



DK2900 dual MODBUS communication process controller



- True color IPS TFT full viewing angle LCD display, full 5 digits, innovative OVERVIEW color changing display technology
- Double MODBUS, optional industrial Ethernet, online communication control, integrated digital PID control of the master station
- Support 20 process curves, each 50 segments, support intra-segment circulation and curve circulation
- Support rate mode curve and time mode curve
- 10-group PID, group output limiting function, suitable for various characteristic loads
- Support analog remote and digital remote control settings, support heater disconnection alarm function
- 47 kinds of input signals, support PT1000 input, industrial oxygen probe carbon potential control, dual sensor redundancy
- Adopt improved DK PID algorithm to support PV differential and differential prior control
- Innovative 32-bit RISC instruction set industrial-grade microprocessor, 0.1-level measurement and control accuracy
- Support dual sensor high and low temperature switching function. Support user-defined input curve 8-point correction function
- Support 9-channel DIO, programmable DI, DO custom input and output functions, time scale function

DK2900 PID intelligent program control instrument

Installation and User Manual

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Dk2900 series process controller

Chapter 1 Overview

1.1 Product Introduction

DK2900 series process controllers are industrial process control instruments designed with the latest measurement control technology. The use of advanced hardware and software design technology has the characteristics of high measurement and control accuracy. With power-on alarm exemption function.

1. Full-screen OVERVIEW display technology, full 5-bit data insight into each process control parameter, maximum display plus or minus 99999.

2. Double MODBUS RTU communication, optional MODBUS TCP Ethernet communication. Support communication data synchronization function, multi-machine operation automatically synchronize SV. It can realize data synchronization control of multiple controllers.

3. It can realize digital control of communication PID and directly control one or more digital power controllers. Realize full digital control.

4. Communication data supports 16-bit integer standard. When the data range exceeds 16 bits, 32-bit shaped data reading and writing are implemented by using offset addresses. Realize high-precision full-resolution true reading for process control.

5. 24-bit high-speed multi-channel synchronous data acquisition, 32-bit RISC instruction set industrial grade microprocessor, anti-interference and fast response

6. Control the output refresh rate of 50MS to adapt to the faster control process.

7. 4-channel hard contact alarm output and program end alarm output. 9 programmable DIO input and output functions, the same IO can be customized as input or output function according to need.

8. Support dual-sensor high-low temperature switching function and redundant switching function. When the sensor fails, it automatically switches to the standby channel.

9. Dual channel math operation function, can realize complex algorithm logic. With high-precision carbon potential measurement and control function.

10. 20 curves, 50 segments per curve. Support loop within the segment and program curve loop.

11. The program curve can be controlled by 9-channel open-collector output. Integrated fixed time scale function output mode and program curve time scale function. It can be flexibly configured as required. Support rate curve mode and classic time mode curve input function.

12. 10-group PID and 10-group output limit control. Meet the needs of various control conditions.

13. Support analog reference and digital remote reference function.

14. 47 kinds of industry standard sensor signal input. Support non-standard signal input, multi-point linearization processing.

1.11 Technical index

1. Control period: 50mS / 100mS

2. Measurement accuracy: 0.1% FS (using 24-bit AD)

3. Sampling rate: 20Hz / 10Hz

4. Control output:

Analog signal: 12 BIT (True DA)

4-20MA, 0-20MA, 0-10MA, 0-10V, 2-10V, 0-5V, 1-5V

Relay: 2A (250V AC)

Solid state relay (transistor): 22V 20MA

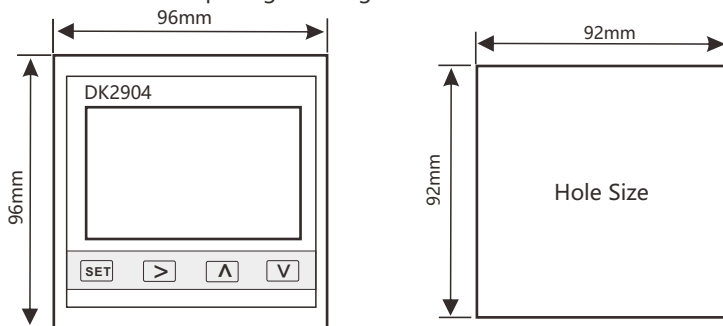
Thyristor: 3A 250V AC

5. Display mode: IPS TFT true color LCD

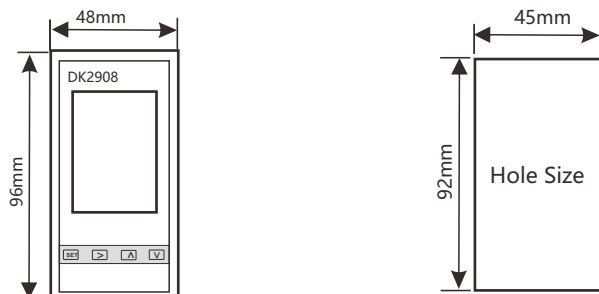
6. Signal measurement input impedance: voltage $\geq 500K\Omega$ (5V, 10V $\geq 100K\Omega$), current $\leq 60\Omega$, thermocouple $\geq 500K\Omega$, carbon potential control oxygen probe input $\geq 50M\Omega$

7. The resistance is measured with a three-wire system, and the resistance of each wire of the signal transmission wire is not more than 10 ohms.
- 8.1 Standard MODBUS RTU communication protocol. Two-wire RS485
 Check method: no check, odd check, even check
 Communication speed: 4800BPS, 9600BPS, 19200BPS
 Communication address range: 1 ~ 247.
- 8.2 Standard MODBUS TCP protocol.
 Mailing address: 0-255
 Subnet mask: 0-255
 Gateway: 0-255
9. Equipment power supply: 86 ~ 260V AC (47 ~ 63HZ)
10. Isolation voltage: input, output, power supply isolation voltage 2300V AC / 1MIN
11. Operating temperature: 0 ~ 50
12. Storage conditions: temperature -40 ~ 80 ; humidity 10% ~ 90% RH
13. Dimensions: 96 * 96 * 130mm (opening size 92 * 92mm),
 96 * 48 * 130mm (opening size 92 * 44mm),
 48 * 96 * 130mm (opening size 44 * 92mm)
14. EMC standard: EN61326 *
15. Safety standard: IEC60950-1
16. Protection level: IP66
17. Power consumption: 12W

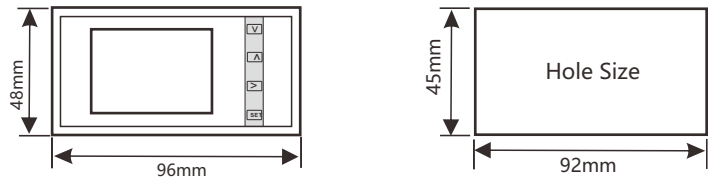
DK2904 outline and opening size diagram



DK2908 outline and opening size diagram

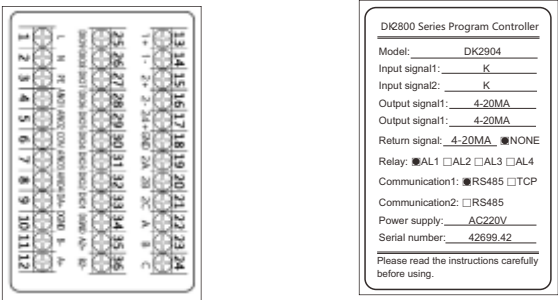


DK29H8 outline and opening size diagram



1.2 Label description

Take DK2904 as an example, one side of the meter is the terminal wiring description, and the other side is the parameter of the meter as shown below:



1.3 Contents in product packaging

When you open the packing box, please check whether the following products and accessories are in the packing box.

- I DK2904 or DK2908 or DK29H8 controller



DK2900 PID controller is a modular design instrument. By changing the internal integrated module, it can achieve a variety of functions such as communication, alarm, transmission, etc., which can be configured as needed. The order parameters of the product are printed on the side label of the instrument. Please check whether the specific configuration matches your order requirements before use.

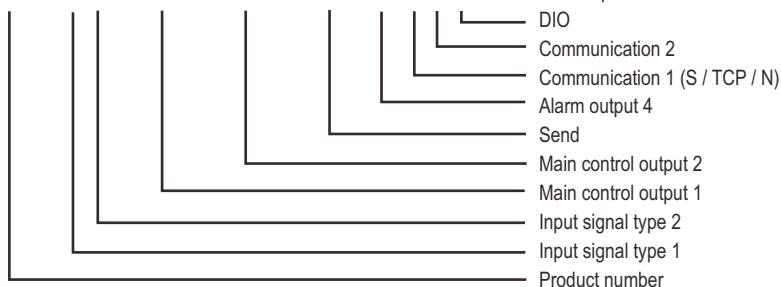
II Panel mounting bracket

There are two fixing brackets used to fix the instrument casing on the control panel.

1.4 Selection description:

Example: The customer needs to measure and collect 1 channel K-type thermocouple signal, 1 channel B-type thermocouple signal, with 4 alarm outputs, dual serial ports, main control output 2 channels 4-20MA signal, transmission output 4-20MA signal. The required hole size is 92 * 92mm.

The selection code is: **DK2904-K-B-4MA20-4MA20-4MA20-4*R-S-S-N-N** — Carbon potential control



1.41 Product model

The DK2900 series is available in three models with different dimensions. The DK2904 panel size is 96X96mm, the DK2908 panel size is 96X48mm, and the DK29H8 panel size is 48X96mm.

1.42 Input type 1 (can be set by yourself, supports 47 signals)

DK2900 series supports 47 kinds of industrial signal input.

Serial number	Selection code	signal type	the meter shows	Measuring range
0	K	K	K	-200 ~ 1300°C
1	S	S	S	0 ~ 1700°C
2	R	R	R	0 ~ 1700°C
3	T	T	T	-200 ~ 400°C
4	E	E	E	0 ~ 1000°C
5	J	J	J	0 ~ 1200°C
6	B	B	B	400 ~ 1800°C
7	N	N	N	0 ~ 1300°C
8	WRe325	WRe3-WRe25	WRe3-WRe25	0 ~ 2300°C
9	WRe526	WRe5-WRe26	WRe5-WRe26	0 ~ 2300°C
10	Cu50	Cu50	Cu50	-180.0 ~ 200.0°C
11	Pt100	Pt100	Pt100	-200.0 ~ 850.0°C
12	Pt500	Pt500	Pt500	-200.0 ~ 850.0°C
13	Pt1000	Pt1000	Pt1000	-200.0 ~ 850.0°C
14	0Ω80	0 ~ 80Ω	0R80	0 ~ 80Ω
15	0Ω400	0 ~ 400Ω	0R400	0 ~ 400Ω

Supported 47 input types selection table:

Serial number	Selection code	signal type	the meter shows	Measuring range
16	0Ω4000	0 ~ 4000Ω	0R4000	0 ~ 4000Ω
17	0MA10	0 ~ 10mA	0MA10	0 ~ 10mA
18	0MA20	0 ~ 20mA	0MA20	0 ~ 20mA
19	4MA20	4 ~ 20mA	4MA20	4 ~ 20mA
20	0MV20	0 ~ 20mV	0MV20	0 ~ 20mV
21	0MV100	0 ~ 100mV	0MV100	0 ~ 100mV
22	20MV	-20 ~ +20mV	-20MV20	-20 ~ +20mV
23	100MV	-100 ~ +100mV	-100MV100	-100 ~ +100mV
24	0V1	0 ~ 1V	0V1	0 ~ 1V
25	0V2	0 ~ 2V	0V2	0 ~ 2V
26	0V5	0 ~ 5V	0V5	0 ~ 5V
27	1V5	1 ~ 5V	1V5	1 ~ 5V
28	0V10	0 ~ 10V	0V10	0 ~ 10V
29	2V10	2 ~ 10V	2V10	2 ~ 10V
30	5V	-5V ~ +5V	-5V5	-5V ~ +5V
31	10V	-10V ~ +10V	-10V10	-10V ~ +10V
32	Cu10	Cu10	Cu10	-180.0 ~ 200.0°C
33	Cu100	Cu100	Cu100	-180.0 ~ 200.0°C
34	Pt10	Pt10	Pt10	-200.0 ~ 850.0°C
35	Pt50	Pt50	Pt50	-200.0 ~ 850.0°C
36	Pt200	Pt200	Pt200	-200.0 ~ 850.0°C
37	JPT10	JPT10	JPT10	-200.0 ~ 850.0°C
38	JPT50	JPT50	JPT50	-200.0 ~ 850.0°C
39	JPT100	JPT100	JPT100	-200.0 ~ 850.0°C
40	JPT200	JPT200	JPT200	-200.0 ~ 850.0°C
41	JPT500	JPT500	JPT500	-200.0 ~ 850.0°C
42	JPT1000	JPT1000	JPT1000	-200.0 ~ 850.0°C
43	Ni100	Ni100	Ni100	-60 ~ 180°C
44	Ni200	Ni200	Ni200	-60 ~ 180°C
45	Ni500	Ni500	Ni500	-60 ~ 180°C
46	Ni1000	Ni1000	Ni1000	-60 ~ 180°C

1.43 Input Type 2

Same as input type 1.

1.44 Main control output 1

Main control output selection table:

Serial number	Types of	Selection code	the meter shows
1	4-20MA	4MA20	Linear output
2	0-10MA	0MA10	Linear output
3	0-20MA	0MA20	Linear output
4	0-10V	0V10	Linear output
5	2-10V	2V10	Linear output
6	0-5V	0V5	Linear output
7	1-5V	1V5	Linear output
8	Relay output	R	Relay
9	Solid state relay output	P	Transistor
10	Thyristor output	T	Thyristor
11	No	N	

1.45 Main control output 2

The main control output 2 is the same as the main control output 1.

1.46 Transmission (optional function)

There are seven transmission types: 4-20MA, 0-10MA, 0-20MA, 0-10V, 2-10V, 0-5V, 1-5V.

1.47 First alarm output

One alarm output by default, selection code R.

1.48 Second alarm output (optional function)

Optional, R if there is, N if not.

1.49 Third alarm output (optional function)

Optional, R if there is, N if not.

1.4A fourth alarm output (optional function)

Optional, R if there is, N if not.

1.4B Communication 1 (optional function)

Optional standard Modbus TCP communication protocol or Modbus RTU, code is TCP or S, no communication is N

1.4C Communication 2 (optional function)

Optional standard Modbus RTU communication protocol, yes for S, no for N

1.4D DIO function (optional function)

Optional up to 9 channels, 9 * DIO if 9 channels, N if not

1.4E Carbon potential control function (optional function)

Optional, CARB if yes, N if not

1.5 Installation

1.51 Unpacking inspection

- 1. Unpack the controller and check whether the controller host is intact and its accessories are complete. Please save the packaging for future use.
- 2. If there is any damage or incomplete accessories, please contact us immediately to verify.

1.52 Installation

Before installation, please check whether the label parameters are consistent with the order. If you have any questions, please contact us in time.

Note: All installations must be completed by trained and experienced staff.

1.53 Use shielded cable

All analog signals must use shielded cables in order to minimize electromagnetic interference. The wiring should be as short as possible. The cable must be grounded at one end. The proper grounding position is close to the sensor and transmitter.

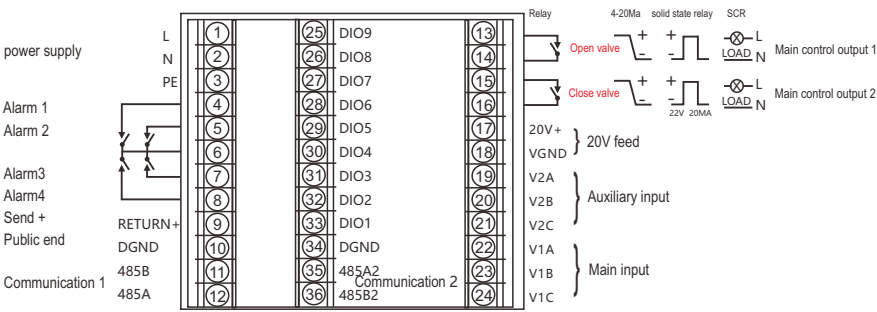
1.54 Measures to suppress interference

Under normal circumstances, if the wiring is good, no other anti-interference measures are required. In the case of very serious interference, you can consider using RC network or diode network to suppress interference.

Anti-interference of the electromagnetic coil-connecting the RC network and the diode in parallel can reduce the instantaneous interference of the inductor coil.

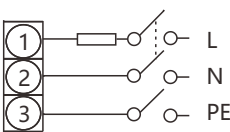
Use RC network to reduce contact arc when contactor is on and off. If the current is below 3A, use a 47 ohm resistor and a 0.1uf capacitor to form a network. When the current is 3-5A, use two RC networks in parallel.

1.6 Electrical connection

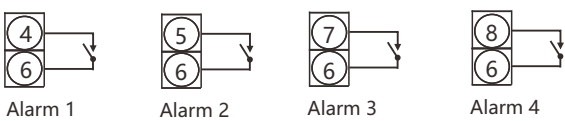


Note: DK2908 / DK29H8 only has 5 channels DIO

A. Power connection (AC 90 ~ 260V):



B. Alarm output wiring:

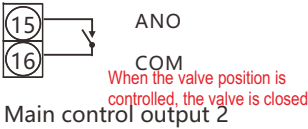
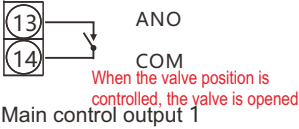


C. Communication wiring:

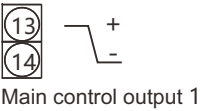


D. Main control output wiring:

Relay:



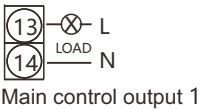
4-20MA:



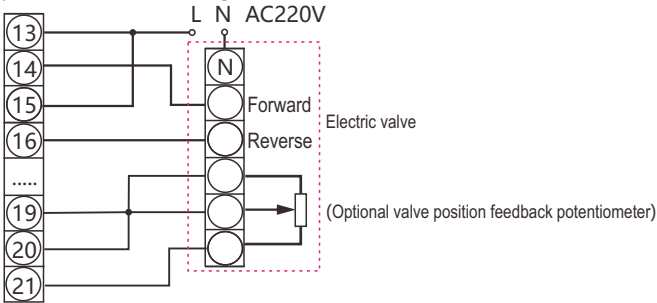
Transistor:



SCR:

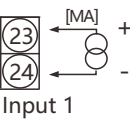
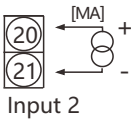


Valve position control wiring:

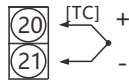


E. Input wiring of different types of sensors:

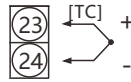
MA Input:



Thermocouple input:

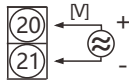


Input 2

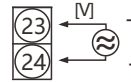


Input1

V input:

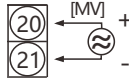


Input 2

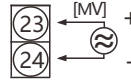


Input1

MV input:

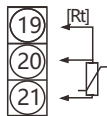


Input 2

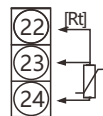


Input1

Thermal resistance input:



Input 2



Input1

F. Digital DIO interface:



Route 1



Route 2



Route 3



Route 4



Route 5



Route 6



Route 7

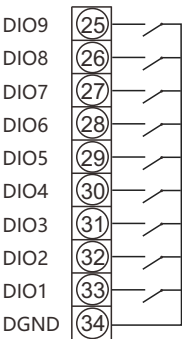


Route 8

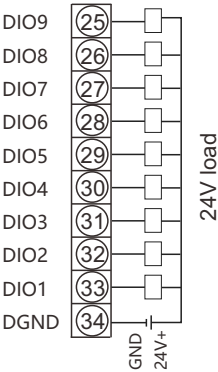


Route 9

This DIO function is programmable and can be defined as input DI or output DO by parameter setting. DI can only accept passive dry contact input signal input. DO is an open collector output. The maximum load capacity is 200MA, and an external 24V power supply is required to drive the intermediate relay.



Input usage wiring diagram



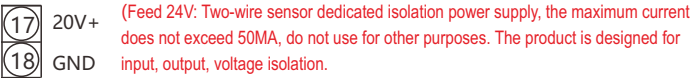
Output usage wiring diagram

Note: DK2908 / DK29H8 only has 5 channels DIO. Each channel can define input / output through parameter setting, and can be used in any combination.

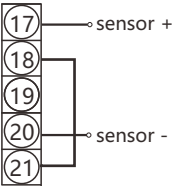
G. Transmit output:



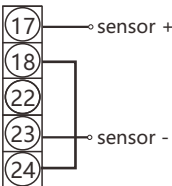
H.Feed:



Two-wire sensor connection method:

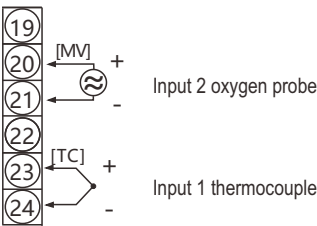
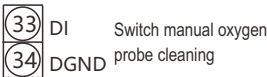


Input 2 Two-wire connection

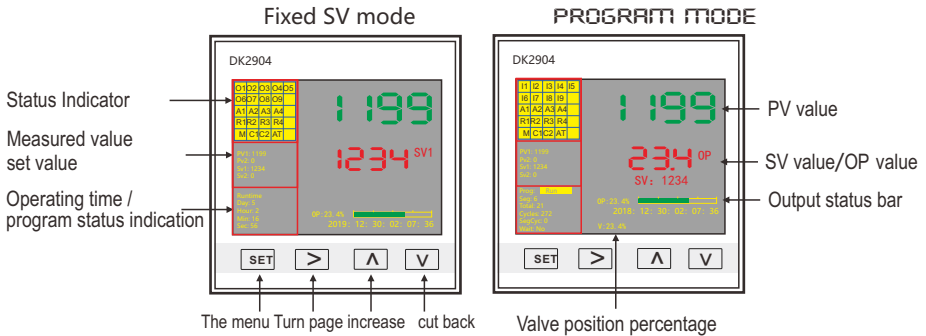


Input 1 Two-wire connection

I. Carbon potential connection:



Chapter 2 Display and Operation



2.1 Panel introduction

Status Indicator:

9-channel DIO indicator: I1 ~ I9 are displayed as input, the background is yellow when open, and green when closed.

As output, it displays O1 ~ O9, the open background is yellow, and the closed red.

Alarm indicator: A1 ~ A4 total 4 alarm outputs. The background color is red when there is an alarm.

Relay output status light: R1 ~ R4 have 4 relay output status, open yellow, close red.

Communication indicator: C1 (serial port 1), C2 (serial port 2). The received data shows green R1, R2.

The transmitted data shows T1 and T2.

M / A / S: M is displayed when the background of the indicator is red, indicating that it is currently in the manual state.

When the background of the indicator is yellow, A is displayed, indicating that it is currently in the automatic state.

When the background flashes red and yellow alternately, S is displayed, indicating that it is currently in the standby state.

AT light: When the background of the indicator flashes alternately red and yellow, it means that the auto tuning is currently in progress.

Measurement settings:

PV1: indicates the current 1 loop measurement value. Open circuit flashes S.break.

PV2: indicates the current 2-loop measurement value. Open circuit flashes S.break.

SV1: indicates the set value 1 for fixed SV mode control.

SV2: indicates the fixed value 2 of SV mode control.

Program status indication:

1. Fixed SV mode:

Runtime

Day: days

Hour: hours

Min: minutes

Sec: seconds

2. Program mode:

Current state of the program, Prog: program state (reverse display)

Current running segment number, Seg1-Seg50: remaining time of the current segment (when the total remaining time of the program is greater than 30000LSB, display 30000LSB until less than 30000LSB)

Total remaining time, Total: total remaining time of the program

Cycles of program: Cycles

Block cycle times SegCyc: times

Wait: NO (no deviation waiting), YES (reverse display, deviation waiting)

Physical button:

(SET) Key: Press for 3 seconds to enter the main menu, a single key press to return to the previous menu from the submenu.

(>) Key: Bit selection key, enter the next menu function.

(▲) Key: Modify the parameter to increase the key, and read the next parameter.

(▼) Key: Modify the parameter to decrease the key, scroll through the previous parameter.

2.2 Operating instructions

A. The system displays the model number on the first row and the program version number on the second row. After 2S, display the input and output types of the two channels of the meter, and then enter the main interface.

B. Enter the menu:

Press **(SET)** on the main interface, press and hold 3S to enter the system menu, press **(▲)** / **(▼)** to switch the submenu. Press **(>)** to enter the password input interface. Press **(>)** to select the digit, press **(▲)** / **(▼)** to enter the password, enter the password correctly, wait 2 seconds, display PASS, and enter the menu. No action if the password is wrong.

Press **(SET)** to return to the previous menu, and press **(>)** to enter the next menu.

Parameter modification:

Press **(>)** to select the digit, press **(▲)** / **(▼)** to modify the parameter, wait for 2 seconds, the interface flashes and the parameter value is automatically saved.

Exit the menu:

Any interface can press **(SET)** to return to the previous menu.

C. Long press **(>)** to switch between automatic state / manual state / standby state.

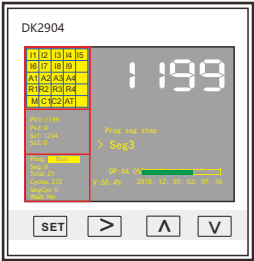
D. **(▲)** / **(▼)** Key usage instructions:

When manual: Press **(>)** to select the digit, press **(▲)** / **(▼)** to modify the output signal percentage.

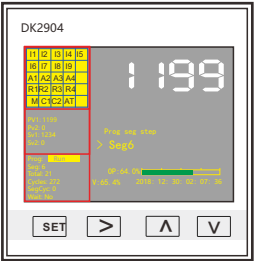
When auto: fixed SV mode, press **(>)** to select the digit, press **(▲)** / **(▼)** to modify the set value SV.

In program running mode, press **(▲)** 3 seconds to pause / run switching, press **(▼)** 3 seconds to end.

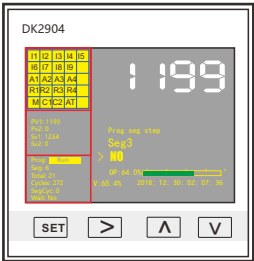
Panel key jump function: This function can only be executed when the program is paused and running. The program cannot be started when the program is not running or stopped. During the program operation, press the **(▼)** screen to jump the jump interface Segment operations are as follows:



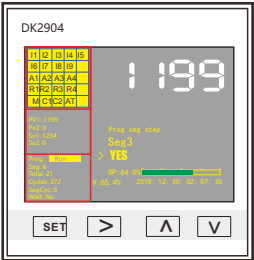
Press **V** when the program is paused and running, Enter the skip section interface, currently segment 3.



Press **^**/**V** to select the segment to jump. For example, if you want to jump to segment 6, the display is as shown above.



Wait for 2S. Displays NO, Press **SET** to exit to the measurement interface.



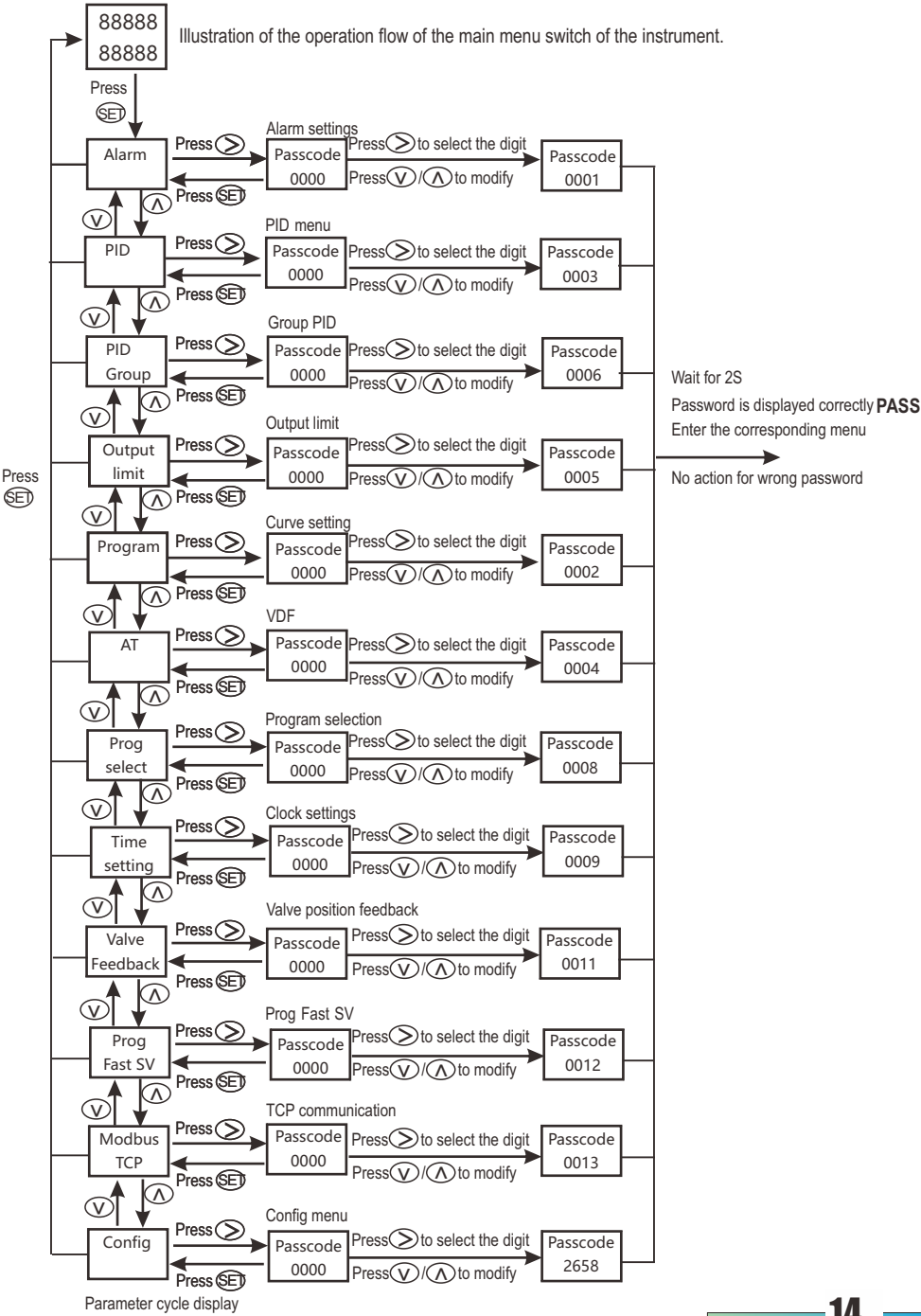
Press **^**/**V** to change NO to YES. Display YES and wait for 2S to automatically execute the skip process.

- E. When the configuration allows switching SV. Press **SET** to enter the switch SV mode. Press **^**/**V** to switch to SV mode for 3s and enter the confirmation interface. Select Yes, No, and automatically save and return after 3s.
- In SV1 / SV2 mode, switch between SV1 and SV2.
 - In SV1 / Prog mode, switch between SV1 and Prog.

2.3 Menu and access code

The instrument has 12 groups of access menus Alarm, PID, PID Group, Output limit, Program, AT, Prog select, Time setting and Config, Valve Feedback, Prog Fast SV, Modbus TCP.

Note: For the above menus that require a password to enter, the factory password cannot be modified. Non-professional engineers are not allowed to configure.



Chapter 3 Alarm

The alarm is used to prompt and generate an alarm signal when the process value exceeds the predetermined limit. During the alarm, the alarm indicator lights AL1 ~ AL4 on the instrument panel will always be on. At this time, an output signal (usually a relay output) can be generated to make the external device generate corresponding actions.

Analog alarm-its role is to monitor an analog quantity (value) to see if it exceeds a predetermined limit. The analog alarm is to alarm the PV value, output value and other variables.

Analog alarm code and type:

Upper: Upper limit alarm, when the process value exceeds the predetermined limit

Lower: lower limit alarm, alarm when the process value is lower than the predetermined limit

Upper Deviation: Upper deviation alarm, when the process value is higher than the set value and exceeds the predetermined limit

Lower Deviation: Lower deviation alarm, when the process value is lower than the set value and exceeds the predetermined limit

Deviation Band: deviation band alarm, when the process value is higher or lower than the set value and exceeds a predetermined limit

Heater Break: heater break alarm, when heater break condition is reached, heater break alarm will be generated

Input break: input sensor fault alarm

Program end: alarm when the program is running

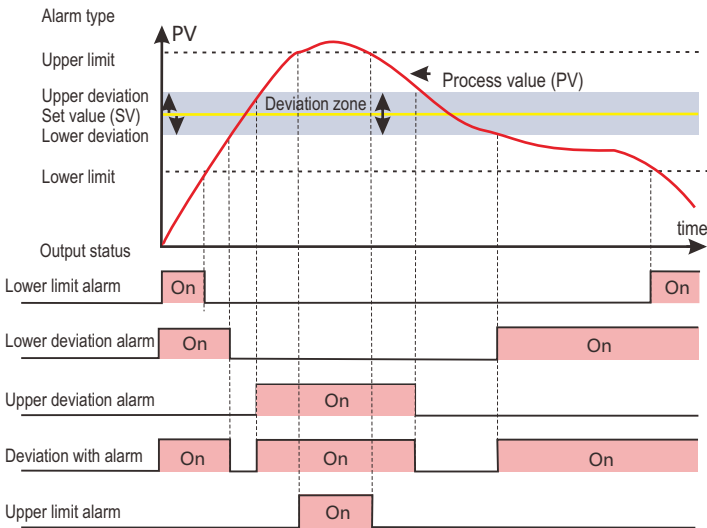
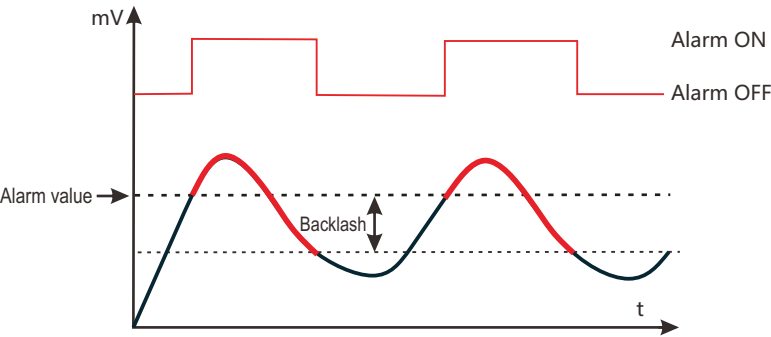
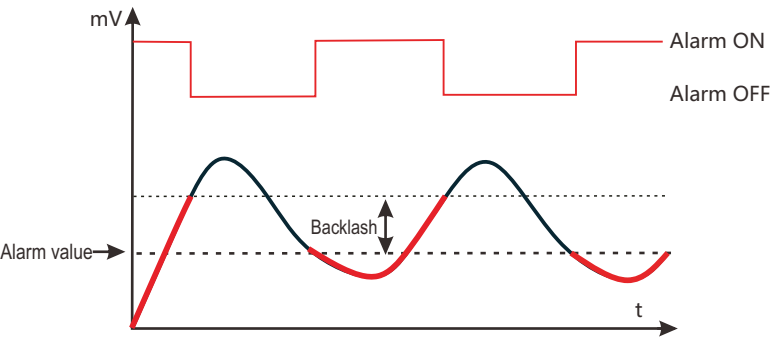


Diagram of various simulated alarm types when PV changes

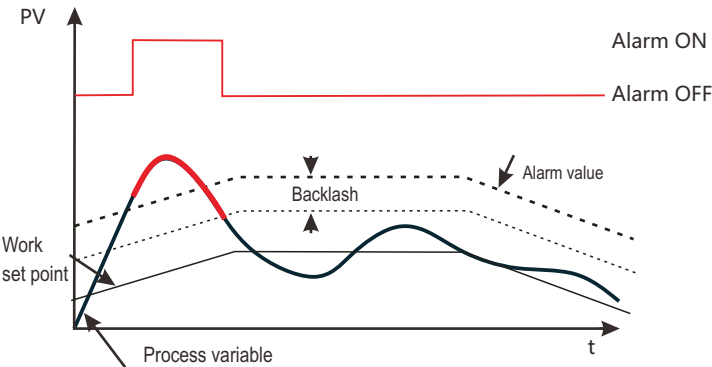
A. Upper limit alarm, when the process variable PV exceeds the set upper limit.
The hysteresis is the difference between the process value of the alarm opening and the process value of the shutdown. It is used to prevent the relay from frequently operating



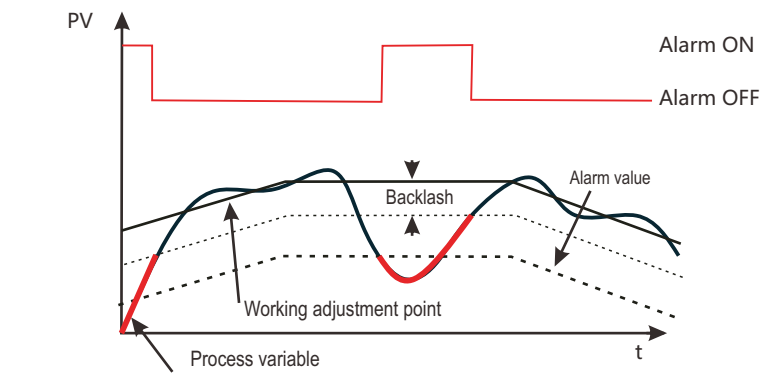
B. Lower limit alarm, when the process variable PV exceeds the set lower limit.



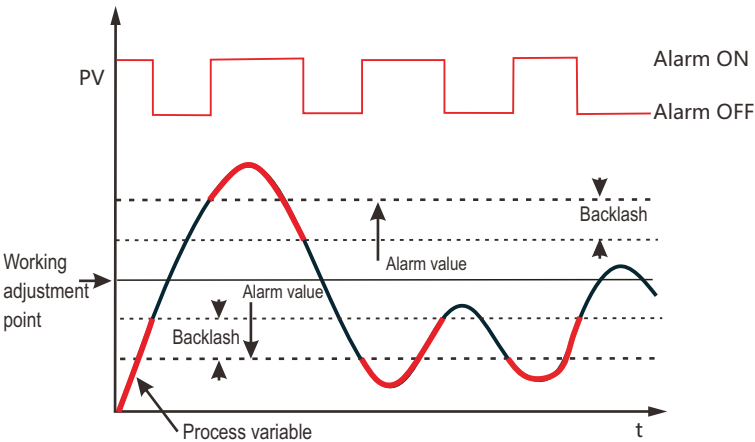
C. Deviation upper limit alarm, when the difference between the process variable and the set value is positive and higher than the alarm adjustment point, the alarm is triggered.



D. Lower deviation alarm, when the difference between the process variable and the set value is negative and higher than the alarm adjustment point, the alarm is triggered.



E. Deviation band alarm, alarm when the difference between PV and SV exceeds the deviation band.



Deviation band alarms are used to monitor process variables and work adjustment points, and constantly compare their deviations with alarm set points. If the deviation is higher than the alarm setting value, or negative is lower than the alarm setting value, the alarm status will be activated.

Menu Alarm (access code 1)

Number	Parameter name	Upper row display	Show below	Value range	Defaults
1	Alarm 1 set value / deviation value	Alarm1	Alarm Value	-99999~99999	0
2	Alarm 1 action difference		Hysteresis	0~2000LSB	0
3	Alarm 1 action delay		Action delay	0~600S	0
4	Alarm 2 set value / deviation value	Alarm2	Alarm Value	-99999~99999	0
5	Alarm 2 action backlash		Hysteresis	0~2000LSB	0
6	Alarm 2 action delay time		Action delay	0~600S	0
7	Alarm 3 set value / deviation value	Alarm3	Alarm Value	-99999~99999	0
8	Alarm 3 action difference		Hysteresis	0~2000LSB	0
9	Alarm 3 action delay		Action delay	0~600S	0
10	Alarm 4 set value / deviation value	Alarm4	Alarm Value	-99999~99999	0
11	Alarm 4 action backlash		Hysteresis	0~2000LSB	0
12	Alarm 4 action delay		Action delay	0~600S	0
13	Heater disconnection alarm value	Heater Value	Break Value	-99999~99999	0
14	Heater disconnection judgment output value	Heater Output	Normal Output	0.0%~100.0%	0.0

The set value of the alarm indicates the alarm value when the upper and lower limit alarms are made; the deviation value is the deviation value relative to the SV value when the deviation alarm occurs, and the SV value $\pm$ deviation value is the alarm value.

In order to prevent the system alarm relay from being applied too frequently and sensitively in some occasions, the alarm return difference can be added appropriately.

In order to avoid that the system alarm relay is applied too frequently and sensitively in some occasions, the alarm action delay time can be set.

Description of heater disconnection alarm:

The condition of heater disconnection alarm is that the signal when PV2 is input as the disconnection alarm function is less than the heater disconnection alarm value, and the value of the main control output is greater than the heater disconnection judgment output value to trigger the heater disconnection alarm.

For example: the heater break alarm value is 100A, the heater break judgment output value is 25%, when the PV2 input signal is less than 100A and the main control output value is greater than 25%, the heater break alarm is triggered, the corresponding alarm The relay pulls in.

Chapter 4 Auto-tuning

Tuning: Set control parameters (PID parameters) that match the system characteristics to achieve better control results.

A good control effect is:

Stable, the process value is stable at the set point, and there is no fluctuation in a straight line.

There is no overshoot.

It can recover quickly when the external disturbance causes deviation.

Auto-tuning: The controller adopts unit step-by-step tuning to automatically calculate and set PID parameters.

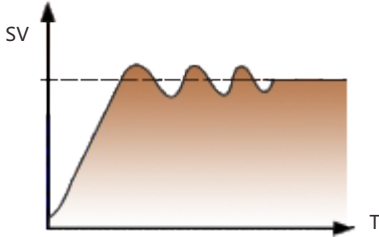
Unit step setting: make the process value fluctuate by making the output fully open and fully closed.

Calculate each control parameter according to the amplitude and oscillation period.

If the system does not allow full power heating or cooling, it can be limited by output limiting. Of course, it is necessary to ensure that the process value can have a certain amplitude of oscillation to calculate the control parameters.

Auto-tuning can be done at any time, but usually only once during initial commissioning.

It is best to perform auto-tuning when the process value is room temperature and the set value is the normal operating value. This can make the control more accurate and stable.



Generally, the output will be maximized after the start of tuning, and the output will be turned off when the PV reaches the set value of SV. This causes the process value to oscillate, thereby calculating the control parameters.

Note: Before auto-tuning, pay attention to the setting of integral and derivative time parameters. If the time constant is 0, the corresponding function is turned off. For example, if you want to implement PI control, set the derivative time to 0 to close the derivative function. The auto-tuning control method is divided into four modes: P, PI, PD and PID.

Auto tuning menu AT parameter table (access password 4)

Number	Parameter name	Upper row display	Show below	Explanation	Defaults
1	Start main auto tuning	Auto Seting PID	At	0- Disable disable auto tuning, 1- Enable start auto tuning	0

Chapter 5 System PID Parameters

P : Proportional band

The proportional band P represents the proportional relationship between the output control amount and the deviation. The larger the value of the parameter P of the instrument proportional band, the lower the control sensitivity. The smaller the setting value of P, the higher the sensitivity.

I: integration time

The purpose of the integral operation is to eliminate static errors. As long as the deviation exists, the integral action moves the control amount in the direction of eliminating the deviation. The integral time is a unit indicating the strength of the integral. The shorter the integral time set by the instrument, the stronger the integral function . (For example, the integration time of the instrument is set to 200s, which means that for the current fixed deviation, the output of the integration function will reach the same output as the proportional function in 200s)

d: differential time

Proportional action and integral action are corrections to the control result. The action response speed is slow. Differential action is supplemented to eliminate its shortcomings. Differential action corrects the output according to the speed of deviation, so that the control process returns to the original In the control state, the differential time is the unit indicating the differential intensity. The longer the differential time set by the meter, the stronger the correction of the control amount caused by the differential action of the meter.

It can be seen from the above that the combination of the three advantages of the rapidity of the proportional action, the thoroughness of the integral action, and the advancement of the differential action constitute an ideal PID regulator.

Most systems can set the best parameters of the system through the self-tuning of the system, but experienced engineers can directly input the PID parameters of the system to achieve precise control.

In some occasions, the PID control parameters obtained by auto-tuning may not be the best value, so the control effect of the instrument after auto-tuning may not be optimal. If the accuracy requirements of the control system cannot be met, you can manually set and fine-tune these several The value of the parameter enables the system to achieve a satisfactory control effect.

1. Selection of proportional band P. Because the size of P directly affects the overshoot, transition time and steady-state error of the system, the selection of P is particularly important. When the proportional band P decreases, the system moves sensitively and speeds up; but it is too small, the overshoot increases, the number of oscillations increases, and the adjustment time is too long; if P increases, the system will tend to be stable; if P is too large, the system will operate slow. The size of P is inversely proportional to the steady-state error. Reducing the proportional effect can reduce the steady-state error and improve the control accuracy.

2. Selection of integration time I. The integral action is designed to eliminate the steady-state error. The integration time I is inversely proportional to the strength of the integral action. If I is too small, too strong an integral action will make the system unstable and the number of oscillations is large. If I is too large, it will affect the system performance Weakened, can not eliminate the steady-state error.

3. Selection of differential time d. Differential control can predict deviations and produce an advance correction effect, which can better improve the dynamic characteristics. However, when d is too large or too small, the overshoot and adjustment time will increase. When controlling quantities such as pressure, speed, etc. that are substantially hysteretic, d should be as small as possible.

It can be seen from the above analysis that the selection of the three parameters affects and restricts each other, and is also constrained by various actual factors. It is necessary to make a compromise choice based on the specific operating conditions and control requirements.

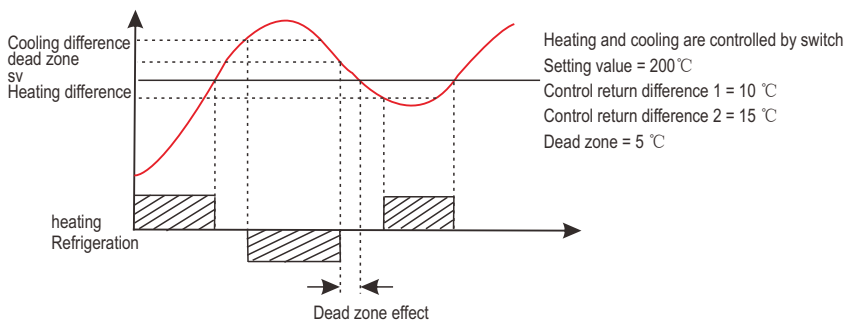
PID control menu PID (access password 3)

Number	Parameter name	Upper row display	Show below	Value range	Defaults
1	Proportional band	PID-Primary (PID for single output, reaction PID for dual output)	Proportional band	0~99999	20
2	integral		Integration time	0~3600	120
3	differential		Differential time	0.0~360.0	10.0
4	Control hysteresis		On-Off Hysteresis	0~2000LSB	1
5	Switch control cycle		Switching cycle	0.1~200.0S	2.0
6	Proportional band	PID-Secondary (PID is active when dual output)	Proportional band	0~99999	20
7	integral		Integration time	0~3600	120
8	differential		Differential time	0.0~360.0	10.0
9	Control hysteresis		On-Off Hysteresis	0~2000LSB	1
10	Switch control cycle		Switching cycle	0.1~200.0S	2.0
11	Cooling dead zone		Output2 No action	0~1000LSB	0
12	Differential filter coefficient	PID config	Diff regulation	1~10	1
13	Suppression of overshoot parameters	Pb coefficient	Lower SV PID Work	1.0~4.0	1.0
14	Suppress overshoot parameters		Upper SV PID Work	1.0~4.0	1.0
15	System reservation				
16	System reservation				

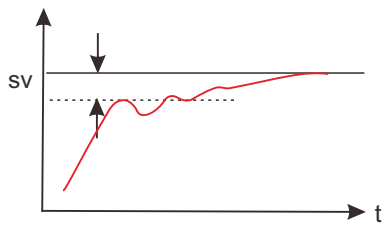
Note: As the value of the differential filter coefficient increases, the differential effect weakens.

Control hysteresis parameter On-Off Hysteresis indicates hysteresis setting during bit control.

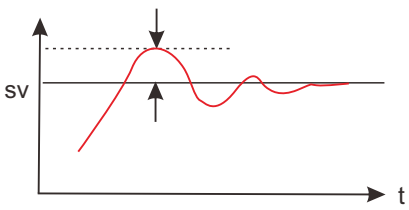
Switching cycle Switching cycle indicates the duty cycle setting time when the solid state relay output and the thyristor output.



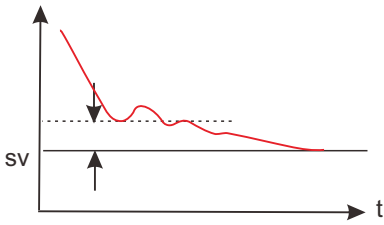
Suppress the overshoot or downshoot parameters: that is lower or higher than SV (1.0 ~ 4.0) times the proportional band starts PID control.



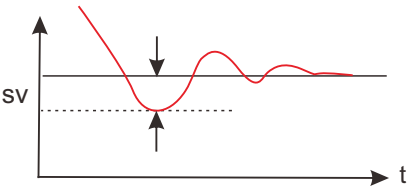
Reduce the suppression of overshoot parameters and reduce undershoot.



Increase the suppression overshoot parameter and reduce the overshoot.



Reduce the overshoot parameter under suppression and reduce undershoot.



Increase the undershoot overshoot parameter and reduce the undershoot.

Chapter 6 Instrument Configuration Parameter Setting

Introduce the function of the instrument configuration menu, enter the Config menu at this level, and access the password 2658, which must be configured by an experienced engineer.

6.1 Instrument function selection menu Instrument

Molecular Menu	Explanation	Value range	Defaults
Key Lock	Panel key lock *1	0-Disable , 1- Enable	0
Manual control	Panel manual / automatic enable	0-Auto, 1- Auto-Manual allows automatic / manual switching, 2-Auto-Manual-Standby allows automatic / manual / standby switching	1
Switch Program	SV1 / PROG switching	0-SV1 fixed SV1 mode, 1- Prog fixed Prog mode, 2-SV1-Prog Enable SV1-Prog switching	0
Switch Sv2	SV1 / SV2 switching	0-SV1 fixed SV1 mode, 1-SV2 fixed SV2 mode, 2-SV1-SV2 Enable SV1-SV2 switching	0
Switch function	Program enable	0- Switch to SV2 Fixed point PID control (SV1 / SV2)switching 1- Switch to Prog allows SV1 / PROG mode switching	0
Temperature unit	Temperature unit conversion	0-°C , 1-°F , 2-K Absolute temperature	0
Digital filter	Digital filter time	0.1~100.0 second	1.0
Control mode	control method *2	0-Single OP1 single output, 1-Double OP1 + OP2 dual output (heating and cooling) 2-Valve open loop valve control without feedback 3-Valve feedback with feedback valve control 4-Single OP1 + DO2 fire control (the second output is a relay, and the output value is greater than or equal to 3.0% to maintain the conduction state)	0
PID mode	PID mode	0 ~ 2 (0- PID classic PID; 1- PID Diff-PV differentiates PV; 2- PID PD-PV without overshoot algorithm;)	0
SV upper limit	Sv can set upper limit	-99999~99999	1000
SV lower limit	Sv can set lower limit	-99999~99999	0
SV1 to SV2 Rate	SV1 to SV2 ramp rate	0-10000	
Display unit	Engineering unit *3	0~35	0
Cold junction	Cold junction compensation type	0-3: 0-Internal , 1-0°C ,2- 45°C ,3- 50°C	0

***1** : When the panel keys are locked, the keys cannot be used. Press **(SET)** key will prompt Key Lock, press **(>)** to enter Unlock interface, input: 2900, after unlocking, you can temporarily perform function operation. Continue to lock after exiting. To unlock completely, you must enter the Config menu to turn off the panel key lock function.

***2** : In control mode: master control output 1 can only be used for master control output.
In heating and cooling, the main control output 1 is used for heating output control, and the main control output 2 is used for cooling control output.

***3** : Engineering unit:
0-NONE, 1-PH, 2-mmHg, 3-Ohms, 4-Bar, 5-mBar, 6-%RH, 7-PSI, 8-PSIG, 9-%O2, 10-PPM, 11-%CO2, 12-%CO, 13-%CP, 14-V, 15-KV, 16-mV, 17-A, 18-mA, 19-KA, 20-W, 21-KW, 22-Kg, 23-g, 24-°C, 25-°F, 26-K, 27-t/s, 28-t/m, 29-t/h, 30-m3/s, 31-m3/m, 32-m3/h, 33-kg/s, 34-kg/m, 35-kg/h, 36-L, 37-L/s, 38-L/m, 39-L/h, 40-t, 41-m3.

6.2 Main input channel configuration PV1 input.

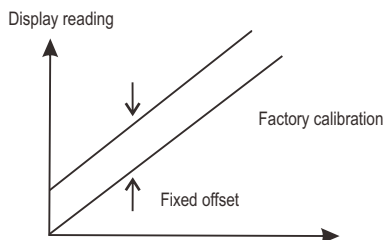
Molecular Menu	Explanation	Value range	Defaults
Input type	Input type	0 ~ 46: 47 signal types, see input type table	0
Display upper limit	Display cap	-99999~99999	1300
Display lower limit	Show lower limit	-99999~99999	-200
Display dot	Decimal places	0 ~ 4 decimal places, the corresponding display is: 10000, 1000.0, 100.00, 10.000, 1.0000	0
Input exception	Input exception handling	0- NO Output to output preset value 1- KEEP Output Maintain the output before opening	0
Fixed output	Input abnormal preset value	0.0~100.0	0.0
Offset	Offset	-1000 ~ 1000LSB	0
Custom input	Custom nonlinear enable	0- Disable , 1- Enable	0
System reservation			
System reservation			

6.2.1 Input exception failure strategy:

Sensor input exception handling is a fault strategy processing method when the sensor input is wrong, and is an important guarantee for the control system.

6.2.2 Offset:

All ranges of the instrument have undergone strict calibration before leaving the factory. There is no need to recalibrate even if the input type is changed. But you can still set an offset to correct the sensor error. PV Offset is to add a fixed offset in the whole range.



6.2.3 Cold junction compensation type:

The principle of thermocouple measuring temperature is to measure the temperature difference potential between the measuring end and the reference end of the thermocouple. Therefore, you must know the temperature of the reference terminal to calculate the temperature of the measuring terminal. There are two methods: one is to fix the reference terminal under a certain known temperature environment. Another method is to measure the reference temperature directly by the meter.

6.2.3.1 Internal compensation

The controller has a temperature detection element to measure the temperature of the thermocouple reference terminal for compensation calculation. To achieve high compensation accuracy and adapt to a variety of thermocouples. The instrument has a built-in high-precision temperature measurement compensation component as the default compensation configuration.

6.2.3.2 Freezing point

The ice bottle uses basic physical principles. The ice bottle is filled with a pure ice-water mixture and its temperature is 0°C under normal pressure.

The electronic ice bottle is cooled by a semiconductor refrigerator, and a high-precision temperature sensor is used for measurement and control to stabilize the temperature at 0°C .

Put the reference end of the thermocouple in the ice bottle and connect it to the controller with copper wire. The controller obtains the measurement signal with the reference point of 0°C .

6.2.3.3 Thermostat

The same principle as the ice bottle, the reference point can also be a higher temperature. As long as the temperature is stable.

The thermostat is just the opposite of the electronic ice bottle. It uses heating to stabilize the temperature at a certain value. This controller allows the use of a 45°C or 50°C thermostat as the reference potential for thermocouples.

6.2.3.4 Compensation wire

Because the internal compensation of the instrument only measures the temperature of the terminal of the instrument, and the length of the thermocouple itself is not enough to connect to the terminal of the instrument. If connected with ordinary wires, the cold end of the thermocouple will be different from the cold end of the instrument, which will cause measurement errors. The most commonly used method is to connect the cold end of the thermocouple to the meter with a compensation wire corresponding to the thermocouple. Since the characteristics of the compensation line are the same as the thermocouple, this is equivalent to extending the thermocouple. So there will be no errors.

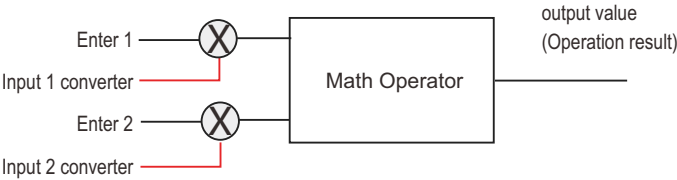
6.3 Second input channel parameters: PV2 input

Molecular Menu	Explanation	Value range	Defaults
Pv2 function	Auxiliary channel function *1	0-Disable, 1-Heater break alarm, 2-Position feedback, 3-Remote-SV, 4-Double input dual input high and low temperature switching, 5-Double PV dual sensor redundancy 6-PV Math Input 1 and Input 2 analog operation function 7-PV1 Pv2 Dev PV1 minus PV2 difference alarm purpose	0
Input type	Input type	0 ~ 46: 47 signal types, see input type table	28
Display upper limit	Display cap	-99999~99999	10000
Display lower limit	Show lower limit	-99999~99999	0
Display dot	Decimal places	0 ~ 4 decimal places, the corresponding display is:10000, 1000.0, 100.00, 10.000, 1.0000	0
Input exception	Input exception handling	0~1: 0-No Output ,1-Keep Output	0
Fixed output	Input abnormal preset value	0.0~100.0	0.0
Offset	Offset	-1000 ~ 1000LSB	0

- *1** : Auxiliary channel function description:
- 1. Sensor signal input for heater disconnection detection, to determine heater disconnection open circuit protection through the set alarm value.
 - 2. The input signal of the remote control setting value is enabled. Process control setpoints are set by changes in input signals. Only valid in single-point SV mode.
 - 3. When the system uses two kinds of high and low temperature measurement sensors, the second input is used as the input source of the high temperature switching sensor.
 - 4. When the auxiliary input is used as a remote SV and high and low temperature switching function, the input type resolution description:
 - A. When the main input channel input type is temperature signal: 0.1 degree resolution.
 - B. When the input type of the main input channel is analog signal:
Set the resolution according to the decimal point, the two channels must have the same resolution. That is, the main input and the auxiliary input maintain the same number of decimal places.
 - 5. Dual sensor redundancy description:
The controller can use dual-sensor redundant switching function. When the first sensor is open, the current measurement is automatically transferred to the measured value of input 2 for control. The same sensor type must be used to use this function. At the same time, it is necessary to set the output preset value when input 2 is open.

6.4 computation: PV Math

Molecular Menu	Explanation	Value range	Defaults
Operation	computation	0~14, 0-Disable , 1-Addition , namely PV1+PV2 2-subtraction , namely PV1-PV2 3-multiplication , namely PV1*PV2 4-division , namely PV1/PV2 5-absolute value , namely PV1-PV2 6-maximum , namely PV1 and PV2 have large values 7- minimum , namely PV1 and PV2 values are small 8- power , namely PV1^{PV2} 9-square root , namely √Pv1 10-logarithm , namely base 10 logarithm of Pv1 11-natural logarithm , The logarithm of PV1 with e as the base, log,PV1 12-exponent , namely e^{PV1} 13-10 power 。namely 10^{PV1} 14-Carburization Carbon potential control function	0
Display upper limit	Operation result display upper limit	-99999~99999	10000
Display lower limit	Operation result display lower limit	-99999~99999	0
Display dot	Decimal places of operation result	0 ~ 4 decimal places, the corresponding display is: 10000, 1000.0, 100.00, 10.000, 1.0000	0
System reservation			
System reservation			



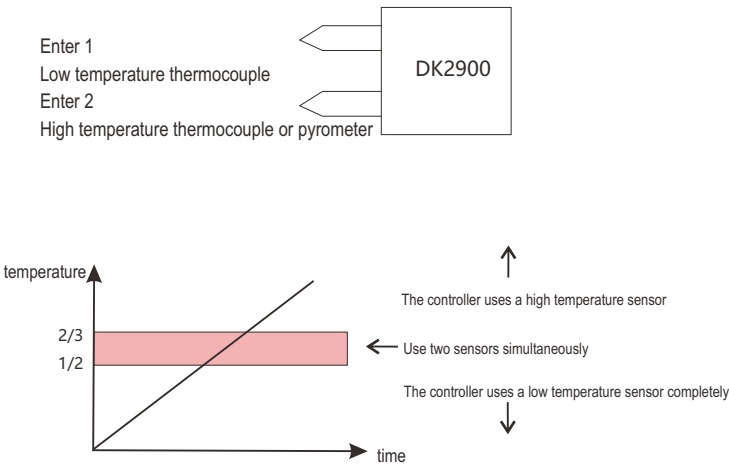
The mathematical operator is a process controller that performs mathematical operations on two input Pvs

6.5 Dual sensor switching Double input

Molecular Menu	Explanation	Value range	Defaults
Switch to input2	Upper limit switching point	-99999~99999	1200
Switch to input1	Lower limit switching point	-99999~99999	1000

This is often used in temperature control applications with a wide temperature range. If the temperature is low, use a thermocouple, and when the temperature is high, use an infrared pyrometer to measure. Two different thermocouples can also be used.

The chart below shows the switching of two sensors. The high switching point (2 to 3) is the high point at which the first sensor works and is determined by the 'Switch to input2' parameter. The low switching point (1 to 2) is the low point of the second sensor operation, which is determined by the 'Switch to input1' parameter. Between these two points, the controller performs smooth calculations.



6.6 Main control output 1 function configuration Output1

Molecular Menu	Explanation	Value range	Defaults
Output type	Output 1 function	0-Linear output linear output, 1-Relay , 2-Transistor solid state relay, 3- Thyristor SCR	0
Mode of action	Output effect	0-Reaction 1-Positive action	0
Linear output type	Output 1 signal type	0- 4-20MA , 1-0-10MA , 2- 0-20MA , 3-0-10V , 4-2-10V , 5-0-5V , 6-1-5V	0
Output upper limit	Output upper limit	0.0~100.0	100.0
Output lower limit	Output lower limit	0.0 ~ 100.0	0.0
System reservation			

6.7 Main control output 2 function configuration Output2

Molecular Menu	Explanation	Value range	Defaults
Output type	Output 2 function	0-Linear output linear output, 1-Relay , 2-Transistor solid state relay, 3- Thyristor SCR	0
Mode of action	Output effect	Fixed, 1-Positive action	1
Linear output type	Output 2 signal type	Same as Output1	0
Output upper limit	Output upper limit	0.0~100.0	100.0
Output lower limit	Output lower limit	0.0 ~ 100.0	0.0
System reservation			

Heating and cooling dual output mode, output 1 is automatically configured as reverse action, output 2 is automatically configured as positive action

6.8 Transmission function configuration Transmitter

Molecular Menu	Explanation	Value range	Defaults
Linear output type	Transmitting signal type	0: 4-20MA , 1: 0-10MA , 2: 0-20MA , 3: 0-10V , 4: 2-10V , 5: 0-5V , 6: 1-5V	0
Upper limit	Upper transmission limit	-99999~99999	1000
Lower limit	Lower transmission limit	-99999~99999	0

Molecular Menu	Explanation	Value range	Defaults
Select content	Transmission parameter selection	0- PV Transmit measured value, 1- SV Transmit the set value, 2- Output Transmit output value, 3- PV SV Dev PV minus SV difference, 4- SV PV Dev SV minus PV difference, 5- PV1 PV2 Dev PV1 minus PV2 difference, 6- PV2 PV1 Dev PV2 minus PV1 difference, 7- PV1 PV2 Dev Abs PV1 minus PV2 absolute difference	0

Note: The difference transmission function between input 1 and input 2 needs to enable input 2 function.

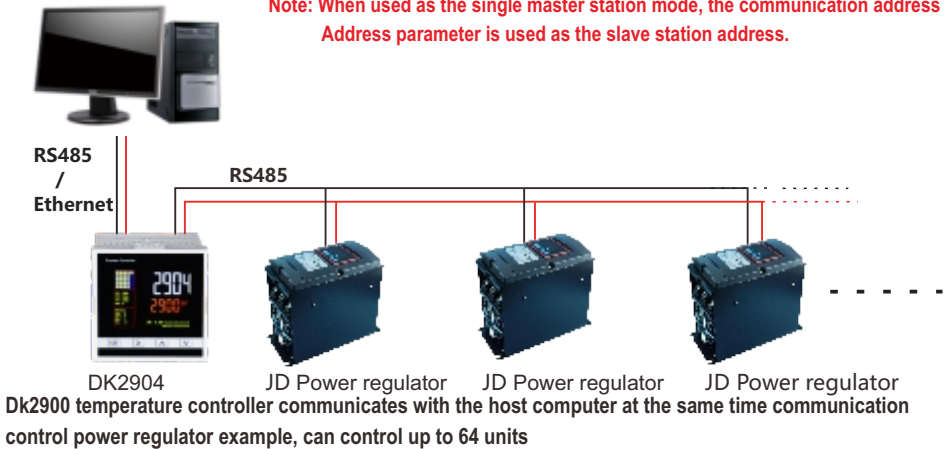
6.9 Communication function configuration Communication1

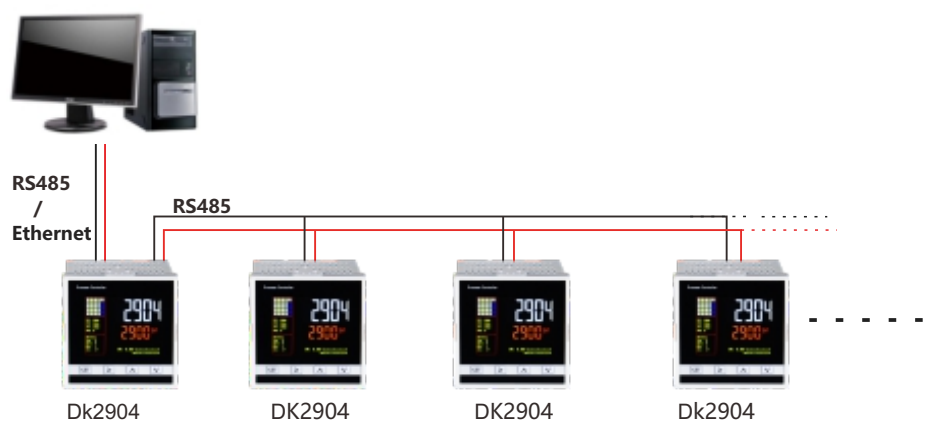
Molecular Menu	Explanation	Value range	Defaults
Baud rate	Baud rate	0- 4800 , 1- 9600 , 2- 19200	2
Parity	Verification method	0- NONE no parity,, 1- ODD odd parity, 2- EVEN even parity	2
Delay time ms	Communication delay	0~60mS	0
Address	mailing address	1 ~ 247, when the online control is started, the instrument is automatically upgraded to the master station, and the address is the slave address of the device to be controlled (single mode)	1
Slave Reg address	Slave register address	0-10000	301
Master function	Online control function	0-12 ; 0- Disable Forbid 1- Single SV Single SV 2- Single OP Single OP 3- Single SV Mul 10 Single SV multiplied by 10 4- Single OP Mul 10 Single OP multiplied by 10 5- Single SV Div 10 Single SV divided by 10 6- Single OP Div 10 Single OP divided by 10 7- More SV Multi SV 8- More OP Multi OP 9- More SV Mul 10 Multi SV multiplied by 10 10- More OP Mul 10 Multi OP multiplied by 10 11- More SV Div 10 Multi SV divided by 10 12- More OP Div 10 Multi OP divided by 10 Main site peer-to-peer mode Main site to many mode	0
Modbus	letter of agreement	0- Modbus RTU , 1- Modbus TCP	0

6.Communication function configuration Communication2

Molecular Menu	Explanation	Value range	Defaults
Baud rate	Baud rate	0- 4800, 1- 9600, 2-19200	2
Parity	Verification method	0- NONE no parity,, 1-ODD odd parity, 2- EVEN even parity	2
Delay time ms	Communication delay	0~60mS	0
Address	mailing address	1 ~ 247, when the online control is started, the instrument is automatically upgraded to the master station, and the address is the slave address of the device to be controlled (single mode)	1
Slave Reg address	Slave register address	0-10000	301
Master function	Online control function	0-12 ; 0-Disable Forbid 1-Single SV Single SV 2-Single OP Single OP 3-Single SV Mul 10 Single SV multiplied by 10 4-Single OP Mul 10 Single OP multiplied by 10 5-Single SV Div 10 Single SV divided by 10 6-Single OP Div 10 Single OP divided by 10 7-More SV Multi SV 8-More OP Multi OP 9-More SV Mul 10 Multi SV multiplied by 10 10-More OP Mul 10 Multi OP multiplied by 10 11-More SV Div 10 Multi SV divided by 10 12-More OP Div 10 Multi OP divided by 10 Main site peer-to-peer mode Main site to many mode	0

Note: When used as the single master station mode, the communication Address parameter is used as the slave station address.





Dk2900 temperature controller communicates with the host computer while master-slave control other temperature controller example diagram, can control up to 64

6.B Alarm function configuration Alarm

Molecular Menu	Explanation	Value range	Defaults
Alarm1	Alarm 1 type setting	0- NONE , 1- Upper upper limit alarm , 2- Lower lower limit alarm , 3- Upper Deviation Upper deviation alarm 4- Lower Deviation lower deviation alarm , 5- Deviation Band deviation band alarm 6- Heater break heater break alarm 7- Input break sensor failure alarm 8- Program end program end alarm 9- Carbon clean Carbon potential control cleaning function 10- PV1 PV2 Dev PV1 minus PV2 difference alarm 11- PV2 PV1 Dev PV2 minus PV1 difference alarm 12- PV1 PV2 Dev Abs PV1 minus PV2 difference absolute value alarm	0
Alarm2	Alarm 2 type setting		
Alarm3	Alarm 3 type setting		
Alarm4	Alarm 4 type setting		
Power-on exemption	Power-on alarm exemption function	0- Disable , 1- Enable	0
Relay logic inverse	Alarm relay action logic	0- Disable , 1- Enable	0
System reservation			
System reservation			

6.C DIO function definition, Digital IO set

Molecular Menu	Value range	Defaults
DIO1	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO2	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO3	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO4	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO5	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO6	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO7	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO8	DIO function definition, parameter range 0-1: 0-output, 1-input	0
DIO9	DIO function definition, parameter range 0-1: 0-output, 1-input	0

6.D DI function configuration Digital Input

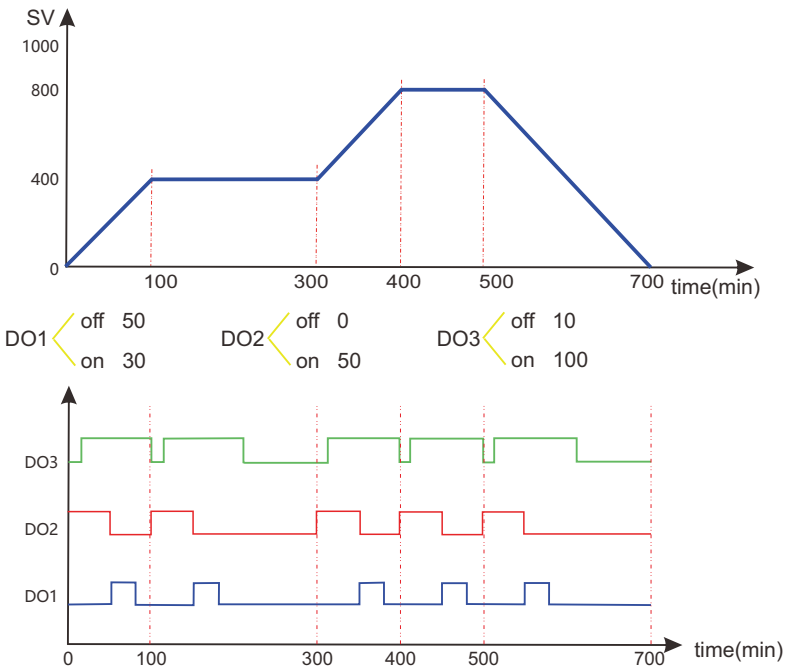
Molecular Menu	Value range	Defaults
DI1	0-19: 0-Disable None, 1-Auto-Manu Switch manual automatic (close manual, open automatic), 2-Remote SV remote setting (close analog analog PV2 remote setting, open local setting), 3-Auto setting PID self-tuning, 4-Program run to run the program, 5-Program hold 6-Program reset The program stops, 7-Prog seg step next In order to switch the segment quickly, jump to the next segment while the program is running, 8-Prog seg step back Jump to the previous paragraph while the program is running, 9- Slow start (close standby state, open slow start), 10-Switch to SV2 Switch SV (close SV2, open Sv1), 11-Switch to Prog Switch Prog (close Prog, open Sv1), 12-Program Curve Switch to the next program process curve. , 13-Output standby (closed standby), 14-Key Lock Key lock (close lock) 15-Prog fast 5 program runs 5 times faster 16-Prog fast 10 program runs at 10 times speed 17-Prog fast 20 program runs at 20 times speed 18-Prog fast 30 program runs at 30 times speed 19-Carbon clean Carbon potential control manual cleaning	0
DI2		
DI3		
DI4		
DI5		
DI6		
DI7		
DI8		
DI9		
Slow start time	Slow start time after power on, range 0 ~ 999, unit: second	0

6.E DO function configuration Digital Output

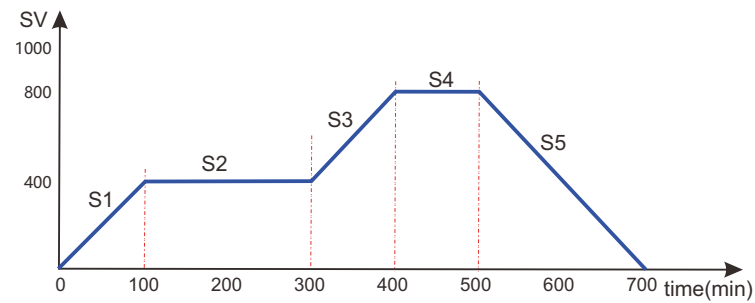
Molecular Menu	Parameter content	Value range	Defaults
DO time unit	Do time scale time unit	0-Hour , 1-Minute , 2-Second	1
DO1 function	Do function definition	0-7; 0-Disable None, 1-COMM write communication write status, 2-Prog time output fixed time scale mode of the CONFIG menu / block definition time scale mode 3-Prog set output specifies the entire process of a certain section of the program, 4-Prog reset program reset instruction, 5-Prog run program running instructions, 6-Prog hold program suspension instruction, 7-Prog end Program end indication	0
DO1 off time	Do time marker function off time	0-30000	0
DO1 on time	Do time scale function closing time	0-30000	0
DO2 function	Do function definition	0-7; Same as Do1	0
DO2 off time	Do time marker function off time	0-30000	0
DO2 on time	Do time scale function closing time	0-30000	0
DO3 function	Do function definition	0-7; Same as Do1	0
DO3 off time	Do time marker function off time	0-30000	0
DO3 on time	Do time scale function closing time	0-30000	0
DO4 function	Do function definition	0-7; Same as Do1	0
DO4 off time	Do time marker function off time	0-30000	0
DO4 on time	Do time scale function closing time	0-30000	0
DO5 function	Do function definition	0-7; Same as Do1	0
DO5 off time	Do time marker function off time	0-30000	0
DO5 on time	Do time scale function closing time	0-30000	0
DO6 function	Do function definition	0-7; Same as Do1	0
DO6 off time	Do time marker function off time	0-30000	0
DO6 on time	Do time scale function closing time	0-30000	0

Molecular Menu	Parameter content	Value range	Defaults
DO7 function	Do function definition	0-7; Same as Do1	0
DO7 off time	Do time marker function off time	0-30000	0
DO7 on time	Do time scale function closing time	0-30000	0
DO8 function	Do function definition	0-7; Same as Do1	0
DO8 off time	Do time marker function off time	0-30000	0
DO8 on time	Do time scale function closing time	0-30000	0
DO9 function	Do function definition	0-7; Same as Do1	0
DO9 off time	Do time marker function off time	0-30000	0
DO9 on time	Do time scale function closing time	0-30000	0
System reservation			

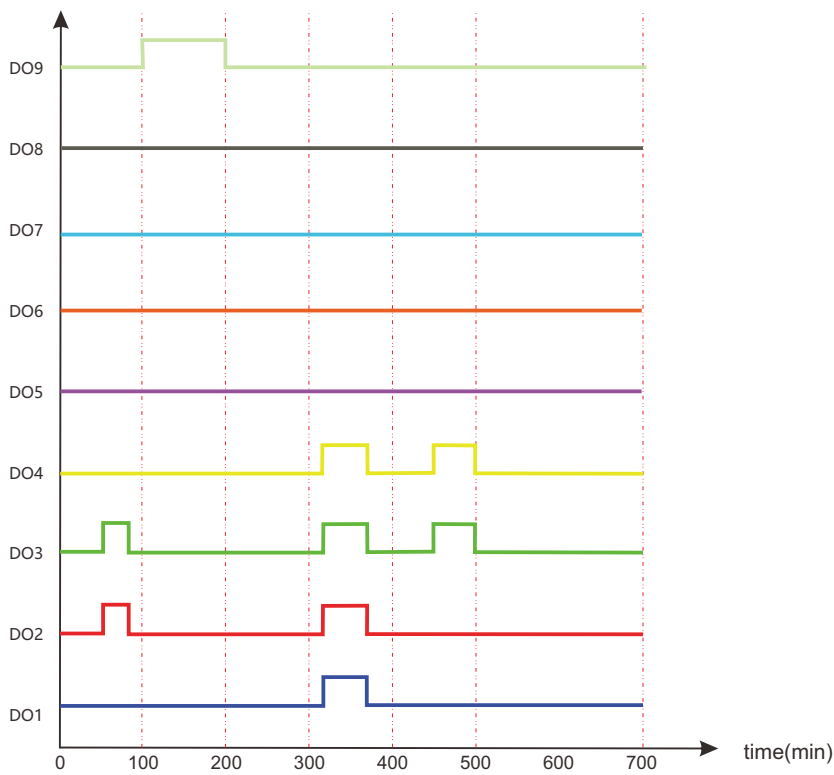
Fixed time scale mode



Block definition time stamping mode

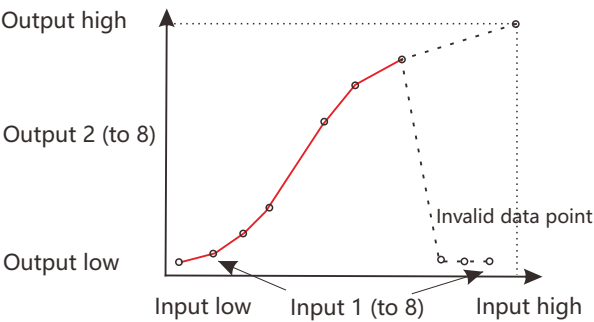


S1	DO: 6	S2	DO: 256	S3	DO: 15	S4	DO: 12	S5	DO: 0
	off: 50		off: 0		off: 20		off: 50		off: 50
	on: 30		on: 100		on: 50		on: 100		on: 50



6.F 8-point linearization of main input Custom input

Molecular Menu	Explanation	Value range	Defaults
Electrical value 1	Voltage and current	Electrical value range of current input type (0-20000LSB)	0
Display value 1	Display value	The engineering value corresponding to the current electrical input type (-99999 ~ 99999LSB)	0
Electrical value 2	Voltage and current	Same as Electrical value 1	0
Display value 2	Display value	Same as Display value 1	0
.....			
Electrical value 8	Voltage and current	Same as Electrical value 1	0
Display value 8	Display value	Same as Display value 1	0



The function is to generate the output value by linearizing the input value through an 8-point linearization table. (The voltage and current values must be in the rising state.) Using this function, the input value must be rising (the display value may or may not be).

Description:
The input types supported by custom nonlinear input are:
20mV、100mV； (LSB：0.01mV)
0-10mA、0-20mA、4-20mA； (LSB: 0.001mA)
0-1V、0-2V、0-5V、1-5V、0-10V、2-10V； (LSB: 1mV)

6.G Valve control

Numbering	Submenu	Molecular Menu	Explanation	Value range	Defaults
1	Value control	Full stroke time	Valve full travel time, unit: second	0.1-300.0	30
2		Minimum pulse time	Valve action minimum time, unit: second, 0-automatic	0.0-100.0	2.0
3		Feedback loop open	Open valve processing method. 0- Close, 1- Open, 3- No action	0-2	0
4		Control Dead Zone	Valve action dead zone, output percentage	0.1-10.0	2.0
5		System reservation			
6		System reservation			
7		System reservation			
8		System reservation			

6.H Carbon potential control

Numbering	Submenu	Molecular Menu	Explanation	Value range	Defaults
1	Carburization	CO Percent	Co concentration percentage	15-36	32
2		Clean wait -min	Automatic cleaning interval, unit: minute	1-480	240
3		Clean time -sec	Automatic cleaning time, unit: second	1-300	10
4		System reservation			
5		System reservation			
6		System reservation			
7		System reservation			
8		System reservation			

Chapter 7 Valve Feedback Upper and Lower Limit Setting

Valve Feedback Menu (access code 11)

Numbering	Submenu	Molecular Menu	Explanation	Value range	Defaults
1	Position Setting	Full open	Start upper limit setting	0 ~ 1, 0- Disable , 1- Enable	0
2		Full close	Start lower limit tuning	0 ~ 1, 0- Disable , 1- Enable	0
3		Upper Percentage	Upper limit setting result	% Of full scale	0.00
4		Lower Percentage	Lower limit setting result	% Of full scale	0.00
5		System reservation			
6		System reservation			
7		System reservation			
8		System reservation			

Note: For valve feedback timing, input 2 function must be set to valve feedback, and the upper and lower limits of input 2 range are automatically set to 0-10000. After the valve is fully opened, the upper limit is enabled and saved after 10 seconds; after the valve is fully closed, the lower limit is enabled and saved after 10 seconds.

Chapter 8 Group PID Function

PID Group Menu (access code 6)

PID-G1	Molecular Menu	Value range	Defaults	Explanation
	Pb-Primary	0~99999	20	Group 1 proportional band 1
	I-Primary	0~3600	120	Group 1 integration time 1
	D-Primary	0.0~360.0	10.0	Group 1 differential time 1
	Pb-Secondary	0~99999	20	Group 1 proportional band 2
	I-Secondary	0~3600	120	Group 1 integration time 2
	D-Secondary	0.0~360.0	10.0	Group 1 differential time 2
.....				
PID-G10	Pb-Primary	0 ~ 99999	20	Group 10 proportional band 1
	I-Primary	0 ~ 3600	120	Group 10 integration time 1
	D-Primary	0.0 ~ 360.0	10.0	Group 10 differential time 1
	Pb-Secondary	0 ~ 99999	20	Group 10 proportional band 2
	I-Secondary	0 ~ 3600	120	Group 10 integration time 2
	D-Secondary	0.0 ~ 360.0	10.0	Group 10 differential time 2

The meter can set up 10 groups of PID calling functions.

In the program curve mode, different PID group parameters can be called according to the curve segment settings. In order to meet the control accuracy of the controlled object under different control states (high temperature \ low temperature \ constant temperature \ rise \ fall).

In the fixed SV mode, the group PID can be called with the group output parameters to achieve different PIDs at different temperatures.

The group PID is called when the output limiter function and the program curve function are enabled, to better adapt to various operating conditions of the system.

PID parameter description:

1. When the system does not enable group PID, the auto-tuning result is saved to the system default PID parameters.
2. When the system enables group PID, after the system starts auto-tuning, the auto-tuning result is automatically saved to the current group PID.
3. Auto tuning can also be enabled in the execution curve (when the production process permits).

Chapter 9 Group output limiting function

Group output limit menu Output limit (Factory password 5)

Level 2 menu	Level 3 menu	Parameter	Explanation	Defaults
Output limit	Output limit	Enable packet output	0- Disable shut down, 1- Enable turn on	0
OP1	PV upper set	Section 1 temperature	-99999~99999	3000
	Upper limit	Upper limit of paragraph 1	1~100	100
	Lower limit	Lower limit of paragraph 1	0~100	0
	PID Group select	Section 1 paragraph calls PID	0- System configuration PID, 1~10: PID-G1 ~ PID-G10	0
.....				
OP10	PV upper set	Section 1 temperature	-99999~99999	3000
	Upper limit	Upper limit of paragraph 1	1~100	100
	Lower limit	Lower limit of paragraph 1	0~100	0
	PID Group select	Section 1 paragraph calls PID	0- System configuration PID, 1~10: PID-G1 ~ PID-G10	0

For example: the load of the silicon molybdenum rod, due to the small cold resistance, the starting current is too large, you can set the first group temperature of 150 degrees, and the upper limit of the first group output is 15%, so that the resistance becomes larger after the system heats up, Can be output without restrictions.

then: Output limit=1

PV upper set =150

Upper limit =15

Lower limit =0

Chapter 10 Program Curve Function

10.1 Curve setting parameters Program (Access code 2)

Parameter name	Level 2 menu	Level 3 menu	Explanation	Defaults
Curve type	Program config	Ramp Mode	0-1 ; 0- Rate Rate mode 1- Time time mode	1
Program time unit		Time unit	0-2 ;0- Hour , 1- Minute , 2- Second	1
Power on processing		Power-on state	0-2 ; 0- Continue carry on 1- Ramp back Ramp back,2- Reset Reset	0
Number of blocks		Segment Quantity	1-50	1
Number of program cycles		Prog Cycles	0-100 , 0-Infinite loop	1
Cycle times		Segment Cycles	0-100 , 0-Disabled segment circulation function	0
Cycle start		Seg Cycles Start	1-50	1
End of loop		Seg Cycles End	1-50	1
Program start setting		Start SV Set	0- PV ,1- Start SV	1
Program start setting		Start SV	-99999-99999	0
Program reset status output		Reset state	0- No Output the output is 0 , 1- SV1 Single point control with Sv1	0
Program end output		End state	0- No Output the output is 0 , 1- End SV SV control with end point	0
Time scale output function		Do time set	0- Config ,1- Segment	0
PID group call		Group Set	0- Prog Set program segment grouping PID call, 1- PV Call the group limiter pair according to the temperature PV of the group limiterShould be PID, 2- SV calls the group limiter pair according to the group limiter temperature SVCorresponding PID	0
Program start output control		Start Output 0%	0- Disable normal control output, 1- PV upper SV PV higher than SV output is 0, 2- PV lower SV PV lower than SV output is 0	0

Parameter name	Upper row display	Lower row display	Explanation	Defaults
Segment 1 setting	Segment 1	SV	-99999 ~ 99999	0
Segment 1 execution rate		Rate	0.0 ~ 1000.0LSB	0
Segment 1 execution/hold time		Time	0 ~ 10000	0
Segment 1 group PID selection		PID Group select	0-10 , 0-default, 1-10 corresponds to group	0
Segment 1 packet output limit		Output limit set	0-10 , 0-none, 1-10 corresponding limit	0
Specify DO action		Do Select	0-511 (*Note)	0
DO off time		Do off time	0-30000	0
DO closing time		Do on time	0-30000	0
Segment 1 program wait type		Wait function	0-3, 0- Disable no waiting, 1- Lower Deviation lower deviation waiting, 2- Upper Deviation upper deviation waiting, 3- Deviation Band deviation with waiting	0
Segment 1 program waiting for deviation value		Wait deviation	0 ~ 10000LSB	0
.....				
Segment 50 setting	Segment 50	SV	-99999 ~ 99999	0
Segment 50 execution rate		Rate	0.0 ~ 1000.0LSB	0
Segment 50 execution/hold time		Time	0 ~ 10000	0
Segment 50 group PID selection		PID Group select	0-10 , 0-default, 1-10 corresponds to group	0
Segment 50 packet output limit		Output limit set	0-10 , 0-none, 1-10 corresponding limit	0
Specify DO action		Do Select	0-511 (*Note)	0
DO off time		Do off time	0-30000	0
DO closing time		Do on time	0-30000	0
Segment 50 program wait type		Wait function	0-3, 0- Disable no waiting, 1- Lower Deviation lower deviation waiting, 2- Upper Deviation upper deviation waiting, 3- Deviation Band deviation with waiting	0
Segment 50 program waiting for deviation value		Wait deviation	0 ~ 10000LSB	0

*Note: 9 DO outputs can be arbitrarily designated actions, multiple action DO is added according to 8421 code is the DO output action

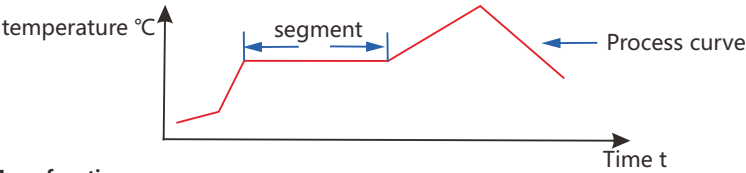
Output point	Action output value
DO1	1
DO2	2
DO3	4
DO4	8
DO5	16
DO6	32
DO7	64
DO8	128
DO9	256

As shown in the table above, if the customer wants to enable DO2 and DO9 as output actions, the parameter is: 2 (DO2) +256 (DO9) = 258, then the specified DO action value will be changed to 258.

10.2 Introduction to Curves:

The DK2900 series can edit the time temperature curve, which can make the temperature climb to a set value at a certain rate within a specified time. After reaching the set value, another process of climbing to the specified set value within a set time is performed. Continue in turn until the end. Each of the above temperature increase (can also be temperature decrease) or heat preservation period is called a period, and several periods constitute a process curve.

DK2900 series instruments can store up to 20 process curves, and each process curve can have up to 50 segments.



10.3 Menu function

1. Block time unit

The time unit can be set to hours, minutes, and seconds. The time unit and the segment execution time parameter value together determine the segment execution time.

2. Number of blocks

The program segment number setting program consists of several program segments, ranging from 1-50, and a maximum of 50 program segments can be set.

3. Number of program cycles

Set the number of loops to run in block mode, 0-100, 0 times is infinite loop mode, 1-100 is the specific number of loops, for example, if the number of loops is set to 5, the program will enter the end state after 5 executions.

4. Initial value setting

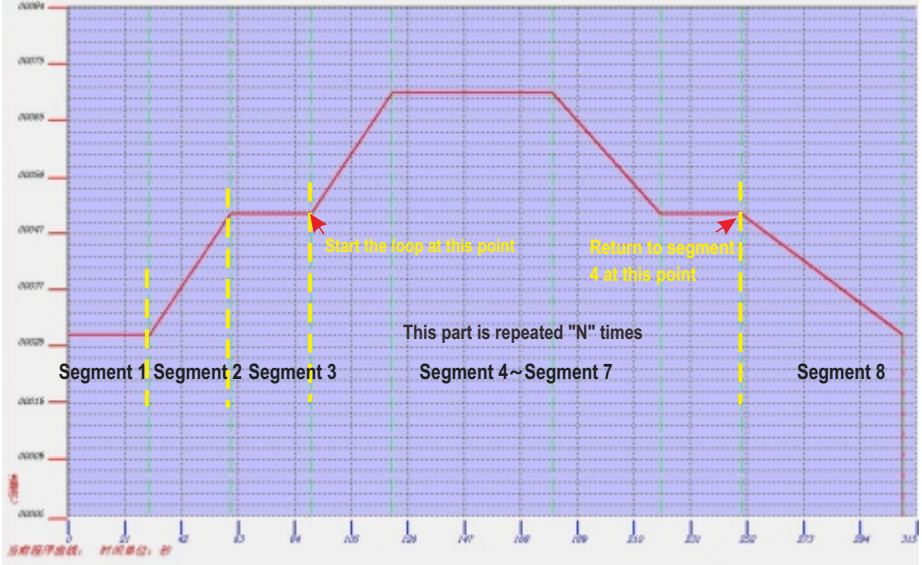
The initial value of the block mode setting value can be set to PV, that is, the current measured value as the starting value, or SV as the starting value. .

5. Internal cycle of the block

The internal loop of the block allows a part of the continuous block in the program to be executed repeatedly. It is equivalent to calling a subroutine.

The internal cycle of the block can reduce the number of blocks stored in the controller and simplify the setting. Just set, the program start segment, the program end segment, the program cycle times can realize the program internal cycle.

The following figure is a simple example:



Segment 4 is the cycle start segment,
and segment 7 is the cycle end segment.

10.4 Curve segment settings

1. Segment setting

Target value of the end point of the block

2. Segment execution time

The execution time value of this section, together with the time unit, determines the execution time of this section of the program

3. Segment definition DO output

You can set DO as the program segment running status indicator, when the program runs to this segment, there will be DO output. Indicates that the current program has reached this segment.

4. Segment PID selection

Select the parameters used to calculate PID control when the program reaches this stage. The value range is 0-10, 0 is the default main PID parameter of the program, and 1-10 is the setting parameter of the group PID.

5. Segment limiting output setting

When the program reaches this section, the output is limited to a certain range. The setting range is 0-10. 0 is the system's default hardware limit, and 1-10 is the group limit output parameter limit.

6. Program wait type

The waiting type and waiting deviation value can be set separately for each section, which is convenient for various working conditions.

Disable: No waiting, Upper Deviation: Wait when $PV > SV + \text{wait deviation value}$, Lower Deviation: Wait when $PV < SV - \text{wait deviation value}$, Deviation Band: When $PV > SV + \text{wait deviation value}$, or $PV < SV - \text{wait deviation value}$ Wait for value.

7. Rate mode

When the program is in rate mode. If the rate of the holding period is 0, the holding time is the time of the holding period. When the program is in rate mode, the skip function is the rate and hold time is 0. The set value SV step is the skip function.

10.5 Recovery after power failure

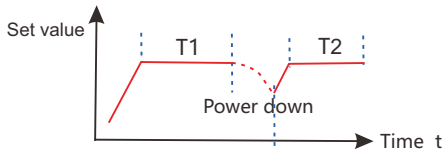
Power failure may occur in the control process, and the operation strategy of the program after power-on can be set in the configuration.

- 1. Continue. The program continues to run from the state before the power failure. This may cause the output to briefly output at full power. The process value will quickly return to the value before power failure. The program is still timing during recovery.
- 2. Ramp back. The program set value starts from the current process value, and the set value is set at the rate of this segment or the previous ramp segment Climb to the target value.
- 3. Reset The program is reset.

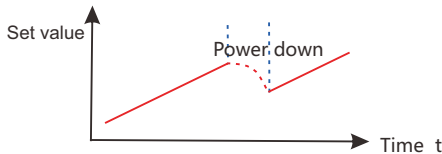
10.6 Slope return

- 1. When power is off, it is in the holding section. The program starts from the measured value at power on, and the slope of the previous ramp section climbs to the setting value of the holding section. Then continue to complete the rest of the process curve.

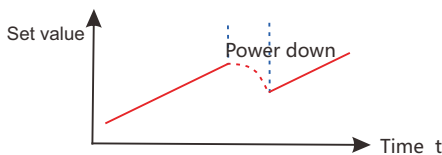
Set time $T = T1 + T2$



- 2. When the power supply is powered off, it is in the ramp section with the speed unit. After power on, continue climbing at the same rate.



- 3. The power supply is in the ramp section in time when the power is turned off. After power on, it will continue to execute this segment with the current measured value. In this process, the climbing rate is the rate before power failure, and the time needs to be recalculated.



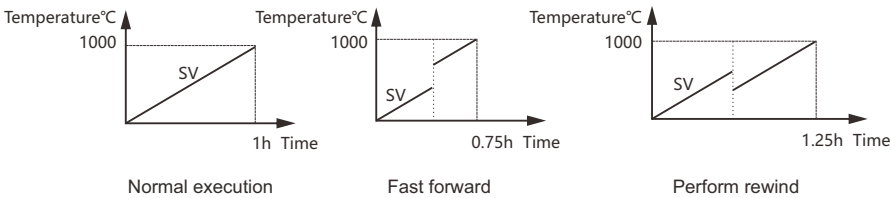
10.7 Program process curve selection **Prog select** (Access code 8)

Parameter name	Upper row display	Lower row display	Explanation	Defaults
Program curve setting	Program Curve	Program Curve	1 ~ 20 curve selection	1

10.8 Prog Fast SV **Function menu**
(fast forward and fast backward function in current segment) password 12

Parameter	Upper row display	Lower row display	Explanation	Defaults
1	Prog Fast SV	Numerical value	Range: lower limit to upper limit of current temperature setting	0

In some process curve control occasions, it is required that the temperature and time of the current segment are executed in this segment according to the process setting curve to achieve fast forward and fast rewind in order to meet the process requirements. Can be set through the Prog Fast SV menu. After entering the menu, the second row shows the current target temperature. You can press the (V) / (A) key to quickly reach the desired setting value, wait for 3 seconds to flash and save automatically, the process curve will start to execute according to the new target temperature, and then press the (SE) key to return to the normal display interface.



- Note: A. Under fixed SV mode control, entering **Prog Fast SV** function is invalid
- B. **Prog Fast SV** function can only be executed in the process curve running and pause state.
- C. The panel buttons **Prog Fast SV** can fast forward and rewind, and can only fast forward and rewind within the current segment. If it exceeds this segment, please select the skip function before executing the fast forward and rewind functions.
- D. The fast forward and fast reverse functions cannot be enabled in the holding section, and only the section can be skipped to change the SV process target value.
- E. In the case that the initial set value of the first segment is the measured value PV, the instrument automatically powers down to save the current PV value, and maintains the same slope fast forward and fast reverse functions before power down.

Chapter 11 **MODBUS TCP** (Access Password 13)

Parameter name	Upper row display	Lower row display	Explanation	Defaults
IP address	IP Address	IP Address 1	0~255	192
IP address		IP Address 2	0~255	168
IP address		IP Address 3	0~255	1
IP address		IP Address 4	0~255	200
Subnet mask	Subnet Mask	Subnet Mask 1	0~255	255
Subnet mask		Subnet Mask 2	0~255	255
Subnet mask		Subnet Mask 3	0~255	255
Subnet mask		Subnet Mask 4	0~255	0
Gateway	Gateway	Gateway 1	0~255	192
Gateway		Gateway 2	0~255	168
Gateway		Gateway 3	0~255	1
Gateway		Gateway 4	0~255	1
System reservation				
System reservation				
System reservation				
System reservation				

Chapter 12 Real time clock setting Time setting menu (factory password 9)

Number	Upper row display	Lower row display	Explanation	Defaults
1	Time	Year	year, 2019~2095	2019
2		Month	month, 1~12	1
3		Day	day, 1~31	1
4		Hour	hour, 0~23	1
5		Minute	minute, 0~59	1
6		Second	second, 0~59	1

Appendix: Introduction to discrete PID control usage
(fixed group and adjustable group heating usage)

One. Overview:

In some occasions that require high system reliability, sometimes it is necessary to have multiple contactors and continuously adjustable combined control,Form an independent closed-loop system. The use of multiple contactor section control improves the reliability of the system, but in order to avoidFrequent start and stop of contactors will affect the service life and the impact of grid current. At the same time, we must finally achieve a closed-loop control goalAccuracy. For this purpose, a fixed group and an adjustable group are designed to form a closed loop. So as to achieve the final target value control of the system.

Two, system schematic diagram

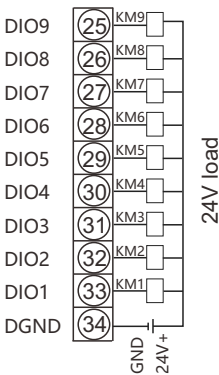
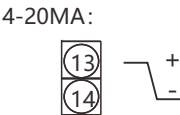
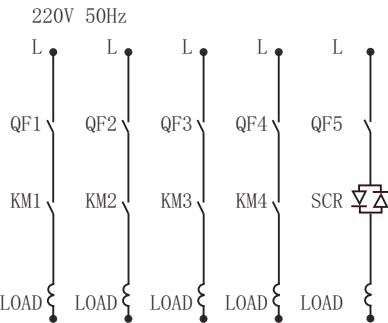


Figure 1: Fixed group wiring terminal diagram



Main control output 1

Figure 2: Terminal diagram of adjustable group



SCR adjustable group, the control signal is connected to the main control output 4-20ma

Figure 3: Usage diagram of 4 adjustable groups + 1 adjustable group

three. Parameter setting description

1. After entering the system CONFIG menu, select the submenu INSTRUMENT:

Find the control mode function, select function 5 discrete output control. After waiting for 2 seconds, the screen flashes to confirm the save and exit the submenu.

编号	功能	当前值	数据范围	默认值	16位地址	32位地址	说明
1	系统控制模式选择	0-1	0	4094	4094		0-停止, 1-强制停止功能(强制停止, 200%)
2	启动/停止控制	0-2	1	4097	4096		0-禁止启动/停止控制, 1-允许启动/停止控制, 2-允许启动/停止控制
3	SV1/PROG 控制模式	0-2	0	4098	4094		0-固定SV1模式, 1-固定Prog模式, 2-强制SV1/Prog控制
4	SV1/SV2 控制模式	0-2	0	4099	4096		0-固定SV1模式, 1-固定SV2模式, 2-强制SV1-SV2控制
5	控制模式选择	0-1	0	4100	4098		NO-无强制停止/禁止控制(强制SV1/SV2), ENA-允许强制停止/禁止控制(SV1/PROG)
6	停止时间	0-2	0	4101	4099		0-停止时间, 1-停止时间, 2-停止时间
7	数字滤波时间	0.1-100.0	1.0	4102	4097		单位: 秒
8	控制方式	0-5	0	4103	4094		0-手动, 1-自动, 2-无反馈, 3-无反馈, 4-无反馈, 5-无反馈

2. After entering the system CONFIG menu, select the submenu Discrete output:

编号	功能	当前值	数据范围	默认值	16位地址	32位地址	说明
160	固定组数			4255	41278		
161	固定组功率	1-9	5	4256	41280		设置固定组功率, 输入固定组的总功率
162	固定组功率占比	10.0-100.0	50	4257	41282		设置固定组功率占比, 输入固定组的功率占总功率的百分比
163	固定组单个设备动作延迟时间	1-60	5	4258	41284		设置固定组单个设备动作延迟时间, 单位: 分钟
164	固定组报警运行时间	0-200	0	4259	41286		0-关闭报警运行功能, 单位: 分钟

a. Set the total number of fixed groups, for example: the fixed group is 4 groups as shown in Figure 3, and the total number is just 4.

b. Set the percentage of the total power of the fixed group to the power. For example: as shown in Figure 3, the 4 adjustable groups are respectively 100KW, and the power of 1 adjustable group is 100KW. Then the power of the fixed group = 400KW (the sum of the power of the 4 fixed groups)/500KW (fixed group + adjustable group) Sum = 80.0

c. In order to avoid too frequent start-stop control of the fixed group and prolong the service life of the contactor, the action time of the contactor can be set as required. Too large a setting value can prolong the life of the contactor but has a certain impact on the closed-loop control accuracy. The customer can adjust the reasonable time according to the actual situation on site.

d. In order to protect the internal heating of the heater evenly, the user can set the automatic circulation heating mode. Ensure that the heaters circulate heating at low output. The default value of 0 means no heating cycle, and the unit is minutes. Note that after enabling this function, the switching times of the fixed group will be increased. Users can choose according to their needs.

Discrete control output description:

- 1. The total output power of the fixed group: P_A_Do (Output power);
Single fixed group output power: P_s_Do (Output power / Output number);
The current total output power: P_pid .
 - 2. The total output power of the linear group: $P_A_line = 100.0 - P_A_Do$.
 - 3. Determine the start power of the fixed group: $P_Do_Start = P_A_line * (DO\ start)\%$.
 - 4. When $P_pid \geq P_Do_Start$, the output quantity of the fixed group: $Num_Do = (P_pid / P_s_Do)$ takes an integer.
 - 5. The current output power of the linear group: $P_C_line = P_pid - (Num_Do * P_s_Do)$.
- For example:

One fixed group has a heating power of 100KW, and an adjustable group has a heating power of 100KW. Then the adjustable group accounts for 50%.
Assuming that the fixed group opening condition is set to 20%, the opening condition is actually $50\% * 20\% = 10\%$, that is, after the current output is greater than 10%, it starts to judge whether the fixed group output needs to be turned on.

