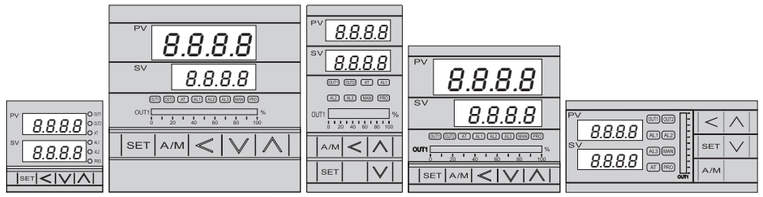
User's Manual

Digital PID Temperature Controller Process Controller

VER 1.3 2021-02



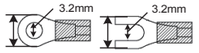
1 Notice

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.

2 Basic Function Setting

2.1 Change Input Type

1.	PV 25 SV 0	Display after power-on.	2.	PV inPt SV K2	Hold SET key + < key 3 seconds, to enter LEVEL_3 upper display showing "INPT" with lower display showing current input type.
3.	PV inPt SV K2	Press < key the lower display flashes.	4.	PV inPt SV Pt1	Press ∧ key and ∨ key to enter the intended input type.
5.	PV inPt SV Pt1	Press SET key to store new value of INPT.	Modify input type needs to interchange of jumper location, and it needs to recalibration for linear input type change.		

2.2 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 0350	Press ∧ key and ∨ key to adjust set value.	4.	PV 25 SV 150	Press SET key to store new value of SV.

2.3 RUN/STOP Mode Selection

1.	PV 25 SV 150	Display after power-on.	2.	PV r_S SV StoP	Press SET key to enter parameter setup display, with "R_S" shown on the upper display.
3.	PV r_S SV StoP	When < key is pressed, the lower display flashes.	4.	PV r_S SV rUN	Press ∧ key or ∨ key to select RUN/STOP mode.
5.	PV r_S SV rUN	Press SET key to store new value of R_S.	When controller is in STOP mode, it disable OUTPUT and ALARM functions.		

2.4 Setting PID Value Automatically(Auto-tunning)

1.	PV 25 SV 150	Display after power-on.	2.	PV At SV oFF	Press SET key to get parameter setup display, as "OFF" will be shown on the upper display.
3.	PV At SV oFF	When < key is pressed, the lower display flashes.	4.	PV At SV on	Press ∧ key or ∨ key to select auto tuning execution or not.
5.	PV At SV on	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.		

2.5 Setting PID Value Manually

1.	PV 25 SV 0	Display after power-on.	2.	PV P1 SV 30	Hold SET key 3 seconds, then entering into LEVEL_2 upper display showing "P1", with lower display show current P1 value.
3.	PV P1 SV 0030	When < key is pressed, the lower display flashes.	4.	PV P1 SV 0500	Press ∧ key and ∨ key to set the intended P1 value.
5.	PV P1 SV 500	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).		

2.6 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 into 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 0001	Press SET key to get parameter setup display, "HYS1" shown on the upper display.
7.	PV HYS1 SV 0001	When < key is pressed, the lower display flashes.	8.	PV HYS1 SV 1.0	Press ∧ key and ∨ key to set the intended HYS1 value.
9.	PV HYS1 SV 1.0	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		

2.7 Alarm Mode Setting

1.	PV 25 SV 0	Display after power-on.	2.	PV inPt SV K2	Hold SET key + < key 3 seconds, then entering into LEVEL_3 upper display showing "INPT" with lower display showing current input type.
3.	PV AL1 1 SV dEV1	Press SET key to get parameter setup display, with "ALD1" shown on the upper display.	4.	PV AL1 1 SV dEV1	When < SHIFT key is pressed, the lower display flashes.
5.	PV AL1 1 SV dELo	Press ∧ key and ∨ key to set the intended ALD1 value.	6.	PV AL1 1 SV dELo	Press SET key to store new value of ALD1.

2.8 Alarm Value Setting

1.	PV 25 SV 0	Display after power-on.	2.	PV AL1H SV 0	Press SET key to get parameter setup display, with "AL1H" shown on the upper display.
3.	PV AL1H SV 0000	When < key is pressed, the lower display flashes.	4.	PV AL1H SV 0020	Press ∧ key and ∨ key to set the intended AL1H value.
5.	PV AL1H SV 20	Press SET key to store new value of AL1H.			

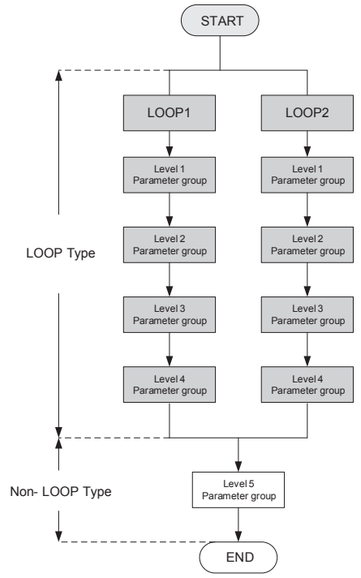
2.9 Controlling With Manual Control

1.	PV 25 SV 150	Display after power-on.	2.	PV A_M SV AUto	Press SET key to get parameter setup display, with "A_M" shown on the upper display.
3.	PV A_M SV AUto	When < key is pressed, the lower display flashes.	4.	PV A_M SV cOMM	Press ∧ key or ∨ key to select AUTO/MMAN mode.
5.	PV A_M SV cOMM	Press SET key to store new value of A_M.	6.	PV MoUt SV 45.0	Press SET key to get parameter setup display, with "MOUT" shown on the upper display.
7.	PV 25 SV 045.0	When < key is pressed, the lower display flashes.	8.	PV 25 SV 100.0	Press ∧ key and ∨ key to set the intended MOUT value.
9.	PV MoUt SV 100.0	Press SET key to store new value of MOUT.	In manual mode and MOUT=100.0, output=100.0% continuously. In manual mode and MOUT=20.0, output=20.0% continuously.		

3 Flow Chart Of Parameter Setting

3.1 Parameter Structure

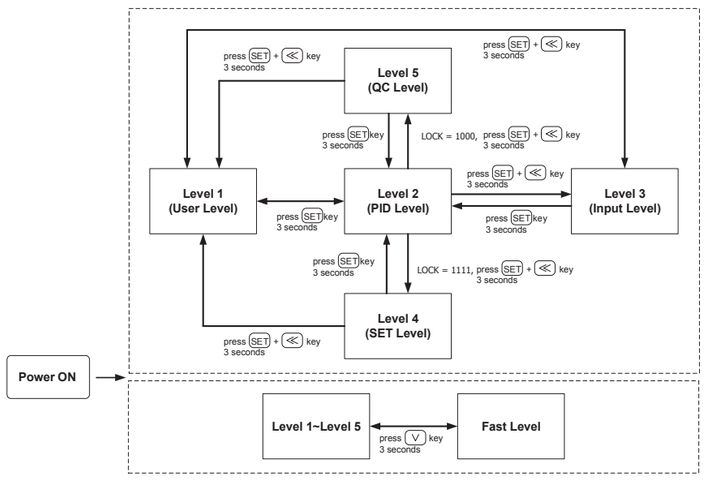
The NFY controller is an original dual-loop controller. The parameter group of Level 1~Level 4 is of LOOP type. There are two copies kept in LOOP1 and LOOP2.
Level 5 parameter group non-LOOP type is of an independent, linked with Level 4 of LOOP1 or LOOP2, as the parameter structure is shown in the diagram below.



3.2 Level Operation Mode

1. **LEVEL 1 enter to the LEVEL 2**
   Hold SET key for 3 seconds then entering into LEVEL 2
2. **LEVEL 1 enter to the LEVEL 3**
   Hold SET key + SHIFT key for 3 seconds then entering into 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 return to LEVEL 3
5. **LEVEL 1 enter to the LEVEL 4**
   Hold SET key for 3 seconds then entering into LEVEL 2, in LEVEL 2 press SET key to find parameter "LOCK", modify LOCK value from current value to 1111 then hold SET key + SHIFT key for 3 seconds then entering into LEVEL 4
6. **LEVEL 2 enter to the LEVEL 5**
   Hold SET key for 3 seconds then entering into LEVEL 2, in LEVEL 2 press SET key to find parameter "LOCK", modify LOCK value from current value to 1000 then hold SET key + SHIFT key for 3 seconds then entering into LEVEL 5
7. **LEVEL 3 return to the LEVEL 1**
   hold SET key + SHIFT key for 3 seconds then return to LEVEL 1
8. **LEVEL 3 return to the LEVEL 2**
   Hold SET key for 3 seconds then return to LEVEL 2
9. **LEVEL 4 return to the LEVEL 1**
   Hold SET key + SHIFT key for 3 seconds then return to LEVEL 1
10. **LEVEL 4 return to the LEVEL 2**
    Hold SET key for 3 seconds then return to LEVEL 2
11. **LEVEL 5 return to the LEVEL 1**
    Hold SET key + SHIFT key for 3 seconds then entering into LEVEL 1
12. **LEVEL 5 return to the LEVEL 2**
    Hold SET key for 3 seconds then return to LEVEL 2

3.3 Level Operation Diagram



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

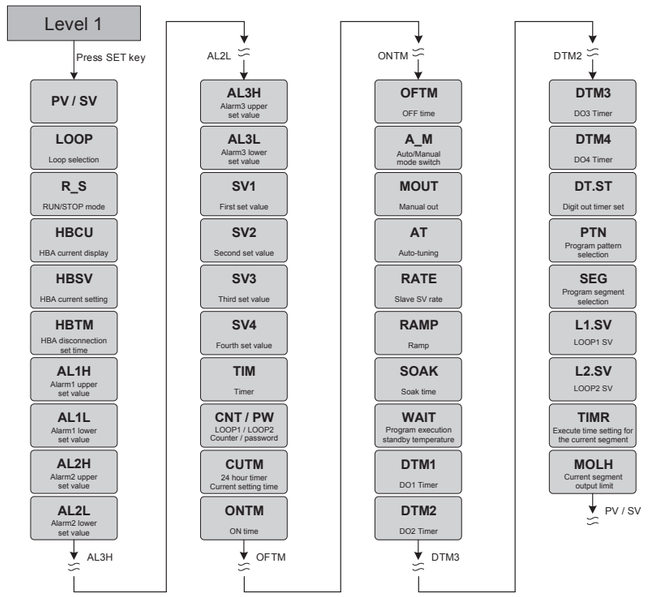
3.4 Data Lock Function

LOCK 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.

LOCK	LEVEL					Descriptions
	Level_1 USER Level	Level_2 PID Level	Level_3 INPUT Level	Level_4 SET Level	Level_5 QC Level	
0000	◎	◎	◎	X	X	All parameters of Level 1, 2 & 3 are able to be modified (Factory default setting)
1111	◎	◎	X	◎	X	All parameters of Level 1, 2 & 4 are able to be modified
1000	◎	◎	X	X	◎	All parameters of Level 1, 2 & 5 are able to be modified
0001	◎	◎	X	X	X	Only SV, LOOP, R_S, A_M,LOCK can be modified
0101	◎	◎	X	X	X	Only LOCK can be modified
0110	◎	◎	X	X	X	Only parameters of Level 1 and LOCK can be modified
Other	◎	◎	◎	X	X	Once jumping to other levels, LOCK will be automatically restored to 0000

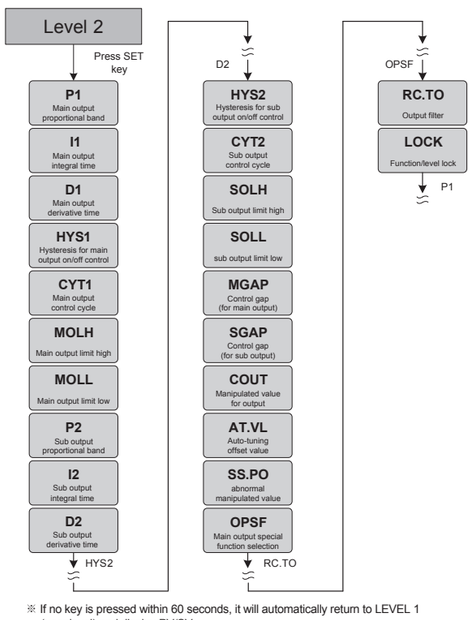
◎ : allow X : inhibit

3.5 Level 1 (User Level) All Parameters Display



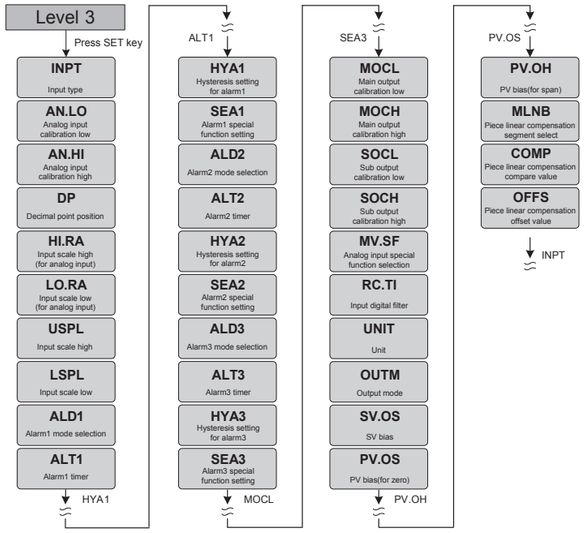
※ If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV.

3.6 Level 2 (PID Level) All Parameters Display



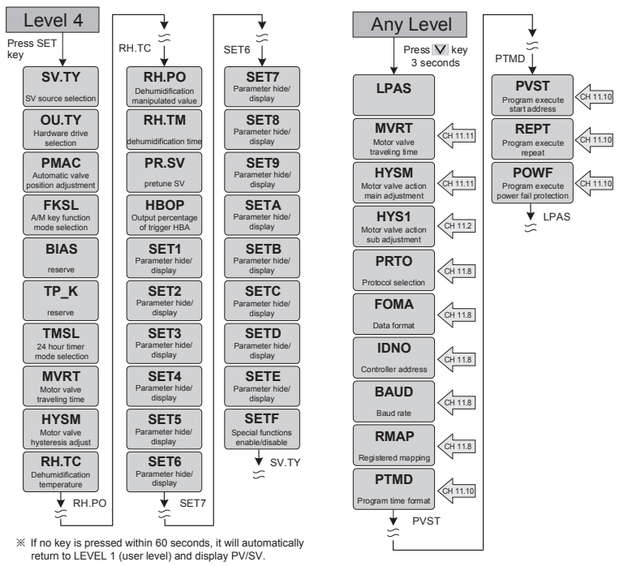
※ If no key is pressed within 60 seconds, it will automatically return to LEVEL 1 (user level) and display PV/SV.

3.7 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.

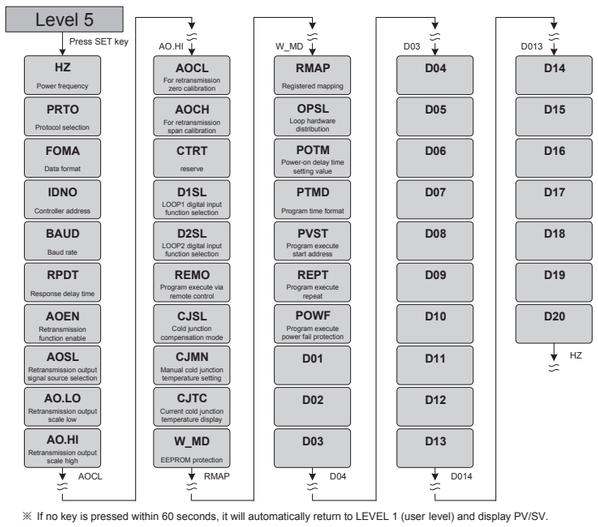
3.8 Level 4 (Setting Level) All Parameters Display



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

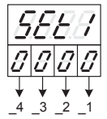
4.0 Fast Parameter Access

3.9 Level 5 (Quality Control) All Parameters Display



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

4 Parameters Hide/Display Table On Level 4

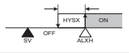
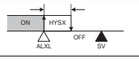
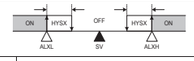
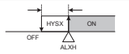
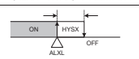
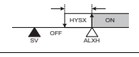
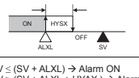
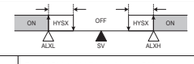
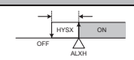
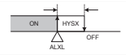


SEt1	SET1_1	0	hide	HBCU HBSV HBTM HBOP
		1	display	HBCU HBSV HBTM HBOP
	SET1_2	0	hide	AL1H AL1L
		1	display	AL1H AL1L
	SET1_3	0	hide	AL2H AL2L
		1	display	AL2H AL2L
	SET1_4	0	hide	AL3H AL3L
		1	display	AL3H AL3L
SEt2	SET2_1	0	hide	SV1 SV2
		1	display	SV1 SV2
	SET2_2	0	hide	SV3 SV4
		1	display	SV3 SV4
	SET2_3	0	hide	TIM
		1	display	TIM
	SET2_4	0	hide	(CNT→ LOOP1) (PW→ LOOP2)
		1	display	(CNT→ LOOP1) (PW→ LOOP2)
SEt3	SET3_1	0	hide	CUTM ONTM OFTM
		1	display	CUTM ONTM OFTM
	SET3_2	0	hide	A_M
		1	display	A_M
	SET3_3	0	hide	AT
		1	display	AT
	SET3_4	0	hide	R_S
		1	display	R_S
SEt4	SET4_1	0	hide	WAIT
		1	display	WAIT
	SET4_2	0	hide	DTM1 DTM2 DTM3 DTM4
		1	display	DTM1 DTM2 DTM3 DTM4
	SET4_3	0	hide	DT.ST
		1	display	DT.ST
	SET4_4	0	hide	PV1 PV2
		1	display	PV1 PV2
SEt5	SET5_1	0	hide	reserve
		1	display	reserve
	SET5_2	0	hide	MOLH MOLL
		1	display	MOLH MOLL
	SET5_3	0	hide	reserve
		1	display	reserve
	SET5_4	0	hide	SOLH SOLL
		1	display	SOLH SOLL
SEt6	SET6_1	0	hide	COUT
		1	display	COUT
	SET6_2	0	hide	AT.VL SS.PO
		1	display	AT.VL SS.PO
	SET6_3	0	hide	OPSF RC.TO
		1	display	OPSF RC.TO
	SET6_4	0	hide	LOOP L2.SV MOLH
		1	display	LOOP L2.SV MOLH
SEt7	SET7_1	0	hide	AN.LO AN.HI DP
		1	display	AN.LO AN.HI DP
	SET7_2	0	hide	HI.RA LO.RA
		1	display	HI.RA LO.RA
	SET7_3	0	hide	LSPL USPL
		1	display	LSPL USPL
	SET7_4	0	hide	ALD1 ALT1 HYA1 SEA1
		1	display	ALD1 ALT1 HYA1 SEA1
SEt8	SET8_1	0	hide	ALD2 ALT2 HYA2 SEA2
		1	display	ALD2 ALT2 HYA2 SEA2
	SET8_2	0	hide	ALD3 ALT3 HYA3 SEA3
		1	display	ALD3 ALT3 HYA3 SEA3
	SET8_3	0	hide	MOCL MOCH
		1	display	MOCL MOCH
	SET8_4	0	hide	SOCL SOCH
		1	display	SOCL SOCH
SEt9	SET9_1	0	hide	MV.SF
		1	display	MV.SF
	SET9_2	0	hide	RC.TI
		1	display	RC.TI
	SET9_3	0	hide	UNIT
		1	display	UNIT
	SET9_4	0	hide	OUTM
		1	display	OUTM
SEtA	SETA_1	0	hide	SV.OS
		1	display	SV.OS
	SETA_2	0	hide	PV.OS PV.OH
		1	display	PV.OS PV.OH
	SETA_3	0	hide	MLNB COMP OFFS
		1	display	MLNB COMP OFFS
	SETA_4	0	hide	Super SV function disable
		1	display	Super SV function enable
SEtb	SETB_1	0	hide	OU.TY
		1	display	OU.TY
	SETB_2	0	hide	reserve
		1	display	reserve
	SETB_3	0	hide	FKSL
		1	display	FKSL
	SETB_4	0	hide	BASE TP_K
		1	display	BASE TP_K
SEtC	SETC_1	0	hide	TMSL
		1	display	TMSL
	SETC_2	0	hide	MVRT HYSM
		1	display	MVRT HYSM
	SETC_3	0	hide	RH.TC RH.PO RH.TM
		1	display	RH.TC RH.PO RH.TM
	SETC_4	0	hide	PR.SV
		1	display	PR.SV
SEtd	SETD_1	0	hide	PRTO FOMA IDNO BAUD RPDT
		1	display	PRTO FOMA IDNO BAUD RPDT
	SETD_2	0	hide	AOEN AOSL AO.LO AO.HI AOCL AOCH
		1	display	AOEN AOSL AO.LO AO.HI AOCL AOCH
	SETD_3	0	hide	CTRT D1SL D2SL
		1	display	CTRT D1SL D2SL
	SETD_4	0	hide	REMO
		1	display	REMO
SEtE	SETE_1	0	hide	CJSL CJMN CJTC W_MD RMAP OPSL POTM
		1	display	CJSL CJMN CJTC W_MD RMAP OPSL POTM
	SETE_2	0	hide	D01 D02 D03 D04 D05 D06 D07 D08 D09 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20
		1	display	D01 D02 D03 D04 D05 D06 D07 D08 D09 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20
	SETE_3	0	hide	reserve
		1	display	reserve
	SETE_4	0	hide	RAMP
		1	display	RAMP
SEtF	SETF_1	0		valve control close Relay b contact out
		1		valve control close Relay a contact out
	SETF_2	0		in abnormal condition MOUT = SS.PO
		1		in abnormal condition MOUT = 0
	SETF_3	0		PV Hysteresis_mode disable
		1		PV Hysteresis_mode enable
	SETF_4	0		disable piece linear compensation function
		1		enable piece linear compensation function

5 Alarm Mode

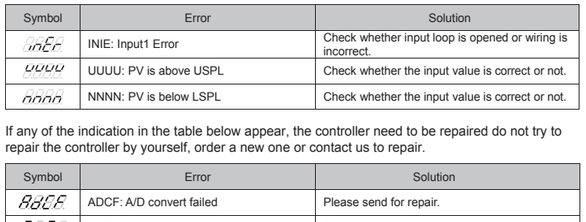
There is a dot on the led display for alarm hold action, such as → dEH.1 (Deviation high with hold action)
When the controller boot completed, the PV is within the alarm range, and no alarm action will be generated at this time, until the PV exceed alarm range then enter the alarm range again the alarm will be activated.

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

ALDX		Index value	Alarm mode	Description
NONE	nonE	0	No alarm function	Not drive any alarm relays and the corresponding LED lamp.
DE.HI	dEH.1	1	Deviation high (With hold action)	 Formula: PV ≥ (SV + ALXH) → Alarm ON; PV ≤ (SV + ALXH - HYAX) → Alarm OFF
DE.LO	dEL.1	2	Deviation low (With hold action)	 Formula: PV ≤ (SV + ALXL) → Alarm ON; PV ≥ (SV + ALXL + HYAX) → Alarm OFF
DE.HL	dEHL	3	Deviation high/low (With hold action)	 Formula: PV ≤ (SV + ALXL) → Alarm ON; PV ≥ (SV + ALXL + HYAX) → Alarm OFF; PV ≥ (SV + ALXH) → Alarm ON; PV ≤ (SV + ALXH - HYAX) → Alarm OFF
BA.ND	bAnd	4	Band (With hold action)	 Formula: PV ≤ (SV + ALXH) → Alarm ON; PV > (SV + ALXH) → Alarm OFF; PV ≥ (SV + ALXL) → Alarm ON; PV < (SV + ALXL) → Alarm OFF
PR.HI	PrH.1	5	Process high (With hold action)	 Formula: PV ≥ ALXH → Alarm ON; PV ≤ (ALXH - HYAX) → Alarm OFF
PR.LO	PrL.1	6	Process low (With hold action)	 Formula: PV ≤ ALXL → Alarm ON; PV ≥ (ALXL + HYAX) → Alarm OFF
PEND	PEnd	7	Program end	When the program is end, the alarm action This mode only available in program type controller
SYAB	SYAb	8	System error	The alert action, when PV displays error message
HBA	HbAb	9	HBA (Heater Break Alarm)	Activated conditions : 1. Heater current(HBCU) is less the HBSV set value 2. OUT1 manipulated value exceed HBOP set value 3. Fit with Condition1 and 2 and exceed set the seconds of HBTM
MSOK	MSoK	10	soak timer	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 please refer to chapter 11.11 RAMP + SOAK
DEHI	dEH.1	11	Deviation high	 Formula: PV ≥ (SV + ALXH) → Alarm ON; PV ≤ (SV + ALXH - HYAX) → Alarm OFF
DELO	dEL.1	12	Deviation low	 Formula: PV ≤ (SV + ALXL) → Alarm ON; PV ≥ (SV + ALXL + HYAX) → Alarm OFF
DEHL	dEHL	13	Deviation high/low	 Formula: PV ≤ (SV + ALXL) → Alarm ON; PV ≥ (SV + ALXL + HYAX) → Alarm OFF; PV ≥ (SV + ALXH) → Alarm ON; PV ≤ (SV + ALXH - HYAX) → Alarm OFF
BAND	bAnd	14	Band	 Formula: PV ≤ (SV + ALXH) → Alarm ON; PV > (SV + ALXH) → Alarm OFF; PV ≥ (SV + ALXL) → Alarm ON; PV < (SV + ALXL) → Alarm OFF
PRHI	PrH.1	15	Process high	 Formula: PV ≥ ALXH → Alarm ON; PV ≤ (ALXH - HYAX) → Alarm OFF
PRLO	PrL.1	16	Process low	 Formula: PV ≤ ALXL → Alarm ON; PV ≥ (ALXL + HYAX) → Alarm OFF
PRUN	PrUn	17	Program run	When the program is being executed, the alarm action This mode only available in program type controller
SYNO	SYnO	18	System normal	The Alert action, when PV normal displays(no error message)
SOAK	SoAK	19	Ramp Soak Timer	Boot completed, the alarm is ON 1. RAMP SV reach target SV 2. PV ≥ target SV When both of the above conditions are true start the soak timer, alarm and control function are turned OFF in soak time finish (in this function ramp function is necessary)
TIM	tIM.1	20	Timer	Alarm action in time up This mode only available in Digital Input function
CNT	CNt.1	21	Counter	Alarm action after counter value is reached This mode only available in Digital Input function
CUTM	CUtO	22	24H Timer	When CUTM = ONTM, alarm activates When CUTM = OFTM, alarm stops
FSOK	FSoK	23	soak timer	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

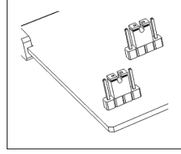
Alarm Example

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

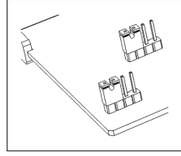


6 Modification Of Input Signal

5.1 Input Modify To Thermocouple

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

5.2 Input Modify To RTD

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

7 Error Message

If controller exhibits any of the following issues, please proceed with the following procedures

Symbol	Error	Solution
inEr	INIE: Input1 Error	Check whether input loop is opened or wiring is incorrect.
UUUU	UUUU: PV is above USPL	Check whether the input value is correct or not.
nnnn	NNNN: PV is below LSPL	Check whether the input value is correct or not.

If any of the indication in the table below appear, the controller need to be repaired do not try to repair the controller by yourself, order a new one or contact us to repair.

Symbol	Error	Solution
AdCF	ADCF: A/D convert failed	Please send for repair.
CJEr	CJER: Cold junction compensation failed	Please send for repair.
rAMF	RAMF: EEPROM failed	Please send for repair.