

M2000 Series

General Artificial Intelligence PID Controller

The Manual V1.0

Thank you for purchasing M 2000 series controller . This manual mainly explains some necessary attention in installation and wiring . Before operation , please read this manual first to fully understand the operation of this product . Please take this manual with you for reference at any time.

一、 Attention

- ! Danger** 1. Attention!Electrical hazard!
Do not touch the AC power terminal after the controller is electrified to avoid electric shock! When implementing controller power wiring, make sure the power is off first!
- ! Warning** 1. Please do not use this product in places full of explosive and combustible gases.
2. Before connecting the power supply, please confirm whether the voltage is within the rated range and whether the wiring terminals are correct, or the controller may be seriously damaged after the power supply.
3. The maximum torque of the terminals should not exceed 8KG.
4. It is strictly forbidden to decompose, modify or repair the product.
5. Please do not use in the following circumstances:
- where the temperature changes dramatically
 - places where humidity is too high and water is produced
 - a place where the vibration or impact is very strong where corrosive gases or dust are present
 - splash of water, oil and chemicals
6. Wiring should be kept away from high-voltage, high-current power lines to avoid interference.
7. Please note that the outer shell of the body is eroded by organic solutions, strong acids, strong alkalis.

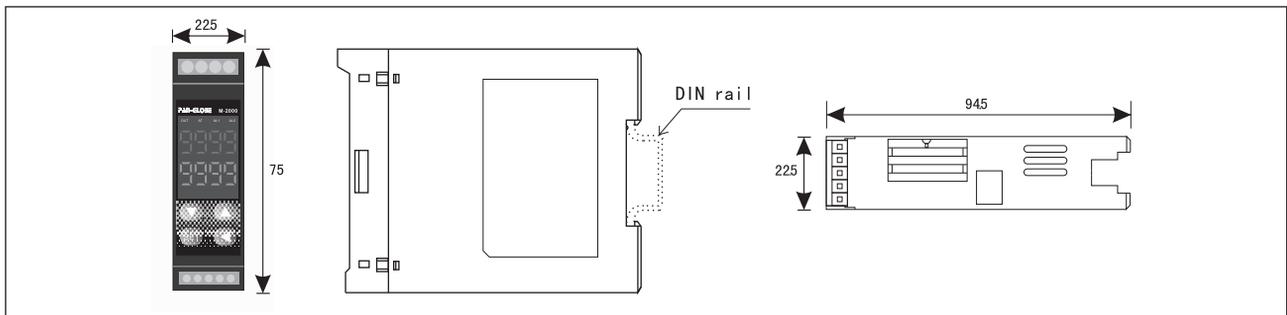
二、 Feature

Power and Voltage	AC85-265V,50/60Hz(DC power is optional)	Display Error	±0. 2%FS
Consumption	5VA Max	Input	General i nput (T/C、 PT100、 Analog signal) 、 Double input
Control mode	PID、 PD、 PI、 P	Output	Relay, SSR, 4-20ma, SCR pulse trigger signal,three-wire motor control
Environment temperature	-10~50℃	Sampling time	150ms
Environment Humidity	0~85%RH		

Specification:

- (1) Use the slope value to compensate the offset.
- (2) 2 in (input) 2 out (output) : 1 to 2 isolated transmission, 2 to 2 isolated transmission; Multiple alarm modes.
- (3) The machine can transmit PV, SV and MV: forward, reverse and difference value in 8 ways.
- (4) Output soft start function.
- (5) Dehumidification function.

三、 Panel cut out and Dimension



四、 Operation Instruction



NO	Symbol	Function
1	PV	Measured value/mode display
2	SV	Set values/schema content
3	OUT	The light is on when the OUT Occurs
4	AT	Autou tuning light
5	AL1	Alarm 1 indicator light
6	AL2	Alarm 2 indicator light
7	▲	Increase button
8	▼	Reduce button
9	◀	Displacement button
10	SET	Loop/confirm button

五、 Input Type/Alarm mode

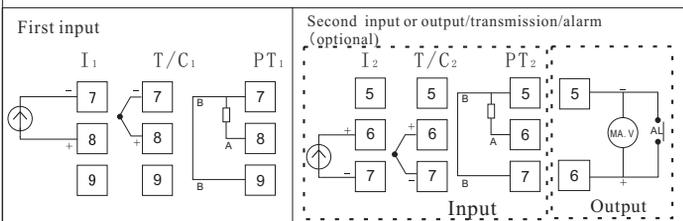
Type	Symbol	Measurement Range
K	ξ	0-1370°C/0-2498°F
J	J	0-1200°C/0-2192°F
R	r	0-1760°C/0-3216°F
S	S	0-1760°C/0-3216°F
B	b	0-1820°C/0-3308°F
E	E	0-1000°C/0-1832°F
T	ξ	0-600.0°C/0-1112°F
PT100	PE	-199.9-600.0°C/-327.8-1112°F
Cu50	Cu50	0-150.0°C/0-302.0°F
LN	Ln	Linear analog signal 4-20mA, 0-1V, 0-50MV, 0-5V
N	n	0-1300.0°C/0-2372.0°F
W1	W1	0-2000.0°C/0-3632.0°F
W2	W2	0-2320.0°C/0-4208.0°F

Code	AL1、AL2 Mode
0	High deviation alarm
1	Deviation low alarm
2	High absolute value alarm
3	Low absolute value alarm
4	Intraregional alarm
5	Out-of-area alarm
6	Low deviation alarm (no alarm for the first time)
7	Low absolute value alarm (not alarm for the first time)
8	Cut (T/C)alarm
9	Out-of-area alarm(no alarm for the first time)
10	One section of program over alarm
11	End of program alarm
19	Constant temperature and timing alarm

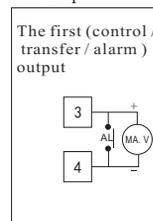
六、 Connecting (Screw functions are subjected to the label on the back of the controller)

6.1 Terminal connection diagram

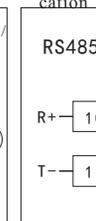
A. Input



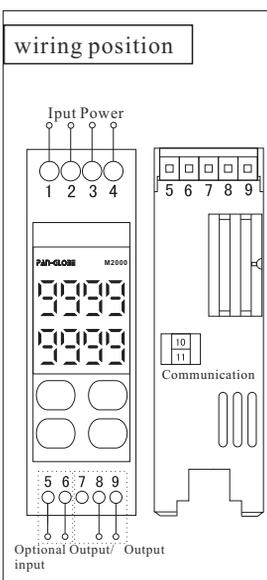
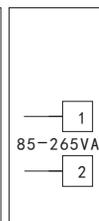
B. Output



C. Communi- cation

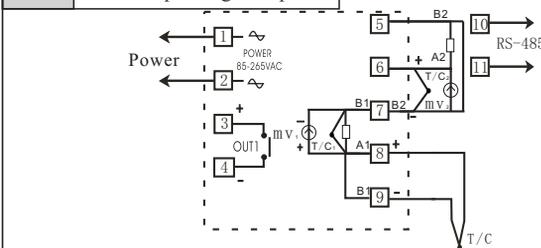


D. Power

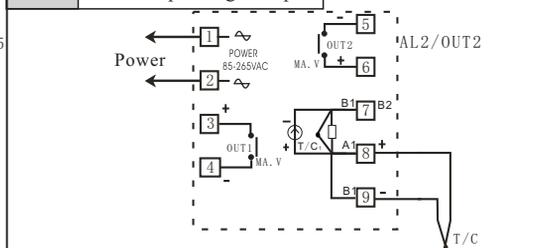


6.2 Applied wiring diagram

6.2.1 Double input single output



6.2.2 Double input single output



七、 Input Signal Processing Point

First Input :

TC : Fully open
RTD : PT1
4-20mA : MA1

Second Input :

TC : Fully open
RTD : PT2
4-20mA : MA2

CPU mainbord

MA1 MA2 PT1 PT2

八、 Error code index

Screen Display	Instruction	Elimination method
UUU!	The first set of sensors were disconnected, polarity reversed or out of range. The first set of input signals were higher than USP	Please check the input signal for errors and rationality
nnn!	The first set of input signals is lower than LSP	Please check the input range
CUCE	Normal temperature compensation failure	Please check the temperature compensation diode
UUUU	Open T/C circuit	Please check T/C or compensating wire

九、 Operation Instruction

1. Basic Operation

Step 1: measure the type of input signal selection

- A. At the same time, press SET key + ◀ key to enter LEVEL3
- B. Press the key ◀ under INP and the SV display will blink
- C. press ▼ or ▲ select the type of input signal (refer to the signal input selection table)
- D. Press SET to confirm modification
- E. At the same time, press SET + ◀ key to return to LEVEL1

Step 3: Set alarm value AL1 (AL2 can also be set)

- A. Press SET key several times to AL1 option, and then press the ◀ key again, the first digit of SV display will flash.
- B. Press ▲ or ▼ to SET the value, and then press the key to next digit and do the same setting . C. After setting, press SET key to confirm.
- D. Press SET to return to LEVEL1

Step 4: program process curve and operation

- A. At LEVEL1 $\left[\begin{smallmatrix} PV \\ SV \end{smallmatrix} \right]$
- B. Press SET key several times to ct
- C. according to the requirements of process, design many groups of curve in advance, and then press SET key to $[C01]$, press ◀ keys used ▲ ▼ in the first SET of temperature at either end of the first paragraph, then press the SET button to enter $[T01]$ items with the same operation in the end of the first group of the first period of time. the first paragraph $[OU0]$ high output range (0-100.0) so on, completed the first SET of multistage presets.
- D. Noted that when the number of segments is finish presetting, CX, TX and OUX of the next segment must all be put "0" as the isolation segment and mark between groups. E. 90 is the maximum segment can be programmed, and can be grouped and set only in range of 90. F. $[CAL]$ menu is the first section number of the startup operation group. For example, in section 15 of the third set of preset process, select the third set of $[CAL]=15$ to start
- G. If the program needs to start from 0, put the $[STA]$ item into 1; if PV is needed, put the STA item into 2 or 3 Program control $[END]$ mode has two options.
- H. The program can select SN during operation, Within the range of this group segment number, can change its current segment number to run forward or backward; Select the ST item to manually modify the countdown of the current running segment.
- I. To start/end the program, please press $[SET]$ key and ▲ key at the same time to select. J. Press the button ▲ to pause/continue the program.
- K. To ensure the constant temperature period during the heating process, you can select WB item and place it into the waiting temperature zone (0.1-10℃), which is invalid when WB=0
- L. According to ON/OFF mode of external start terminal or connect time can select.
 - Press the key once (3-4 seconds) to start the program control ; if press the button once (3-4 seconds) to end the program control;
 - during the program control operation • Press the key once (1-2 seconds) to stop the program control. If press next time program control to continue to run.

Step 5: 1. Automatic calculus (AT)

- A. When field conditions permit, please try your best to carry out self-tuning work of AT parameters. It is better to install loads equal to practical ones in the object. B. This AT calculation cannot fail in the process of thermal parameters.
- C. The maximum value of the process curve should be about 80% of the range of instrument detection.
- D. Before the program is not started (fixed value control STA=0), it is better to carry out AT around the maximum value of the process curve (SV=0.3).
- E. In LEVEL1 process, press SET key several times to reach AT option, then press ◀ and ▲ to put "1" to start AT calculation.
- F. This machine is used as a fixed value control when $[STA]=0$, and as a program controller when $[STA]=1, 2, 3$.
- G. Once the controller is powered on, as long as $[STA]$ does not equal 0 (the program control machine does not start the program operation, the controller has no output.

2. Advanced operation

1) manually modify PID parameters.

At LEVEL1, press SET key for 5 seconds to enter LEVEL2. Press SET key to select P, I and D parameter options and SET them.

2) Indoor temperature display correction

If the input terminal is short, the value displayed by the instrument should be approximately room temperature. If there is a big difference, please press SET key and key ▼ to enter LEVEL4 at the same time. Then press SET key several times to find TM1 and TS1 options.

3) Fast search for preset or modified segment parameters

The maximum programming is 90 segments, and the $[SET]$ key can only to segment number per press. For fast programming, the following methods are adopted: When press the SET key to enter the menu of the programming area, each press ▲ or ▼ key once can increase COX by 10 (C1X...CNX) or decrement (C90, C50, C10). When entering the predetermined 10 segments, use $[SET]$ key to step through the modification. No matter whether the current main screen is in the programming area or in the second or third process, if you press the key ▲ ▼ at the same time, it will immediately return $\left[\begin{smallmatrix} PV \\ SV \end{smallmatrix} \right]$.

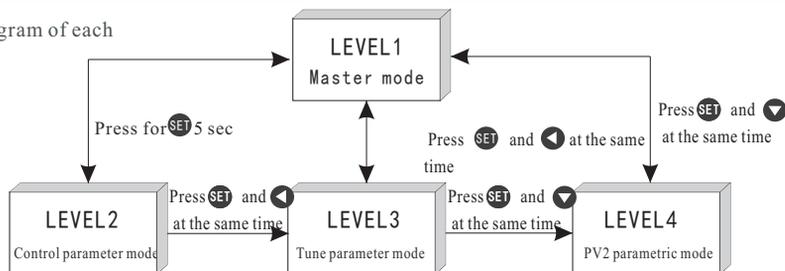
Step 2: alarm mode setting Ad1 (Ad2 can also be set)

- A. Press SET to enter LEVEL2
- B. Press SET for several times to the option of Ad1, and then press ◀ the key, the SV display will flash.
- C. press ▼ or ▲ select the mode you need (refer to the alarm mode selection table)
- D. Press SET key to confirm modification
- E. Press SET to return to LEVEL1

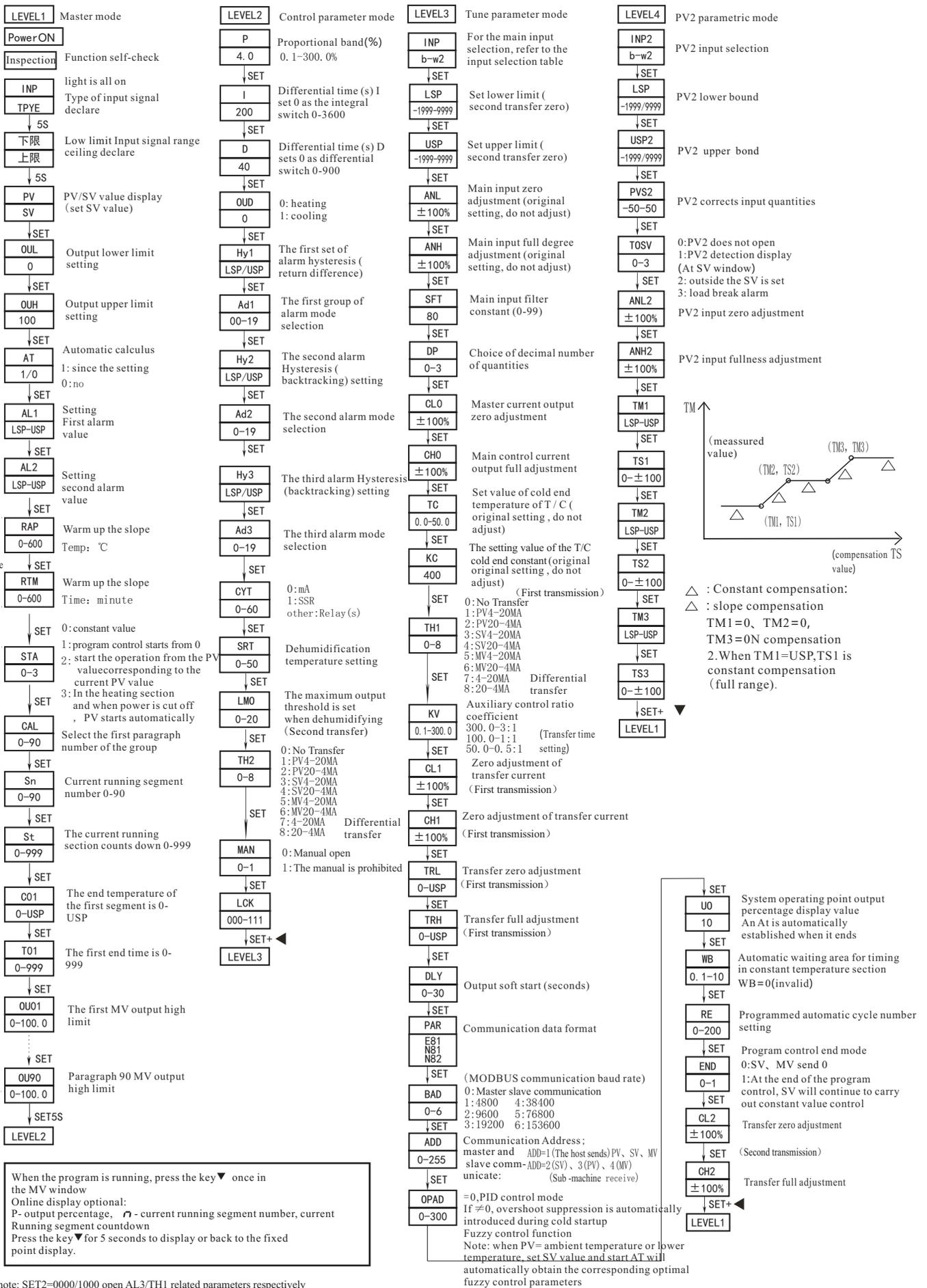
Note: the value of AL1 and AL2 in alarm mode 0, 1, 4, 5, 6, 9 is the deviation value of SV ; In mode 2, 3, 7, is the absolute temperature of alarm ; Nostandard at mode 8; Both AL1 and AL2 can choose alarm mode 10, which can be used as the end of alarm or choose mode . At 11, no setting is required as the alarm at the end of the program.

十、 Operation process

Schematic diagram of each stratum



*no keys pressed for 60 seconds Automatic return to LEVEL(main setting layer)



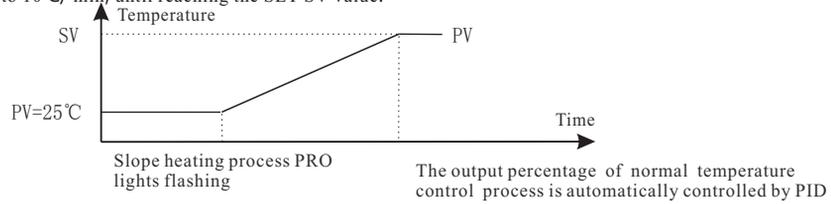


Application Example

Case 1, slope temperature rise control

When your system needs a soft start (SV preset slope heating), please operate in the following order :

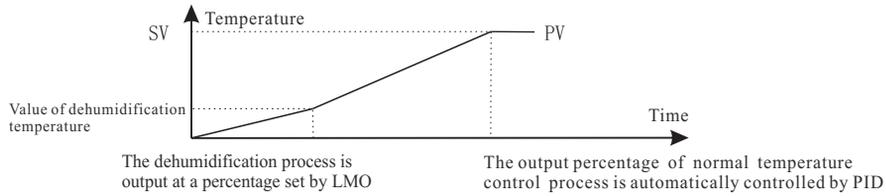
SET SV value → at LEVEL1, press SET key to find **[RAP]**, set slope temperature value, and → then press SET key to find **[RTM]**, set slope time (minutes)(for example, set slope to 10°C/ min, **[RAP]** to 10.0, **[RTM]** to 001.0) → after setting, SV value will be set immediately from the current PV value to 10°C/ min, until reaching the SET SV value.



Case 2: Dehumidification function

When your system requires dehumidification, operate in the following order:

Under the LEVEL1, press SET button several times, find the **[SRT]**, preset dehumidification PV value, range generally is 10 ~ 40 °C, → press SET key, find the **[LMO]**, preset dehumidification work output percentage, preset V = 2.0 ~ 5.0 (for example **[SRT]** set to 40 °C, **[LMO]** to 2.0, for the instrument to turn it off when the system temperature below 40 °C, the instrument output at 2%, during the process, can cause the furnace internal temperature heating wire frozen water vapor, evaporation, so you can avoid burning heater).



Case 3: process control

It is equipped with preset 90-segment multi-group multi-segment free combination temperature programmable function, can choose a variety of start mode, arbitrary jump operation, manually modify the current running clock; When STA=0, it can be used as a fixed value controller

Curvilinear control parameter: STA, CAL, SN, ST, C01, T01, WB, KP, EK

0: constant value control

1: program control starts from 0

2: start the operation from the PV value corresponding to the current PV value 3. In the heating section and when power is cut off, PV starts automatically

[STA]

Select the first paragraph number of the group

[CAL]

[SN]

Current running segment number

[ST]

Current running section countdown

[C01]

First end temperature

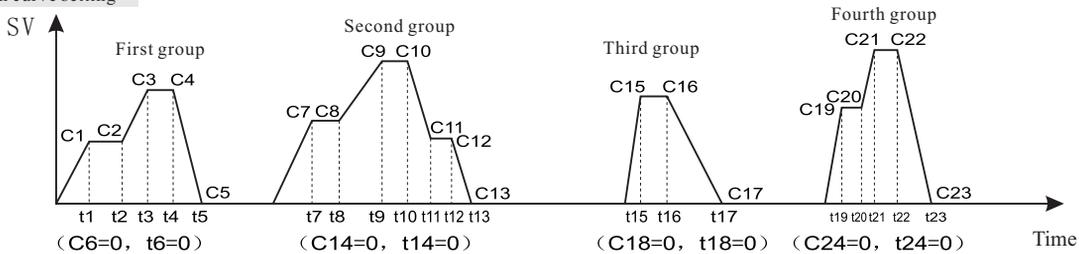
[T01]

First end time

[WB]

Automatic waiting area for timing in constant temperature section

Program curve setting



Set four groups as shown in the figure :

In the first group, there are five stages: the first stage, the terminal temperature is C1, and the terminal time is t1. In the second segment, the end temperature is C2 and the end time is t2. In the third stage, the terminal temperature is C3 and the terminal time is t3. In the fourth section, the terminal temperature is C4 and the terminal time is t4. In paragraph 5, the terminal temperature is C5 and the terminal time is t5. The second set of seven sections: the first section, the end temperature is C7, the end time is t7. In the second segment, the end temperature is C8 and the end time is t8. In the third section, the end temperature is C9 and the end time is t9. In the fourth segment, the end temperature is C10 and the end time is t10. In paragraph 5, the terminal temperature is C11 and the terminal time is t11. In the sixth paragraph, the terminal temperature is C12 and the terminal time is t12. In the seventh section, the end temperature is C13 and the end time is t13. The third set of three sections: the first section, the end temperature is C15, the end time is t15. In the second segment, the end temperature is C16 and the end time is t16. In the third section, the end temperature is C17 and the end time is t17. The fourth set of five segments: the first segment, the end temperature is C19, the end time is t19. In the second segment, the end temperature is C20 and the end time is t20. In the third section, the terminal temperature is C21 and the terminal time is t21. In the fourth segment, the end temperature is C22 and the end time is t22. In paragraph 5, the terminal temperature is C23 and the terminal time is t23.

Case 4. Difference transmission (dual-input model applicable)

This machine in the original transfer on the basis of a new set of positive and negative 4-20MA difference value transfer

① (PV1-PV2)=A1 → 4MA/ (20MA)

② (PV1-PV2)=A2 → 20MA/ (4MA)

③ A2>A1

④ PV1: input signals of the first group

PV2: input signals of the second group

A1, A2: difference value

Case 5. double-group output (auxiliary control ratio coefficient)(suitable for 301/801/901 model)

When your system requires sub-control ratio factor, please operate the instrument in the following order:

Set SV value → press SET key to find **[KV]** at LEVEL3 and SET sub-control distribution coefficient value (the output of the first group is in a certain ratio to the output of the second group)

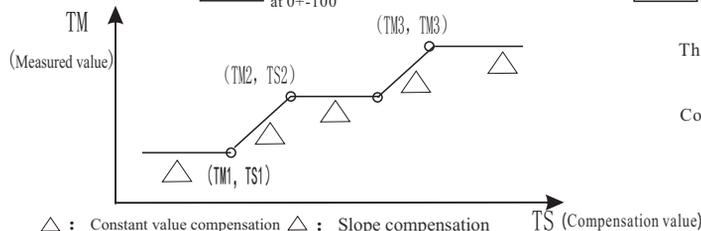
(for example, if the first group is required to output fully, and the second group is required to output half, just set **[KV]** to 50) → once the setting is completed, the sub-control ratio coefficient will be immediately implemented (another group of output can be provided, which is completely proportional to the output of the main control).

Case 6. Temperature compensation setting

Curvilinear control parameter: TM1、TS1、TM2、TS2、TM3、TS3

- TM1** The first point is to set LSP~USP
- TM2** The 2nd point is to set LSP~USP
- TS1** The first compensation value is set at 0+-100
- TS2** The 2nd compensation value is set at 0+-100

- TM3** The 3rd point is to set LSP~USP
- TS3** The 3rd compensation value is set at 0+-100



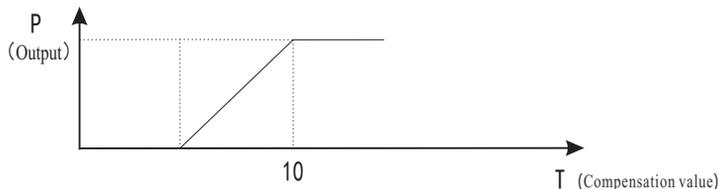
As shown in the left picture :
The temperature controller adopts :
constant value compensation
Slope compensation

Conditions:
1. TM1=0, TM2=0, TM3=0 No Compensation

Case 7. Output soft start

When your system needs output soft start, operate to set SV in the following order :

Set SV value → In LEVEL3, press SET key to find **DLY** , SET the output soft start value, (such as to SET the output after 10S, then **DLY** SET to 10) → finish setting, the output soft start will be immediately executed.



十二、M2000 series - MODBUS communication protocol

一、Summary of the agreement

1. Scope of selection: pan-globe M2000 series communication instrument
2. Work realization: data exchange between instrument and host computer (instrument can only be used as slave to receive interrogation and reply)
3. Serial transmission mode: RTU
4. Transmission interface: RS485
5. Communication medium: shielded twisted pair
6. Communication stack number: 1~255. The upper limit of the number of connecting meters is related to the load capacity of the host
7. Function code implementation: read hold register (03), write single register (06), write multiple registers (10)
8. Data length: 1) when writing data to the machine, a maximum of 16 consecutive menus (32 bytes) can be written at one time. 2) when reading the menu data inside the machine, the non-programmed menu can read 16 consecutive menus at a time (the unrealized address outside the parameter address table is 0), while the programmed menu can only read 16 consecutive menus at a time
9. Numerical format: signed 16-bit binary complement; The data read is 10.0 times larger; Before writing the data, enlarge the data 10.0 times before sending it; Notice the transition
10. serial port parameters: 1), baud rate :4800, 9600, 19200, 38400, 76800, 153600 2) start position: 1 3) data bit: 8 4) check bit: E(even check), N(no check) 5) stop bits: 1, 2
11. Frame check method: cyclic redundancy check (CRC16)
12. Message format (N=2 here)

Address	Function code	Data	CRC Inspection
8bit	8bit	N × 8 bit	16bit

- Note: 1. read AM and AM1 (cold control manual) menus, 0 represents manual state, 1 represents automatic state.
2. RAP is the program control menu, read, return 0X0000 represents the program control close, return 0X0001 represents the program control start: write 0X0000 to close the program control, write 0X0001 to start the program control, write 0X0002 to stop the program control, write 0X0002 to end the suspension, continue to run the program control.
 3. Before writing the program-controlled menu, please write 0x0000 to RAP to close the program-controlled menu.
 4. Before writing MV/MV1 threshold, please first write 0x0000 to AM/AM1 to make the system switch to manual control.
 5. When the multiplier is 10, the returned data is magnified 10 times.
 6. PV1 and PV2 are read-only parameters.
 7. There should be a time interval between write parameter instructions, no matter the same address or not, which may cause instrument failure, and the time interval should be no less than 150 milliseconds.

二、The instance/example

1、Function code 03(read the set value SV=100.0):

Request		Response	
Field name	(Hexadecimal)	Field name	((Hexadecimal)
Number	01	Number	01
Function code	03	Function code	03
Start Address Hi	00	Byte count	02
Start Address Lo	04	Register value Hi	03
Register number Hi	00	Register value Lo	E8
Register number Lo	01	CRC Lo	B8
CRC Lo	C5	CRC Hi	FA
CRC Hi	CB		

2、Function code 06(read the set value SV=100.0):

Request		Response	
Field name	(Hexadecimal)	Field name	(Hexadecimal)
Number	01	Number	01
Function code	06	Function code	06
Start Address Hi	00	Start Address Hi	00
Start Address Lo	04	Start Address Lo	04
Register number Hi	03	Register value Hi	03
Register number Lo	E8	Register value Lo	E8
CRC Lo	C8	CRC Lo	C8
CRC Hi	B5	CRC Hi	B5

3、Function code 10(read the set value SV=100.0):

Request		Response	
Field name	(Hexadecimal)	Field name	(Hexadecimal)
Number	01	Number	01
Function code	10	Function code	10
Start Address Hi	00	Start Address H	00
Start Address Lo	04	Start Address Lo	04
Register number Hi	00	Register number Hi	00
Register number Lo	01	Register number Lo	01
Byte count	02	CRC Lo	40
Register value Hi	03	CRC Hi	08
Register value Lo	E8		
CRC Lo	A7		
CRC Hi	6A		

三、Signed parameter address allocation table (" NC "means the address is empty)

parameter name	Address		Read / write state	Ratio	Ratio (No Range)
	Hexadecimal	Decimalism			
MV	00H	0	R/W	10 ^①	0~100
MV1	01H	1	R/W	10	
PV1	02H	2	R	10	LSP~USP
PV2	03H	3	R	10	LSP~USP
SV	04H	4	R	10	LSP~USP
NC	05H	5	R		
AD1	06H	6	R/W	1 ^②	0-11
AL1	07H	7	R/W	10	-1999~9999
HY1	08H	8	R/W	10	LSP~USP
AD2	09H	9	R/W	1	0-11
AL2	0AH	10	R/W	10	-1999~9999
HY2	0BH	11	R/W	10	LSP~USP
A/M	0CH	12	R/W	1	0/1
AT	0DH	13	R/W	1	0/1
P	0EH	14	R/W	10	0.1~3600
I	0FH	15	R/W	10	0~3600
D	10H	16	R/W	10	0~3600
ODU	11H	17	R/W	1	0/1
CYT	12H	18	R/W	10	0~200
INP	13H	19	R/W	1	0~9
LSP	14H	20	R/W	10	-1999~9999
USP	15H	21	R/W	10	-1999~9999
OUL	16H	22	R/W	10	0~100
OUH	17H	23	R/W	10	0~100
TH	18H	24	R/W	1	0~8
KU	19H	25	R/W	10	0.1~300
TRL	1AH	26	R/W	10	LSP~USP
TRH	1BH	27	R/W	10	LSP~USP
TM1	1CH	28	R/W	10	LSP~USP

TS1	1DH	29	R/W	10	-200~1000
TM2	1EH	30	R/W	10	LSP~USP
TS2	1FH	31	R/W	10	-200~1000
TM3	20H	32	R/W	10	LSP~USP
TS3	21H	33	R/W	10	-200~1000
RAP	22H	34	R/W	1	0~2
STA	23H	35	R/W	1	0~3
CAL	24H	36	R/W	1	1~90
SN	25H	37	R/W	1	1~90
WB	26H	38	R/W	10	0~3600
KP	27H	39	R/W	10	0.1~100
EK	28H	40	R/W	10	0~3600
RE	29H	41	R/W	1	0~255
END	2AH	42	R/W	1	0/1
C_0	2BH	43	R/W	1	0~3
PMA	2CH	44	R/W	1	0/180
KO	2DH	45	R/W	1	0~255
SFT	2EH	46	R/W	1	0~99
DP	2FH	47	R/W	1	0~3
MAN	30H	48	R/W	1	0/1
INP2	31H	49	R/W	1	0~9
LSP2	32H	50	R/W	10	-1999~9999
USP2	33H	51	R/W	10	-1999~9999
PVS2	34H	52	R/W	10	-50~50
CYT2	35H	53	R/W	10	0~200
GAP	36H	54	R/W	10	-50~50
Pc	37H	55	R/W	10	0.1~3600
Ic	38H	56	R/W	10	0~3600
Dc	39H	57	R/W	10	0~3600

Note:1: No symbol ; 10:With symbol

Program menu address:

CX=(X-1)*12+256,X is segment number:C90,X=90,Input RangeLSP~USP;

TX=(X-1)*12+260,Input Range (0~9999)

OUX=(X-1)*12+264,Input Range (0~100)

INP(INP2)Enter corresponding form

b	0	j	5
s	1	k	6
r	2	pt	7
t	3	cu	8
e	4	ln	9
n	10	wl	11
w2	12		