for use in locations subject to flammable or explosive gases.
- Do not touch high-voltage connections such as power supply terminals, etc. to avoid electric shock.
- TAIWAN INSTRUMENT & CONTROL Co., Ltd. is not responsible if this instrument is repaired, modified or disassembled by other than factory-approved personnel. Malfunction can occur and warranty is void under these conditions.

⚠ CAUTION

• This product is intended for use with industrial machines, test and measuring equipment. It is not designed for use with medical equipment and nuclear energy.

• This is a Class A instrument. In a domestic environment, this instrument may cause radio interference, in which case the user may be required to take additional measures.

• This instrument is protected from electric shock by reinforced insulation.
Provide reinforced insulation between the wire for the input signal and the wires for instrument power supply, source of power and loads.

• This instrument is designed for installation in an enclosed instrumentation panel. All high-voltage connections such as power supply terminals must be enclosed in the instrumentation panel to avoid electric shock by operating personnel.

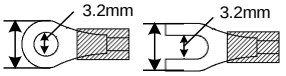
• All precautions described in this manual should be taken to avoid damage to the instrument or equipment.

• All wiring must be completed before power is turned on to prevent electric shock, instrument failure, or incorrect action.

• The power must be turned off before repairing work for input break and output failure including replacement of sensor, contactor or SSR, and all wiring must be completed before power is turned on again.

• Prevent metal fragments or lead wire scraps from falling inside instrument case to avoid electric shock, fire or malfunction.

• Please use crimp terminals suitable for M3 screws, as shown below:



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

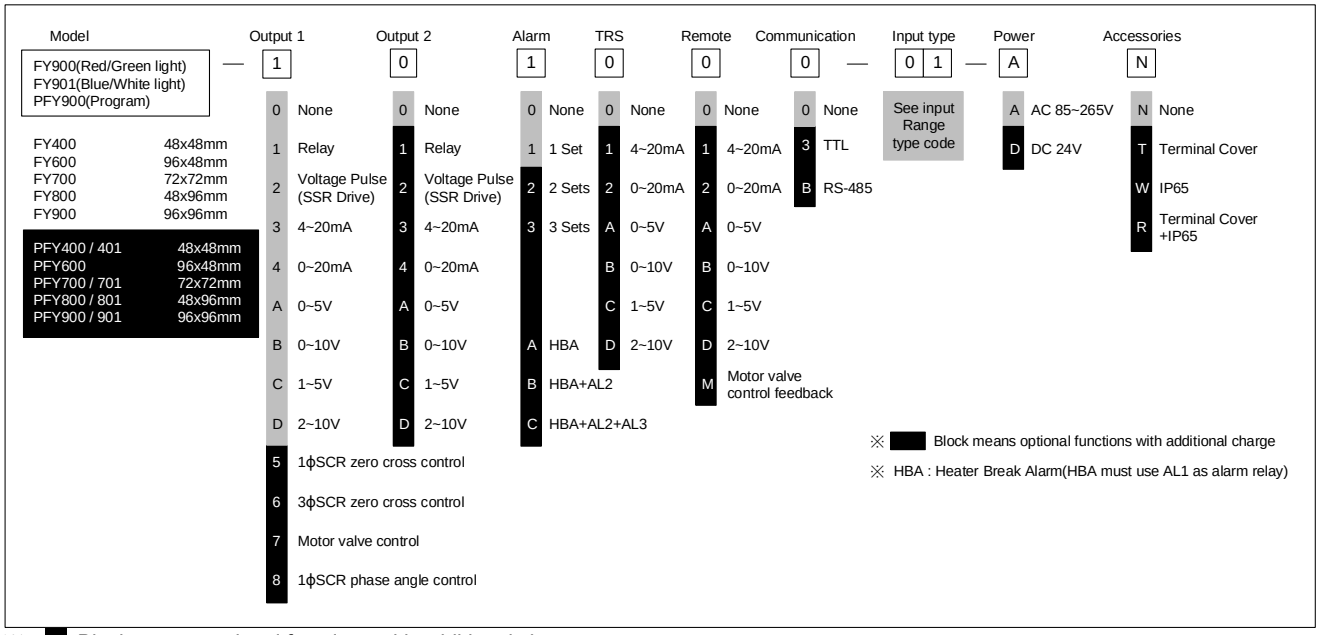
• Tighten each terminal screw to the specified torque found in the manual to avoid electric shock, fire or malfunction.

• When the thermocouple wiring is extended, please use the compensation lead of the corresponding type to this thermocouple.

Content

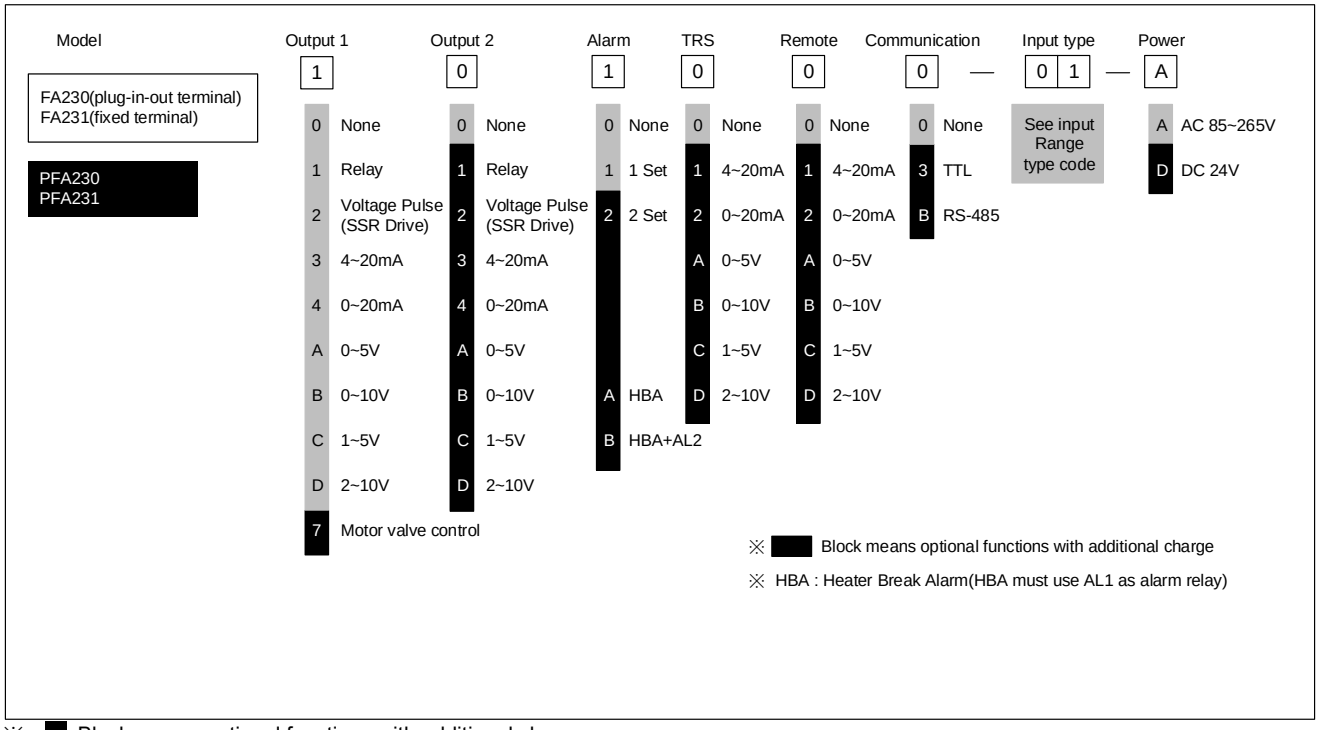
1. Order Information

1.1 FY Order Information



※ ■ Block means optional functions with additional charge.

1.2 FA Order Information



※ ■ Block means optional functions with additional charge.

2. Specifications

2.1 FY Specifications

Model		FY400	FY600	FY700	FY800	FY900
Supply Voltage		AC 85 ~ 265V, DC 24V (Optional Functions)				
Power Frequency		50/60 Hz				
Power Consumption		Approximately 6VA				
Memory		Non-Volatile Memory EEPROM				
Sensor Input ※ Please refer to Input Range Table		Cold junction compensation device external Accuracy : 0.1%				
		Cold junction compensation device internal Accuracy : 0.3%				
		Sample time : 50ms				
		Thermocouple : (K, J, R, S, B, E, N, T, W, PLⅡ, L)				
		RTD: PT100				
		DC Linear Analog Input : 0~20mA, 4~20mA 0~1V, 0~5V, 0~10V, 0~2V, 1~5V, 2~10V 0~25mV, 0~50mV, 0~70mV				
Output	OUT1 Relay	1a	1c	1c	1c	1c
		1a SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations 1c SPDT-NO, 250 VAC, 5A (resistive load), electrical life: 50,000 operations SPDT-NC, 250 VAC, 2A (resistive load), electrical life: 20,000 operations				
	OUT2 Relay	SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations				
	SSR Driver	ON: 24 V OFF: 0V max. load current: 20mA, with short circuit protection circuit				
	linear	4~20mA,0~20mA, 0~5V,0~10V, 1~5V,2~10V				
Control Method		ON-OFF or P, PI, PID control				
Alarm	Alarm 1	1a	1c	1a	1c	1c
		1a SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations 1c SPDT-NO, 250 VAC, 5A (resistive load), electrical life: 50,000 operations SPDT-NC, 250 VAC, 2A (resistive load), electrical life: 20,000 operations				
	Alarm 2	SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations				
	Alarm 3	---	1a	1a	1a	1a
		SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations				
TRS	Re-transmitted Signal	4~20mA, 0~20mA, 0~5V, 0~10V, 1~5V, 2~10V				
	Source of Re-transmission	SV, PV				
	Accuracy	0.1%				
	Resolution	14 bit				
Remote SV	Signal	4~20mA, 0~20mA, 0~5V, 0~10V, 1~5V, 2~10V				
	Resolution	18 bit				
	controlled by	SV				
Motor valve	Signal	1KΩ, 560Ω				
	Resolution	18 bit				
	Controlled by	PV2				
Commun ication	Interface	RS-485 Half duplex Communication MAX. 31 units, MAX. distance 1200 meters				
	Protocol	Modbus RTU , TAIE				
	Parity bit	NONE, ODD, EVEN				
	Data bit	8 bit				
	Stop bit	1 or 2 bit				
	Baud rate	2400,4800,9600,19200,38400,57600,115200 bps				
Malfunction vibration		10~55 Hz 20m / s^2 , for 10 min each in X, Y and Z directions.				
Vibration resistance		10~55 Hz 20m / s^2 , for 2 hr each in X, Y and Z directions.				
Malfunction shock		100m / s^2 , 3 times each in X, Y and Z directions.				
Shock resistance		300m / s^2 , 3 times each in X, Y and Z directions.				
Operating Environment Temperature/Humidity		0 ~ 50°C (in the case of no freezing or condensatioin) / 20% ~ 90% RH				
Storage Environment Temperature		-25 ~ 65°C (in the case of no freezing or condensatioin)				
Dimension (mm)		W48 x H48 x D95	W96 x H48 x D95	W72 x H72 x D95	W48 x H96 x D95	W96 x H96 x D95
Weight		Appox.120g	Appox.170g	Appox.150g	Appox.170g	Appox.230g

2.2 FA Specifications

Model		FA231	FA230
Terminal		Fixed	Pluggable
Supply Voltage		AC 85 ~ 265V, DC 24V (Optional Functions)	
Power Frequency		50/60 Hz	
Power Consumption		Approximately 6VA	
Memory		Non-Volatile Memory EEPROM	
Sensor Input ※ Please refer to Input Range Table		Accuracy : 0.2%	
		Sample time : 50ms	
		Thermocouple : (K, J, R, S, B, E, N, T, W, PLⅡ, L)	
		RTD : PT100	
		DC Linear Analog Input : 0~20mA, 4~20Ma 0~1V, 0~5V, 0~10V, 0~2V, 1~5V, 2~10V 0~25mV, 0~50mV, 0~70mV	
Output	OUT1 Relay	1a	1c
		1a SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations 1c SPDT-NO, 250 VAC, 5A (resistive load), electrical life: 50,000 operations SPDT-NC, 250 VAC, 2A (resistive load), electrical life: 20,000 operations	
	OUT2 Relay	SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations	
	SSR Driver	ON: 24 V OFF: 0V max. load current: 20mA, with short circuit protection circuit	
	linear	4~20mA,0~20mA, 0~5V,0~10V, 1~5V,2~10V	
Control Method		ON-OFF or P, PI, PID control	
Alarm	Alarm 1	1a	1c
		1a SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations 1c SPDT-NO, 250 VAC, 5A (resistive load), electrical life: 50,000 operations SPDT-NC, 250 VAC, 2A (resistive load), electrical life: 20,000 operations	
	Alarm 2	SPST-NO, 250 VAC, 5A (resistive load), electrical life: 100,000 operations	
TRS	Re-transmitted Signal	4~20mA, 0~20mA, 0~5V, 0~10V, 1~5V, 2~10V	
	Source of Re-transmission	SV, PV	
	Accuracy	0.1%	
	Resolution	14 bit	
Remote SV	Signal	4~20mA, 0~20mA, 0~5V, 0~10V, 1~5V, 2~10V	
	Resolution	18 bit	
	controlled by	SV	
Communication	Interface	RS-485 Half duplex Communication MAX. 31 units, MAX. distance 1200 meters	
	Protocol	Modbus RTU , TAIE	
	Parity bit	NONE, ODD, EVEN	
	Data bit	8 bit	
	Stop bit	1 or 2 bit	
	Baud rate	2400,4800,9600,19200,38400,57600,115200 bps	
Malfunction vibration		10~55 Hz 20m / s^2 , for 10 min each in X, Y and Z directions.	
Vibration resistance		10~55 Hz 20m / s^2 , for 2 hr each in X, Y and Z directions.	
Malfunction shock		100m / s^2 , 3 times each in X, Y and Z directions.	
Shock resistance		300m / s^2 , 3 times each in X, Y and Z directions.	
Operating Environment Temperature/Humidity		0 ~ 50°C (in the case of no freezing or condensatioin) / 20% ~ 90% RH	
Storage Environment Temperature		-25 ~ 65°C (in the case of no freezing or condensatioin)	
Dimension (mm)		W40 x H107 x D43	
Weight		Appox.115g	

3. Input Range Table

Types of input			Code	Range	
				°C	°F
Thermocouple	K	K1	01	-50.0~600.0	-58.0~999.9
		K2	02	-50~1200	-58~2192
	J	J1	03	-50.0~400.0	-58.0~752.0
		J2	04	-50~1200	-58~2192
	R	R	05	-50~1760	-58~3200
	S	S	06	-50~1760	-58~3200
	B	B	07	-50~1820	-58~3308
	E	E	08	-50~900	-58~1652
	N	N	09	-50~1300	-58~2372
	T	T1	10	-199.9~400.0	-199.9~752.0
		T2	11	-199~400	-326~752
	W	W	12	-50~2320	-58~4208
	PL	PL	13	-50~1200	-58~2192
	L	L	14	-50~800	-58~1472
RTD	PT100	PT1	15	-199.9~850.0	-199.9~999.9
		PT2	16	-199~850	-326~1562
		PT3	17	0~850	32~1562
Linear	AN1	0~25mV	18	-1.999~9.999 -19.99~99.99 -199.9~999.9 -1999~9999	
	AN2	0~50mV	19		
		0~20mA	20		
		0~1V	21		
		0~2V	22		
		0~5V	23		
		0~10V	24		
	AN3	0~70mV	25		
	AN4	4~20mA	26		
		10~50mV	27		
		1~5V	28		
		2~10V	29		

4. Packing List & Label Information

4.1 Packing List Guide

FY400/600/700/800/900

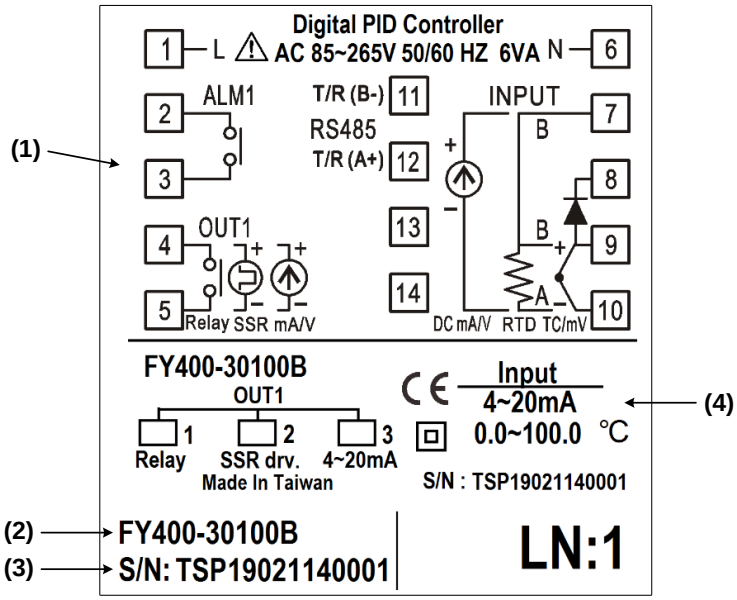
1. Temperature Controller…1 unit
2. Mounting frame……2 units
3. Brief manual……..1 pcs

FA230/231

1. Temperature Controller…1 unit
2. Terminal cover……...2 units
3. Brief manual……..1 pcs

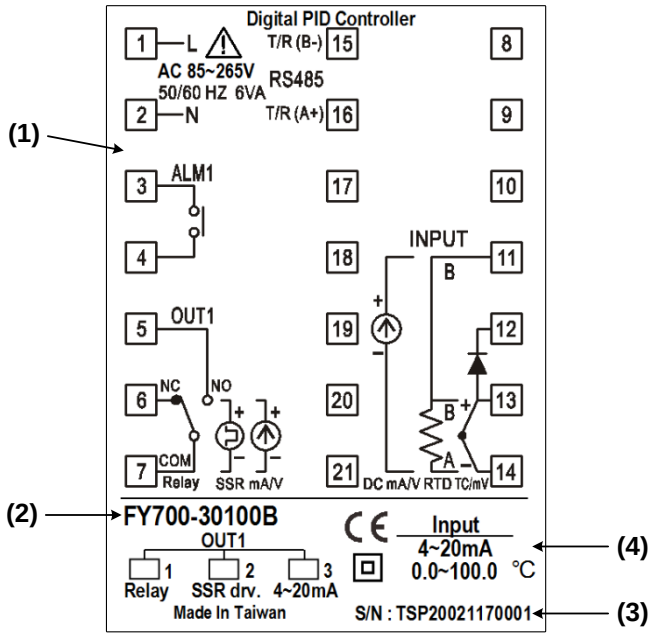
4.2 Label Guide

4.2.1 FY400



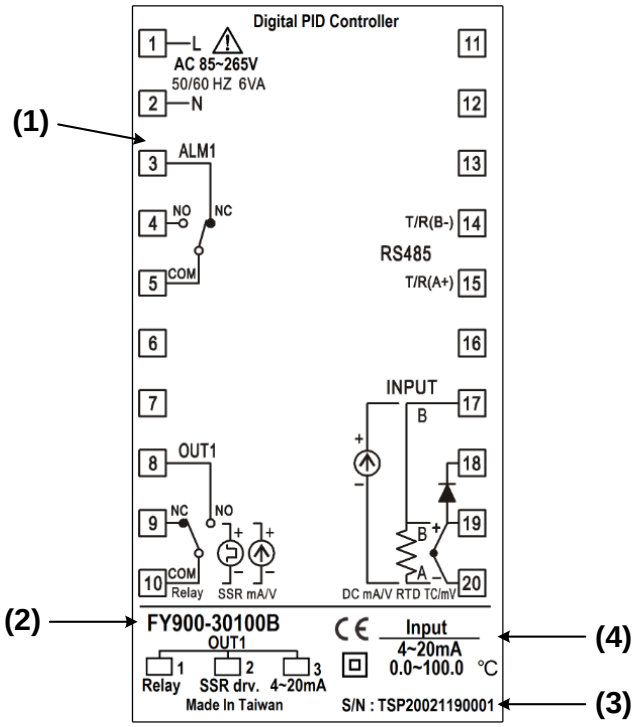
No.	Item	Description
(1)	Terminal arrangement	FY400 Terminal Wiring Diagram
(2)	Model number	FY400 model name
(3)	Serial number	TSP19021140001
(4)	Input type	Controller Input Signal and Range

4.2.2 FY700



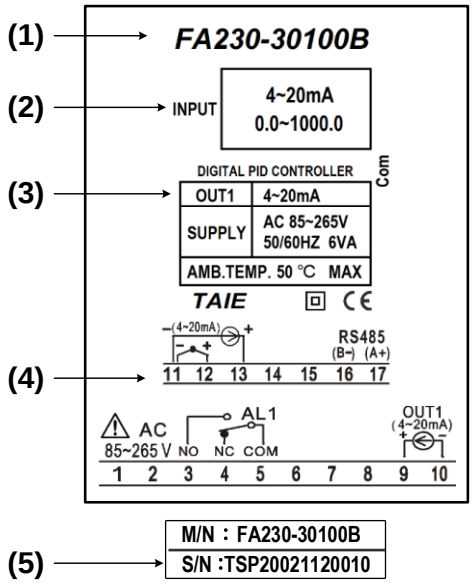
No.	Item	Description
(1)	Terminal arrangement	FY700 Terminal Wiring Diagram
(2)	Model number	FY700 model name
(3)	Serial number	TSP20021170001
(4)	Input type	Controller Input Signal and Range

4.2.3 FY600/800/900



No.	Item	Description
(1)	Terminal arrangement	FY900 Terminal Wiring Diagram
(2)	Model number	FY900 model name
(3)	Serial number	TSP20021190001
(4)	Input type	Controller Input Signal and Range

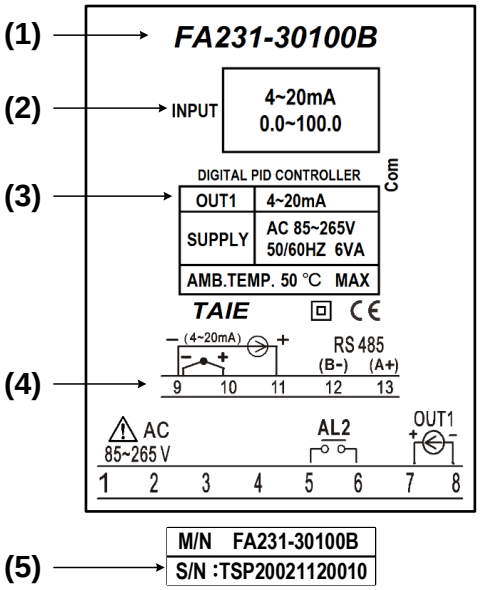
4.2.4 FA230



(5) → M/N：FA230-30100B
S/N :TSP20021120010

No.	Item	Description
(1)	Model number	FA230 model name
(2)	Input type	Controller Input Signal and Range
(3)	Control output	4~20mA
(4)	Terminal arrangement	FA230 Terminal Wiring Diagram
(5)	Serial number	TSP20021120010

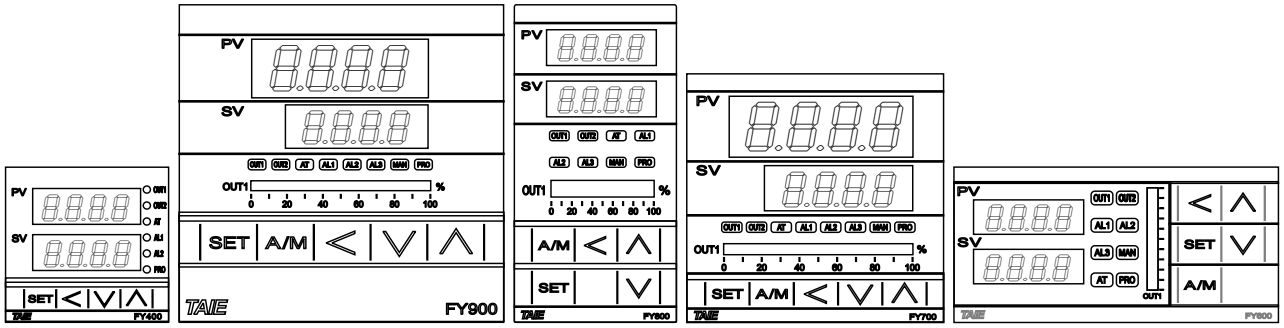
4.2.5 FA231



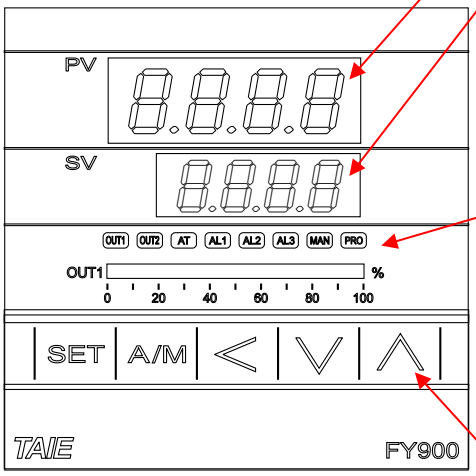
No.	Item	Description
(1)	Model number	FA231 model name
(2)	Input type	Controller Input Signal and Range
(3)	Control output	4~20mA
(4)	Terminal arrangement	FA231 Terminal Wiring Diagram
(5)	Serial number	TSP20021120010

5. Parts Description

5.1 FY Series

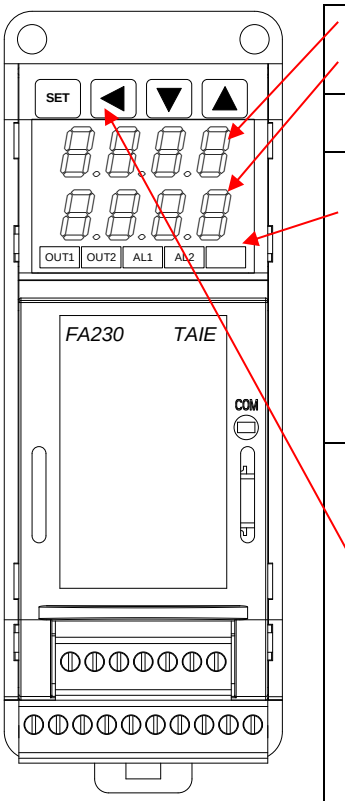


FY400 FY900 FY800 FY700 FY600



1	PV		Indicating PV (measured value) and character information such as parameter codes or error codes(Red)
2	SV		Indicating SV (target set value) or parameter values(Green)
3	LED	OUT1	Lamp lit when OUT1 is activated (Green)
		OUT2	Lamp lit when OUT2 is activated (Green)
		AT	Lamp lit when Auto-tuning is activated (Orange)
		AL1	Lamp lit when Alarm 1 is activated (Red)
		AL2	Lamp lit when Alarm 2 is activated (Red)
		AL3	Lamp lit when Alarm 3 is activated (Red)
		MAN	Lamp lit when controller in manual mode or get error condition (Orange)
		PRO	When the program is executed, this light is on (orange)
		OUT1%	Output% bar-graph indicator(Green)
4	Keypad	SET	For parameter call-up and set value registration
		A/M	Auto manual transfer
		SHIFT	Shift digits when changing settings
		DOWN	Decrease numerals
		UP	Increase numerals

5.2 FA Series

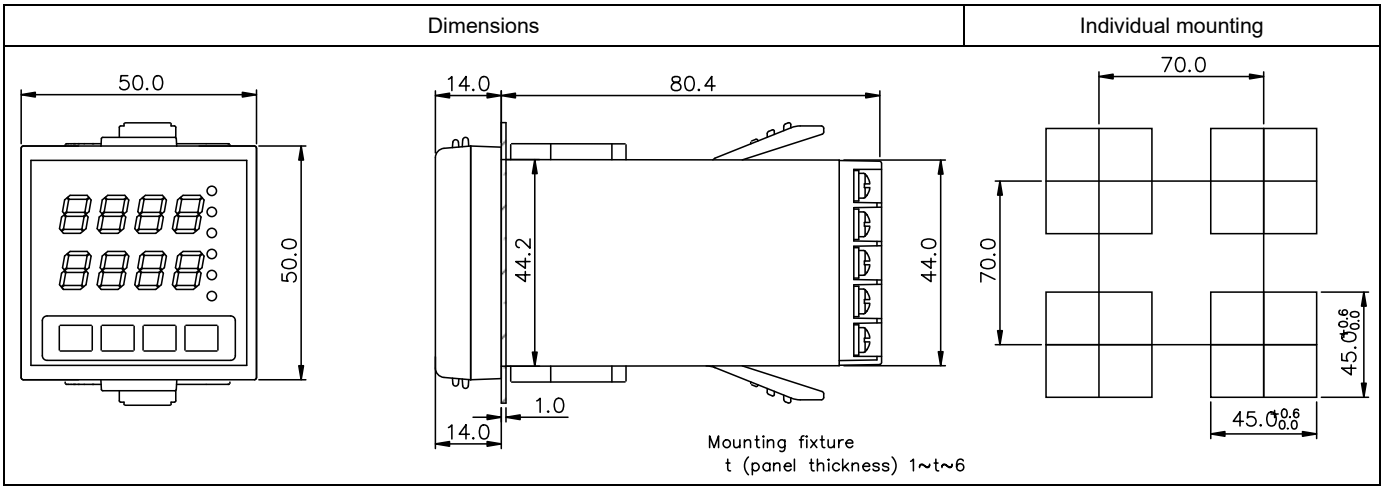


1	PV			Indicating PV (measured value) and character information such as parameter codes or error codes(Red)
2	SV			Indicating SV (target set value) or parameter values(Green)
3	LED	OUT1		Lamp lit when OUT1 is activated (Green)
		OUT2		Lamp lit when OUT2 is activated (Green)
		AL1		Lamp lit when Alarm 1 is activated (Red)
		AL2		Lamp lit when Alarm 2 is activated (Red)
		▭		1. Lamp lit when Auto-tuning is activated (Orange) 2. When the program is executed, this light is on (orange)
		COM		Lights when controller response data (Orange)
4	Keypad	SET	SET	For parameter call-up and set value registration
		◀	SHIFT	Shift digits when changing settings
		▼	DOWN	Decrease numerals
		▲	UP	Increase numerals

6. Installation

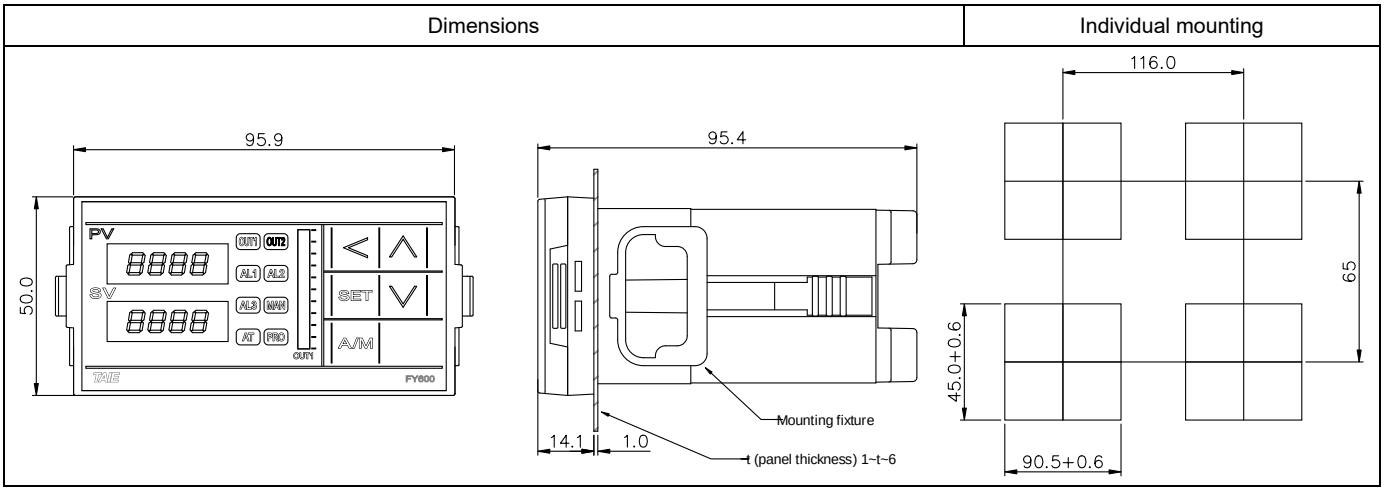
6.1 FY400 Dimensions

(Unit: mm)



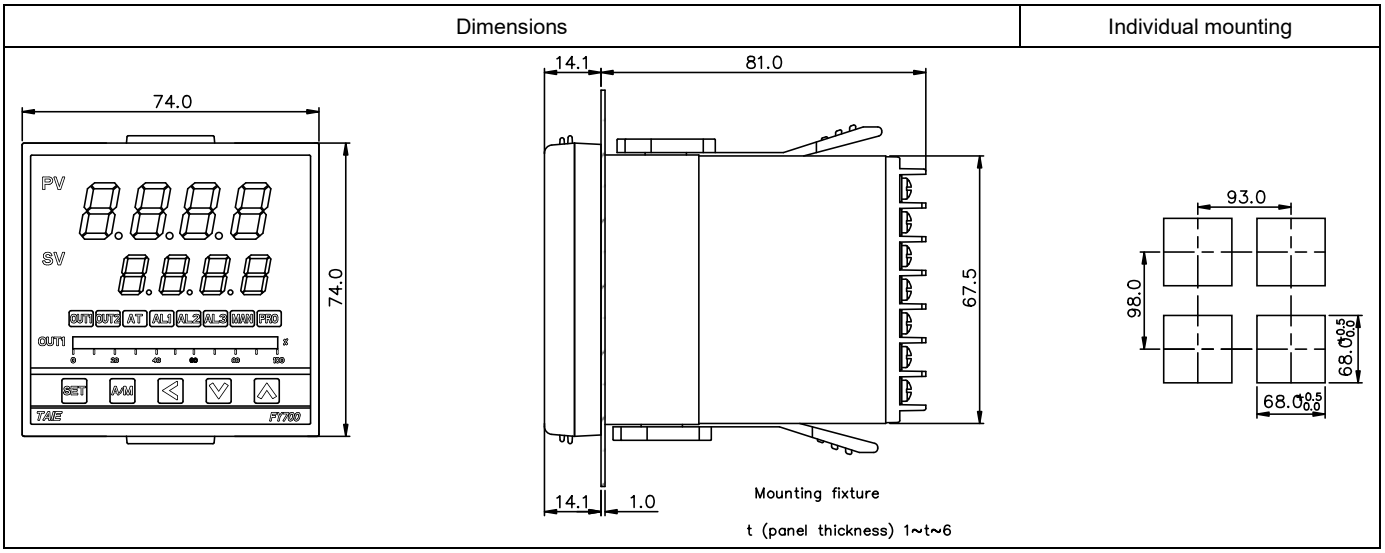
6.2 FY600 Dimensions

(Unit: mm)



6.3 FY700 Dimensions

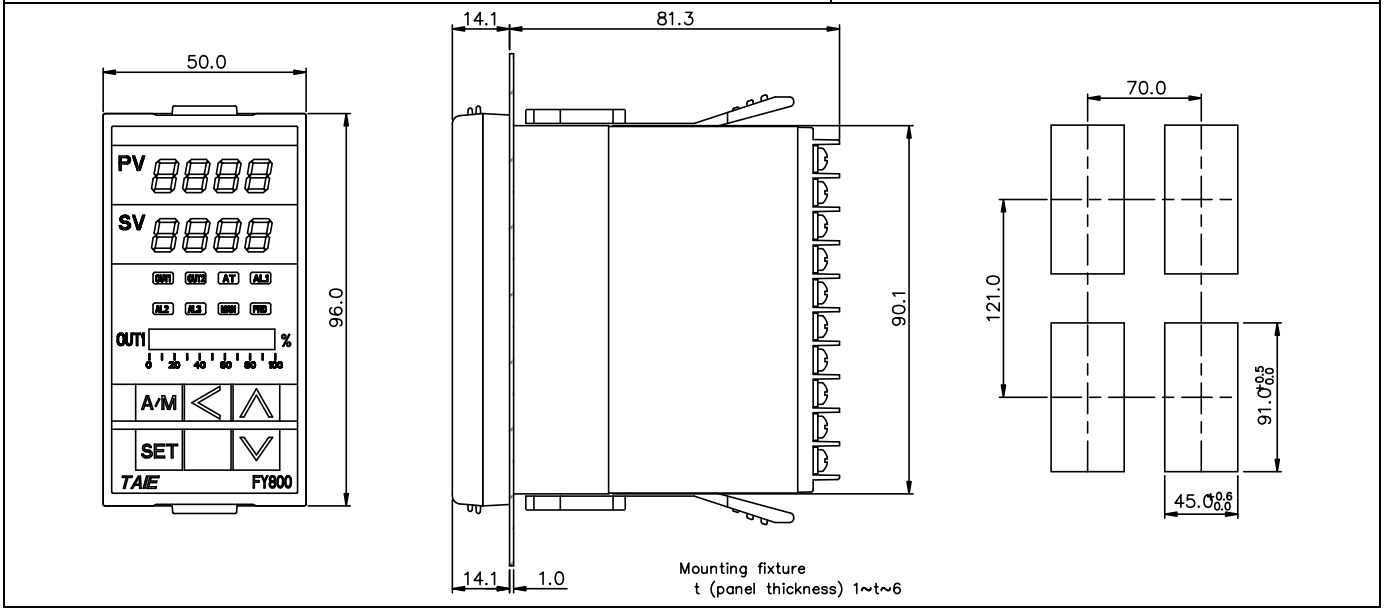
(Unit: mm)



6.4 FY800 Dimensions

(Unit: mm)

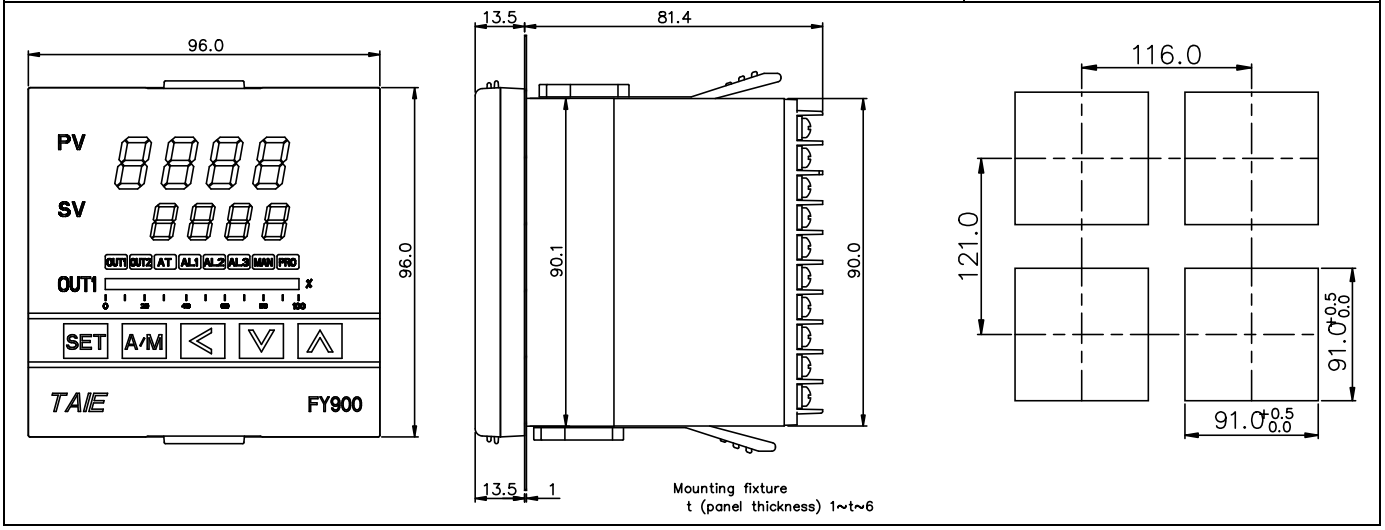
Dimensions	Individual mounting



6.5 FY900 Dimensions

(Unit: mm)

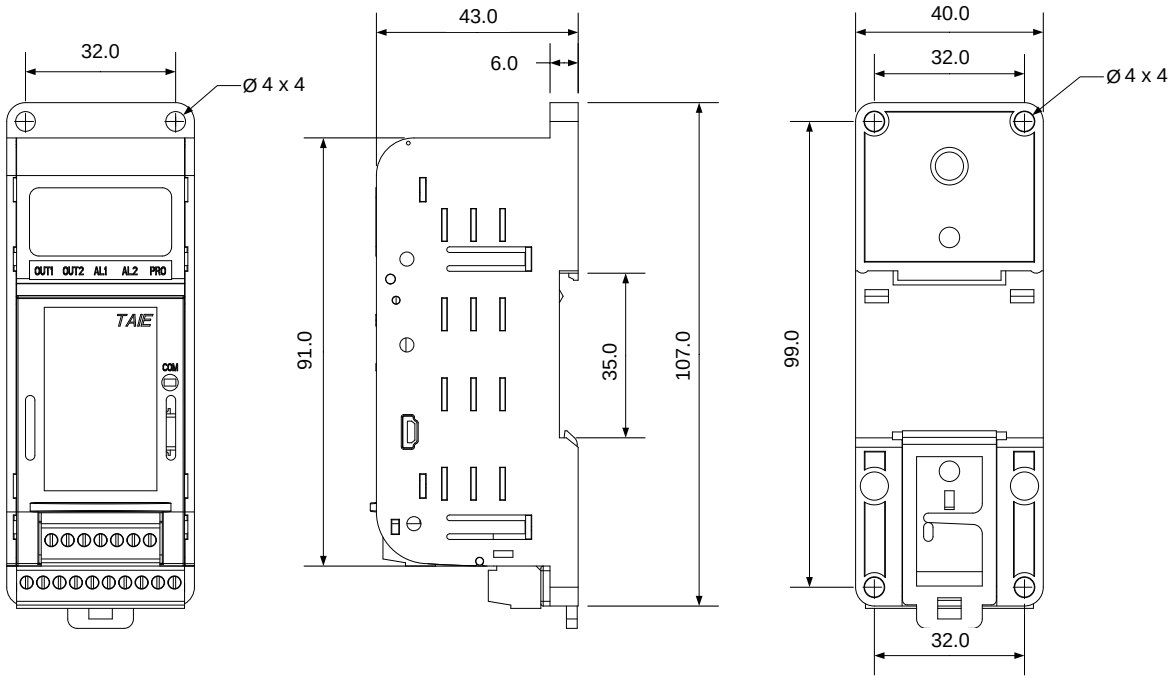
Dimensions	Individual mounting



6.6 FA230/231 Dimensions

(Unit: mm)

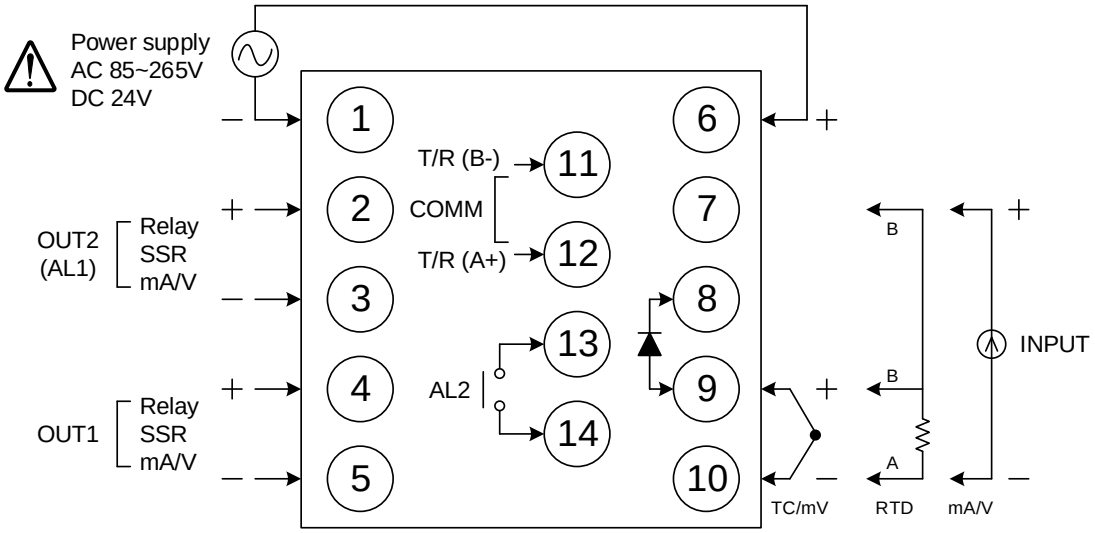
Dimensions

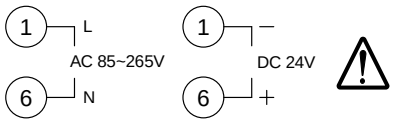
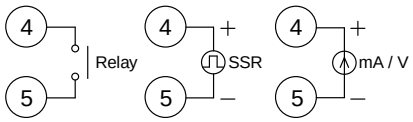
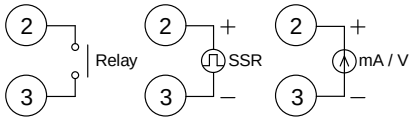
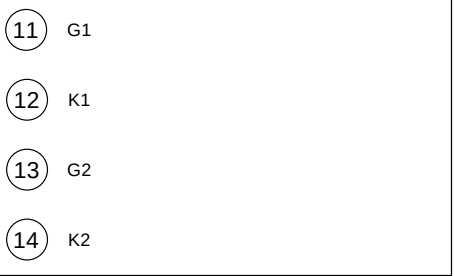
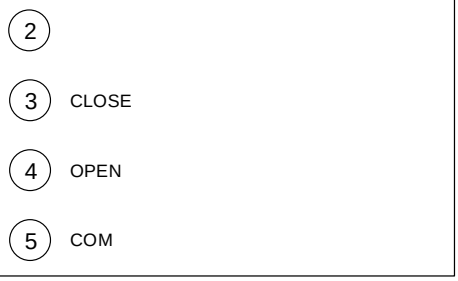


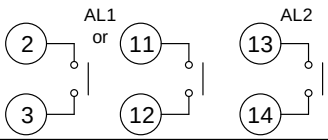
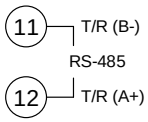
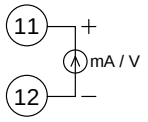
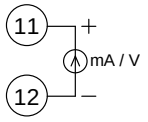
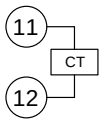
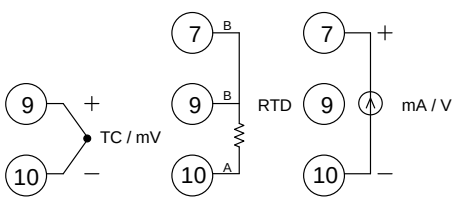
7. Terminal Arrangement

> **⚠ Caution**
>
> When implementing wiring for the controller power supply, please make sure that the power supply is turned off to avoid electric shock!
> Do not touch the live parts, such as the terminals, while the power is on. Otherwise death or serious injury may be resulted from short circuit of the contact electrode.

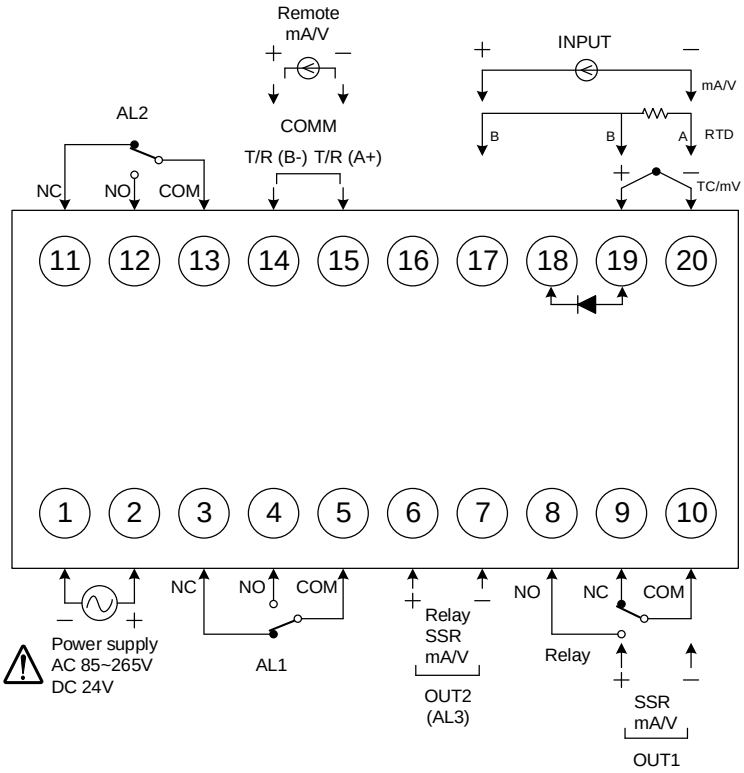
7.1 FY400 Terminal Arrangement



Power	
Output-1	
Output-2	
1ϕ Zero cross	
Motor valve	

Alarm-1 Alarm-2	
Communication	
Transmission	
Remote SV	
CT	
Input	

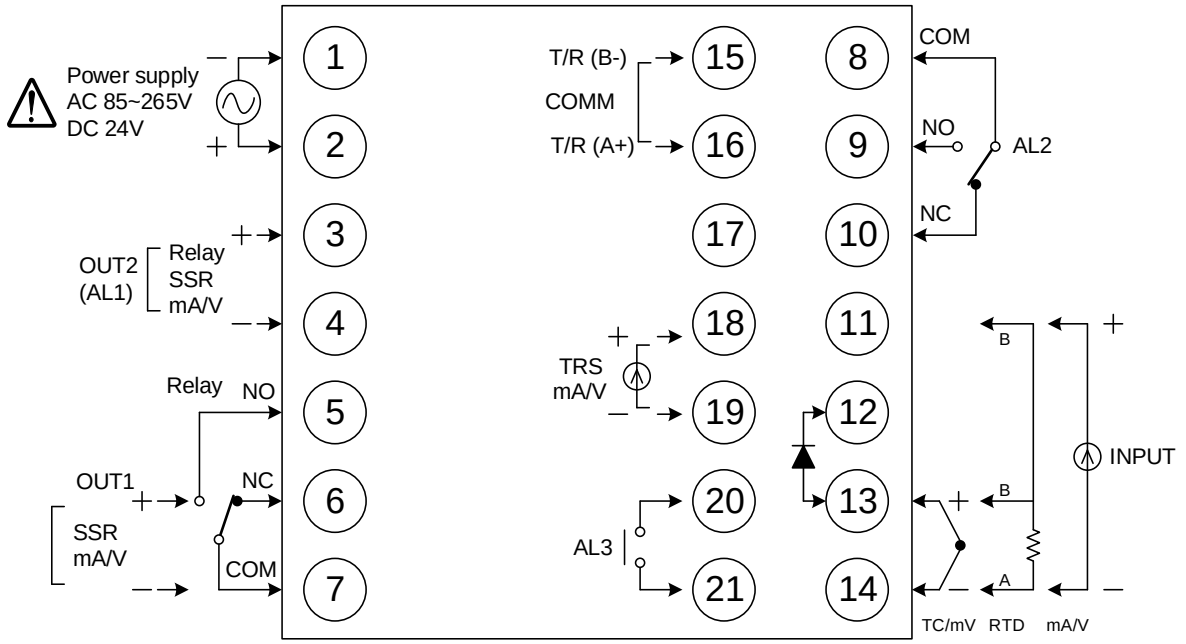
7.2 FY600 Terminal Arrangement

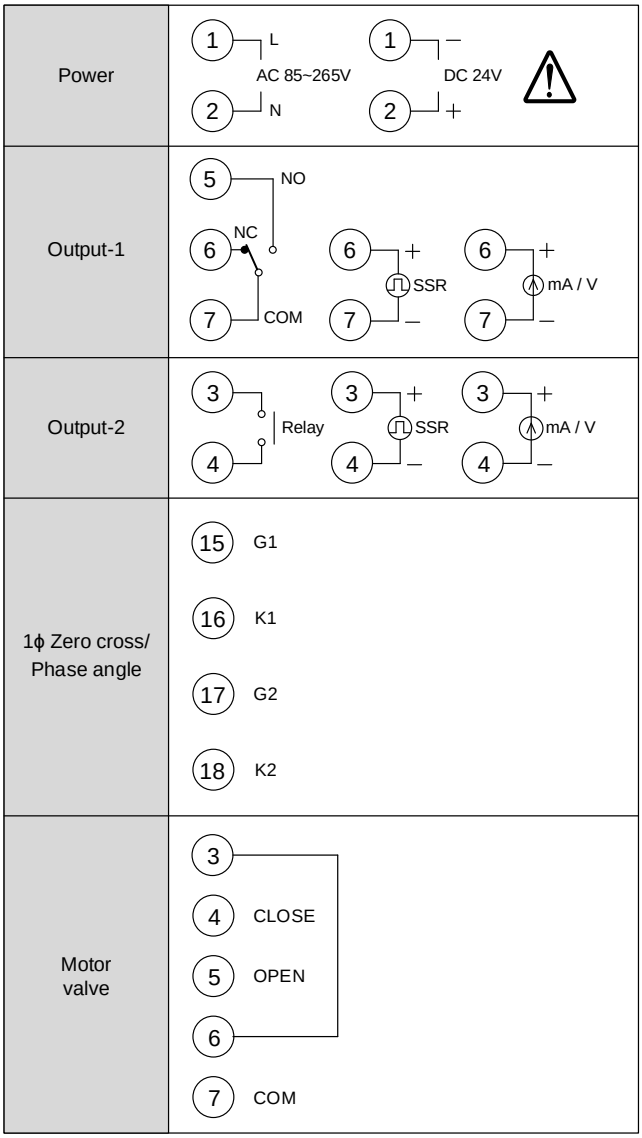


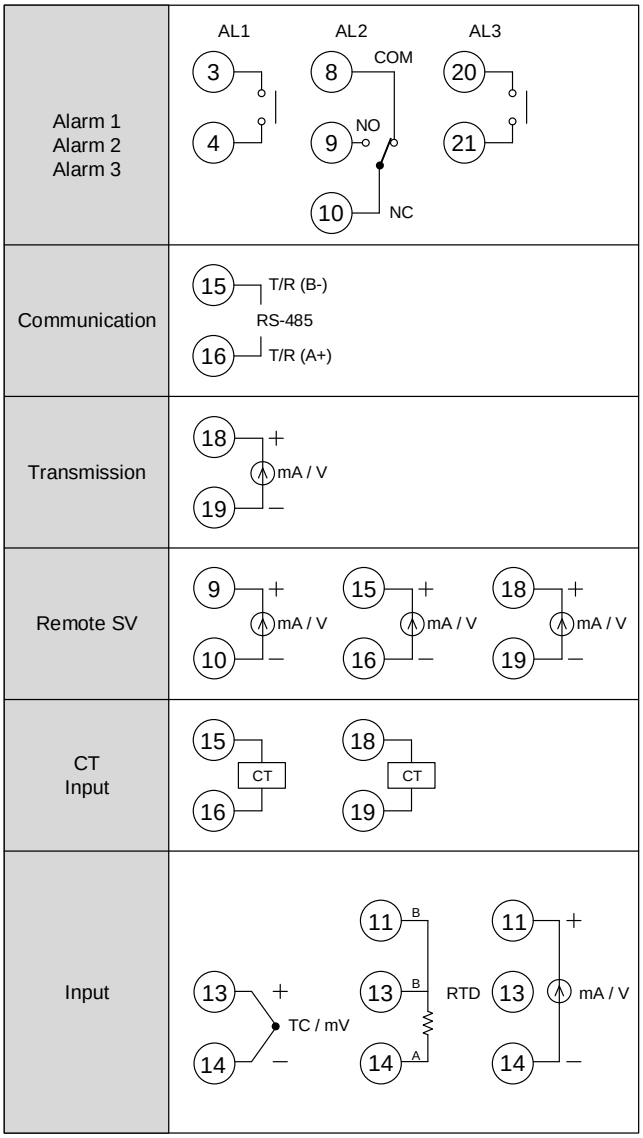
Power	1 L, 2 N — AC 85~265V; 1 −, 2 + — DC 24V
Output-1	8 NO, 9 NC, 10 COM; 9 (+) SSR (−) 10; 9 (+) mA / V (−) 10
Output-2	6, 7 Relay; 6 (+) SSR (−) 7; 6 (+) mA / V (−) 7
Motor valve	6, 7 CLOSE, 8 OPEN, 9, 10 COM

Communication	14 T/R (B-), RS-485, 15 T/R (A+)
Transmission	12 (+) mA / V (−) 13; 14 (+) mA / V (−) 15
Remote SV/ CT Input	14 (+) mA / V (−) 15; 14, CT, 15
Alarm 1 Alarm 2 Alarm 3	AL1: 3 NC, 4 NO, 5 COM; AL2: 11 NC, 12 NO, 13 COM; AL3: 6, 7
Input	19 (+) TC / mV (−) 20; 17 B, 19 B, 20 A — RTD; 17 (+) 19 mA / V (−) 20

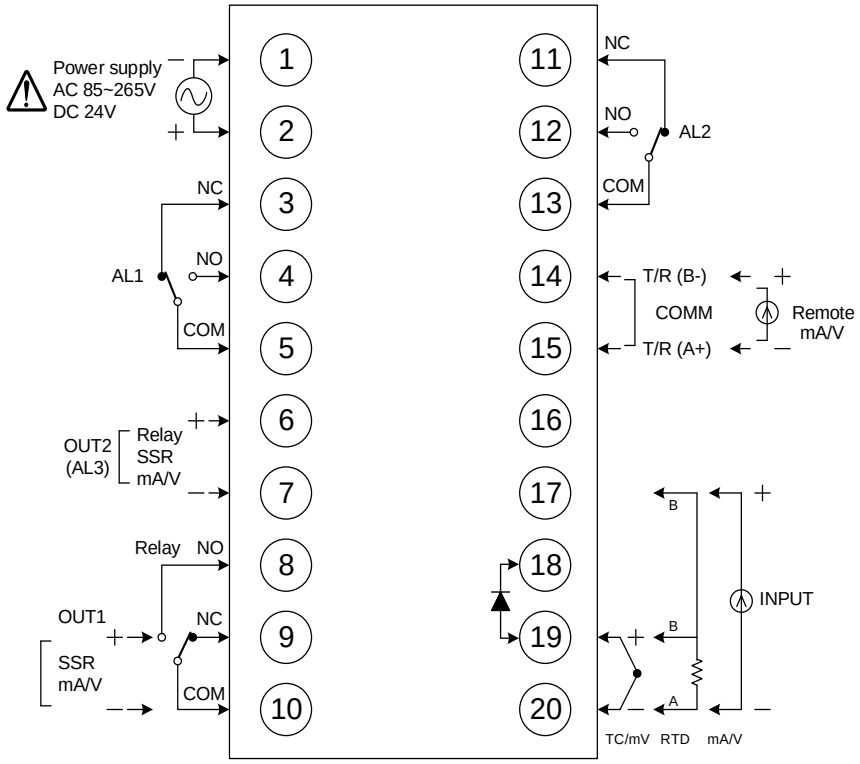
7.3 FY700 Terminal Arrangement







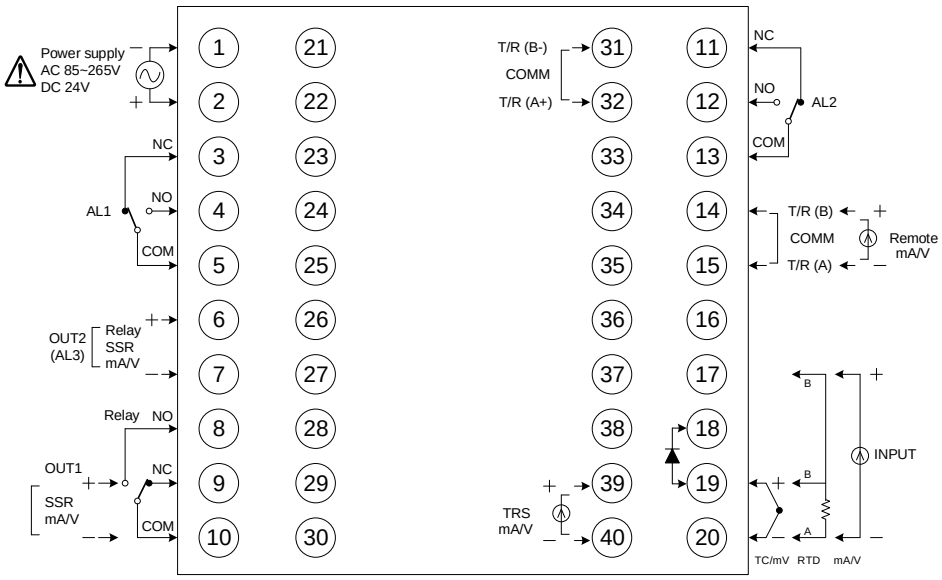
7.4 FY800 Terminal Arrangement



Power	1 L, 2 N — AC 85~265V; 1 −, 2 + — DC 24V
Output-1	8 NO, 9 NC, 10 COM; 9 +, 10 − SSR; 9 +, 10 − mA / V
Output-2	6, 7 Relay; 6 +, 7 − SSR; 6 +, 7 − mA / V
Motor valve	6, 7 CLOSE, 8 OPEN, 9, 10 COM

Communication	14 T/R (B-), 15 T/R (A+) — RS-485
Transmission	12 +, 13 − mA / V; 14 +, 15 − mA / V
Remote SV/ CT Input	14 +, 15 − mA / V; 14, 15 CT
Alarm 1 Alarm 2 Alarm 3	AL1: 3 NC, 4 NO, 5 COM; AL2: 11 NC, 12 NO, 13 COM; AL3: 6, 7
Input	19 +, 20 − TC / mV; 17 B, 19 B, 20 A RTD; 17 +, 19, 20 − mA / V

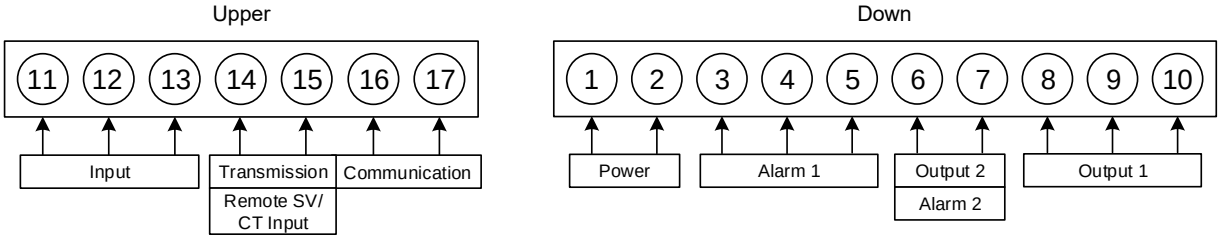
7.5 FY900 Terminal Arrangement



Power	1 L, 2 N — AC 85~265V; 1 −, 2 + — DC 24V
Output-1	8 NO, 9 NC, 10 COM; 9 (+) SSR 10 (−); 9 (+) mA / V 10 (−)
Output-2	6, 7 Relay; 6 (+) SSR 7 (−); 6 (+) mA / V 7 (−)
3ϕ Zero cross	31 RG1 32 RK1 33 RG2 34 RK2 35 TG1 36 TK1 37 TG2 38 TK2
1ϕ Zero /Phase angle	31 G1 32 K1 33 G2 34 K2

Motor valve	6 7 CLOSE 8 OPEN 9 10 COM
Alarm 1 Alarm 2 Alarm 3	AL1: 3 NC, 4 NO, 5 COM AL2: 11 NC, 12 NO, 13 COM AL3: 6, 7
Communication	14 T/R (B-), 15 T/R (A+) RS-485 — or — 31 T/R (B-), 32 T/R (A+) RS-485
Transmission	39 (+) mA / V 40 (−)
Remote SV/ CT Input	14 (+) mA / V 15 (−); 14 CT 15
Input	19 (+) TC / mV 20 (−); 17 B, 19 B, 20 A RTD; 17 (+) mA / V 19 20 (−)

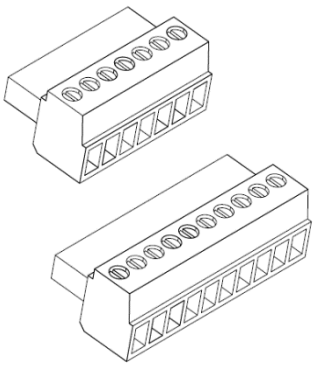
7.6 FA230 Terminal Arrangement



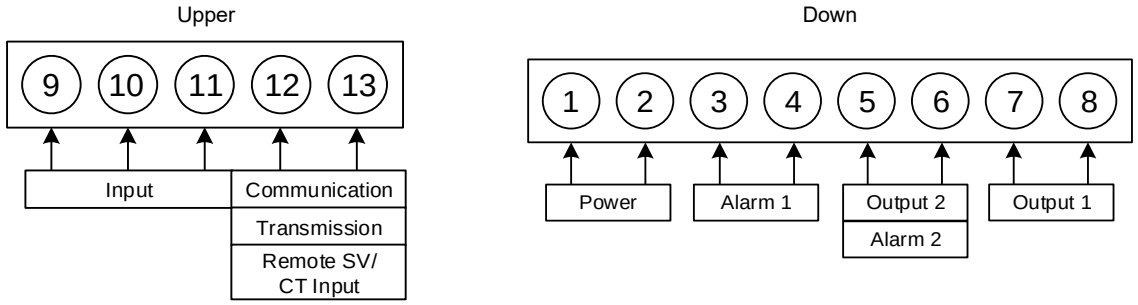
INPUT	TC / mV, RTD mA / V
Transmission	mA / V
Remote SV / CT Input	mA / V, CT
Communication	RS-485 T/R (B-) T/R (A+)

Power	AC 85~265V L N DC 24V
Alarm	AL1 NO NC COM AL2
Output 2	Relay SSR mA / V
Output 1	Relay NO NC COM SSR mA / V
Motor valve	CLOSE OPEN COM

FA230 terminal diagram

Pluggable Terminal M2.0 “—” screwdriver


7.7 FA231 Terminal Arrangement

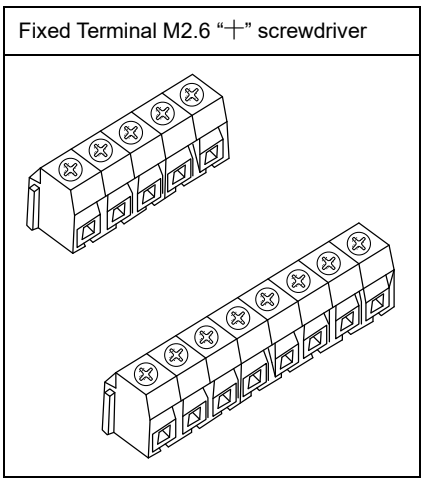


Input	TC / mV (9, 10) RTD (9, 10, 11) — mA / V (9, 10, 11)
Transmission	mA / V (12, 13)
Remote SV / CT Input	mA / V (12, 13) CT (12, 13)
Communication	RS-485 T/R (B-) T/R (A+) (12, 13)

Power	AC 85~265V L N (1, 2) DC 24V (1, 2) ⚠
Alarm	AL1 (3, 4) AL2 (5, 6)
Output 2	Relay (5, 6) SSR (5, 6) mA / V (5, 6)
Output 1	Relay (7, 8) SSR (7, 8) mA / V (7, 8)
Motor valve	CLOSE (5) OPEN (6) COM (7, 8)

FA231 terminal diagram

Fixed Terminal M2.6 "┼" screwdriver



8. Basic Function Setting

8.1 Changing Input Type

1.	PV 25 SV 0	Display after power-on.	2.	PV INP1 SV Pt2	Hold SET key + ◁ key 3 seconds, to enter LEVEL_3 upper display showing "INP1" with lower display showing current input type.
3.	PV INP1 SV Pt2	Press ◁ key the lower display flashes.	4.	PV INP1 SV Pt1	Press △ key and ▽ key to enter the intended input type.
5.	PV INP1 SV Pt1	Press SET key to store new value of INP1.	Modify input type needs to interchange of jumper location, and it needs to recalibration for linear input type change. Please refer to chapter 14. "Modification of Input Signal".		

8.2 SV Setting

1.	PV 25 SV 0	Display after power-on.	2.	PV 25 SV 0000	When ◁ key is pressed, the lower display flashes.
3.	PV 25 SV 0150	Press △ key and ▽ key to adjust set value.	4.	PV 25 SV 150	Press SET key to store new value of SV.

8.3 Setting PID Values Automatically(Auto-tuning)

1.	PV 25 SV 150	Display after power-on.	2.	PV AT SV no	Press SET key until show "AT"。
3.	PV AT SV no	When ◁ key is pressed, the lower display flashes.	4.	PV AT SV YES	Press △ key or ▽ key to select auto-tuning execution or not.
5.	PV AT SV YES	Press SET key to store new value of AT.	When auto-tuning AT LED lamp lit and start to output, through a few circles to get new PID value with the precise control, if finished the AT LED will be lamp off. Please refer to chapter 10.11 Auto-tuning and Startup tuning		

8.4 Setting PID Values Manually

1.	PV 25 SV 150	Display after power-on.	2.	PV P1 SV 3.0	Hold SET key 3 seconds, then entering LEVEL_2 upper display showing "P1", with lower display show current P1 value.
3.	PV P1 SV 003.0	When ◁ key is pressed, the lower display flashes.	4.	PV P1 SV 050.0	Press △ key and ▽ key to set the intended P1 value.
5.	PV P1 SV 50.0	Press SET key to store new value of P1.	By the same procedure, use the same ways to set integral time(I1) and derivative time(D1).		

8.5 Controlling With ON/OFF Action

1.	PV 25 SV 150	Display after power-on.	2.	PV P1 SV 3.0	Hold SET key 3 seconds, then entering LEVEL_2, as upper display shows “P1”, with lower display showing current P1 value.
3.	PV P1 SV 003.0	When ⋖ key is pressed, the lower display flashes, upper display.	4.	PV P1 SV 000.0	Press ⋁ key until P1 = 0.0
5.	PV P1 SV 0.0	Press SET key to store new value.	6.	PV HYS1 SV 1	Press SET key until show “HYS1”。
7.	PV HYS1 SV -1	When ⋖ key is pressed, the lower display flashes.	8.	PV HYS1 SV -10	Press ⋀ key and ⋁ key to set the intended HYS1 value.
9.	PV HYS1 SV 10	Press SET key to store new value.	Heat mode formula: PV ≥ (SV + HYS1) → OUT1 OFF PV ≤ (SV - HYS1) → OUT1 ON Cool mode formula: PV ≥ (SV + HYS1) → OUT1 ON PV ≤ (SV - HYS1) → OUT1 OFF		

8.6 Alarm Mode Setting

1.	PV 25 SV 0	Display after power-on.	2.	PV INP1 SV K2	Hold SET key + ⋖ key 3 seconds, then entering LEVEL_3 upper display showing “INP1” with lower display showing current input type.
3.	PV ALd1 SV 11	Press SET key until show “ALD1”。	4.	PV ALd1 SV -11	When ⋖ key is pressed, the lower display flashes
5.	PV ALd1 SV -12	Press ⋀ key and ⋁ key to set the intended ALD1 value.	6.	PV ALd1 SV 12	Press SET key to store new value of ALD1. ※ Please refer to ch11.1 Alarm mode.

8.7 Alarm Value Setting

1.	PV 25 SV 0	Display after power-on.	2.	PV AL1 SV 0	Press SET key until show “AL1”。
3.	PV AL1 SV 0000	When ⋖ key is pressed, the lower display flashes.	4.	PV AL1 SV 0020	Press ⋀ key and ⋁ key to set the intended AL1 value.
5.	PV AL1 SV 0020	Press SET key to store new value of AL1.			

8.8 Controlling With Manual Control

1.	PV 25 SV 150	Display after power-on.	2.	PV OUTL SV 0.0	Hold A/M 2 seconds.
3.	PV 25 SV 000.0	When ◁ key is pressed, the lower display flashes.	4.	PV 25 SV 050.0	Press △ key and ▽ key to set the intended output% value.
5.	PV OUTL SV 50.0	Press SET key to store new value.	In manual mode OUTL=100.0，output=100.0 % continuously. In manual mode OUTL=20.0，output=20.0 % continuously.		

9. Flow Chart of Parameter Setting

9.1 Level Operation Mode

1. LEVEL 1 enter to the LEVEL 2
   Hold SET key for 3 seconds then entering LEVEL 2

2. LEVEL 1 enter to the LEVEL 3
   Hold SET key + SHIFT key for 3 seconds then entering LEVEL 3

3. LEVEL 2 return to the LEVEL 1
   Hold SET key for 3 seconds then return to LEVEL 1

4. LEVEL 2 enter to the LEVEL 3
   Hold SET key for 3 seconds then entering to LEVEL 3

5. LEVEL 2 enter to the LEVEL 4
   On the LEVEL 2 then press SET key to find parameter “LCK
   modify LCK value from current value to 1111
   after hold SET key + SHIFT key 3 seconds entering LEVEL 4

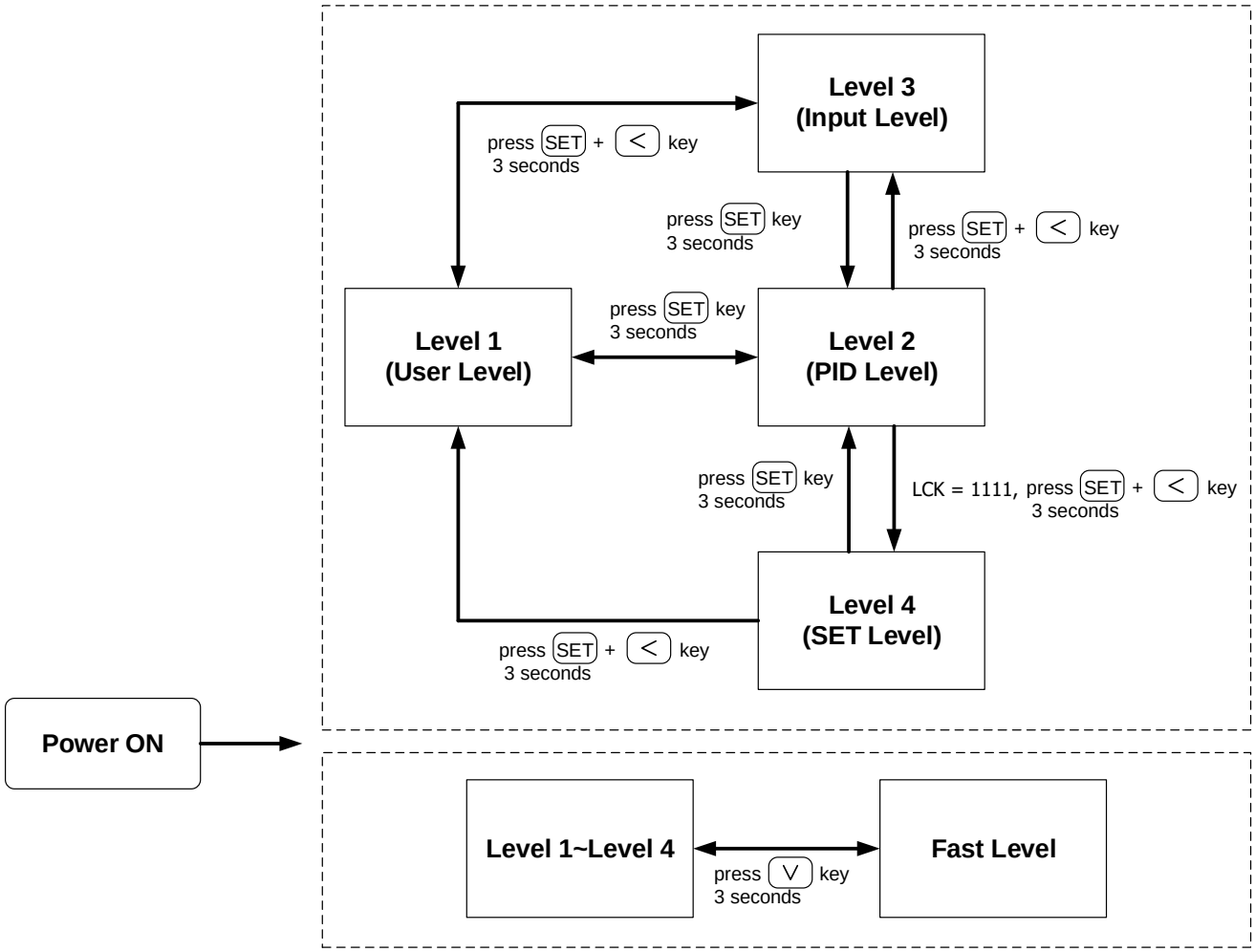
6. LEVEL 3 return to the LEVEL 1
   Hold SET key + SHIFT key for 3 seconds then return to LEVEL 1

7. LEVEL 3 return to the LEVEL 2
   Hold SET key for 3 seconds then return to LEVEL 2

8. LEVEL 4 return to the LEVEL 1
   Hold SET key + SHIFT key for 3 seconds then return to LEVEL 1

9. LEVEL 4 return to the LEVEL 2
   Hold SET key for 3 seconds then return to LEVEL 2

9.2 Level Operation Diagram



※ : If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV.

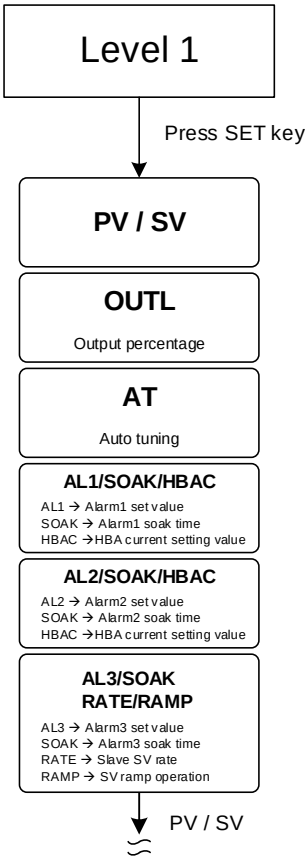
9.3 Data Lock Function

LCK provides a parameter protection function to prevent the operator from touching or modifying important parameters. Conversely, when the parameter cannot be modified, please check that the set value of LCK.

LCK	LEVEL				Descriptions
	Level_1 USER Level	Level_2 PID Level	Level_3 INPUT Level	Level_4 SET Level	
0000	◎	◎	◎	X	All parameters of Level 1, 2 & 3 are able to be modified (Factory default setting)
1111	◎	◎	X	◎	All parameters of Level 1, 2 & 4 are able to be modified
0100	◎	◎	X	X	All parameters of Level 1, 2 are able to be modified
0110	◎	◎	X	X	Only parameters of Level 1 and LCK can be modified
0001	◎	◎	X	X	Only SV, LCK can be modified
0101	◎	◎	X	X	Only LCK can be modified
Other	◎	◎	◎	X	Once jumping to other levels, LCK will be automatically restored to 0000

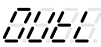
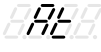
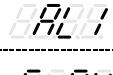
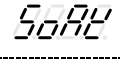
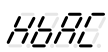
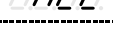
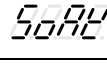
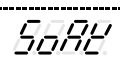
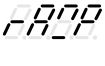
◎ : allow X : inhibit

9.4 Level 1 (User Level) All Parameters Display



※ : If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV

9.5 LEVEL_1 Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
PV	---	Process value	USPL	LSPL	---	---
SV	---	Set value	USPL	LSPL	---	---
OUTL		High limit setting of manipulated value when PID gain > OUTL use OUTL as manipulated value	100.0	0.0	100.0	SET1.1
AT		Auto-tuning execute selection 0 : NO (PID control) 1 : YES (execute auto-tuning) 2 : PR.TU (Startup tuning, execute once) 3 : PRTU (Startup tuning, execute always when reboot)	PRTU	NO	NO	SET1.2
*AL1		Alarm1 set value (Please refer to Chapter 11)	USPL	-1999	1.0	SET1.3
SOAK		Alarm1 soak time Time format : hr.min	99.59	0.00	0.10	ALD1=10 or ALD1=19
HBAC		HBA current setting value Upper : heater current display Down : current setting value unit : ampere(A)	100.0	0.0	1.0	INP2=4 & ALD1=9
*AL2		Alarm2 set value (Please refer to Chapter 11)	USPL	-1999	1.0	SET1.4
HBAC		HBA current setting value Upper : heater current display Down : current setting value unit : ampere(A)	100.0	0.0	1.0	INP2=4 & ALD2=9
SOAK		Alarm2 soak time Time format : hr.min	99.59	0.00	0.10	ALD2=10 or ALD2=19
*AL3		Alarm3 set value (Please refer to Chapter 11)	USPL	-1999	1.0	SET2.1
SOAK		Alarm3 soak time Time format : hr.min	99.59	0.00	0.10	ALD3=10
RAMP		The rate of change during SV ramp operation format : °C / minute (Please refer to Chapter 10.7)	99.99	-19.99	10.00	ALD3=9 & SET2.1
RATE		Slave SV rate RATE SV = SV x (RATE/9999) (Please refer to Chapter 10.9)	9999	0	9999	SET2.1 & SET0.2

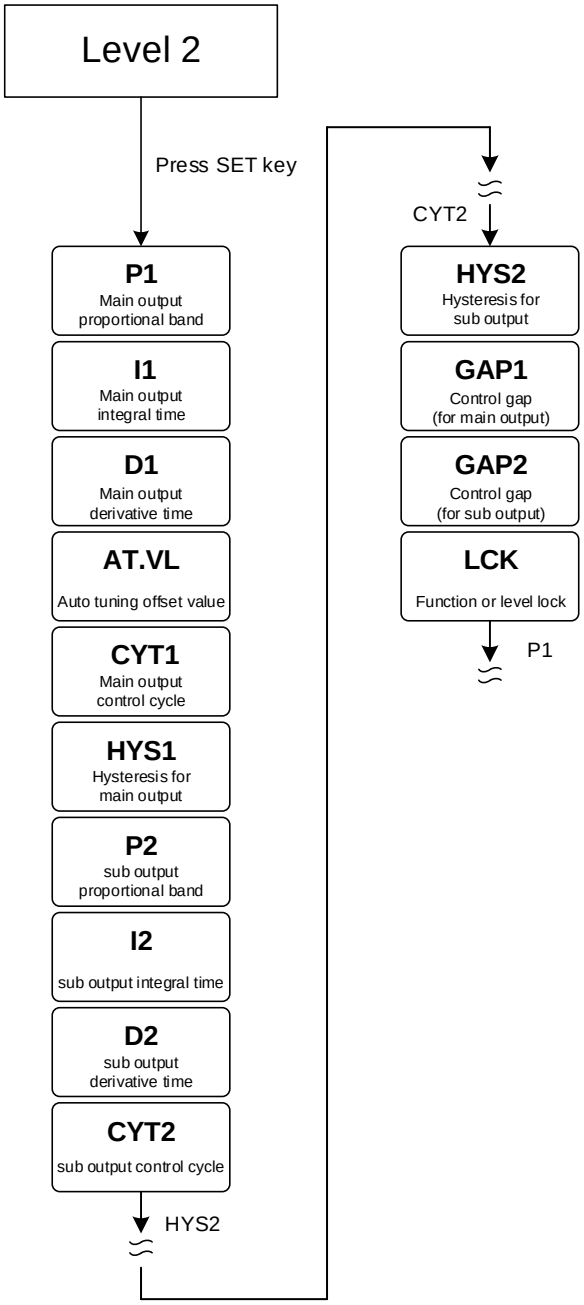
* Automatically display corresponding parameters according to different setting conditions

EX1: When alarm1 is used as HBA function(ALD1= 09), original AL1 will become HBAC display

EX2: When alarm2 is used as SOAK_B function(ALD2= 19), original AL2 will become SOAK display

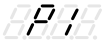
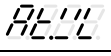
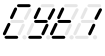
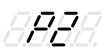
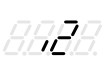
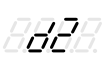
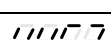
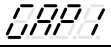
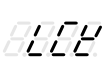
EX3: When alarm3 is used as RAMP function(ALD3= 09), original AL3 will become RAMP display

9.6 Level 2 (PID Level) All Parameters Display

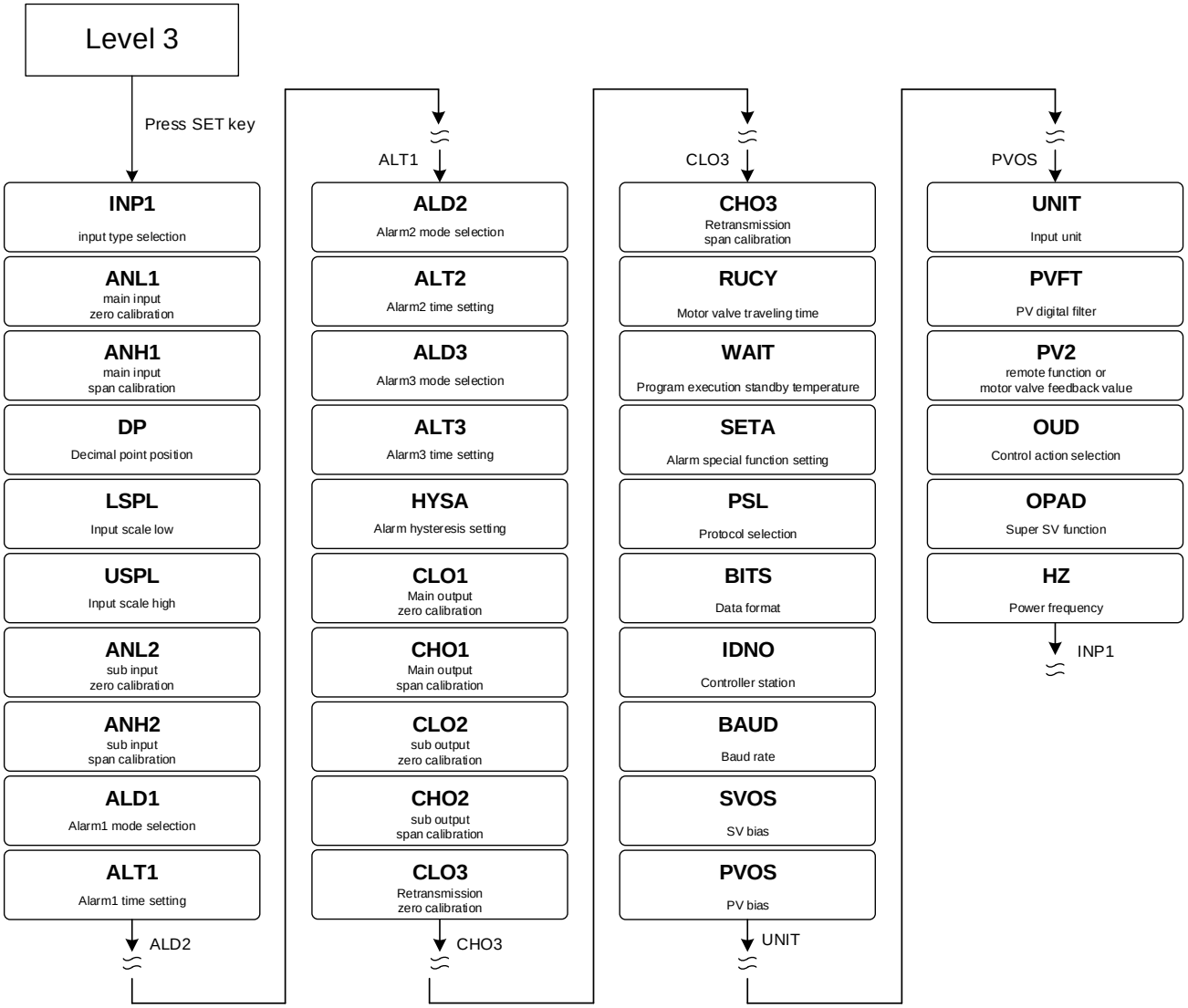


※ If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV

9.7 LEVEL_2 Parameter

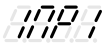
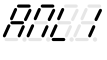
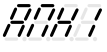
Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
P1		Main output proportional band 0.0 : ON/OFF control Other values : proportional band setting value	200.0	0.0	3.0	---
I1		Main output integral time 0 : disable integral function Other values : integral time setting value	3600	0	240	---
D1		Main output derivative time 0 : disable derivative function Other values : derivative time setting value	900	0	60	---
AT.VL		Auto-tuning offset value execute auto-tuning in (SV+ATVL) point	100.0	-100.0	0.0	---
CYT1		Main output control cycle 0 : Linear signal 1 : SSR drive 2~150 : Relay	150	0	10	---
HYS1		Hysteresis for main output on/off control use(when P1 = 0.0 appear) heating formula： PV ≥ (SV + HYS1) → OUT1=OFF PV ≤ (SV - HYS1) → OUT1=ON cooling formula： PV ≥ (SV + HYS1) → OUT1=ON PV ≤ (SV - HYS1) → OUT1=OFF	100.0	-100.0	1.0	P1 = 0.0
P2		Sub output proportional band 0.0 : ON/OFF control Other values : proportional band setting value	200.0	0.0	3.0	OUTY = 1
I2		Sub output integral time 0 : disable integral function Other values : integral time setting value	3600	0	240	OUTY = 1
D2		Sub output derivative time 0 : disable derivative function Other values : derivative time setting value	900	0	60	OUTY = 1
CYT2		Sub output control cycle 0 : Linear signal 1 : SSR drive 2~150 : Relay	150	0	10	OUTY = 1
HYS2		Hysteresis for sub output on/off control use(when P2 = 0.0 appear)	100.0	-100.0	1.0	P2 = 0.0
GAP1		Control gap (for main output)	1000	-1000	0	OUTY = 1
GAP2		Control gap (for sub output)	1000	-1000	0	OUTY = 1
LCK		Function or level lock (Please refer to Chapter 9.3 Data Lock Function)	1111	0000	0000	---

9.8 Level 3 (Input Level) All Parameters Display

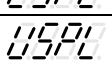
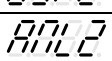
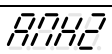
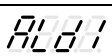
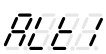
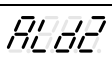
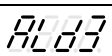
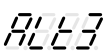
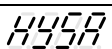
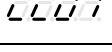
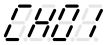
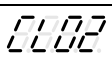
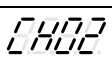
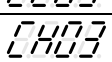


※ If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV

9.9 LEVEL_3 Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
INP1		Main input type selection Change this parameter USPL&LSPL will be reset (please refer to Chapter 3 Input Range Table)	AN4	K1	K1	---
ANL1		Main input zero calibration, only available in linear input (Please refer to chapter 14.4)	9999	-1999	0	SET2.2
ANH1		Main input span calibration, only available in linear input (hex display) (Please refer to chapter 14.4)	0x7FFF	0x0000	0x5FFF	SET2.2
DP		Decimal point position (only available in linear signal input AN1~AN4) 0 : 0000 1 : 000.0 2 : 0.00 3 : 0.000	0.000	0000	000.0	SET2.2

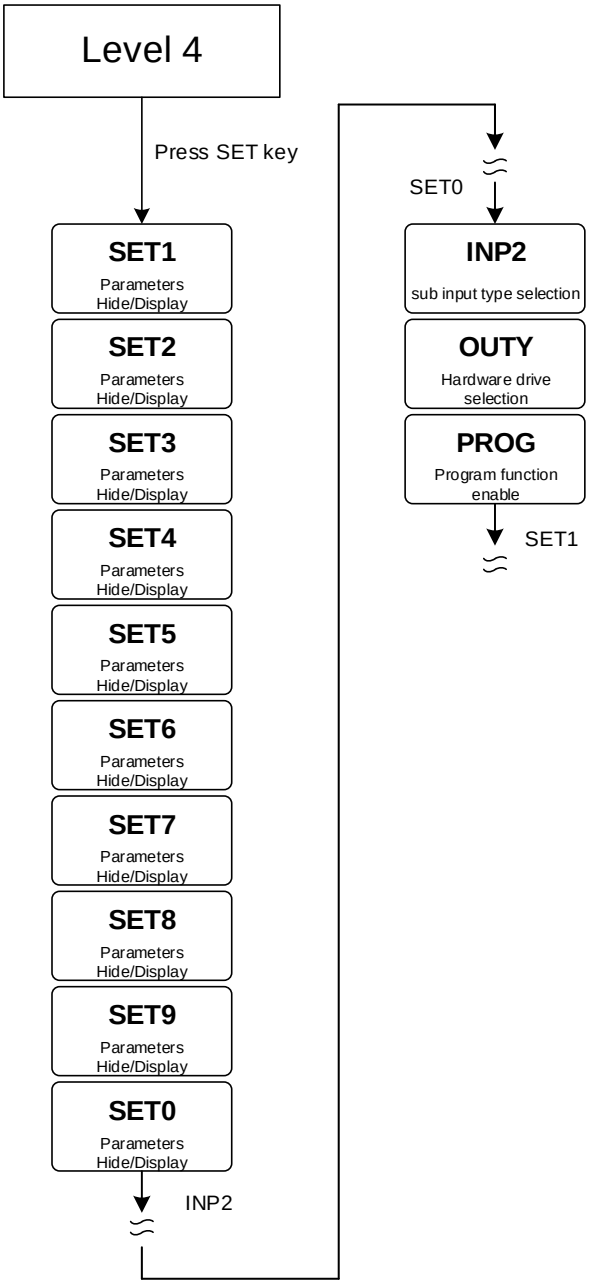
9.9 LEVEL_3 Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
LSPL		Input scale low	9999	-1999	---	SET2.3
USPL		Input scale high	9999	-1999	---	SET2.3
ANL2		Sub input zero calibration	9999	-1999	0	SET2.4
ANH2		Sub input span calibration (hex display)	0x7FFF	0x0000	0x5FFF	SET2.4
ALD1		Alarm1 mode selection (Please refer to Chapter 11.1 Alarm Mode)	19	0	11	SET3.1
ALT1		Alarm1 time setting 0.00：Flicker 99.59：Continued ON 0.01~99.58：delay time Time format：min . sec	99.59	0.00	99.59	SET3.2
ALD2		Alarm2 mode selection (Please refer to Chapter 11.1 Alarm Mode)	19	0	0	SET3.3
ALT2		Alarm2 time setting 0.00：Flicker 99.59：Continued ON 0.01~99.58：delay time Time format：min . sec	99.59	0.00	99.59	SET3.4
ALD3		Alarm3 mode selection (Please refer to Chapter 11.1 Alarm Mode)	18	0	0	SET4.1
ALT3		Alarm3 time setting 0.00：Flicker 99.59：Continued ON 0.01~99.58：delay time Time format：min . sec	99.59	0.00	99.59	SET4.2
HYSA		Hysteresis setting for alarm1~3	999.9	-199.9	1.0	SET4.3
CLO1		Main output zero calibration , only available in linear output (Please refer to Chapter 13.5)	9999	0	0	SET4.4
CHO1		Main output span calibration , only available in linear output (Please refer to Chapter 13.5)	9999	0	3600	SET4.4
CLO2		Sub output zero calibration , only available in linear output	9999	0	0	SET5.1
CHO2		Sub output span calibration , only available in linear output	9999	0	3600	SET5.1
CLO3		Retransmission zero calibration	9999	0	0	SET5.2
CHO3		Retransmission span calibration	9999	0	3600	SET5.2
RUCY		Motor valve traveling time unit：second (Please refer to Chapter 10.6)	150	5	5	SET5.3
WAIT		Program execution standby temperature 0 : when program executed reach SV do not waiting for PV temperature Other values : when PV= (target SV-WAIT), program entering next segment (Please refer to Chapter 12)	100.0	0	0	SET5.3

9.9 LEVEL_3 Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
SETA	SEtA	Alarm special function setting (Please refer to Chapter 11.2)	1111	0000	0000	SET5.3
PSL	PSL	Protocol selection 0 : TAIE 1 : RTU (Please refer to communication manual)	RTU	TAIE	RTU	SET5.4
BITS	bitS	Data format 0 : O_81 (parity bit=odd, stop bit=1) 1 : O_82 (parity bit=odd, stop bit=2) 2 : E_81 (parity bit=even, stop bit=1) 3 : E_82 (parity bit=even, stop bit=2) 4 : N_81 (parity bit=none, stop bit=1) 5 : N_82 (parity bit=none, stop bit=2)	N_82	O_81	O_81	SET5.4
IDNO	IdnO	Controller station	254	0	1	SET5.4
BAUD	bAUd	Baud rate 0 : 24(2400) 1 : 48(4800) 2 : 96(9600) 3 : 192(19200) 4 : 384(38400) 5 : 576(57600) 6 : 1152(115200) bps	1152	24	384	SET5.4
SVOS	SUOS	SV bias	100.0	-100.0	0	SET6.1
PVOS	PUOS	PV bias PV = PV x (PVOH / 5000) + PVOS	199.9	-199.9	0	SET6.2
UNIT	UnIt	Unit Change this parameter USPL&LSPL will be reset 0 : °C 1 : °F 2 : U (Linear signal)	2	0	---	SET6.3
PVFT	PUFt	PV digital filter The PV filter is used to eliminate noise against the measured input Unit : second	10.00	0.01	2.00	SET6.4
PV2	PU2	Use for motor valve feedback value	100.0	0.0	---	OUTY=2 & SET7.1
OUD	OUd	Control action selection 0 : HEAT reverse action 1 : COOL direct action	COOL	HEAT	HEAT	SET7.2
OPAD	OPAd	Super SV function, suppressing overshoot 0 : OFF 1 : ON	ON	OFF	OFF	SET7.3
HZ	Hz	Power frequency 0 : 50HZ 1 : 60HZ	50HZ	60HZ	60HZ	SET7.4

9.10 Level 4 (Setting Level) All Parameters Display



※ If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV

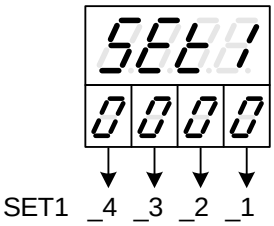
9.11 LEVEL_4 Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
SET1	SEt1	Parameters Hide/Display	1111	0000	---	---
SET2	SEt2	Parameters Hide/Display	1111	0000	---	---
SET3	SEt3	Parameters Hide/Display	1111	0000	---	---
SET4	SEt4	Parameters Hide/Display	1111	0000	---	---
SET5	SEt5	Parameters Hide/Display	1111	0000	---	---
SET6	SEt6	Parameters Hide/Display	1111	0000	---	---
SET7	SEt7	Parameters Hide/Display	1111	0000	---	---
SET8	SEt8	Parameters Hide/Display	1111	0000	---	---
SET9	SEt9	Parameters Hide/Display	1111	0000	---	---

9.11 LEVEL_4 Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
SET0	SEt0	Function enable/disable	1111	0000	---	---
INP2	inP2	Sub input type selection 0 : none 1 : 10~50mV / 4~20mA / 1~5V / 2~10V (only available in remote SV) 2 : 0~50mV / 0~20mA / 0~5V / 0~10V (only available in remote SV) 3 : valve feedback 4 : CT input	4	0	0	---
OUTY	outy	Hardware drive selection 0 : single output control 1 : dual output control 2 : valve control with feedback 3 : valve control without feedback selection 4 : single phase angle control	4	0	0	---
PROG	Prog	Program function enable 0 : OFF , SV source from keypad or communication 1 : ON , SV source from program	ON	OFF	OFF	---

9.12 Parameters Hide/Display Table on Level 4



SEt1	SET1_1	0	Hide	OUTL
		1	Display	OUTL
	SET1_2	0	Hide	AT
		1	Display	AT
	SET1_3	0	Hide	AL1
		1	Display	AL1
	SET1_4	0	Hide	AL2
		1	Display	AL2

SEt2	SET2_1	0	Hide	AL3
		1	Display	AL3
	SET2_2	0	Hide	ANL1 ANH1 DP TRCL TRCH
		1	Display	ANL1 ANH1 DP TRCL TRCH
	SET2_3	0	Hide	LSPL USPL
		1	Display	LSPL USPL
	SET2_4	0	Hide	ANL2 ANH2
		1	Display	ANL2 ANH2

SEt3	SET3_1	0	Hide	ALD1
		1	Display	ALD1
	SET3_2	0	Hide	ALT1
		1	Display	ALT1
	SET3_3	0	Hide	ALD2
		1	Display	ALD2
	SET3_4	0	Hide	ALT2
		1	Display	ALT2

SEt4	SET4_1	0	Hide	ALD3
		1	Display	ALD3
	SET4_2	0	Hide	ALT3
		1	Display	ALT3
	SET4_3	0	Hide	HYSA
		1	Display	HYSA
	SET4_4	0	Hide	CLO1 CHO1
		1	Display	CLO1 CHO1

SEt5	SET5_1	0	Hide	CLO2 CHO2
		1	Display	CLO2 CHO2
	SET5_2	0	Hide	CLO3 CHO3
		1	Display	CLO3 CHO3
	SET5_3	0	Hide	RUCY WAIT SETA
		1	Display	RUCY WAIT SETA
	SET5_4	0	Hide	PSL BITS IDNO BAUD W_MD
		1	Display	PSL BITS IDNO BAUD W_MD

SEt6	SET6_1	0	Hide	SVOS
		1	Display	SVOS
	SET6_2	0	Hide	PVOS PVOH
		1	Display	PVOS PVOH
	SET6_3	0	Hide	UNIT
			Disable Fast Level	
		1	Display	UNIT
			Enable Fast Level	
	SET6_4	0	Hide	PVFT
		1	Display	PVFT

SEt7	SET7_1	0	Hide	PV2
		1	Display	PV2
	SET7_2	0	Hide	OUD
		1	Display	OUD
	SET7_3	0	Hide	OPAD
		1	Display	OPAD
	SET7_4	0	Hide	HZ
		1	Display	HZ

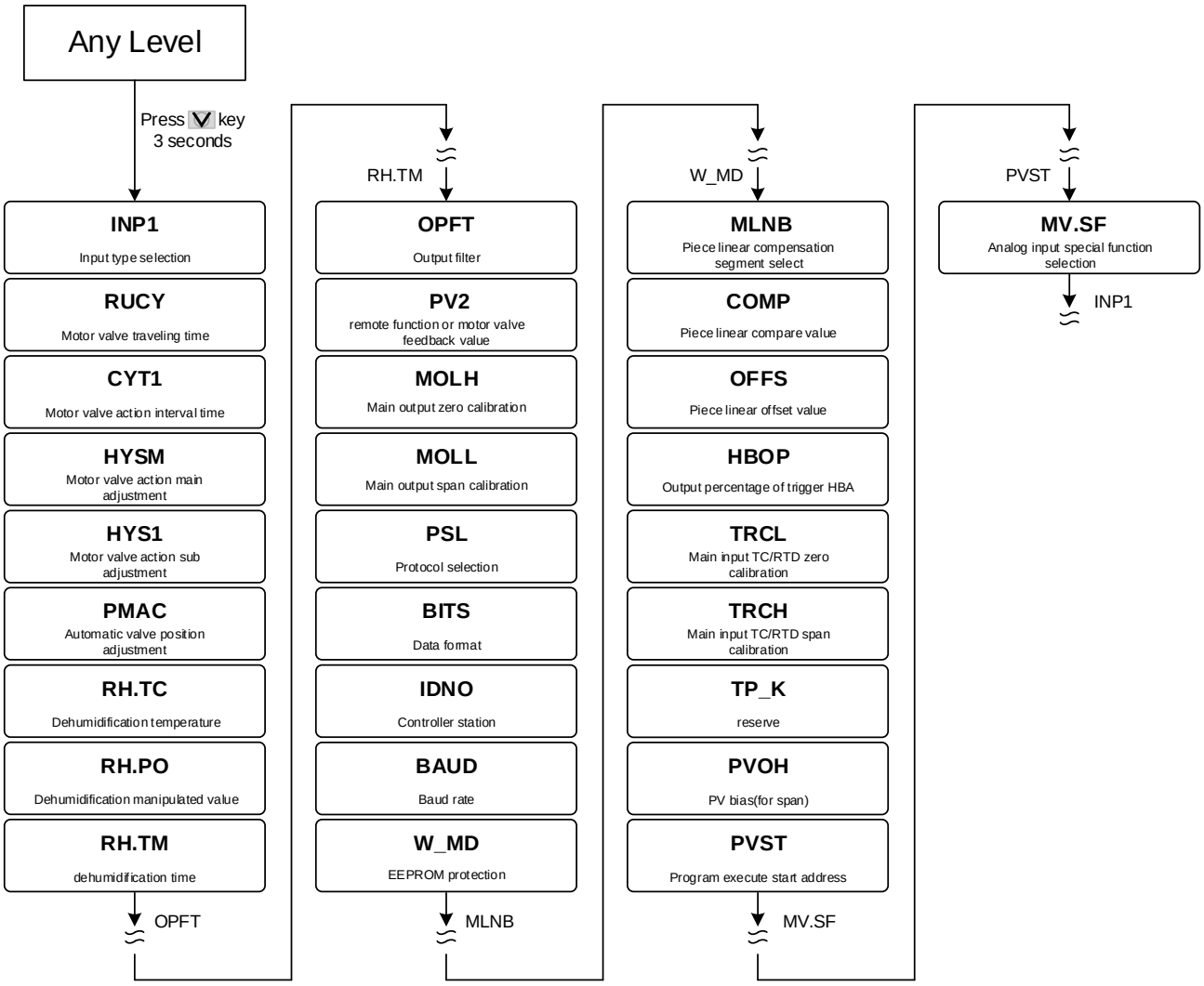
SEt8	SET8_1	0	Program not repeat	
		1	Program repeat	
	SET8_2	0	No power failure protection	
		1	With power failure protection	
	SET8_3	0	Hide	PVST
			Program execute from 0	
		1	Display	PVST
			Program execute from PV	
	SET8_4	0	Hide	MLNB COMP OFFS
		1	Display	MLNB COMP OFFS

SEt9	SET9_1	0	Disable piece linear compensation
		1	Enable piece linear compensation
	SET9_2	0	Program Timer Unit = “Hour : Minute”
		1	Program Timer Unit = “Minute : Second”
	SET9_3	0	Disable transmission SV
		1	Enable transmission SV
	SET9_4	0	Disable transmission PV
		1	Enable transmission PV

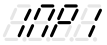
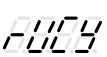
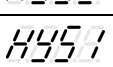
SEt0	SET0_1	0	TTL Communication (Slave)	
		1	TTL Communication (Master)	
	SET0_2	0	Hide	RATE
		1	Display	RATE
	SET0_3	0	Disable Remote SV function	
		1	Enable Remote SV function	
	SET0_4	0	use output relay “b” contact when motor valve closed	
		1	use output relay “a” contact when motor valve closed	

9.13 Fast Level All Parameters Display

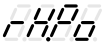
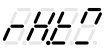
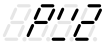
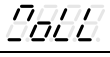
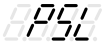
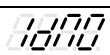
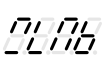
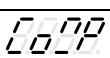
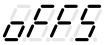
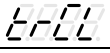
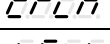
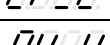
FY/FA controller provides a fast parameter access operation, easy for users to quickly access communication group, program group, motor valve group related parameters
SET6.3 = 1 (Enable Fast Level)
Enter fast level : press down key for 3 seconds at any level
Leave fast level : press down key for 3 seconds at fast level



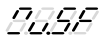
9.14 Fast Level Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
INP1		Main input type selection Change this parameter USPL&LSPL will be reset (Please refer to Chapter 3 Input Range Table)	AN4	K1	K1	---
RUCY		Motor valve traveling time Time unit：second (Please refer to Chapter 10.6)	150	5	5	OUTY = 2 or 3
CYT1		Motor valve action interval time. Time unit : second	10	0	5	OUTY = 2 or 3
HYSM		Motor valve action main adjustment unit : percentage	5.0	0.0	1.0	OUTY = 2 or 3
HYS1		Motor valve action sub adjustment unit : percentage	HYSM	0.0	0.5	OUTY = 2 or 3
PMAC		Automatic valve position adjustment 0 : OFF stop automatic adjust 1 : ON start automatic adjust 2 : E_PB Valve position determined by external button	E_PB	OFF	OFF	OUTY=2
RH.TC		Dehumidification temperature If PV less than RHTC manipulated value = RHPO (Please refer to Chapter 10.5)	200.0	0.0	125.0	---

9.14 Fast Level Parameter

Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
RH.PO		Dehumidification manipulated value 0 : OFF disable dehumidification function Other values : 0.1~100.0 manipulated value (Please refer to Chapter 10.5)	100.0	OFF	OFF	---
RH.TM		Dehumidification time time format : min.sec	99.59	0.00	15.00	---
OPFT		Output filter unit: second	10.00	0.10	2.00	---
PV2		Use for motor valve feedback value	100.0	0.0	---	OUTY=2 & SET7.1
MOLH		High limit setting of manipulated value for main output	100.0	0.0	100.0	---
MOLL		low limit setting of manipulated value for main output	100.0	0.0	0.0	---
PSL		Protocol selection 0 : TAIE 1 : RTU (Please refer to communication manual)	RTU	TAIE	RTU	SET5.4
BITS		Data format 0 : O_81 (parity bit=odd, stop bit=1) 1 : O_82 (parity bit=odd, stop bit=2) 2 : E_81 (parity bit=even, stop bit=1) 3 : E_82 (parity bit=even, stop bit=2) 4 : N_81 (parity bit=none, stop bit=1) 5 : N_82 (parity bit=none, stop bit=2)	N_82	O_81	O_81	SET5.4
IDNO		Controller station	254	0	1	SET5.4
BAUD		Baud rate 0 : 24(2400) 1 : 48(4800) 2 : 96(9600) 3 : 192(19200) 4 : 384(38400) 5 : 576(57600) 6 : 1152(115200) bps	1152	24	384	SET5.4
W_MD		EEPROM protection 0 : OFF communication write command only write to CPU RAM 1 : ON communication write command write to CPU RAM and EEPROM	ON	OFF	ON	SET5.4
MLNB		Piece linear compensation segment select TRIP : leave setting loop 1~10 : segment select	10	TRIP	TRIP	SET8.4
COMP		Piece linear compare value	USPL	LSPL	LSPL	SET8.4
OFFS		Piece linear offset value	150.0	-150.0	0.0	SET8.4
HBOP		Output percentage of trigger HBA	100.0	0.0	90.0	INP2=4 & ALD1=9
TRCL		Main input TC/RTD zero calibration	9999	0	0	SET2.2
TRCH		Main input TC/RTD span calibration (hex display)	7FFF	0	5FFF	SET2.2
TP_K		reserve	100.0	10.0	15.0	PROG = ON
PVOH		PV bias(for span) PV = PV x (PVOH / 5000) + PVOS	9999	0	5000	SET6.2
PVST		Program execute start address 0 : FULT (execute from current PV, but use segment 1 fully time) 1 : CUTT (execute from current PV,cut time)	CUTT	FULT	FULT	SET8.3

9.14 Fast Level Parameter

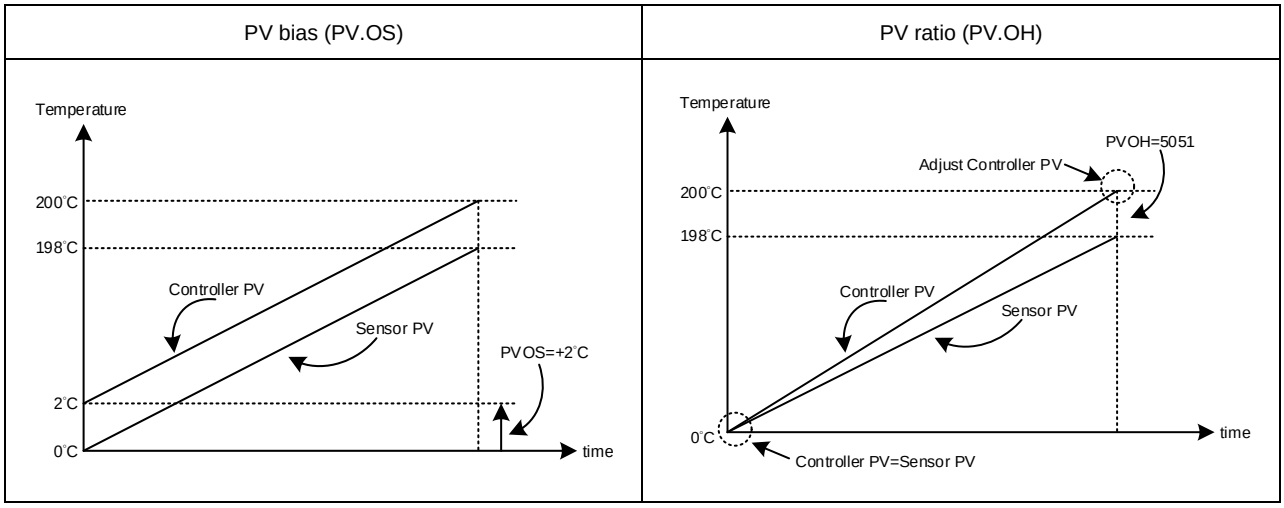
Parameter	Symbol	Content	Range		Default	Hide/ Display
			MAX	MIN		
MV.SF		Analog input special function selection 0 : NONE (special function OFF) 1 : SQUA (analog input square) 2 : ROOT (analog input square root) 3 : REVE (analog input reverse) 4 : SQ.RE (analog input square reverse) 5 : RO.RE (analog input square root reverse)	RO.RE	NONE	NONE	INP1= AN1~AN4

10. Functional Descriptions

10.1 PV bias

Description
The FY/FA series controller offers PV bias for input calibration, PV bias functions correct the deviation of each sensor, as well as PV difference between controllers.

Function Diagram



The related parameters of input calibration are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
PVOS	PV.OS	PV bias(for zero) PV = PV + PVOS	199.9	-199.9	0	Level 3	SET6.2
PVOH	PV.OH	PV bias(for span) PV = PV x (PVOH / 5000) + PVOS	9999	0	5000	Fast	SET6.2

Examples
PV bias (PVOS) adds bias to the Measured value(PV):
When two controllers measure the temperature of the same type of load, the measured values of the respective characteristics of the sensors are displayed as
Controller A : 200°C Controller B : 195°C
As shown above, Controller B is compensated by PV offset (PVOS) The PV.OS parameter value must be corrected by +5°C.
The display value will be changed to 200°C, Same as Controller A, but Controller B will show 5°C at 0°C.

Parameter setting

Level	Parameter	Set value	Description
4	SET6.2	1	Display PVOS
3	PVOS	5	PV adds +5°C
Fast	PVOH	5000	PV ratio unchanging

Example 2
PV ratio (PVOH) is a multiplier to be applied to the measured value(PV):
When two controllers measure the temperature of the same type of load, the measured values of the respective characteristics of the sensors are displayed as
Controller A : 200°C Controller B : 195°C
As shown above, if Controller B is compensated by the PV ratio (PVOH), then the PVOH parameter value is adjusted to display at 200°C. Consistent with Controller A, Controller B will show 0°C at 0°C.

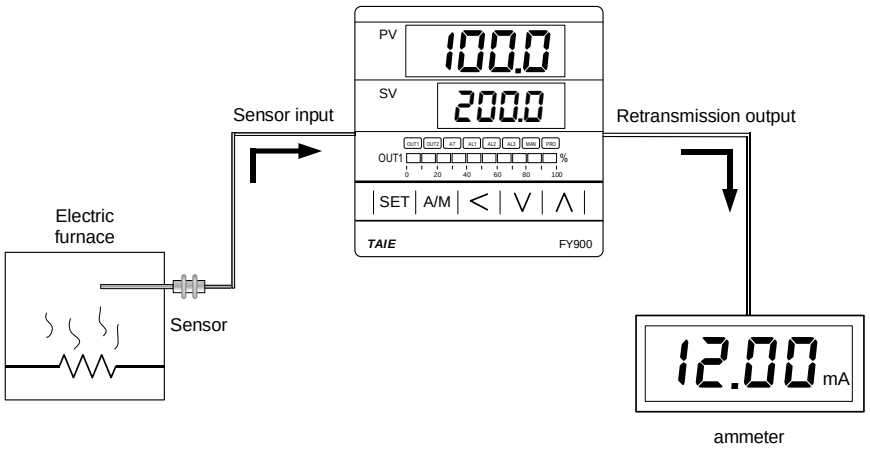
Parameter Setting

Level	Parameter	Set value	Description
4	SET6.2	1	Display PVOS / PVOH
3	PVOS	0	PV bias unchanging
Fast	PVOH	5129	PV ratio=(5129/5000)=1.0258

10.2 Retransmission

Description
The retransmission function of the FY/FA series controller can provide digital values for parameters such as SV or PV etc. Analog signals are transmitted to external devices according to the set range (EX: PLC AI module, inverter, etc.).
transmission output signal selectable: 4~20mA, 0~20mA, 0~5V, 0~10V, 1~5V, 2~10V

Function Diagram



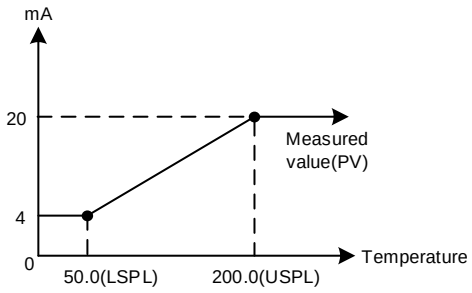
The related parameters of Transmission are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
SET9.3	SEt9	0 : Retransmission SV disable 1 : Retransmission SV enable	1	0	0	Level 4	---
SET9.4	SEt9	0 : Retransmission PV disable 1 : Retransmission PV enable	1	0	0	Level 4	---
CLO3	CLO3	Retransmission zero calibration	9999	0	0	Level 3	SET5.2
CHO3	CHO3	Retransmission span calibration	9999	0	3600	Level 3	SET5.2

Examples
Assume the input range (LSPL & USPL) = -50.0~600.0 retransmit PV
When the PV value is between -50.0 and 600.0, the retransmission signal is based on the PV value, and the linear output analog signal is presented.
When the PV is less than -50.0, the retransmission signal remains at 4mA
When the PV value is greater than 600.0, the retransmission signal remains at 20mA

Parameter setting

Level	Parameter	Set value	Description
3	SET9.4	1	Retransmission PV
3	CLO3	3133	Retransmission signal low point calibration value (each controller calibrate value is different)
3	CHO3	3508	Retransmission signal high point calibration value (each controller calibrate value is different)

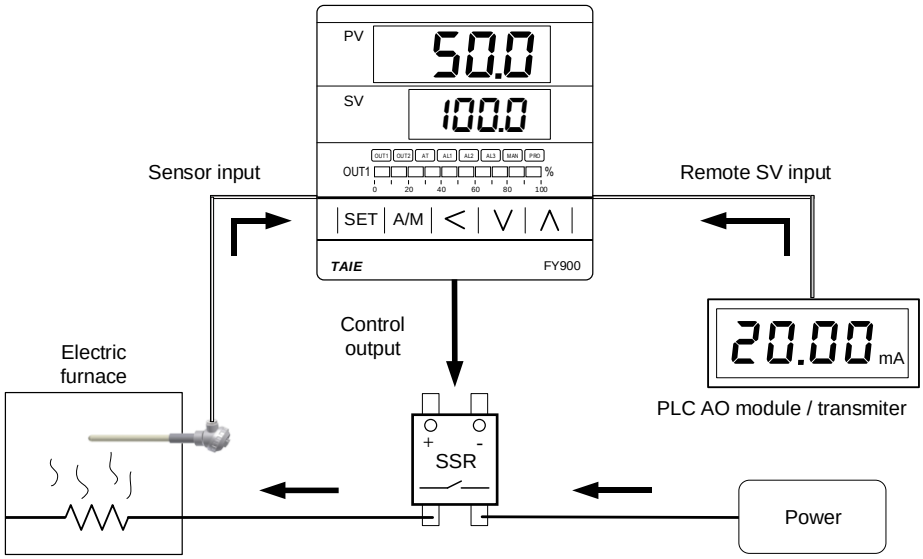


Notes
1. To order TRS function, please confirm the type of retransmission output signal and retransmit signal range.
2. The user can select the source to be transmitted according to the parameter SET9.4 or SET9.3. The factory default is to retransmit the PV.
3. Modify the parameter INP1/UNIT will reset the retransmission range.
4. CLO3 & CHO3 are the calibration parameters of the re-transmission signal. It has been calibrated before leaving the factory. do not change this parameter value.
5. The user only needs to set SET9.4 or SET9.3, the rest of the parameters will be set & calibrated at the factory.

10.3 Remote SV

Description
Remote SV functions as an analog signal (4~20mA or 0~10V) generated by external devices (EX: PLC AO module, transmitter) to the Remote SV terminal of the controller, to change the SV with a preset range.
Remote SV signal selection: 4~20mA, 0~20mA, 0~5V, 0~10V, 1~5V, 2~10V

Function Diagram

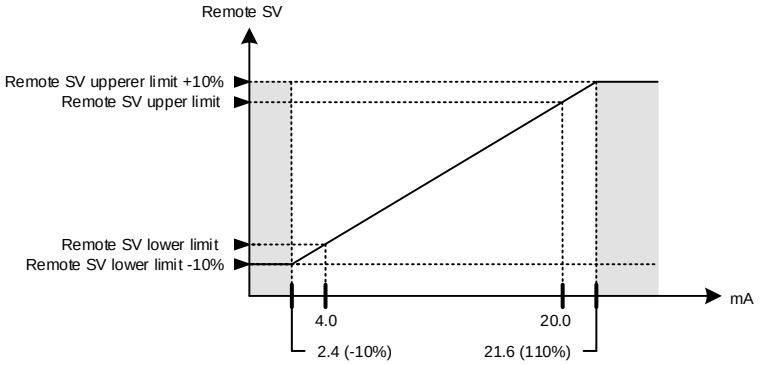


The related parameters of Remote SV are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
SET0.3	SEt0	0 : Remote SV disable 1 : Remote SV enable	1	0	0	Level 4	---
INP2	InP2	Sub input type selection 0 : none 1 : 10~50mV / 4~20mA / 1~5V / 2~10V (only available in remote SV) 2 : 0~50mV / 0~20mA / 0~5V / 0~10V (only available in remote SV) 3 : valve feedback 4 : CT input	4	0	0	Level 4	---
ANL2	AnL2	Sub input zero calibration	9999	-1999	0	Level 3	SET2.4
ANH2	AnH2	Sub input span calibration (hex display)	0x7FFF	0x0000	0x5FFF	Level 3	SET2.4

Examples
Input signal is K1 and its range is -50.0~600.0. When an external analog signal is input to the Remote SV terminal, the signal will be based on the range presents linear display of SV parameters

When the signal input value is less than 2.4mA, the PV position shows nnn2, indicating that the signal of Remote SV is lower than the lower limit value
When the signal input value is greater than 21.6mA, the PV position shows uuu2, indicating that the signal of Remote SV is higher than the upper limit value



Parameter setting

Level	Parameter	Set value	Description
4	SET0.3	1	Enable Remote SV function
4	INP2	1	Remote SV signal=4~20mA
3	ANL2	744	Remote SV signal low point calibration value (each controller calibrate value is different)
3	ANH2	0x657C	Remote SV signal high point calibration value (each controller calibrate value is different)

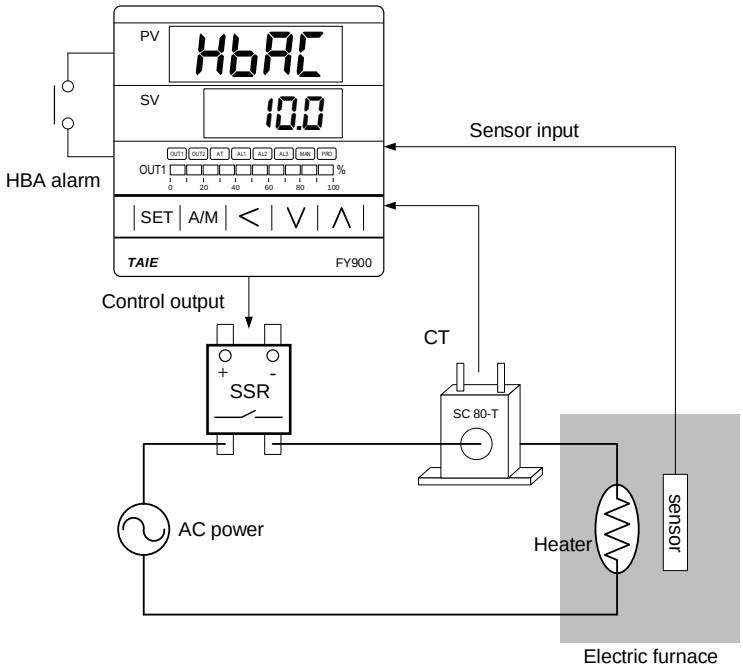
Notes

1. To order Remote SV function, please confirm signal type and Remote SV input range first.
2. Modify the parameter INP1 & UNIT will reset the input range
3. The ANL2 and ANH2 are the calibration parameters of Remote SV. It has been calibrated before leaving the factory. Please do not change this parameter.

10.4 Heater Break Alarm

Description
The HBA (Heater-Break-Alarm) function measures the heater current and displays the measured current value on the parameter HBAC upper area so that the heater status can be monitored at any time.
When it is detected that the heater is disconnected or the heater current is abnormally reduced, an alarm message may be immediately output to notify the user.

Function Diagram



The related parameters of Heater Break Alarm are as below :

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
*HBAC	HbAC	HBA current setting value Upper : heater current display Down : current setting value unit : ampere(A)	100.0	0.0	1.0	Level 1	INP2=4 & ALD1=9
HBOP	HbOP	Output percentage of trigger HBA	100.0	0.0	90.0	Fast	INP2=4 & ALD1=9

* when ALD1=9 & INP2=4，original AL1 become HBAC display

HBA operating conditions
1. Heater current is less than the setting of HBAC
2. OUT1 output exceeds HBOP setting value
3. The conditions of 1 & 2 above are established and continue to exceed 20 seconds

Examples
Heating system with SSR as control element, set HBAC=1.0(down display area)
1. The heater current display value HBAC = 0.0(upper display area), when a heater disconnection occurs
   → The heater current is less than the set value of HBAC=1.0. At this time ,condition 1 is satisfied.
2. The heater no longer heats when the heater disconnection occurs, and the gap between the PV and SV will become larger and larger.
   → The manipulated value of OUT1 is also getting larger and larger, and eventually exceeds 90%. At this time ,condition 2 is
3. Satisfied, alarm_1 will be activated when both 1 & 2 conditions are met and continue for more than 20 seconds.

Parameter setting

Level	Parameter	Set value	Description
1	HBAC	1.0	HBA action current (Unit: A)
Fast	HBOP	90.0	When the output exceeds 90.0%
4	INP2	4	CT current input
3	ALD1	9	HBA Alarm
3	ANL2	-12	Current low-point calibration value (each controller calibrate value is different)
3	ANH2	0x4527	Current High-point calibration value (each controller calibrate value is different)

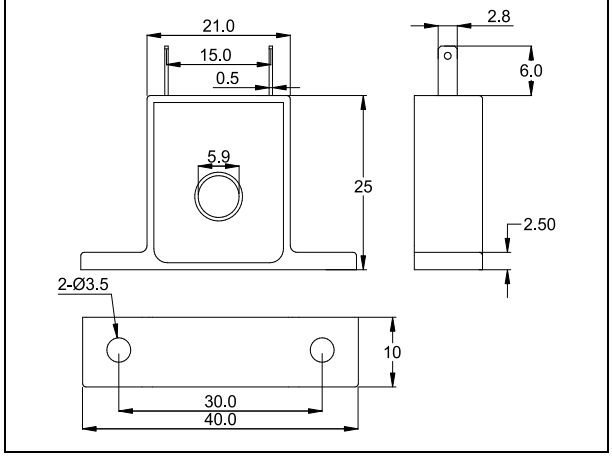
Notes
1. ANL2 & ANH2 is the current signal calibration parameters. It has been calibrated before leaving the factory. do not change these two parameters value.
2. The user only needs to set HBAC & HBOP, the rest of the parameters will be set & calibrated at the factory.
3. CT has two specifications: SC 80-T & SC 100-T. Please check heater wire diameter and specify required CT.

CT Specifications

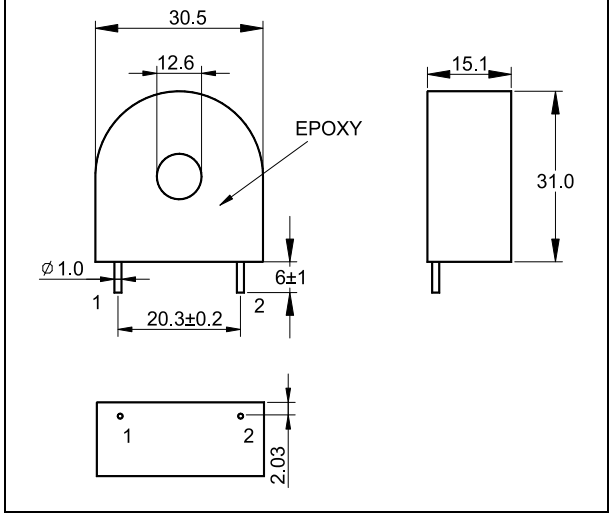
Item	Specifications	
Model number	SC 80-T	SC 100-T
Turns Ratio	800:1	1000:1
Max. continuous current	80A	100A
Accuracy	3%	5%
Aperture	5.9mm	12.6mm
Dieiectric Withstanding Voltage(Hi-pot)	2500Vrms / 1 minute	4000Vrms / 1 minute
Vibration resistance	50 HZ, 98 m/s^2	
Weight	Approx. 12 g	Approx. 30 g

Dimensions (UNIT : mm)

SC 80-T



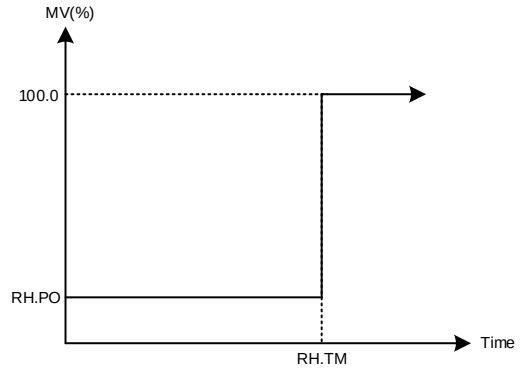
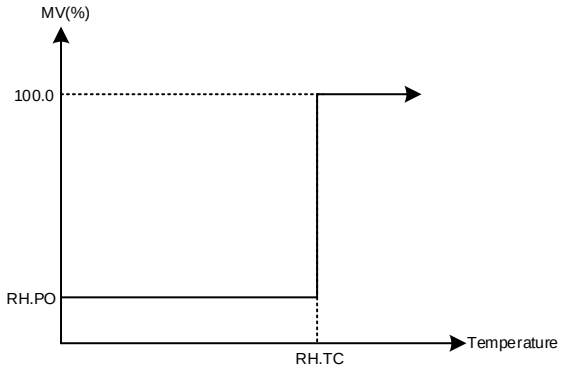
SC 100-T



10.5 Dehumidification Function

Description
The FY/FA series controller provides dehumidification function to protect the heater. When the power is turned on, the heater is dehumidified with low power. When the dehumidification is completed, the normal power is output to the heater.

Function Diagram

Time < RH.TM use RH.PO as manipulated output value	PV < RH.TC use RH.PO as manipulated output value
	

The related parameters of Dehumidification Function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
RH.TC	rHtC	Dehumidification temperature If PV less than RHTC manipulated value = RHPO	200.0	0.0	125.0	Fast	---
RH.PO	rHPo	Dehumidification manipulated value 0 : OFF disable dehumidification function Other values : 0.1~100.0 manipulated value	100.0	OFF	OFF	Fast	---
RH.TM	rHtM	Dehumidification time time format : min.sec	COTI	0.00	15.00	Fast	---

Example
After the controller is turned on, when the PV does not reach 50°C, manipulated value fixed in 20%. When the time exceeds 15 minutes or the PV is greater than 50°C, the controller will produce output of normal PID gain.

Parameter setting

Level	Parameter	Set value	Description
1	SV	100.0	Target temperature
Fast	RH.TC	50.0	Execute de-humidifying function when PV is lower than this temperature
Fast	RH.PO	20.0	When executing dehumidification function the manipulated value fixed in 20%
Fast	RH.TM	15.00	Max dehumidification function time

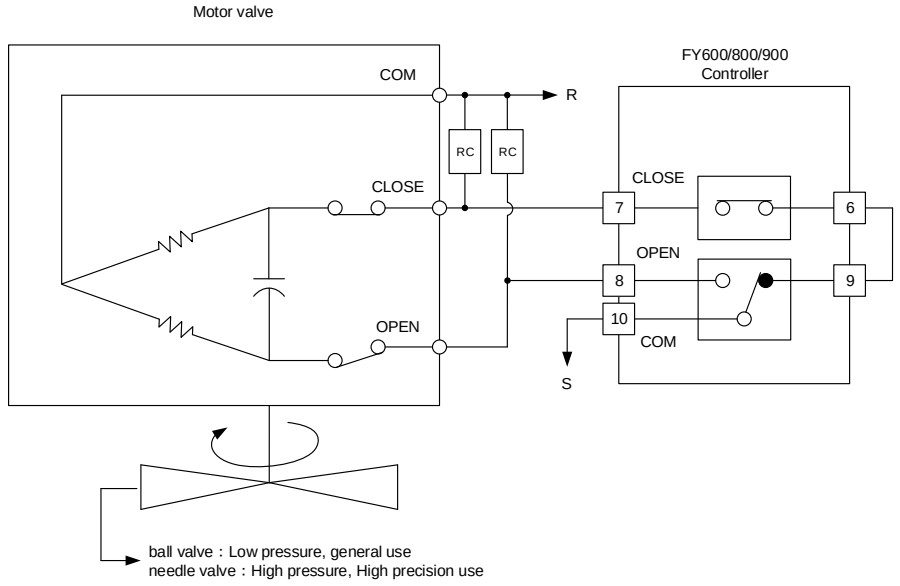
Notes
1. For use in heating mode only (OUD=HEAT)
2. SV must be greater than PV (SV>PV)

10.6 Motor Valve Control

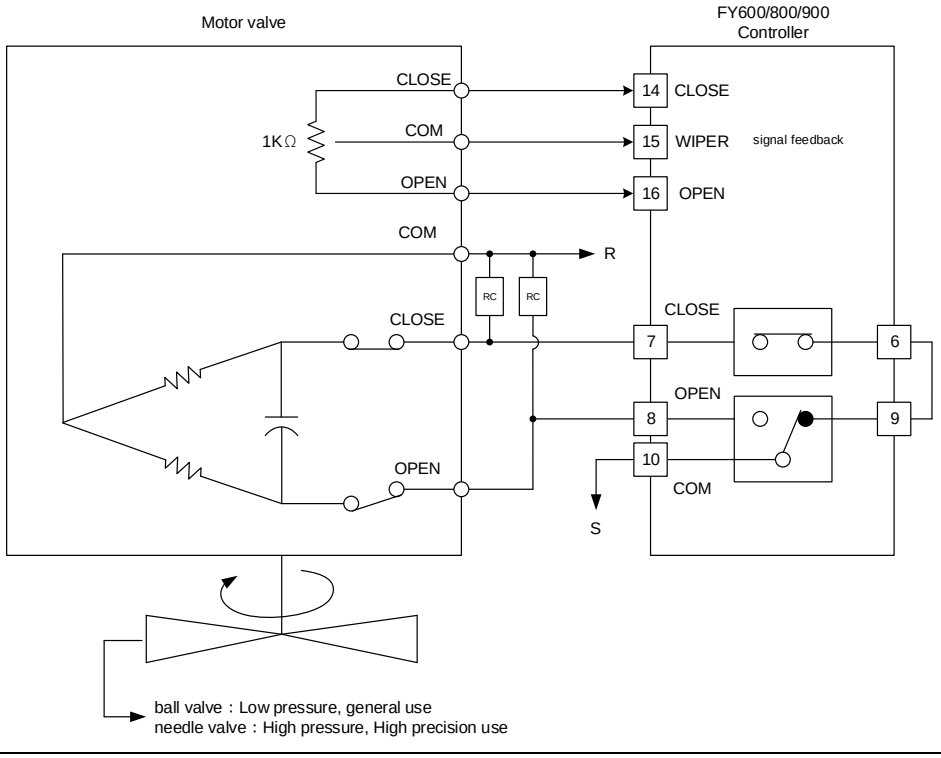
Description
FY/FA motor valve control function converts the control output value of the controller into the corresponding signal to control a motor driven valve and then performs temperature control of a controlled object by regulating fluid flow.

Function Diagram

Without resistance feedback



With resistance feedback



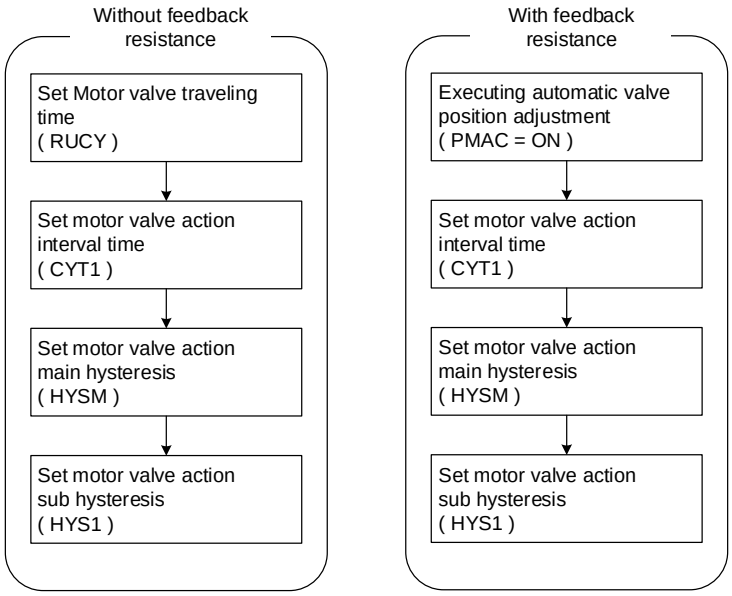
Description of function
When the feedback resistance is provided
1. Adjusting valve position automatically
2. The valve position can be manually changed.
3. Force the controller to switch to no feedback resistance control mode when feedback resistance input breaks
4. High/Low limit of valve position can be set.

When the feedback resistance is not provided:
1. Control motor operation can be restricted by the parameter “OUTL”.
2. The UP/DOWN key is used to output opening or closing signal in manual mode
   2.1 UP key(open-side)：While the UP key is being pressed, open-side output (OUT1) is output continuously. Releasing the UP key turns off the output on the open-side to hold the opened state at that time.
   2.2 DOWN key(close-side)：While the DOWN key is being pressed, close-side output (OUT2) is output continuously. Releasing the DOWN key turns off the output on the closed-side to hold the opened state at that time.

The related parameters of motor valve control function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
PV2	PV2	Valve opening monitor	100.0	0.0	---	Fast	OUTY=2 & SET7.1
OUTY	OUTY	Hardware drive selection 0 : single output control 1 : dual output control 2 : valve control with feedback 3 : valve control without feedback selection 4 : single phase angle control	4	0	0	Level 4	---
INP2	INP2	Sub input type selection 0 : none 1 : 10~50mV / 4~20mA / 1~5V / 2~10V (only available in remote SV) 2 : 0~50mV / 0~20mA / 0~5V / 0~10V (only available in remote SV) 3 : valve feedback 4 : CT input	4	0	0	Level 4	---
PMAC	PMAC	Automatic valve position adjustment 0 : OFF stop automatic adjust 1 : ON start automatic adjust 2 : E_PB Valve position determined by external button	E_PB	OFF	OFF	Fast	OUTY=2
RUCY	RUCY	Motor valve traveling time Time unit：second	150	5	5	Fast	OUTY = 2 or 3
CYT1	CYT1	Motor valve action interval time. Time unit : second	10	1	5	Fast	OUTY = 2 or 3
HYSM	HYSM	Motor valve action main adjustment unit : percentage	5.0	0.0	1.0	Fast	OUTY = 2 or 3
HYS1	HYS1	Motor valve action sub adjustment unit : percentage	HYSM	0	0.5	Fast	OUTY = 2 or 3

Motor valve Initial Setting



1. Executing automatic valve position adjustment

Parameter	Symbol	Content	Default	Level
PMAC	PMAC	Automatic valve position adjustment 0 : OFF stop automatic adjust 1 : ON start automatic adjust 2 : E_PB Valve position determined by external button	OFF	Fast

The motor valve low position(ANL2) and high position(ANH2) are calibrated and the travel time from completely open to completely closed is set automatically

When the measurement has been complete the setting of the parameter will change to OFF."PMER" will be display if any of following errors occurs during execution.If an error occur check the wiring and other factors and execute automatic valve position adjustment again.

2. Setting motor valve traveling time

Parameter	Symbol	Content	Default	Level
RUCY	rUCY	Motor valve traveling time Time unit：second	5	Fast

With feedback resistance mode
Executing automatic valve position adjustment will get RUCY setting value automatically

Without feedback resistance mode
Check the motor valve specification and setting the RUCY value of a manually

3. Setting valve action interval time

Parameter	Symbol	Content	Default	Level
CYT1	CYt1	Motor valve action interval time. Time unit : second	5	Fast

EX1 : Setting CYT1=5, after executing current valve action, If the controller calculates that the valve needs to be closed for 2 seconds, controller will delay 5 seconds before performing close valve action

EX2 : Setting CYT1=7, after executing current valve action, If the controller calculates that the valve needs to be open for 2 seconds, controller will delay 7 seconds before performing open valve action

4. Setting motor valve action main adjustment

Parameter	Symbol	Content	Default	Level
HYSM	HYSM	motor valve action main adjustment unit : percentage	1.0	Fast

When error% accumulates to the set value of HYSM the controller will drive motor valve to eliminate this error%
EX1 : set HYSM =0.5, when error% accumulates to 0.5 the controller will drive motor valve to eliminate this error%
EX2 : set HYSM =1.0, when error% accumulates to 1.0 the controller will drive motor valve to eliminate this error%
The smaller the set value of this parameter, the more frequent the valve action, the more precise the control, but it will also affect the valve life, proper HYSM setting reduces valve operating frequency to protect valve life

5. Setting motor valve action sub adjustment

Parameter	Symbol	Content	Default	Level
HYS1	HYS1	motor valve action sub adjustment unit : percentage	0.5	Fast

When the error% accumulates to the set value of HYSM, the controller will drive the valve to eliminate the set value of HYS1
EX1 : set HYSM =0.5, HYS1 =0.3, when error% accumulates to 0.5% the controller will drive motor valve to eliminate 0.3%
EX2 : set HYSM =1.0，HYS1 =0.5, when error% accumulates to 1.0% the controller will drive motor valve to eliminate 0.5%

6. Setting motor valve high/low limit in resistance feedback control mode

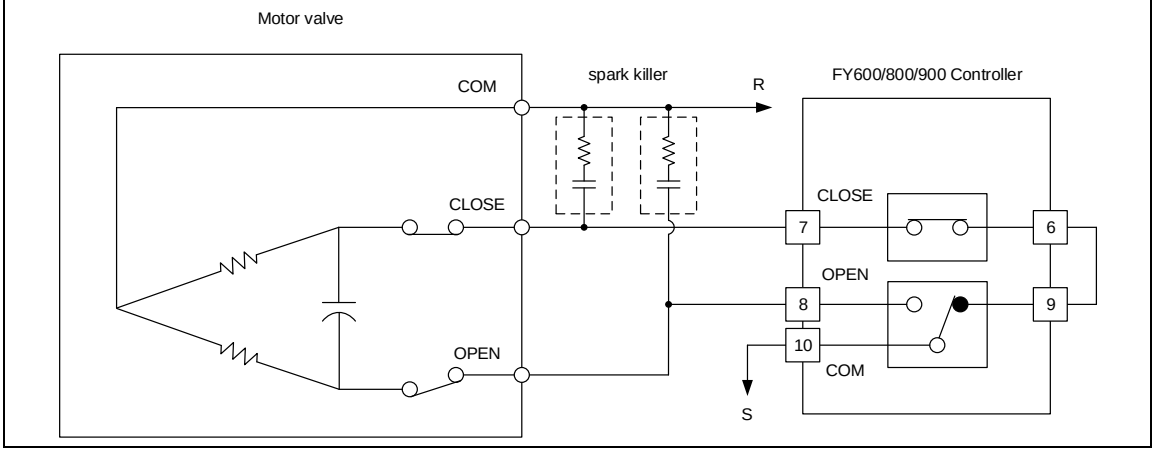
Parameter	Symbol	Content	Default	Level
MOLL	MOLL	low limit of valve position	0.0	Fast
MOLH	MOLH	high limit of valve position	100.0	Fast

EX1 : if you want set 20% low limit of valve position, setting MOLL=20.0
EX2 : if you want set 80% high limit of valve position, setting MOLH=80.0

Notes

1. The lowest valve position and the highest valve position are automatically written into ANL2 & ANH2 after executing automatic valve position adjustment
2. When performing automatic valve position adjustment(PMAC=ON), please make sure that the fuel is closed
3. When the controller detects that the feedback resistance is disconnected, it will automatically switch to no feedback control mode and PV area show “PMER” message
4. It is recommended to install spark killer at the relay junction to prolong the service life of the relay.

Spark killer connection



10.7 RAMP & SOAK

Description
The FY/FA series controller provides a single ramp and soak function, after booting completed, the SV starts to increase according to the set value of RAMP. when the soak condition is met the SOAK function will be executed according to the set value of SOAK, and driving the output and alarm to ON or OFF after the SOAK time is executed finish.

The related parameters of ramp and soak function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
SOAK (AL1)	SOAK	Alarm1 soak time Time format : hr.min	99.59	0.00	0.10	Level 1	ALD1=10 or ALD1=19
SOAK (AL2)	SOAK	Alarm2 soak time Time format : hr.min	99.59	0.00	0.10	Level 1	ALD2=10 or ALD2=19
SOAK (AL3)	SOAK	Alarm3 soak time Time format : hr.min	99.59	0.00	0.10	Level 1	ALD3=10
RAMP (AL3)	rAMP	The rate of change during an SV ramp format : °C / minute	99.99	-19.99	99.99	Level 1	ALD3=9

※ when ALD1=10 or 19, original AL1 become SOAK display
when ALD2=10 or 19, original AL2 become SOAK display
when ALD3=9, original AL3 become RAMP display

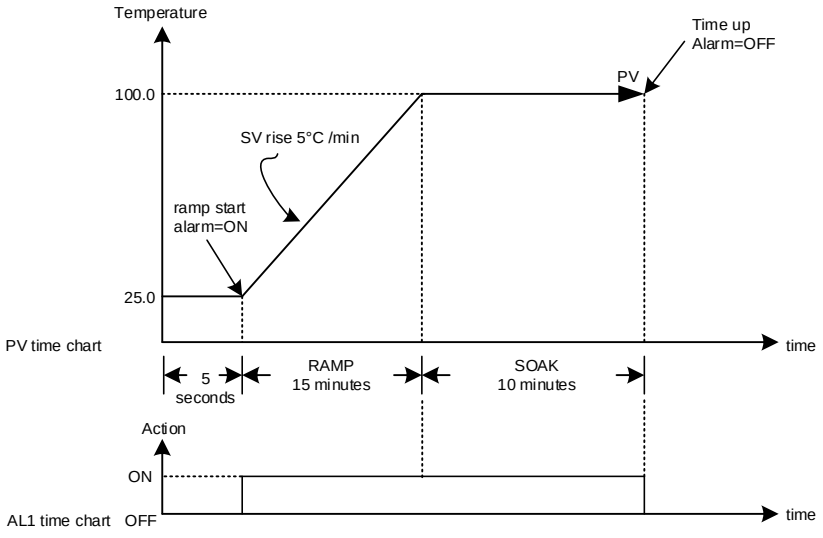
Parameter	Set value	Description
ALDX	10 (SOAK_A)	Boot completed, the alarm is ON. When PV ≥ target SV start the soak timer, alarm and control function are turned OFF in soak time finish (In this mode, the time format is fixed to “hour.minute”)
	19 (SOAK_B)	Boot completed, the alarm is OFF. when PV ≥ target SV start the soak timer, alarm is turned ON and the control function keep ON in soak time finish (In this mode, the time format is fixed to “hour.minute”)

X : 1 / 2(SOAK function available in alarm1 or alarm2)

Example(1) Single RAMP+SOAK_A (ALD3=9 + ALD1=10)
Boot completed, the alarm1 is ON, SV rise 5.00°C per minute. when the PV reaches 100 °C, the temperature is kept for 10 minutes. after 10 minutes alarm1 and control function are turned OFF

Parameter setting

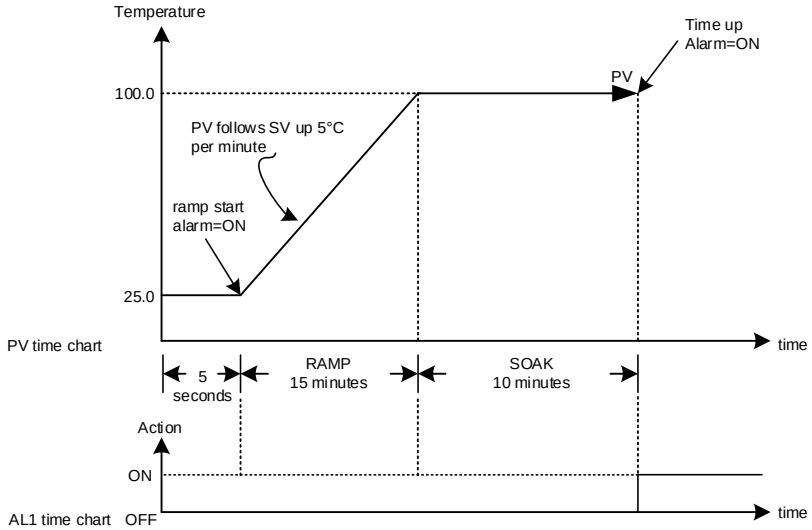
Level	Parameter	Set value	Description
1	SV	100.0	Target temperature
4	SET2.1	1	Display AL3
4	SET4.1	1	Display ALD3
3	ALD1	10	AL1 as soak timer
3	ALD3	9	Enable RAMP function
1	SOAK(AL1)	0.10	Soak for 10 minutes
1	RAMP(AL3)	5.00	5.00°C rise per minute



Example(2) Single RAMP+SOAK_B (ALD3=9 + ALD1=19)
Boot completed, the alarm1 is OFF, SV rise 5.00°C rise per minute. when the PV reaches 100 °C, the temperature is kept for 10 minutes. after 10 minutes alarm is turned ON and the control function keep ON

Parameter setting

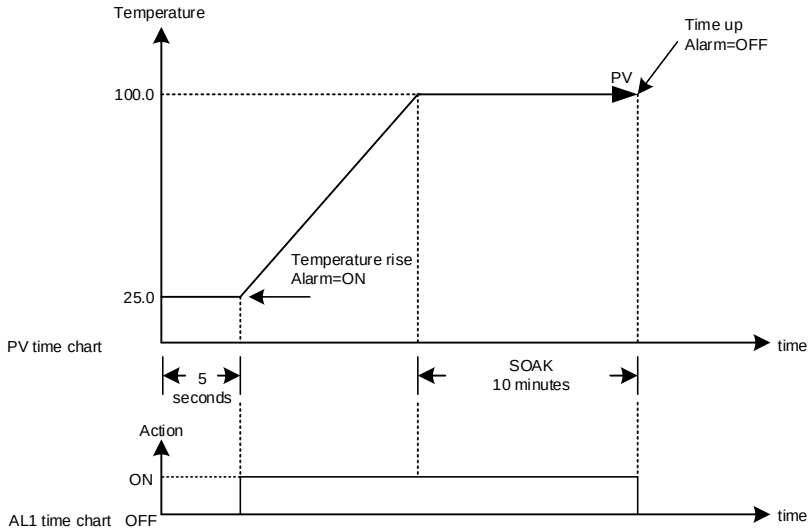
Level	Parameter	Set value	Description
1	SV	100.0	Target temperature
4	SET2.1	1	Display AL3
4	SET4.1	1	Display ALD3
3	ALD1	19	AL1 as soak timer
3	ALD3	9	Enable RAMP function
1	SOAK(AL1)	0.10	Soak for 10 minutes
1	RAMP(AL3)	5.00	5.00°C rise per minute



Example(3) only use SOAK_A (ALD1=10)
Boot completed, the alarm1 is ON, and the PV is directly controlled at 100 °C. when the PV reaches 100 °C, the temperature is kept for 10 minutes. after 10 minutes alarm1 and control function are turned OFF

Parameter setting

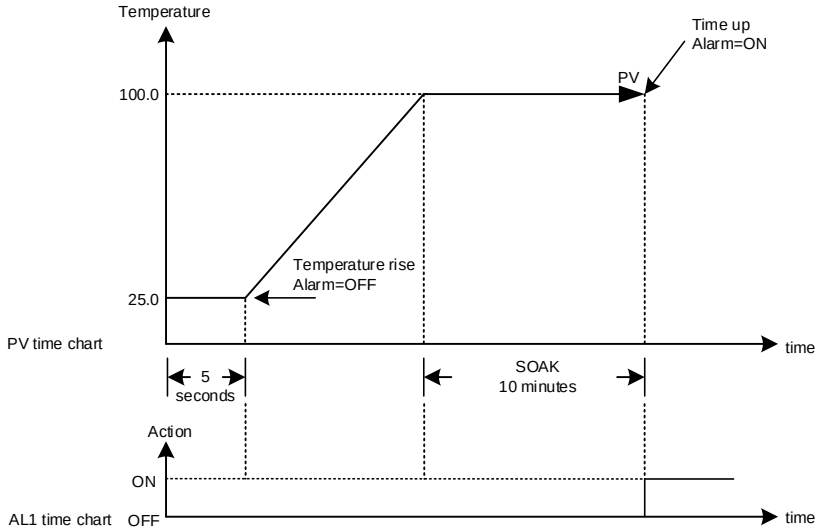
Level	Parameter	Set value	Description
1	SV	100.0	Target temperature
3	ALD1	10	AL1 as soak timer
1	SOAK(AL1)	00.10	Soak for 10 minutes



Example(4) only use SOAK_B (ALD1=19)
Boot completed, the alarm1 is OFF, and the PV is directly controlled at 100 °C. when the PV reaches 100 °C, the temperature is kept for 10 minutes. after 10 minutes alarm is turned ON and the control function keep ON

Parameter setting

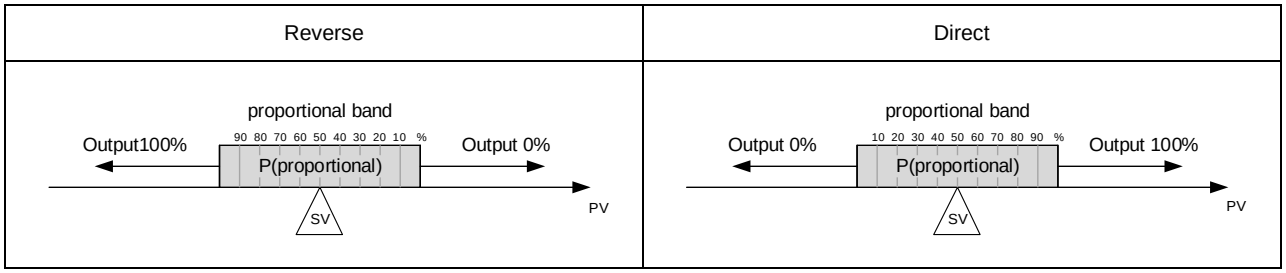
Level	Parameter	Set value	Description
1	SV	100.0	Target temperature
3	ALD1	10	AL1 as soak timer
1	SOAK(AL1)	00.10	Soak for 10 minutes



10.8 Proportional Control

Description
Proportional control is one of the simplest ways to control method, controller manipulated value proportional to input error signal, this chapter explains how to set related parameters.

Function Diagram

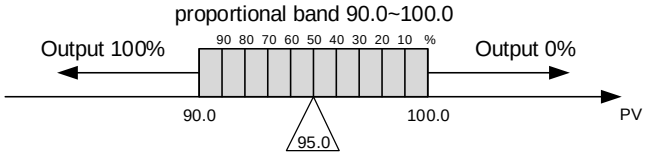


The related parameters of proportional control are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
SV	---	Set value	USPL	LSPL	---	Level 1	---
P1	P1	Main output proportional band 0.0 : ON/OFF control Other values : proportional band setting value	200.0	0.0	3.0	Level 2	---
OUD	OUD	Control action selection 0 : HEAT reverse action 1 : COOL direct action	COOL	HEAT	HEAT	Level 3	SET7.2

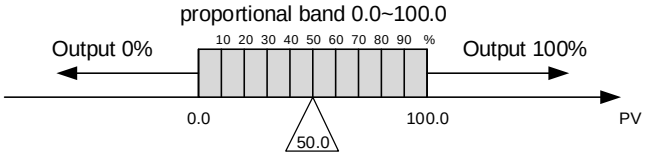
Setting step
1. Select control action
2. Determine the proportional band
3. Set SV, SV = (proportional band maximum + proportional band minimum) / 2
4. Full range = (Range maximum – range minimum)
5. Calculate P = ((proportional band maximum - proportional band minimum) / Full range) x 100

Example 1 :
INP1 = K1(-50.0~600.0) when PV in the range of 90.0 ~ 100.0 output proportional(decrease) SV= ? P= ?



1. OUD = HEAT(Reverse)
2. Proportional band→ 90.0~100.0
3. SV = (proportional band maximum + proportional band minimum) / 2
   → (100.0 + 90.0) / 2 = 95.0
4. Full range = (Range maximum – range minimum)
   → 600.0 - (-50.0) = 650.0
5. P= ((proportional band maximum - proportional band minimum) / Full range) x 100
   → ((100.0-90.0) / 650.0) x 100 = 1.5384(approx 1.5)

Example 2 :
INP1= AN4(0.0~100.0) when PV in the range of 0.0 ~ 100.0 output proportional(increase) SV= ? P= ?



1. OUD = COOL(Direct)
2. Proportional band→ 0.0~100.0
3. SV = (proportional band maximum + proportional band minimum) / 2
   → (100.0 + 0.0) / 2 = 50.0

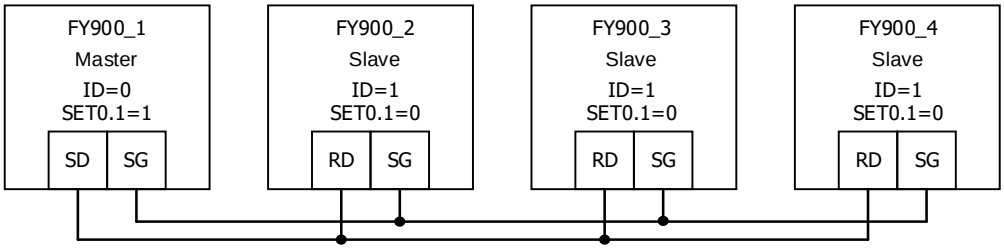
4. Full range = (Range maximum – range minimum)
   → 100.0 - 0.0 = 100.0
5. P= ((proportional band maximum - proportional band minimum) / Full range) x 100
   → ((100.0-0.0) / 100.0) x 100 = 100.0

Notes
1. When using proportional control I1 and D1 must be set to 0
2. Full range please check Chapter 4 “Input Range Table”
3. Only using proportional control will eventually have a steady state error

10.9 Master-Slave communication

Description
Transmission master controller SV to slave controller SV, all slave controller SV can be consistent

Wiring



The related parameters of master-slave communication are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
RATE	rAtE	Slave SV rate RATE SV = SV x (RATE/9999)	9999	0	9999	Level 1	SET2.1 & SET0.2
PSL	PSL	Protocol selection 0 : TAIE 1 : RTU (Please refer to communication manual)	RTU	TAIE	TAIE	Level 3	SET5.4
BITS	bitS	Data format 0 : O_81 (parity bit=odd, stop bit=1) 1 : O_82 (parity bit=odd, stop bit=2) 2 : E_81 (parity bit=even, stop bit=1) 3 : E_82 (parity bit=even, stop bit=2) 4 : N_81 (parity bit=none, stop bit=1) 5 : N_82 (parity bit=none, stop bit=2)	N_82	O_81	O_81	Level 3	SET5.4
IDNO	idnO	Controller station	254	0	1	Level 3	SET5.4
BAUD	bAUd	Baud rate 0 : 24(2400) 1 : 48(4800) 2 : 96(9600) 3 : 192(19200) 4 : 384(38400) 5 : 576(57600) 6 : 1152(115200) bps	1152	24	96	Level 3	SET5.4
SET0.1	SEt0	0 : TTL Communication (Slave) 1 : TTL Communication (Master)	1	0	0	Level 4	---
SET0.2	SEt0	0 : RATE hide 1 : RATE display	1	0	0	Level 4	---

Master controller setting step
1. IDNO= 0, PSL= TAIE
2. BITS= O_81, BAUD= 96
3. SET0.1= 1
4. SET0.2= 0
5. After completing the above steps, master controller start to transmit SV to slave controller SV

Slave controller setting step
1. IDNO= 1, PSL= TAIE
2. BITS= O_81, BAUD= 96
3. SET0.1= 0
4. SET0.2= 1
5. RATE= 9999
6. After completing the above steps, slave controller start to receive master controller SV

Notes
1. Afer adding master-slave communication, RS-485 communication not available
2. Master-slave communication only available in TAIE protocol(PSL= TAIE)
3. Master controller does not use parameter RATE, to attenuate the SV received by slave controller just adjust parameter RATE
4. Master controller can connect up to 10 slave controllers, and the wiring between every controller should not exceed 1 meter.

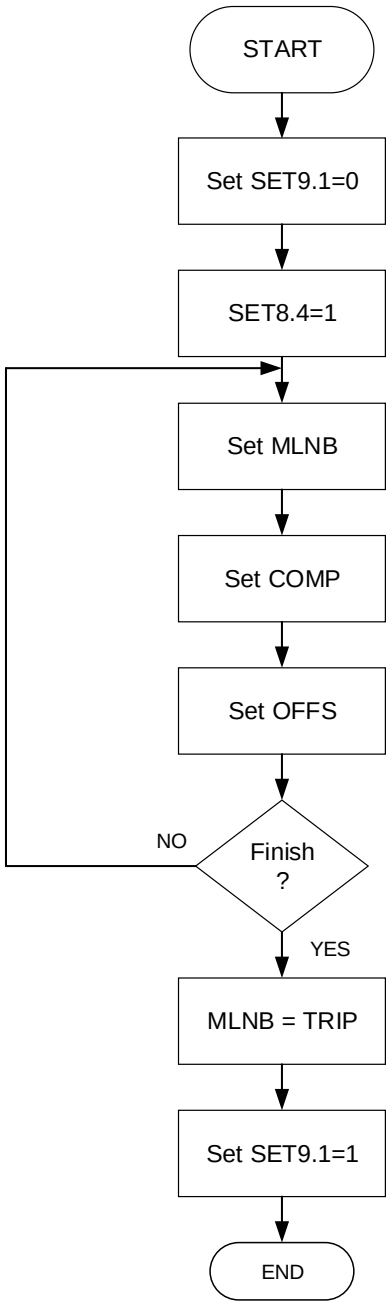
10.10 Piece Linear Compensation

Description
When the analog input signal source is nonlinear, using piece linear compensation method to compensate this signal, make it linearity

The related parameters of piece linear compensation are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/Display
			MAX	MIN			
MLNB	MLNB	Piece linear compensation segment select TRIP : leave setting loop 1~10 : segment select	10	TRIP	TRIP	Fast	SET8.4
COMP	COMP	Piece linear compare value	USPL	LSPL	LSPL	Fast	SET8.4
OFFS	OFFS	Piece linear offset value	150.0	-150.0	0.0	Fast	SET8.4
SET8.4	SET8	0 : MLNB, COMP, OFFS hide 1 : MLNB, COMP, OFFS display	1	0	0	Level 4	---
SET9.1	SET9	0 : Disable piece linear compensation 1 : Enable piece linear compensation	1	0	0	Level 4	---

Edit flow-chat



Set MLNB

Parameter	LED display	Description	Default	Level
MLNB	MLNB	Piece linear compensation segment select TRIP : leave setting loop 1~10 : segment select	TRIP	Fast

When MLNB≠TRIP the display loop in MLNB → COMP → OFFS
When MLNB=TRIP leave piece linear compensation parameter loop

Set COMP

Parameter	LED display	Description	Default	Level
COMP	COMP	Piece linear compensation compare value	LSPL	Fast

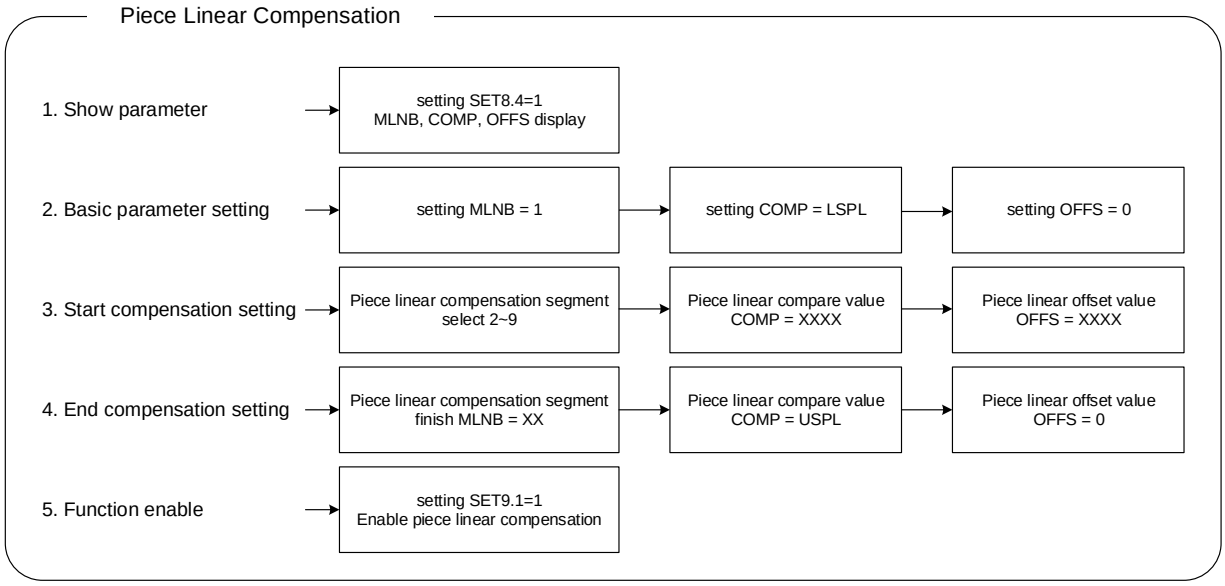
When non-linear signal value within the set value of COMP, it needs to be compensated.
First COMP set value=LSPL
First COMP set value=USPL

Set OFFS

Parameter	LED display	Description	Default	Level
OFFS	OFFS	Piece linear compensation offset value	0.0	Fast

When non-linear signal value within the set value of COMP, OFFS use for increase or decrease original non-linear signal

Before the function starts

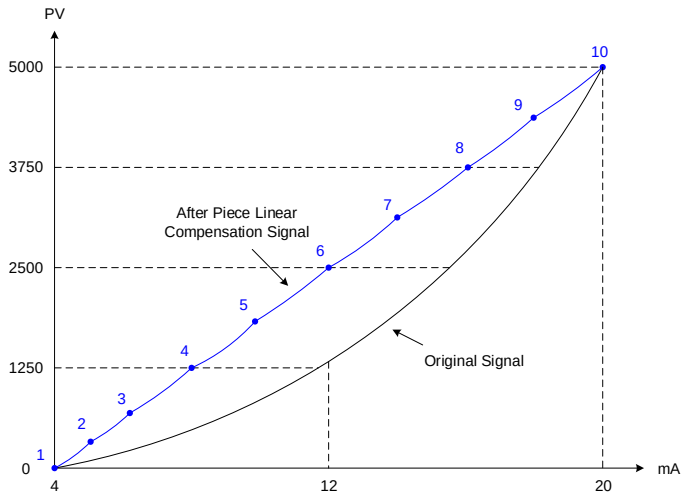


Example1
Assume signal source is a nonlinear signal within 320 °C, and the controller is set to correct at three temperature points.

(1) When the temperature is 95°C, it needs to be corrected by +5°C.
(2) When the temperature is 185°C, it needs to be corrected by +15°C.
(3) When the temperature is 320°C, it needs to be corrected by +30°C.

Step 1: Set SET8.4=1 and SET9.1=0
Step 2: Set MLNB = 1, COMP = LSPL, OFFS = 0
Step 3: set MLNB = 2, COMP = 95, OFFS = 5
Step 4: Set MLNB = 3, COMP = 185, OFFS = 15
Step 5: Set MLNB = 4, COMP = 320, OFFS = 30
Step 6: Set MLNB = 5, COMP = USPL, OFFS = 0
Step 7: Set MLNB = TRIP and SET9.1=1

Example2
Input signal 4~20mA, range 0~5000, the input signal is nonlinear (as shown in the figure below), use 10 points piece linear compensation.



Step1：SET9.1 = 0 disable function
Step2：SET8.4 = 1 display MLNB、COMP、OFFS
Step3：MLNB = 1, COMP = 0(LSPL), OFFS = 0
Step4：MLNB = 2, COMP = 100, OFFS = 400
Step5：MLNB = 3, COMP = 150, OFFS = 550
Step6：MLNB = 4, COMP = 500, OFFS = 750
Step7：MLNB = 5, COMP = 800, OFFS = 1075
Step8：MLNB = 6, COMP = 1300, OFFS = 1200
Step9：MLNB = 7, COMP = 1900, OFFS = 1225
Step10：MLNB = 8, COMP = 2650, OFFS = 1100
Step11：MLNB = 9, COMP = 3720, OFFS = 680
Step12：MLNB = 10, COMP = 5000(USPL), OFFS = 0
Step13：SET9.1 = 1 enable function

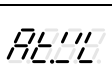
Notes
1. The Piece Linear Compensation function must be enabled (SET9.1=1) when MLNB, COMP, OFFS are set, otherwise the controller may display an error message.
2. Regardless of the number of use segments, the first segment COMP must be equal to LSPL, the last segment COMP must be equal to USPL.

10.11 Auto-tuning and Startup tuning

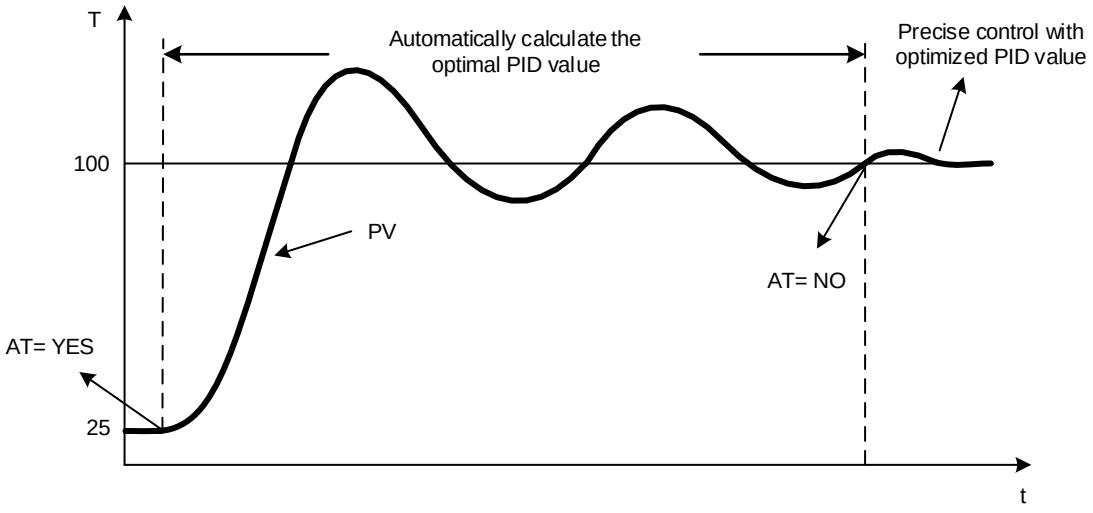
Description
Auto-tuning
When AT is executed, the optimum PID constants for the SV at that time are set automatically. A method (called the limit cycle method) for forcibly changing the manipulated variable and finding the characteristics of the control object is employed.

Startup tuning
As simple auto-tuning, the PID values can be found in a short time without disturbing controllability for controlled systems with slow response at power ON.

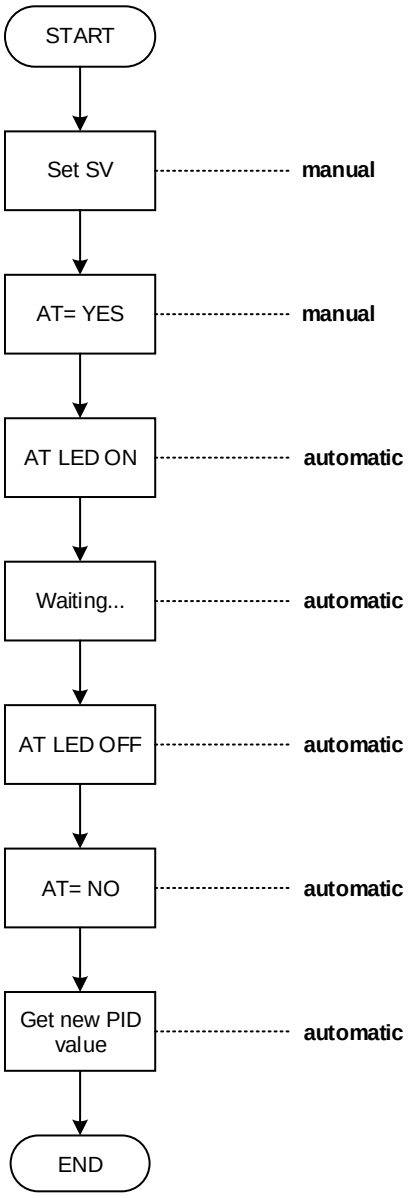
The related parameters of Auto-tuning and Startup tuning function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/Display
			MAX	MIN			
AT		Auto-tuning execute selection 0 : NO (PID control) 1 : YES (execute auto-tuning) 2 : PR.TU (Startup tuning, execute once) 3 : PRTU (Startup tuning, execute always when reboot)	PRTU	NO	NO	Level 1	SET1.2
AT.VL		Auto-tuning offset value execute auto-tuning in (SV-ATVL) point	100.0	-100.0	0.0	Level 2	---

Auto-tuning diagram

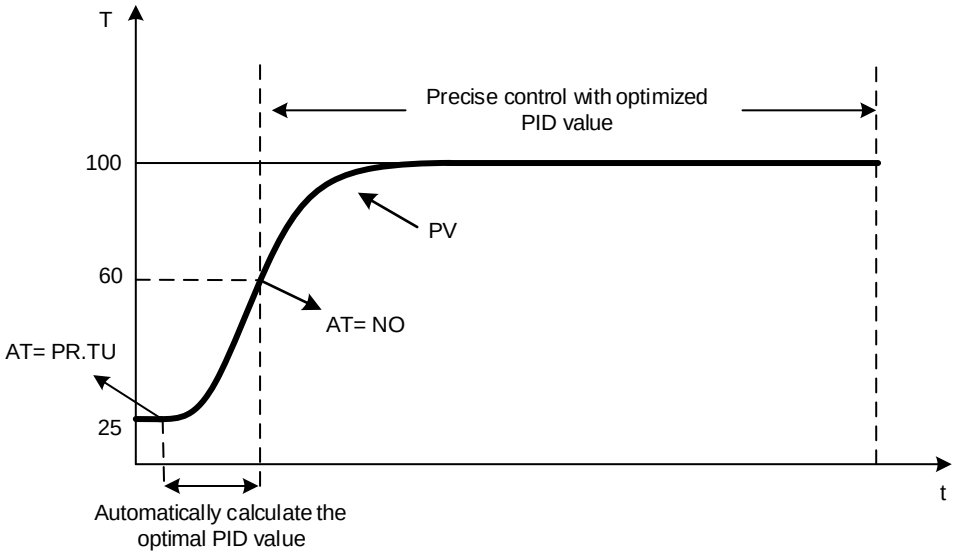


Auto-tuning execution flow



Notes
1. During the execution of auto-tuning, PV will change significantly, do not production during this period
2. During the execution of auto-tuning, please release the function of limiting the output percentage first(set OUTL=100.0)
3. If the alarm terminal link to output terminal, please release it before the execution of auto-tuning.
4. if execute auto-tuning over 2 hours, the controller will return to the control state and display the auto-tuning failure message (AUTF)
5. If the system components (**e.g.** heater, sensor...) are replaced, please execute the auto-tuning again
6. Auto-tuning can be used for heating or cooling equipment
7. Perform auto-tuning on the dual-output controller, the PID values on the heating side and cooling side will be updated at the same time
8. Can perform auto-tuning at any temperature

Startup tuning diagram



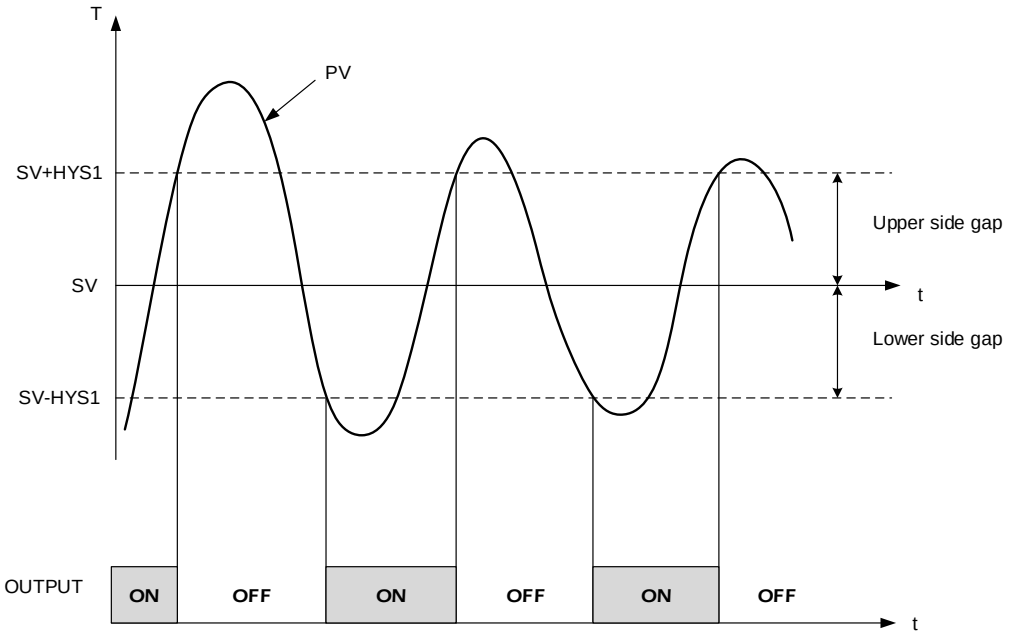
Notes

1. When executing the startup tuning, there is no AT led indicator, when PV > (SV x 0.6), the startup-tuning will be completed.
2. The startup tuning only available in heating equipment, can't be used in cooling equipment
3. Startup tuning only available in single output controller, and can't be used in dual output controller
4. The gap between SV and PV must be greater than full range x 0.06 before the startup tuning is started
   e.g. K1= -50.0~600.0，full range= 650.0 (650.0 x 0.06) = 39
   PV= 25.0，SV must be greater than 64(25+39) startup tuning can't be action
5. Please perform the startup tuning when the system is not heated and the PV is at room temperature

10.12 ON / OFF Control

Description
In ON/OFF control, the output is turned on or off depending on the measured value (PV) whether it is above or below the Set value (SV), user can set a hysteresis zone to prevent turned on and off too frequently for a small change of temperature.

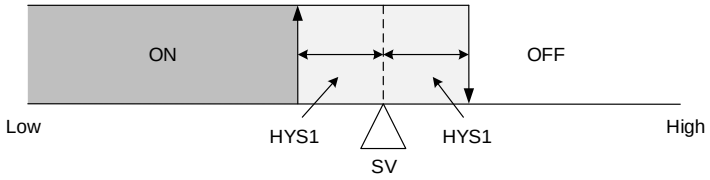
Function Diagram (single output, heat mode)



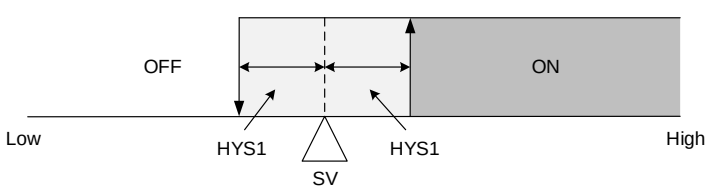
The related parameters of ON/OFF control are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
P1	P1	Main output proportional band 0.0 : ON/OFF control Other values : proportional band setting value	200.0	0.0	3.0	Level 2	---
HYS1	HYS1	Hysteresis for main output on/off control use(when P1 = 0.0 appear)	100.0	-100.0	1.0	Level 2	P1 = 0.0
P2	P2	Sub output proportional band 0.0 : ON/OFF control Other values : proportional band setting value	200.0	0.0	3.0	Level 2	OUTY = 1
HYS2	HYS2	Hysteresis for sub output on/off control use(when P2 = 0.0 appear)	100.0	-100.0	1.0	Level 2	P2 = 0.0
GAP1	GAP1	Control gap (for main output)	1000	-1000	0	Level 2	OUTY = 1
GAP2	GAP2	Control gap (for sub output)	1000	-1000	0	Level 2	OUTY = 1
OUD	OUD	Control action selection 0 : HEAT reverse action 1 : COOL direct action	COOL	HEAT	HEAT	Level 3	SET7.2

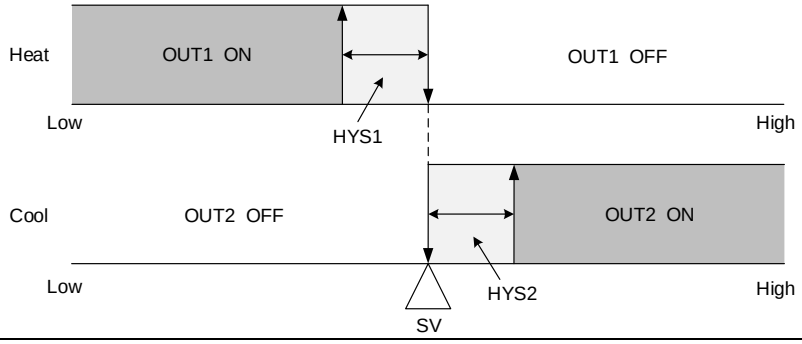
Example(1)
single output, heat mode

Description	When PV<=95.0℃ OUT1：ON，When PV>=105.0℃ OUT1：OFF
Formula	PV ≥ (SV + HYS1) → OUT1 OFF PV ≤ (SV - HYS1) → OUT1 ON
diagram	
Parameter setting	SV=100.0
	P1=0.0
	HYS1=5.0
	OUD=HEAT

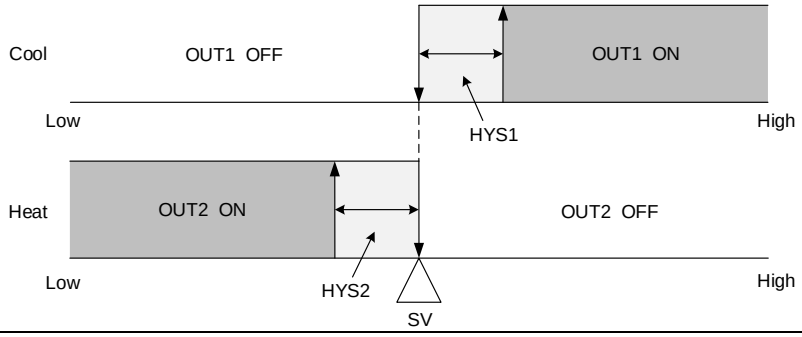
Example(2)
single output, cool mode

Description	When PV>=20.0℃ OUT1：ON，When PV<=10.0℃ OUT1：OFF
Formula	PV ≥ (SV + HYS1) → OUT1 ON PV ≤ (SV - HYS1) → OUT1 OFF
diagram	
Parameter setting	SV=15.0
	P1=0.0
	HYS1=5.0
	OUD=COOL

Example(3)
dual output(OUT1：heat mode, OUT2：cool mode)

Formula	heat side	PV ≥ (SV + GAP1) → OUT1 OFF PV < (SV + GAP1 - HYS1) → OUT1 ON
	Cool side	PV ≤ (SV + GAP2) → OUT2 OFF PV > (SV + GAP2 - HYS2) → OUT2 ON
diagram		

Example(4)
dual output(OUT1：cool mode, OUT2：heat mode)

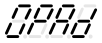
Formula	Cool side	PV ≤ (SV + GAP1) → OUT1 OFF PV > (SV + GAP1 + HYS1) → OUT1 ON
	heat side	PV ≥ (SV + GAP2) → OUT2 OFF PV < (SV + GAP2 - HYS2) → OUT2 ON
diagram		

Notes
1. There is a large control error in ON/OFF control compared with PID control
2. Do not set the hysteresis parameter HYS1/HYS2 too small, so as to avoid frequent action of the relay and affect the lifetime
3. When performing ON/OFF control in dual output mode, both sets of outputs must be used for ON/OFF control, please do not adjust to one set of PID control and one set of ON/OFF control

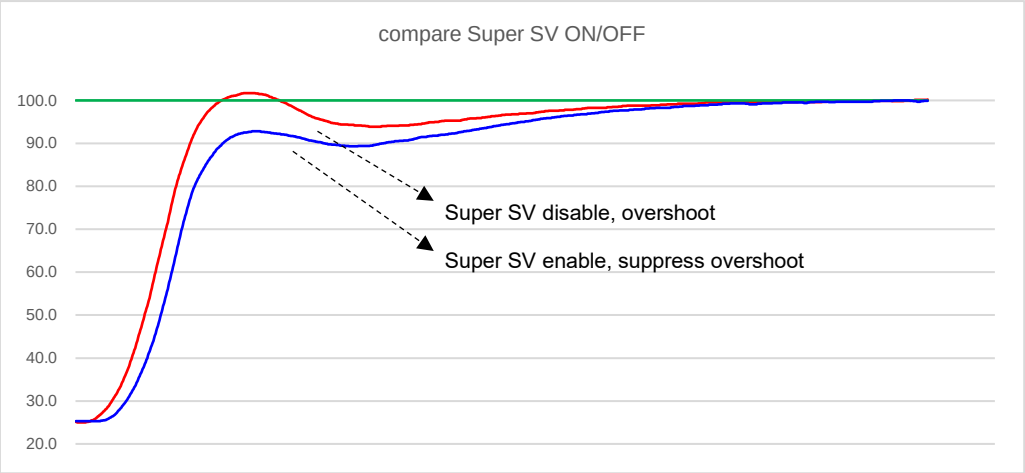
10.13 Super SV

Description
When the SV is changed, the output increases, massive output may cause overshoot and damage the system.
FY series controllers provide the Super SV function, which can effectively suppress the overshoot

The related parameters of Super SV are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
OPAD		Super SV function, suppressing overshoot 0 : OFF 1 : ON	ON	OFF	OFF	Level 3	SET7.3

Example
Set the SV to 100.0°C, use the default PID value to control the industrial oven,
and compare the control curves of Super SV function on or off



Notes
1. The time to reach the set value after enabling Super SV function may be longer than the time without Super SV function
2. I (Integral) value cannot be zero when using Super SV function
3. Super SV function is recommended for single output heating system

10.14 Input Math Function

Description
TFY series controllers provide advance mathematical function in terms of input linear signals, such as inverse, square root, square etc. Users can directly connect differential pressure type flow transmitter to controller, or other transmitters that require special conversion.

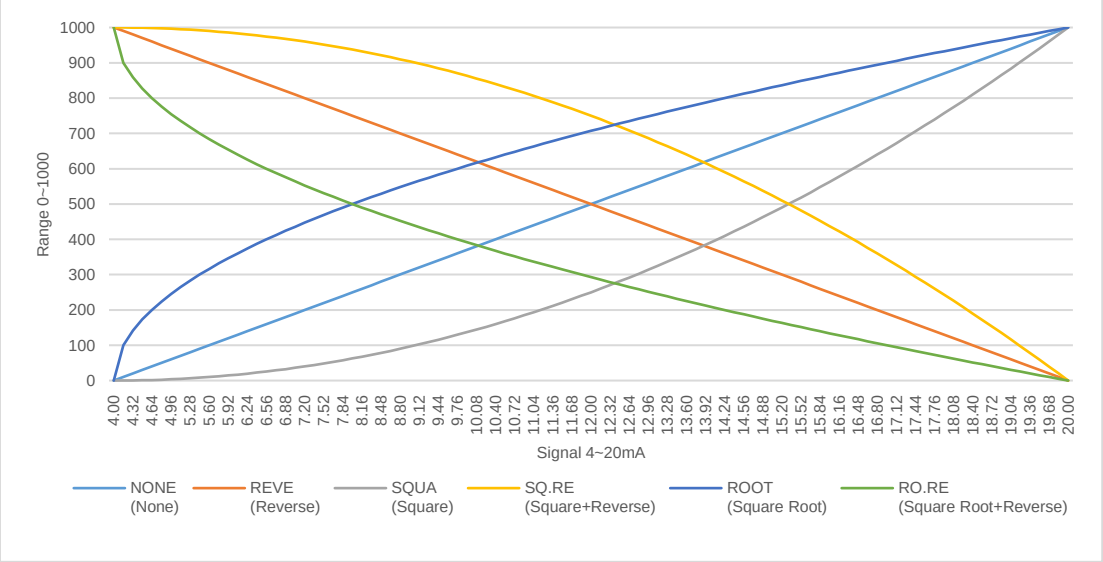
The related parameters of Input math function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
LSPL	LSPL	Input scale low	9999	-1999	---	Level 3	SET2.3
USPL	USPL	Input scale high	9999	-1999	---	Level 3	SET2.3
MV.SF	MV.SF	Analog input special function selection 0 : NONE (special function OFF) 1 : SQUA (analog input square) 2 : ROOT (analog input square root) 3 : REVE (analog input reverse) 4 : SQ.RE (analog input square reverse) 5 : RO.RE (analog input square root reverse)	RO.RE	NONE	NONE	Fast Level	INP1= AN1~AN4

Notes
1. The parameter MV.SF is only available in when the input signal is a linear signal (INP1=AN1~AN4)
2. When using the SQUA/ROOT/SQ.RE/RO.RE function, you must ensure that the range is a positive range

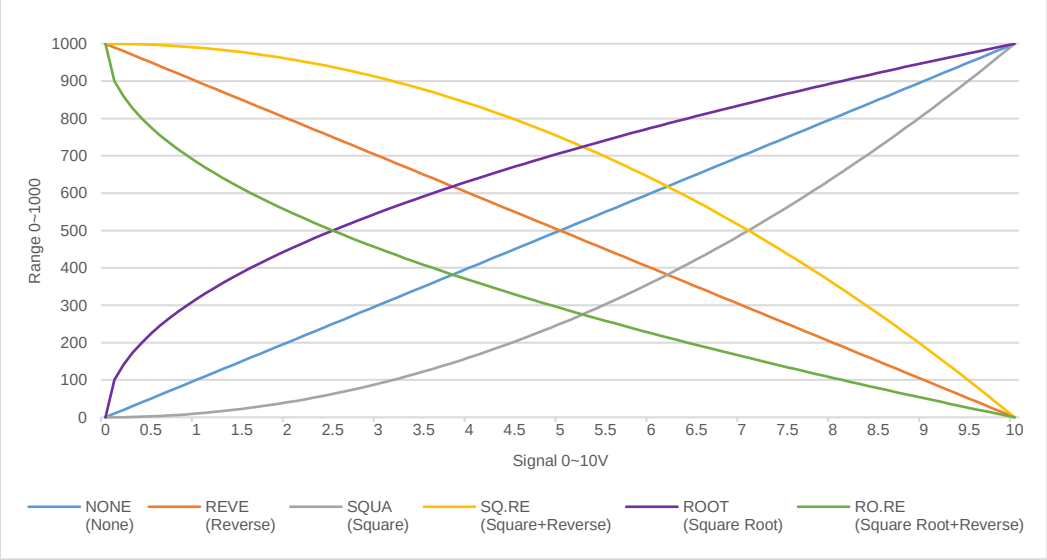
Example(1)
Input signal 4~20mA aim range 0~1000, the value and graphical representation of MV.SF functions

input signal 4~20mA	NONE	REVE (reverse)	SQUA (square)	SQ.RE (square+ reverse)	ROOT (square root)	RO.RE (square root+ reverse)
4.00	0	1000	0.0	1000.0	0.00	1000.00
4.32	20	980	0.4	999.6	141.42	858.58
4.64	40	960	1.6	998.4	200.00	800.00
4.96	60	940	3.6	996.4	244.95	755.05
5.28	80	920	6.4	993.6	282.84	717.16
5.60	100	900	10.0	990.0	316.23	683.77
5.92	120	880	14.4	985.6	346.41	653.59
6.24	140	860	19.6	980.4	374.17	625.83
6.56	160	840	25.6	974.4	400.00	600.00
6.88	180	820	32.4	967.6	424.26	575.74
7.20	200	800	40.0	960.0	447.21	552.79
7.52	220	780	48.4	951.6	469.04	530.96
7.84	240	760	57.6	942.4	489.90	510.10
8.16	260	740	67.6	932.4	509.90	490.10
8.48	280	720	78.4	921.6	529.15	470.85
8.80	300	700	90.0	910.0	547.72	452.28
9.12	320	680	102.4	897.6	565.69	434.31
9.44	340	660	115.6	884.4	583.10	416.90
9.76	360	640	129.6	870.4	600.00	400.00
10.08	380	620	144.4	855.6	616.44	383.56
10.40	400	600	160.0	840.0	632.46	367.54
10.72	420	580	176.4	823.6	648.07	351.93
11.04	440	560	193.6	806.4	663.32	336.68
11.36	460	540	211.6	788.4	678.23	321.77
11.68	480	520	230.4	769.6	692.82	307.18
12.00	500	500	250.0	750.0	707.11	292.89
12.32	520	480	270.4	729.6	721.11	278.89
12.64	540	460	291.6	708.4	734.85	265.15
12.96	560	440	313.6	686.4	748.33	251.67
13.28	580	420	336.4	663.6	761.58	238.42
13.60	600	400	360.0	640.0	774.60	225.40
13.92	620	380	384.4	615.6	787.40	212.60
14.24	640	360	409.6	590.4	800.00	200.00
14.56	660	340	435.6	564.4	812.40	187.60
14.88	680	320	462.4	537.6	824.62	175.38
15.20	700	300	490.0	510.0	836.66	163.34
15.52	720	280	518.4	481.6	848.53	151.47
15.84	740	260	547.6	452.4	860.23	139.77
16.16	760	240	577.6	422.4	871.78	128.22
16.48	780	220	608.4	391.6	883.18	116.82
16.80	800	200	640.0	360.0	894.43	105.57
17.12	820	180	672.4	327.6	905.54	94.46
17.44	840	160	705.6	294.4	916.52	83.48
17.76	860	140	739.6	260.4	927.36	72.64
18.08	880	120	774.4	225.6	938.08	61.92
18.40	900	100	810.0	190.0	948.68	51.32
18.72	920	80	846.4	153.6	959.17	40.83
19.04	940	60	883.6	116.4	969.54	30.46
19.36	960	40	921.6	78.4	979.80	20.20
19.68	980	20	960.4	39.6	989.95	10.05
20.00	1000	0	1000.0	0.0	1000.00	0.00



Example(2)
Input signal 0~10V aim range 0~1000, the value and graphical representation of MV.SF functions

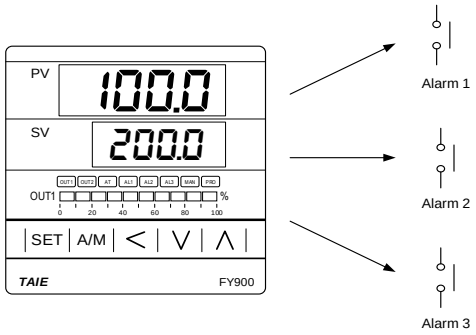
input signal 0~10V	NONE	REVE (reverse)	SQUA (square)	SQ.RE (square+ reverse)	ROOT (square root)	RO.RE (square root+ reverse)
0.0	0	1000	0.0	1000.0	0.00	1000.00
0.2	20	980	0.4	999.6	141.42	858.58
0.4	40	960	1.6	998.4	200.00	800.00
0.6	60	940	3.6	996.4	244.95	755.05
0.8	80	920	6.4	993.6	282.84	717.16
1.0	100	900	10.0	990.0	316.23	683.77
1.2	120	880	14.4	985.6	346.41	653.59
1.4	140	860	19.6	980.4	374.17	625.83
1.6	160	840	25.6	974.4	400.00	600.00
1.8	180	820	32.4	967.6	424.26	575.74
2.0	200	800	40.0	960.0	447.21	552.79
2.2	220	780	48.4	951.6	469.04	530.96
2.4	240	760	57.6	942.4	489.90	510.10
2.6	260	740	67.6	932.4	509.90	490.10
2.8	280	720	78.4	921.6	529.15	470.85
3.0	300	700	90.0	910.0	547.72	452.28
3.2	320	680	102.4	897.6	565.69	434.31
3.4	340	660	115.6	884.4	583.10	416.90
3.6	360	640	129.6	870.4	600.00	400.00
3.8	380	620	144.4	855.6	616.44	383.56
4.0	400	600	160.0	840.0	632.46	367.54
4.2	420	580	176.4	823.6	648.07	351.93
4.4	440	560	193.6	806.4	663.32	336.68
4.6	460	540	211.6	788.4	678.23	321.77
4.8	480	520	230.4	769.6	692.82	307.18
5.0	500	500	250.0	750.0	707.11	292.89
5.2	520	480	270.4	729.6	721.11	278.89
5.4	540	460	291.6	708.4	734.85	265.15
5.6	560	440	313.6	686.4	748.33	251.67
5.8	580	420	336.4	663.6	761.58	238.42
6.0	600	400	360.0	640.0	774.60	225.40
6.2	620	380	384.4	615.6	787.40	212.60
6.4	640	360	409.6	590.4	800.00	200.00
6.6	660	340	435.6	564.4	812.40	187.60
6.8	680	320	462.4	537.6	824.62	175.38
7.0	700	300	490.0	510.0	836.66	163.34
7.2	720	280	518.4	481.6	848.53	151.47
7.4	740	260	547.6	452.4	860.23	139.77
7.6	760	240	577.6	422.4	871.78	128.22
7.8	780	220	608.4	391.6	883.18	116.82
8.0	800	200	640.0	360.0	894.43	105.57
8.2	820	180	672.4	327.6	905.54	94.46
8.4	840	160	705.6	294.4	916.52	83.48
8.6	860	140	739.6	260.4	927.36	72.64
8.8	880	120	774.4	225.6	938.08	61.92
9.0	900	100	810.0	190.0	948.68	51.32
9.2	920	80	846.4	153.6	959.17	40.83
9.4	940	60	883.6	116.4	969.54	30.46
9.6	960	40	921.6	78.4	979.80	20.20
9.8	980	20	960.4	39.6	989.95	10.05
10.0	1000	0	1000.0	0.0	1000.00	0.00



11. Alarm Action

Description
The FY/FA series controller can support up to three sets of alarm functions. Each set of alarms has 19 mode.
Users can choose the most suitable alarm mode according to their needs for system protection or application.

Function Diagram

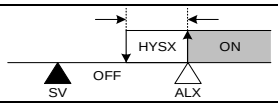
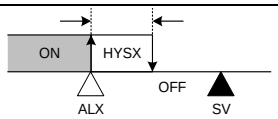
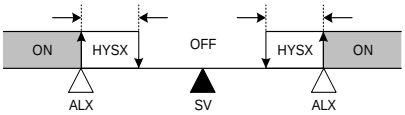
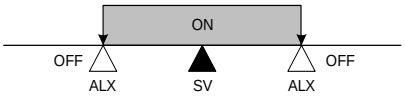
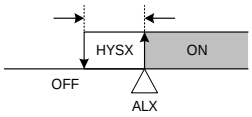
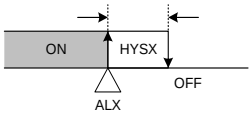


The related parameters of alarm function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
AL1	AL1	Alarm1 set value	USPL	-1999	1.0	Level 1	SET1.3
AL2	AL2	Alarm2 set value	USPL	-1999	1.0	Level 1	SET1.4
AL3	AL3	Alarm3 set value	USPL	-1999	1.0	Level 1	SET2.1
ALD1	ALd1	Alarm1 mode selection (Please refer to Chapter 11.1 Alarm Mode)	19	0	11	Level 3	SET3.1
ALT1	ALt1	Alarm1 time setting 0：Flicker 99.59：Continued ON 0.01~99.58：delay time Time format：min . sec	99.59	0.00	99.59	Level 3	SET3.2
ALD2	ALd2	Alarm2 mode selection (Please refer to Chapter 11.1 Alarm Mode)	19	0	11	Level 3	SET3.3
ALT2	ALt2	Alarm2 time setting 0：Flicker 99.59：Continued ON 0.01~99.58：delay time Time format：min . sec	99.59	0.00	99.59	Level 3	SET3.4
ALD3	ALd3	Alarm3 mode selection (Please refer to Chapter 11.1 Alarm Mode)	18	0	11	Level 3	SET4.1
ALT3	ALt3	Alarm3 time setting 0：Flicker 99.59：Continued ON 0.01~99.58：delay time Time format：min . sec	99.59	0.00	99.59	Level 3	SET4.2
HYSA	HYSA	Hysteresis setting for alarm1~3	999.9	-199.9	1.0	Level 3	SET4.3
SETA	SEtA	Alarm special function setting (Please refer to Chapter 11.2)	1111	0000	0000	Level 3	SET5.3

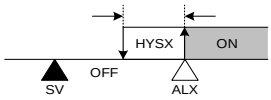
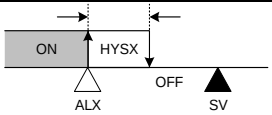
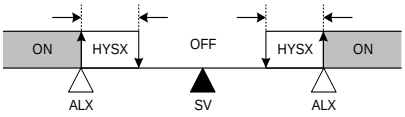
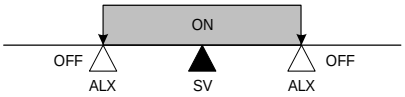
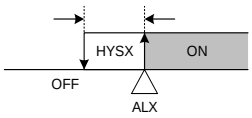
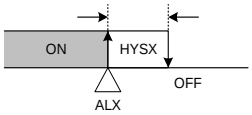
11.1 Alarm Mode

▲ : SV △ : Alarm set value **X** : 1 / 2 / 3 (There are up to 3 sets of alarms)

ALD**X**	Alarm mode	Description	
0	No alarm function	Not drive any alarm relays and the corresponding LED lamp.	
1	Deviation high (With hold action)		
		Formula	PV ≥ (SV+ALX) → Alarm ON PV ≤ (SV+ALX-HYSA) → Alarm OFF
2	Deviation low (With hold action)	 *ALX must to be set to a negative value	
		Formula	PV ≤ (SV+ALX) → Alarm ON PV ≥ (SV+ALX+HYSA) → Alarm OFF
3	Deviation high/low (With hold action)		
		Formula	PV ≥ (SV+ALX) → Alarm ON PV ≤ (SV-ALX) → Alarm ON PV ≥ (SV-ALX+HYSA) → Alarm OFF PV ≤ (SV+ALX-HYSA) → Alarm OFF
4	Band (With hold action)		
		Formula	PV ≤ (SV+ALX) → Alarm ON PV ≥ (SV-ALX) → Alarm ON PV > (SV+ALX) → Alarm OFF PV < (SV-ALX) → Alarm OFF
5	Process high (With hold action)		
		Formula	PV ≥ ALX→ Alarm ON PV ≤ (ALX-HYSA) → Alarm OFF
6	Process low (With hold action)		
		Formula	PV ≤ ALX→ Alarm ON PV ≥ (ALX+HYSA) → Alarm OFF
7	Segment execute alarm	When SEG=ALX alarm ON *This mode only available in program type controller	
8	System error	The Alert action, when PV displays error message	
9	HBA (Heater Break Alarm)	Activated conditions : 1. Heater current is less the HBAC set value 2. OUT1 manipulated value exceed HBOP set value 3. Conditions of 1 & 2 above are established and continue to exceed 20 seconds. *Please refer to Chapter 10.4 *This mode only available in ALD1 or ALD2	
	Single RAMP	Please refer to Chapter 10.7 This mode only available in ALD3	

11.1 Alarm Mode

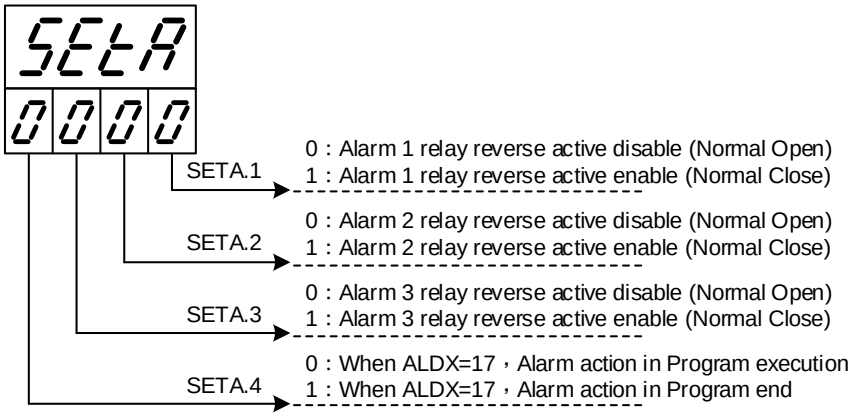
▲ : SV　　△ : Alarm set value　　**X** : 1 / 2 / 3 (There are up to 3 sets of alarms)

ALD**X**	Alarm mode	Description	
10	SOAK_A	Boot completed, the alarm is ON, when PV ≥ target SV start the timer, alarm and control function are turned OFF in timed out. If the RAMP function is used, even if the RAMP SV has not reached the target SV, the timer will start counting as long as the condition PV ≥ target SV is met. *Please refer to Chapter 10.7 *This mode only available in ALD1 or ALD2 *In this mode, the time format is fixed to “hour.minute”	
11	Deviation high		
		Formula	PV ≥ (SV+ALX) → Alarm ON PV ≤ (SV+ALX-HYSA) → Alarm OFF
12	Deviation low	 *ALX must to be set to a negative value	
		Formula	PV ≤ (SV+ALX) → Alarm ON PV ≥ (SV+ALX+HYSA) → Alarm OFF
13	Deviation high/low		
		Formula	PV ≥ (SV+ALX) → Alarm ON PV ≤ (SV-ALX) → Alarm ON PV ≥ (SV-ALX+HYSA) → Alarm OFF PV ≤ (SV+ALX-HYSA) → Alarm OFF
14	Band		
		Formula	PV ≤ (SV+ALX) → Alarm ON PV ≥ (SV-ALX) → Alarm ON PV > (SV+ALX) → Alarm OFF PV < (SV-ALX) → Alarm OFF
15	Process high		
		Formula	PV ≥ ALX→ Alarm ON PV ≤ (ALXH-HYSA) → Alarm OFF
16	Process low		
		Formula	PV ≤ ALX→ Alarm ON PV ≥ (ALX+HYSA) → Alarm OFF
17	Program run	SETA.4=0　When program execution, alarm action SETA.4=1　When program end, alarm action *This mode only available in program type controller	
18	System normal	The Alert action, when system in normal condition (no-error message)	

11.1 Alarm Mode

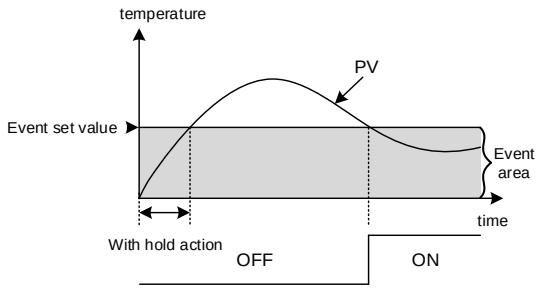
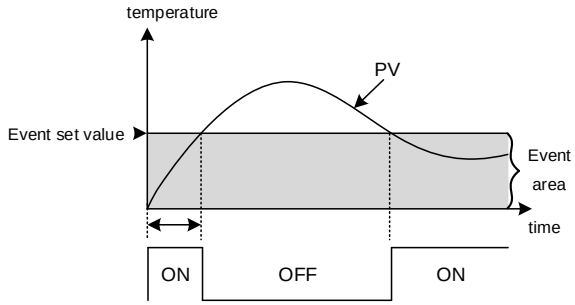
ALD**X**	Alarm mode	Description
19	SOAK_B	Boot completed, the alarm is OFF, when PV ≥ target SV start the timer, alarm is turned ON and the control function keep ON in timed out. If the RAMP function is used, even if the RAMP SV has not reached the target SV, the timer will start counting as long as the condition PV ≥ target SV is met. *Please refer to Chapter 10.7 *This mode only available in ALD1 or ALD2 *In this mode, the time format is fixed to “hour.minute”

11.2 Alarm Special Setting



11.3 Alarm Example

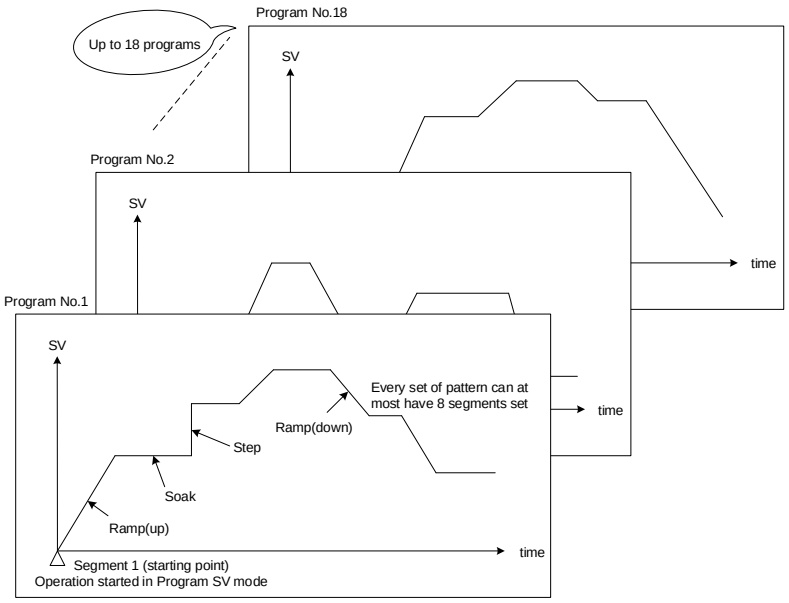
Example 1 : Deviation low, the difference between With alarm hold action and without alarm hold action, shown in the diagram below

With alarm hold action (ALDX=06)	without alarm hold action (ALDX=16)
	

12. Programmable

Description
Programmable function is SV function that is variable to time, as user can set SV value to their needs according to time-based variation curve, which is called program setting

1. There are at most 18 sets of pattern setting
2. Every set of pattern can at most have 8 segments
3. Every segment include 4 settings such as ramp, soak, step and continue
4. Pattern can be randomly linked up, as each pattern of program contains 144 segment, at most.



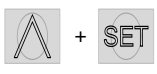
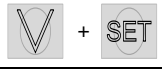
12.1 Parameter

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
PTN	PtN	Program pattern selection 1~18	18	1	1	Level 1	PROG=ON
SEG	SEG	Current program segment display	144	1	1	Level 1	PROG=ON
TIMR	tiMr	Current segment remain time display Upper area：display current segment remain time Down area：display current segment executed time	99.59	0.00	0.00	Level 1	PROG=ON
SV_1	SV01	Segment 1 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_1	tM01	Segment 1 execute time setting, this parameter determines the link between segment and segment or pattern and pattern END(-1) : program end in this segment 0.00 : program step change in this segment 0.01~99.58 : program in this segment execute time 99.59 : program continue execute this segment, no end	99.59	-1	0.00	Level 1	PROG=ON
OUT1	OUt1	Segment 1 output limit	100.0	0.0	100.0	Level 1	PROG=ON
SV_2	SV02	Segment 2 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_2	tM02	Segment 2 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT2	OUt2	Segment 2 output limit	100.0	0.0	100.0	Level 1	PROG=ON
SV_3	SV03	Segment 3 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_3	tM03	Segment 3 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT3	OUt3	Segment 3 output limit	100.0	0.0	100.0	Level 1	PROG=ON

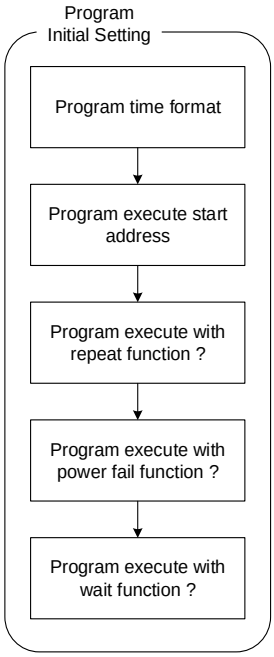
12.1 Parameter

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
SV_4	SV_4	Segment 4 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_4	tM_4	Segment 4 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT4	OUt4	Segment 4 output limit	100.0	0.0	100.0	Level 1	PROG=ON
SV_5	SV_5	Segment 5 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_5	tM_5	Segment 5 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT5	OUt5	Segment 5 output limit	100.0	0.0	100.0	Level 1	PROG=ON
SV_6	SV_6	Segment 6 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_6	tM_6	Segment 6 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT6	OUt6	Segment 6 output limit	100.0	0.0	100.0	Level 1	PROG=ON
SV_7	SV_7	Segment 7 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_7	tM_7	Segment 7 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT7	OUt7	Segment 7 output limit	100.0	0.0	100.0	Level 1	PROG=ON
SV_8	SV_8	Segment 8 SV	USPL	LSPL	0.0	Level 1	PROG=ON
TM_8	tM_8	Segment 8 execute time setting	99.59	-1	0.00	Level 1	PROG=ON
OUT8	OUt8	Segment 8 output limit	100.0	0.0	100.0	Level 1	PROG=ON
WAIT	JAtt	Program execution standby temperature 0 : when program execute do not wait for PV temperature Other values : when PV= (target SV-WAIT), program entering next segment	1000	0	0	Level 1	SET5.3
SET8.1	SEt8	Program execute repeat 0 : disable repeat function 1 : Program execute repeat	1	0	0	Level 4	---
SET8.2	SEt8	Program execute power fail protection 0 : disable power fail protection 1 : enable power fail protection	1	0	0	Level 4	---
SET8.3	SEt8	Program execute start address 0 : execute from zero 1 : execute from current PV	1	0	1	Level 4	---
SET9.2	SEt9	Program time format 0 : hour.minute 1 : minute.second	1	0	0	Level 4	---
PVST	PUSt	Program execute start address 0 : FULT (execute from current PV, but use segment 1 fully time) 1 : CUTT (execute from current PV, cut time)	CUTT	FULT	FULT	Fast	SET8.3

12.2 Key Operation Description

Functions	Keys	Description
Run		Eexecuting program, PRO_LED lamp ON, Upper area shows 3 times "RUN" messages.
Halt		Pause executing program, PRO_LED lamp remains ON, at this moment upper area will display current temperature value and “HALT” message alternately.
Jump		Jump to the next segment, and it can skip segment continuously.
		Holding UP key and press SET key 1 time to skip 1 segment, press SET key 2 times to skip 2 segments, so on and so forth.
Reset		Stop executing program, PRO_LED lamp OFF, Upper area shows 3 times "REST" messages.
PV/SV monitor		Press the A / M key for 2 seconds jump to the parameter OUTL, then pressing the A / M key for 2 seconds return to PV / SV monitor.

12.3 Program Initial Setting



1. Setting program time format

Parameter	LED display	Description	Default	Level
SET9.2	SEt9	Program time format 0 : hour.minute 1 : minute.second	0	Level 4

This parameter determines the time format of timer during program execution
When SET9.2 =0 , TM_n=33.23, it indicates that the execution time of this segment is 33 hours and 23 minutes
When SET9.2 =1 , TM_n=33.23, it indicates that the execution time of this segment is 33 minutes and 23 seconds

2. Setting program execute start address

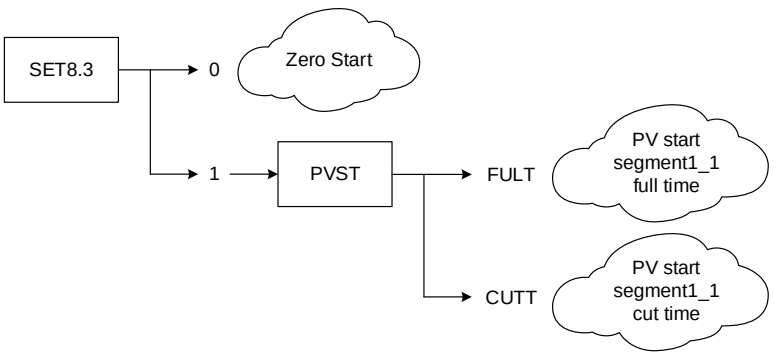
Parameter	LED display	Description	Default	Level
SET8.3	SEt8	Program execute start address 0 : execute from zero 1 : execute from current PV	1	Level 4
PVST	PUSt	Program execute start address 0 : FULT (execute from current PV,but use segment 1 fully time) 1 : CUTT (execute from current PV,cut time)	FULT	Fast

When program starts, SV initial value will execute according to SET8.3 and PVST setting value

(1) SET8.3 =0, PTN=1, PV=50.0, SV_1=100.0, TM_1=1.00(1 hour)
When program starts, SV will start to execute from PV, and SV shall reach SV_1 in one hour

(2) SET8.3 =1, PVST=FULT, PTN=1, PV=50.0, SV_1=100.0, TM_1=1.00(1 hour)
When program starts, SV will start to execute from PV temperature of 50.0, and SV shall reach SV_1 in one hour

(3) SET8.3 =1, PVST=CUTT, PTN=1, PV=50.0, SV_1=100.0, TM_1=1.00(1 hour)
When program starts, SV will start to execute from PV, while controller will deduct the time taken to go from 0.0 to 50.0, as SV shall reach SV_1 in half hour



3. Setting program execute with repeat function

Parameter	LED display	Description	Default	Level
SET8.1		Program execute repeat 0 : disable repeat function 1 : Program execute repeat	0	Level 4

When program completes the execution of the final segment, and “END” message is not shown, the program will be executed again.

4. Setting program execute with power failure protection function

Parameter	LED display	Description	Default	Level
SET8.2		Program execute power fail protection 0 : disable power fail protection 1 : enable power fail protection	0	Level 4

power failure during program execution, if there is power failure protection function set, controller will execute current segment program after booting finish
Assume power failure occurring in the segment_4, ramp temperature from 100°C to 200°C, and power failure occurring at SV=125, the program will execute from 100°C (segment_4), after controller booting finish

5. Setting program execute with wait function

Parameter	LED display	Description	Default	Level
WAIT		Program execution standby temperature 0 : when program execute do not wait for PV temperature Other values : when PV=(target SV-WAIT), program entering next segment	0.0	Level 3

When program executes, if WAIT=0.0, and SV reaches set temperature, whether PV reaches target temperature or not, the controller will enter the next segment
When program executes, if WAIT value is not 0.0, and SV reaches set temperature, as PV has not reached target temperature, controller will wait for PV temperature to reach (target SV-WAIT)

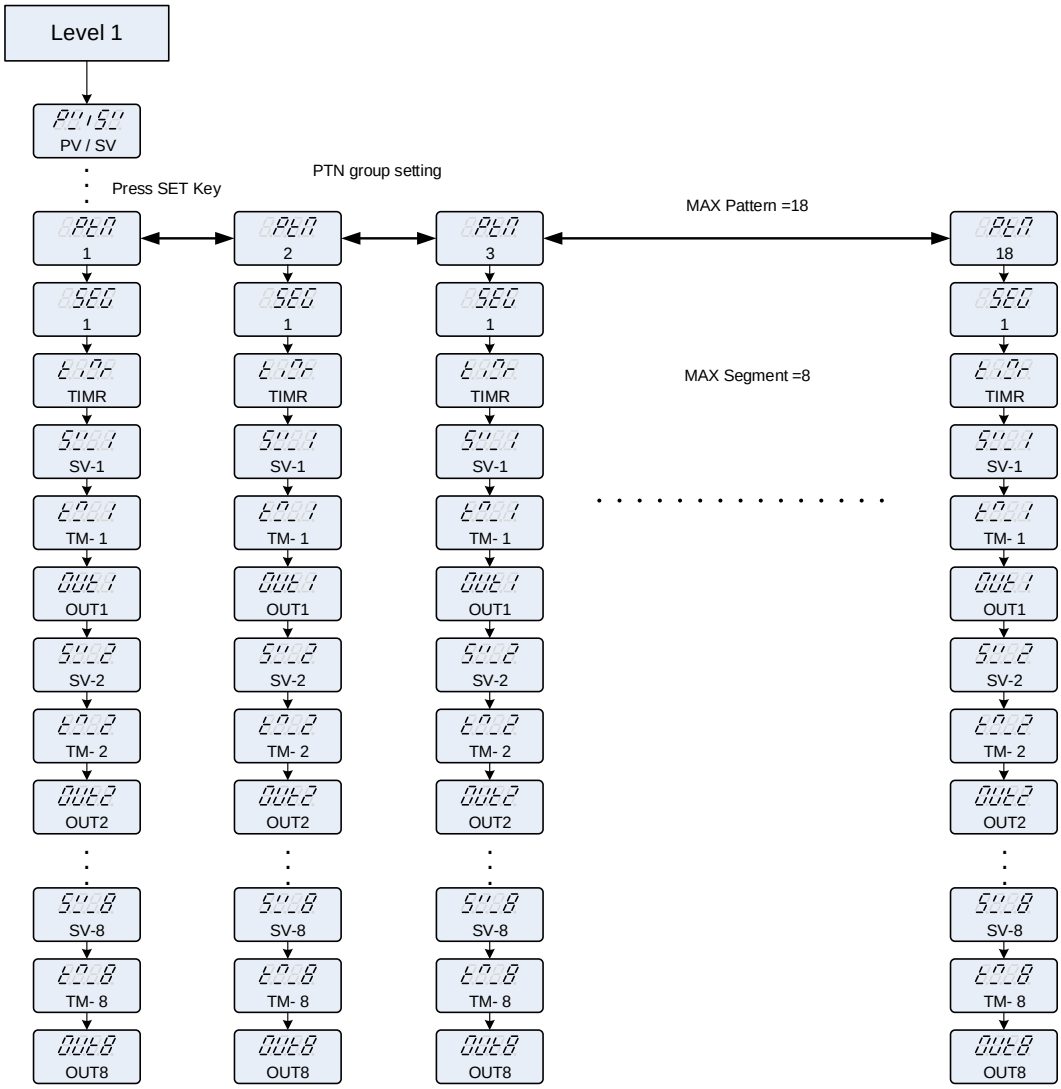
(1) WAIT = 0.0 without wait function set
Assume the set temperature of current segment is 100.0°C, and as SV reaches the set temperature of this segment, the controller will enter the next segment

(2) WAIT = 5.0 with wait function set
Assume the set temperature of current segment is 100.0°C, and as SV reaches the set temperature of this segment, PV temperature needs to reach 100.0-5.0 (SV-WAIT)=95.0 then entering the next segment

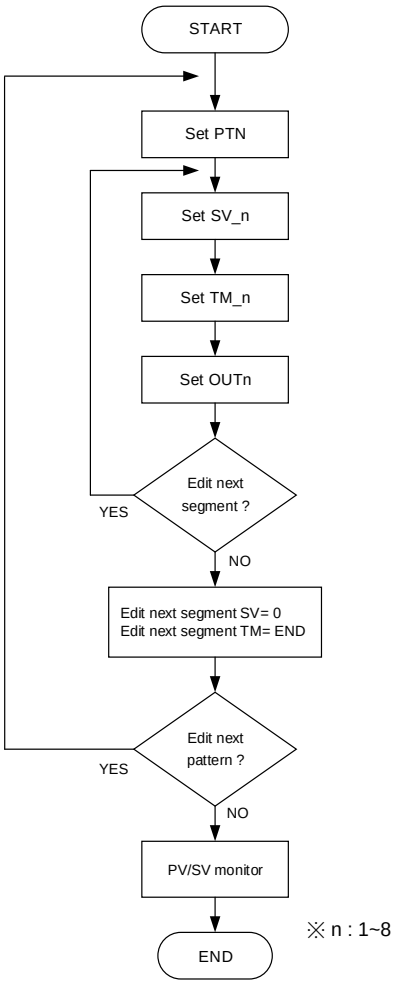
12.4 Create Program

There are 18 sets PTN to choose and each PTN have 8 segments for setting

Program structure diagram



Program edit flow-chat



1. Choose program pattern number

Parameter	LED display	Description	Default	Level
PTN	PTN	Program pattern selection 1~18	1	Level 1

2. Setting segment n target SV

Parameter	LED display	Description	Default	Level
SV_n	SV_1	Segment n SV (n=1~8)	0	Level 1

3. Setting segment n TM

Parameter	LED display	Description	Default	Level
TM_n	tM_1	Segment 1 execute time setting, this parameter determines the link between segment and segment or pattern and pattern END(-1) : program end in this segment 0.00 : program step change in this segment 0.01~99.58 : program in this segment execute time 99.59 : program continue execute in this segment, no end	0	Level 1

TM setting explain：

In segment_5(SEG_5) setting TM_5 =END ➔ When the program finishes segment_4(SEG_4), program end and display “END” Message in segment_5(SEG_5).

In segment_5(SEG_5) setting TM_5=0.00 ➔ When the program finishes segment_4(SEG_4), enter next segment, SV change suddenly.

In segment_5(SEG_5) setting TM_5 =10.00 ➔ When the program finishes segment_4(SEG_4), enter next segment and executing TM_5 setting value.

In segment_5(SEG_5) setting TM_5 =99.59 ➔ When the program finishes segment_4(SEG_4) , enter next segment and executing continuously.

4. Setting segment n OUTn

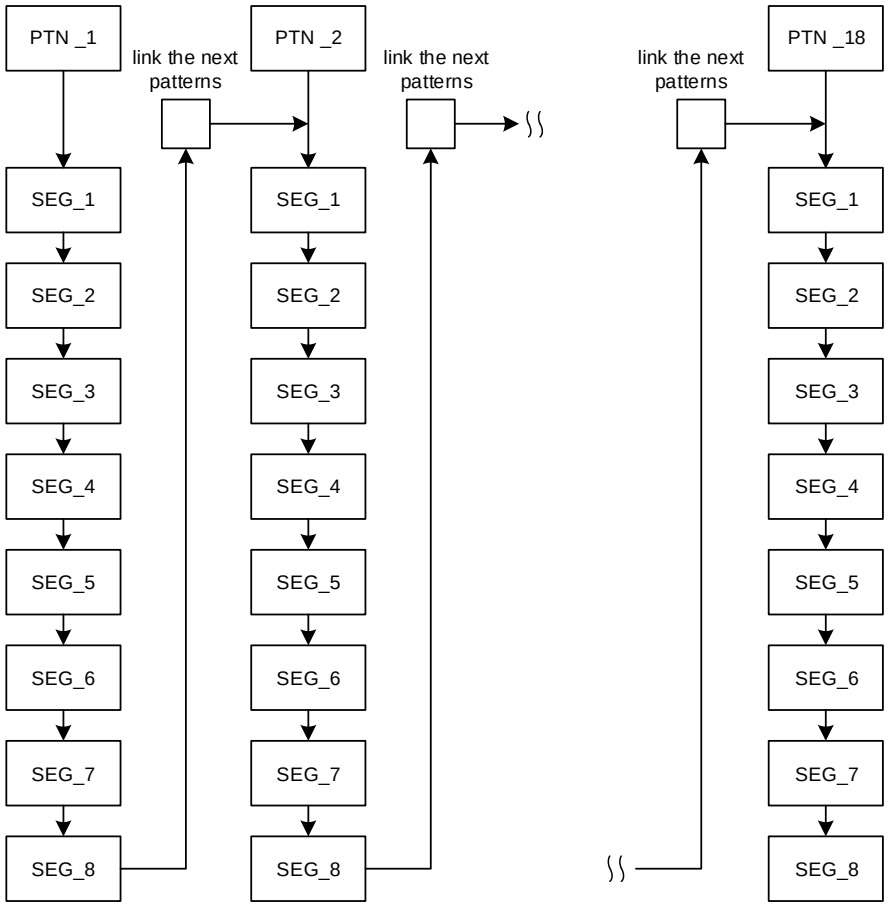
Parameter	LED display	Description	Default	Level
OUTn	OUt_1	Segment n output limit (n=1~8)	100.0	Level 1

Notes

1. When the program is executed, it will end when it hits TIMR=END. Please be sure to add an end segmentafter the last segment of the program.
2. When OUD=COOL, no matter what the PVST setting is, it will always start with PVST=FULT
3. Programs can be started from different PTN to execute different recipes
4. user can use the " Program Design Table " of chapter 19 to plan the recipe in advance

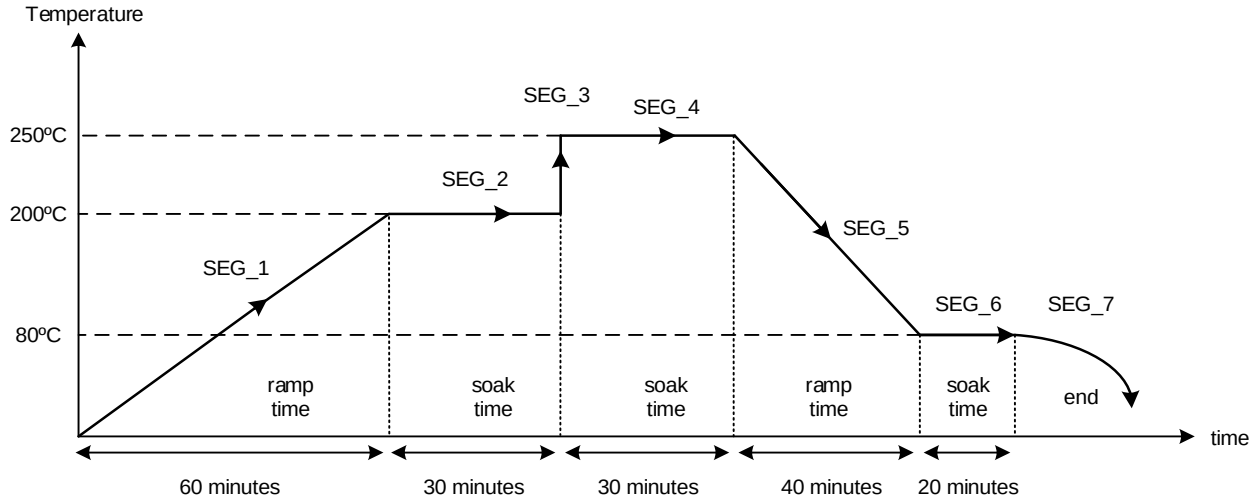
12.5 Program Execution Flow

The program can be up to 18 patterns. If you connect all the patterns, up to 144 segments.



12.6 Program Setting Example

In pattern_1 edit program ramp, soak, step then end



Initial setting

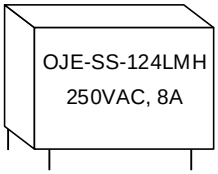
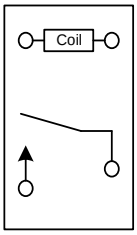
SET9.2 = 1	SET8.3 = 0	SET8.1 = 0	SET8.2 = 1	WAIT = 0.5

Program edit

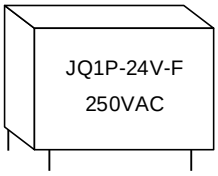
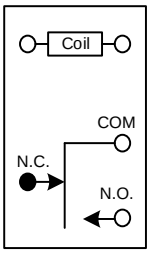
Segment_1	Segment_2	Segment_3	Segment_4	Segment_5	Segment_6	Segment_7
PTN = 1	PTN = 1	PTN = 1	PTN = 1	PTN = 1	PTN = 1	PTN = 1
SV_1 = 200	SV_2 = 200	SV_3 = 250	SV_4 = 250	SV_5 = 80	SV_6 = 80	SV_7 = 0
TM_1 = 60.00	TM_2 = 30.00	TM_3 = 0.00	TM_4 = 30.00	TM_5 = 40.00	TM_6 = 45.00	**TM_7 = END**
OUT1 = 100.0	OUT2 = 100.0	OUT3 = 100.0	OUT4 = 100.0	OUT5 = 100.0	OUT6 = 100.0	OUT7 = 0.0

13. Modification of Output Module

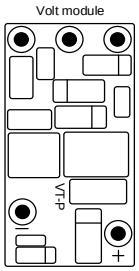
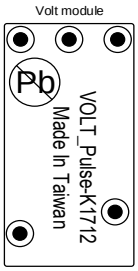
13.1 Relay Control (1a)

Side view	Bottom view	Software Setting
		Parameter set as “CYT1 =10”

13.2 Relay Control (1c)

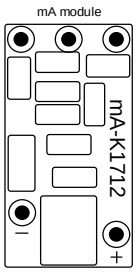
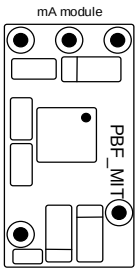
Side view	Bottom view	Software Setting
		Parameter set as “CYT1 =10”

13.3 SSR Control

Top view	Bottom view	Software Setting
		Parameter set as “CYT1 =1”

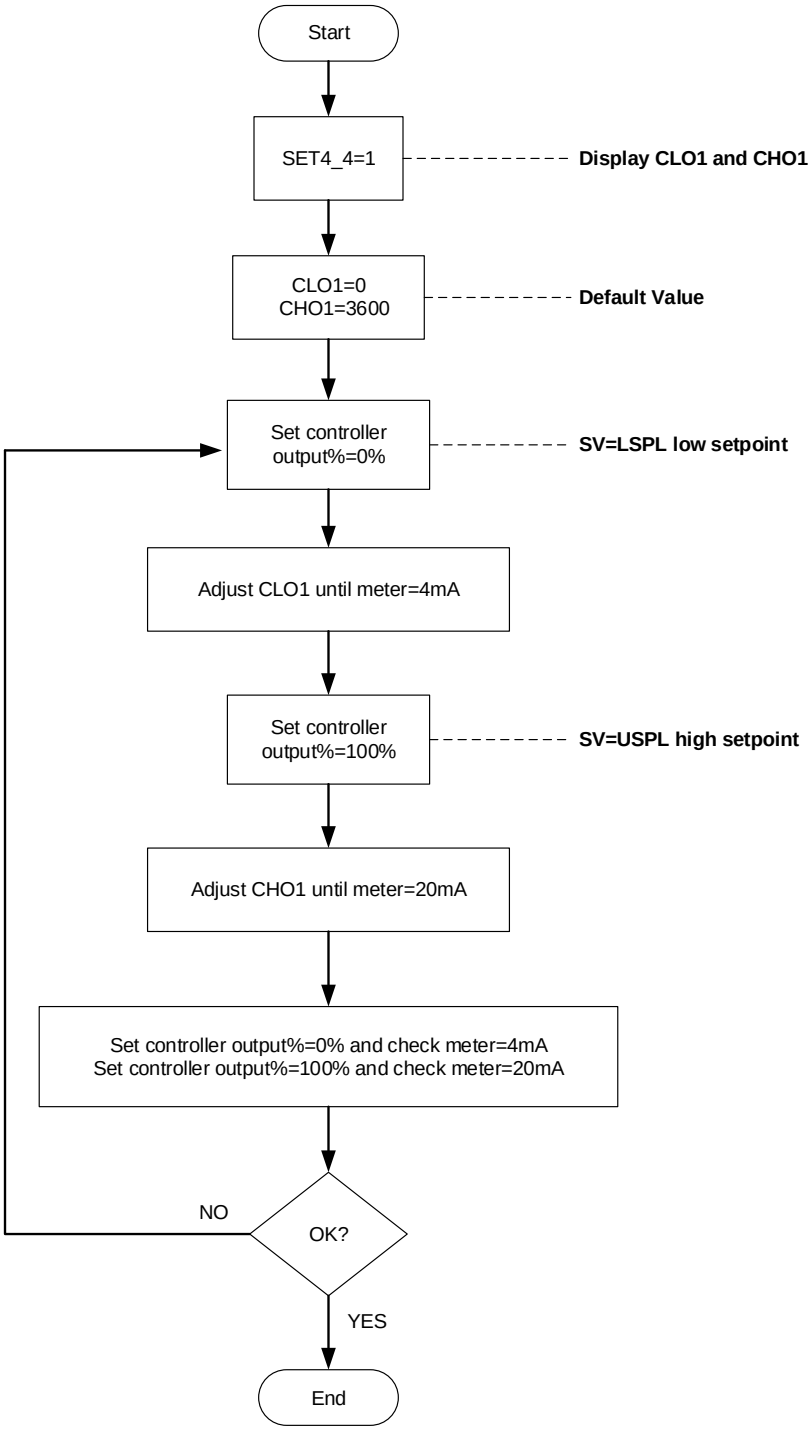
13.4 Linear Control

※ : When modifying mA current module, output signal needs to be calibrated, and for detailed calibration procedure, please refer to Chap. 13.5 Output Calibration Procedure Diagram.

Top view	Bottom view	Software Setting
		Parameter set as “CYT1 =0”

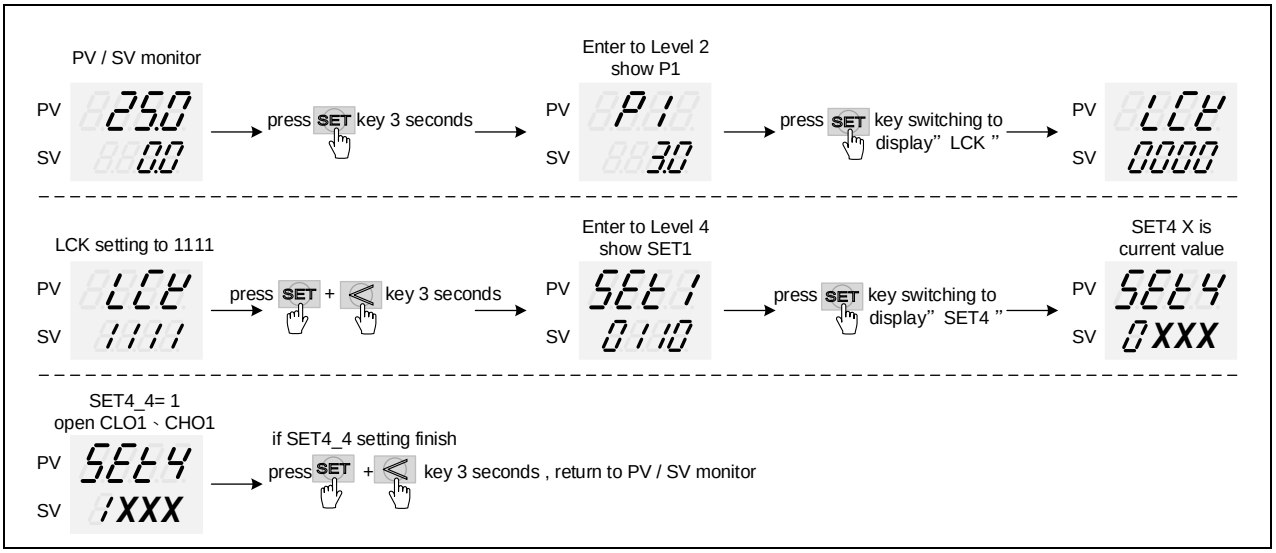
13.5 Output Calibration Procedure Diagram

Output1 Signal (4mA~20mA) calibration flowchart



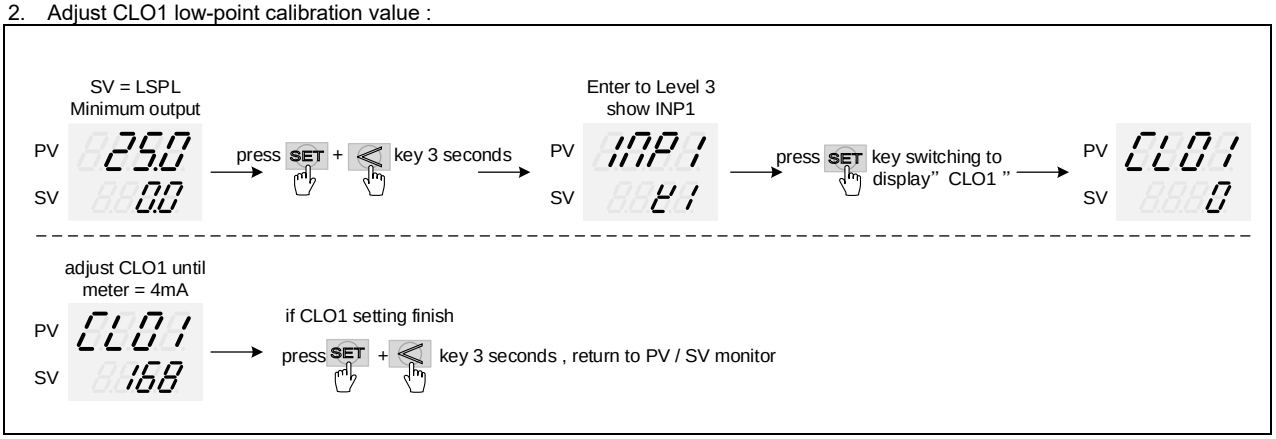
13.6 Output Calibration Steps

1. Display CLO1 & CHO1 :



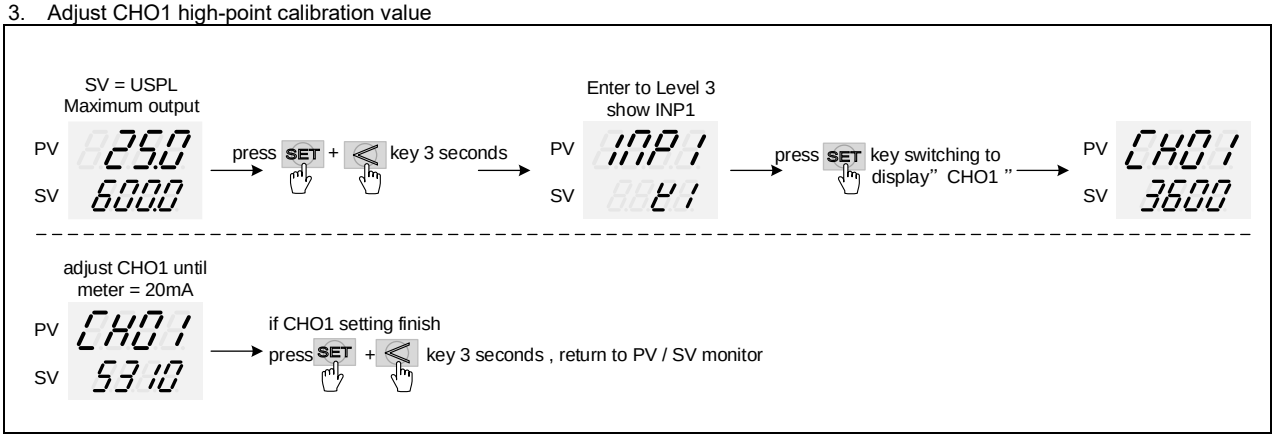
※ : X is default value which does not need to be modified

2. Adjust CLO1 low-point calibration value :



※ : CLO1 calibration value of each controller is different from the other

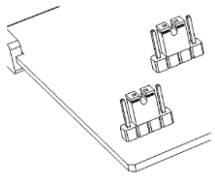
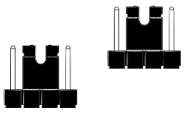
3. Adjust CHO1 high-point calibration value



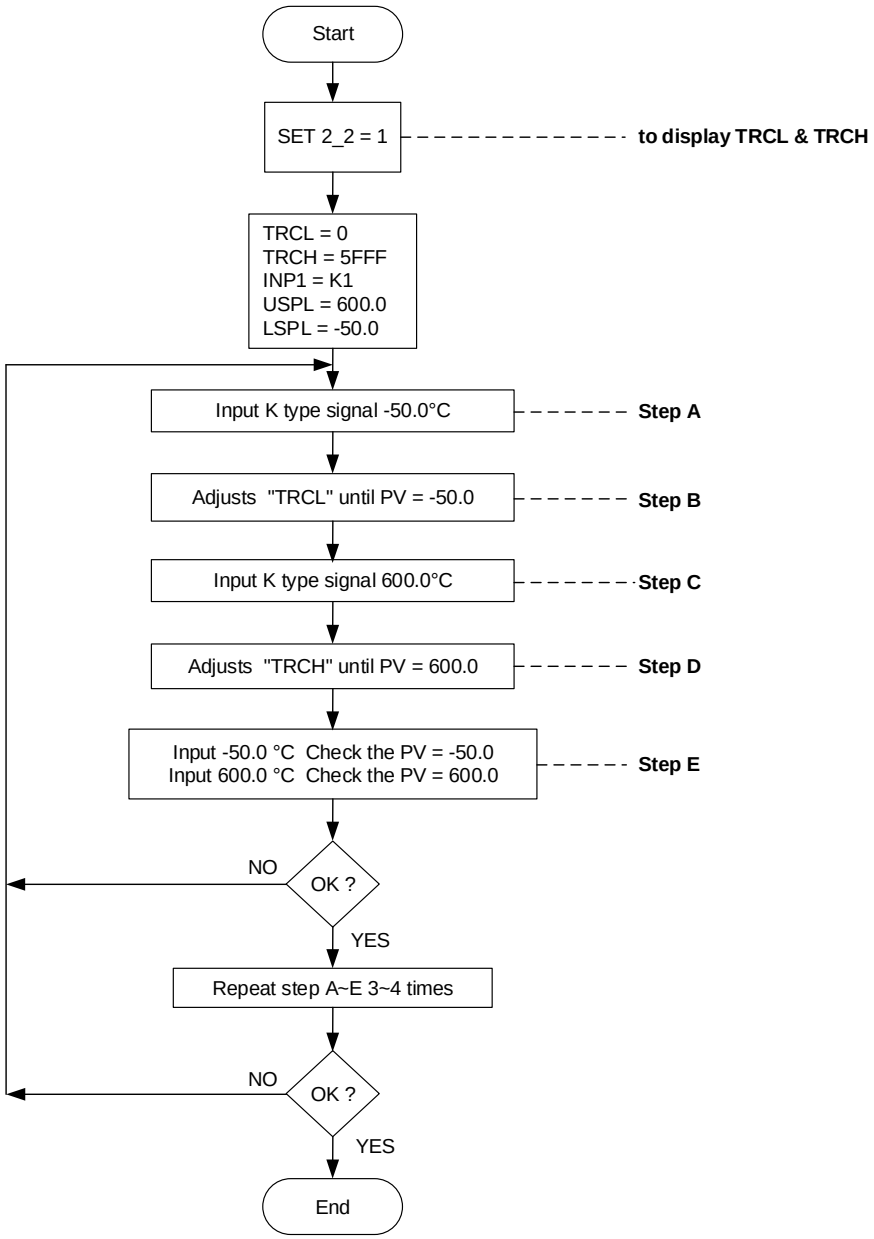
※ : CHO1 calibration value of each controller is different from the other

14. Modification of Input Signal

14.1 Input modify to thermocouple

Jumper Position		Software Setting
Plug 2 pcs of Jumper in the middle slot as shown		
		Parameter set as “INP1=K1~L”

Thermocouple calibration flowchart

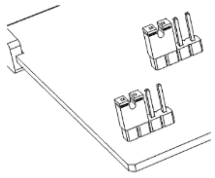
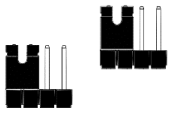


Set the range you want

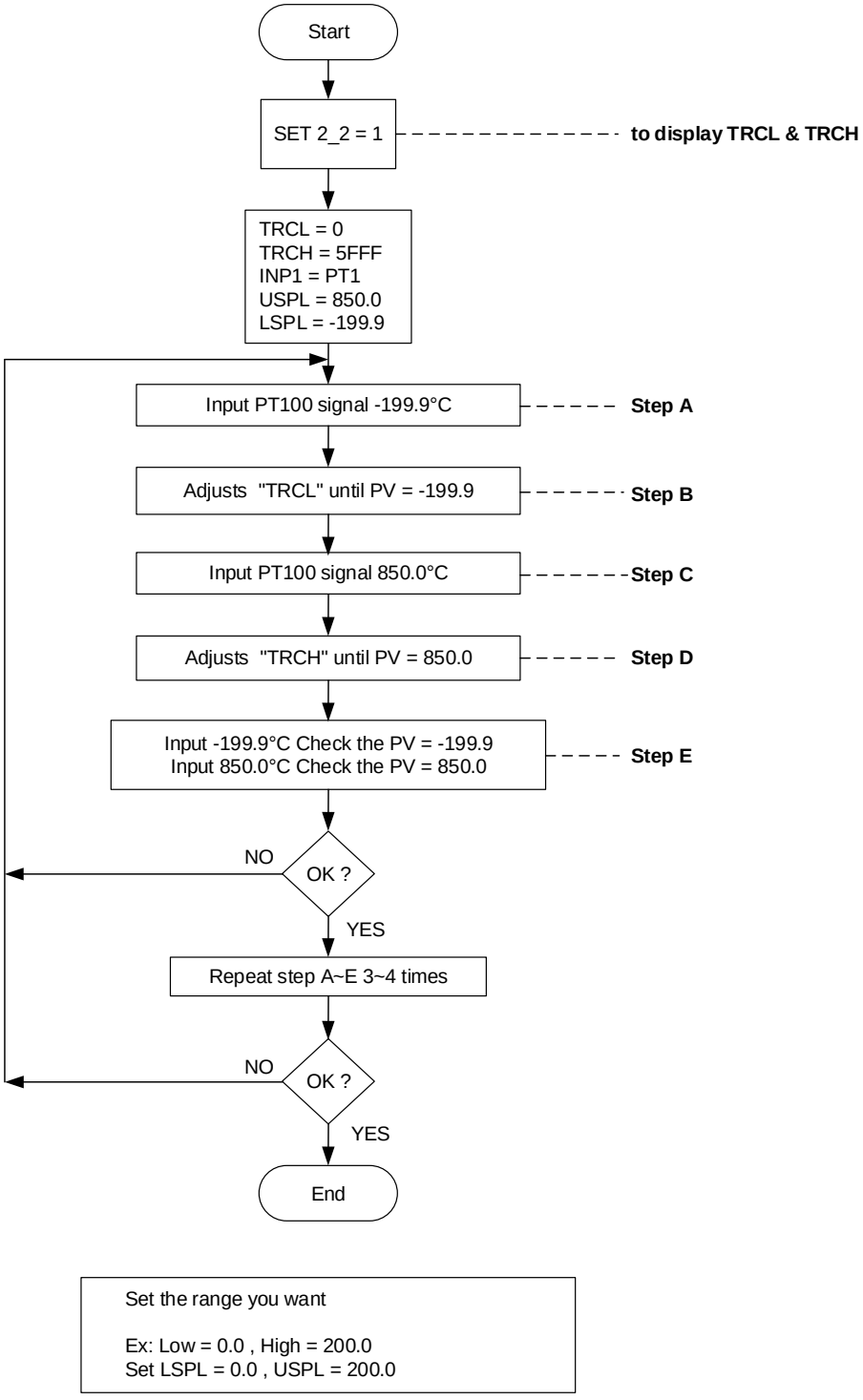
Ex: Low = 0.0 , High = 200.0
Set LSPL = 0.0 , USPL = 200.0

Notes
When input is thermocouple or PT100, it has been calibrated and tested at the factory, we don’t recommend customers to make their own calibration.

14.2 Input modify to RTD

Jumper Position Plug 2 pcs of Jumper in the left slot as shown		Software Setting
		Parameter set as“INP1=PT1~PT3”

RTD calibration flowchart

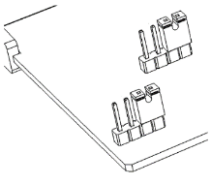
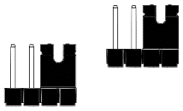


Set the range you want

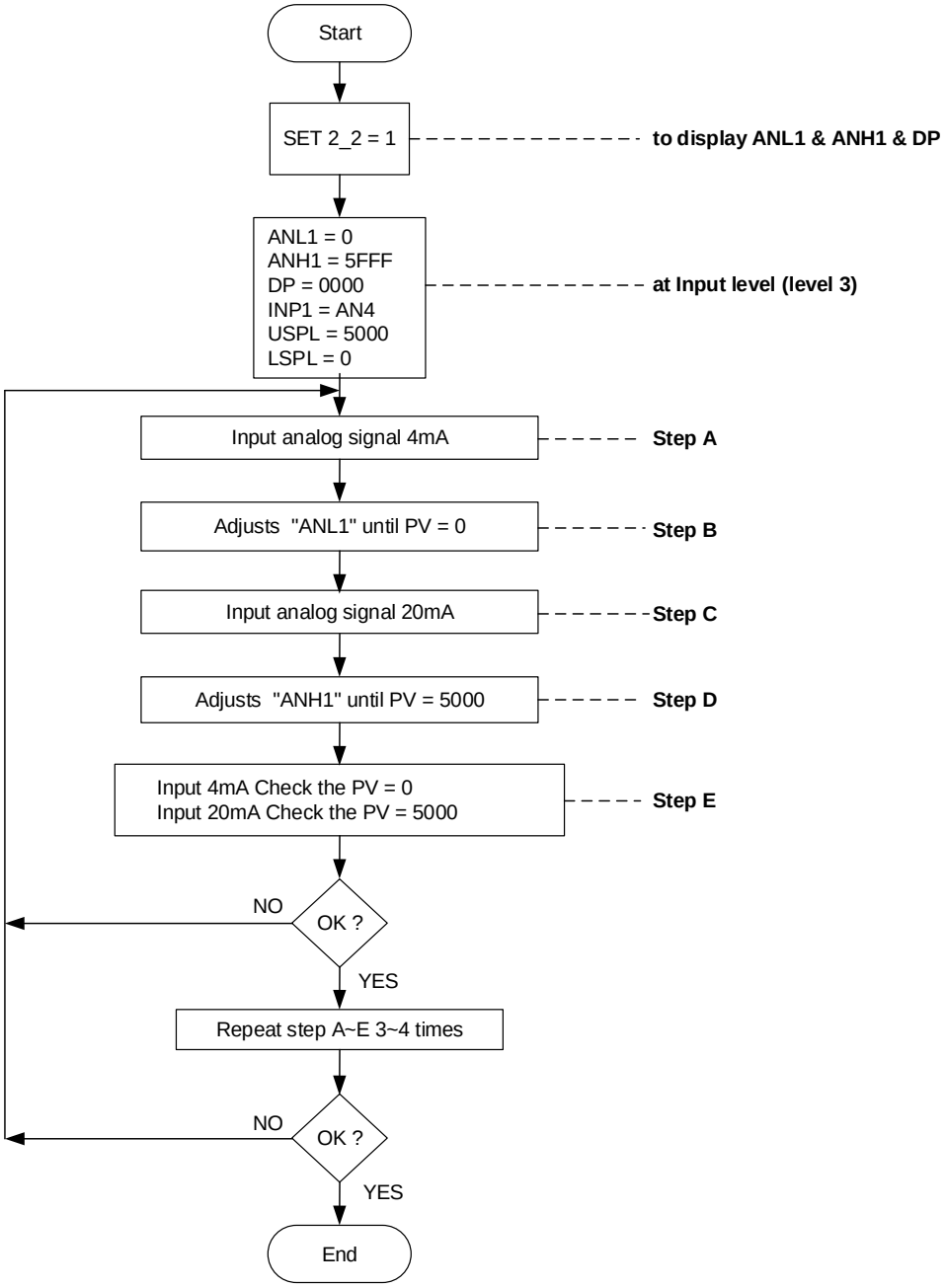
Ex: Low = 0.0 , High = 200.0
Set LSPL = 0.0 , USPL = 200.0

Notes
When input is thermocouple or PT100, it has been calibrated and tested at the factory, we don’t recommend customers to make their own calibration.

14.3 Input modify to Linear (4~20mA)

Jumper Position Plug 2 pcs of Jumper in the right slot as shown		Software Setting
		Parameter set as “INP1=AN4”

Linear analog signal (4~20mA) calibration flowchart

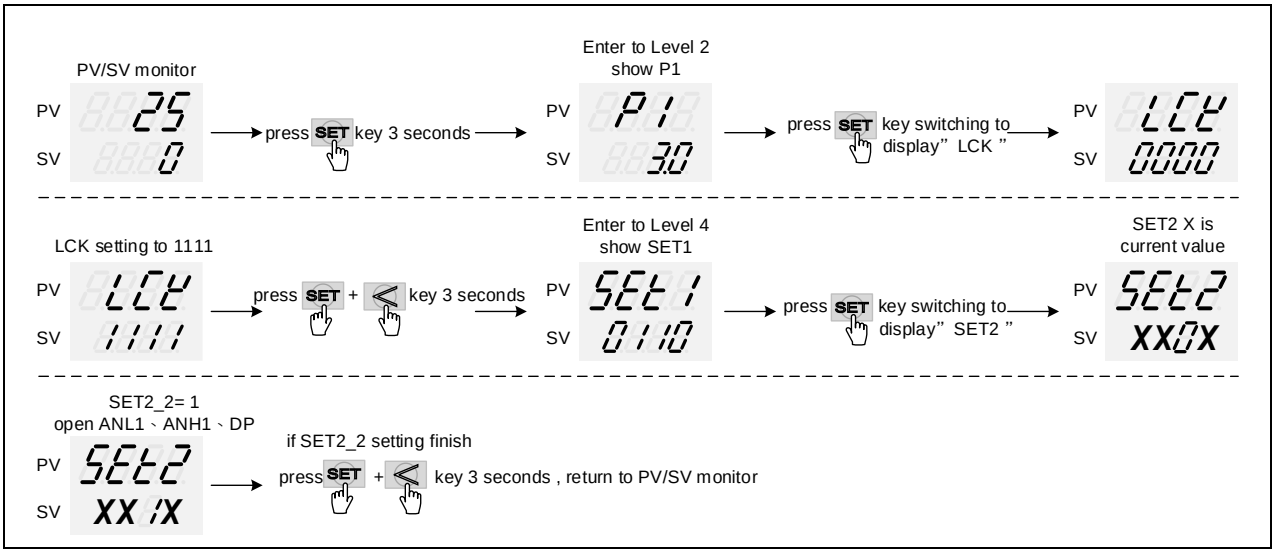


Set the range you want

Ex: Low = -10.0, High = 10.0
Set LSPL = -10.0, USPL = 10.0, DP : 000.0

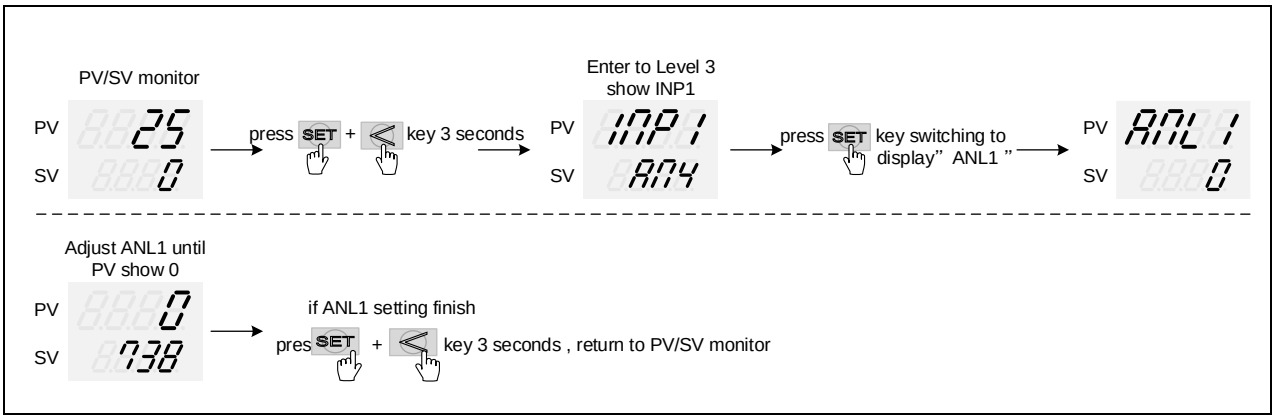
14.4 Steps For Linear Input Calibration

1. Display ANL1, ANH1, DP：



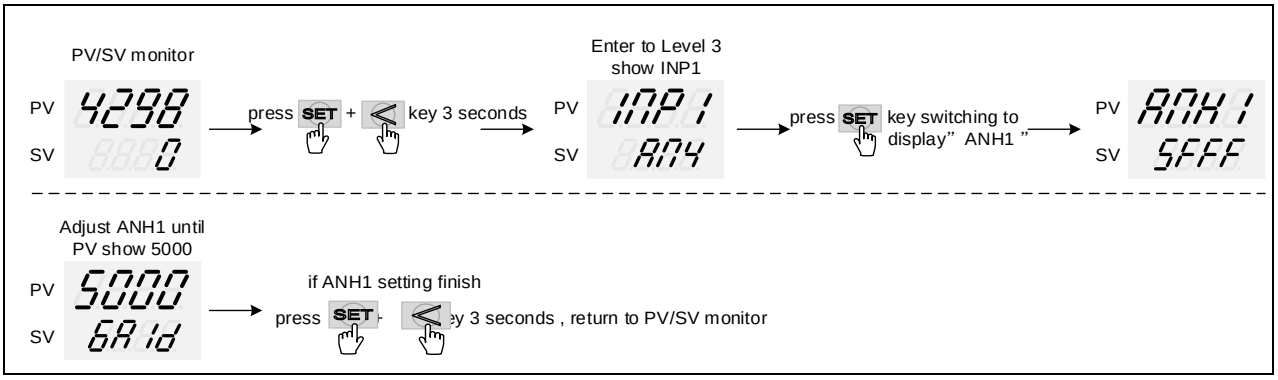
※ X is the default value which doest not require modification

2. input 4mA and djust ANL1 calibration values：



※ ANL1 calibration value of each controller is different from the other

3. input 20mA and djust ANH1 calibration values：



※ ANH1 calibration value of each controller is different from the other

15. Phase angle / Zero cross Control

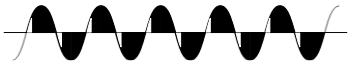
Description
The FY controller can directly drive the thyristor. In the phase angle control mode, the phase angle of the thyristor can be controlled to cut the sine wave. In the zero cross control mode, it can automatically detect the zero point to turn-on or turn-off sine wave, phase angle control and zero cross control are the use of cutting or turn-on/off the sine wave to achieve the power control

The related parameters of Dehumidification Function are as below:

Parameter	Symbol	Content	Range		Default	Level	Hide/ Display
			MAX	MIN			
OUTY	OUtY	Hardware drive selection 0 : single output control 1 : dual output control 2 : valve control with feedback 3 : valve control without feedback selection 4 : single phase angle control	4	0	0	Level 4	---
CYT1	CYt1	Main output control cycle 0 : Linear signal 1 : SSR drive 2~150 : Relay	150	0	00	Level 2	---
CLO1	CLO1	phase angle adjustment	9999	0	0	Level 3	SET4.4
CHO1	CHO1	phase angle adjustment	9999	0	3600	Level 3	SET4.4

Phase angle control default setting : OUTY=4、CYT1=0、CLO1=150、CHO1=3800
Zero cross control default setting : OUTY=0、CYT1=1

control waveform diagram

Control	OUT%=10	OUT%=50	OUT%=80
Phase angle control			
Zero crossing control	 1 cycle ON and 9 cycle OFF	 5 cycle ON and 5 cycle OFF	 8 cycle ON and 2 cycle OFF

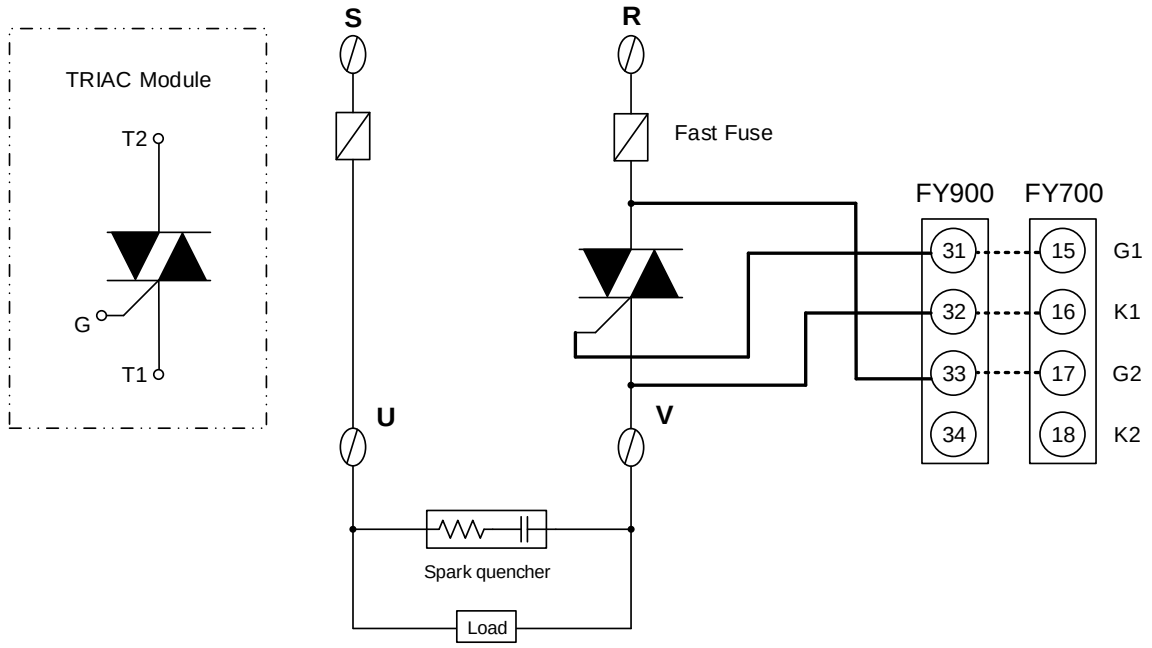
※ Description of zero cross control
power frequency=50HZ, the period of a sine wave is 20ms.
when the controller is in zero cross control the control period is 200ms

when OUT%=10 :1 full sine wave is turned on within 200ms, and the remaining 180ms is turned off
when OUT%=50 :5 full sine wave is turned on within 200ms, and the remaining 100ms is turned off
when OUT%=80 :8 full sine wave is turned on within 200ms, and the remaining 40ms is turned off

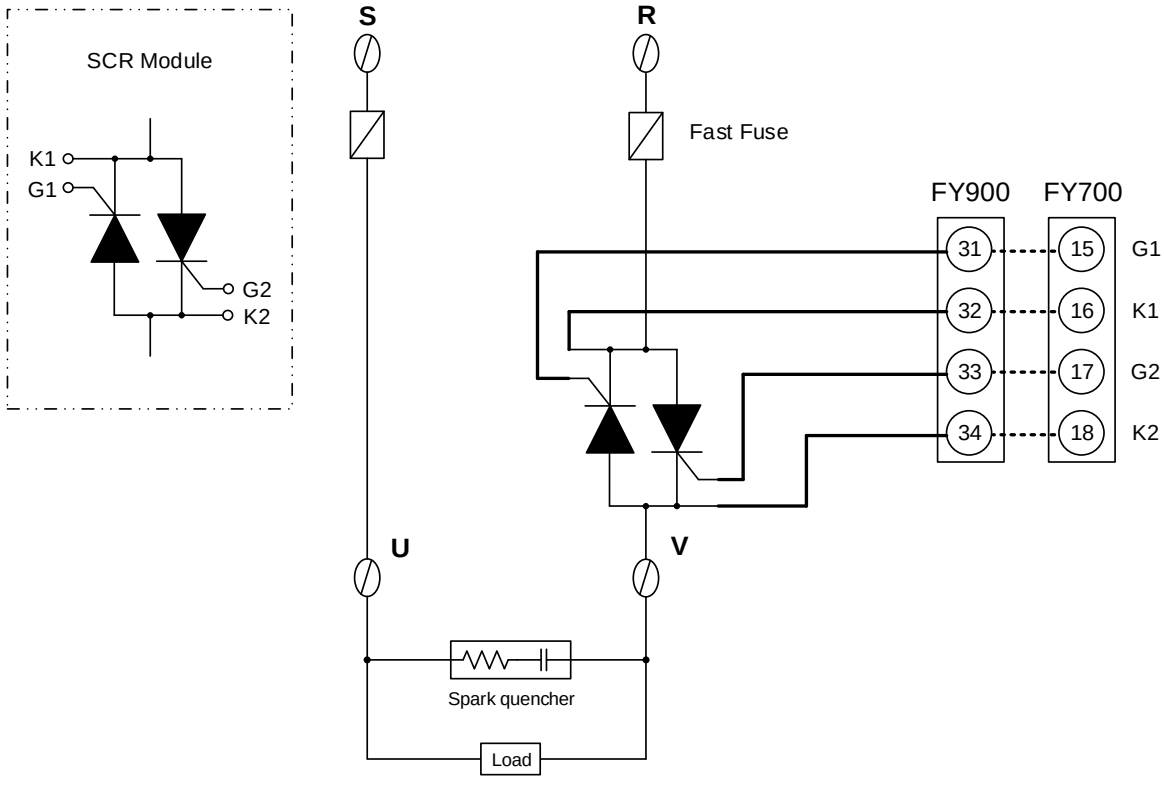
Note
1. Load power and control power need to be in the same phase
2. When single phase angle control is used, CLO1 and CHO1 are used to adjust the phase angle of the thyristor.
   When the trigger waveform is abnormal, CLO1 can be increased or CHO1 can be reduced to meet the thyristor characteristics
3. When the phase angle control is used, if the load is a bulb, the brightness will change with continuous, and when the zero cross control is used, the brightness will change with flicker

1ϕ Phase Angle Control

TRIAC Module

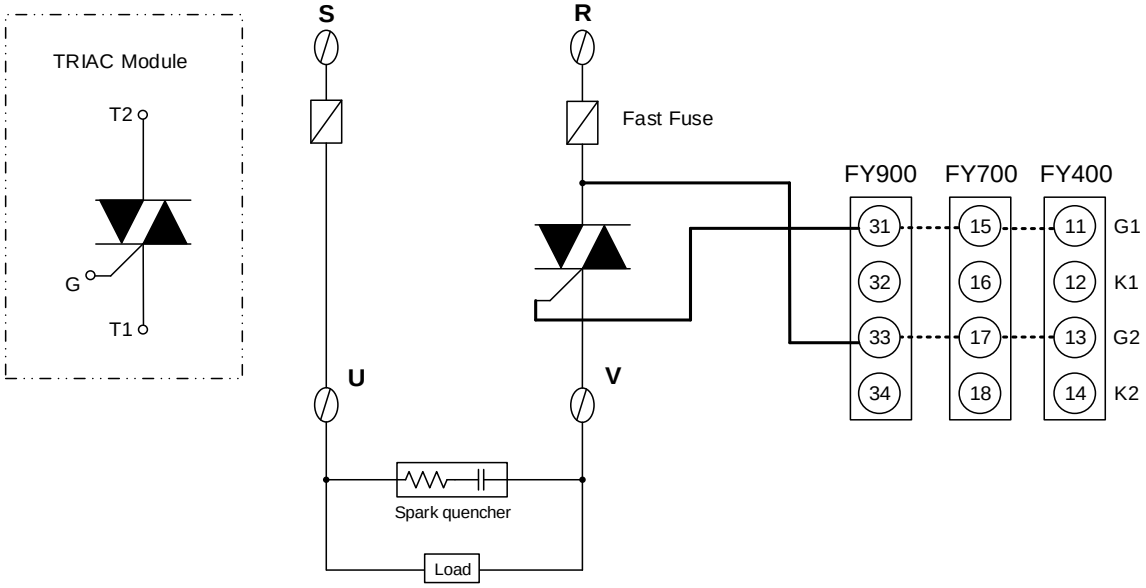


SCR Module

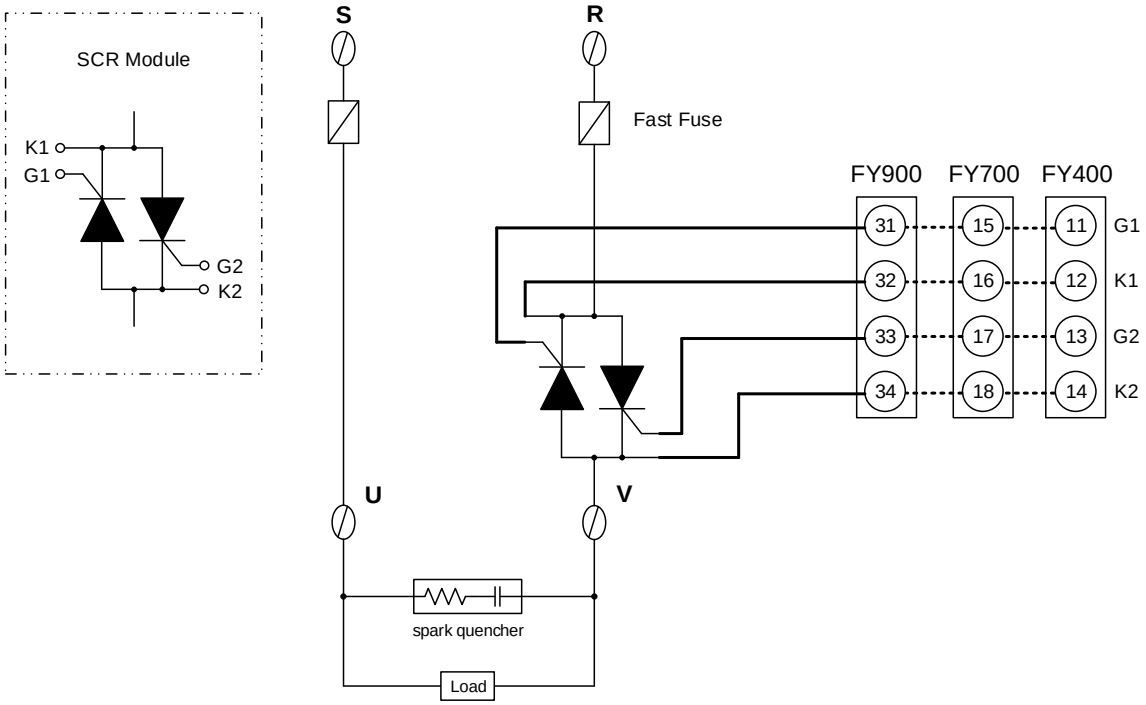


1φ Zero Cross Control

TRIAC Module

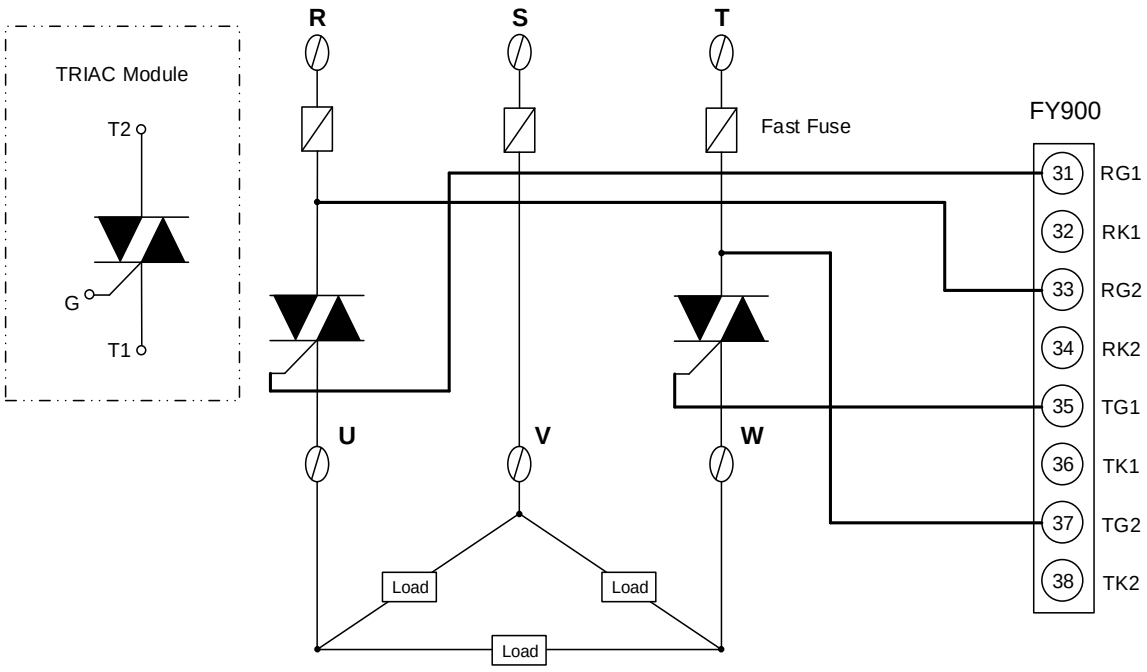


SCR Module

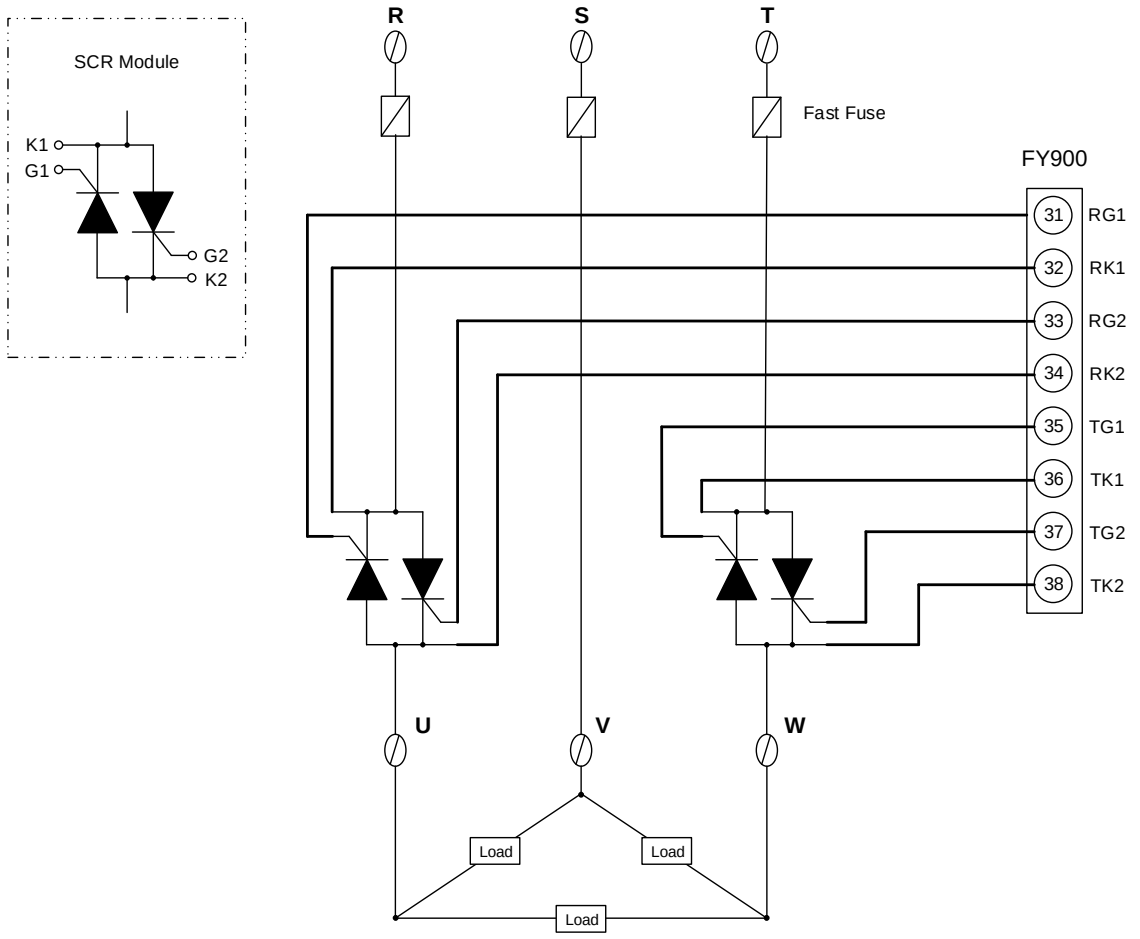


3ϕ Zero Cross Control

TRIAC Module

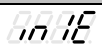
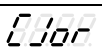
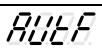
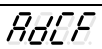
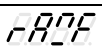
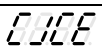
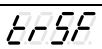
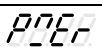


SCR Module



16. Troubleshooting

This chapter describes error displays and procedures to follow when problems occur.

Symbol	Text	description	Solution
	IN1E	Input1 Error	Check whether input loop is opened or wiring is incorrect.
	UUU1	PV is above USPL	Check whether the input value or input type is correct or not.
	NNN1	PV is below LSPL	Check whether the input value or input type is correct or not.
	CJOR	Ambient temperature over range(>50°C)	Decrease ambient temperature
	AUTF	Auto-tuning failure	Manually set the PID value
	ADCF	A/D convert failed	Send for repair.
	RAMF	EEPROM failed	Send for repair.
	CJCE	Cold junction diode failure	Send for repair.
	TRSF	Transmission hardware failure	Send for repair.
	PMER	Motor valve potentiometer feedback error	1. Check the potentiometer feedback wiring 2. Send for repair.

17. FY/FA Communication Register Address Table

Parameter	Register Address		R / W
	Hex	Dec	
SV	0x00	0	R / W
OUTL	0x01	1	R / W
AT	0x02	2	R / W
AL1 SOAK HBAC	0x03	3	R / W
AL2 SOAK HBAC	0x04	4	R / W
AL3 SOAK RAMP RATE	0x05	5	R / W
PTN	0x06	6	R / W
SEG	0x07	7	R
TIMR	0x08	8	R
SV_1	0x09	9	R / W
TM_1	0x0A	10	R / W
OUT1	0x0B	11	R / W
SV_2	0x0C	12	R / W
TM_2	0x0D	13	R / W
OUT2	0x0E	14	R / W
SV_3	0x0F	15	R / W
TM_3	0x10	16	R / W
OUT3	0x11	17	R / W
SV_4	0x12	18	R / W
TM_4	0x13	19	R / W
OUT4	0x14	20	R / W
SV_5	0x15	21	R / W
TM_5	0x16	22	R / W
OUT5	0x17	23	R / W
SV_6	0x18	24	R / W
TM_6	0x19	25	R / W
OUT6	0x1A	26	R / W
SV_7	0x1B	27	R / W
TM_7	0x1C	28	R / W
OUT7	0x1D	29	R / W
SV_8	0x1E	30	R / W
TM_8	0x1F	31	R / W
OUT8	0x20	32	R / W
SV_12	0x21	33	R / W
TM_12	0x22	34	R / W
OUT12	0x23	35	R / W
SV_22	0x24	36	R / W
TM_22	0x25	37	R / W
OUT22	0x26	38	R / W
SV_32	0x27	39	R / W
TM_32	0x28	40	R / W
OUT32	0x29	41	R / W
SV_42	0x2A	42	R / W
TM_42	0x2B	43	R / W
OUT42	0x2C	44	R / W
SV_52	0x2D	45	R / W
TM_52	0x2E	46	R / W
OUT52	0x2F	47	R / W
SV_62	0x30	48	R / W
TM_62	0x31	49	R / W
OUT62	0x32	50	R / W
SV_72	0x33	51	R / W
TM_72	0x34	52	R / W
OUT72	0x35	53	R / W
SV_82	0x36	54	R / W
TM_82	0x37	55	R / W
OUT82	0x38	56	R / W
P1	0x39	57	R / W
I1	0x3A	58	R / W
D1	0x3B	59	R / W
AT.VL	0x3D	61	R / W
CYT1	0x3E	62	R / W
HYS1	0x3F	63	R / W
P2	0x40	64	R / W
I2	0x41	65	R / W

Parameter	Register Address		R / W
	Hex	Dec	
D2	0x42	66	R / W
CYT2	0x43	67	R / W
HYS2	0x44	68	R / W
GAP1	0x45	69	R / W
GAP2	0x46	70	R / W
LCK	0x47	71	R / W
INP1	0x48	72	R / W
ANL1	0x49	73	R / W
ANH1	0x4A	74	R / W
DP	0x4B	75	R / W
LSPL	0x4C	76	R / W
USPL	0x4D	77	R / W
ANL2	0x4E	78	R / W
ANH2	0x4F	79	R / W
ALD1	0x50	80	R / W
ALT1	0x51	81	R / W
ALD2	0x52	82	R / W
ALT2	0x53	83	R / W
ALD3	0x54	84	R / W
ALT3	0x55	85	R / W
HYSA	0x56	86	R / W
CLO1	0x57	87	R / W
CHO1	0x58	88	R / W
CLO2	0x59	89	R / W
CHO2	0x5A	90	R / W
CLO3	0x5B	91	R / W
CHO3	0x5C	92	R / W
RUCY	0x5D	93	R / W
WAIT	0x5E	94	R / W
SETA	0x5F	95	R / W
PSL	0x60	96	R
BITS	0x61	97	R
IDNO	0x62	98	R
BAUD	0x63	99	R
SVOS	0x64	100	R / W
PVOS	0x65	101	R / W
UNIT	0x66	102	R / W
PVFT	0x67	103	R / W
PV2	0x68	104	R
OUD	0x69	105	R / W
OPAD	0x6A	106	R / W
HZ	0x6B	107	R / W
SET1	0x6C	108	R / W
SET2	0x6D	109	R / W
SET3	0x6E	110	R / W
SET4	0x6F	111	R / W
SET5	0x70	112	R / W
SET6	0x71	113	R / W
SET7	0x72	114	R / W
SET8	0x73	115	R / W
SET9	0x74	116	R / W
SET0	0x75	117	R / W
INP2	0x76	118	R / W
OUTY	0x77	119	R / W
OUT%	0x87	135	R
OBIT	0x88	136	R
CV	0x89	137	R
PV	0x8A	138	R

18. FY/FA Fast Communication Register Address Table

Parameter	Register Address		R / W
	Hex	Dec	
INP1	0x48	72	R / W
RUCY	0x5D	93	R / W
CYT1	0x3E	62	R / W
HYSM	0x44	68	R / W
HYS1	0x3F	63	R / W
PMAC	0x12A	298	R / W
RH.TC	0x12F	303	R / W
RH.PO	0x130	304	R / W
RH.TM	0x131	305	R / W
OPFT	0x12D	301	R / W
PV2	0x68	104	R / W
MOLH	0x01	1	R / W
MOLL	0x12E	302	R / W
PSL	0x60	96	R

Parameter	Register Address		R / W
	Hex	Dec	
BITS	0x61	97	R
IDNO	0x62	98	R
BAUD	0x63	99	R
W_MD	0x119	281	R
MLNB	---	---	---
COMP	---	---	---
OFFS	---	---	---
MV.SF	0x12B	299	R / W
HBOP	0x12C	300	R / W
TRCL	0x132	306	R / W
TRCH	0x133	307	R / W
TP_K	0x121	289	R / W
PVOH	0x134	308	R / W

19. Program Design Table

OUD(control action)	☐ HEAT	
	☐ COOL	
WAIT		
Program repeat (SET8.1)	☐ 0 : not repeat	
	☐ 1 : repeat	
Power failure (SET8.2)	☐ 0 : disable	
	☐ 1 : enable	
Program start address (SET8.3)	☐ 0 : from zero	
	☐ 1 : from PV	
PVST	☐ 0 : FULT	
	☐ 1 : CUTT	
Program time format (SET9.2)	☐ 0 : hour.minute	
	☐ 1 : minute.second	

SEG	Parameter	PTN=1	PTN=2	PTN=3	PTN=4	PTN=5	PTN=6
1	SV_1						
	TM_1						
	OUT1						
2	SV_2						
	TM_2						
	OUT2						
3	SV_3						
	TM_3						
	OUT3						
4	SV_4						
	TM_4						
	OUT4						
5	SV_5						
	TM_5						
	OUT5						
6	SV_6						
	TM_6						
	OUT6						
7	SV_7						
	TM_7						
	OUT7						
8	SV_8						
	TM_8						
	OUT8						

SEG	Parameter	PTN=7	PTN=8	PTN=9	PTN=10	PTN=11	PTN=12
1	SV_1						
	TM_1						
	OUT1						
2	SV_2						
	TM_2						
	OUT2						
3	SV_3						
	TM_3						
	OUT3						
4	SV_4						
	TM_4						
	OUT4						
5	SV_5						
	TM_5						
	OUT5						
6	SV_6						
	TM_6						
	OUT6						
7	SV_7						
	TM_7						
	OUT7						
8	SV_8						
	TM_8						
	OUT8						

SEG	Parameter	PTN=13	PTN=14	PTN=15	PTN=16	PTN=17	PTN=18
1	SV_1						
	TM_1						
	OUT1						
2	SV_2						
	TM_2						
	OUT2						
3	SV_3						
	TM_3						
	OUT3						
4	SV_4						
	TM_4						
	OUT4						
5	SV_5						
	TM_5						
	OUT5						
6	SV_6						
	TM_6						
	OUT6						
7	SV_7						
	TM_7						
	OUT7						
8	SV_8						
	TM_8						
	OUT8						

20. Glossary of Characters Used In This Manual

LED Display										
Characters	0	1	2	3	4	5	6	7	8	9
LED Display										
Characters	A	B	C	D	E	F	G	H	I	J
LED Display										
Characters	K	L	M	N	O	P	Q	R	S	T
LED Display										
Characters	U	V	W	Y	Z	°C	°F			

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2022.12.20

台 灣 儀 控 股 份 有 限 公 司
TAIWAN INSTRUMENT & CONTROL CO., LTD
Phone: +886-2-8226-1867
Fax: +886-2-8226-1834
E-mall:contact@fa-tale.com.tw
URL:http://www.fa-tale.com.tw