SINGLE CHANNEL CONTROL PANEL

OPERATING MANUAL

Model Number: NCP-1P-240V-15A-1UARP

Table of Contents

1. INTRODUCTION

This Operating Manual is a part of the documentation for the portable control panel which can be used in variety of applications. The manual contains the operating instructions and procedure to operate and along with the safety instructions for the instruments.

The control panel is compactible for the below specifications

• Controller Model number	NCP-1P-240V-15A-1UARP
• Supply Voltage	Single Phase,110-240 Volt, 50-60HZ
• Heater supply voltage	110-240V
• Maximum Current Output	15 Ampere
• Alarm output	Yes
• Communication	RS485 to USB, RS485 (Raw)
• Controller Input type	Thermocouple K, S, R, E, J, B, N, T, B, WRe25, WRe5-WRe26, and RTD Cu50, PT100
• Enclosure	Polyester enclosure Fiberglass Rated for NEMA 4X vented.

Caution

Before operating the control panel, read this operating manual

This controller is intended to control the equipment under normal operating conditions. Failure or malfunction of the controller may lead to abnormal operating conditions, which may result in personal injury or damage to the equipment or other property. Devices (limit or safety controls) or systems (alarm or supervisory) intended to warn and protect against failure or malfunction of the controller must be incorporated into and maintained as part of the control system.

2. WARRANTY AND LIABILITY

- The manufacturer will not be liable for defects and damage caused by failure to follow the product installation and maintenance instructions.
- The control panel can only be used to control products which should be within the specification such as ampere rating for the heater, type of thermocouple etc
- Do not connect and disconnect the control panel connector while the panel is in running state.
- After the product is switched off, it should not be switched on again for at least 5–10 seconds.
- For safe product operation, after two unsuccessful attempts to start the product in a row, contact the service department for troubleshooting information.
- The warranty operating period of the control panel is 12months from the date of sale, provided the operation, transportation and storage rules are followed by the consumer.
- The warranty does not cover defects appearing as a result of:
  force major circumstances, including lightning strike, fire, flood, impermissible voltage surges or traffic accidents; failure to follow the rules for installation, operation, storage, and transportation specified in the Operating Manual, use of the control panel for purposes other than intended.

3. SAFETY

- Do not switch on and operate the product in locations where combustible vapours or gases or large amounts of dust can form (filling stations or petroleum, fuel, coal, timber or grain storage facilities). may lead to Explosion hazard.
- All wiring and component replacement to be made by qualified personnel only
- Do not use a faulty product. Injury hazard due to use of faulty device
- Do not switch on and operate the product in enclosed or non-ventilated premises. Hazard of poisoning and asphyxiation by exhaust gases.
- Do not switch on and operate the product if combustible materials or fluids are present in the exhaust gas which may lead to Fire hazard.

4. PRODUCT SPECIALITY AND FEATURES

Figure 4-1 Control panel Side labelling

Figure 4-2 control panel side labelling

4.1 PRODUCT SPECIALITY

- Plug and play type with quick installation
- PV display with LCD screen for improved visibility
- Advanced artificial intelligence FUZZY+PID control
- Fastest response time up to 80mS
- Additional special features like Ramp mode, Soak mode programmable to control various state of the output process temperature.
- Control panel can be used with a universal input which support all kinds of thermocouples
- Alarm output for easy rectification of errors
- Dedicated output connector for heater, alarm and thermo sensor
- RS485 to USB serial converted output
- RS485 raw serial output.
- Additional special features like Ramp mode, Soak mode programmable to control various state of the output process temperature

4.2 PRODUCT SAFETY FEATURES

- Tough Plastic panel for Electrical shock proof
- Dedicated fuse for Heater and panel separately
- Controller can be programmed without turning on the heaters with its separate power switch.
- Door locking system with a key
- Lockable input and output panel mounted connectors for safe and stable operation
- 110 – 240V wide input voltage range to panel
- Separate Alarm output port.
- Separate Switch and LED indication for both Controller and Heater

5. WIRING AND INSTALLATION

5.1 FIXING THE TAB TO THE PANEL

Step1: Remove the bolt (all 4 bolts) from the panel by holding the nut inside the panel

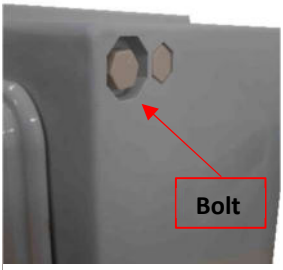


Figure 5-1: Removal of Bolt

Figure 5-2: Removal of nut

Step2: Place the tab as per the required orientation (horizontal/vertical) and insert the bolt and tight the nut which is present inside the panel box. And later fix the panel to the wall

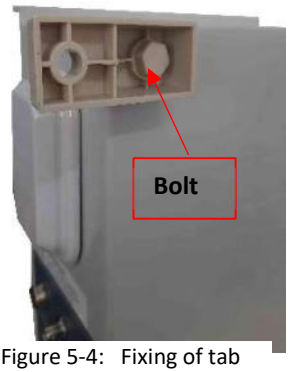


Figure 5-4: Fixing of tab

5.2 FIXING THE MAIN POWER CABLE TO THE TERMINAL BOX

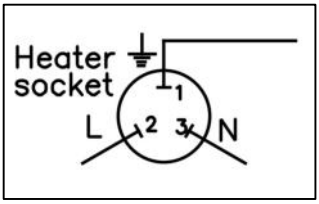
Step1: Open the cover of the terminal box.

Step 2: Connect the wires Line, neutral and ground cable via cable gland and make sure that the wire strands are properly connected and not touching anywhere.

Figure 5-2-1: Terminal Block

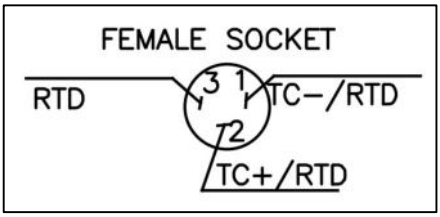
5.3 FIXING THE HEATER POWER CABLE, THERMOSENSOR, ALARM AND SERIAL PORT

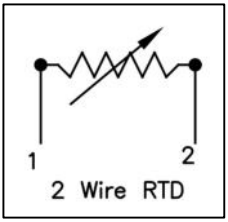
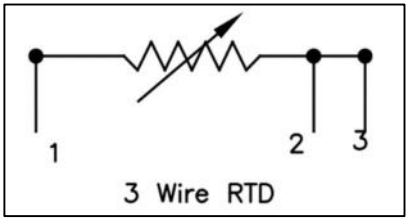
Step1: Connect the heater wires as per the wiring diagram as below.



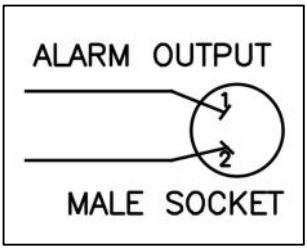
Heater Wiring details	
Pin no.	**Type**
Pin1	Ground
Pin 2	Line (heater Power)
Pin 3	Neutral (heater Power)

Step 2: Connect the thermocouple leads as per the polarity.

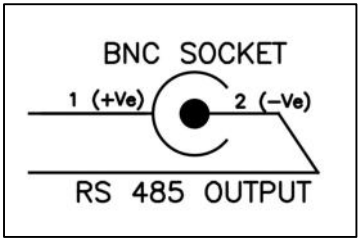


Thermocouple wiring details	
Sensor type	**Connection details**
K S R T E J B N	Pin 1:TC -ve Pin 2:TC +ve Pin 3: N/A
2 Wire RTD	 Pin 1: RTD Pin 2: RTD **Pin 3: To be shorted with Pin 2**
3 Wire RTD	 Pin 1: RTD cable Pin 2: RTD cable Pin 3: RTD cable

Step 3: Connect the alarm leads as per the requirement.
Alarm output type: NO
Alarm rated power: 5 Amps



Step 4: Connect the raw output data of serial connector (if multiple panels connected or to a PLC)



Serial Wiring details	
Pin no.	**Type**
Pin1	Serial cable +ve
Pin 2	Serial cable -ve

Step 5: Connect the USB cable provided with controller to the computer for controlling the temperature setting and data logging via software.

Note:

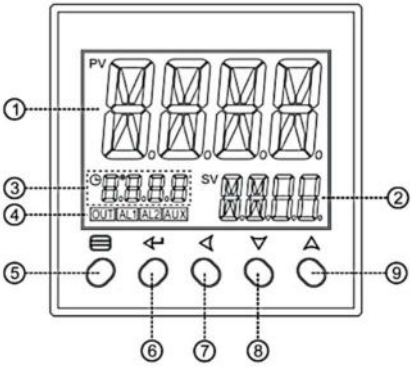
- Step 4 and step 5 is optional.
- To connect the panel via RS 485(Raw), then connect via BNC connector.
- To connect the panel via RS 485 to serial, then connect via USB cable

6. GETTING STARTED

- Connect the power input to the mains
- Solder the heater cable, alarm cable, temperature sensor cable and Serial output to the dedicated plugs provided (refer Pic 4.2)
- Before plugging to main socket, make sure that mains, controller and heater switch is in OFF position.
- Plug the main socket to the input rated power.
- Switch ON the mains
- Switch ON the controller switch and set the thermocouple type, heater set temperature, and alarm settings (optional) (Refer below in PID controller settings (Refer ins chapter 7))
- Switch ON the auto tuning in controller to set the PID values automatically (Refer below in PID controller settings) (For advanced users set the PID values in controller accordingly) (refer Appendix II for more details)
- Switch ON the Heater so that the controller will attain and set the required temperature.
- Before turning OFF the main power, make sure that heater switch, controller switch and Mains is in OFF position.

7. SETTING THE PID CONTROLLER

7. Front Panel Description



① No.1 display, PV or specified parameter
② No.2 display, SP or specified parameter value
③ No.3 display MV
④ Operation indicators:
OUT ,AL1,AL2,AUX indicators
⑤ Setup key: For accessing parameter table and conforming parameter modification.
⑥ Enter key:For Confirm and change to another parameter
⑦ Data shift key, start auto tuning
⑧ Data decrease key, and also run switch
⑨ Data increase key, and also stop key

7.1 SELECTING A THERMOCOUPLE TYPE

Step 1: In the basic display state, press and hold  for 2 sec

Step 2: Set LOC = 800 and then press  key

Step 3: Select INT function and later select the temperature sensor as per the below table

Int	Input spec	Int	Input spec
0	K (-50.0~+1300°C)	18	J (0~300.00°C)
1	S	20	Cu50
2	R	21	Pt100 (-200.0~+600.0 °C)
3	T		
4	E	22	Pt100 (-100~+300.00 °C)
5	J		
6	B	25	0~75mV
7	N	26	0~80Ω
8	WRe3-WRe25	27	0~400Ω
9	WRe5-WRe26	28	0~20mV
10	Special custom input specification	29	0~100mV
		30	0~60mV
12	F2 radiation type pyromter	31	0~1V
		32	0.2~1V
15	Spare	33	1~5V (4~20mA)
		34	0~5V (0~20mA)
16	Spare	35	-20~+20mV
		36	-100~+100mV
17	K (0~300.00°C)	37	-5V~+5V

7.2 SELECTING AUTOTUNING OPTION

In basic display press for 2 sec then 'At' parameter will appear, press to change the value from OFF to ON

7.3 SETTING CONTROL PERIOD

Step 1: In the basic display state, press and hold for 2 sec

Step 2: Set LOC = 801 and then press ↵ key

Step 3: Select CP function and later Set the period between 0.5 to 3 seconds for SSR control type

7.4 FOR ALARM SETTINGS,

please refer the appendix (II) i.e. function parameters and alarm settings.

7.5 TO STOP THE OPERATION IN BETWEEN BY USING PID CONTROLLER

In basic display pres △ for 2 sec then stop screen blinks in the place of Set value.

7.6 TO RUN THE OPERATION IN BETWEEN BY USING PID CONTROLLER

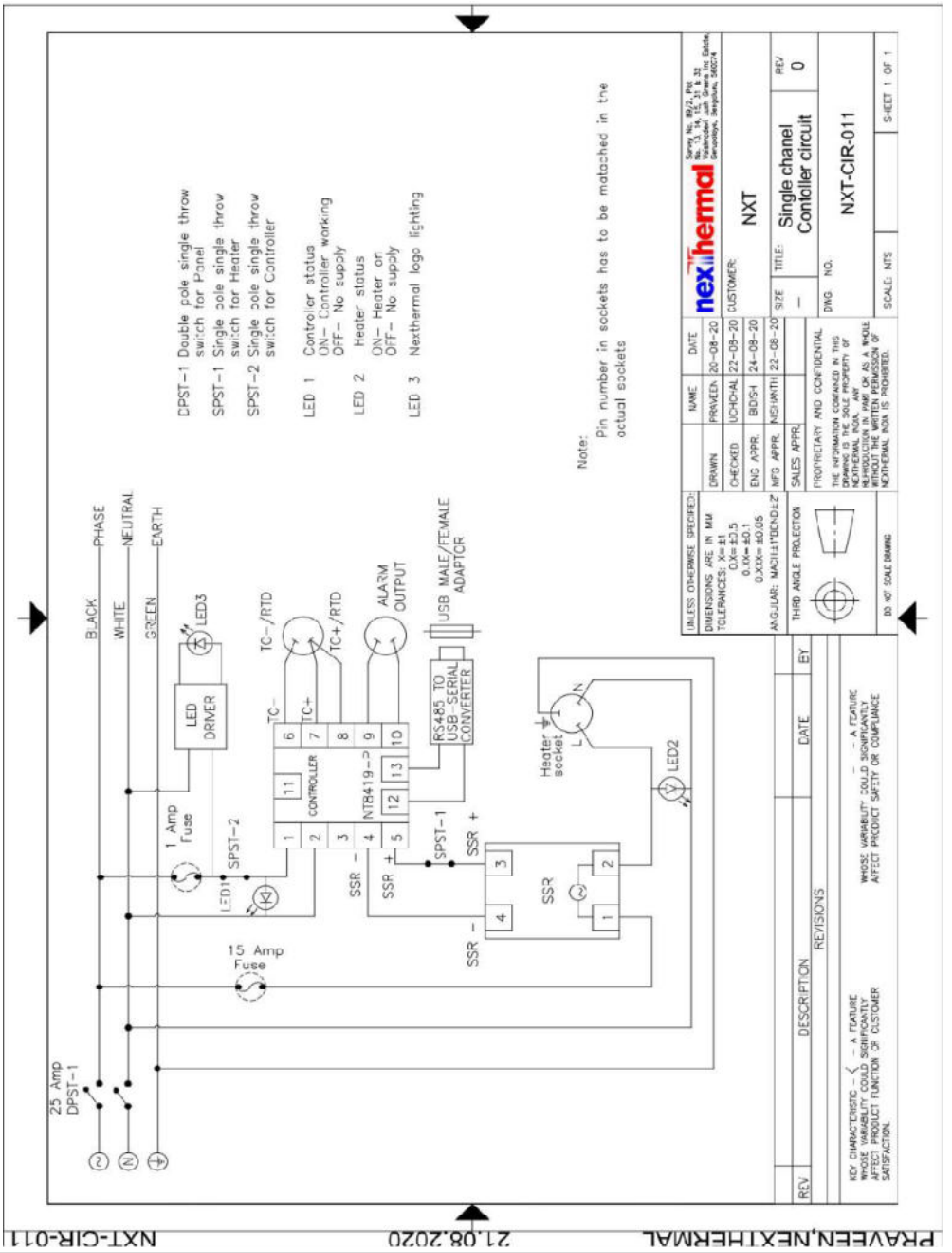
In basic display press ▽ for 2 sec then run appears in the place of Set value.

8. OPERATIONAL PROCEDURE

i. Make sure that the Main switch is off
ii. Connect the main cord wire to the standard input
iii. Connect the thermocouple and heater to the control panel
iv. Switch ON the mains
v. Switch ON the PID controller switch and make sure the PID controller is ON.
vi. Select the type of the thermocouple in the PID controller refer Appendix III or section 6 for the PID settings
vii. Set the required temperature in the PID controller
viii. Switch ON the autotuning in PID controller refer Appendix III or section 6 for the PID autotuning settings
ix. Switch ON the heater ON switch
x. After the completion the process, kindly switch of the heater, controller switch and finally switch of the mains ON switch.

Problem	Possible Fault	Identification	Cause	Solution
Heater not working	Heater failed, Heater Fuse burning	Check the heater resistance and check the fuse with multi-meter	Over current or short circuit	Replace the Heater (or) fuse with similar specifications
Control panel not switching on	Fuse burning	Check the Controller fuse with multi-meter	Over current or short circuit	Replace the fuse having similar rating
Sensor input is open	temperature sensor failed	Check the working of temperature sensor	Sensor might fail	Replace the temperature sensor having similar specifications
Heater temperature is continuously raising	PID controller may not working properly OR SSR may be faulty	check the PID controller and as well as SSR inside the panel	Internal failure of the PID or SSR	Replace the PID controller or SSR whichever is faulty with similar ratings and specifications (or)
				Contact Nexthermal
Software is not connecting to PC	Driver of RS 485 might not installed properly or check the Com port	Check the driver and comm port is correct	Port error	Check software settings and guidelines
			Convertor error	For driver issues contact Nexthermal.
			OS issues	
			Software error	

10. APPENDIX-I (WIRING DIAGRAM)



11. APPENDIX-II (DETAILED PID CONTROLLER MANUAL)

nexthermal Operating instructions

NT8419/NT8419P High performance digital temperature controller

1.Main features

●White PV display and new higher contrast LCD with greatly improved visibility.
●Get practical patent Plastic waterproof type keys,Firm and never wear and Operation feel clear and smooth and Good waterproof performance.
●Universal input: support all kinds of thermocouples,RTDs , linear current/voltage, resistance and radiation (infrared) thermometer signals are selectable .
●Use digital calibration technology for input measurement with input measurement accuracy F.S.0.15%,and achieving accurate and stable measurement,maximum resolution is 0.01℃.
●Use advanced modular structure, conveniently providing plentiful output options, able to satisfy the requirements of various applications.
●Use advanced artificial intelligent control algorithm, no overshoot and with the function of auto tuning (AT) and self-adaptation.
●Can provide up to Three alarm output and LBA control circuit disconnection alarm function.
●Support RS485 or RS232C communication interface, the use of advanced MODBUS RTU and FTBUS communication protocol.
●The measured value (PV) or a set value (SV) can be changed into a standard current signal output, which can be used as a temperature transmitter.
●Can Using OUt PID Control Output and AUX transmitter Output,A PID Control Output Assignment An auxiliary output is used as the transmitter output.
●Can manual / automatic switch control and manual auto Tuning function .

2.Technical Specification

Series model	NT8419	NT8419P
Category	High performance temperature controller	Base on NT8419 added 50 segments programmable functions.
Indication method	11-segment digital LCD display and individual indicators	
Power supply voltage	AC/DC100~240V ,or AC/DC12-24V(-15%, +10%/50-60HZ)	
Power consumption	Approx. 5.2 VA at 100 to 240 VAC, Approx. 3 VA at 12 to 24 VDC	
Input type	Thermocouple:K, S, R, E, J, B, N, T, B,WRe3-WRe25, WRe5-WRe26. Resistance temperature detector:Cu50, Pt100. Linear voltage :0~5V、1~5V、0~1V、0.2~1V、0~20mV、0~60mV、0~75mV、0~100mV、-5~+5V、-1V~+1V、-20mV~+20mV、-100~+100mV etc. Linear voltage(external precise shunt resist needed) :0~10mA、0~20mA、4~20mA etc. Extended input (install I4 module in MIO) : 0~20mA, 4~20mA or two line transmitter.	
Instrument Input range	K (-50~+1300℃) 、S (-50~+1700℃) 、R (-50~+1700℃) 、T (-200~+350℃) 、E (0~800℃) 、J (0~1000℃) 、B (200~1800℃) 、N (0~1300℃) 、WRe3-WRe25 (0~2300℃) 、WRe5-WRe26 (0~2300℃) 、Cu50 (-50~+150℃) 、Pt100(-200~+600℃) . Linear Input: -9990 ~ 30000 defined by user	
Measurement accuracy	0.15% FS ± 1 measurement unit	
Resolution	0.1℃ for K, E, T, N, J, Cu50, Pt100; 1℃ for S,R	
Decimal point	0,0.0,0.00,0.000	
Response time	80mS(when digital filter parameter InF=0),Display response time≤0.5Sec	

Temperature shift	≤0.015%FS /℃ (typical value is 80ppm/℃)
Control period	0.24～300.0 seconds selectable
Control mode	one-stop regulating, Intelligent Fuzzy PID algorithm
Relay contact output	3A/250VAC 5A/30VDC
SSR voltage output	12VDC/50mA(Used to drive SSR)
TRIAC no contact discrete output	100～240VAC/0.2A (continuous), 2A (20mS instantaneous, repeat period⩾5s)
Thyristor zero crossing trigger output	Can trigger TRIAC of 5～500A, a pair of inverse paralleled SCRs or SCR power module.
Linear current output	0～20mA, 4～20mA can scaling by user. (Output voltage⩾10.5V maximum load resistor 500ohm, output precision 0.2%FS)
Electromagnetic compatibility (EMC)	±4KV/5KHz according to IEC61000-4-4; 4KV according to IEC61000-4-5
Isolation withstanding voltage	Between power, relay contact or signal terminals ⩾2300VDC; between isolated electroweak terminals ⩾600V
Operating Ambient	Temperature:0~60°C; Humidity≤90%RH

3.Ordering Code Definition

NT8419
NT8419P — □ □ □ □ □ — □
① ② ③ ④ ⑤ ⑥

①

Code	Multiple function Input(MIO)
N	None
I3	4-20mA/0-20mA input
I4	4-20mA/0-20mA input , has a 24VDC/50mA power supply for a transmitter.
I2	Switch / frequency signal input

②

Code	Main output(OUT)
N	None
R	relay contact output(Normally open + normally close)
Q	SSR voltage output
W1	TRIAC no contact normal open discrete output
W2	TRIAC no contact normal close discrete output
K1	Single-phase thyristor zero crossing trigger output
K3	Three-phase thyristor zero crossing trigger output
X	0-20mA/4-20mA Linear current output
X5	0-5V/1-5V Linear voltage output
X8	0-10V/2-10V Linear voltage output
K5	Single-phase thyristor phase-shift trigger output , suitable for 200-240VAC power
K6	Single-phase thyristor phase-shift trigger output ,suitable for 340～415VAC power

③

Code	Alarm (ALM)
N	None
R1	relay contact output(Normally open)
R2	Dual relay output (Dual Normally open)
Q	SSR voltage output
Q2	Dual SSR voltage driver

④

Code	Auxiliary output (AUX)
N	None
R1	relay contact output(Normally open + normally close)
Q	SSR voltage output
X	0-20mA/4-20mA Linear current output
X5	0-5V/1-5V Linear voltage output
V24	24VDC voltage output
V12	12VDC voltage output
V10	10DC voltage output
U5	5DC voltage output

⑤

Code	Communication Interface (COMM)
N	None
S	RS485 communication interface
S2	RS232C communication interface

⑥

Code	Instrument power supply
None	AC/DC100~240V
D	DC12~24V

NT8419/NT8419P By installing different modules, the controller can meet the requirements of different functions and output types.

Multiple function Input (MIO):

Can input signal from 2-wire transmitter4-20mA signal by installing I4 (current input) module and I4 module can provide 24VDC to transmitter. If a I2 (on-off signal input) module is installed, the instrument can switch between set points SV1 and SV2 by an external switch.

Main output (OUTP):

Commonly used as control output such as on-off control, and PID+FUZZY control. It can be used as retransmission output of process value (PV) or set point (SV).Installing R modular can realize Normally open + normally close relay contact output; installing X module can realize 0-20mA/4-20mA /0-10mA linear current output; installing Q module can realize SSR voltage output; installing W1 or W2 module can implement TRIAC no contact switch output.

Alarm (ALM):

Commonly used as alarm output. Support 1 normally open relay output (AL1) by installing R1 module or 2 normally open relay outputs (AL1+AL2) by installing R2 module.

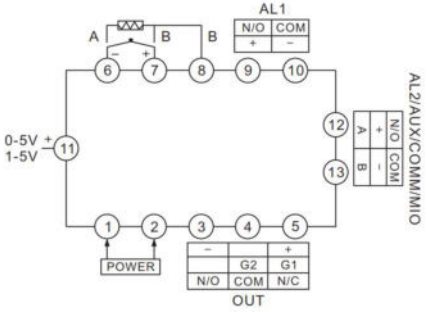
Auxiliary output (AUX):

In a heating/refrigerating dual output system, module X, R1, G, W1, W2 can be installed for the second control output. It can also output alarm by installing R1 module,and it can also be used as power supply for external sensor when equipped with a voltage output module.

Communication Interface (COMM):

Module S or S4 can be installed in for communicating with computer (RS485 communication interface).

4. Wiring diagram.

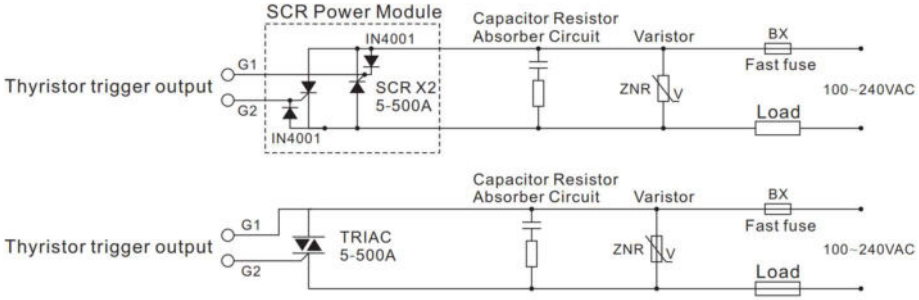


Note 1: For linear voltage input, if the range is below 500mV, connect to terminals 6 and 7. 0～5V or 1～5V signal can be inputted from terminals 6 and 11.

Note 2: 4～20mA linear current signal can change to 1～5V voltage signal by connecting a 250 ohm resistor, and then be inputted from terminals 6 and 11. If I3 module is installed in MIO slot, 4～20mA signal can be inputted from terminals 12+ and 13-, If I4 module is installed in MIO slot,4-20mA signal 2-wire transmitter can be inputted from terminals 12+ and 13-.

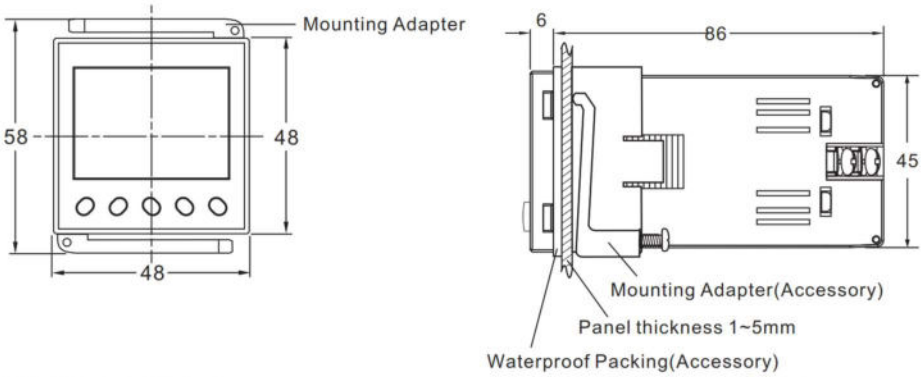
Note 3:If out is the SSR output, most can achieve up to three road alarm output.

5.Thyristor trigger output wiring diagram

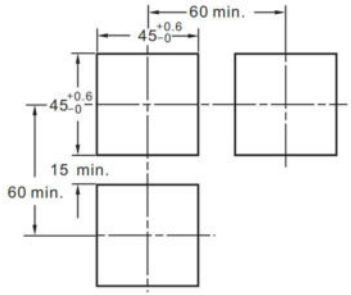


Note 1: According to the voltage and current of load, choose a suitable varistor to protect the thyristor. A resistor-capacitor circuit (RC circuit) is needed for inductance load or phase-shift trigger output.
Note 2: SCR power module is recommended. A power module includes two SCRs, is similar to the above dashed square.
Note 3: K5 and K6 TRAIC trigger module only support 220～380VAC and 50Hz power.

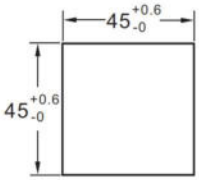
6. size



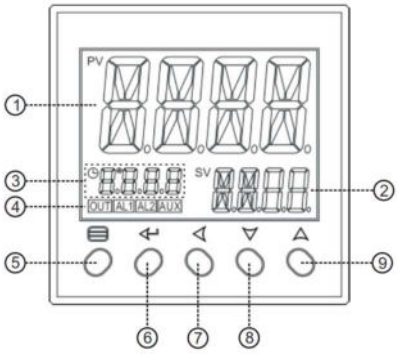
●Multiple install Cutouts



●Single install Cutout



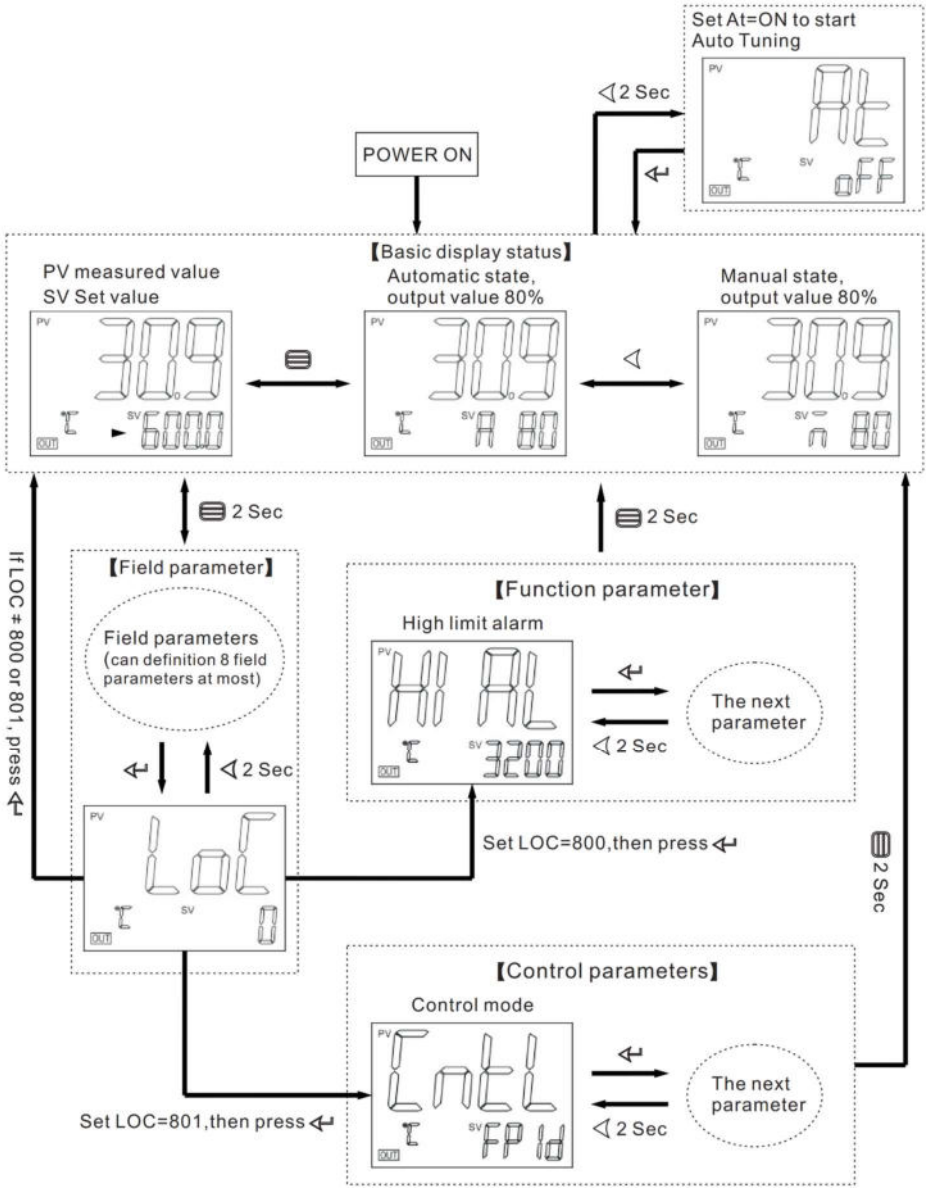
7. Front Panel Description



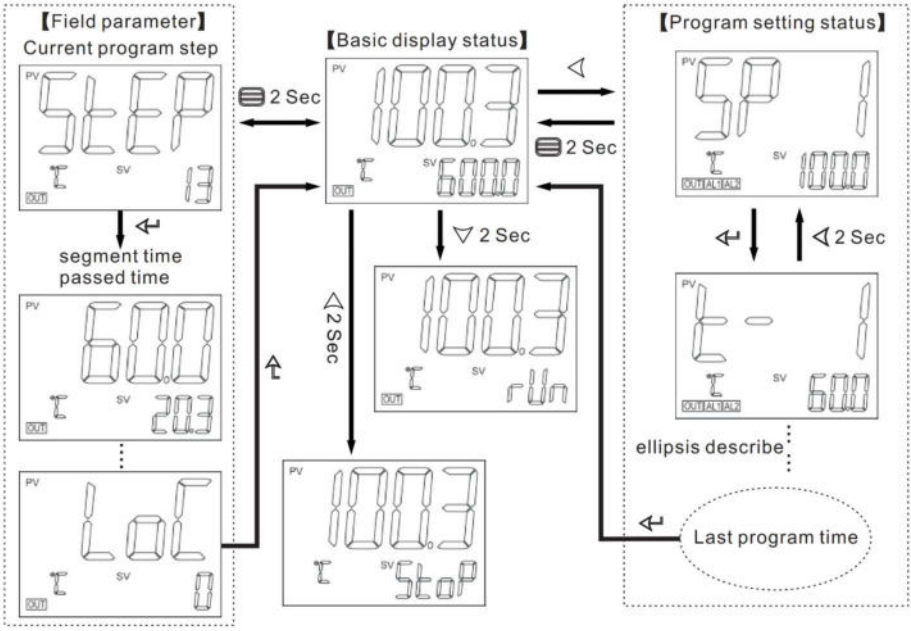
1. No.1 display, PV or specified parameter
2. No.2 display, SP or specified parameter value
3. No.3 display MV
4. Operation indicators: OUT ,AL1,AL2,AUX indicators
5. Setup key: For accessing parameter table and conforming parameter modification.
6. Enter key:For Confirm and change to another parameter
7. Data shift key, start auto tuning
8. Data decrease key, and also run switch
9. Data increase key, and also stop key

8.Parameter Setting Flow Chart and operation method description

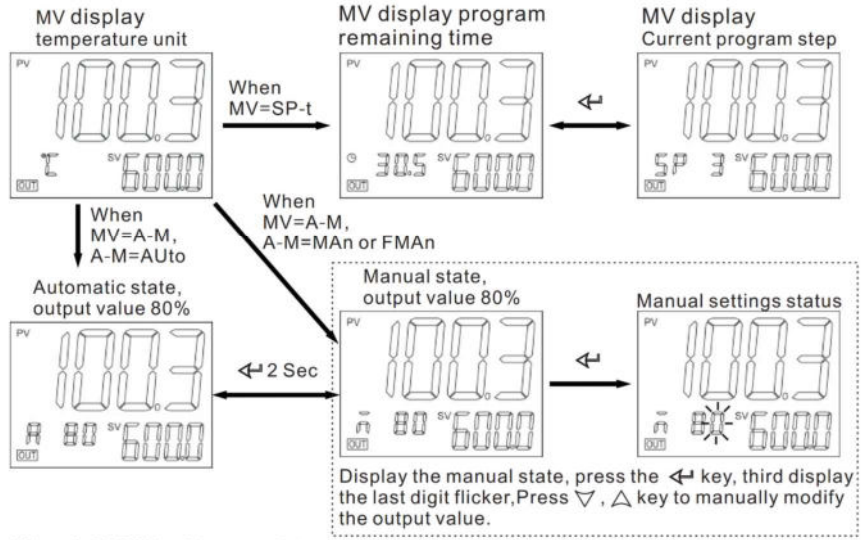
8.1 display status and basic operation flow chart



8.2 Program flow chart (NT8419P only)



8.3 No.3 display MV



When A-M=FMAn, For manual state only , no manual / automatic state switch.

8.4 Parameter Setting

In basic display status, press ☰ and hold for about 2 seconds can access Field Parameter Table. Press ↵ can go to the next parameter; press ◁ 、▽ or △ can modify a parameter. Press and hold ◁ can return to the previous parameter. Under parameter setting state, press ☰ key 2 seconds simultaneously can escape from the parameter table. The instrument will escape auomatically from the parameter table if no key is pressed within 25 seconds, and the change of the last parameter will not be saved.
In Field Parameter Table, ☰ till the last field parameter Loc appears. Setting Loc=800 and then press ↵ can access function parameter Table.Setting Loc=801 and then press ↵ can access Control parameters Table.

8.5 Set Value Setting

In basal display status, if the parameter lock "Loc" isn't locked, we can set setpoint (SV) by pressing ◁ first、then can press ◁ , ▽ or △ to adjust value. Press ▽ key to decrease the value, △ key to increase the value, and ◁ key to move to the digit expected to modify. Keep pressing ▽ or △ , the speed of decreasing or inscreasing value get quick. The range of setpoint is between the parameter SPL and SPH. The default range is -99~999.

8.6 Man/Auto mode switch(this function is enabled by the A-M parameter)

In the second display SV display output value state (for example, second display SV display the given value, double-click ☰ key to switch to the output value display state), press the ◁ key, can be performed to Bumpless switching between AUTO and MAN .
If the instrument works on Manual mode, its output value can be increased or decreased by pressing ▽ key and △ key under basic display status.

8.7 Run / Hold only (for NT8419P)

In basic display status, if the program is in stoP status ("StoP" is alternately displayed on the lower window), press and hold the ▽ key for about 2 seconds until the lower display window displays the "Run" symbol, the instrument then will start the program.
If parameter "PAF" set F=1, user can hold the ▽ key for about 2 seconds, instrument will changes to hold status and lower display window displays the "HoLd" symbol. If parameter "PAF" set F=0, "Hold" status only can activate by parameter setting (Srun).
At Hold status, the program is still executing, and the process value is controlled same as set, but the timer stop working, and the running time and setpoint remains. At Hold status, press and hold the ▽ key for about 2 econds until the lower display window displays the "Run" symbol, the instrument will back to run program.

8.8 Stop

Press and hold the △ key for about 2 seconds in the basic display status, until the lower display window displays the "stoP" symbol, means the stoP operation is executed now, when program stopped, timer will be reset and stop. This operation forces the instrument to stop running, meanwhile,the StEP number will reset to 1, nd control output is also stopped.

8.9 Auto Tuning

When FUZZY+PID control method is chosen (CntL=FPId), the PID parameters can be obtained by running auto-tuning.
In basal display status, press ◁ for 2 seconds, the "At" parameter will appear. Press to change the value of "At" from "oFF" to "on", then press ↵ to active the auto-tuning process. During auto tuning, the instrument executes on-off control. After 2-3 times of on-off action, the instrument will obtain the optimal control parameter value.
If you want to escape from auto tuning status, press and hold the ◁ key for about 2 seconds until the "At" parameter appear again. Change "At" from "on" to "oFF", press ↵ to confirm, then the auto tuning process will be cancelled. (P.S. If parameter "rAte" activate and the heating was running, then will stop the "At" until completed the heat up process.) If the controller was applied on heat/cooling duel output system, PID parameter need separate two group to process auto tuning. When the controller was cooling control from AUX, this time can enable auto tuning to obtain P2, I2, d2.

Note 1: If the setpoint is different, the parameters obtained from auto-tuning are possible different. So you'd better set setpoint to an often-used value or middle value first, and then start auto-tuning. For the ovens with good heat preservation, the setpoint can be set at the highest applicable temperature. Depending on the system, the auto-tuning time can be from several seconds to several hours.
Note 3: Parameter HYS (on-off differential, control hysteresis) has influence on the accuracy of auto-tuning. Generally, smaller value of HYS, will get higher precision of auto tuning result. Too large value of HYS,will made the controller out of control, so, HYS is recommended to be 2.0.
Note 4: NT84** series instrument has the function of self-adaptation. It is able to learn the process while working. he control effect at the first run after auto tuning is probably not perfect, but excellent control result will be obtained after a period of time because of self-adaptation.

9.Parameter list and function

9.1 Field parameter

In the basic display state, press and hold ⛁ key 2 seconds, Enter the field parameters. Through the definition of FP field parameters, You can select 8 parameters as field parameters in the Field parameters.

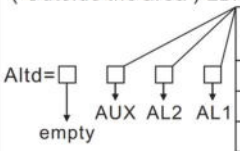
Code	Name	Description	Setting Range
StEP	Current execution Program segment (applicable only to NT8419P)	indicating the currently executing program segment number. Modify this parameter, the program will immediately jump, for example: the current StEP=3, represent the program The runs to the third segment. If you set StEP=8, the program immediately jumps to the eighth segment execution. The settings range for StEP is limited by Prgd and Prg, example:Prgd=8, Prg=2, and so on The program is divided into 8 curves. Now the program performs second curves,Now the program executes the 2 curve, executed by the 11-20 segment program, and the StEP set range is limited to 11-20, and After the instrument is stopped running (StoP), the StEP is automatically set to 11. Another example: Prgd=0, Prg=0, PrSn=80, then the program does not group, then StEP settings range 1-80, and After the instrument is stopped running (StoP), the StEP is automatically set to 1.	
PrG	Curve group number (applicable only to NT8419P)	Display the currently executing curve group number. When Prgd set curve grouping, you can program multiple curves to deal with different technology to be Seeking, by choosing this parameter to choose to perform the appropriate curve. The PrG setting range is limited by the PrGd parameter: When PrGd = 0, the program is not grouped, PrG can not be set, PrG is fixed at 0. When PrGd = 4, the program is forcibly divided into 4 groups of curves, PrG setting range is 1-4. When PrGd = 8, the program is forcibly divided into 8 groups of curves, PrG setting range is 1-8. When PrGd is forced to group, you can pre program a number of different groups of curves, Then by setting PrG you can quickly and easily choose to execute the appropriate curve. For example: PrGd = 4, PrG = 2, then the program is forced	

		into four groups of curves, the current implementation of the second curve (ie, to implement the procedures in paragraphs 21-40),When the controller implement stop after, StEP is automatically set as the start of the 2nd curve (ie, 21 steps)	
25.0 10.0	Section setting time and already run time(applicable only to NT8419P)	For example: the current segment setting time is 25 minute, and the already running time is 10 minute.	
PIDn	PID parameter group number (applicable only to NT8419P)	indicating the currently running PID parameter group number. This parameter cannot be modified and can only be defined programmatically.	
	Custom field parameters	maximum 8 field parameters can be defined by FP1 ~ FP8 (The defined parameters will be transferred from the function parameters or control parameters to the field parameter)	
LOC	Password lock	Set the LOC=800 and then press the ↵ key to enter the function parameters.Set the LOC=801 and then press the ↵ key to enter the control parameters.	

9.2 Function parameter

In the field parameters,set Loc=800,Then press the ↵ key to enter the function parameters.

Code	Name	Description	Setting Range
HIAL	High limit alarm	Alarm on when PV>HIAL Alarm off when PV<HIAL-AHYS, When the value set to Max. will disable this function Alarm output action can be defined by parameter ALtd.	
LoAL	Low limit alarm	Alarm on when PV<LoAL; Alarm off when PV>LoAL+AHYS When the value set to Min. will disable this function	
HdAL	Deviation high alarm	Alarm on when PV-SV>HdAL; Alarm off when PV-SV<HdAL-AHYS When the value set to Max. will disable this function	
LdAL	Deviation low alarm	Alarm on when PV-SV<LdAL; Alarm off when PV-SV>LdAL+AHYS When the value set to Min. will disable this function HdAL and LdAL can also be used as high limit and low limit alarms when needed.(Refer to the description of parameter SSCo)	
LbA	Control loop break off / shorted Alarm	When the instrument control output is equal to otL or otH, and the continuous time is greater than LBA setting time, And the PV measurement does not exceed 2 °C change, then determine the control loop failure, the output alarm. When LBA = 0, cancel the LBA Alarm function.	

<table>
<tr>
<td>ALtd</td>
<td>Alarm output definition</td>
<td>The number of bits of ALtd represents the output port, the units represents AL1, the tens represents AL2, the hundreds represents AUX,The value of each bit 0 ~ 9 represents the different alarm function selection,0 represents no alarm output, 1, 2, 3, 4, 5, 6, 7, 8,9 respectively represents to HIAL,LoAL,HdAL,LdAL, HIAL+LoAL （within the area）,HdAL+LdAL（within the area）、HIAL+LoAL（Outside the area）、HdAL+LdAL （Outside the area）LBA.
 

<table><tr><th>value</th><th>Representative alarm function parameters</th></tr><tr><td>0</td><td>Closing the alarm function</td></tr><tr><td>1</td><td>HIAL(High limit alarm)</td></tr><tr><td>2</td><td>LoAL(Low limit alarm)</td></tr><tr><td>3</td><td>HdAL(Deviation high alarm)</td></tr><tr><td>4</td><td>LdAL(Deviation low alarm)</td></tr><tr><td>5</td><td>HIAL+LoAL(Outside the area)</td></tr><tr><td>6</td><td>HdAL+LdAL(Outside the area)</td></tr><tr><td>7</td><td>HIAL+LoAL(within the area)</td></tr><tr><td>8</td><td>HdAL+LdAL(within the area)</td></tr><tr><td>9</td><td>LBA(Control loop shorted Alarm)</td></tr></table>
For example:
ALtd=501,
It indicates that theHigh limit alarm is output from the AL1 port, AL2 port has no alarm output,
HiAL and LoAL are all output by AUX port, and can realize within the area High-Low limit alarm.</td>
<td></td>
</tr>
<tr>
<td>AHYS</td>
<td>Alarm hysteresis</td>
<td>Avoid frequent alarm on-off action because of the fluctuation of PV</td>
<td></td>
</tr>
<tr>
<td>Adon</td>
<td>Alarm ON delay</td>
<td>Alarm ON action delay, unit is seconds,When Adon=0, will no alarm ON delay function.</td>
<td></td>
</tr>
<tr>
<td>AdoF</td>
<td>Alarm OFF delay</td>
<td>Alarm OFF action delay, unit is seconds,When AdoF=0, will no alarm OFF delay function.</td>
<td></td>
</tr>
<tr>
<td>Adt</td>
<td>Alarm delay definition</td>
<td>0: no alarm delay function.
1:AL1 alarm output has delay.
2:AL2 alarm output has delay.
3:AUX alarm output has delay.
4:empty
5:AL1, AL2 alarm output has delay.
6:empty
7:AL1, AL2, AUX alarm output has delay.</td>
<td></td>
</tr>
<tr>
<td>ALL</td>
<td>Definition of alarm self lock</td>
<td>When the alarm self - lock takes effect, the alarm output remains self - locking, no matter how the measured value changes.When the measured value does not conform to the alarm condition, the power supply is reopened, and the alarm will be lifted.</td>
<td></td>
</tr>
</table>

<table>
<tr><td></td><td></td><td>0: no alarm self locking function.
1:AL1 alarm has self lock.
2:AL2 alarm has self lock.
3:AUX alarm has self lock.
4:empty.
5:AL1, AL2 alarm has self lock.
6:empty.
7:AL1, AL2, AUXalarm has self lock.</td><td></td></tr>
<tr><td>ALE</td><td>Definition of First alarm exemptions</td><td>When Power start, if the happen first alarm will be exemption.
0: No First alarm exemptions function.
1: HIAL has First alarm exemptions.
2: LoAL has First alarm exemptions.
3: HdAL has First alarm exemptions.
4: LdAL has First alarm exemptions.
5: HIAL, LoAL has First alarm exemptions.
6: HdAL, LdAL has First alarm exemptions.
7: HIAL, LoAL, HdAL, LdAL has First alarm exemptions.</td><td></td></tr>
<tr><td>Int</td><td>Input specification Code</td><td>
<table>
<tr><th>Int</th><th>Input spec</th><th>Int</th><th>Input spec</th></tr>
<tr><td>0</td><td>K (-50.0~+1300°C)</td><td>18</td><td>J (0~300.00℃)</td></tr>
<tr><td>1</td><td>S</td><td>20</td><td>Cu50</td></tr>
<tr><td>2</td><td>R</td><td rowspan="2">21</td><td rowspan="2">Pt100 (-200.0~+600.0 °C)</td></tr>
<tr><td>3</td><td>T</td></tr>
<tr><td>4</td><td>E</td><td rowspan="2">22</td><td rowspan="2">Pt100 (-100~+300.00 ℃)</td></tr>
<tr><td>5</td><td>J</td></tr>
<tr><td>6</td><td>B</td><td>25</td><td>0~75mV</td></tr>
<tr><td>7</td><td>N</td><td>26</td><td>0~80Ω</td></tr>
<tr><td>8</td><td>WRe3-WRe25</td><td>27</td><td>0~400Ω</td></tr>
<tr><td>9</td><td>WRe5-WRe26</td><td>28</td><td>0~20mV</td></tr>
<tr><td rowspan="2">10</td><td rowspan="2">Special custom input specification</td><td>29</td><td>0~100mV</td></tr>
<tr><td>30</td><td>0~60mV</td></tr>
<tr><td rowspan="2">12</td><td rowspan="2">F2 radiation type pyromter</td><td>31</td><td>0~1V</td></tr>
<tr><td>32</td><td>0.2~1V</td></tr>
<tr><td rowspan="2">15</td><td rowspan="2">4～20mA (installed I4 module in MIO)</td><td>33</td><td>1~5V (4~20mA)</td></tr>
<tr><td>34</td><td>0~5V (0~20mA)</td></tr>
<tr><td rowspan="2">16</td><td rowspan="2">0～20mA (installed I4 module in MIO)</td><td>35</td><td>-20~+20mV</td></tr>
<tr><td>36</td><td>-100~+100mV</td></tr>
<tr><td>17</td><td>K (0~300.00℃)</td><td>37</td><td>-5V~+5V</td></tr>
</table>
</td><td></td></tr>
<tr><td>dp</td><td>Display Resolution</td><td>Four formats (0, 0.0, 0.00, 0.000) are selectable Note 1: For thermocouples or RTD input, only 0 or 0.0 is selectable, and the internal resolution is 0.1. When S type thermocouple is used, dPt is recommended to be 0. If Inp= 17, 18 or 22, resolution will support display 0.0 or 0.00</td><td></td></tr>
<tr><td>InL</td><td>Signal scale low limit</td><td>Define scale low limit of input. It is also the low limit of transmitter output (CntL=Pvtr or Svtr) and light bar display.</td><td></td></tr>
</table>

InH	Signal scale high limit	Define scale high limit of input. It is also the high limit of retransmission output (CntL=Pvtr or Svtr) and light bar display.	
Sc	Input Shift Adjustment	Sc is used to shift input to compensate the error caused by transducer, input signal, or auto cold junction compensation of thermocouple. PV after compensation=PV before compensation + Sc It is generally set to 0. The incorrect setting will cause measurement inaccurate.	
InF	PV input filter	The value of InFt will determine the ability of filtering noise. When a large value is set, the measurement input is stabilized but the response speed is slow. Generally, it can be set to 1 to 3. If great interference exists, then you can increase parameter "InF" gradually to make momentary fluctuation of measured value less than 2 to 5. When the instrument is being metrological verified, "InF" s can be set to 0 or 1 to shorten the response time.	
du	temperature unit	**℃:** Centigrade. **℉: Fahrenheit degree.** **thermocouples and RTDs only**	
rSPL	Signal scale low limit for External input SV set value	Use the External input SV set value function to define the lower limit of the signal scale. Use the position proportional output function to define the lower limit of the valve position feedback signal,This parameter can be set automatically by the valve auto-tuning function.	
rSPH	Signal scale high limit for External input SV set value	Use the External input SV set value function to define the high limit of the signal scale. Use the position proportional output function to define the high limit of the valve position feedback signal,This parameter can be set automatically by the valve auto-tuning function. WARNING: Valve position auto-tuning values Do not modify rSPH and rSPL parameters unless you are a professional.	
AdrS	Communication address	In the same communication line, different instrument should be set to different address.	
bPS	Baud rate	bPS parameter defines the communication baud rate, which can be defined as the range of 1200 ~ 19200bit / s (19.2K). When the COM position is not used for the communication function, the COMM port function can be set by the bPS parameter as the PV retransmission output function: bPS = 3, the COMM port as 0 ~ 20mA PV measured value retransmission output function; bPS = 4, the COMM port as 4 ~ 20mA PV measured value retransmission output function.	

PArI	Communication verification	**nonE:**No verification **odd:**Odd number verification **EVEn:**Even number verification	
CoMM	Communication protocol	**FBUS:** instrument communication protocol for FTBUS. **MBUS:** instrument communication protocol for MODBUS.	
Evt	Event input type	When I2 module was installed, the meter have following functions. **nonE :** Disable event input function. **reSt :** Run / Stop switching function. Connected in short time, start to running program, keep connect more than 2 sec, program switch to stop. **SP1.2 :** Switching between setpoint 1 and setpoint 2 when use NT8419 or PrSn=0 at NT8419P. MIO in open status, SV=SP1, when MIO in close status, SV=SP2. **Pid2 :** Switching 1st PID and 2nd PID. When use as single direction control, MIO in open status, P, I, d and CP was active, when MIO in close status, P2, I2, d2 and CP2 was active.	
SSCo	Advanced system code	SSCo is used to select advanced function. The value of AF is calculated as below: AF=A×1+B×2 +C×4 +D×8+E×16+F×32+G×64+H×128 A=0, Normal application on HIAL and LoAL; A=1, HIAL AND LoAL will become to deviation high alarm and Deviation low alarm. **B=0,** HdAL and LdAL work as deviation high and low limit alarms; **B=1,** HdAL and LdAL work as high and low limit alarms, and the instrument can have two groups of high and low limit alarms. **C=0,** Alarm and control hysteresis work as unilateral hysteresis; **C=1,** As bilateral hysteresis. **D=0,**The SV set value is set by the instrument panel operation; D=1,The SV set value is external input and the external input signal is from the 5V input. E=0,The External input SV set value signal is 1-5V; E=1,The External input SV set value signal is 0-5V. F=0,The transmit output is defined scale with InL/InH; F=1,The transmit output is defined scale with rSPL/rSPH. G = 0, normal input mode, G = 1, linear input signal for rooting processing. H=0, Fine control mode, internal control resolution was demonstration's 10 times. When on linear input mode, biggest display value is 3200 units; H=1, Wide range display mode, This mode is selected when the linear input requires a maximum display value greater than 3200.	
SPL	Low limit of SV	Minimum value that SV is allowed to be.	

SPH	Upper limit of SV	Maximum value that SV is allowed to be.	
SP1	Setpoint 1	For NT8419 meter or NT8419P parameters PrSn=0 or 1, normally Given value SV=SP1.	
SP2	Setpoint 2	For NT8419 meter or NT8419P parameters PrSn=0 or 1, When I2 module installed in MIO position, SP1 and SP2 can be switched by an external switch. If the switch is off, SV=SP1; if the switch is on, SV=SP2.	
Pont	Program run mode after power restart (applicable only to NT8419P)	**Cont :** Continue to run the program from the original break point. If STOP STATUS was activated before power cut, then it (the program) will keep stop status after power restart. **StoP :** Stop the program after power restart **run1 :** Start to run the program from step 1 unless the instrument was in "stop" state before power cut. **dASt :** If these have deviation alarm after power resume, then stop the program, otherwise, continue run the program from the original break point. **HoLd :** Go into HOLD state after power on. If it is in StoP state before power cut, then keep in StoP State after power on.	
PSYS	Program Running mode (applicable only to NT8419P)	The PSYS parameter is used to select the program control function, which is calculated as follows: PSYS = Ax1 + Bx2 + Cx4 + Dx8 + Ex16 + Fx32 When **A=0,** Disenable ready (rdy) function; **A=1,** Enable ready (rdy) function. **B=0,** Ramp mode; **B=1,** Soak mode. **C=0,** Time unit in Minute, the range is 0.1~3200; **C=1,** Time unit in Hour, the range is 0.1~3200. **D=0,** Disable PV start up function; **D=1,** Enable PV start up function. **E=0,** When work as program generator, upper windows display PV; **E=1,** When work as program generator, upper windows display the current step. **F = 0,** the standard operating mode; **F = 1,** the program running RUN operation will enter the pause state.	
PrGd	Program grouping definition (applicable only to NT8419P)	When Prgd=0, no grouping. When the Prgd=4 is divided into 4 curves, each group has 20 segments program , SP1-20 segment procedures for the 1 curve group, SP21-40 segment procedures for the 2 curve group, SP41-60 segment procedures for the 3 curve group, SP61-80 segment procedures for the 4 curve group. When the Prgd=8 is divided into 8 curves, each group has 10 segments program. SP1-10 segment procedures for the 1 curve group,	

<table>
<tr><td></td><td></td><td>SP11-20 segment procedures for the 2 curve group,
SP21-30 segment procedures for the 3 curve group,
SP31-40 segment procedures for the 4 curve group,
SP41-50 segment procedures for the 5 curve group,
SP51-60 segment procedures for the 6 curve group,
SP61-70 segment procedures for the 7 curve group,
SP71-80 segment procedures for the 8 curve group.</td><td></td></tr>
<tr><td>PrSn</td><td>No. of Program step (applicable only to NT8419P)</td><td>When Prgd=0, PrSn to define the number of program in use.
PrSn= 0: disable the program running mode, then NT8419P will same as NT8419, meanwhile, can set the parameter “rAte” to limit the ramp time.
Pno=1~80: NT8419P working as normal programmable controller.
When Prgd=4 or 8, the PrSn is fixed to 80.</td><td></td></tr>
<tr><td>LoC2</td><td>Parameter Lock</td><td>Parameter was protected by LoC2 (Parameter LOCK) to prevent setting error. The function was shown as below:
√ : allow to modify data or execute
X : not allow to modify data or execute
Run, Stop, Hold. and Program Time & Temp. function just for NT8419P only
<table>
<tr><th>LOC</th><th>Field parameters</th><th>SV</th><th>Program Step Time & Temp</th><th>Shortcut keys for run, stopp, or hold</th></tr>
<tr><td>0</td><td>√</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>1</td><td>√</td><td>√</td><td>√</td><td>X</td></tr>
<tr><td>2</td><td>√</td><td>X</td><td>X</td><td>√</td></tr>
<tr><td>3</td><td>√</td><td>X</td><td>X</td><td>X</td></tr>
<tr><td>4</td><td>X</td><td>√</td><td>√</td><td>√</td></tr>
<tr><td>5</td><td>X</td><td>√</td><td>√</td><td>X</td></tr>
<tr><td>6</td><td>X</td><td>X</td><td>X</td><td>X</td></tr>
</table></td><td></td></tr>
<tr><td>MV</td><td>No.3 display MV</td><td>OFF: off MV function, MV only as a temperature unit display.
A-M: automatic / manual control will be displayed by MV.
SP-t: MV will display the current program remaining time / block number.</td><td></td></tr>
<tr><td>FP1~ FP8</td><td>Field parameter definition</td><td>You can select 8 parameters in the function parameters or control parameters as field parameters.
If there are no or less than 8 field parameters, the FP* value can be set to nonE.</td><td></td></tr>
</table>

9.3 Control parameter

In the field parameters,set Loc=801,Then press the ↵ key to enter the control parameters.

Code	Name	Description	Setting Range
CntL	Control mode	**onoF:** on-off control. For situation not requiring high precision **FPId:** advanced artificial intelligence FUZZY+PID control. **PVtr:** Transmit PV. The instrument works as a temperature re-transmitter. **SVtr:** Transmit SV. The instrument works program generator.	
HYS	Control Hysteresis	HYS is used for on-off control to avoid frequent on-off action of relay. For a reverse acting (heating) system, when PV > SV, output turns off; when PV<SV-HYS, output turns on. For a direct acting (cooling) system, when PV<SV, output turns off; when PV>SV+HYS, output turns on.	
orEV	Acting method	**onr:** Reverse acting. Increase in measured variable **causes a decrease in the output, such as heating control.** **ond: Direct acting. Increase in measured variable causes an increase in the output, such as refrigerating control.**	
Srun	Running Status	**run:** Control or program was running, "RUN" led light on **StoP :** Control or program was stopped. Lower display keep flashing "StoP" and "RUN" led light off. **HoLd:** This only functioned on NT8419P, this will keeping temperature when this HoLd was appeared. If the parameter Pno=0(Non timing limitation mode), controller will functioning same at NT8419, if Pno>0 (in program mode),and Srun was set as "HoLd", means the timer stops and the temperature remains; user can resume the timer by pressing the "Hold" from panel.	
A-M	Auto / manual Control selection	**OFF:** no automatic / manual switching control function, the instrument for the automatic control of the state. **Man:** manually control the state, manually adjust the output of oUT,and can switch to automatic control.. **Auto:** automatic control state, oUT output determined by the CntL decision after the decision,and can switch to manual control. **FMAn:** fixed manual control state, this mode prohibits the direct operation from the front panel keys Change to automatic state.	
At	Auto tuning	**oFF:** Auto tuning function was off. **on:** Active auto turning function to calculate the values **FoFF :** Auto tuning function was off, cannot activate again by pressing key from panel .	
P	Proportional band (No.1 PID parameter)	Proportional band in FPID control. Instead of percentage of the measurement range, the unit is the same as PV. Generally, optimal P, I, D and CP can obtained by auto tuning. They can also be manually inputted if you already know the correct values.	

I	Time of ntegral (No.1 PID parameter)	No integral effect when I=0	
d	Time of Derivative (No.1 PID parameter)	No derivative effect when d=0	
CP	Control period (No.1 PID parameter)	Small value can improve control accuracy. For SSR, thyristor or linear current output, it is generally 0.5 to 3 seconds. For Relay output or in a heating/refrigerating dual output control system, generally 15 to 40 seconds, because small value will cause the frequent on-off action of mechanical switch or frequent heating/refrigerating switch, and shorten its service life. CP is recommended to be 1/5 – 1/10 of derivative time. (It should be integer times of 0.5 second) When the parameter OUt or Aut = rELy, CP will be limited to more than 3 seconds. Auto tuning will automatically set CP to suitable value considering both control precision and mechanical switch longevity. When the parameter CntL = onoF, CP will used as timer to make delay time to avoid the power restart in short period. It suit for compressor protection. If the output for the control valve, recommended CP=3~15 seconds, taking into account the response speed and avoid the valveFrequent action.	
P2	Proportional band 2 (No.2 PID parameter)	When the instrument uses the heating / cooling dual output adjustment, it is used as a cold output proportional band. When NT8419P can be used as the second group of PID proportional band.	
I2	Time of ntegral 2 (No.2 PID parameter)	When the instrument uses the heating / cooling dual output adjustment, it is used as a cold output time of ntegral. When NT8419P can be used as the second group of PID time of ntegral.	
d2	Time of Derivative 2 (No.2 PID parameter)	When the instrument uses the heating / cooling dual output adjustment, it is used as a cold output time of Derivative. When NT8419P can be used as the second group of PID time of Derivative.	
Cp2	Control period 2 (No.2 PID parameter)	When the instrument uses the heating / cooling dual output adjustment, it is used as a cold output control period. When NT8419P can be used as the second group of PID control period.	
P3	Proportional band 3 (No.3 PID parameter)	applicable only to NT8419P	

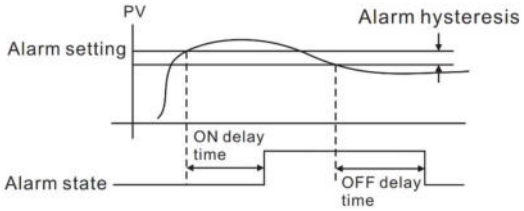
I3	Time of ntegral 3 (No.3 PID parameter)	applicable only to NT8419P	
d3	Time of Derivative 3 (No.3 PID parameter)	applicable only to NT8419P	
CP3	Control period 3 (No.3 PID parameter)	applicable only to NT8419P	
oUt	Main output type	**SSr:** Output SSr drive voltage or thyristor zero crossing trigger signal. **rELy:** Relay contact output **0-20:** 0～20mA linear current output. **4-20:** 0～20mA linear current output. **PHA:** Single-phase phase-shift output. PHA is only for 50Hz power supply, and don't support bidirectional control system. **NFEd:** no feedback signal position proportional output, direct control valve motor positive / reverse,Valve travel time defined by Vrtt parameters. **FEd:** position feedback signal output, the valve travel time should be more than 10 seconds,Feedback signal input from the 0~5V/1~5V input.Note: The External input SV set value function can no longer be used in this output mode. **FEAt:** auto-tuning valve position, the instrument will first close the valve will be feedback signal recorded in the rSPL parameters, and then fully open the valve memory valve feedback signal in the rSPH parameters, after completion Automatically returns the FEd control mode.	
Aut	Auxiliary output type (as a refrigeration output)	**Ssr**: Output SSr drive voltage or thyristor zero crossing trigger signal. **rELy:** Relay contact output **0-20:** 0～20mA linear current output. **4-20:** 0～20mA linear current output.	
otL	Output low limit	0～100%: OtL is the minimum output of OUT in single directional control system. -1～-110%: The instrument works for a bidirectional system, and has heating/refrigerating dual output. When orEV=onr or rbA, OUT (main output) works for heating, and AUX (Auxiliary output) works for refrigerating. When orEV=ond or dbA, OUT works for refrigerating, and AUX works for heating. In a bidirectional system, OtL for define the limitation of maximum cooling output. So, when the OtL= -100%, means no limitation on cooling output. If set OtL=-110%, it can made current output excess 10% on maximum output. When the output type is SSR output or relay output, maximum of cooling output should not set more than 100%	

otH	Output upper limit	When the measured value PV is less than otEr, otH limits the maximum output value of the main output(oUt), and when PV is greater than otEr, the system correction output upper limit is 100%; In the non-feedback position proportional output (when oUt = nFEd), if otH is less than 100, the Controller Auto Tuning the valve position at power-on. If otH = 100, the Controller Auto Tuning the valve position when the output is 0% and 100% , Can shorten the power on time. otH setting must be greater than otL.	
Vrtt	Valve travel time	Defines the travel time of the valve rotation when the meter is the position proportional control output, If there is a valve feedback signal, the instrument will automatically select the valve control signal according to Vrtt's setting Of the hysteresis, the shorter the travel time, the greater the hysteresis, the valve positioning accuracy will be reduced. When using a valveless feedback signal mode or valve feedback signal to generate an Outrange malfunction,The instrument will be based on Strt travel time comparison output to determine the valve motor action time.	
otEr	Work range of OPH	When PV<otEr, the upper limit of OUTP is OPH; when PV>otEr, the upper limit of OUTP is 100%. For example, to avoid that the temperature raises too quickly, under 150℃, a heater can work only under 30% of power, then we can set otEr=150.0 (℃), OtH=30 (%)	
rAte	limit (applicable only to NT8419P)	Once rAte was set, if PV<SV when program start, the first step of ramp slope will limited by rAte value until the temperature reach the first SV , under this limitation, the RUN lamp will keep flashing. For Ramp mode. rAte had effect on first step only. For Soak mode, rAte had effect on each step.	

10. Additional Remarks of Special Functions

10.1 Alarm delay

Alarm delay is a time delay setting for the alarm output, as shown in the diagram. When powered-on alarm delay is also effective.



10.2 LBA Control loop break off / shorted Alarm

When the control output becomes otH or otL,At each interval LBA set time as a unit to monitor of changes in the PV value,According to the amount of change to determine whether there is any abnormal control circuit. The time unit of LBA is second and by AL1 alarm.
The following conditions for the alarm status:
① When orEV is onr Reverse action: When the control output of the instrument continues to be otH, the increase of the measured value (PV) within the setting time of LBA is less than the change of LBA judgment (2℃).

When orEV is ond is positive: When the instrument control output continues to otH, the measured value (PV) decreases less than LBA judgment range (2℃) within the setting time of LBA.

② orEV is onr Inverse operation: When the instrument control output continues for otL, the measured value (PV) decreases less than the LBA judgment range (2℃) within the setting time of LBA.

When orEV is ond is in positive operation: When the instrument control output continues to otL, the measured value (PV) rises less than LBA judgment range (2℃) within the setting time of LBA.

10.3 First alarm exemptions

Sometimes the fault alarm may occur at the beginning of power on.In a heating system, at the beginning of power on, its temperature is much lower than the set point. If low limit and deviation low limit are set and the alarm conditions are satisfied, the instrument should alarm, but there is no problem in the system. Contrarily, in an refrigerating system, the unnecessary high limit or deviation high limit alarm may occur at the beginning of power on. Therefore, NT84** instruments offer the function of alarm blocking at the beginning of power on. When ALE is set to 1~7, the corresponding low or high alarms are blocked until the alarm condition first clears. If the alarm condition is satisfied again, the alarm will work.

10.4 Single-phase phase-shift trigger output

When OUt is set to PHA, installing a K5 or K6 module in OUT slot can single-phase phase-shift trigger a TRIAC or 2 inverse parallel SCRs. It can continuously adjust heating power by control the conduction angle of thyristor. With non-linear power adjustment according to the characters of sine wave, it can get ideal control. The trigger adopts self-synchronizing technology, so it can also work even when the power supplies of the instrument and the heater are different. Phase-shift trigger has high interference to the electric power, so user should pay attention to the anti-interference ability of other machines in the system. Now the K5 or K6 module can be only used in 50Hz power supply.

10.5 Setpoints switch

If an I2 module is installed in MIO slot. User can connect external on off switch to realize some control function. Set Evt = rust, can switching program run and stop. For NT8419, or NT8419P when its PrSn=0, set Evt = SP1.2, can switching between setpoint 1 and setpoint 2.

10.6 Communication function

S or S2 module can be installed at COMM slot to communicate with a computer. The instrument can be controlled by computer. NT84** instruments can be connected to the computer through RS485 or RS232 or USB communication port. Every communication port of a computer can connect up to 60 NT84** instruments, or 80 NT84** instruments if a repeater is installed. A computer with 2 communication ports can connect up to 160 instruments. Please note that every instrument connecting to the same communication line should be set to a unique communication address. If the number of instrument are enough, 2 or more computers can be used and a local network can be set up.

Nt84 ** support international standard industrial field bus protocol Modbus communication protocol and FTbus TMCON company its standard communication protocol,And with no authentication or odd and even verification options,Making the instrument has a wide range of compatibility.

10.7 Temperature re-transmitter / Program generator / Manual current output

Besides FUZZY+PID ,and on-off control, if the output is defined as current output, the instrument can also retransmit PV (process value) or SV (setpoint) into linear current and output from OUTport . The precision of current output is 0.2%FS. Base on that ability, NT8419 can become temperature re-transmitter and NT8419P can become program generator
The corresponding parameters are set as below:
When CntL=Pvtr, PV is retransmitted to linear current, the instrument works as temperature re-transmitter.
When CntL=Svtr, SV is transmitted and outputted, and the instrument works as manual current output controller(NT8419) or prodram generator(NT8419) .
OUt is used to choose output type, generally 4～20mA or 0～20mA output.
Parameter Int, InL, InH, and Sc are used for selecting input specification, setting low limit or high limit of PV and adjusting input.
For example, in order to retransmit temperature read from K thermocouple, range 0～400℃, to current 4～20mA, the parameters are set as below: Int=0, InL=0.0, InH=400.0, OUt=4~20, and X linear current module is installed in OUT slot. When the temperature is less than or equal to 0℃, the output is 4mA. When the temperature equals to 400℃, the output is 20mA.

11. Further description for the operation of NT8419P series instrument

NT8419P program type temperature controller is used in the application where the setpoint should be changed automatically with the time. It provides 50 segments program control which can be set in any slope and the function of jump, run, hold and stop can also be set in the program. Measurement startup function, preparation function and power-cut/power-resume event handling modes also provided.

11.1 Concepts and functions Program

StEP:
The No. of the program Step can be defined from 1 to 50, and the current Step is the program Step being executing.

StEP time:
Total run time of the program step. The unit is minute and the available value range from 1 to 9999.

Running time:
The Time of current Step has run. As the running time reaches the Step time, the program will jump to the next Step automatically.

Jump:
The program can jump to any other steps in the range of 1 to 50 automatically as you programmed in the program Step, and realize cycle control.

Run/Hold:
When program is in the running status, timer works, and set point value changes according to the preset curve. When program is in the holding status, timer stops, and set point remains to make temperature hold also. The holding operation can be programmed into the program step.

Stop:
When the stop operation is activated, the program will stop, running time will be clear, event

output switch will reset and the output control will stop output. If run operation is activated when instrument is in the stop status, the program will start-up and run again from the set step no. The stop function can be programmed into the program Step. The stop operation can also be performed manually at any time. (After stop operation is done, the step no. will be set to 1, but user can modify it again). If the program ran the last step of "PrSn", program will stop automatically.

Power cut/resume event handling:
There are 5 events handling method selectable for power resume after power cut off. Please refer to parameter Pont .

PV startup and PV preparation function (rdy function) :
At the beginning of starting a program, resuming a program after power cut or continuing to run a program after it is just modified, the PV (process value) are often quite different from the set point. PV startup function and PV preparation function can make PV and set point consistent, and avoid unexpected result. When PV startup function enabled, the instrument will adjust the running time automatically to make the expecte d set point is the same as the current PV.
For example, the program is set that the temperature will be raised from 25℃ to 625℃ in 600 minutes. But the current PV is 100℃, then the instrument will automatically to run this program start from 75 minutes, that mean changed the temperature raised from 100℃ to 625℃ in 525 minutes (600-75) min.
At the above situation(PV=100, SV=25, first step SV), when PV preparation function is enable, the alarm function will be blocked at that time, and PV will be adjusted to approach SV until the deviation alarm condition is released (PV is between SV-LdAL and SV+HdAL). After deviation alarm was off, the controller starts to run the program again. Preparation function (rdy Function) is helpful to keep the integrity of the program, but it will prolong the program time because the start of the program is postponed.
PV startup function is prior to PV preparation function. If both function are enabled, the system apply PV startup first, if PV startup function works, PV preparation function will not be activated.

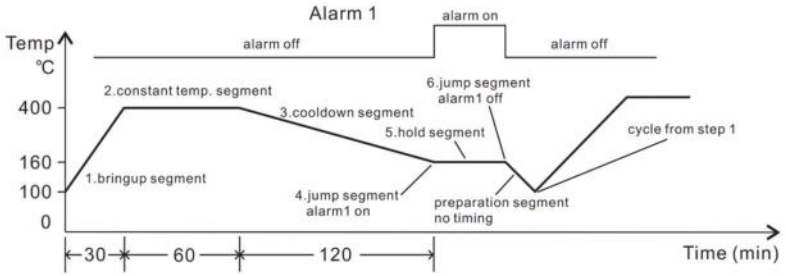
Curve fitting:
Curve fitting is adopted as a kind of control technology for NT8419P series instrument. As controlled process often has lag time in system response, by the way of curve fitting the instrument will smooth the turning point of the linear heating-up, cooling-down and constant temperature curves automatically. The degree of the smooth is relevant with the system's lag time t (t=d+CP) ; the longer of the lag time, the curve will more smooth. On the opposite the smooth function will be weaker. Generally the shorter of the process lag time (such as temperature inertia), the better of the program control on effect. By the way of the curve fitting to deal with the program curves, will avoid overshoot. Note: The characteristic of the curve fitting will force the program control to generate fixed negative deviation during the linear heating-up and fixed positive deviation during the linear cooling-down, the deviation is direct proportional to the lag time and the speed of heating-up (cooling-down). This phenomenon is normal.

11.2 Programming and operation (For NT8419P only)

11.2.1 Ramp Mode(PSYS : B=0)
Programming of instrument has uniform format of temperature-time-temperature, which means temperature "A"(SP 1), passed Time "A"(t01), then reached Temperature "B"(SP 2). The unit of temperature set is ℃ and the unit of time set is minute. The following example includes 5 steps, which is linear temperature heating up, constant temperature, linear temperature cooling down, jump cycling, ready, Hold..

StEP1: SP 1= 100, t-1=-0.1; adopts No.1 PID parameters to control;
StEP2: SP 2=100 , t-2=30.0 Start linear temperature heating up from 100℃, and the time needed 30 minutes to reach SP 2(400 degree).
StEP3: SP 3=400 , t-3=60.0 Temperature raised to 400℃, slope of raising curve is 10℃/minute, The program take 60 minutes to raise temperature to SP3 (400 degree). It means keep the same temperature in 60 minutes.
StEP4: SP 4=400 , t-4=120.0 This is the step for temperature cooling down, slope of cooling curve is 2℃/minute, and the time needed is 120 minutes to reach SP4 (160 degree).
StEP5: SP 5=160 , t-5=0.0 When temperature reached 160℃ , the program get in Hold state. If need go to next step, it needed operator to executed the "run" for next step.
StEP6: SP 6=160 , t-6=-1.0 Jump to StEP1 to start from beginning.

In this example, it is assumed that the deviation high alarm is set to 5℃. Because the temperature of StEP 5 is 160℃, and the temperature of StEP1 is 100℃, when program jumps from StEP 5 to StEP 1, the program will change to preparation state at first(if preparation mode "rdy" was enabled), i.e., Control the temperature until the deviation between setpoint and PV is
less than deviation high alarm value. After temperature is controlled to 105℃, the program will be started from StEP 1, and run the above steps again. The temperature control drawing was shown below.



11.2.2 Soak mode(PSYS : B=1)

Suitable for the process which does not need to establish the temperature slope, can simplify the programming and more effective. Each step also can set parameter "rAte" to define temperature raise slope, if "rAte=0" raising speed will set to maximum. Because cannot know the actual time which spend on temperature raising, user can enable "rdy" function to ensure the correct soak time.

11.2.3 Set the given value and time of the program

Each program includes a given value and time,the given value indicates the temperature value to be controlled,time in besides regard as running time, there are special control functions, when t is positive the value represents the running time, when t is negative value represents a jump + command,The meaning is as follows:
The scope of t:-122.0~3200
t-XX=0.1 ~ 3200 represents the run time value
t-XX=0.0 ~ -0.1 ~ -122.0 represents a jump + command

t's command:
0.0,represents that the controller enters the hold running state (HoLd) in this stage, and the program is suspended here and stops the timing.
-121.0, the program executes the StOP operation and enters a stop state
-XXX.1, represents that first group of PID parameters are specified
-XXX.2, represents that second group of PID parameters are specified
-XXX.3, represents that third group of PID parameters are specified
-XXX.4, represents the AL1 action
-XXX.5, represents the release of AI1
-XXX.6, represents the action of AL1 and AI2
-XXX.7, represents the release of AL1 and AI2

For example, if t- 1 = -0.1 is set, the first group of PID parameters will be executed and the PIDn parameter will be set to 1 automatically when running to the first-stage program.
For another example, setting t- 7 = -11.2 means that when running reaches the program in the 7th stage, it will jump to the 11th stage to execute and specify the second group of PID parameters, and the PIDn parameter will be set to 2 automatically.

For example: Set t- 5 = -1.4, which means that when running to the fifth-stage program, AL1 action and jumps to the first-stage running.

Note: In addition to the implementation of the operation or switch on the power to meet the jump segment can continue to jump to run in the program run to allow up to 2 consecutive jumps, continuous 3 or more jumps the program automatically suspended execution (That is, the instrument automatically inserts a suspend operation for three consecutive jumps), an external running operation is required to release the suspended state. Note that if the jump segment is itself (for example, t-6 = -6), the pause state will not be able to be released because such a segment is meaningless.

Multi-group PID application case:
SP 1 = any value, t 1 = -0.1, the next paragraph, specify the first group of PID parameters (PIDn parameters automatically 1);
SP 2 = 100, t 2 = 30.0 at 100 ℃, the linear temperature was raised to SP 3, the temperature rising time was 30 minutes and the temperature rising rate was 10 ℃ / minute;
SP 3 = 400, t 3 = 60.0, Reach 400 degrees and keep warm for 60 minutes;
SP 4 = 400, t 4 = -0.2, the next paragraph, specify the second group of PID parameters (PIDn parameters automatically 2);
SP 5 = 400, t 5 = 80, heated to 800 ℃ at 400 ℃ for 80 minutes and heated at a rate of 5 ℃/ min;
SP 6 = 800, t 6 = 120.0, Reach 800 degrees and keep warm for 120 minutes;
SP7 = 800, t7 = -0.3, continue to the next paragraph, specify the third group of PID parameters (PIDn parameters automatically 3);
Sp8 = 800, t8 = 60.0, 800 ℃ to 1220 ℃, the heating time is 60 minutes, the heating rate is 7 ℃ / min;
SP 9 = 1220, t 9 = 60, Reach 1200 degrees and keep warm for 60 minutes;
SP 10 = 1220, t 10 = -1.4, AL1 alarm action (the alarm delay function can be used to close the alarm after the alarm action), and jump to the first paragraph of the implement, from scratch loop to run.

11.2.4 Auto Tuning procedure setting method:

For example: Auto Tuning for first group of PID parameters, Auto Tuning target value 400℃:
SP 1 = any value, t 1 = -0.1, the next paragraph, specify the first group PID;
SP 2 = 400, t 2 = 0.0, self-tuning target value 400℃, After the end of the auto tuning, enters the keep warm.

Again,For example: Auto Tuning for second group of PID parameters, Auto Tuning target value 800℃:
SP 1 = any value, t 1 = -0.1, the next paragraph, specify the second group PID;
SP 2 = 400, t 2 = 0.0, self-tuning target value 400℃, After the end of the auto tuning, enters the keep warm.

Note: After setting the auto tuning program,when the temperature of the equipment is close to room temperature,setting the At=ON will start auto tuning.

11.2.5 In addition to setting PrGd to group multiple curves outside, you can also use the program layout method flexible grouping multiple curves:

NT8419P has the advanced function of flexible program arrangement. Normally, when the program stops, the StEP will be automatically set to1. Thus if StEP is not change to other value, a program will start from step1. If multiple curves are defined, the control can jump to different curve by setting step 1 as jump segment.

For example: There are three curves with the length of 3 steps represent three groups of process parameter, they
are separately arranged on StEP2-StEP4, StEP5-StEP7, StEP8-StEP10. Settings are as follows:
t- 1=-2.0 Execute the program of curve 1 (StEP2-StEP4)
t- 1=-5.0 Execute the program of curve 2 (StEP5-StEP7)
t- 1=-8.0 Execute the program of curve 3 (StEP8-StEP10)
Note: Can choose the curves by setting the value of StEP "t-1" set to -2.0, -5.0 or -8.0 before the program startup.

12. APPENDIX-III CONTROLLER COMMUNICATION PROTOCOL

NT Series Smart Controller RS485 Protocol Supports FTBUS and MODBUS (FBUS / MBUS is selected by setting the parameter COMM). MODBUS is recommended for a universal compatibility with wide range of devices and program.

MODBUS communication comes with 16-bit sum correction code, reliable communication, and supports 1200,2400,4800,9600,19200 and other baud rates too. At 19200 baud rate, to access a controller the average time is only 20mS. The controller allows up to 101 units to be connected to a RS485 communication interface (In order to ensure reliable communication, for more than 60 units, it is recommended to add an RS485 repeater).

1: Interface Specifications

NT series of controllers apply asynchronous serial communication interface and are RS485 compatible. The data structure is 1 start bit + 8 data bit (nonE / odd / even), parity bit (by setting the parameter PArI to select the check digit None, Odd, Even), 1 or 2 stops Bit. The communication baud rate is selectable from 1200 to 19200 bit/second, (for baud rate of 19200 it is recommended to configure high-speed optocoupler communication module).

When the controller connected to multiple devices using RS485 communication interface, one can configure the controller address from 1 ~ 101, provided that the address should be unique with respect to the connected devices.

The communication distance of RS485 can be longer than 1KM. To use on a personal computer, use the RS485 to USB serial converter (However the same has been provided to the control panel via USB output).

According to RS485 standard, a communication line can only connect maximum 32 number of instruments or computers and more than that one need to connect RS485 repeater. The NT Series controller's RS485 communication interface uses low power chip and a certain anti-lightning and anti-static function, thus no repeaters needed to connect till 60 controller units.

The RS485 communication interfaces of the controller has an electrical isolation technology to separate the communication interface from the other part of the controller's circuit. If there is any problem with the communication port or with the computer, the controller can still work well, and can be operated by its front panel. The 16-bit CRC check bytes not only to ensure data reliability, and

to ensure that the communication is not abnormal, such as the network has the same address of the instruments or other company products, the controller and the computer can still work, will not produce data chaos. So, the use of instrumentation composed of distributed control system with high reliability.

2: Communication Instruction:

MODBUS Compatible Command

Protocol format: 8 data bits, 1 stop bit, (no / odd / even) parity bit, send and receive data are in hexadecimal byte format

The Reading / Writing instructions are as below:

A. Send data format:

Send bytes	1	2	3	4	5	6	7
Meaning	address	Read / write	A1	A2	A3	A4	CRC16
	Controller address	03H, 06H					Check code

Description:
First Byte: The communication address of the controller is indicated by a byte, defaults to 00H.
Second Byte: 03H are for read command, where 06H for the write command.
A1, A2: A1, A2 consists of two double byte data and represents the parameter address / starting address. A1 is the high and A2 is the low byte data. Usually, A1 always remains 00H.
A3, A4: A3, A4 constitute two double byte data and represents the number of continuous parameters to read. Maximum of continuous 10 parameters can be read at a time. A3 is the high and A4 is the low byte data. Usually, A3 always remains 00H.
CRC16: CRC check code is a double byte data, low byte in the front, and high byte at the post.

For example:

To Read SV value
HEX Code is：01 03 00 00 00 01 84 0a
1 2 3 4 5

a. Controller communication address Adrs.
b. Read instruction.
c. Parameter communication address, SV address is 00H.
d. The number of parameters to read (i.e., word length), 00 01 is to read a single parameter.
e. CRC Check code for 01 03 00 00 01 is 84 0a.

To Write SV value
HEX Code is：01 06 00 00 00 96 09 A4
1 2 3 4 5

a. Controller communication address Adrs.
b. write instruction.
c. Parameter communication address, SV address is 00H.
d. To write a value, 00 96 is to write 150.
e. CRC Check code for 01 06 00 00 00 96 is 09 A4.

Note: only one parameter can be written at a time

B. 04H Instruction parameter address table – Read Only:

Controller address	00H(30001)	01H(30002)	02H(30003)	03H(30004)	04H(30005)	05H(30006)
Meaning	PV measurements	Alarm status **	MV output value	Set value SV	Int	dP

For example:
To Read PV value
HEX Code is：01 04 00 00 00 01 31 CA
1 2 3 4 5

a. Controller communication address Adrs.
b. Read instruction.
c. Parameter communication address, PV address is 00H.
d. The number of parameters read (i.e., word length), 00 01 is to read a single parameter. To read from PV to ahys, then it is 6 parameters, and the code will be 00 06.
e. CRC Check code for 01 04 00 00 01 is 31 CA.

** Alarm status:

The HEX return code to be converted to binary and to be interpreted, as follows:

Bit 0 is 0, the upper limit alarm (HIAL) is off,
1, the upper limit alarm is on.

Bit 1 is 0, the lower limit alarm (LoAL) is off,
1, the lower limit alarm is on.

Bit 2 is 0, the Positive offset alarm (HdAL) is off,
1, the Positive offset alarm in on.

Bit 3 is 0, the negative deviation alarm (LdAL) is off,
1, the negative deviation alarm is on.

Bit 4 is 0, the overrange alarm (orAL) is off,
1, the overrange alarm is on.

Bit 5 is 0, the AL1 is on,
1, the AL1 id off

Bit 6 is 0, the AL2 is on,
1, the AL2 is off

Bit 7 is 0, MIO has no signal input,
1, MIO has signal input.

C. Return the data format:

- For 06H instruction to write data, the return data will be the same HEX code.
- The 03H, 04H instruction returns the data format

Return byte	1	2	3	4	5				
Meaning	Controller address	03H /04H	Returns the number of valid bytes of data	High byte	Low byte	High byte	Low byte	Low byte	High byte
				First data		Nth data		CRC16	

Description:

The number of valid bytes for the return data is: N × 2

For example:

To Read PV value
HEX Code is : 01 04 00 00 00 01 31 CA

When the PV value is 100.0
Return HEX code: 01 04 02 03 E8 B9 8A
1 2 3 4 5

a. Controller communication address Adrs.
b. Return of the Read instruction
c. Number of valid Bytes of data received 02H.
d. PV value in HEX but need to be considered w.r.t the Decimal Point (dP) after converting to integer. Example, 03E8 when converted to decimal it gives 1000 but reading is 100.0, so need to check the dP parameter if it is 1 then divide the 1000 should be 100.0.
e. CRC Check code for 01 04 02 03 E8 is B9 8A.

Table 1 : Controller read (03H) and write (06H) parameter address:

Parameter Address	Parameter	Description
00H(40001)	SV (setpoint)	Same unit as PV
01H(40002)	HIAL (High limit alarm)	Same unit as PV
02H(40003)	LoAL (Low limit alarm)	Same unit as PV
03H(40004)	HdAL (High deviation alarm)	Same unit as PV
04H(40005)	LdAL (Low deviation alarm)	Same unit as PV
05H(40006)	AHYS (Alarm hysteresis)	Same unit as PV
06H(40007)	CntL (Control mode)	0: ONOFF 1: APID 2: nPID 3: PoP 4: SoP
07H(40008)	P (Proportional band)	Same unit as PV
08H(40009)	I (Time of intergral)	Second

09H(40010)	d (Time of derivative)	0.1 second
0AH(40011)	CP (Control Period)	0.1 second
0BH(40012)	Int (Input Spec.)	Refer to manual
0CH(40013)	dP (Decimal point)	0: 0 1: 0.0 2: 0.00 3: 0.000 If the return value is larger than +128, it implies that all PV and parameter using the same unit (including temperature and linear signal) and must be divided by 10 and round off to display. E.g. When dPt=128+1=129, the 16-bit return PV and related parameters is 1000, the actual display should be 10.0. If dPt=1, the actual display should be 100.0 ; This parameter is writable, and no need to add 128 while writing. The range is 0~3.
0DH(40014)	INL (Signal scale low limit)	Same unit as PV
0EH(40015)	INH (Signal scale high limit)	Same unit as PV
0FH(40016)	ALtd (Alarm allocation)	Refer to manual
10H(40017)	Sc (Input shift adjustment)	Same unit as PV
11H(40018)	Out(Main output type)	0: SSR 1: rELy 2: 0-20 3: 4-20 4: PHA
12H(40019)	OtL (Output low limit)	%
13H(40020)	Oth (Output high limit)	%

14H(40021)	SSCo (Advance function)	Refer to manual
15H(40022)	Instrument mode identity	
16H(40023)	AdrS (Communication Address)	
17H(40024)	INF(PV input filter)	
18H(40025)**	A-M (Auto/manual selection)	0: MAN 1: Auto 2: FMAn 3: OFF
19H(40026)	Loc (Parameter Lock)	
1AH(40027)**	MV (Manual output valve)	
1BH(40028)	Srun (Running Status)	0: run 1: StoP 2: HoLd
1CH(40029)	HYS (Control Hysteresis)	Same unit as PV
1DH(40030)	At (Auto-tuning)	0: OFF 1: on 2: FoFF
1EH(40031)	SPL (Low limit of SV)	Same unit as PV
1FH(40032)	SPH (High limit of SV)	Same unit as PV
20H(40033)	du (Power frequency and temperature scale)	0: OC 1: OF
21H(40034)	OtEr OPH (Work range of OPH)	Same unit as PV
22H(40035)	OrEV (Acting method)	0: onr 1: ond
23H(40036)**	MV(Window display selection)	0: OFF 1: A-M 2: SP-T
*		
24H(40037)	Aut (Auxiliary output type)	0: SSR 1: rELy 2: 0-20 3: 4-20
25H(40038)	P2 (Second proportional band)	Same unit as PV

26H(40039)	I2 (Second time of integral)	Second
27H(40040)	d2 (Second time of derivative)	0.1 second
28H(40041)	CP2 (Second control period)	0.1 second
29H(40042)	EVt (Event input type)	0: OFF 1: rUSt 2: SP1.2 3: 2PId
2AH(40043)**	rAtE (Ramp Slope limit)	Unit of PV/minute required process of unit）
2BH(40044)*	PrSn (No. of program step)	Integer
2CH(40045)*	Pont(Program run mode after power restart)	0: Cont 1: StoP 2: run1 3: dASt 4:HoLd
2DH(40046)*	PSYS (Program running mode)	Refer to manual
2EH(40047)*	STEP (Program step no)	Integer
2FH(40048)*	Time of program already run	0.1 minute or 0.1 hour, depending on PAF parameter
30H(40049)*	Event output status	0: No event output 1: Event 1（AL1）activated 2: AL2 activated 3: AL1 and AL2 activated
31H(40050)**	OPrt (Time of soft start)	
32H(40051)**	Vrtt (Valve rotating time)	Define valve rotating time required
33H(40052)**	rSPL (Low limit of external setpoint)	When external setpoint is used as valve feedback signal, set the valve position to 1.
34H(40053)**	rSPH (High limit of external setpoint)	When external setpoint is used as valve feedback signal, set the valve position to 2.

35H(40054)	Adt (Alarm delay definition)	Refer to manual
36H(40055)	ALL(Definition of alarm self lock)	Refer to manual
37H(40056)	AdoN(Alarm ON delay)	
38H(40057)	AdoF(Alarm OFF delay)	
39H(40058)	LbA(Control loop break off / shorted Alarm)	
3AH(40059)	CoMM(Communication protocol)	0: FBUS 1: MBUS(Recommended)
3BH(40060)	P3(Proportional band 3) (No.3 PID parameter)	Same unit as PV
3CH(40061)	I3(Time of ntegral 3) (No.3 PID parameter)	second
3DH(40062)	d3	0.1second
3EH(40063)	CP3	0.1second
3FH(40064)	ALE(Definition of First alarm exemptions)	Refer to manual
40H~47H(4006 5~ 40072)	FP1~FP8(Field parameter definition)	
48H(40073)	PrG(Curve group number)	Refer to manual
49H(40074)	PrGd(Program grouping	0,1 group; 1,4 group; 2, 8 group
	definition)	
4AH~4FH	Spare	
50H~51H(4008 1~ 40082)	SP1, t-1	SP1 is first period Setting value, and t-1 is the first period of time
52H~(40083~)	SP2~ Refer Table 2 for more.	Program segment data, the number is defined by the PrSn parameter

Table 2:

Parameter	Addr	Parameter	Addr		Parameter	Addr	Parameter	Addr
SP1	50H	t-1	51H		SP26	82H	t-26	83H
SP2	52H	t-2	53H		SP27	84H	t-27	85H
SP3	54H	t-3	55H		SP28	86H	t-28	87H
SP4	56H	t-4	57H		SP29	88H	t-29	89H
SP5	58H	t-5	59H		SP30	8A	t-30	8B
SP6	5A	t-6	5B		SP31	8C	t-31	8D
SP7	5C	t-7	5D		SP32	8E	t-32	8F
SP8	5E	t-8	5F		SP33	90H	t-33	91H
SP9	60H	t-9	61H		SP34	92H	t-34	93H
SP10	62H	t-10	63H		SP35	94H	t-35	95H
SP11	64H	t-11	65H		SP36	96H	t-36	97H
SP12	66H	t-12	67H		SP37	98H	t-37	99H
SP13	68H	t-13	69H		SP38	9A	t-38	9B
SP14	6A	t-14	6B		SP39	9C	t-39	9D
SP15	6C	t-15	6D		SP40	9E	t-40	9F
SP16	6E	t-16	6F		SP41	A0H	t-41	A1H
SP17	70H	t-17	71H		SP42	A2H	t-42	A3H
SP18	72H	t-18	73H		SP43	A4H	t-43	A5H
SP19	74H	t-19	75H		SP44	A6H	t-44	A7H
SP20	76H	t-20	77H		SP45	A8H	t-45	A9H
SP21	78H	t-21	79H		SP46	AA	t-46	AB
SP22	7A	t-22	7B		SP47	AC	t-47	AD
SP23	7C	t-23	7D		SP48	AE	t-48	AF
SP24	7E	t-24	7F		SP49	B0H	t-49	B1H
SP25	80H	t-25	81H		SP50	B2H	t-50	B3H

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