# XD/XL series PLC

## User manual［positioning control］

Wuxi XINJE Electric Co., Ltd.

Data no.　PD02 20170518 3.4

XD/XL series PLC

User manual

[Positioning control]

Version 1

- Basic explanation

Thank you for purchasing Xinje XD/XL series PLC.
This manual mainly introduces XD/XL series PLC instructions.
Please read this manual carefully before using and wire after understanding the content.
About software and programming instructions, please refer to related manuals.
Please hand this manual over to operation users.

- Notices for users

Only experienced operator can wire the plc. If any problem, please contact our technical department.
The listed examples are used to help users to understand, so it may not act.
Please confirm that PLC specifications and principles are suitable when connect PLC to other products. Please conform safety of PLC and machines by yourself when use the PLC. Machines may be damaged by PLC errors.

- Responsibility declaration

The manual content has been checked carefully, however, mistakes may happen.
We often check the manual and will correct the problems in subsequent version. Welcome to offer advices to us.
Excuse us that we will not inform you if manual is changed.

- Contact information

If you have any problem about products, please contact the agent or Xinje company.
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# Catalog

# Preface

———positioning control

This manual is XD/XL series PLC positioning control manual, it introduces pulse output and motion control function, is suitable for XD2, XD3, XD5, XDM, XDC, XD5E, XDME, XDH, XL3, XL5, XL5E, XLME series PLC (XD1 and XL1 have no positioning function).

1. XD/XL series PLC features:

- **Faster instruction processing speed**

XD/XL series PLC instruction processing speed is 12~15 times faster than XC series, especially for the floating number instruction, the unit of scanning period is μs.

- **Up to 10 to 16 modules and 2 BD cards, 1 ED module can be extended**

Similar to XC series PLC, XD3, XD5, XDM, XDC, XD5E series PLC also support extension module and BD card (XD1/XD2 cannot extend module and BD card, XDH cannot extend ED and BD), including digital, analog, temperature module. The extension modules can be 10 or 16, BD card 1 or 2.
XL series PLC can support 10 right extension modules, 1 left extension ED module.

- **Compatible with most functions of XC series**

XD/XL series PLC support most basic functions of XC series PLC.

- **Compatible with XC series program**

XD/XL series PLC software XDPPro can open the program of XC series PLC, but some different instructions will be shown in red colors, user only needs to modify this part of program.

- **XL has compact size**

XL series PLC is card type PLC, with a thinner and smaller appearance, which can greatly save the installation space.

- **X-NET fieldbus**

XD/XL PLC supports xnet fieldbus communication, which can realize fast and stable communication to XD/XL PLC and TG/TN touch screen. XDC series PLC supports the function of x-net motion bus and can control 20-axis synchronous motion.

- **Ethernet communication**

Ethernet PLC has RJ45 port and supports TCP/IP protocol. It can realize MODBUS-TCP communication and free format communication based on Ethernet. Supports program download, online monitoring, remote monitoring, and communication with other TCP/IP devices.

- **EtherCAT bus**

XDH series PLC supports EtherCAT bus function, and can control 32 axes synchronously, with synchronization period ≤ 1ms.

2. Product models

XD1 series models:

- XD1-16R/T-E/C
- XD1-32R/T-E/C

XD2 series models:

- XD2-16R/T-E/C
- XD2-24R/T/RT-E/C
- XD2-32R/T/RT-E/C
- XD2-48R/T/RT-E/C
- XD2-60R/T/RT-E/C

XD3 series models:

- XD3-16R/T/RT-E/C, XD3-16PT-E/C
- XD3-24R/T/RT-E/C, XD3-24PR/T/RT-E/C
- XD3-32R/T/RT-E/C, XD3-32PR/T/RT-E/C
- XD3-48R/T/RT-E/C, XD3-48PT-E/C
- XD3-60R/T/RT-E/C, XD3-60PT-E/C

XD5 series models:

- XD5-16R/T-E/C
- XD5-24R/T/RT-E/C, XD5-24T4-E/C
- XD5-32R/T/RT-E/C, XD5-32T4-E/C
- XD5-48R/T/RT-E/C
- XD5-60R/T/RT-E/C
- XD5-48T4-E/C
- XD5-48T6-E/C
- XD5-60T4-E/C
- XD5-60T6-E/C
- XD5-60T10-E/C

XDM series models:

- XDM-24T4-E/C, XDM-24PT4-E/C
- XDM-32T4-E/C, XDM-32PT4-E/C
- XDM-60T4-E/C
- XDM-60T10-E/C, XDM-60PT10-E/C
- XDM-60T4L-E

XDC series models:

- XDC-24T-E/C
- XDC-32T-E/C
- XDC-48T-E/C
- XDC-60T-E/C

XD5E series models:

- XD5E-30T4-E
- XD5E-60T10-E

XDME series models:

- XDME-60T10-E

XDH series models:

- XDH-60T4-E

3．XL series PLC

XL1 serise PLC:

- XL1-16T, XL1-16T-U

XL3 serise PLC:

- XL3-16R/T, XL3-16PR, XL3-32T

XL5 serise PLC:

- XL5-16T, XL5-32T, XL5-32T4

XL5E serise PLC:

- XL5E-16T, XL5E-32T, XL5E-32T4, XL5E-64T6

XLME serise PLC:

- XLME-32T4

4. Version requirements

XD series PLC: XDPpro software v3.2 and up.
XL series PLC: XDPpro software v3.5 and up.
Part of the instructions have version requirements, please refer to the instruction details.

# 1 Pulse output

Pulse output instruction list:

| instruction | function | Instruction writing format | chapter |
|---|---|---|---|
| **Pulse output** | | | |
| PLSR | Multi-segment pulse output | PLSR S0 S1 S2 D | 1-2-2 |
| PLSF | Variable frequency pulse output | PLSF S0 S1 D | 1-2-3 |
| DRVI | Relative single segment positioning | DRVI S0 S1 S2 D1 D2 | 1-2-4 |
| DRVA | Absolute single segment positioning | DRVI S0 S1 S2 D1 D2 | 1-2-5 |
| ZRN | Mechanical return zero | ZRN S0 D | 1-2-6 |
| STOP | Stop pulse | STOP S0 S1 | 1-2-7 |
| GOON | Continue to output pulse | GOON Yn | 1-2-8 |

## 1-1. Function overview

XD2, XD3, XD5 (except XD5-48T6/60T6), XDC, XL3 series PLC have 2 channels of pulse output. XD5-48T6/60T6, XDM, XD5E series PLC have 4~10 channels of pulse output. The different pulse functions include single direction pulse output with or without accelertion/deceleration, multi-segment double direction pulse output. The max output frequency can up to 100KHz.

**Note: as XC series PLC cannot write two or more pulse output instructions for same terminal in main program or process. But XD series PLC has no problem cause its condition is edge-triggered.**

**Pulse output terminal:**

| PLC model | Pulse channels | Pulse output terminal | output frequency | Output mode | Output format |
|---|---|---|---|---|---|
| XD2-16T/RT<br>XD2-24T/RT<br>XD2-32T/RT<br>XD2-48T/RT<br>XD2-60T/RT | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XD3-16T/RT<br>XD3-24T/RT<br>XD3-32T/RT<br>XD3-48T/RT<br>XD3-60T/RT | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XD5-16T/RT<br>XD5-24T/RT<br>XD5-32T/RT<br>XD5-48T/RT<br>XD5-60T/RT | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XD5-24T4<br>XD5-32T4<br>XD5-48T4<br>XD5-60T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XD5-48T6<br>XD5-60T6 | 6 | Y0, Y1, Y2, Y3, Y4, Y5 | 0~100KHz | Open collector | Pulse+direction |
| XD5-48D4T4 | 8 | Y0, Y2, Y4, Y6 | 0~920KHz | Differential | Pulse+direction |
| | | Y0/Y1, Y2/Y3, Y4/Y5, Y6/Y7 | | | AB phase |
| | | Y10, Y12, Y14, Y16 | | | Pulse+direction |
| XD5-60T10 | 10 | Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11 | 0~100KHz | Open collector | Pulse+direction |
| XDM-24T4<br>XDM-32T4<br>XDM-60T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |

| | | | | | |
|---|---|---|---|---|---|
| XDM-60T4L | | | | | |
| XDM-60T10 | 10 | Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11 | 0~100KHz | Open collector | Pulse+direction |
| XDC-24T<br>XDC-32T<br>XDC-48T<br>XDC-60T | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XD5E-24/30/48/60T | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XD5E-30/60T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XD5E-60T6 | 6 | Y0, Y1, Y2, Y3, Y4, Y5 | 0~100KHz | Open collector | Pulse+direction |
| XD5E-60T10 | 10 | Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11 | 0~100KHz | Open collector | Pulse+direction |
| XDME-60T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XDME-60T10 | 10 | Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11 | 0~100KHz | Open collector | Pulse+direction |
| XDH-60T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XL3-16/32T | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XL5-16/32T | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XL5-32T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XL5E-16/32T | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse+direction |
| XL5E-32T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XLME-32T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector | Pulse+direction |
| XL5E-64T6 | 6 | Y0, Y1, Y2, Y3, Y4, Y5 | 0~100KHz | Open collector | Pulse+direction |

**Note:**

※1: all the pulse can output frequency 100~200KHz, but not all the servo can work well, please connect 500Ω resistor between output and 24V power supply.

※2: the direction terminal can be set to any terminal except pulse output terminal when using positioning instruction.

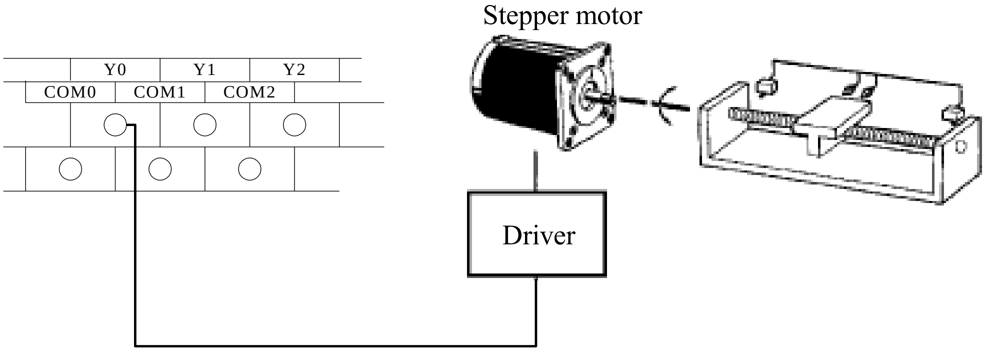
※3: pulse output terminal transistor response time is below 0.5μs, other transistors is below 0.2ms.

※4: the pulse output terminal can be used to pulse direction output when it has no pulse output.

※5: For differential pulse output, if pulse + direction mode is adopted, transistor or differential output terminal can be selected as direction terminal (differential output terminal +, - should be connected); if it is in AB phase mode, terminals must be used in pairs, such as Y0 and Y1. See the table above for specific distribution.

**Load current**

Please make the open collector transistor output load current in the range of 10~100mA (DC5~24V) when the basic unit (transistor output type) pulse output terminal is used to pulse output or positioning instruction.




**Note:**

※1: please use transistor terminal for pulse output. Such as XD3-16T-E or XD3-60T-E.

※2: it can choose any terminals for direction output except pulse output terminal.

※3: the pulse direction temirnal will keep the state after the pulse output finished. if the state is ON, it will keep ON after pulse output finished. if the pulse output instruction does not have direction, user can control the direction terminal state by manual. If the pulse output instruction has direction, the instruction will automatically control the direction terminal.

※4: the pulse output terminal LED will slight light when the pulse is outputting. Because the pulse is 50% empty square wave, so the LED will light in half of the period and off in another half of period.

※5: the pulse output terminal Yn will be ON in software when the pulse is outputting, and it will be OFF when the pulse output finished.

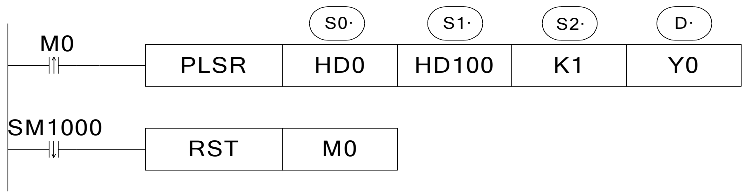
## 1-2. Pulse output type and instruction application

### 1-2-1. Pulse parameter and configuration

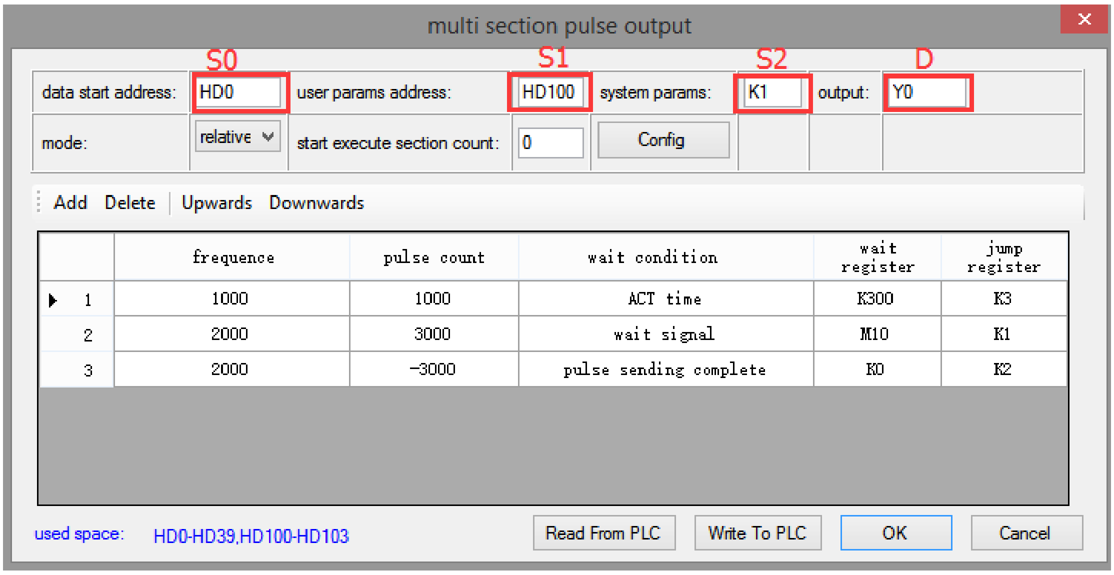
XD/XL series PLC pulse output function needs to configure the pulse data, user parameters and system parameters. This chapter will introduce all the parameters and configuration methods.

Now we take PLSR instruction as an example.

PLSR instruction write format:




Click in the software or right click the PLSR instrution in the program to open the configuration window of PLSR.




Configuration table:

| Configuration item | Function |
|---|---|
| Data start address | Pulse data parameter address, occupied 【S0】~【S0+N*10+8】 (double words, N is pulse segment no.), store the pulse total segment number, pulse numbers, wait condition, register type and number, jump register type and number… |
| User parameter address | User parameter address, occupied【S1】~【S1+2】 (double words), store the mode (relative/absolute), starting execute segment no. |
| System parameter | Choose which group of parameters, each pulse output terminal can set four group of parameters, the default is K1 (group 1) |
| Mode | Relative, absolute mode, default is relative mode |
| Start execute section count | PLSR executed from which segment, default is 0 (start from segment 1) |
| Config | Set the system parameters which are saved in special Flash register SFD900~SFD2193, it can set 4 groups of parameters of 10 pulse output terminals |

### 1-2-1-1. Pulse data parameters (S0)

The pulse data parameters are set in the address starting from S0, please refer to the following table:

◆ **Data starting address S0**

| Address | Contents | Remark |
|---|---|---|
| S0+0 (double words) | Pulse total segment number (1~100) | |
| S0+2 (8 words) | Reserved (8 words) | |
| S0+10 (double words) | Segment 1 pulse frequency | Segment 1 |
| S0+12 (double words) | Segment 1 pulse number | |
| S0+14 | High 8-bit: 【wait condition】 (set when to send the next segment of pulse)<br>H00: pulse output finished ("H" means hex format)<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse output finished | |
| | Low 8-bit:【wait condition register type】 (use together with【wait condition】)<br>H00: constant<br>H01: D<br>H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | |
| S0+15 (double words) | 【constant/register number (wait condition)】, use together with【wait condition】,【wait condition register type】 | |
| S0+17 | Low 8-bit:【jump register type】(set the next pulse segment no.)<br>H00: constant<br>H01: D<br>H02: HD<br>H03: FD | |
| S0+18 (double words) | 【constant/jump register number】, use together with【jump register type】 | |
| …… | …… | …… |
| S0+N*10+0 (double words) | Segment N pulse frequency | Segment N |
| S0+N*10+2 (double words) | Segment N pulse numbers | |
| S0+N*10+4 | Wait condition, wait condition register type | |
| S0+N*10+5 (double words) | Constant or register number (wait condition) | |
| S0+N*10+7 | Jump register type | |
| S0+N*10+8 (double words) | Constant or register number (jump register) | |

**Note:**

※1: pulse frequency is positive value ( $\geq 0$), the value become larger is acceleration, become smaller is deceleration, it is not related to the pulse direction.

※2: pulse numbers can be positive or negative value, negative value means reverse direction pulse.

■ **Wait condition (【S0+14】 high 8-bit)**

To set when to enter next segment of pulse.

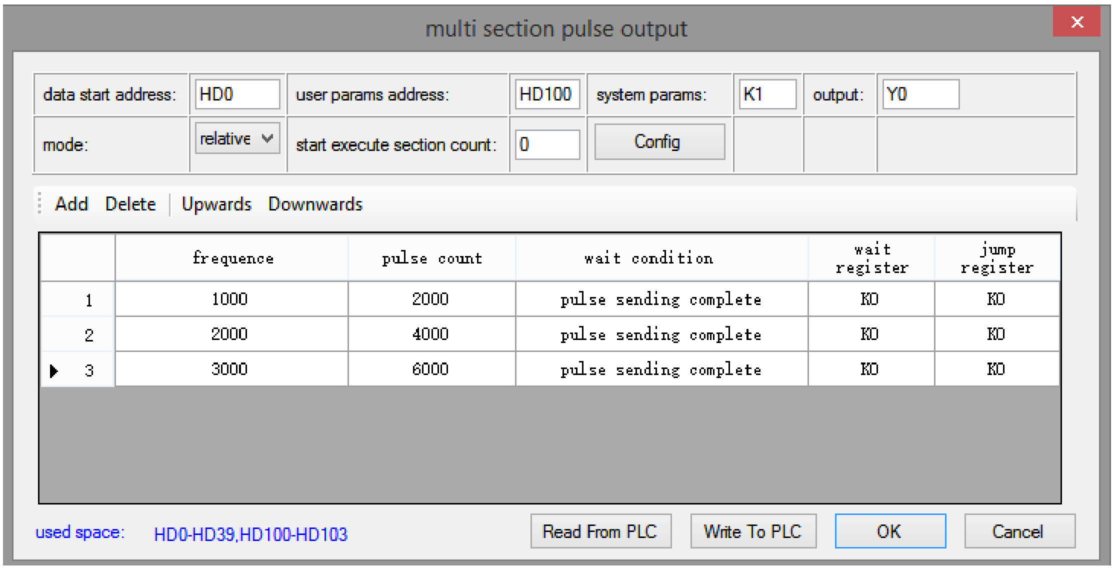
● **Pulse sending finished (H00)**

Jump to the setting pulse segment after executing this segment of pulse.

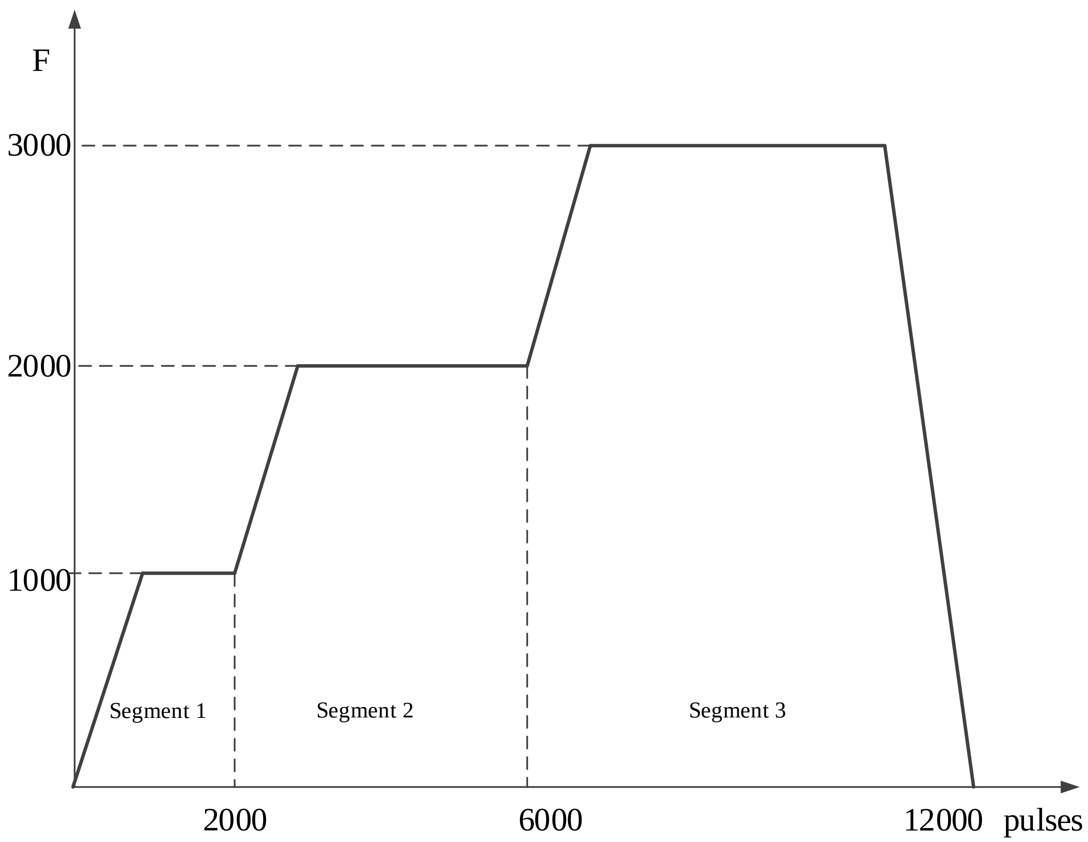
**Example 1:**

When the pulse intruction PLSR is triggered, it will send segment 1 2000 pulses with the speed 1000Hz, and jump to segment 2 at once after segment 1 finished. Segment 2 is 4000 pulses with speed 2000Hz. Then it will jump to segment 3 at once after semgent 2 finished. Segment 3 has 6000 pulses.

Configuration window:




**Multi-segment pulse configuration**

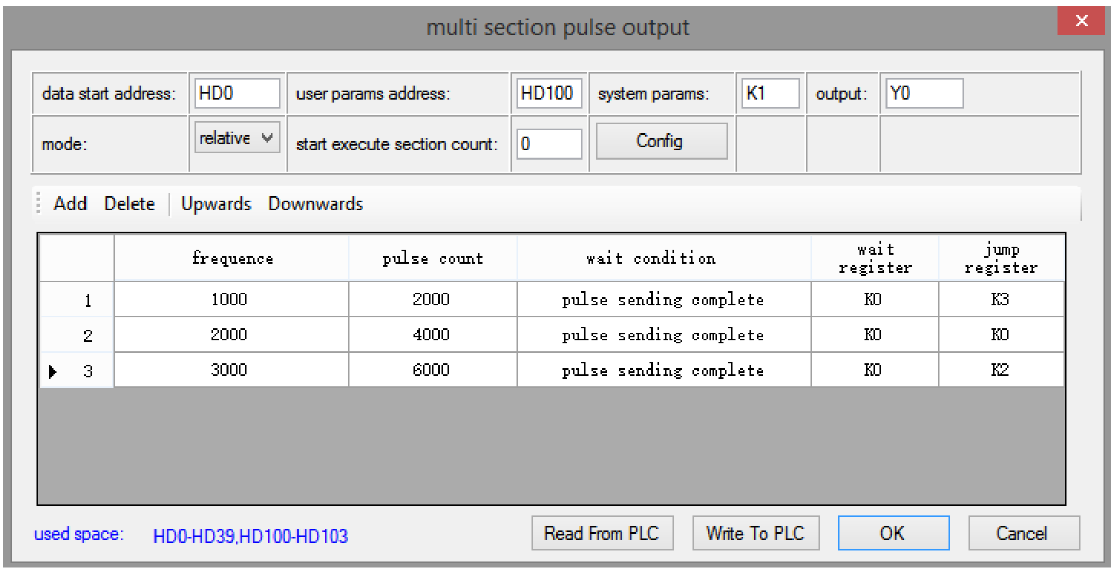



**Multi-segment sequence control pulse wave**

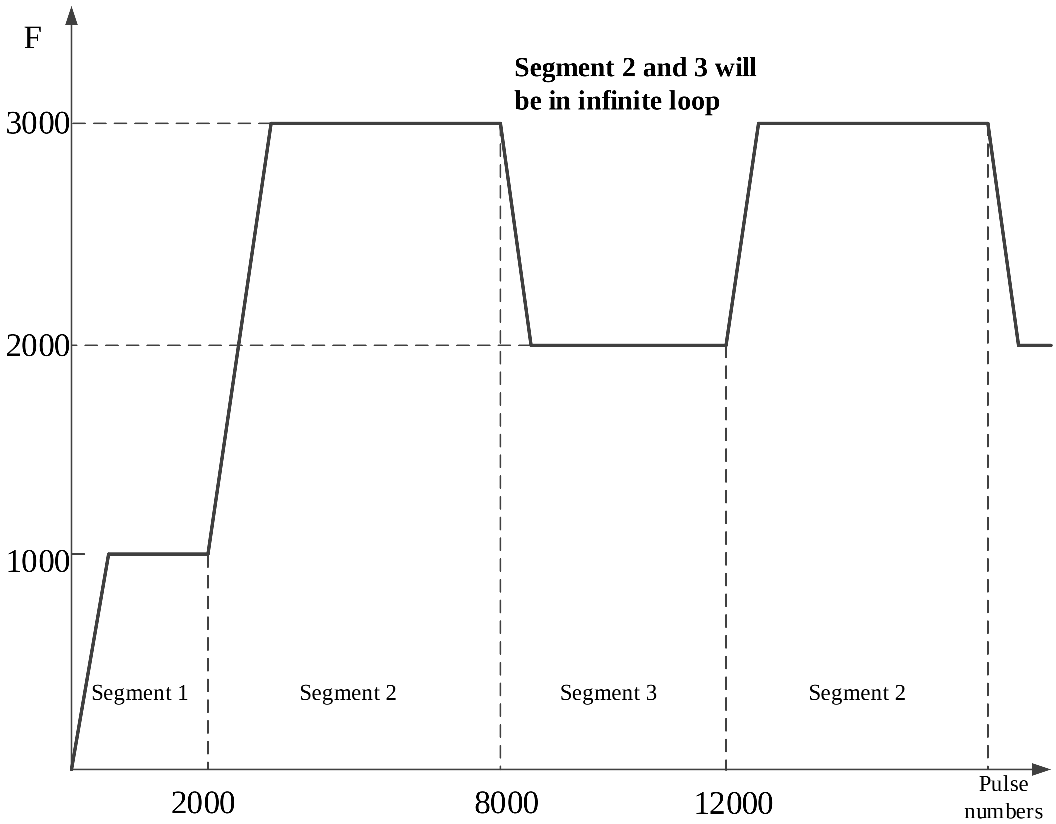
**Example 2:**

When the pulse instruction PLSR is triggered, it will send 2000 pulses with the speed 1000Hz, and jump to segment 3 to send 6000 pulses with the speed 3000Hz, then jump to segment 2 to send 4000 pulses, then jump to segment 3 to repeat the cycle.

The configuration window:




**Multi-segment pulse output configuration table**




**Multi-segment pulse sending diagram**

**Note:**

※1: the acceleration deceleration time can be set in 【config】 list, all the parameter details are in 【config guide】.

※2:【jump register】 set to K0, it will jump to the next segment. If it is not 0, it will jump to corresponding segment. For example, K3 will jump to segment 3.

※3: when setting multi-segment of pulse, and【jump register】is set, endless pulse outputting loop should be avoided.

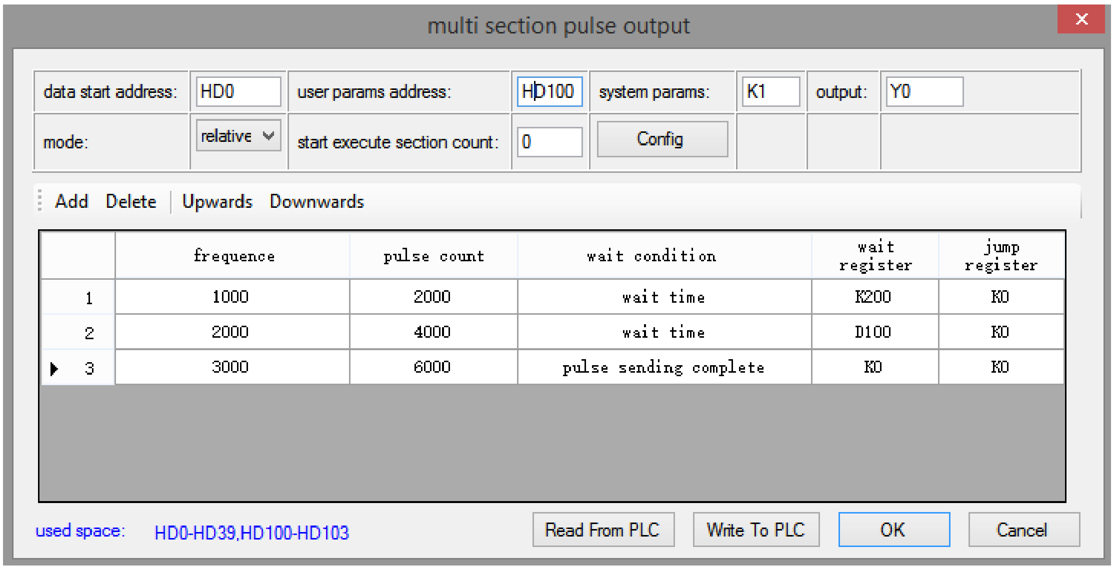
- **Wait time (H01)**

It starts to timing after present pulse segment end, it will jump to appointed segment when the time is up. The time can be constant or register D, HD, FD. The unit is ms.

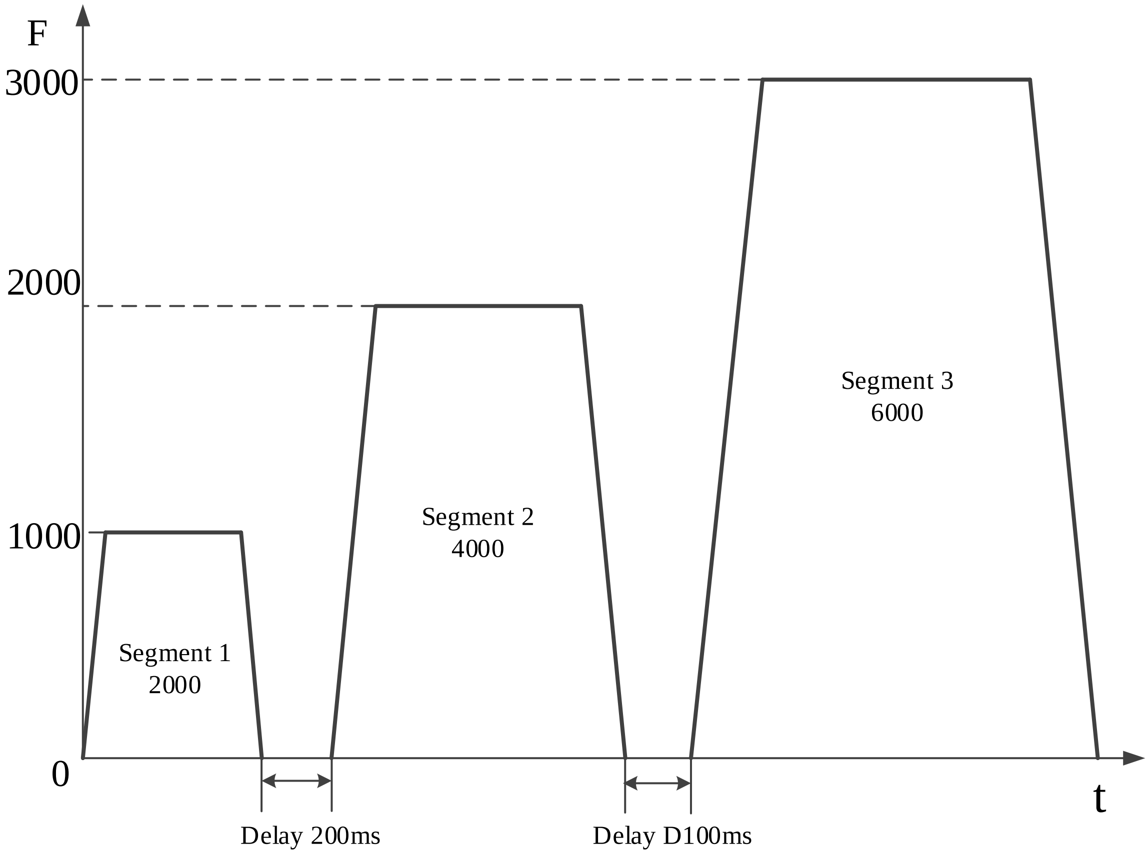
**For example:**

When the relative mode pulse instruction PLSR is triggered, it sends 2000 pulses with the speed of 1000Hz, it will delay 200ms after segment 1 end then jump to segment 2. It sends 4000 pulses with the speed 2000Hz, it will delay the time of D100 (if D100=100, it will delay 100ms), then jump to segment 3 which will send 6000 pulses.

**Configurations:**




**Multi-segment pulse configuration table**




**Pulse sending diagram**

**Note:**

※1: the acceleration deceleration time can be set in 【config】 list, all the parameter details are in 【config guide】.

※2: delay time range: 1~32767ms, set to 0 will be seemed to 1ms.

※3: if the delay time is over 32767ms, please use two pulse instructions, and timer between them.

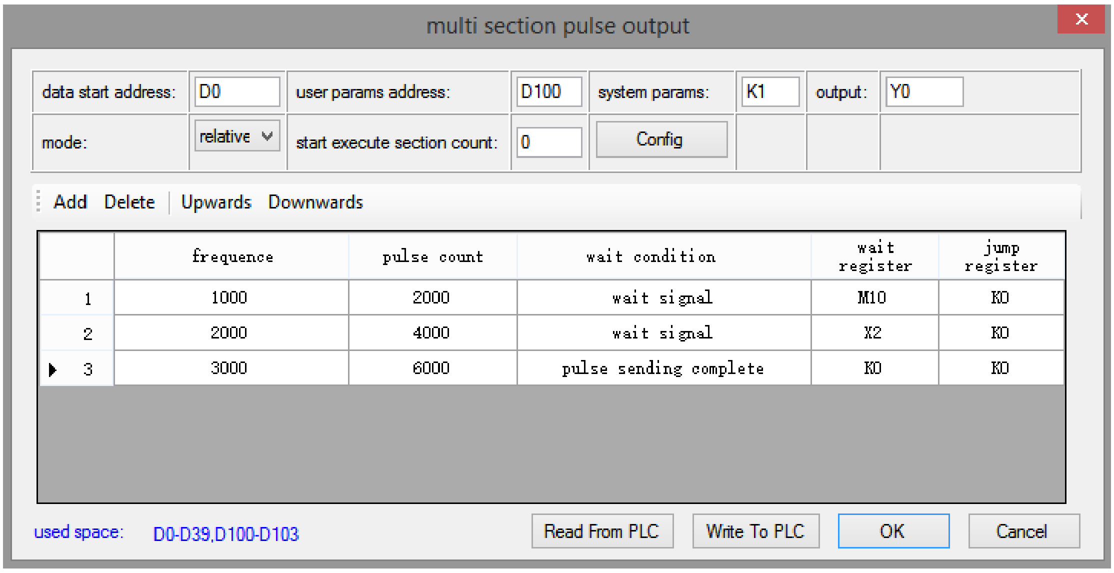
- **Wait signal (H02)**

It will wait for the wait signal after pulse sending finished. When the signal is ON or from OFF to ON, it will jump to appointed segment. The wait signal can be X, M, HM and so on.

**For example:**

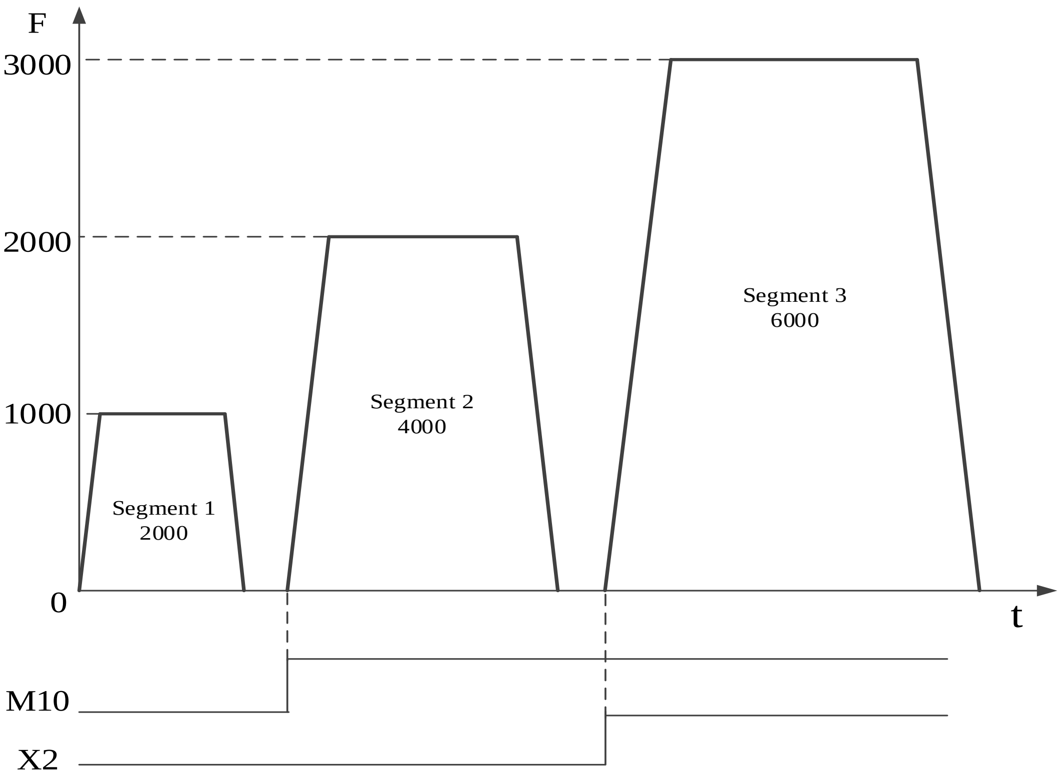
When the relative mode pulse instruction is triggered, it will send 2000 pulses with the speed 1000Hz, after segment 1 finished, it will wait for the M10 from OFF to ON, then jump to segment 2 which will send 4000 pulses with the speed 2000Hz, it will wait for X2 from OFF to ON, then jump to segment 3 which will send 6000 pulses.

Configurations:




| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 1000 | 2000 | wait signal | M10 | K0 |
| 2 | 2000 | 4000 | wait signal | X2 | K0 |
| 3 | 3000 | 6000 | pulse sending complete | K0 | K0 |

**Multi-segment pulse output configuration table**

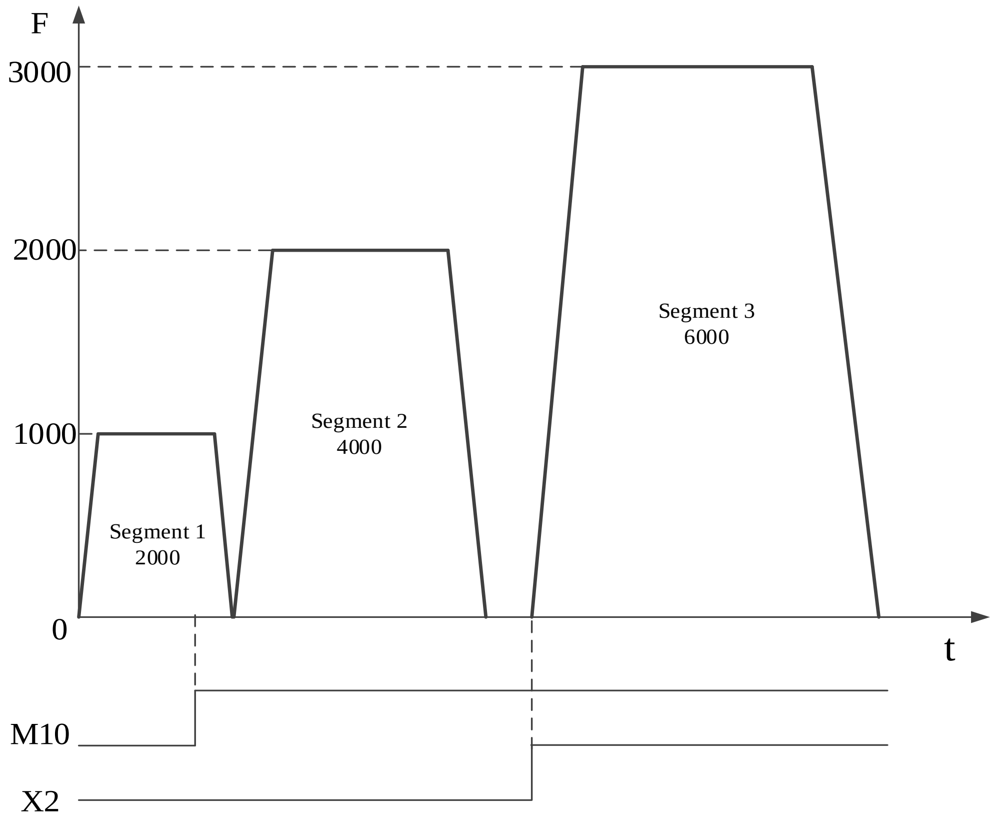



**Pulse sending diagram**

**Note:**

※1: the acceleration deceleration time can be set in 【config】 list, all the parameter details are in 【config guide】.

※2: if the present segment has not finished, but the wait signal is ON, it will jump to next segment after present segment finished, the wave is shown as below (M10 from OFF to ON in advance)




**Pulse sending diagram**

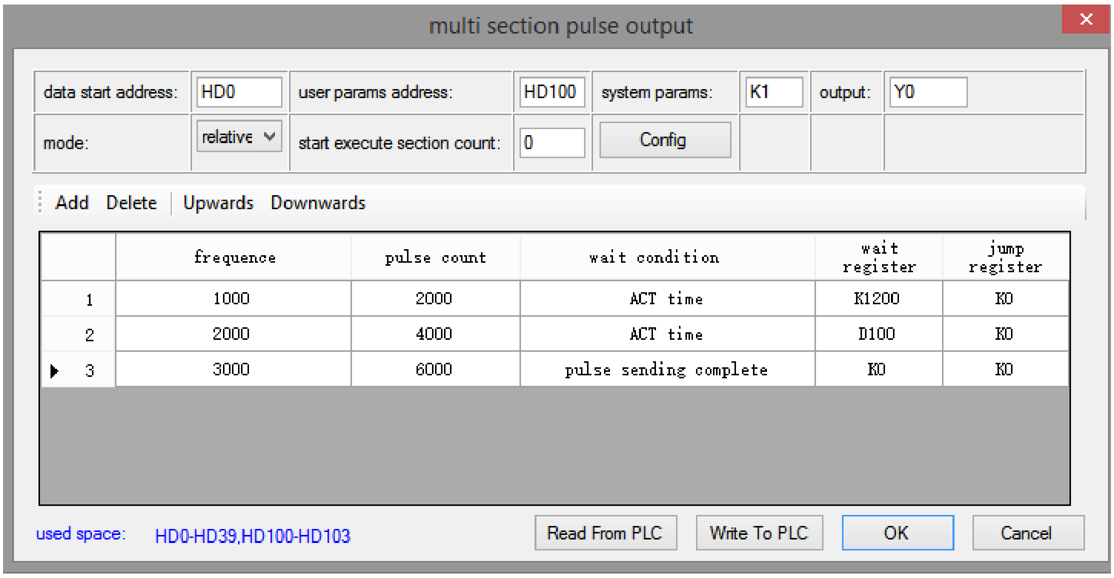
※3: if the wait signal is not ON after the present segment finished, it will wait until the signal is ON, then jump to the next segment.

- **ACT time (H03)**

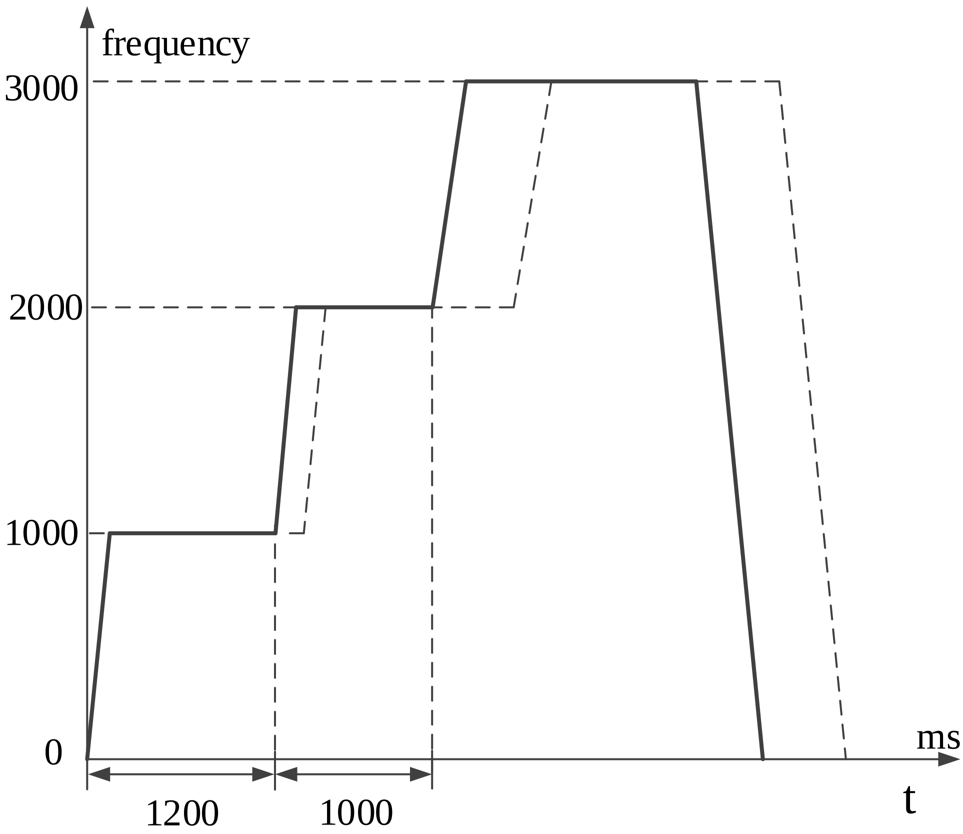
The pulse will output for the time appointed by ACT time, no matter the pulse sending process is finished or not, it will jump to the next segment at once. ACT time can be constant, or set through register D, HD, FD, the unit is ms.

For example: when the relative mode pulse instruction PLSR is triggered by pulse edge, it will output the first segment of pulse numbers with the speed 1000Hz, when the first segment pulse output time reaches 1200ms, no matter the pulse sending process is finished or not, it will jump to the second segment at once. When the second segment of pulse outputs with the speed 2000Hz and reaches the time setting in D100 (for example D100=1000), no matter the pulse sending process is finished or not, it will jump to the third segment at once and output 6000 pulses.

The configuration:




**Multi-segment pulse output configuration**

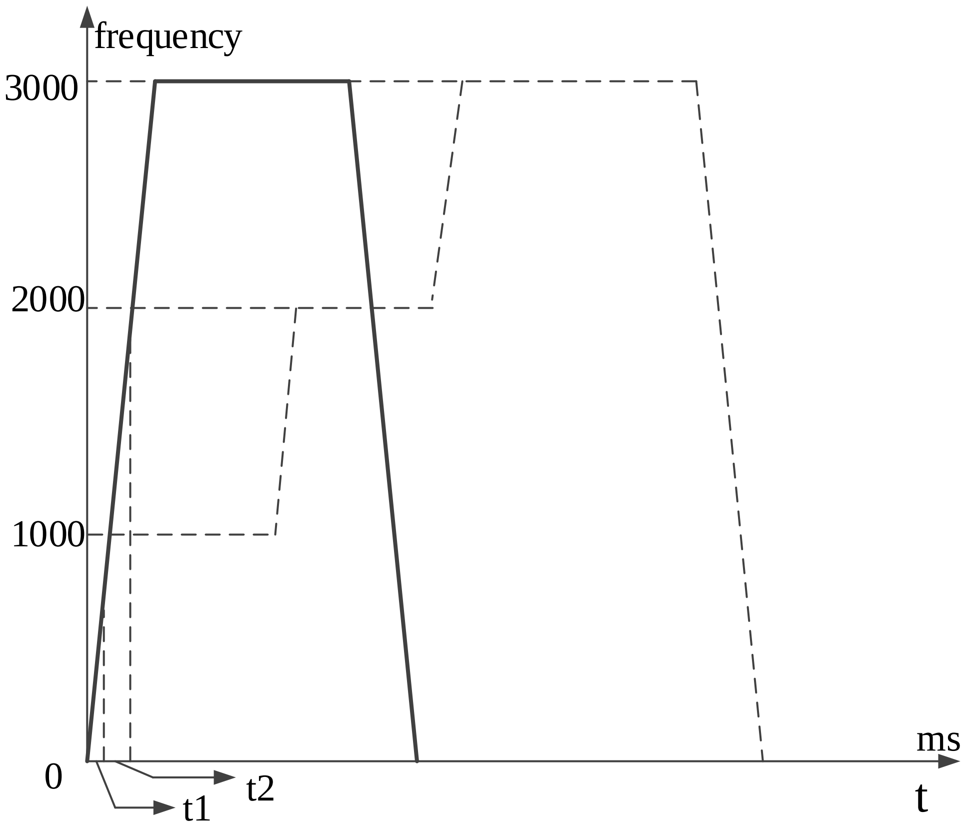



**Pulse output diagram**

**Note:**

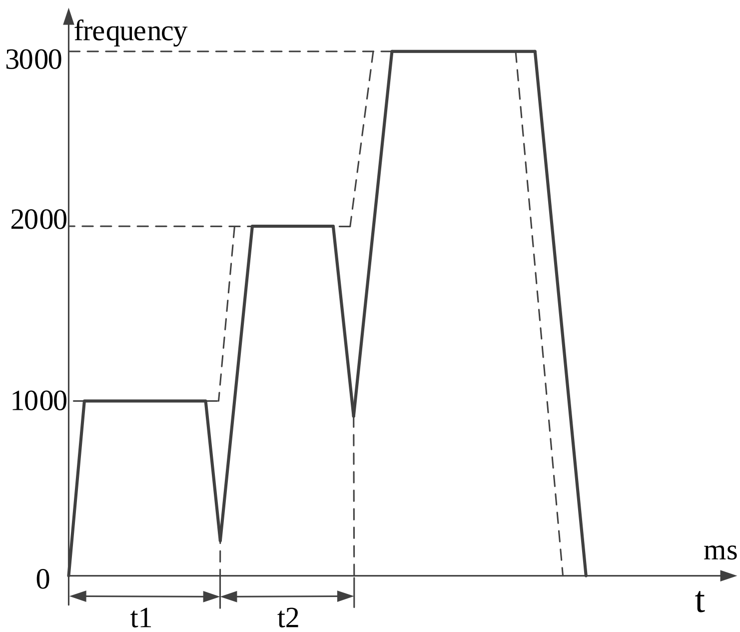
1: the accelertion time and deceleration time can be set in the parameter table, it will be explained in system parameters.

2: if the ACT time is very short and in the acceleration stage of the pulse segment, it will accelerate to the second segment from the position of ACT time reached, the same, it will accelerate to the third segment from the position of ACT time reached. Please see as the below diagram.



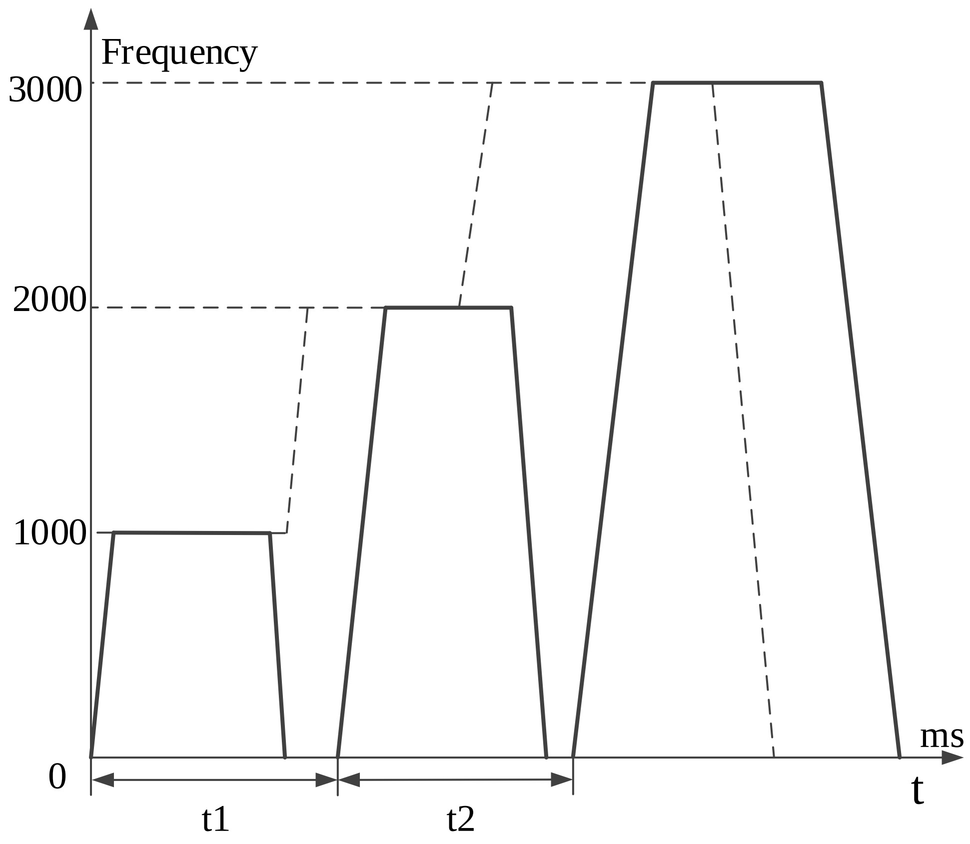

**Pulse output diagram**

3: if the ACT time is very long, and in the deceleration stage of the pulse segment, it will accelerate to the second segment from the position of ACT time reached, the same, it will accelerate to the third segment from the position of ACT time reached. Please see as the below diagram.




**Pulse output digram**

4: if the ACT time is very long, and the present pulse segment ends, it will wait the ACT time arrival and start the next segment. Please see the below diagram.



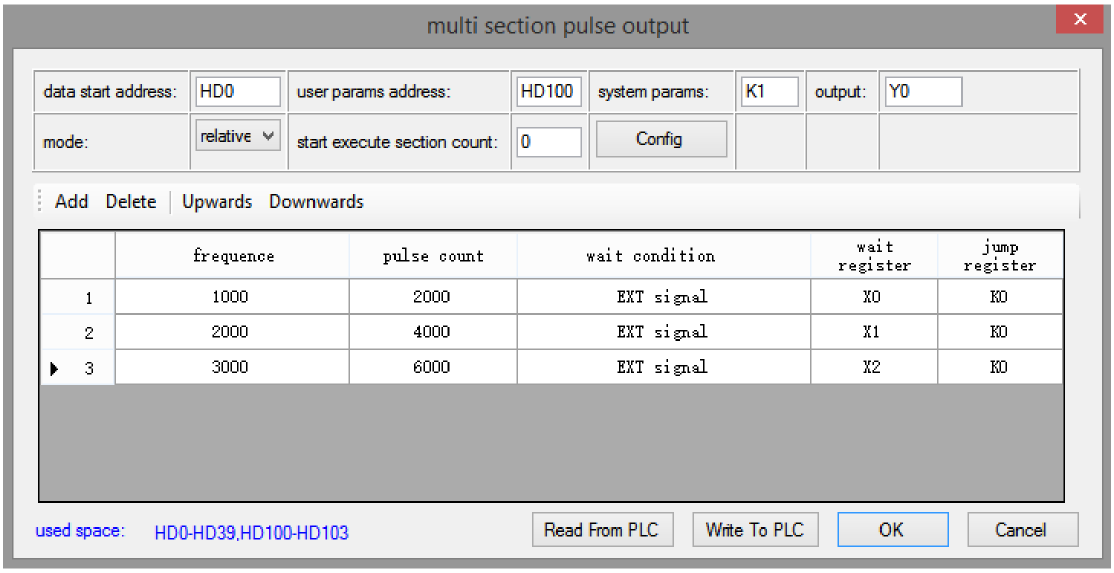

**Pulse output diagram**

- **EXT signal (H04)**

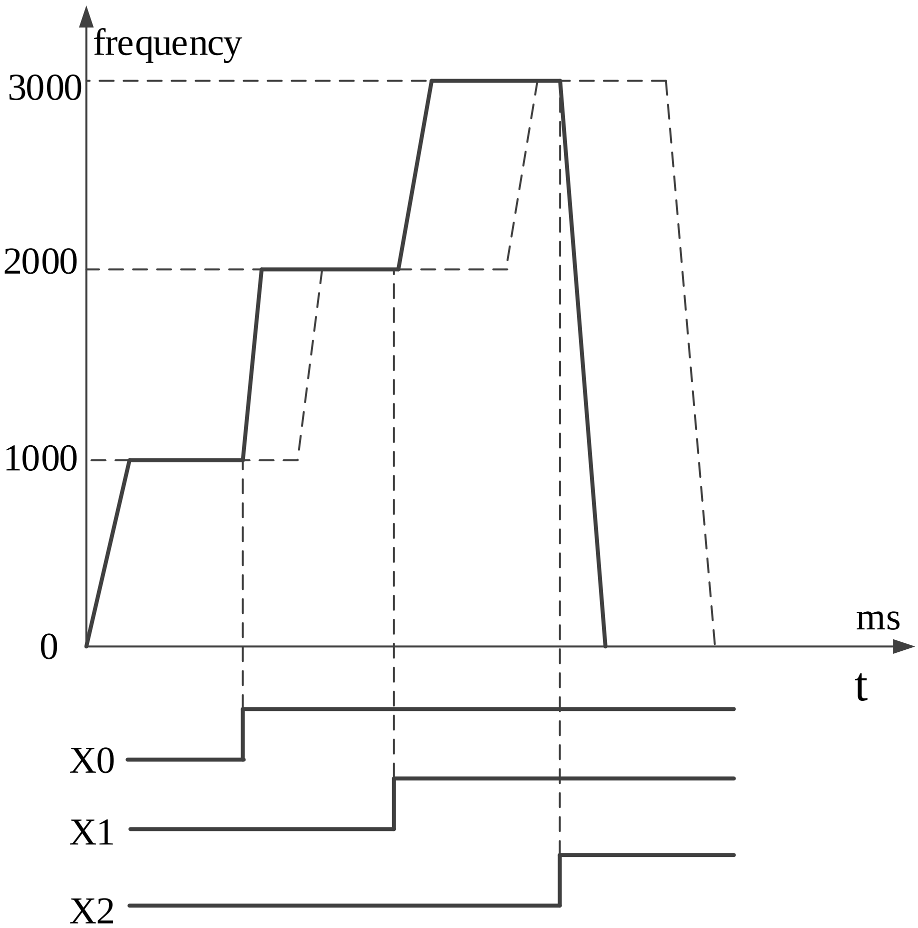
When the pulse is outputting (the pulse numbers have not been sent yet), if external signal is ON, it will jump to the next appointed segment. If the external signal has no action when the present pulse segment ends, it will wait for this signal. The external signal will input from X terminal (the response is higher if using external interruption terminal).

For example: when the relative mode pulse instruction PLSR is triggered by pulse edge, it will output the first segment of pulse numbers with the speed 1000Hz, the external signal inputs from X0 during the pusle is sending, it will jump to segment 2 at once. When the segment 2 pulse is sending with the speed 2000Hz, the external signal inputs from X1, it will jump to segment 3 at once. When the segment 3 pulse is sending with the speed 3000Hz, external signal inputs from X2, it will slow stop the pulse output at once.

The configuration window:




**Multi-segment pulse output configuration**

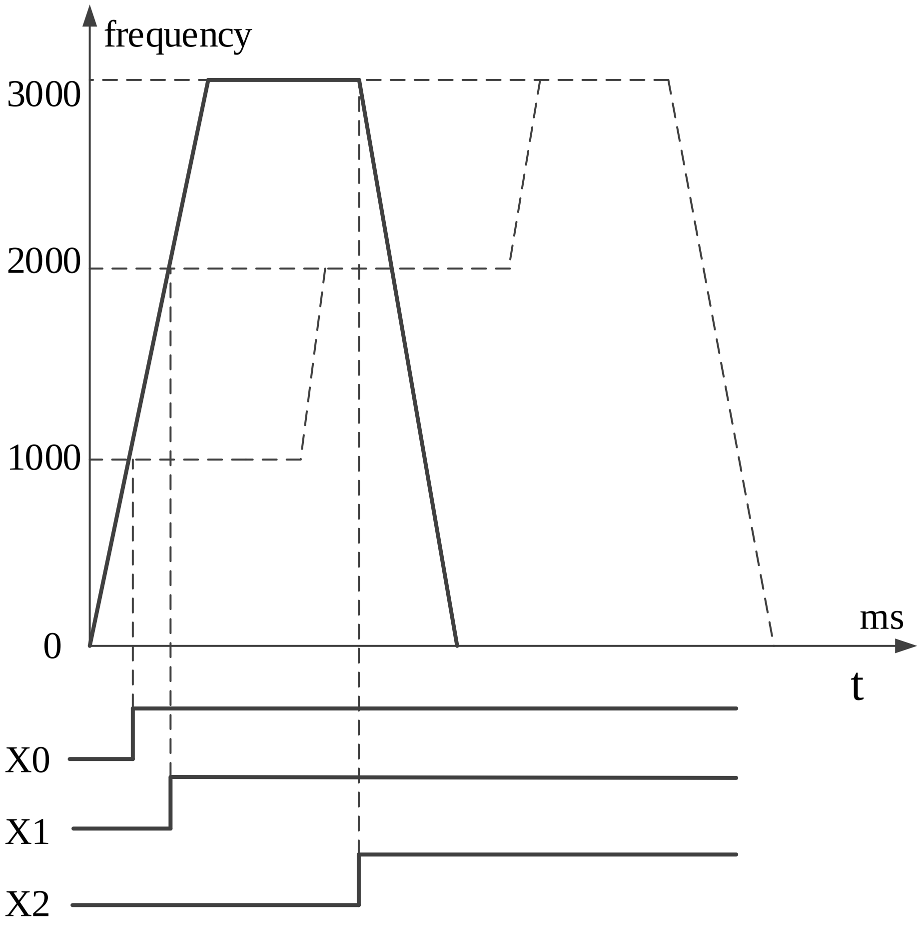



**Pulse output diagram**

**Note:**

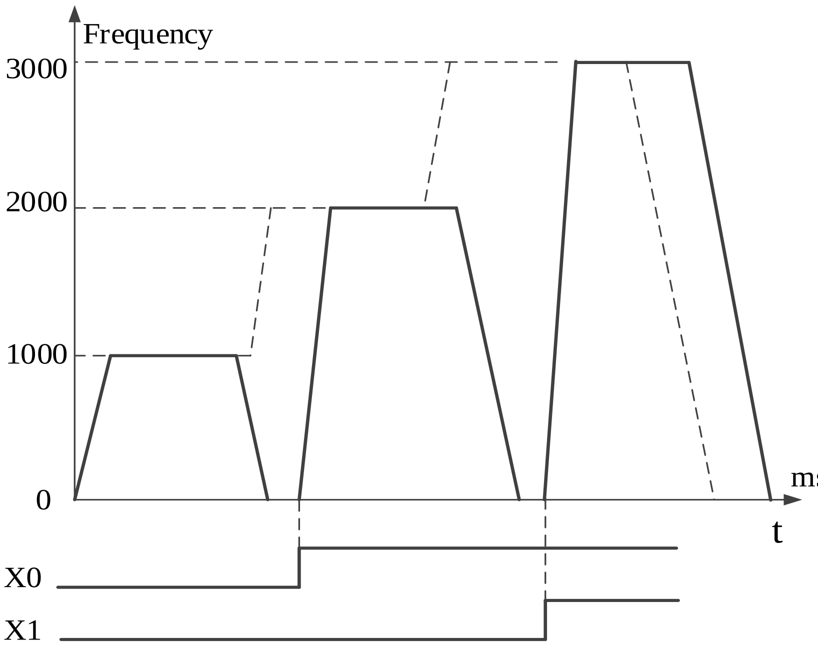
1: the acceleration and deceleration time can be set in parameter table, please refer to system parameters for details.

2: the pulse is accelerating when the EXT signal is triggered, it will accelerate from the present position to pulse segment 2. The same, it will accelerate from the present position of EXT singal triggered to segment 3. As shown of below diagram:



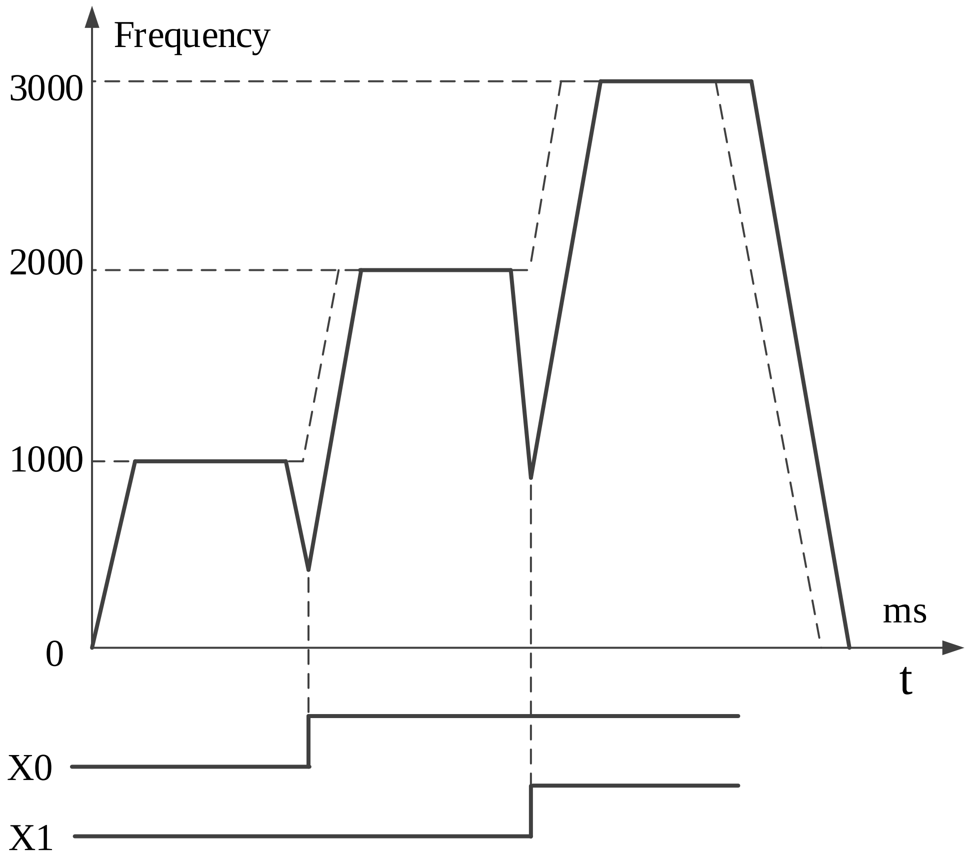

**Pulse output diagram**

3: if the EXT signal is triggered when the present pulse already ends, it will wait the EXT signal and start the next segment. Refer to below diagram.




**Pulse output diagram**

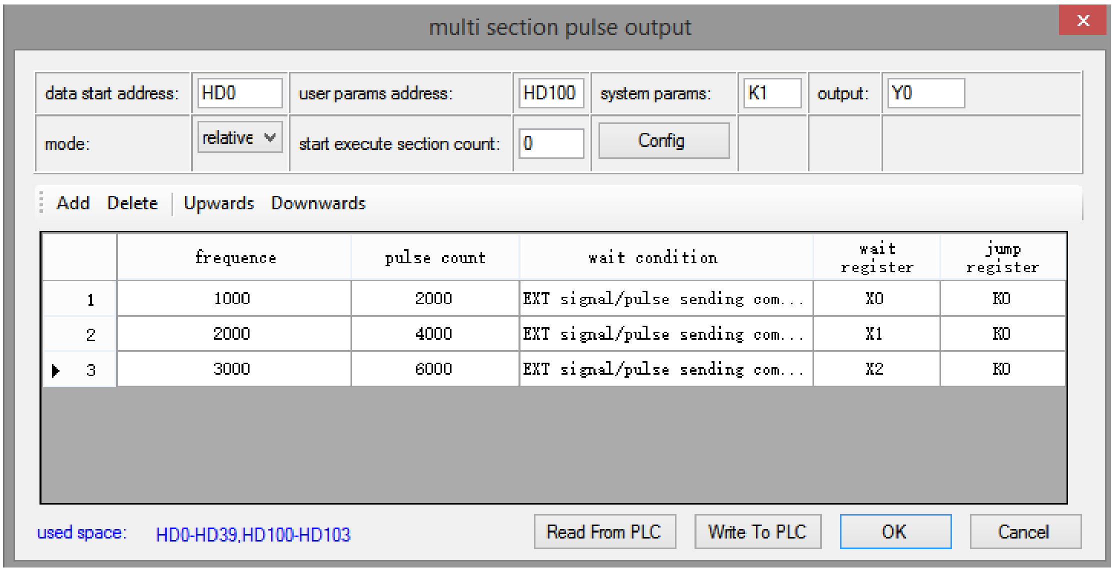
4: if the EXT signal is triggered when the pulse is decelearting, it will accelerate from present position to pulse segment 2, the same way, it will accelerate to pulse segment 3 from the position EXT signal is triggered. Refer to below diagram:




**Pulse output diagram**

- **EXT signal/pulse sending complete (H05)**

It will jump to appointed segment when the bit signal is triggered or pulse sending completes.
If the external signal is triggered before the pulse sending ends, it will jump to appointed segment, otherwise it will jump to appointed segment when present segment finishes (the pulse segment will send pulse as configuration parameters, if there is external EXT signal, it will not continue the present segment but jump to appointed segment).
For example:




**Multi-segment pulse configuration**

EXT signal X0 is valid when segment 1 pulse is sending(frequency 1000Hz, pulse number 2000), EXT signal X1 is valid when segment 2 pulse is sending(frequency 2000, pulse number 4000), EXT signal X2 is valid when segment 3 pulse is sending(frequency 3000Hz, pulse number 6000).

■ Wait register

● **Constant (H00)**

The value in register S0+N*10+5 (double word) is constant, range K0~K2147483647, eg. K2, K6, K3000.

● **D (H01)**

The value in register S0+N*10+5 (double word) is register D, for example, D0, D200.

● **HD (H02)**

The value in register S0+N*10+5 (double word) is register HD(latched register), for example HD0, HD200.

● **FD (H03)**

The value in register S0+N*10+5 (double word) is register FD(Flash register), for example, FD0, FD200.

● **X (H04)**

The value in register S0+N*10+5 (double word) is X(input signal), if the signal is external interruption terminal, the pulse will be triggered by interruption signal(response faster), for example X0, X6.

● **M (H05)**

The value in register S0+N*10+5 (double word) is M(normal coil), for example, M0, M200.

● **HM (H06)**

The value is register S0+N*10+5 (double word) is HM(latched coil), for example, HM0, HM200.

■ Jump register

● **Constant (H00)**

The register value in S0+N*10+8 (double word) is constant, range K0~K100, for example K2, K6.

● **D (H01)**

The value in register S0+N*10+8 (double word) is D(normal register), for example D0, D200.

- **HD (H02)**

The value in register S0+N*10+5 (double word) is HD(latched register), for example HD0, HD200.

- **FD (H03)**

The value in register S0+N*10+5 (double word) is FD(Flash register), for example FD0, FD200.

**Note:**

1: whatever it is constant or register, the value range is K0~K100.
2: this parameter means the present pusle segment ends and jumps to appointed segment. For example, the value is K6, it will jump to pulse segment 6 when the present pulse segment ends.
3: if the jump register or constant is 0, it will jump to next segment, if there is no next pulse segment, it will finish the present pulse segment then stop.
4: if the constant or register value is present segment number, it will infinite loop the present pulse segment.

### 1-2-1-2. Pulse user parameters (S1)

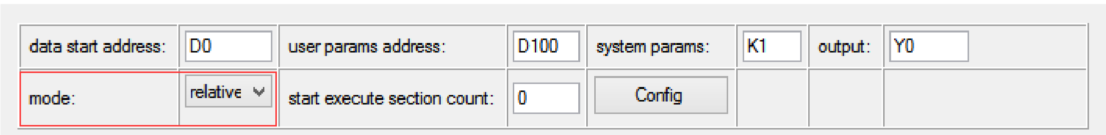
The pulse user parameters start from S1.

**The pulse user parameters starting address (S1)**

| Address | Content |
|---|---|
| S1+0 (double word) | Pulse relative/absolute mode (0: relative 1: absolute) *[1] |
| S1+2 (double word) | Pulse start execution segment number ( 1~100)*[2] |

a. Relative/absolute mode

S1+0 (double word) defines the pulse configuration mode is relative or absolute, default is relative mode.




**For example:**

There are 3 segments of pulse, segment 1 is 2000 pulse numbers, 1000Hz, segment 2 is 4000 pulse numbers, 2000Hz, segment 3 is 6000 pulse numbers, 3000Hz. The pulse configuration is shown as below:

| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 1000 | 2000 | pulse sending complete | K0 | K0 |
| ▸ 2 | 2000 | 4000 | pulse sending complete | K0 | K0 |
| 3 | 3000 | 6000 | pulse sending complete | K0 | K0 |

**Relative mode configuration table**

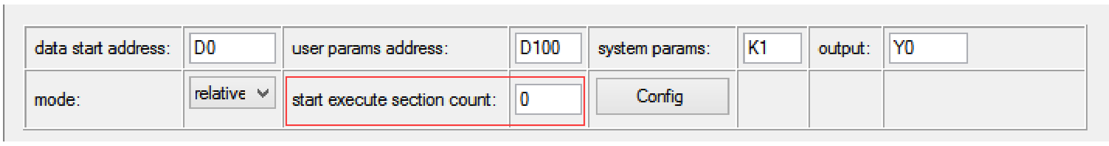
| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 1000 | 2000 | pulse sending complete | K0 | K0 |
| 2 | 2000 | 6000 | pulse sending complete | K0 | K0 |
| 3 | 3000 | 12000 | pulse sending complete | K0 | K0 |

**Absolute mode configuration table**

b. Start execution segment

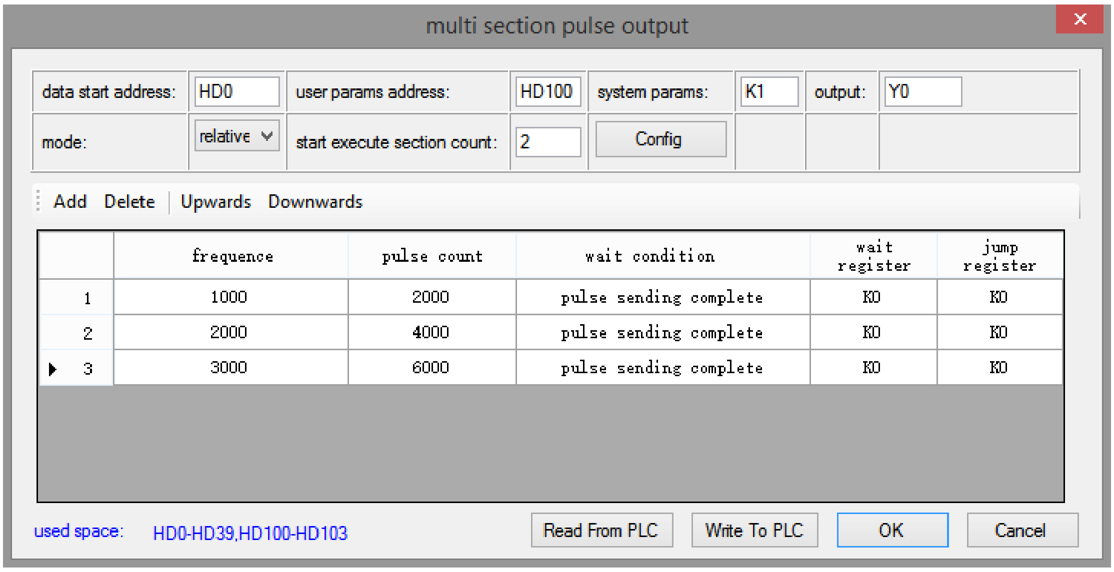
Start execution segment means the pulse instruction start segment (the pulse will start from the appointed segment but not segment 1).

Note: if it is set to 0 or 1, it will start from segment 1.




**For example:**

There are three segments of pulse: segment 1 is 1000Hz, 2000 pulse numbers, segment 2 is 2000Hz, 4000 pulse numbers, segment 3 is 3000Hz, 6000 pulse numbers, the start execution segment is 2:




| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 1000 | 2000 | pulse sending complete | K0 | K0 |
| 2 | 2000 | 4000 | pulse sending complete | K0 | K0 |
| 3 | 3000 | 6000 | pulse sending complete | K0 | K0 |

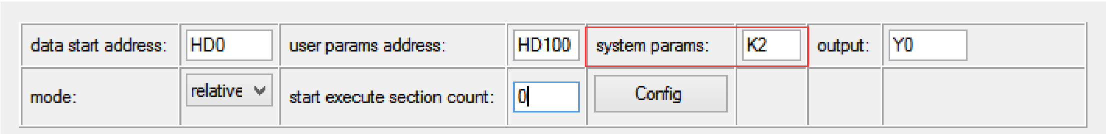
**Multi-segment pulse output configuration table**

The PLSR will send 4000 pulse numbers with the speed 2000Hz, then send 6000 pulse numbers with the speed 3000Hz.

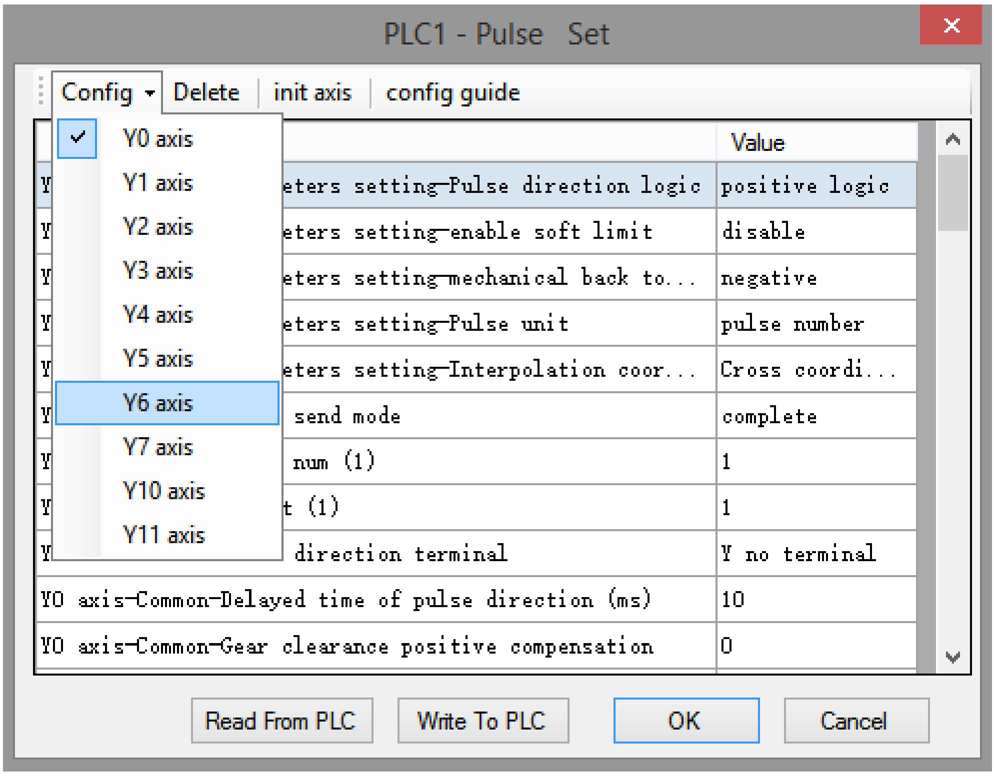
### 1-2-1-3. System parameters (S2)

There are 4 groups of system parameters. User can select one of them to execute the pulse output. Each pulse output terminal has related system parameter address.

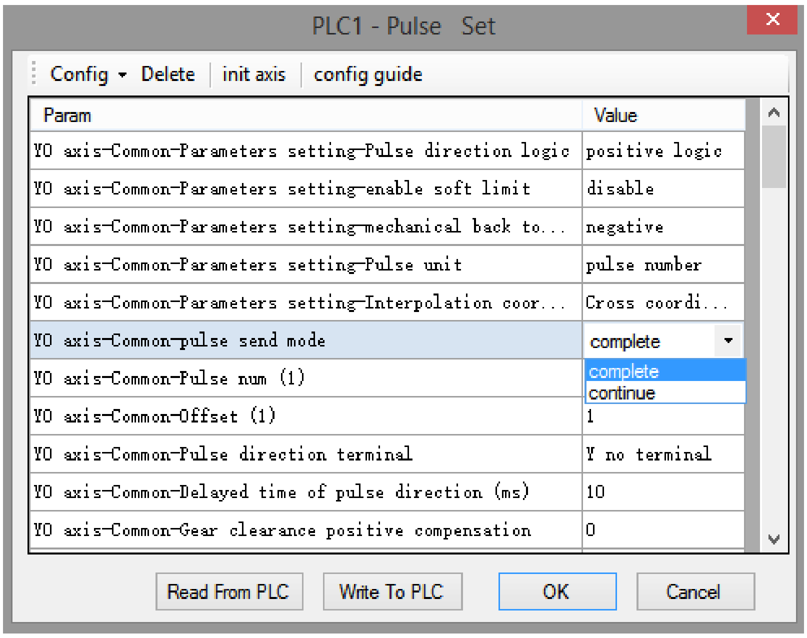
User can set the system parameter group no. in S2 (constant, register D, HD, FD…). As the following figure, system parameter group is 2, output terminal is Y0.



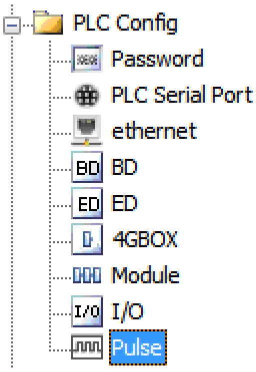

Click “config” button to enter system parameters.



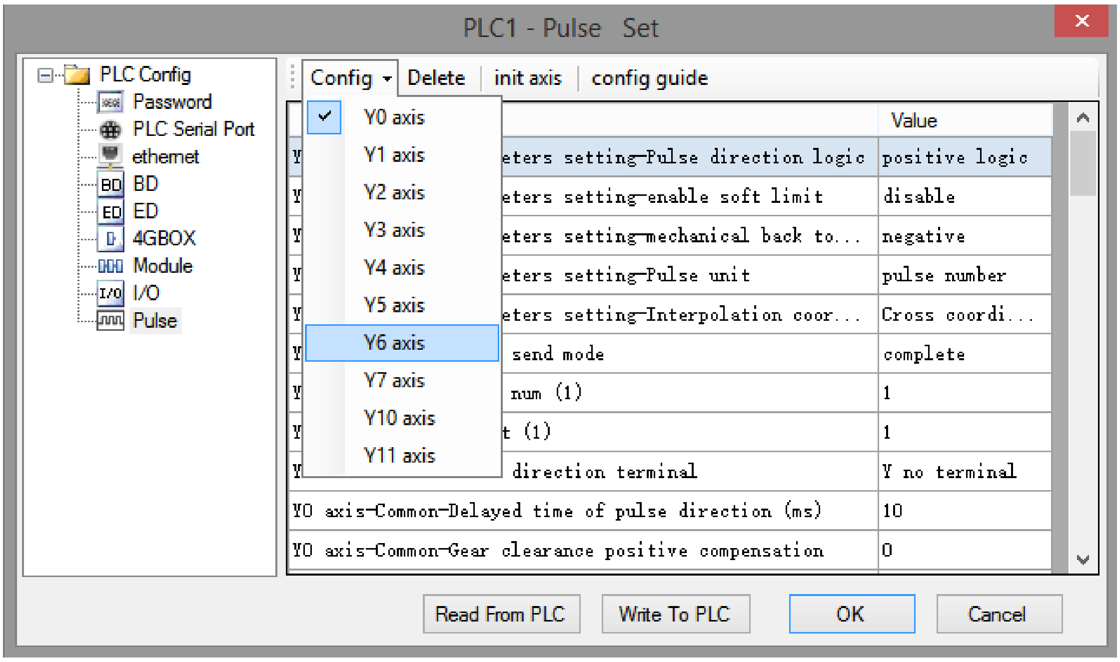

Click “config” can configure 10 channels (Y0~Y11) system parameters. Click each parameter to set the value:



Some instructions do not have panel configuration mode, when user needs to set the system parameters, please click the left side of software, and click “pulse” to set the parameters.




Then click “config” to set the parameters:




**Note:**

For the same pulse output terminal, the system parameters are shared. For example, if set the system parameters is K1, all the pulse instructions for Y0 will use system parameter group 1.

The following table shows the 4 groups of system parameter of first channel (Y0), each group of parameter can set different pulse default speed, pulse default speed acceleration and deceleration time, gear clearance acceleration/deceleration time, max speed limit, start speed and end speed…(please see below details).

Take first channel (Y0) as an example, other terminal system parameters please refer to appendix 3.

| Address | Parameter | Explanation | Type | Output terminal |
|---|---|---|---|---|
| SFD900 | Pulse parameters | Bit1: pulse direction logic<br>0: positive logic, 1: negative logic, default is 0<br>Bit2: soft position limit<br>0: OFF 1: ON, default is 0<br>Bit3: machine back to origin direction<br>0: negative direction 1: positive direction, default is 0<br>Bit10~ Bit8: pulse unit<br>Bit8: 0: pulse numbers, 1: equivalent<br>000: pulse numbers<br>001: micron<br>011: centimillimeter<br>101: decimillimeter<br>111: millimeter<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate, 1: polar coordinate<br>Default is 0 | Common parameter | PULSE_1 |
| SFD901 | Pulse output mode | Bit0: pulse output mode<br>0: completion mode, 1: subsequent mode<br>Default is 0 | | |
| SFD902 | Pulse number/1 rotate low 16-bit | | | |
| SFD903 | Pulse number/1 rotate high 16-bit | | | |
| SFD904 | Movement amount/1 rotate low 16-bit | | | |
| SFD905 | Movement amount/1 rotate high 16-bit | | | |
| SFD906 | Pulse direction terminal | The number of terminal Y, 0xFF is no terminal | | |
| SFD907 | Direction delay time | Default is 20, unit: ms | | |
| SFD908 | Gear clearance positive compensation | | | |
| SFD909 | Gear clearance negative compensation | | | |

| | | | | |
|---|---|---|---|---|
| SFD910 | Electric origin low 16-bit | | | |
| SFD911 | Electric origin high 16-bit | | | |
| SFD912 | Signal terminal state setting | Bit0: origin signal ON/OFF state<br>Bit1: Z phase ON/OFF state<br>Bit2: positive limit ON/OFF state<br>Bit3: negative limit ON/OFF state<br>0: normally ON(positive logic), 1: normally close(negative logic), default is 0 | | |
| SFD914 | Z phase terminal setting | Bit0~Bit7: X terminal number, 0xFF is no terminal | | |
| SFD915 | Limit terminal setting | Bit7~Bit0: positive limit X terminal number, 0xFF is no terminal<br>Bit15~Bit8: negative limit X terminal number, 0xFF is no terminal | | |
| SFD917 | Zero clear CLR signal output terminal setting | Bit0~Bit7: Y terminal number, 0xFF is no terminal | | |
| SFD918 | Return speed VH low 16-bit | | | |
| SFD919 | Return speed VH high 16-bit | | | |
| SFD922 | Crawling speed VC low 16-bit | | | |
| SFD923 | Crawling speed VC high 16-bit | | | |
| SFD924 | Mechanical origin low 16-bit | | | |
| SFD925 | Mechanical origin high 16-bit | | | |
| SFD926 | Z phase numbers | | | |
| SFD927 | CLR signal delay time | Default is 20, unit: ms | | |
| SFD928 | Wheel radius (polar coordinate) | Low 16-bit | | |
| SFD929 | | High 16-bit | | |
| SFD930 | Soft limit positive pole value | Low 16-bit | | |
| SFD931 | | High 16-bit | | |
| SFD932 | Soft limit negative pole value | Low 16-bit | | |
| SFD933 | | High 16-bit | | |
| …… | | | | |

| | | | | |
|---|---|---|---|---|
| SFD950 | Pulse default speed low 16-bit | It will output pulse with default speed when the speed is 0 | Group1 parameter | |
| SFD951 | Pulse default speed high 16-bit | | | |
| SFD952 | Pulse default speed acceleration time | | | |
| SFD953 | Pulse default speed deceleration time | | | |
| SFD954 | Gear clearance acc/dec time | | | |
| SFD955 | Acceleration deceleration mode | Bit1~Bit0: acc/dec mode<br>00: linear acc/dec<br>01: S curve acc/dec<br>10: sine curve acc/dec<br>11: reserved<br>Bit15~ Bit2: reserved | | |
| SFD956 | Max speed limit low 16-bit | | | |
| SFD957 | Max speed limit high 16-bit | | | |
| SFD958 | Start speed low 16-bit | | | |
| SFD959 | Start speed high 16-bit | | | |
| SFD960 | End speed low 16-bit | | | |
| SFD961 | End speed high 16-bit | | | |
| SFD962 | Follow performance parameter | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 ticks. | | |
| SFD963 | Follow feedforward compensation parameter | 0~100, percentage | | |
| …… | | | | |
| SFD970 | Pulse default speed low 16-bit | It will output pulse with default speed when the speed is 0 | Group2 parameter | |
| SFD971 | Pulse default speed high 16-bit | | | |
| SFD972 | Pulse default speed acceleration time | | | |
| SFD973 | Pulse default speed deceleration time | | | |

| | | | | |
|---|---|---|---|---|
| SFD974 | Gear clearance acc/dec time | | | |
| SFD975 | Acceleration deceleration mode | Bit1~Bit0: acc/dec mode<br>00: linear acc/dec<br>01: S curve acc/dec<br>10: sine curve acc/dec<br>11: reserved<br>Bit15~ Bit2: reserved | | |
| SFD976 | Max speed limit low 16-bit | | | |
| SFD977 | Max speed limit high 16-bit | | | |
| SFD978 | Start speed low 16-bit | | | |
| SFD979 | Start speed high 16-bit | | | |
| SFD980 | End speed low 16-bit | | | |
| SFD981 | End speed high 16-bit | | | |
| SFD982 | Follow performance parameter | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 ticks. | | |
| SFD983 | Follow feedforward compensation parameter | 0~100, percentage | | |
| …… | | | | |
| SFD990 | Pulse default speed low 16-bit | It will output pulse with default speed when the speed is 0 | Group3 parameter | |
| SFD991 | Pulse default speed high 16-bit | | | |
| SFD992 | Pulse default speed acceleration time | | | |
| SFD993 | Pulse default speed deceleration time | | | |
| SFD994 | Gear clearance acc/dec time | | | |
| SFD995 | Acceleration deceleration mode | Bit1~Bit0: acc/dec mode<br>00: linear acc/dec<br>01: S curve acc/dec<br>10: sine curve acc/dec<br>11: reserved<br>Bit15~ Bit2: reserved | | |

| | | | | |
|---|---|---|---|---|
| SFD996 | Max speed limit low 16-bit | | | |
| SFD997 | Max speed limit high 16-bit | | | |
| SFD998 | Start speed low 16-bit | | | |
| SFD999 | Start speed high 16-bit | | | |
| SFD1000 | End speed low 16-bit | | | |
| SFD1001 | End speed high 16-bit | | | |
| SFD1002 | Follow performance parameter | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 ticks. | | |
| SFD1003 | Follow feedforward compensation parameter | 0~100, percentage | | |
| …… | | | | |
| SFD1010 | Pulse default speed low 16-bit | It will output pulse with default speed when the speed is 0 | Group4 parameter | |
| SFD1011 | Pulse default speed high 16-bit | | | |
| SFD1012 | Pulse default speed acceleration time | | | |
| SFD1013 | Pulse default speed deceleration time | | | |
| SFD1014 | Gear clearance acc/dec time | | | |
| SFD1015 | Acceleration deceleration mode | Bit1~Bit0: acc/dec mode<br>00: linear acc/dec<br>01: S curve acc/dec<br>10: sine curve acc/dec<br>11: reserved<br>Bit15~ Bit2: reserved | | |
| SFD1016 | Max speed limit low 16-bit | | | |
| SFD1017 | Max speed limit high 16-bit | | | |
| SFD1018 | Start speed low 16-bit | | | |
| SFD1019 | Start speed high 16-bit | | | |

| | | | | |
|---|---|---|---|---|
| SFD1020 | End speed low 16-bit | | | |
| SFD1021 | End speed high 16-bit | | | |
| SFD1022 | Follow performance parameter | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 ticks. | | |
| SFD1023 | Follow feedforward compensation parameter | 0~100, percentage | | |
| … | | | | |

**Common parameter**

- Pulse direction logic

Pulse direction includes positive logic(default) and negative logic.

Positive logic: when the pulse numbers are positive value, it will output forward direction pulse (for example, HSD0 value is increasing), pulse direction terminal is ON. when the pulse numbers are negative value, it will output reverse direction pulse(for example, HSD0 value is decreasing), pulse direction terminal is OFF.

Negative logic: when the pulse numbers are positive value, it will output forward direction pulse (for example, HSD0 value is increasing), pulse direction terminal is OFF. when the pulse numbers are negative value, it will output reverse direction pulse(for example, HSD0 value is decreasing), pulse direction terminal is ON.

When the pulse is outputting, the direction terminal is ON, this terminal will not be reset automatically after the pulse output ends. The direction terminal will change the direction according to the pulse settings when pulse sends next time. If the pulse instruction has no direction, it needs to reset the direction terminal in the program.

Note:

1: this parameter default value is positive logic. All the program in this manual is made as positive logic.

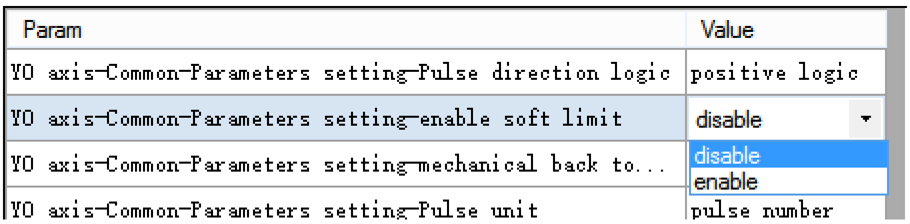
2: fit for the instruction PLSR, PLSF, ZRN.

- Enable soft limit

In order to avoid the movement beyond the range of travel, the protection function is added to both ends of the travel. It is used to auto-search the origin signal and protect when backing to mechanical origin. It will judge the value of pulse accumulated register and protect the travel.

Note: soft limit and hardware limit can be used at the same time.

The parameter configuration:



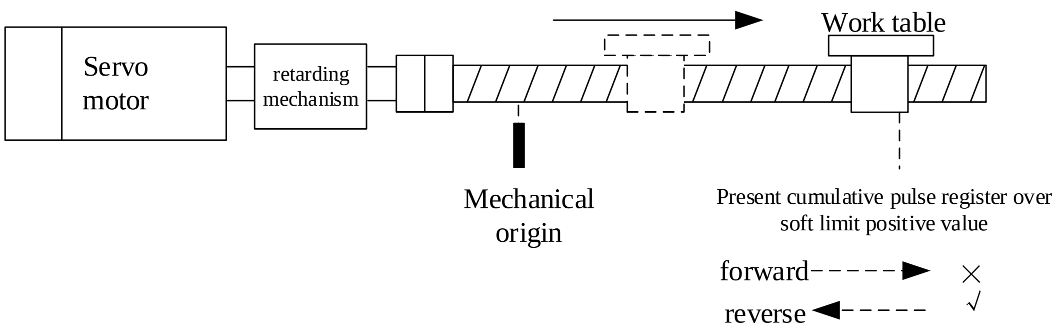
- Soft limit positive value

To prevent the table from moving beyond the range when executing the instruction PLSR, PLSF, DRVA, DRVI, interpolation instructions, it will add the value of present accumulated pulse register at the positive side of travel to protect the machine.

The configuration:

| | |
|---|---|
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |
| Y0 axis-group 1-Pulse default speed | 0 |

If the forward sending pulse reaches soft limit positive value for instruction PLSR, PLSF, DRVA, DRVI, interpolation instruction, the pulse will slow stop. If the present cumulative pulse register value is over soft limit positive value, the forward pulse will always be prohibitted, but the reverse pulse can be triggered.




**Note:**

1: the parameter value cannot over max positive travel.

2: fit for PLSR, PLSF, DRVA, DRVI and interpolation instruction.

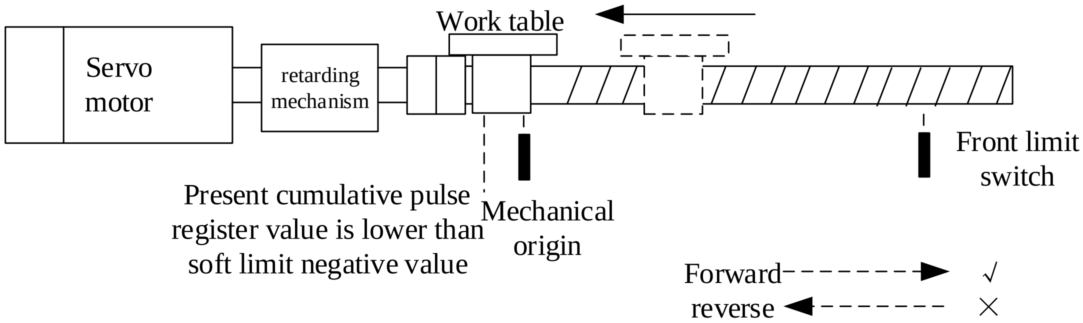
- Soft limit negative value

To prevent the table from moving beyond the range when executing the instruction PLSR, PLSF, DRVA, DRVI, interpolation instructions, it will add the value of present accumulated pulse register at the negative side of travel to protect the machine.

The configuration:

| | |
|---|---|
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |
| Y0 axis-group 1-Pulse default speed | 0 |

If the forward sending pulse reaches soft limit negative value for instruction PLSR, PLSF, DRVA, DRVI, interpolation instruction, the pulse will slow stop. If the present cumulative pulse register value is lower than soft limit negative value, the reverse pulse will always be prohibitted, but the forward pulse can be triggered.



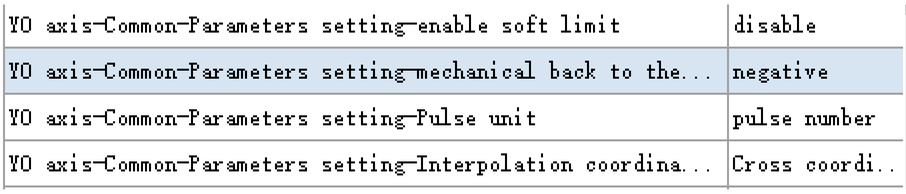

**Note:**

1: the parameter value cannot below min negative travel.

2: fit for PLSR, PLSF, DRVA, DRVI and interpolation instruction.

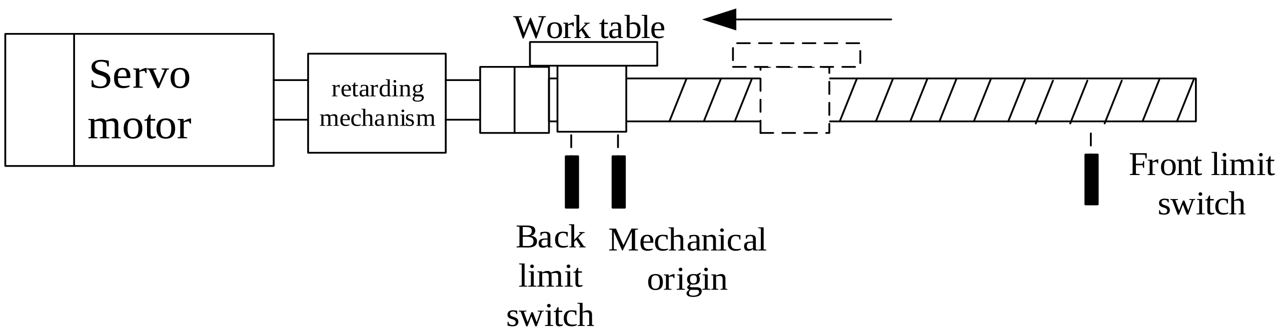
- Mechanical back to origin default direction

The work table default movement direction when the mechanical back to origin instruction ZRN is executed. The configuration:

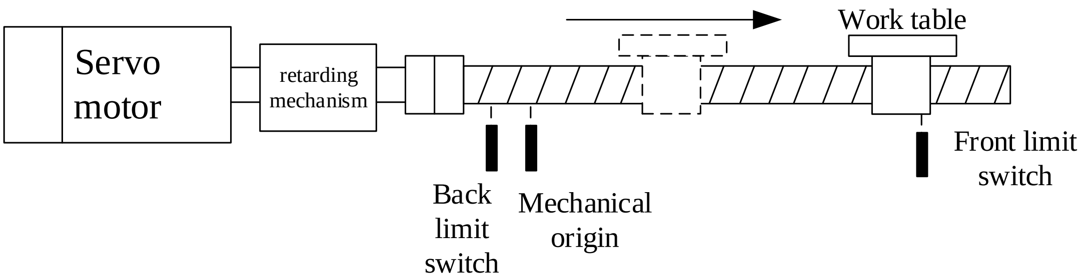


| | |
|---|---|
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to the... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coordina... | Cross coordi.. |

Negative: the work table will move in reverse direction when executing ZRN.




Positive: the work table will move in forward direction when executing ZRN.




- Pulse unit

The pulse unit include pulse number(default) and equivalent (1um, 0.01mm, 0.1mm,1mm optional).

| | |
|---|---|
| axis-Common-Parameters setting-mechanical back to the... | negative |
| axis-Common-Parameters setting-Pulse unit | pulse number |
| axis-Common-Parameters setting-Interpolation coordina... | pulse number<br>1um<br>0.01mm<br>0.1mm<br>1mm |
| axis-Common-pulse send mode | |
| axis-Common-Pulse num (1) | |

pulse number: if the pulse unit is pulse number, all the pulse frequency and number in the configuration table are calculated by pulse number. for example:

| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 1000 | 2000 | pulse sending complete | K0 | K0 |
| 2 | 2000 | 4000 | pulse sending complete | K0 | K0 |
| 3 | 3000 | 6000 | pulse sending complete | K0 | K0 |

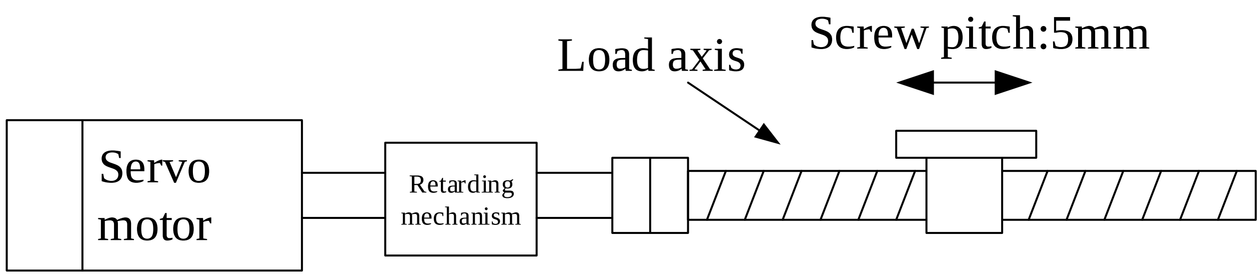
There are three segments in the configuration table, segment 1 will send 2000 pulses at the speed 1000Hz, segment 2 will send 4000 pulses at the speed 2000Hz, segment 3 will send 6000 pulses at the speed 3000Hz.

Equivalent: 1um, 0.01mm, 0.1mm, 1mm optional. All the pulse frequency and equivalent in the configuration table are calculated by length unit. Before explaining the equivalent, we will introduce pulse number (1 rotate) and offset(1 rotate) first.

- Pulse number (1 rotate)

The pulse number that the transmission mechanism rotates 1 circle. As there is retarding mechanism, the motor rotates one circle does not mean the transmission mechanism rotates one circle.

For example: one servo motor drives lead screw through retarding mechanism, the servo drive model is DS2-20P7-AS, servo motor model is MS-80ST-M02430B-20P7(encoder 2500 ppr), the servo drive electronic gear ratio is 1:1, reduction ratio of retarding mechanism is 1:5, the pitch of the ball screw is 5mm.




The pulse number of ball screw rotating one circle:

$$50000 = 2500 * 4 * \frac{5}{1}$$

- Offset(1 rotate)

The movement quantity of transmission mechanism rotates 1 circle. For example, in the above application, the offset is the ball screw pitch 5mm. If the object is synchronous belt, the offset is the synchronous belt transmission mechanism shaft perimeter.

After knowing the pulse number and offset, next we will understand how to set the equivalent. We will send three segments of pulse through the above mechanical structure.

| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 10 | 20 | pulse sending complete | K0 | K0 |
| 2 | 15 | 30 | pulse sending complete | K0 | K0 |
| 3 | 20 | 40 | pulse sending complete | K0 | K0 |

It configured three segments in above table. The pulse unit is equivalent. Segment 1 will move 20mm at the speed 10mm/s, segment 2 will move 30mm at the speed of 15mm/s, segment 3 will move 40mm at the speed of 20mm/s. The common parameters are configured as the below table:

| | |
|---|---|
| axis-Common-Parameters setting-Pulse unit | 1mm |
| axis-Common-Parameters setting-Interpolation coordina... | Cross coordi... |
| axis-Common-pulse send mode | complete |
| axis-Common-Pulse num (1) | 50000 |
| axis-Common-1mm(revolve) | 5 |

transform the equivalent to related pulse frequency and pulse number, please see below table:

| No. | Pulse unit | Frequency/speed | Pulse number/length |
|---|---|---|---|
| 1 | equivalent | 10mm/s | 20mm |
| | Pulse number | 100000pulse/s | 200000 pulse |
| 2 | equivalent | 15mm/s | 30mm |
| | Pulse number | 150000pulse/s | 300000 pulse |
| 3 | equivalent | 20mm/s | 40mm |
| | Pulse number | 200000pulse/s | 400000 pulse |

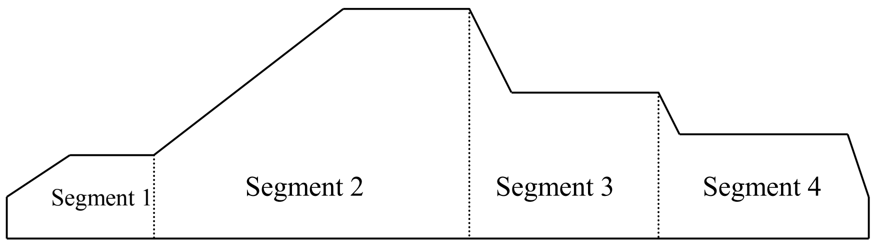
Note:
1: when the pulse unit is pulse number, Y0 axis cumulative pulse register HSD0 (double word) is pulse numbers. When the pulse unit is equivalent, Y0 axis cumulative pulse register HSD0 (double word) is pulse numbers. Register HSD2(double word) is cumulative equivalent length.
2: when the pulse unit is equivalent, all the parameters will execute as equivalent, the length unit will transform to the equivalent unit, for example 1mm, then all the unit will transform as 1mm. and the unit of offset(1 rotate) should be same to pulse unit setting, for example, pulse unit is 0.1mm, offset is 6, which means the offset of one rotate is 6*0.1mm=0.6mm, and other unit related to length and speed will be 0.1mm or 0.1mm/s.
3: please note the max output frequency cannot over 200Khz when the pulse unit is equivalent.
4: fit for instruction PLSR, PLSF, ZRN.

- Interpolation coordinate mode

This parameter is not valid for now, no need to modify.

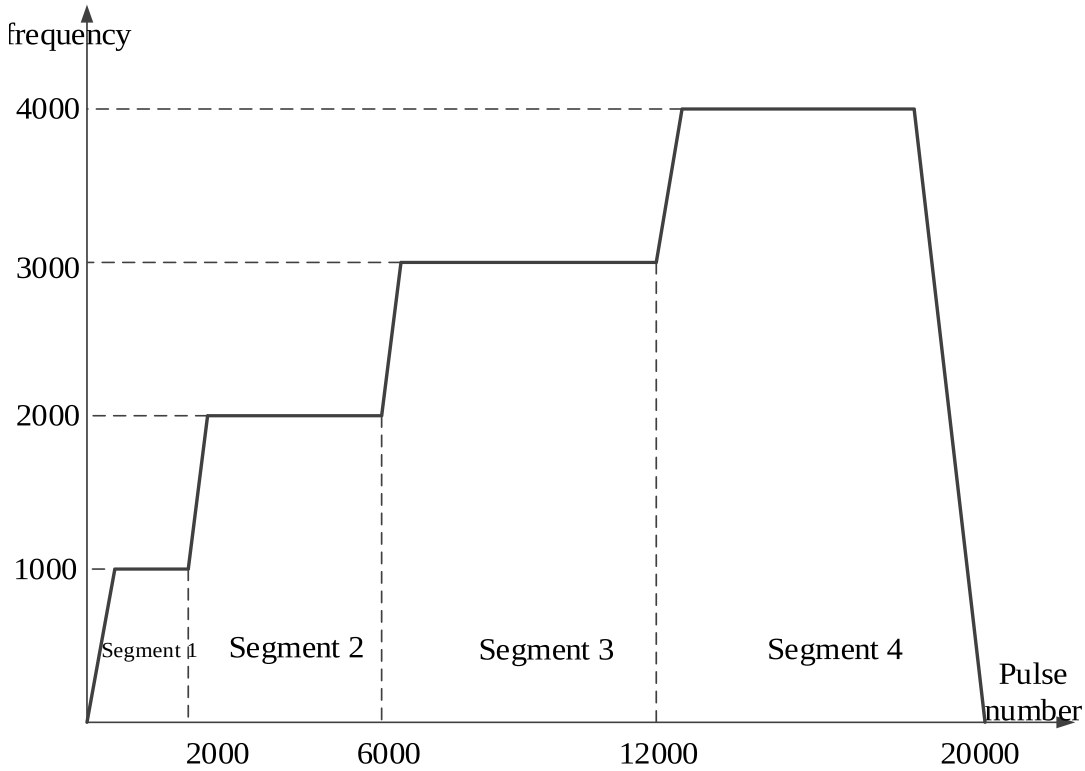
- Pulse send mode

It includes complete mode and continue mode.
Complete mode: it starts next segment of pulse when present segment pulse finishes.

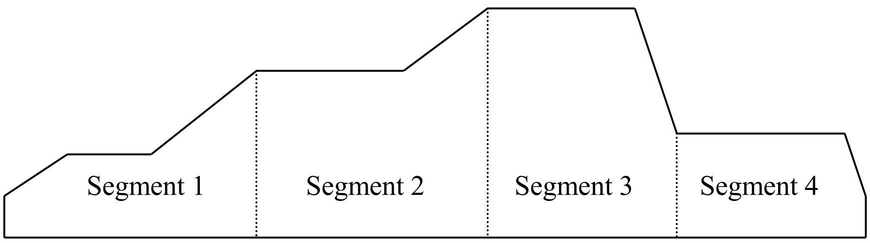



The pulse curve please refer to above diagram. Each segment will send the pulse numbers at setting speed. Except the last segment, each segment includes rising or falling part, stable part. The last segment includes rising part, falling part and stable part.

For example: the PLC needs to send four segments of pulse, segment 1 frequency is 1000Hz, pulse number is 2000, segment 2 frequency is 2000Hz, pulse number is 4000, segment 3 frequency is 3000Hz, pulse number is 6000, segment 4 frequency is 4000Hz, pulse number is 8000. It will send the pulse as complete mode, the curve please see below diagram.

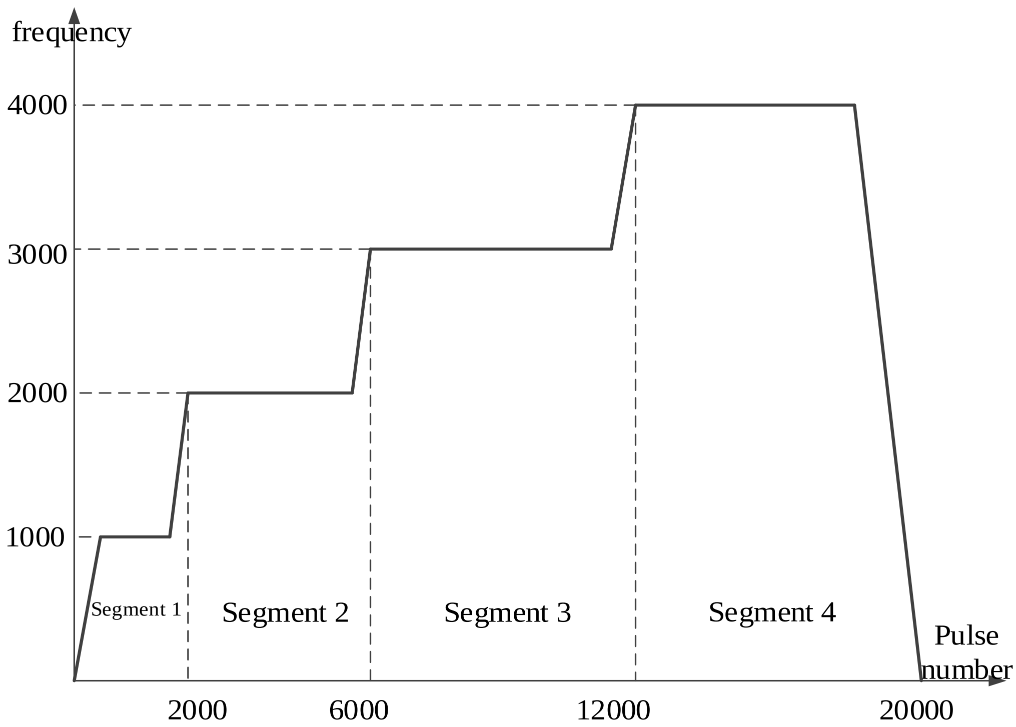



Continue mode: it already accelerates or decelerates to next segment when present segment pulse finishes sending.




The pulse curve diagram is as the above. When the present segment finishes sending, it already switch to next segment speed. Except segment 1, each segment includes stable part, rising part or falling part. Segment 1 includes rising part or falling part, stable part, rising or falling part.

For example: the PLC needs to send four segments of pulse, segment 1 frequency is 1000Hz, pulse number is 2000, segment 2 frequency is 2000Hz, pulse number is 4000, segment 3 frequency is 3000Hz, pulse number is 6000, segment 4 frequency is 4000Hz, pulse number is 8000. It will send the pulse as continue mode, the curve please see below diagram.




Note: the two modes are fit for instruction PLSR and PLSF.

- Pulse direction terminal

The pulse direction of PLSR needs to configure in the parameter table:

| | |
|---|---|
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y no terminal |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

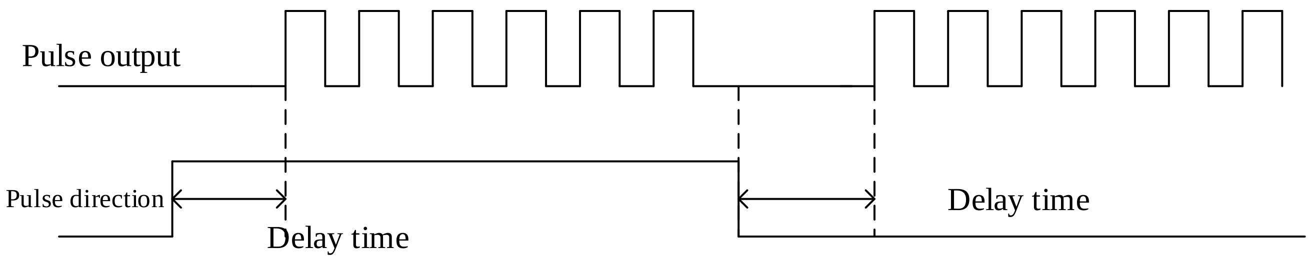
XD2, XD3, XD5 (except XD5-48T6/60T6) and XDC series transistor output PLC all have two channels of pulse output (Y0, Y1), the direction terminal can be any terminal except Y0 and Y1. XD5-48T6/60T6 has 6 channels of pulse output (Y0, Y1, Y2, Y3, Y4, Y5). XDM series has 4 channels or 10 channels pulse output (Y0, Y1, Y2, Y3 or Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11). The direction terminal can be any terminal except pulse output terminal.
The pulse output terminal uses high-speed optocoupler(response time below 5us), other terminals use normal optocoupler(response time below 0.2ms).
When Y0 is used to pulse output, and other pulse output terminals no need to output pulse, these terminals also can be pulse direction terminal. If Y0 no needs to output pulse, it also can be pulse direction terminal.

**Note:**
1: please do not choose the terminal over the actual output terminal number.
2: fit for PLSR, PLSF, ZRN.

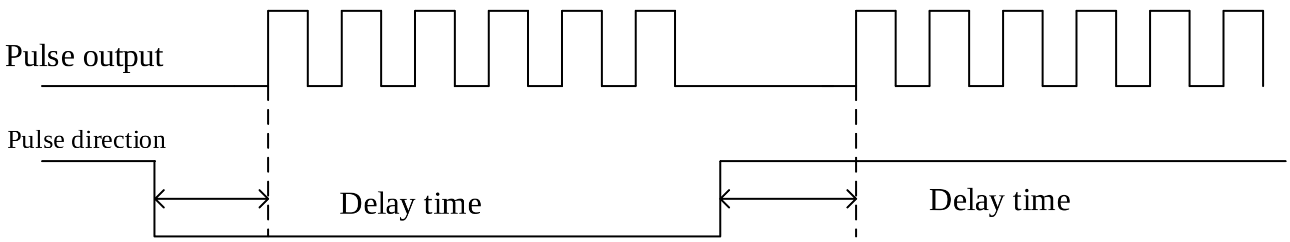
- Delayed time of pulse direction

When it is sending forward direction pulse, it will set ON the direction terminal first, then output the pulse after the delay time. When it is sending reverse direction pulse, it will set OFF the direction terminal first, then output the pulse after the delay time.

| | |
|---|---|
| Y0 axis-Common-Pulse direction terminal | Y no terminal |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |
| Y0 axis-Common-Gear clearance positive compensation | 0 |




**Pulse start, forward pulse switch to reverse pulse**



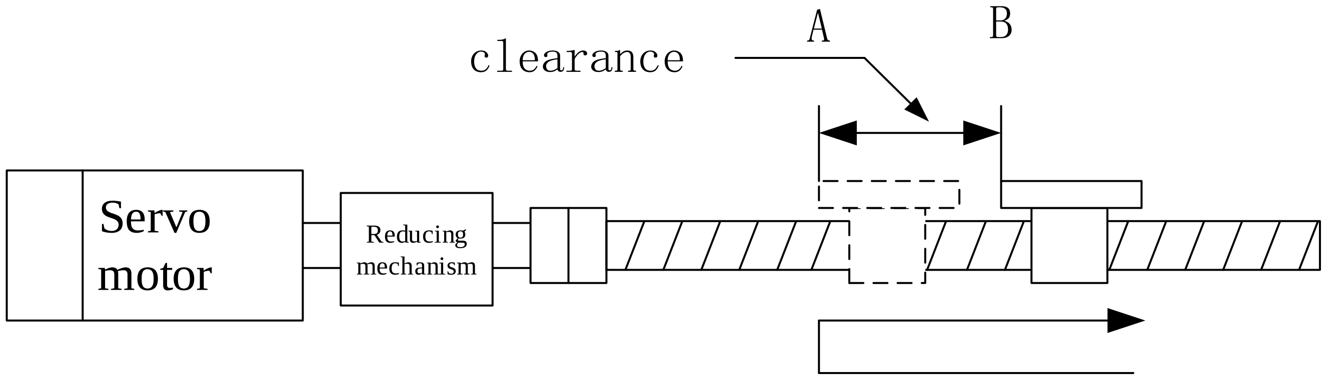

**Reverse pulse switch to forward pulse**

As the pulse output terminal is high-speed optocoupler(response time below 5us), other terminals are normal optocoupler(response time below 0.2ms)(such as XD3-32T-E) or relay output(about 10ms)(such as XD3-24R-E), the direction terminal will output after pulse terminal, so the direction terminal must be triggered first, then delay some time to output pulse. This can avoid the pulse error caused by direction switch lag(forward pulse switch to reverse pulse or reverse pulse switch to forward pulse).
The default pulse direction delay time is 10ms, user can adjust the time according to the terminal output type and scanning period(Y0 and Y1 response time is 5us, other transistor terminal is 0.2ms, relay output is 10ms).

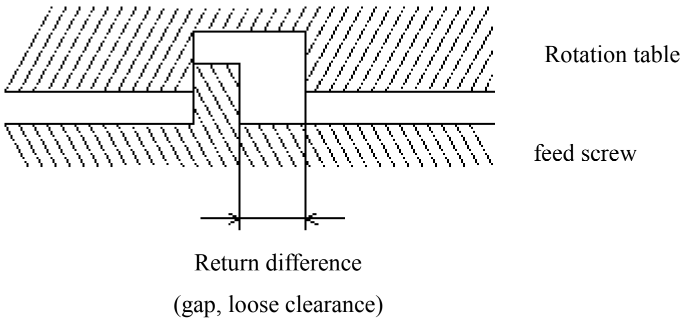
Note: suitable for PLSR, PLSF, ZRN.

- Gear clearance positive compensation

When the work table finished reverse moving and switched to forward moving, there is clearance between table and ball screw, it will cause the actual moving distance is less than setting value, this parameter can delete this error.

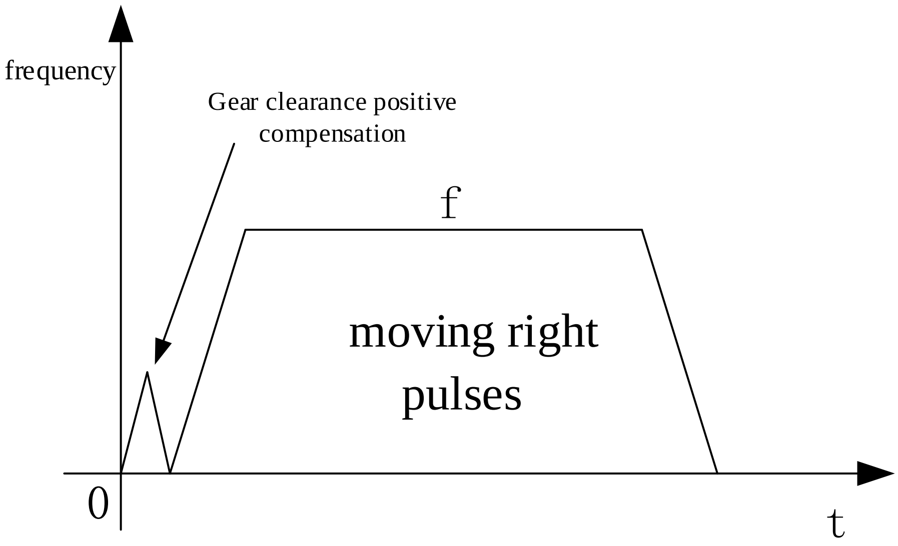



**Mechanical structure**




**Mechanical clearance structure**

The table moves from right to left, when the table left side moves to position A, it will stop and moves from left to right. As the ball screw clearance, it cannot move right for some pulses, and the actual moving distance is less than setting value. If there is no clearance, it will move from A to B. in order to delete the error, we must send some pulses before moving right, and then send the actual moving right pulses.



**Note:**

※1: it only execute the gear clearance positive compensation when the direction of last and present pulse segment is different.

※2: the gear clearance positive compensation pulses should output in separate segment, it cannot output in the same pulse segment of moving right pulses.

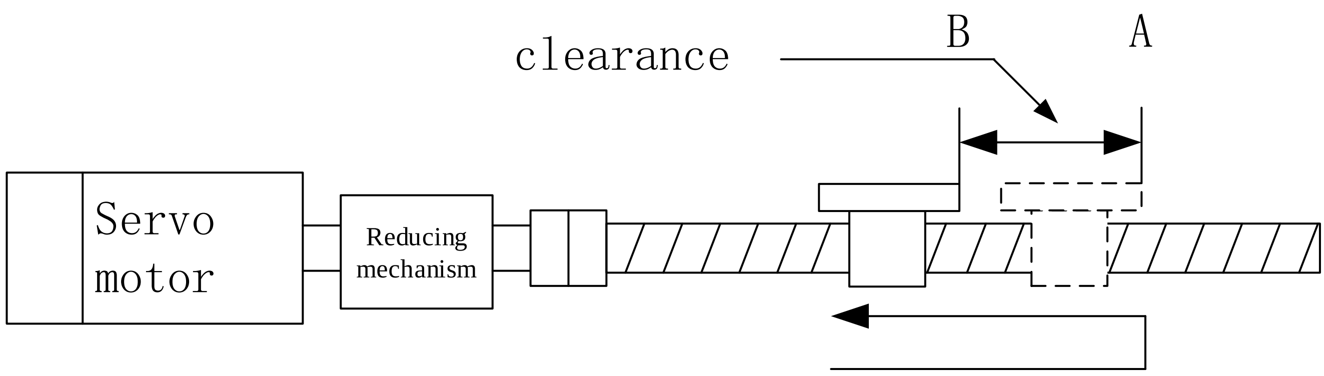
※3: the gear clearance positive compensation pulses will not be counted in pulse cumulative registers (such as HSD0 for Y0 output terminal).

※4: suitable for instruction PLSR, PLSF, ZRN.

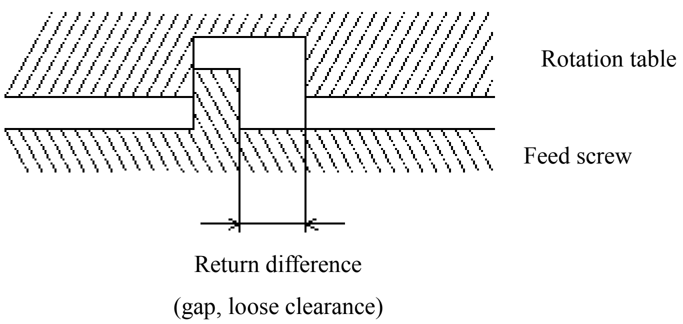
※5: the unit of gear clearance positive compensation is decided by pulse unit.

- Gear clearance negative compensation

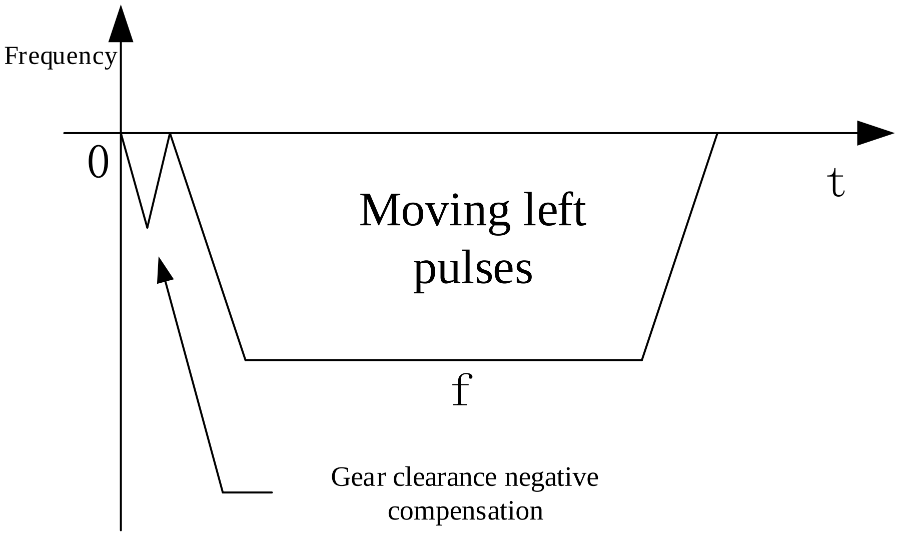
When the work table finished forward moving and switched to reverse moving, there is clearance between table and ball screw, it will cause the actual moving distance is less than setting value, this parameter can delete this error.




**Mechanical structure**




The table moves from left to right, when the table right side moves to position A, it will stop and moves from right to left. As the ball screw clearance, it cannot move left for some pulses, and the actual moving distance is less than setting value. If there is no clearance, it will move from A to B. in order to delete the error, we must send some pulses before moving left, and then send the actual moving left pulses.




**Note:**

※1: it only execute the gear clearance negative compensation when the direction of last and present pulse segment is different.

※2: the gear clearance negative compensation pulses should output in separate segment, it cannot output in the same pulse segment of moving left pulses.

※3: the gear clearance negative compensation pulses will not be counted in pulse cumulative registers (such as HSD0 for Y0 output terminal).

※4: suitable for instruction PLSR, PLSF, ZRN.

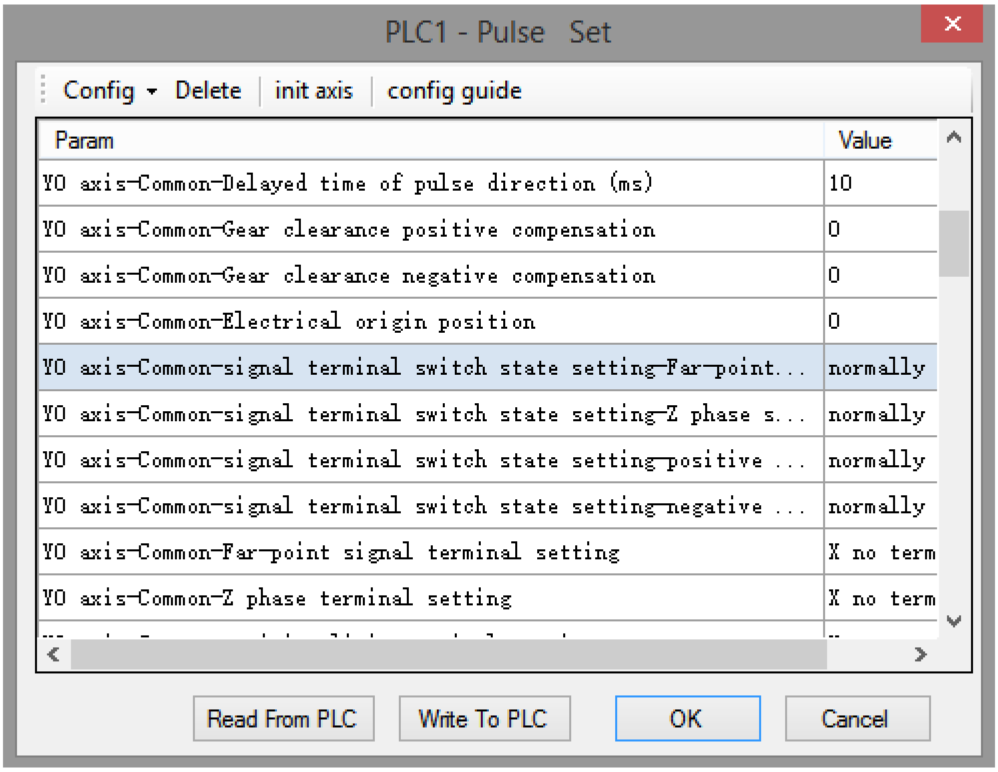
※5: the unit of gear clearance negative compensation is decided by pulse unit.

- Electrical origin position

This parameter cannot modify.

- Signal terminal switch state-point switch state setting

It can set the state of the signal collection terminal. The terminal state can be normally open and normally close. The signal terminal includes origin point, Z phase switch, positive limit switch, negative limit switch.



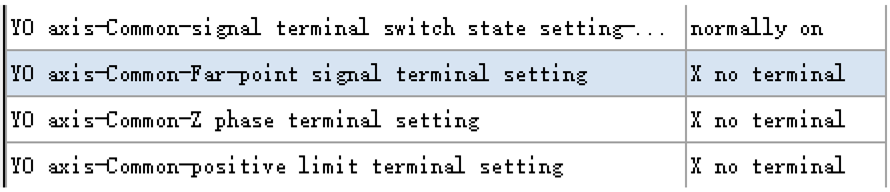

Take origin point as an example.

Normally open: the mechanical origin switch is normally open(OFF) when it returns origin, it will be ON when the machine touches the origin switch.

Normally close: the mechanical origin switch is normally close(ON) when it returns origin, it will be OFF when the machine touches the origin switch.

- Origin point signal terminal setting

The PLC input point of mechanical origin switch.




**Note:**

※1: the input point range cannot over actual input of PLC.

※2: only fit for mechanical return origin instruction ZRN.

※3: the origin point can be PLC input terminal, if the terminal is for external interruption input, the returning mechanical origin process will be operated as interruption and the precision will be improved (Z phase return origin has no effect). If the terminal is not for external interruption, the returning origin process will be affected by PLC scanning period (Z phase return origin has no effect).

※4: please refer to appendix 4 for details of external interruption terminal.

- Z phase terminal setting

When returning mechanical origin, it will move reverse slowly with slow speed and acceleration slop until reach origin creep speed, and it starts to count the Z phase signal at the moment of leaving the origin signal. Here can set the Z phase count input terminal.

| | |
|---|---|
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |
| Y0 axis-Common-negative limit terminal setting | X no terminal |

**Note:**

※1: only fit for mechanical return origin instruction ZRN.

※2: Z phase terminal only can be PLC external interruption input. As the pulse width of Z phase signal outputting from servo drive is very narrow, normal PLC input filter time is 10ms, the Z phase signal only can be catched through high speed optical coupler input. If using normal terminal, it cannot catch the Z phase signal and cause returning mechanical origin error.

※3: Z phase input terminals:

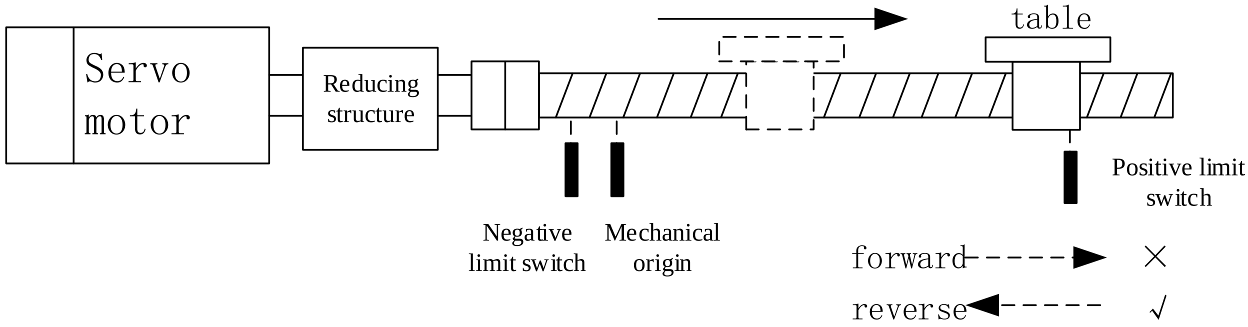
| PLC model | Z phase terminal setting |
|---|---|
| XD2-16/24/32/48/60 | X2, X3, X4, X5, X6, X7 |
| XD3-16/24/32/48/60 | X2, X3, X4, X5, X6, X7 |
| XD5-16 | X2, X3, X4, X5, X6, X7 |
| XD5-24/32/24T4/32T4/48T4/48D4T4/60T4 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XD5-48/60/48T6/60T6/60T10 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XDM-24T4/32T4 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XDM-60T4/60T4L/60T10 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XDC-24/32/48/60 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XD5E-24/30/48/60/30T4/60T4/60T6/60T10 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XDME-30T4/60T4/60T10 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XDH-60T4 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XL3-16 | X2, X3, X4, X5, X6, X7 |
| XL3-32 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XL5-16 | X2, X3, X4, X5, X6, X7 |
| XL5-32/32T4 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XL5E-16 | X2, X3, X4, X5, X6, X7 |
| XL5E-32T/32T4 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XL5E-64T6 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |
| XLME-32T4 | X2, X3, X4, X5, X6, X7, X10, X11, X12, X13 |

- Positive limit terminal setting

When the machine is returning origin (instruction ZRN), to prevent the table from moving beyond the range, the protection terminal is installed at both ends of the range. Please refer to ZRN instruction for details.

| | |
|---|---|
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |

When the instruction ZRN, PLSR, PLSF are executed, if the forward pulse touches positive limit, the pulse will stop in slow stop mode (make sure the positive limit switch is in triggered state after pulse stop). The pulse will be always prohibitted when the positive limit switch is triggered, but the reverse pulse can be triggered.




**Notes:**

※1: the input terminal cannot over the PLC actual input range.

※2: make sure the positive limit block is long enough, to ensure the positive limit switch is still triggered after pulse stop. Otherwise the table will strick the machine when the forward pulse is triggered again.

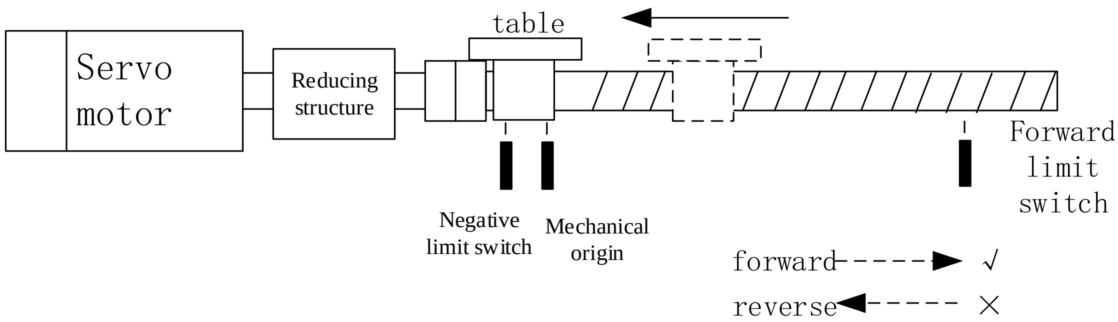
※3: fit for instruction PLSR, PLSF, ZRN.

- Negative limit terminal setting

When the machine is returning origin (instruction ZRN), to prevent the table from moving beyond the range, the protection terminal is installed at both ends of the range. Please refer to ZRN instruction for details.

| | |
|---|---|
| Y0 axis-Common-positive limit terminal setting | X no terminal |
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |

When the instruction ZRN, PLSR, PLSF are executed, if the reverse pulse touches negative limit, the pulse will stop in slow stop mode (make sure the negative limit switch is in triggered state after pulse stop). The pulse will be always prohibitted when the negative limit switch is triggered, but the forward pulse can be triggered.




**Notes:**

※1: the input terminal cannot over the PLC actual input range.

※2: make sure the negative limit block is long enough, to ensure the negative limit switch is still triggered after pulse stop. Otherwise the table will strick the machine when the reverse pulse is triggered again.

※3: fit for instruction PLSR, PLSF, ZRN.

- Zero clear CLR output setting

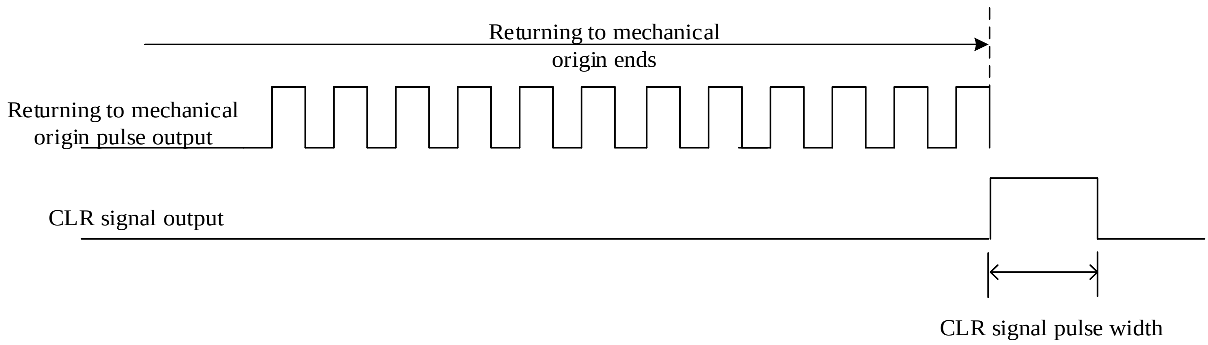
It will output the signal after the returning mechanical origin ends. This signal can send to other device such as servo drive to clear the servo motor error counter, then copy the mechanical origin position to present position to finish the returning to zero process.

| | |
|---|---|
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |

- CLR signal delayed time

The CLR signal pulse width time, the unit is ms. The range is 0 to 32767 (default is 20ms).

| | |
|---|---|
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |




**CLR signal diagram**

**Notes:**
※1: only fit for instruction ZRN.
※2: please use PLC main unit output terminal for CLR signal output.
※3: please do not set too small CLR signal delay time, otherwise the servo drive cannot receive too narrow pulse width signal.

- Return speed VH

When it starts to run ZRN, the table accelerates to return speed VH and moves towards mechanical origin, this can shorten the returning time.

| | |
|---|---|
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |

**Notes:**
※1: only fit for instruction ZRN.
※2: when the ZRN starts, VH accelerates as setting acceleration slop, then decelerates as setting deceleration slop when touching the near origin signal or origin signal.
※3: if there is no near origin signal, please do not set the VH speed too large, otherwise it will cause mechanical oscillation as the VH speed quickly decelerating to zero.
※4: if there is no near origin signal, please do not set the VH speed too large and deceleration slop too small, otherwise it will cause the table out of origin signal and even touching the reverse limit signal when decelerating to zero as the table decelerating time is too long.

- Creeping speed VC

When it meets the origin signal, the start speed decelerates to zero, after delay time, it reverse accelerates to creeping speed. It will stop the creeping speed at once when the work table leaves origin signal. As the stop position of work table leaving origin signal is mechanical origin, in order to improve mechanical origin precision, generally, the creeping speed is small.

| | |
|---|---|
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |

Note:
※1: only fit for instruction ZRN.
※2: the creeping speed acc/dec slope is same to setting acceleration/deceleration slope. It will urgent stop or count the Z phase pulse numbers when leaving origin signal.
※3: Do not set the creeping speed over 100r/min, otherwise it will affect the high precision returning to origin.
※4: Do not set the creeping speed larger than or equal to returning to origin speed VH.

- Mechanical zero position

The present position after returning to mechanical origin ends. Take axis Y0 as an example, set the present position value HSD0(double word) or HSD2(double word) after returning to mechanical origin.

Generally, the present value of mechanical origin is 0, it also can be set to other value. After the returning to mechanical origin, the related cumulative pulse register will be updated to setting value.

| | |
|---|---|
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |

Note:

※1: only fit for instruction ZRN.

※2: if the pulse unit of axis Y0 is set to pulse numbers, the mechanical origin setting value will be written in HSD0(double word) after returning to mechanical origin. If the pulse unit of axis Y0 is set to equivalent (1mm, 0.1mm, 0.01mm, 1um), the mechanical origin setting value will be written in HSD2(double word) after returning to mechanical origin.

- Z phase numbers

When it meets the origin signal, the start speed decelerates to zero, after delay time, it reverse accelerates to creeping speed. It can count the servo motor Z phase pulse when the work table leaves origin signal. It will stop creeping speed at once when the count value reaches setting Z phase pulse numbers, and mechanical returning to origin ends.

| | |
|---|---|
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |

Note:

※1: only fit for instruction ZRN.

※2: if the Z phase numbers is set to 0, it means Z phase pulse catching function is invalid, it will stop at once when leaving origin with creeping speed and returning to origin ends.

※3: please avoid the interval between work table leaving origin signal and Z phase signal is too short, otherwise the origin position will be error.

※4: Z phase signal maybe changed after install the servo motor again, please adjust it.

※5: if it is stepper motor, the external proximity switch signal can be used to Z phase signal.

- Grinding wheel radius(polar)

This parameter cannot be used right now.

| | |
|---|---|
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |

**Group 1 parameters (group 2 to 4 parameters please refer to group 1)**

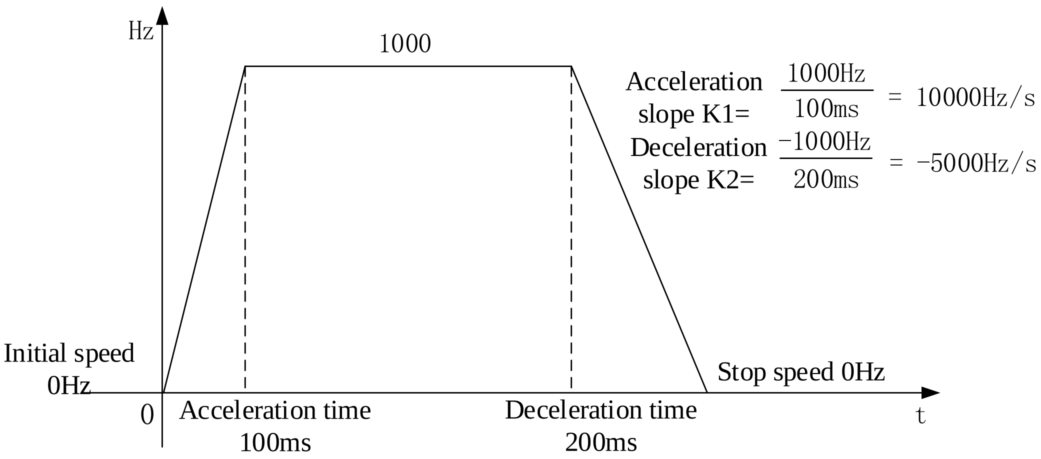
- Pulse default speed/acceleration time of default pulse speed/deceleration time of default pulse speed(ms)

The three parameters and initial speed, stop speed are used to define the pulse acceleration and deceleration slop. The pulse default speed unit is decided by pulse unit parameter.

| | |
|---|---|
| Y0 axis-group 1-Pulse default speed | 0 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 0 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 0 |

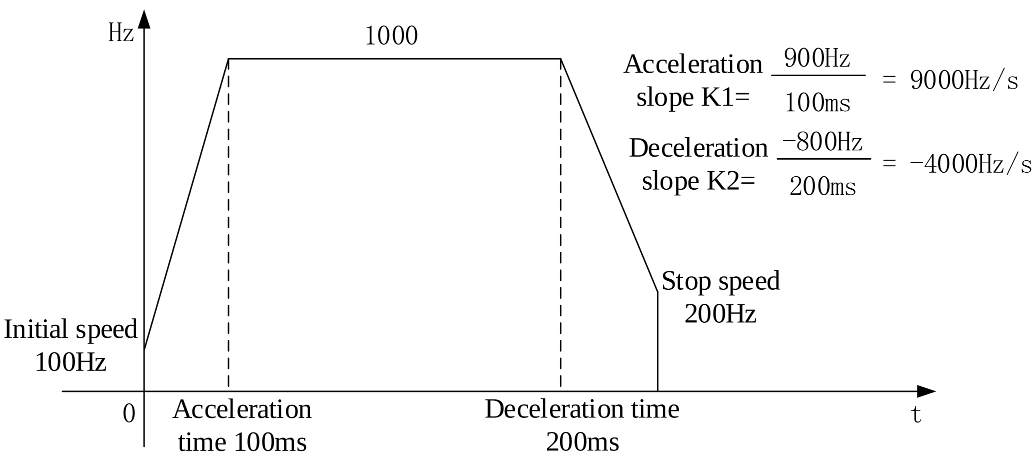
**Example 1:**

When the pulse unit is pulse numbers, pulse default speed is 1000Hz, acceleration time of pulse default speed is 100ms, deceleration time of pulse default speed is 200ms, initial speed is 0Hz, stop speed is 0Hz, it means the pulse frequency takes 100ms to increase 1000Hz and takes 200ms to decrease 1000Hz. If it accelerates from 0Hz to 5000Hz, the time is 5000/1000*100=500ms, if it decelerates from 5000Hz to 0Hz, the time is 5000/1000*200=1000ms.



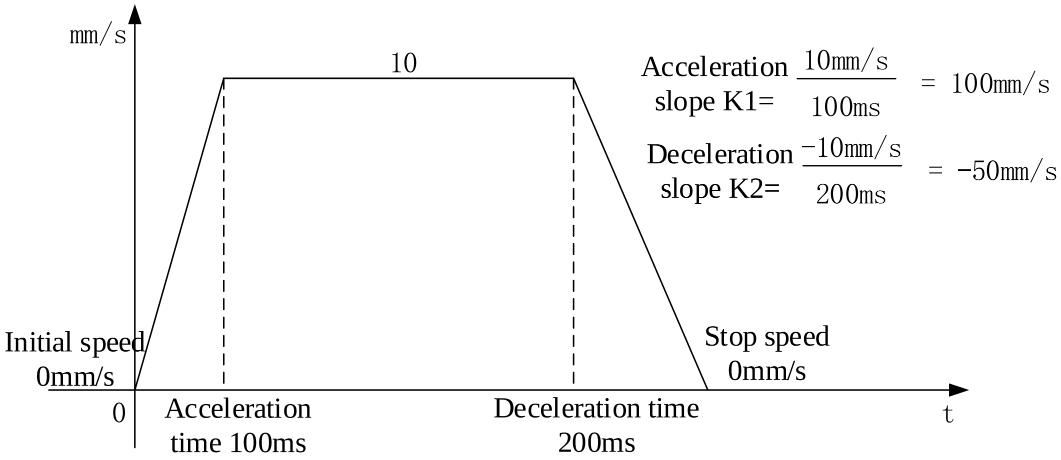

**Example 2:**

When the pulse unit is pulse numbers, pulse default speed is 1000Hz, acceleration time of pulse default speed is 100ms, deceleration time of pulse default speed is 200ms, initial speed is 100Hz, stop speed is 200Hz, it means the pulse frequency takes 100ms to increase (1000-100)=900Hz and takes 200ms to decrease (1000-200)=800Hz. If it accelerates from 0Hz to 5000Hz, the time is 5000/900*100=555ms, if it decelerates from 5000Hz to 0Hz, the time is 5000/800*200=1250ms.



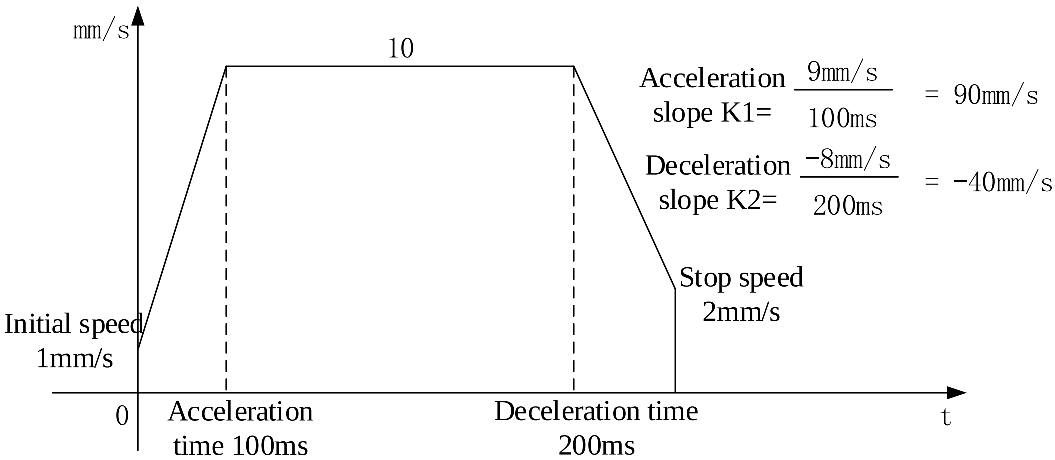
**Example 3:**

When the pulse unit is equivalent 1mm, pulse default speed is 10mm/s, acceleration time of pulse default speed is 100ms, deceleration time of pulse default speed is 200ms, initial speed is 0mm/s, stop speed is 0mm/s, it means the pulse frequency takes 100ms to increase 10mm/s and takes 200ms to decrease 10mm/s . If it accelerates from 0 to 50mm/s, the time is 50/10*100=500ms, if it decelerates from 50mm/s to 0, the time is 50/10*200=1000ms.




**Example 4:**

When the pulse unit is equivalent 1mm, pulse default speed is 10mm/s, acceleration time of pulse default speed is 100ms, deceleration time of pulse default speed is 200ms, initial speed is 1mm/s, stop speed is 2mm/s, it means the pulse frequency takes 100ms to increase (10-1)=9mm/s and takes 200ms to decrease (10-2)=8mm/s . If it accelerates from 0 to 50mm/s, the time is 50/9*100=555ms, if it decelerates from 50mm/s to 0, the time is 50/8*200=1250ms.




**Note:**

※1: the three parameters and initial speed, stop speed are used to define the acceleration and deceleration slope.

※2: the pulse acceleration slope is determined by the time accelerating from initial speed to default pulse speed, the pulse deceleration slope is determined by the time decelerating from default pulse speed to stop speed.

※3: the parameter is fit for instruction PLSR, PLSF, DRVI, DRVA, ZRN.

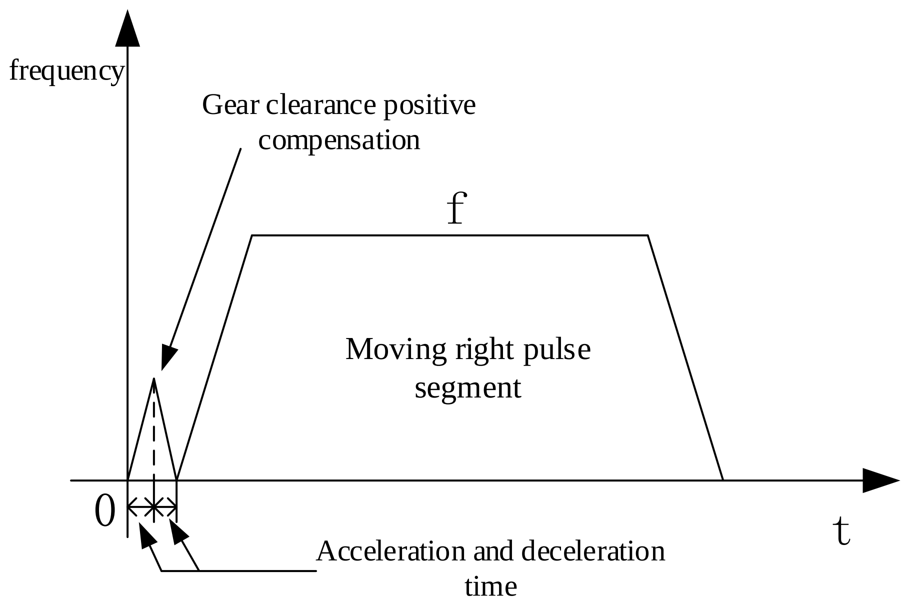
※4: initial speed and stop speed must be less than rated speed.

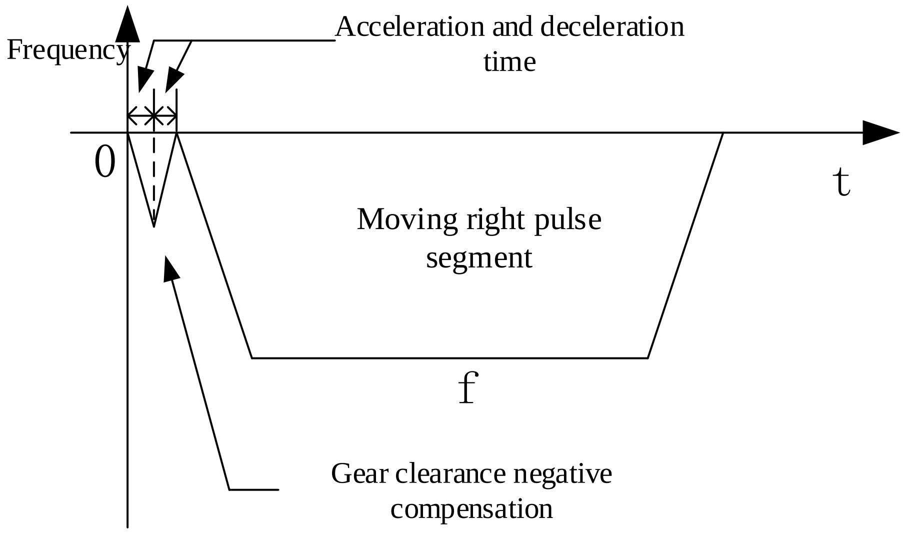
※5: the pulse default speed is not related to the pulse frequency, it is only used to set the acceleration and deceleration slope. But when the pulse frequency is 0, it will output pulse as the default pulse speed.

- Acceleration and deceleration time (ms)

This time is for gear clearance positive and negative compensation. This acceleration and deceleration time is same whatever how many is the gear clearance compensation quantity, the unit is ms.

| | |
|---|---|
| Y0 axis-group 1-Deceleration time of pulse default s... | 0 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 0 |






**Note:**

※1: the acceleration time and deceleration time is same.

※2: the acceleration and deceleration time is fixed value whatever how many is the gear clearance compensation.

※3: this parameter is fit for instruction PLSR, PLSF, DRVI, DRVA, ZRN.

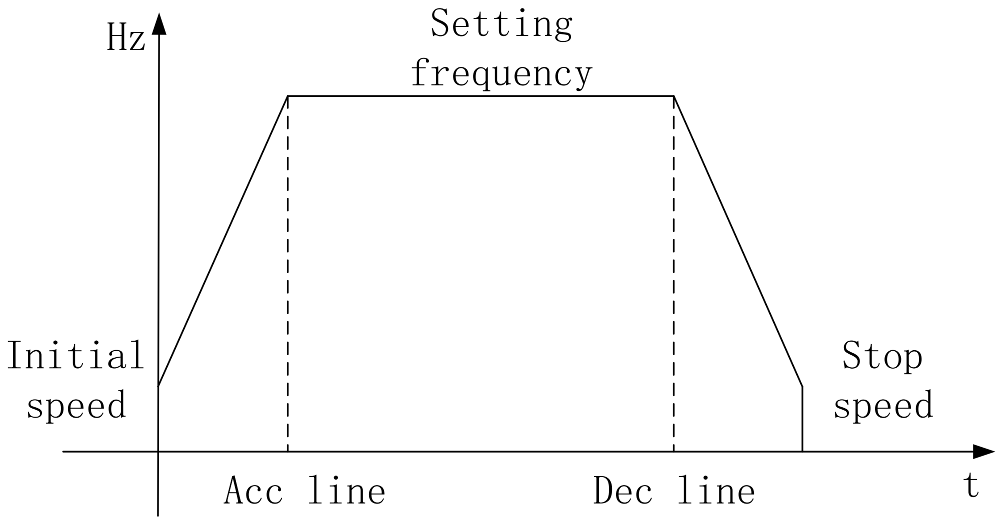
- Pulse acc/dec mode

The pulse acceleration mode accelerating from initial speed to setting frequency and pulse deceleration mode decelerating from setting frequency to initial speed.

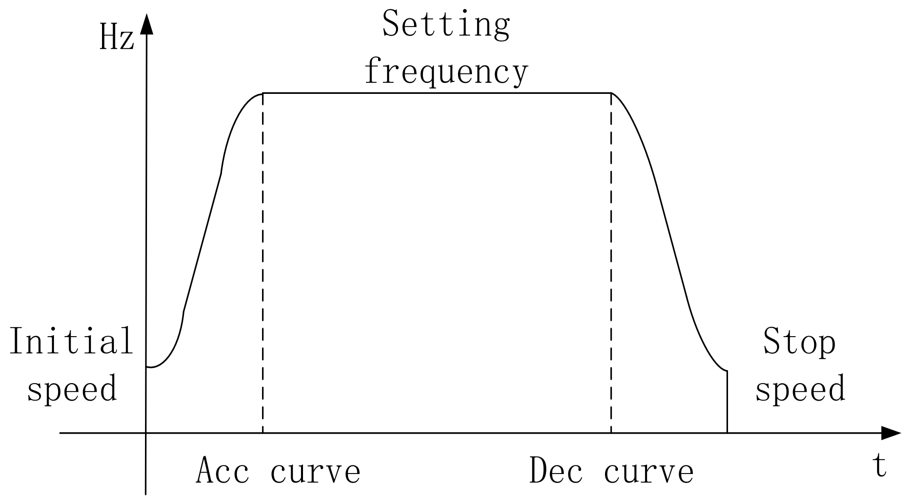
| | |
|---|---|
| Y0 axis-group 1-Deceleration time of pulse default s... | 0 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 0 |
| Y0 axis-group 1-Initial speed | 0 |

The pulse acc/dec mode include linear mode, S curve mode and sine curve mode.

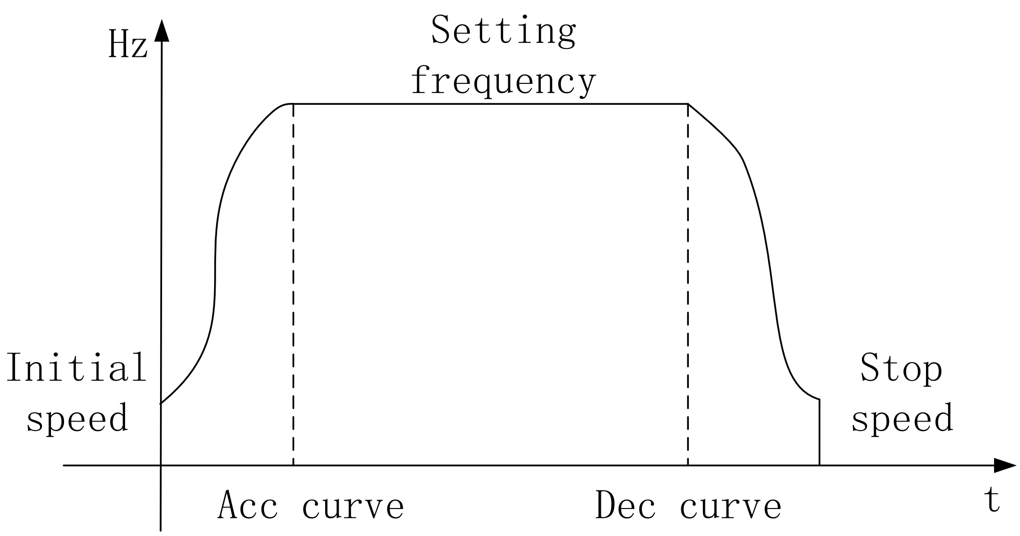
Linear mode: the speed changing for accelerating or decelerating is line.




S-curve mode: the speed changing for accelerating or decelerating is S-curve.




Sine curve mode: the speed changing for accelerating or decelerating is sine curve.



Sine-curve mode is fit for the receiving of stepper motor and servo motor and improve the run performance of stepper motor and servo motor. The details please refer to S-curve acceleration and deceleration.
Note: this parameter is fit for the instruction PLSR, PLSF, ZRN.

- Max speed

When all the pulse instructions in the program is executing parameter group 1, the highest pulse frequency cannot over the max speed, if it is over the max speed, PLC will run as the max speed.

| | |
|---|---|
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 0 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |

**Note:**
※1: the max speed unit is changing as pulse unit(pulse number or equivalent).
※2: XD all series PLC pulse output frequency max speed is 200Khz. The max speed cannot over this value.
※3: when the pulse unit is equivalent, the transformed pulse frequency maybe very large and over max speed, please pay attention.
※4: User must set the max speed when using pulse instruction, otherwise the pusle cannot output normally.
※5: this parameter is fit for instruction PLSR, PLSF, ZRN.

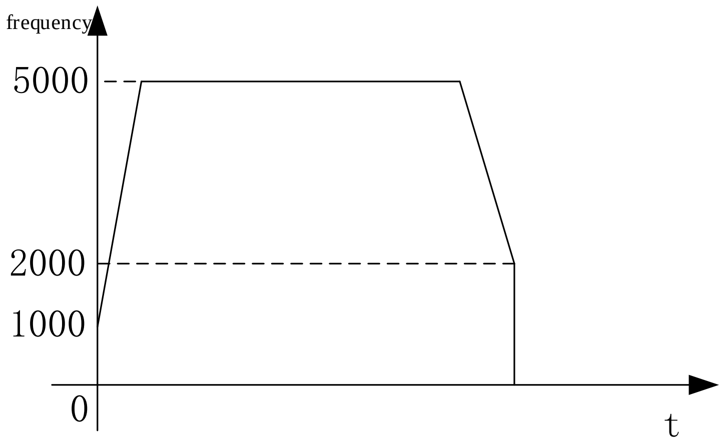
- Initial speed and stop speed

The pulse start frequency and end frequency for the pulse instruction start and completion. Generally, the initial and stop speed is 0, but for some special occasions, the pulse needs to start with non-zero speed and complete with non-zero speed.

| | |
|---|---|
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 0 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |

For example, it needs to output 30000 pulses, and accelerates from 1000Hz, takes 100ms to reach 5000Hz. And it decelerates from 5000Hz, takes 50ms to reach 2000Hz, and the pulse will complete here. The configuration is shown as below:

| | |
|---|---|
| Y0 axis-group 1-Max speed | 200000 |
| Y0 axis-group 1-Initial speed | 1000 |
| Y0 axis-group 1-stop speed | 2000 |




**Note:**

※1: the pulse unit of initial speed and stop speed is changing as the pulse number or equivalent.

※2: the initial speed and stop speed must be less than the max speed.

※3: when the pulse unit is equivalent, the transformed pulse frequency maybe very large and over max speed, please pay attention.

※4: make sure to set the initial speed and stop speed for pulse instruction, the default value is 0.

※5: this parameter is fit for instruction PLSR, PLSF, ZRN.

- Follow parameters

The FOLLOW instruction can make the slave axis servo motor or stepper motor following the master axis motor motion (which means the slave axis motion is consistant with main axis). The parameters include FOLLOW performance and FOLLOW feedforward compensation.

The FOLLOW instruction is motion following function, it can control the servo or stepper motor by outputting pulse according to motor encoder feedback.

FOLLOW performance: the function is similar to servo drive rigidity function. The smaller the value, the smaller the follow rigidity (delay time is long), the larger the value, the larger the follow rigidity (delay time is short).

FOLLOW feedforward compensation: there is delay time from receiving pulse to outputting pulse. In order to reduce the delay time, it can set the feedforward compensation, make the pulse a little advanced. But if the feedforward parameter is too large, it will enter infinite loop, the motor will vibrate when the follow process ends.

| | |
|---|---|
| Y0 axis-group 1-stop speed | 2000 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |
| Y0 axis-group 2-Pulse default speed | 0 |

### 1-2-1-4. Pulse interruption flag

Pulse instruction PLSR can set up to 100 segments of pulse. It can produce a interruption flag after each pulse segment completion.

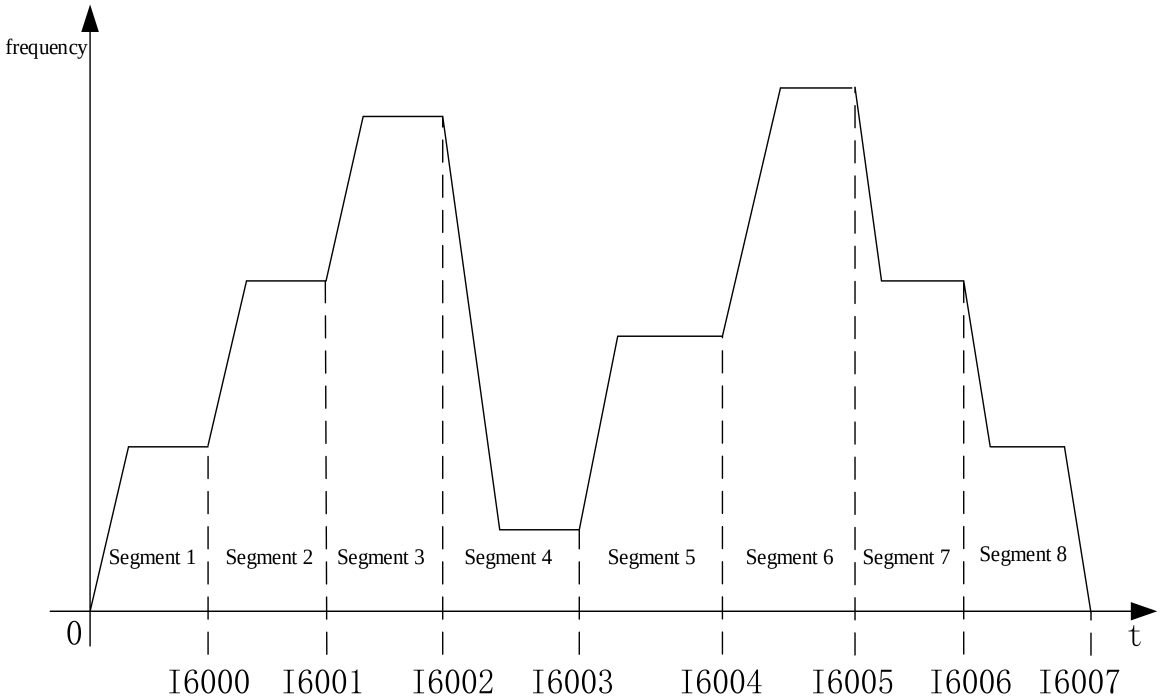
Note: each pulse segment has only one related interruption flag, whatever how is the pulse configuration jump setting, the interruption flag will be executed when this pulse segment is running.

Interruption flag for each pulse segment:

| Interruption flag | Pulse axis | Notes |
|---|---|---|
| I60**(I6000~I6099) | PLS+0 (pulse) | Y0 axis 100 pulse segments interruption |
| I61**(I1000~I6199) | PLS+1 (pulse) | Y1 axis 100 pulse segments interruption |
| I62**(I6200~I6299) | PLS+2 (pulse) | Y2 axis 100 pulse segments interruption |
| I63**(I6300~I6399) | PLS+3 (pulse) | Y3 axis 100 pulse segments interruption |
| I64**(I6400~I6499) | PLS+4 (pulse) | Y4 axis 100 pulse segments interruption |
| I65**(I6500~I6599) | PLS+5 (pulse) | Y5 axis 100 pulse segments interruption |
| I66**(I6600~I6699) | PLS+6 (pulse) | Y6 axis 100 pulse segments interruption |
| I67**(I6700~I6799) | PLS+7 (pulse) | Y7 axis 100 pulse segments interruption |
| I68**(I6800~I6899) | PLS+8 (pulse) | Y8 axis 100 pulse segments interruption |
| I69**(I6900~I6999) | PLS+9 (pulse) | Y9 axis 100 pulse segments interruption |

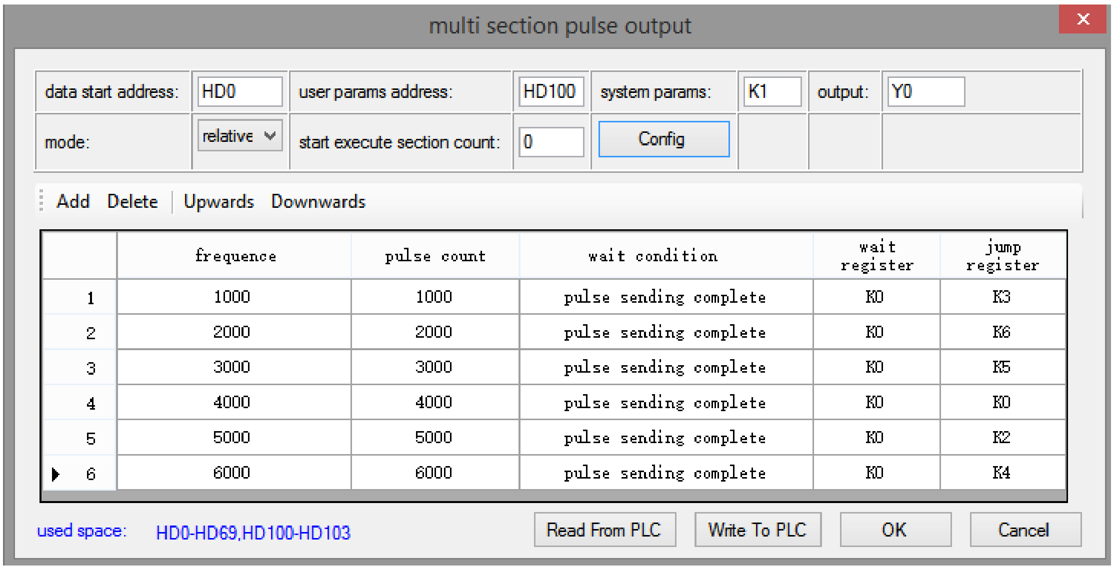
**Example 1:**

Now PLC has 8 pulse segments and executes from the first segment, the pulse output terminal is Y0, the interruption is shown as below:



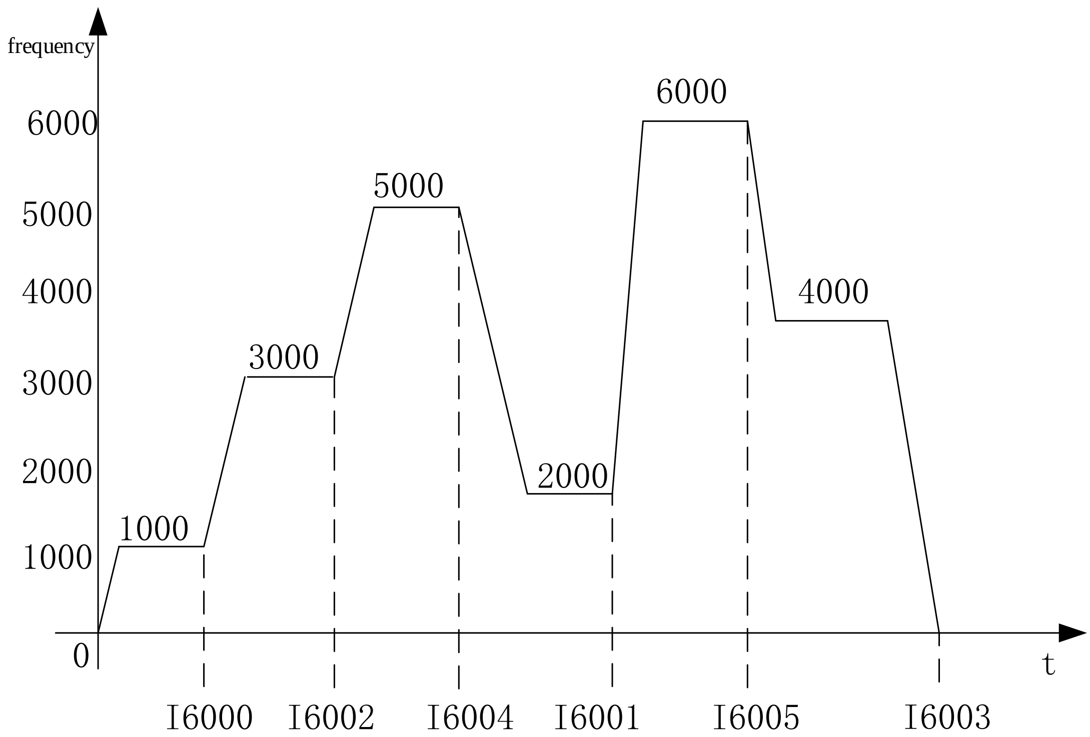

**Example 2:**

The PLC has 6 pulse segments, the pulse output terminal is Y0, but the pulse is not continuous outputting.

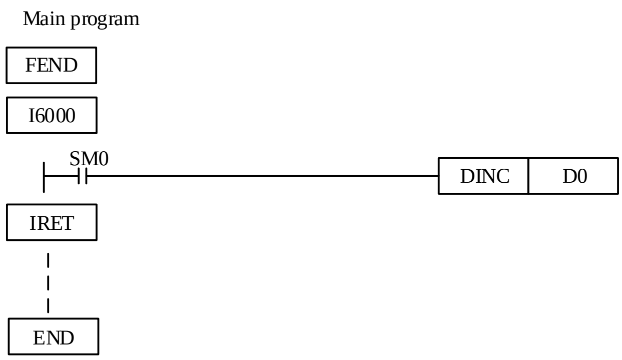



| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 1000 | 1000 | pulse sending complete | K0 | K3 |
| 2 | 2000 | 2000 | pulse sending complete | K0 | K6 |
| 3 | 3000 | 3000 | pulse sending complete | K0 | K5 |
| 4 | 4000 | 4000 | pulse sending complete | K0 | K0 |
| 5 | 5000 | 5000 | pulse sending complete | K0 | K2 |
| 6 | 6000 | 6000 | pulse sending complete | K0 | K4 |

As the pulse configuration table, the pulse outputting sequence is segment 1, 3, 5, 2, 6, 4. The interruption flag is I6000, I6002, I6004, I6001, I6005, I6003, please see below diagram:



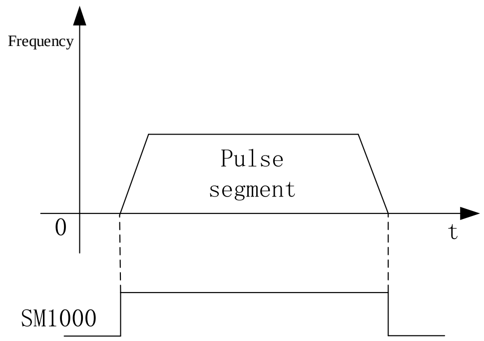

**Note: the program format is same for pulse interruption and external interruption.**




### 1-2-1-5. Pulse monitoring coil and register

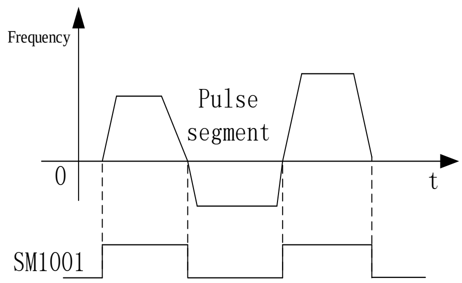
➢ **Pulse sending flag**

| No. | Coil | Axis no. | Note |
|---|---|---|---|
| 1 | SM1000 | PULSE_1 | The coil is ON when the pulse is sending, the coil will be OFF when the pulse sending ends. The falling edge of coil can judge whether the pulse sending is completed. |
| 2 | SM1020 | PULSE_2 | |
| 3 | SM1040 | PULSE_3 | |
| 4 | SM1060 | PULSE_4 | |
| 5 | SM1080 | PULSE_5 | |
| 6 | SM1100 | PULSE_6 | |
| 7 | SM1120 | PULSE_7 | |
| 8 | SM1140 | PULSE_8 | |
| 9 | SM1160 | PULSE_9 | |
| 10 | SM1180 | PULSE_10 | |




➢ **Pulse sending direction flag**

| No. | Coil | Axis no. | Note |
|---|---|---|---|
| 1 | SM1001 | PULSE_1 | When the pulse number is positive value and forward direction, the coil is ON, when the pulse number is negative value and reverse direction, the coil is OFF. |
| 2 | SM1021 | PULSE_2 | |
| 3 | SM1041 | PULSE_3 | |
| 4 | SM1061 | PULSE_4 | |
| 5 | SM1081 | PULSE_5 | |
| 6 | SM1101 | PULSE_6 | |
| 7 | SM1121 | PULSE_7 | |
| 8 | SM1141 | PULSE_8 | |
| 9 | SM1161 | PULSE_9 | |
| 10 | SM1181 | PULSE_10 | |




➢ **High speed pulse special regsiter HSD (latched)**

| No. | Function | Note | Axis no. |
|---|---|---|---|
| HSD0 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_1 |
| HSD1 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_1 |
| HSD2 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_1 |
| HSD3 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_1 |
| HSD4 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_2 |
| HSD5 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_2 |
| HSD6 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_2 |
| HSD7 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_2 |
| HSD8 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_3 |
| HSD9 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_3 |
| HSD10 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_3 |
| HSD11 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_3 |
| HSD12 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_4 |
| HSD13 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_4 |
| HSD14 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_4 |
| HSD15 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_4 |
| HSD16 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_5 |
| HSD17 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_5 |
| HSD18 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_5 |
| HSD19 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_5 |
| HSD20 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_6 |
| HSD21 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_6 |
| HSD22 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_6 |
| HSD23 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_6 |
| HSD24 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_7 |
| HSD25 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_7 |
| HSD26 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_7 |
| HSD27 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_7 |
| HSD28 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_8 |
| HSD29 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_8 |
| HSD30 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_8 |
| HSD31 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_8 |
| HSD32 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_9 |
| HSD33 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_9 |
| HSD34 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_9 |
| HSD35 | Cumulative pulses high 16-bit | The unit is equivalent | PULSE_9 |
| HSD36 | Cumulative pulses low 16-bit | The unit is pulse number | PULSE_10 |
| HSD37 | Cumulative pulses high 16-bit | The unit is pulse number | PULSE_10 |
| HSD38 | Cumulative pulses low 16-bit | The unit is equivalent | PULSE_10 |

| | | | |
|---|---|---|---|
| HSD39 | Cumulative pulses high 16-bit | | |

## 1-2-2. Multi-segment pulse output [PLSR]

◆ Instruction overview

Multi-segment pulse output instruction.

| Multi-segment pulse output [PLSR] | | | |
|---|---|---|---|
| 16-bit | - | 32-bit | PLSR |
| Execution condition | Rising /falling edge of the coil | Suitable model | XD, XL (except XD1, XL1) |
| Hardware | - | Software | - |

◆ Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Pulse data start address | 32-bit double word |
| S1 | User parameter start address | 32-bit double word |
| S2 | System parameter start address (1 to 4) | 32-bit double word |
| D | Pulse output terminal | Bit |

◆ Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | ● | ● | ● | ● | | | |
| S1 | ● | ● | ● | ● | ● | ● | ● | ● | | | |
| S2 | ● | ● | | | | | | | ● | | |

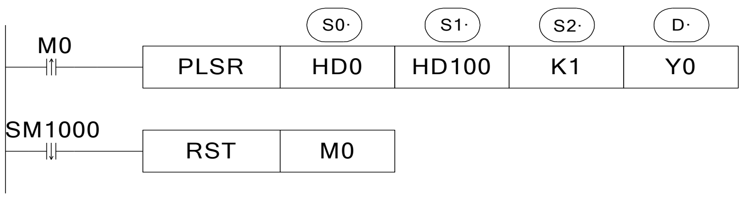
Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dnm |
| D | | ● | | | | | |

*Note: D means D, HD. TD means TD, HTD. CD means CD, HCD, HSCD, HSD. DM means DM, DHM. DS means DS, DHS. M means M, HM, SM. S means S, HS. T means T, HT. C means C, HC.

**Function and action**

instruction format

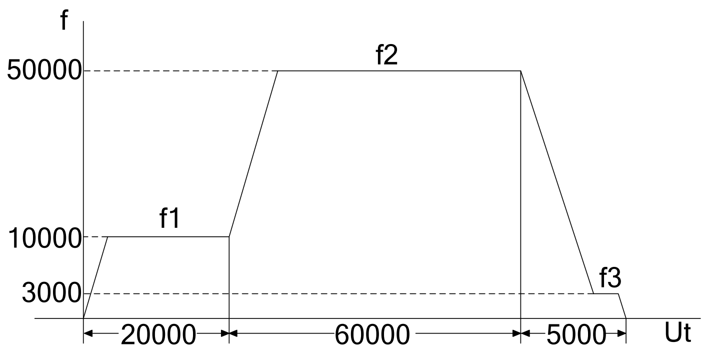



- S0【data start address】refer to chapter 1-2-1-1
- S1【user parameter start address】refer to chapter 1-2-1-2
- S2【system parameter group】K1~K4, refer to 1-2-1-3
- D【pulse output terminal】refer to chapter 1-1
- Pulse frequency range: 1Hz~100KHz. The value increasing means acceleration, the value

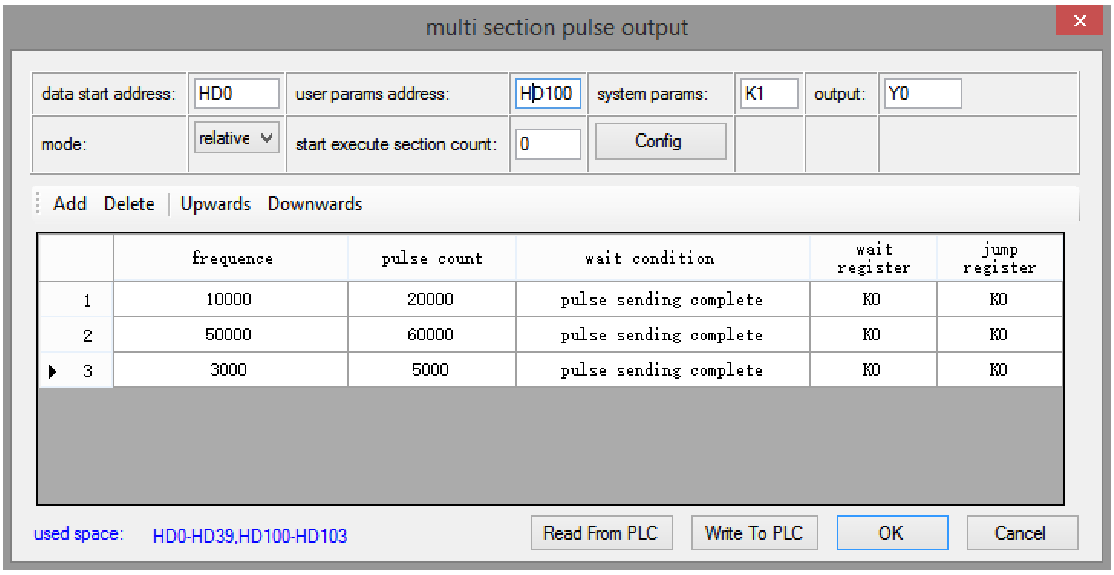
decreasing means deceleration, it is not related to the pulse direction.

- Pulse number: K-2,147,483,648 ~ K2,147,483,647, negative value means reverse direction. The acceleration and deceleration is set in system parameters, refer to chapter 1-2-1-3.
- When M0 is from OFF to ON, PLC executes the instruction PLSR, even M0 is cut off, the pulse will keep sending until end.
- If it needs to stop the pulse outputting, please use the instruction STOP.
- When the pulse is sending, the pulse sending flag of Y0 axis SM1000 is ON, when the pulse sending ends, SM1000 is OFF.
- Y0 cumulative pulse numbers are saved in HSD0(double word), the present pulse numbers are saved in SD1002(double word), more details please refer to chapter 6-5.
- For the instruction PLSR, if the frequency is changed when the pulse is sending, it will be effective at once. Other parameters will not be effective at once after changing, but be effective when the condition triggerring next time.
- **In absolute mode, if the pulse numbers and cumulative pulse numbers(HSD0) is equal, SM1000 has no action, there is no falling edge.**

**Instruction mode**




**Pulse curve**



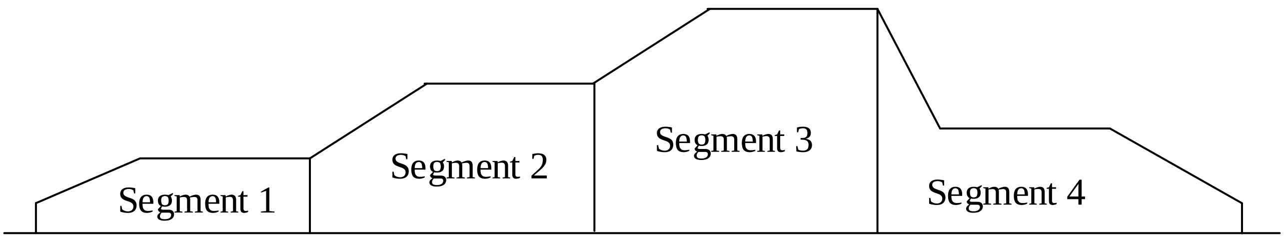

| | frequence | pulse count | wait condition | wait register | jump register |
|---|---|---|---|---|---|
| 1 | 10000 | 20000 | pulse sending complete | K0 | K0 |
| 2 | 50000 | 60000 | pulse sending complete | K0 | K0 |
| 3 | 3000 | 5000 | pulse sending complete | K0 | K0 |

**Pulse instruction parameter configuration table**

**How to do**

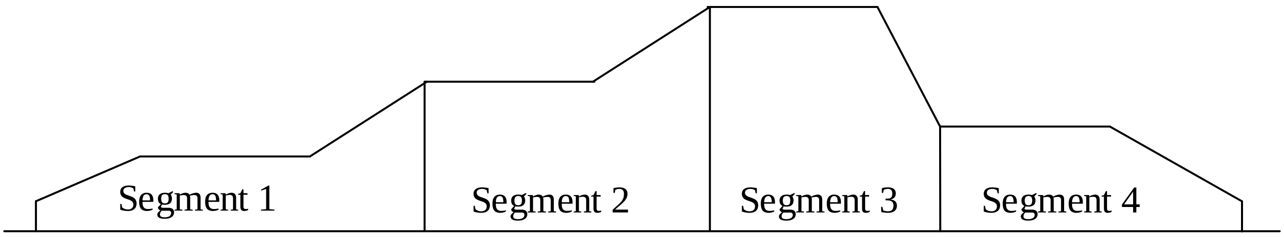
The following curves are set the parameters when the acceleration time is 0.

(1) Pulse segment completion mode division




- The segment are divided as above diagram
- Except the last segment, all the segments include rising, stable and falling part.
- The last segment includes rising or falling, stable and rising or falling part.

(2) Pulse segment subsequent mode division

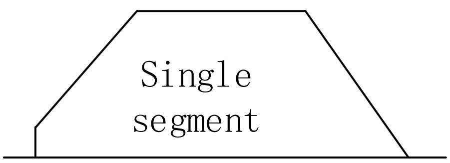



- The segment subsequent mode curve is shown as above diagram.
- It already switched to next segment speed when present segment ends. Except the first segment, other segments include stable part, rising or falling part.
- The first segment includes rising part or falling part, stable part, rising part or falling part.

(3) Single segment pulse curve

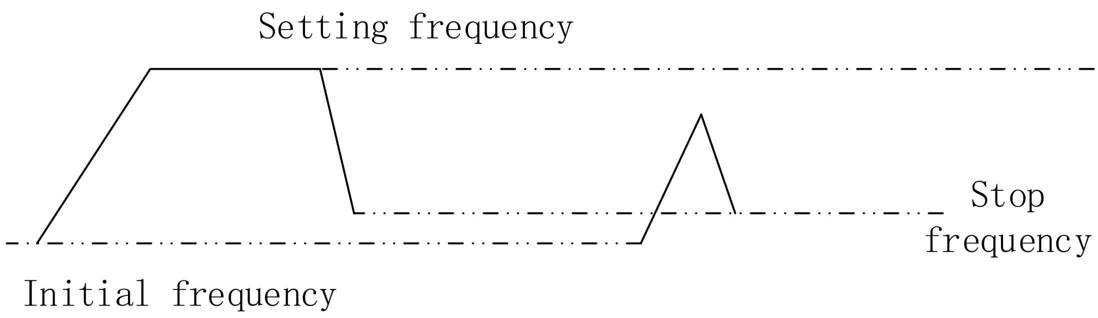
- The pulse numbers are enough

The pulse can reach the setting max frequency, the curve is trapezoid.

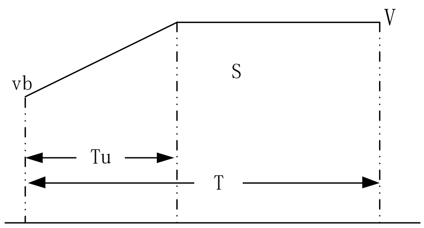



- The pulse numbers are not enough

The pulse curve is triangle.

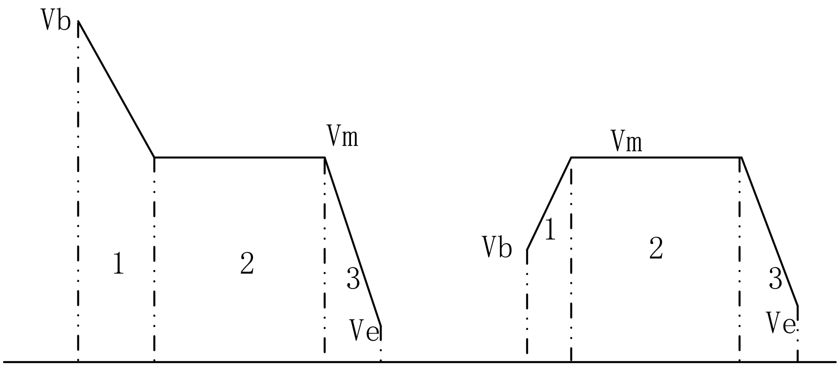



(4) One segment pulse outputting (not the last segment)




- V: setting present segment frequency
- S: present segment pulse numbers
- Vb: present segment initial frequency
- T: present segment pulse sending time
- Tu: pulse rising/falling time (Tu = (V-VB) / K , K is rising or falling slope).

(5) The last segment



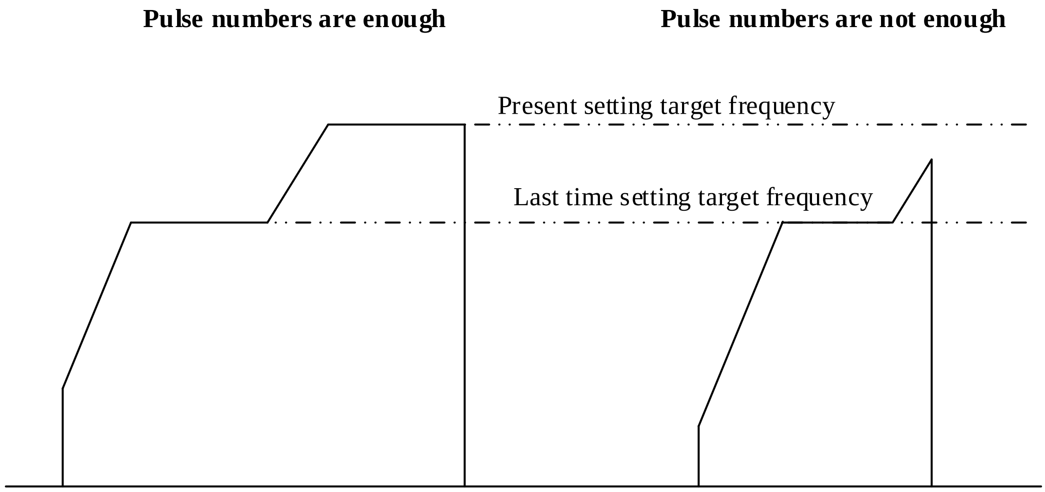

- The last segment includes rising/falling part, stable part, rising/falling part.

(6) the segment which the pulse numbers are 0

- If the present segment pulse frequency or pulse number is 0, it will output pulse as default speed.

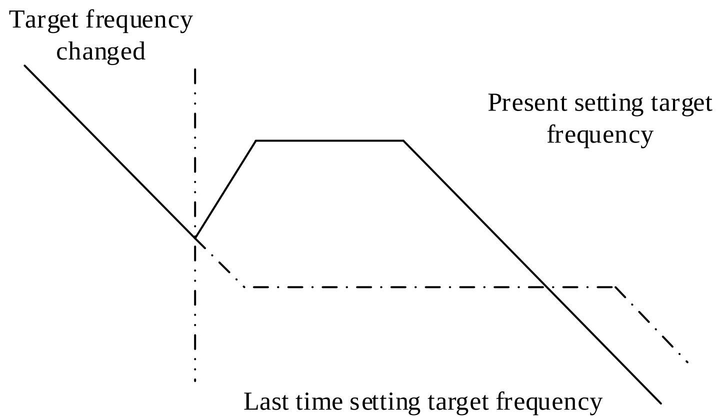
(7) dynamic modify present pulse frequency

- Not the last segment




When the present frequency is changed, it will accelerate/decelerate to target frequency as rising/falling slope.

- The last segment



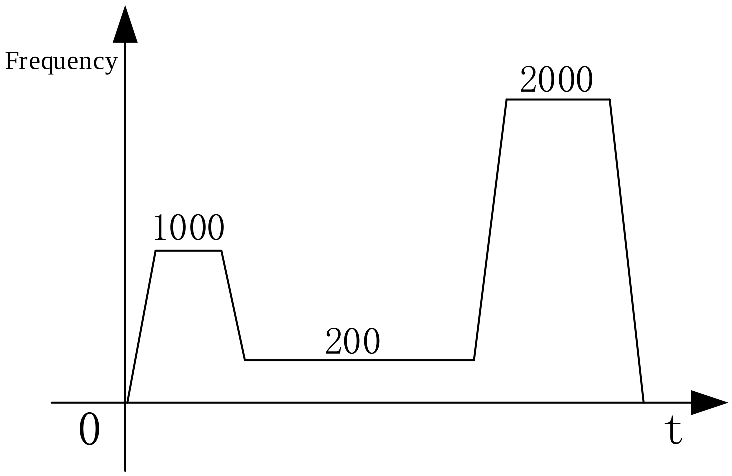

When the present pulse frequency is changed by user, PLC will calcuate the pulse curve again, then output pulse as the new pulse curve.

**Example 1**

It needs to output 3 continuous segments of pulse, the pulse terminal is Y0, direction terminal is Y2.

| Segment | Setting frequency (Hz) | Setting pulse numbers |
|---|---|---|
| Segment 1 | 1000 | 2000 |
| Segment 2 | 200 | 1000 |
| Segment 3 | 2000 | 6000 |
| Acceleration/deceleration | The frequency will change 1000Hz every 100ms | |

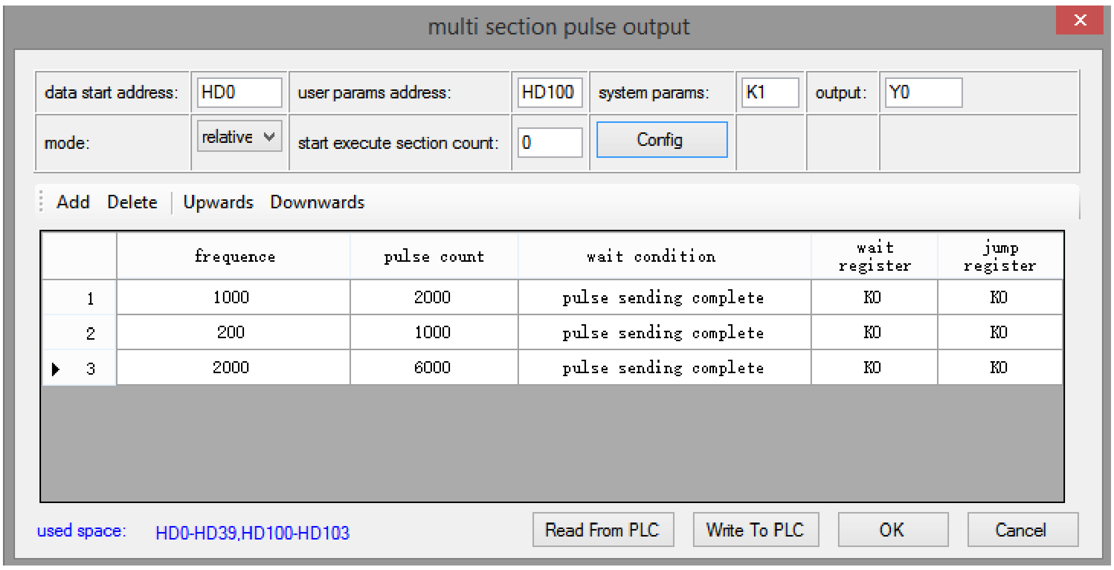
- Pulse curve




- Pulse instruction


- Software configuration

(1) Pulse segment configuration




(2) Pulse configuration parameters

PLC1 - Pulse Set

Config ▾ Delete | init axis | config guide

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
|---|---|
| Y0 axis-Common-Gear clearance positive compensation | 0 |
| Y0 axis-Common-Gear clearance negative compensation | 0 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |
| Y0 axis-Common-negative limit terminal setting | X no terminal |

| Param | Value |
|---|---|
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 1-Pulse default speed | 1000 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 100 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 100 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 200000 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

(3) Pulse data address distribution table

| Address | Notes | Value |
|---|---|---|
| HD0 (double word) | Pulse total segments (1 to 100) | 3 |
| HD2 (8 words) | Reserved | 0 |
| HD10 (double words) | Pulse frequency (#1) | 1000 |
| HD12 (double word) | Pulse number (#1) | 2000 |
| HD14 | bit15~bit8: waiting condition (#1)<br>H00: pulse sending completion<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse sending completion<br>bit7~bit0: waiting condition register type<br>H00: constant<br>H01: D<br>H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | 0 |
| HD15 (double word) | Constant value/ register no. (for waiting condition)(#1) | 0 |
| HD17 | bit7~bit0: jump register type<br>H00: constant value<br>H01: D<br>H02: HD | 0 |

| | | |
|---|---|---|
| | H03: FD | |
| HD+18 (double word) | Constant value/register no. (for jump register)( #1) | 0 |
| HD+20 (double word) | Pulse frequency (#2) | 200 |
| HD+22 (double word) | Pulse number (#2) | 1000 |
| HD+24 | Waiting condition, waiting condition register type (#2) | 0 |
| HD+25 (double word) | Constant value or register no. (for waiting condition) (#2) | 0 |
| HD+27 | Jump type, jump register type (#2) | 0 |
| HD+28 (double word) | Constant value or register no. (for jump register) (#2) | 0 |
| HD+30 (double word) | Pulse frequency (#3) | 2000 |
| HD+32 (double word) | Pulse number (#3) | 6000 |
| HD+34 | Waiting condition, waiting condition register type (#3) | 0 |
| HD+35 (double word) | Constant value or register no. (for waiting condition) (#3) | 0 |
| HD+37 | Jump type, jump register type (for waiting condition) (#3) | 0 |
| HD+38 (double word) | Constant value or register no. (for jump register) (#3) | 0 |

(4) System parameters

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 0 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | 0 | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 1 | |
| SFD903 | Pulse number/1 rotation high 16 bits | | 0 | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 1 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | 0 | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 2 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 20 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0 | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | FFFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0xFF | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 0 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 20 | |
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 0 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 0 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 1000 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |
| SFD952 | Pulse default speed acceleration time | | 100 | |

| | | | | |
|---|---|---|---|---|
| SFD953 | Pulse default speed deceleration time | | 100 | |
| SFD954 | Acceleration and deceleration time | | 0 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | | |
| SFD956 | Max speed limit low 16 bits | | 3392 | |
| SFD957 | Max speed limit high 16 bits | | 3 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 50 | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |

**Note:**

※1: As there are many configuration parameters of PLSR, we suggest to use software configuration table to set the parameters.

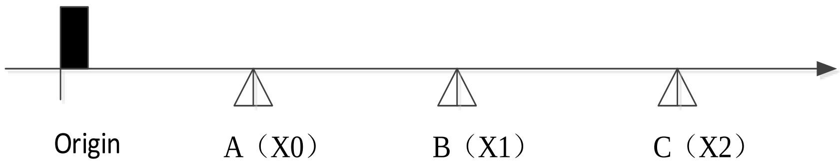
※2: if user needs to set each segment pulse frequency and pulse numbers in the HMI, please configure through the configuration table first, then use instruction DMOV in the program to set the registers (S0+N*10+0, S0+N*10+2).

For example:

```
DMOV   HD200   HD10       //HD200 set segment 1 pulse frequency in HMI
DMOV   HD202   HD12       //HD202 set segment 1 pulse numbers in HMI
DMOV   HD204   HD20       //HD204 set segment 2 pulse frequency in HMI
DMOV   HD206   HD22       //HD206 set segment 2 pulse numbers in HMI
DMOV   HD208   HD30       //HD208 set segment 3 pulse frequency in HMI
DMOV   HD210   HD32       //HD210 set segment 3 pulse numbers in HMI
```

It can also set pulse frequency and numbers in registers HD10, HD12, HD20, HD22, HD30, HD32 directly in the HMI.

**Example 2**

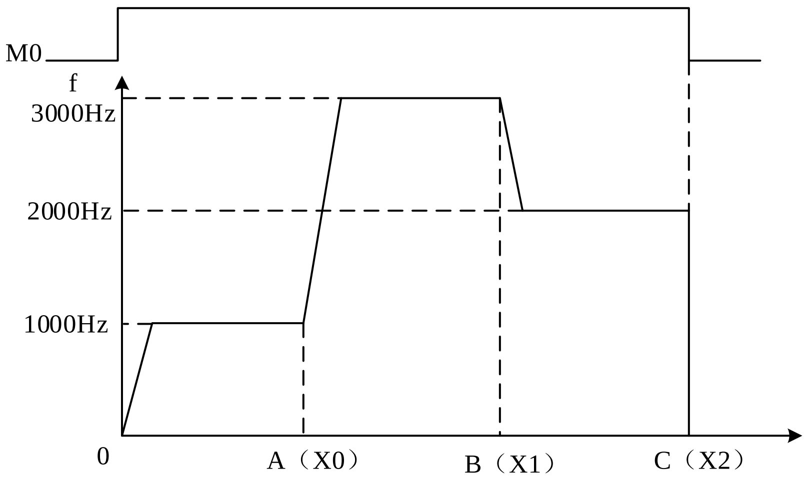



As the above diagram, it needs to move three segments of distance, the position of A, B, C is unknown and the moving speed is different for each segment. We can configure the PLSR to do it. First we install proximity switch at point A, B, C and connect to PLC input X0, X1, X2. The pulse output terminal is Y0, the direction terminal is Y2.

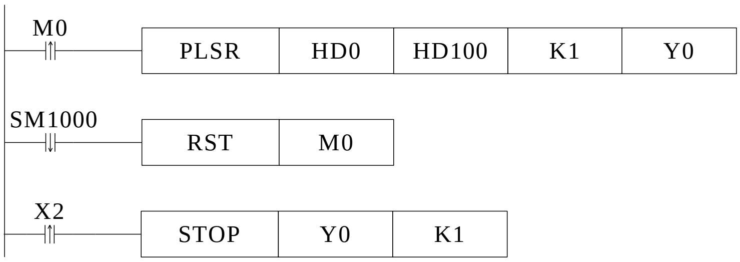
Each segment pulse frequency and numbers:

| Segment | Frequency setting (Hz) | Pulse number setting |
|---|---|---|
| Origin to A | 1000 | 999999999 |
| A to B | 3000 | 999999999 |
| B to C | 2000 | 999999999 |
| Acceleration/deceleration time | The frequency will change 1000Hz every 100ms | |

Note:
As the pulse numbers are unknown for each segment, we set a very large pulse numbers to ensure it can reach the proximity switch. When it reaches point C, the pulse will urgent stop by instruction STOP.

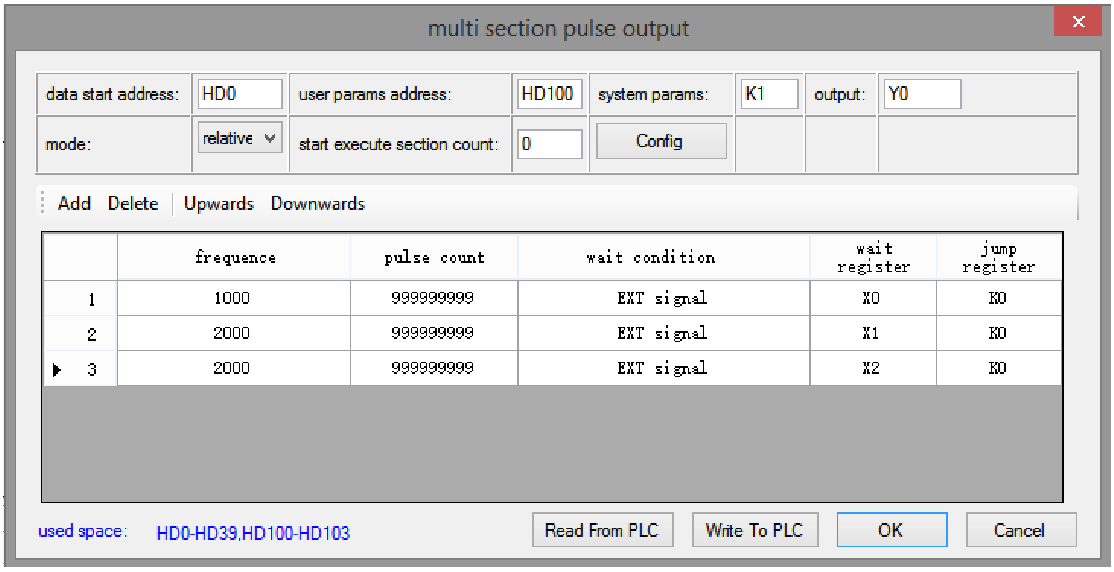



- Pulse instructions



- ➢ Software configuration

(1) Pulse segment configuration




(2) Pulse configuration parameters

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to th... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coordin... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
|---|---|
| Y0 axis-Common-Gear clearance positive compensation | 0 |
| Y0 axis-Common-Gear clearance negative compensation | 0 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-Far... | normally on |
| Y0 axis-Common-signal terminal switch state setting-Z p... | normally on |
| Y0 axis-Common-signal terminal switch state setting-pos... | normally on |
| Y0 axis-Common-signal terminal switch state setting-neg... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |

| Param | Value |
|---|---|
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 1-Pulse default speed | 1000 |
| Y0 axis-group 1-Acceleration time of Pulse default spee... | 100 |
| Y0 axis-group 1-Deceleration time of pulse default spee... | 100 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 200000 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

(3) Pulse data address distribution table

| Address | Notes | Value |
|---|---|---|
| HD0 (double word) | Pulse total segments (1 to 100) | 3 |
| HD2 (8 words) | Reserved | 0 |
| HD10 (double words) | Pulse frequency (#1) | 1000 |
| HD12 (double word) | Pulse number (#1) | 999999999 |
| HD14 | bit15~bit8: waiting condition (#1)<br>H00: pulse sending completion<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse sending completion | 1028 |

| | | |
|---|---|---|
| | bit7~bit0: waiting condition register type<br>H00: constant<br>H01: D<br>H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | |
| HD15<br>(double word) | Constant value/ register no. (for waiting condition)(#1) | 0 |
| HD17 | bit7~bit0: jump register type<br>H00: constant value<br>H01: D<br>H02: HD<br>H03: FD | 0 |
| HD+18<br>(double word) | Constant value/register no. (for jump register)( #1) | 0 |
| HD+20<br>(double word) | Pulse frequency (#2) | 3000 |
| HD+22<br>(double word) | Pulse number (#2) | 999999999 |
| HD+24 | Waiting condition, waiting condition register type (#2) | 1028 |
| HD+25<br>(double word) | Constant value or register no. (for waiting condition) (#2) | 1 |
| HD+27 | Jump type, jump register type (#2) | 0 |
| HD+28<br>(double word) | Constant value or register no. (for jump register) (#2) | 0 |
| HD+30<br>(double word) | Pulse frequency (#3) | 2000 |
| HD+32<br>(double word) | Pulse number (#3) | 999999999 |
| HD+34 | Waiting condition, waiting condition register type (#3) | 1028 |
| HD+35<br>(double word) | Constant value or register no. (for waiting condition) (#3) | 2 |
| HD+37 | Jump type, jump register type (for waiting condition) (#3) | 0 |
| HD+38<br>(double word) | Constant value or register no. (for jump register) (#3) | 0 |

(4) System parameters

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 0 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | 1 | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 0 | |
| SFD903 | Pulse number/1 rotation high 16 bits | | 1 | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 0 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | 2 | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 20 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 0 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0xFF | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | FFFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | 0xFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0 | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 20 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 0 | |
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 0 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 1 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 1000 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |
| SFD952 | Pulse default speed acceleration time | | 100 | |

| | | | | |
|---|---|---|---|---|
| SFD953 | Pulse default speed deceleration time | | 100 | |
| SFD954 | Acceleration and deceleration time | | 0 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | 0 | |
| SFD956 | Max speed limit low 16 bits | | 3392 | |
| SFD957 | Max speed limit high 16 bits | | 3 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 50 | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |

**Note:**

※1: As there are many configuration parameters of PLSR, we suggest to use software configuration table to set the parameters.

※2: if user needs to set each segment pulse frequency and pulse numbers in the HMI, please configure through the configuration table first, then use instruction DMOV in the program to set the registers (S0+N*10+0, S0+N*10+2).

For example:

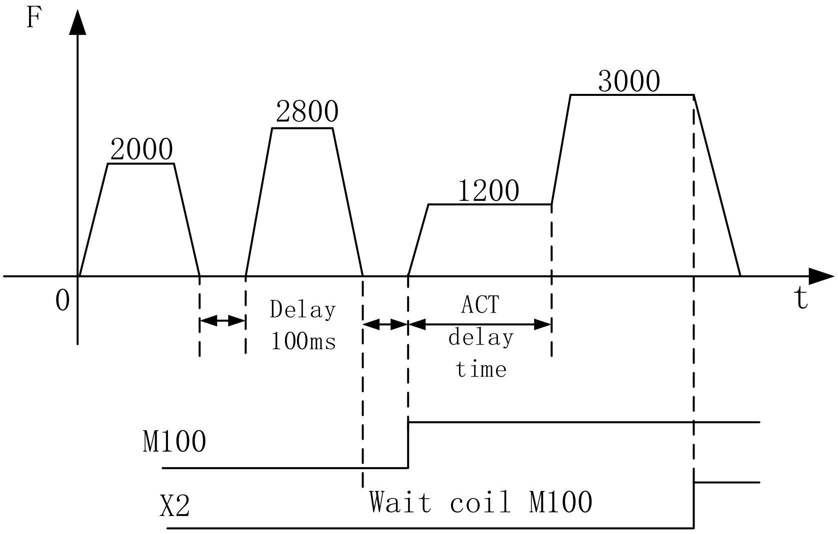
```
DMOV   HD200   HD10        //HD200 set segment 1 pulse frequency in HMI
DMOV   HD202   HD12        //HD202 set segment 1 pulse numbers in HMI
DMOV   HD204   HD20        //HD204 set segment 2 pulse frequency in HMI
DMOV   HD206   HD22        //HD206 set segment 2 pulse numbers in HMI
DMOV   HD208   HD30        //HD208 set segment 3 pulse frequency in HMI
DMOV   HD210   HD32        //HD210 set segment 3 pulse numbers in HMI
```

It can also set pulse frequency and numbers in registers HD10, HD12, HD20, HD22, HD30, HD32 directly in the HMI.

**Example 3**

It needs to execute 4 segments of pulse: segment 1 pulse frequency is 2000Hz, pulse number is 3000, it will delay 100ms then segment 2 is executed. Segment 2 pulse frequency is 2800Hz, pulse number is 4000. It will wait for M100, when M100 is ON, the segment 3 starts to run. Segment 3 pulse frequency is 1200Hz, pulse number is 999999999. It will delay ACT time 2s after the pulse is outputting then switch to segment 4 at once. Segment 4 pulse frequency is 3000Hz, pulse number is 999999999. When the external signal X2 is ON, it will decelerate and stop the pulse. Pulse acceleration slope is 80ms every 1000Hz, deceleration slope is 120ms every 1000Hz. The pulse direction terminal is Y2.

- Pulse curve:



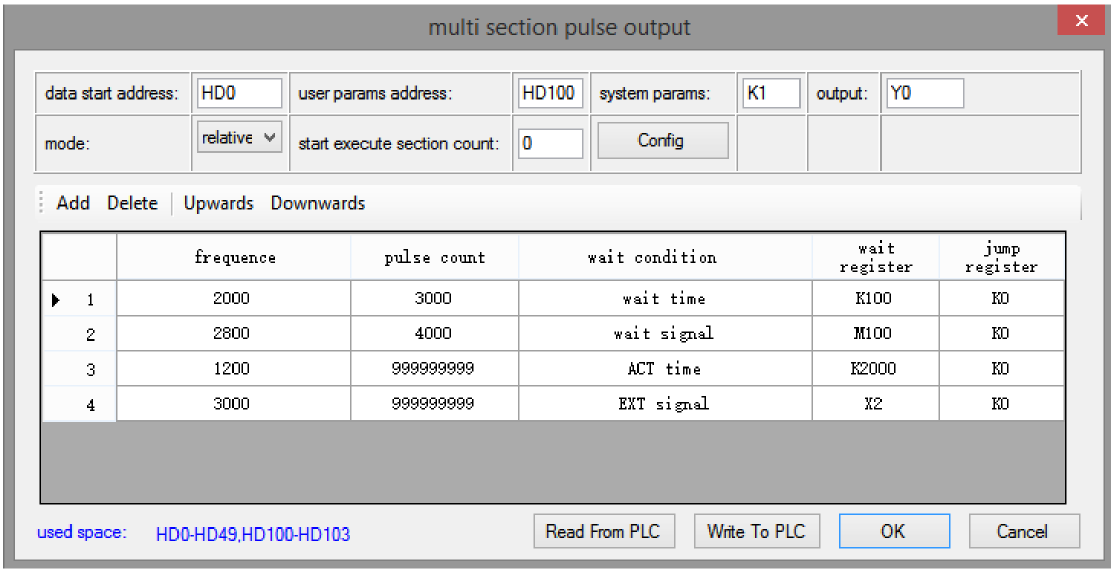

- Pulse instruction

M0

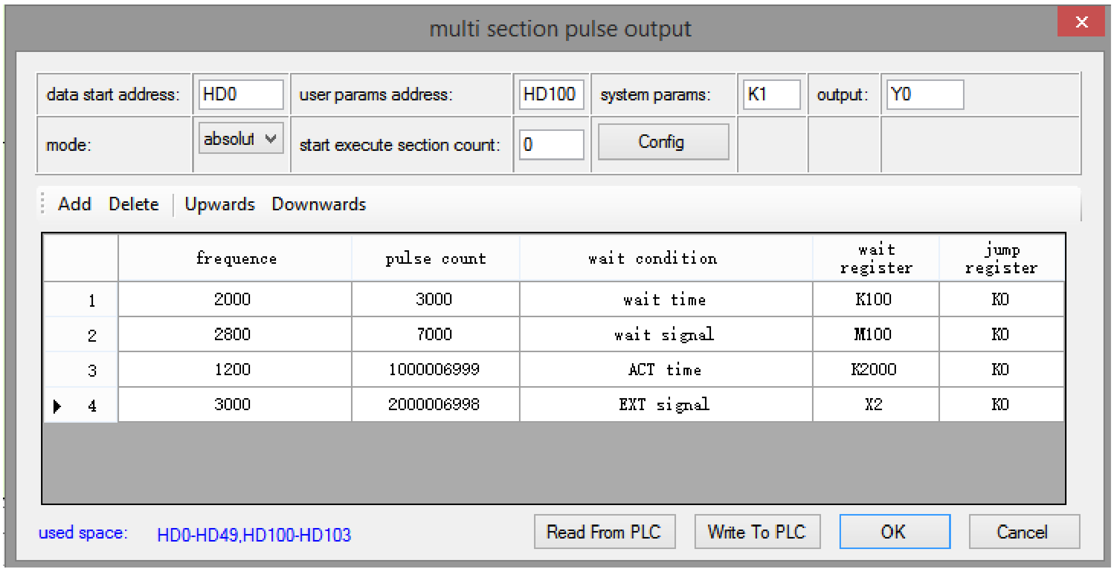
| | | | | |
|---|---|---|---|---|
| PLSR | HD0 | HD100 | K1 | Y0 |

- Pulse data configuration

(1) Pulse segment configuration




Pulse data configuration (relative mode)




Pulse data configuration (absolute mode)

(2) System parameters

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
|---|---|
| Y0 axis-Common-Gear clearance positive compensation | 0 |
| Y0 axis-Common-Gear clearance negative compensation | 0 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |

| Param | Value |
|---|---|
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 1-Pulse default speed | 1000 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 80 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 120 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 200000 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

(3) Pulse data address distribution table

| Address | Notes | Value |
|---|---|---|
| HD0<br>(double word) | Pulse total segments (1 to 100) | 4 |

| | | |
|---|---|---|
| HD2 (8 words) | Reserved | 0 |
| HD10 (double words) | Pulse frequency (#1) | 2000 |
| HD12 (double word) | Pulse number (#1) | 3000 |
| HD14 | bit15~bit8: waiting condition (#1)<br>H00: pulse sending completion<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse sending completion<br>bit7~bit0: waiting condition register type<br>H00: constant<br>H01: D<br>H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | 256 |
| HD15 (double word) | Constant value/ register no. (for waiting condition)(#1) | 100 |
| HD17 | bit7~bit0: jump register type<br>H00: constant value<br>H01: D<br>H02: HD<br>H03: FD | 0 |
| HD+18 (double word) | Constant value/register no. (for jump register)( #1) | 0 |
| HD+20 (double word) | Pulse frequency (#2) | 2800 |
| HD+22 (double word) | Pulse number (#2) | 7000 |
| HD+24 | Waiting condition, waiting condition register type (#2) | 517 |
| HD+25 (double word) | Constant value or register no. (for waiting condition) (#2) | 100 |
| HD+27 | Jump type, jump register type (#2) | 0 |
| HD+28 (double word) | Constant value or register no. (for jump register) (#2) | 0 |
| HD+30 (double word) | Pulse frequency (#3) | 1200 |
| HD+32 (double word) | Pulse number (#3) | 999999999 |

| | | |
|---|---|---|
| HD+34 | Waiting condition, waiting condition register type (#3) | 768 |
| HD+35<br>(double word) | Constant value or register no. (for waiting condition) (#3) | 2000 |
| HD+37 | Jump type, jump register type (for waiting condition) (#3) | 0 |
| HD+38<br>(double word) | Constant value or register no. (for jump register) (#3) | 0 |
| HD+40<br>(double word) | Pulse frequency (#4) | 3000 |
| HD+42<br>(double word) | Pulse number (#4) | 999999999 |
| HD+44 | Waiting condition, waiting condition register type (#4) | 1028 |
| HD+45<br>(double word) | Constant value or register no. (for waiting condition) (#4) | 2 |
| HD+47 | Jump type, jump register type (for waiting condition) (#4) | 0 |
| HD+48<br>(double word) | Constant value or register no. (for jump register) (#4) | 0 |

(4) System parameters

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 0 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | 0 | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 1 | |

| | | | | |
|---|---|---|---|---|
| SFD903 | Pulse number/1 rotation high 16 bits | | 0 | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 1 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | 0 | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 2 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 20 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0 | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | FFFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0xFF | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 0 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 20 | |

| | | | | |
|---|---|---|---|---|
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 0 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 0 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 1000 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |
| SFD952 | Pulse default speed acceleration time | | 100 | |
| SFD953 | Pulse default speed deceleration time | | 100 | |
| SFD954 | Acceleration and deceleration time | | 0 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | 0 | |
| SFD956 | Max speed limit low 16 bits | | 3392 | |
| SFD957 | Max speed limit high 16 bits | | 3 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 50 | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |

**Note:**

※1: As there are many configuration parameters of PLSR, we suggest to use software configuration table to set the parameters.

※2: if user needs to set each segment pulse frequency and pulse numbers in the HMI, please configure through the configuration table first, then use instruction DMOV in the program to set the registers (S0+N*10+0, S0+N*10+2).

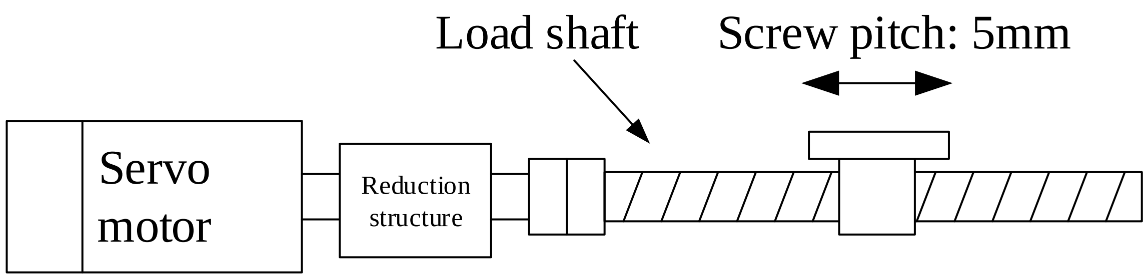
For example:

```
DMOV  HD200  HD10   //HD200 set segment 1 pulse frequency in HMI
DMOV  HD202  HD12   //HD202 set segment 1 pulse numbers in HMI
DMOV  HD204  HD20   //HD204 set segment 2 pulse frequency in HMI
DMOV  HD206  HD22   //HD206 set segment 2 pulse numbers in HMI
DMOV  HD208  HD30   //HD208 set segment 3 pulse frequency in HMI
DMOV  HD210  HD32   //HD210 set segment 3 pulse numbers in HMI
DMOV  HD212  HD40   //HD212 set segment 4 pulse frequency in HMI
DMOV  HD214  HD42   //HD214 set segment 4 pulse numbers in HMI
```

It can also set pulse frequency and numbers in registers HD10, HD12, HD20, HD22, HD30, HD32, HD40, HD42 directly in the HMI.

**Example 4**

There is a transmission mechanism which includes one servo drive (electronic gear ratio is 1:1), one servo motor (encoder is 2500ppr), it connects the ball screw through a reducer (the reduction ratio is 1:2), the ball screw pitch is 10mm, the ball screw drives a working table which can move left and right. Now it needs to move the table from left to right for 200mm, then move in reverse direction for 200mm, the speed is 20mm/s, acceleration time is 100ms, deceleration time is 200ms, the pulse direction terminal is Y2.




**Mechanical structure**

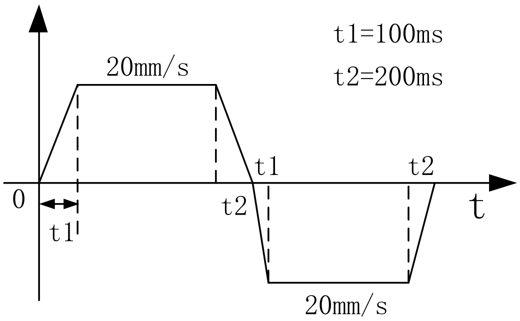
$$\text{Pulse number per rotate} = 20000 = 2500 * 4 * \frac{2}{1}$$

$$\text{Motion quantity per rotate} = \text{pitch} = 10\text{mm}$$

$$20\text{mm/s} = \frac{20\text{mm}}{10\text{mm}} * 20000 = 40000 \text{ pulse/s}$$

The max pulse output frequency is 40K/s, less than 200K/s, the PLC can run well.

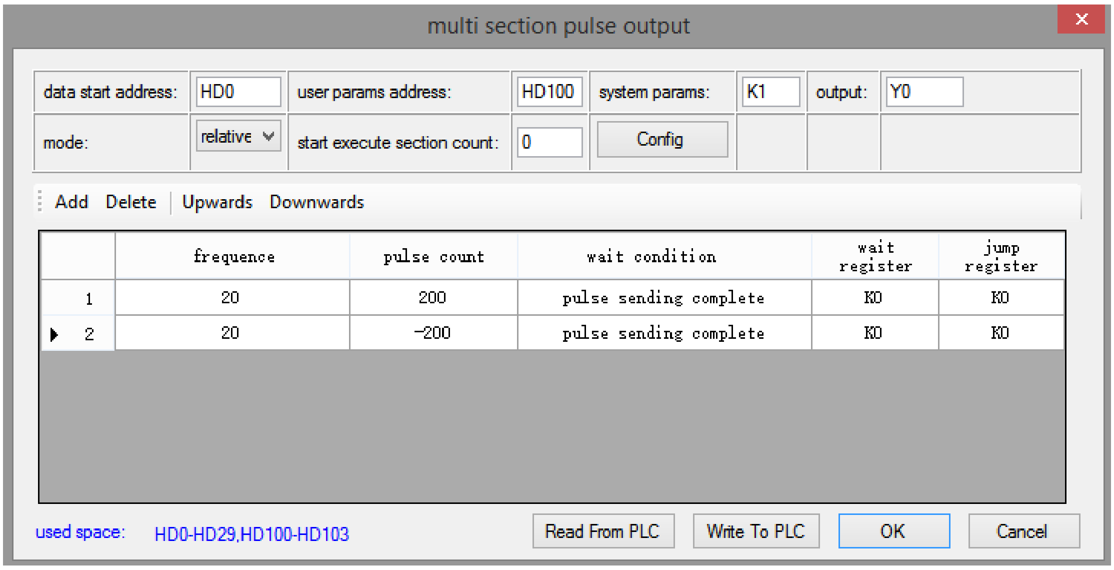
➢ Pulse curve



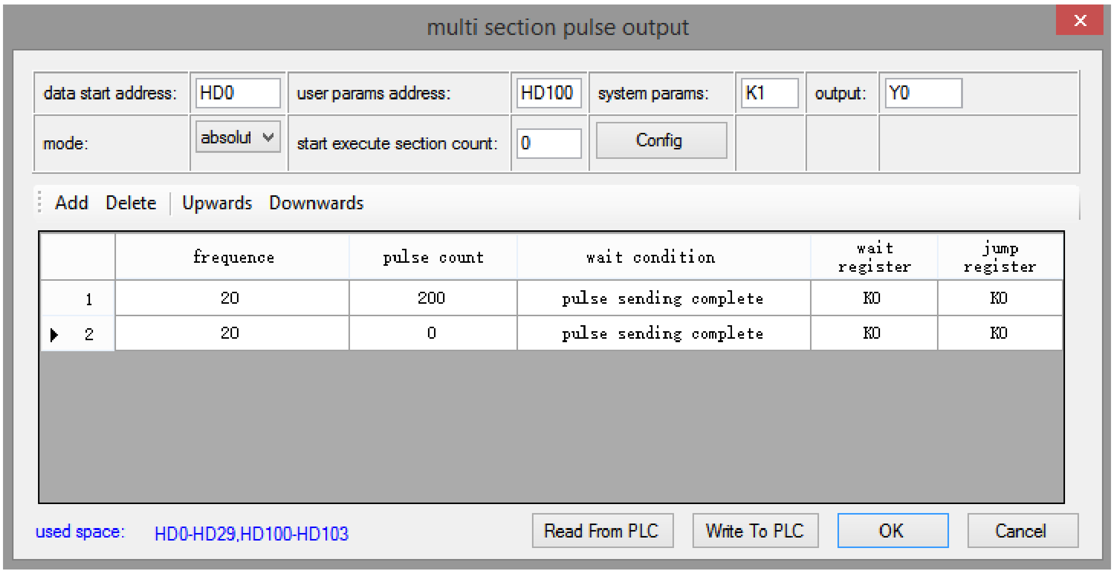

➢ Pulse instruction


➢ Pulse configuration

(1) Pulse segment configuration




**Relative mode**




**Absolute mode**

(2) System parameters (relative mode)

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | 1mm |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 20000 |
| Y0 axis-Common-1mm(revolve) | 10 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
|---|---|
| Y0 axis-Common-Gear clearance positive compensation | 0 |
| Y0 axis-Common-Gear clearance negative compensation | 0 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |

| Param | Value |
|---|---|
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 1-Pulse default speed | 20 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 100 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 200 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 100 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

(3) Pulse data address distribution table

| Address | Notes | Value |
|---|---|---|
| HD0 (double word) | Pulse total segments (1 to 100) | 2 |
| HD2 (8 words) | Reserved | 0 |
| HD10 (double words) | Pulse frequency (#1) | 20 |
| HD12 (double word) | Pulse number (#1) | 200 |
| HD14 | bit15~bit8: waiting condition (#1)<br>H00: pulse sending completion<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse sending completion<br>bit7~bit0: waiting condition register type | 0 |

| | | |
|---|---|---|
| | H00: constant<br>H01: D<br>H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | |
| HD15<br>(double word) | Constant value/ register no. (for waiting condition)(#1) | 0 |
| HD17 | bit7~bit0: jump register type<br>H00: constant value<br>H01: D<br>H02: HD<br>H03: FD | 0 |
| HD+18<br>(double word) | Constant value/register no. (for jump register)( #1) | 0 |
| HD+20<br>(double word) | Pulse frequency (#2) | 20 |
| HD+22<br>(double word) | Pulse number (#2) | -200 |
| HD+24 | Waiting condition, waiting condition register type (#2) | 0 |
| HD+25<br>(double word) | Constant value or register no. (for waiting condition) (#2) | 0 |
| HD+27 | Jump type, jump register type (#2) | 0 |
| HD+28<br>(double word) | Constant value or register no. (for jump register) (#2) | 0 |

(4) System parameters

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 1792 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | 0 | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 20000 | |
| SFD903 | Pulse number/1 rotation high 16 bits | | | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 10 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 2 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 20 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0 | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | FFFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0xFF | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 0 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 20 | |
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 0 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 0 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 20 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |
| SFD952 | Pulse default speed acceleration time | | 100 | |

| | | | | |
|---|---|---|---|---|
| SFD953 | Pulse default speed deceleration time | | 200 | |
| SFD954 | Acceleration and deceleration time | | 0 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | 0 | |
| SFD956 | Max speed limit low 16 bits | | 100 | |
| SFD957 | Max speed limit high 16 bits | | 0 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 50 | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |

**Note:**

※1: As there are many configuration parameters of PLSR, we suggest to use software configuration table to set the parameters.

※2: if user needs to set each segment pulse frequency and pulse numbers in the HMI, please configure through the configuration table first, then use instruction DMOV in the program to set the registers (S0+N*10+0, S0+N*10+2).

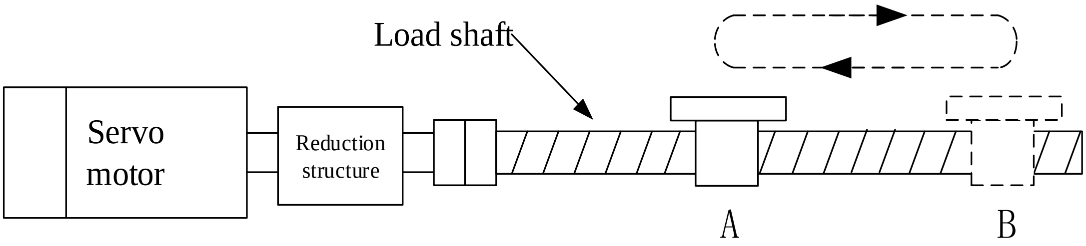
For example:

```
DMOV   HD200   HD10        //HD200 set segment 1 pulse frequency in HMI
DMOV   HD202   HD12        //HD202 set segment 1 pulse numbers in HMI
DMOV   HD204   HD20        //HD204 set segment 2 pulse frequency in HMI
DMOV   HD206   HD22        //HD206 set segment 2 pulse numbers in HMI
```

It can also set pulse frequency and numbers in registers HD10, HD12, HD20, HD22 directly in the HMI.

**Example 5**

There is a transmission mechanism which includes one servo drive (electronic gear ratio is 1:1), one servo motor (encoder is 2500ppr), it connects the ball screw through a reducer (the reduction ratio is 1:2), the ball screw pitch is 5mm, the ball screw drives a working table which can move left and right. Now it needs to move forth and back on the table, A to B distance is 200mm, A to B speed is 20mm/s, B to A speed is 30mm/s, acceleration time is 100ms, deceleration time is 200ms, the pulse direction terminal is Y2, the mechanical clearance of A to B to A is 3mm, B to A to B is 2mm.




**Mechanical structure**

We can calculate the following things:

$$\text{Pulse number per rotate} = 20000 = 2500 * 4 * \frac{2}{1}$$

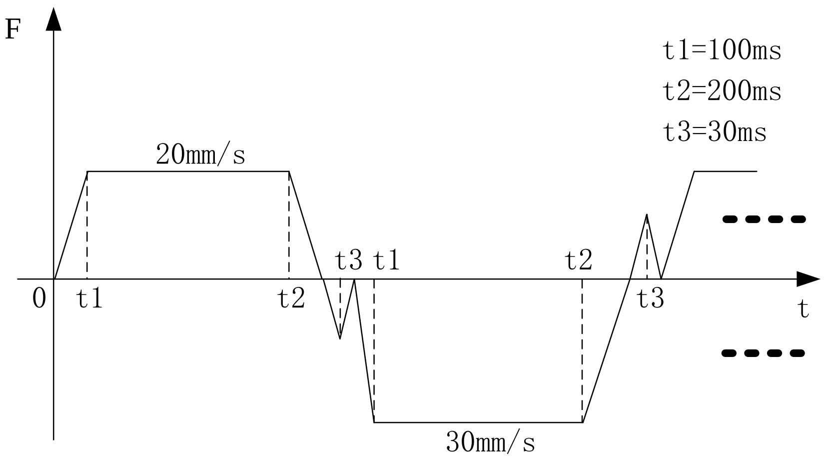
$$\text{Moving quantity} = \text{pitch} = 5\text{mm}$$

$$20\text{mm/s} = \frac{20\text{mm}}{5\text{mm}} * 20000 = 80000\text{pulse/s}$$

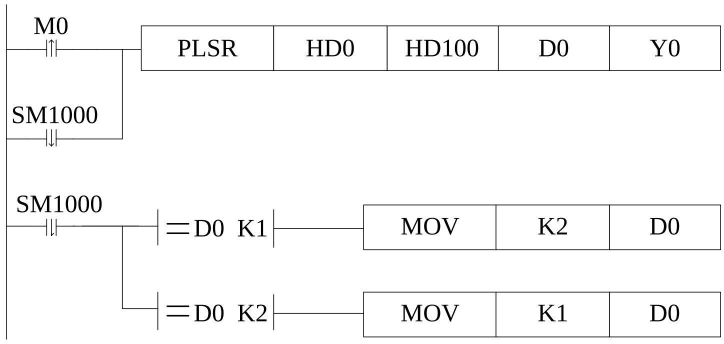
$$30\text{mm/s} = \frac{30\text{mm}}{5\text{mm}} * 20000 = 120000\text{pulse/s}$$

As the acceleration and deceleration time for forward motion and reverse motion is same, but the max frequency is different, so their acceleration and deceleration slope is different.
Forward acceleration slope: 80000Hz/100ms, forward deceleration slope: 80000Hz/200ms.
Reverse acceleration slope: 120000Hz/100ms, reverse deceleration slope: 120000Hz/200ms.
We needs to set two groups of parameter as there are two groups of acc/dec slope.
The max frequency is 40K/s and 120K/s, less than 200K/s, so PLC can work normally.

- Pulse curve

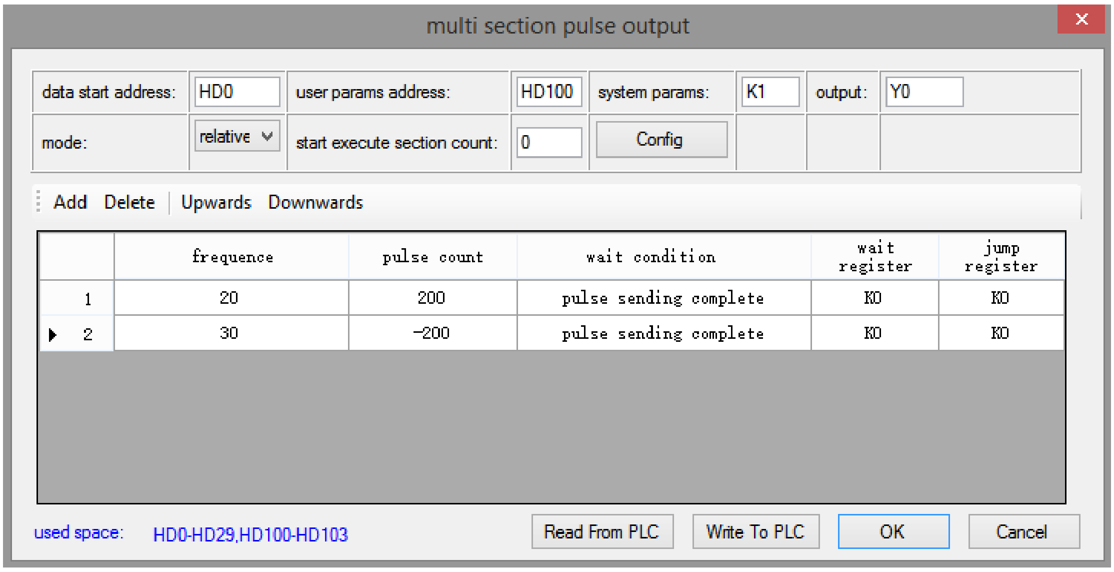



➢ Pulse instruction

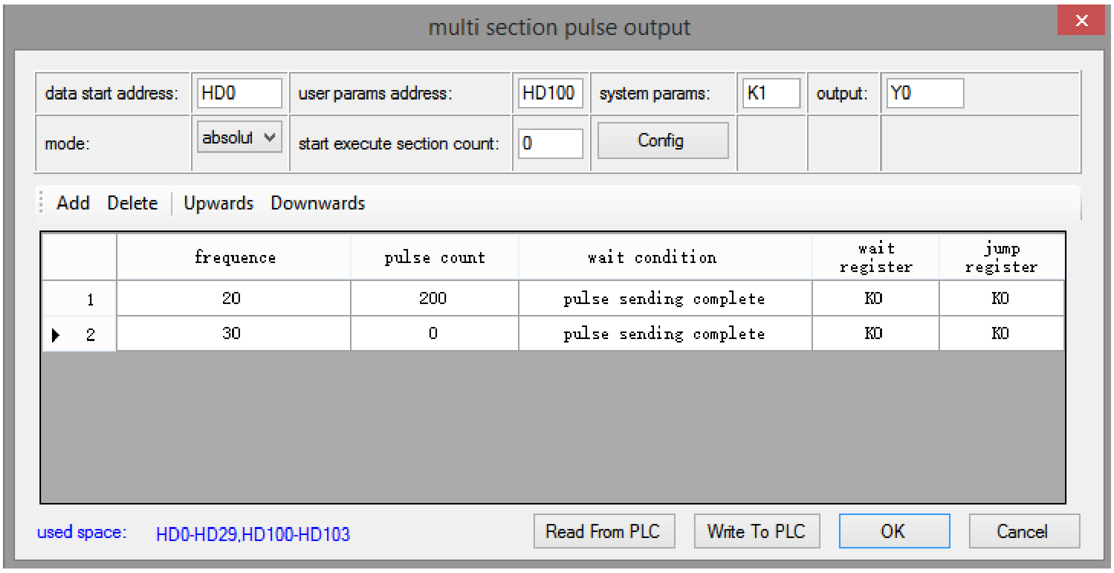



➢ Pulse data configuration

(1) Pulse segment configuration




Relative mode




Absolute mode

(2) System parameters

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | 1mm |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 20000 |
| Y0 axis-Common-1mm(revolve) | 5 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
|---|---|
| Y0 axis-Common-Gear clearance positive compensation | 3 |
| Y0 axis-Common-Gear clearance negative compensation | 2 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |

| Param | Value |
|---|---|
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 1-Pulse default speed | 20 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 100 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 200 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 30 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 50 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 2-Pulse default speed | 30 |
| Y0 axis-group 2-Acceleration time of Pulse default s... | 100 |
| Y0 axis-group 2-Deceleration time of pulse default s... | 200 |
| Y0 axis-group 2-Acceleration and deceleration time (ms) | 30 |
| Y0 axis-group 2-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 2-Max speed | 50 |
| Y0 axis-group 2-Initial speed | 0 |
| Y0 axis-group 2-stop speed | 0 |
| Y0 axis-group 2-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 2-FOLLOW forward compensation(0-100) | 0 |

(3) Pulse data address distribution table(relative mode)

| Address | Notes | Value |
|---|---|---|
| HD0 (double word) | Pulse total segments (1 to 100) | 2 |
| HD2 (8 words) | Reserved | 0 |
| HD10 (double words) | Pulse frequency (#1) | 20 |
| HD12 (double word) | Pulse number (#1) | 200 |
| HD14 | bit15~bit8: waiting condition (#1)<br>H00: pulse sending completion<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse sending completion<br>bit7~bit0: waiting condition register type<br>H00: constant<br>H01: D<br>H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | 0 |
| HD15 (double word) | Constant value/ register no. (for waiting condition)(#1) | 0 |
| HD17 | bit7~bit0: jump register type<br>H00: constant value<br>H01: D<br>H02: HD<br>H03: FD | 0 |
| HD+18 (double word) | Constant value/register no. (for jump register)( #1) | 0 |
| HD+20 (double word) | Pulse frequency (#2) | 20 |
| HD+22 (double word) | Pulse number (#2) | -200 |
| HD+24 | Waiting condition, waiting condition register type (#2) | 0 |
| HD+25 (double word) | Constant value or register no. (for waiting condition) (#2) | 0 |
| HD+27 | Jump type, jump register type (#2) | 0 |
| HD+28 (double word) | Constant value or register no. (for jump register) (#2) | 0 |

(4) System parameters

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 1792 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | 0 | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 20000 | |
| SFD903 | Pulse number/1 rotation high 16 bits | | 0 | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 5 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | 0 | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 2 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 20 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0 | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | FFFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0xFF | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 0 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 20 | |
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 0 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 0 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 20 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |
| SFD952 | Pulse default speed acceleration time | | 100 | |

| | | | | |
|---|---|---|---|---|
| SFD953 | Pulse default speed deceleration time | | 200 | |
| SFD954 | Acceleration and deceleration time | | 30 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | 0 | |
| SFD956 | Max speed limit low 16 bits | | 50 | |
| SFD957 | Max speed limit high 16 bits | | 0 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 50 | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |
| SFD970 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 30 | Group 2 |
| SFD971 | Pulse default speed high 16 bits | | 0 | |
| SFD972 | Pulse default speed acceleration time | | 100 | |
| SFD973 | Pulse default speed deceleration time | | 200 | |
| SFD974 | Acceleration and deceleration time | | 30 | |
| SFD975 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | 0 | |
| SFD976 | Max speed limit low 16 bits | | 50 | |
| SFD977 | Max speed limit high 16 bits | | 0 | |
| SFD978 | Initial speed low 16 bits | | 0 | |
| SFD979 | Initial speed high 16 bits | | 0 | |
| SFD980 | Stop speed low 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD981 | Stop speed high 16 bits | | 0 | |
| SFD982 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 50 | |
| SFD983 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |

**Note:**

※1: As there are many configuration parameters of PLSR, we suggest to use software configuration table to set the parameters.

※2: if user needs to set each segment pulse frequency and pulse numbers in the HMI, please configure through the configuration table first, then use instruction DMOV in the program to set the registers (S0+N*10+0, S0+N*10+2).

For example:

```
DMOV   HD200   HD10        //HD200 set segment 1 pulse frequency in HMI
DMOV   HD202   HD12        //HD202 set segment 1 pulse numbers in HMI
DMOV   HD204   HD20        //HD204 set segment 2 pulse frequency in HMI
DMOV   HD206   HD22        //HD206 set segment 2 pulse numbers in HMI
```

It can also set pulse frequency and numbers in registers HD10, HD12, HD20, HD22 directly in the HMI.

## 1-2-3. Variable frequency pulse output [PLSF]

■ Instruction summarization

Variable frequency pulse output instruction.

| Variable frequency pulse output [PLSF] | | | |
|---|---|---|---|
| 16-bit | - | 32-bit instruction | PLSF |
| Execution condition | Normally open/close coil | Suitable mode | XD, XL (except XD1, XL1) |
| Hardware | - | Software | - |

■ Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Pulse frequency | 32-bit, double word |
| S1 | System parameters (1 to 4) | 32-bit, double word |
| D | Pulse output terminal | Bit |

■ Suitable soft component

word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | • | • | • | • | • | • | • | • | • | | |
| S1 | • | • | | | | | | | • | | |

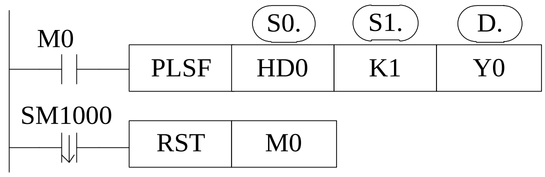
bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dnm |
| D | | • | | | | | |

*Note: D means D, HD. TD means TD, HTD. CD means CD, HCD, HSCD, HSD. DM means DM, DHM.
DS means DS, DHS. M means M, HM, SM. S means S, HS. T means T, HT. C means C, HC.

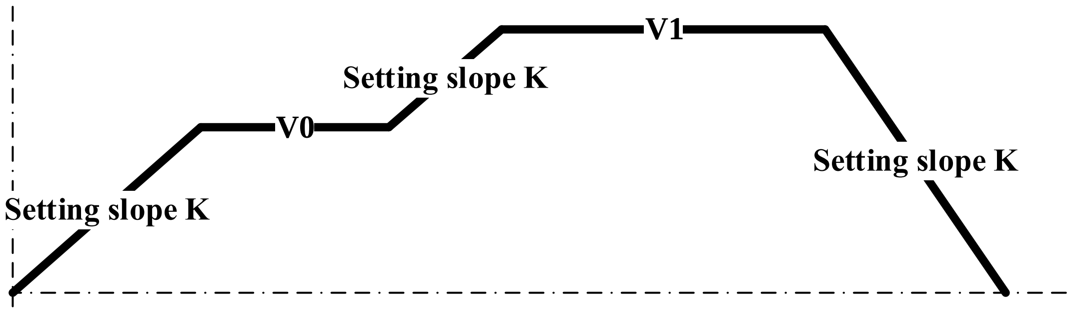
## Function and action

Instruction mode:




- Frequency range: 1Hz ~100KHz or -100KHz ~ -1Hz (note: PLC can output 100~200KHz pulse, but we cannot ensure all the servo drive can work fine, please connect 500Ω resistor between output terminal and 24V power supply)
- When the frequency is positive, it outputs pulse in forward direction, when the frequency is negative, it outputs pulse in reverse direction
- Pulse direction terminal is set in system parameters
- The pulse frequency outputting from Y terminal will change as the S0 value
- HSD0 (double word) is cumulative pulse numbers, HSD2 (double word) is cumulative equivalents
- The frequency jump (acceleration/deceleration) will dynamic adjust as pulse rising or falling slope (refer to chapter 1-2-1-3)
- The system parameters are same to PLSR, refer to chapter 1-2-1-3

## Output mode

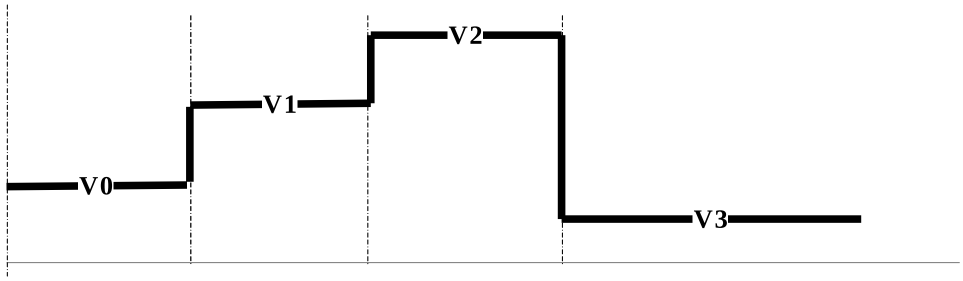



- The pulse output terminal is set in system parameters (refer to chapter 6-2-1-3)
- When the frequency is positive, it outputs pulse in forward direction, when the frequency is negative, it outputs pulse in reverse direction
- When S0 is 0, PLSF stop pulse outputting.
- It will dynamic adjust pulse curve according to pulse slope and setting frequency. If the setting frequency is 0, pulse will stop outputting. And it will output pulses when setting frequency is non-zero value.

**Switching mode analysis**

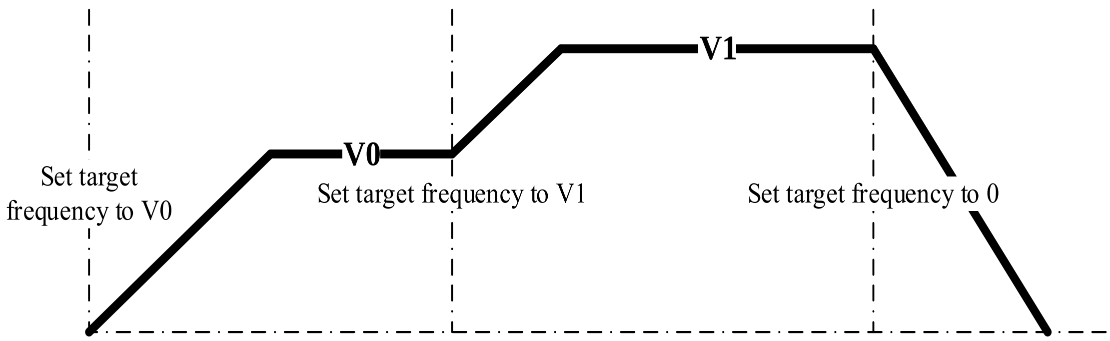
(A) Pulse default speed acceleration deceleration time is 0

The pulse frequency will change as setting frequency.

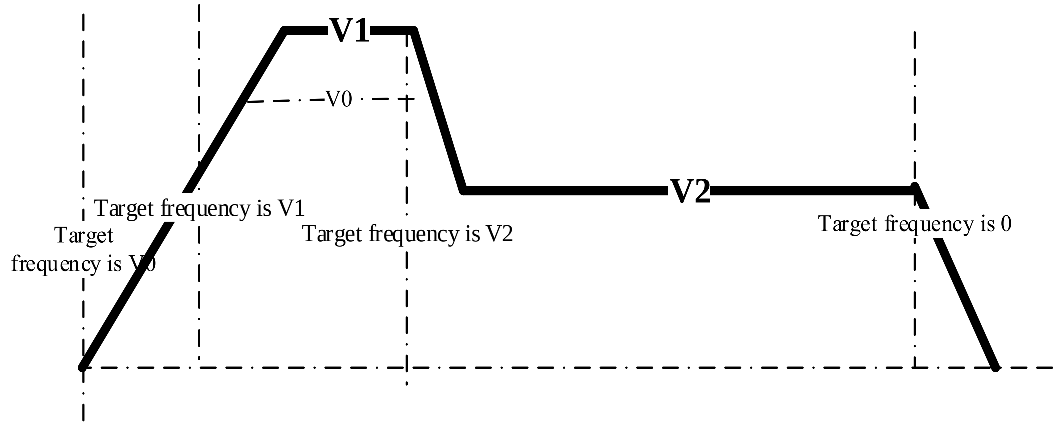



(B) Pulse default speed acceleration deceleration time is not 0

(1) the pulse is in stable segment when user setting new frequency, it will switch to setting frequency through the slope.

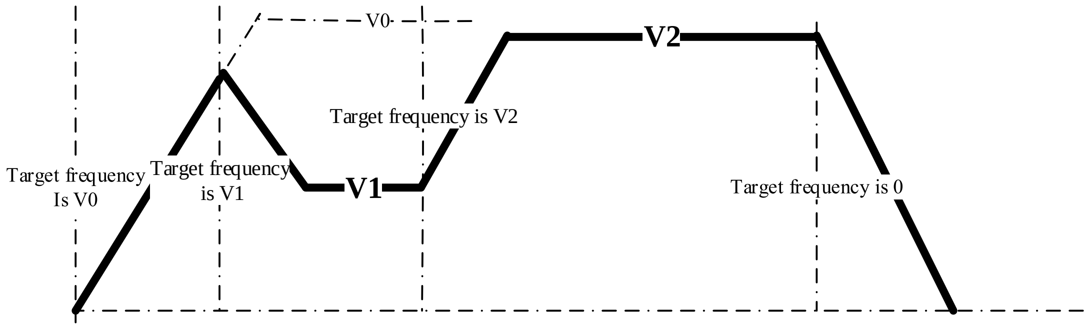


(2) the pulse is not in stable segment when user setting new frequency, it will switch to setting frequency through the slope. (present setting frequency > last time setting frequency, takes present setting frequency as target).




User set target frequency V1 (V1>V0) before reaching setting frequency V0, at this time, it will go to new setting frequency V1 as the slope.

(3) the pulse is not in stable segment when user setting new frequency, it will switch to setting frequency through the slope. (present setting frequency < last time setting frequency, and present setting frequency < present frequency). setting frequency as target).

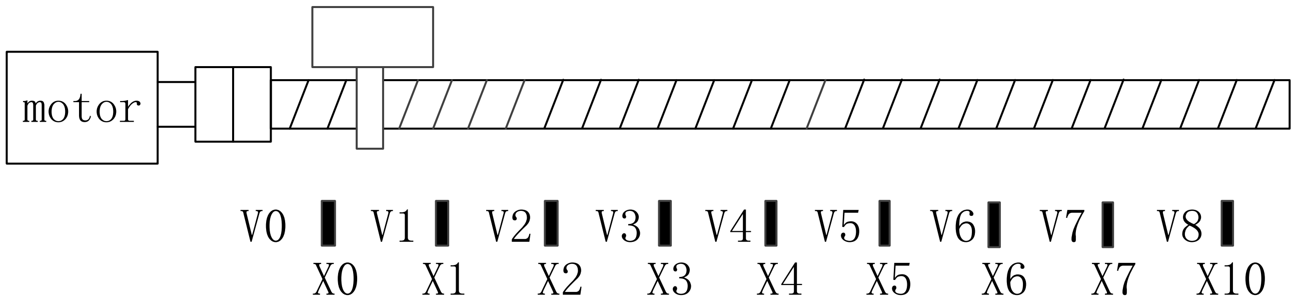



User set target frequency V1 (V1<V0, V1<present frequency) before reaching setting frequency V0, at this time, it will go to new setting frequency V1 as the down slope.

**Example 1**

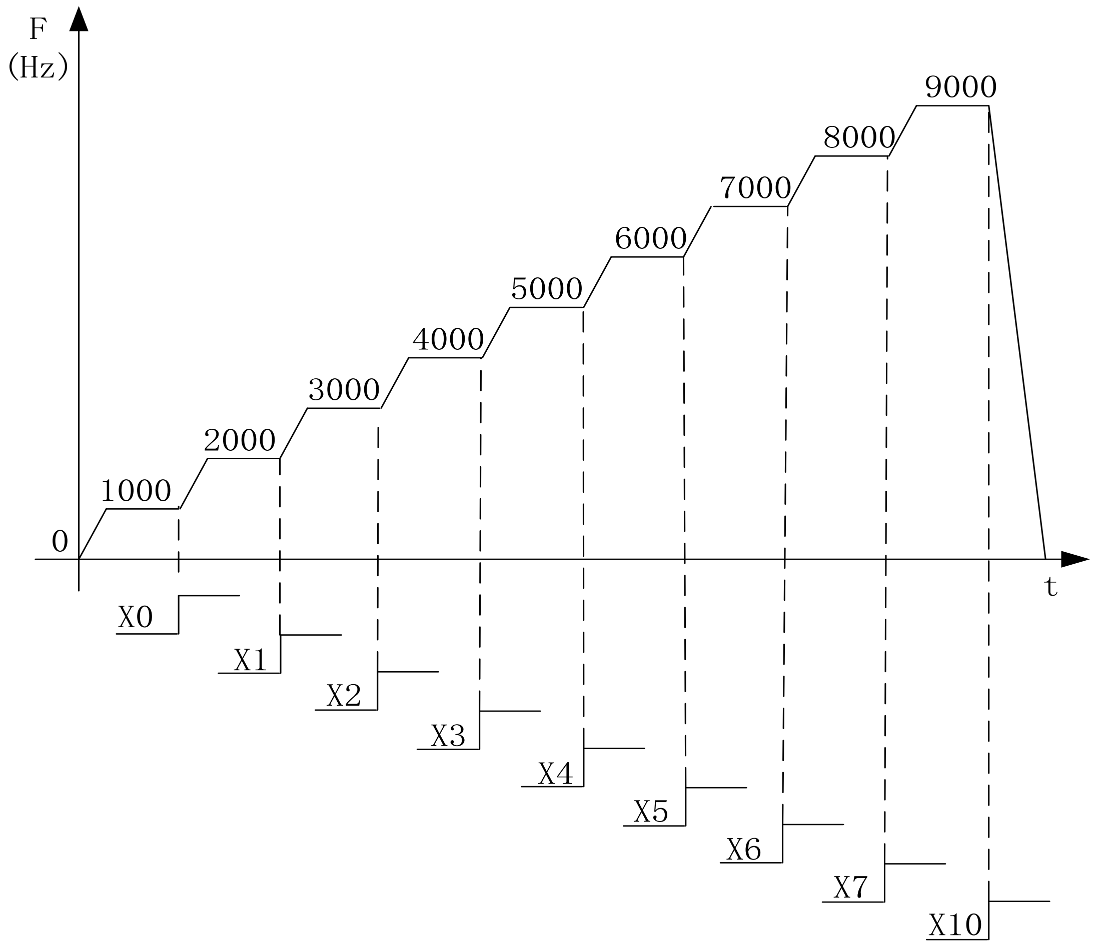
As below diagram, the working table needs to move from left to right position X10. Now the position X0 to X10 all installed proximity switch. The speed from left to X0 is V0, X0 to X1 speed is V1, X1 to X2 speed is V2, X2 to X3 speed is V3, X3 to X4 speed is V4, X4 to X5 speed is V5, X5 to X6 speed is V6, X6 to X7 speed is V7, X7 to X10 speed is V8. Acceleration/deceleration slope is 1000Hz/100ms. Pulse direction terminal is Y2.

| No. | Speed name | Speed | No. | Speed name | speed |
|---|---|---|---|---|---|
| 1 | V0 | 1000Hz | 6 | V5 | 6000Hz |
| 2 | V1 | 2000Hz | 7 | V6 | 7000Hz |
| 3 | V2 | 3000Hz | 8 | V7 | 8000Hz |
| 4 | V3 | 4000Hz | 9 | V8 | 9000Hz |
| 5 | V4 | 5000Hz | | | |

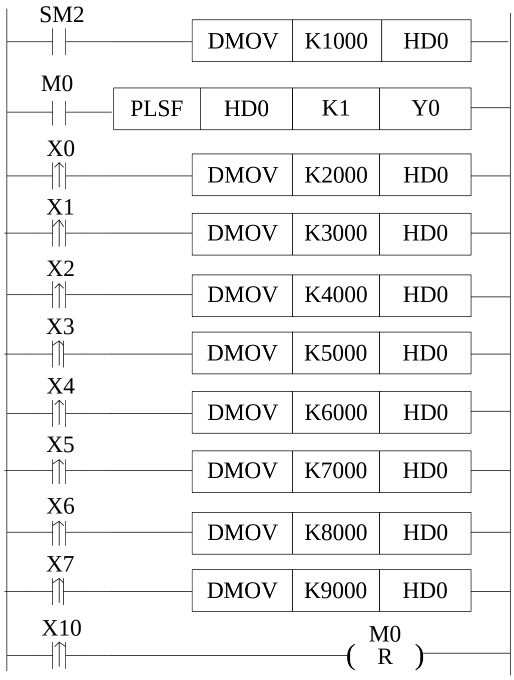



**Mechanical structure**

➢ Pulse curve

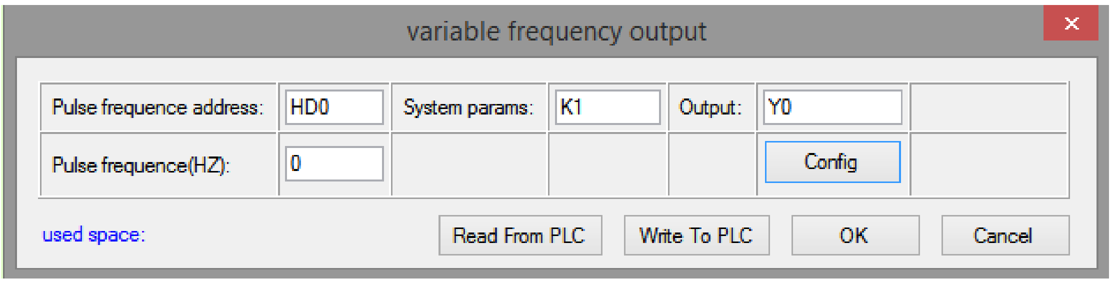


- Pulse instruction




- Software configuration

(1) Pulse segment configuration




(2) System parameter configuration (relative mode)

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
| --- | --- |
| Y0 axis-Common-Gear clearance positive compensation | 0 |
| Y0 axis-Common-Gear clearance negative compensation | 0 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |

| Param | Value |
| --- | --- |
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
| --- | --- |
| Y0 axis-group 1-Pulse default speed | 1000 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 100 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 100 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 200000 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

(3) System parameters address:

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 0 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 0 | |
| SFD903 | Pulse number/1 rotation high 16 bits | | 0 | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 0 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | 0 | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 2 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 20 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0 | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | FFFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0xFF | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 0 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 20 | |
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 2 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 0 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 1000 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |
| SFD952 | Pulse default speed acceleration time | | 100 | |

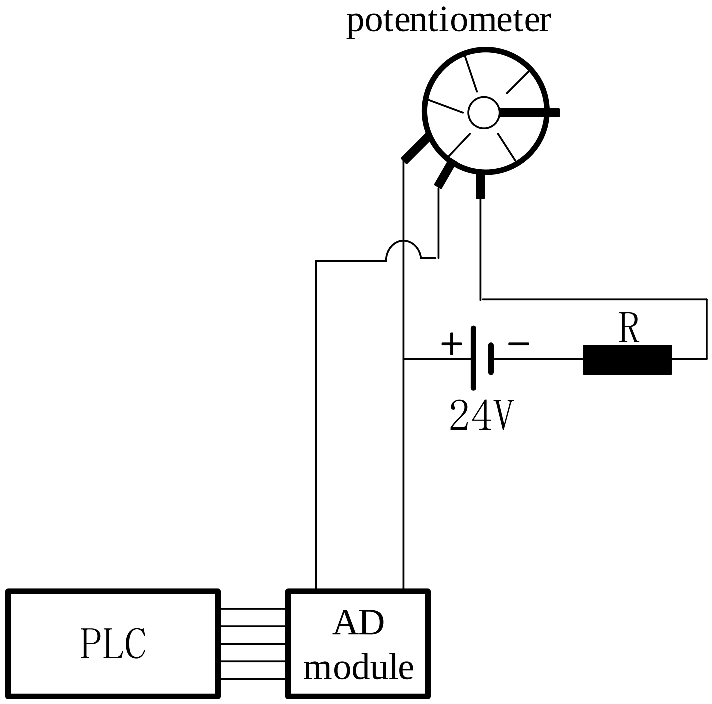
| | | | | |
|---|---|---|---|---|
| SFD953 | Pulse default speed deceleration time | | 100 | |
| SFD954 | Acceleration and deceleration time | | 0 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | 0 | |
| SFD956 | Max speed limit low 16 bits | | 3392 | |
| SFD957 | Max speed limit high 16 bits | | 3 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | 0 | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | 0 | |
| … | | | | |

**Note:**

※1: As there are many configuration parameters of PLSF, we suggest to use software configuration table to set the parameters.

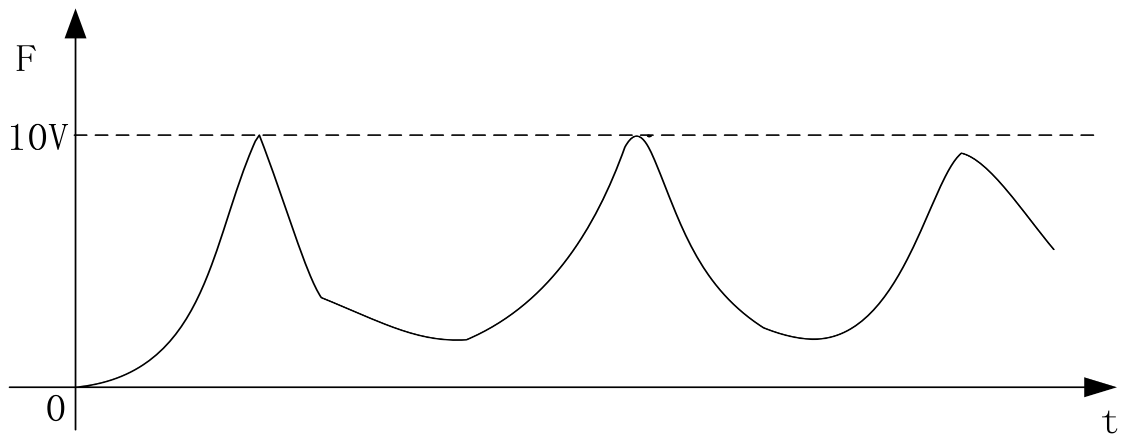
**Example 2**

As below diagram, the AD module collects 0-10V voltage signal and transforms to digital value 0-16383, this value will be sent to PLSF pulse frequency register, and PLC will output the pulse curve changing as the voltage signal.



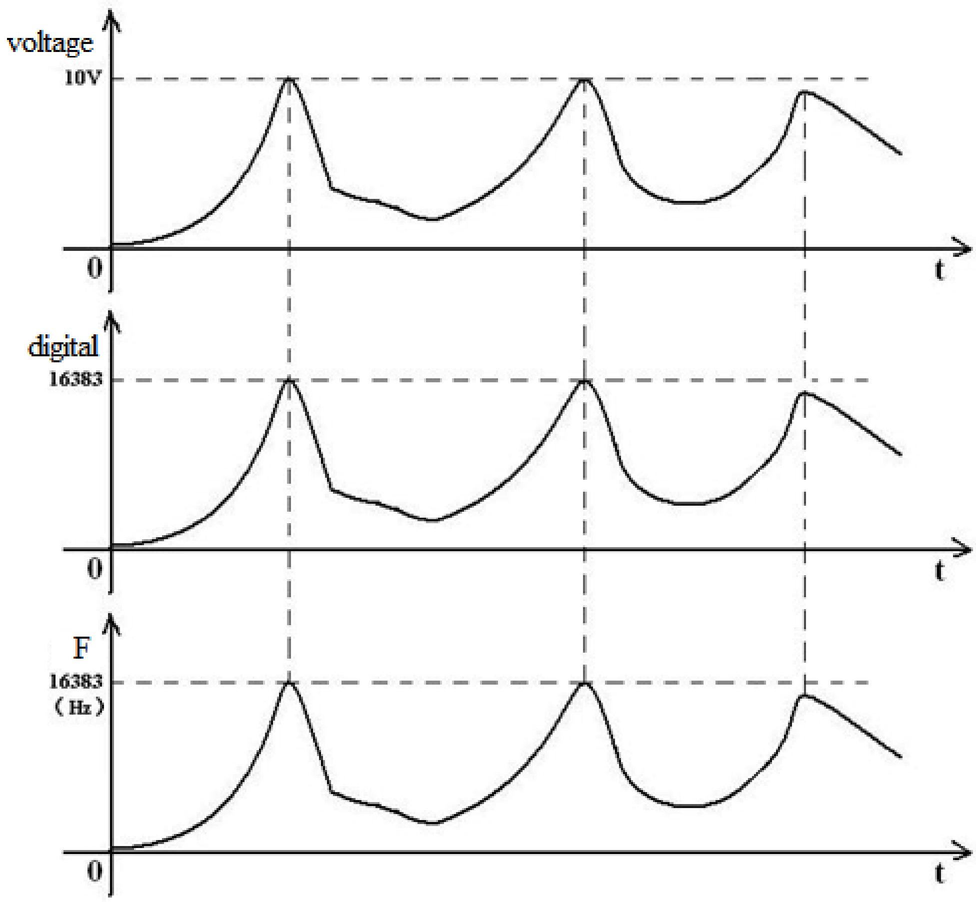

**Structure diagram**

For example: the output signal of potentiometer is shown as below:



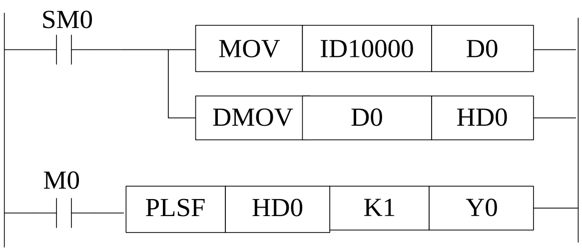

voltage signal diagram

The transformed digital value is 0 to 16383 of 0-10V voltage signal, which means the pulse frequency is 0~16383Hz (because of the response problem, PLSF acceleration deceleration time is 0). The relationship of voltage signal, digital value and pulse output frequency is shown as below diagram:



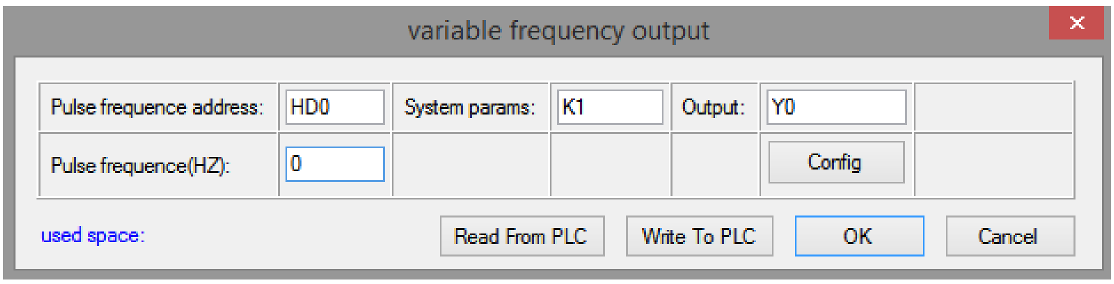

**Relationship of voltage signal/digital value/pulse frequency**

- Pulse instruction




- Software configuration

(1) Pulse segment configuration



(2) System parameters (relative mode)

| Param | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

| Param | Value |
|---|---|
| Y0 axis-Common-Gear clearance positive compensation | 0 |
| Y0 axis-Common-Gear clearance negative compensation | 0 |
| Y0 axis-Common-Electrical origin position | 0 |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-signal terminal switch state setting-... | normally on |
| Y0 axis-Common-Far-point signal terminal setting | X no terminal |
| Y0 axis-Common-Z phase terminal setting | X no terminal |
| Y0 axis-Common-positive limit terminal setting | X no terminal |

| Param | Value |
|---|---|
| Y0 axis-Common-negative limit terminal setting | X no terminal |
| Y0 axis-Common-Zero clear CLR output setting | Y no terminal |
| Y0 axis-Common-Return speed VH | 0 |
| Y0 axis-Common-Creeping speed VC | 0 |
| Y0 axis-Common-Mechanical zero position | 0 |
| Y0 axis-Common-Z phase num | 0 |
| Y0 axis-Common-CLR signal delayed time (ms) | 20 |
| Y0 axis-Common-grinding wheel radius(polar) | 0 |
| Y0 axis-Common-soft limit positive value | 0 |
| Y0 axis-Common-soft limit negative value | 0 |

| Param | Value |
|---|---|
| Y0 axis-group 1-Pulse default speed | 0 |
| Y0 axis-group 1-Acceleration time of Pulse default s... | 0 |
| Y0 axis-group 1-Deceleration time of pulse default s... | 0 |
| Y0 axis-group 1-Acceleration and deceleration time (ms) | 0 |
| Y0 axis-group 1-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 1-Max speed | 200000 |
| Y0 axis-group 1-Initial speed | 0 |
| Y0 axis-group 1-stop speed | 0 |
| Y0 axis-group 1-FOLLOW performance param(1-100) | 50 |
| Y0 axis-group 1-FOLLOW forward compensation(0-100) | 0 |

**Note:**

※1: As there are many configuration parameters of PLSF, we suggest to use software configuration table to set the parameters.

## 1-2-4. Relative single segment positioning [DRVI]

■ Instruction overview

Relative single segment positioning pulse instruction.

| Relative single segment positioning [DRVI] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | DRVI |
| Execution condition | Rising/falling edge coil | Suitable model | XD, XL (except XD1, XL1) |
| Hardware | V3.3.1 and up | Software | V3.3 and up |

■ Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Pulse numbers or soft component address | 32-bit, BIN |
| S1 | Pulse frequency or soft component address | 32-bit, BIN |
| S2 | Pulse acceleration/deceleration time or soft component address | 32-bit, BIN |
| D0 | Pulse output terminal | Bit |
| D1 | Pulse direction terminal | Bit |

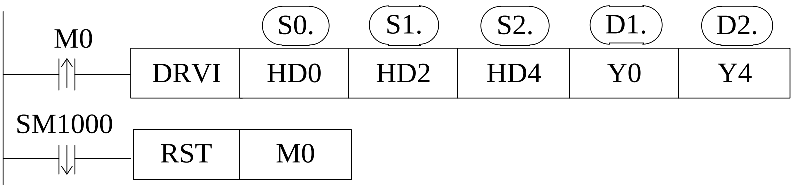
■ Suitable soft component

| | Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Word | | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| | S0 | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| | S1 | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| | S2 | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |

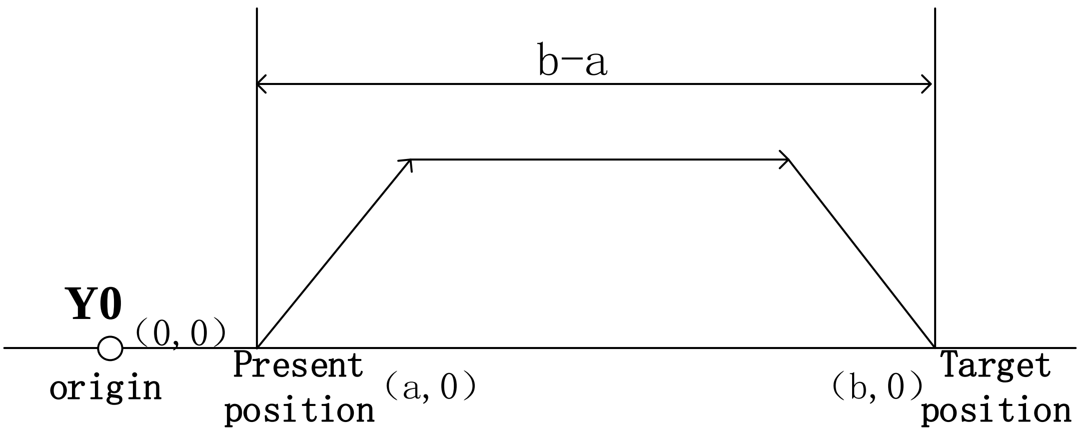
| | Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Bit | | X | Y | M* | S* | T* | C* | Dn.m |
| | D1 | | ● | | | | | |
| | D2 | | ● | | | | | |

*Note: D means D, HD. TD means TD, HTD. CD means CD, HCD, HSCD, HSD. DM means DM, DHM.
DS means DS, DHS. M means M, HM, SM. S means S, HS. T means T, HT. C means C, HC.

**Function and action**



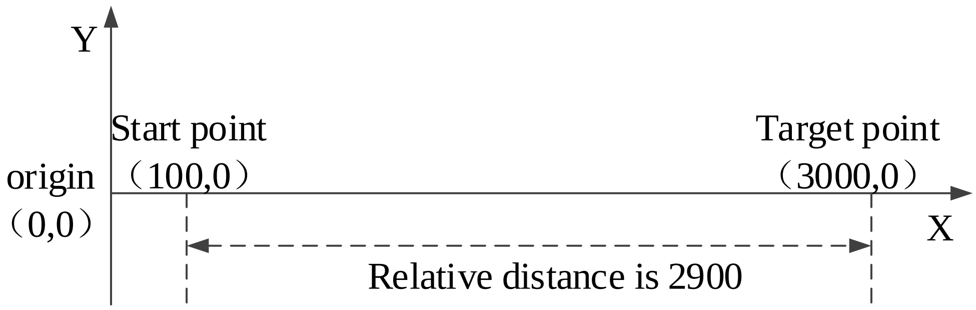

- Pulse frequency output range:1Hz ~100KHz (note: PLC can output 100~200KHz pulse, but we cannot ensure all the servo drive can work fine, please connect 500Ω resistor between output terminal and 24V power supply)
- Pulse numbers: K-2,147,483,648 ~ K2,147,483,647; negative value means output pulse in reverse direction.
- Relative driving mode: move from the present position (the distance between present position and target position), HSD0, HSD2, HSD4, HSD6…… are the reference point.



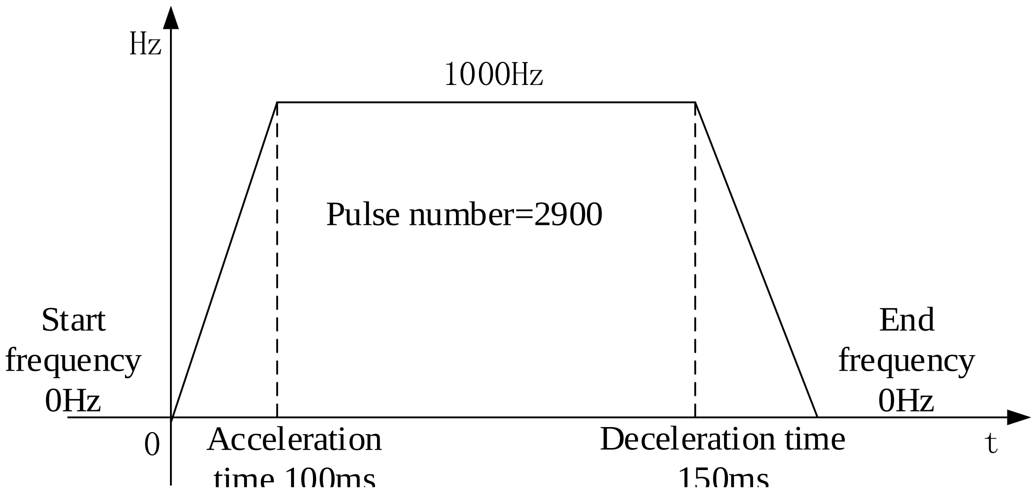
- The pulse number is accumulated in register HSD0 (double word).
- The pulse frequency can be real-time changed when the instruction is executing, the new frequency will be effective at once. (PLC firmware v3.4.5 and up can support)
- The acceleration and deceleration time is same for DRVI instruction.
- The direction of relative positioning instruction depends on S0 (pulse number), if the number of pulses is set to a positive value, the pulse is sent in forward direction and the accumulative pulse register (HSD0, HSD4...) value increases; if the number of pulses is set to a negative value, the pulse is sent in reverse direction and the accumulative pulse register (HSD0, HSD4...) value decreases.
- DRVI does not use the system parameter block configuration mode, if the public and the first set of parameters (except the deceleration parameters) are configured, they will be effective for DRVI.

**Example 1**

X axis present coordinates is (100, 0), it needs to move to target position (3000, 0) with the speed 1000Hz, start frequency and end frequency is 0Hz, pulse output terminal is Y0, direction terminal is Y4. As HSD0(dword) present value is 100, the relative distance from target position 3000 to present position 100 is 3000-100=2900. The execution diagram of DRVI is shown as below:

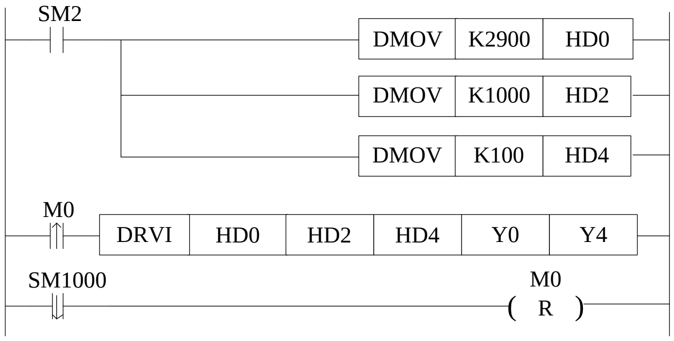



**Pulse coordinates diagram**




Pulse curve diagram

- **Program:**




//set pulse number to 2900

//set pulse frequency to 1000

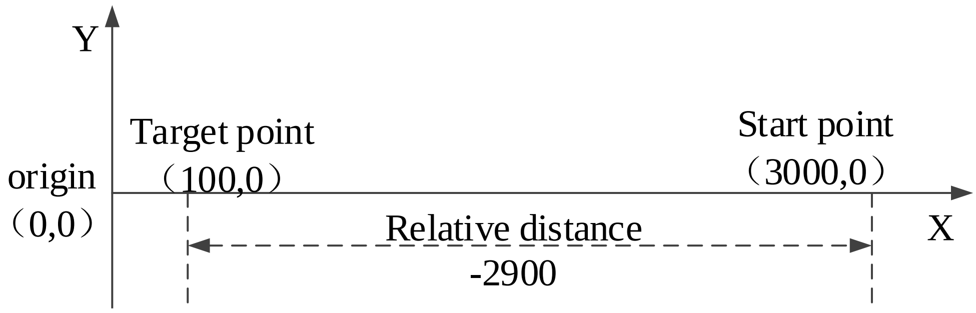
//set acceleration/deceleration to 100

//execute the DRVI instruction

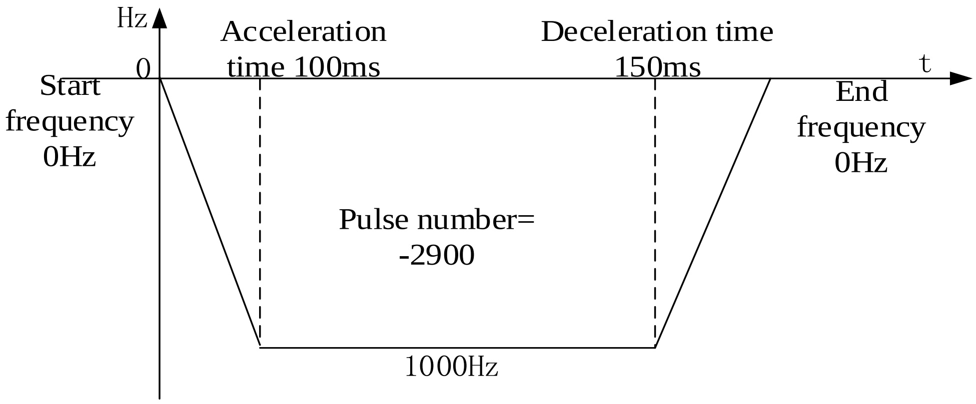
//reset M0 at the falling edge of pulse outputting end flag

**Example 2**

X axis present coordinates is (3000, 0), it needs to move to target position (100, 0) with the speed 1000Hz, start frequency and end frequency is 0Hz, pulse output terminal is Y0, direction terminal is Y4. As HSD0(dword) present value is 3000, the relative distance from target position 100 to present position 3000 is 100-3000=-2900. The execution diagram of DRVI is shown as below:

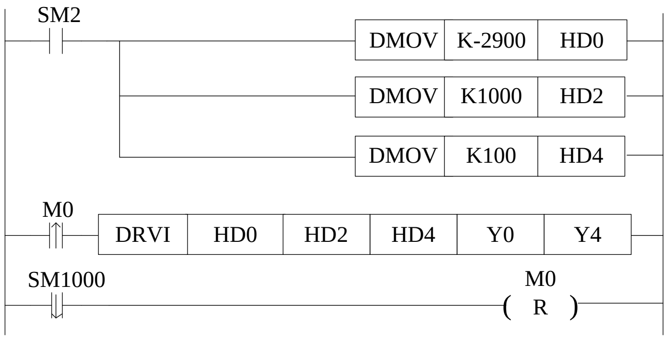



**Pulse coordinate diagram**




**Pulse curve diagram**

- **Program:**




//set pulse number to -2900

//set pulse frequency to 1000

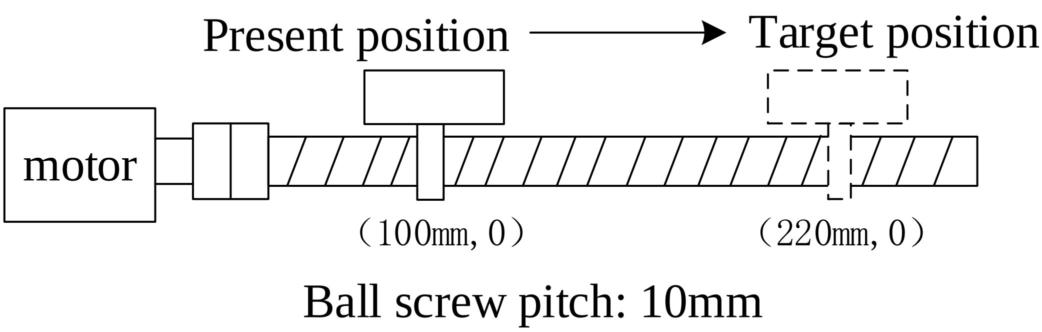
//set acceleration/deceleration to 100

//execute the DRVI instruction

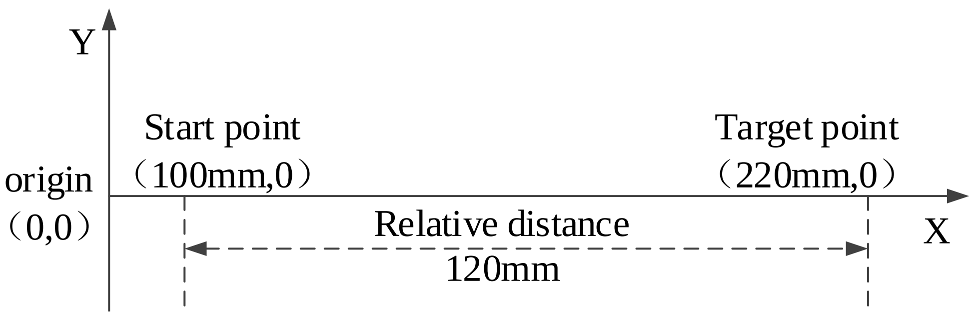
//reset M0 at the falling edge of pulse outputting end flag

**Example 3**

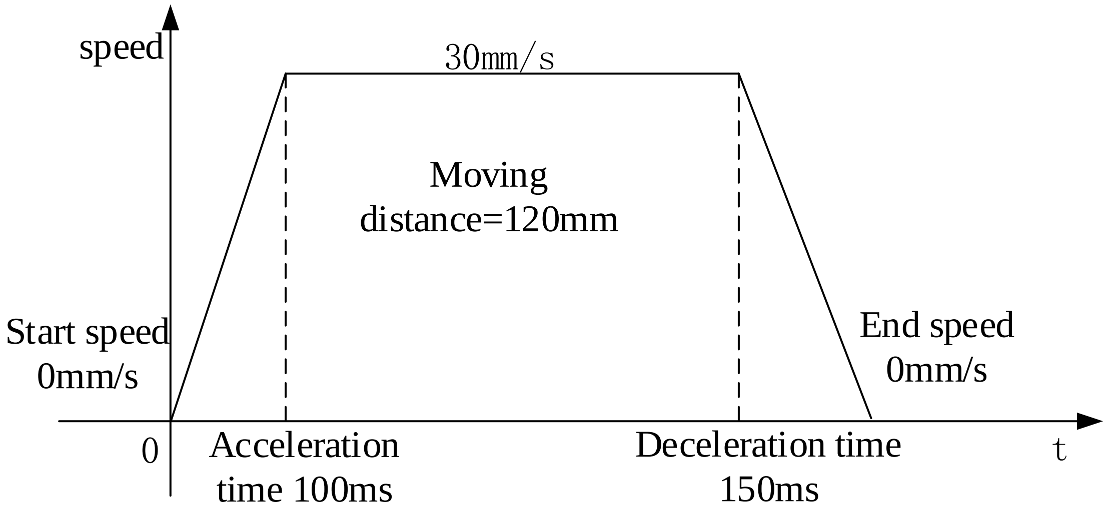
There is a ball screw workbench, the motor has 5000 pulses per circle, X axis present coordinate is (100mm, 0), start speed and end speed is 0mm/s, it needs to reach the target position (220mm, 0) with the speed 15000（30mm/s）, the pulse output terminal is Y0, pulse direction terminal is Y4,as the accumulated pulse number register HSD0 present value is 50000 (100mm), the relative distance from target position 110000 (220mm) to present position 50000 (100mm) is 60000=110000-50000. The execution diagram of DRVI is shown as below:




**Ball srew diagram**

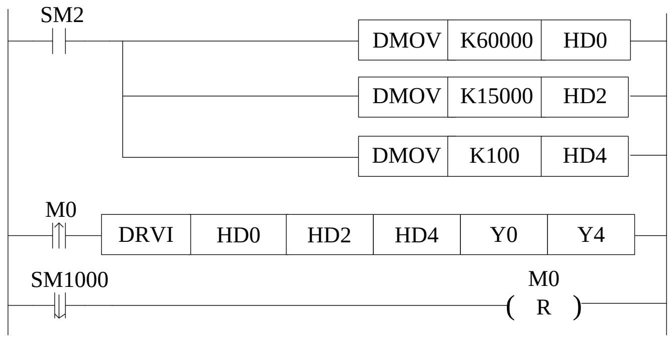



**Pulse coordinate diagram**




**pulse curve diagram**

- **Program:**




//set moving distance to 60000

//set speed to 15000

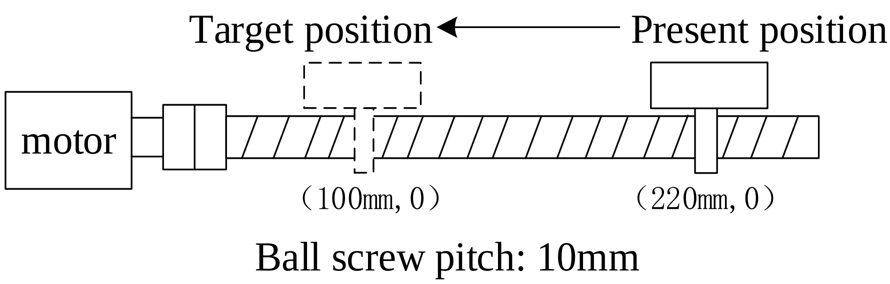
//set acceleration/deceleration to 100

//execute the DRVI instruction

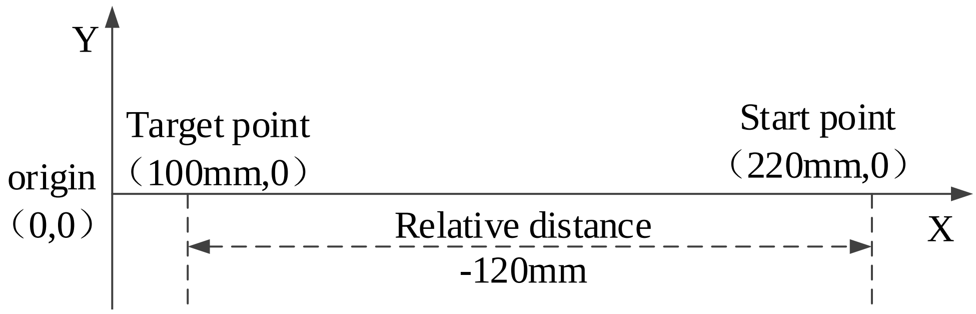
//reset M0 at the falling edge of pulse outputting end flag

**Example 4**

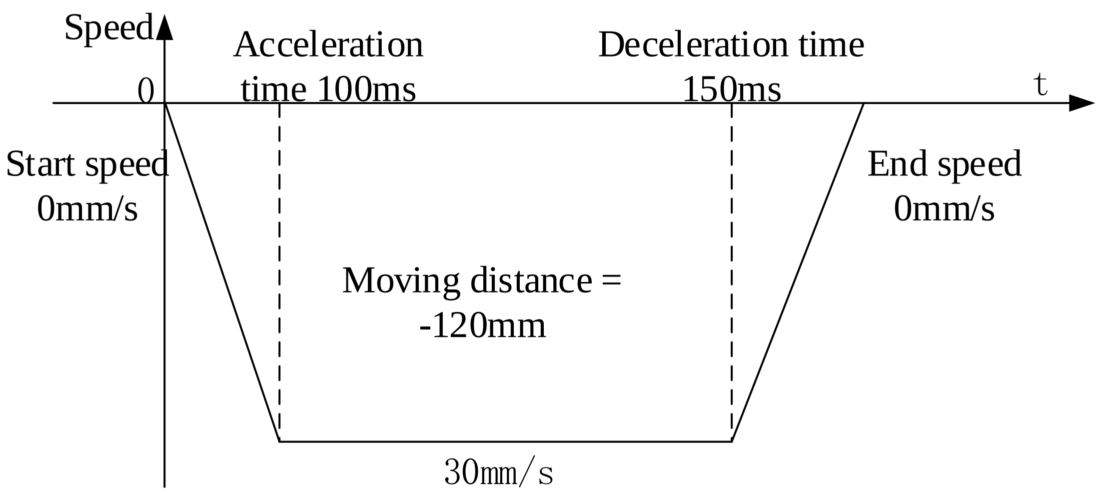
There is a ball screw workbench, the motor has 5000 pulses per circle, X axis present coordinate is (220mm, 0), start speed and end speed is 0mm/s, it needs to reach the target position (100mm, 0) with the speed 15000（30mm/s）, the pulse output terminal is Y0, pulse direction terminal is Y4,as the accumulated pulse number register HSD0 present value is 110000 (220mm), the relative distance from target position 50000 (100mm) to present position 110000 (220mm) is -60000=50000-110000. The execution diagram of DRVI is shown as below:




**Ball screw diagram**

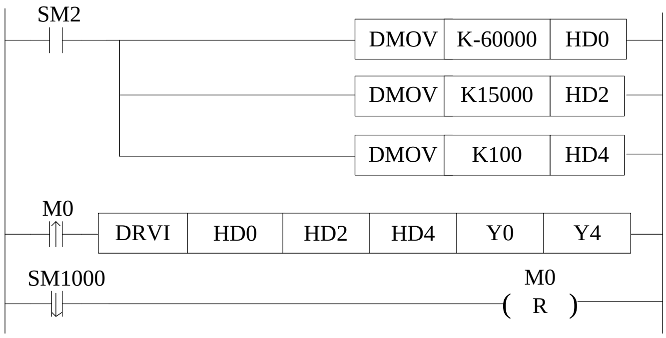



**Pulse coordinate diagram**




**Pulse curve diagram**

➢ **Program:**




//set moving distance to -60000

//set speed to 15000

//set acceleration/deceleration to 100

//execute the DRVI instruction

//reset M0 at the falling edge of pulse outputting end flag

## 1-2-5. Absolute single-segment positioning [DRVA]

1. Instruction summarization

Absolute single-segment positioning instruction.

| Absolute single-segment positioning [DRVA] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | DRVA |
| Execution condition | Rising/falling edge of the coil | Suitable model | XD, XL (except XD1, XL1) |
| Hardware | V3.3.1 and up | Software | V3.3 and up |

2. operand

| Operand | Function | Type |
|---|---|---|
| S0 | Output pulse numbers register address | 32-bit, BIN |
| S1 | Output pulse frequency register address | 32-bit, BIN |
| S2 | Pulse acceleration/deceleration time register address | 32-bit, BIN |
| D0 | Pulse output terminal | Bit |
| D1 | Pulse output direction | Bit |

3. Suitable soft component

word

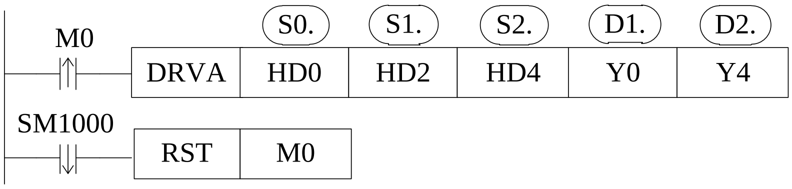
| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| S1 | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |
| S2 | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |

Bit

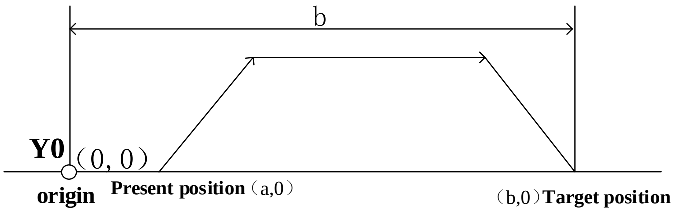
| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dnm |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*Note: D means D, HD. TD means TD, HTD. CD means CD, HCD, HSCD, HSD. DM means DM, DHM.
DS means DS, DHS. M means M, HM, SM. S means S, HS. T means T, HT. C means C, HC.

## Function and action




- Pulse frequency output range:1Hz ~100KHz (note: PLC can output 100~200KHz pulse, but we cannot ensure all the servo drive can work fine, please connect 500Ω resistor between output terminal and 24V power supply)
- Pulse numbers: K-2,147,483,648 ~ K2,147,483,647; negative value means output pulse in reverse direction.
- Absolute driving mode: move from the origin point (the distance between origin position and target position), origin point is the reference point.

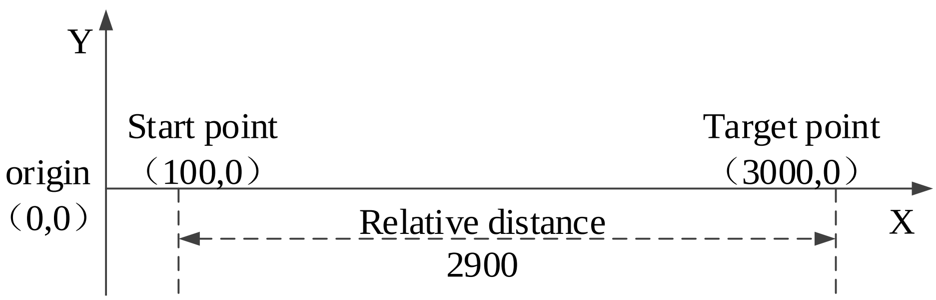



- DRVA does not use the system parameter block configuration mode, if the public and the first set of parameters (except the deceleration parameters) are configured, they will be effective for DRVA.
- The pulse number is accumulated in register HSD0 (double word).
- The pulse frequency can be real-time changed when the instruction is executing, the new frequency will be effective at once. (PLC firmware v3.4.5 and up can support)

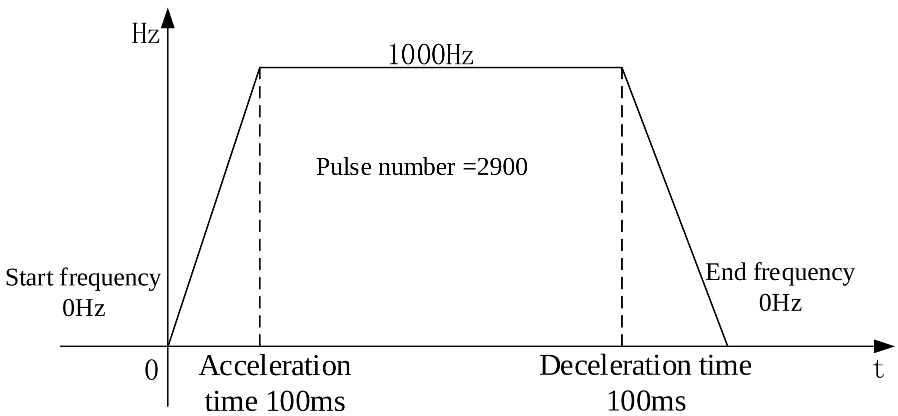
- The acceleration and deceleration time is same for DRVA instruction.
- The direction of absolute positioning instruction depends on whether the target position is larger than present position, if the target position is larger than present position(the target position is on the right of present position on the axis), the pulse is sent in forward direction and the accumulative pulse register (HSD0, HSD4...) value increases; if the target position is smaller than present position(the target position is on the left of present position on the axis), the pulse is sent in reverse direction and the accumulative pulse register (HSD0, HSD4...) value decreases, if the target position is equal to present position(the target position overlaps present position on the axis), it will not send pulse.
- When S0 parameters are same to pulse accumulated register HSD0, SM1000 will not act, no falling edge.

**Example 1**

X axis present coordinates is (100, 0), it needs to move to target position (3000, 0) with the speed 1000Hz, start frequency and end frequency is 0Hz, pulse output terminal is Y0, direction terminal is Y4. As HSD0(dword) present value is 100, the target position is 3000, target position is larger than present position, send forward direction pulse, the execution diagram of DRVA is shown as below:

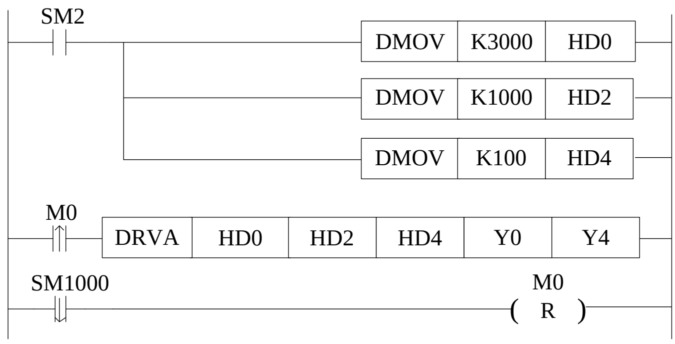



**Pulse coordinate diagram**




**Pulse curve diagram**

- **Program:**




//set pulse number to 3000

//set pulse frequency to 1000

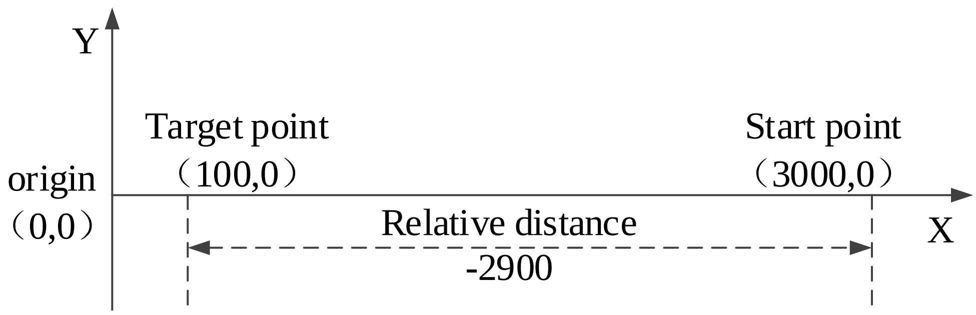
//set acceleration/deceleration to 100

//execute the DRVA instruction

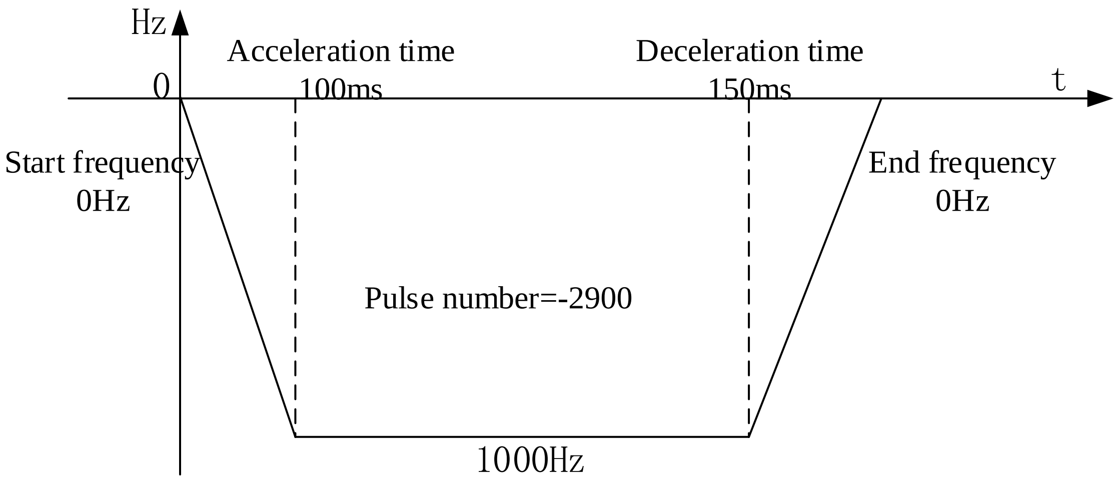
//reset M0 at the falling edge of pulse outputting end flag

**Example 2**

X axis present coordinates is (3000, 0), it needs to move to target position (100, 0) with the speed 1000Hz, start frequency and end frequency is 0Hz, pulse output terminal is Y0, direction terminal is Y4. As HSD0(dword) present value is 3000, the target position is 100, present position is 3000, the relative ditance is 100-3000=-2900, the execution diagram of DRVA is shown as below:

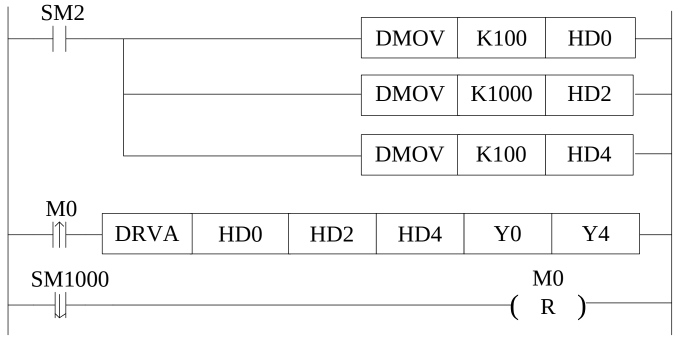



**Pulse coordinate diagram**




**Pulse curve diagram**

- **Program:**




//set pulse number to 100

//set pulse frequency to 1000

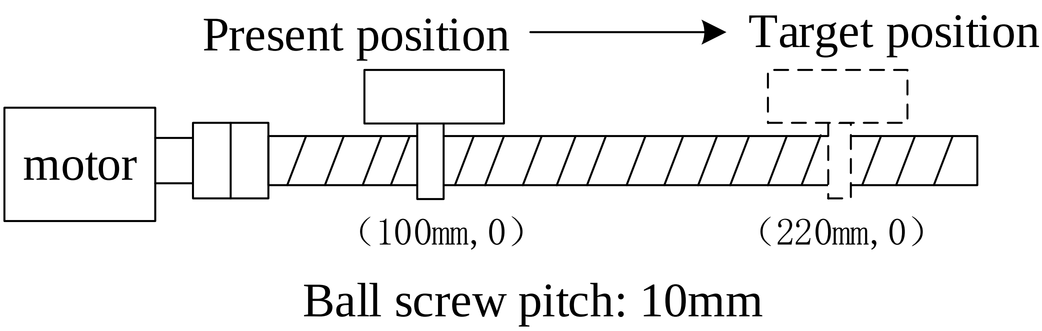
//set acceleration/deceleration to 100

//execute the DRVA instruction

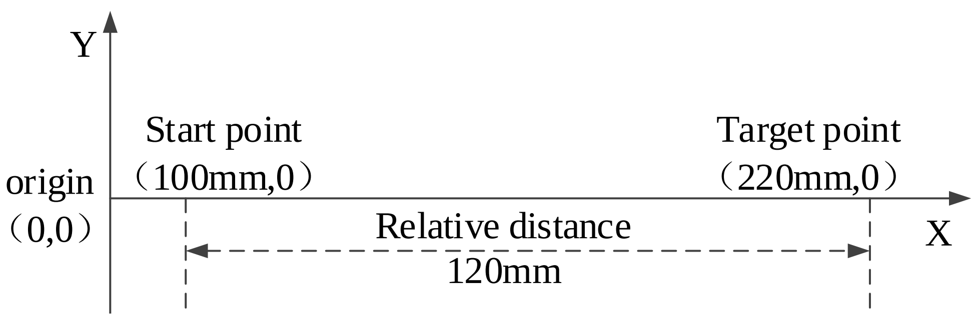
//reset M0 at the falling edge of pulse outputting end flag

**Example 3**

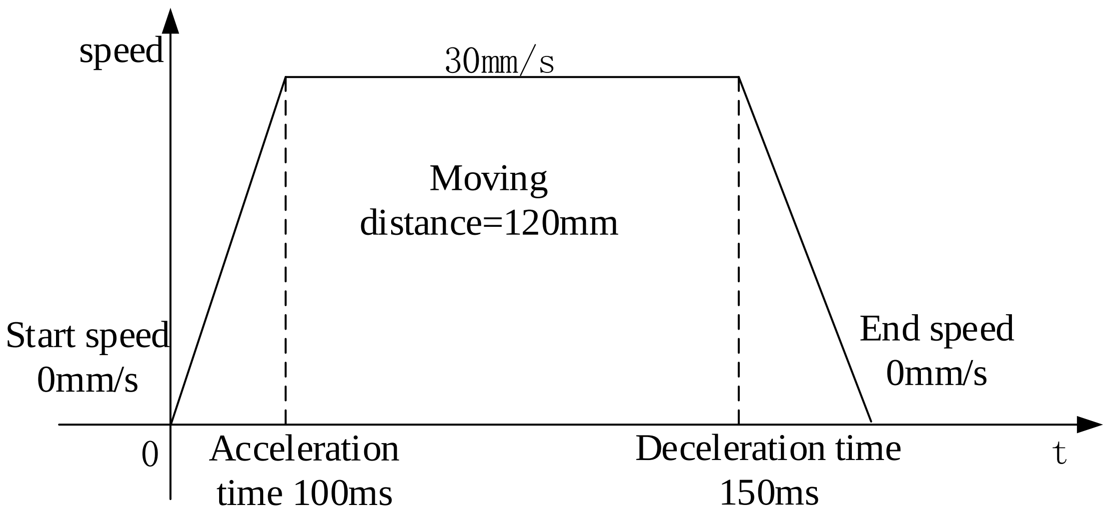
There is a ball screw workbench, the motor has 5000 pulses per circle, X axis present coordinate is (100mm, 0), start speed and end speed is 0mm/s, it needs to reach the target position (220mm, 0) with the speed 15000（30mm/s）, the pulse output terminal is Y0, pulse direction terminal is Y4, as the accumulated pulse number register HSD0 present value is 50000 (100mm), the relative distance from target position 110000 (220mm) to present position 50000 (100mm) is 60000=110000-50000. The execution diagram of DRVA is shown as below:




**Ball srew diagram**

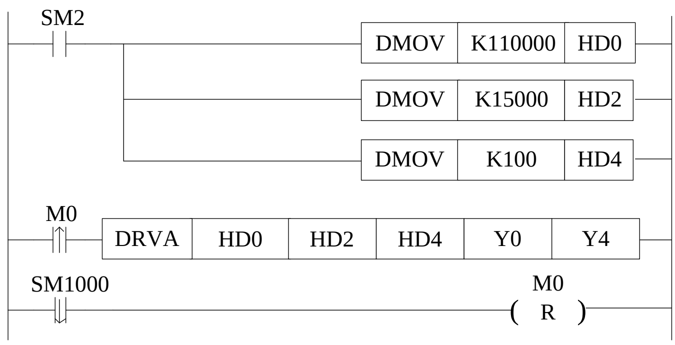


**Pulse coordinate diagram**




pulse curve diagram

➢ **Program:**




//set moving distance to 110000

//set speed to 15000

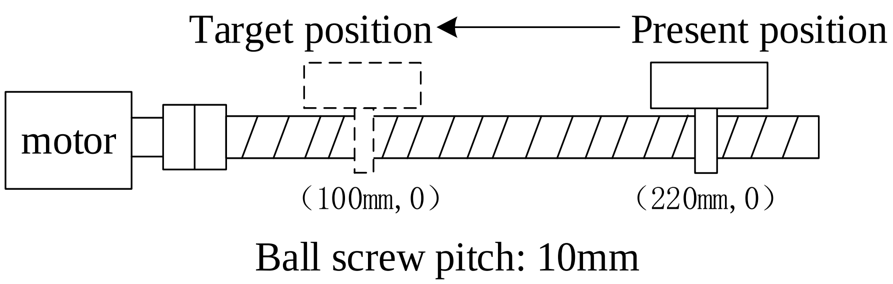
//set acceleration/deceleration to 100

//execute the DRVA instruction

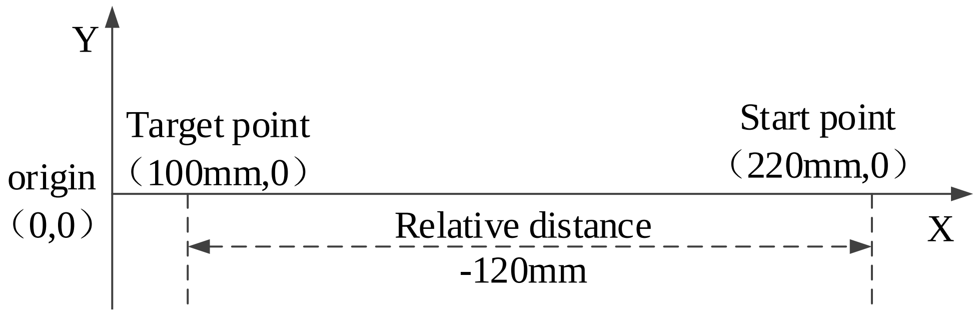
//reset M0 at the falling edge of pulse outputting end flag

**Example 4**

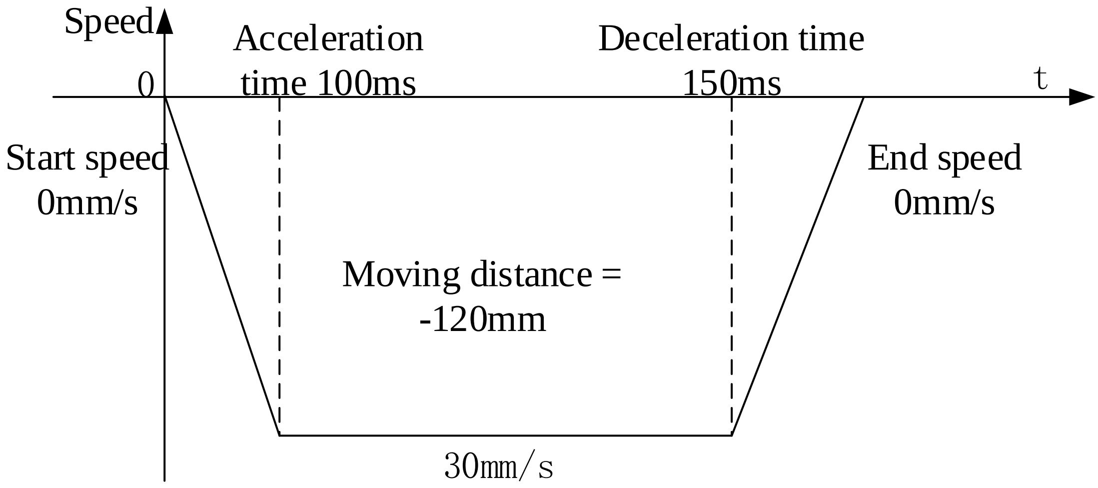
There is a ball screw workbench, the motor has 5000 pulses per circle, X axis present coordinate is (220mm, 0), start speed and end speed is 0mm/s, it needs to reach the target position (100mm, 0) with the speed 15000（30mm/s）, the pulse output terminal is Y0, pulse direction terminal is Y4, as the accumulated pulse number register HSD0 present value is 110000 (220mm), the relative distance from target position 50000 (100mm) to present position 110000 (220mm) is -60000=50000-110000. The execution diagram of DRVA is shown as below:




**Ball screw diagram**

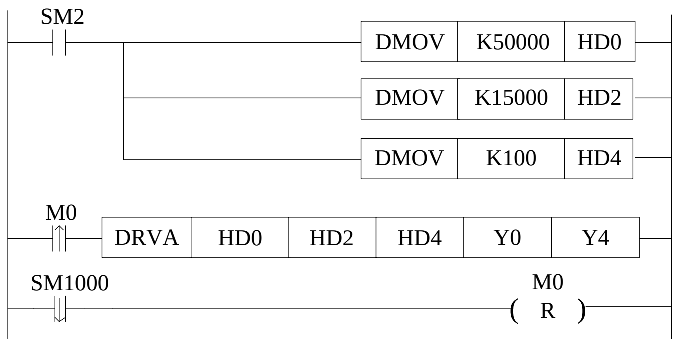



**Pulse coordinate diagram**




**Pulse curve diagram**

➢ **Program:**




//set moving distance to 50000

//set speed to 15000

//set acceleration/deceleration to 100

//execute the DRVA instruction

//reset M0 at the falling edge of pulse outputting end flag

## 1-2-6. Mechanical origin return[ZRN]

1. Instruction overview

Mechanical origin return instruction. (note: ZRN cannot support the function of soft limit and origin auxiliary signal)

| Mechanical origin return [ZRN] | | | |
|---|---|---|---|
| 16-bit instruction | | 32-bit instruction | ZRN |
| Execution condition | Rising/falling edge of the coil | Suitable model | XD, XL (except XD1, XL1) |
| Hardware | - | Software | - |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S | System parameter block address | 32-bit, double words |
| D | Pulse output terminal | Bit |

3. Suitable soft component

word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S | ● | ● | ● | ● | ● | ● | ● | ● | ● | | |

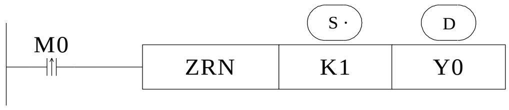
Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dnm |
| D | | ● | | | | | |

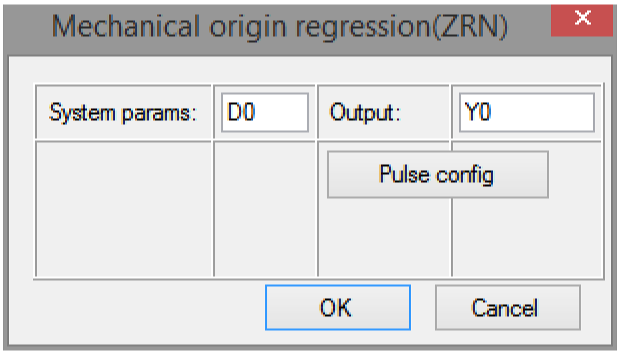
*Note: D means D, HD. TD means TD, HTD. CD means CD, HCD, HSCD, HSD. DM means DM, DHM.

DS means DS, DHS. M means M, HM, SM. S means S, HS. T means T, HT. C means C, HC.

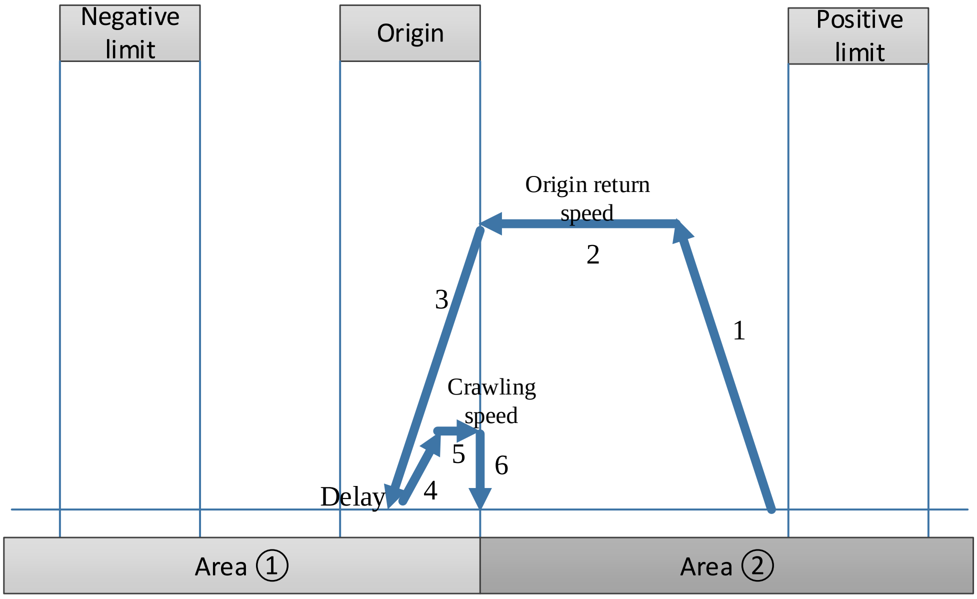
**Function and action**




- The system parameter block please refer to chapter 1-2-1-3.
- ZRN instruction panel configuration is shown as below:

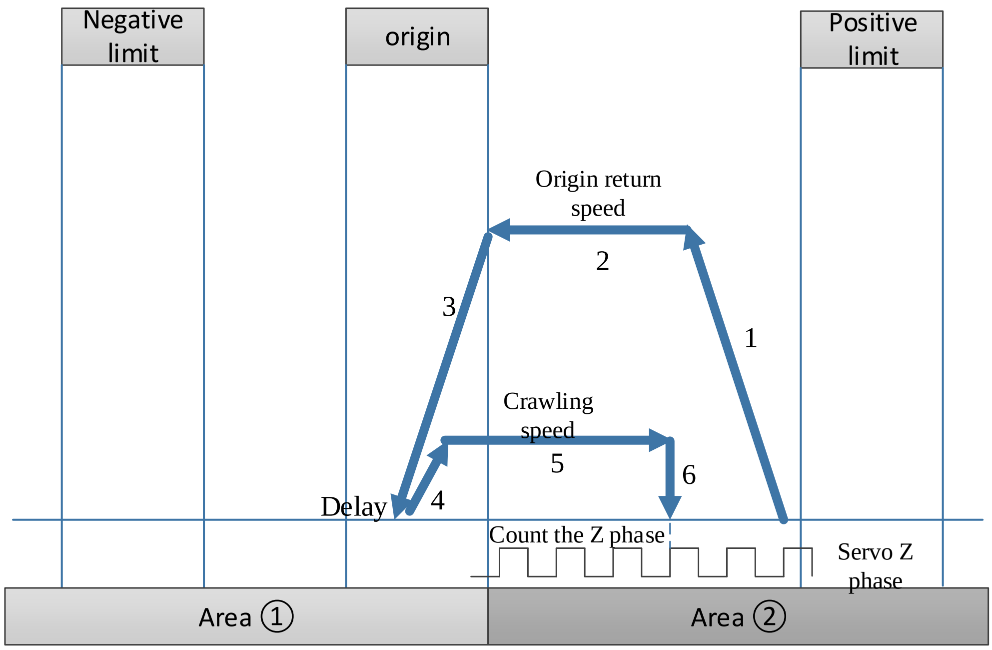



- Mechanical origin returning diagram:




**Note:**

If setting the servo Z phase, it starts to count the Z phase signal at the monment of leaving the origin signal with crawling speed (5), it stops mechanical origin return instruction after Z phase signal counting reached, please see below diagram:



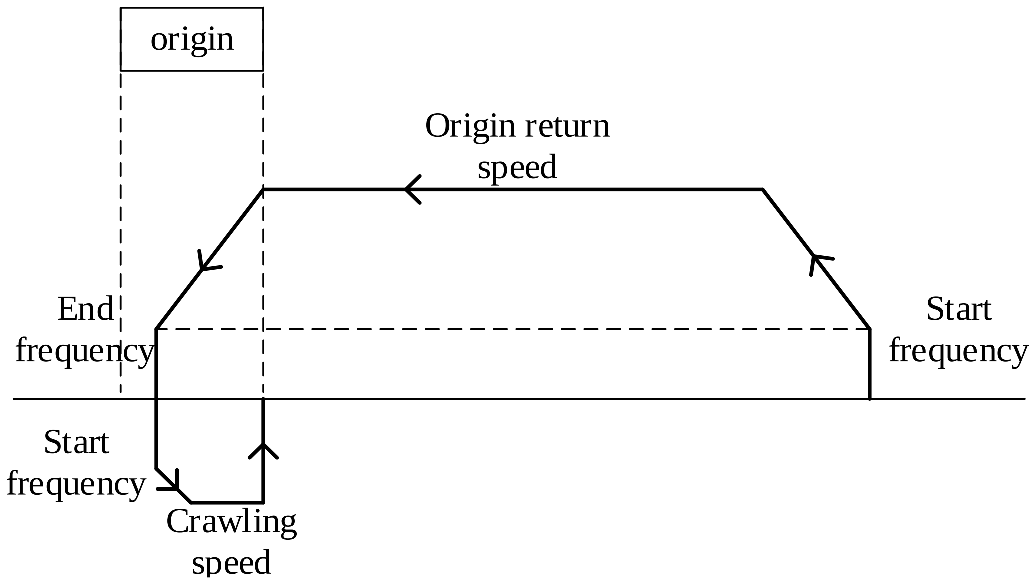

- Mechanical origin return movement

(1) when the origin return starts, it accelerates as the acceleration slope, after reaching the origin return speed, it will move towards origin return direction with this speed.

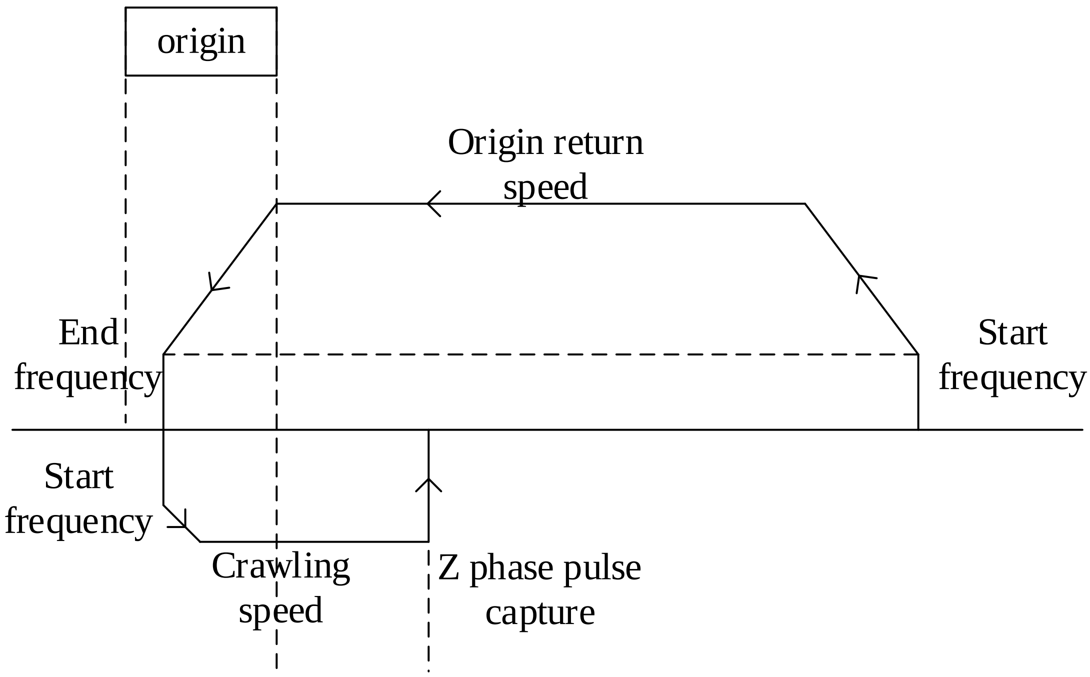
(2) when it meets the rising edge of origin signal, it will decelerate with deceleration slope until stop(frequency =0).

(3) delay(direction delay time in SFD), then accelerate with acceleration slope until reaching the crawling speed, it stops origin return action at the moment of leaving the origin signal falling edge (if setting the Z phase pulse, it starts counting the Z phase after leaving the origin signal falling edge, it will stop origin return action after the counting value reached).

(4) if setting the origin return clear signal CLR, it will output CLR signal and delay (the CLR signal delay time in SFD, CLR signal can be used to clear the servo motor error counter), finally, copy the mechanical origin position to present position and the origin return action finished.

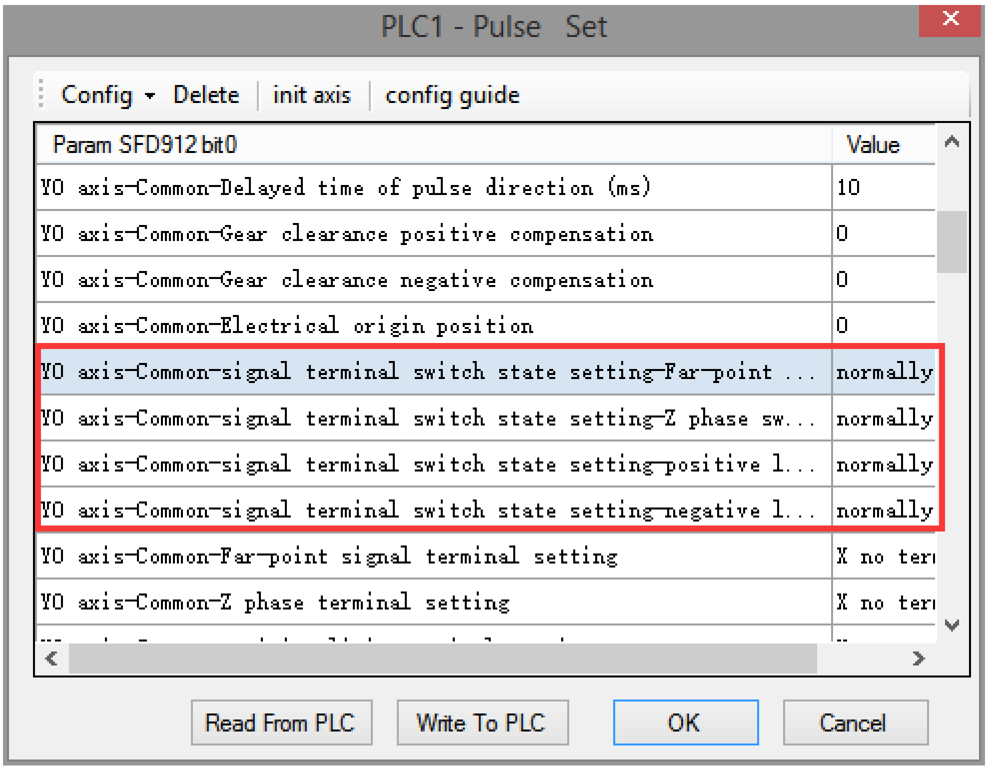



**No Z phase capture**




**Z phase capture**

**Mechanical origin input terminal positive/negative logic (normally on/off) setting:**




**Mechanical orgin return setting notes:**

The origin signal terminal can select all input points on the PLC; However, if the selected input point is the external interrupt terminal on the PLC, the process of returning to the mechanical origin will be processed according to the interrupt, so as to further improve the accuracy of returning to the mechanical origin (it will not be affected if Z phase is used to return to the origin). The selected input point is the external interrupt terminal not from the PLC, which will be affected by the scanning cycle of PLC in the process of mechanical origin (it will not be affected if Z phase is used to return to the origin). For detailed external interrupt terminals, please refer to appendix 4 of this manual.

**Pulse output terminal configuration table:**

| PLC mode | Pulse channel | Pulse output terminal | Max output frequency | Output mode | Output mode |
|---|---|---|---|---|---|
| XD2-16T/RT<br>XD2-24T/RT<br>XD2-32T/RT<br>XD2-48T/RT<br>XD2-60T/RT | 2 | Y0, Y1 | 0~100KHz | Open collector mode | Pulse + direction |
| XD3-16T/RT<br>XD3-24T/RT<br>XD3-32T/RT<br>XD3-48T/RT<br>XD3-60T/RT | 2 | Y0, Y1 | 0~100KHz | Open collector mode | Pulse + direction |
| XD5-16T/RT<br>XD5-24T/RT<br>XD5-32T/RT<br>XD5-48T/RT<br>XD5-60T/RT | 2 | Y0, Y1 | 0~100KHz | Open collector mode | Pulse + direction |
| XD5-24T4<br>XD5-32T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector mode | Pulse + direction |
| XD5-48T6<br>XD5-60T6 | 6 | Y0, Y1, Y2, Y3, Y4, Y5 | 0~100KHz | Open collector mode | Pulse + direction |
| XDM-24T4<br>XDM-32T4<br>XDM-60T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector mode | Pulse + direction |
| XDM-60T10 | 10 | Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11 | 0~100KHz | Open collector mode | Pulse + direction |
| XD5E-30T4 | 4 | Y0, Y1, Y2, Y3 | 0~100KHz | Open collector mode | Pulse + direction |
| XL3-16 | 2 | Y0, Y1 | 0~100KHz | Open collector | Pulse + direction |

| | | | | | |
|---|---|---|---|---|---|
| | | | | mode | |

**Note:**

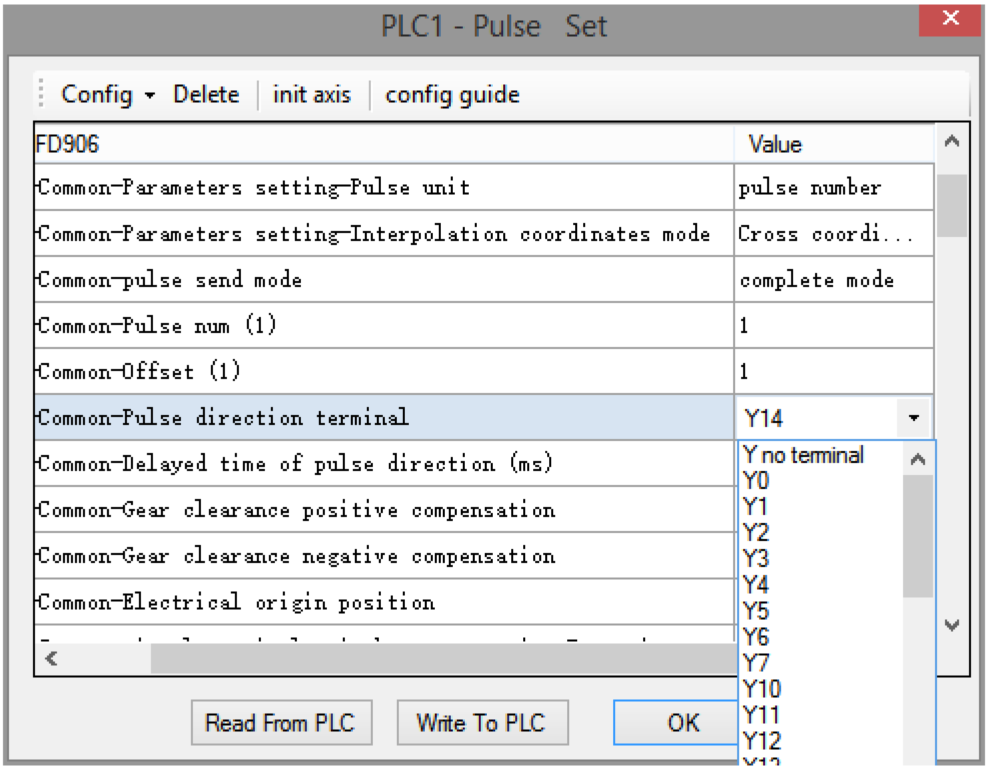
1: PLC can output 100 KHz to 200 KHz pulses, but we cannot sure that all servo is running, please connect 500 Ω resistance between output and 24V power supply.

2. when using the positioning command, the pulse direction terminal can be freely defined in all the output transistor terminals except the pulse output terminal;

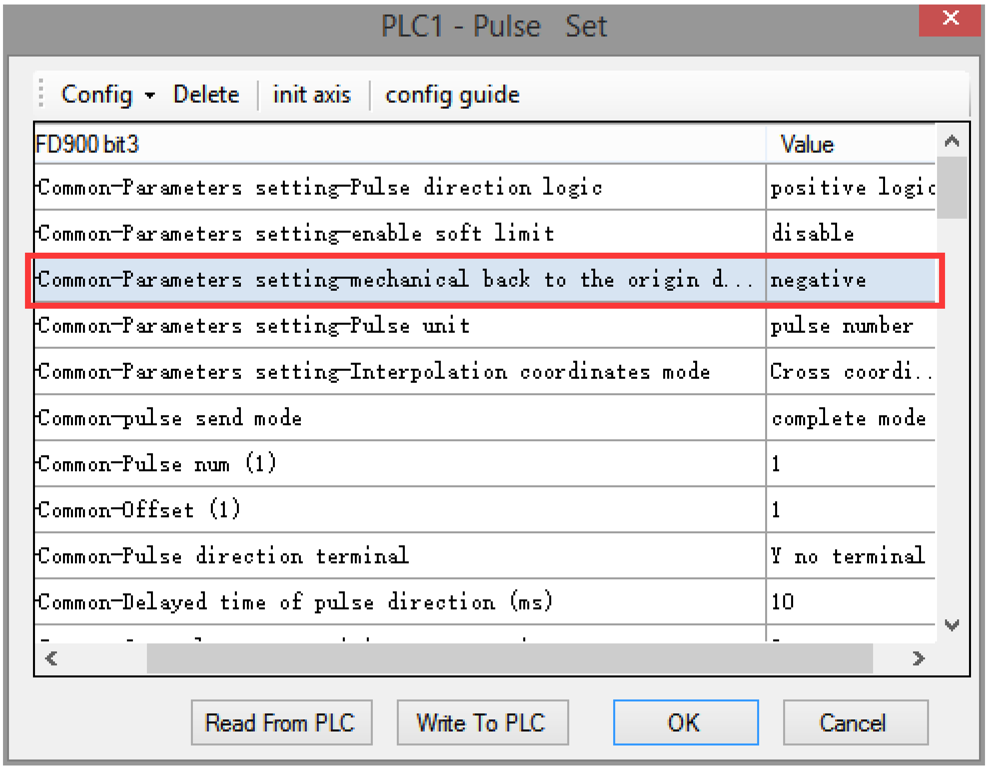
3. response time of pulse output transistor is 0.5us, response time of other output transistors is below 0.2ms.

4. when the pulse output terminal does not make the pulse output, it can also be used as the pulse direction terminal.

**Mechanical origin returning pulse direction signal:**

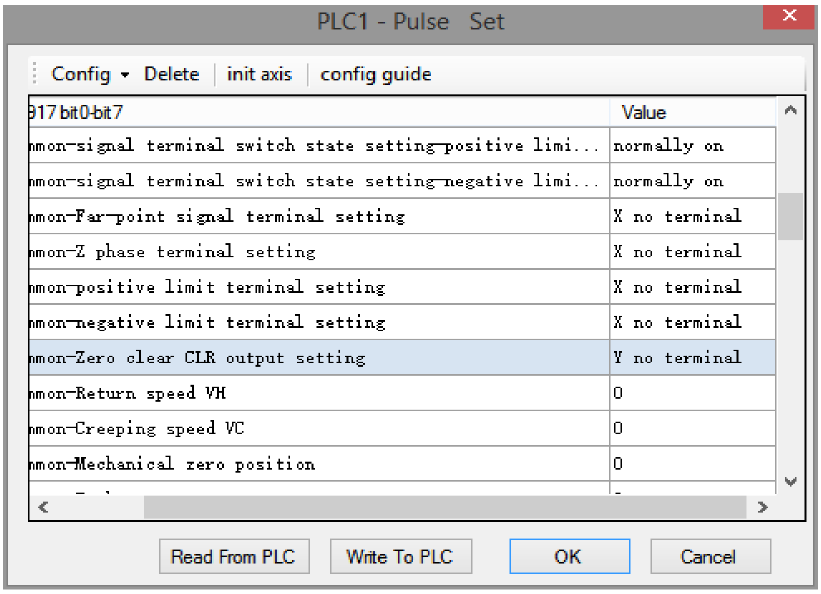


**Origin direction setting of mechanical origin returning:**



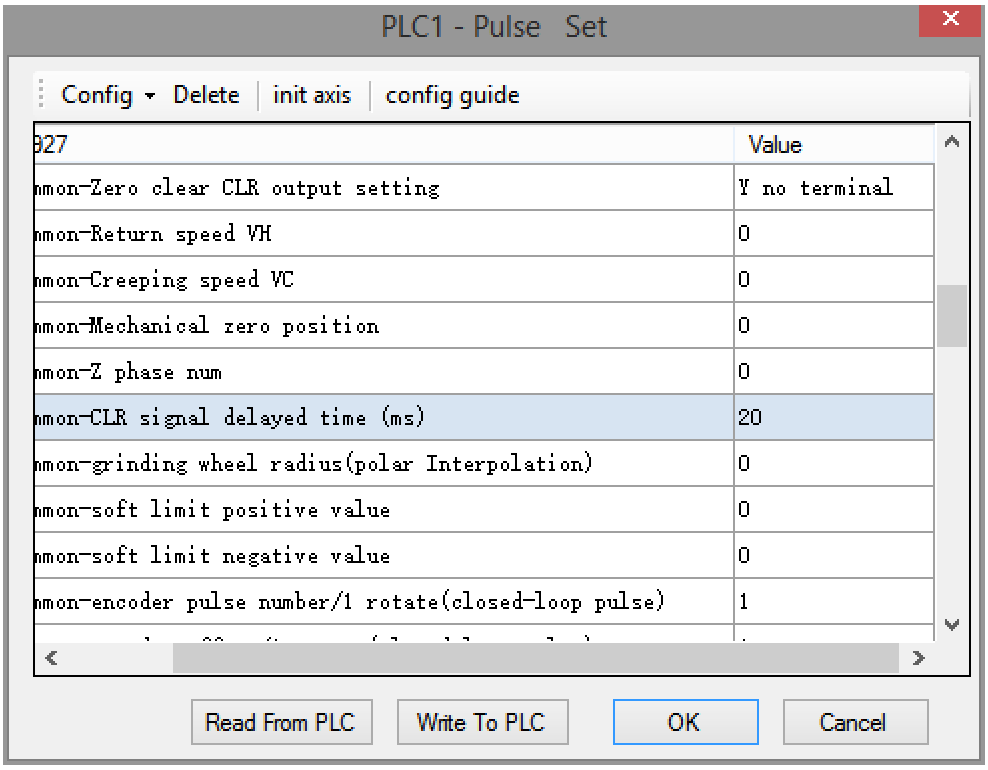

**Clear output signal CLR**

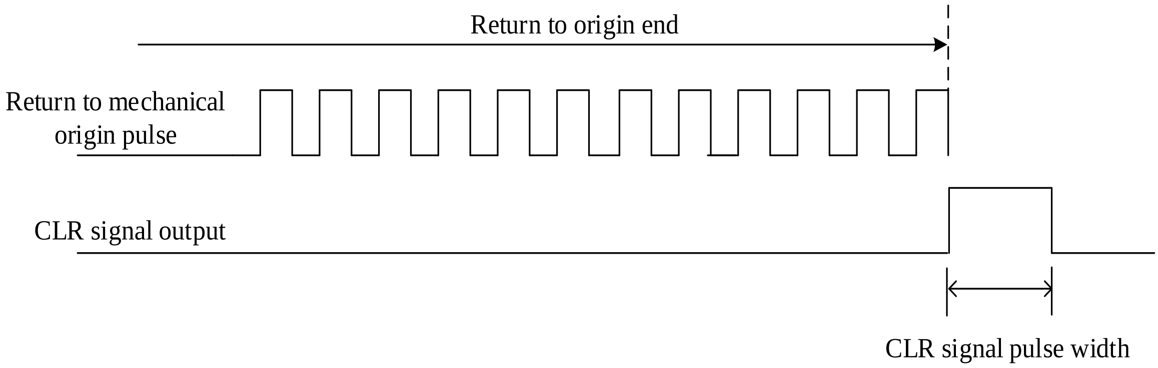
CLR signal setting, to output an output signal immediately after the end of returning to the mechanical origin, this signal can be sent to some other control equipment to achieve the purpose of rapid information transmission between each other. For example, after returning to the mechanical origin, the CLR signal is output to the servo driver immediately, so as to output clearance signal to clear the Error Counter of the servo motor. At last, copy the mechanical origin position value to the current position and the origin returning action is completed. The parameter configuration table is as follows:



**CLR signal delay time:**

the pulse width of CLR signal outputting after mechanical origin returning, the unit is ms, range is 0~32767 (default 20ms). The parameter configuration table is as follows:




**CLR signal diagram**

**Note:**

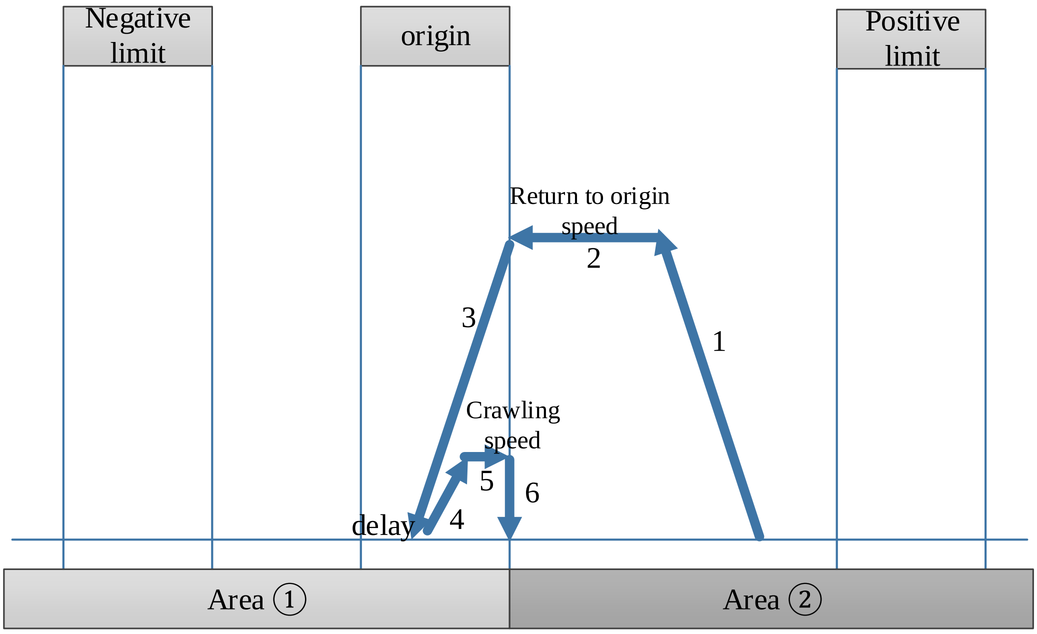
1. The CLR signal output terminal should use the output terminal of the PLC.
2. Do not set the delay time of CLR signal too small, or the servo driver may be unable to receive the CLR signal.

**Motion analysis**

**1. The table is in area 2 when ZRN instruction started:**

When the table is in area 2, it can be subdivided into three situations: the table is between the origin and the positive limit, the table is in the positive limit and the table is out of the positive limit.

(1) The workbench is between origin and positive limit, return to origin in reverse direction




**Reverse return to origin**

**Actions:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and the acceleration is accelerated to the origin regression speed, and then the regression speed of the origin is pushed back toward the mechanical origin direction.

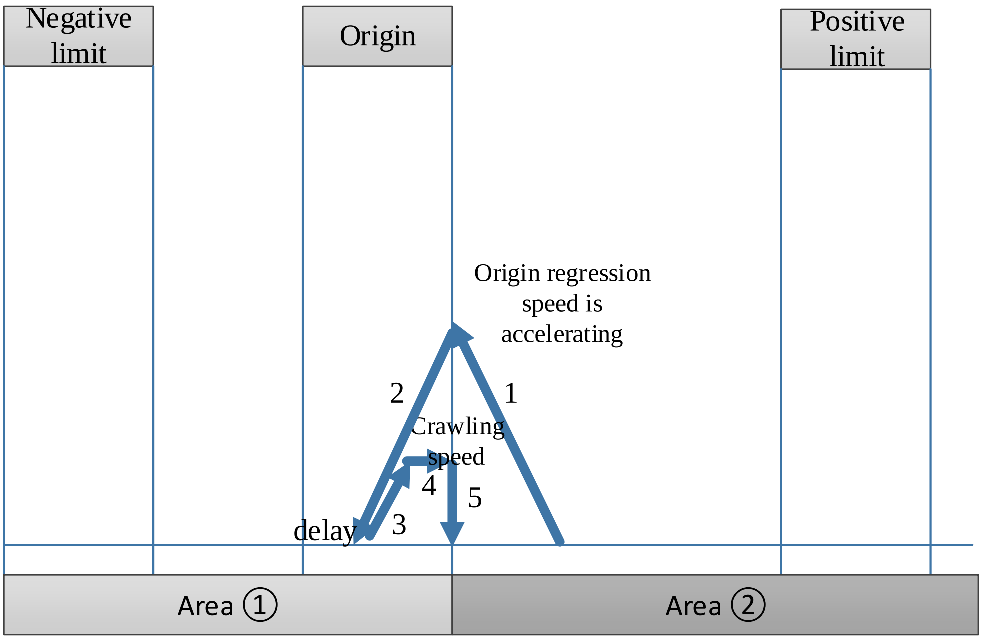
(2) When encountering the rising edge of the mechanical origin signal, slow down with the set deceleration slope until the deceleration to complete rest (frequency =0).

(3) delay (direction delay time in SFD), and then accelerate as the set acceleration slope, move forward until reaching the crawling speed, when leaving the mechanical origin falling edge signal instantaneous stop zero movement (if it sets the Z phase pulse, it starts to count Z phase signal after leaving the origin signal falling edge, then immediately stop motion when the counting reached).

(4) If "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

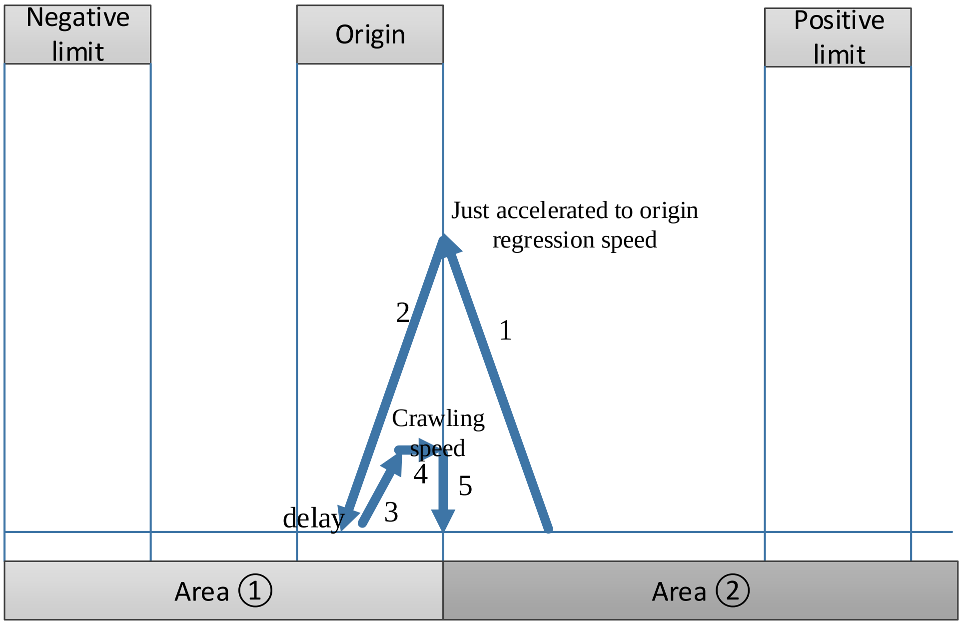
**Special case 1:**

When the acceleration of the just started ZRN instruction has reached the rising edge of the mechanical origin signal, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); delay (direction delay time in SFD) and then run in reverse direction at low speed as acceleration slope until reach origin regression speed, when leaving the origin falling edge signal instantaneous stop zero movement (if it sets the Z phase pulse, it starts to count Z phase signal after leaving the origin signal falling edge, then immediately stop motion when the counting reached), if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Special case 2:**

When the acceleration of the just started ZRN instruction, it just accelerated to origin regression speed and reached the rising edge of the mechanical origin signal, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); delay (direction delay time in SFD) and then run in reverse direction at low speed as acceleration slope until reach origin regression speed, when leaving the origin falling edge signal instantaneous stop zero movement (if it sets the Z phase pulse, it starts to count Z phase signal after leaving the origin signal falling edge, then immediately stop motion when the counting reached), if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.



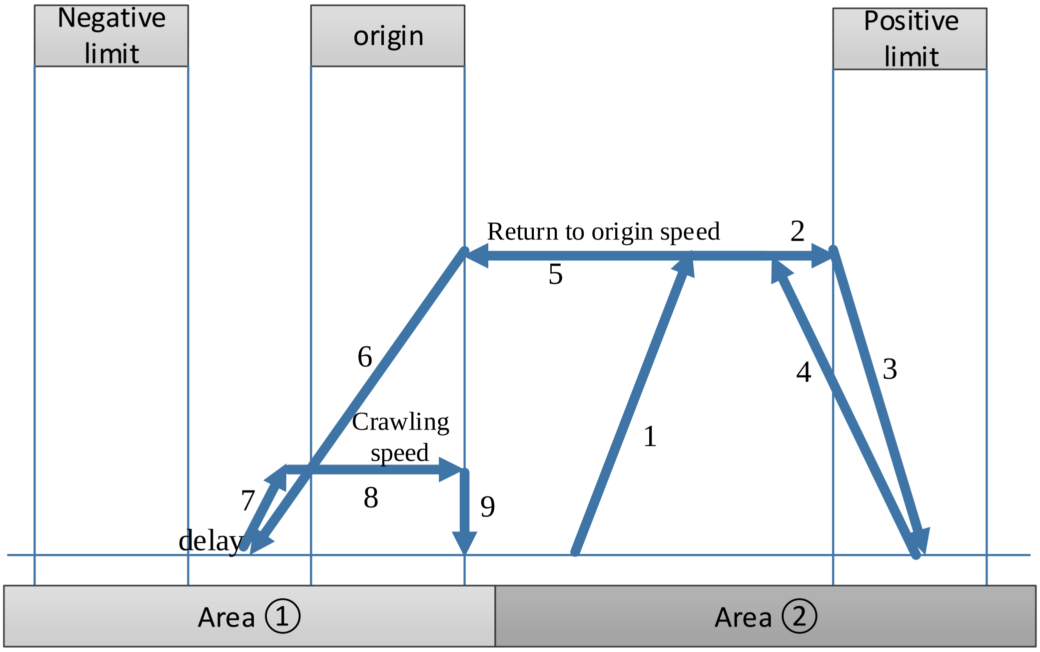

**Note:**

※1: In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the speed is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate in the same way.

※2: when it sets the servo Z phase pulse, Z phase pulse returning to origin capture function is effective, it will stop the mechanical origin regression in Z phase mode.

※3: If the stopping position falls beyond the negative limit position, it may lead to collision. Please try your best to avoid such situation. This can be done by reducing the set deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(2) workbench is between origin and positive limit, return to origin in forward direction




**Return to origin in positive direction**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and the acceleration is accelerated to the origin regression speed, and then the regression speed of the origin moves toward the positive limit direction.

(2) When encountering the rising edge of the positive limit signal, slow down with the set deceleration slope until the deceleration to complete rest (frequency =0).

(3) Immediately reverse and start accelerating according to the specified acceleration slope until reaching origin regression speed, then the speed begins to recede towards the origin.

(4) when encountering the rising edge of origin signal, slow down with the set deceleration slope until the deceleration to complete rest (frequency =0).

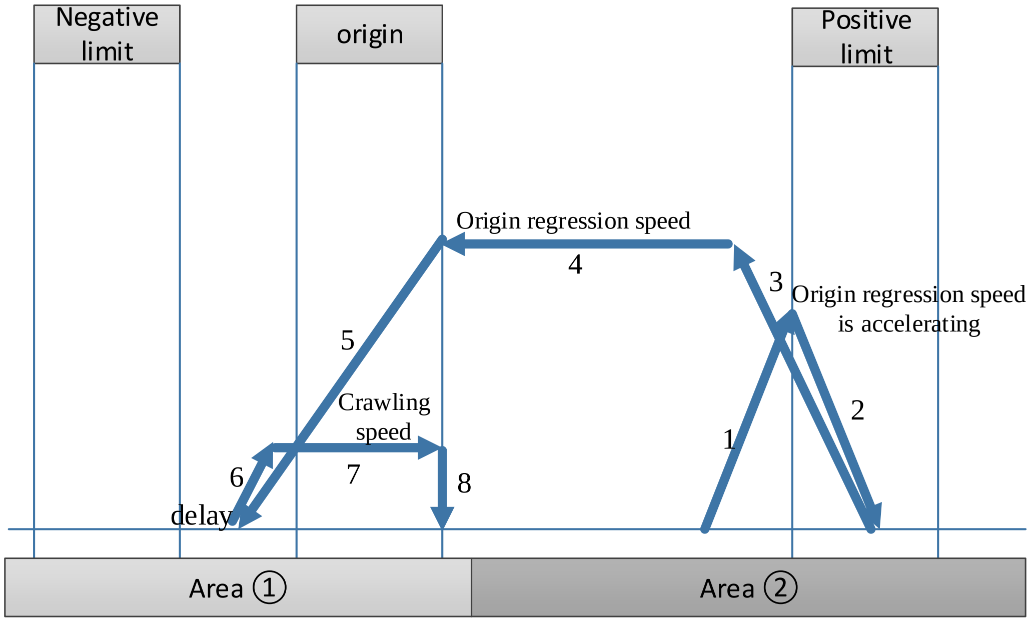
(5) delay (direction delay time in SFD), and then accelerate as the set acceleration slope, move forward until reaching the crawling speed, when leaving the mechanical origin falling edge signal instantaneous stop zero movement (if it sets the Z phase pulse, it starts to count Z phase signal after leaving the origin signal falling edge, then immediately stop motion when the counting reached).

(6) If "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

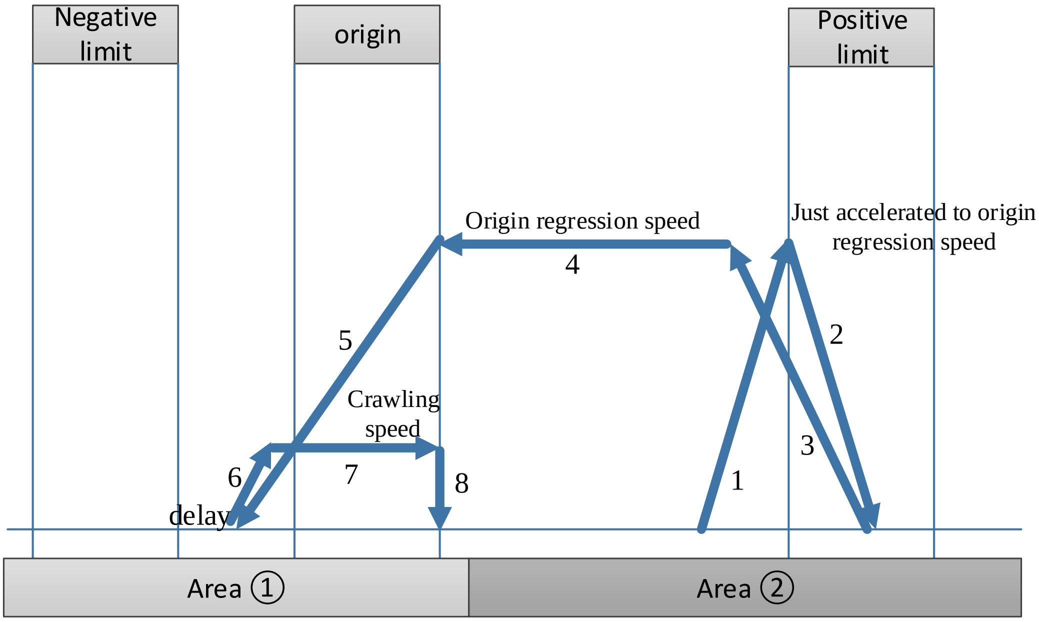
**Special case 1:**

For the just started ZRN instruction, when accelerating in the positive limit direction and already reached the rising edge of the positive limit signal, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); then accelerate in reverse direction as acceleration slope until reach origin regression speed, then go back in origin direction, when meet the rising edge of origin signal, decelerate as deceleration slope until the

deceleration is completely still (frequency=0). Delay (direction delay time in SFD), low speed slow move in reverse direction with acceleration slope until reaching the origin regression speed,
When leaving the origin falling edge signal instantaneous stop pulse outputting (if it sets the Z phase pulse, it starts to count Z phase signal after leaving the origin signal falling edge, then immediately stop zero return motion when the counting reached), if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Special case 2:**
For the just started ZRN instruction, when accelerating to origin regression speed in the positive limit direction and just reached the rising edge of the positive limit signal, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); then accelerate in reverse direction as acceleration slope until reach origin regression speed, then go back in origin direction, when meet the rising edge of origin signal, decelerate as deceleration slope until the deceleration is completely still (frequency=0). Delay (direction delay time in SFD), low speed slow move in reverse direction with acceleration slope until reaching the origin regression speed,
When leaving the origin falling edge signal instantaneous stop pulse outputting (if it sets the Z phase pulse, it starts to count Z phase signal after leaving the origin signal falling edge, then immediately stop zero return motion when the counting reached), if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Conclusion:**

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touched the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

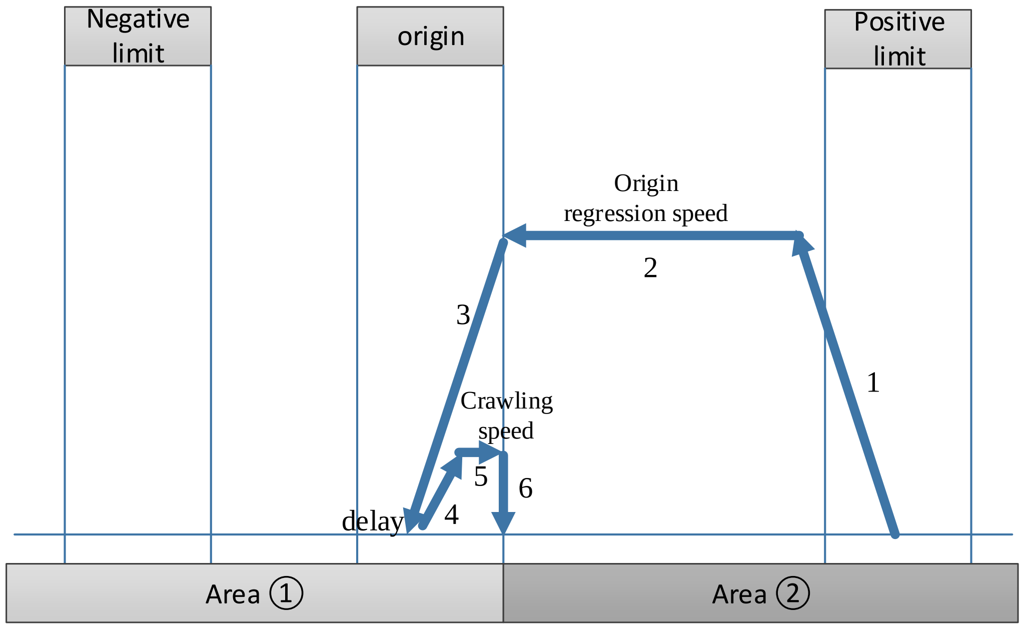
**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: When the working table moves towards the positive limit with the speed of returning to the mechanical origin, it will start to decelerate according to the deceleration slope when it encounters the positive limit signal rising edge, and the deceleration stop position may fall on the positive limit or exceed the positive limit; Accidents that can occur when the positive limit is exceeded can be avoided by reducing the deceleration slope or widening the positive limit signal width. If the stopping position falls beyond the negative limit position, it may impact the machine. Please try your best to avoid such situation. This can be done by reducing the set deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(3) Execute origin returning when the workbench is in the positive limit

When the workbench is in the positive limit, return to the origin can only be performed by default in the reverse return to the origin mode, no matter whether the direction of return to the origin is set as forward return to the origin or reverse return to the origin, as shown in the figure below:




**In the positive limit and execute origin returning**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and accelerated to the origin regression speed, and then the regression speed of the origin is withdrawn back to the direction of the origin.

(2) When encountering the rising edge of the origin signal, slow down with the deceleration slope until the deceleration is complete still (frequency =0).

(3) delay (the direction delay time in SFD), accelerate as the acceleration slope until reach the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(4) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

**Conclusion:**

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touched the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

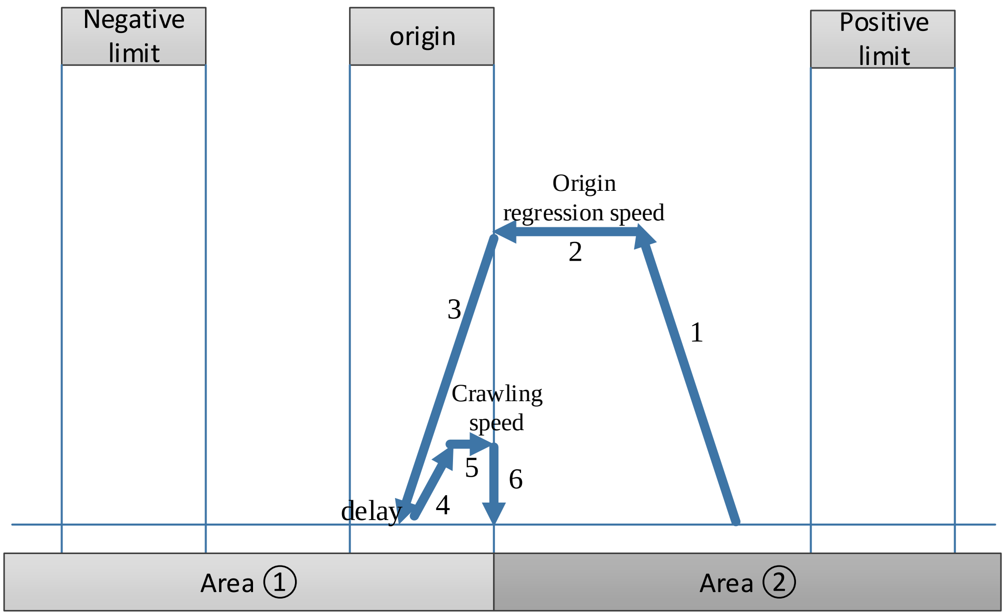
※2: If the stopping position falls beyond the negative limit position, it may impact the machine. Please try your best to avoid such situation. This can be done by reducing the set deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(4) execute the origin returning when workbench exceeds the positive limit

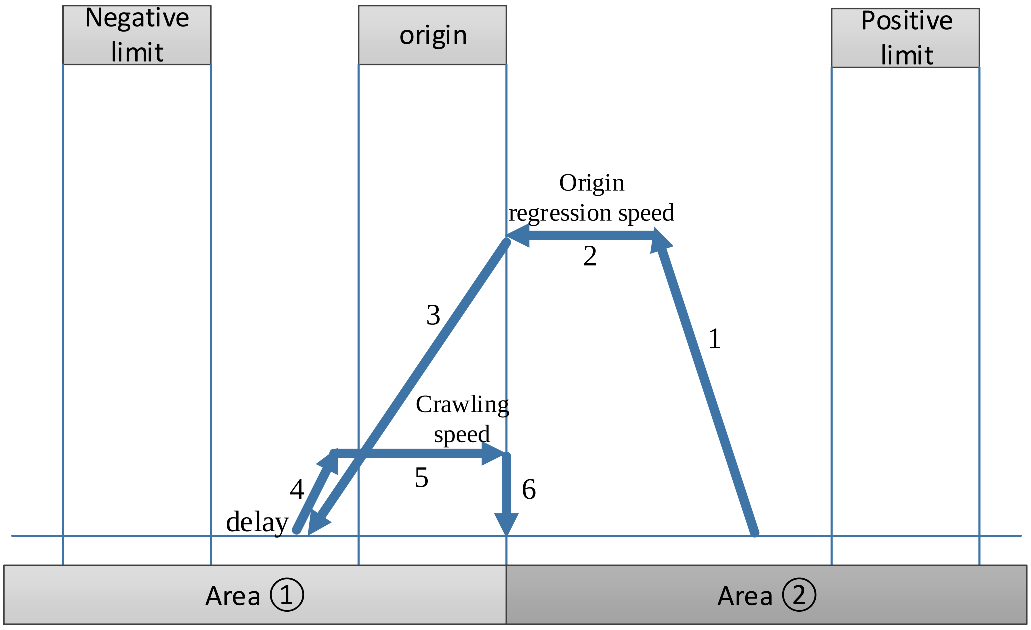
When the working table exceeds the positive limit, in order to prevent the occurrence of machine impact caused by positive return-to-origin, do not execute the return-to-origin. Please move the working table back to the negative( or positive) limit or between the positive limit and the negative limit manually, and then execute the mechanical return-to-origin instruction!

The limit switch width of the negative limit and positive limit can also be widened to avoid the occurrence of breaking off the positive limit and negative limit when the pulse deceleration stops.

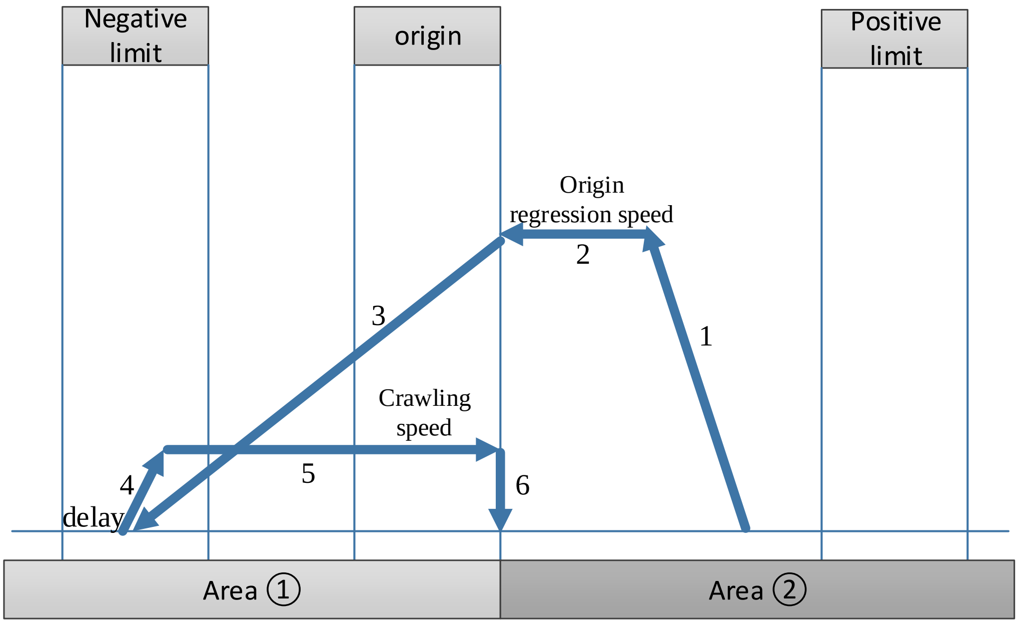
(5) When the table moves back toward the origin with the speed of mechanical return, it will start to slow down according to the set deceleration slope when it touches the rising edge of the mechanical origin. Due to the setting of different speed of mechanical return to the origin and deceleration slope, the final stop position of the table is relatively long, which shall be executed according to the following situations:



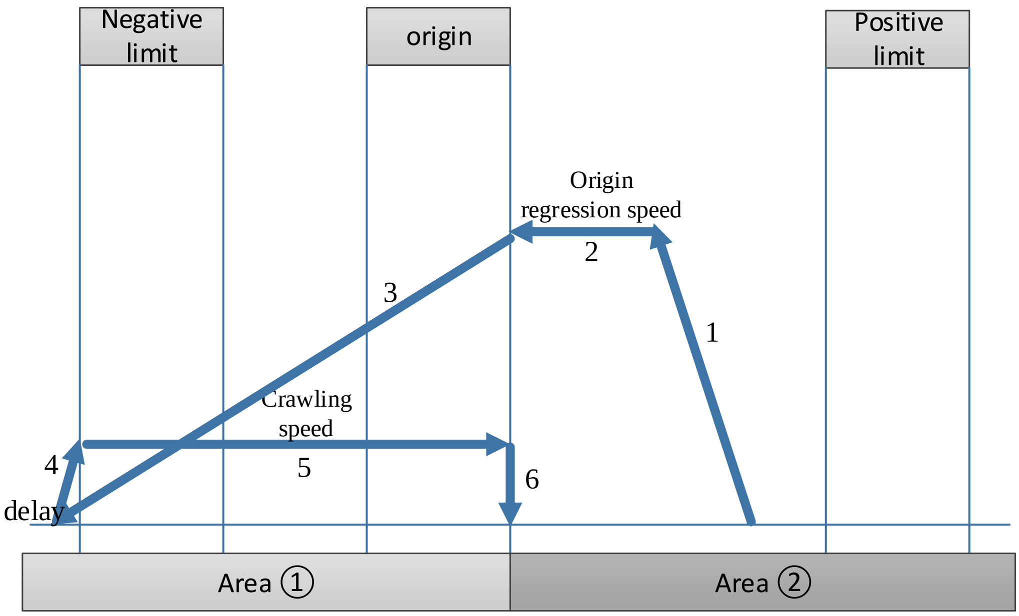

**Stop position is on the mechanical origin**




**Stop position is between mechanical origin and negative limit**




**Stop position is on the negative limit**




**Stop position exceeded negative limit**

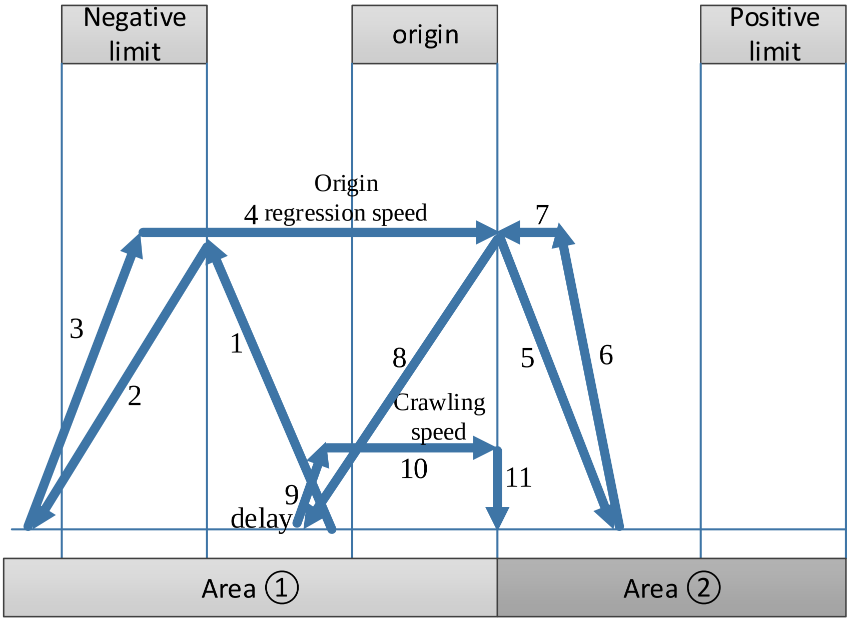
**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: If the stopping position falls beyond the negative limit position, it may impact the machine. Please try your best to avoid such situation. This can be done by reducing the set deceleration slope or lengthening the length between the negative limit and the mechanical limit.

2. when the mechanical origin returning instruction ZRN starts, the working table is in area ①: When the work table is located in the region, it can be divided into four situations: the work table is between the origin and the negative limit, the work table is at the mechanical origin, the work table is at the negative limit and the work table is beyond the negative limit position.

(1) execute origin regression when the work table is between the origin and negative limit




**Execute origin regression in reverse direction**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first by the set acceleration slope, and then go back in the negative limit direction with the origin regression speed after accelerating to the origin regression speed.

(2) when the work table encounters the rising edge of negative limit with the origin regression speed, it decelerates as the set deceleration slope until stop.

(3) accelerate as the set acceleration slope until reach the origin regression speed, move forward in mechanical origin direction.

(4) When the working table breaks away from the falling edge of the mechanical origin at the speed of mechanical return, it immediately begins to slow down according to the set deceleration slope, until the speed is 0.

(5) The working table immediately accelerates to the speed of returning to the mechanical origin according to the set acceleration slope, and moves back toward the mechanical origin.

(6) When encountering the rising edge of the origin signal, slow down with the deceleration slope until complete still (frequency =0).

(7) delay (the direction delay time in SFD), accelerate as the acceleration slope until reach the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(8) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

**Conclusion:**

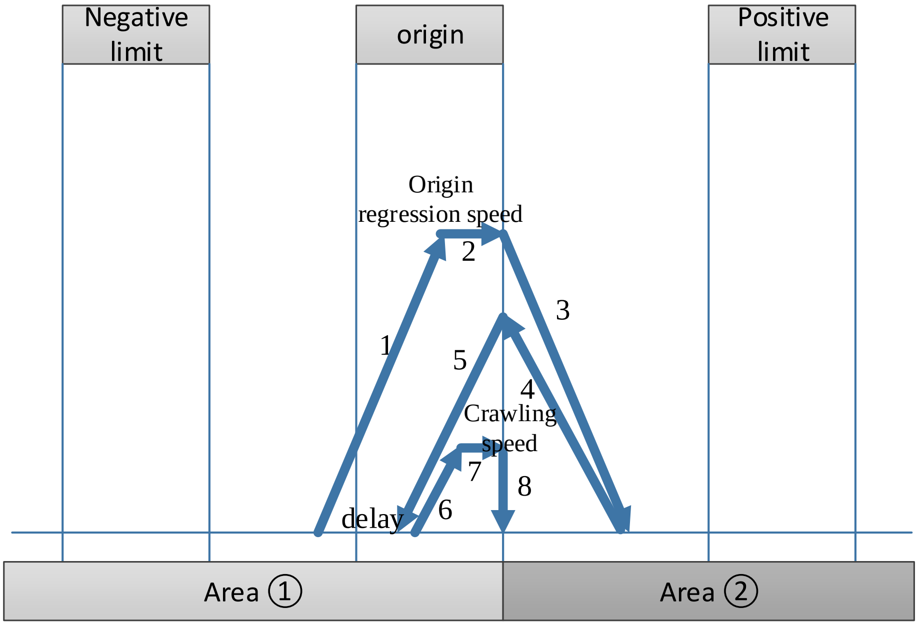
In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: If the stopping position falls beyond the negative limit position, it may impact the machine. Please try your best to avoid such situation. This can be done by reducing the set deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(2) execute the origin regression when the work table is between origin and negative limit




**Return to origin in positive direction**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and then accelerated to the origin regression speed and moved forward in mechanical origin direction.

(2) When the working table breaks away from the falling edge of the mechanical origin at the speed of mechanical return, it immediately begins to slow down according to the set deceleration slope, until the speed is 0.

(3) accelerate as the set acceleration slope until reach the mechanical origin regression speed, go back in mechanical origin direction.

(4) when the work table encounters the rising edge of origin signal, it decelerates as the set deceleration slope until stop (frequency is 0). Delay (the direction delay time in SFD), accelerate as the acceleration slope until reach the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action

at once when the count value reached)

(5) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

**Conclusion:**

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

**Note:**

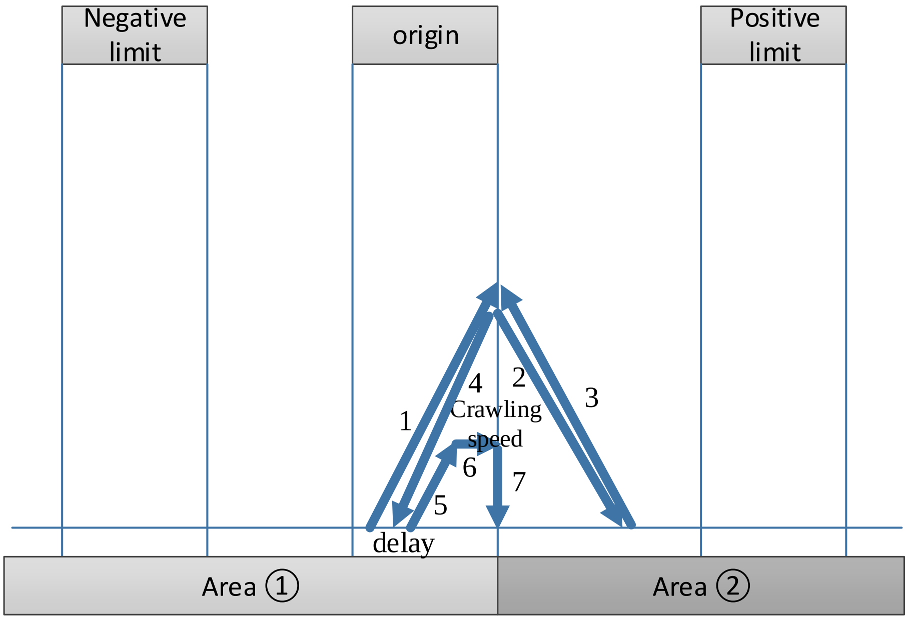
※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: When the origin returning action is started, the speed shall be accelerated by the set acceleration slope first. No matter whether the speed is accelerated to the speed of mechanical return to the origin, the work table will start to decelerate according to the set deceleration slope as soon as it touches the decline edge of mechanical origin signal.

(3) execute the origin returning when the work table is at the mechanical origin

When execute the reverse origin returning and the work table is at the mechanical origin, it will switch to positive origin returning inside, the details please refer to condtion (4).

(4) execute the positive origin regression when the work table is at the mechanical origin



**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and then accelerated to the origin regression speed and moved forward in falling edge of mechanical origin direction.

(2) Whether the table has been accelerated to the speed of the mechanical return to the origin according to the set acceleration slope, it will immediately begin to decelerate according to the set deceleration slope at the descent edge of the mechanical origin until the speed is 0.

(3) The working table immediately starts to accelerate to the speed of returning to the mechanical origin according to the set acceleration slope, and moves back toward the mechanical origin.

(4) Whether the table has been accelerated to the speed of the mechanical return to the origin according to the set acceleration slope, it will immediately begin to decelerate according to the set deceleration slope at the rising edge of the mechanical origin until the speed is 0. Delay (the direction delay time in SFD), accelerate as the acceleration slope until reach the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(5) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

**Conclusion:**

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

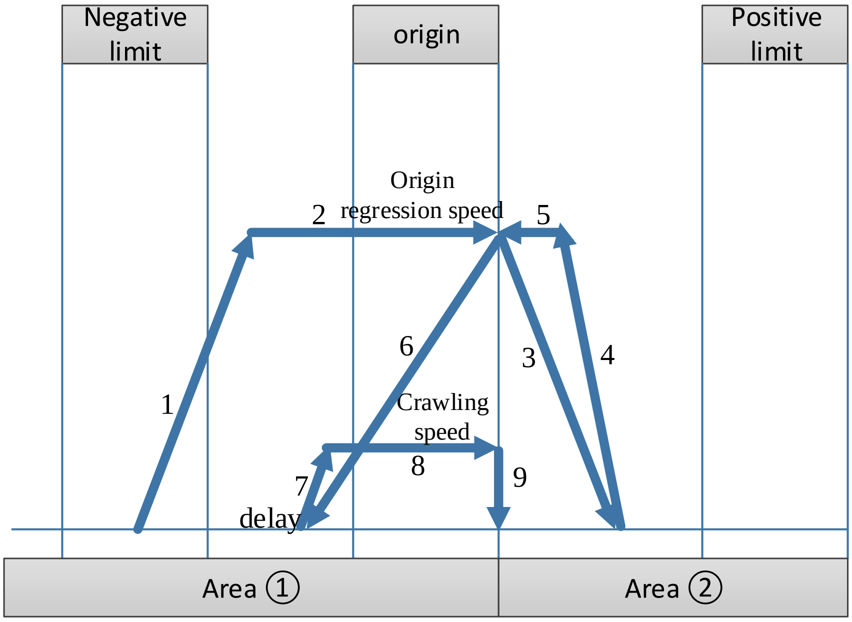
**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: When the origin returning action is started, the speed shall be accelerated by the set acceleration slope first. No matter whether the speed is accelerated to the speed of mechanical return to the origin, the work table will start to decelerate according to the set deceleration slope as soon as it touches the decline edge of mechanical origin signal.

(5) execute the origin returning when the working table is at the negative limit

When the working table is at the negative limit, whatever the origin returning direction is set to positive or negative, it must execute as defaulted positive direction, shown as below:




**Execute origin regression at the negative limit**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and then accelerated to the origin regression speed and moved forward in origin direction.

(2) When encountering the descent edge of the origin signal, slow down by the deceleration slope until complete rest (frequency =0).

(3) The table starts to accelerate immediately according to the set acceleration slope. Whether it has accelerated to the speed of mechanical return to the origin or not, as long as the table touches the rising edge of mechanical origin signal, it will immediately start to decelerate according to the set deceleration slope.

(4) when the work table decelerated to stop, it started to delay (the direction delay time in SFD), then accelerated as the acceleration slope until reaching the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(5) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

**Conclusion:**

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

Note: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

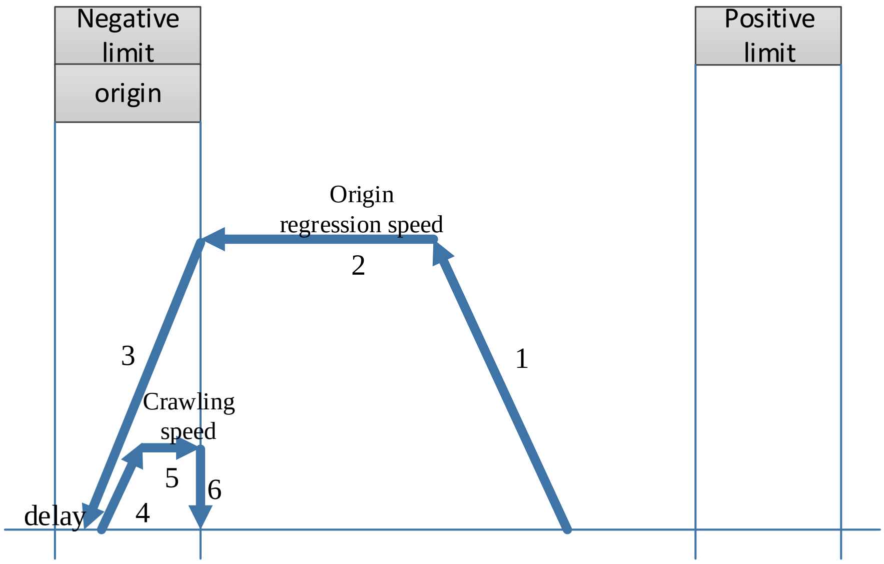
(6) execute origin returning when the work table exceeded negative limit
When the working table exceeds the negative limit, in order to prevent the occurrence of machine impact caused by reverse-returning to the origin, please do not go back to the origin. Please move the working table back to the negative or positive limit or between them by manual and then carry out the execution of the mechanical returning to the origin instruction!
The limit switch width of the negative limit and positive limit can also be widened to avoid the occurrence of breaking off the positive limit and negative limit when the pulse deceleration stops.

3. When in consideration of equipment cost or mechanical structure, negative limit switches and mechanical origin switches may need to be used with a proximity switch or travel switch.

First, we set the mechanical origin and negative limit switch in system parameter block as the same input point. When executing the ZRN mechanical return instruction, this input point is used as the mechanical origin. This input point is used as a negative limit when using pulse output commands such as PLSR, PLSF, DRVI, and DRVA.

In view of the position of the work table returning to the mechanical origin, the following will be explained according to the following situations: the work table is between negative limit and positive limit, the work table is in negative limit, the work table is in positive limit, the work table exceeds positive limit position and the work table exceeds negative limit position.

(1) execute reverse origin returning when the work table is between negative limit and positive limit




**Return to origin in reverse direction**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and accelerated to the origin regression speed, and then went back toward the

mechanical origin direction.

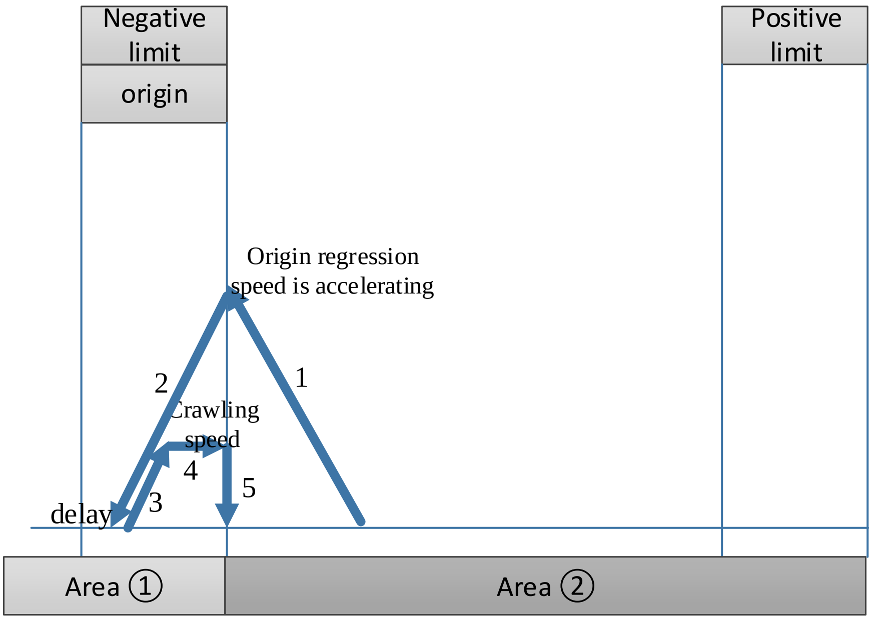
(2) When encountering the rising edge of the origin signal, slow down by the deceleration slope until complete rest (frequency =0).

(3) delay (the direction delay time in SFD), then accelerated as the acceleration slope until reaching the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(4) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

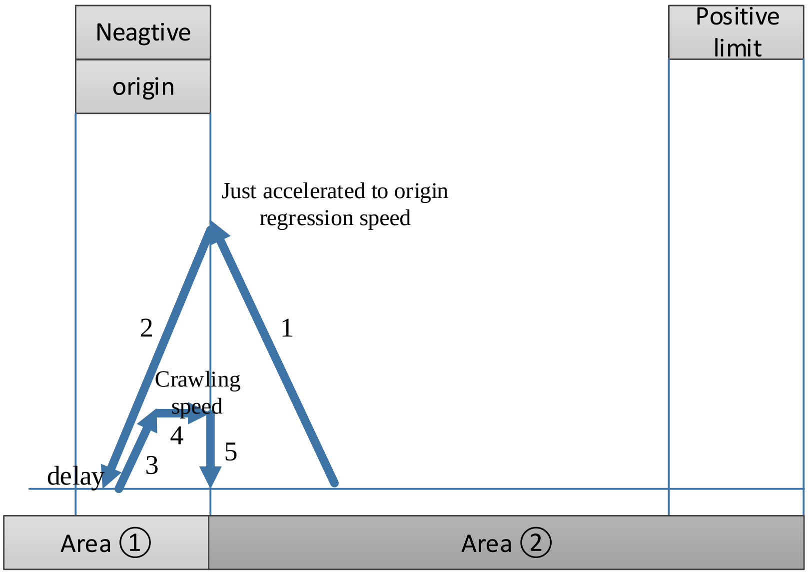
**Special case 1:**

When the acceleration of the just started ZRN instruction has reached the rising edge of the mechanical origin signal, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); delay (the direction delay time in SFD), then reverse move at slow speed as acceleration slope until reach origin regression speed, when at the moment of leaving the origin signal falling edge, if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Special case 2:**

In the acceleration process of the just started ZRN instruction, when it just accelerated to origin regression speed, it reached the rising edge of the mechanical origin signal, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); delay (the direction delay time in SFD), then reverse move at slow speed as acceleration slope until reach origin regression speed, stop returning action at the moment of leaving the origin signal falling edge (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached), if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Conclusion:**

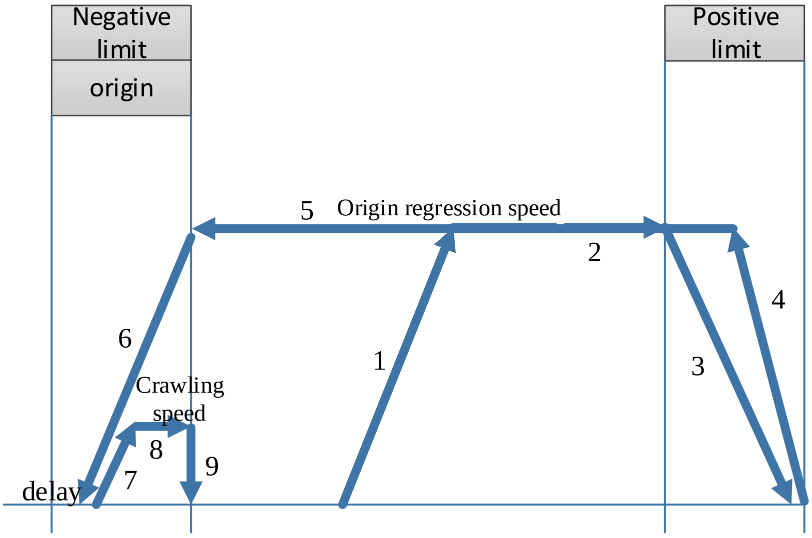
In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: If the stopping position falls beyond the negative limit position, it may lead to machine impact. Please try your best to avoid such situation. This can be done by reducing the stated deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(2) execute origin returning in forward direction when the work table is between negative limit and positive limit




**Return to origin in positive direction**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and accelerated to the origin regression speed, and then went forward toward the positive direction of positive limit.

(2) When encountering the rising edge of the origin signal, slow down by the deceleration slope until complete rest (frequency =0).

(3) Immediately reverse and start accelerating according to the specified acceleration slope until reaching the origin regression speed and begins to recede towards the origin.

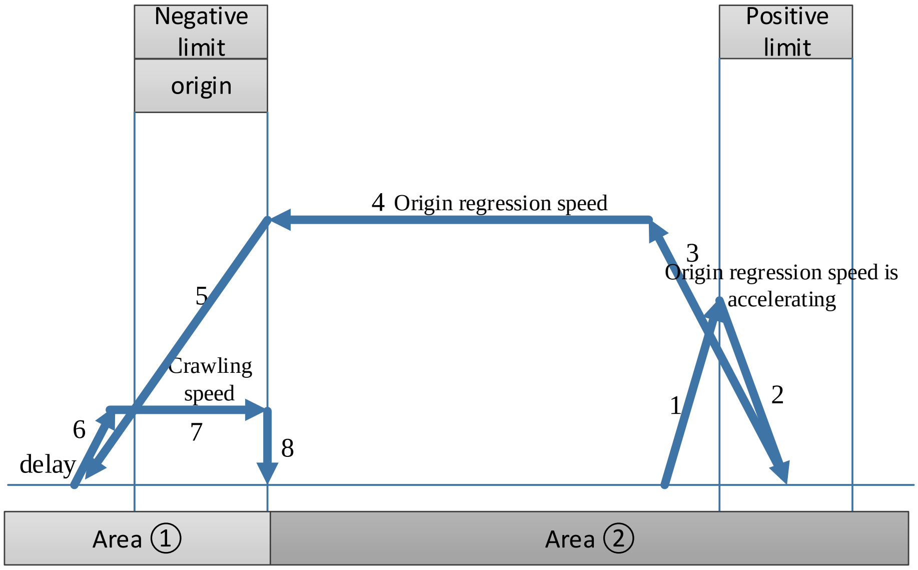
(4) When encountering the rising edge of the origin signal, slow down by the deceleration slope until complete rest (frequency =0).

(5) delay (the direction delay time in SFD), then accelerated as the acceleration slope until reaching the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(6) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

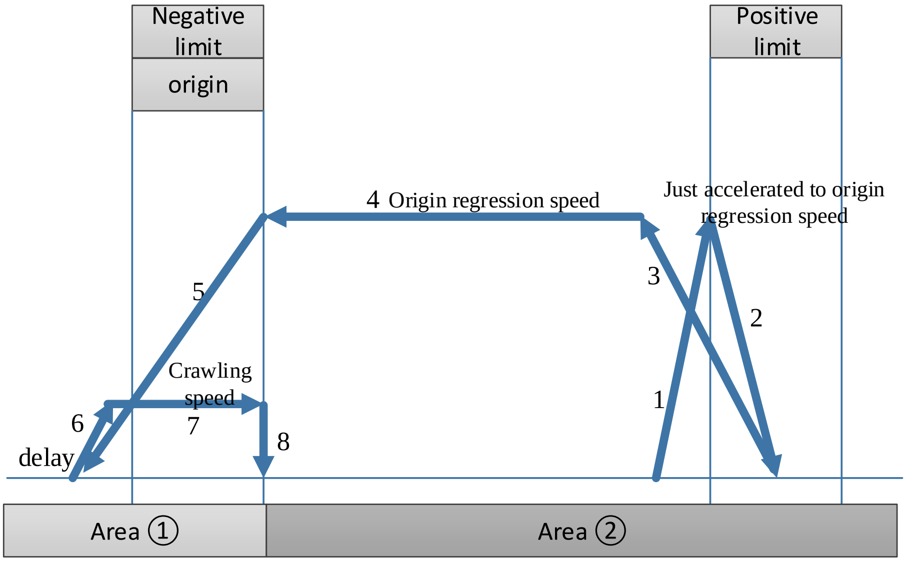
**Special case 1:**

For the just started ZRN instruction, when it has already reached the rising edge of the positive limit signal in the process of accelerating towards positive limit, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); immediately reverse and start accelerating according to the set acceleration slope until reaching the origin regression speed, then start go back, when encountering the rising edge of the origin signal, slow down by the deceleration slope until complete stop (frequency =0); delay(direction delay time in SFD), then reverse move at slow speed as acceleration slope until reach origin regression speed, at the moment of leaving the origin signal falling edge, stop pulse outputting at once(if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached). If "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Special case 2:**

For the just started ZRN instruction, when it just reached the rising edge of the positive limit signal in the process of accelerating towards positive limit and just accelerated to origin returning speed, the deceleration slope is used as the deceleration action until the deceleration is completely still (frequency =0); immediately reverse and start accelerating according to the set acceleration slope until reaching the origin regression speed, then start go back, when encountering the rising edge of the origin signal, slow down by the deceleration slope until complete stop (frequency =0); delay(direction delay time in SFD), then reverse move at slow speed as acceleration slope until reach origin regression speed, at the moment of leaving the origin signal falling edge, stop pulse outputting at once(if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached). If "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.




**Conclusion:**

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

**Note:**

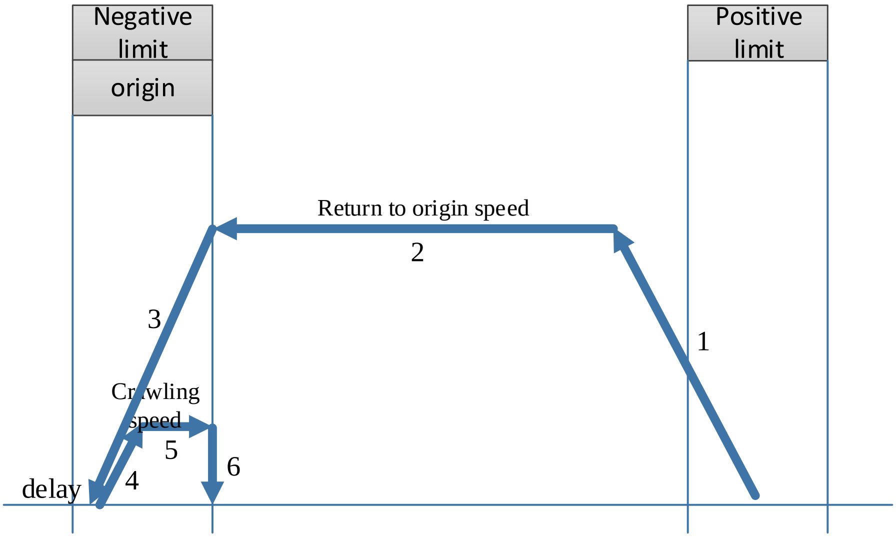
※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: When the working table moves towards the positive limit with the speed of returning to the mechanical origin, it will start to decelerate according to the deceleration slope when it encounters the positive limit signal rising edge, and the deceleration stop position may fall on the positive limit or exceed the positive limit; Accidents that can occur when the positive limit is exceeded, which can be avoided by reducing the deceleration slope or widening the positive limit signal width.

※3: If the stopping position falls beyond the negative limit position, it may lead to machine impact. Please try your best to avoid such situation. This can be done by reducing the stated deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(3) execute the origin returning when the work table is in the positive limit

When the work station is in the positive limit, return to the origin can only be performed by default in the reverse return to the origin mode, no matter whether the direction of return to the origin is set as forward return to the origin or reverse return to the origin, as shown in the figure below:




**Return to origin in the positive limit**

**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, and accelerated to the origin regression speed, and then the regression speed of the origin is withdrawn back towards the direction of the origin.

(2) When encountering the rising edge of the origin signal, slow down by the deceleration slope until complete rest (frequency =0).

(3) delay (the direction delay time in SFD), then accelerated as the acceleration slope until reaching the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)

(4) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

**Conclusion:**

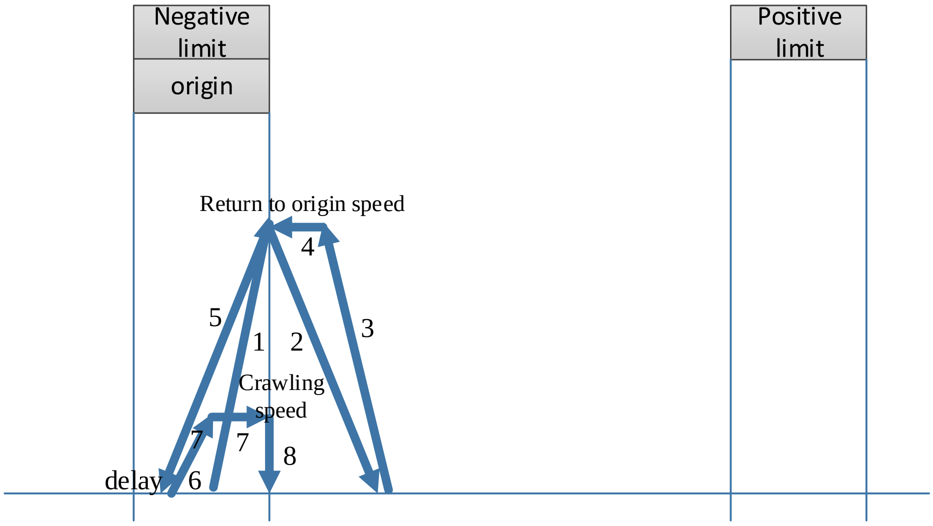
In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

Note:

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: If the stopping position falls beyond the negative limit position, it may lead to machine impact. Please try your best to avoid such situation. This can be done by reducing the stated deceleration slope or lengthening the length between the negative limit and the mechanical limit.

(4) execute origin returning when the work table is at the mechanical origin
When the worktable is at the mechanical origin, the worktable will return to the origin in positive direction no matter the setting direction is positive or negative, as shown in the figure below:




**Action:**

(1) When the origin regression action starts, the acceleration is carried out first with the set acceleration slope, after accelerated to the origin regression speed, move forward towards mechanical origin falling edge direction with origin returning speed.
(2) Whether or not the work table has been accelerated to the speed of the mechanical return to the origin according to the set acceleration slope, it will immediately begin to decelerate according to the set deceleration slope when leaving the descent edge of the mechanical origin until the speed acceleration is 0.
(3) The working table immediately starts to accelerate to the speed of returning to the mechanical origin according to the set acceleration slope, and moves back toward the mechanical origin.
(4) whatever the working table has been accelerated to the speed of mechanical return to the origin according to the set acceleration slope, when encountering the rising edge of the origin signal, the deceleration slope is used as the deceleration action until complete rest (frequency =0). Delay (the direction delay time in SFD), then accelerated as the acceleration slope until reaching the crawling speed, then move forward, stop zero returning action at the moment of leaving the falling edge of origin signal (if it set Z phase pulse, it starts counting the Z phase after leaving the falling edge of the origin signal, stop zero returning action at once when the count value reached)
(4) if "zeroing clear CLR signal" is set, it will output the clear signal immediately and delay (CLR signal delay time in SFD can be used to clear the Error Counter of the servo motor), At last, copy the mechanical origin position value to the current position and the zeroing action will be completed.

Conclusion:

In the above cases, as long as the rising edge of the origin signal is touched (the right edge of the origin), whether the acceleration has reached the speed of returning to the mechanical origin, is in the process of acceleration, or just accelerated to the speed of returning to the origin, the deceleration starts immediately according to the deceleration slope, until the deceleration is 0. Similarly, when the working table described below touches the rising edge of the negative limit (the right edge of the negative limit) and the rising edge of the positive limit (the left edge of the positive limit), please operate them in the same way.

**Note:**

※1: When the servo Z phase pulse is set, the Z phase pulse back to the origin capture function is effective, and the mechanical return to the origin will be stopped according to the Z phase mode.

※2: When the return operation of the origin is started, it will be accelerated by the set acceleration slope first. No matter the speed is accelerated to the speed of mechanical return to the origin, the work table will start to decelerate according to the set deceleration slope as soon as it touches the decline edge of mechanical origin signal.

※3: When the table starts to accelerate towards the mechanical origin signal, whether it has accelerated to the speed of mechanical return to the origin or not, as long as the table touches the rising edge of the mechanical origin signal, it will immediately start to decelerate according to the set deceleration slope.

(5) execute the origin returning when the work table exceeds the positive limit

When the working table exceeds the positive limit, in order to prevent the occurrence of machine impact caused by positive return-to-origin, do not execute the return-to-origin. Please move the working table back to the negative(positive) limit or between the positive limit and the positive limit manually, and then execute the mechanical return-to-origin instruction!

The limit switch width of the negative limit and positive limit can also be widened to avoid the occurrence of breaking off the positive limit and negative limit when the pulse deceleration stops.

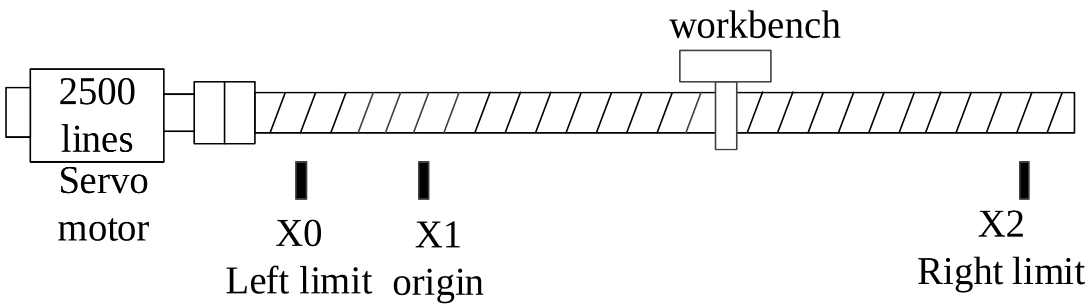
(6) execute the origin returning when the work table exceeds the negative limit

When the working table exceeds the negative limit, in order to prevent the occurrence of machine impact caused by positive return-to-origin, do not execute the return-to-origin. Please move the working table back to the negative(positive) limit or between the positive limit and the positive limit manually, and then execute the mechanical return-to-origin instruction!

The limit switch width of the negative limit and positive limit can also be widened to avoid the occurrence of breaking off the positive limit and negative limit when the pulse deceleration stops.

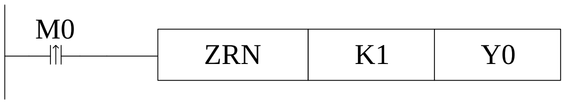
**Example 1**

As shown in the diagram below, one servo driver (electronic gear ratio is 1:1 by default) controls one servo motor (encoder 2500 lines), which is connected to the ball screw, whose pitch is 10mm. the ball screw drives workbench which can move right and left. Now the workbench needs to return to the origin, left limit switch connects the PLC input X0 (normally open), the right limit switch connects the PLC input X2 (normally open), the origin position switch connects the PLC input X1 (normally open), the origin regression speed VH is 10000hz, direction delay time in SFD is 100 ms, crawling speed VC is 100hz, not count the Z phase signal, pulse output port is Y0, direction terminal is Y2, mechanical origin position is set to 0, accelerate slope is 1000hz per 100 ms, The deceleration slope is 1000Hz per 150ms.

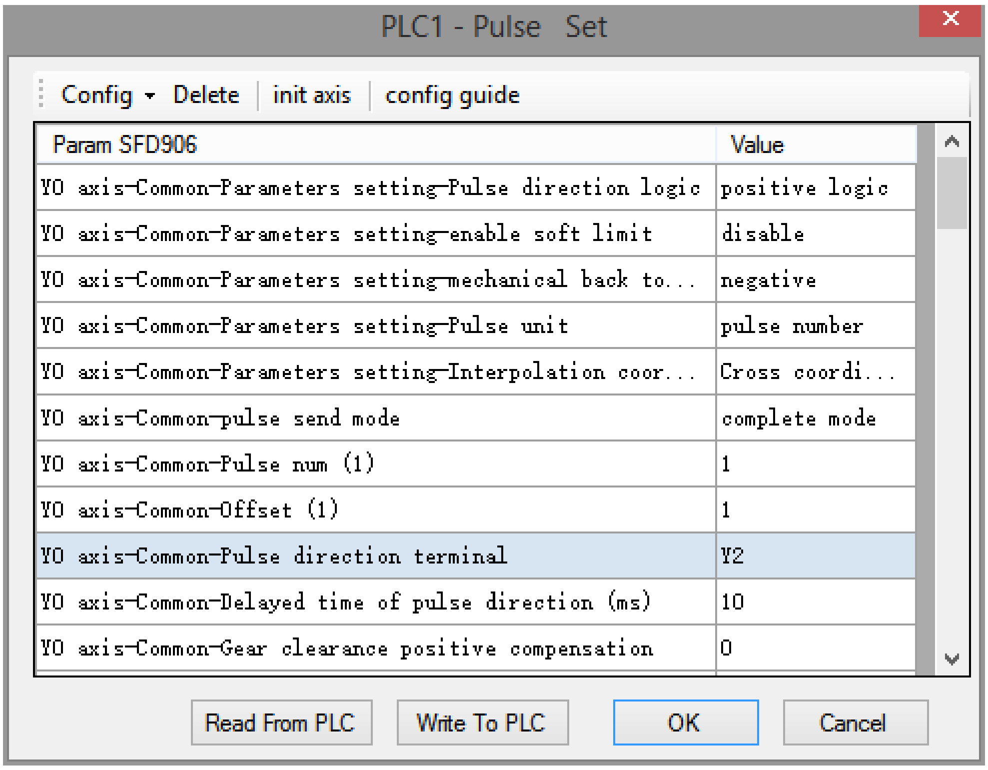



**Structure diagram**

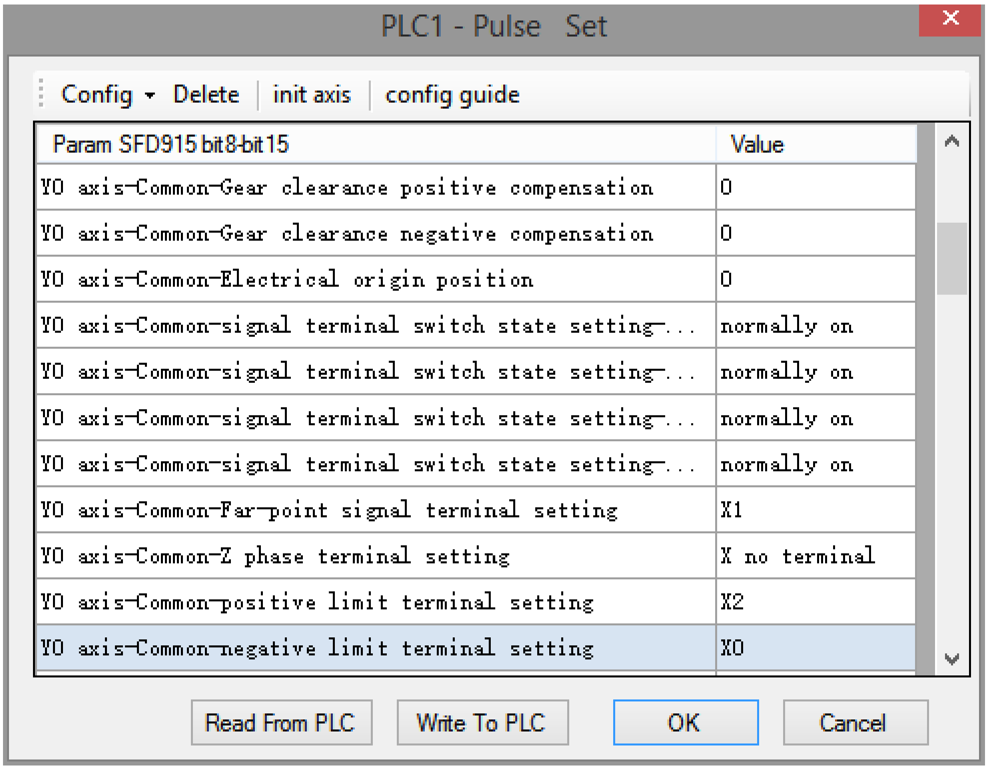
- **The instruction to return to the mechanical origin**

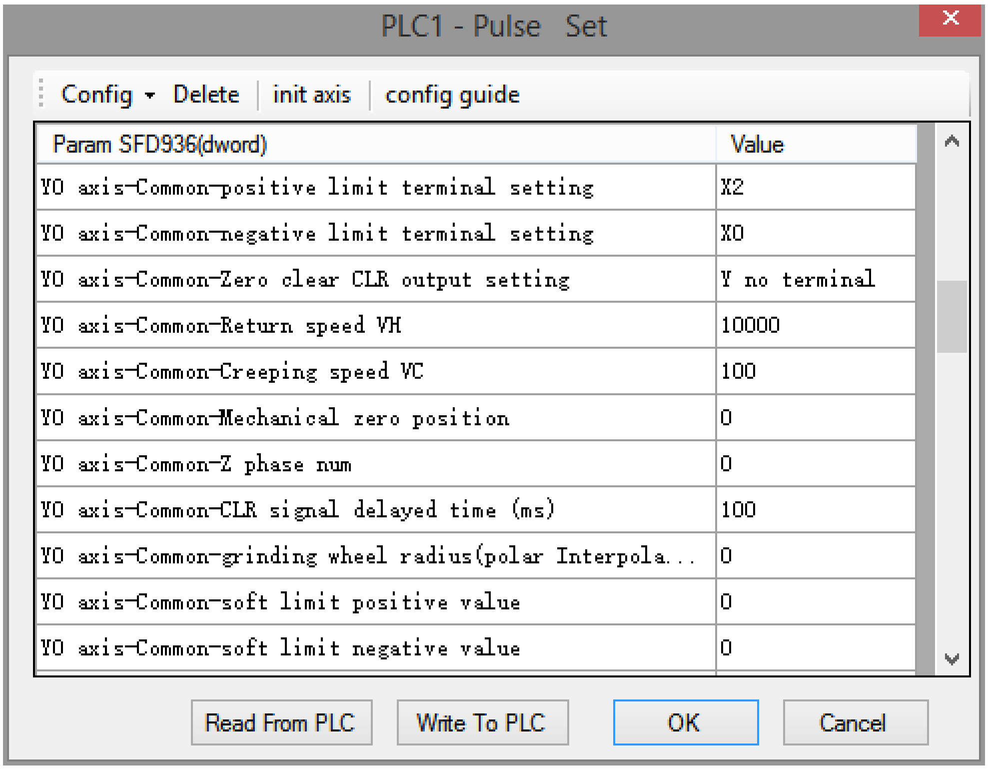


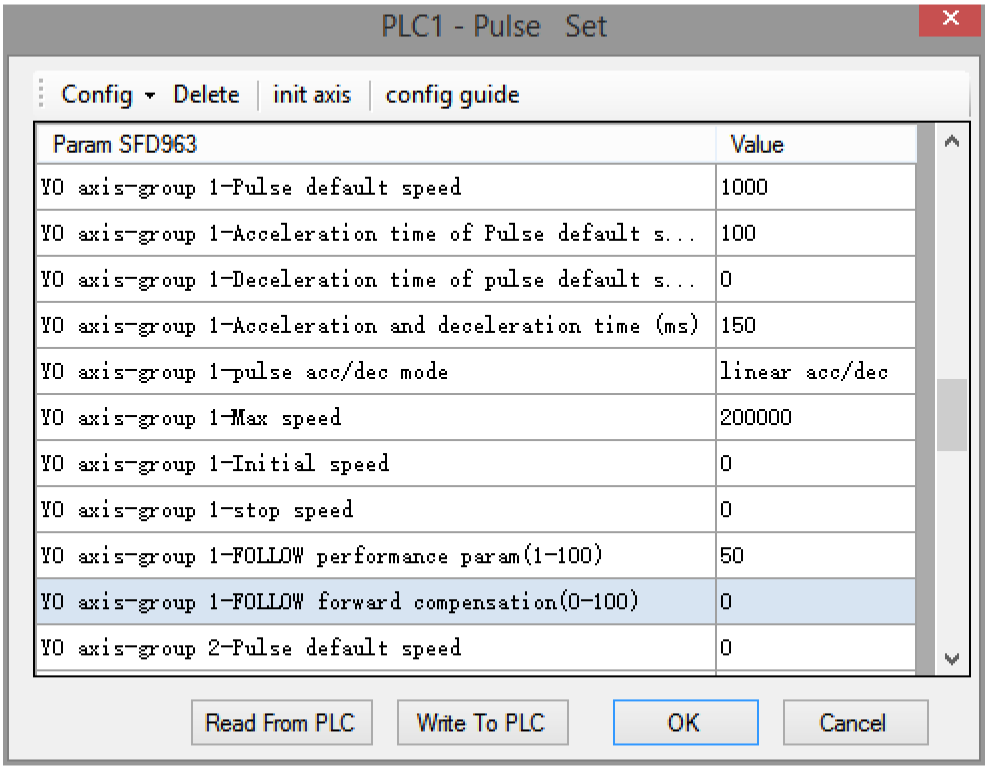

- **System parameter configurations**



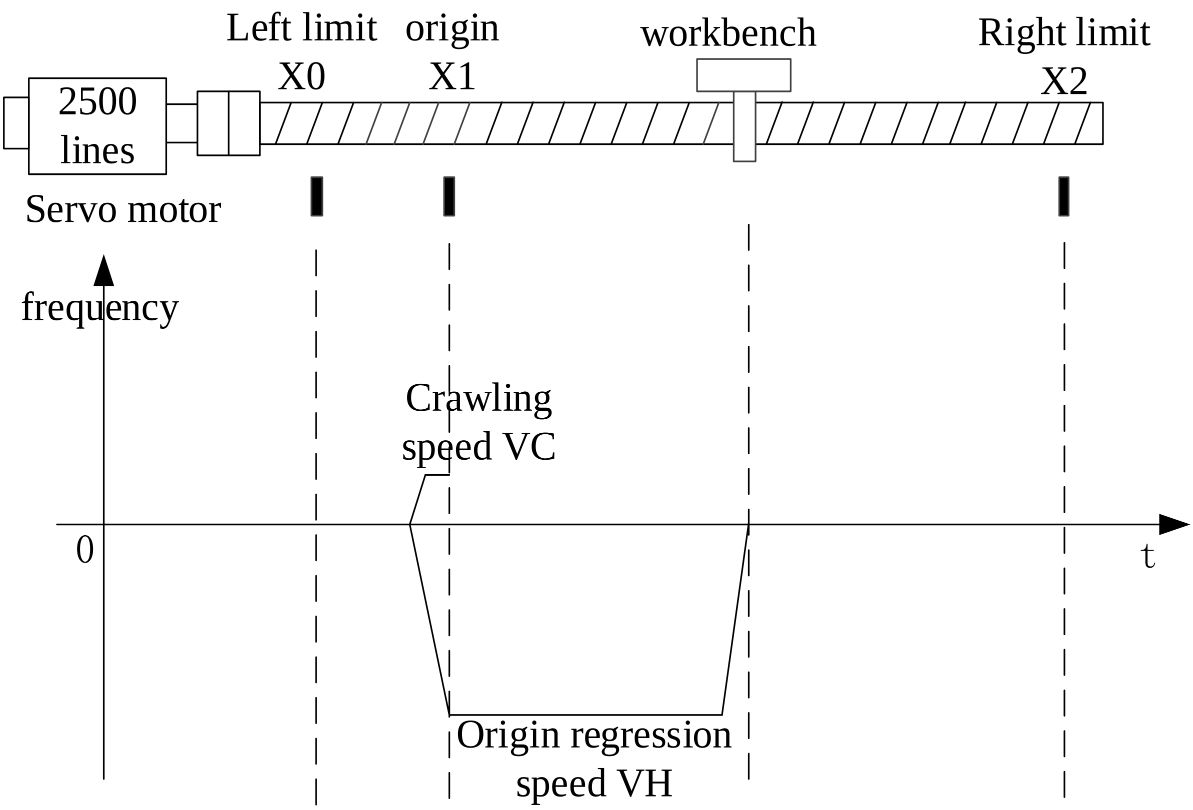

| Param SFD906 | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete mode |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-Offset (1) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y2 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |
| Y0 axis-Common-Gear clearance positive compensation | 0 |


PLC1 - Pulse Set
Config Delete init axis config guide
Param SFD915 bit8-bit15
Value
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X1
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X2
Y0 axis-Common-negative limit terminal setting
X0
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
Config Delete init axis config guide
Param SFD936(dword)
Value
Y0 axis-Common-positive limit terminal setting
X2
Y0 axis-Common-negative limit terminal setting
X0
Y0 axis-Common-Zero clear CLR output setting
Y no terminal
Y0 axis-Common-Return speed VH
10000
Y0 axis-Common-Creeping speed VC
100
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
100
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Read From PLC
Write To PLC
OK
Cancel



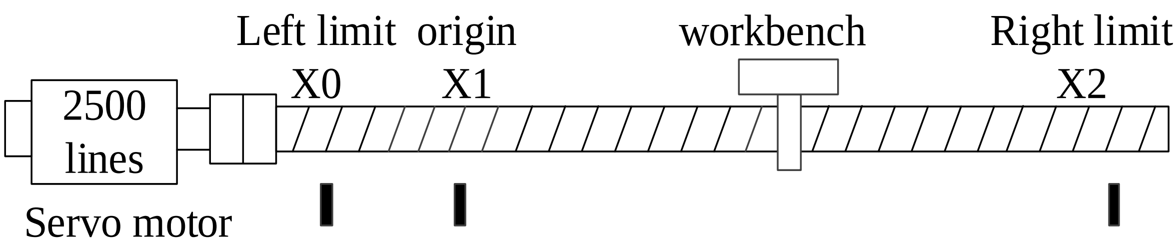

➢ **Mechanical origin regression motion diagram**



- in the moment of leaving the falling edge of origin signal X1 with crawling speed, the mechanical origin regression end immediately.
- if origin regression speed, acceleration/deceleration time, and left limit origin position settings are unreasonable, in the deceleration process of touching the origin signal it has already touched left limit, although there are solutions for such special cases inside the software, we try our best to avoid such special cases in the design of the solution. Special circumstances are not explained here.
- Y2 pulse direction terminal always keeps OFF when the workbench is moving from right to left, Y2 is ON when reverse moving with crawling speed until stop.

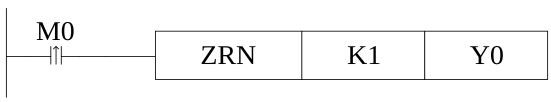
**Example 2**

As shown in the diagram below, one servo driver (electronic gear ratio is 1:1 by default) controls one servo motor (encoder 2500 lines), which is connected to the ball screw, whose pitch is 10mm. the ball screw drives workbench which can move right and left. Now the workbench needs to return to the origin, left limit switch connects the PLC input X0 (normally open), the right limit switch connects the PLC input X2 (normally open), the origin position switch connects the PLC input X1 (normally open), the origin regression speed VH is 10000hz, direction delay time in SFD is 100 ms, crawling speed VC is 100hz, count the Z phase signal when reverse leaving the origin signal(connects to PLC input X4), Z phase number is set to 6, pulse output port is Y0, direction terminal is Y2, mechanical origin position is set to 0, accelerate slope is 1000hz per 100 ms, The deceleration slope is 1000Hz per 150ms.

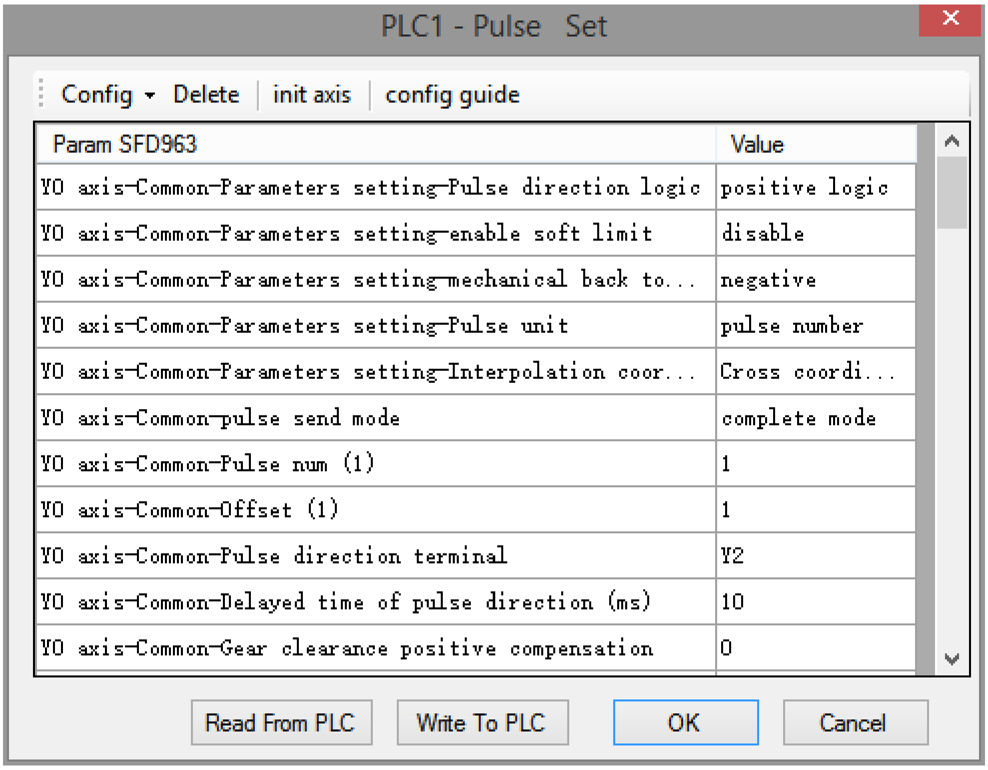


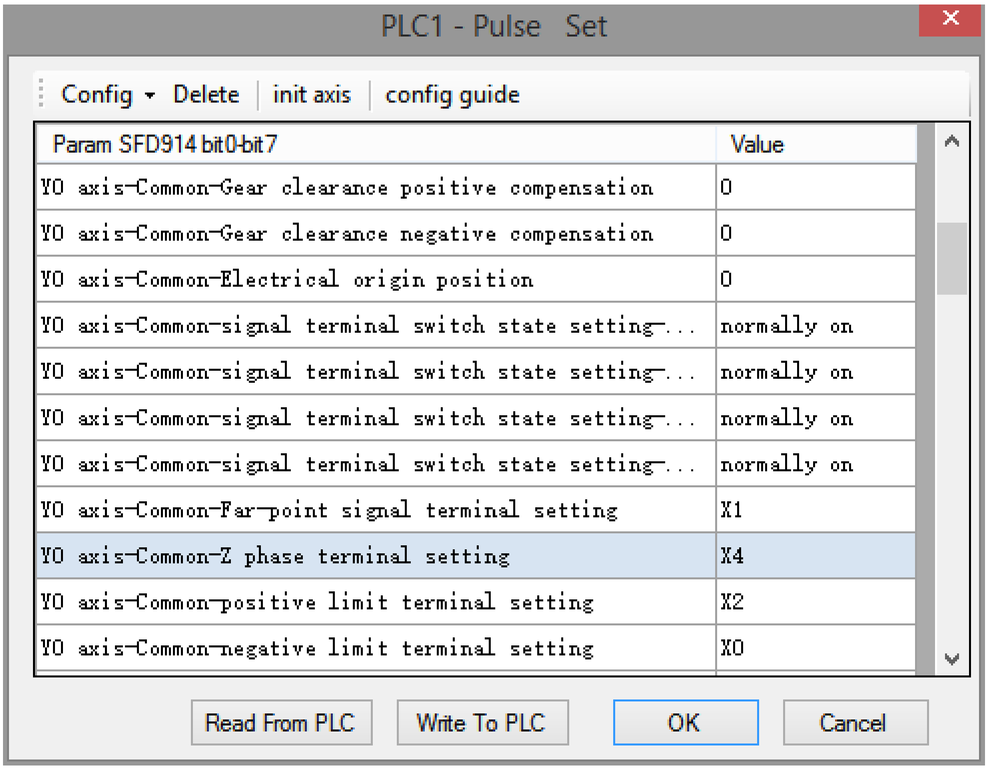

**Structure diagram**

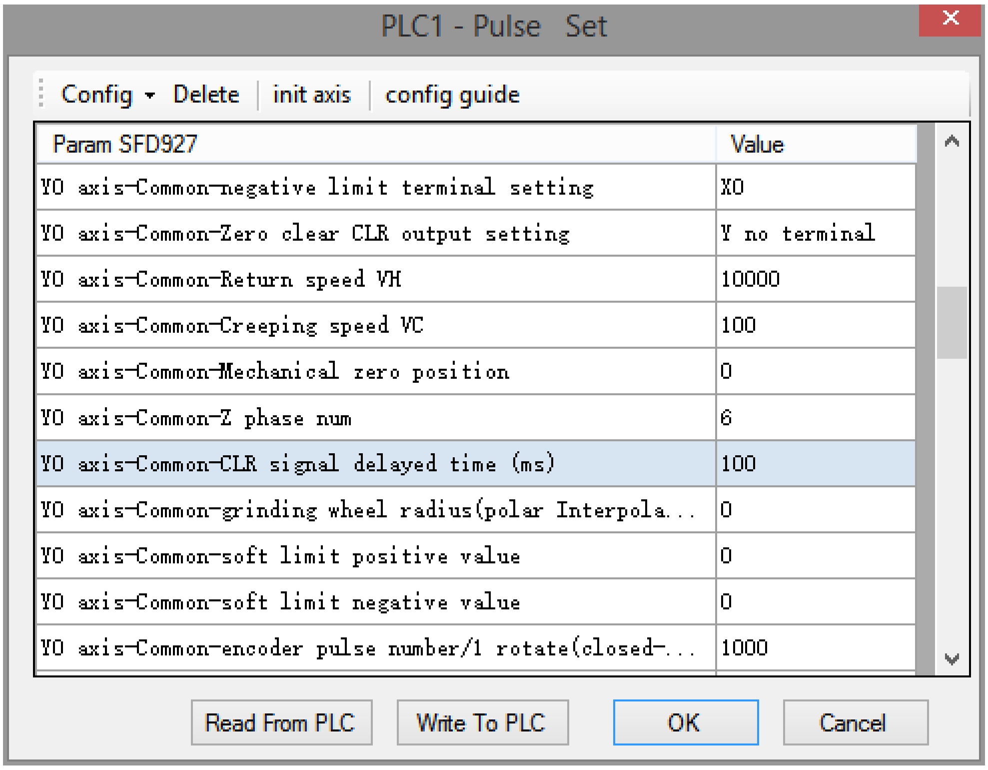
- **The instruction of origin regression**

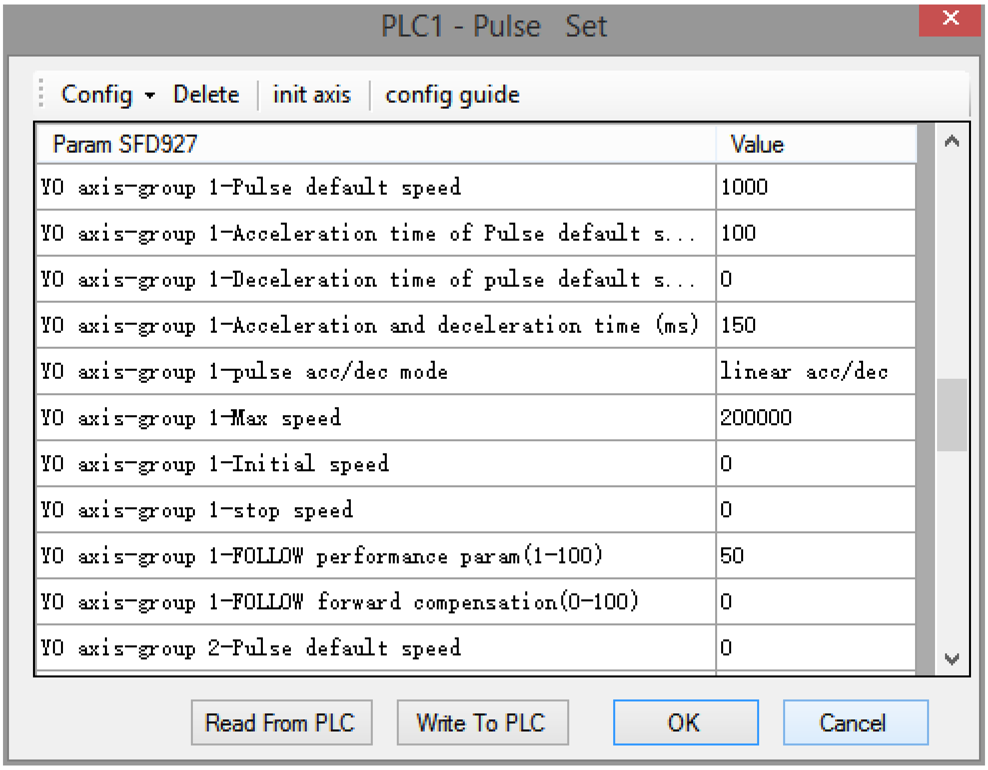



- **System parameter configurations**

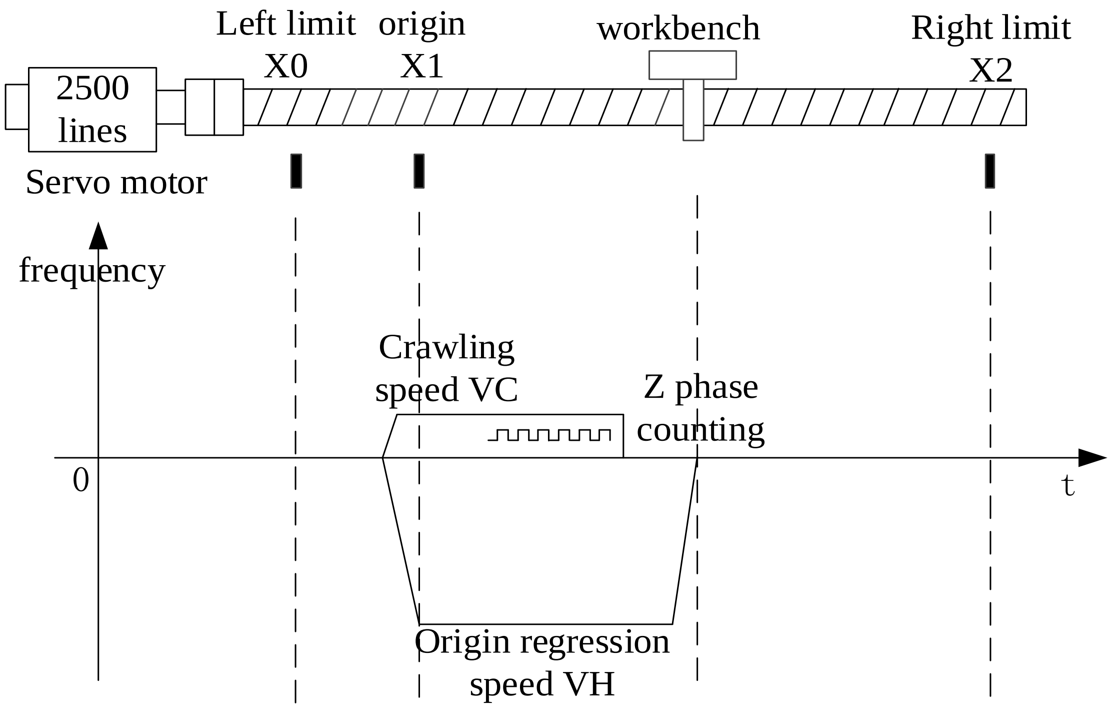

PLC1 - Pulse Set
Config Delete init axis config guide
Param SFD963
Value
Y0 axis-Common-Parameters setting-Pulse direction logic
positive logic
Y0 axis-Common-Parameters setting-enable soft limit
disable
Y0 axis-Common-Parameters setting-mechanical back to...
negative
Y0 axis-Common-Parameters setting-Pulse unit
pulse number
Y0 axis-Common-Parameters setting-Interpolation coor...
Cross coordi...
Y0 axis-Common-pulse send mode
complete mode
Y0 axis-Common-Pulse num (1)
1
Y0 axis-Common-Offset (1)
1
Y0 axis-Common-Pulse direction terminal
Y2
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
Config Delete init axis config guide
Param SFD914 bit0-bit7
Value
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X1
Y0 axis-Common-Z phase terminal setting
X4
Y0 axis-Common-positive limit terminal setting
X2
Y0 axis-Common-negative limit terminal setting
X0
Read From PLC
Write To PLC
OK
Cancel




- **Mechanical origin regression motion diagram**




- When leaving origin signal X1 with crawling speed, count Z phase at once, pulse stop at once when the Z phase counting value reached, the mechanical origin regression end immediately.
- if origin regression speed, acceleration/deceleration time, and left limit origin position settings are unreasonable, in the deceleration process of touching the origin signal it has already touched left limit, although there are solutions for such special cases inside the software, we try our best to avoid such special cases in the design of the solution. Special circumstances are not explained here.
- Y2 pulse direction terminal always keeps OFF when the workbench is moving from right to left, Y2 is ON when reverse moving with crawling speed until stop.

## 1-2-7. Pulse stop [STOP]

1. deceleration stop pulse outputting

| Pulse stop [STOP] | | | |
|---|---|---|---|
| 16-bit instruction | STOP | 32-bit instruction | - |
| Execution condition | Rising edge /falling edge of the coil | Suitable model | XD, XL (except XD1, XL1) |
| Hardware | - | Software | - |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S | The terminal to stop the pulse outputting | bit |
| D | Pulse stop mode ( 0: stop slowly, 1: scram) | 16-bit, word |

3. Suitable soft component

word

| operand | System | | | | | | | | constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| D | ● | ● | ● | ● | ● | ● | ● | ● | | | |

bit

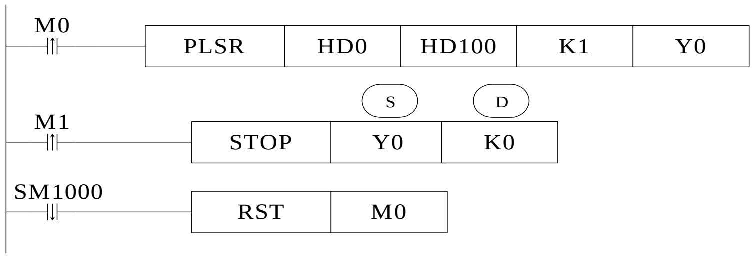
| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| S | | ● | | | | | |

*Note: D means D, HD; TD means TD, HTD; CD means CD, HCD, HSCD, HSD. DM means DM, DHM; DS means DS, DHS.

M means M, HM, SM; S means S, HS; T means T, HT; C means C, HC.

**Function and action**

**Instruction format**

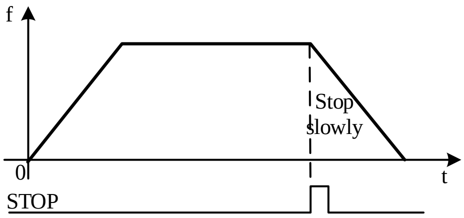



- Pulse stop mode: K0 (stop slowly), K1(scram)
- When M0 is from OFF to ON, PLSR instruction outputs pulse from Y0, and stop pulse outputting when the pulse output numbers reached setting value
- At the rising edge of M1, STOP instruction will stop the pulse outputting of Y0 immediately,

as the D parameter is K0, the pulse will stop slowly.

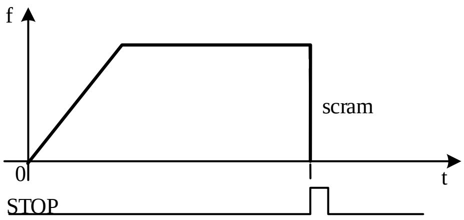
- Stop pulse includes PLSR, PLSF, DRVI, DRVA, ZRN.

- Stop slowly (K0)




According to the descending slope, the current pulse frequency of the pulse falls to the pulse stop frequency or the number of pulses in the pulse section is all sent out and stop the pulse output.

- Scram (K1)




Stop the pulse outputting immediately.

## 1-2-8. Pulse continue [GOON]

1. Instruction overview

Continue the pulse output.

| Pulse continue [GOON] | | | |
|---|---|---|---|
| 16-bit instruction | GOON | 32-bit instruction | - |
| Execution condition | Rising/falling edge of the coil | Suitable model | XD, XL (except XD1, XL1) |
| Hardware | - | Software | - |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S | The terminal to continue outputting the pulse | bit |

3. Suitable soft component

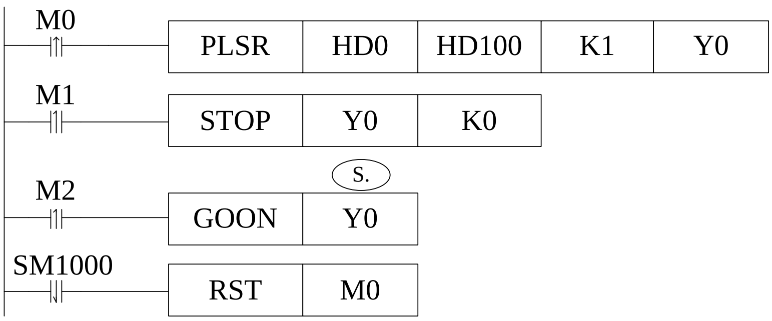
Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| S | | ● | | | | | |

*Note: D means D, HD; TD means TD, HTD; CD means CD, HCD, HSCD, HSD. DM means DM, DHM; DS means DS, DHS.
M means M, HM, SM; S means S, HS; T means T, HT; C means C, HC.

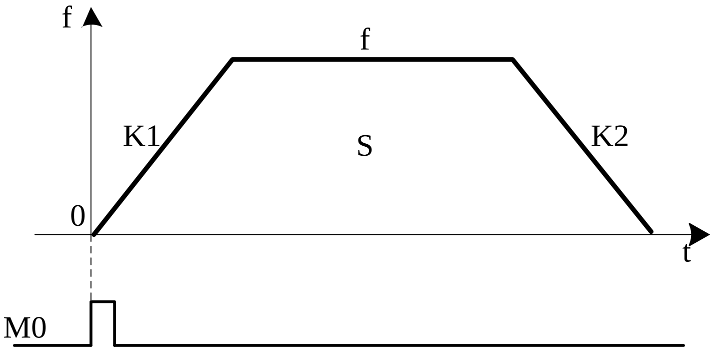
**Function and action**

**Instruction format**

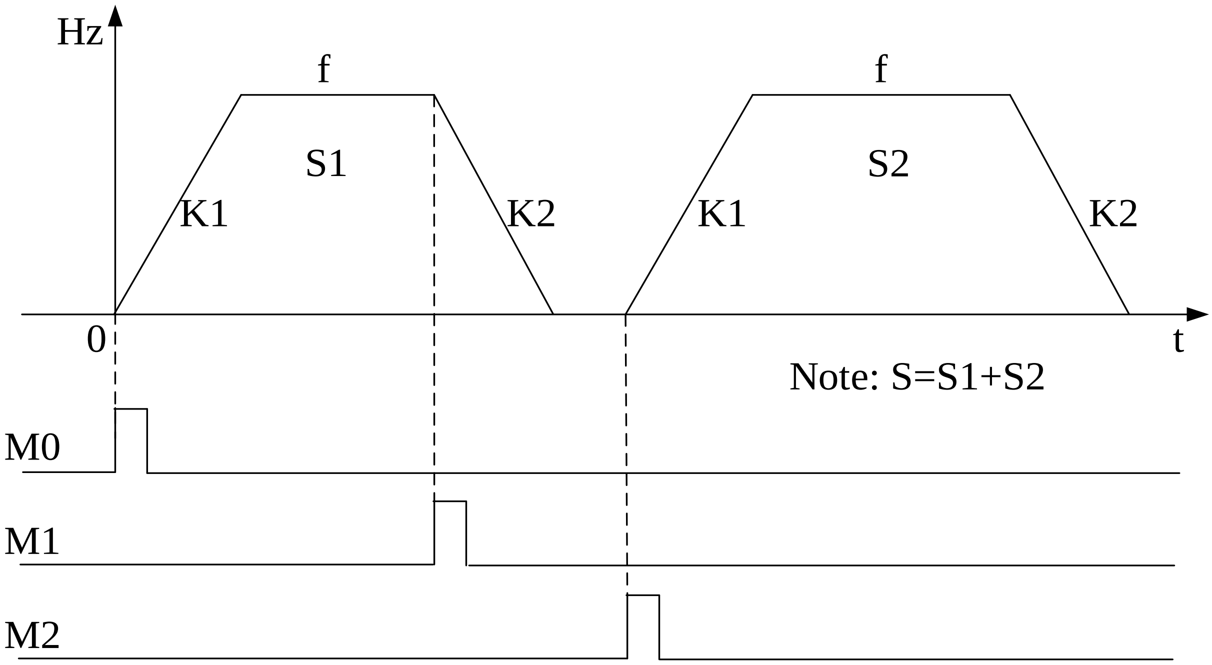



- When M0 from OFF to ON, PLSR instruction outputs pulse from Y0; When the number of output pulses reaches the set value, stop the output pulse.
- In the process of sending pulse, M1 from OFF to ON rising edge, STOP instruction immediately stop Y0 pulse outputting, as the parameter is K0, so the pulse will stop slowly;
- when M2 from OFF to ON rising edge, GOON Y0 instruction is executed, remaining pulses will send out according to the original deceleration slope.
- Please set ON M2 after pulse stop, otherwise GOON will not send pulse.
- Pulse continue instruction is applicable to the PLSR, DRVI, DRVA instructions.

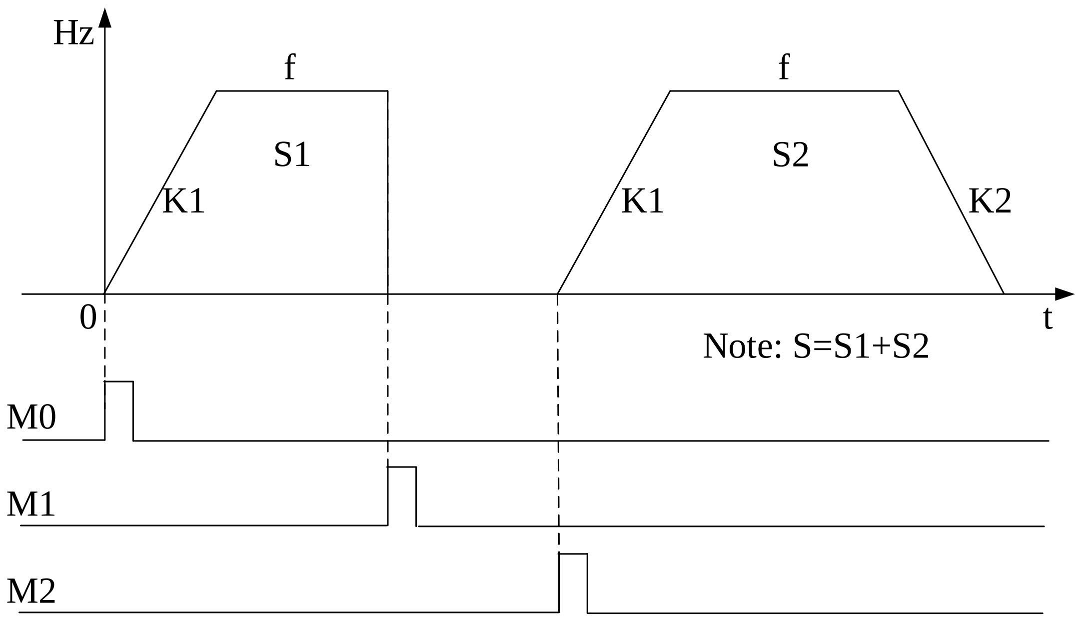
- The schematic diagram is as follows:




**Complete Pulse diagram**




**Pulse continue wave diagram（STOP Y0 K0）**



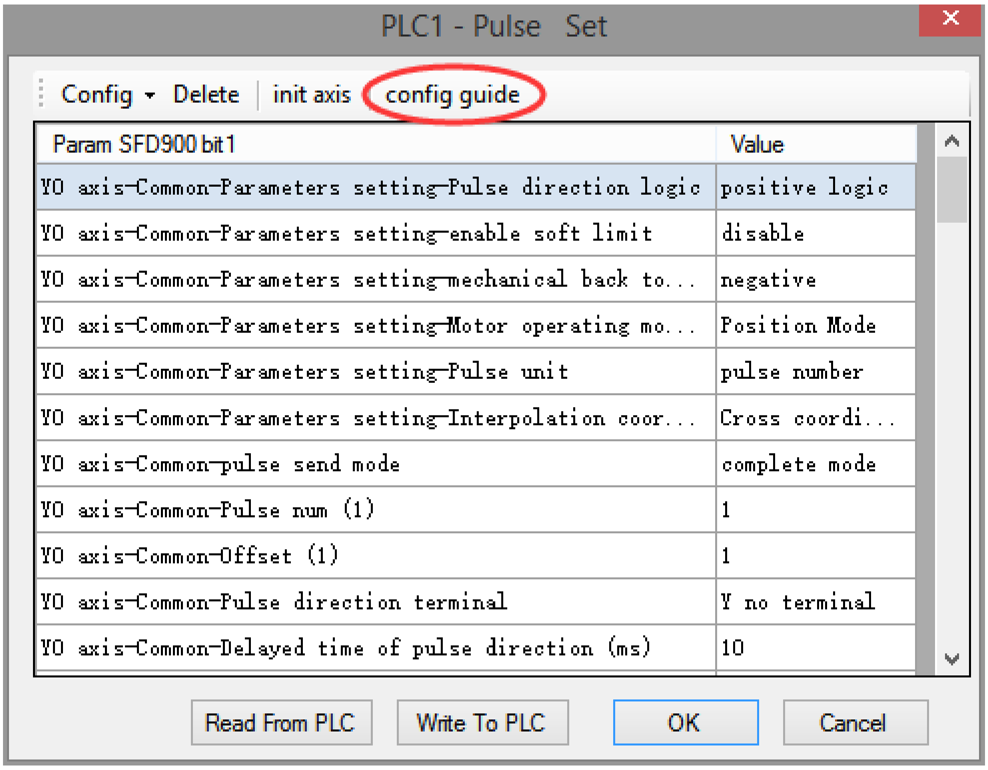

**Pulse continue wave diagram（STOP Y0 K1）**

## 1-3. Pulse parameter configuration wizard

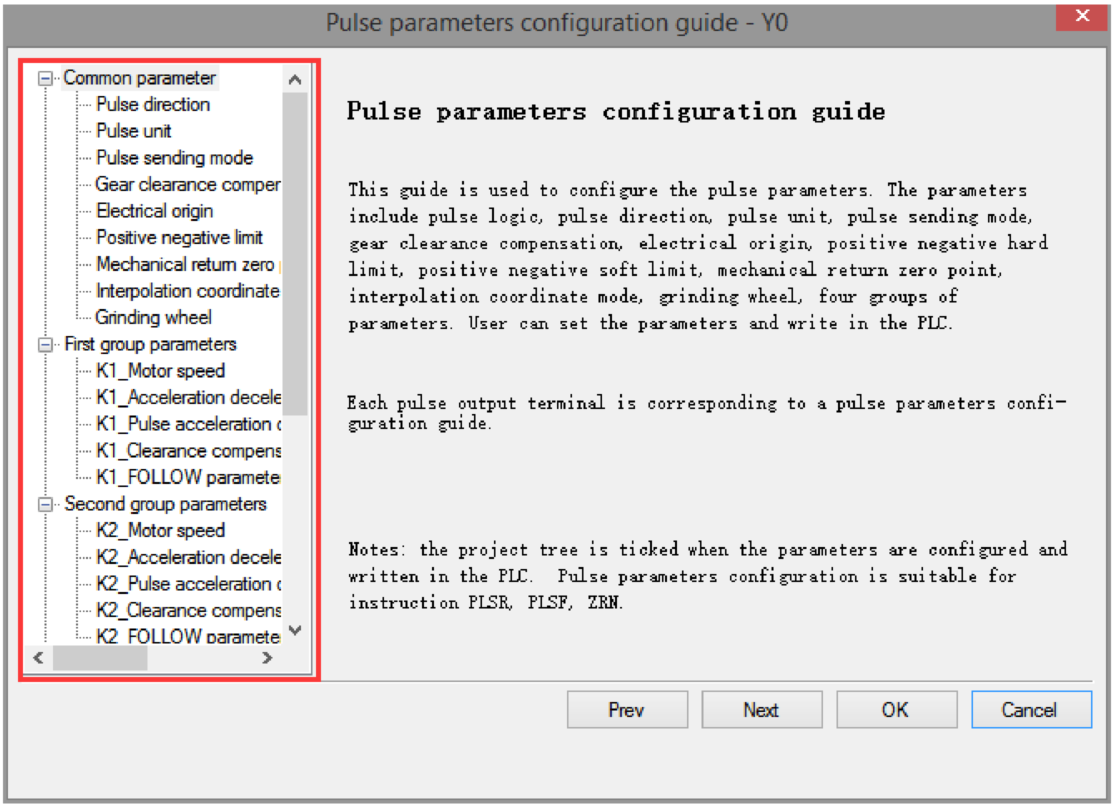
Pulse parameter configuration wizard function was added in V3.3.2 and higher version software. Because there are many system parameters of the pulse axis (including common parameters and the first to fourth sets of parameters), it may be difficult for novices. To solve this problem, a pulse parameter configuration wizard is added to the latest PC software, which configures the pulse parameters of each pulse axis directly through the pulse parameter configuration wizard, which is simple and convenient.

### 1-3-1. Pulse Parameter Configuration Wizard Opening Mode

On the top of the pulse parameter configuration interface, there is a "Config guide" option. Click on the "Configuration Wizard" to open the pulse parameter configuration wizard. As shown in the figure:

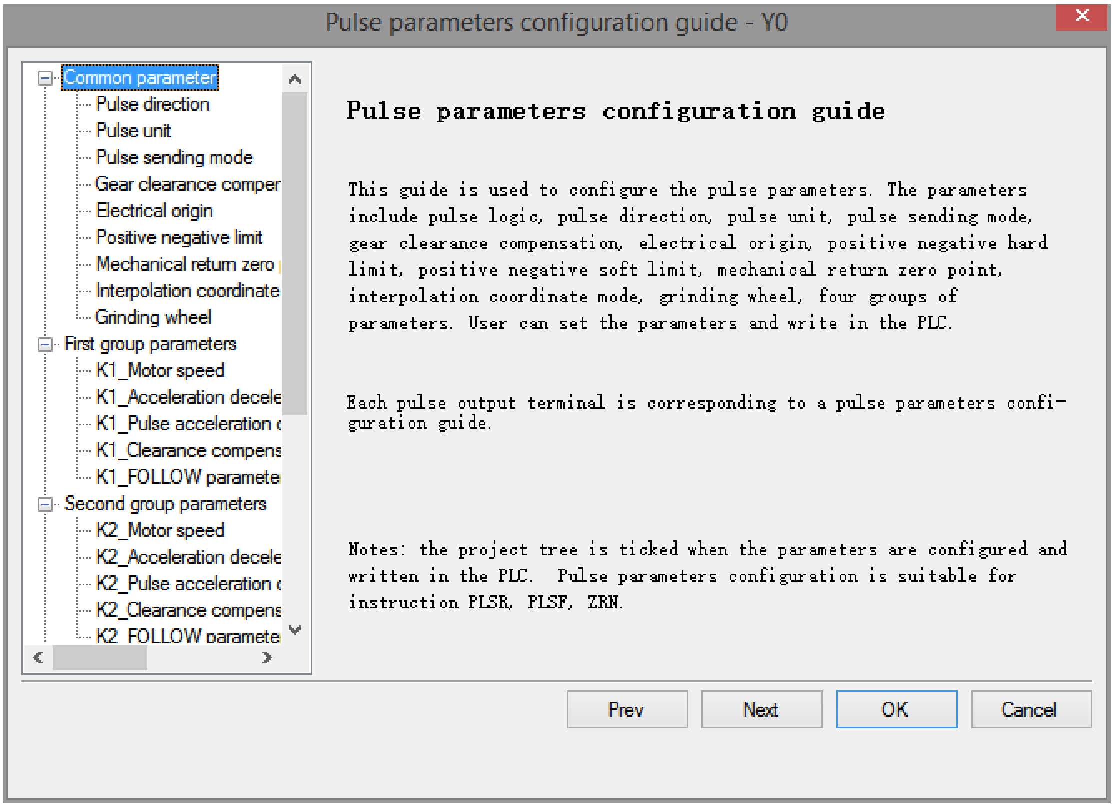



Engineering Tree is on the left of the following window. You can select the option you want to open in the Engineering Tree, and click directly to open it quickly. As shown in the figure:



## 1-3-2. Instructions for the Use of the Pulse Parameter Config guide

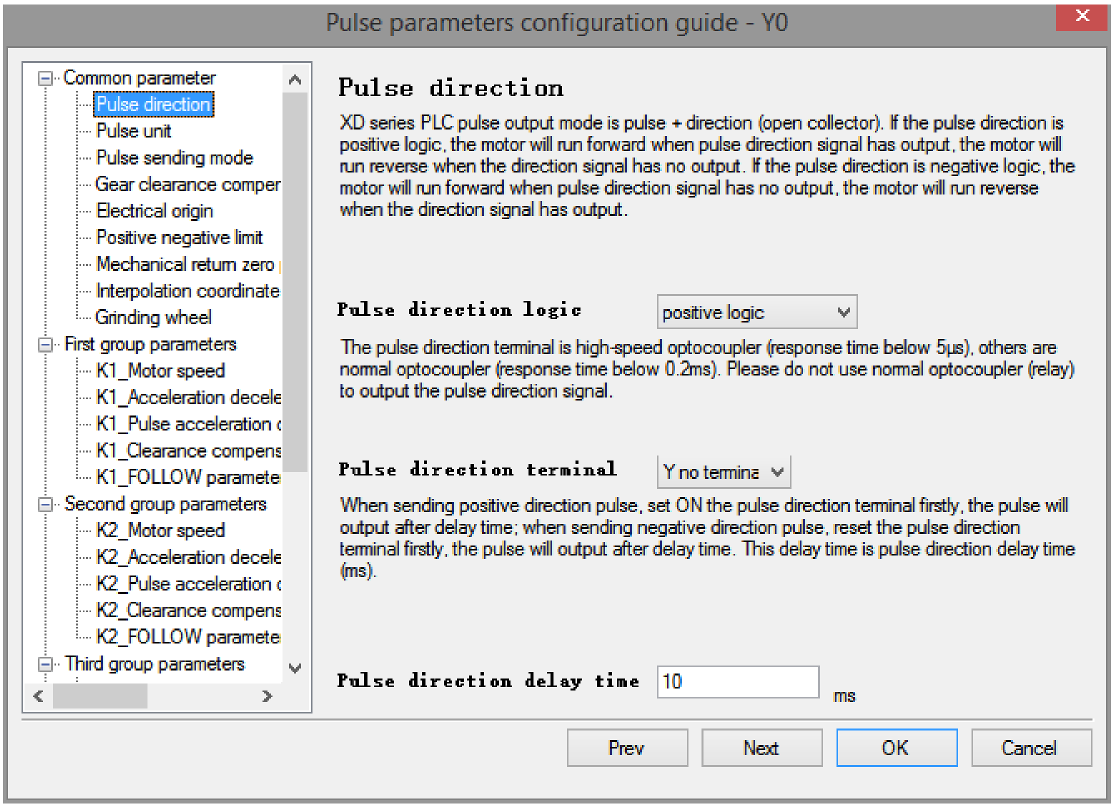
**The pulse parameter config guide describes:**




This interface is mainly used to briefly explain the pulse parameter configuration wizard.

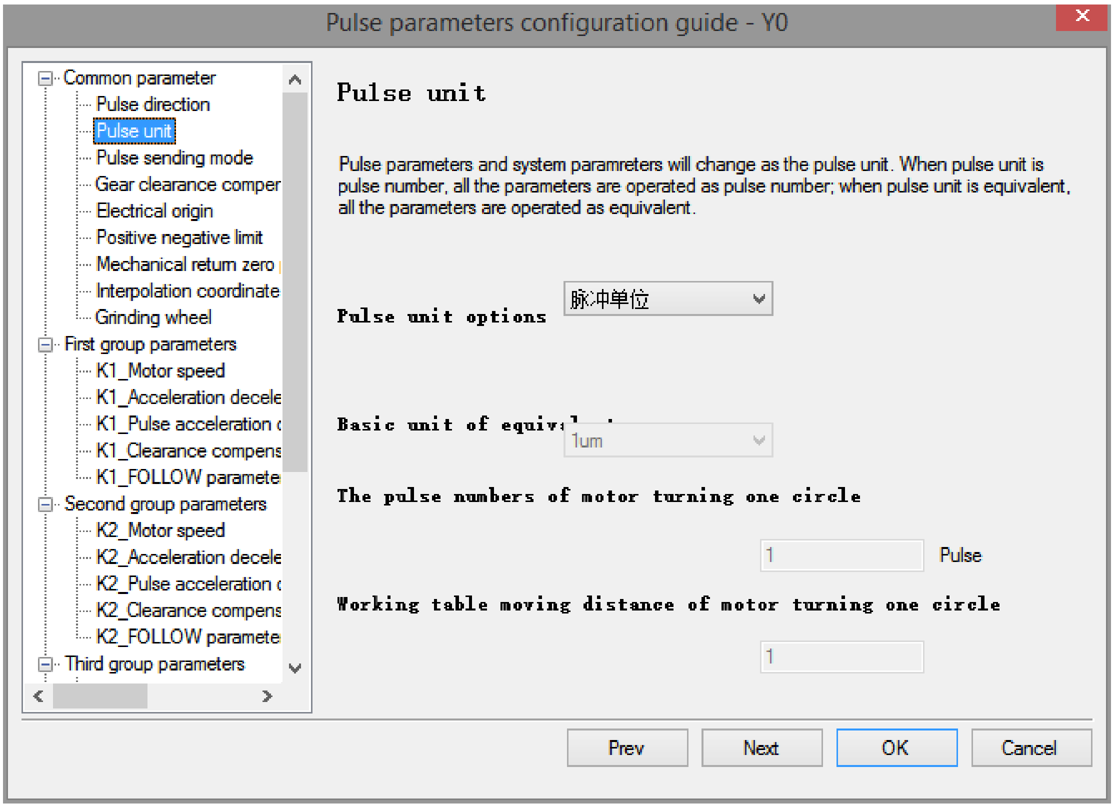
**★ Common parameter—pulse direction**

It is used to set the pulse direction logic, the pulse direction terminal and the delay time of the pulse direction.

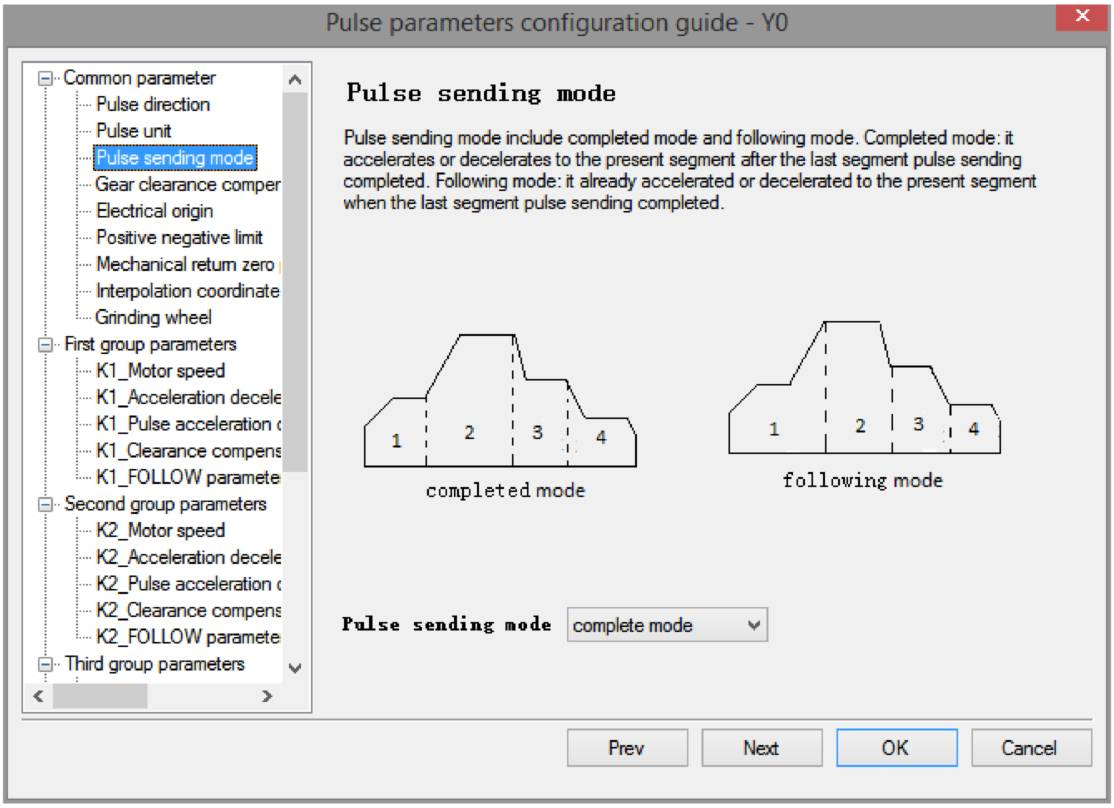



**★ common parameters—pulse unit**

It is used to set the unit of pulse, the basic unit of equivalent, the number of pulses and the amount of movement.

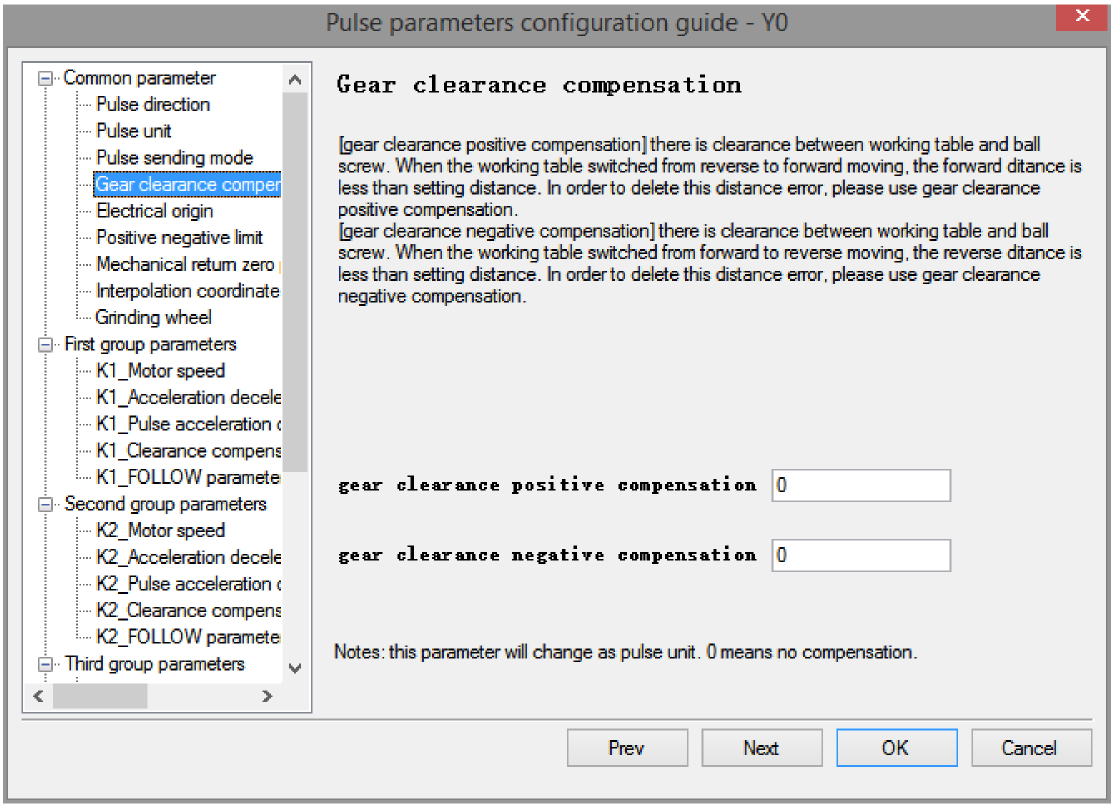


## ★ Common parameters—pulse sending mode

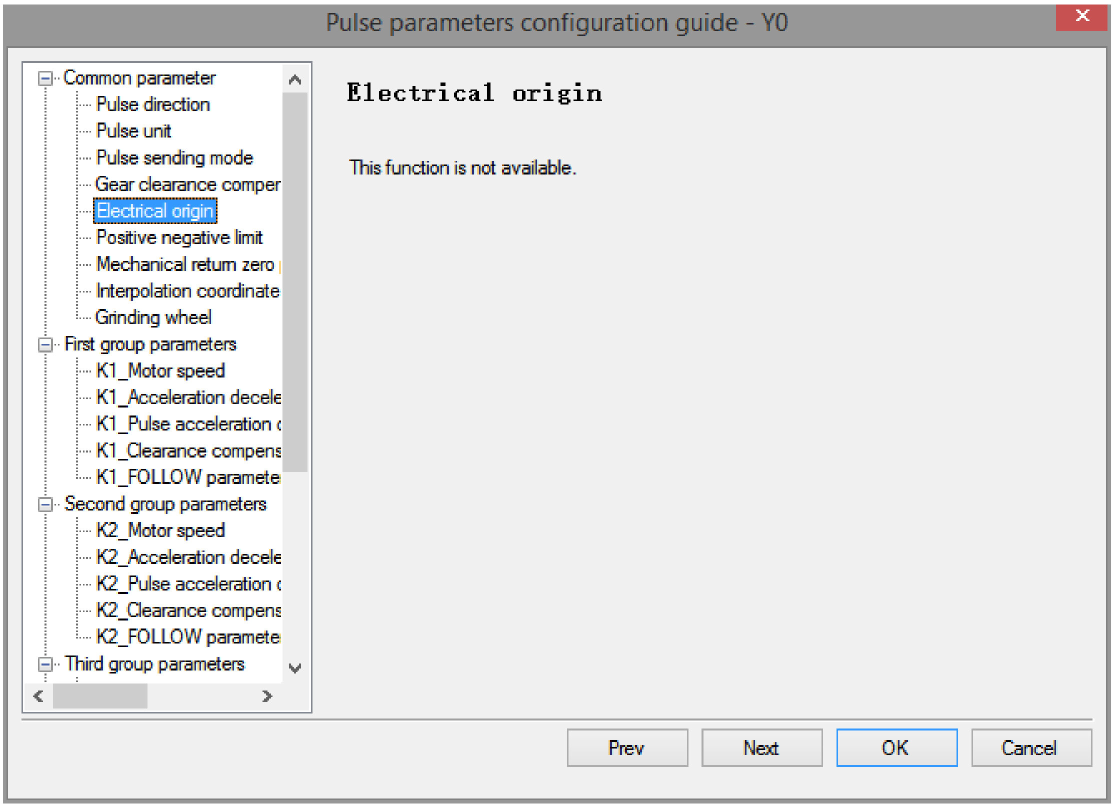



## ★ Common parameters—gear clearance compensation

It is used for setting forward compensation of gear clearance and reverse compensation of gear clearance.

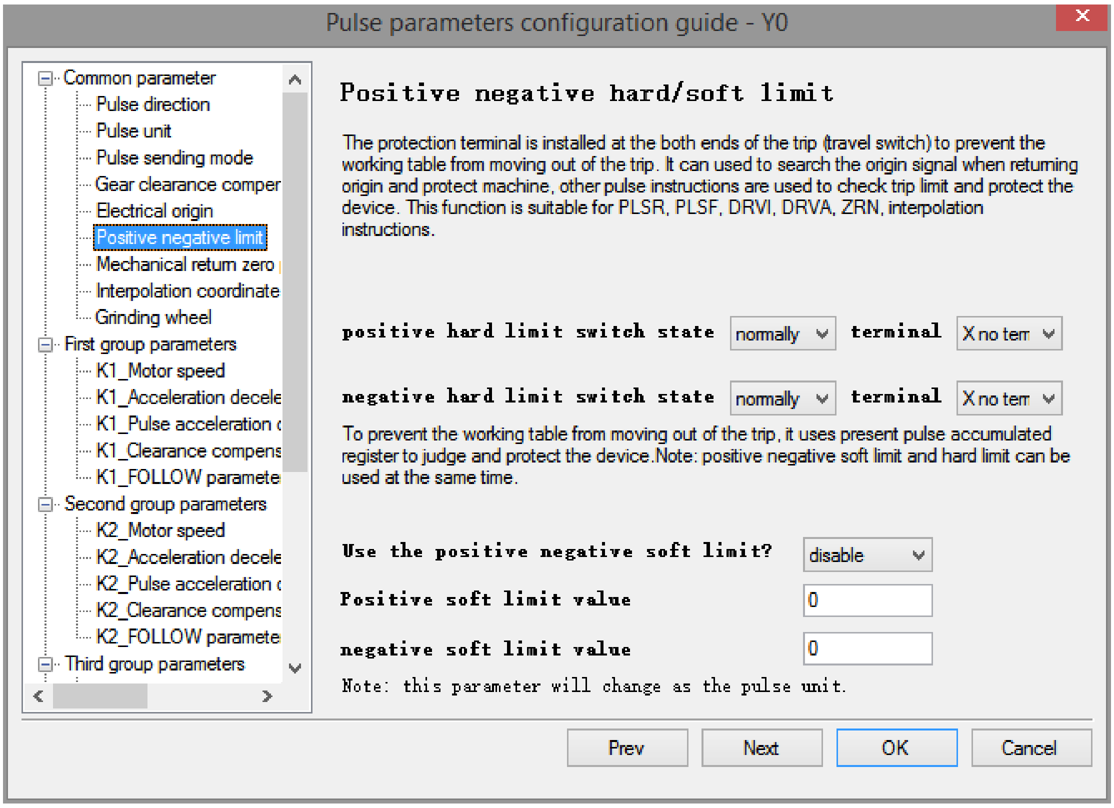


## ★ Common parameters —electric origin



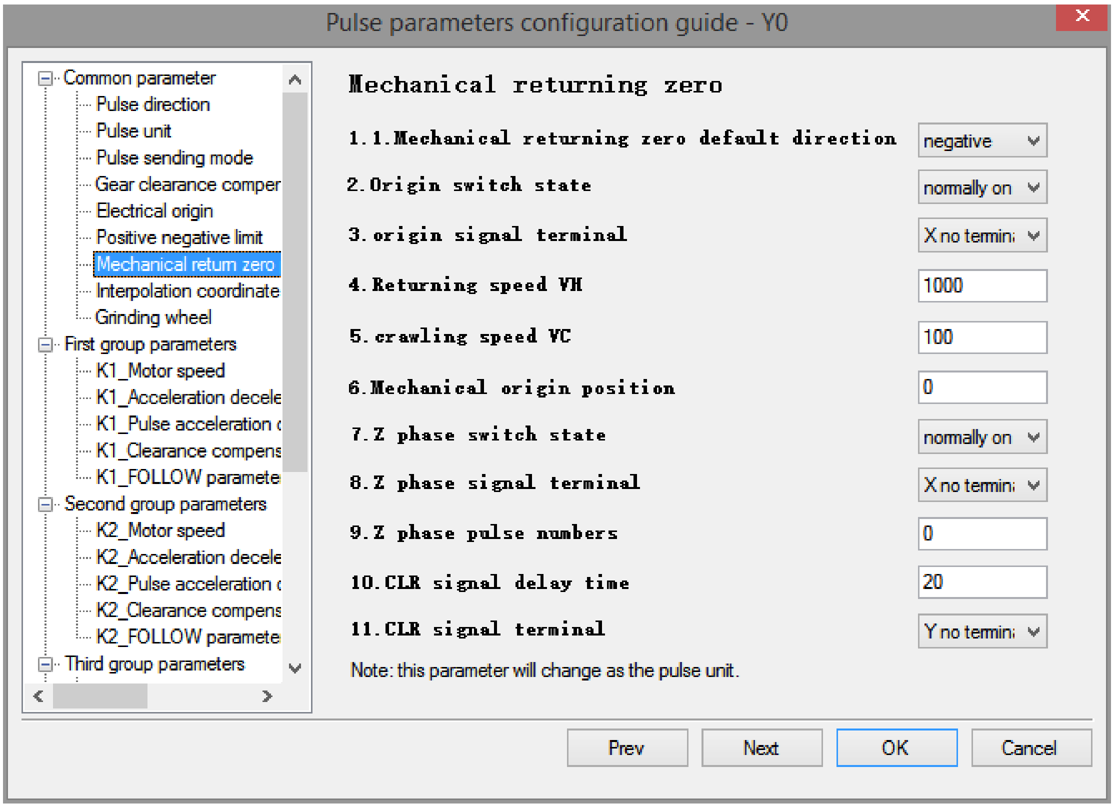

## ★ Common parameters—positive neagtive hard/soft limit

Used for setting positive and negative hard limit and positive and negative soft limit.



**★ Common parameters—Mechanical Zero Return Setting**

Used to set the default direction of mechanical zero return, origin switch, Z phase switch, regression speed, CLR signal, mechanical origin position.

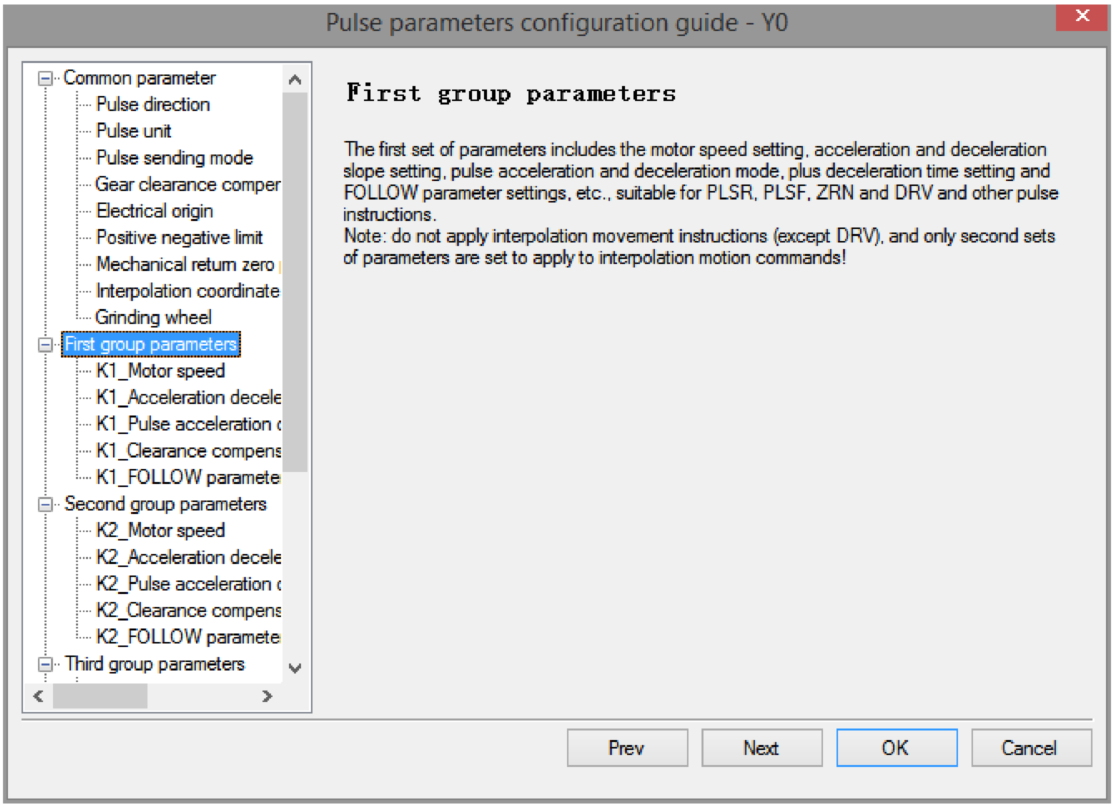



**★ Common parameters —Interpolation coordinate mode**

**★ Common parameters —grinding wheel radius**

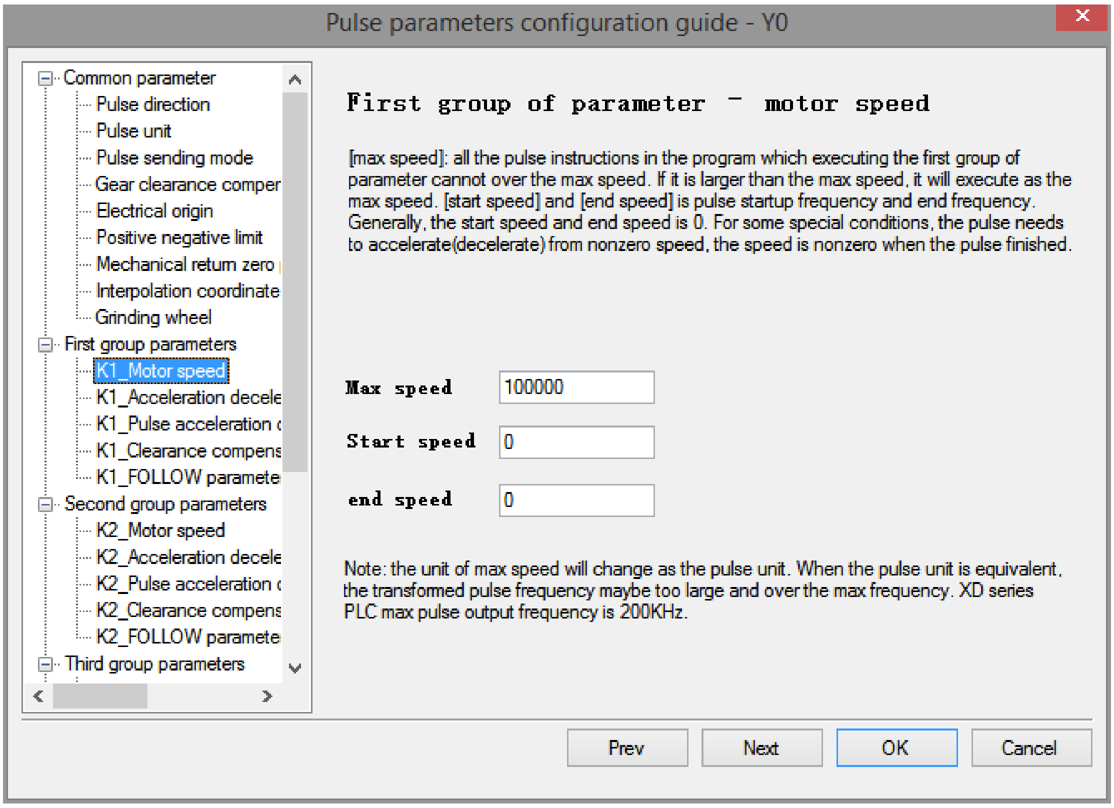
The functions are not avaliable.

### ★ First group parameter setting



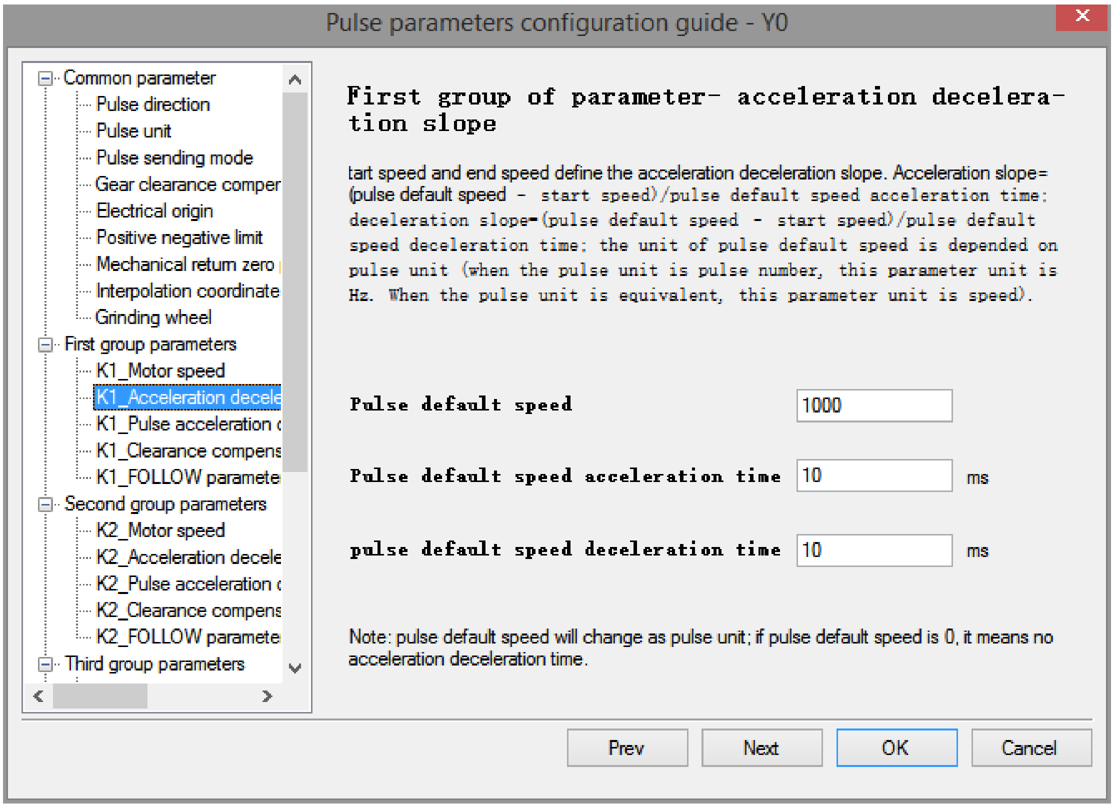

### ★ First group parameters—motor speed

Used to set the maximum speed, starting speed, termination speed.



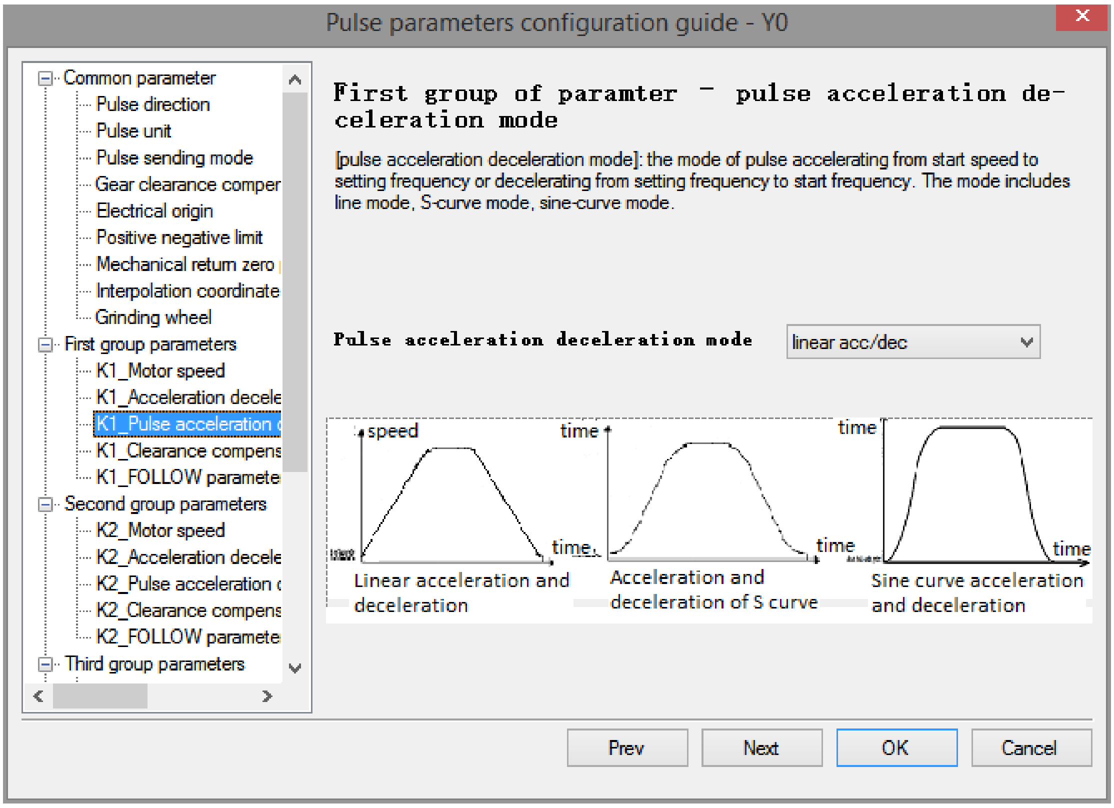
### ★ First group parameters —Acceleration and deceleration slope

Used to set default speed, default speed acceleration time, default speed deceleration time.



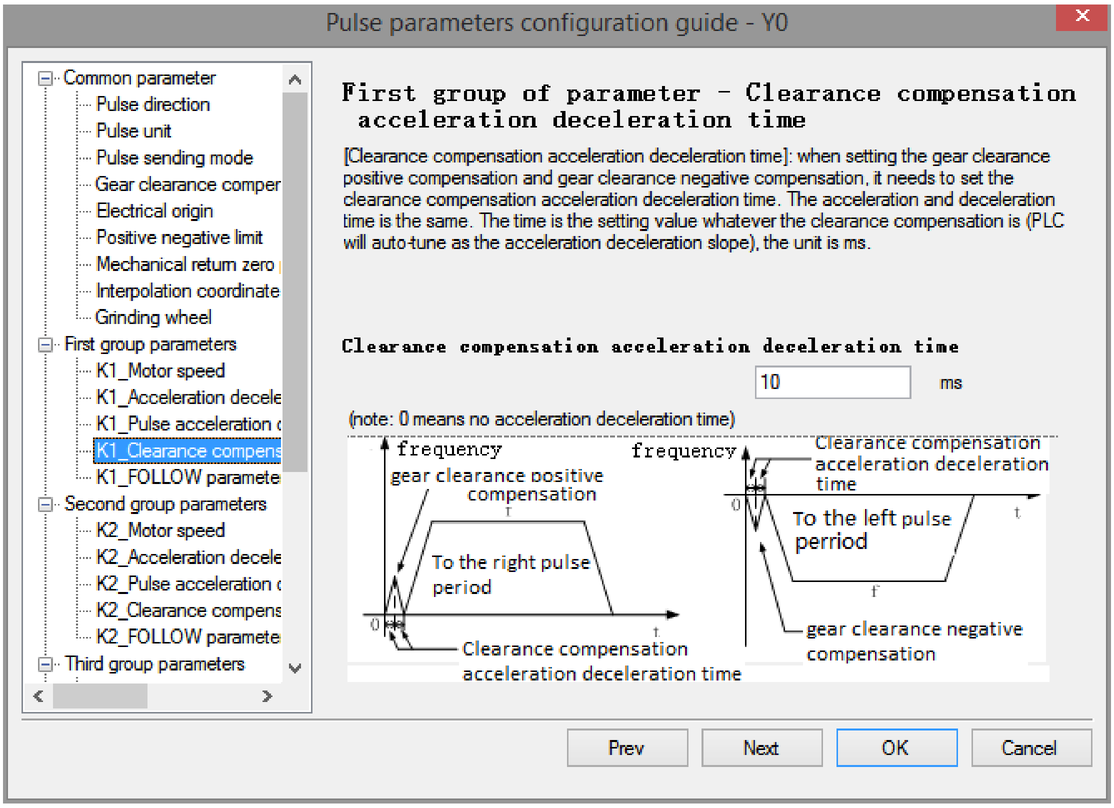

### ★ First group parameters —Pulse acceleration and deceleration mode

It is used to set three pulse acceleration and deceleration modes.



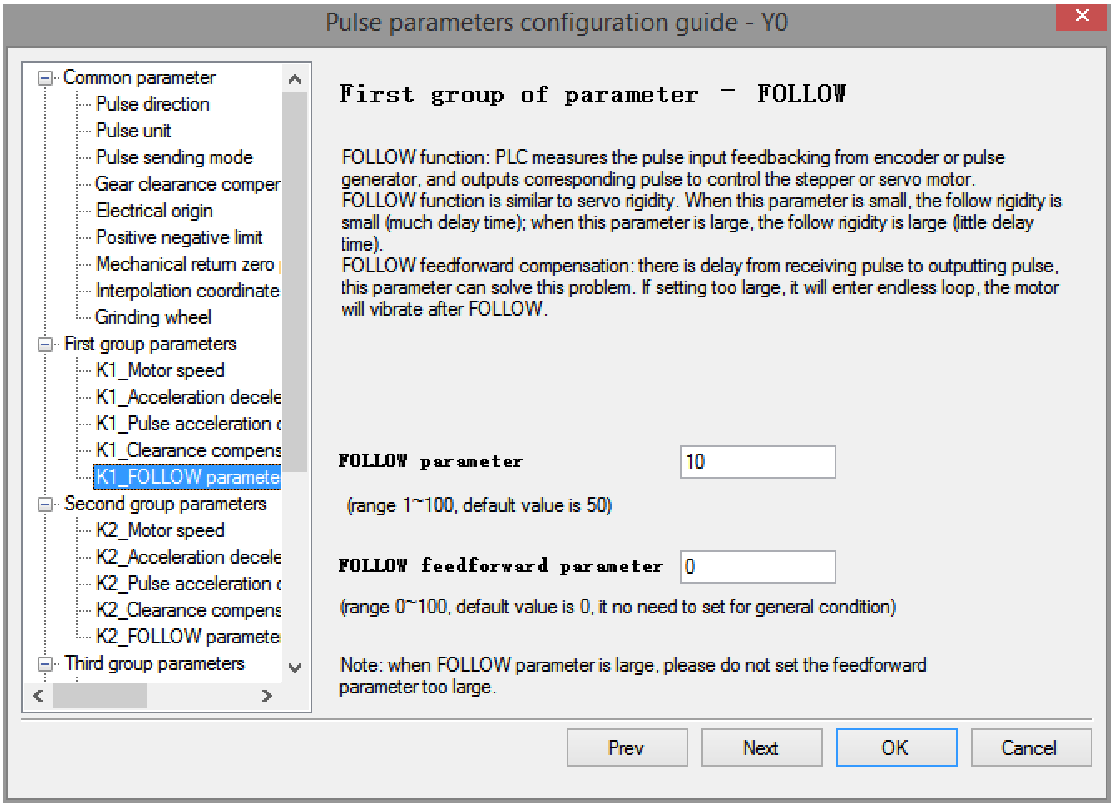
## ★ First group parameters —Clearance compensation acceleration and deceleration time

It is used to set the clearance compensation acceleration and deceleration time.



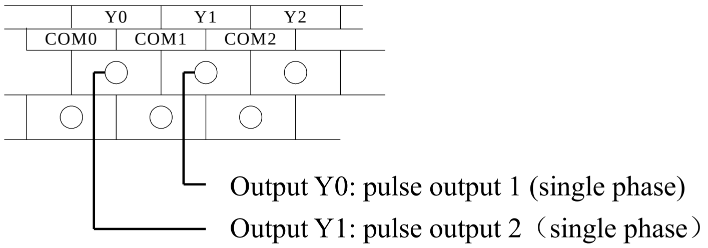

## ★ First group parameters —FOLLOW parameter

It is used to set the FOLLOW parameter and feedforward parameter.

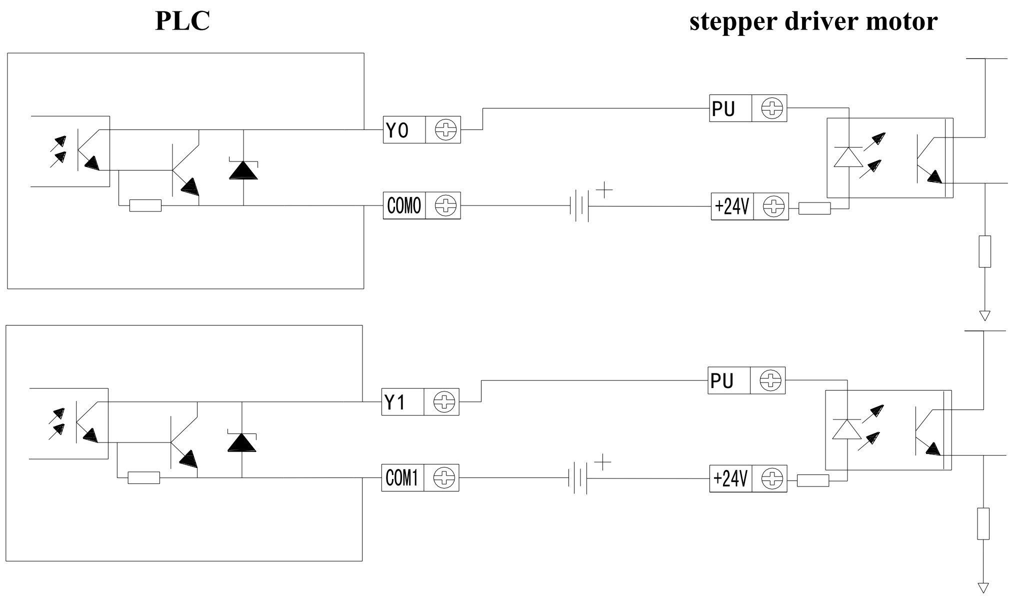


The second to fourth group of parameters are the same as the first group of parameters, please refer to the first group of parameters! After configuring the parameters, the program is downloaded to the PLC again, and then the power is cut off and restarted to take effect.

## 1-4. Output wiring and notes

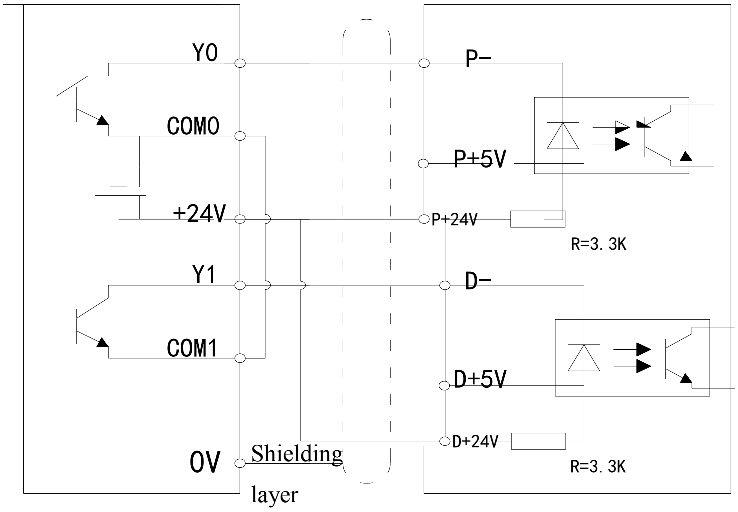



Below is a wiring diagram of the connection between the T-type output terminal and the stepper motor driver.




Note: If the pulse and direction terminals of stepper motor are driven by DC5V, please connect 2.2K resistance behind the pulse output terminal and direction output terminal.

Below is a wiring diagram of the connection between the T-type output terminal and the XINJE servo motor driver.



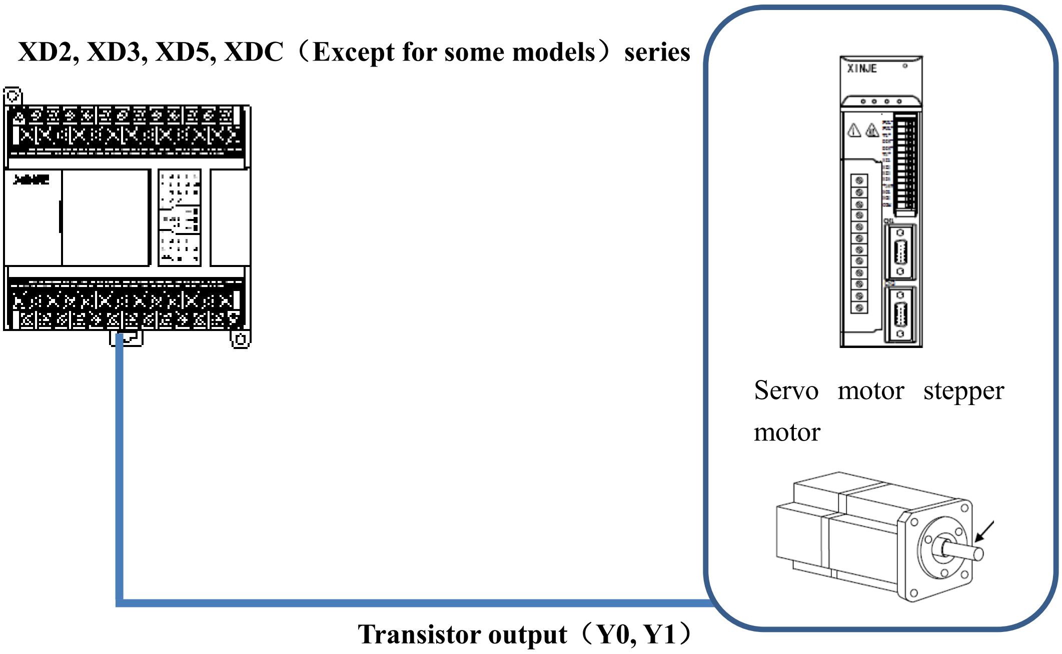

Note: Please suspend P+5V and D+5V.

Detailed hardware wiring diagram refers to XD/XL Series Programmable Controller hardware User Manual.

## 1-4-1. Composition of Connecting Equipment

- **XD2, XD3, XD5, XDC series PLC**

**XD2, XD3, XD5, XDC（Except for some models）series**

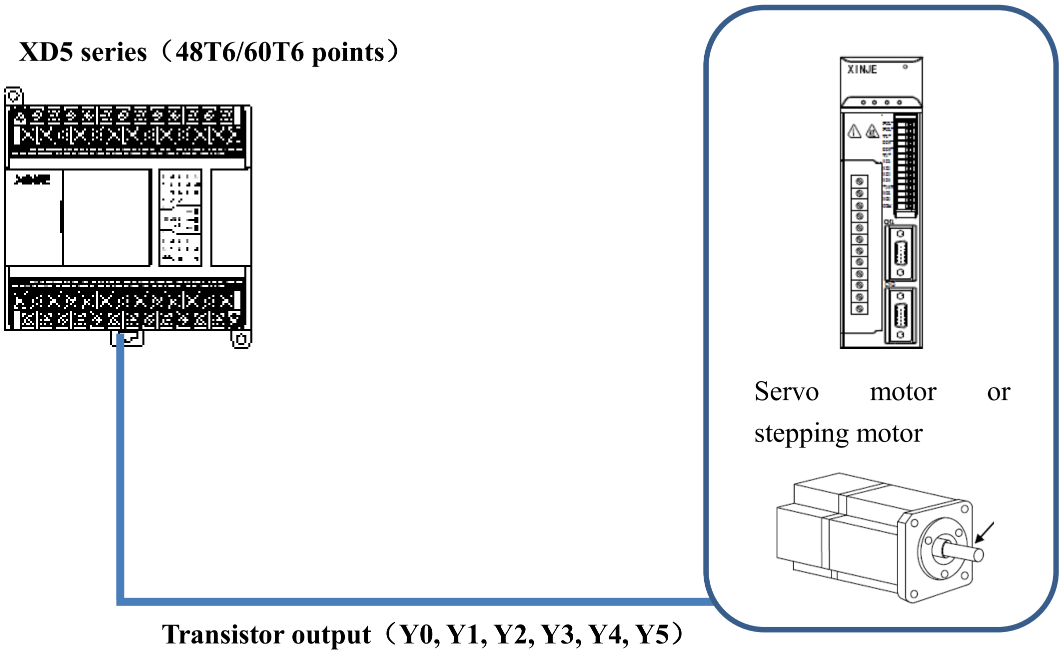



**Transistor output（Y0, Y1）**

※:Two-axis servo motor or stepping motor can be controlled.

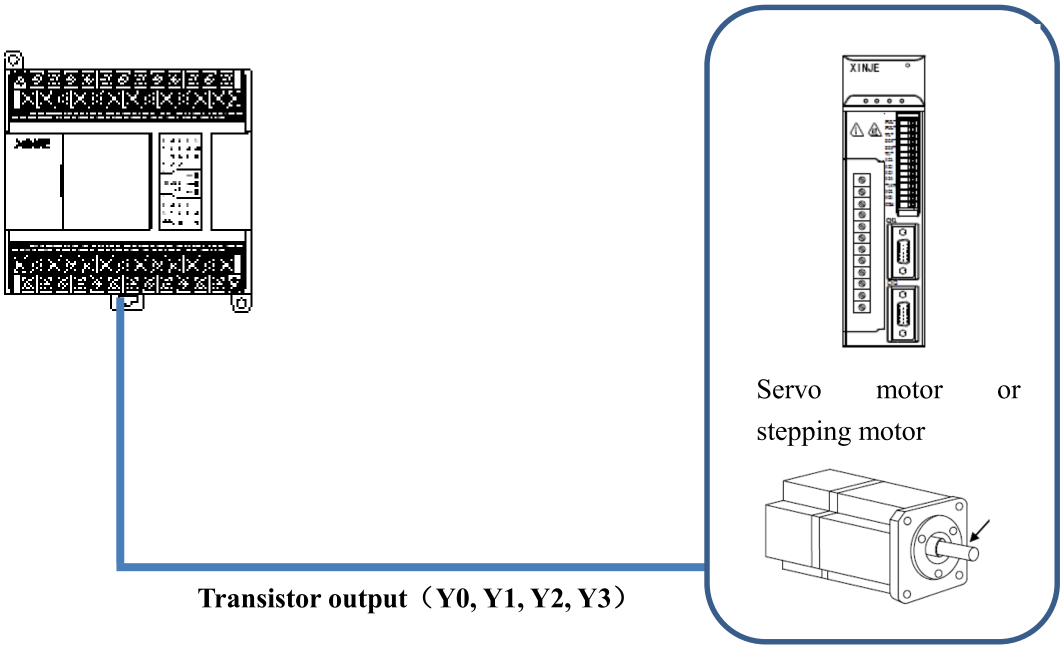
- **XD5, XDM, XD5E, XDME series PLC**

**XD5 series（48T6/60T6 points）**



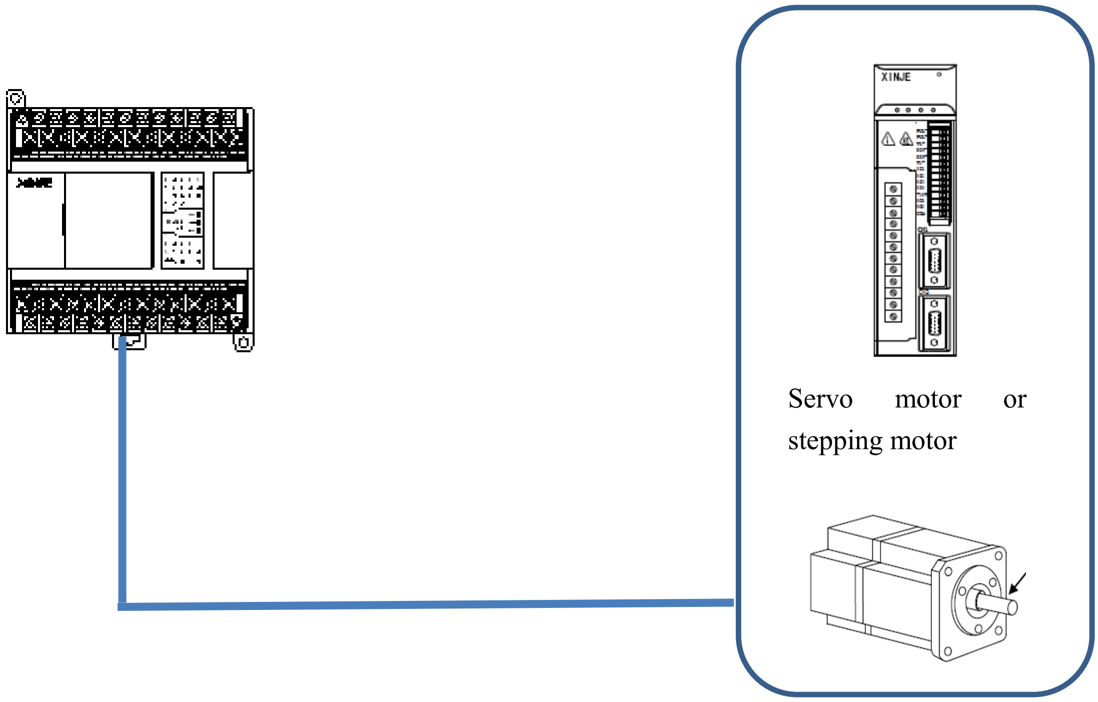

※: Six-axis servo motor or stepping motor can be controlled.

**XD5/XDM series（24T4/32T4）, XDM series（60T4/60T4L）, XD5E-30T4**




※: Four-axis servo motor or stepping motor can be controlled.

**XDM series（60T10）, XD5E series (60T10), XDME series (60T10)**

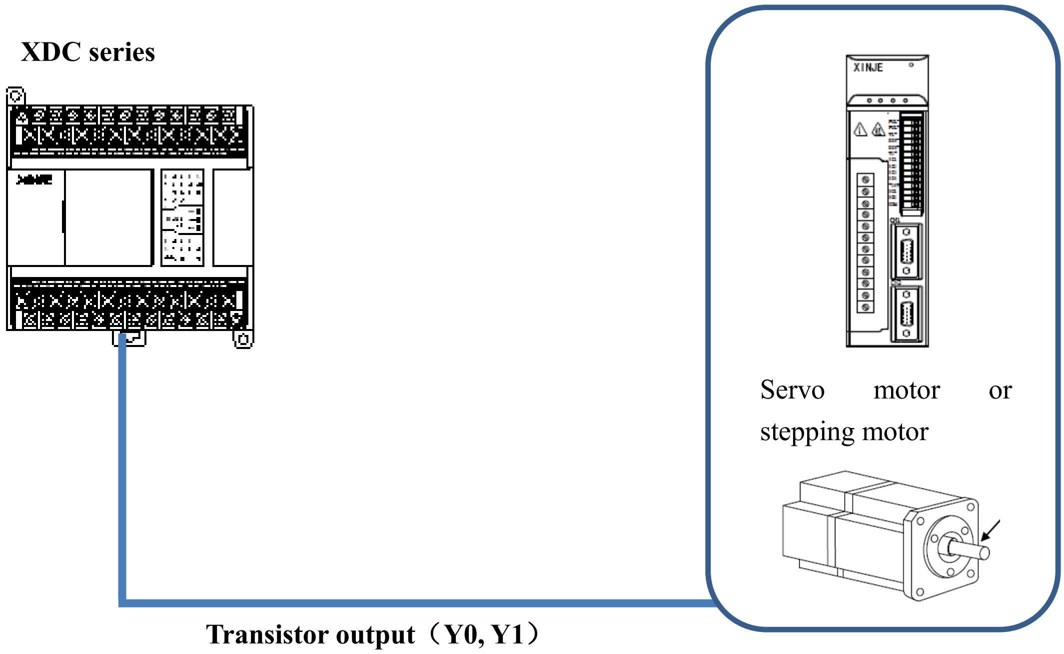



**Transistor output（Y0, Y1, Y2, Y3, Y4, Y5, Y6, Y7, Y10, Y11）**

※: Ten-axis servo motor or stepping motor can be controlled.

- **XDC series PLC**

**XDC series**

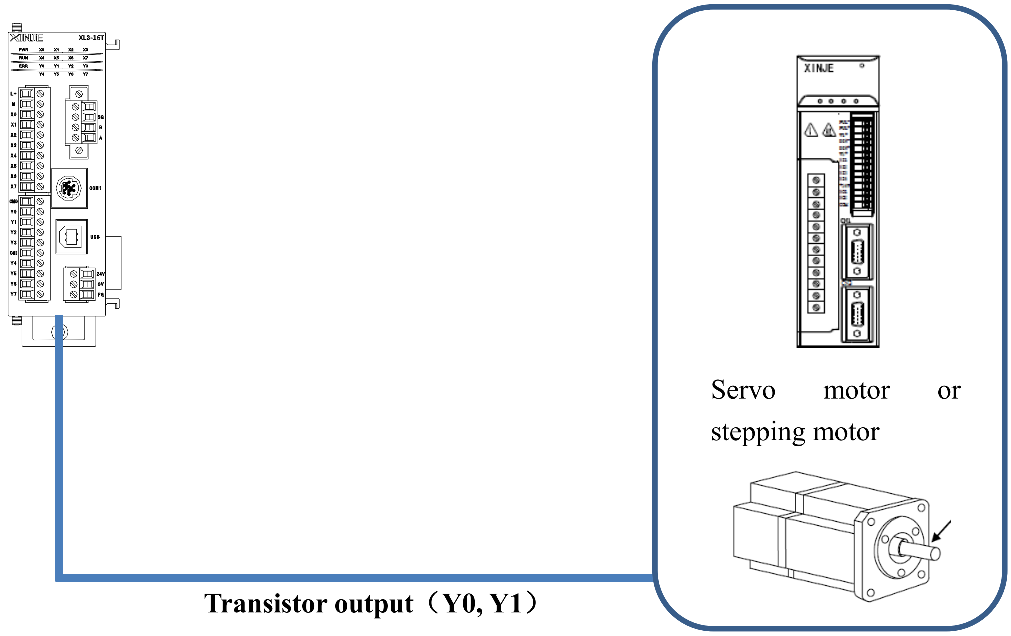



**Transistor output（Y0, Y1）**

※: Two-axis servo motor or stepping motor can be controlled.

- **XL3 series PLC**

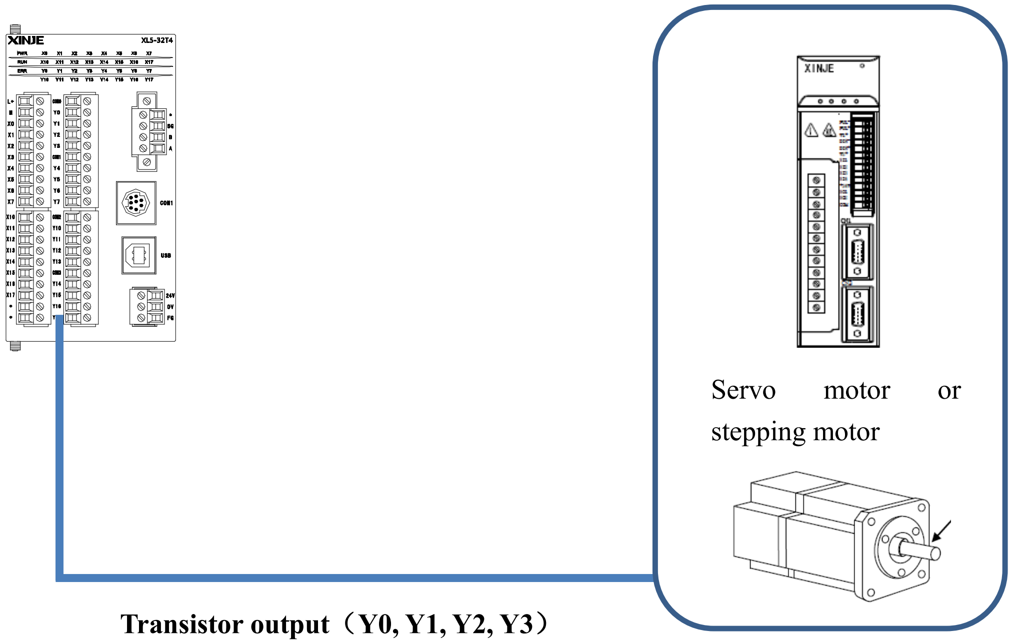
**XL3 series**




※: Two-axis servo motor or stepping motor can be controlled.

- **XL5, XL5E series PLC**

**XL5, XL5E series**




※: 4-axis servo motor or stepping motor can be controlled.

## 1-4-2. Pulse output performance specification

Pulse output performance specification:

<table>
<tr><th>Parameter</th><th>T/RT</th><th>T4</th><th>T6</th><th>T10</th><th>D4T4</th></tr>
<tr><td>Axis number</td><td>2</td><td>4</td><td>6</td><td>10</td><td>8</td></tr>
<tr><td>Interpolation function</td><td>/</td><td>XDM/XDME/ XDH/XLME support</td><td>/</td><td>XDM/XDME support</td><td>/</td></tr>
<tr><td>Output mode</td><td colspan="4">Open circuit mode of collector</td><td>Open collector, differential</td></tr>
<tr><td>Output form</td><td colspan="4">Pulse + direction</td><td>pulse+direction, AB phase</td></tr>
<tr><td>Max frequency</td><td colspan="4">100KHz</td><td>Open collector: 100KHz<br>Differential: 920KHz</td></tr>
<tr><td>Acceleration and deceleration treatment</td><td colspan="5">Linear acceleration and deceleration + S curve acceleration and deceleration + sine curve acceleration and deceleration</td></tr>
<tr><td>Control unit</td><td colspan="5">Pulse, 1mm, 0.1mm, 0.01mm, 1um</td></tr>
<tr><td>Positioning range</td><td colspan="5">-2147483648~2147483647 (pulse)</td></tr>
<tr><td>Programming language</td><td colspan="5">Ladder chart</td></tr>
<tr><td>Manual pulse connection</td><td>/</td><td>XDM/XDME/ XDH/XLME support</td><td>/</td><td>XDM/XDME support</td><td>/</td></tr>
</table>

**Note:**

(1) All XD/XL series PLC's pulse output must be transistor output type, otherwise it can't send pulse!

(2) PLC can output high-speed pulses ranging from 100KHz to 200KHz, but it can not guarantee the normal operation of all servos. Please connect 500Ω resistance between the output and 24V power supply.

## 1-4-3. Positioning control layout and wiring notes

>>>>> Design notes<<<<<

**Danger!**

Please set up a safety circuit outside the programmable controller, so that when there are abnormal external power supply and programmable controller failure, the whole system can also be ensured to operate in a safe state. Misoperation and misoutput may lead to accidents.

1. Make sure to set up emergency stop circuit, protection circuit, interlocking circuit to prevent reverse and positive actions simultaneously, positioning upper and lower limits and other interlocking circuits to prevent mechanical breakage outside the programmable controller.

2. When the programmable controller CPU detects abnormalities through self-diagnostic functions such as watchdog timer, all outputs become OFF. In addition, when abnormalities occur in the input and output control parts which cannot be detected by the programmable controller CPU, the output control sometimes fails.

At this point, please design the external circuit and structure to ensure that the machine is running in a safe state.

3. Because of the faults of relays, transistors, thyristors and so on in the output unit, sometimes the output is always ON or OFF.

In order to ensure the safe operation of machinery, please design the external circuit and structure for the output signal which may lead to major accidents.

**Attention!**

1. The control line should not be tied up with the main circuit or power line, or close to the connection.

   In principle, please leave more than 100 mm or away from the main circuit. Otherwise, the noise will cause misoperation.

2. When using, please ensure that the built-in programming interface, power connector, input and output connector are not subject to external forces.

   Otherwise, it will lead to disconnection and malfunction.

>>>>> Wiring notes <<<<<

**Danger!**

1. When installing, wiring and other operations, be sure to disconnect all external power supply before operation.

Otherwise, there is a risk of electric shock and product damage.

2. After installation, wiring and other operations, when running on power, be sure to install the attached wiring terminal cover on the product.

Otherwise, there is a risk of electric shock.

**Attention!**

1. AC power supply wiring should be connected to the special terminals recorded in the basic unit manual.
If AC power supply is connected to DC output input terminal and DC power supply terminal, the programmable controller will be burned down.
2. DC power supply wiring should be connected to the special terminals recorded in the basic unit manual.
If AC power supply is connected to DC output input terminal and DC power supply terminal, the programmable controller will be burned down.
3. Please do not wiring the empty terminals outside.
It may damage the product.
4. Grounding terminals of basic units of XD/XL series should be D grounded with wires over 2 $mm^2$ (grounding resistance below 100Ω).
However, do not grounding with strong current (refer to XD/XL Series Programmable Controller hardware User Manual).
5. When processing bolt holes and wiring operations, do not drop chips and wire chips into the ventilation holes of the programmable controller.
Otherwise, it may lead to fire, malfunction and misoperation.
6. When using, make sure that the input and output connectors are not subject to external forces.
Otherwise, it will lead to disconnection and malfunction.
7. The input and output cables should be firmly mounted on the specified connectors.
Poor contact can lead to erroneous movements.
8. When wiring the basic units of XD/XL series and terminal of XD/XL series extension equipment, please follow the following precautions.
Otherwise, it may lead to electric shock, fault, short circuit, wire breakage, misoperation and damage to the product.
- Please process the end of the wire according to the size recorded in the manual.
Tightening torque, please follow the torque recorded in the manual.

>>>>> Cautions in Starting and Maintenance <<<<<

**Danger!**

1. Do not touch the terminal when electrifying.
Otherwise, there is the danger of electric shock, and it may cause misoperation.
2. When cleaning and tightening terminals, be sure to operate after disconnecting all external power supply.
If operated in the state of electrification, there is a danger of electric shock.
3. In order to change procedures, perform mandatory output, RUN, STOP and other operations

during operation, you must read the manual well before you can operate it with full confirmation of safety.
Operational errors may lead to mechanical damage and accidents.

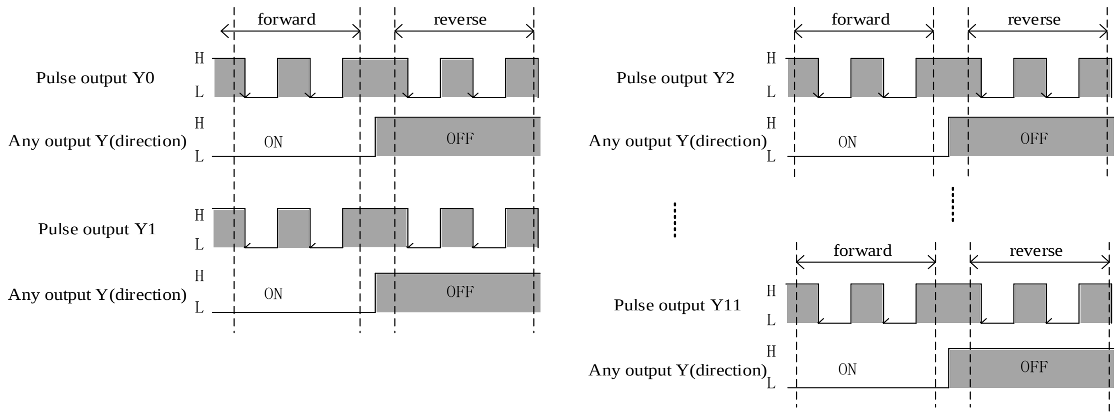
**Attention!**

1. Do not disassemble or alter products without authorization.
Otherwise, it may cause malfunction, misoperation and fire.
2. When disassembling and assembling connecting cables such as extended cables, please operate after disconnecting the power supply.
Otherwise, it may cause malfunction and misoperation.
3. Be sure to cut off the power supply when disassembling and assembling the following equipment.
Otherwise, it may cause malfunction and misoperation.
--Peripheral devices, extended function boards, special adapters,
--Input and Output Extension Module, Network Module, etc.

## 1-4-4. Setting of Servo Amplifier (Driving Unit) Side

**Pulse Output Form of Programmable Controller Side**

The pulse output types of XD/XL series PLC are all collector open circuit signals (pulse + direction), as shown in the following figure:




Note: ON and OFF represent the output state of the programmable controller; H and L represent the waveform of HIGH and LOW.

- **Setting of Instruction Pulse Input Form for Servo Amplifier (Driving Unit)**

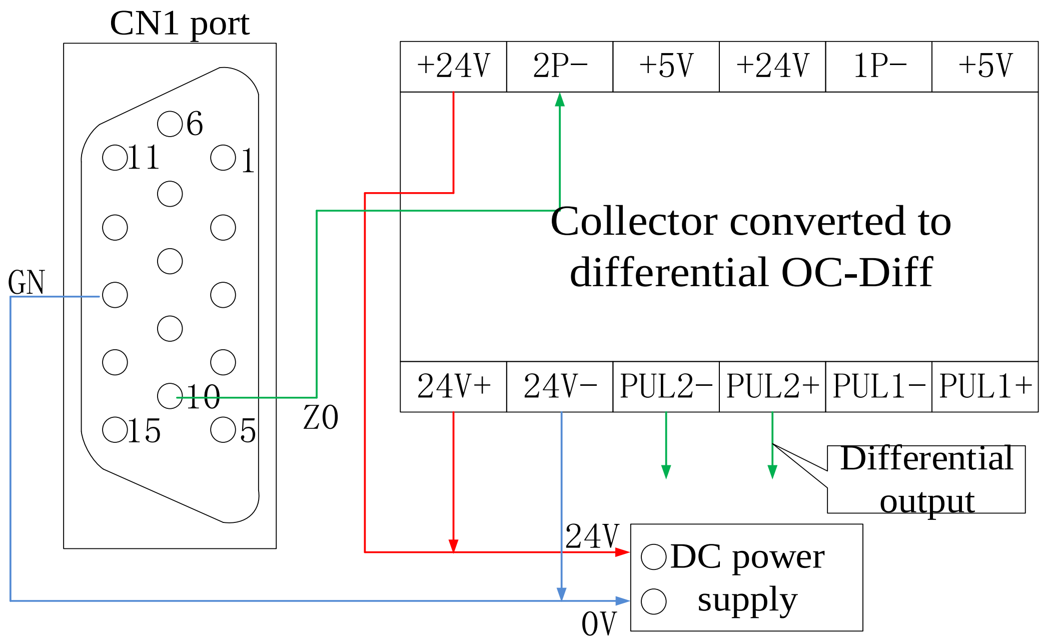
As shown in the table below, please make the input form of the pulse in the parameters of servo amplifier (driving unit) coincide with the output form of the programmable controller.

| servo amplifier (driving unit) | Pulse output form of basic unit | Collector convert to differential DC-Diff |
|---|---|---|

| | Transistor output (Leakage output) | Differential drive |
|---|---|---|
| | Pulse + direction | Forward and reverse pulses |
| Instruction pulse input form | Pulse + sign | Forward and reverse pulses |
| Instruction pulse logic | Negative logic | Negative logic |

Note: The main pulse output form of XD/XL series PLC is collector open-circuit signal output (pulse + direction). The collector open-circuit signal output (pulse + direction) can be converted into differential signal output through collector-to-differential expansion board DC-Diff.

**Wiring diagram of the open collector signal (pulse + direction) converted into differential signal by DC-Diff (taking DS2-21P5-A as an example):**




**DS series servo driver parameter settings:**

| Series | Parameter | Settings | |
|---|---|---|---|
| | | Pulse+direction (negative logic) | Differential signal (negative logic) |
| DS2-AS | — | √ | — |
| DS2-AS2 | — | √ | — |
| DS2-AS6 | P2-00 | 2 | 1 |
| DS2-BS | — | √ | — |
| DS2-BS6 | P2-00 | 2 | 1 |
| DS2-BSW | — | √ | — |
| DS2-BSW6 | P2-00 | 2 | 1 |
| DS3-PQA | P2-00 | 2 | 1 |
| DS3E-PFA | P2-00 | 2 | 1 |
| DS3 series | P0-10 | 2 | 1 |
| DS3E series | P0-10 | 2 | 1 |

- **Electronic Gear Ratio of Servo Amplifier (Driving Unit) (Taking DS2 Series as an Example)**

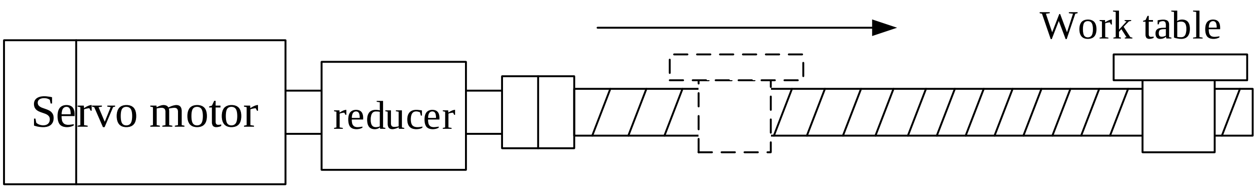
By using the electronic gear of the servo motor, the movement of each pulse can be set.
For the setting of electronic gears, please refer to the manual of servo driver, set values that are consistent with the use.

**Example 1**

The movement of each pulse is set to 10 μ m (when using mechanical screw).

**Mechanical specifications**

| Servo driver | DS2 series |
|---|---|
| Rated Speed of Servo Motor | 3000r/min |
| Ball screw lead pitch（Pb） | 10mm |
| Reduction ratio of reducer（n） | 1：5 |
| Resolution of servo motor（Pt） | 10000PLS/REV |




f0：Instruction pulse frequency

CMX：Electronic gear/numerator

CDV：Electronic gear/denominator

NR：Servo motor speed r/min

X：Movement per pulse mm

The formula for calculating the ratio of electronic gears is as follows:

$$\frac{CMX}{CDV} = X \times \frac{Pt}{n \times Pb} = 10 \times 10^{-3} \times \frac{10000}{1/5 \times 10} = \frac{50}{1}$$

As can be seen from the figure above, the ratio of electronic gear of servo driver should be set to 50:1.
At this time, the rotation speed of the servo motor at the maximum output pulse frequency (200,000 Hz) of the basic unit is calculated as follows:

$$NR = \frac{CMX}{CDV} \times \frac{60}{Pt} \times f0$$

$$= \frac{50}{1} \times \frac{60}{10000} \times 200000$$

$$= 6000r/min > 3000r/min \text{（Rated speed）}$$

**Note: Please set the maximum speed on the side of the programmable controller so that the rotation speed of the servo motor can be controlled below the rated speed.**

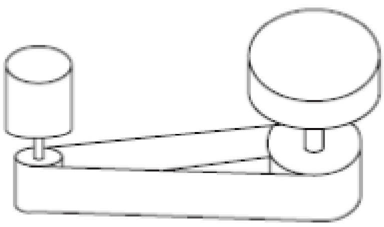
**Example 2**

The movement of each pulse is set to 0.01 degree (turntable).

**Mechanical specifications**

| Servo driver | DS2 series |
|---|---|
| Servo motor rated speed | 3000r/min |
| Turn table angle | 360°/ REV |
| Reduction ratio（n） | 1：5 |
| Servo motor resolution（Pt） | 10000PLS/REV |

Servo motor
Pt=10000[PLS/REV]



Turn table

Synchronous belt：1:5

F0： Instruction pulse frequency[Hz]（Collector open circuit）
CMX：Electronic gear（Instruction Pulse Multiplier numerator）
CDV：Electronic gear（Instruction Pulse Multiplier denominator）
NR： Servo motor speed [r/min]
X ： Movement per pulse[°]

The formula for calculating the ratio of electronic gears is as follows:

$$\frac{CMX}{CDV} = X \times \frac{Pt}{n \times 360} = 1 \times 10^{-2} \times \frac{10000}{1/5 \times 360} = \frac{25}{18}$$

As can be seen from the figure above, the ratio of electronic gear of servo driver should be set to 25:1.
At this time, the rotation speed of the servo motor at the maximum output pulse frequency (200,000 Hz) of the basic unit is calculated as follows:

$$NR = \frac{CMX}{CDV} \times \frac{60}{Pt} \times f0$$

$$= \frac{25}{18} \times \frac{60}{10000} \times 100000$$

$$= 833.33r/min < 3000r/min \text{ (Rated speed)}$$

Because the rotating speed of the servo motor is below the rated speed, the maximum speed of the programmable controller side does not need to be limited.

- **Ready signal of servo driver（take DS2 as an example）**

DS2 series servo enabling signal effectively represents the electrification of the servo motor. When the servo enabling signal is invalid, the motor does not operate.

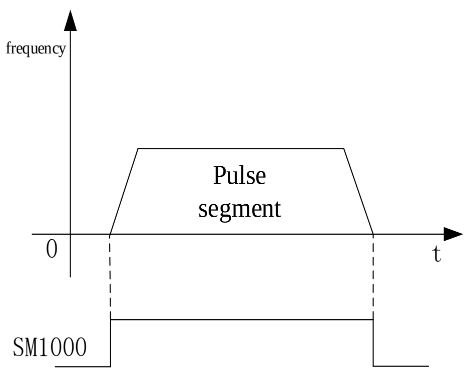
| Series name | Parameter | Setting value |
|---|---|---|
| DS2 series | P5-10 | 0010 |

## 1-4-5. Pulse sending complete flag notes

When the pulse sending flag SM1000, SM1020, SM1040 are changed from ON to OFF, it means that the action of instruction (pulse output action, etc.) is over. However, it does not mean that the action of the servo motor is over. In order to accurately grasp the end of the servo motor's operation, please correctly use the pulse sending flag.

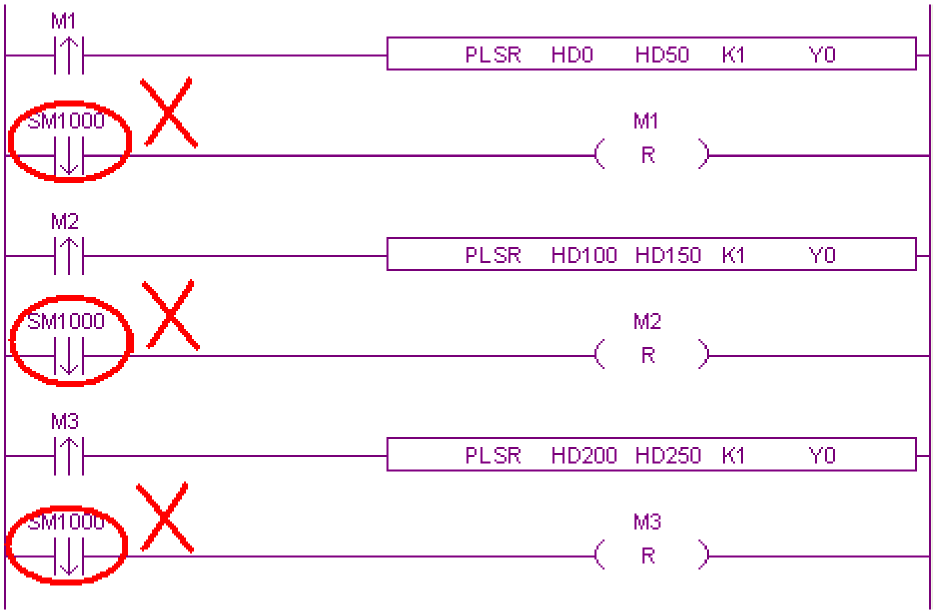
Pulse sending flag:

| Flag | Axis | Explanation |
|---|---|---|
| SM1000 | PULSE_1 | When the pulse is sending, the coil is ON, and the OFF is set immediately after the pulse is sent. The falling edge of the coil is used to judge whether the pulse is sent or not. |
| SM1020 | PULSE_2 | |
| SM1040 | PULSE_3 | |
| SM1060 | PULSE_4 | |
| SM1080 | PULSE_5 | |
| SM1100 | PULSE_6 | |
| SM1120 | PULSE_7 | |
| SM1140 | PULSE_8 | |
| SM1160 | PULSE_9 | |
| SM1180 | PULSE_10 | |

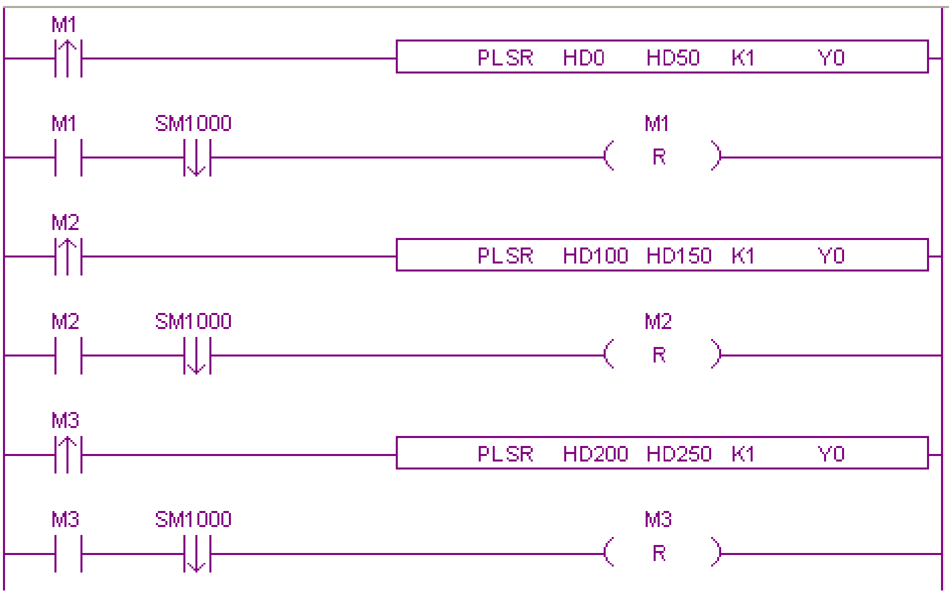


If multiple positioning instructions for the same pulse output port are written, then when the instructions are executed, the pulse flag SM1000, SM1020, SM1040 will change beween ON and OFF as each instructions. Therefore, if multiple instructions are executed, the sending pulse flag SM1000, SM1020, SM1040... are used in the same program at the same time, it is impossible to judge which instruction is executed, and at the same time, it is impossible to obtain the flag supported by each instruction.

Wrong writing is as below:




Correct writing is as below:



## 1-4-6. Cautions for triggering conditions of positioning instructions

XD/XL series of PLC positioning instructions are mainly PLSR (edge trigger), PLSF (normal open/close trigger), DRVI (edge trigger), DRVA (edge trigger), ZRN (edge trigger). Except PLSF instruction, all the other pulse instructions are edge trigger. In the process of executing a positioning instruction, the same pulse output port (such as Y0) is sending pulse, flag bit (SM1000) is always ON. The PLC will not respond to the pulse instruction triggered at the same pulse output port until the pulse output instructions being executed are sent out and the signal bit being sent is reset.

Since the conduction condition of PLSF pulse instruction is normally open/closed, when PLSF instruction is used, the conduction condition of PLSF instruction should be reset immediately when the pulse does not need to be executed (do not only set the pulse output frequency to 0 Hz, but not reset the pulse conduction condition).

## 1-4-7. Positioning Instruction and System Parameter Block Related Parameters

The following table sorts out the parameters setting of pulse output instruction and system parameter block:

| System parameter | PLSR | PLSF | DRVI | DRVA | ZRN |
|---|---|---|---|---|---|
| Common parameter—pulse direction logic | **Must set** | **Must set** | × | × | **Must set** |
| Common parameter—enable soft limit | May not set | May not set | × | × | May not set |
| Common parameter — Default direction of mechanical return to origin | × | × | × | × | **Must set** |
| Common parameter —pulse unit | **Must set** | **Must set** | × | × | **Must set** |
| Common parameter — Interpolated coordinate mode | × | × | × | × | × |
| Common parameter — pulse send mode | **Must set** | **Must set** | × | × | **Must set** |
| Common parameter — pulse number(1 rotation) | May not set | May not set | × | × | May not set |
| Common parameter — offset(1 rotation) | May not set | May not set | × | × | May not set |
| Common parameter —pulse direction terminal | May not set | May not set | × | × | **Must set** |
| Common parameter —delay time of pulse direction | May not set | May not set | × | × | May not set |
| Common parameter —gear clearance positive compensation | May not set | May not set | × | × | May not set |
| Common parameter —gear clearance | May not | May not | × | × | May not |

| | | | | | |
|---|---|---|---|---|---|
| negative compensation | set | set | | | set |
| Common parameter —electric origin position | × | × | × | × | × |
| Common parameter —origin switch state setting | × | × | × | × | **Must set** |
| Common parameter —origin signal terminal setting | × | × | × | × | **Must set** |
| Common parameter —Z phase switch state setting | × | × | × | × | May not set |
| Common parameter — Z phase terminal setting | × | × | × | × | May not set |
| Common parameter —positive limit switch status setting | May not set | May not set | × | × | **Must set** |
| Common parameter —positive limit terminal setting | May not set | May not set | × | × | **Must set** |
| Common parameter —negative limit switch status setting | May not set | May not set | × | × | **Must set** |
| Common parameter —negative limit terminal setting | May not set | May not set | × | × | **Must set** |
| Common parameter —zero clear CLR signal output terminal setting | × | × | × | × | May not set |
| Common parameter —return speed VL | × | × | × | × | **Must set** |
| Common parameter —creeping speed VC | × | × | × | × | **Must set** |
| Common parameter — mechanical zero position | × | × | × | × | **Must set** |
| Common parameter — Z phase number | × | × | × | × | May not set |
| Common parameter —CLR signal delay time | × | × | × | × | May not set |
| Common parameter —grinding wheel radius(polar coordinate mode) | × | × | × | × | × |
| Common parameter — soft limit positive limit value | | | | | |
| Common parameter — soft limit negative limit value | | | | | |
| Group 1 parameter — pulse default speed | **Must set** | **Must set** | × | × | **Must set** |
| Group 1 parameter — acceleration time of pulse default speed | **Must set** | **Must set** | × | × | **Must set** |
| Group 1 parameter — deceleration time of pulse default speed | **Must set** | **Must set** | × | × | **Must set** |

| | | | | | |
|---|---|---|---|---|---|
| Group 1 parameter — Interval acceleration and deceleration time | May not set | May not set | × | × | May not set |
| Group 1 parameter —pulse acc/dec mode | **Must set** | **Must set** | × | × | **Must set** |
| Group 1 parameter —max speed | **Must set** | **Must set** | × | × | **Must set** |
| Group 1 parameter —start speed | **Must set** | **Must set** | × | × | **Must set** |
| Group 1 parameter —end speed | **Must set** | **Must set** | × | × | **Must set** |

**Note: group 2 to 4 parameters are same to group 1.**

### 1-4-8. Troubleshooting of Servo Motor and Stepping Motor

When the servo motor and stepper motor do not work, please confirm the following items:

1) Please confirm the connection.

2) Please execute the positioning instructions to confirm the status of the following LED.

LED set as pulse output signal

LED set as pulse direction signal

3) Make sure that when the programmable controller executes the positioning instructions, the values of the accumulated pulse registers of each axis are changing.

The cumulative registers for each pulse output are shown in the following table:

| No. | Function | Notes | Axis |
|---|---|---|---|
| HSD0 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_1 |
| HSD1 | High 16-bit of cumulative pulse | | |
| HSD2 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD3 | High 16-bit of cumulative pulse | | |
| HSD4 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_2 |
| HSD5 | High 16-bit of cumulative pulse | | |
| HSD6 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD7 | High 16-bit of cumulative pulse | | |
| HSD8 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_3 |
| HSD9 | High 16-bit of cumulative pulse | | |
| HSD10 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD11 | High 16-bit of cumulative pulse | | |
| HSD12 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_4 |
| HSD13 | High 16-bit of cumulative pulse | | |
| HSD14 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD15 | High 16-bit of cumulative pulse | | |
| HSD16 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_5 |
| HSD17 | High 16-bit of cumulative pulse | | |
| HSD18 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD19 | High 16-bit of cumulative pulse | | |

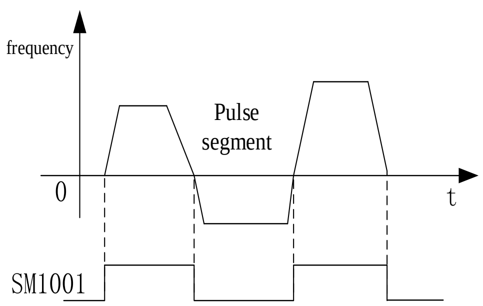
| | | | |
|---|---|---|---|
| HSD20 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_6 |
| HSD21 | High 16-bit of cumulative pulse | | |
| HSD22 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD23 | High 16-bit of cumulative pulse | | |
| HSD24 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_7 |
| HSD25 | High 16-bit of cumulative pulse | | |
| HSD26 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD27 | High 16-bit of cumulative pulse | | |
| HSD28 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_8 |
| HSD29 | High 16-bit of cumulative pulse | | |
| HSD30 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD31 | High 16-bit of cumulative pulse | | |
| HSD32 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_9 |
| HSD33 | High 16-bit of cumulative pulse | | |
| HSD34 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD35 | High 16-bit of cumulative pulse | | |
| HSD36 | Low 16-bit of cumulative pulse | Pulse number is the unit | PULSE_10 |
| HSD37 | High 16-bit of cumulative pulse | | |
| HSD38 | Low 16-bit of cumulative pulse | Pulse equivalent is the unit | |
| HSD39 | High 16-bit of cumulative pulse | | |

4) Make sure that the pulse output form of the programmable controller side and the servo amplifier (driving unit) is consistent.

5) Make sure that the stop bit of the pulse output is in action.

The pulse output flags of each pulse are shown in the table below.

| No. | Coil | Axis | Note |
|---|---|---|---|
| 1 | SM1001 | PULSE_1 | When the pulse value is positive, the coil is ON; when the pulse value is negative, the coil is OFF. |
| 2 | SM1021 | PULSE_2 | |
| 3 | SM1041 | PULSE_3 | |
| 4 | SM1061 | PULSE_4 | |
| 5 | SM1081 | PULSE_5 | |
| 6 | SM1101 | PULSE_6 | |
| 7 | SM1121 | PULSE_7 | |
| 8 | SM1141 | PULSE_8 | |
| 9 | SM1161 | PULSE_9 | |
| 10 | SM1181 | PULSE_10 | |




6) Please confirm whether the limit (positive limit and reverse limit) is in action.

7) Please confirm the action sequence of positioning instruction.

When the pulse flag bit is ON, the positioning instruction or the pulse output instruction using the same output terminal can not be executed.

### 1-4-9. Troubleshooting of incorrect stop position of servo motor and stepper motor

When the stop position is incorrect, please confirm the following items:
1) Make sure that the setting of the electronic gear of the servo amplifier (driving unit) is correct.
2) Please confirm whether the origin position is offset.

**A. When designing the origin signal, consider that there is enough time for ON to slow down to crawling speed.**

The ZRN instruction begins to decelerate to stop at the front end of the origin, delays and reverse accelerates to crawl speed, stops when it leaves the origin, and clears the current value register.
Failure to slow down to crawl speed in front of the back end of the origin will cause stop position offset.

**B. Please make the crawling speed slow enough.**

The stop of the origin regression instruction is not decelerated, so if the crawling speed is too fast, the stop position will be offset due to inertia.

**C. Soft components for origin signals.**

The origin signal terminal can select all the input points on the PLC; but if the selected input point is the external interrupt terminal on the PLC main unit, the process of returning to the mechanical origin will be handled according to the interrupt, which can further improve the accuracy of returning to the mechanical origin (if Z phase is used to return to the origin, it will not affect); and the selected input point is the external interrupt terminal on PLC extention module, in the process of mechanical origin, it will be affected by the scanning cycle of PLC (if Z phase is used to return to the origin, it will not be affected).

3) After the forward and reverse rotation (round-trip action), the stop position deviates.
Because of the contact gap between the worktable and the ball screw, when the worktable switches from the forward movement to the reverse movement, the reverse actual movement distance is less than the set distance; when the worktable switches from the reverse movement to the forward movement, the forward actual movement distance is less than the set distance.
It can be corrected by forward gear clearance compensation and reverse gear clearance compensation.

# 1-5. Positioning instruction example programs

This section mainly introduces the use of PLSR, PLSF, DRVA, DRVI, ZRN instructions through several sample programs.

| Action | Instruction | Program example | |
|---|---|---|---|
| | | Sequential ladder chart | Process ladder chart |
| Multi section pulse positioning | PLSR | 1-5-4<br>1-5-6 | 1-5-5<br>1-5-7 |
| Variable frequency pulse output | PLSF | 1-5-2<br>1-5-4 | 1-5-3<br>1-5-5 |
| Relative single section positioning | DRVI | 1-5-2<br>1-5-6 | 1-5-3<br>1-5-7 |
| Absolute single section positioning | DRVA | 1-5-2<br>1-5-6 | 1-5-3<br>1-5-7 |
| Mechanical origin regression | ZRN | 1-5-2<br>1-5-4<br>1-5-6 | 1-5-3<br>1-5-5<br>1-5-7 |

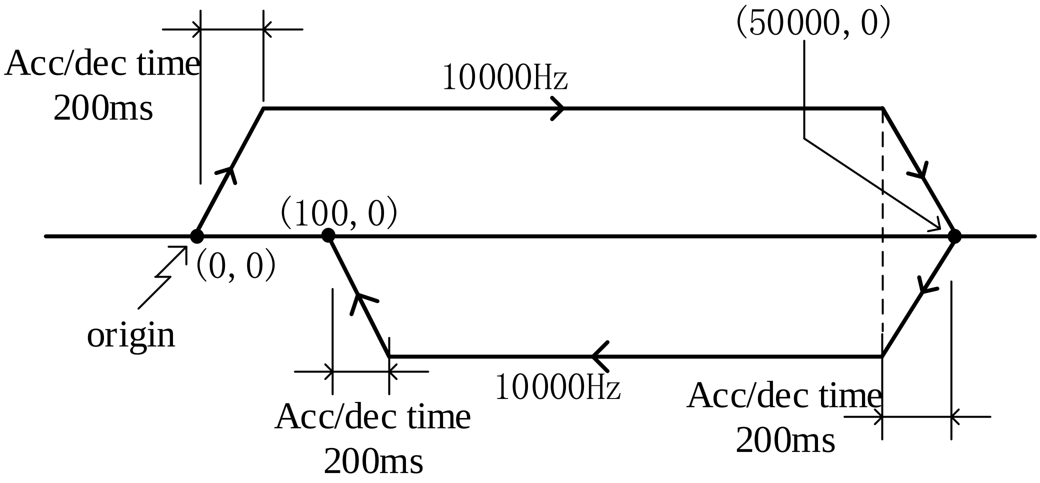
## 1-5-1. I/O point assignment

The pulse output Y0 (axis 1) is used in the program example. When using other pulse output terminals, please modify the corresponding soft components of the pulse axis.

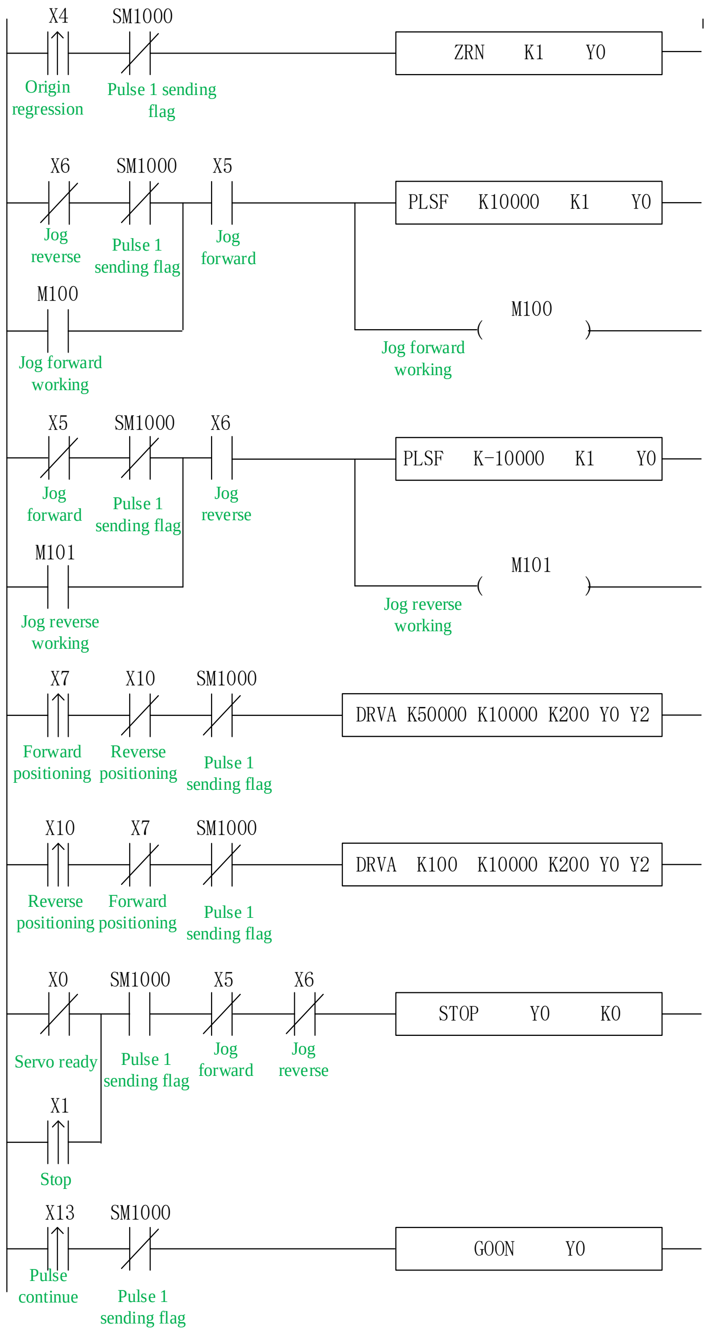
| Signal name | I/O points | Notes |
|---|---|---|
| Pulse output port | Y0 | |
| Pulse direction port | Y2 | |
| CLR zero clear signal | Y3 | |
| Servo ready | X0 | |
| Stop | X1 | |
| Pulse continue | X13 | |
| Origin regression | X4 | |
| Jog forward | X5 | |
| Jog reverse | X6 | |
| Forward rotation positioning | X7 | |
| Reverse rotation positioning | X10 | |
| Close origin input terminal | X2 | |
| Origin input terminal | X3 | External interruption terminal |
| Forward limit switch | X11 | |
| Reverse limit switch | X12 | |

### 1-5-2. Forward and reverse rotation sequence control sample program 【PLSF, DRVI, DRVA, ZRN】

**Example 1: According to the following figure, use the absolute single section positioning method.**




Firstly, the ladder chart program is shown as follows:




//mechanical origin regression (use group 1 parameters)

//jog forward control, speed is 10000Hz (use group 1 parameters)

//jog reverse control, speed is -10000Hz (use group 1 parameters)

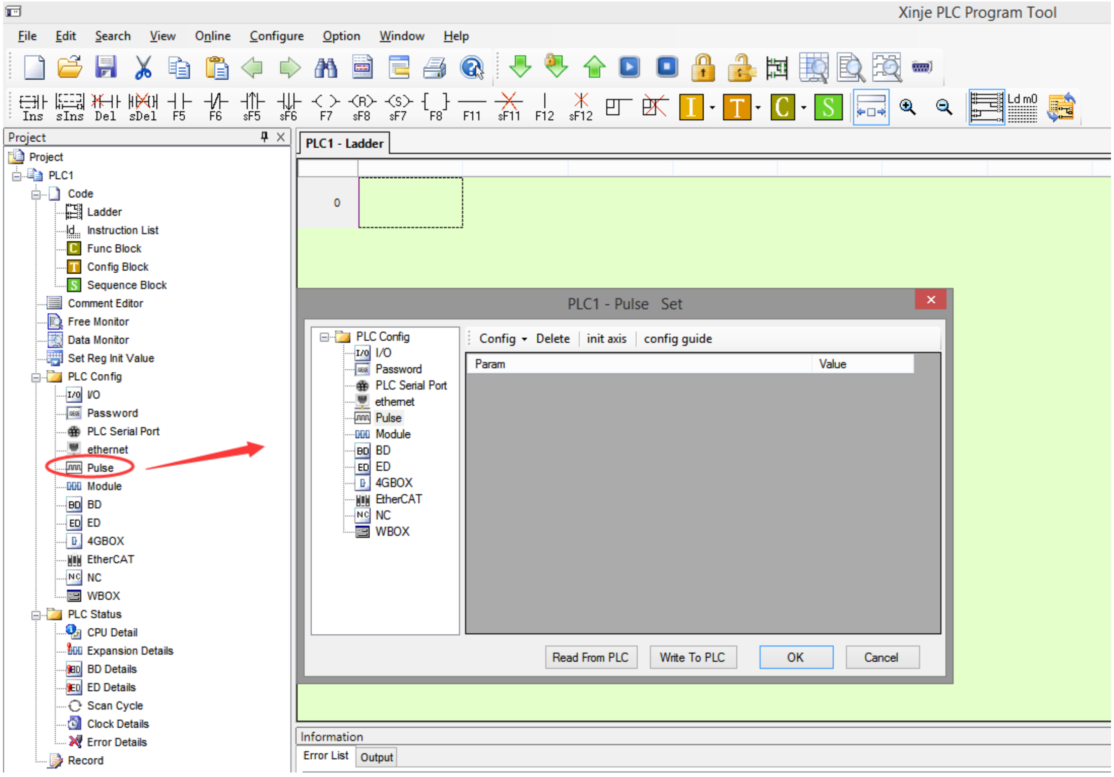
//forward rotation positioning control

//reverse rotation positioning control

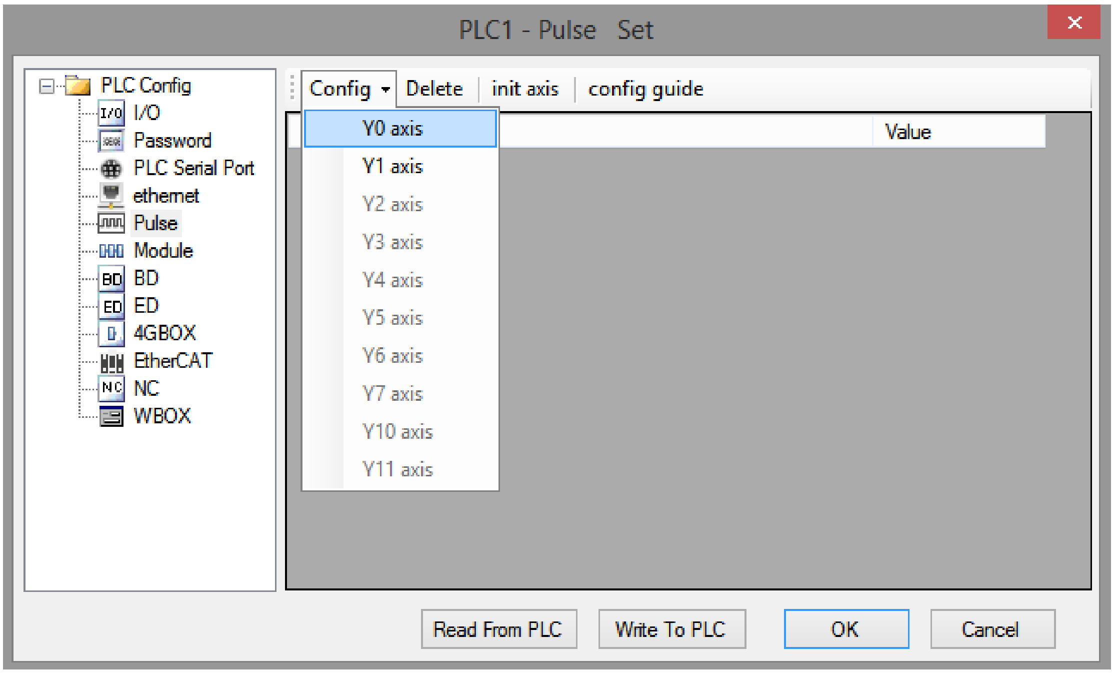
//pulse stop sending (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

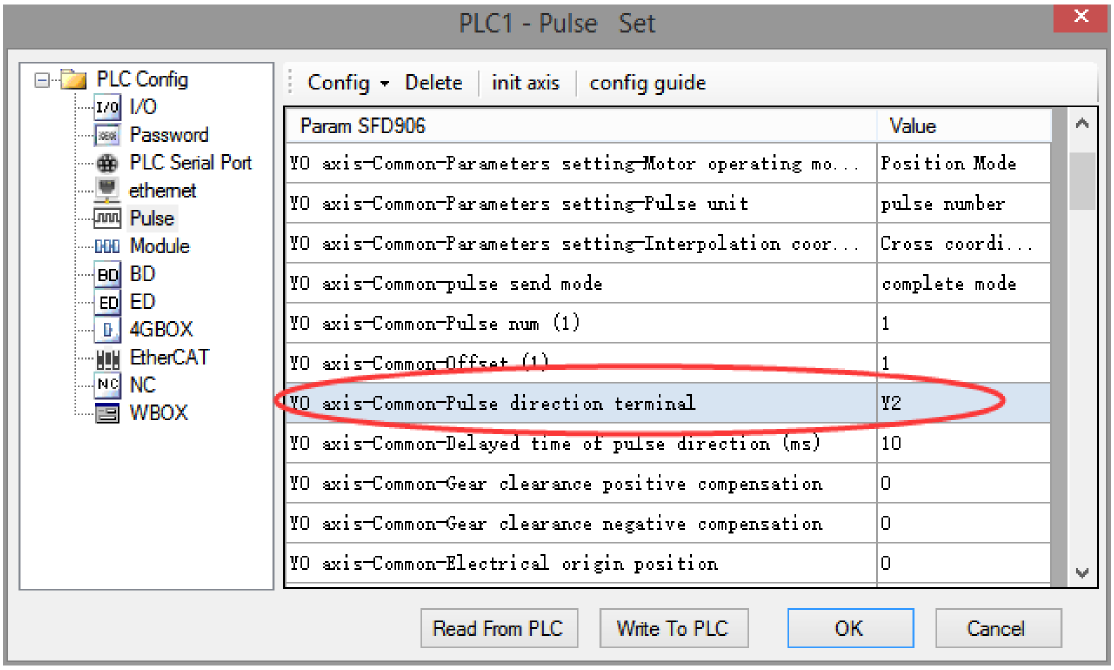
In the sample program, except DRVI and DRVA, all the system parameters used in the pulse instructions are group 1 parameters. So we click the "pulse configuration parameters" in the PLC programming software, as follows:

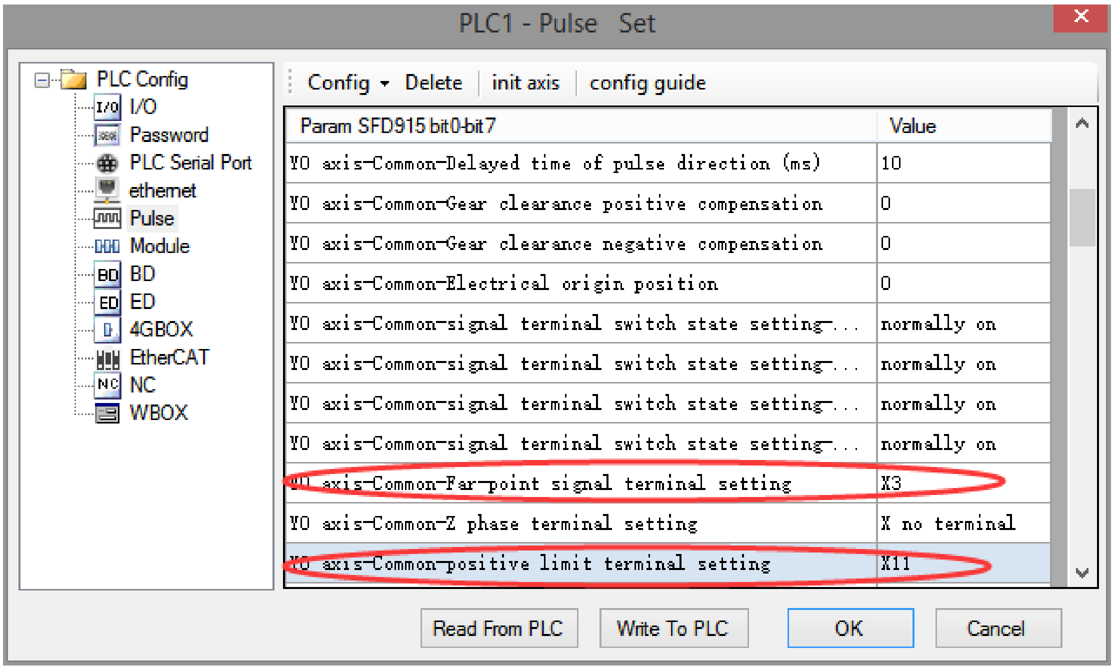


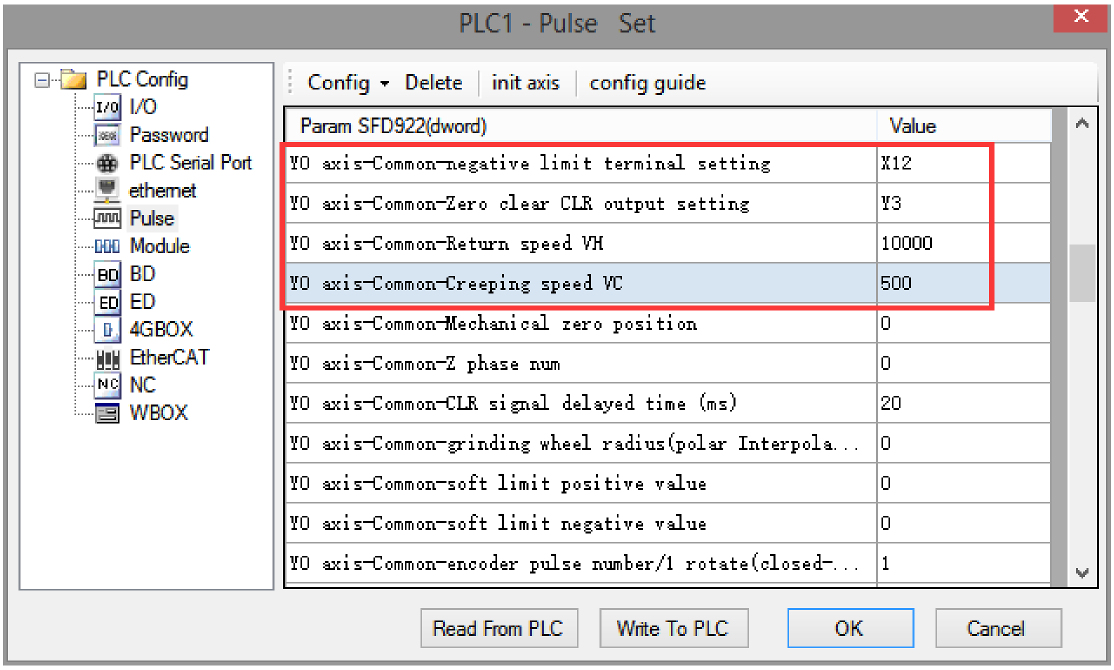

Click config, then select Y0 axis.

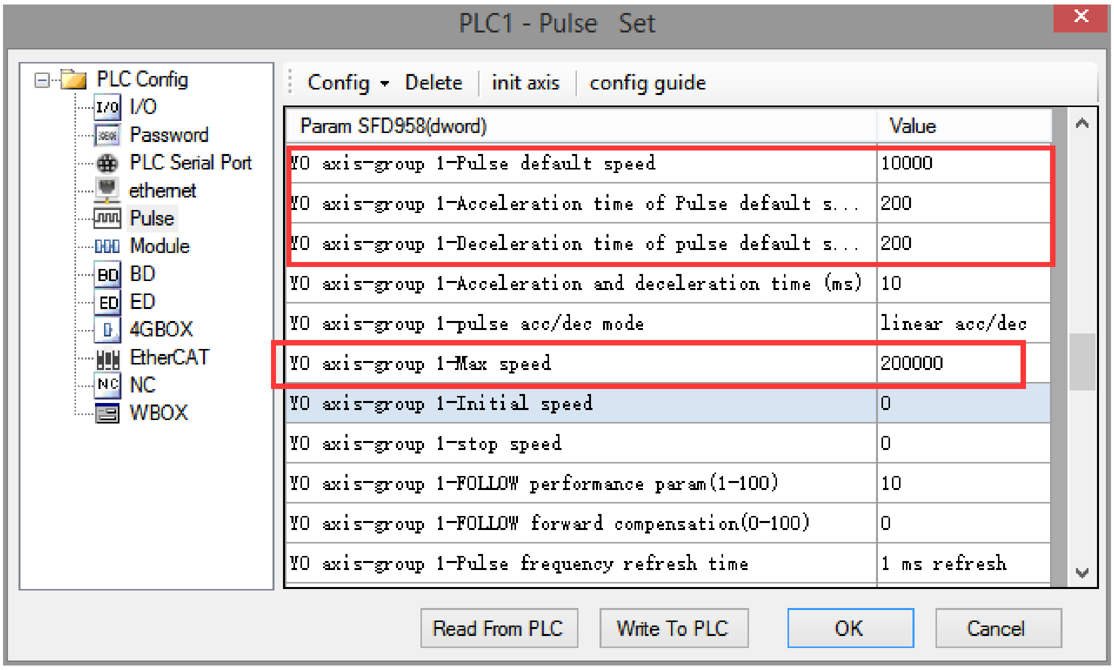


In the parameter configuration table, configure as follows (circled parameters need to be modified):



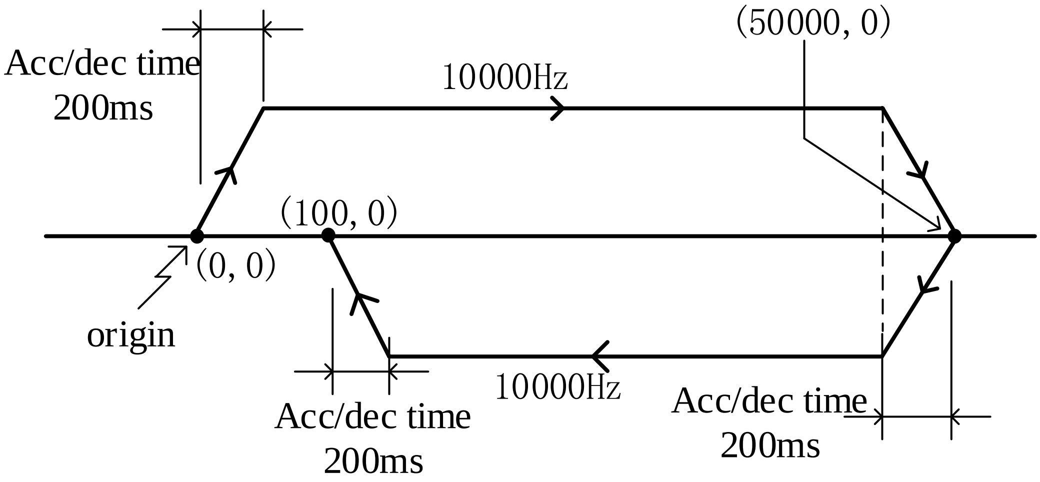


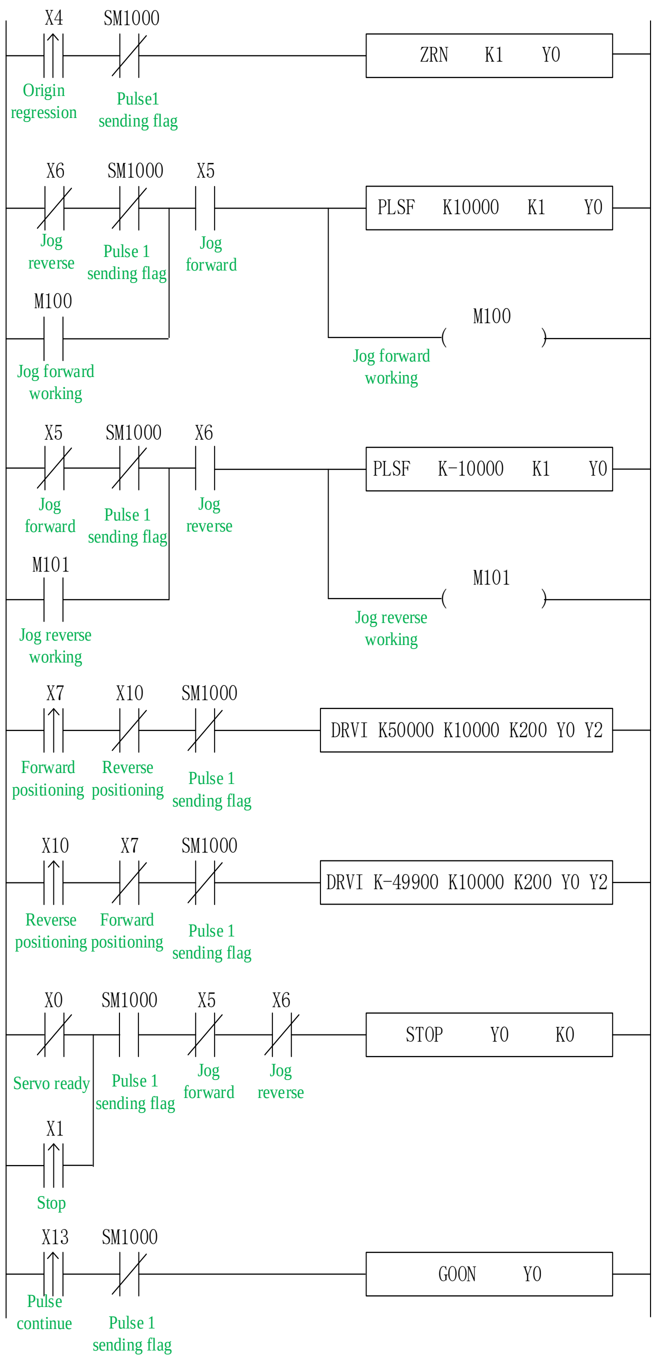

After configuring the parameters, click the "Write to PLC" button to write the parameters into the PLC. After downloading the program, power off the PLC and then power on again.

Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

**Example 2: According to the following figure, use the relative single segment positioning method.**




Firstly, make the ladder chart as follows:




//mechanical origin regression (use group 1 parameters)

//jog forward control, speed is 10000Hz (use group 1 parameters)

//jog reverse control, speed is -10000Hz (use group 1 parameters)

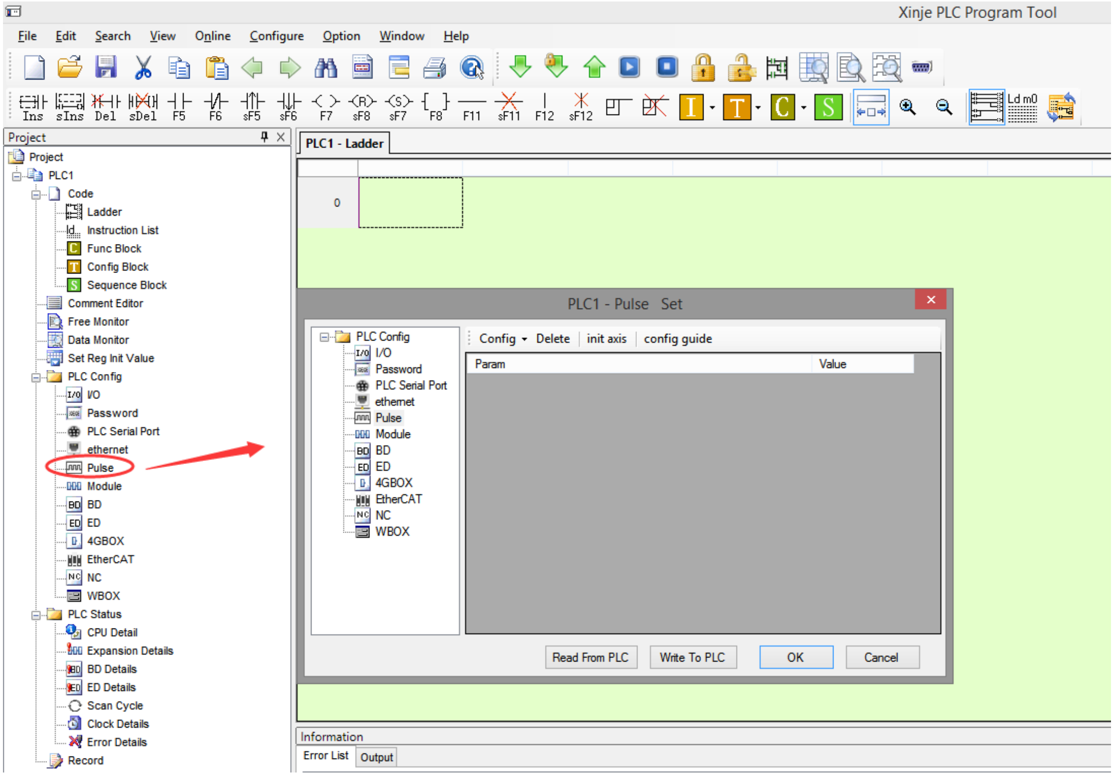
//forward rotation positioning control

//reverse rotation positioning control

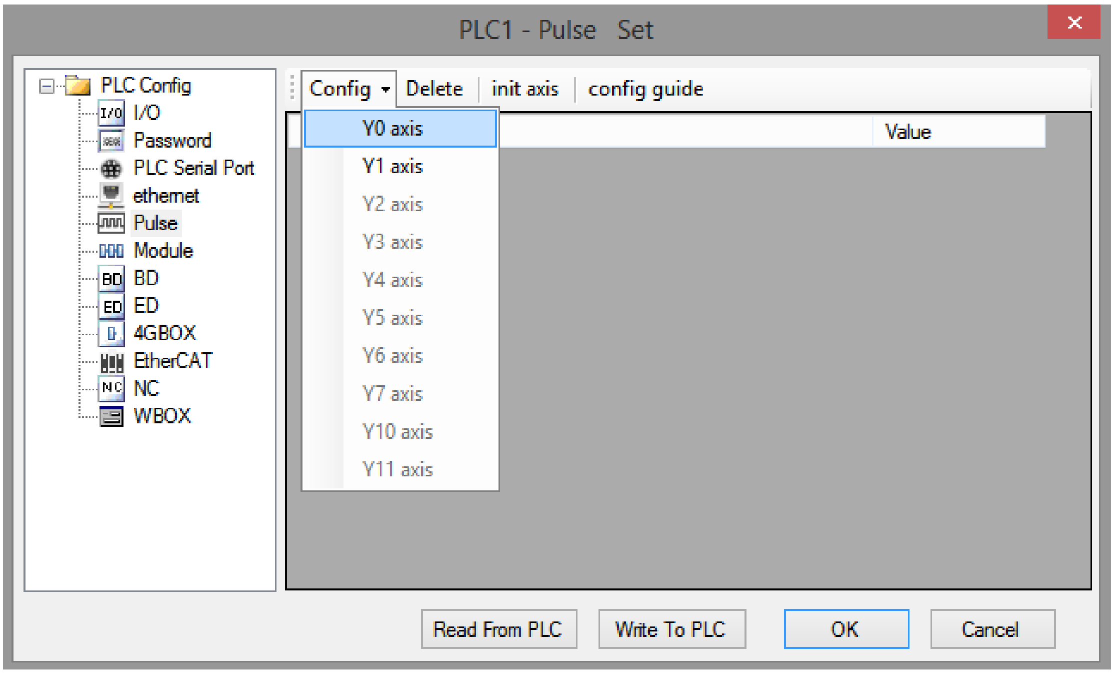
//pulse stop sending (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

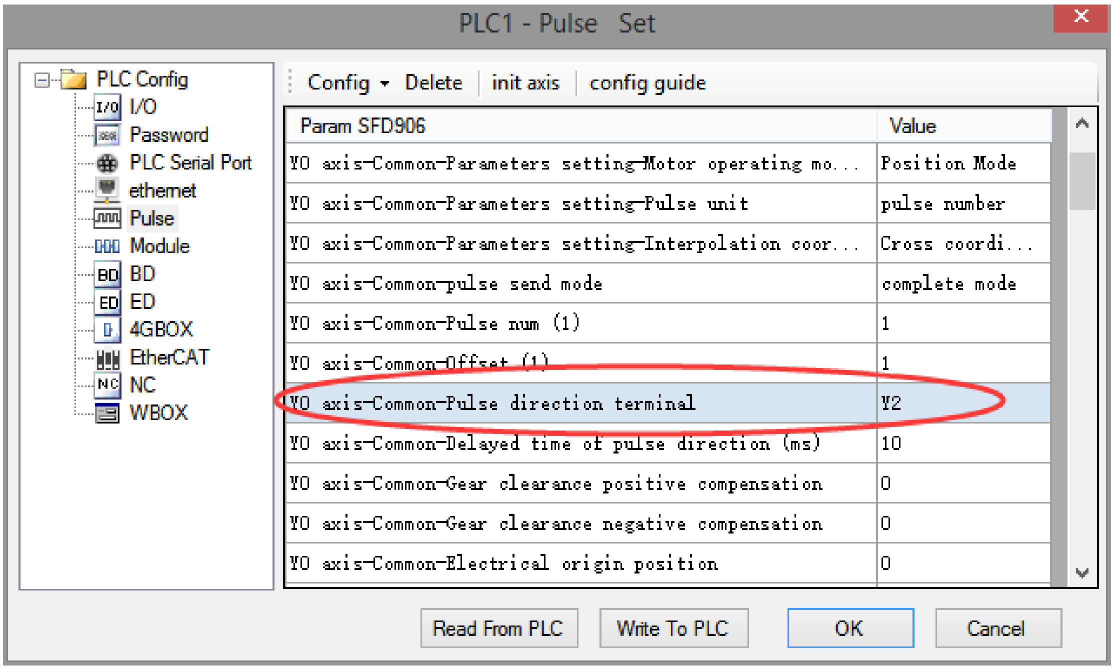
In the sample program, except DRVI and DRVA, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

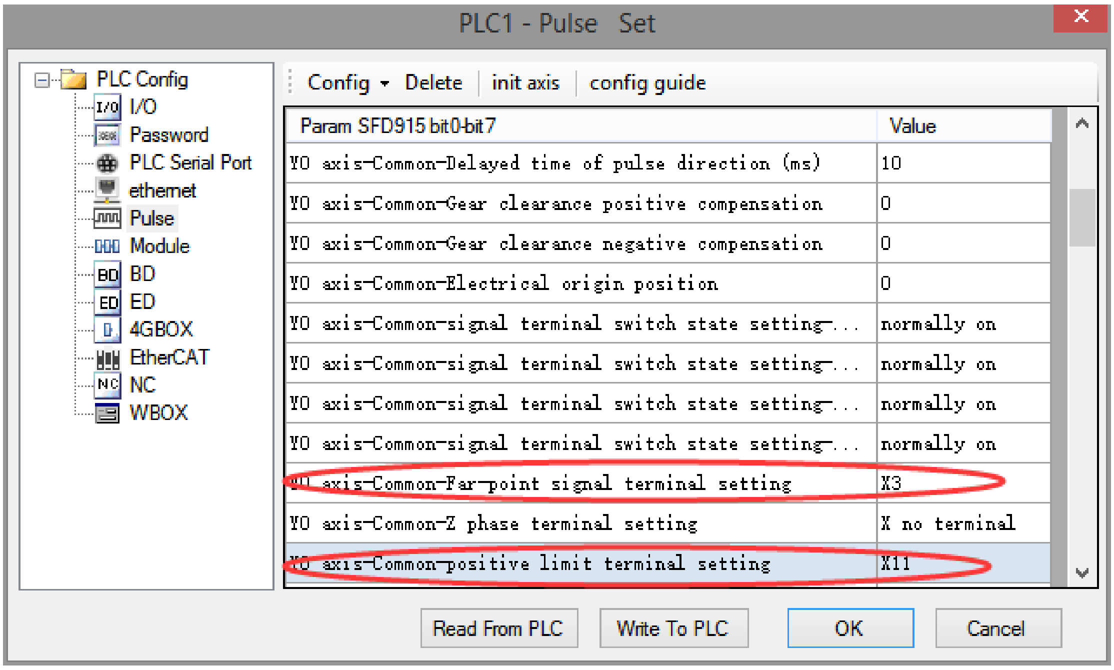


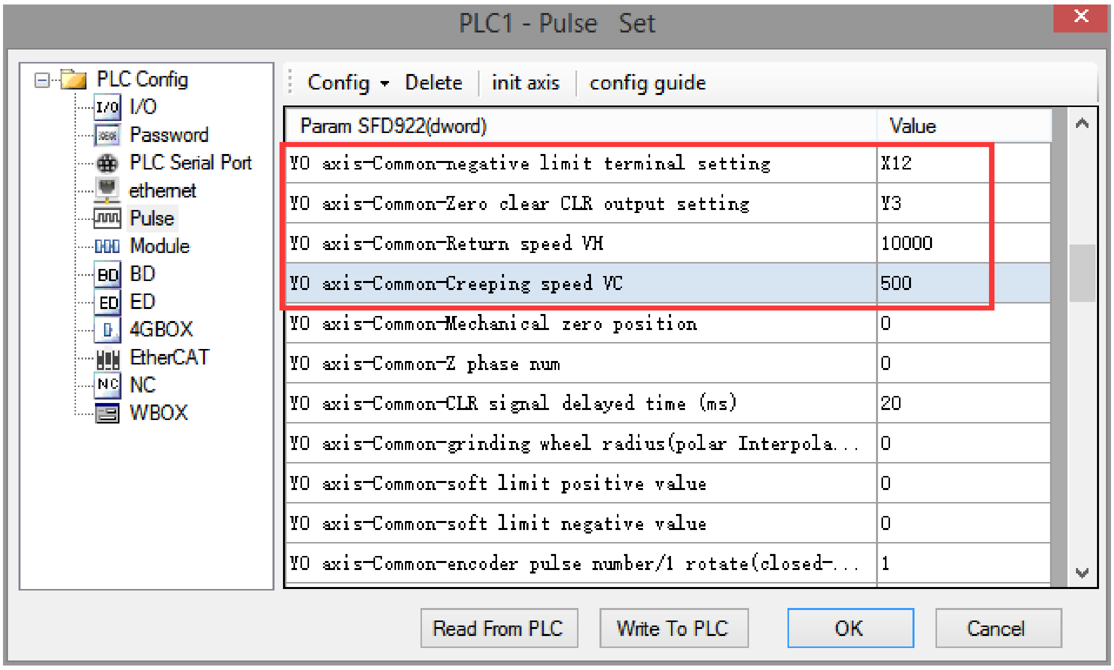

Click config, then select Y0 axis.

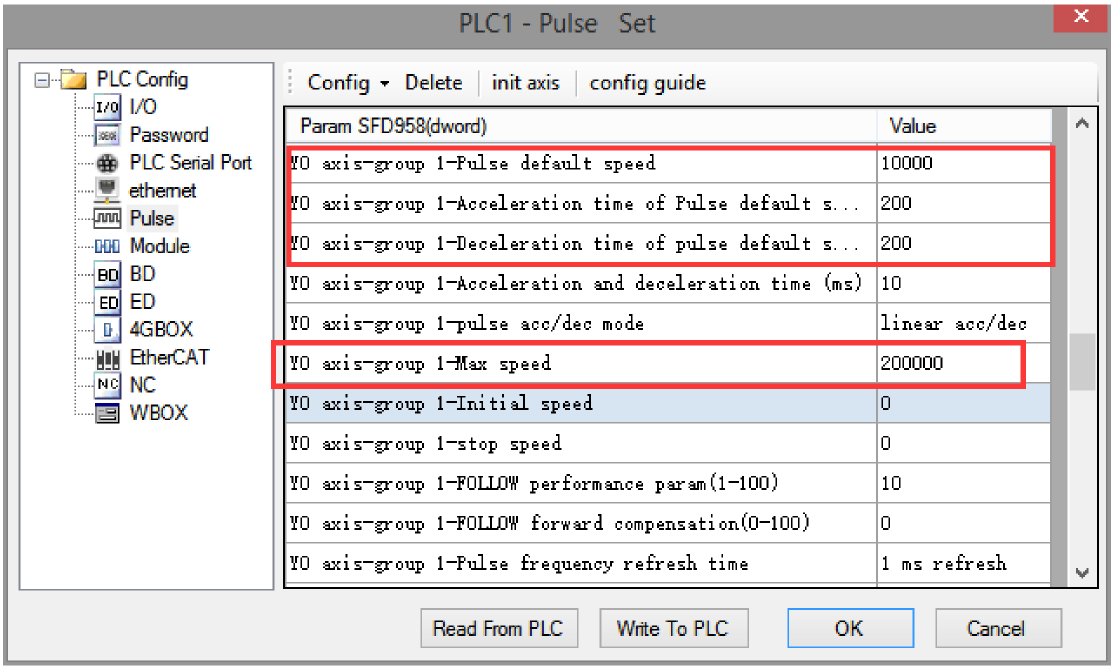


In the parameter configuration table, configure as follows (circled parameters need to be modified):





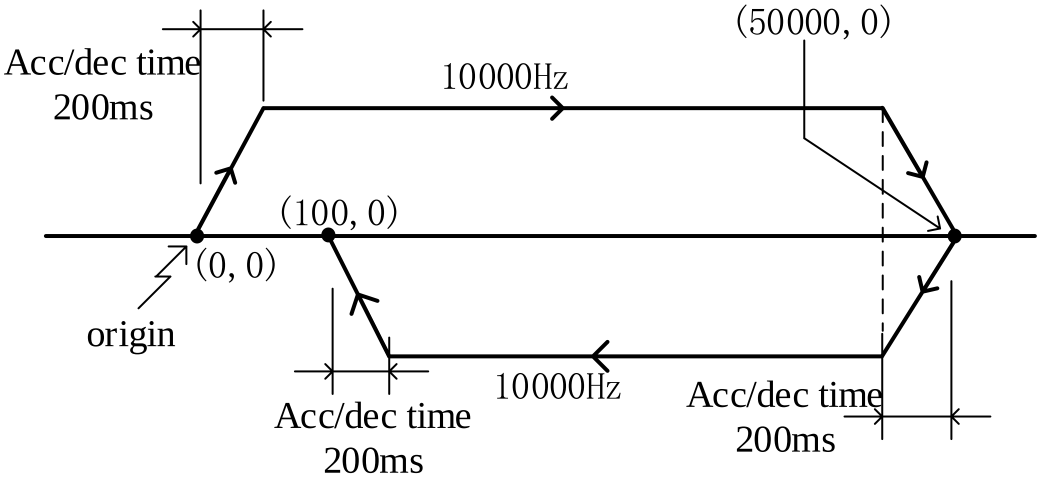




After configuring the parameters, click the "Write to PLC" button to write the parameters into the PLC. After downloading the program, power off the PLC and then power on again.

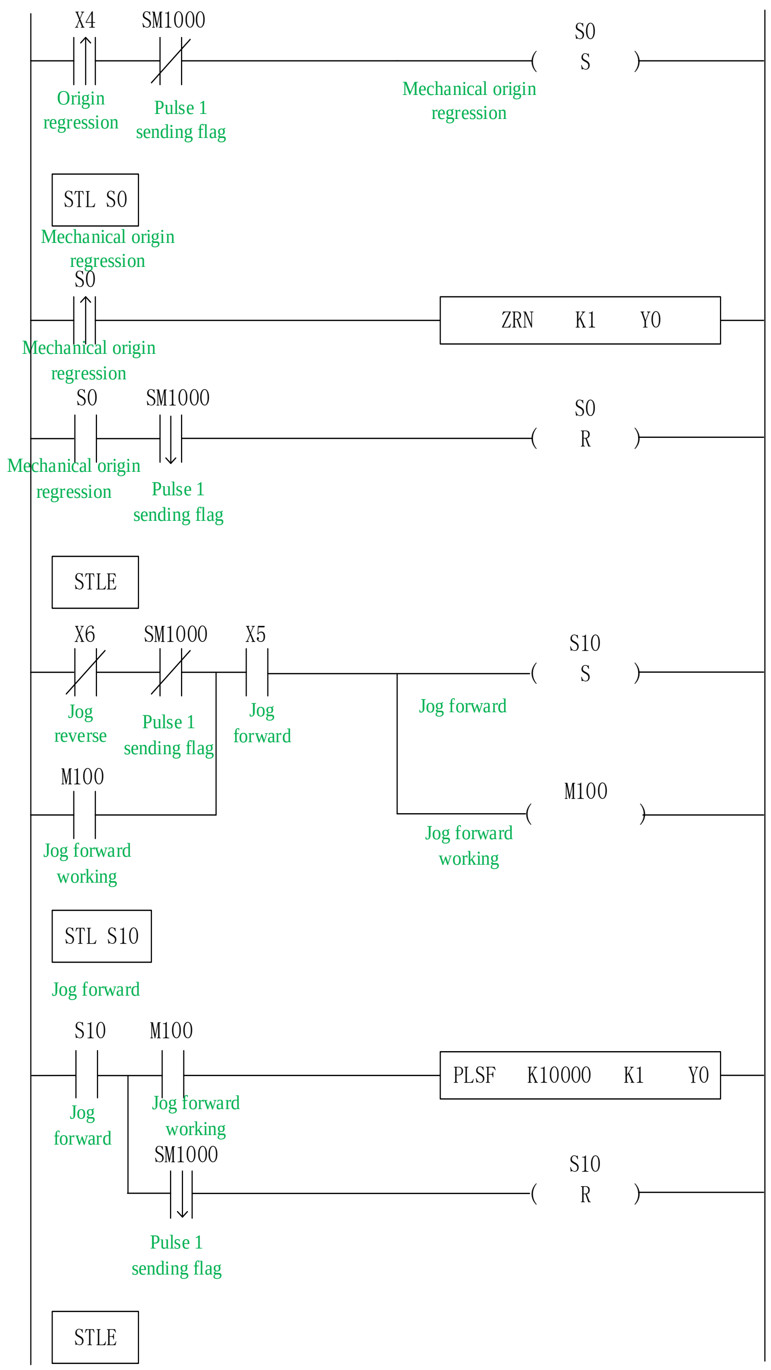
Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

### 1-5-3. Forward and reverse rotation process program 【PLSF, DRVI, DRVA, ZRN】

**Example 1: According to the following figure, use the absolute single segment positioning method.**

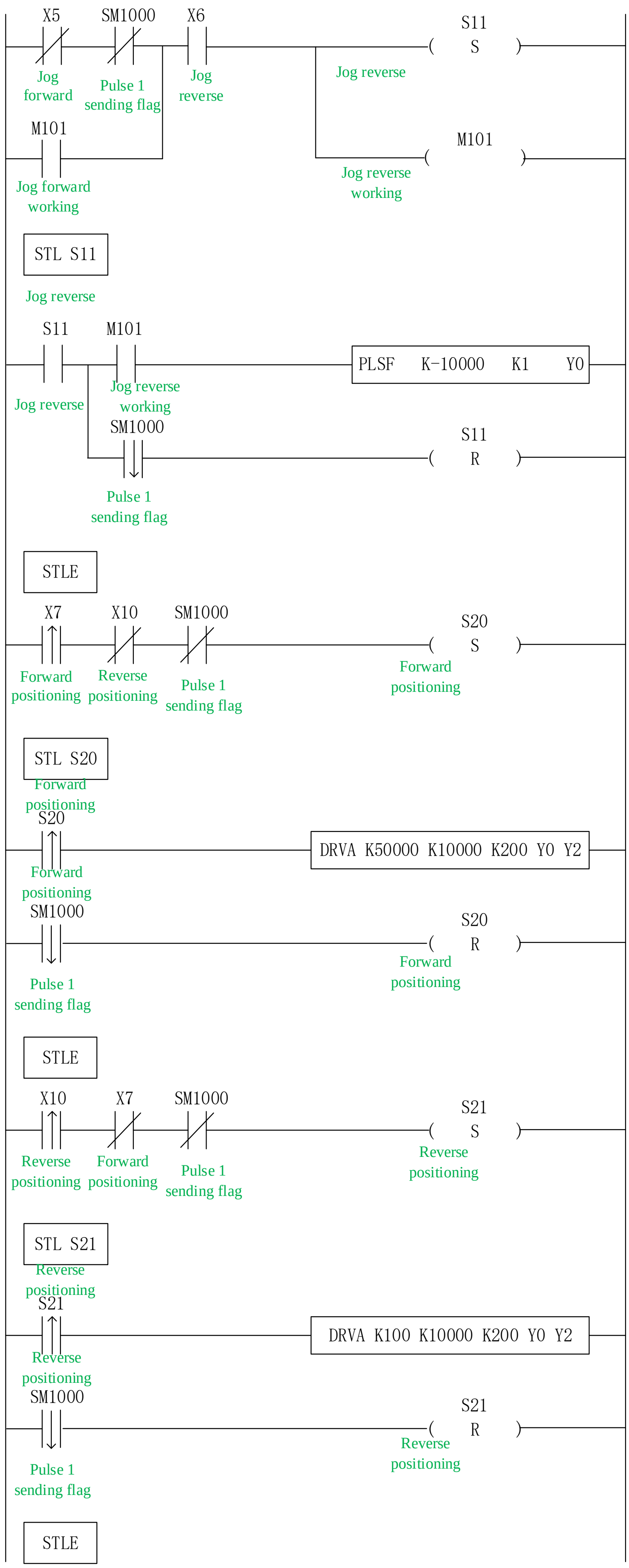



Firstly, make the ladder chart as follows:




//mechanical origin regression instruction (group 1 parameters)

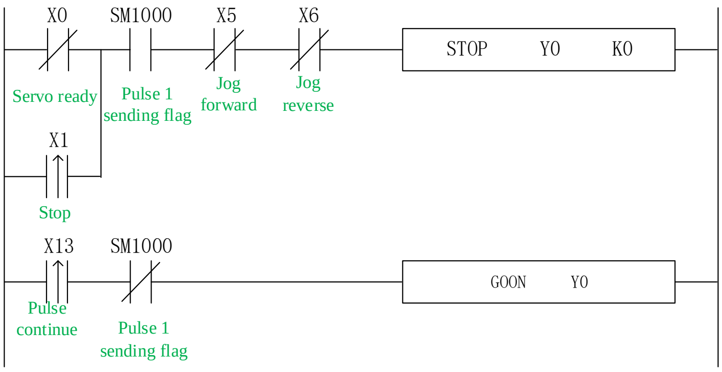
//jog forward control, speed is 10000Hz (group 1 parameters)




//jog reverse control, the speed is 10000Hz (group 1 parameters)

//forward positioning control

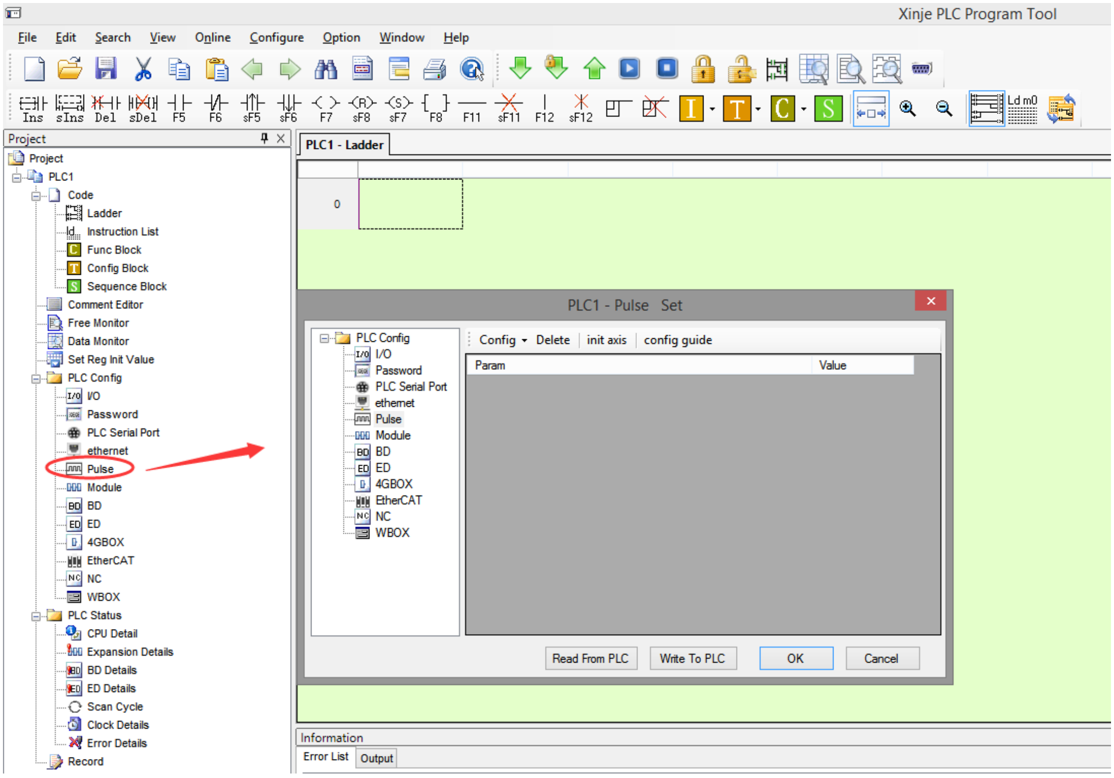
//reverse positioning control



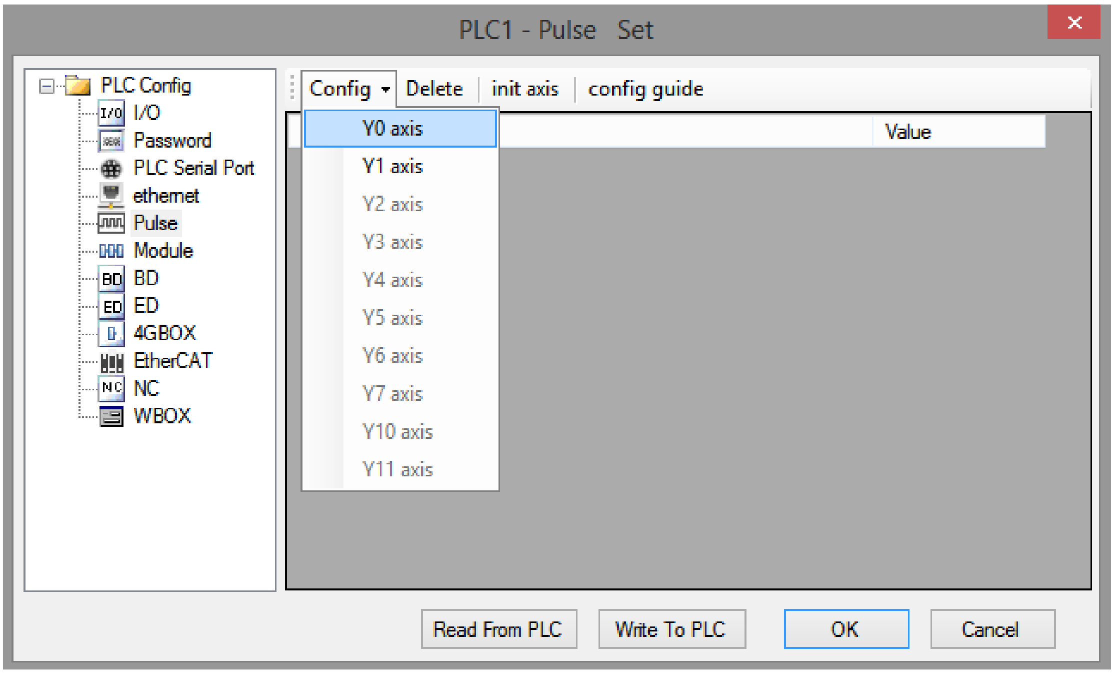

//pulse stop (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

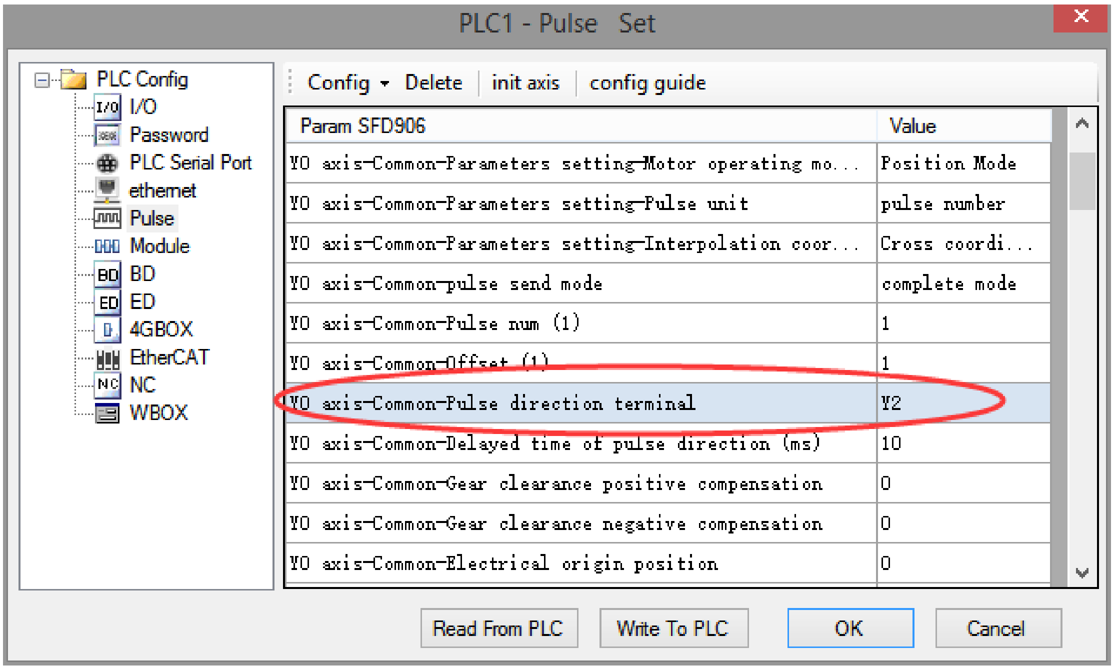
In the sample program, except DRVI and DRVA, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

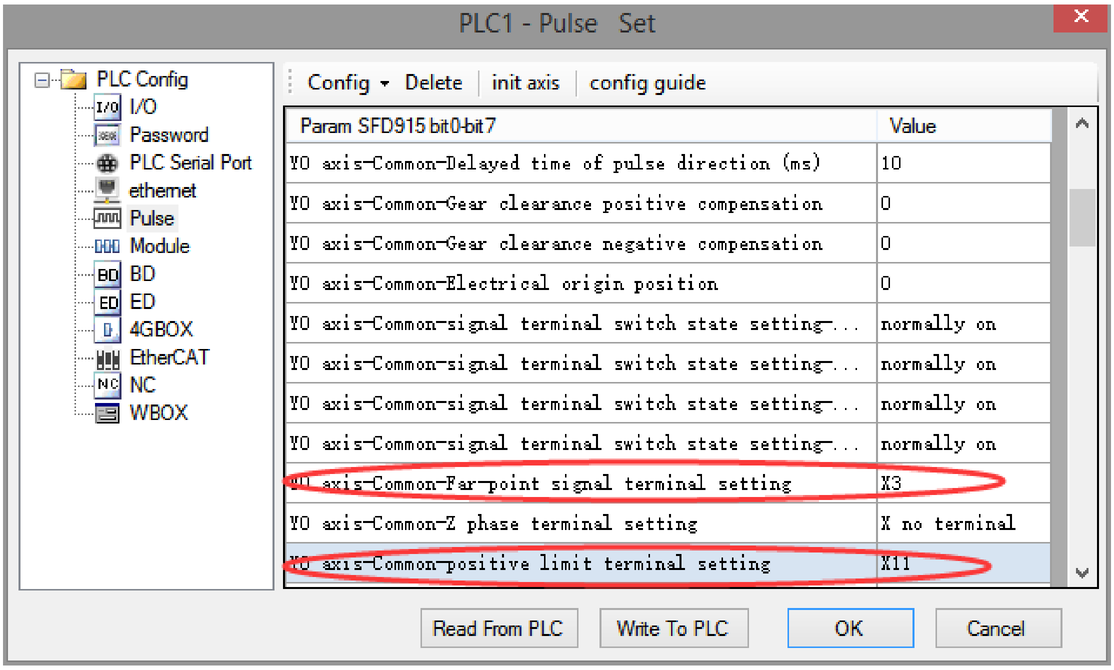


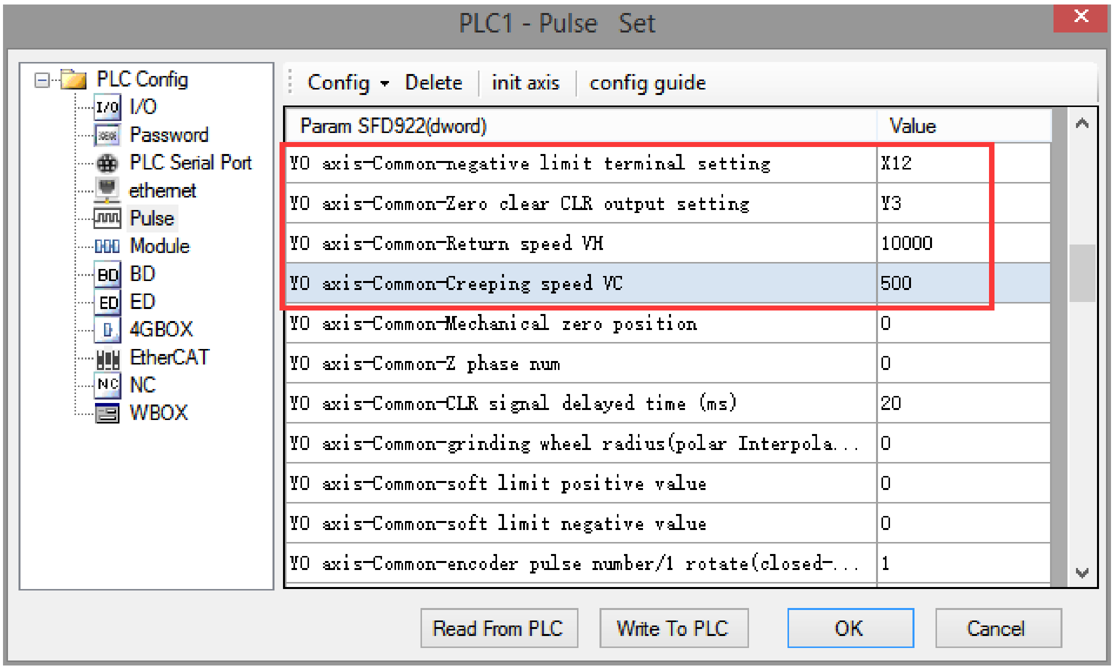

Click config, then select Y0 axis.

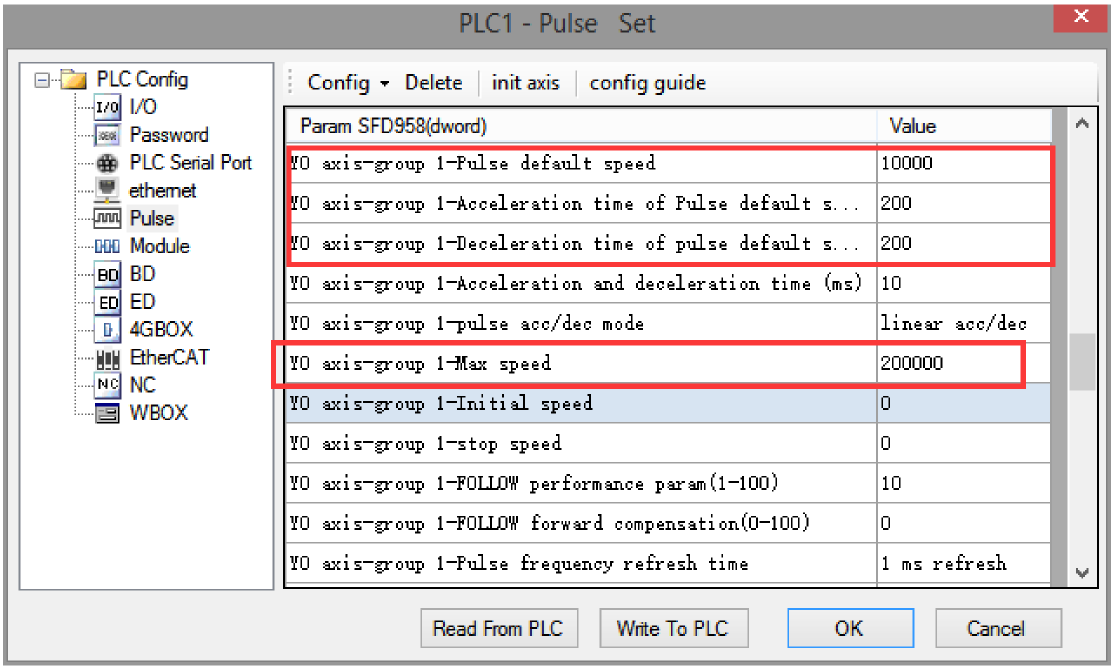



In the parameter configuration table, configure as follows (circled parameters need to be modified):




PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel

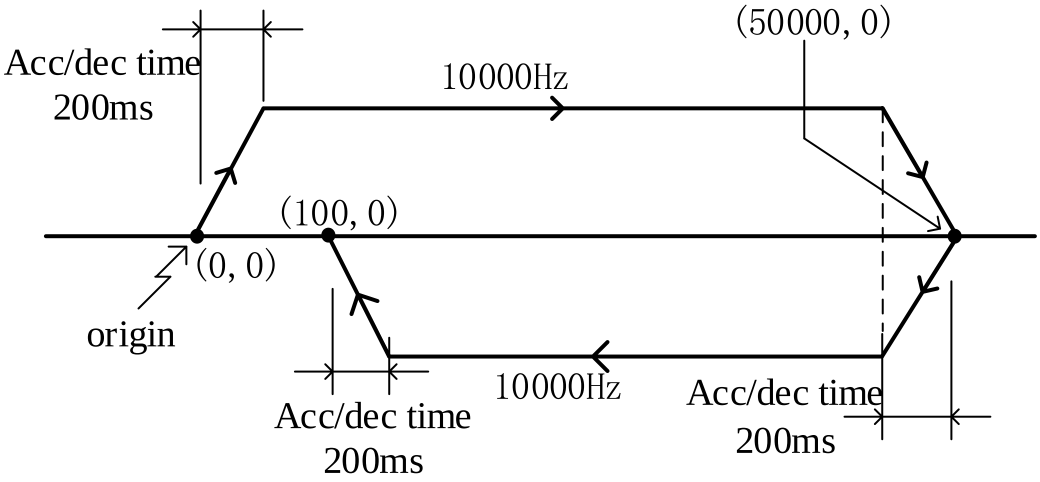

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD922(dword)
Value
Y0 axis-Common-negative limit terminal setting
X12
Y0 axis-Common-Zero clear CLR output setting
Y3
Y0 axis-Common-Return speed VH
10000
Y0 axis-Common-Creeping speed VC
500
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Y0 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel



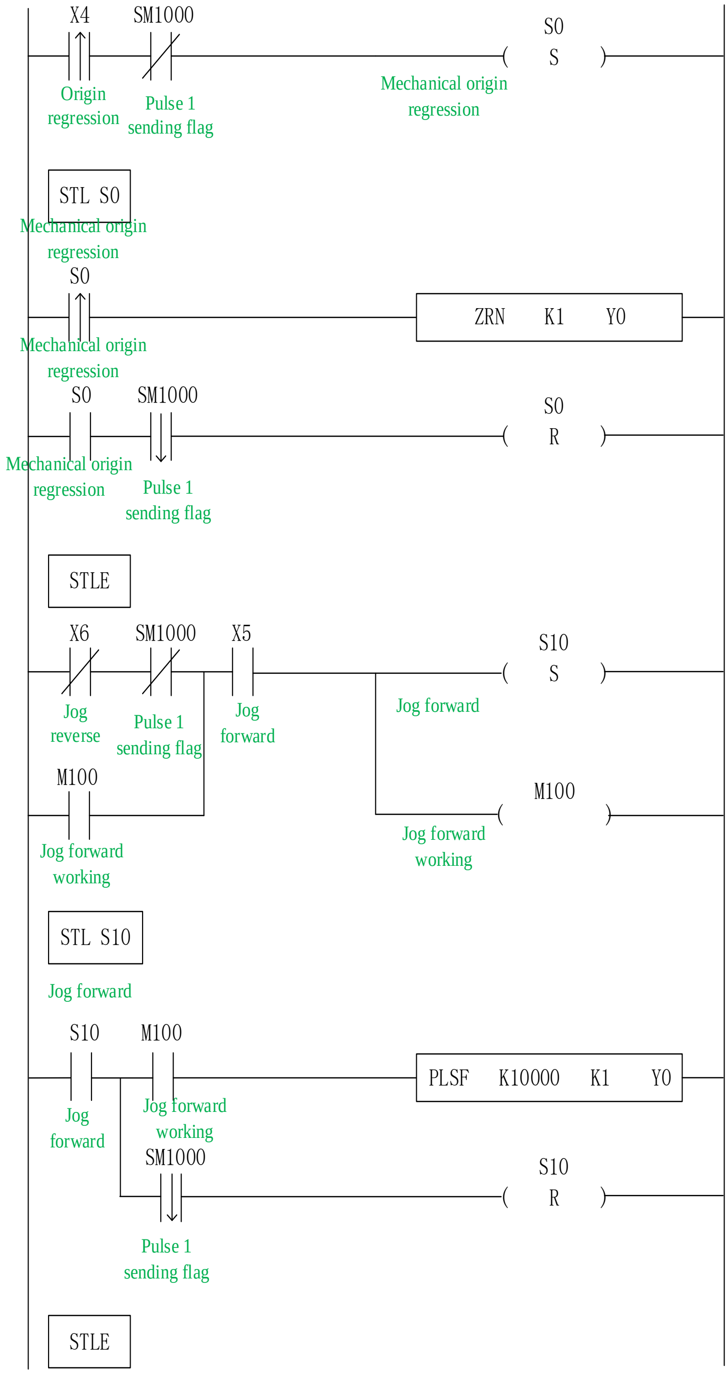

After configuring the parameters, click the "Write to PLC" button to write the parameters into the PLC. After downloading the program, power off the PLC and then power on again.

Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

**Example 2: According to the following figure, use the relative single segment positioning method.**

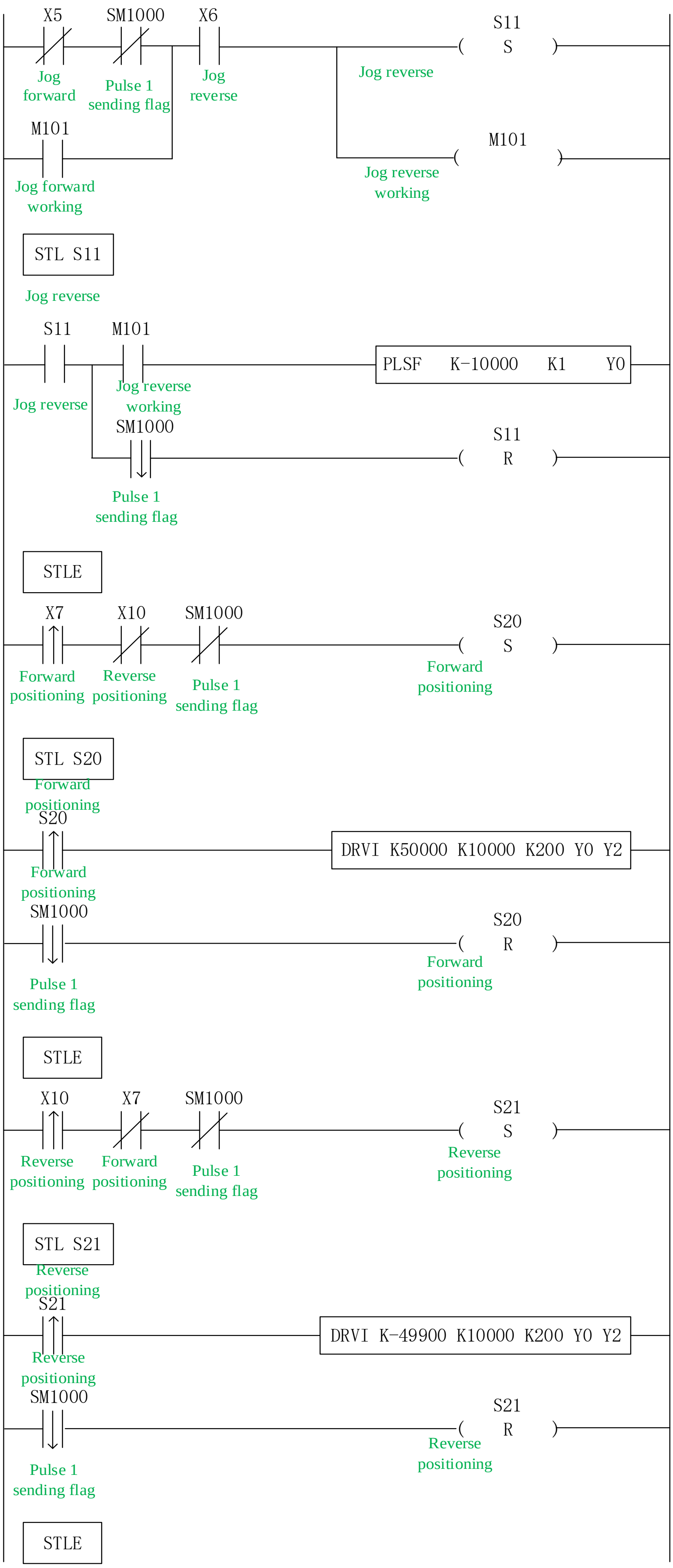



Firstly, make the ladder chart as follows:




//mechanical origin regression instruction (use group 1 parameters)

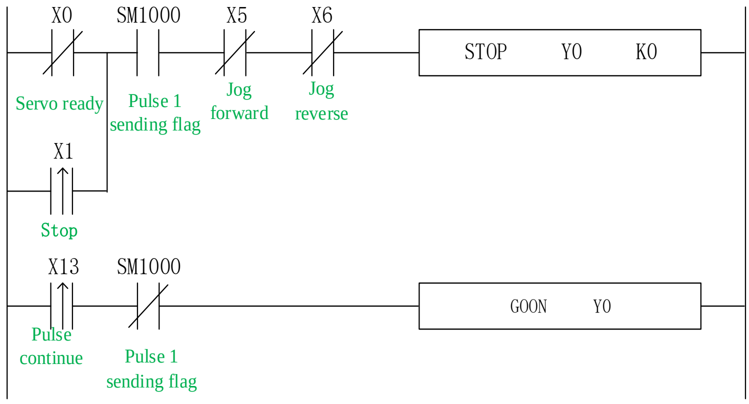
//jog forward control, the speed is 10000Hz (use group 1 parameters)




//jog reverse control, the speed is 10000Hz (use group 1 parameters)

//forward positioning control

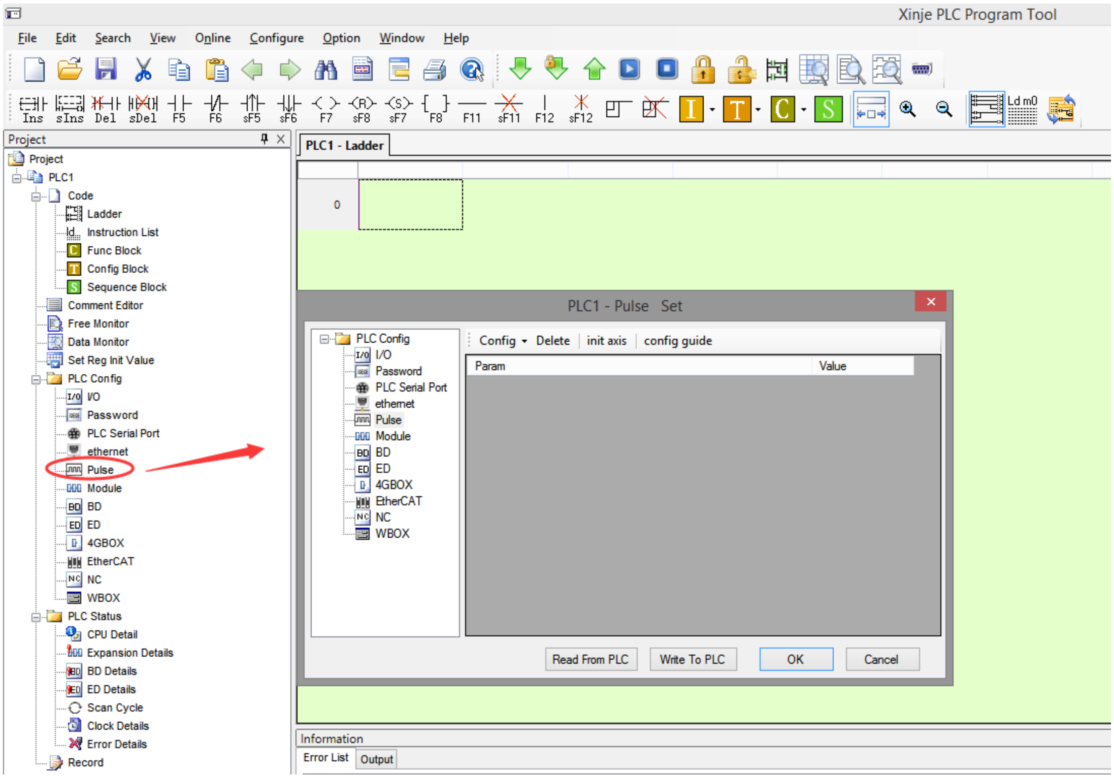
//reverse positioning control



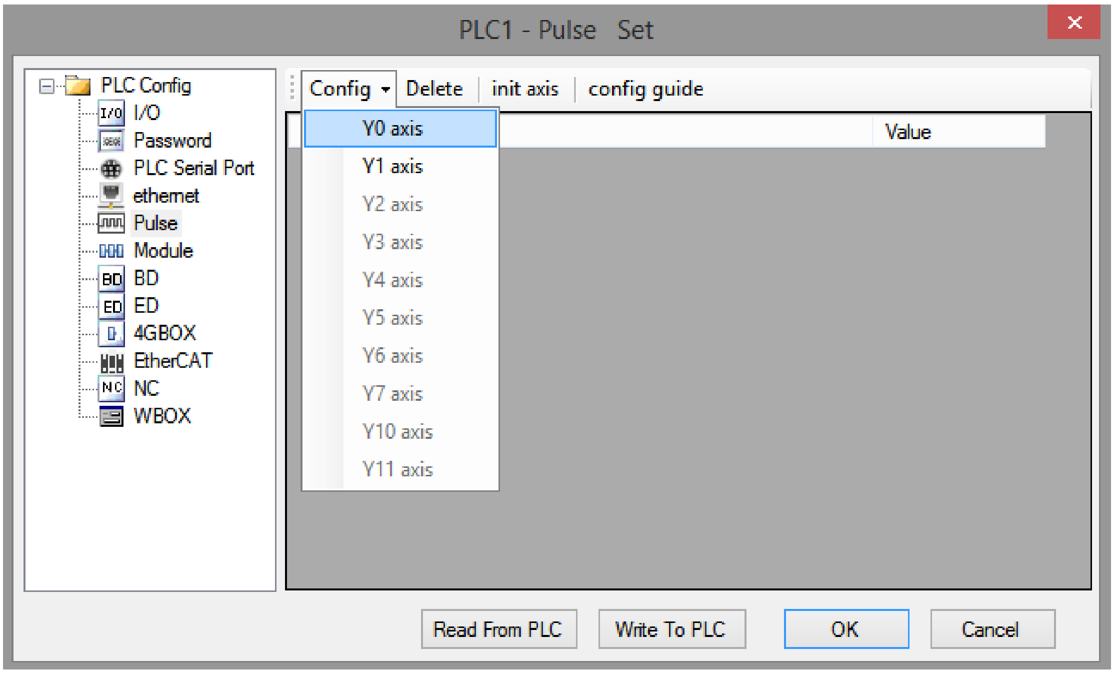

//pulse stop (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

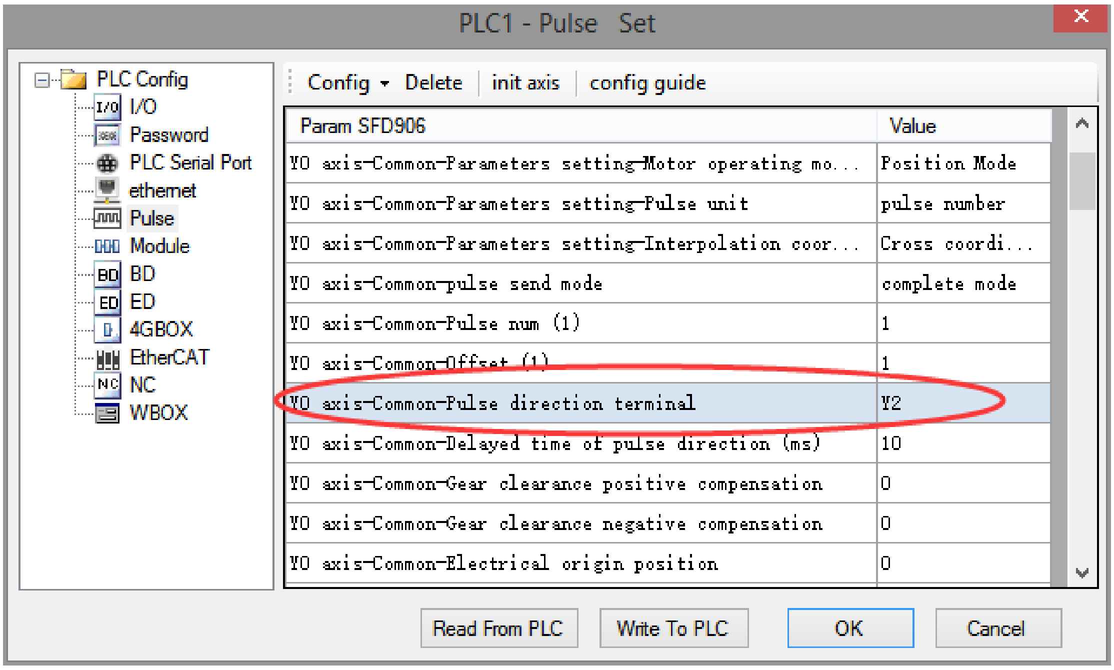
In the sample program, except DRVI and DRVA, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

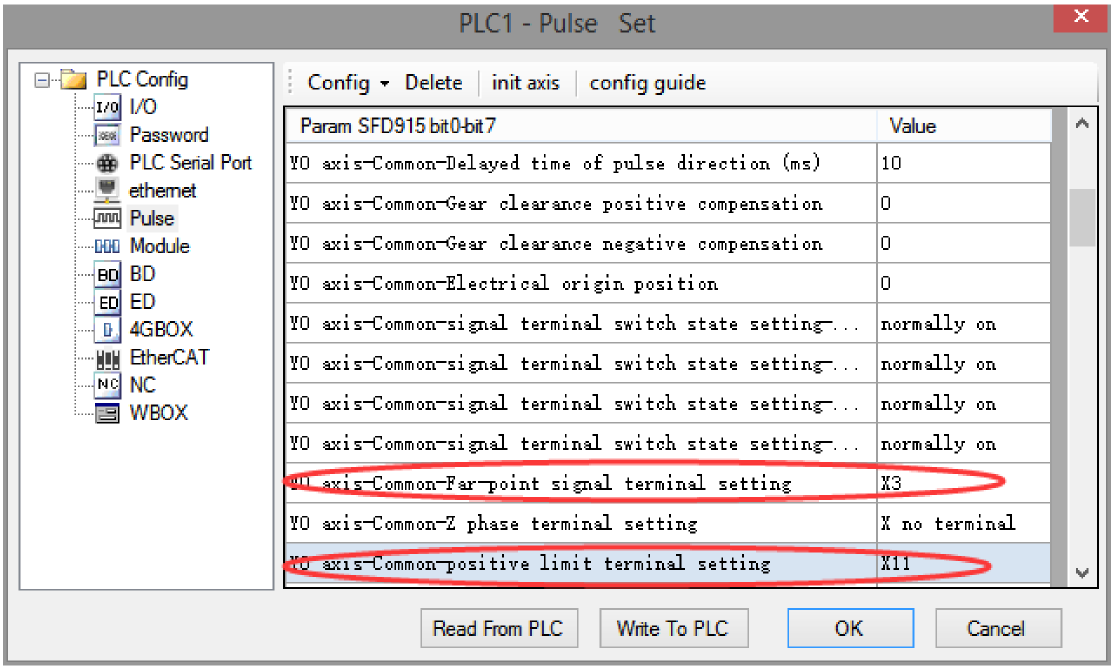


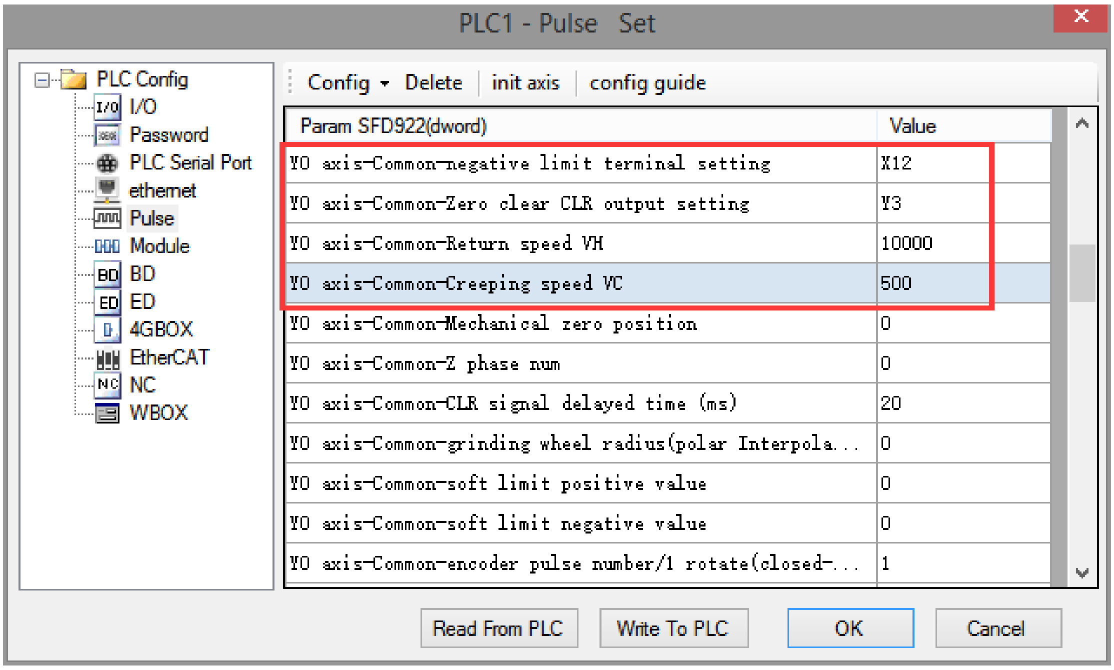

Click config, then select Y0 axis.

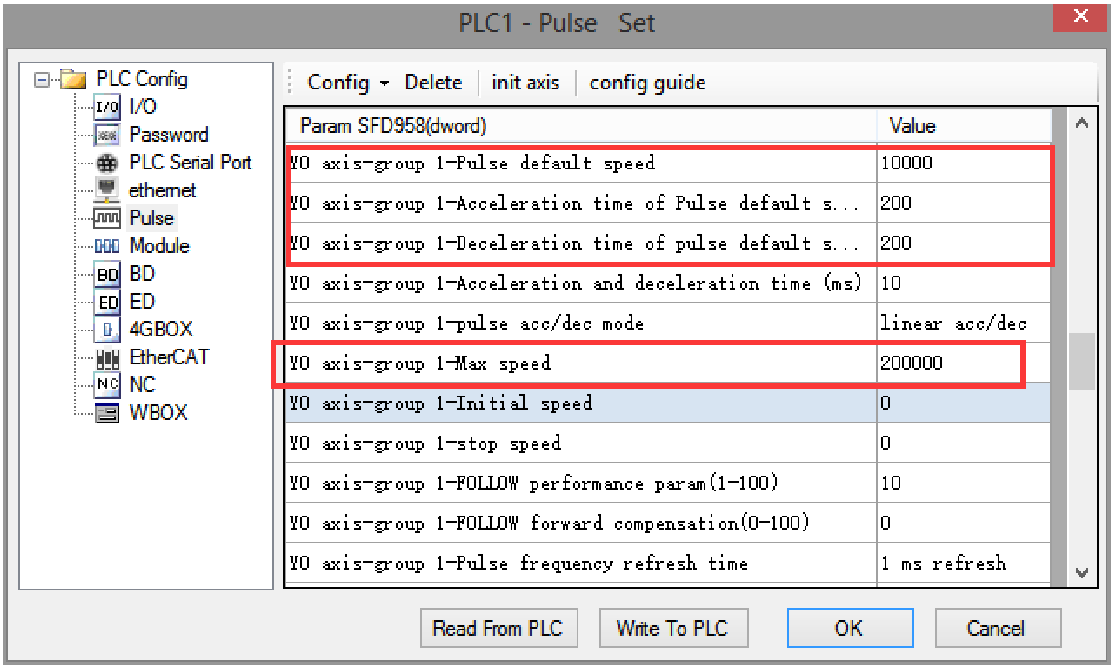



In the parameter configuration table, configure as follows (circled parameters need to be modified):




PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD922(dword)
Value
Y0 axis-Common-negative limit terminal setting
X12
Y0 axis-Common-Zero clear CLR output setting
Y3
Y0 axis-Common-Return speed VH
10000
Y0 axis-Common-Creeping speed VC
500
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Y0 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel

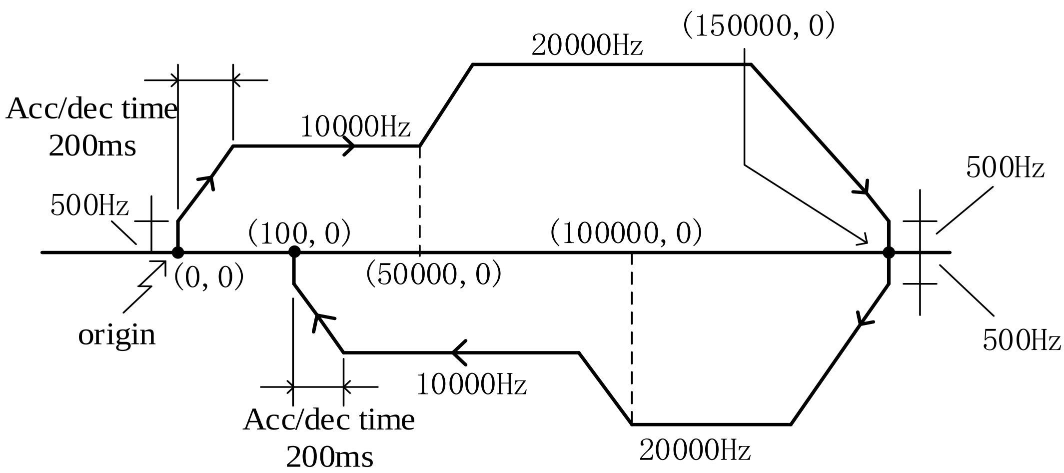



After configuring the parameters, click the "Write to PLC" button to write the parameters into the PLC. After downloading the program, power off the PLC and then power on again.

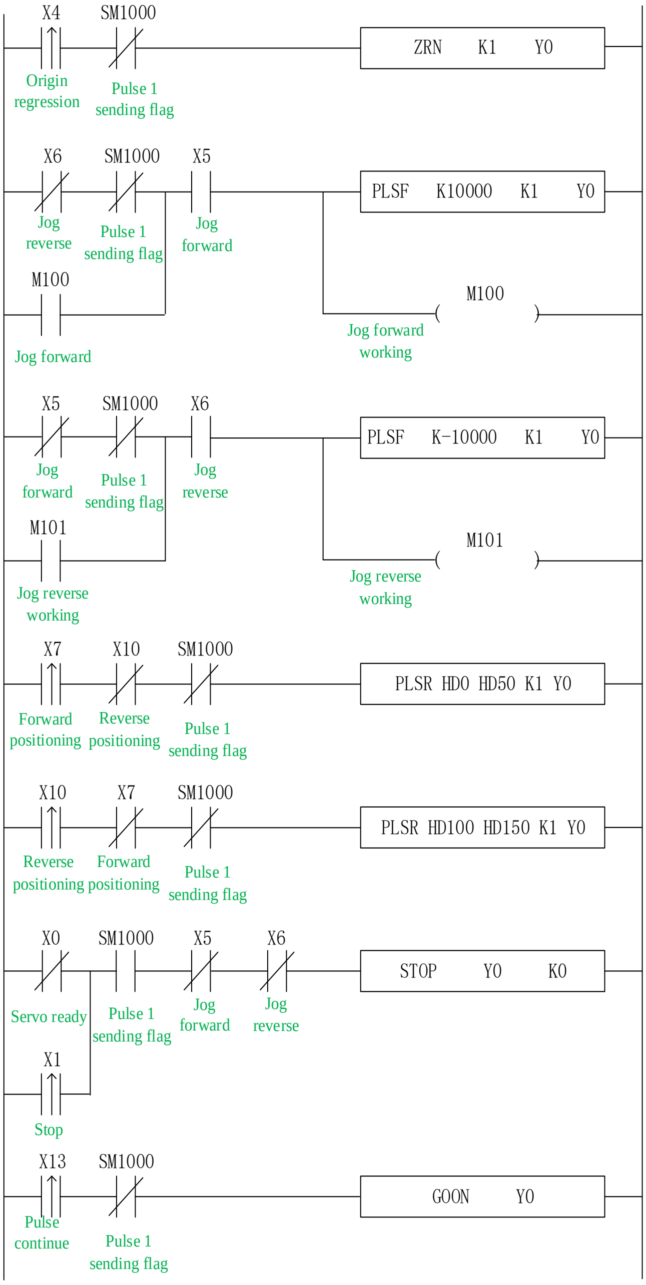
Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

## 1-5-4. Forward and reverse rotation multi-section process program 【PLSF, PLSR, ZRN】

**Example 1: According to the following figure, use multi-segment absolute positioning mode.**



Firstly, make the ladder chart as follows:




//mechanical origin regression instruction (use group 1 parameters)

//Jog forward control, the speed is 10000Hz (use group 1 parameters)

//jog reverse control, the speed is -10000Hz (use group 1 paramreters)

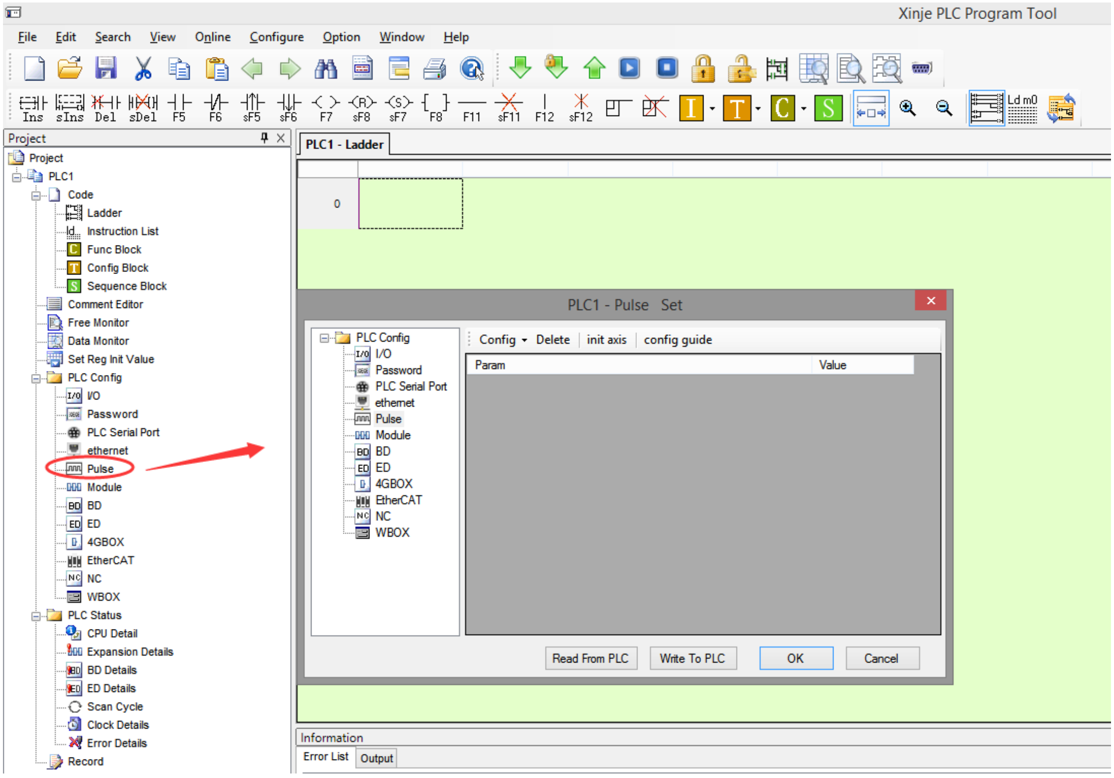
//forward positioning control (use group 1 parameters)

// reverse positioning control (use group 1 parameters)

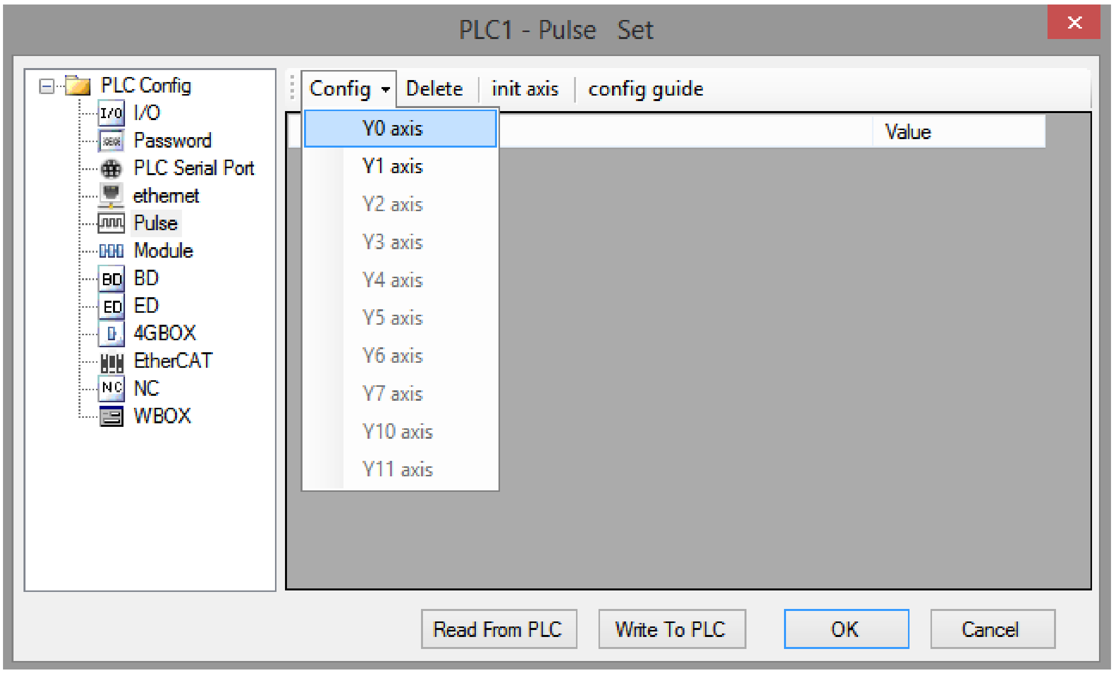
//pulse stop (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

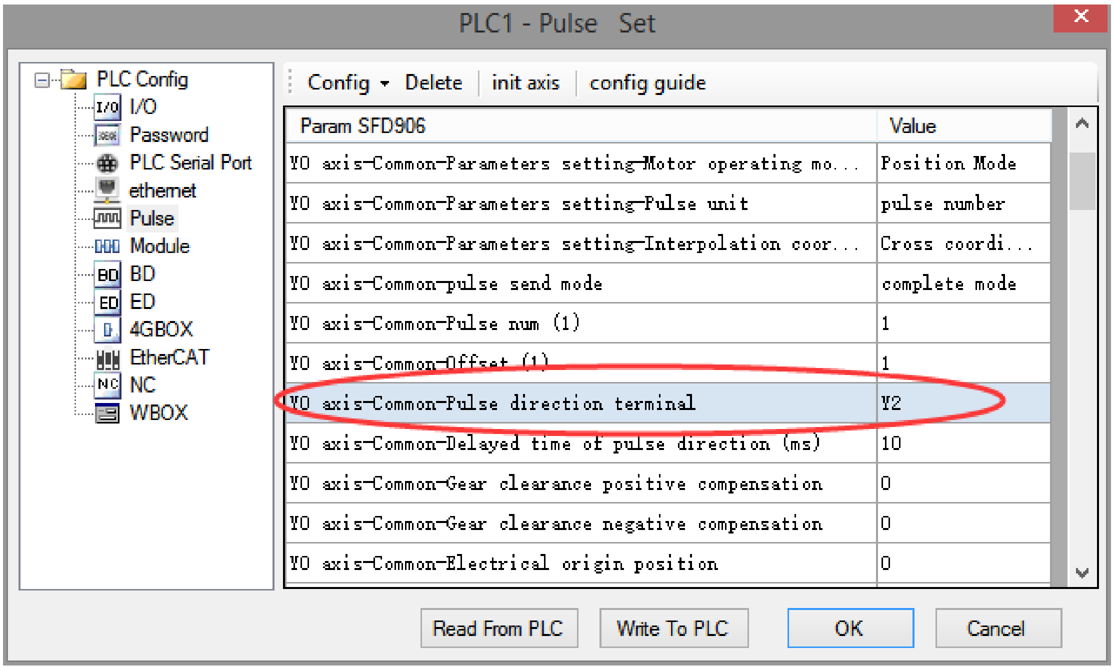
In the sample program, except DRVI and DRVA, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

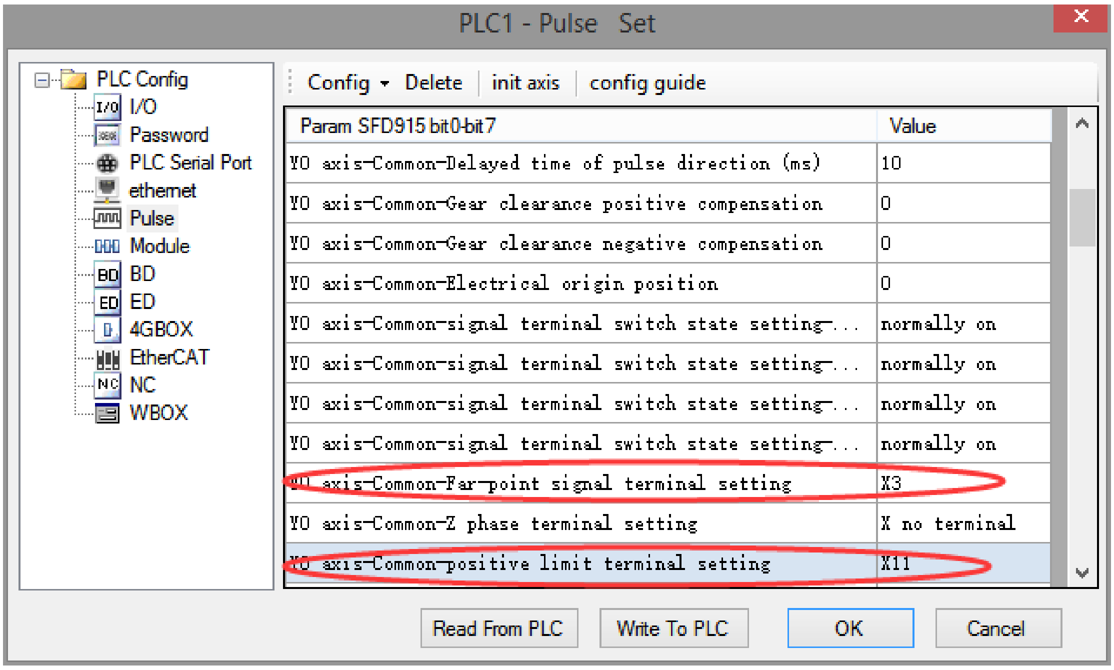


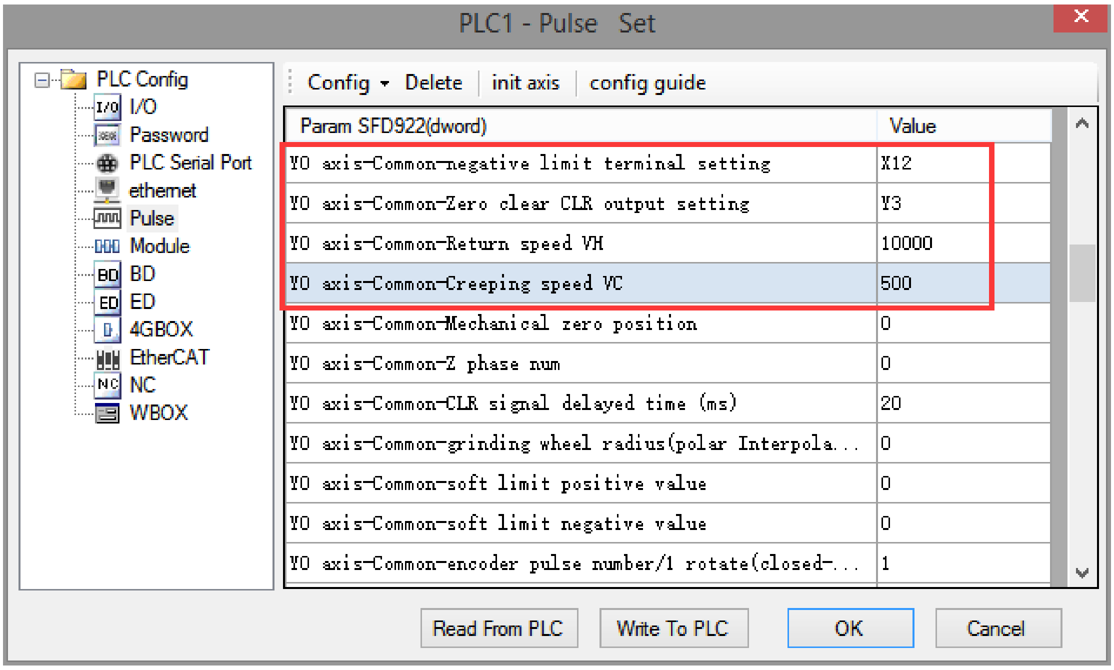
Click config, then select Y0 axis.

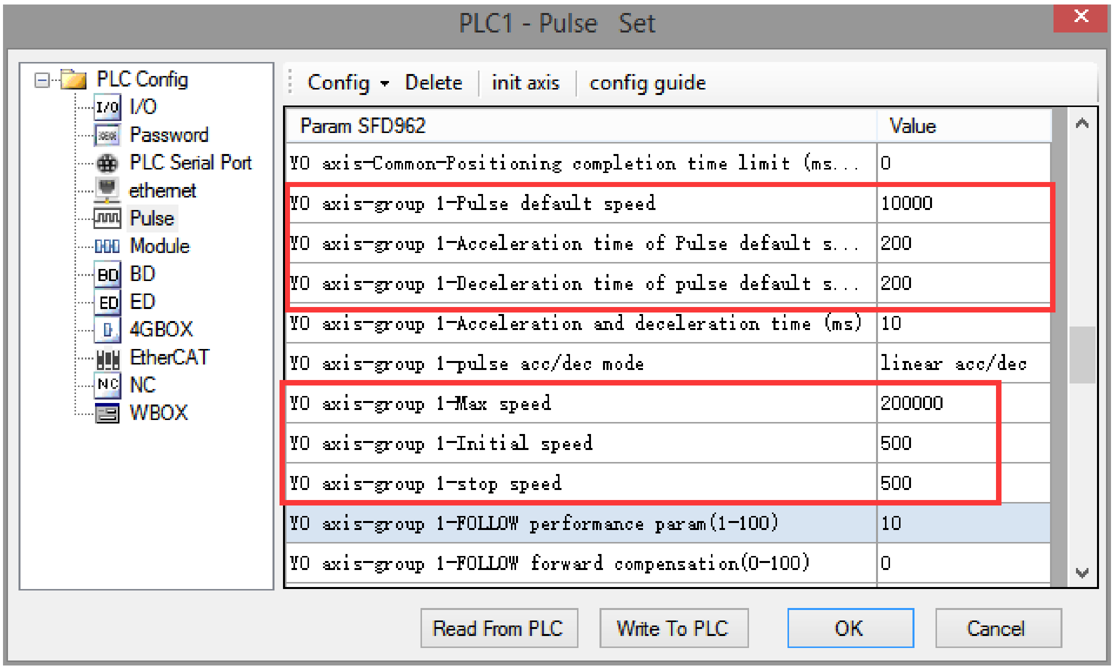


In the parameter configuration table, configure as follows (circled parameters need to be modified):


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Parameters setting-Motor operating mo...
Position Mode
Y0 axis-Common-Parameters setting-Pulse unit
pulse number
Y0 axis-Common-Parameters setting-Interpolation coor...
Cross coordi...
Y0 axis-Common-pulse send mode
complete mode
Y0 axis-Common-Pulse num (1)
1
Y0 axis-Common-Offset (1)
1
Y0 axis-Common-Pulse direction terminal
Y2
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Read From PLC
Write To PLC
OK
Cancel

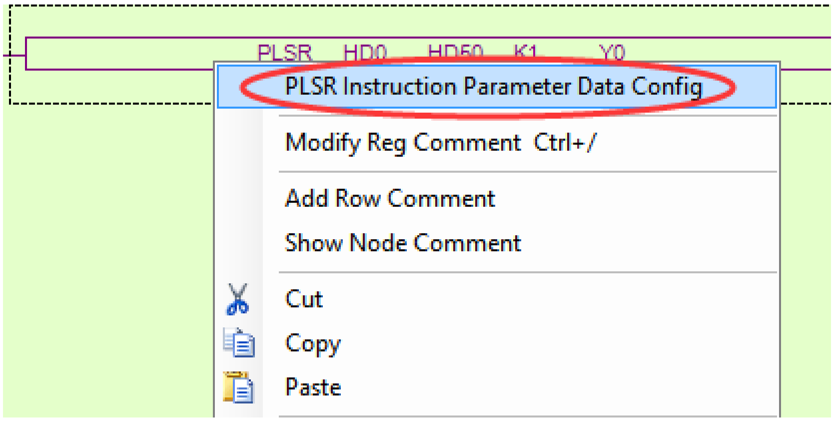

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel



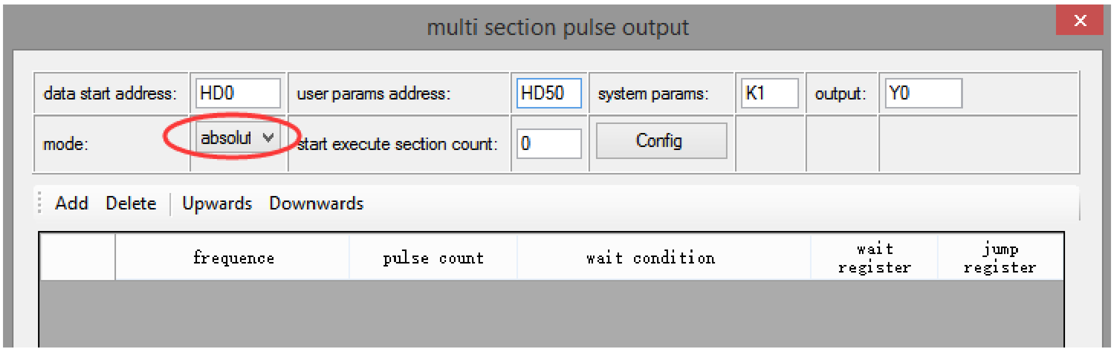




After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

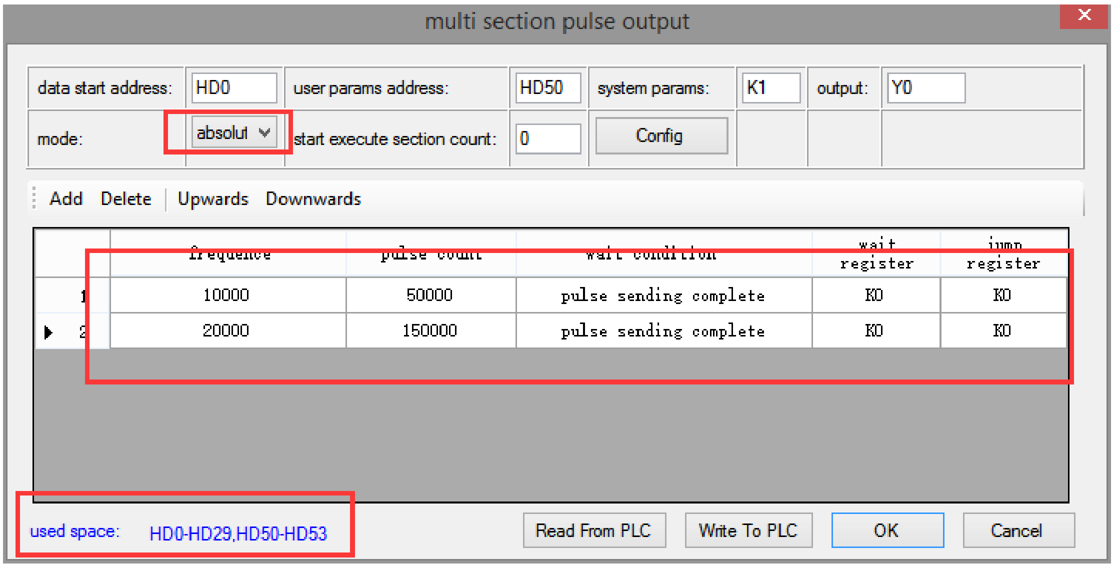
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:

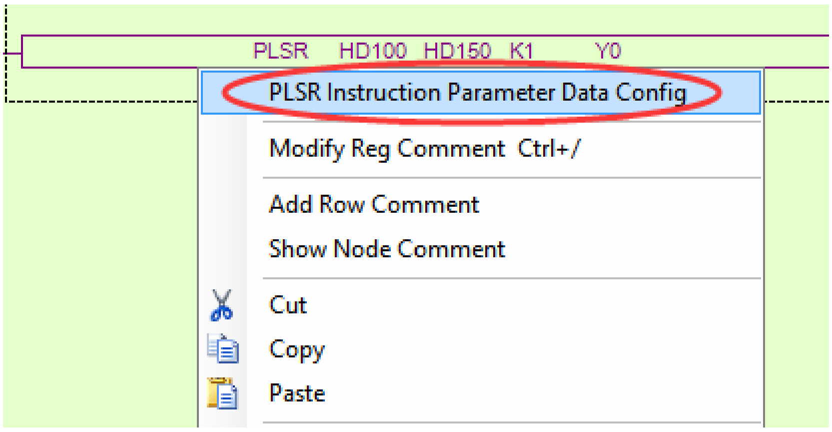



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

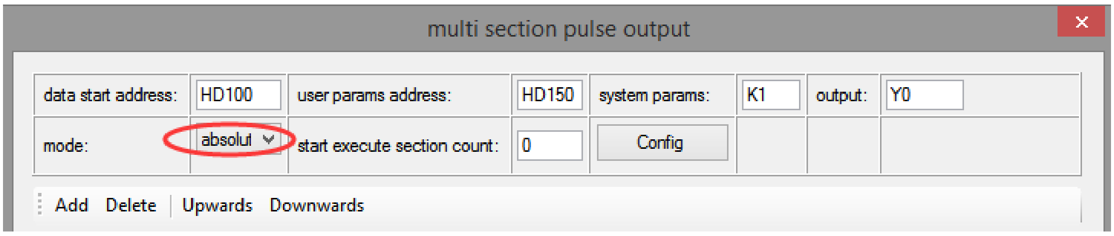



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

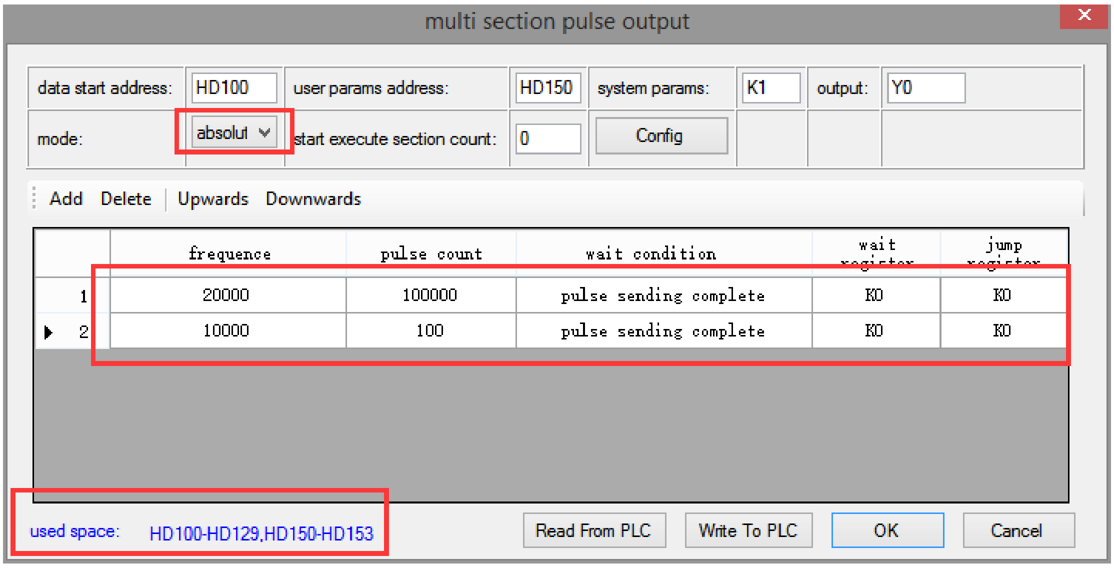
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:



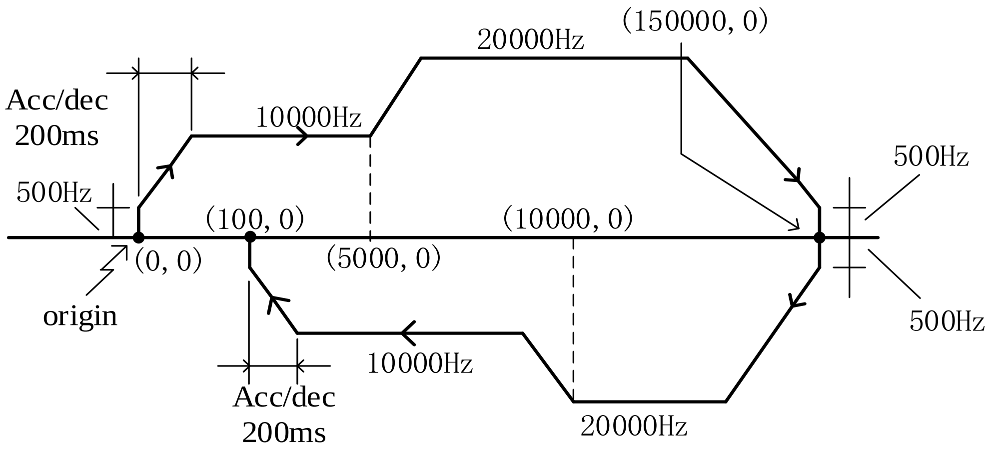

After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:



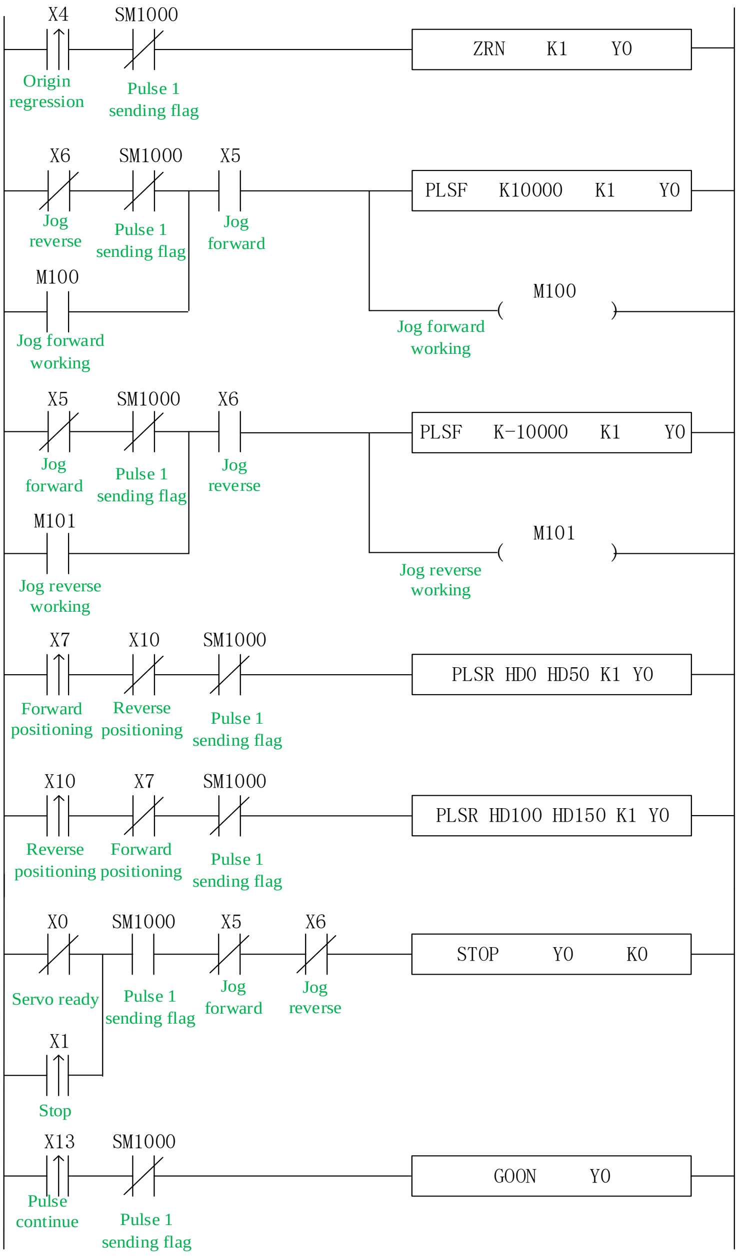

**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

After downloading the program, power off the PLC and then re-energize it.
Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

**Example 2: According to the following figure, multi-segment relative positioning method is used.**




Firstly, make the ladder chart as follows:




//mechanical origin regression instruction (use group 1 parameters)

//Jog forward control, the speed is 10000Hz (use group 1 parameters)

//jog reverse control, the speed is -10000Hz (use group 1 paramreters)

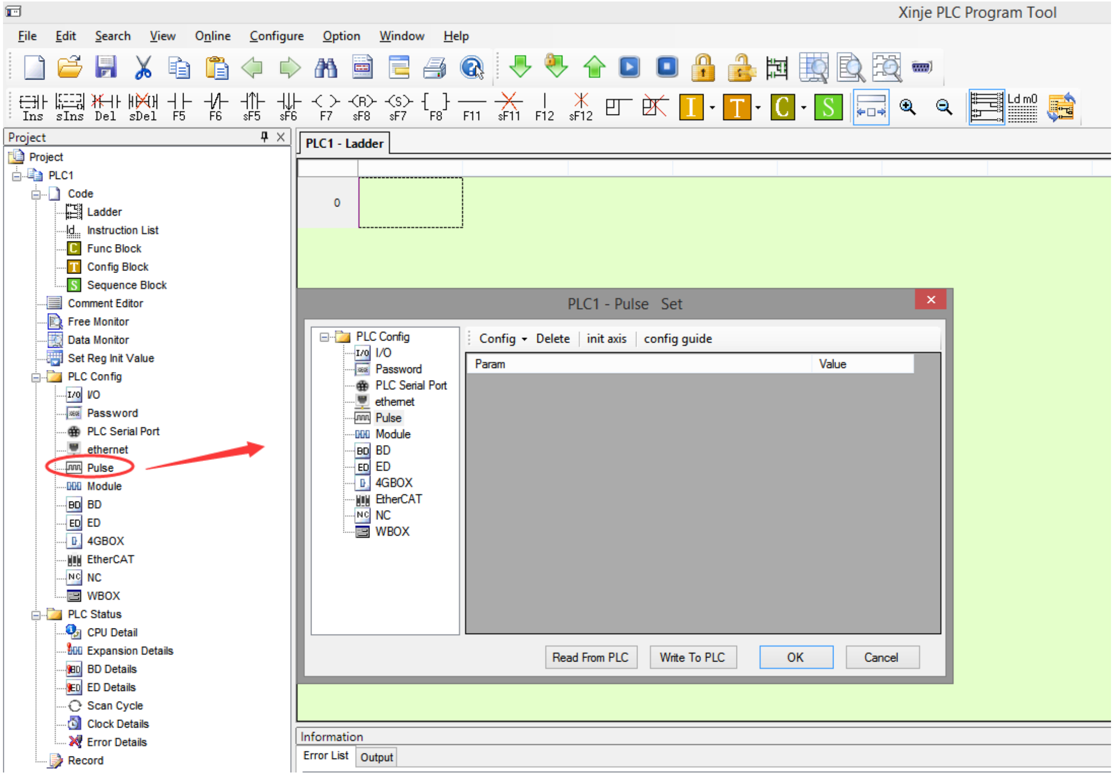
//forward positioning control (use group 1 parameters)

// reverse positioning control (use group 1 parameters)

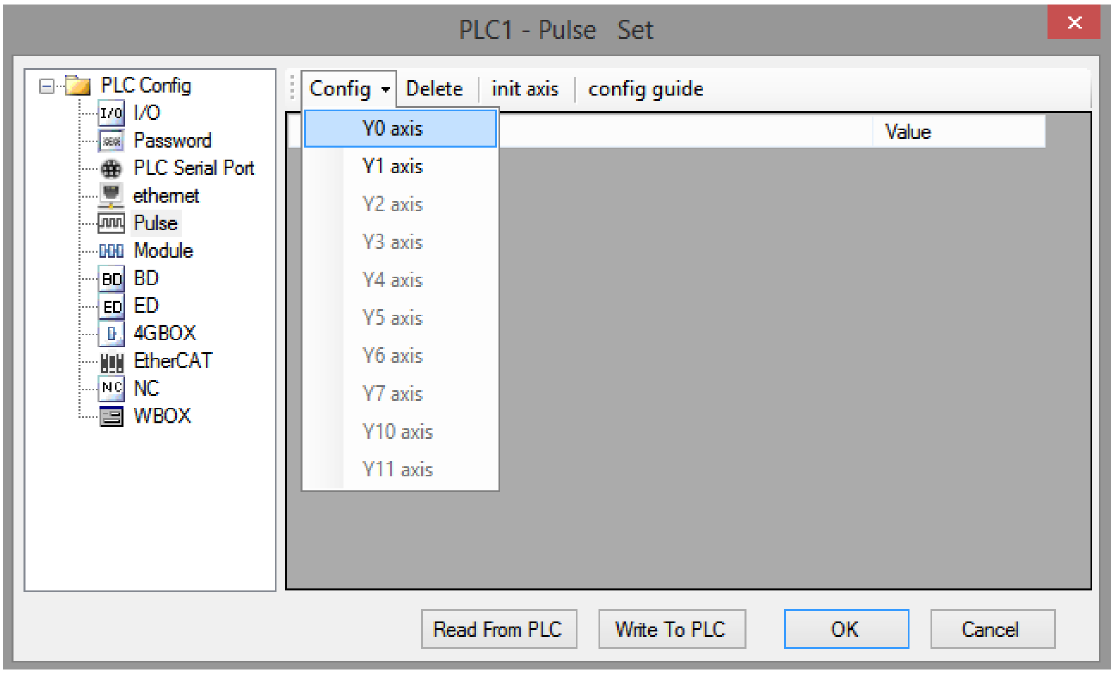
//pulse stop (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

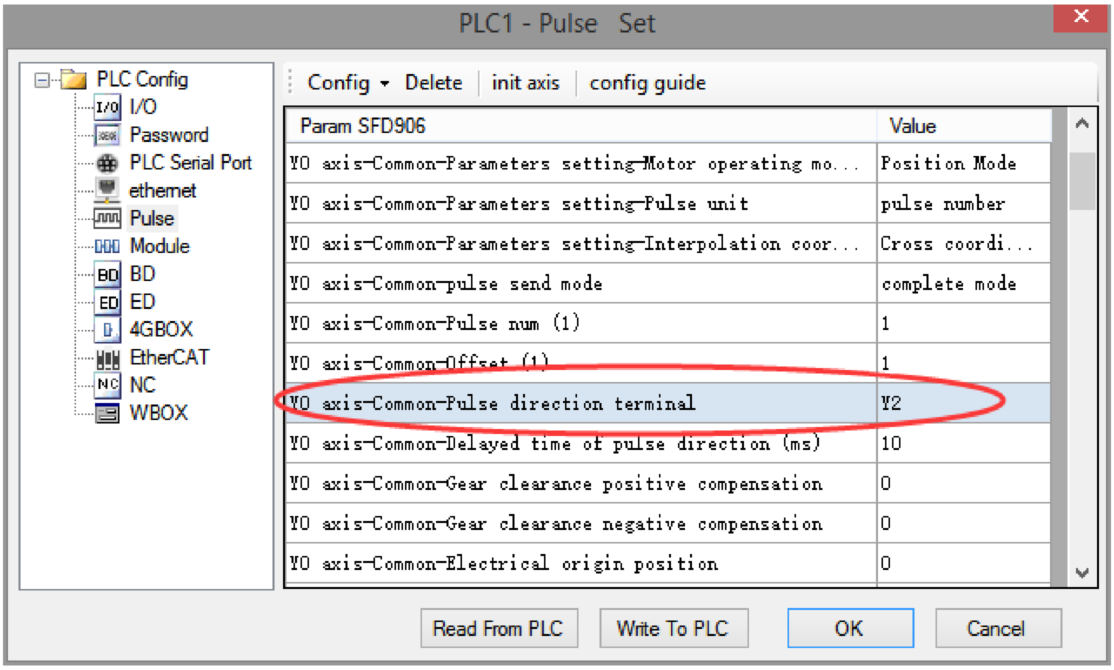
In the sample program, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

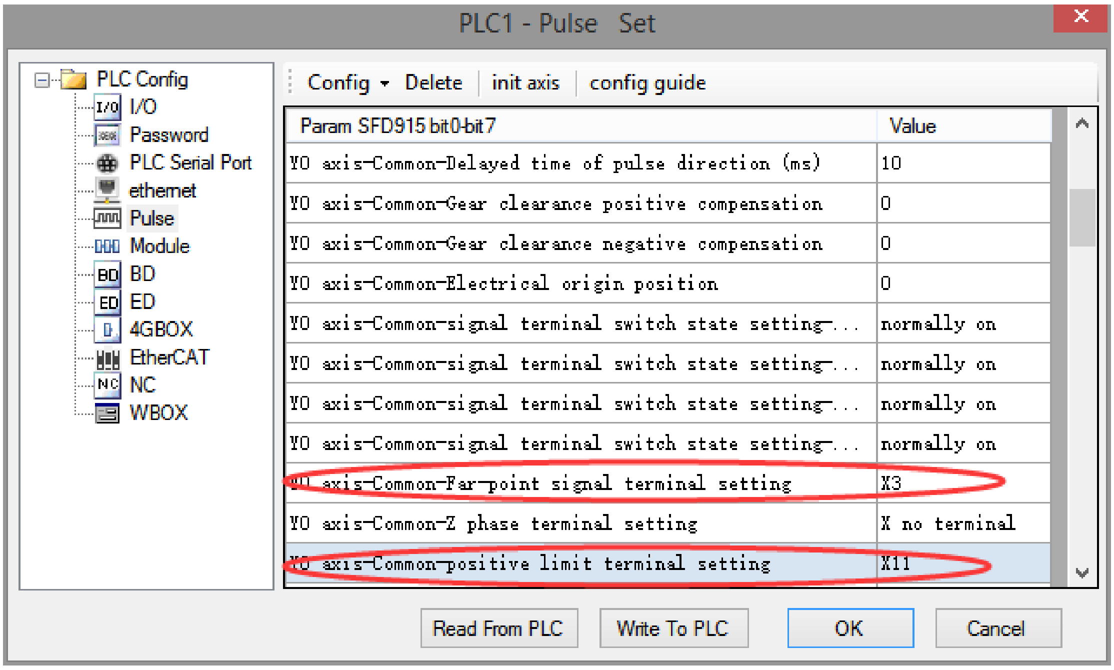


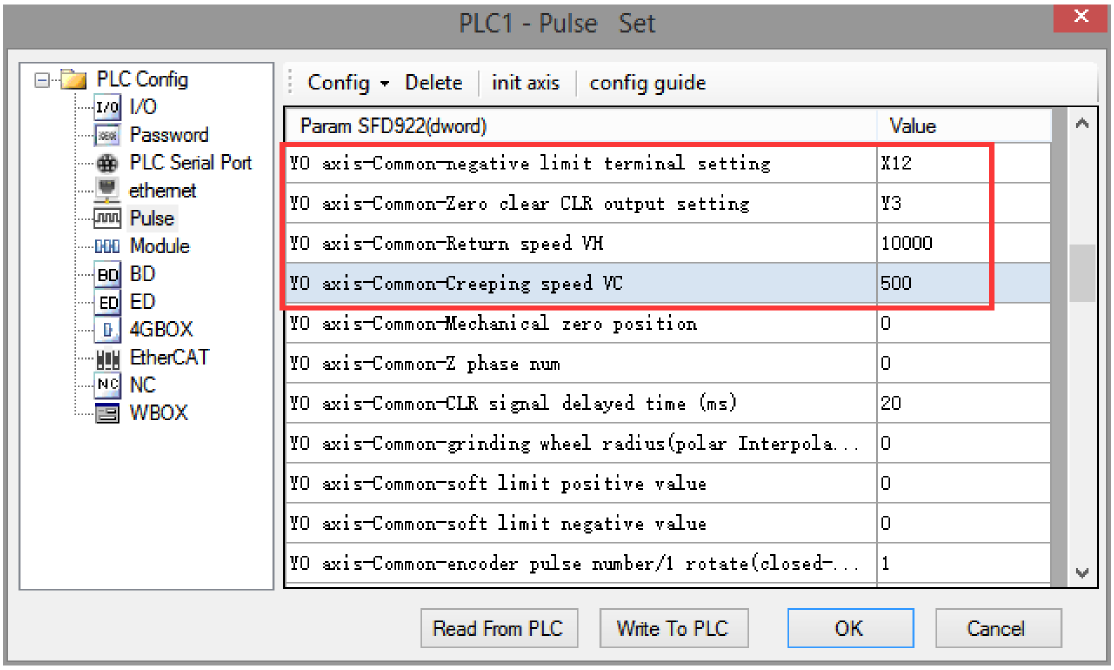

Click config, then select Y0 axis.

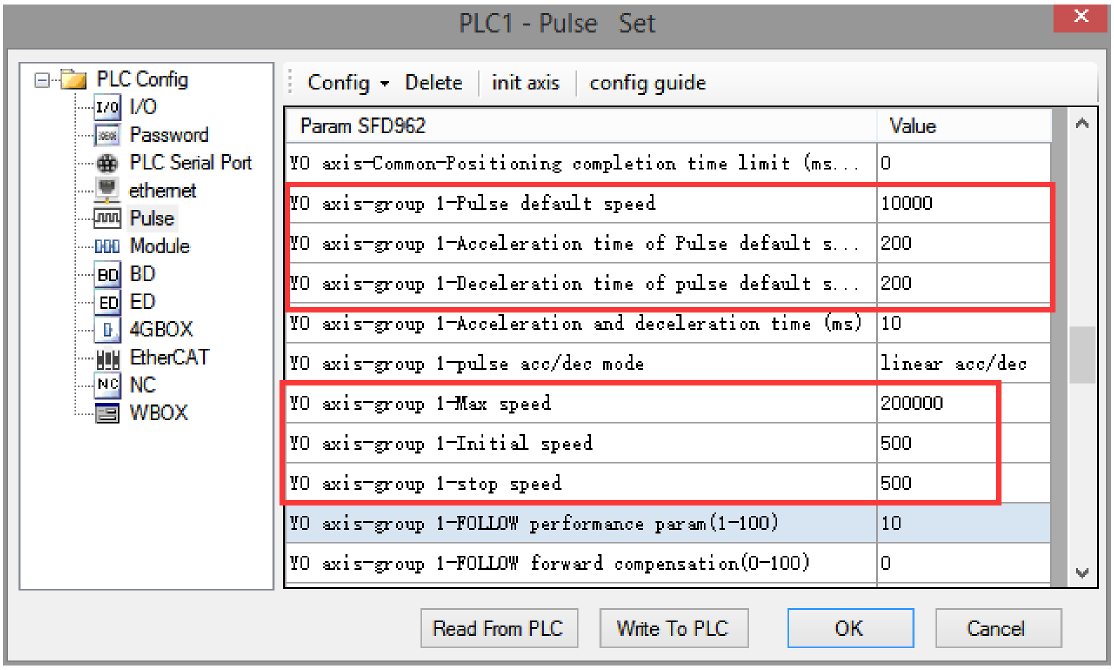



In the parameter configuration table, configure as follows (circled parameters need to be modified):


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Parameters setting-Motor operating mo...
Position Mode
Y0 axis-Common-Parameters setting-Pulse unit
pulse number
Y0 axis-Common-Parameters setting-Interpolation coor...
Cross coordi...
Y0 axis-Common-pulse send mode
complete mode
Y0 axis-Common-Pulse num (1)
1
Y0 axis-Common-Offset (1)
1
Y0 axis-Common-Pulse direction terminal
Y2
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Read From PLC
Write To PLC
OK
Cancel

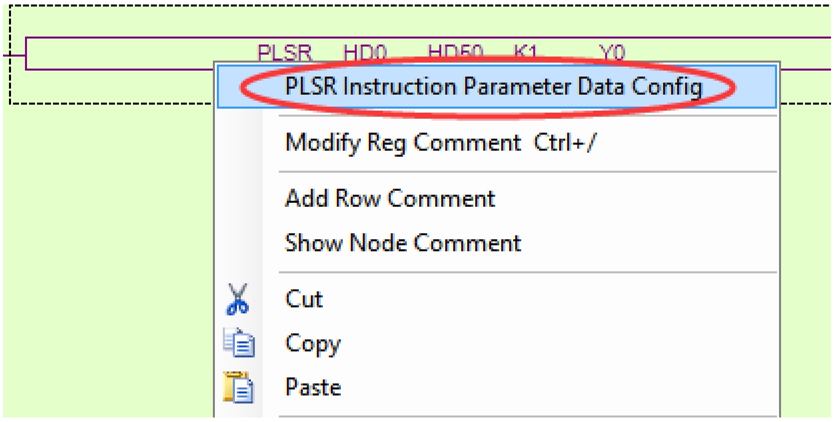

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel



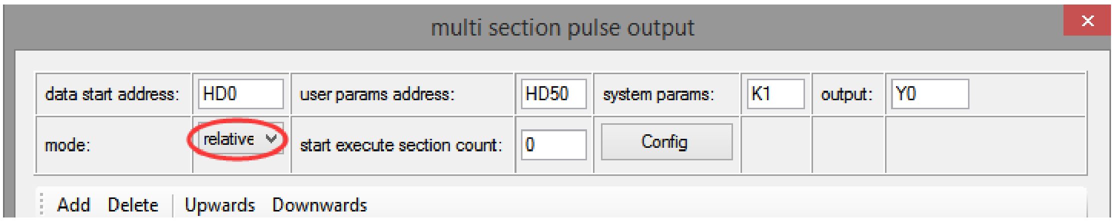




After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

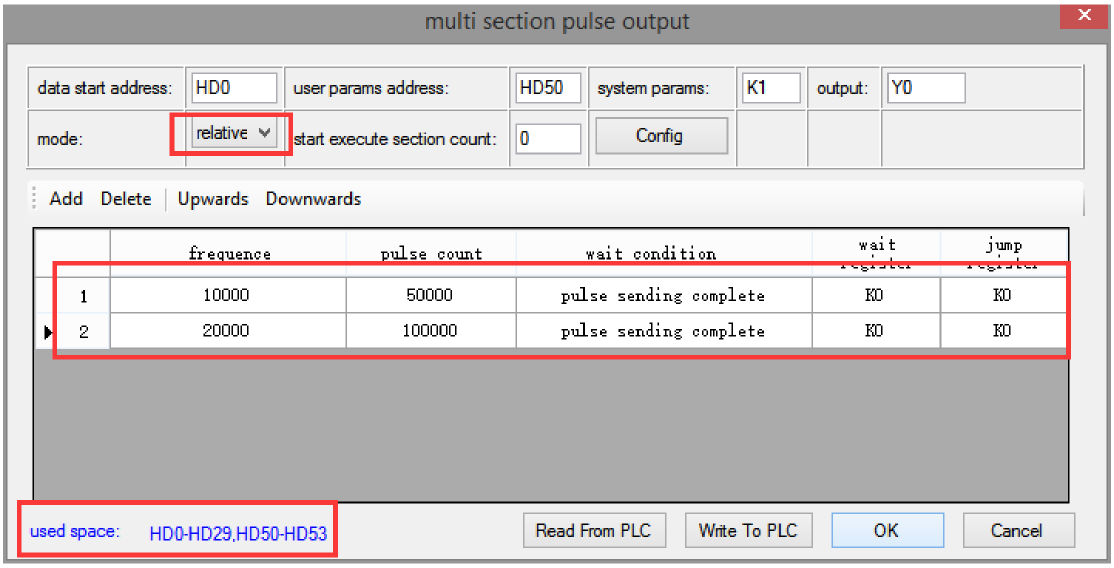
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:

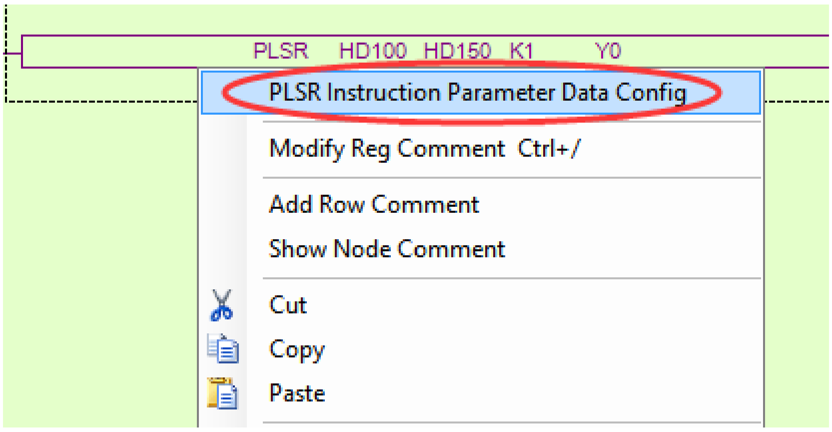



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

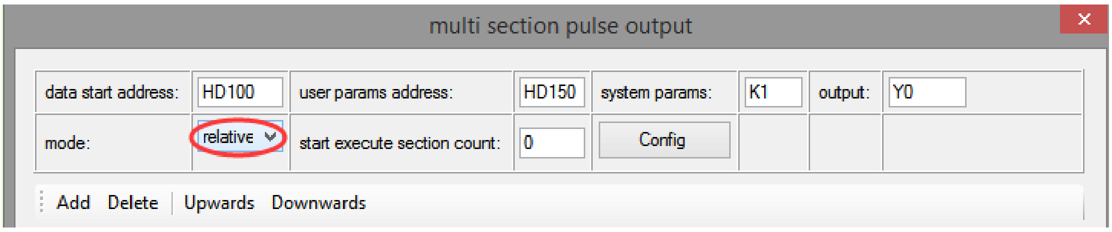



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

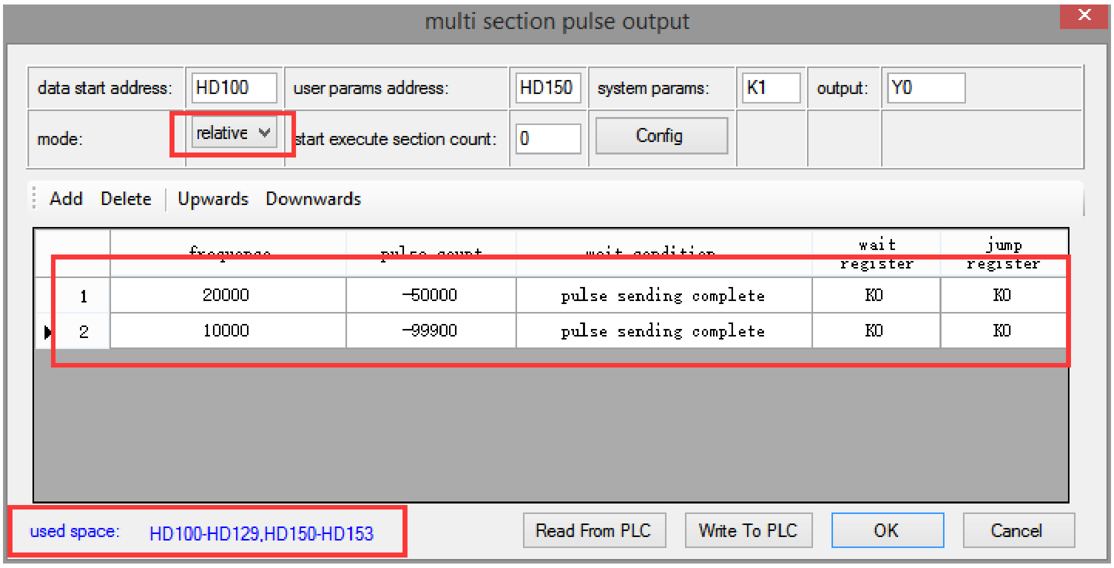
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:




After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of reverse rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

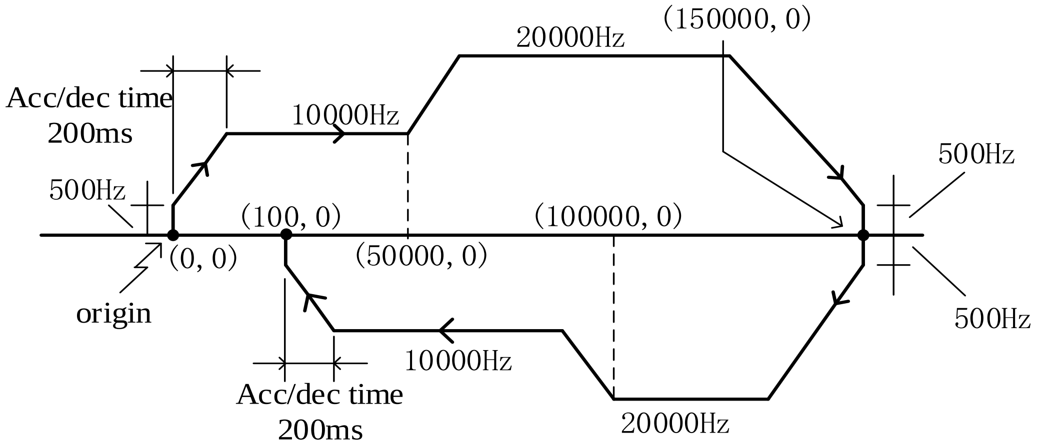



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

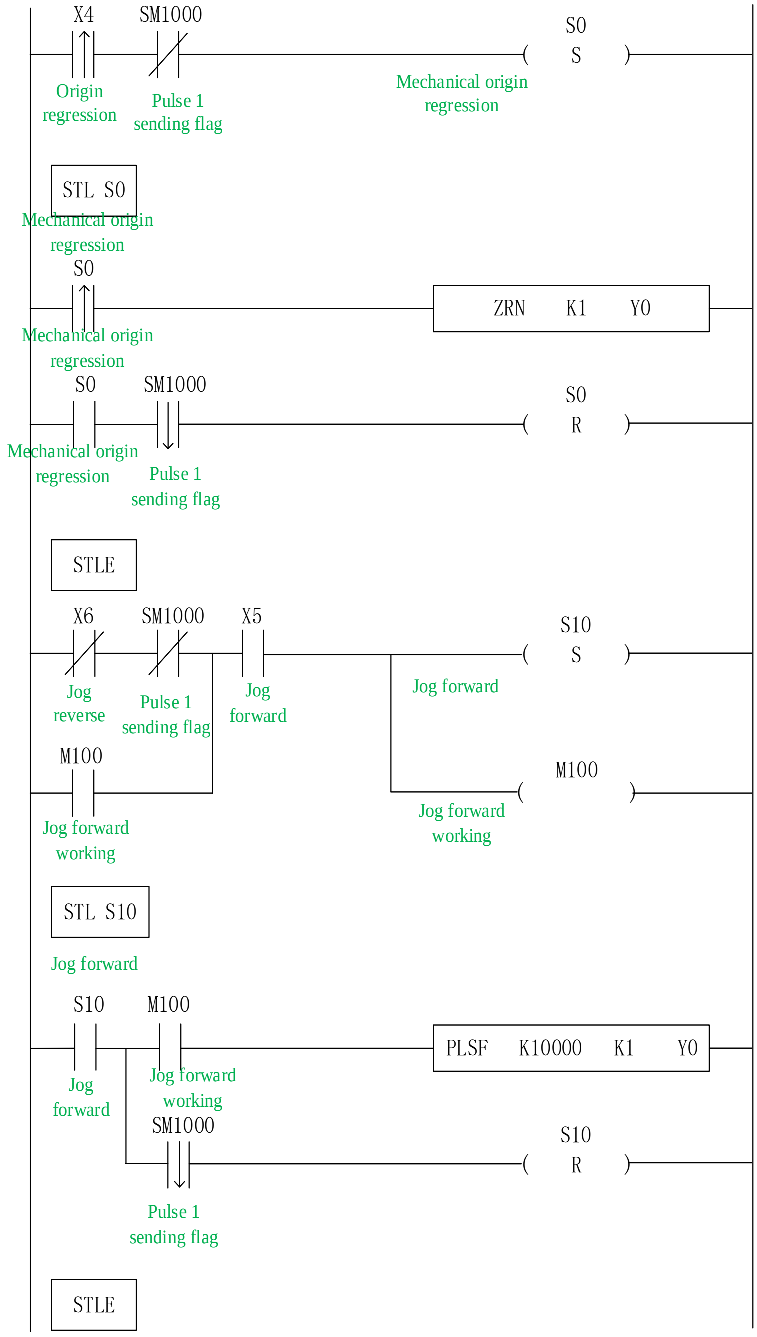
After downloading the program, power off the PLC and then re-energize it.
Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

## 1-5-5. Forward reverse multi-segment process program【PLSF, PLSR, ZRN】

**Example 1: According to the following figure, multi-segment absolute positioning is used.**

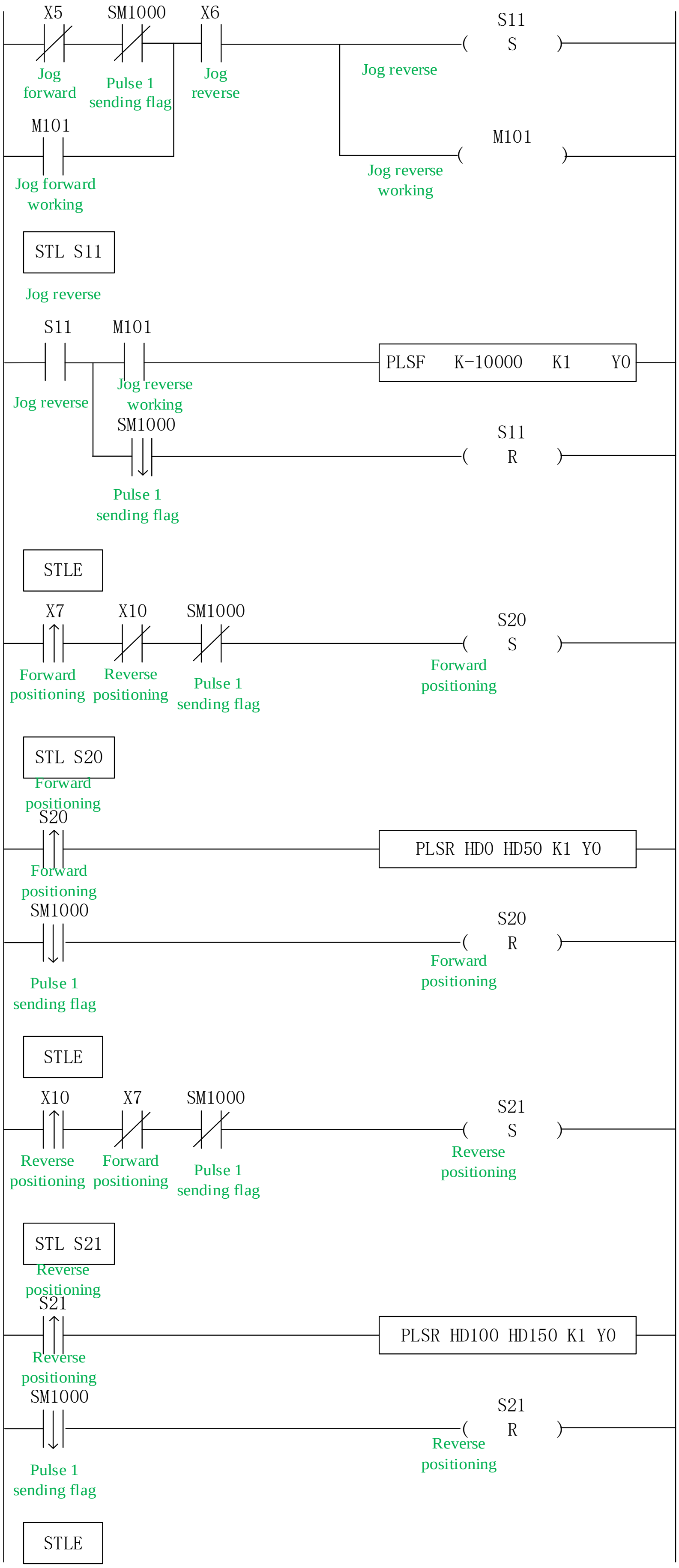



Firstly, make the ladder chart as follows:




//mechanical origin regression (use group 1 parameters)

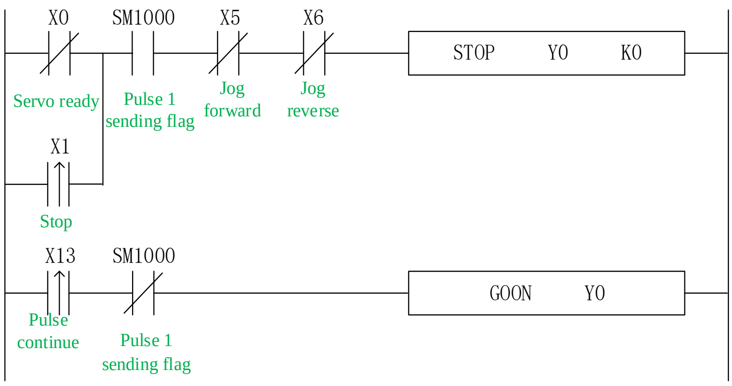
//jog forward control (use group 1 parameters)




//jog reverse control (use group 1 parameters)

//forward positioning control (use group 1 parameters)

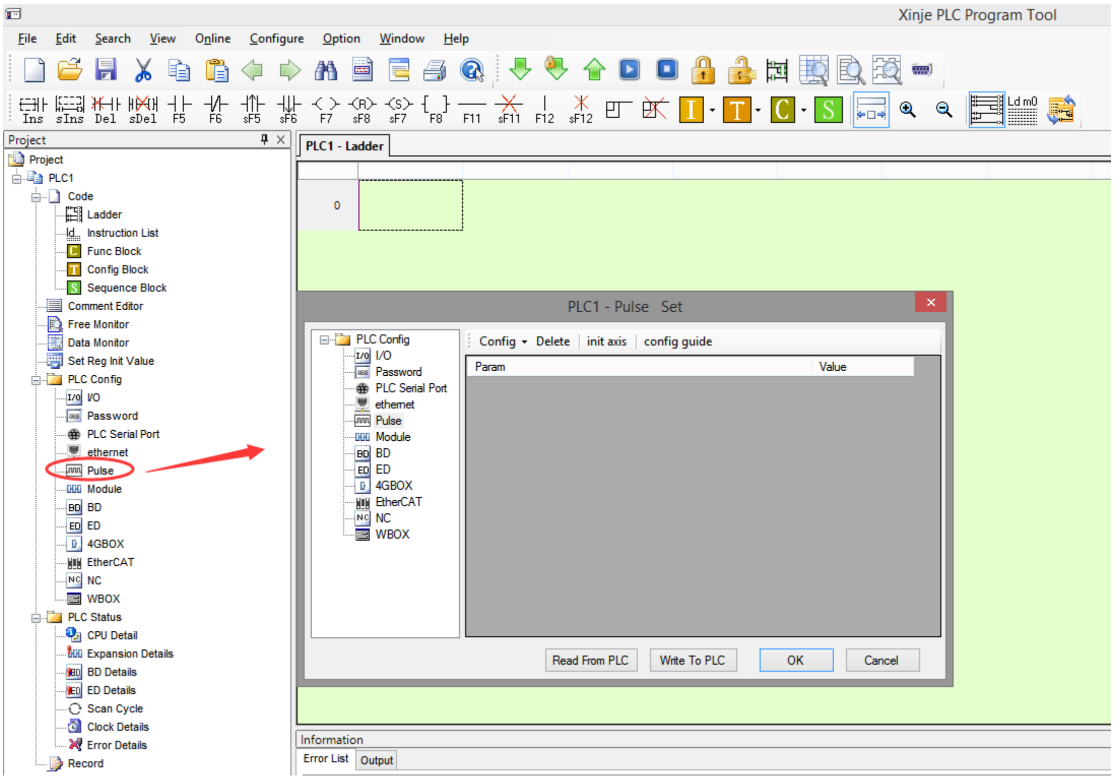
//reverse positioning control (use group 1 parameters)



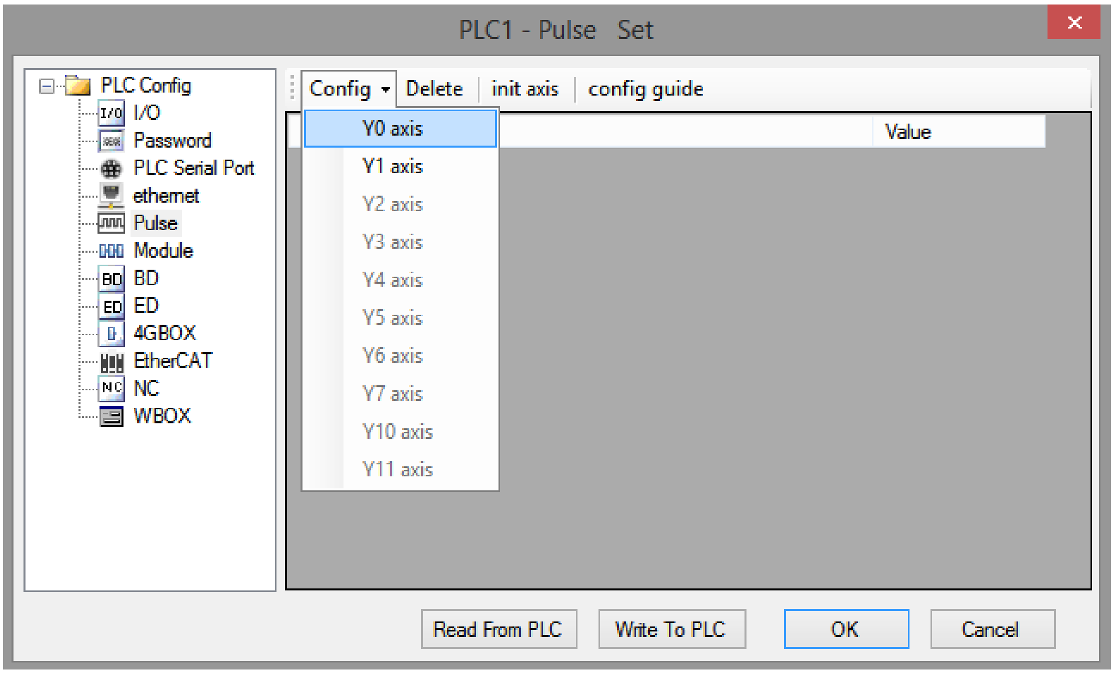

//stop pulse sending (slow stop)

// If the pulse has not been sent out, the execution pulse will continue to send out the remaining pulse.

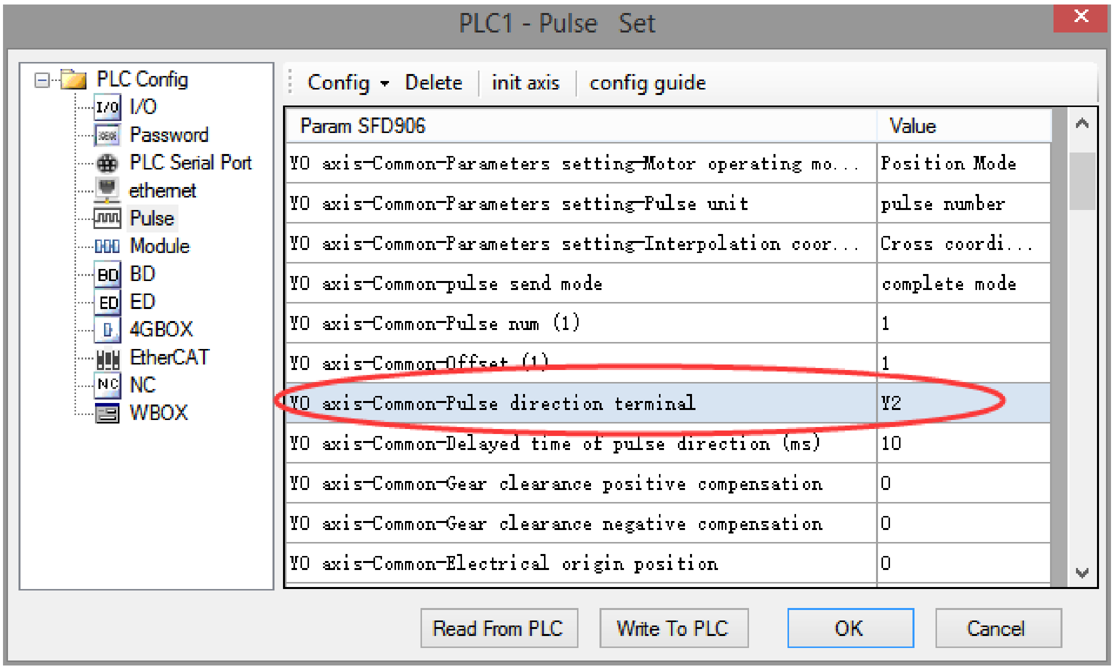
In the sample program, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

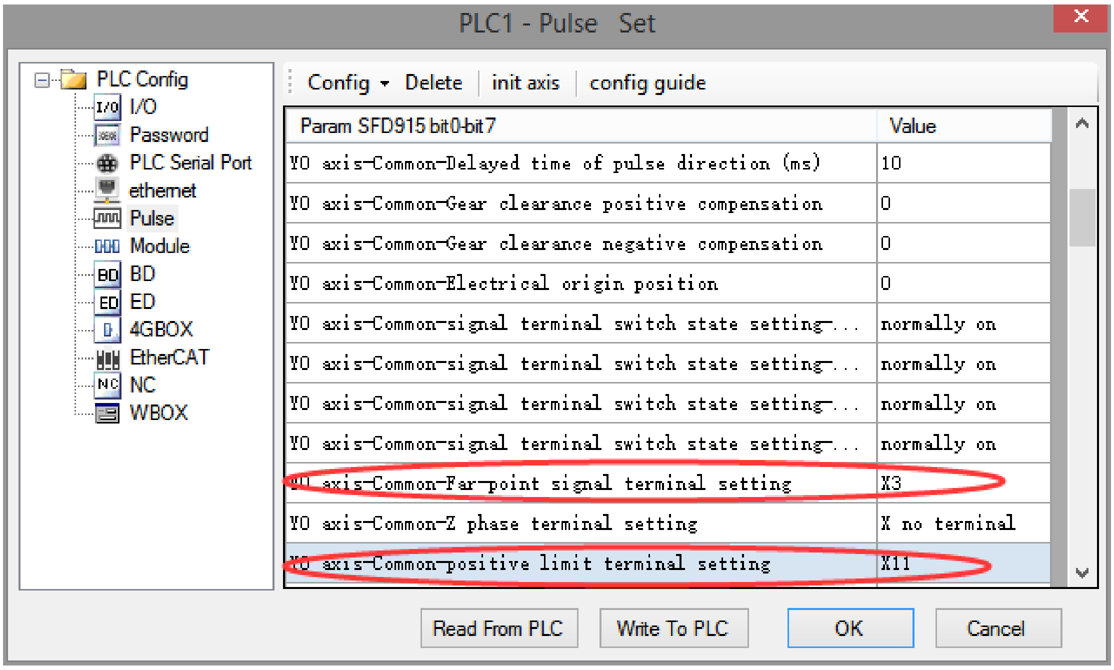


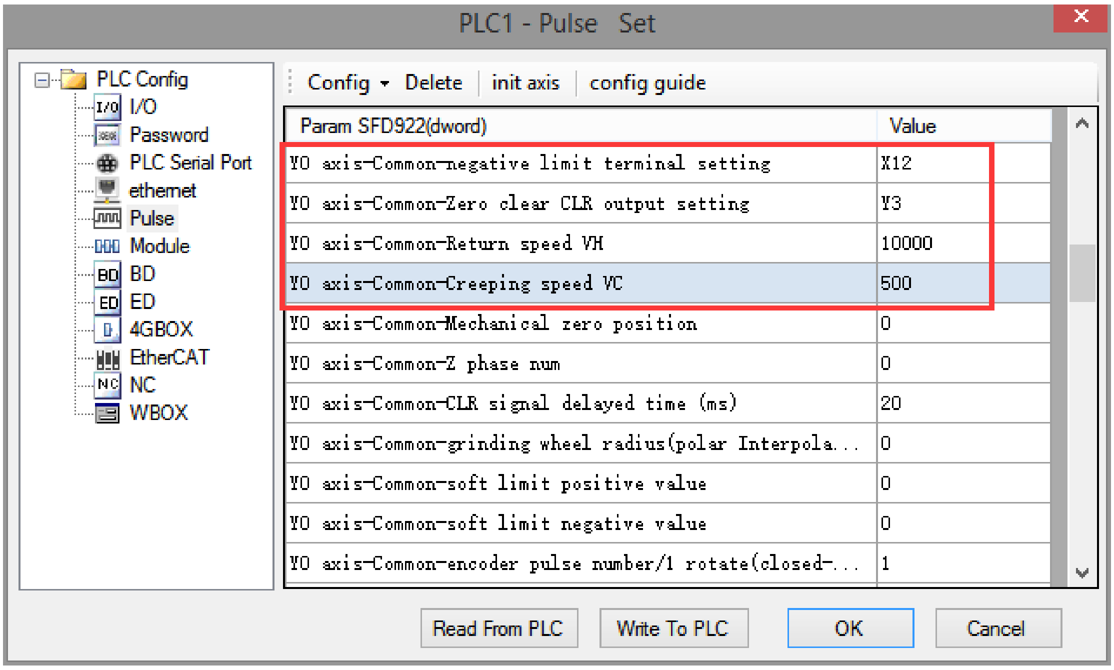

Click config, then select Y0 axis.

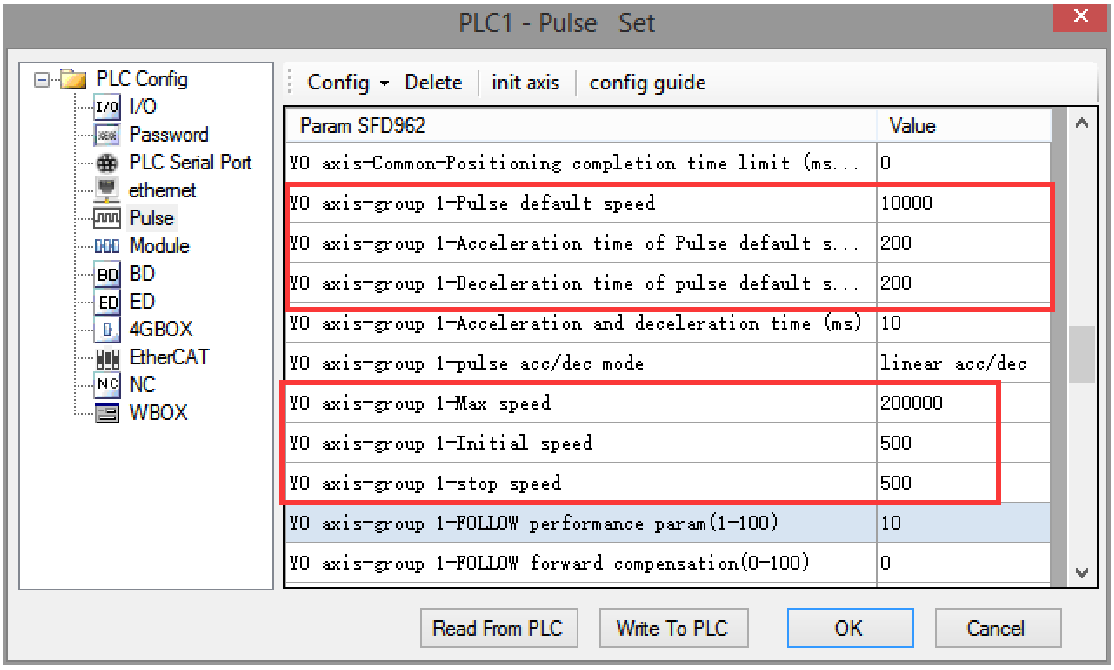



In the parameter configuration table, configure as follows (circled parameters need to be modified):



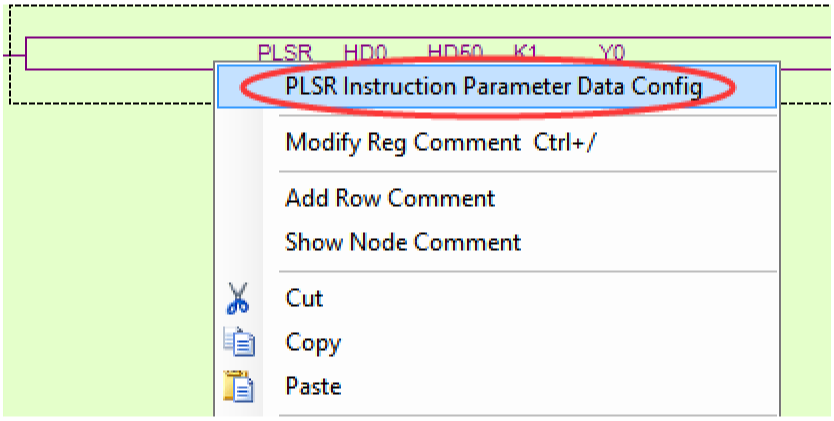

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD922(dword)
Value
Y0 axis-Common-negative limit terminal setting
X12
Y0 axis-Common-Zero clear CLR output setting
Y3
Y0 axis-Common-Return speed VH
10000
Y0 axis-Common-Creeping speed VC
500
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Y0 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel

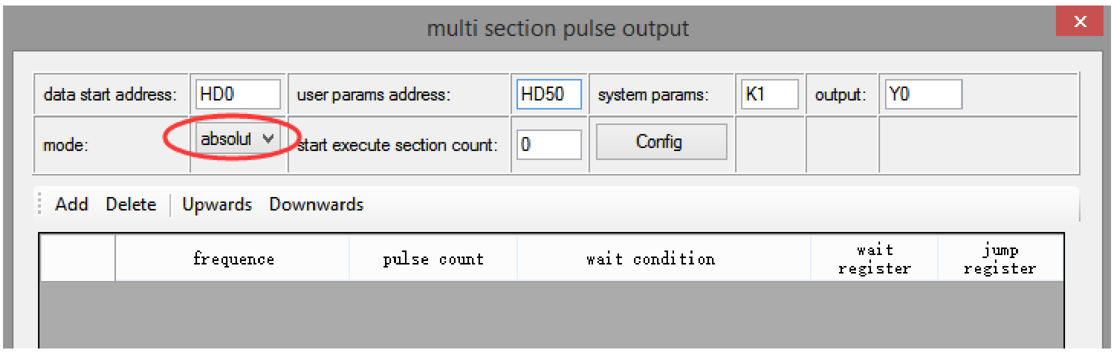



After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

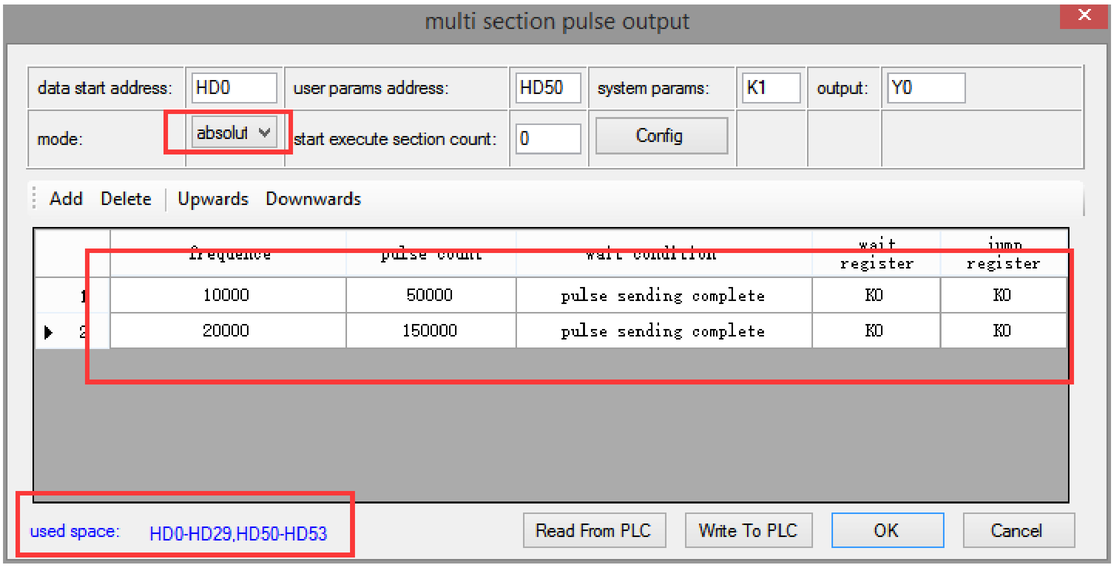
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:

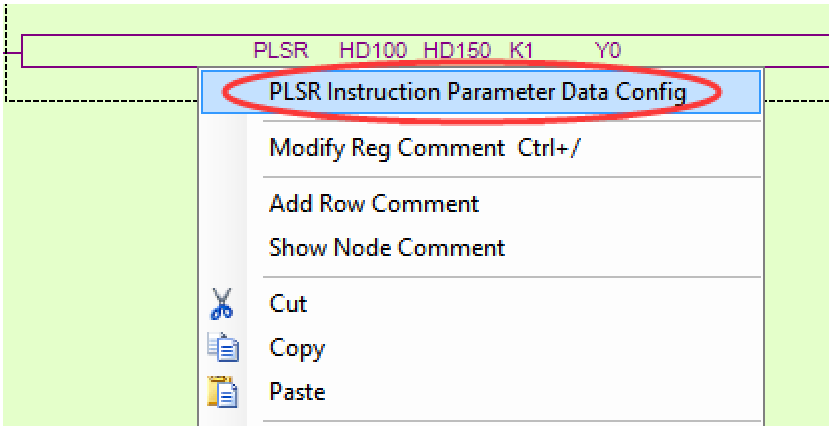


After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

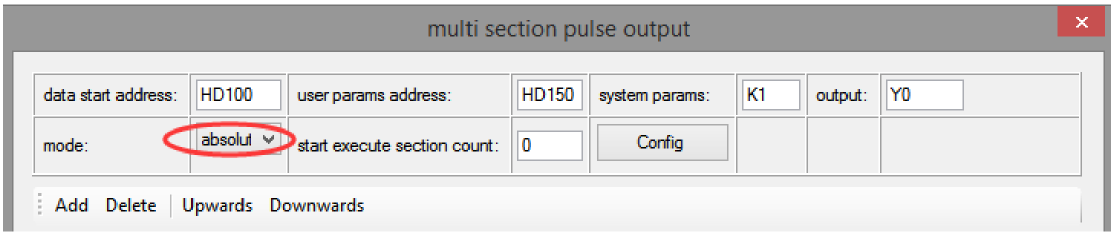



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

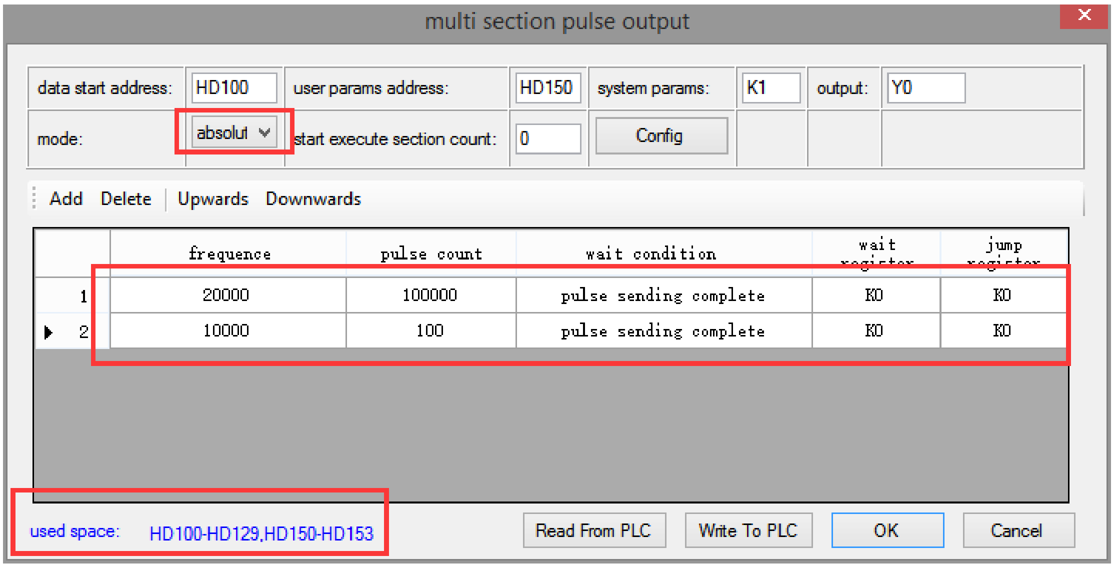
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

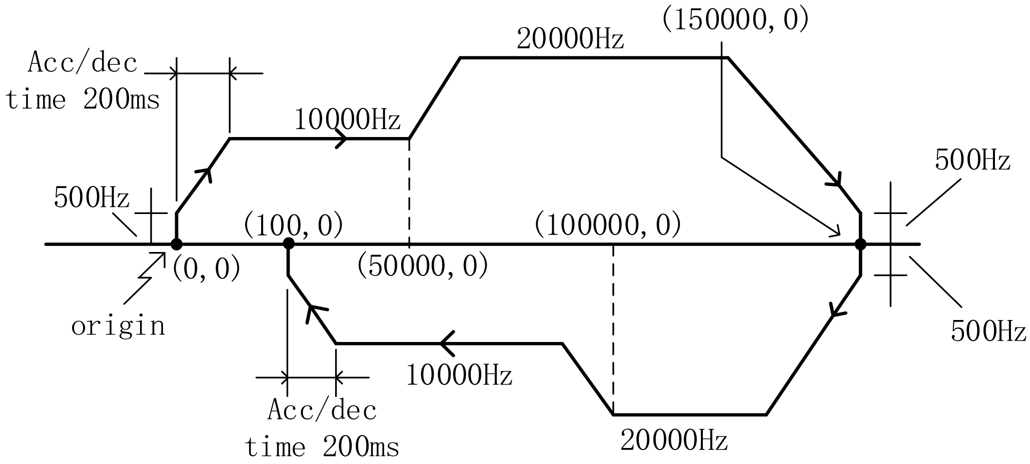



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

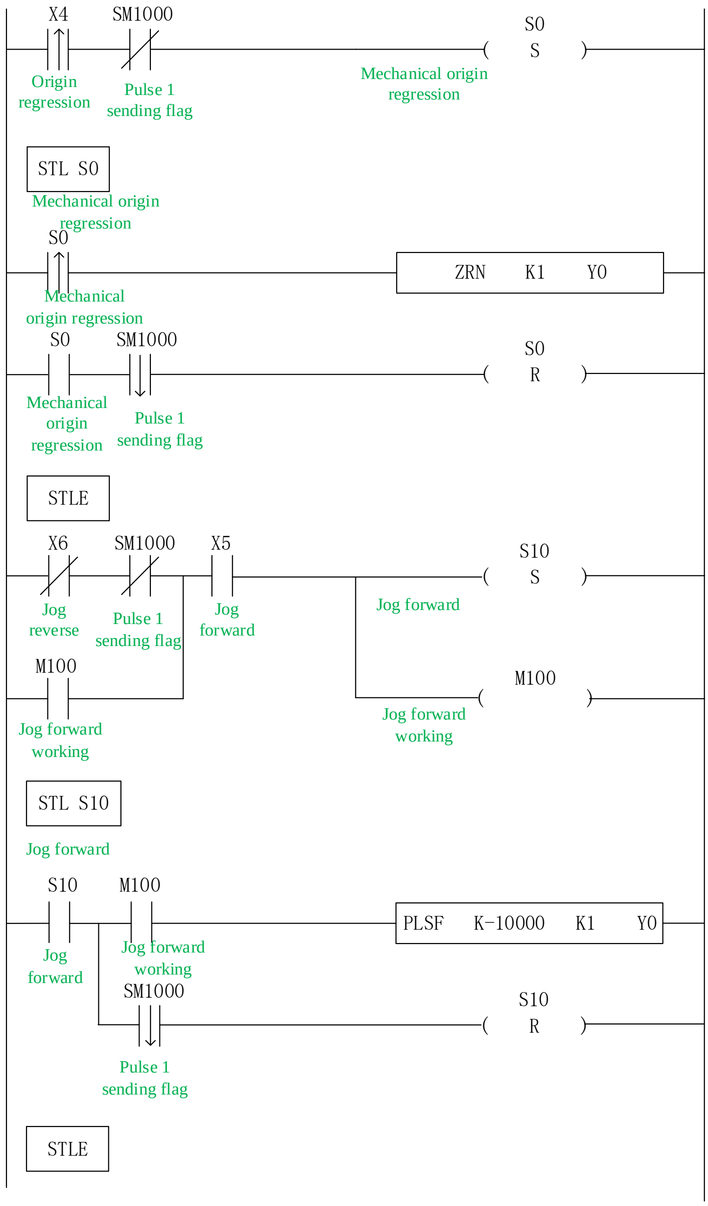
After downloading the program, power off the PLC and then re-energize it.

Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

**Example 2: According to the following figure, multi-segment absolute positioning mode is adopted.**

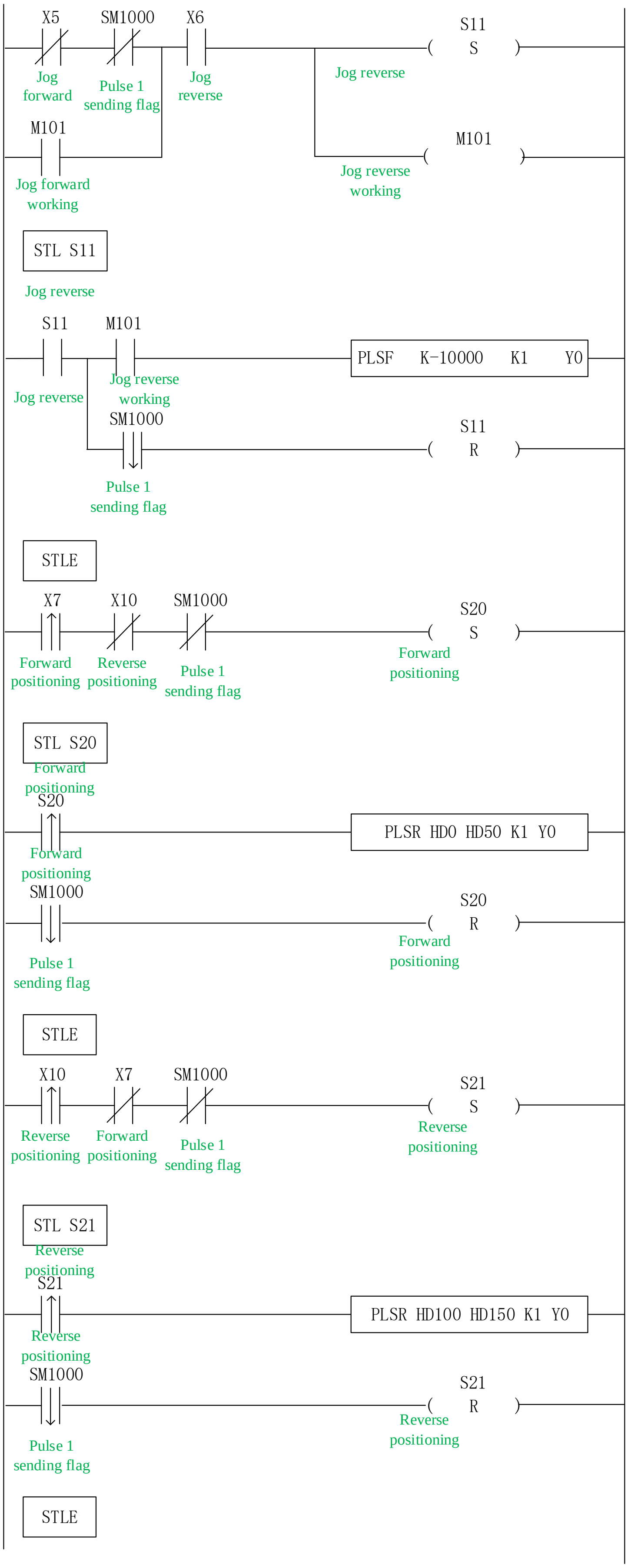



Firstly, make the ladder chart as follows:




//mechanical origin regression (use group 1 parameters)

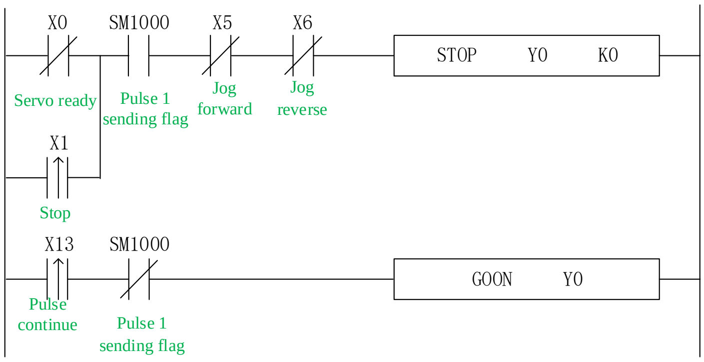
//jog forward control (use group 1 parameters)




//jog reverse control (use group 1 parameters)

//forward positioning control (use group 1 parameters)

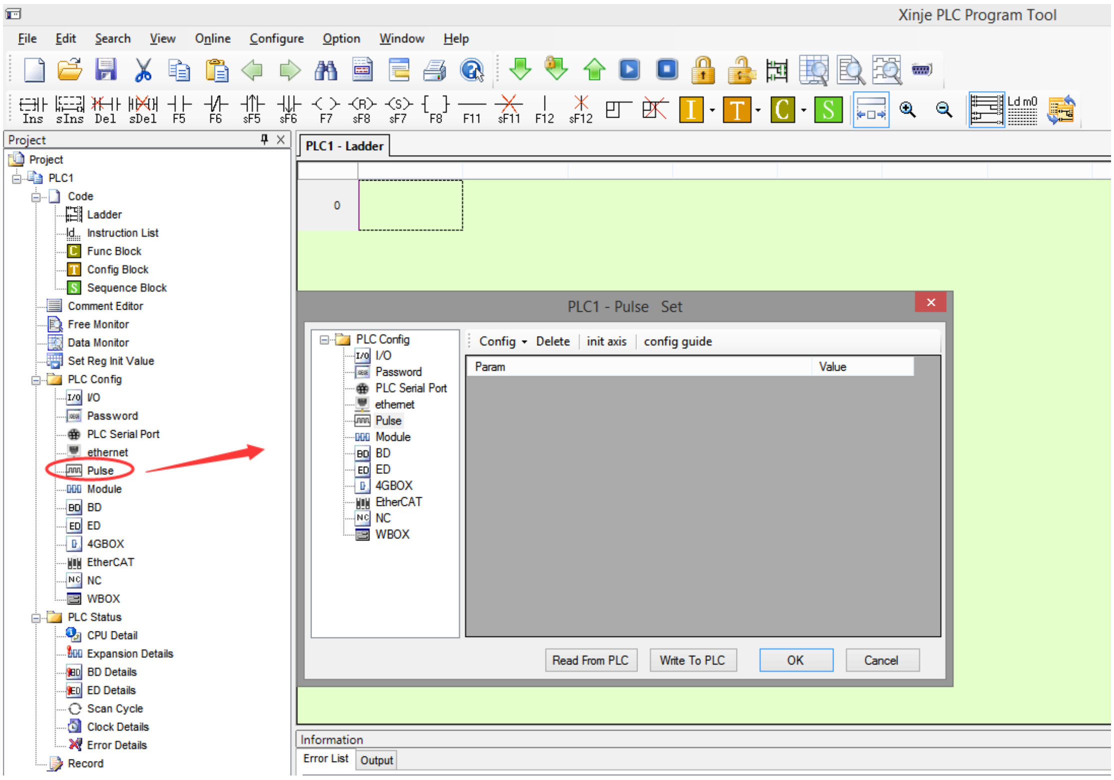
//reverse positioning control (use group 1 parameters)



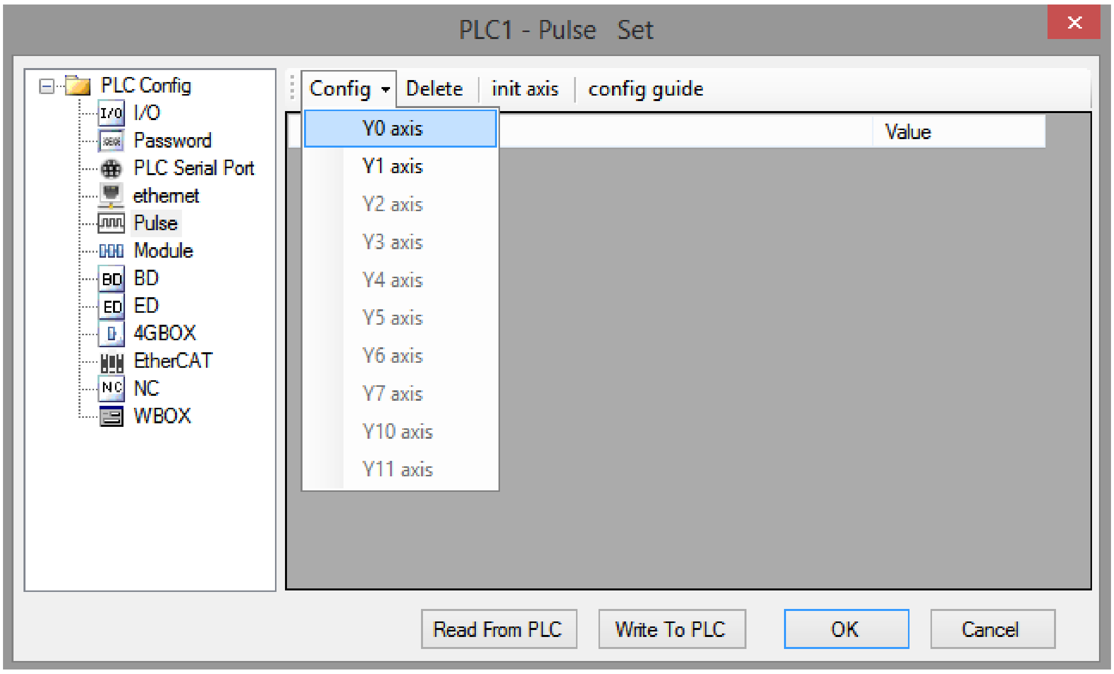

//stop pulse sending (slow stop)

// If the pulse has not been sent out, the execution pulse will continue to send out the remaining pulse.

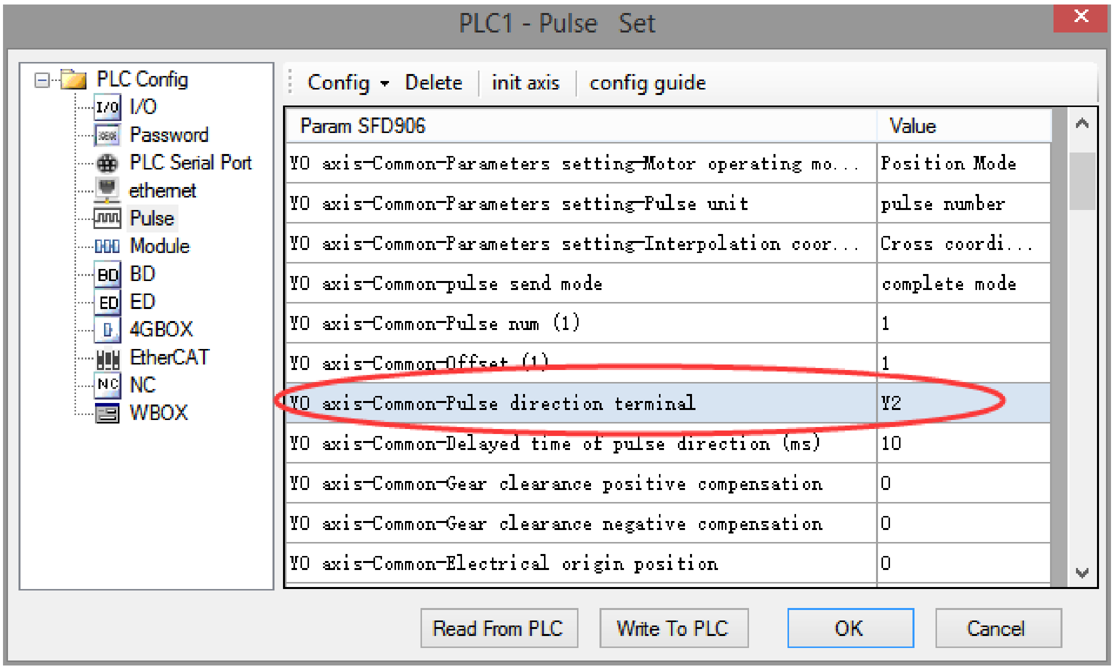
In the sample program, all the system parameters used in the pulse instructions are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

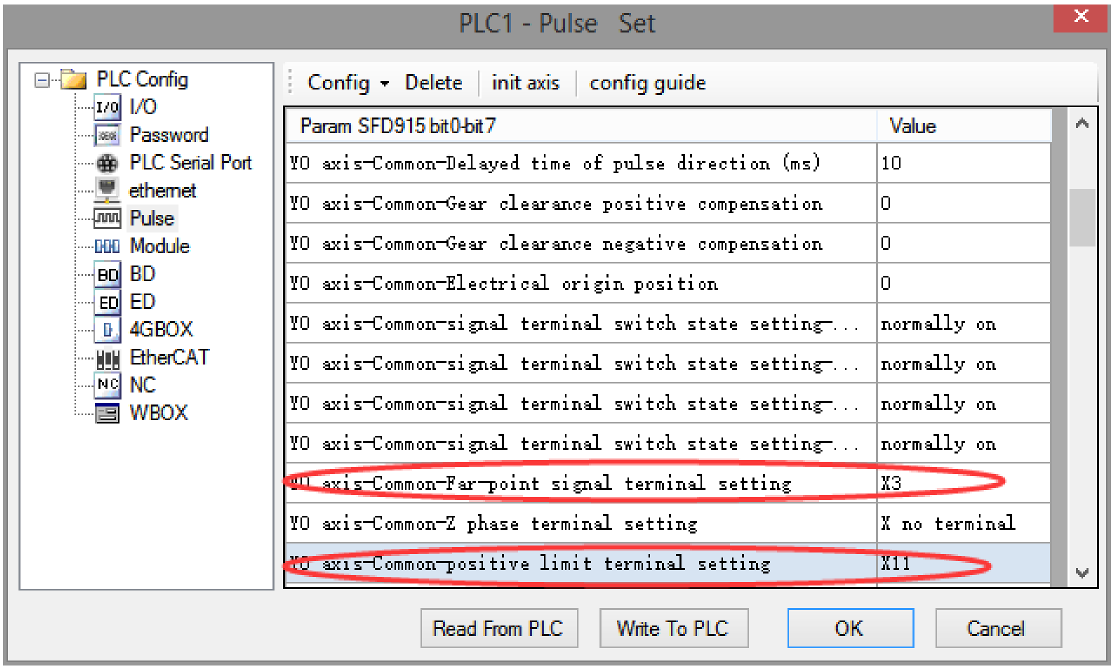


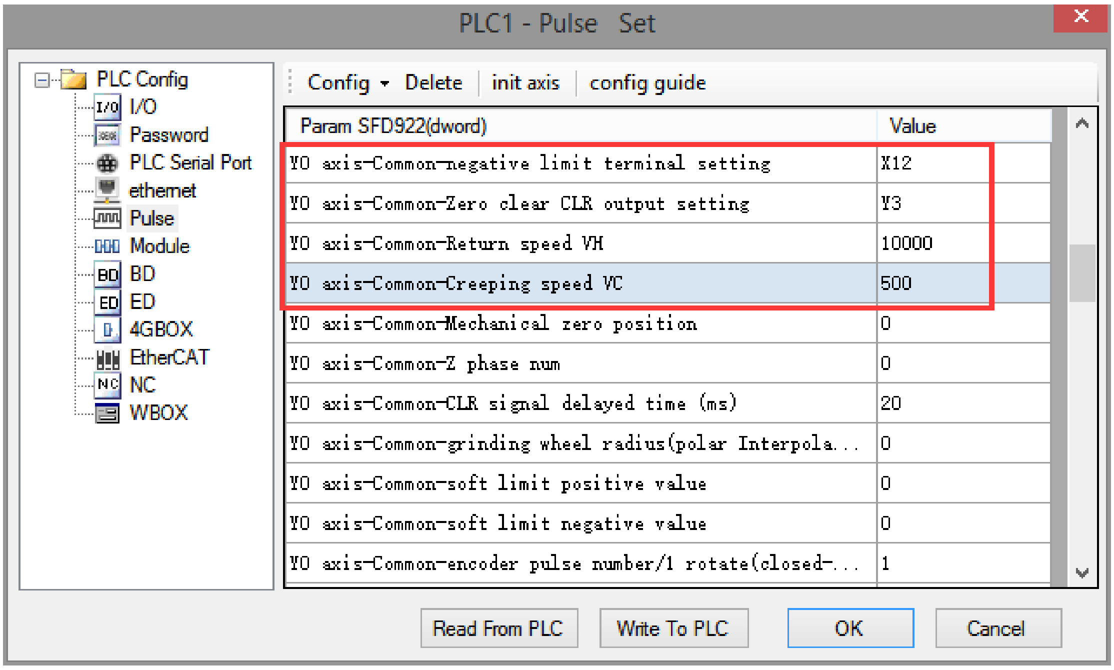

Click config, then select Y0 axis.

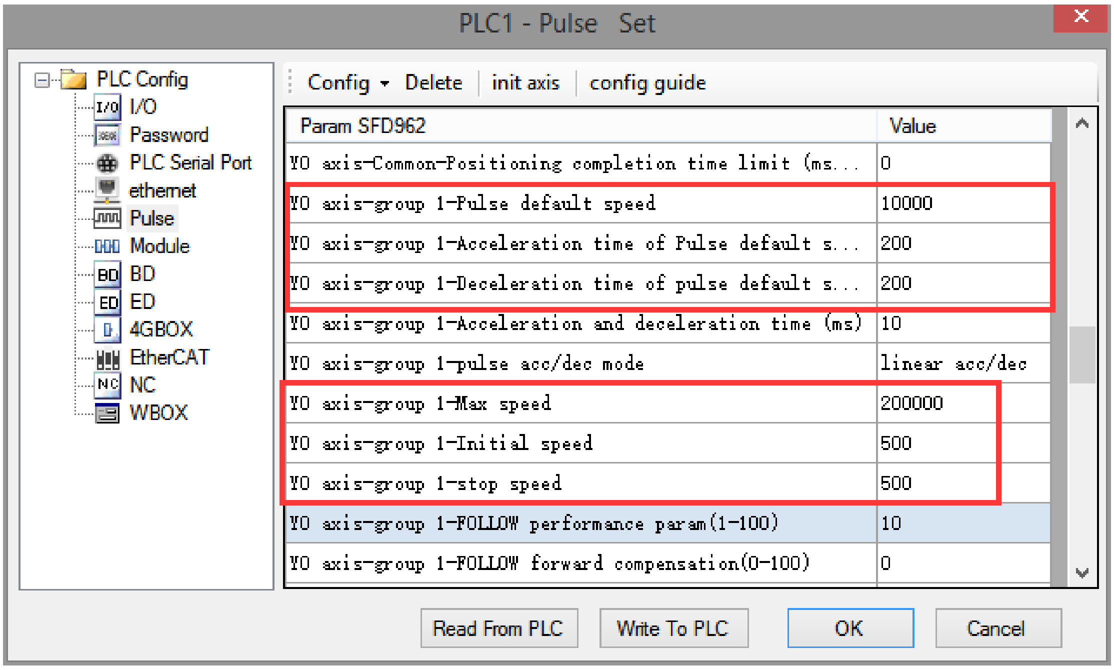



In the parameter configuration table, configure as follows (circled parameters need to be modified):



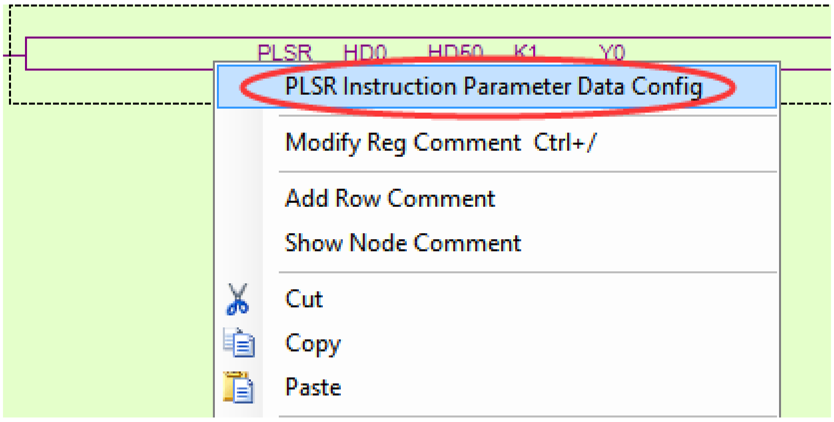

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD922(dword)
Value
Y0 axis-Common-negative limit terminal setting
X12
Y0 axis-Common-Zero clear CLR output setting
Y3
Y0 axis-Common-Return speed VH
10000
Y0 axis-Common-Creeping speed VC
500
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Y0 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel

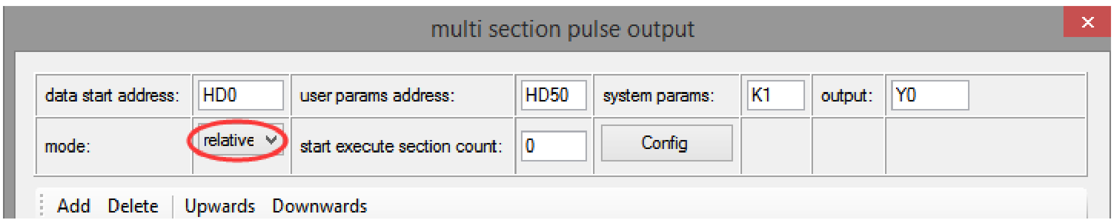



After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

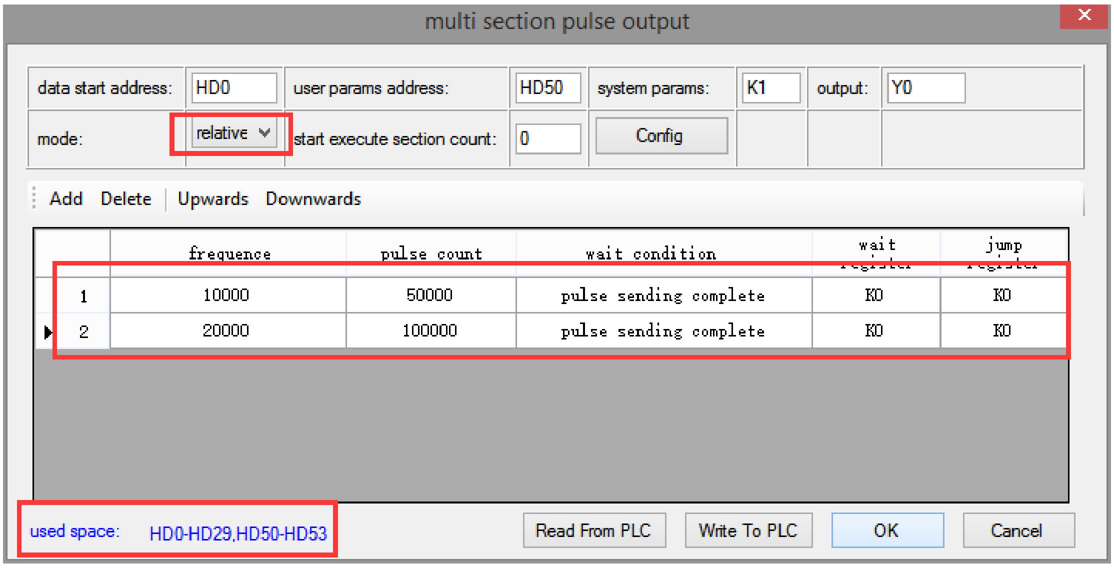
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:

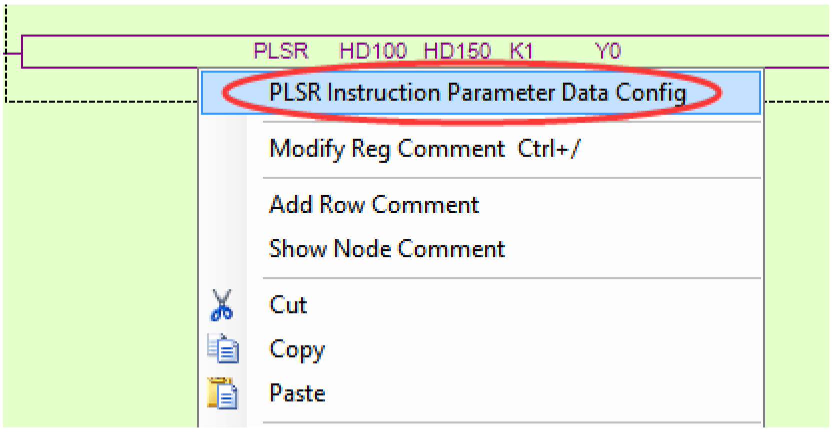



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

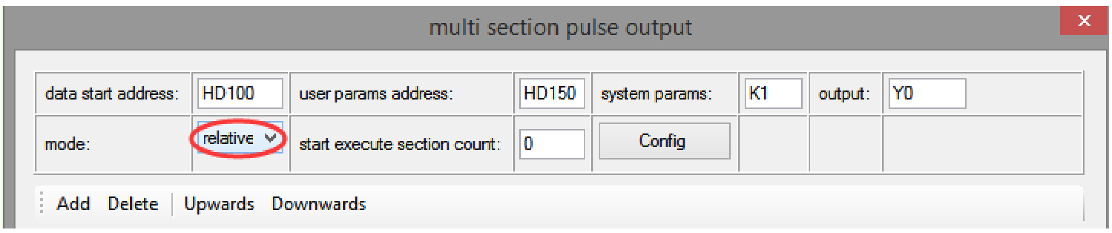



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

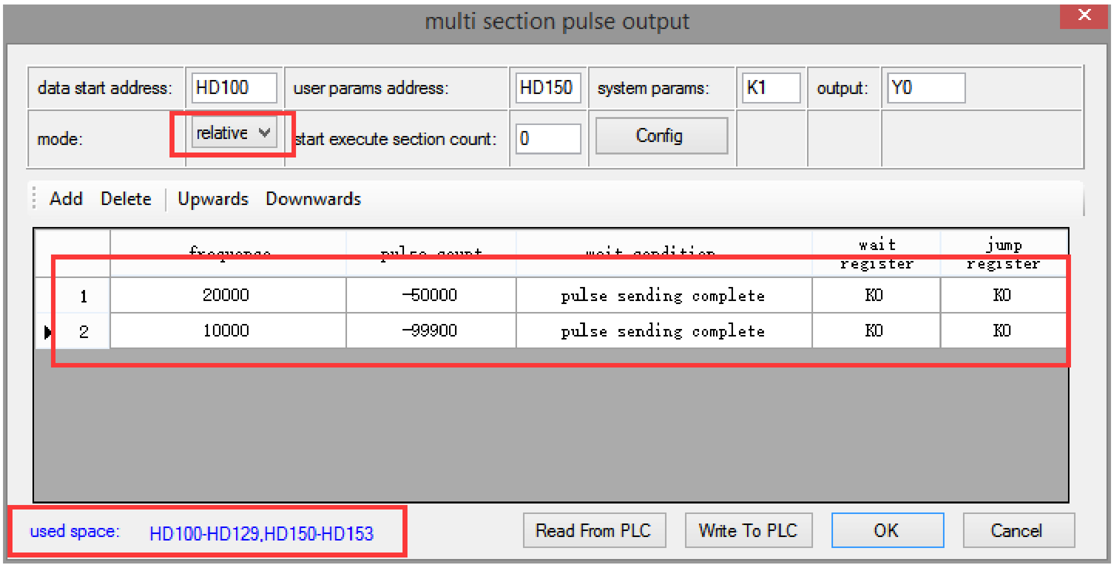
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:




After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of reverse rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:



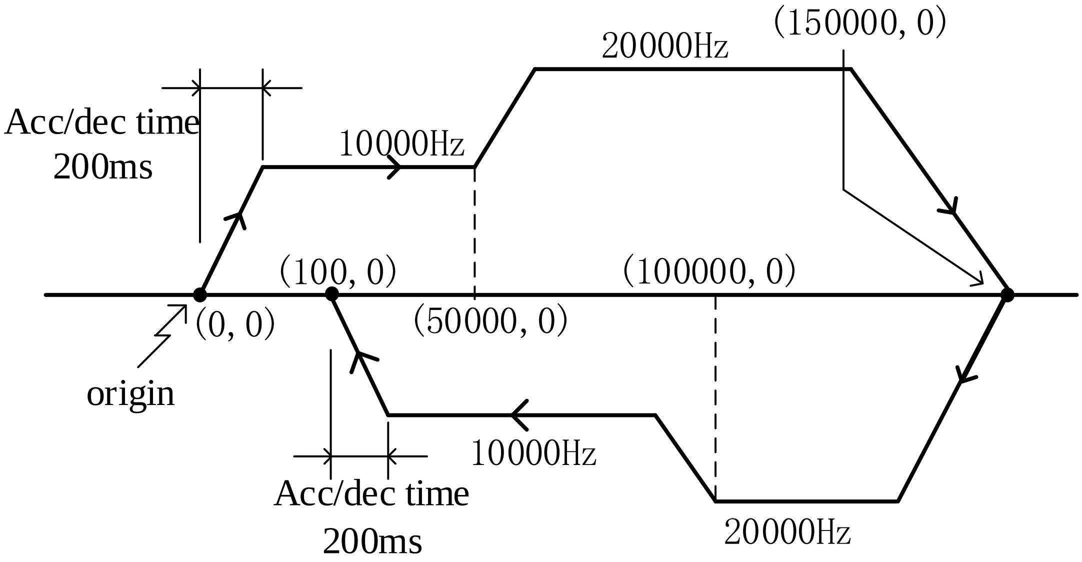

**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

After downloading the program, power off the PLC and then re-energize it.

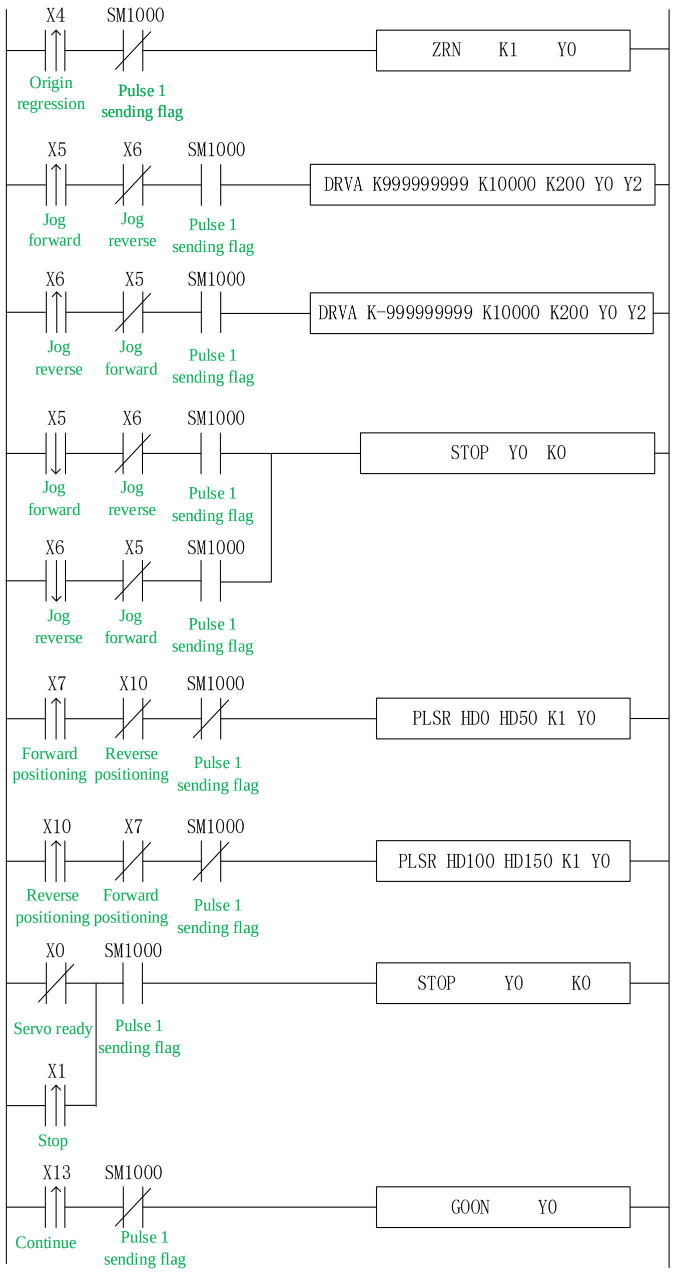
Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

## 1-5-6. Forward reverse rotation mulsti-segment sequential control program 【DRVI, DRVA, PLSR, ZRN】

**Example 1: According to the following figure, multi-segment absolute positioning mode is adopted.**




Firstly, make the ladder chart as follows:




//mechanical origin regression (use group 1 parameters)

//jog forward control, the speed is 10000Hz

//jog reverse control, the speed is -10000Hz

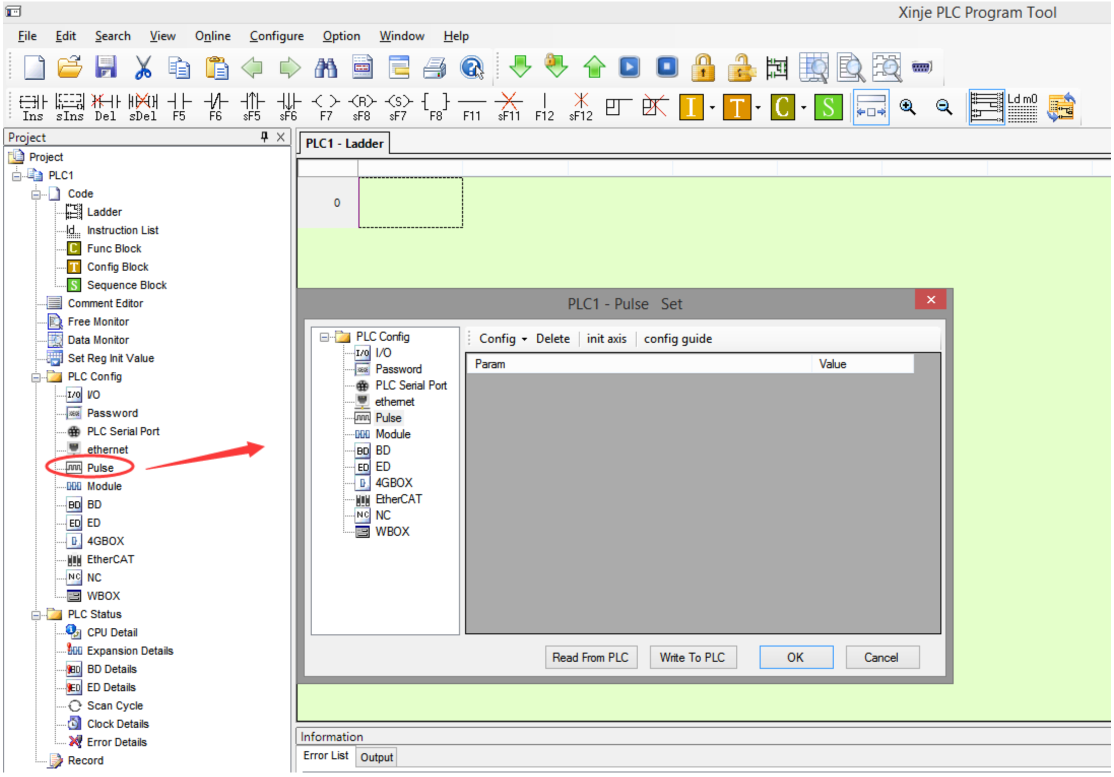
//forward positioning control (use group 1 parameters)

//reverse positioning control (use group 1 parameters)

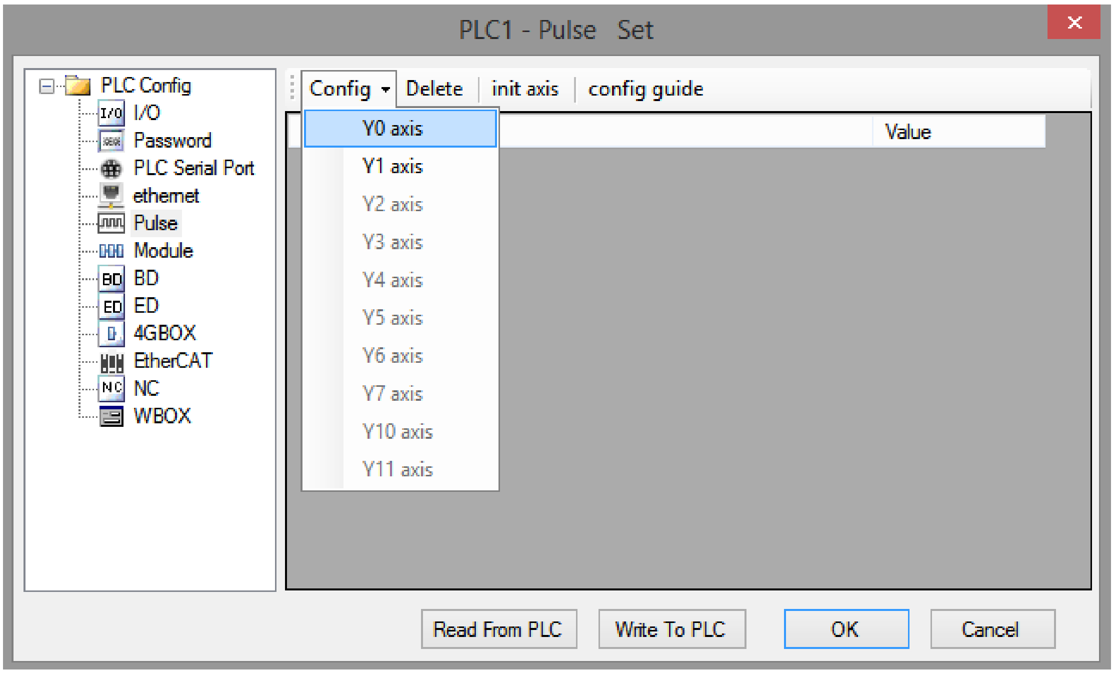
// pulse stop sending (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

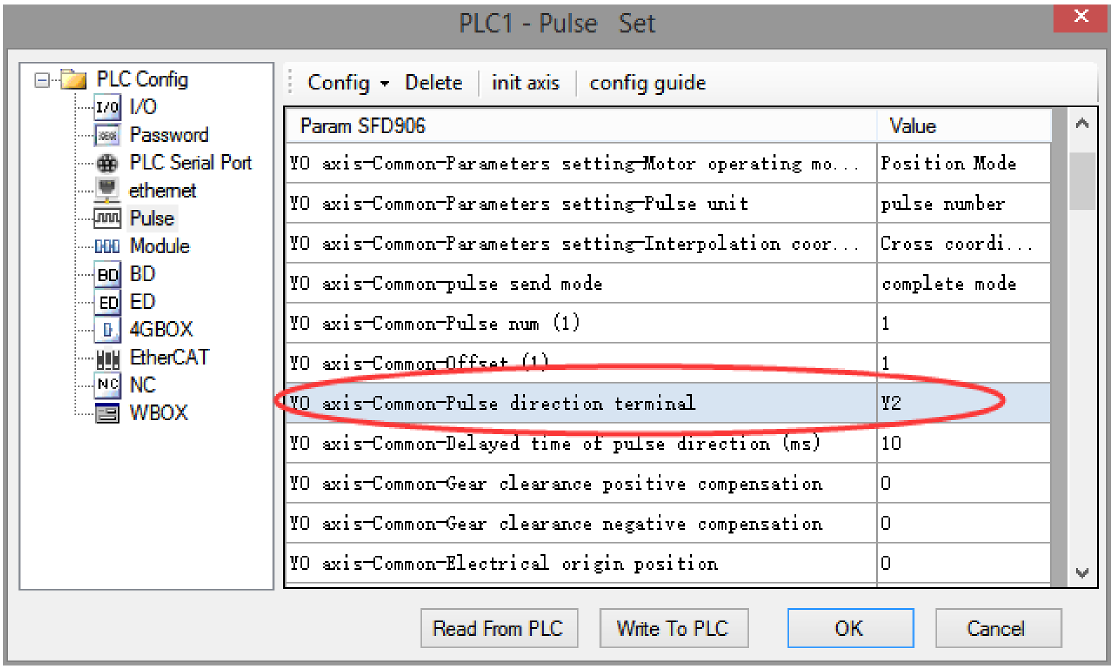
In the sample program, all the system parameters used in the pulse instructions (except DRVA, DRVI) are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

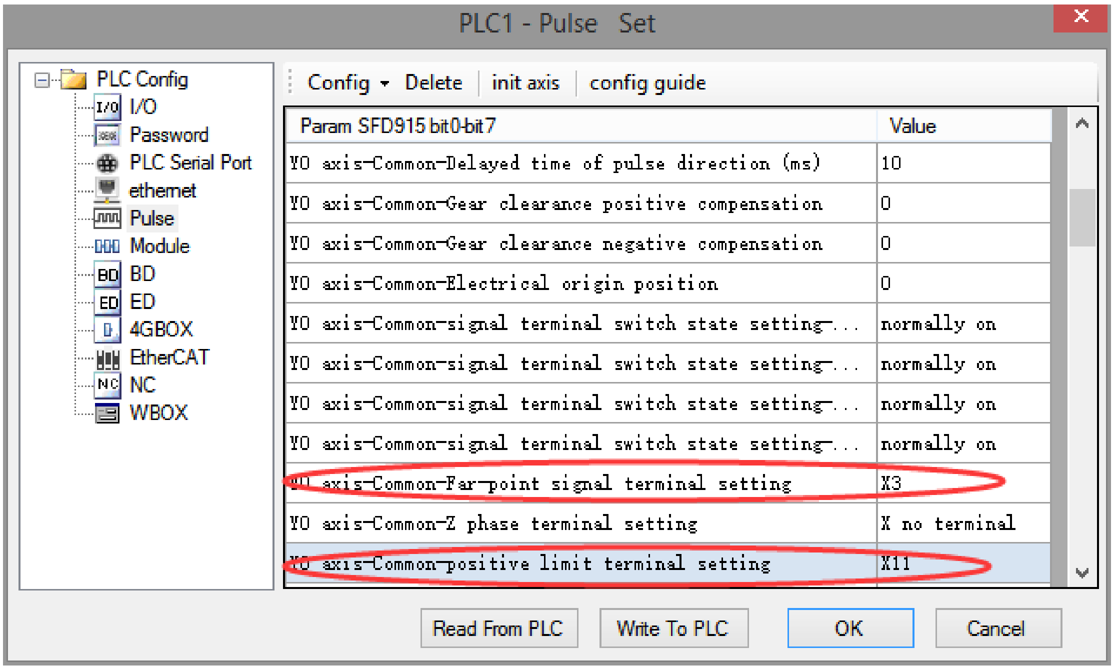


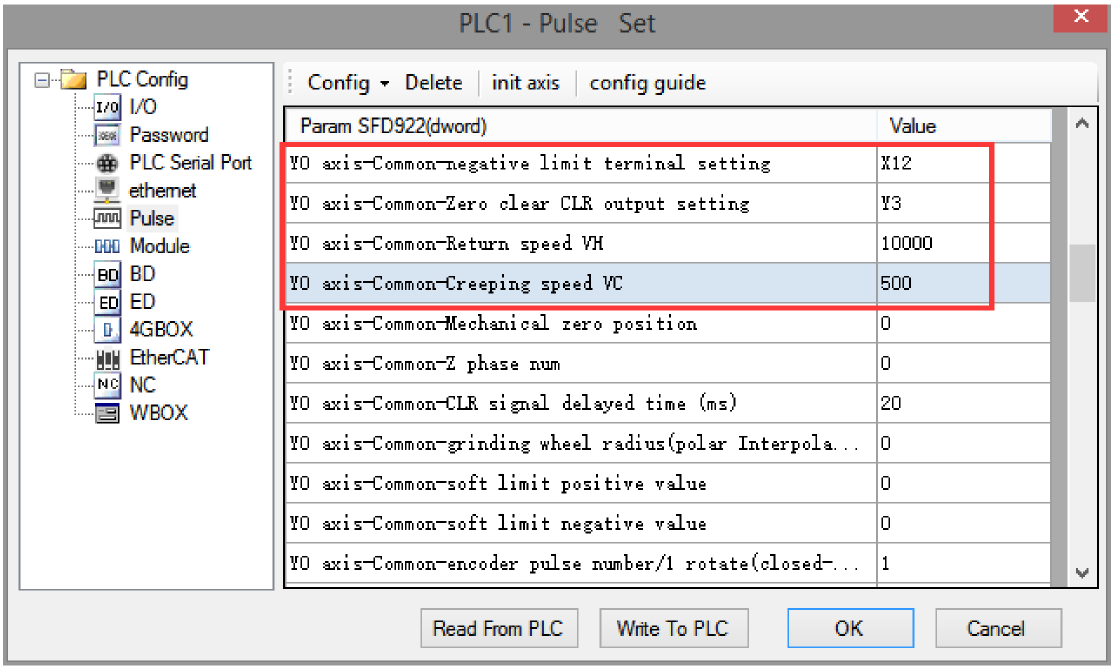

Click config, then select Y0 axis.

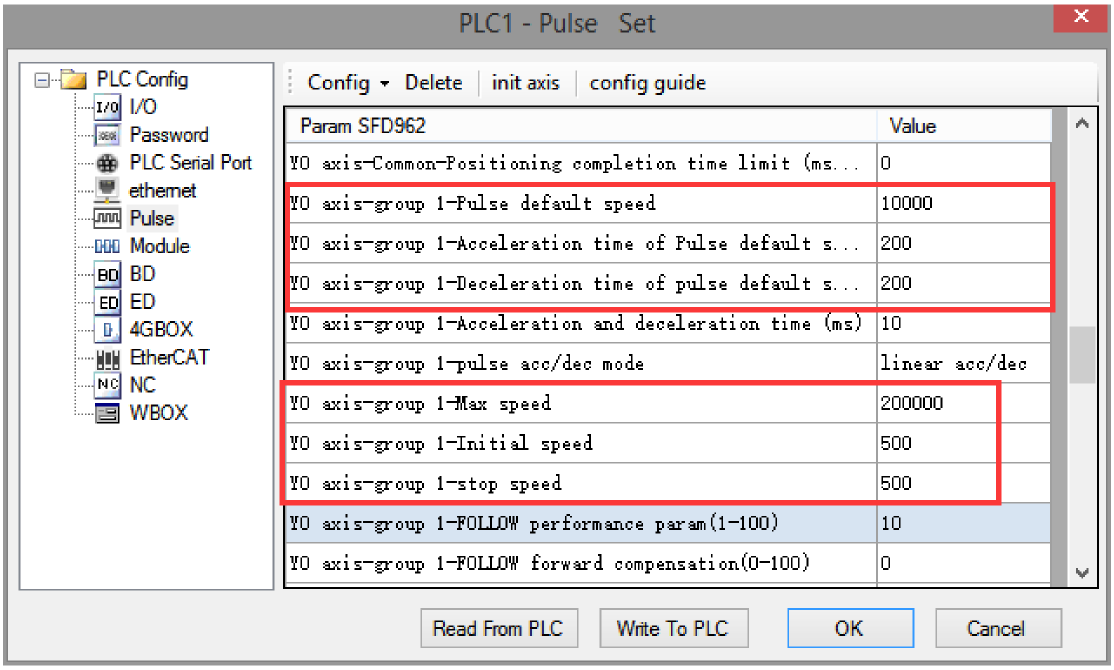



In the parameter configuration table, configure as follows (circled parameters need to be modified):


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Parameters setting-Motor operating mo...
Position Mode
Y0 axis-Common-Parameters setting-Pulse unit
pulse number
Y0 axis-Common-Parameters setting-Interpolation coor...
Cross coordi...
Y0 axis-Common-pulse send mode
complete mode
Y0 axis-Common-Pulse num (1)
1
Y0 axis-Common-Offset (1)
1
Y0 axis-Common-Pulse direction terminal
Y2
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Read From PLC
Write To PLC
OK
Cancel

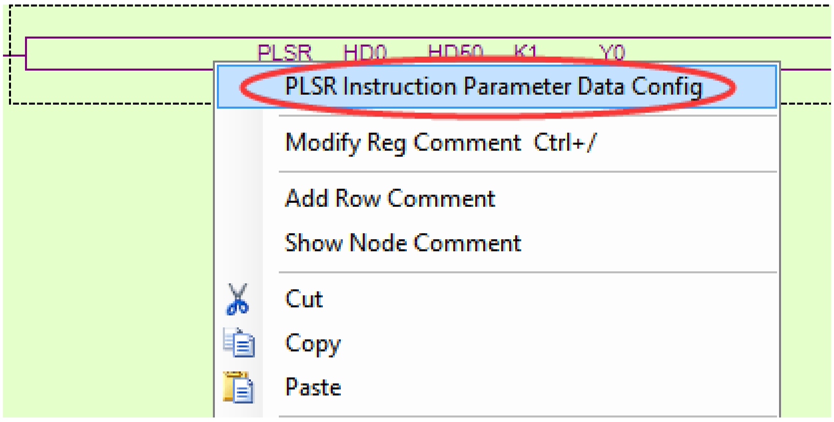

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel



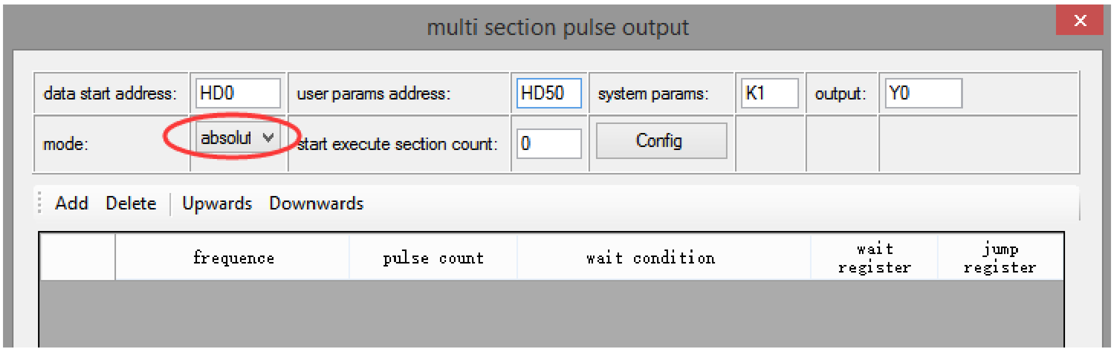




After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

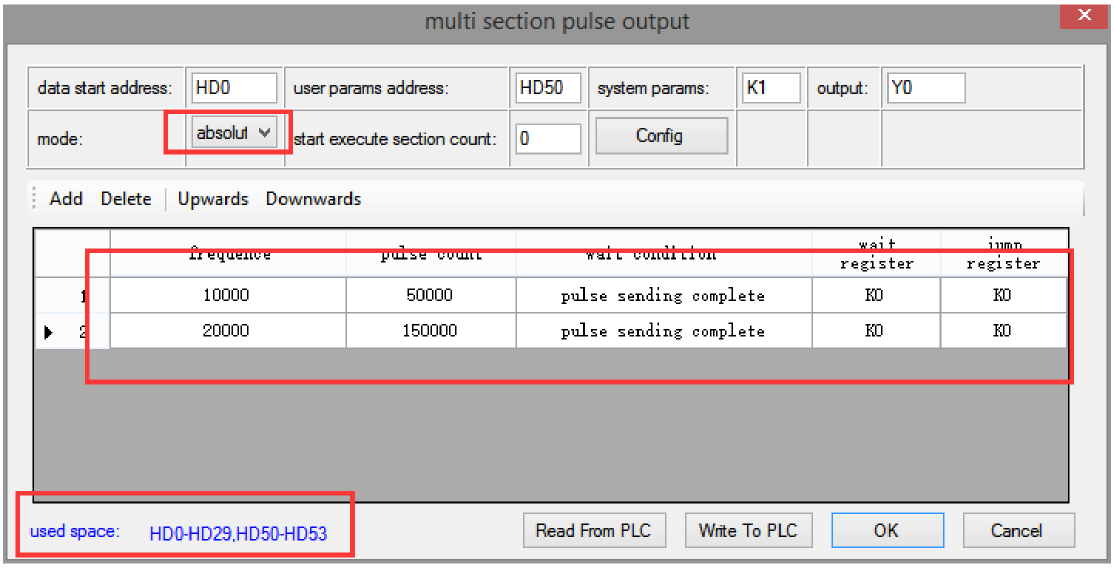
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:

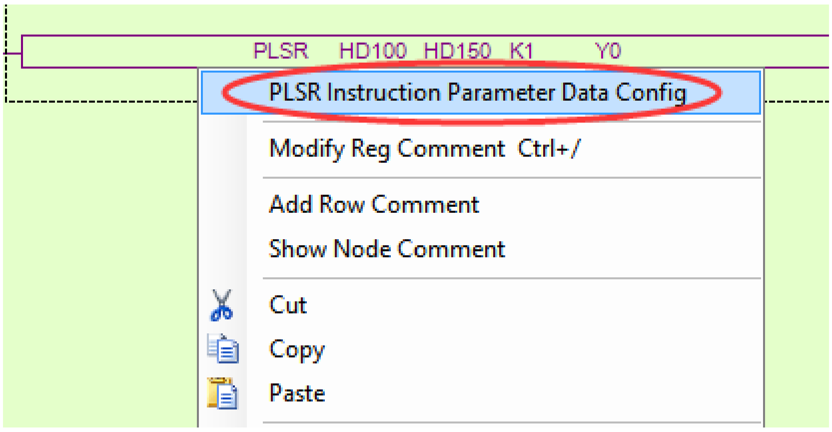



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

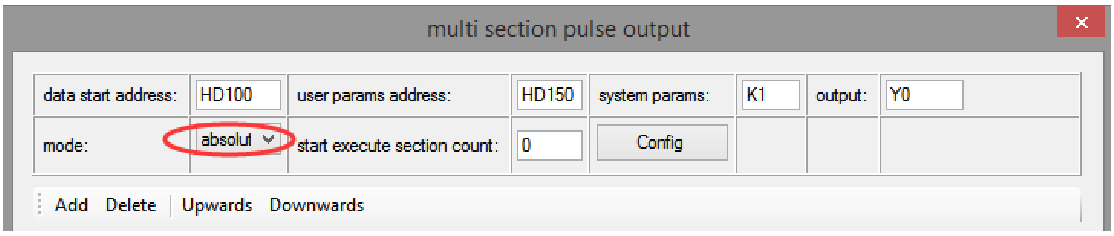



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

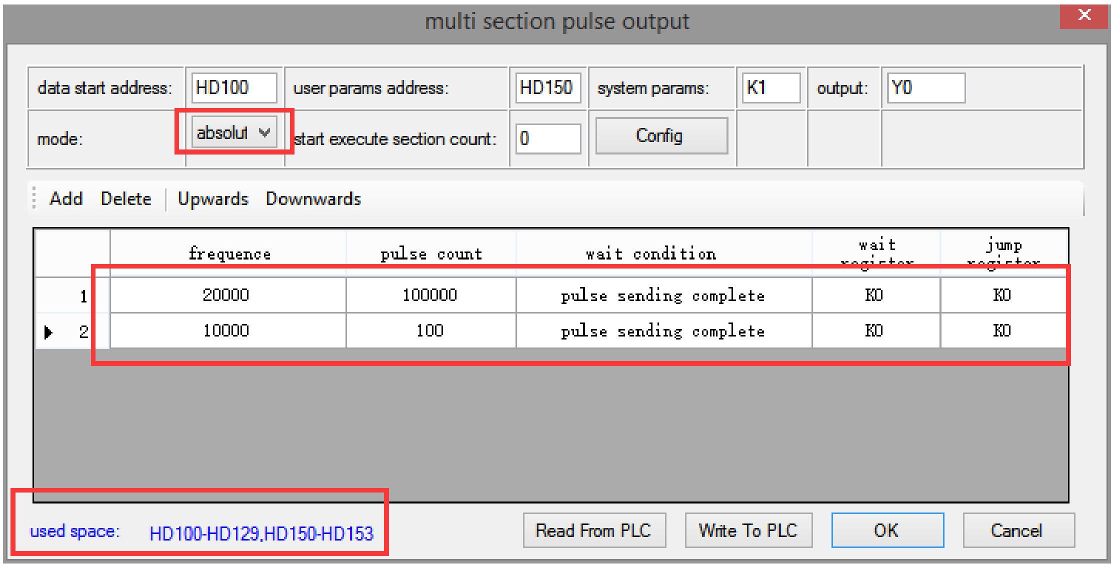
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:



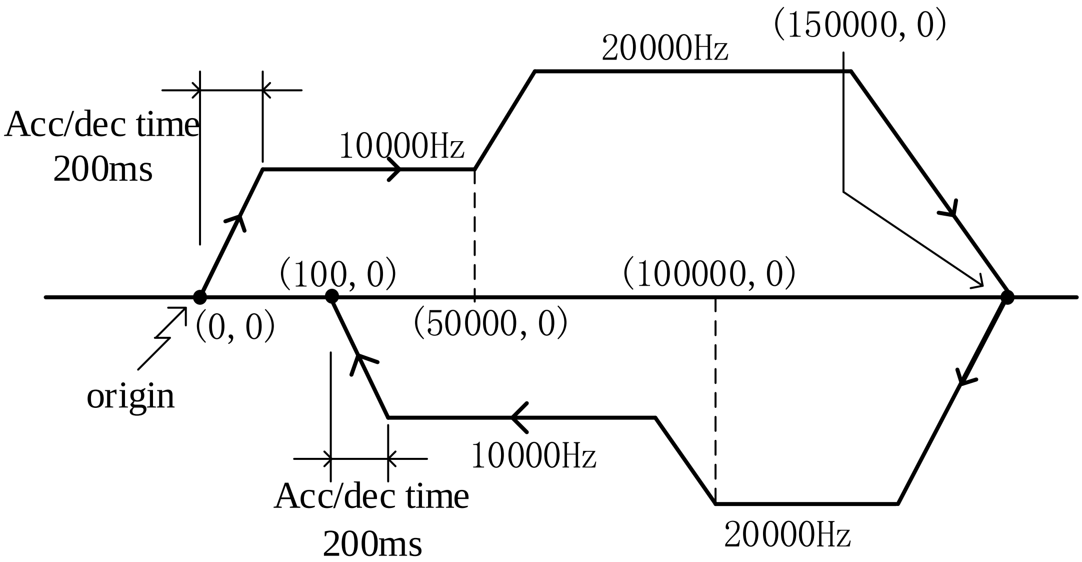

After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:



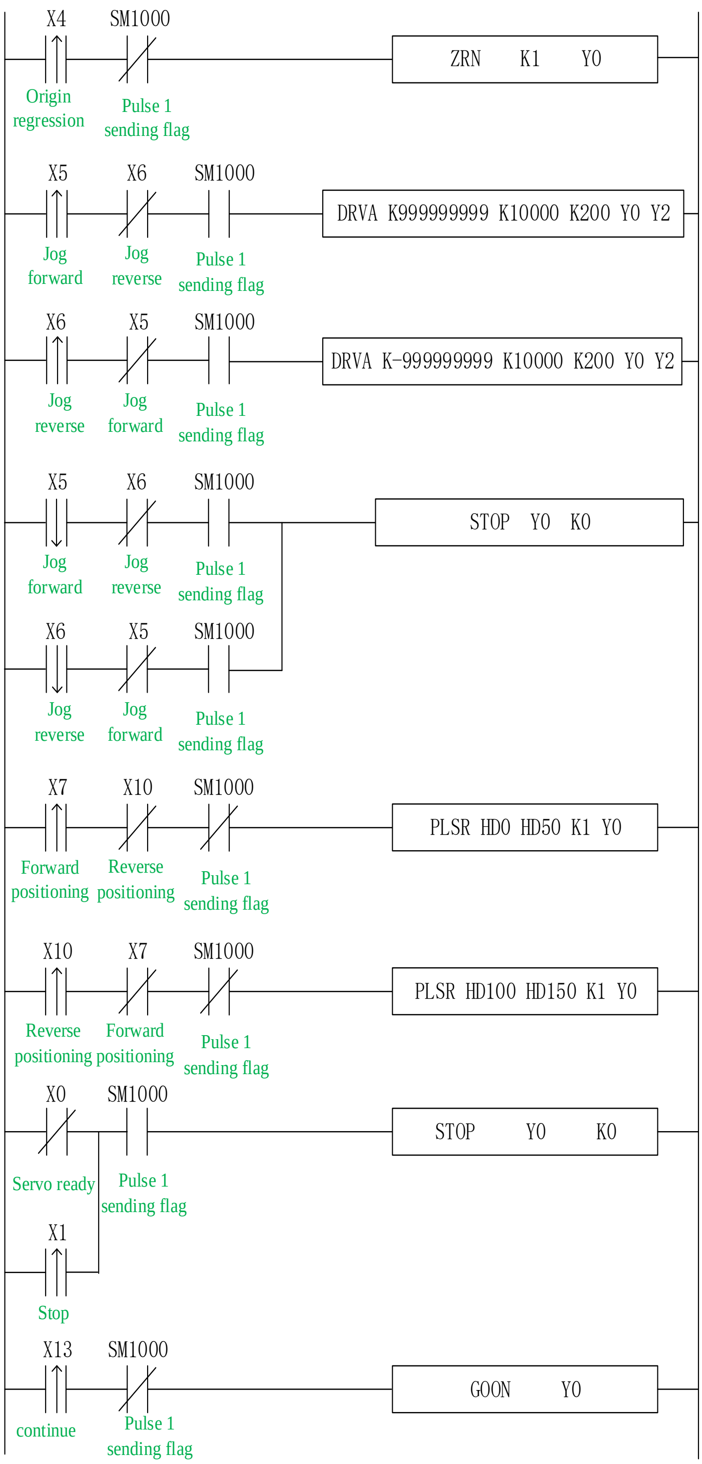

**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

After downloading the program, power off the PLC and then re-energize it.
Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

**Example 2: According to the following figure, the relative multi-segment pulse positioning method is used.**




Firstly, make the ladder chart as the follows:




//mechanical origin regression (use group 1 parameters)

//jog forward control, the speed is 10000Hz

//jog reverse control, the speed is -10000Hz

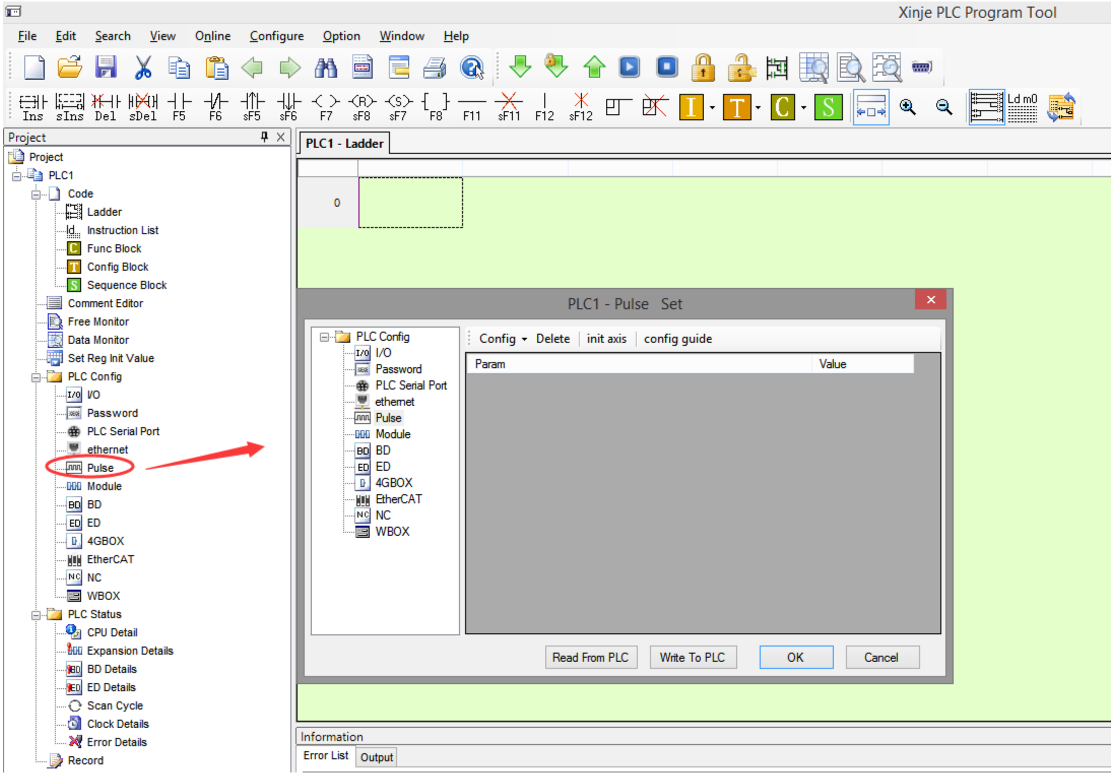
//forward positioning control (use group 1 parameters)

//reverse positioning control (use group 1 parameters)

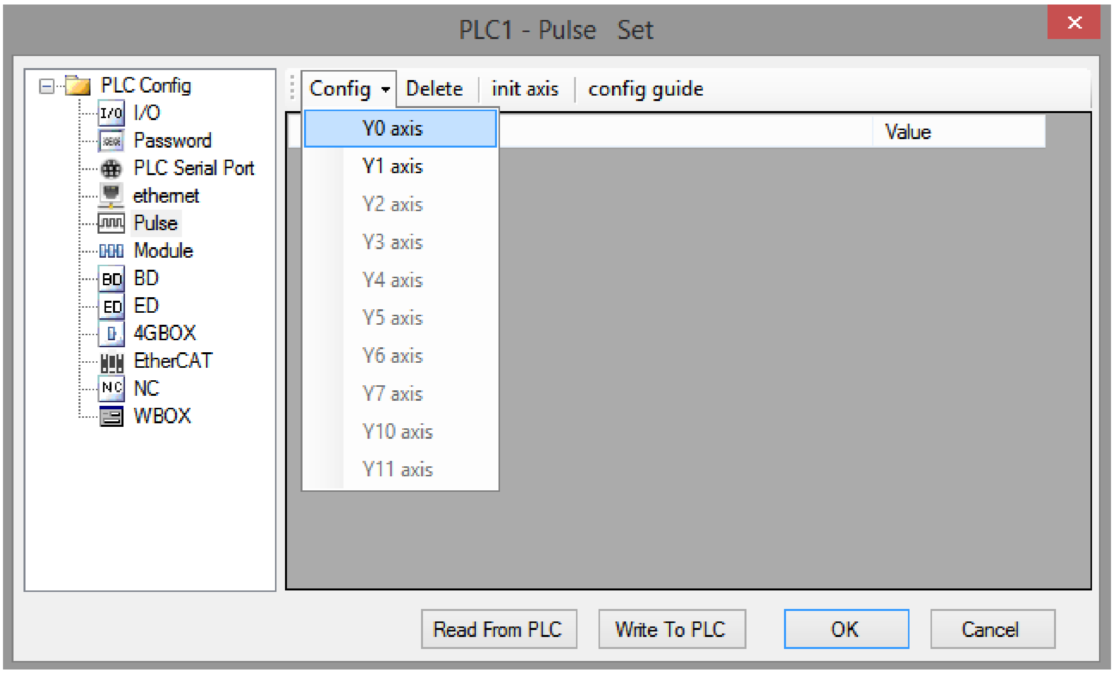
// pulse stop sending (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

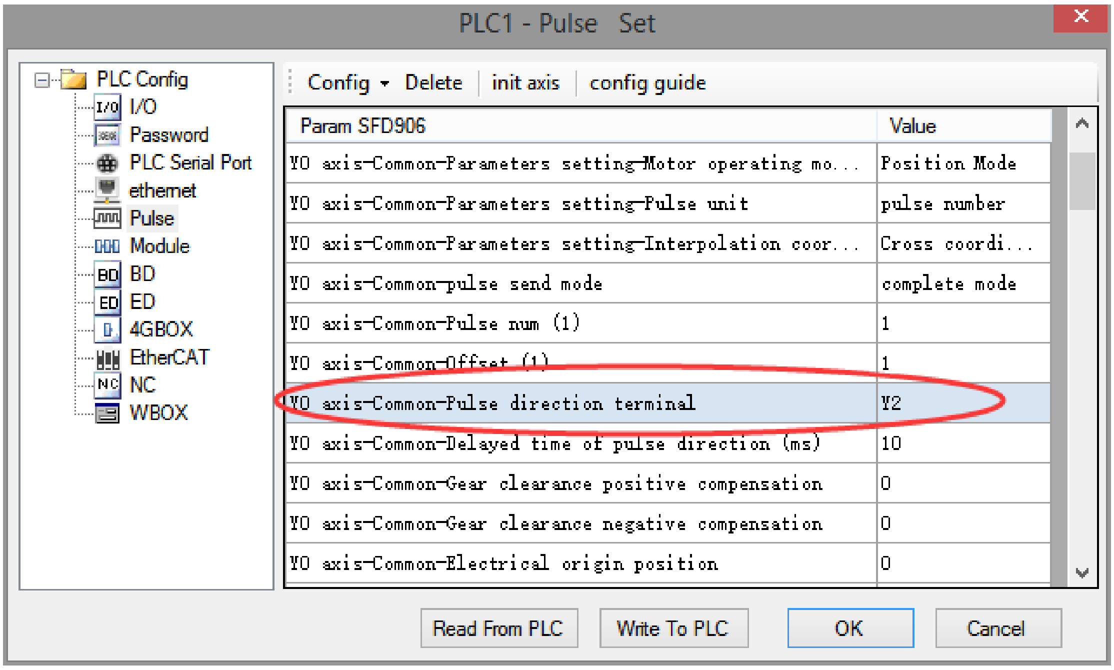
In the sample program, all the system parameters used in the pulse instructions (except DRVA, DRVI) are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

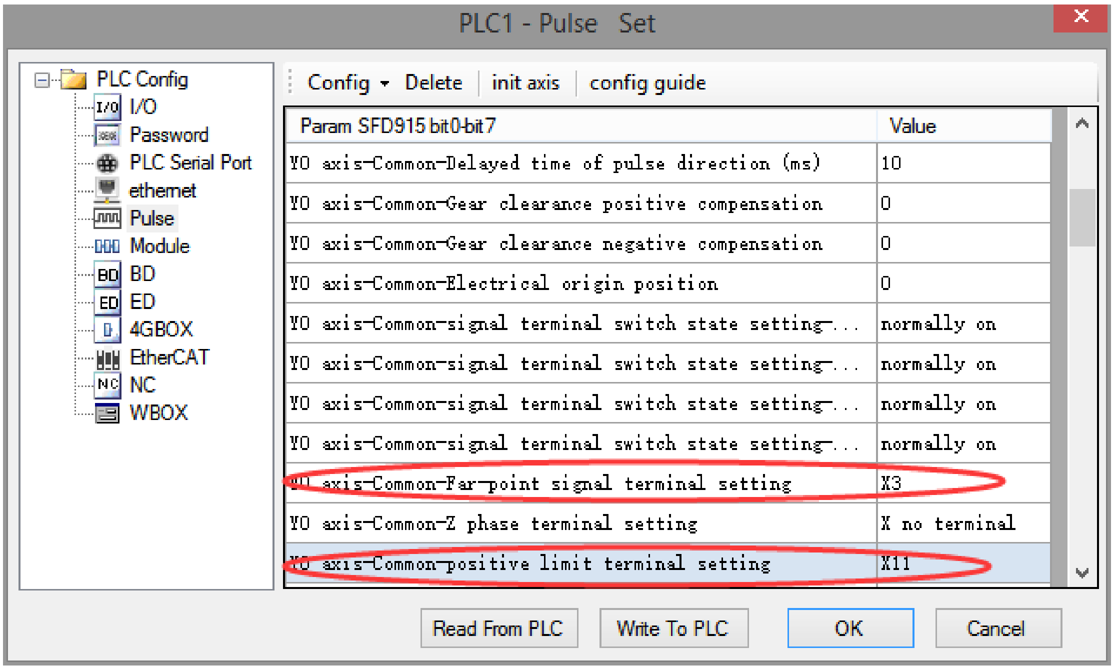


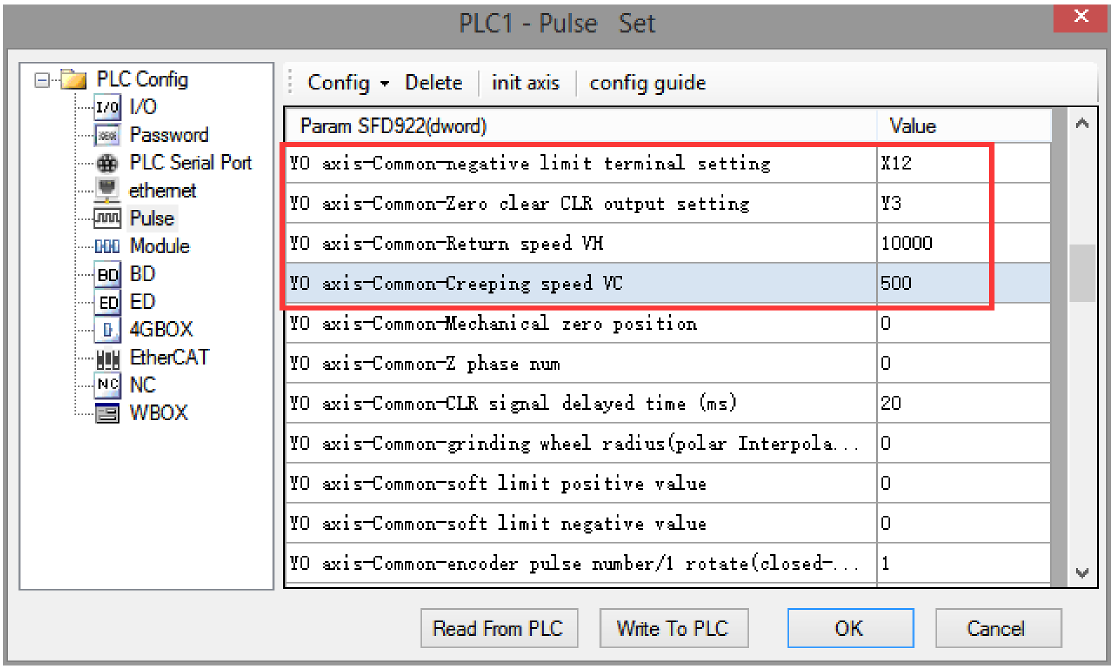

Click config, then select Y0 axis.

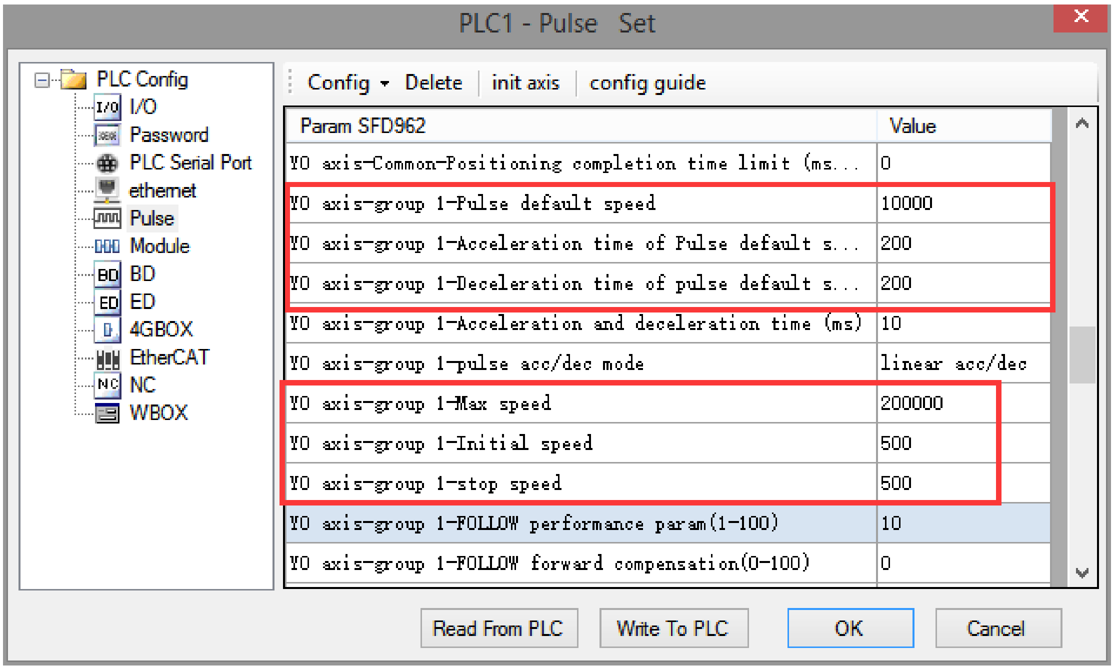



In the parameter configuration table, configure as follows (circled parameters need to be modified):


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Parameters setting-Motor operating mo...
Position Mode
Y0 axis-Common-Parameters setting-Pulse unit
pulse number
Y0 axis-Common-Parameters setting-Interpolation coor...
Cross coordi...
Y0 axis-Common-pulse send mode
complete mode
Y0 axis-Common-Pulse num (1)
1
Y0 axis-Common-Offset (1)
1
Y0 axis-Common-Pulse direction terminal
Y2
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Read From PLC
Write To PLC
OK
Cancel

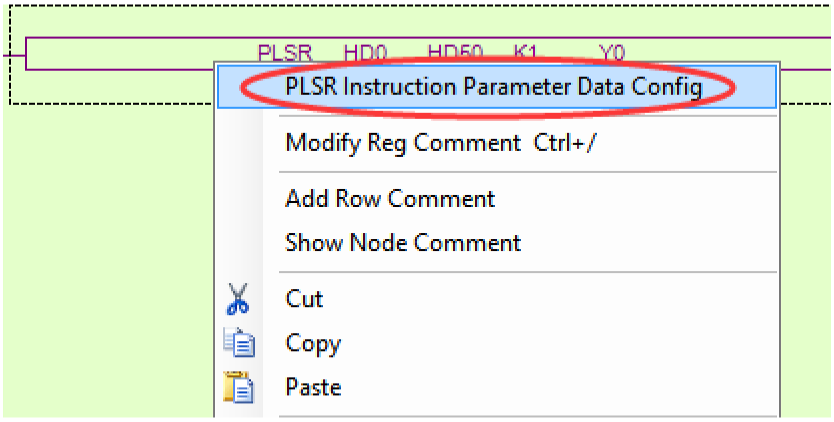

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel



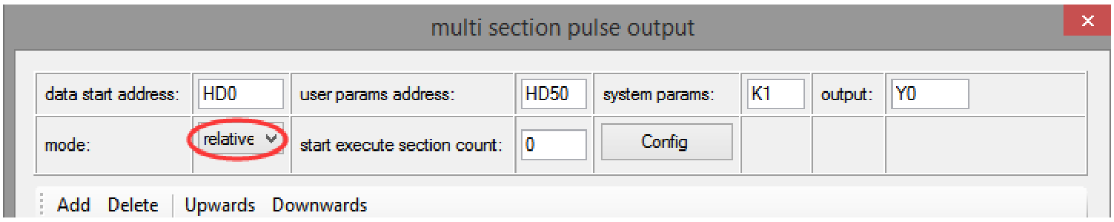




After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

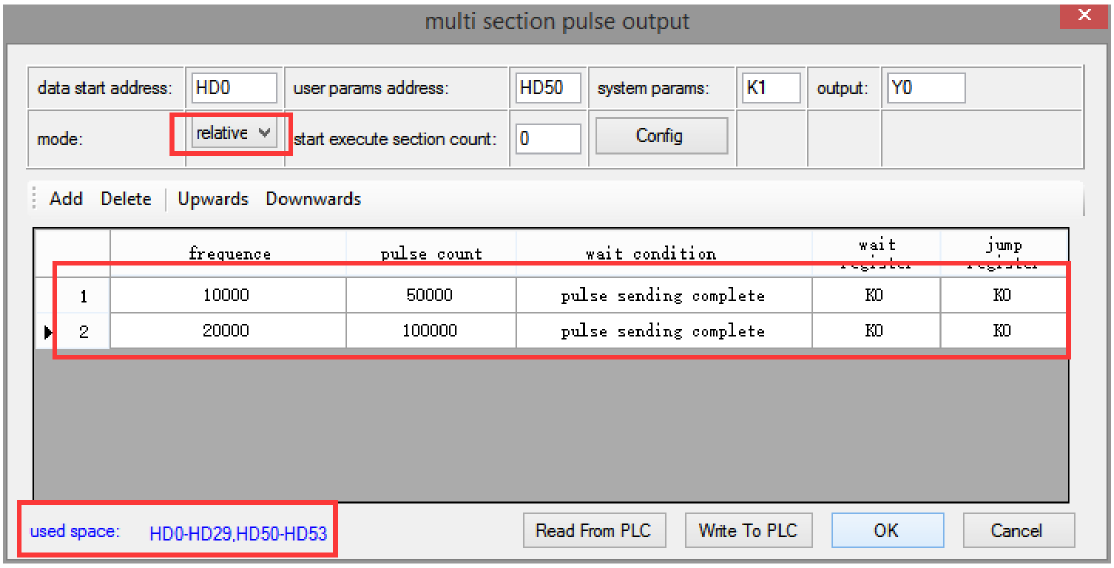
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:

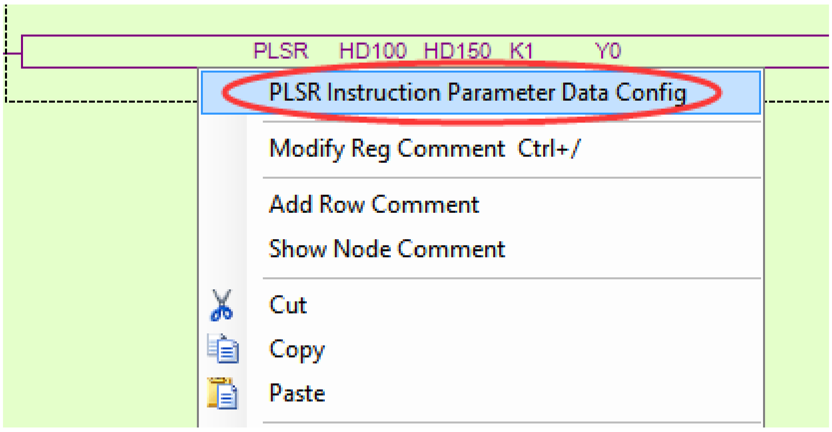



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

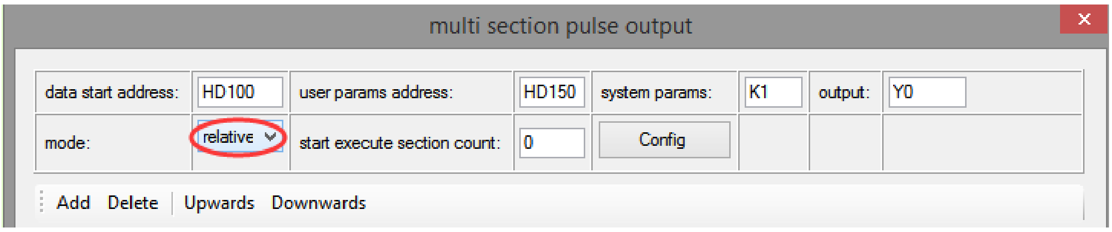



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

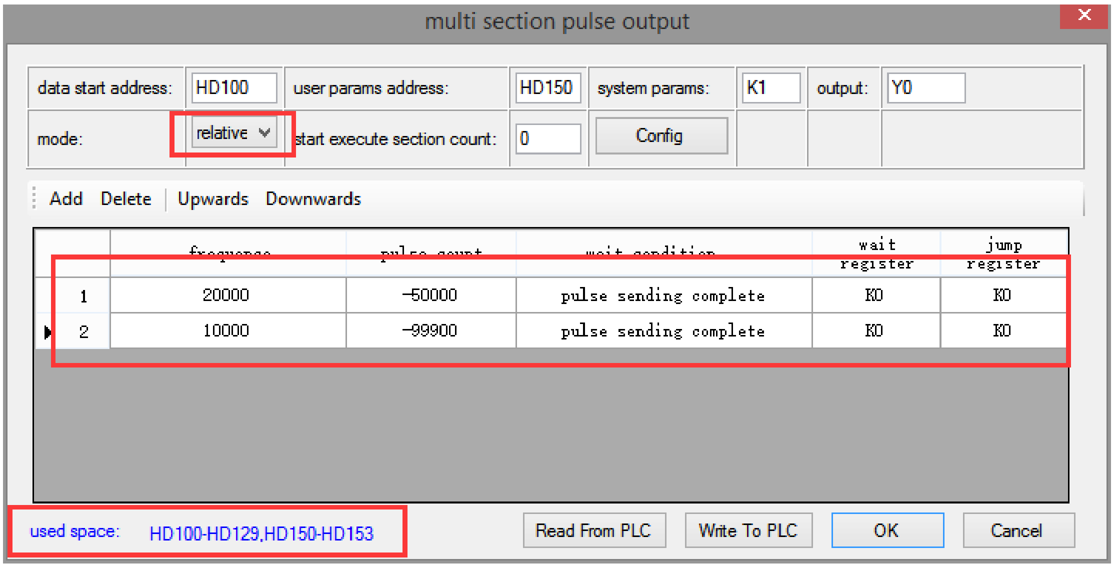
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:




After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of reverse rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:




**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

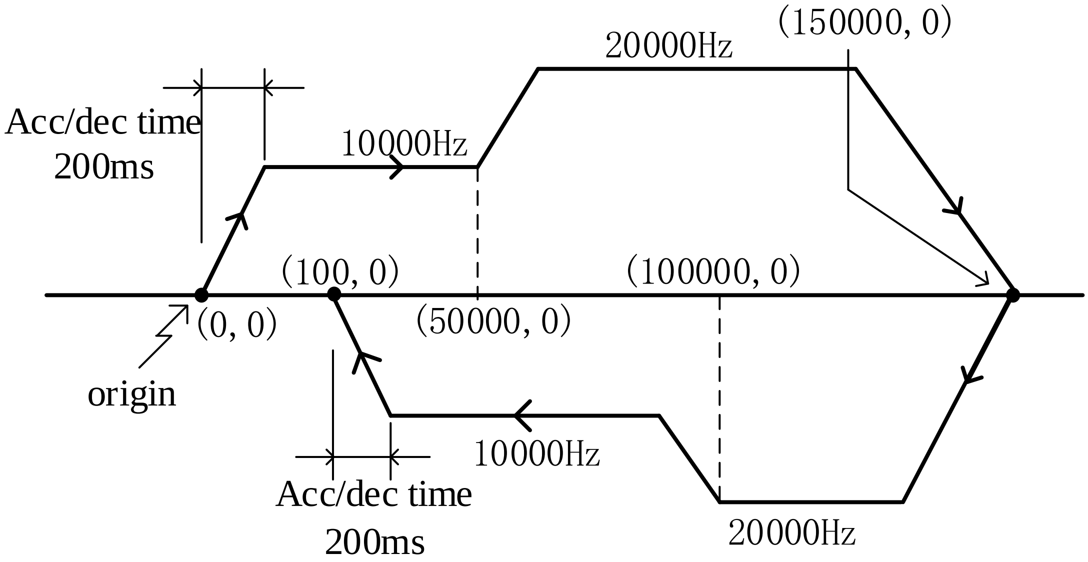
After downloading the program, power off the PLC and then re-energize it.

Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of

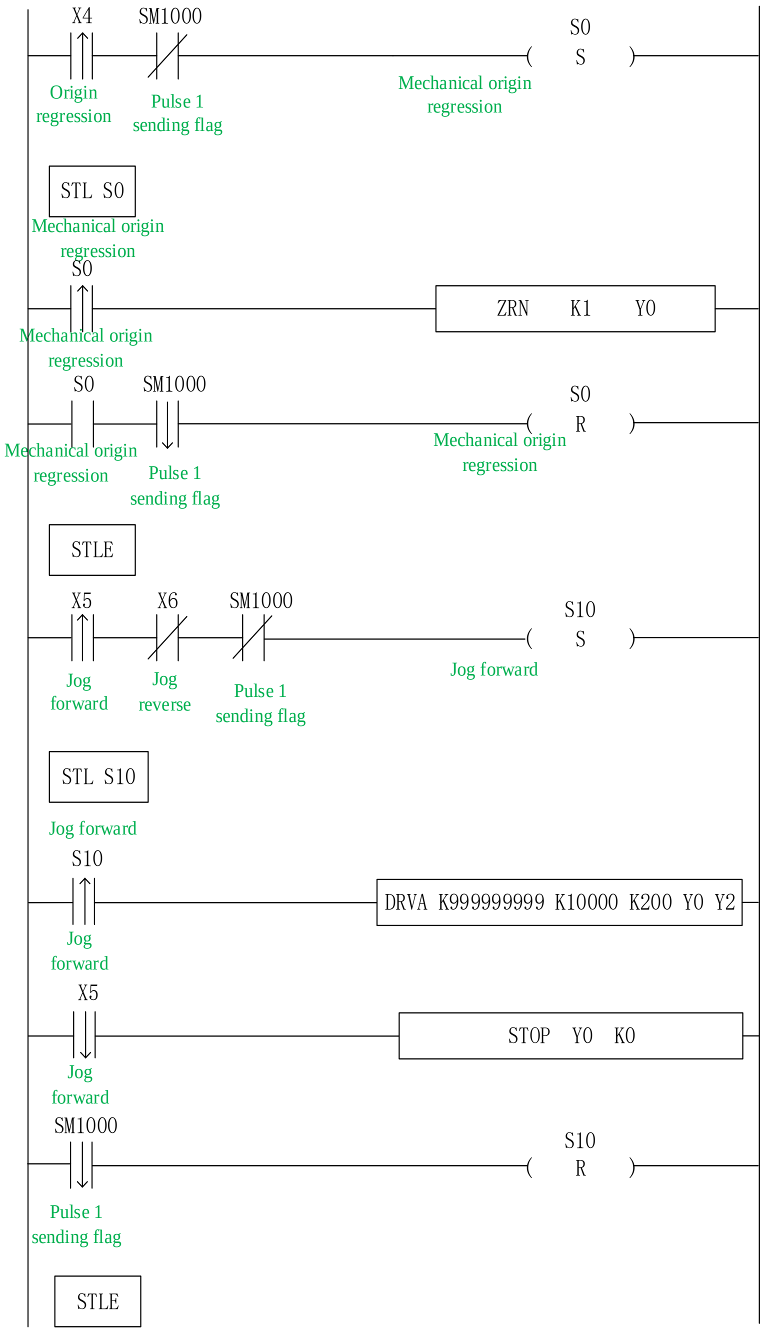
ZRN, PLSF, DRVI and DRVA instructions.

### 1-5-7. Forward and reverse rotation multi-segment process program 【DRVI, DRVA, PLSR, ZRN】

**Example 1: According to the following figure, multi-segment absolute positioning mode is adopted.**

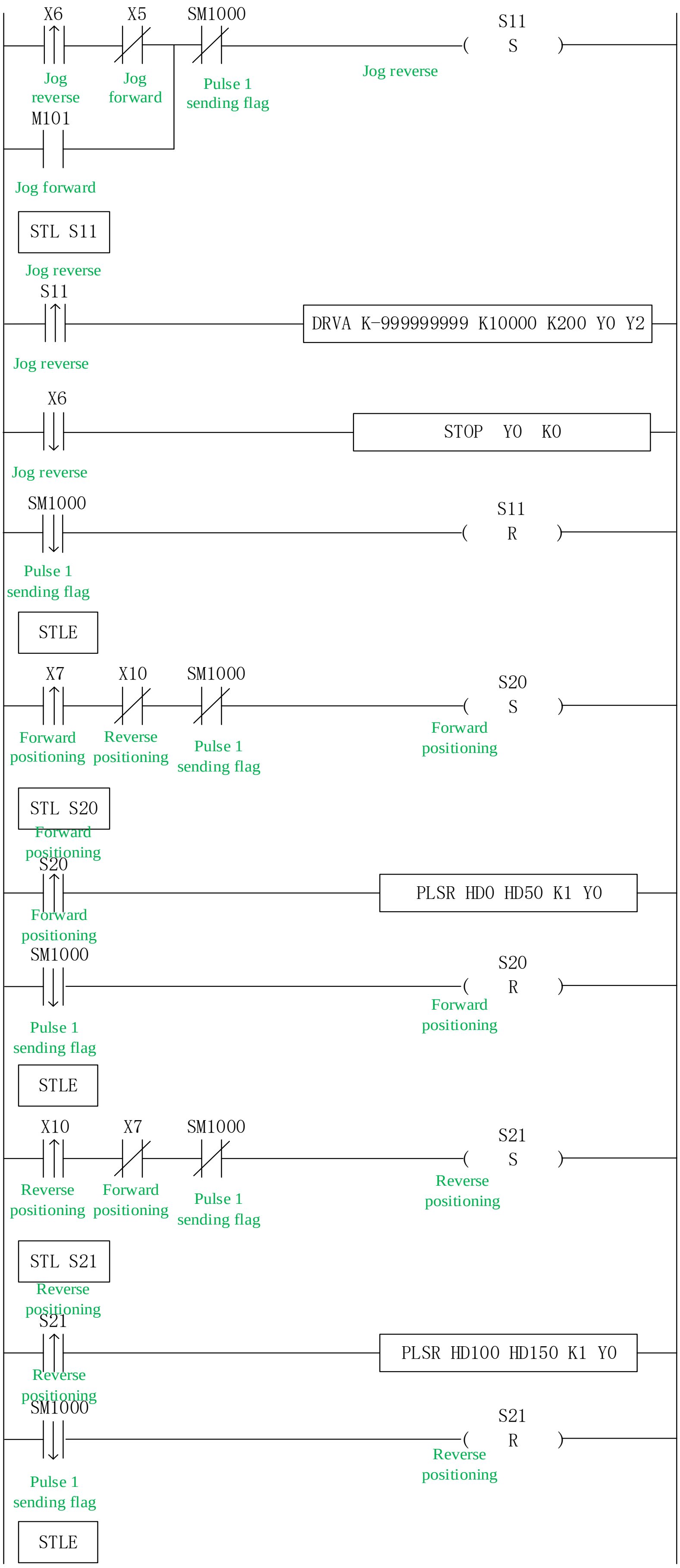



Firstly, make the ladder chart as follows:




//mechanical origin regression (use group 1 parameter)

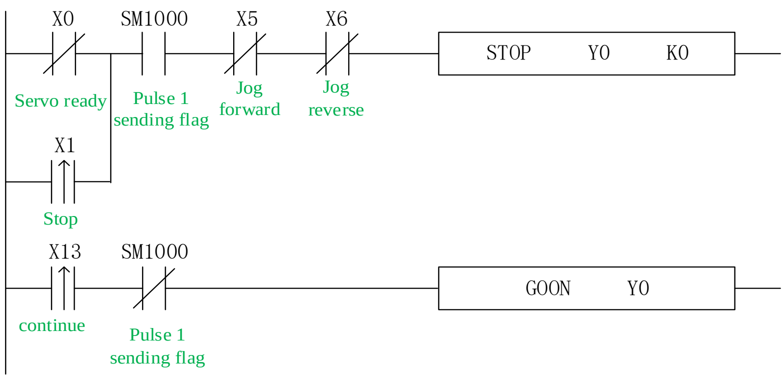
//jog forward control, the speed is 10000Hz




//jog reverse control, the speed is -10000Hz

//forward positioning control (use group 1 parameters)

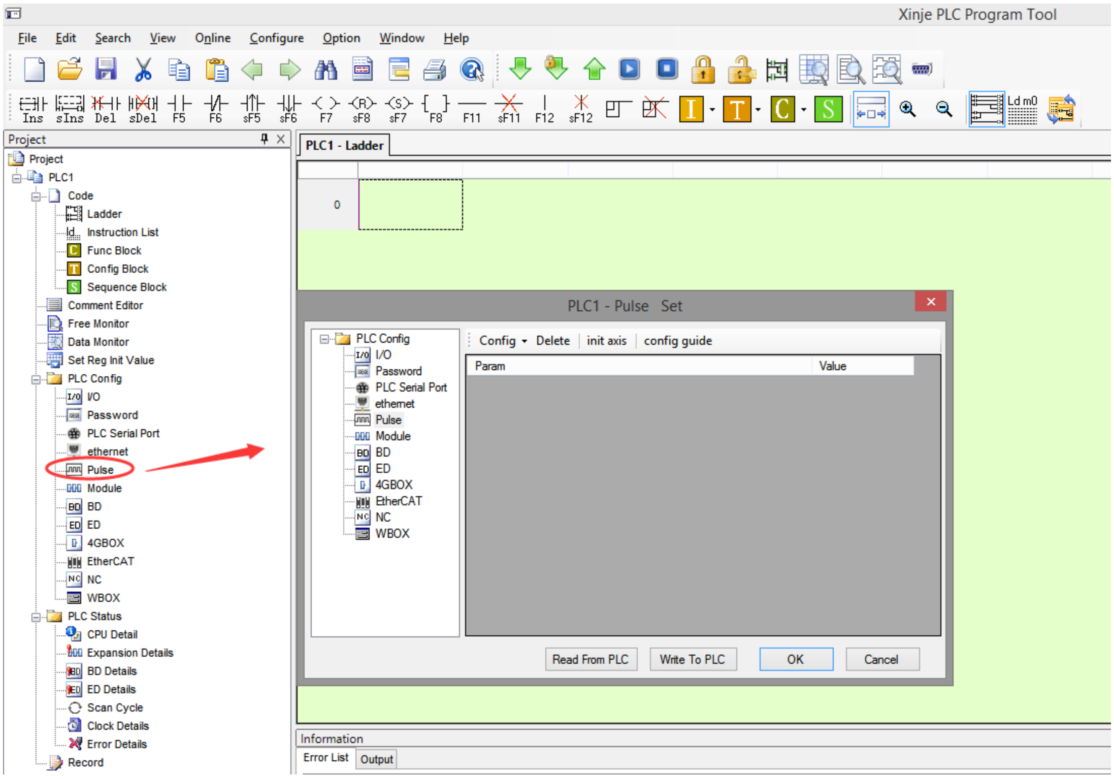
//reverse positioning control (use group 1 parameters)



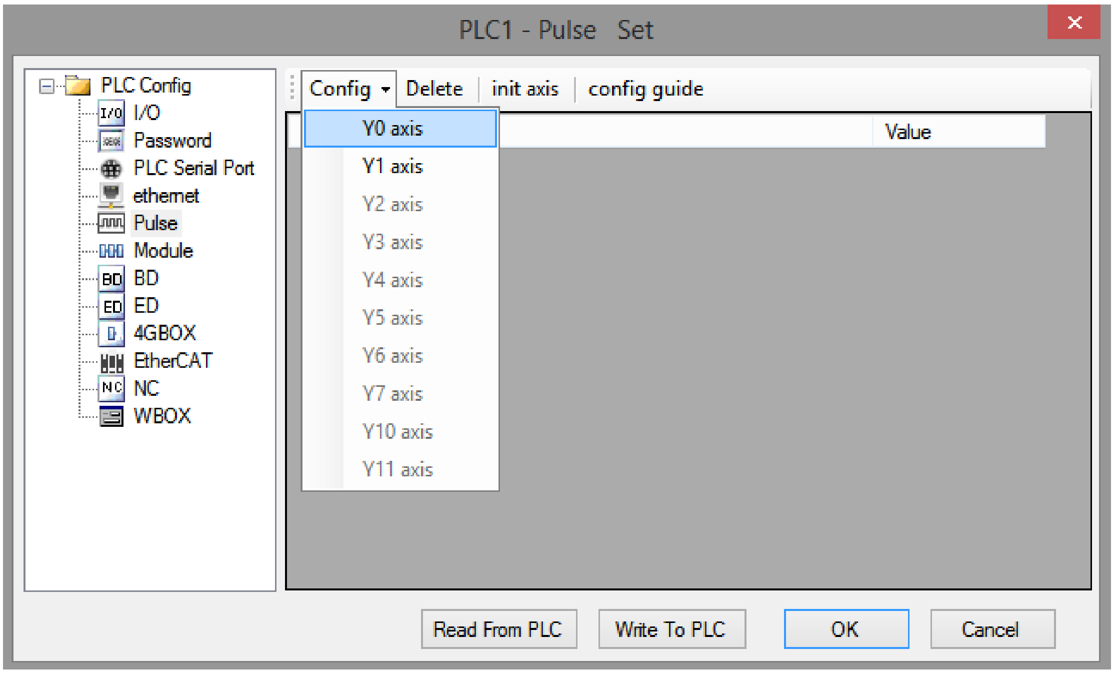

//pulse stop sending (slow stop)

// The execution pulse is not finished and the remaining pulse is continued to be sent out.

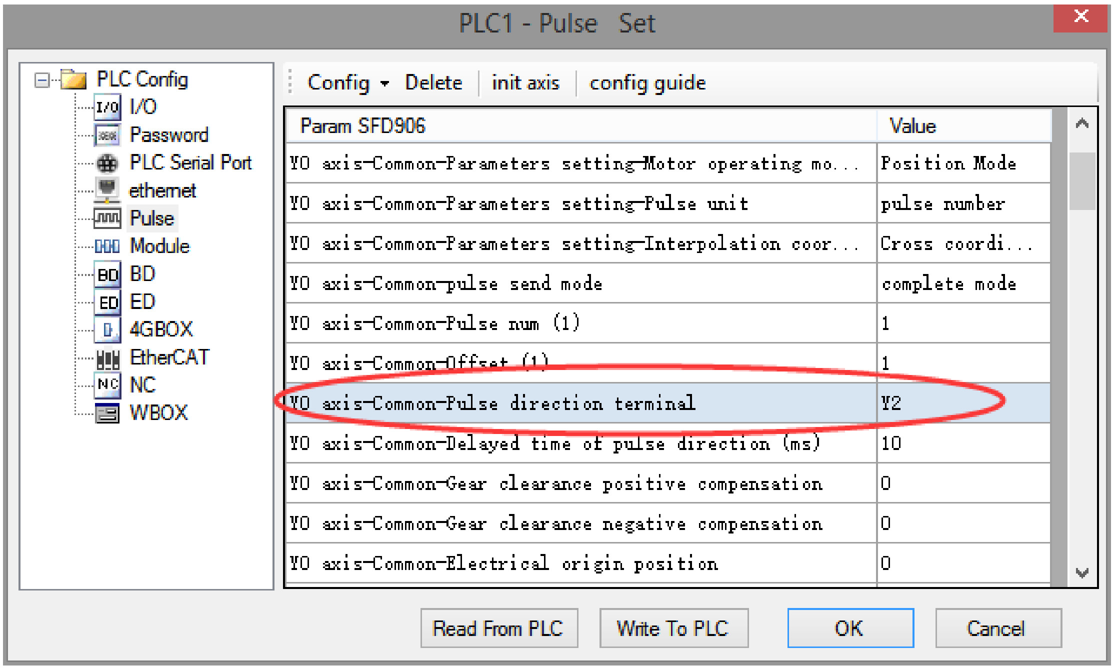
In the sample program, all the system parameters used in the pulse instructions (except DRVA, DRVI) are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

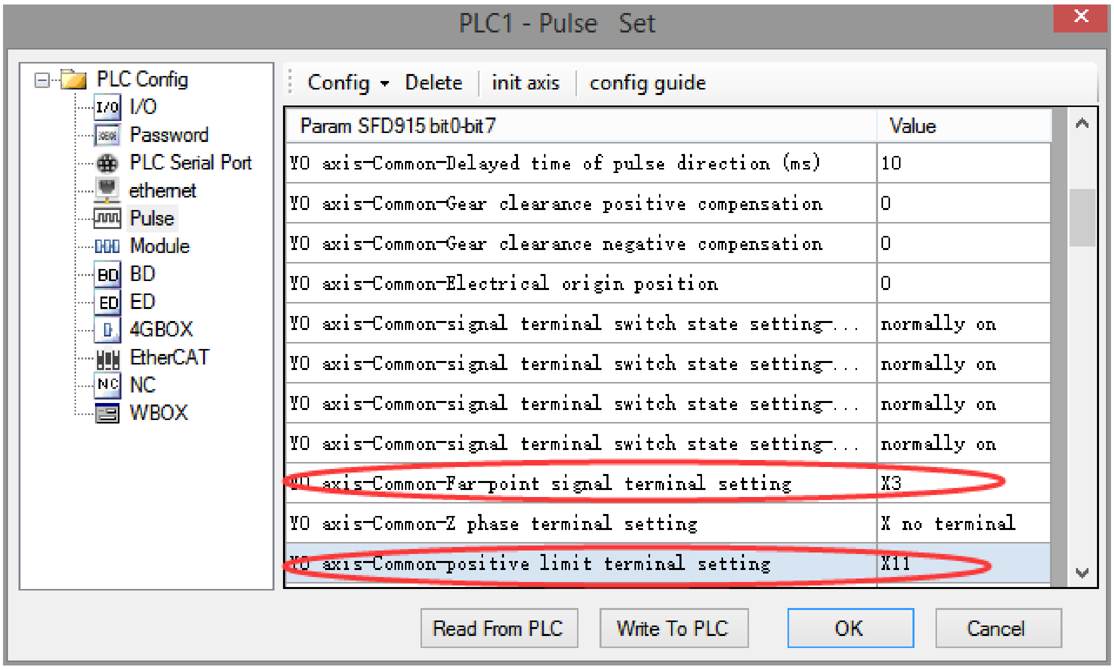


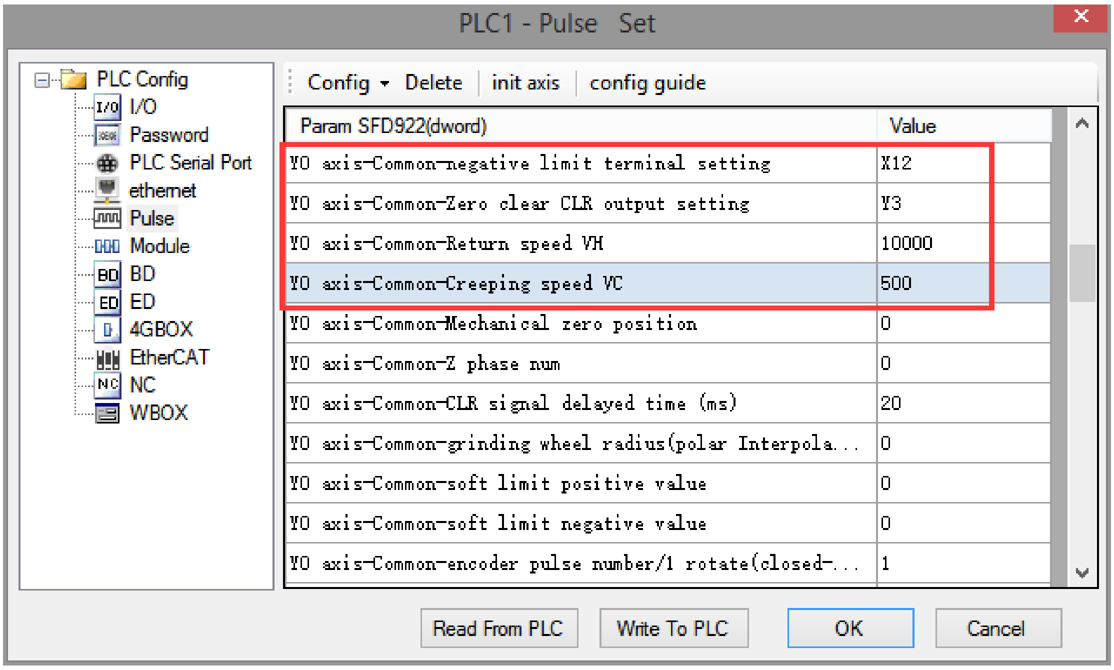

Click config, then select Y0 axis.

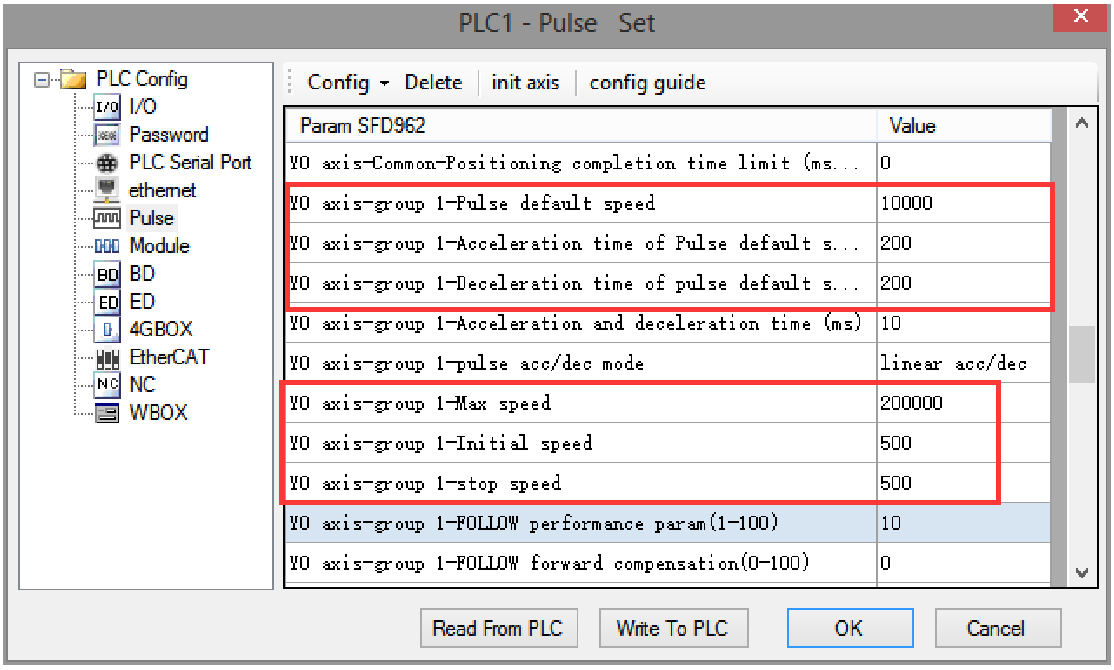



In the parameter configuration table, configure as follows (circled parameters need to be modified):



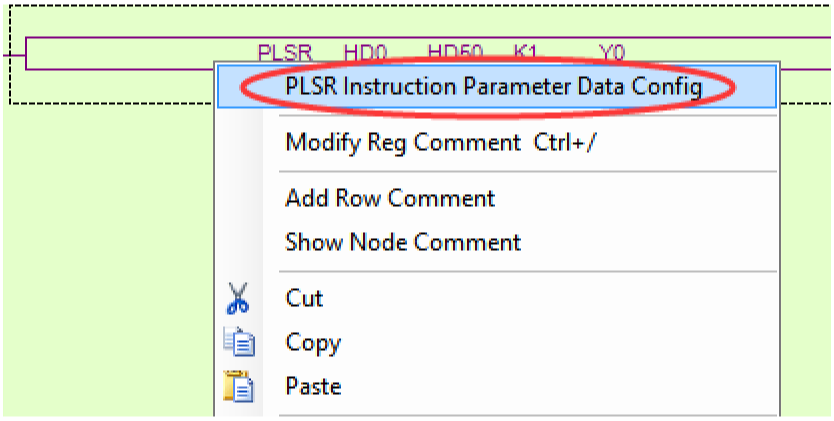

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD922(dword)
Value
Y0 axis-Common-negative limit terminal setting
X12
Y0 axis-Common-Zero clear CLR output setting
Y3
Y0 axis-Common-Return speed VH
10000
Y0 axis-Common-Creeping speed VC
500
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Y0 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel

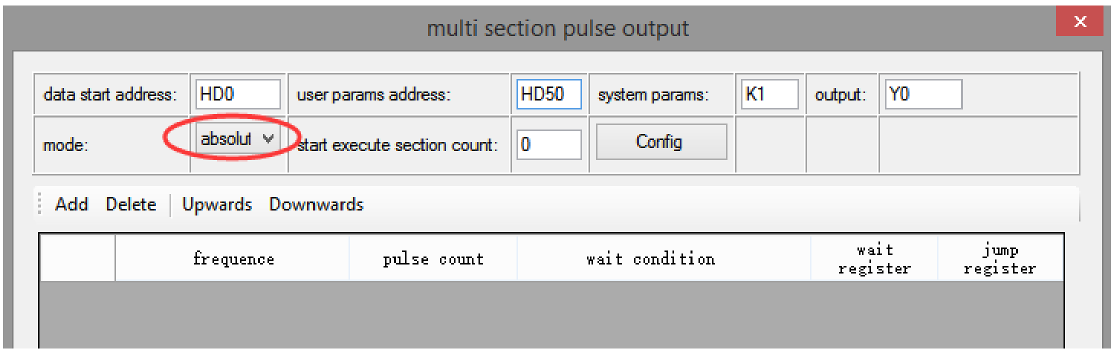



After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

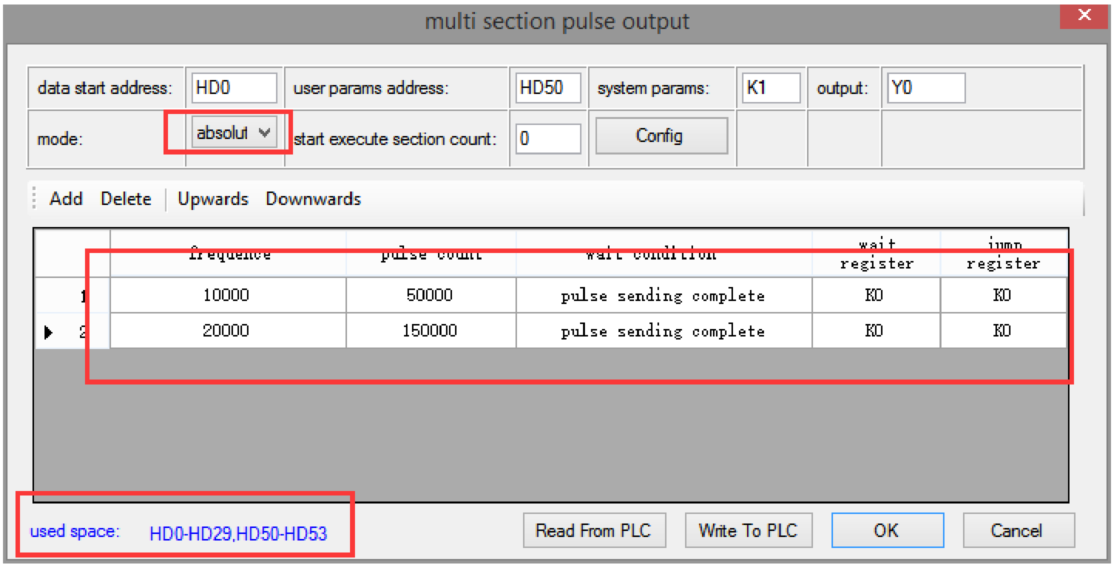
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:

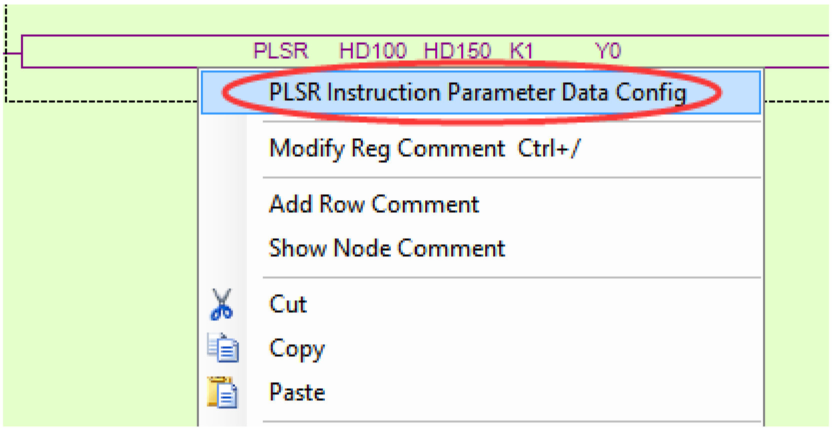


After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

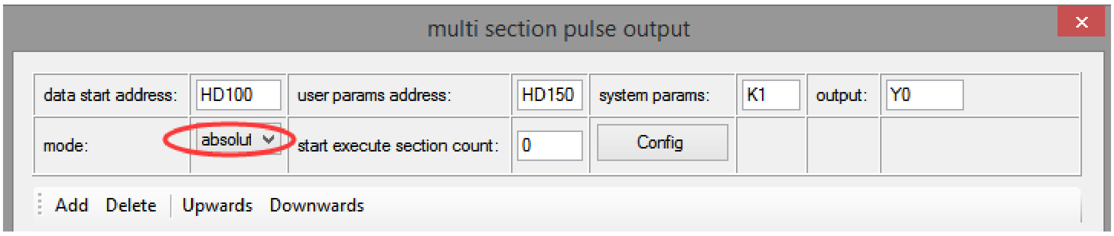



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

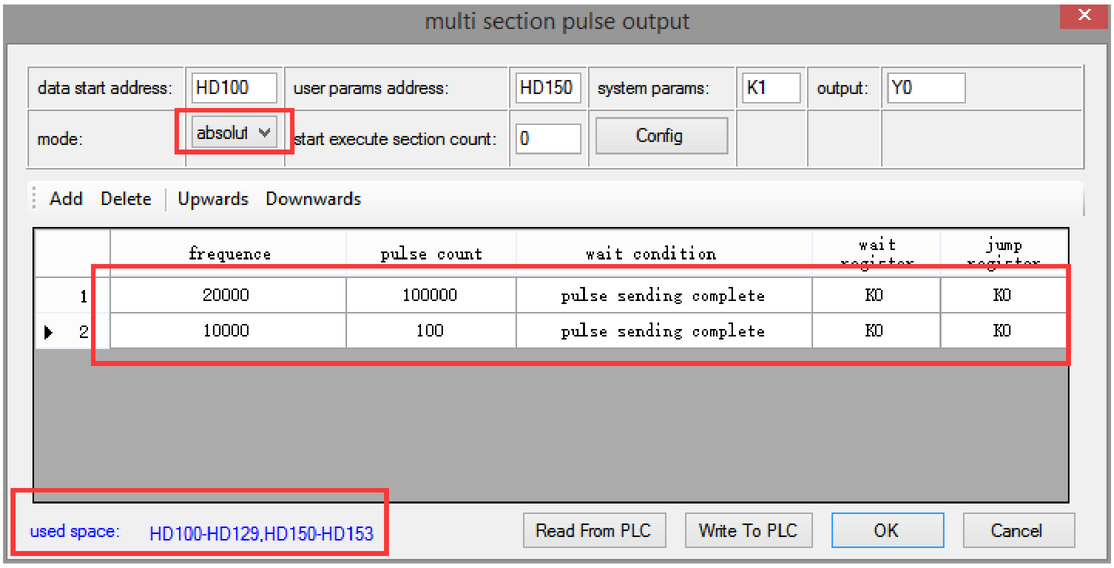
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "absolute" (default is "relative"), as shown in the following figure:



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

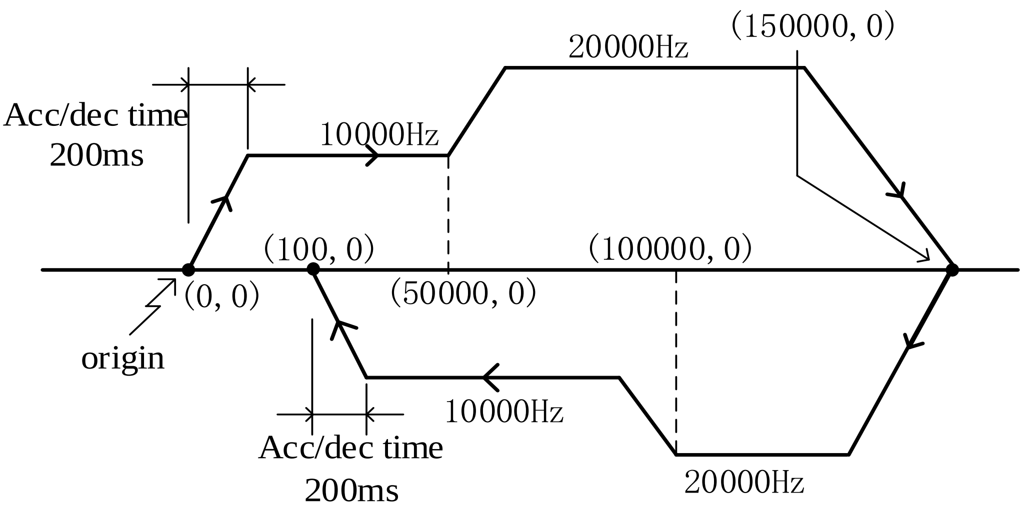



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

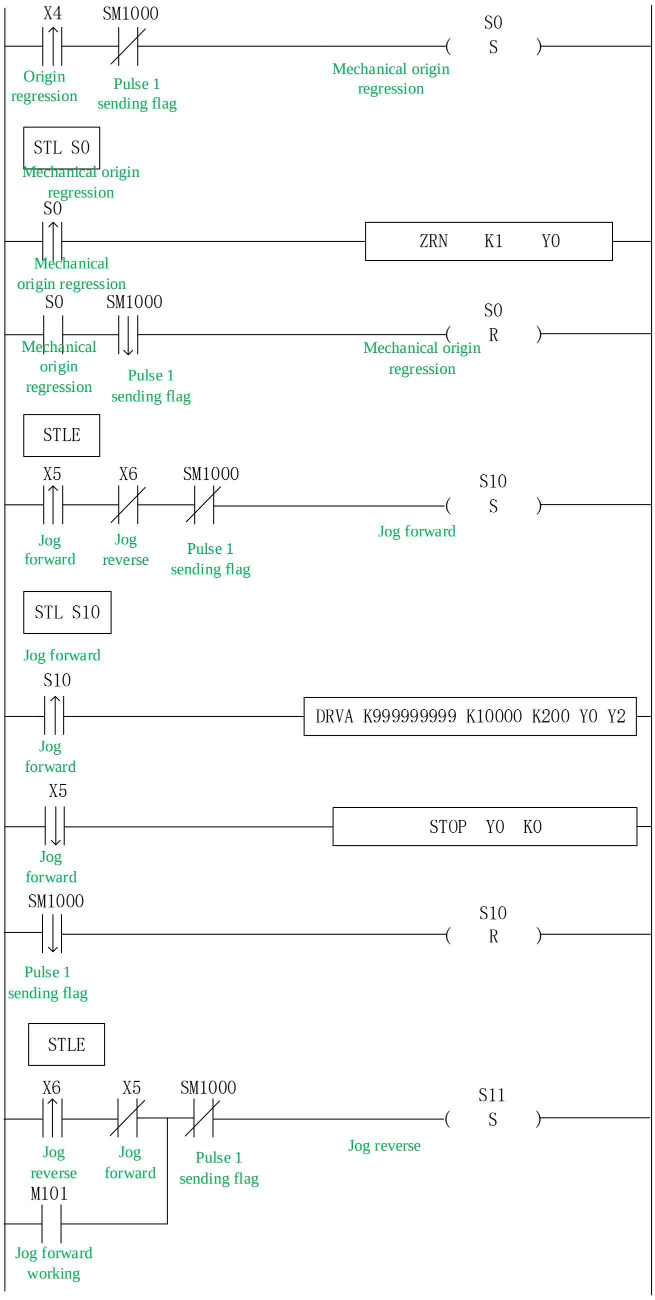
After downloading the program, power off the PLC and then re-energize it.

Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of ZRN, PLSF, DRVI and DRVA instructions.

**Example 2: According to the following figure, multi-segment relative positioning method is used.**

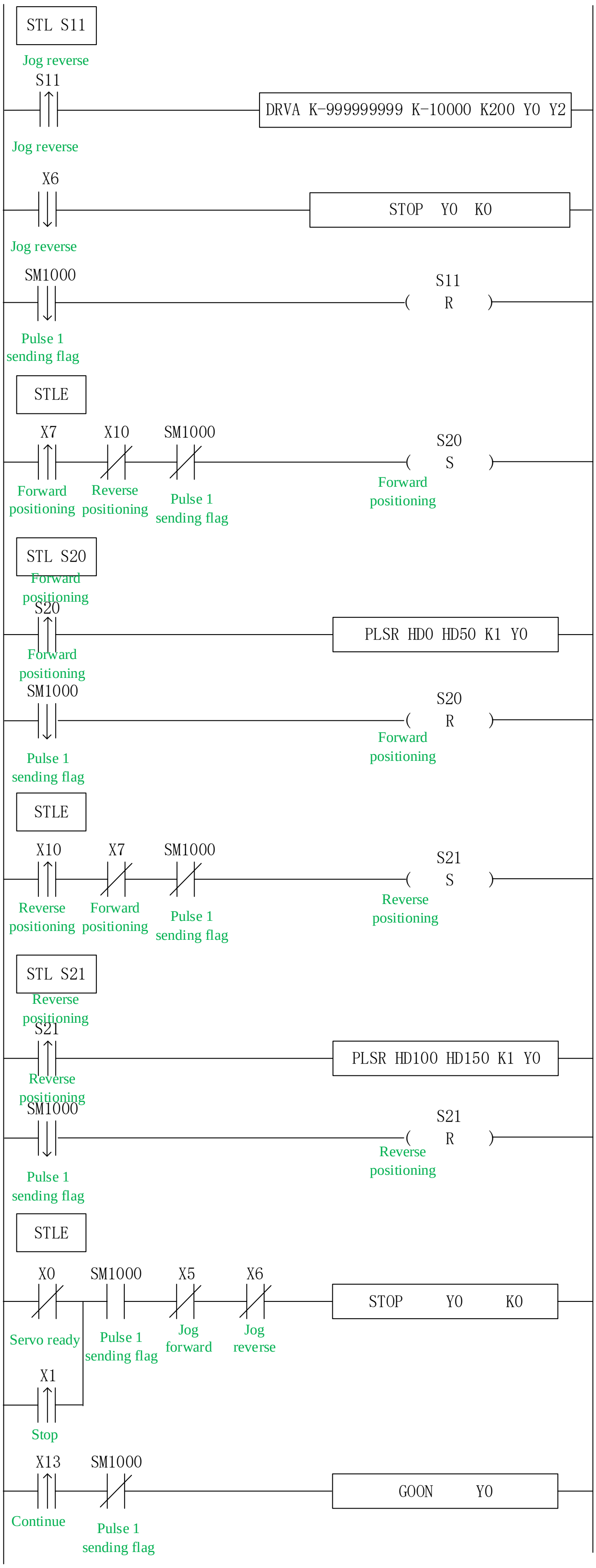


Firstly, make the ladder chart as follows:




//mechanical origin regression (use group 1 parameters)

// Jog forward control, the speed is 10000Hz




//jog reverse control, the speed is -10000Hz

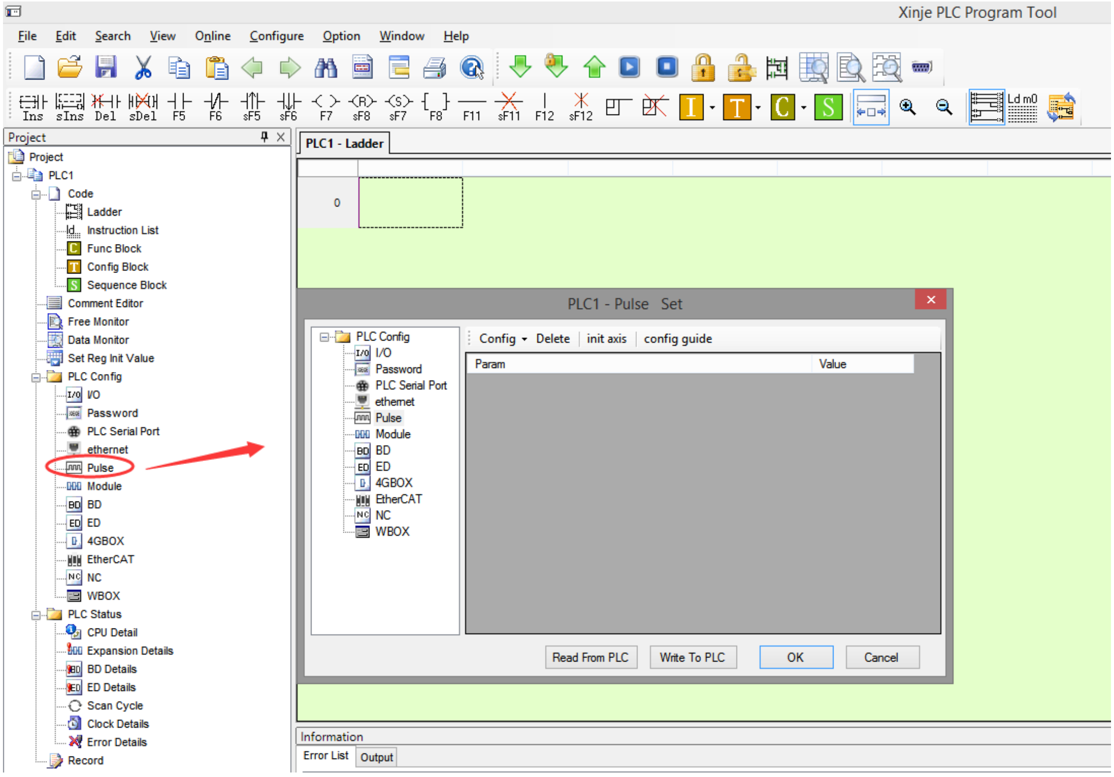
//forward positioning control (use group 1 parameters)

//reverse positioning control (use group 1 parameters)

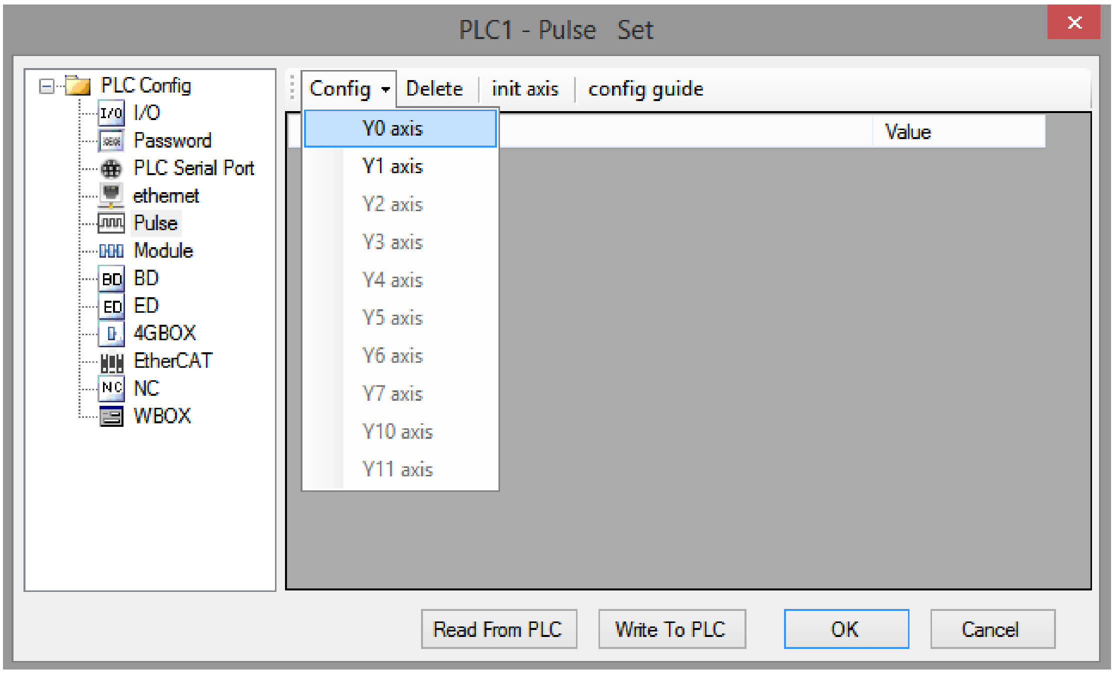
//pulse stop sending (slow stop)

//The execution pulse is not finished and the remaining pulse is continued to be sent out.

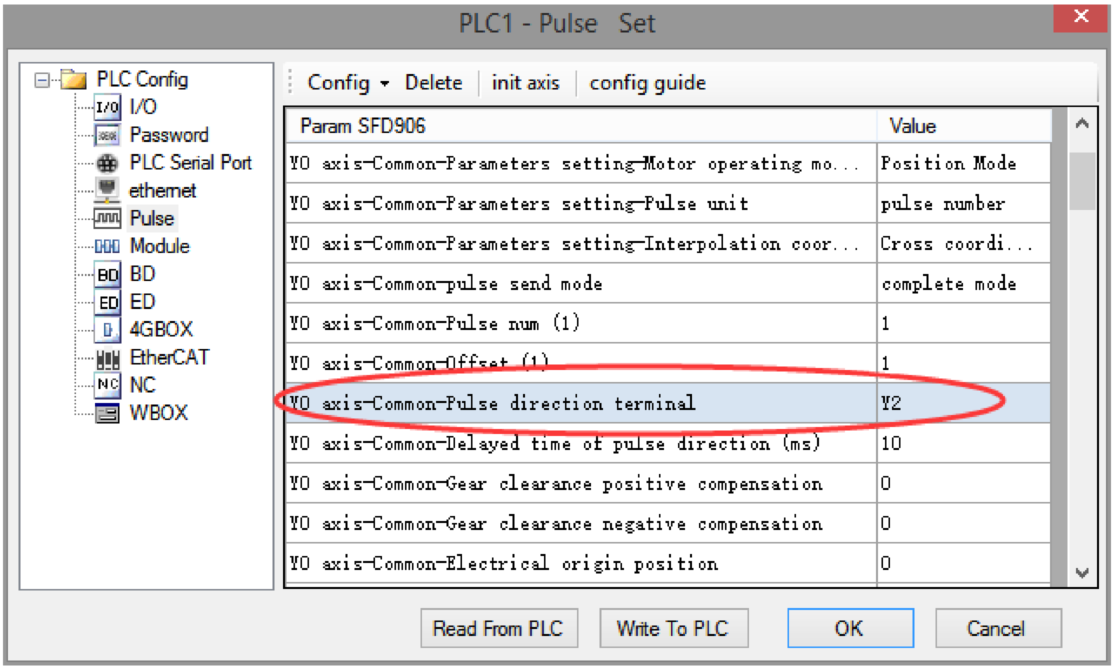
In the sample program, all the system parameters used in the pulse instructions (except DRVA, DRVI) are group 1 parameters. So, we click "pulse configuration parameters" in the PLC programming software, as follows:

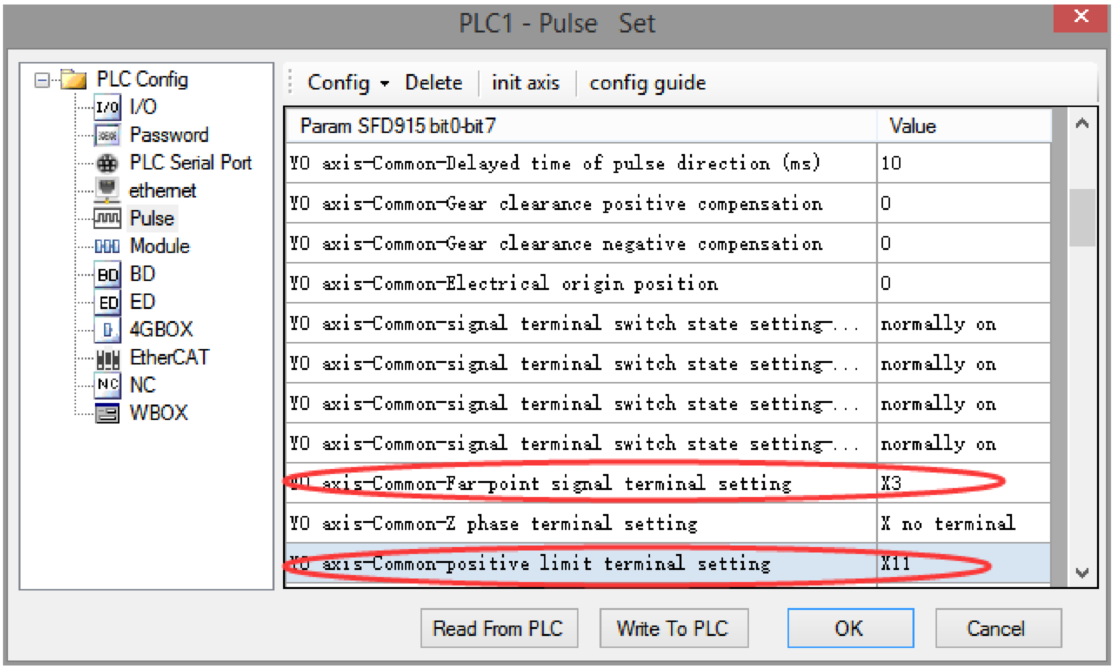


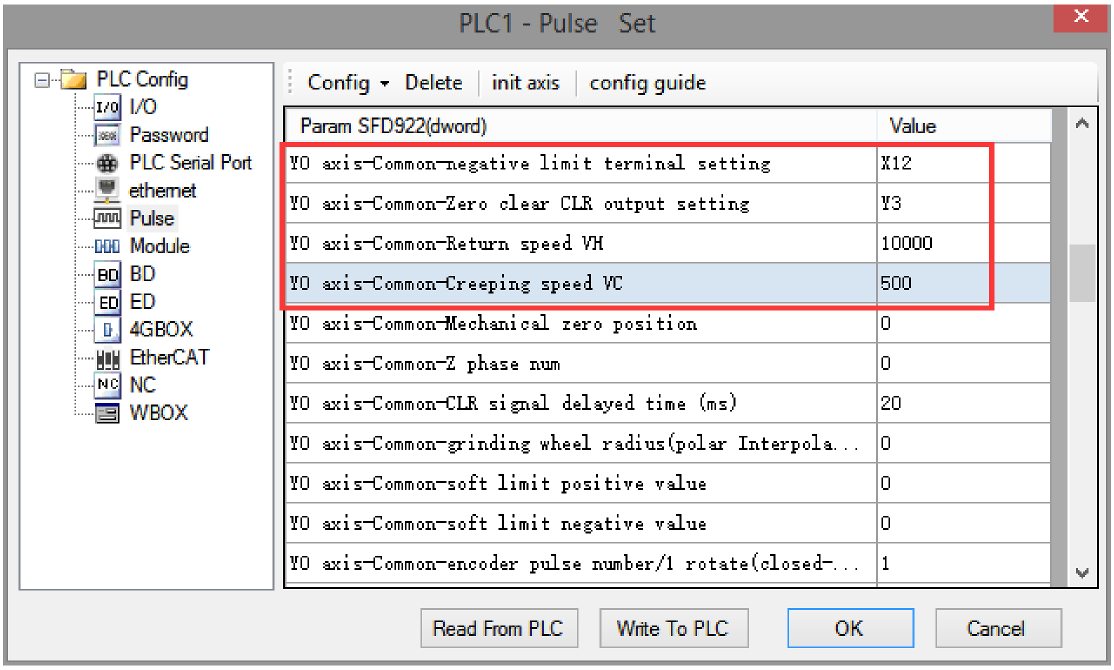

Click config, then select Y0 axis.

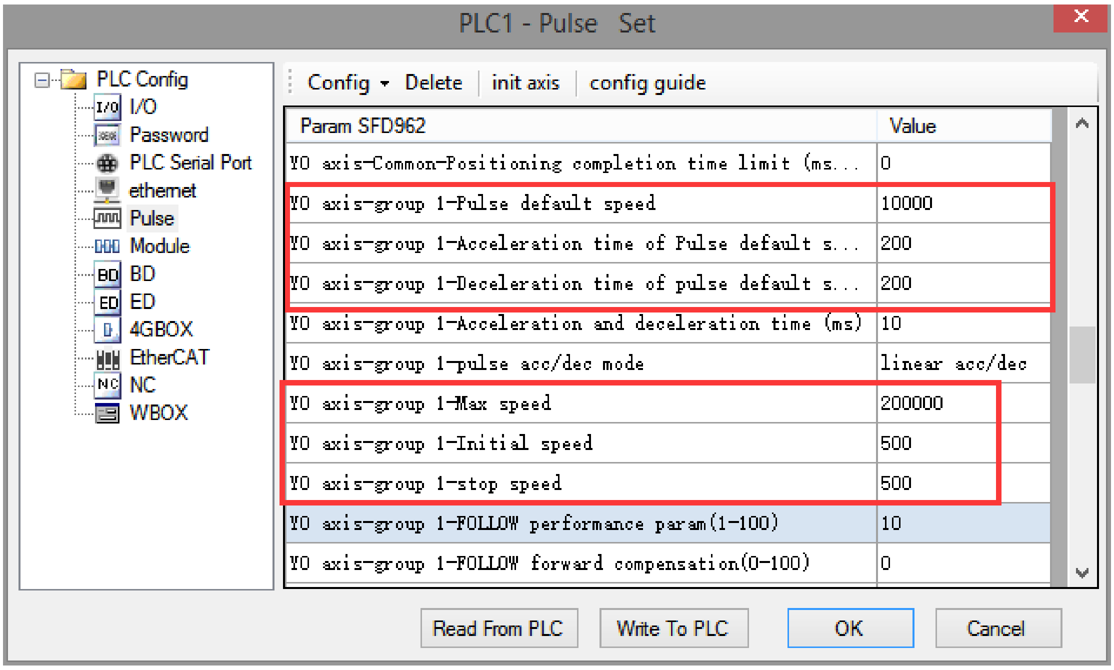



In the parameter configuration table, configure as follows (circled parameters need to be modified):


PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Parameters setting-Motor operating mo...
Position Mode
Y0 axis-Common-Parameters setting-Pulse unit
pulse number
Y0 axis-Common-Parameters setting-Interpolation coor...
Cross coordi...
Y0 axis-Common-pulse send mode
complete mode
Y0 axis-Common-Pulse num (1)
1
Y0 axis-Common-Offset (1)
1
Y0 axis-Common-Pulse direction terminal
Y2
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Read From PLC
Write To PLC
OK
Cancel

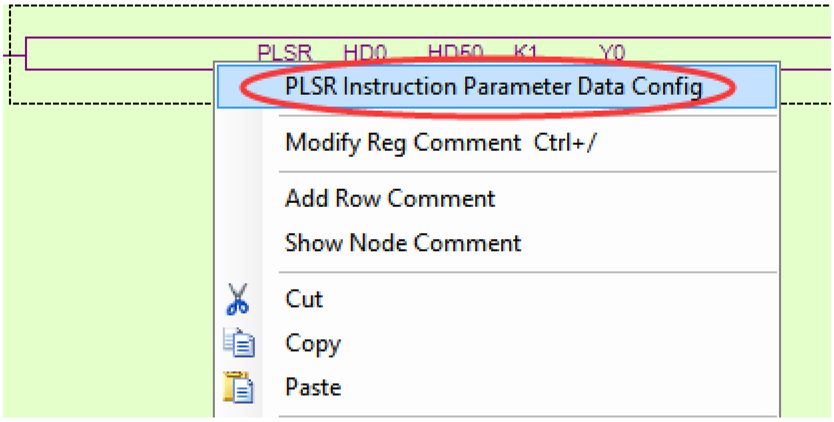

PLC1 - Pulse Set
PLC Config
I/O
Password
PLC Serial Port
ethernet
Pulse
Module
BD
ED
4GBOX
EtherCAT
NC
WBOX
Config
Delete
init axis
config guide
Param SFD915 bit0-bit7
Value
Y0 axis-Common-Delayed time of pulse direction (ms)
10
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X3
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X11
Read From PLC
Write To PLC
OK
Cancel



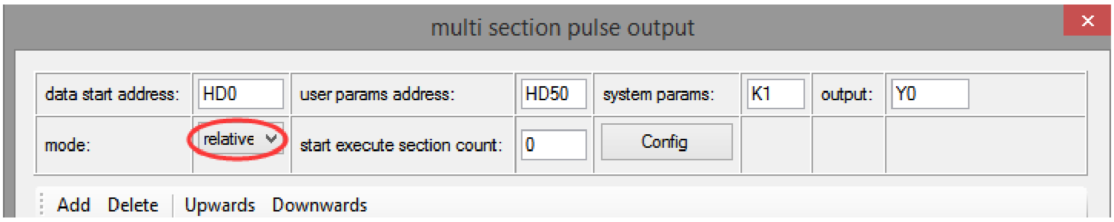




After configuring the parameters of the system parameter block, click the "Write to PLC" button to write the parameters into the PLC. Since the PLSR is used as the multi-segment pulse output instruction, we also need to configure the parameters of the pulse segment (the output frequency and the number of pulses per pulse segment).

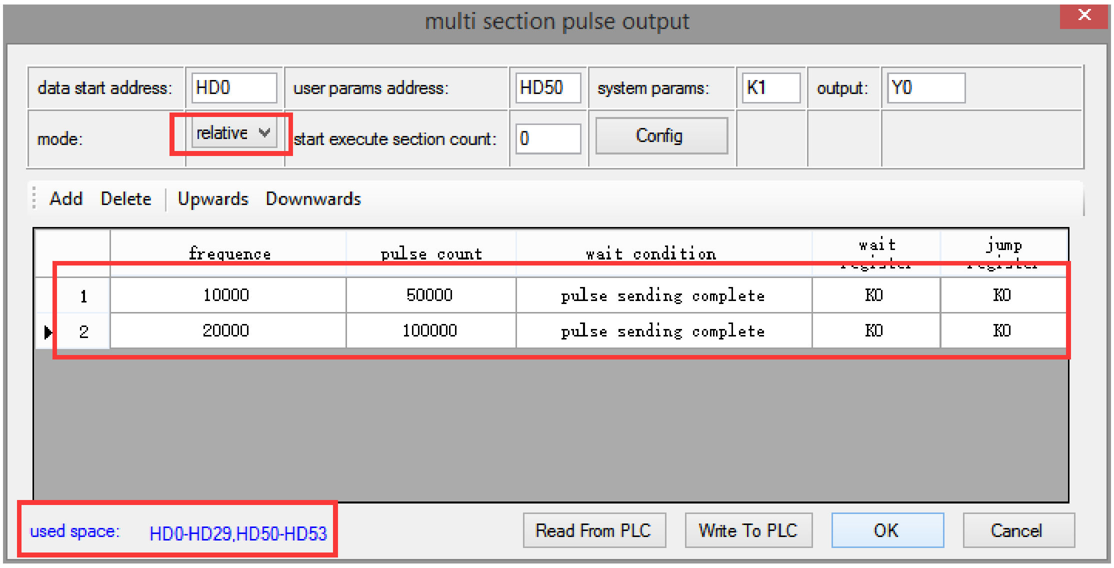
Firstly, right-click on the forward positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:

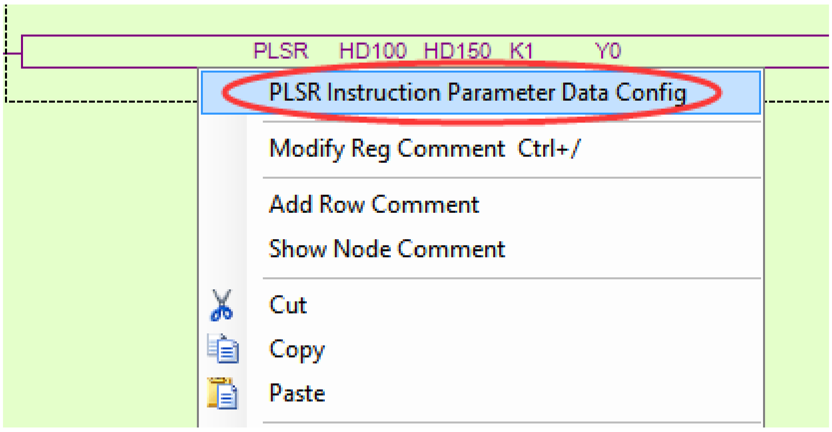



After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of forward rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:

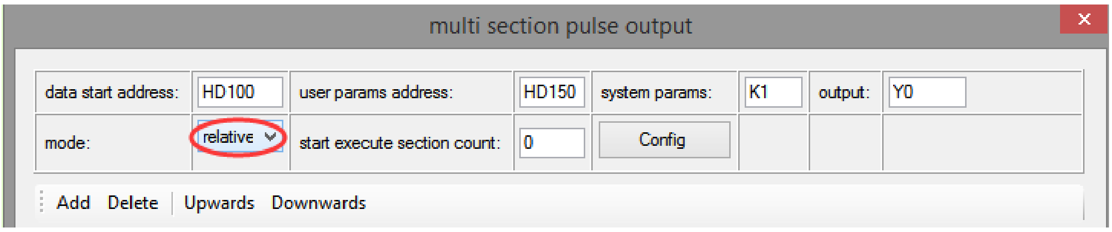



**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD0-HD29, and the range of system parameter block address is HD50-HD53, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

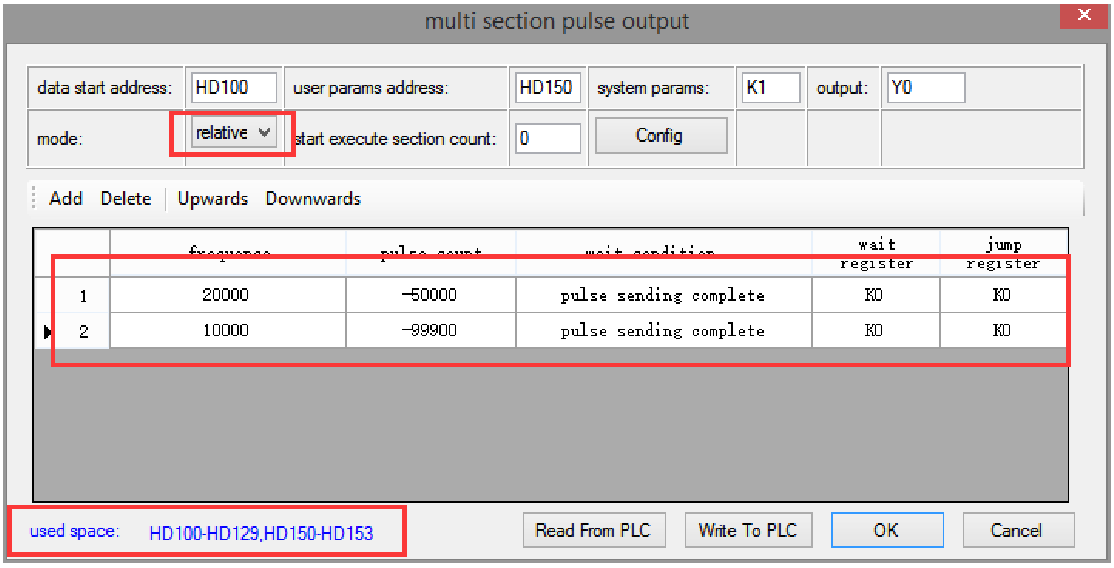
Then, right-click on the reverse positioning command PLSR and pop up the following options. Select the first "PLSR Instruction Parameter data Config":




In the open multi-segment pulse output configuration table, select "mode" as "relative" (default is "relative"), as shown in the following figure:




After choosing the mode, click the "Add" button in the configuration interface to add two continuous pulse parameters of reverse rotation; after configuring, click the "Write to PLC" button to write parameters into the PLC, as shown in the following figure:




**Note: Please note the range of real-time occupied registers displayed by "used space". Because the range of starting address of pulse parameter data of PLSR pulse instruction is HD100-HD129, and the range of system parameter block address is HD150-HD153, the range of real-time occupied registers address is not beyond the range. If the range exceeds, the error of pulse output will occur.**

After downloading the program, power off the PLC and then re-energize it.

Positive Limit (X11) and Negative Limit (X12) will play an important role in the execution of

ZRN, PLSF, DRVI and DRVA instructions.

## 1-6. Pulse Output Coil and Register

**Pulse output flag bit:**

| Coil | Function | Notes | |
|---|---|---|---|
| SM1000 | Pulse sending flag | 1 is pulse sending | PULSE_1 |
| SM1001 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1002 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1003 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1010 | Pulse error flag | ON is error | |
| SM1020 | Pulse sending flag | 1 is pulse sending | PULSE_2 |
| SM1021 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1022 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1023 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1030 | Pulse error flag | ON is error | |
| SM1040 | Pulse sending flag | 1 is pulse sending | PULSE_3 |
| SM1041 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1042 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1043 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1050 | Pulse error flag | ON is error | |
| SM1060 | Pulse sending flag | 1 is pulse sending | PULSE_4 |
| SM1061 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1062 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1063 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1070 | Pulse error flag | ON is error | |

| | | | |
|---|---|---|---|
| SM1080 | Pulse sending flag | 1 is pulse sending | PULSE_5 |
| SM1081 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1082 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1083 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1090 | Pulse error flag | ON is error | |
| SM1100 | Pulse sending flag | 1 is pulse sending | PULSE_6 |
| SM1101 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1102 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1103 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1110 | Pulse error flag | ON is error | |
| SM1120 | Pulse sending flag | 1 is pulse sending | PULSE_7 |
| SM1121 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1122 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1123 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1130 | Pulse error flag | ON is error | |
| SM1140 | Pulse sending flag | 1 is pulse sending | PULSE_8 |
| SM1141 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1142 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1143 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1150 | Pulse error flag | ON is error | |
| SM1160 | Pulse sending flag | 1 is pulse sending | PULSE_9 |
| SM1161 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1162 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1163 | Overflow flag of accumulated pulse | 1 is overflow | |

| | | | |
|---|---|---|---|
| | equivalent | | |
| SM1170 | Pulse error flag | ON is error | |
| SM1180 | Pulse sending flag | 1 is pulse sending | PULSE_10 |
| SM1181 | Direction flag | 1 is positive direction, related direction output is ON | |
| SM1182 | Overflow flag of accumulated pulse number | 1 is overflow | |
| SM1183 | Overflow flag of accumulated pulse equivalent | 1 is overflow | |
| SM1190 | Pulse error flag | ON is error | |

**Pulse output related sepcial registers:**

| Register | Function | Notes | |
|---|---|---|---|
| SD1000 | Present segment (represents segment n) | | PULSE_1 |
| SD1001 | | | |
| SD1002 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1003 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1004 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1005 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1006 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1007 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1008 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1009 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1010 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error | |

| | | | |
|---|---|---|---|
| | | 4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1011 | Error pulse data block number | | |
| | | | |
| SD1020 | Present segment (represents segment n) | | PULSE_2 |
| SD1021 | | | |
| SD1022 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1023 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1024 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1025 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1026 | Present pulse number low 16-bit (the unit is pulse number) | | |

| | | | |
|---|---|---|---|
| SD1027 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1028 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1029 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1030 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1031 | Error pulse data block number | | |
| | | | |
| SD1040 | Present segment (represents segment n) | | |
| SD1041 | | | PULSE_3 |
| SD1042 | Present pulse number | | |

| | | | |
|---|---|---|---|
| | low 16-bit (the unit is pulse number) | | |
| SD1043 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1044 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1045 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1046 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1047 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1048 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1049 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1050 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC⩾VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ⩽ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ⩽0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed | |

| | | | |
|---|---|---|---|
| | | is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1051 | Error pulse data block number | | |
| | | | |
| SD1060 | Present segment (represents segment n) | | PULSE_4 |
| SD1061 | | | |
| SD1062 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1063 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1064 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1065 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1066 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1067 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1068 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1069 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1070 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal | |

| | | | |
|---|---|---|---|
| | | 10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1071 | Error pulse data block number | | |
| | | | |
| SD1080 | Present segment (represents segment n) | | |
| SD1081 | | | |
| SD1082 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1083 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1084 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1085 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1086 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1087 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1088 | Present pulse number | | PULSE_5 |

| | | | |
|---|---|---|---|
| | low 16-bit (the unit is pulse equivalent) | | |
| SD1089 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1090 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC⩾VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ⩽ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ⩽0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1091 | Error pulse data block number | | |
| | | | |
| SD1100 | Present segment (represents segment n) | | PULSE_6 |
| SD1101 | | | |
| SD1102 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1103 | Present pulse number high 16-bit (the unit is | | |

| | | | |
|---|---|---|---|
| | pulse number) | | |
| SD1104 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1105 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1106 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1107 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1108 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1109 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1110 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error | |

| | | | |
|---|---|---|---|
| | | 24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1111 | Error pulse data block number | | |
| | | | |
| SD1120 | Present segment (represents segment n) | | PULSE_7 |
| SD1121 | | | |
| SD1122 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1123 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1124 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1125 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1126 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1127 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1128 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1129 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1130 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH | |

| | | | |
|---|---|---|---|
| | | 13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1131 | Error pulse data block number | | |
| | | | |
| SD1140 | Present segment (represents segment n) | | |
| SD1141 | | | |
| SD1142 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1143 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1144 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1145 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1146 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1147 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1148 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1149 | Present pulse number high 16-bit (the unit is pulse equivalent) | | PULSE_8 |

| | | | |
|---|---|---|---|
| SD1150 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC⩾VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ⩽ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ⩽0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1151 | Error pulse data block number | | |
| | | | |
| SD1160 | Present segment (represents segment n) | | PULSE_9 |
| SD1161 | | | |
| SD1162 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1163 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1164 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |

| | | | |
|---|---|---|---|
| SD1165 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1166 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1167 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1168 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1169 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1170 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1171 | Error pulse data block | | |

| | | | |
|---|---|---|---|
| | number | | |
| | | | |
| SD1180 | Present segment (represents segment n) | | PULSE-_10 |
| SD1181 | | | |
| SD1182 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1183 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1184 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1185 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1186 | Present pulse number low 16-bit (the unit is pulse number) | | |
| SD1187 | Present pulse number high 16-bit (the unit is pulse number) | | |
| SD1188 | Present pulse number low 16-bit (the unit is pulse equivalent) | | |
| SD1189 | Present pulse number high 16-bit (the unit is pulse equivalent) | | |
| SD1190 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per rotation and the movement per rotation is 0<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC≥VH<br>13: Origin regression signal error<br>15:Follow Performance Parameters ≤ 0 or >100<br>16:Follow Feedforward Compensation <0 or>100 | |

| | | | |
|---|---|---|---|
| | | 17:Follow Multiplication Coefficient and Division Coefficient Ratio ≤0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1191 | Error pulse data block number | | |
| | | | |

**High speed pulse special data register HSD (power off memory)**

| Register | Function | Note | |
|---|---|---|---|
| HSD0 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD1 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD2 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD3 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_1 |
| HSD4 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD5 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD6 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD7 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_2 |
| HSD8 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD9 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD10 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD11 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_3 |

| | | | |
|---|---|---|---|
| HSD12 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD13 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD14 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD15 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_4 |
| HSD16 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD17 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD18 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD19 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_5 |
| HSD20 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD21 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD22 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD23 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_6 |
| HSD24 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD25 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD26 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD27 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_7 |
| HSD28 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD29 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD30 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD31 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_8 |
| HSD32 | Low 16 bits of cumulative pulse (the unit is pulse number) | | PULSE_9 |

| | | | |
|---|---|---|---|
| HSD33 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD34 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD35 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD36 | Low 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD37 | High 16 bits of cumulative pulse (the unit is pulse number) | | |
| HSD38 | Low 16 bits of cumulative pulse (the unit is pulse equivalent) | | |
| HSD39 | High 16 bits of cumulative pulse (the unit is pulse equivalent) | | PULSE_10 |

# 2 Motion control

## 2-1. Motion control instruction list

The following motion control instructions are suitable for XDM, XDME, XLME series PLC.

| Instruction | Function | Chapter |
|---|---|---|
| DRV | Quick positioning | 2-4-1 |
| DRVR | Quick positioning, polar coordinate mode (temporarily unavailable) | 2-4-2 |
| LIN line | Linear interpolation | 2-4-3 |
| LIN line VM | Linear interpolation, maximum speed can be specified separately | 2-4-3 |
| LIN line VBEM | Linear interpolation, can specify the starting speed, terminal speed and maximum speed separately | 2-4-3 |
| CW clockwise | Clockwise circular interpolation | 2-4-4 |
| CW closewise VM | Clockwise circular interpolation, maximum speed can be specified separately | 2-4-4 |
| CW closewise VBEM | Clockwise circular interpolation，can specify the starting speed, terminal speed and maximum speed separately | 2-4-4 |
| CCW anticlockwise | Anticlockwise circular interpolation | 2-4-5 |
| CCW anticlockwise VM | Anticlockwise circular interpolation, maximum speed can be specified separately | 2-4-5 |
| CCW anticlockwise VBEM | Anticlockwise circular interpolation, can specify the starting speed, terminal speed and maximum speed separately | 2-4-5 |
| CW_R closewise | Clockwise circular interpolation (Specified radius) | 2-4-6 |
| CW_R closewise VM | Clockwise circular interpolation(Specified radius), maximum speed can be specified separately | 2-4-6 |
| CW_R closewise VBEM | Clockwise circular interpolation(Specified radius)，can specify the starting speed, terminal speed and maximum speed separately | 2-4-6 |
| CCW_R anticlockwise | Anticlockwise circular interpolation(Specified radius) | 2-4-7 |
| CCW_R anticlockwise VM | Anticlockwise circular interpolation(Specified radius), maximum speed can be specified separately | 2-4-7 |
| CCW_R anticlockwise VBEM | Anticlockwise circular interpolation(Specified radius)，can specify the starting speed, terminal speed and maximum speed separately | 2-4-7 |

| | | |
|---|---|---|
| ARC three points | Three points arc | 2-4-8 |
| ARC three point VM | Three points arc, maximum speed can be specified separately | 2-4-8 |
| ARC three point VBEM | Three points arc, can specify the starting speed, terminal speed and maximum speed separately | 2-4-8 |
| FOLLOW | Single phase follow | 2-4-9 |
| FOLLOW_AB | AB phase follow | 2-4-9 |

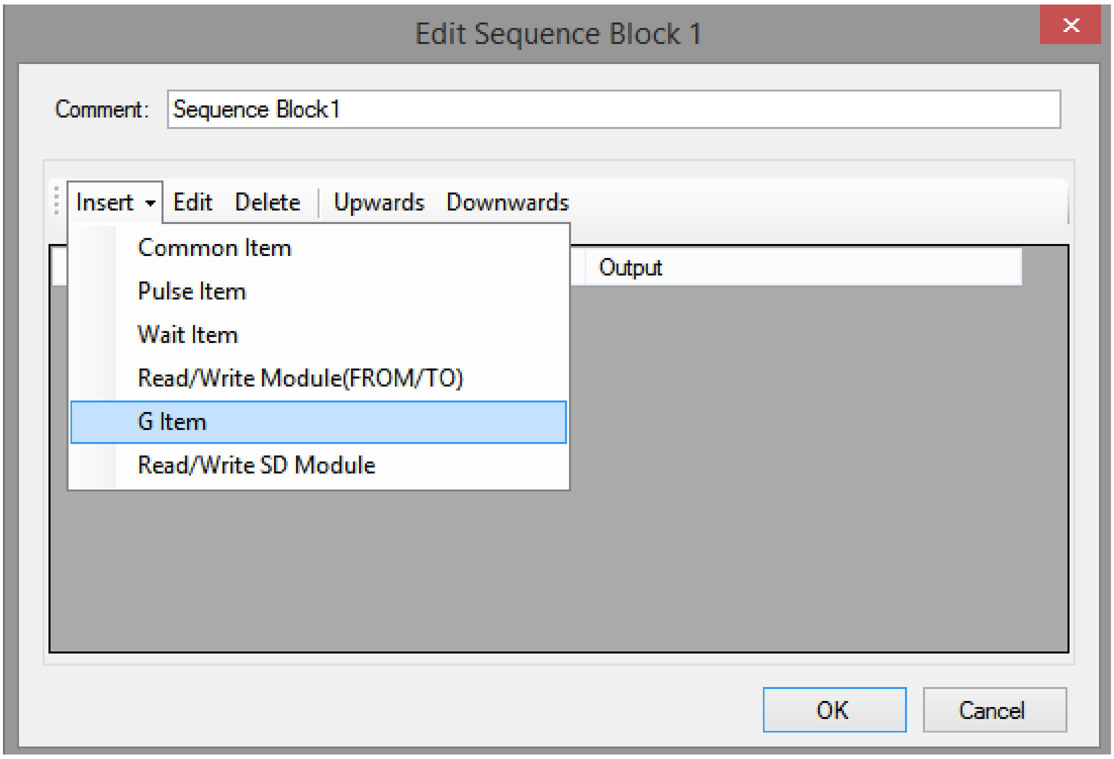
**Note: All interpolation instructions have no stop when jumping, there is inflection point.**

## 2-2. Writing method of motion control instruction

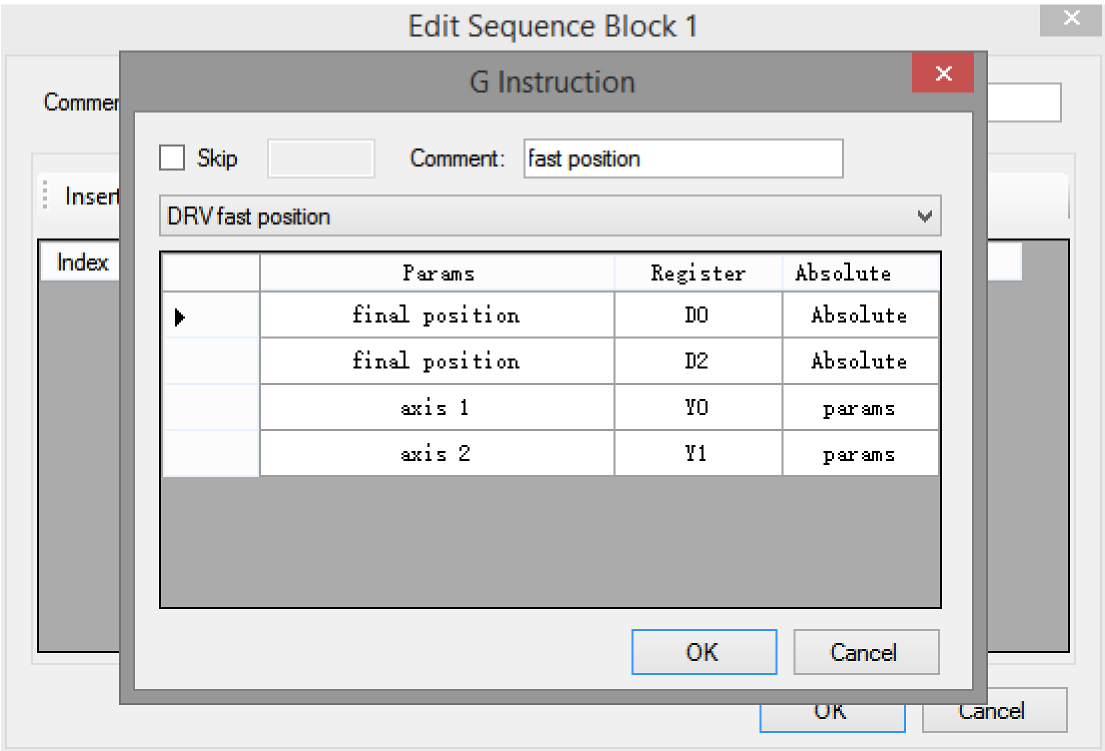
Except FOLLOW, other motion control instructions must be written in the BLOCK. The specific methods are as follows:

1. insert a sequence block 

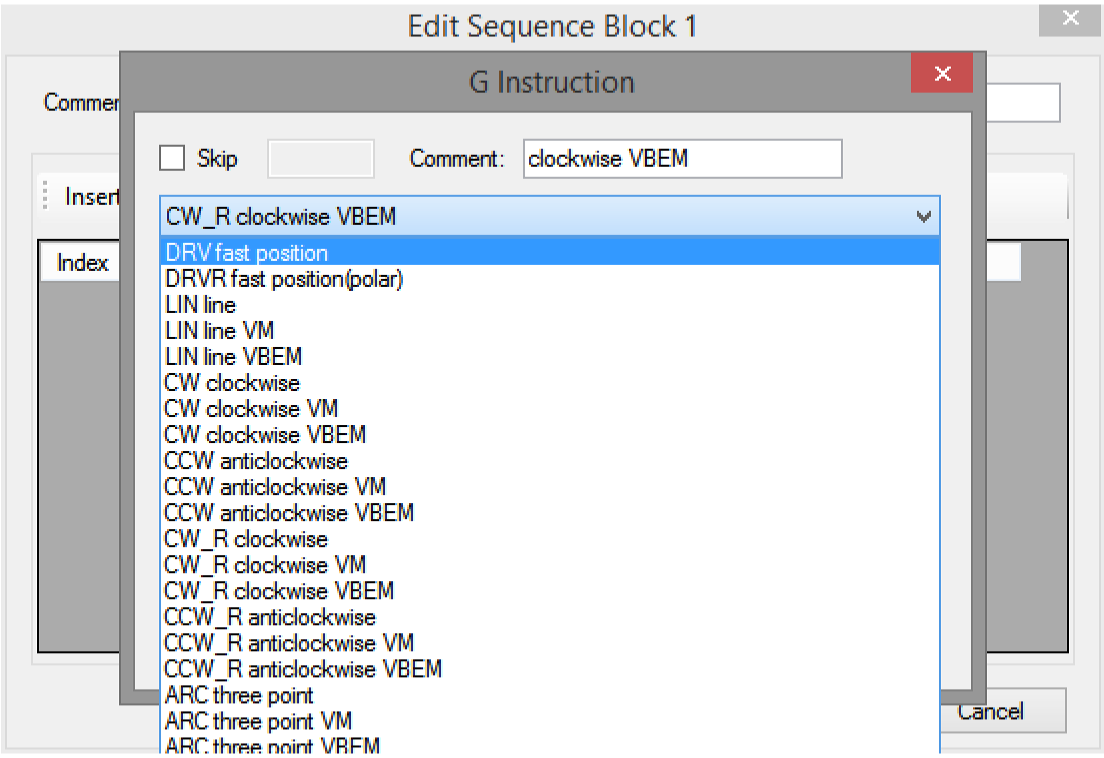
in the ladder chart, then insert G instruction.



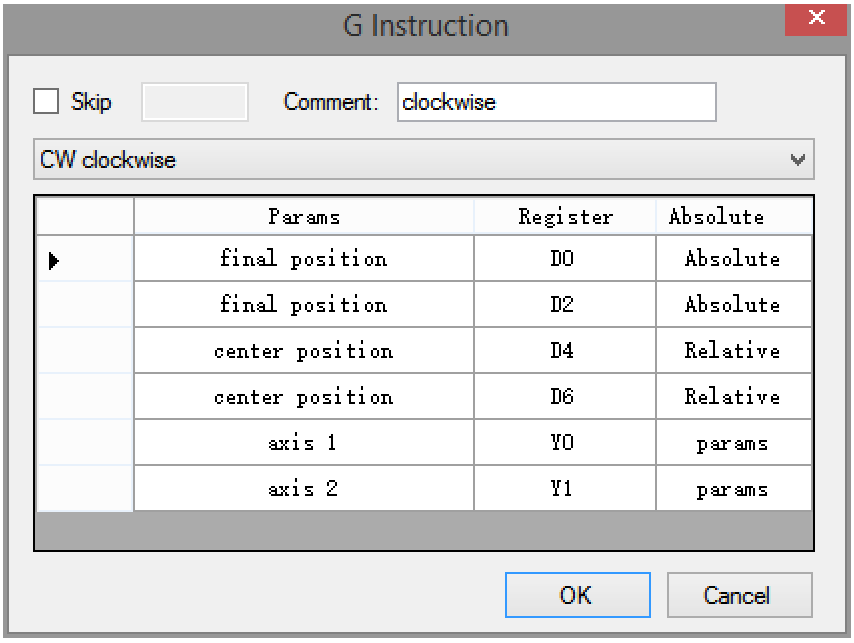

2. it will show the following window




3. click the dropdown menu, select the motion control instruction to

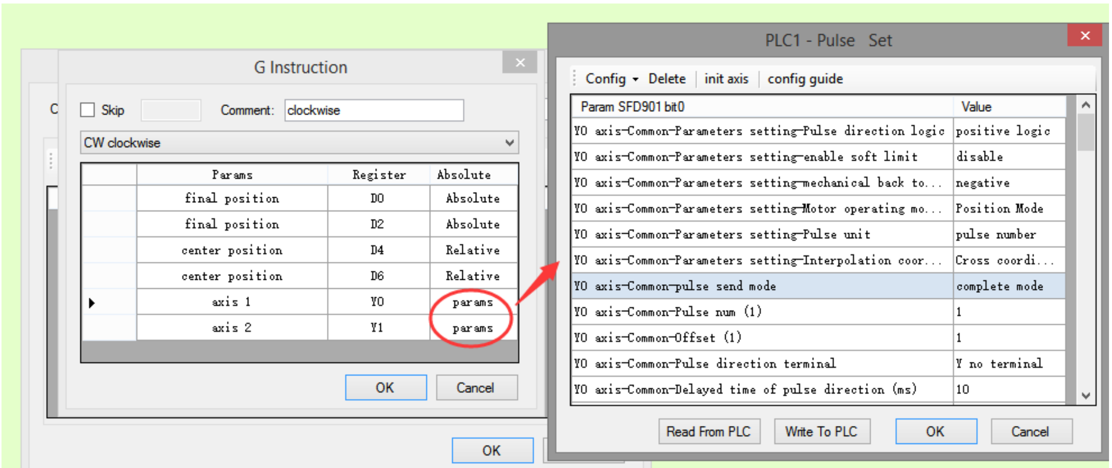



4. click the motion control instruction CW clockwise, it will show the instruction configuration window:




In the register list, double click the value can change the register address and axis output terminal. In the absolute list, double click the value can set the mode (relative/absolute).

Double click the parameters can set the direction, speed, acc/dec time of the two axes, please see the follows:

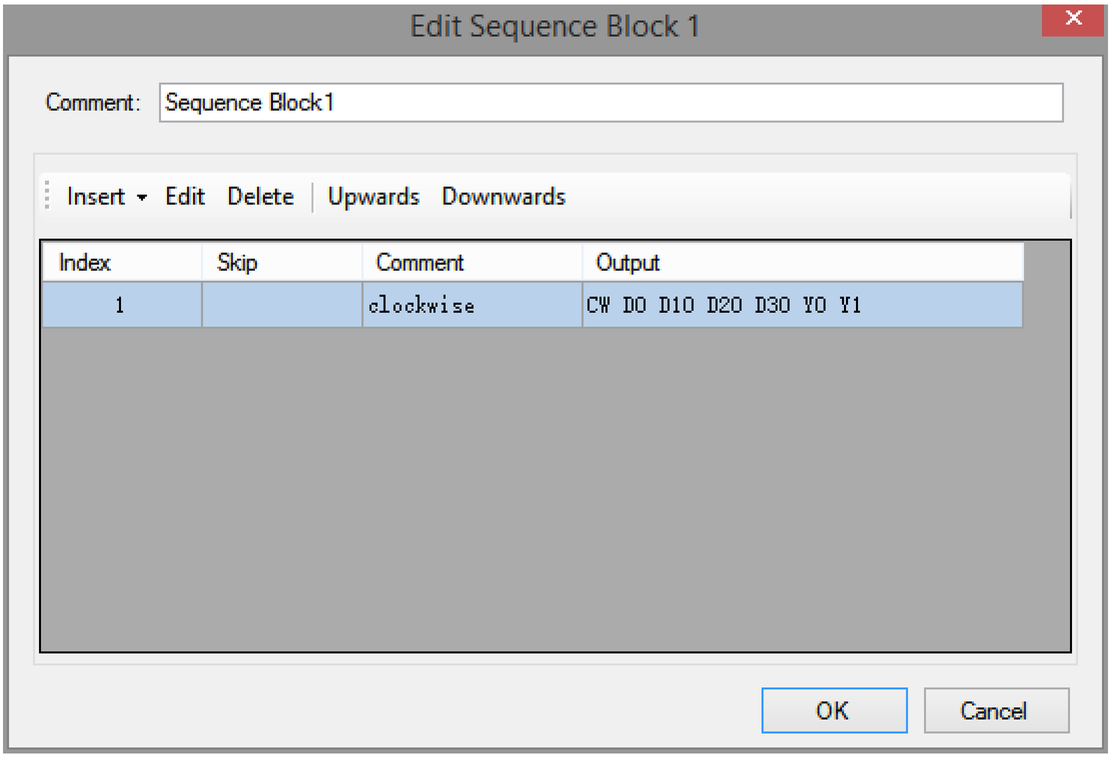



**Note:**

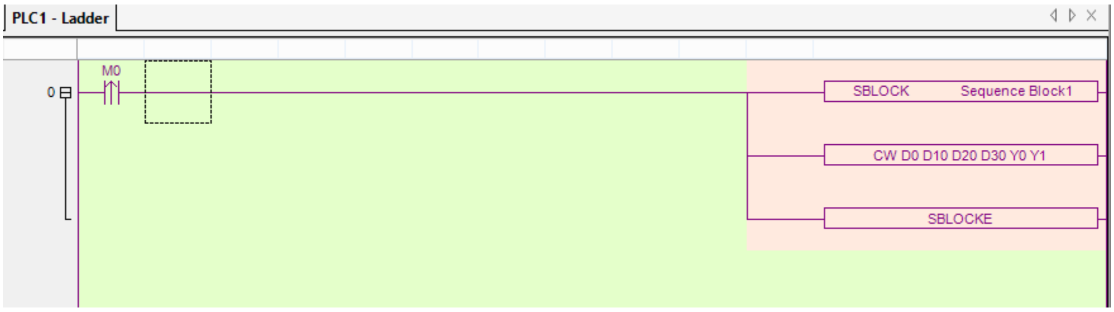
**(1) Different instructions require different system parameter blocks. See chapter 2-3-2 and instructions for details.**

**(2) See chapter 1-2-1 for system parameters.**

5. Configuration is completed, click OK, and you can see the general situation of the generated instructions in the SBLOCK:




6. A complete motion control instruction is completed by generating the motion control instructions in the ladder diagram and inputting the driving conditions.




7. Execute BLOCK once every time M0 rises.

8. Multiple motion control instructions can be inserted into BLOCK. Lines and arcs can be used to fulfill different interpolation requirements.

## 2-3. Pulse output terminal distribution and parameters

This section will introduce the distribution of the output port of each PLC pulse in XD series and the configuration of the parameters of each axis pulse.

### 2-3-1. Pulse output port distribution

In all transistor output terminals of XDM series PLC, the operation axes of axle 1 and axle 2 can be arbitrarily specified, and the corresponding direction terminals can also be arbitrarily specified.

**XDM-24T4**

| Output | Y0~Y3 | Y4~Y11 |
|---|---|---|
| Function | Pulse output | Direction output |

**XDM-32T4, XLME-32T4**

| Output | Y0~Y3 | Y4~Y15 |
|---|---|---|
| Function | Pulse output | Direction output |

**XDM-60T4, XDM-60T4L, XDME-60T4, XDH-60T4**

| Output | Y0~Y3 | Y4~Y27 |
|---|---|---|
| Function | Pulse output | Direction output |

**XDM-60T10, XDME-60T10**

| Output | Y0~Y11 | Y12~Y27 |
|---|---|---|
| Function | Pulse output | Direction output |

**Note: Pulse output terminals that are not used can also be used as directional terminals.**

### 2-3-2. Pulse output terminal parameters

In order to execute the motion control command, it is necessary to configure the pulse control parameters of axis 1 and axis 2. However, only part of the pulse parameters are used in the motion control command, and part of these parameters are common parameters of two axes (i.e. the parameters configurated in axis 1 are valid). As shown in the following figure:

| | | | |
|---|---|---|---|
| Common parameter | Pulse direction logic | Independent parameter | Axis 1 and 2 need to be set |
| | Enable soft limit | Common parameter | Only need to set axis 1 |
| | Pulse unit | Common parameter | Only need to set axis 1 |
| | Pulse number | Independent | Axis 1 and 2 need to be set |

| | | | |
|---|---|---|---|
| | | parameter | |
| | Offset | Independent parameter | Axis 1 and 2 need to be set |
| | Pulse direction terminal | Independent parameter | Axis 1 and 2 need to be set |
| | Signal terminal switch state setting---positive limit | Independent parameter | Axis 1 and 2 need to be set |
| | Signal terminal switch state setting---negative limit | Independent parameter | Axis 1 and 2 need to be set |
| | Positive limit terminal setting | Independent parameter | Axis 1 and 2 need to be set |
| | Negative limit terminal setting | Independent parameter | Axis 1 and 2 need to be set |
| | Soft limit positive value | Independent parameter | Axis 1 and 2 need to be set |
| | Soft limit negative value | Independent parameter | Axis 1 and 2 need to be set |
| Group 2 parameters | Pulse default speed | Common parameter | Only need to set axis 1 |
| | Acceleration time of pulse default speed | Common parameter | Only need to set axis 1 |
| | Deceleration time of pulse default speed | Common parameter | Only need to set axis 1 |
| | Max speed | Common parameter | Only need to set axis 1 |
| | Initial speed | Common parameter | Only need to set axis 1 |
| | Stop speed | Common parameter | Only need to set axis 1 |

**Note: The above table is applicable to all motion control instructions except DRV and DRVR.**

**DRV and DRVR instructions used parameters:**

| | | | |
|---|---|---|---|
| Common parameters | Pulse direction logic | Independent parameter | Axis 1 and 2 need to be set |
| | Enable soft limit | Common parameter | Only need to set axis 1 |
| | Pulse unit | Common parameter | Only need to set axis 1 |
| | Pulse number | Independent parameter | Axis 1 and 2 need to be set |
| | Offset | Independent parameter | Axis 1 and 2 need to be set |
| | Pulse direction terminal | Independent | Axis 1 and 2 need to be set |

| | | | |
|---|---|---|---|
| | | parameter | |
| | Signal terminal switch state setting---positive limit | Independent parameter | Axis 1 and 2 need to be set |
| | Signal terminal switch state setting---negative limit | Independent parameter | Axis 1 and 2 need to be set |
| | Positive limit terminal setting | Independent parameter | Axis 1 and 2 need to be set |
| | Negative limit terminal setting | Independent parameter | Axis 1 and 2 need to be set |
| | Soft limit positive value | Independent parameter | Axis 1 and 2 need to be set |
| | Soft limit negative value | Independent parameter | Axis 1 and 2 need to be set |
| Group 1 parameters | Pulse default speed | Common parameter | Axis 1 and 2 need to be set |
| | Acceleration time of pulse default speed | Common parameter | Axis 1 and 2 need to be set |
| | Deceleration time of pulse default speed | Common parameter | Axis 1 and 2 need to be set |
| | Max speed | Common parameter | Axis 1 and 2 need to be set |
| | Initial speed | Common parameter | Axis 1 and 2 need to be set |
| | Stop speed | Common parameter | Axis 1 and 2 need to be set |

**Note: For a detailed description of the pulse parameters, please refer to the relevant content of Chapter 1.**

# 2-4. Motion control instruction

## 2-4-1. Quick positioning [DRV]

1. instruction overview

Quick positioning instructions. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Quick positioning [DRV] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | DRV |
| Execute condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. operand

| Operand | Function | Type |
|---|---|---|
| S0 | The target position of axis 1 | Double words, 32-bit |
| S1 | The target position of axis 2 | Double words, 32-bit |
| D0 | Pulse output terminal of axis 1 | Bit |
| D1 | Pulse output terminal of axis 2 | Bit |

3. suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

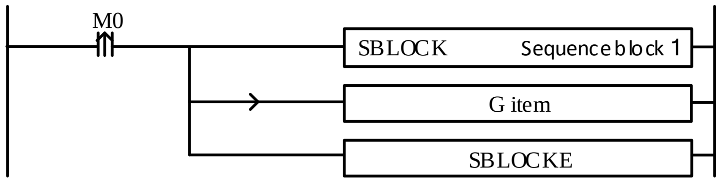
4. Parameter setting

| Relative parameters | Settings | Note |
|---|---|---|
| Final position | Free to specify register address | Must set |
| Relative/ absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Axis 1 pulse output port | Free to specify pulse output terminal | Must set |
| Axis 2 pulse output | Free to specify pulse output terminal | Must set |

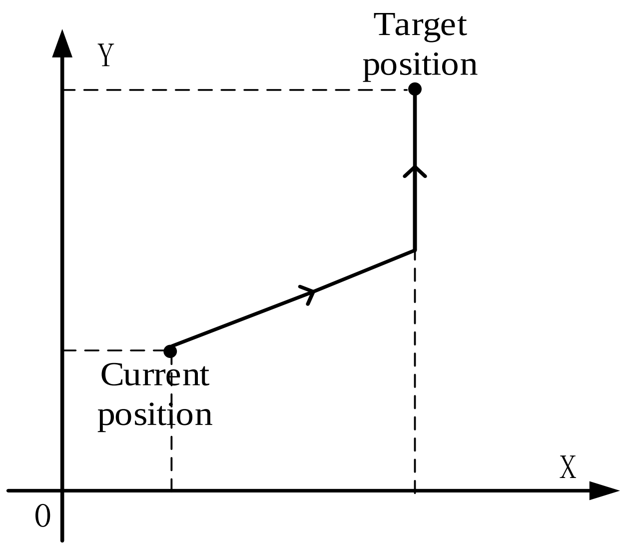
| | | |
|---|---|---|
| port | | |
| Axis 1 direction port | Arbitrarily specify idle output points, set in system parameters | Must set |
| Axis 2 direction port | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | Setting in System Parameters of Axis 1 | Must set |
| Pulse default speed | Specify in group 1 parameters of the system parameters of each axis | Must set |
| Acceleration time | Specify in group 1 parameters of the system parameters of each axis | No need to set |
| Deceleration time | Specify in group 1 parameters of the system parameters of each axis | No need to set |

**Function and action**

《Instruction format》



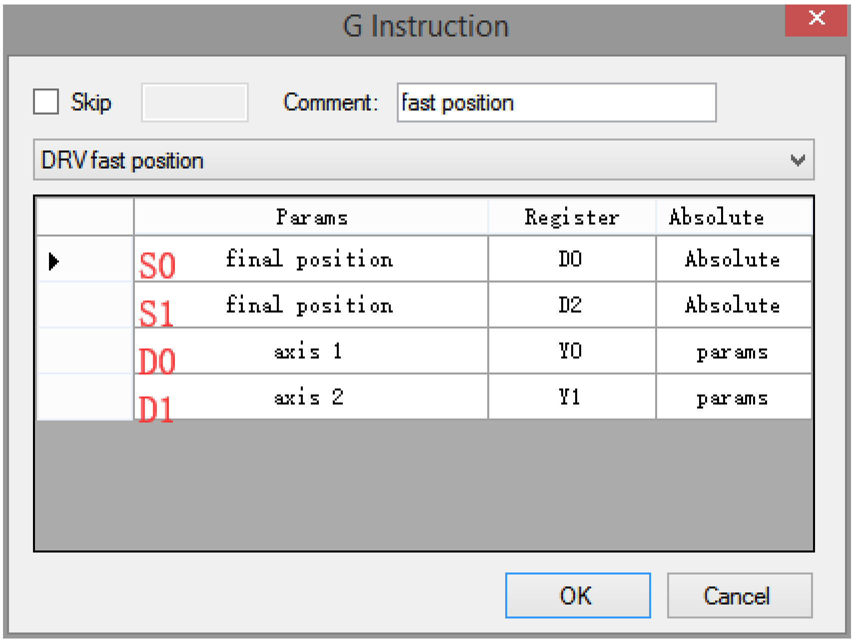

When the quick positioning DRV command is executed, the two axes will move rapidly from the current position to the target position at the default pulse speed set by their respective axes (when one axis is finished first, the other axis will continue to move at the default pulse speed, and then finish positioning after reaching the target position). As shown in the following figure:



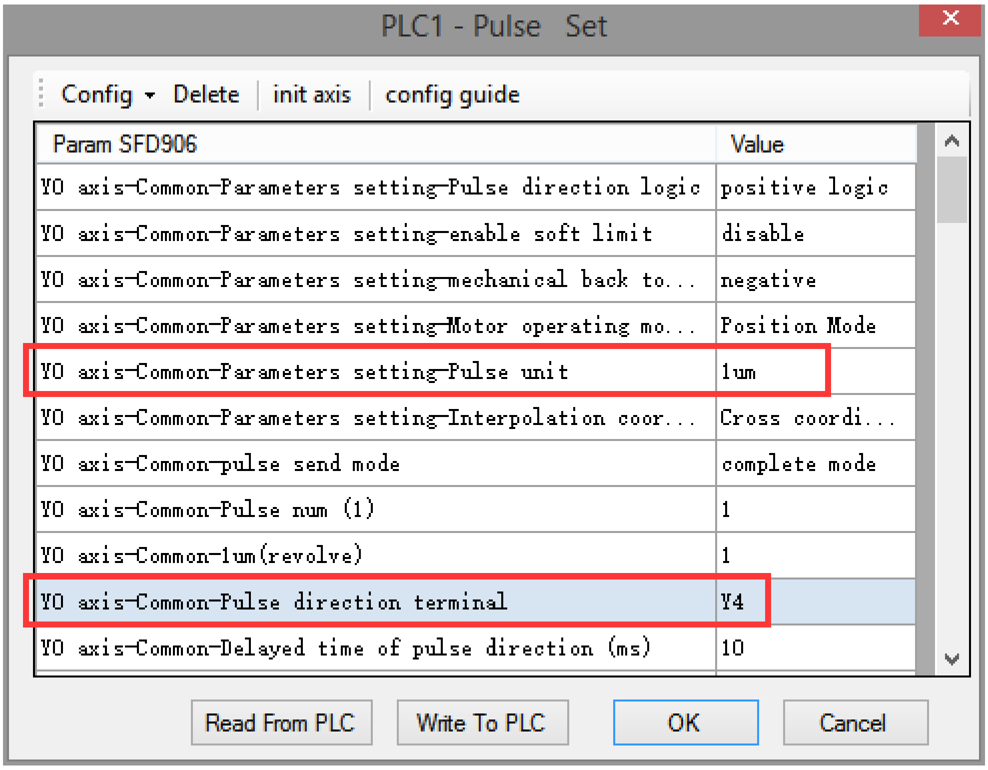

**DRV quick positioning**

**Parameter configuration**

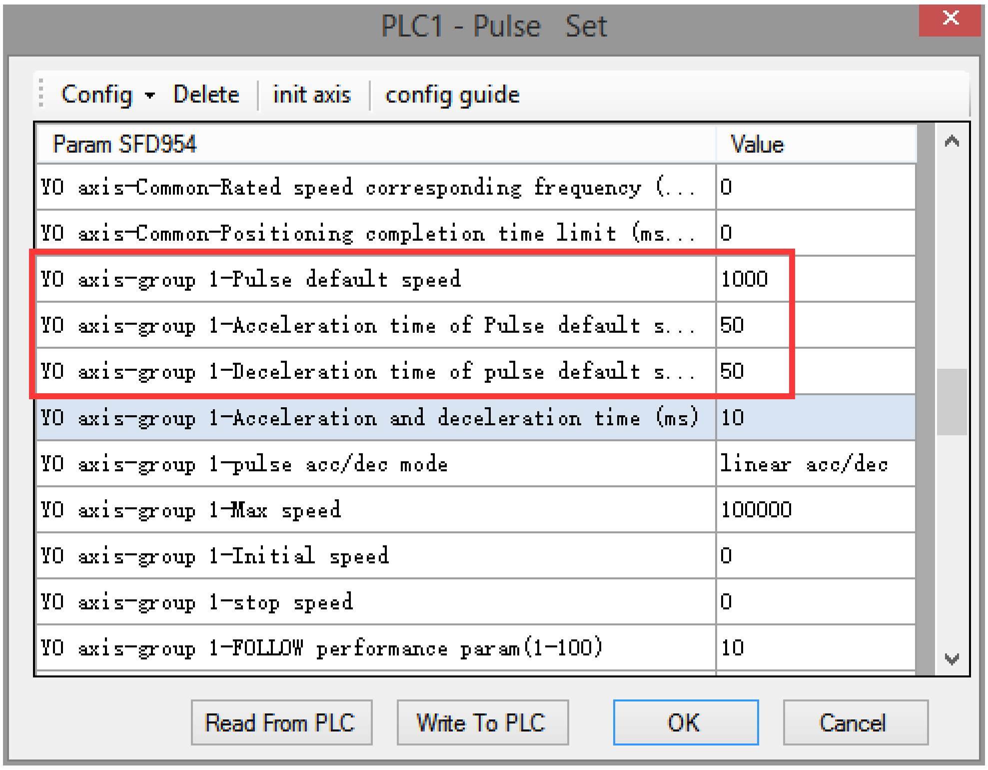
Double click G item, it will pop up the DRV configuration panel:



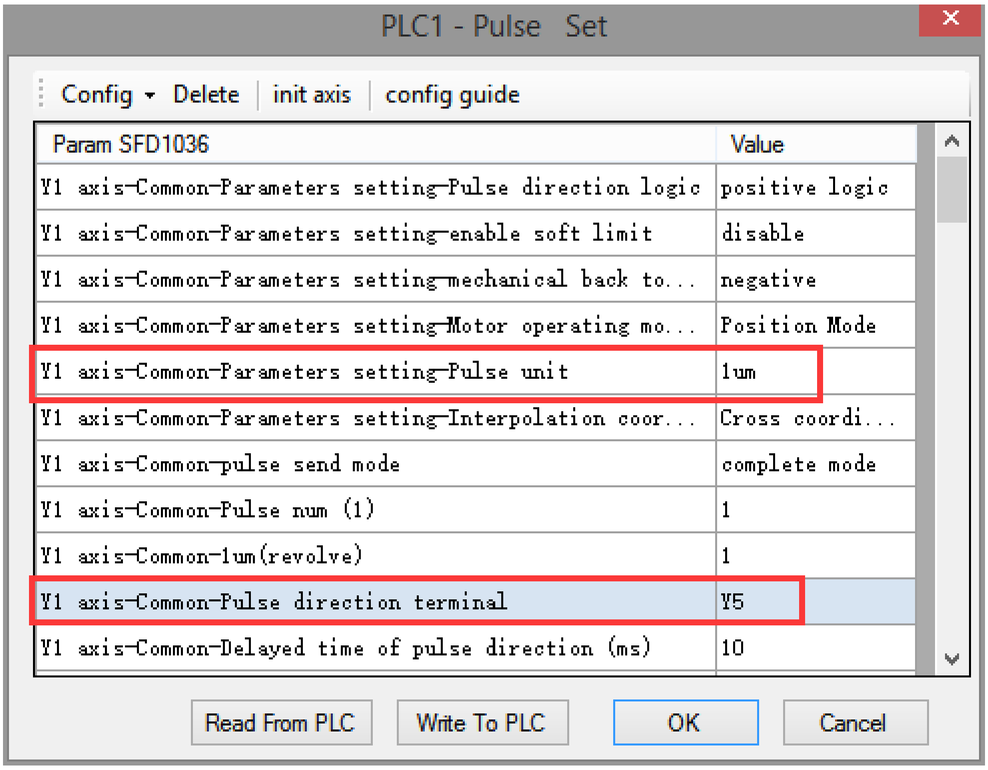

**Command configuration**



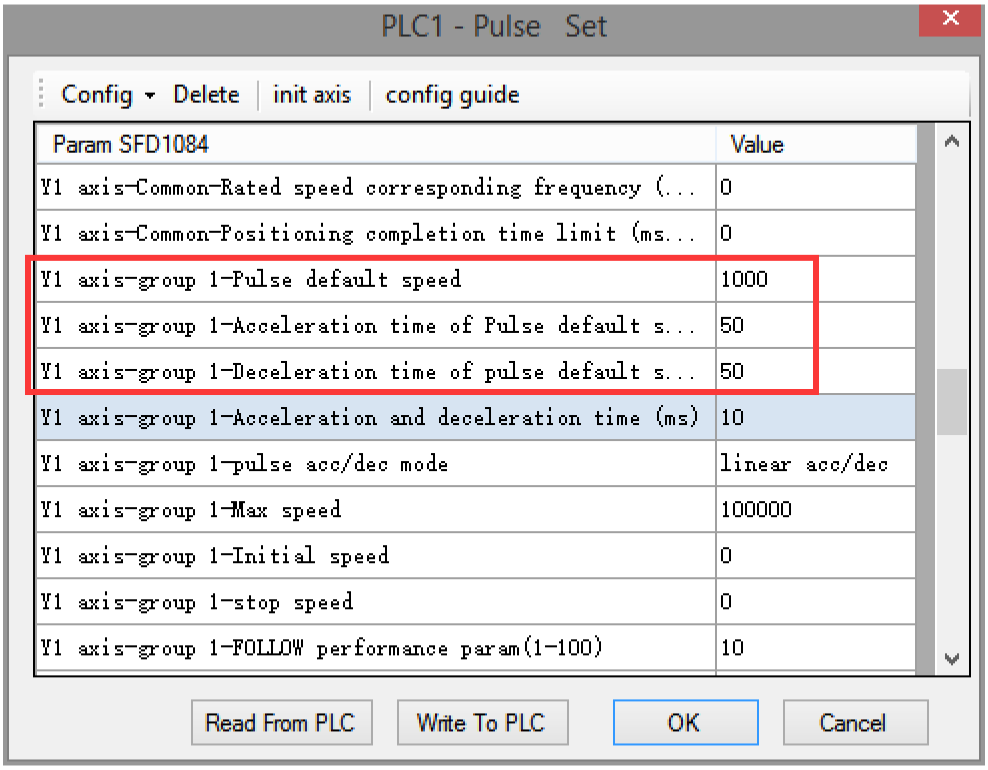

**Y0 axis system parameters (1)**




**Y0 axis system parameters (2)**




**Y1 axis system parameters (1)**

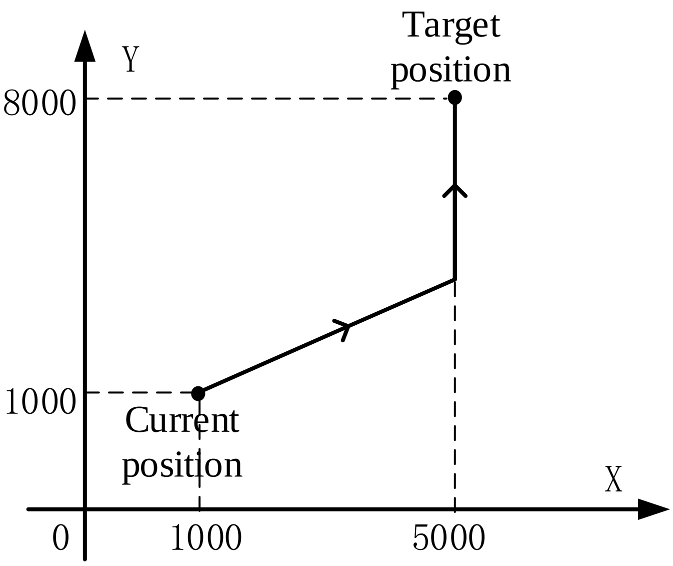



**Y1 axis system parameters (2)**

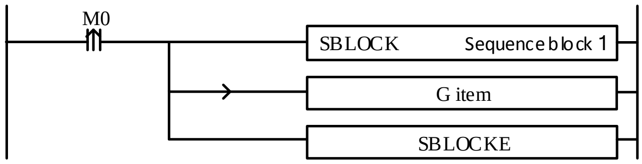
- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is set ON for the forward pulse and set OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Position movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 500, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute DRV instructions and move to the target position with 1000 Hz, 50ms acceleration/deceleration time, if:
  (1) If the final position is absolute mode, the target position is (5000,2000);
  (2) When the final position is in the relative mode, the target position is (5500,3000).
- When the DRV instruction is running, the pulse flag bit corresponding to the output port Y of the DRV instruction will be set on.

**Note: DRV instructions are fixed using group 1 parameters!**

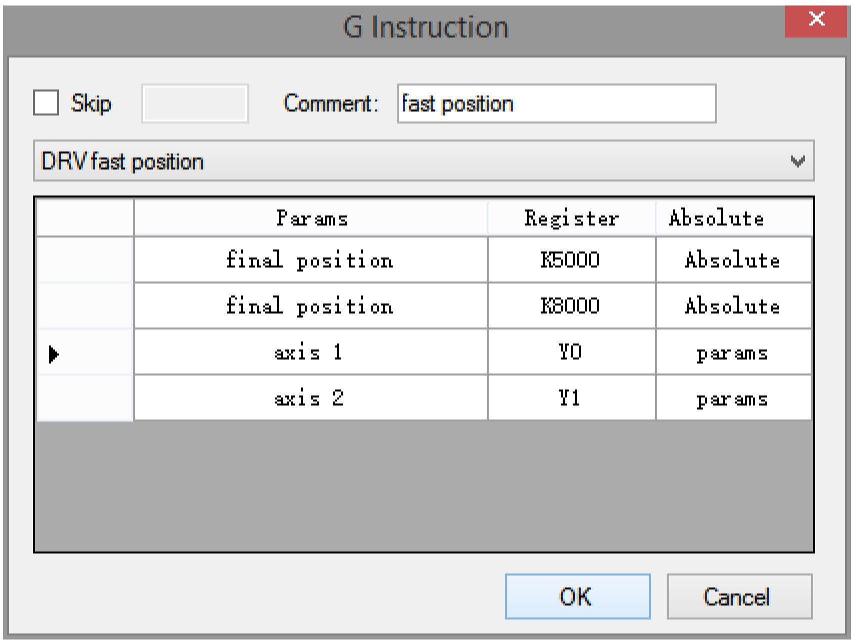
As shown in the figure below, the current position coordinates of the worktable are (1000,1000) and the target coordinates are (5000,8000). The two axes are Y0 and Y1, respectively. The default pulse speeds are all 5000. The acceleration and deceleration slopes are changed by 1000Hz for 30ms, and the pulse direction terminals are Y4 and Y5. Note: The above numerical units are pulse numbers.



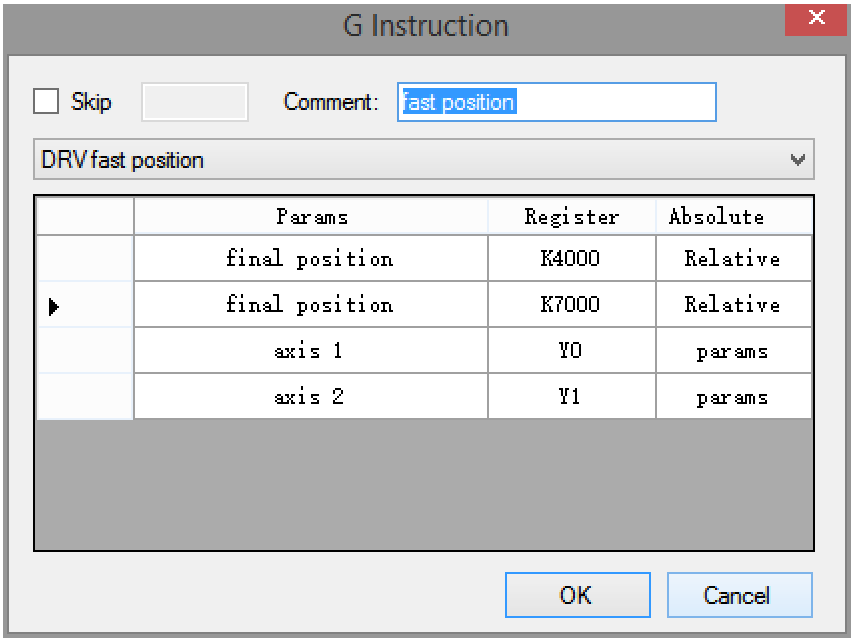

Ladder chart:




G item configurations:

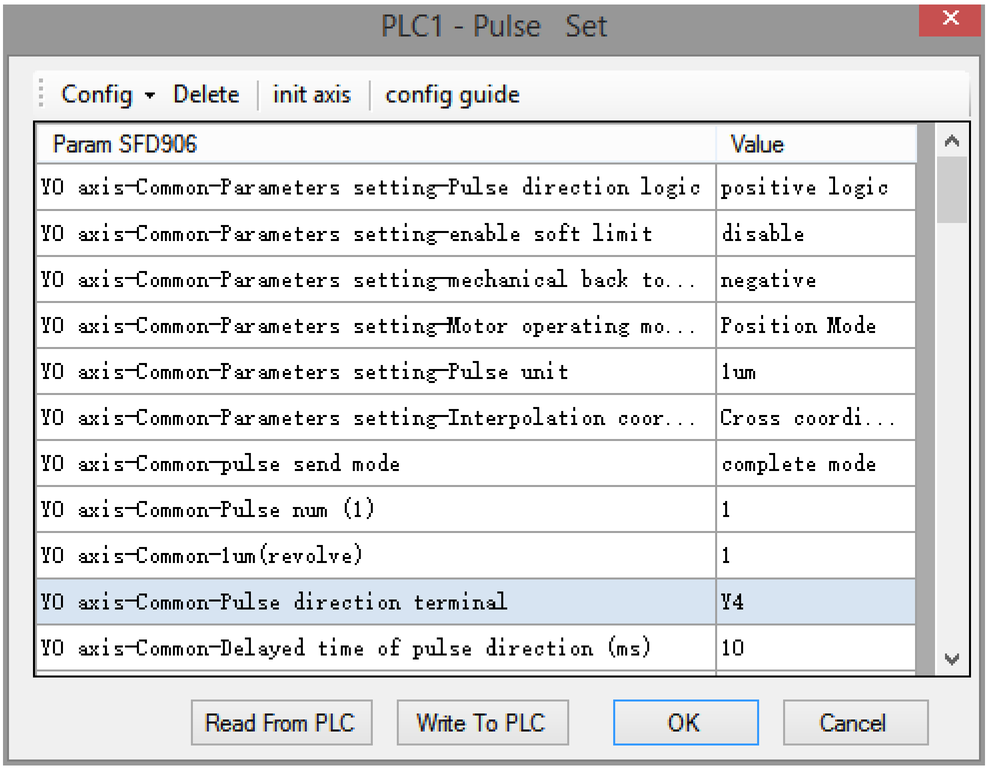


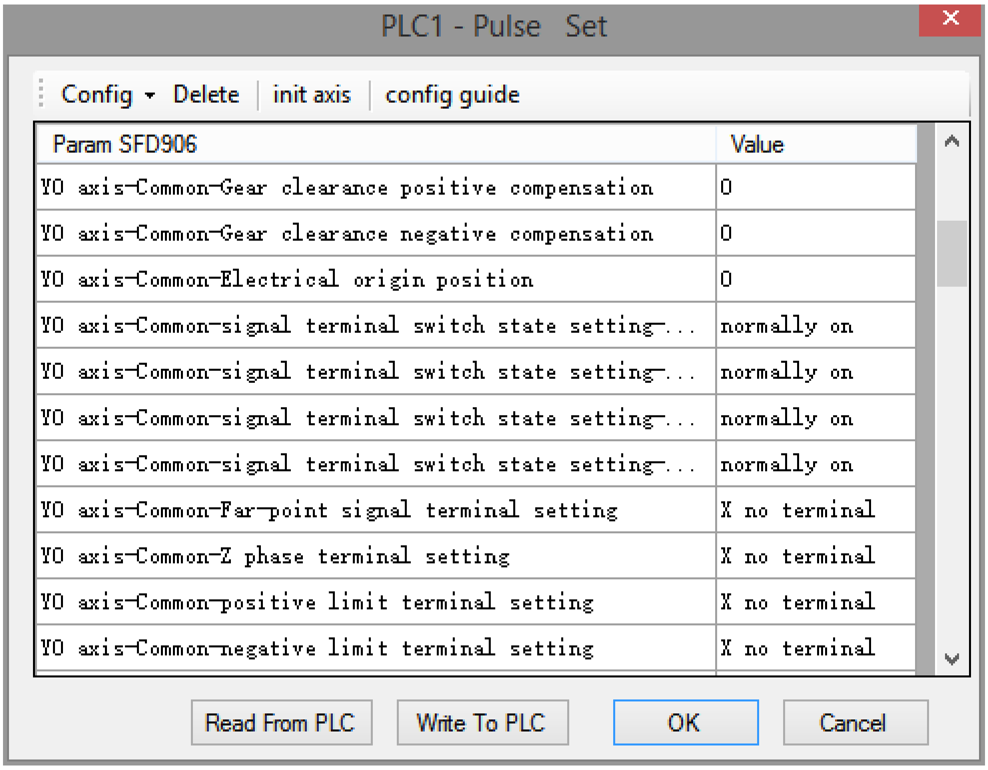

**Absolute mode**

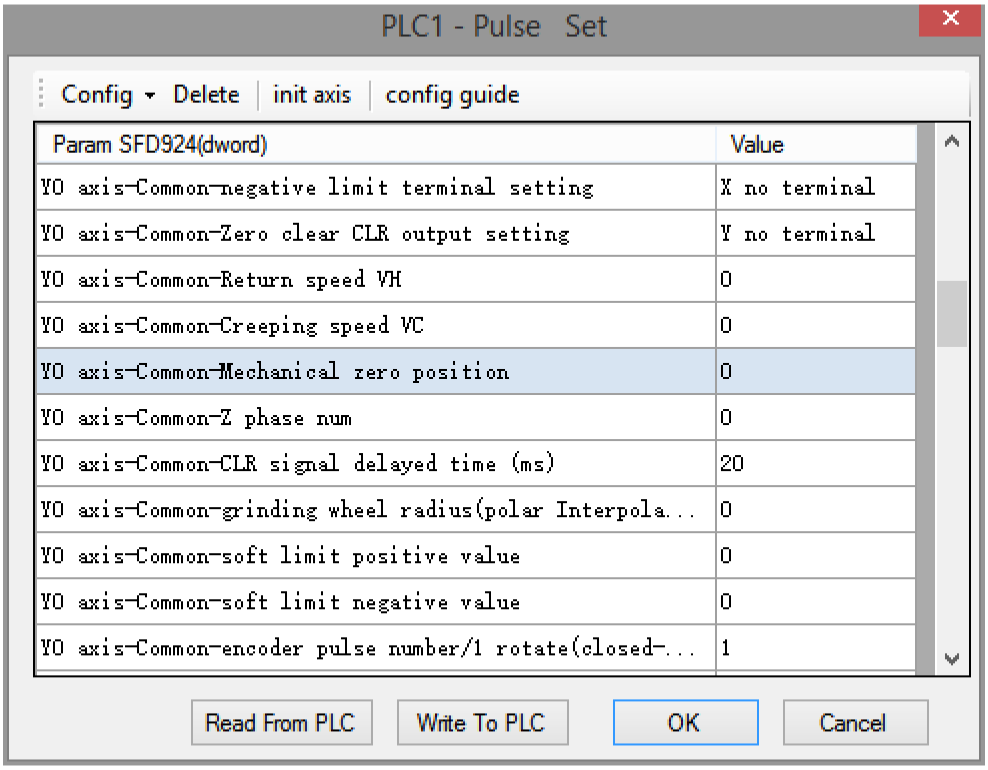


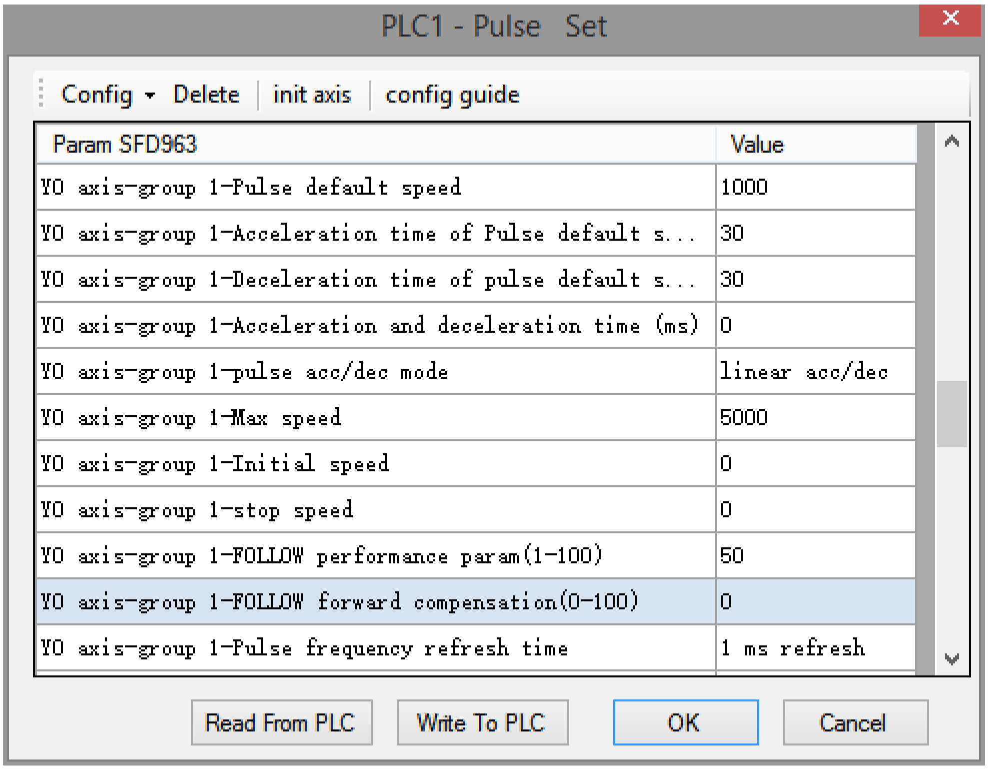

**Relative mode**

Axis 1(Y0) parameters:

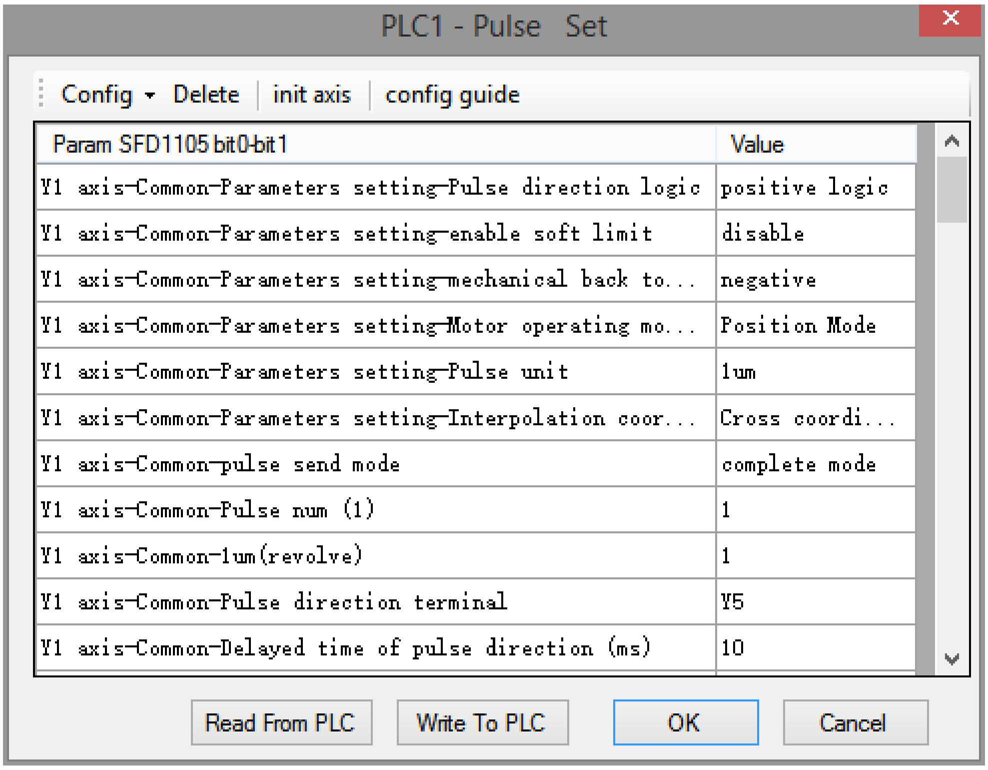


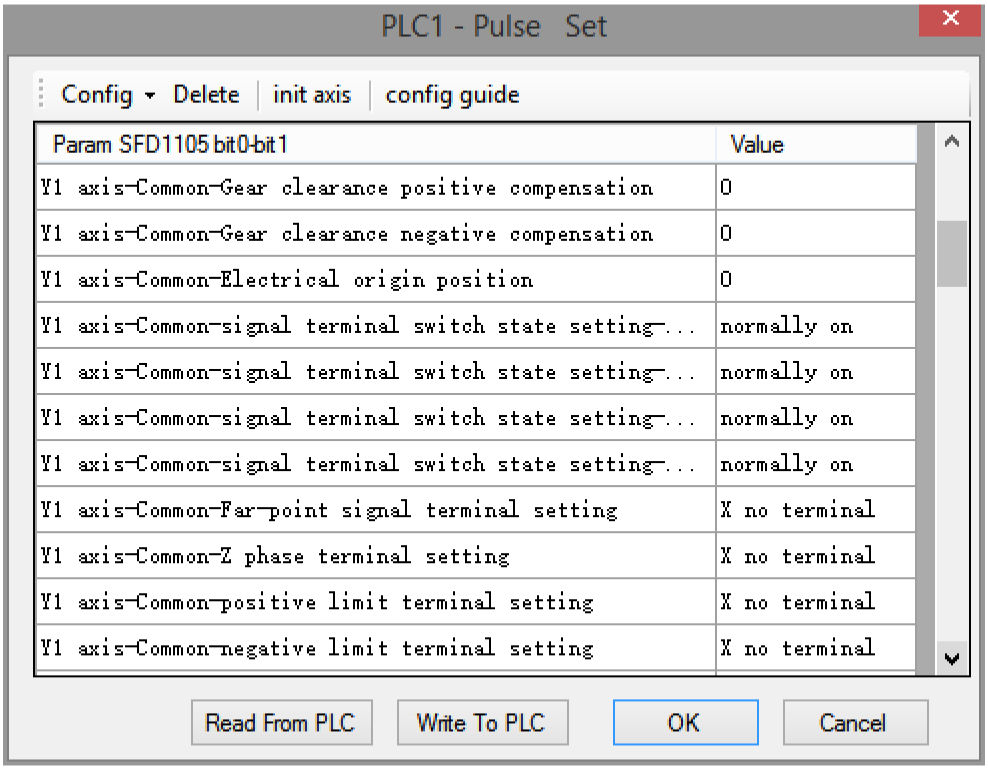

PLC1 - Pulse Set
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X no terminal
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X no terminal
Y0 axis-Common-negative limit terminal setting
X no terminal
Read From PLC
Write To PLC
OK
Cancel

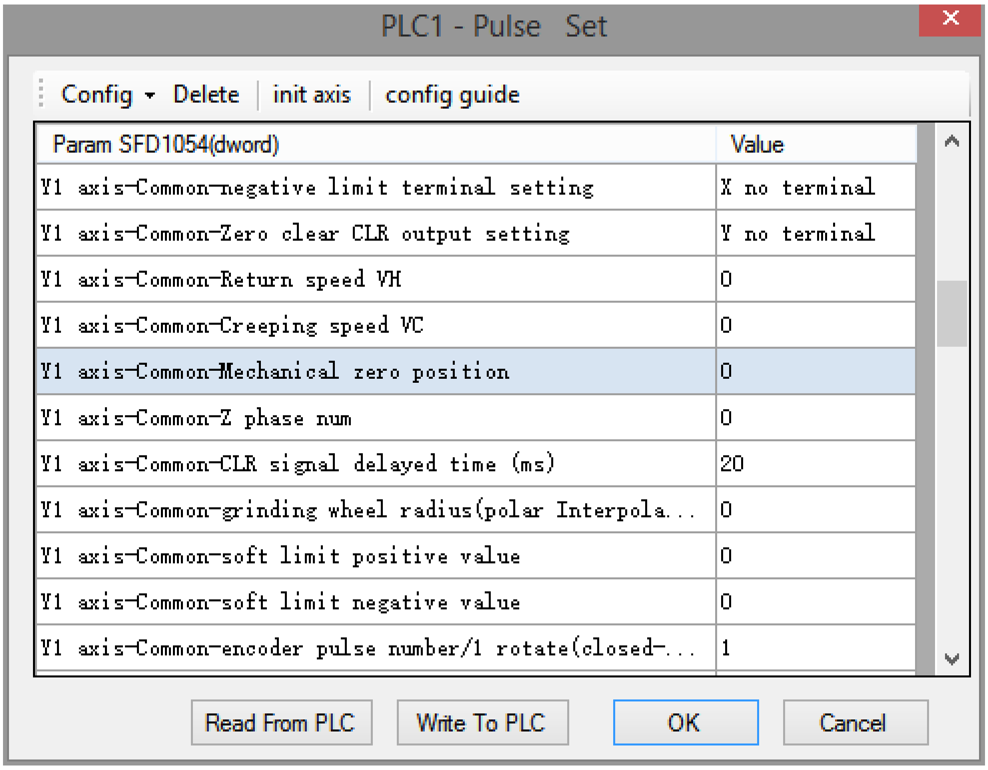

PLC1 - Pulse Set
Config
Delete
init axis
config guide
Param SFD924(dword)
Value
Y0 axis-Common-negative limit terminal setting
X no terminal
Y0 axis-Common-Zero clear CLR output setting
Y no terminal
Y0 axis-Common-Return speed VH
0
Y0 axis-Common-Creeping speed VC
0
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Y0 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel

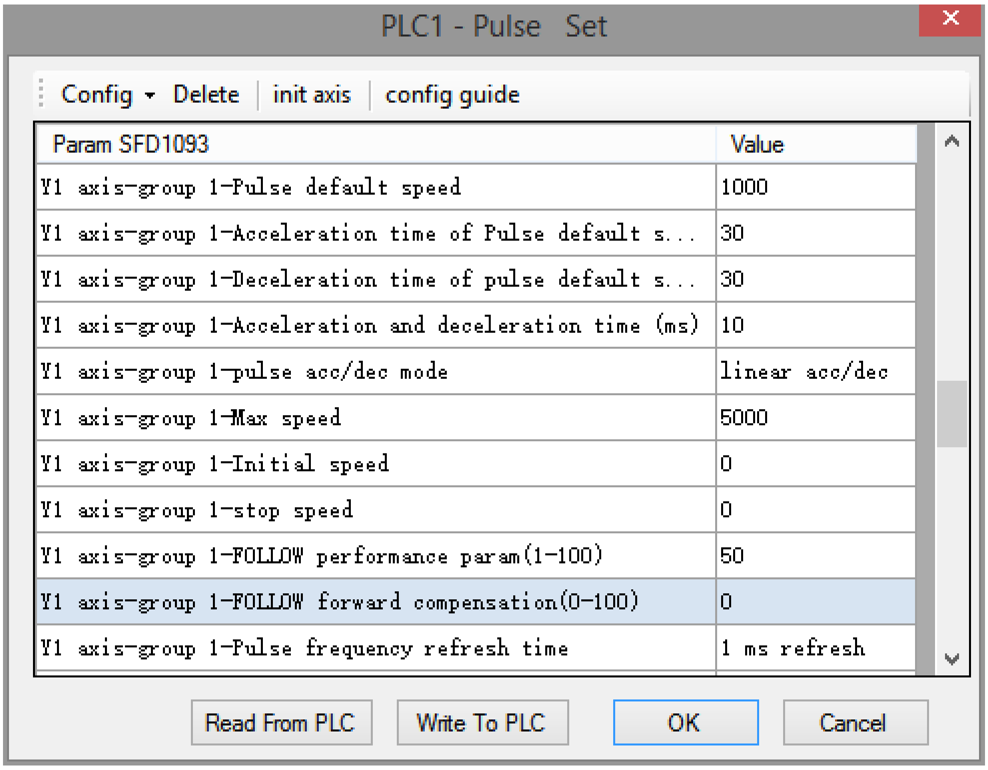



Axis 2 (Y1) parameters:




PLC1 - Pulse Set
Config Delete init axis config guide
Param SFD1105 bit0-bit1
Value
Y1 axis-Common-Gear clearance positive compensation
0
Y1 axis-Common-Gear clearance negative compensation
0
Y1 axis-Common-Electrical origin position
0
Y1 axis-Common-signal terminal switch state setting-...
normally on
Y1 axis-Common-signal terminal switch state setting-...
normally on
Y1 axis-Common-signal terminal switch state setting-...
normally on
Y1 axis-Common-signal terminal switch state setting-...
normally on
Y1 axis-Common-Far-point signal terminal setting
X no terminal
Y1 axis-Common-Z phase terminal setting
X no terminal
Y1 axis-Common-positive limit terminal setting
X no terminal
Y1 axis-Common-negative limit terminal setting
X no terminal
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
Config Delete init axis config guide
Param SFD1054(dword)
Value
Y1 axis-Common-negative limit terminal setting
X no terminal
Y1 axis-Common-Zero clear CLR output setting
Y no terminal
Y1 axis-Common-Return speed VH
0
Y1 axis-Common-Creeping speed VC
0
Y1 axis-Common-Mechanical zero position
0
Y1 axis-Common-Z phase num
0
Y1 axis-Common-CLR signal delayed time (ms)
20
Y1 axis-Common-grinding wheel radius(polar Interpola...
0
Y1 axis-Common-soft limit positive value
0
Y1 axis-Common-soft limit negative value
0
Y1 axis-Common-encoder pulse number/1 rotate(closed-...
1
Read From PLC
Write To PLC
OK
Cancel




## 2-4-2. Quick positioning (polar coordinates) [DRVR]

1. Instruction overview

Quick positioning (polar coordinates) instructions. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Quick positioning [DRVR] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | DRVR |
| Execute condition | Rise/fall edge of the coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis X target position | Double words, 32-bit |
| S1 | Axis Y target position | Double words, 32-bit |
| D0 | Pulse output port of axis X | Bit |
| D1 | Pulse output port of axis Y | Bit |

3. suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

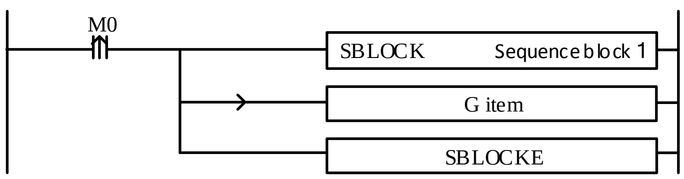
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

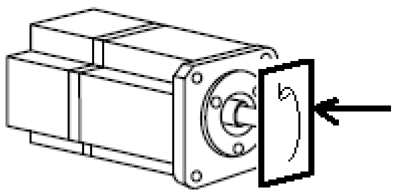
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Free to specify register address | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | Set in axis 1 system parameters | Must set |
| Default speed | Set in axis 1 group 1 parameters | Must set |
| Acceleration time | Set in axis 1 group 1 parameters | No need to set |
| Deceleration time | Set in axis 1 group 1 parameters | No need to set |

**Function and action**

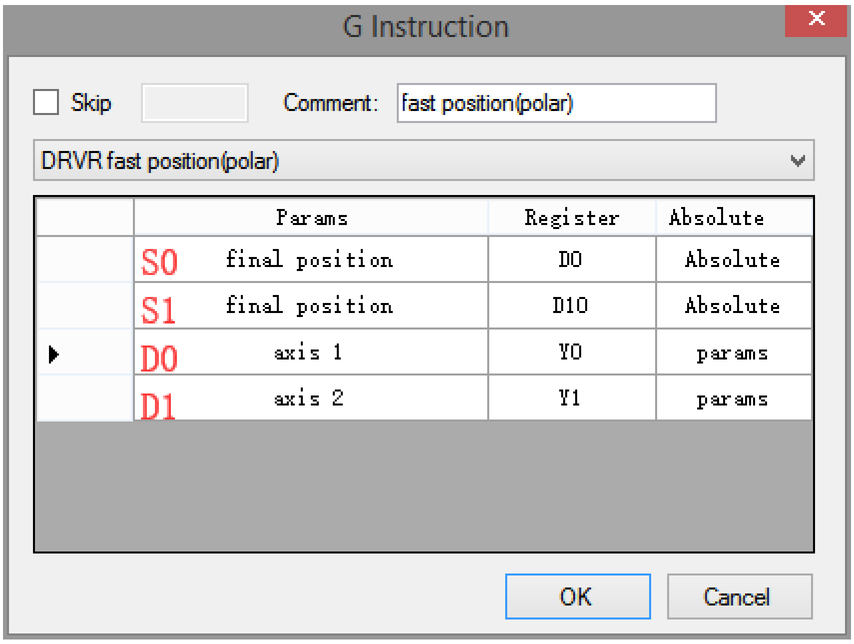
《instruction format》




Fast positioning (polar coordinates) instruction refers to the rotation axis of one axis, which rotates the workpiece on the rotating axis, and the forward and backward feed axis which is perpendicular to the rotating axis. When the rotating axis drives the workpiece to rotate, the feed axis processes the trajectory of the rotating workpiece through forward and backward processing. The trajectory of motion can include straight line and arc, and can be used in processing and grinding equipment.



Double click G item, it will pop up DRVR fast position(polar) instruction configuration panel, as shown below:



### 2-4-3. Linear interpolation [LIN]

There are three modes of linear interpolation, the following will introduce one by one.

**Mode 1: LIN line**

1. Instruction overview

Linear interpolation instruction, operate according to the set default speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Linear interpolation [LIN] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | LIN |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

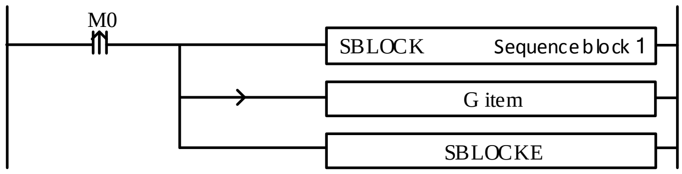
4. Parameter setting

| Related parameters | Setting | Note |
|---|---|---|
| Final position | Free to specify register address | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Pulse output port of | Arbitrary specify pulse output point | Must set |

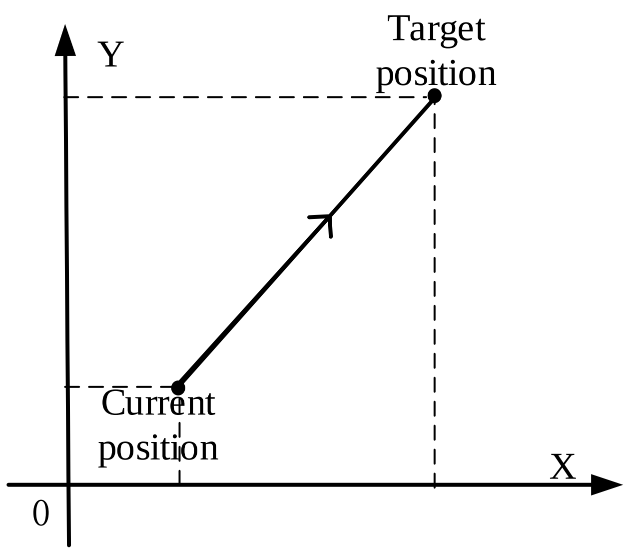
| | | |
|---|---|---|
| axis 1 | | |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | Set in axis 1 system parameters | Must set |
| Default speed | The synthetic speed of two axes, set in axis 1 group 2 parameters | Must set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



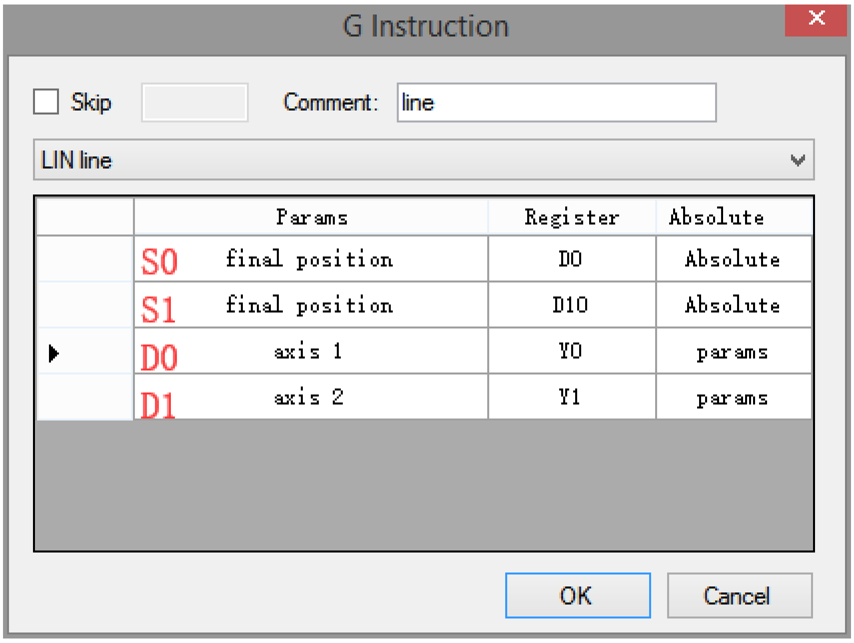

When the LIN instruction of linear interpolation (mode 1) is executed, the two axes will move rapidly from the current position to the target position at the highest synthetic speed of the two axes (the default speed set in axis 1 group 2 parameters). As shown in the following figure:



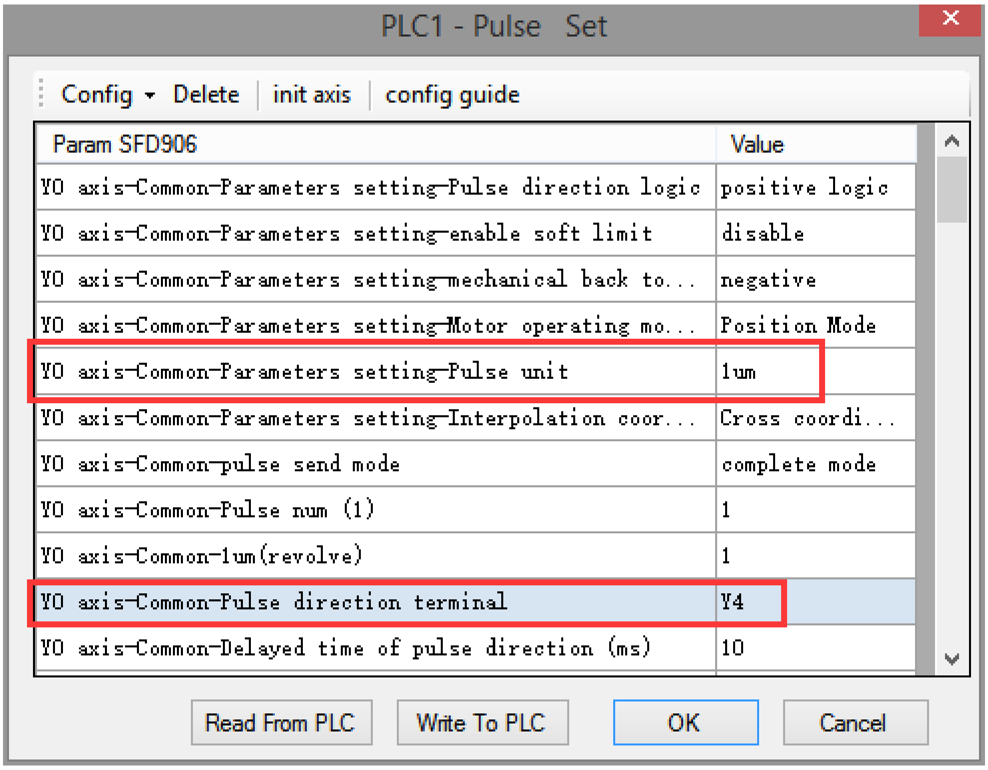

**LIN linear interpolation**

The parameter configuration is shown in the following figure:

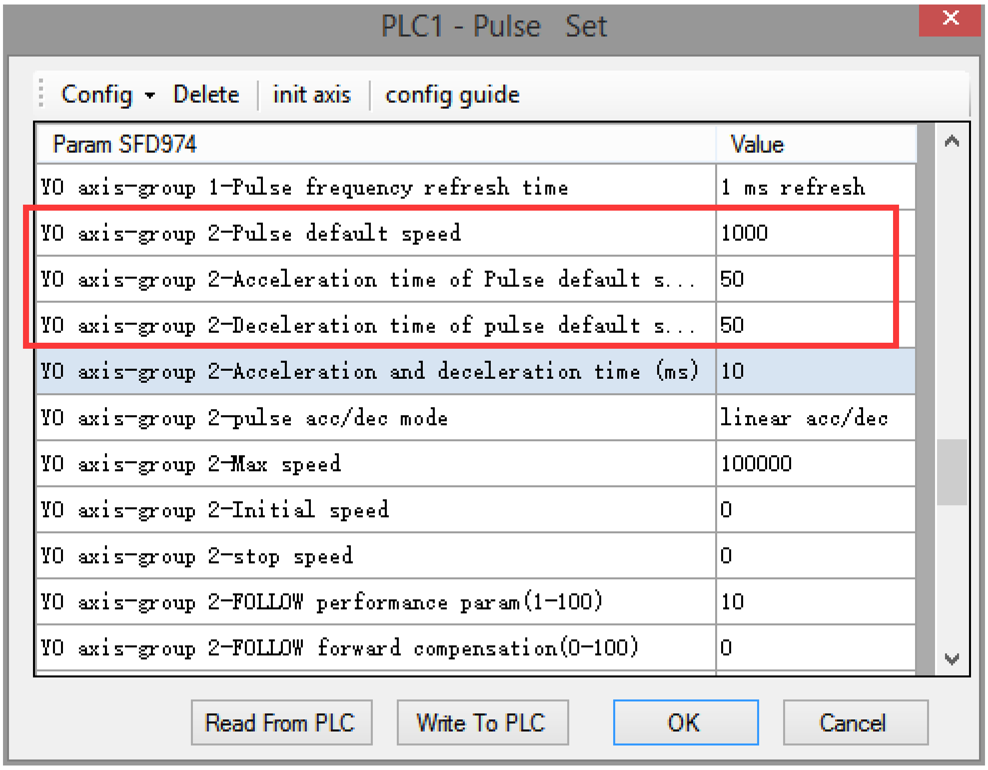
Double-click G item and pop up the configuration panel. Set it as follows:



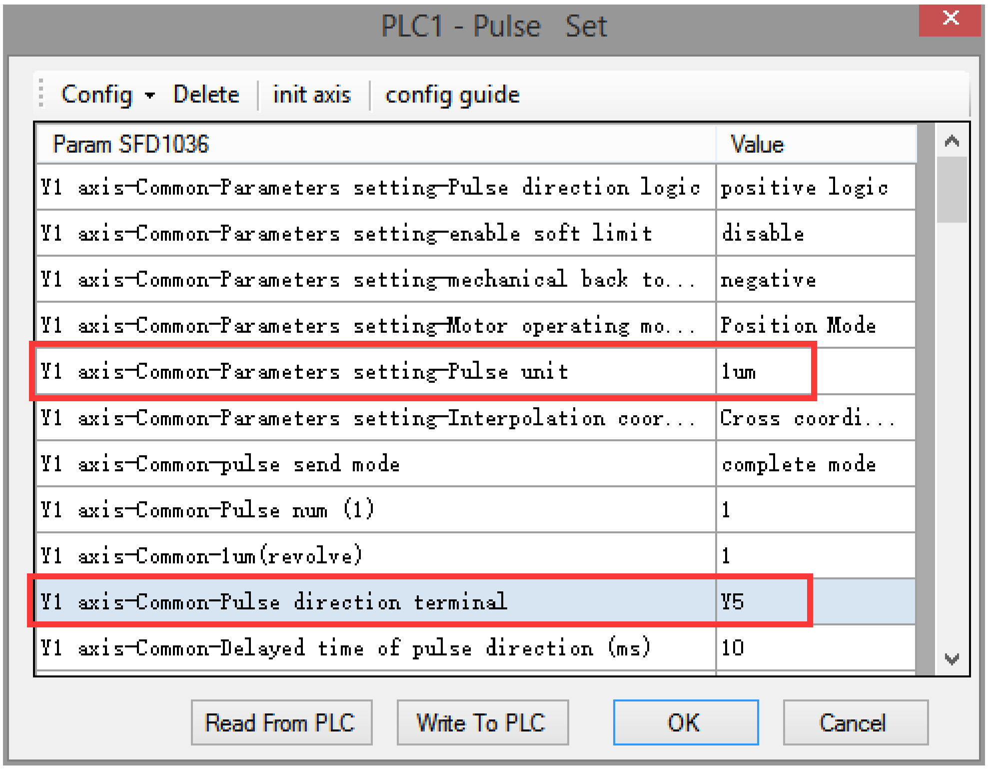

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3

for other optional ports.

- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 500, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute LIN command and move to the target position at the default speed of 1000Hz:

(1) If the final position is absolute mode, the target position is (5000,2000);

(2) When the final position is in the relative mode, the target position is (5500,3000).

- When the LIN instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

**Mode 2: LIN line VM**

1. Instruction overview

Linear interpolation instruction, operate according to the set maximum synthetic speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Linear interpolation [LIN] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | LIN |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | maximum synthetic speed of axis 1 and 2 | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

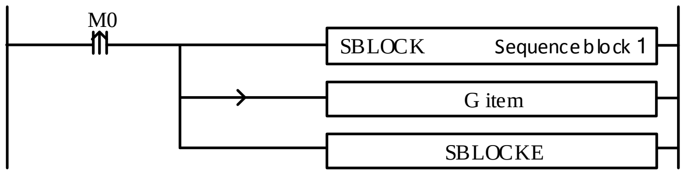
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

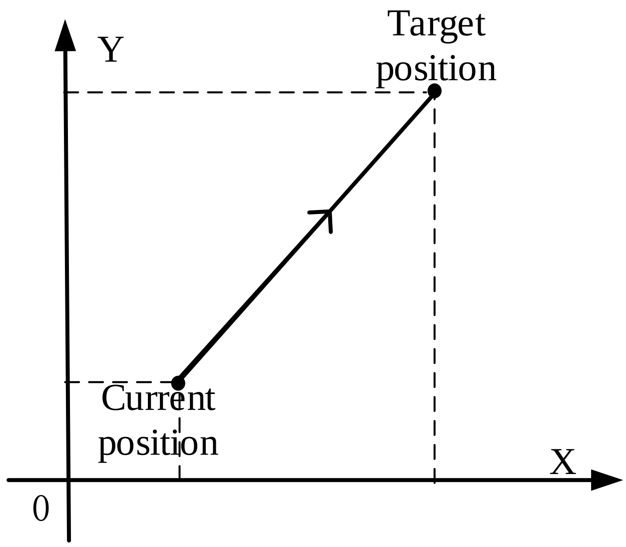
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Free to specify register address | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Max speed | Specify the maximum smooth running speed of the two-axis combination, and specify any address. | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



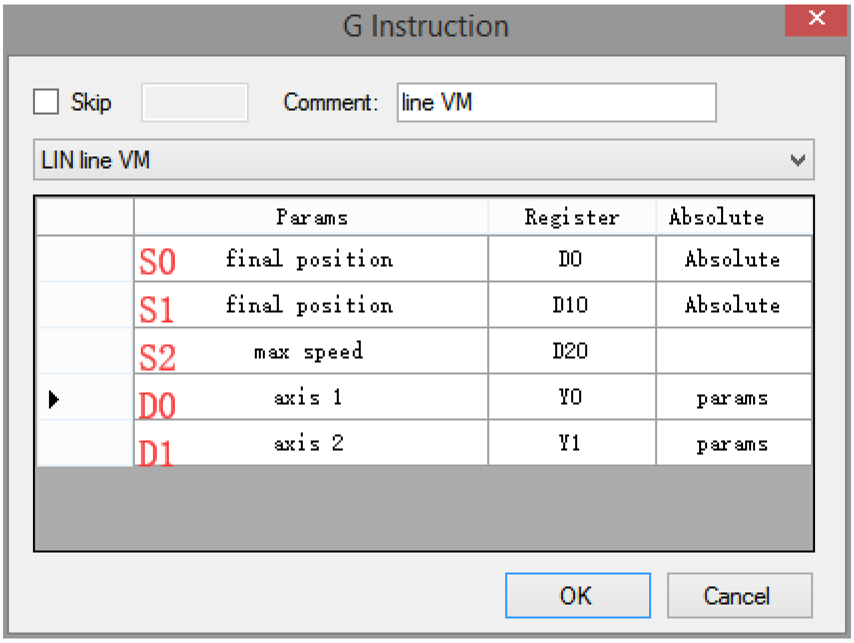

When the LIN instruction of linear interpolation (mode 2) is executed, the two axes will move rapidly from the current position to the target position at the set max synthetic speed. As shown in the following figure:



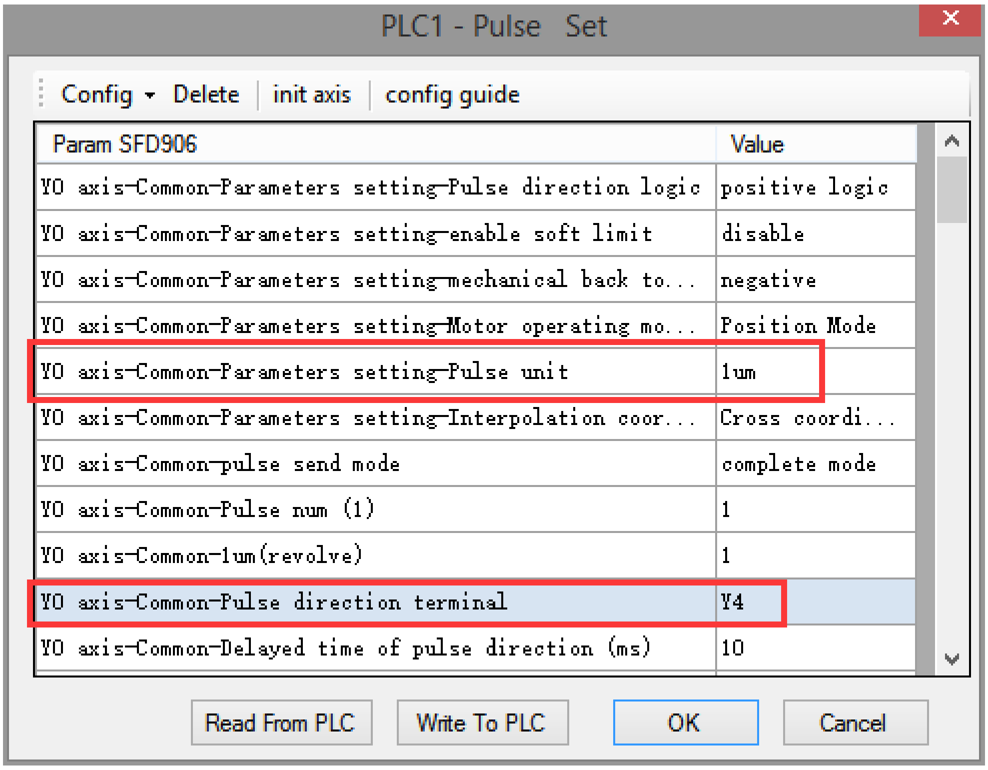

**LIN linear interpolation**

The parameter configuration is shown in the following figure:

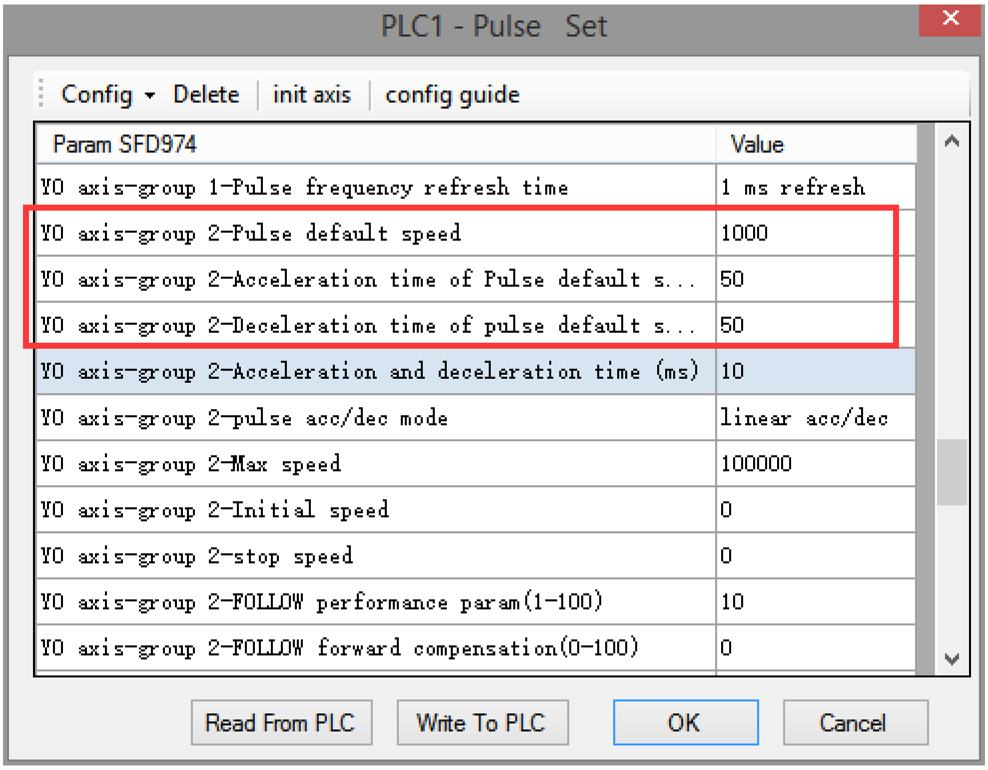
Double-click G item and pop up the configuration panel. Set it as follows:




**Instruction configuration**

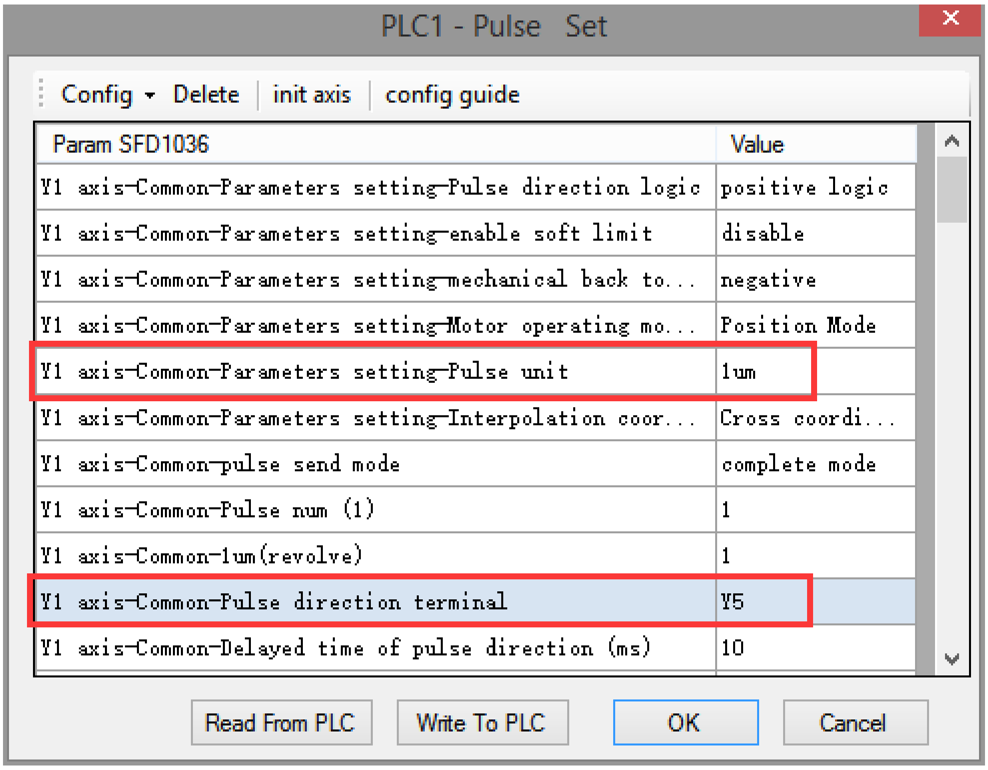



**Axis Y0 system parameters (1)**




| Param SFD974 | Value |
|---|---|
| Y0 axis-group 1-Pulse frequency refresh time | 1 ms refresh |
| Y0 axis-group 2-Pulse default speed | 1000 |
| Y0 axis-group 2-Acceleration time of Pulse default s... | 50 |
| Y0 axis-group 2-Deceleration time of pulse default s... | 50 |
| Y0 axis-group 2-Acceleration and deceleration time (ms) | 10 |
| Y0 axis-group 2-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 2-Max speed | 100000 |
| Y0 axis-group 2-Initial speed | 0 |
| Y0 axis-group 2-stop speed | 0 |
| Y0 axis-group 2-FOLLOW performance param(1-100) | 10 |
| Y0 axis-group 2-FOLLOW forward compensation(0-100) | 0 |

**Axis Y0 system parameters (2)**




| Param SFD1036 | Value |
|---|---|
| Y1 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y1 axis-Common-Parameters setting-enable soft limit | disable |
| Y1 axis-Common-Parameters setting-mechanical back to... | negative |
| Y1 axis-Common-Parameters setting-Motor operating mo... | Position Mode |
| Y1 axis-Common-Parameters setting-Pulse unit | 1um |
| Y1 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y1 axis-Common-pulse send mode | complete mode |
| Y1 axis-Common-Pulse num (1) | 1 |
| Y1 axis-Common-1um(revolve) | 1 |
| Y1 axis-Common-Pulse direction terminal | Y5 |
| Y1 axis-Common-Delayed time of pulse direction (ms) | 10 |

**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the max speed.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3

for other optional ports.

- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 500, HSD6 = 1000, D0 = 5000, D10 = 2000, D20 = 2000, when M0 rises, execute LIN command and move to the target position at the speed of 2000Hz:

(1) If the final position is absolute mode, the target position is (5000,2000);

(2) When the final position is in the relative mode, the target position is (5500,3000).

- When the LIN instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

**Mode 3: LIN line VBEM**

1. Instruction overview

Linear interpolation instruction, operate according to the set maximum synthetic speed, start speed and stop speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Linear interpolation [LIN] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | LIN |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Start speed of axis 1 and 2 | Double words, 32-bit |
| S3 | Stop speed of axis 1 and 2 | Double words, 32-bit |
| S4 | maximum synthetic speed of axis 1 and 2 | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |
| S4 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dnm |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

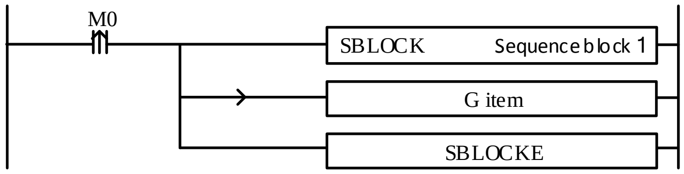
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

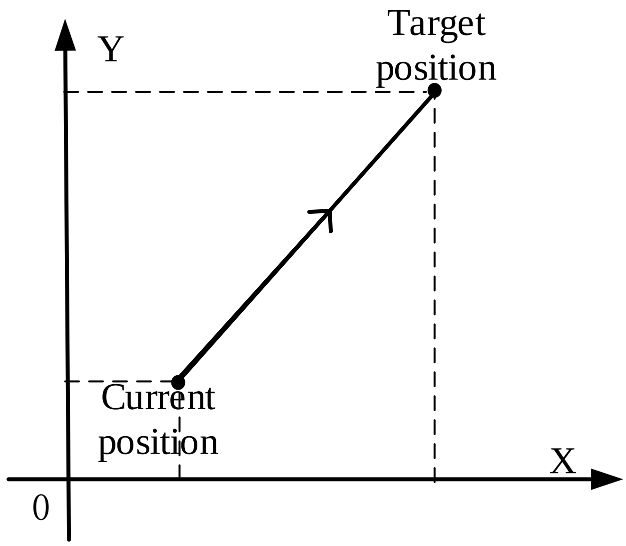
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Free to specify register address | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Start speed | Start speed at the starting point of the two axes | Must set |
| Stop speed | Stop speed at the end point of the two axes | Must set |
| Max speed | Specify the maximum smooth running speed of the two-axis combination, and specify any address. | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



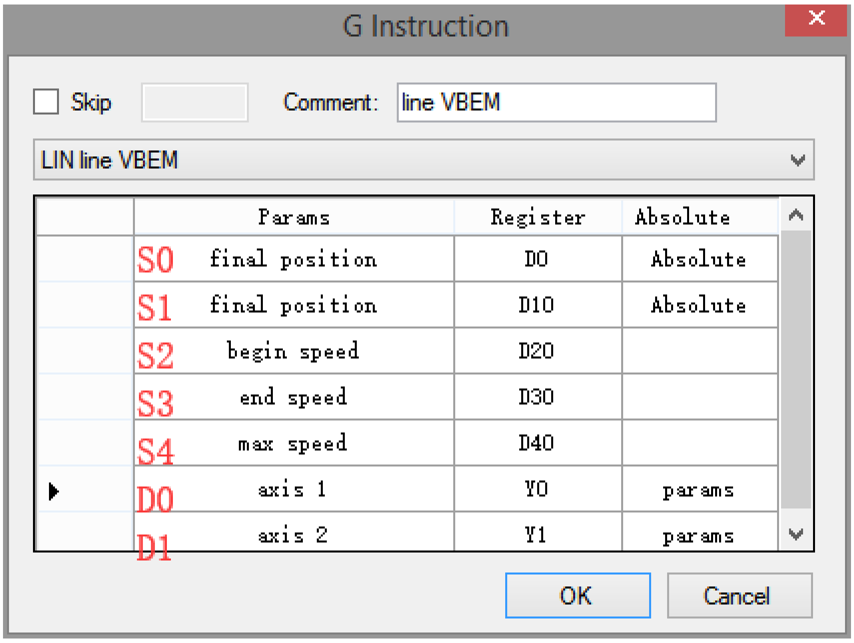

When the LIN instruction of linear interpolation (mode 3) is executed, the two axes will move rapidly from the current position to the target position at the set max synthetic speed, start speed and stop speed. As shown in the following figure:



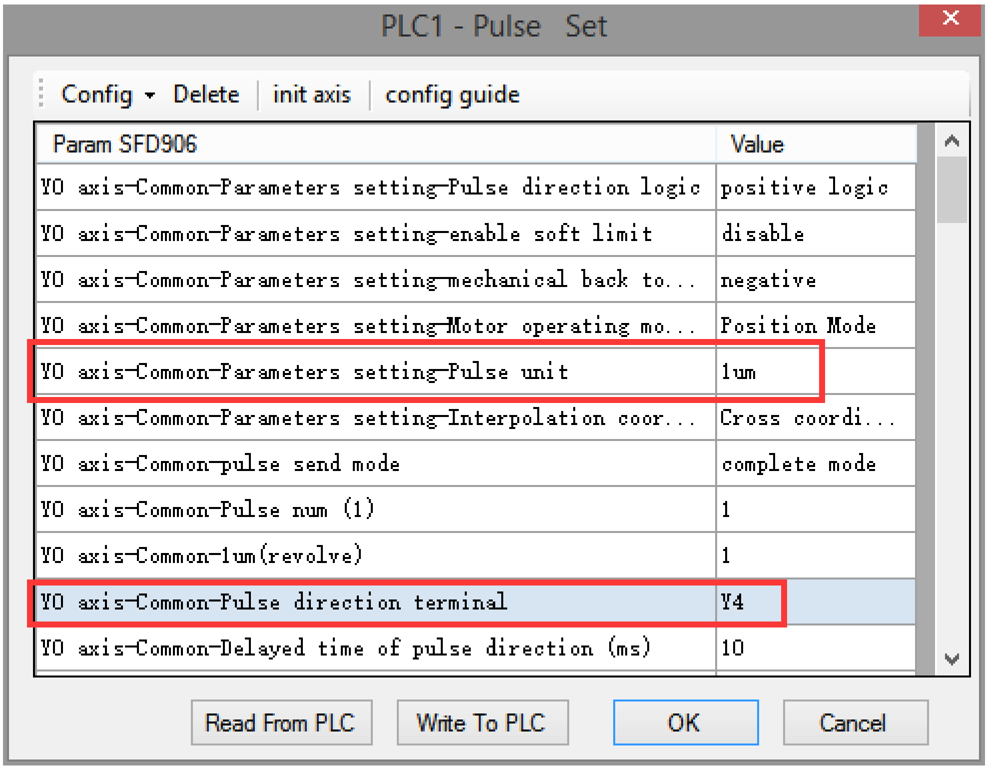

**LIN linear interpolation**

The parameter configuration is shown in the following figure:

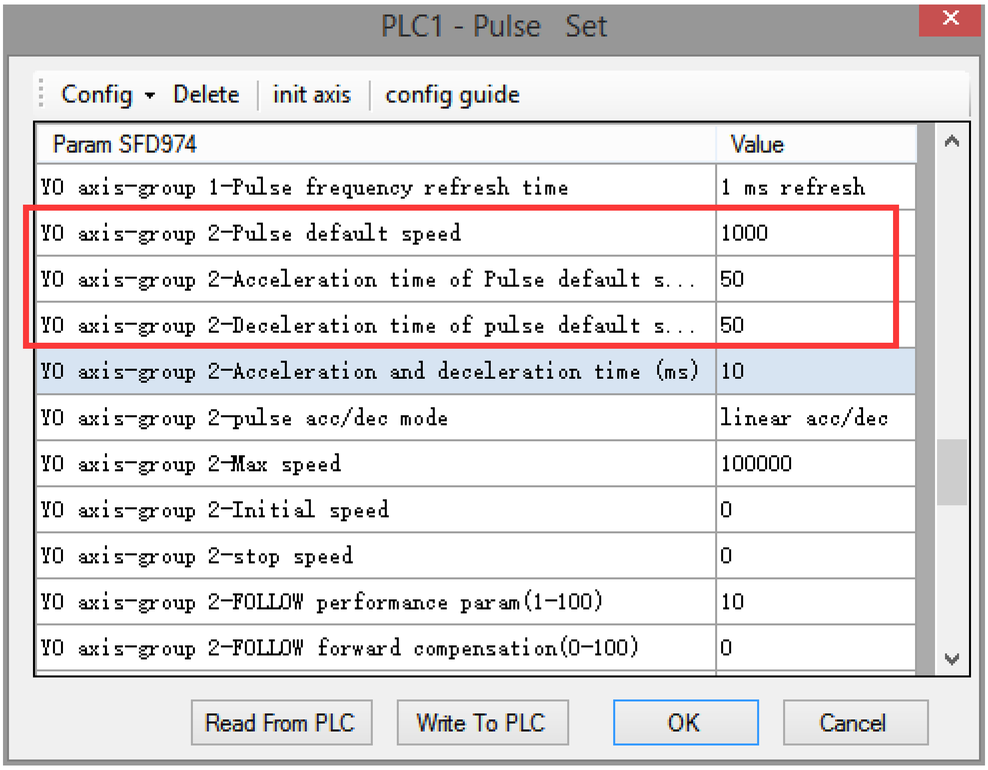
Double-click G item and pop up the configuration panel. Set it as follows:



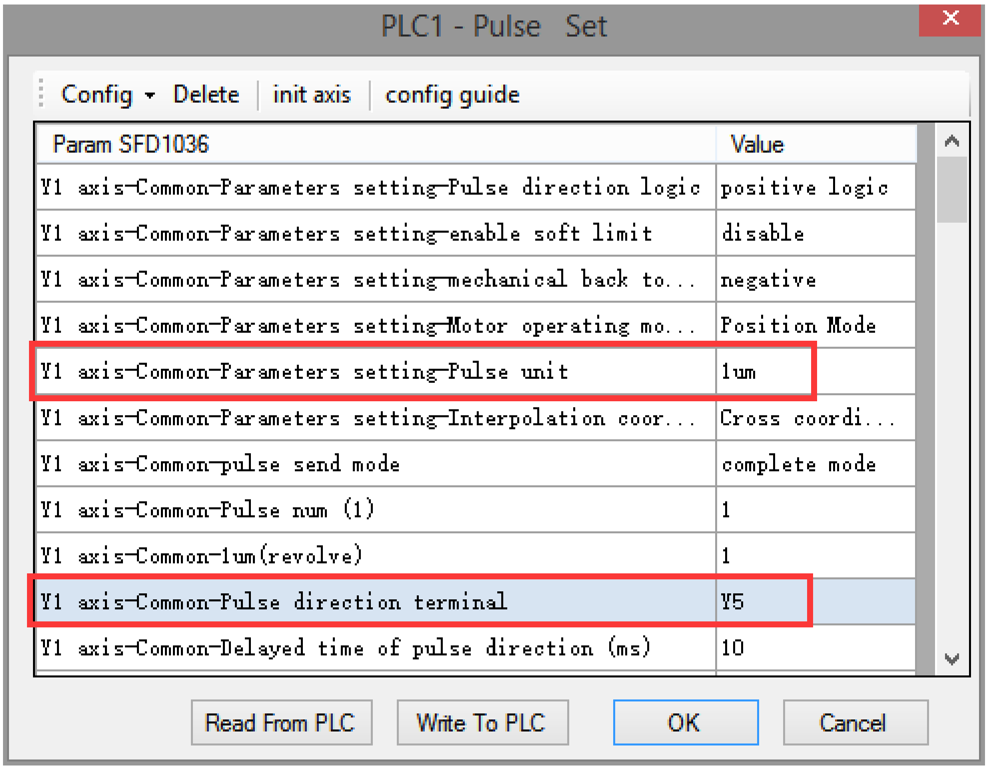

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the start speed, D30 specifies the stop speed, D40 specifies the max speed.

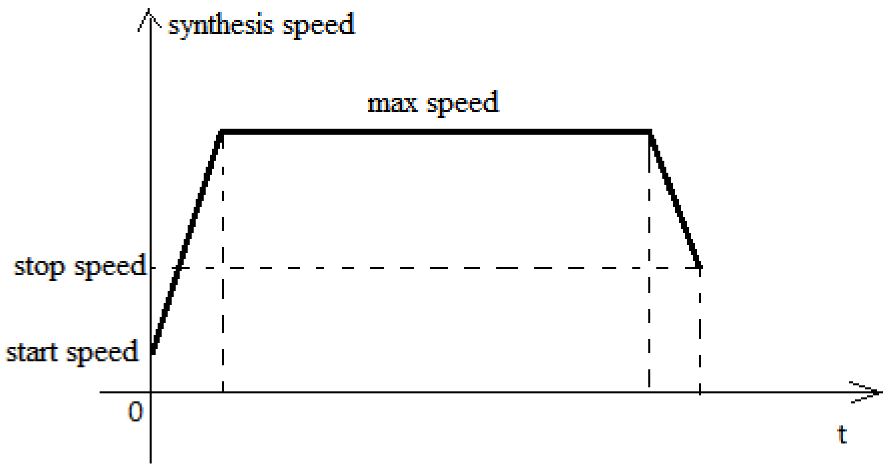
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
    - Assuming HSD2 = 500, HSD6 = 1000, D0 = 5000, D10 = 2000, D20 = 100, D30 = 50, D40 = 2000, when M0 rises, execute LIN command, accelerate from the starting point at 100Hz to 2000 Hz and stop at 50Hz after moving to the target position.

(1) If the final position is absolute mode, the target position is (5000,2000);

(2) When the final position is in the relative mode, the target position is (5500,3000).

- When the LIN instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

Note: In this mode, the start speed (S2), the stop speed (S3) and the max speed (S4) are all expressed as the two-axis synthesis speed, as shown in the following figure:

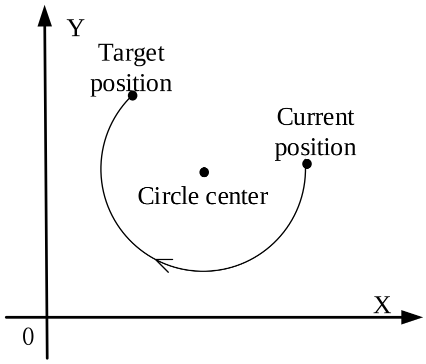



When there are multiple continuous linear/arc interpolation instructions and the speed between them needs to be constant and jump directly, the stop speed and maximum speed of the previous linear/arc interpolation can be set the same as the start speed and maximum speed of the next segment.

When the third mode is used, the initial and stop speed in the pulse parameter configuration tables of axis 1 and axis 2 are only effective for calculating the slope of pulse acceleration and deceleration.

## 2-4-4. Clockwise arc [CW]

CW interpolation mainly determines the arc through the current position of the arc, the target position and the coordinates of the center of the circle, as shown in the following figure:




From the above figure, we can see that when we need to draw a whole circle, we only need to set the target position to the current position. CW has three modes. The usage of CW is described below.

**Mode 1: CW clockwise**

1. Instruction overview

Clockwise arc interpolation instruction, operate according to the set default speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Clockwise arc interpolation [CW] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CW |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the center position of axis 1 (always relative to the starting coordinates) | Double words, 32-bit |
| S3 | Specify the center position of axis 2 (always relative to the starting coordinates) | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

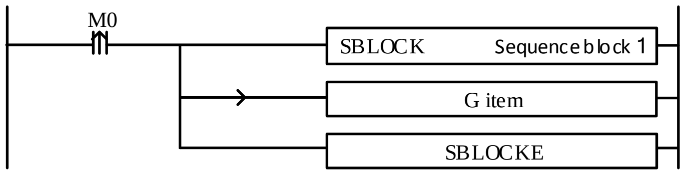
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

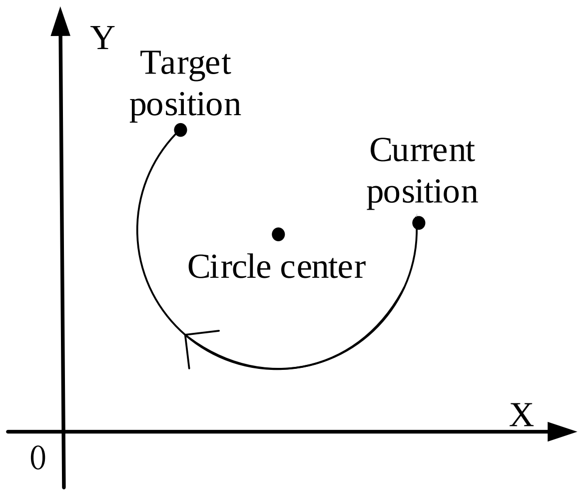
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Circle center position | The position of the center is determined by the position of the starting point and the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | Must set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

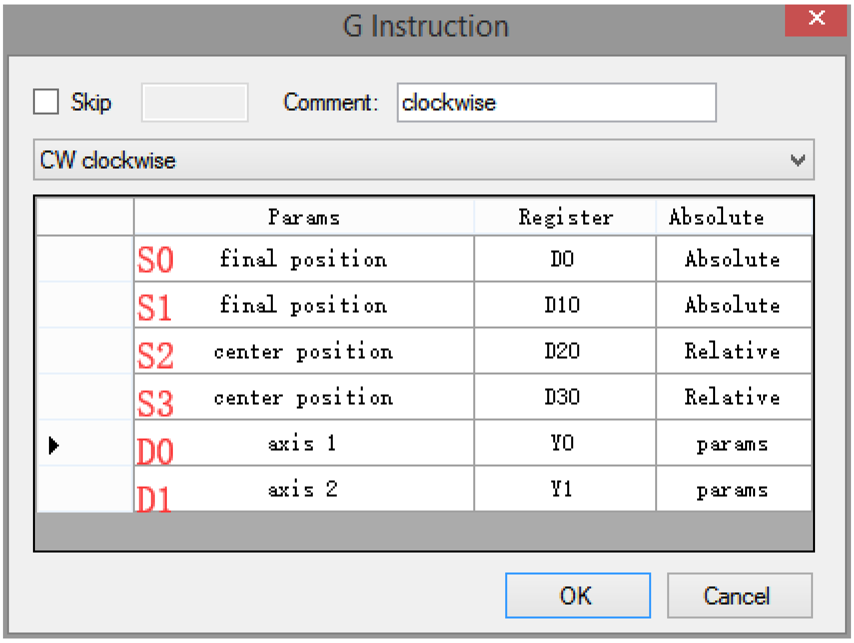



When the CW instruction of arc interpolation (mode 1) is executed, the two axes will run at the highest synthesis speed. As shown in the following figure:

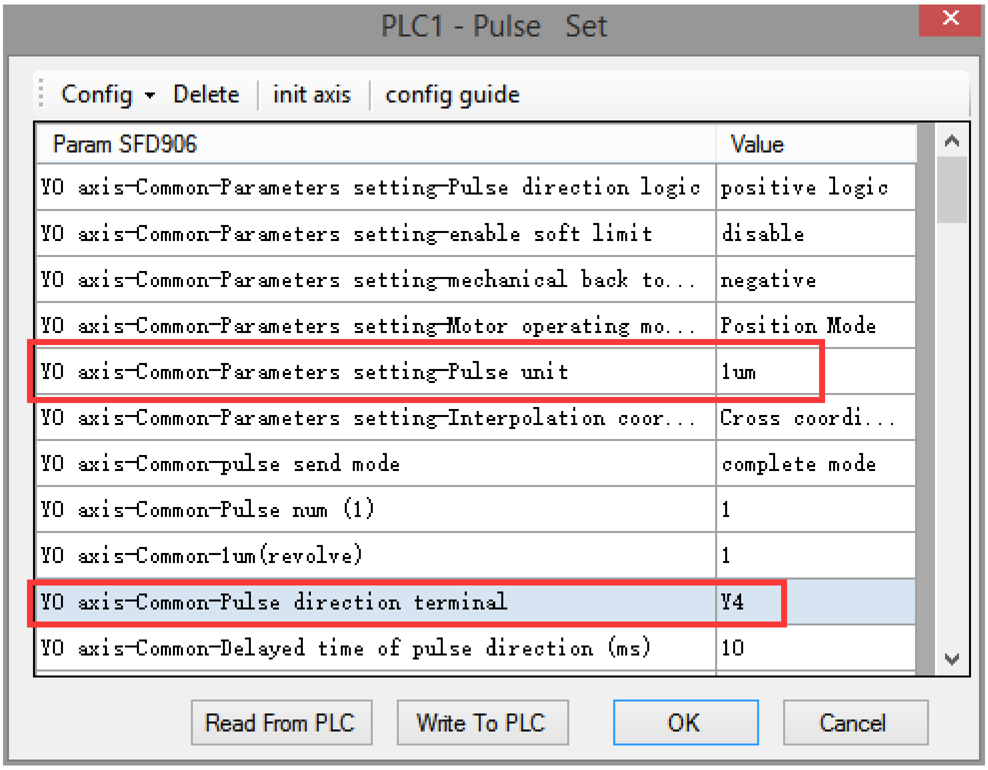



**CW clockwise arc interpolation**

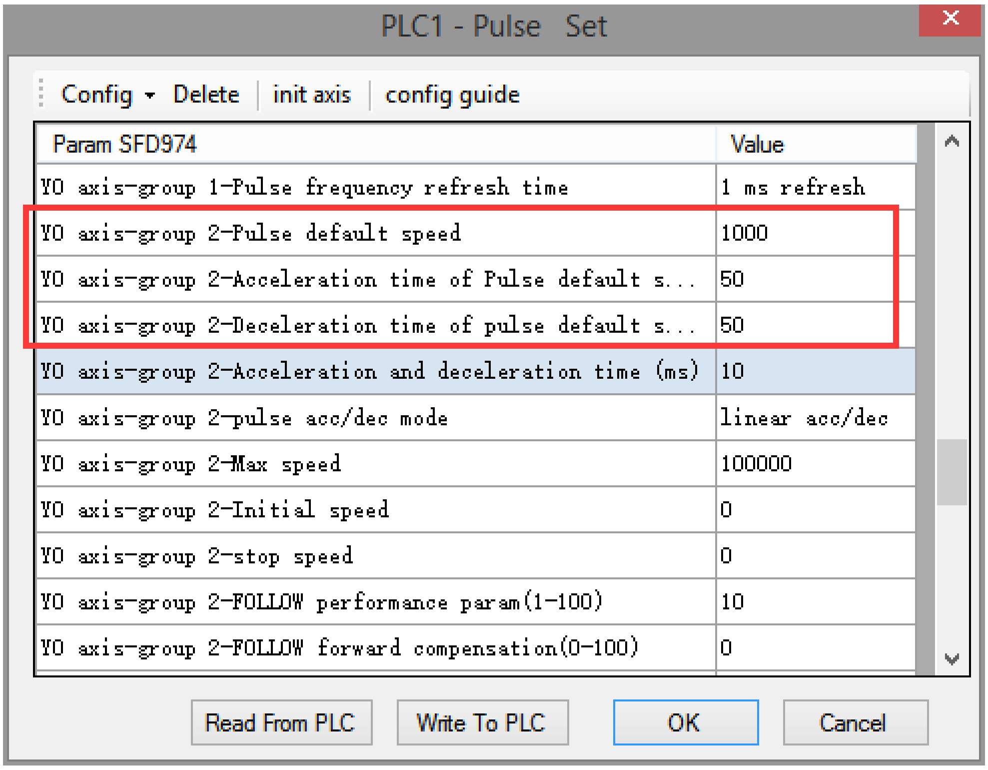
The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:



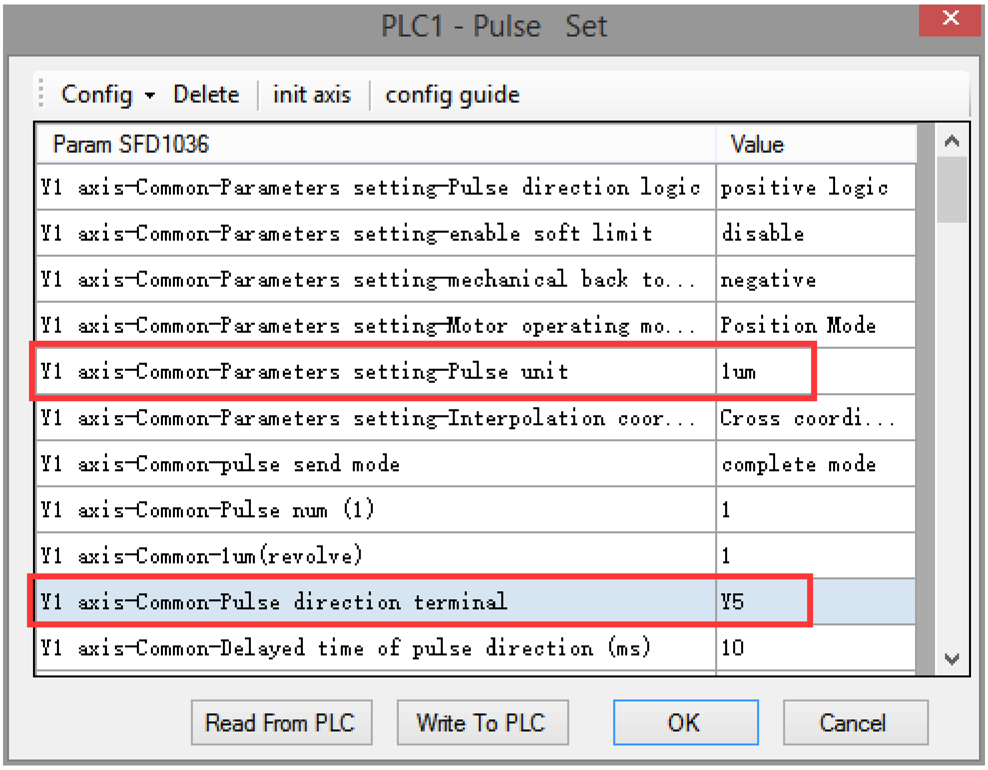

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle center of axis 1, D30 specifies the circle center of axis 2.

- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute CW command, move from the starting position (1000, 1000) to the target position at the default speed of 1000Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000), the center position is (3000,1500), and D20 = 2000, D30 = 500.

(2) When the end point is in the relative mode, the target position is (6000,3000), the center position is (3500,2000), and D20 = 2500, D30 = 1000.

- When the CW instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

**Mode 2: CW clockwise VM**

1. Instruction overview

Clockwise arc interpolation instruction, operate according to the set maximum synthetic speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Clockwise arc interpolation [CW] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CW |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the center position of axis 1 (always relative to the starting coordinates) | Double words, 32-bit |
| S3 | Specify the center position of axis 2 (always relative to the starting coordinates) | Double words, 32-bit |
| S4 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |
| S4 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

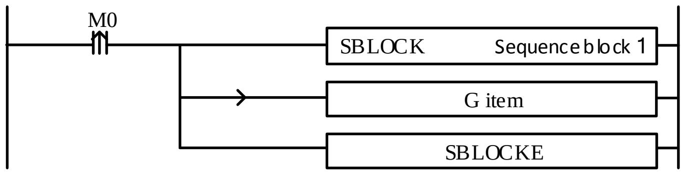
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

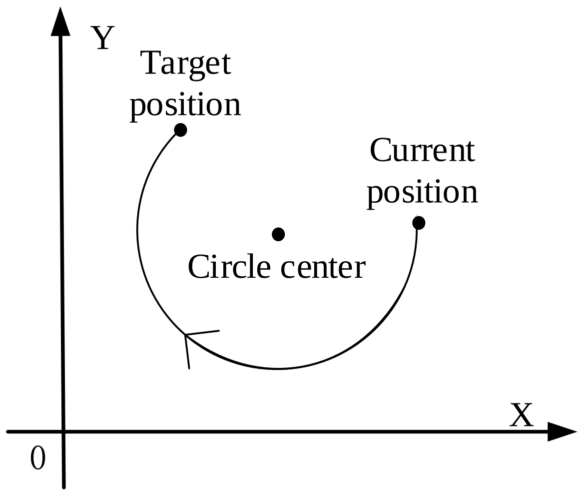
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Circle center position | The position of the center is determined by the position of the starting point and the end point | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



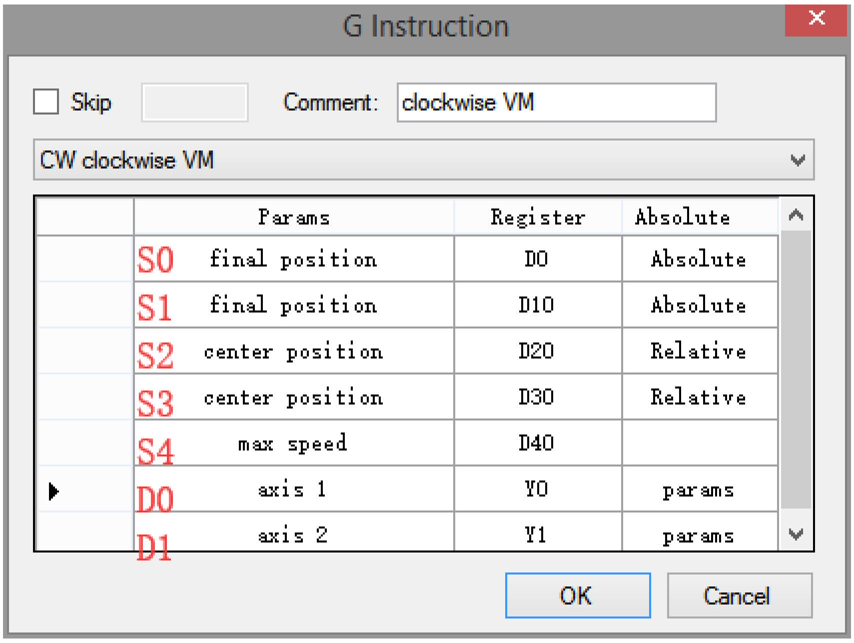

When the CW instruction of arc interpolation (mode 2) is executed, the two axes will run at the set max synthesis speed. As shown in the following figure:



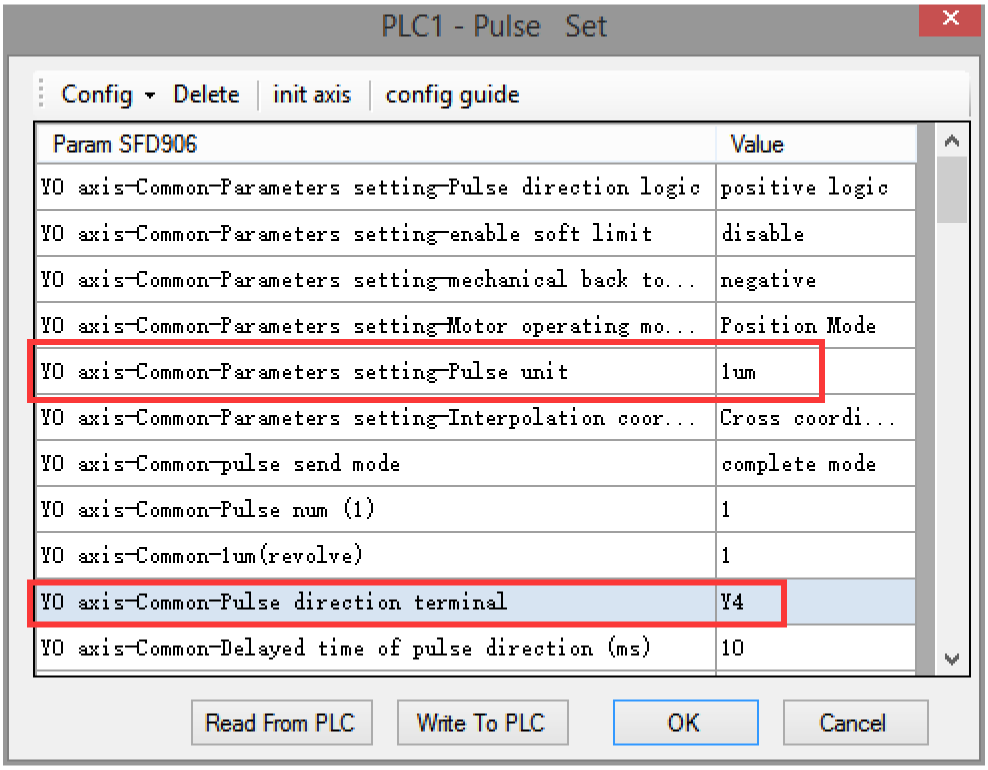

**CW clockwise arc interpolation**

The parameter configuration is shown in the following figure:

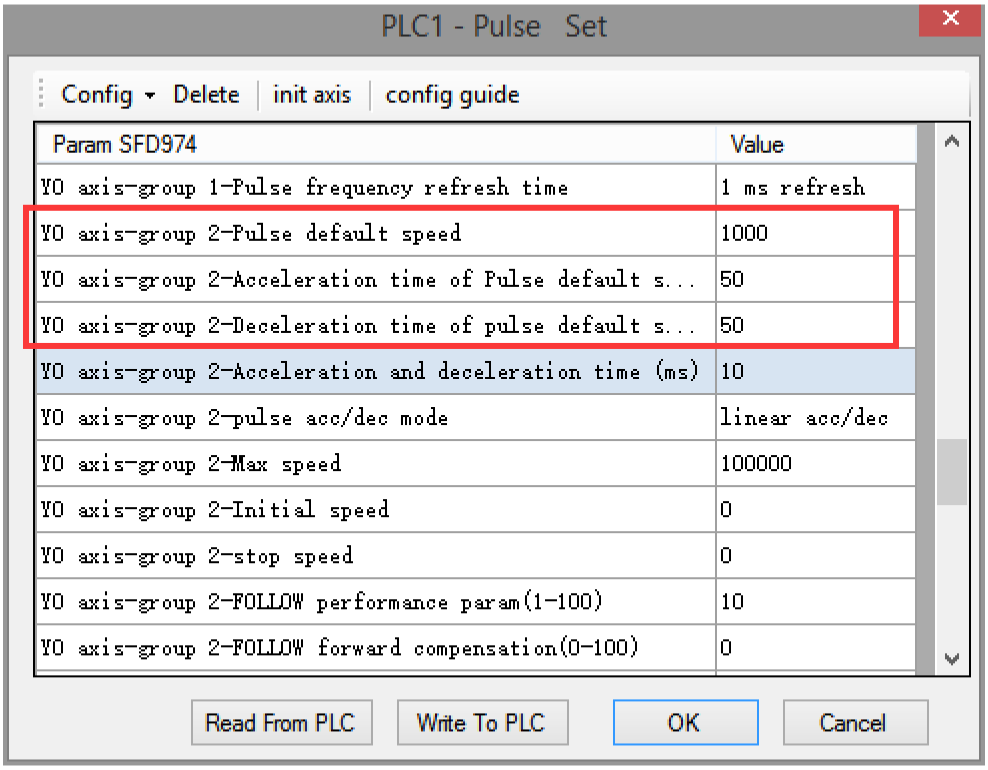
Double-click G item and pop up the configuration panel. Set it as follows:



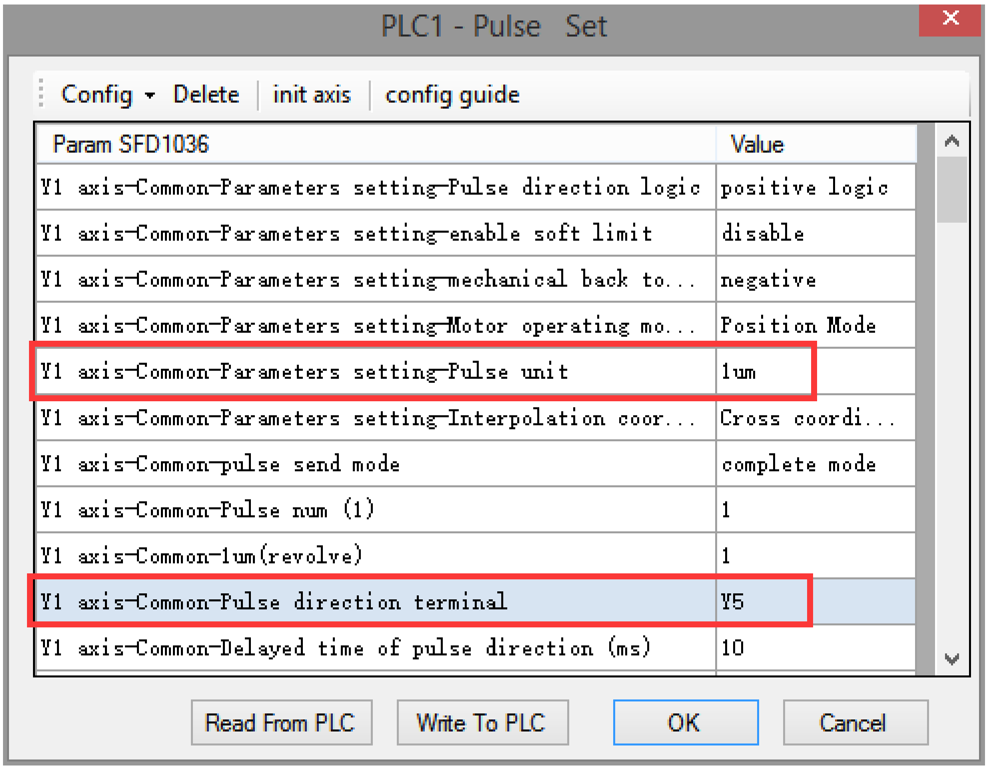

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle center of axis 1, D30 specifies the circle center of axis 2, D40 specifies the max speed.

- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 500Hz, when M0 rises, execute CW command, move from the starting position (1000, 1000) to the target position at the max speed of 500Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000), the center position is (3000,1500), and D20 = 2000, D30 = 500.

(2) When the end point is in the relative mode, the target position is (6000,3000), the center position is (3500,2000), and D20 = 2500, D30 = 1000.

- When the CW instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

### Mode 3: CW clockwise VBEM

1. Instruction overview

Clockwise arc interpolation instruction, operate according to the set maximum synthetic speed, start speed and stop speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Clockwise arc interpolation [CW] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CW |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the center position of axis 1 (always relative to the starting coordinates) | Double words, 32-bit |
| S3 | Specify the center position of axis 2 (always relative to the starting coordinates) | Double words, 32-bit |
| S4 | Specify the starting speed at the starting point of the two axes | Double words, 32-bit |

| | | |
|---|---|---|
| S5 | Specify the stop speed at the end point of the two axes | Double words, 32-bit |
| S6 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0~S6 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

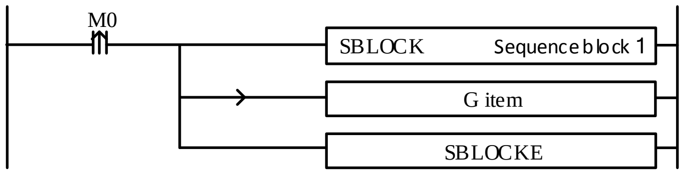
4. Parameter setting

| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Circle center position | The position of the center is determined by the position of the starting point and the end point | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Start speed | The start speed from the starting point | Must set |
| Stop speed | The stop speed at the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |

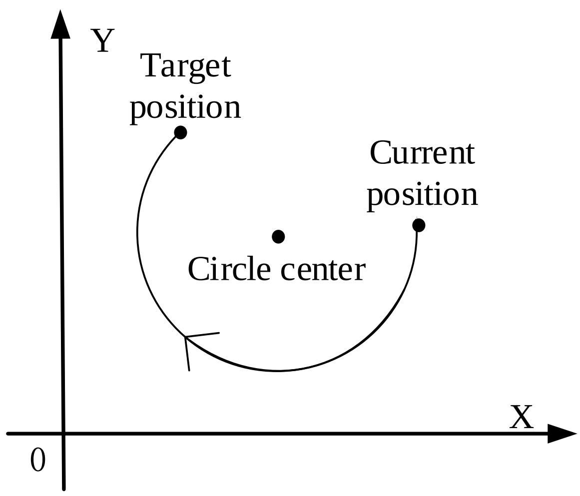
| | | |
|---|---|---|
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

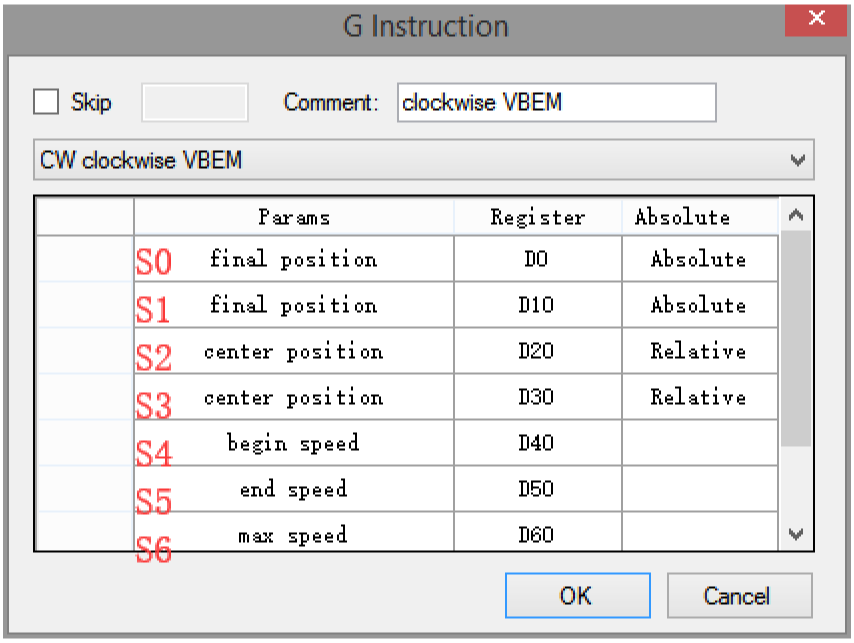


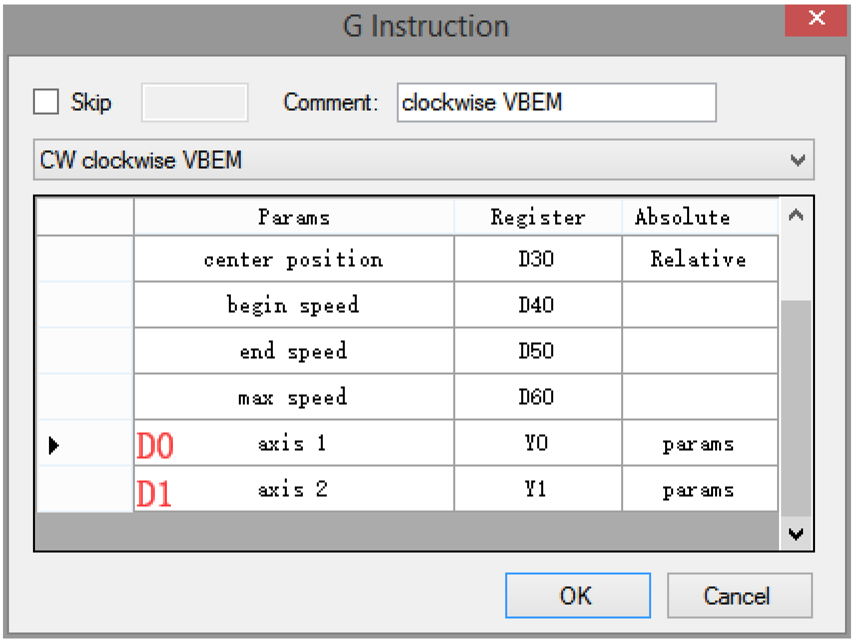

When the CW instruction of arc interpolation (mode 3) is executed, the two axes will run at the set max synthesis speed, start speed and stop speed. As shown in the following figure:



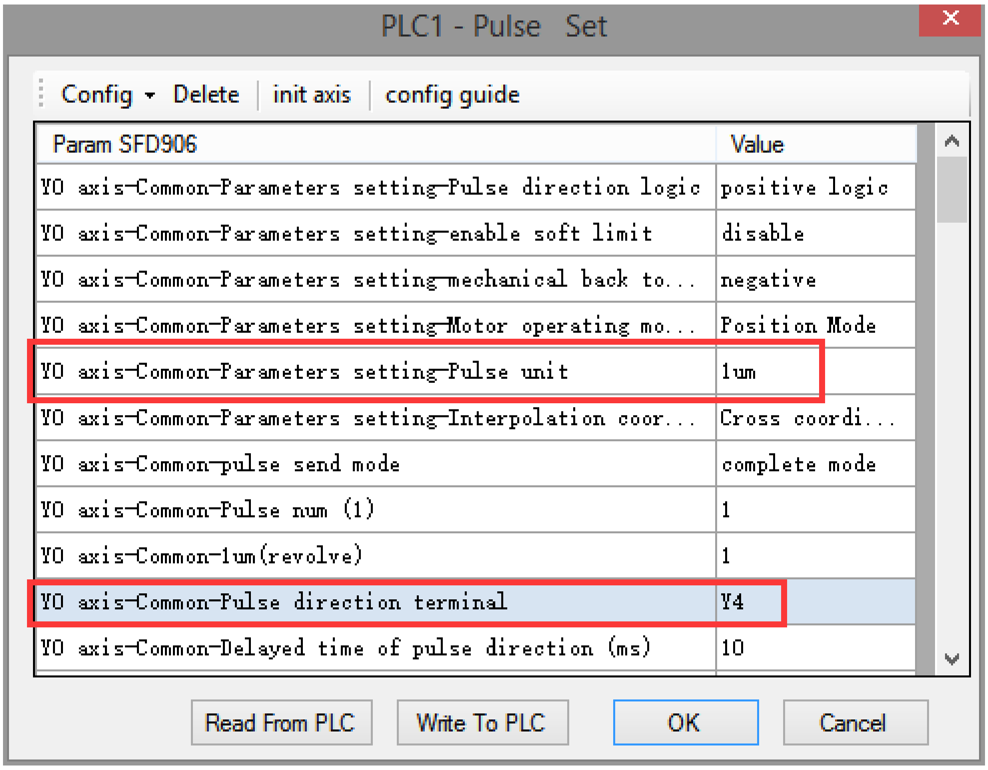

**CW clockwise arc interpolation**

The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:

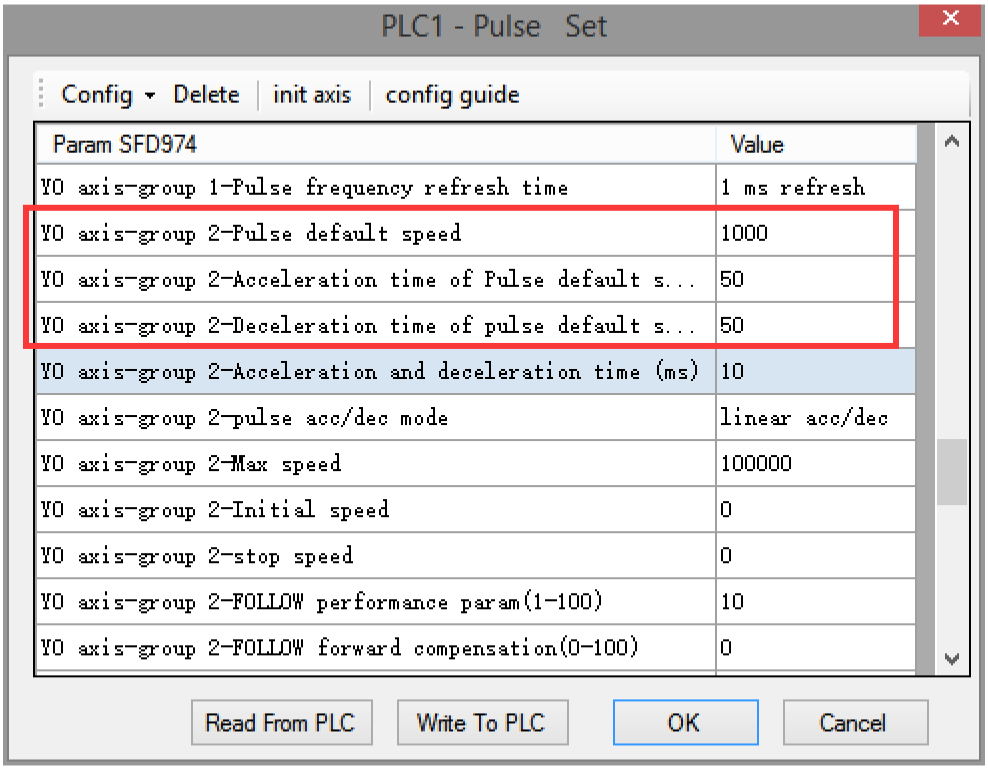


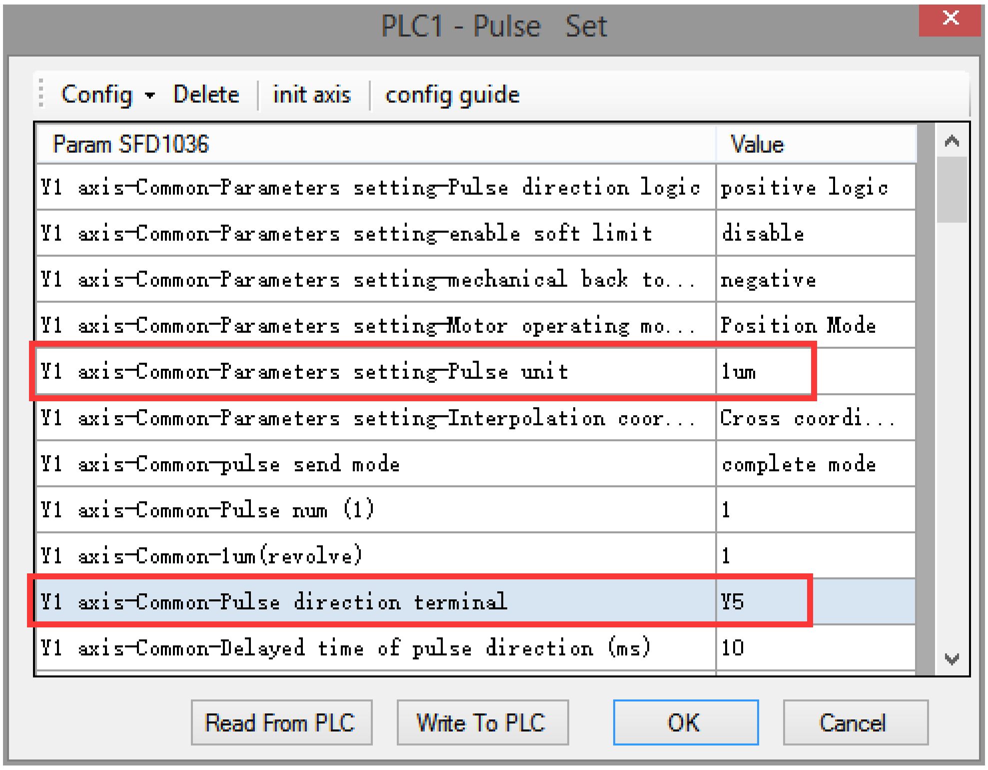

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

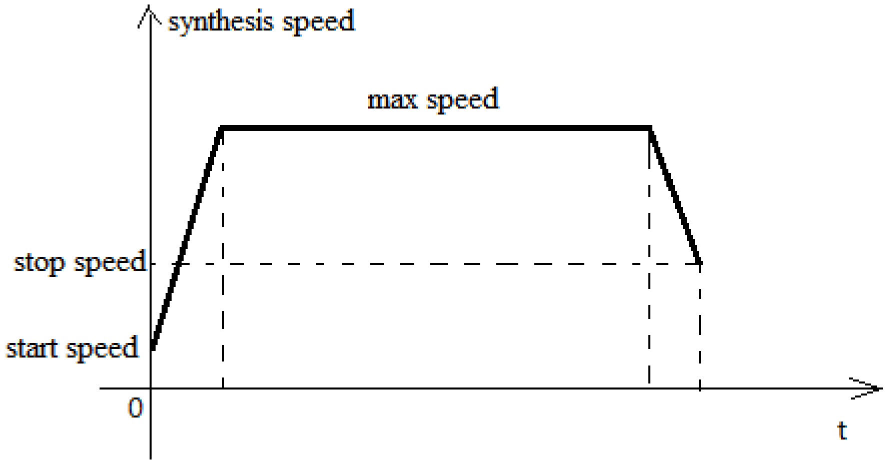
- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle center of axis 1, D30 specifies the circle center of axis 2, D40 specifies the start speed, D50 specifies the stop speed, D60 specifies the max speed.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 50Hz, D50 = 20, D60 = 2000, when M0 rises, execute CW command, accelerate from the starting position (1000,1000) at speed 50Hz to the maximum speed (2000Hz), and stop at the end speed of 20Hz when moving to the target position.

(1) When the end point is in absolute mode, the target position is (5000,2000), the center position is (3000,1500), and D20 = 2000, D30 = 500.

(2) When the end point is in the relative mode, the target position is (6000,3000), the center position is (3500,2000), and D20 = 2500, D30 = 1000.

- When the CW instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

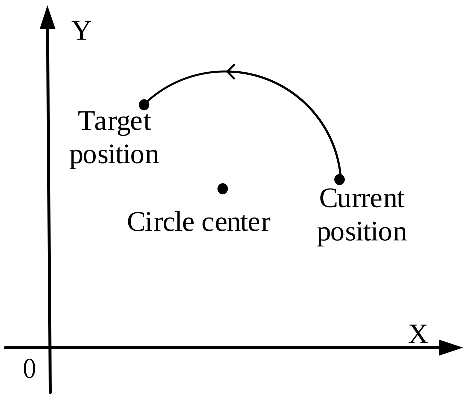
Note: In this mode, the starting speed (S4), the ending speed (S5) and the maximum speed (S6) are all expressed as the two-axis synthesis speed, as shown in the following figure:




When there are multiple continuous linear/arc interpolation instructions and the speed between them needs to be constant and jump directly, the termination speed and maximum speed of the previous linear/arc interpolation can be set the same as the starting speed and maximum speed of the next segment.
When mode 3 is used, the starting and ending speed in the pulse parameter configuration tables of axis 1 and axis 2 are only effective for calculating the slope of pulse acceleration and deceleration.

## 2-4-5. Anticlockwise arc [CCW]

Anticlockwise arc interpolation CCW determines a section of arc mainly through the current position of arc, the target position and the counterclockwise coordinates of the center of the circle, as shown in the following figure:




With the above image, when you need to draw an entire circle, just set the target position to the current position. There are three modes of anticlockwise arc interpolation CCW, the usage of which is described below.

**Mode 1: CCW anticlockwise arc**

1. Instruction overview

Anticlockwise arc interpolation instruction, operate according to the set default speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Anticlockwise arc interpolation [CCW] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CCW |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the center position of axis 1 (always relative to the starting coordinates) | Double words, 32-bit |
| S3 | Specify the center position of axis 2 (always relative to the starting coordinates) | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

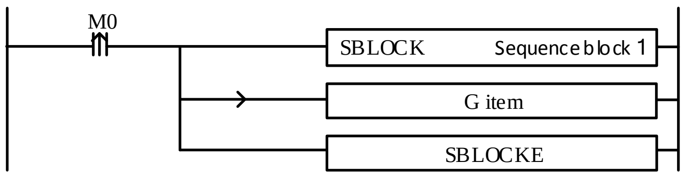
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

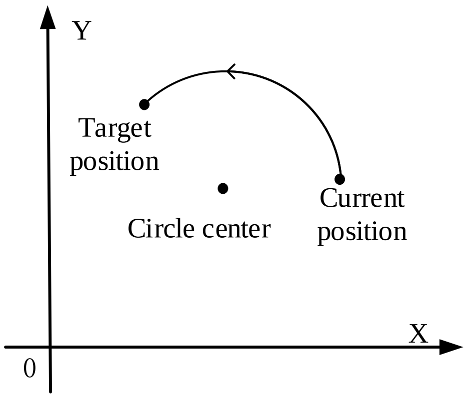
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Circle center position | The position of the center is determined by the position of the starting point and the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | Must set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

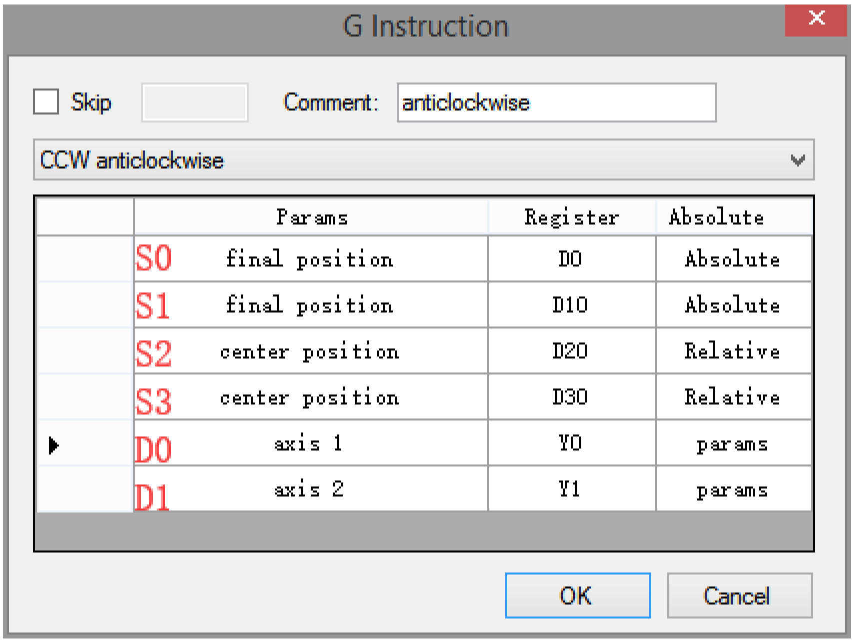



When the CCW instruction of arc interpolation (mode 1) is executed, the two axes will run at the highest synthesis speed. As shown in the following figure:

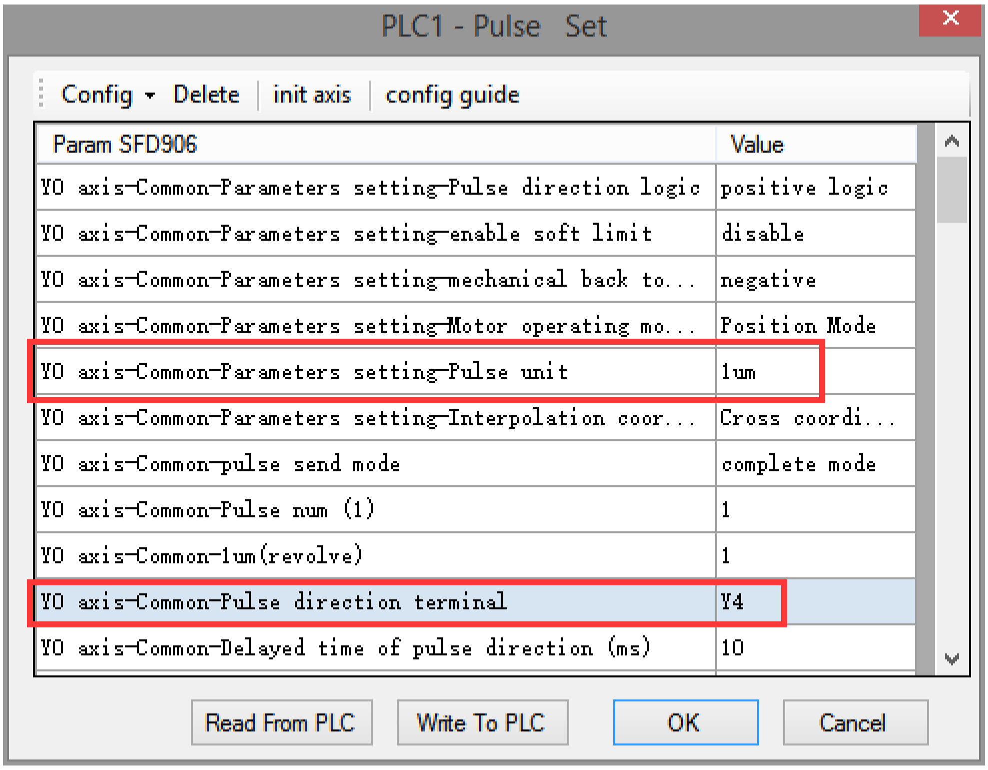



**CCW clockwise arc interpolation**

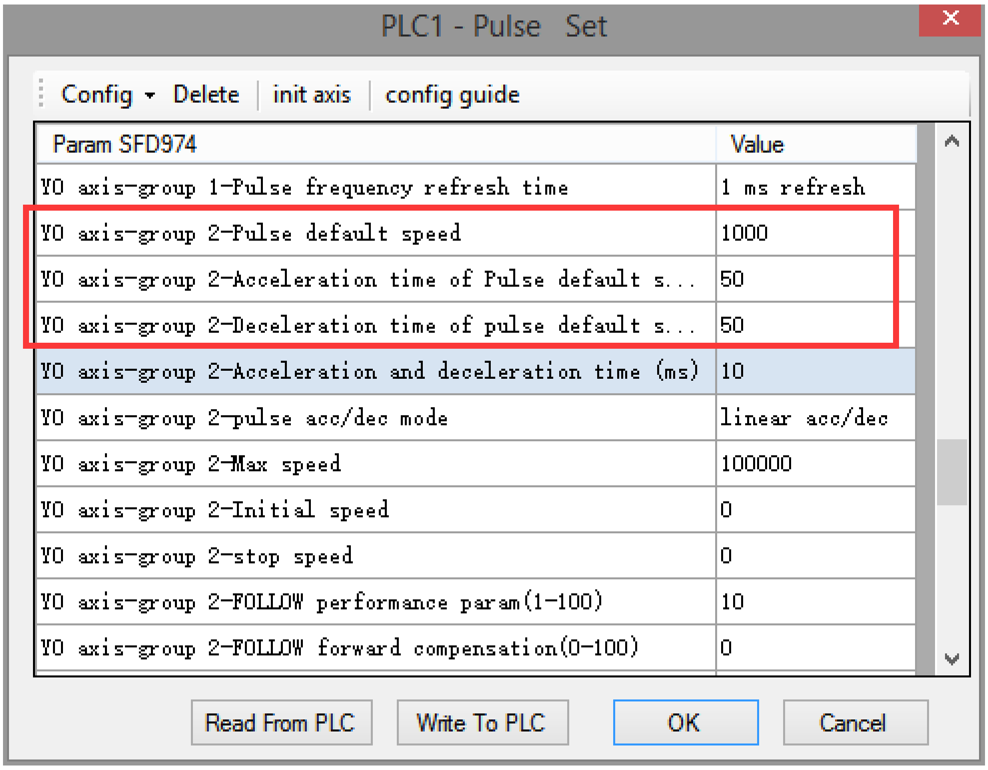
The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:



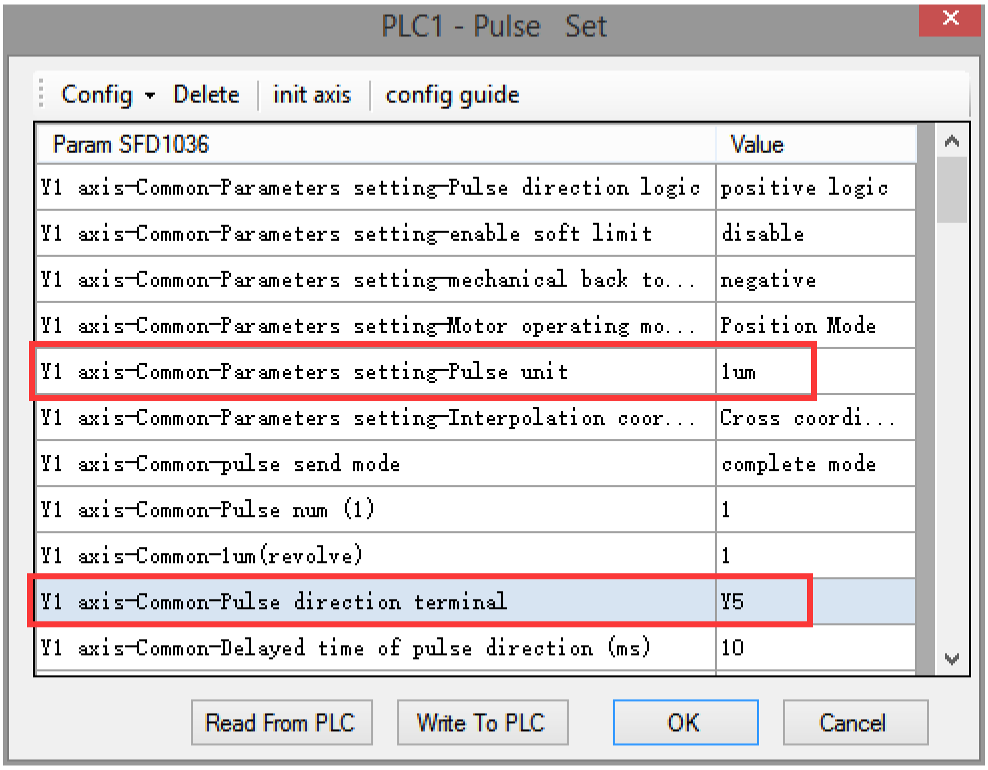

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




1

**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle center of axis 1, D30 specifies the circle center of axis 2.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute CCW command, move from the starting position (1000, 1000) to the target position at the default speed of 1000Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000), the center position is (3000,1500), and D20 = 2000, D30 = 500.

(2) When the end point is in the relative mode, the target position is (6000,3000), the center position is (3500,2000), and D20 = 2500, D30 = 1000.

- When the CCW instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

## Mode 2: CCW anticlockwise VM

1. Instruction overview

Anticlockwise arc interpolation instruction, operate according to the set maximum synthetic speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Anticlockwise arc interpolation [CCW] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CCW |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the center position of axis 1 (always relative to the starting coordinates) | Double words, 32-bit |
| S3 | Specify the center position of axis 2 (always relative to the starting coordinates) | Double words, 32-bit |
| S4 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |
| S4 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dnm |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

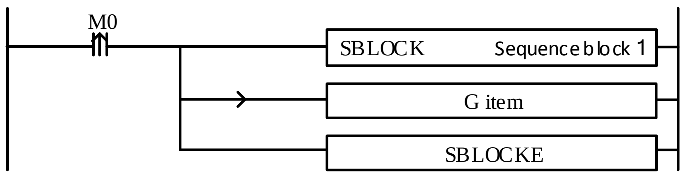
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

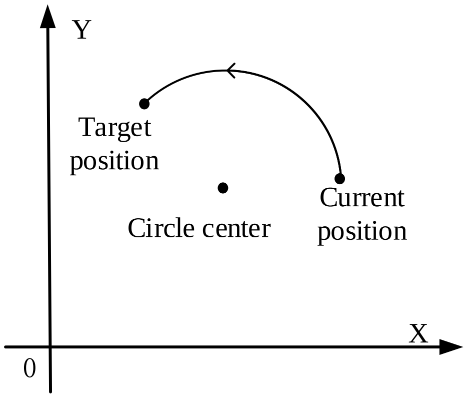
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Circle center position | The position of the center is determined by the position of the starting point and the end point | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

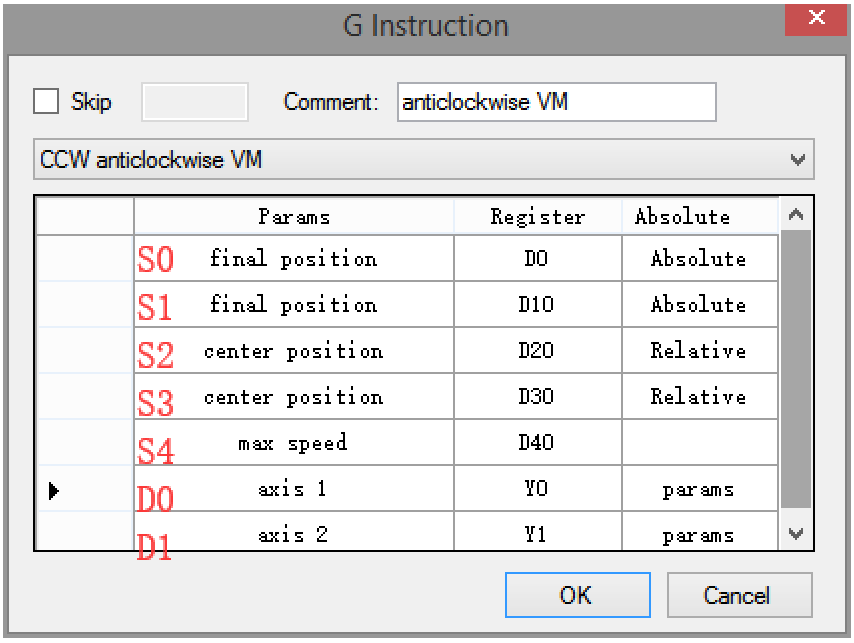



When the CCW instruction of arc interpolation (mode 2) is executed, the two axes will run at the set max synthesis speed. As shown in the following figure:

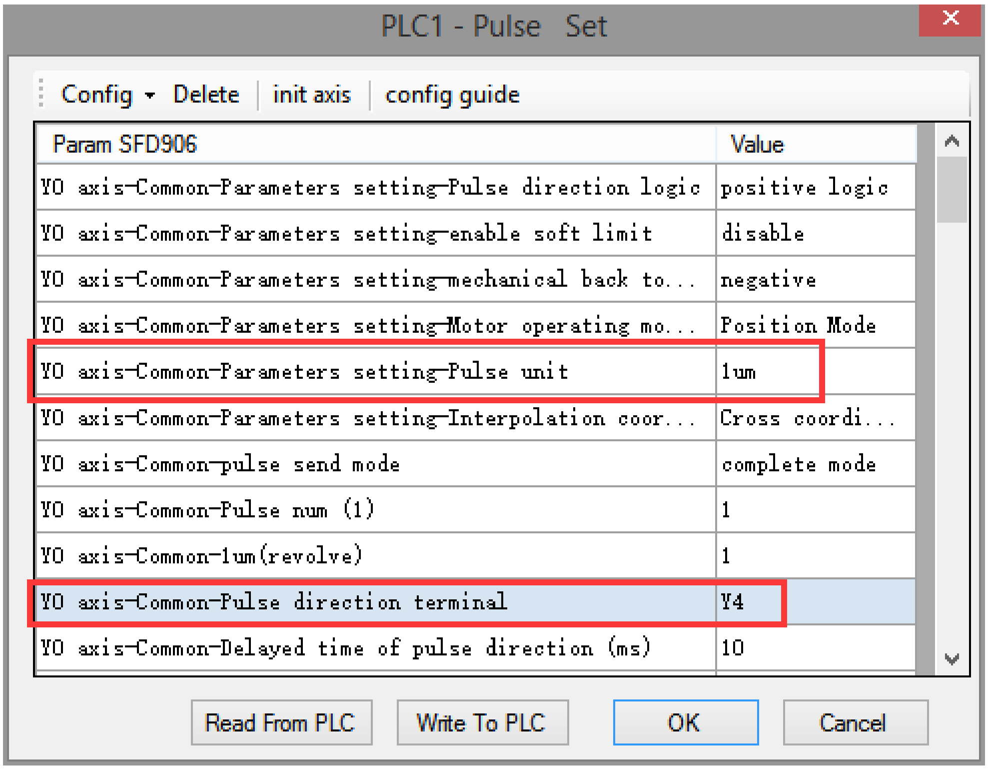



**CCW clockwise arc interpolation**

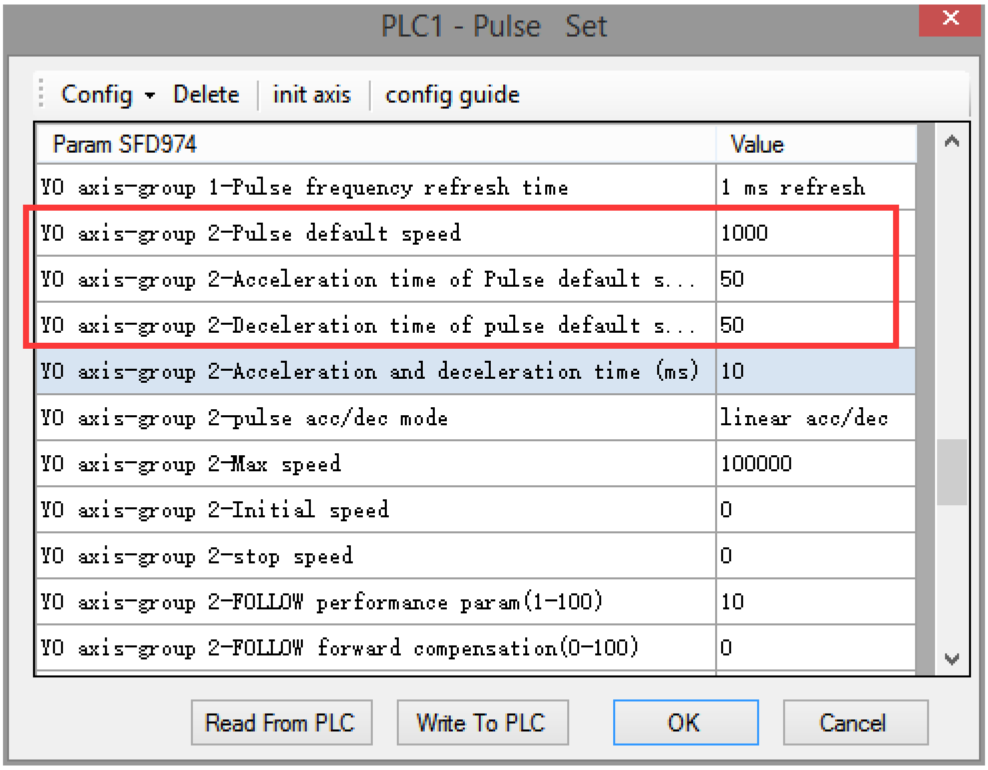
The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:



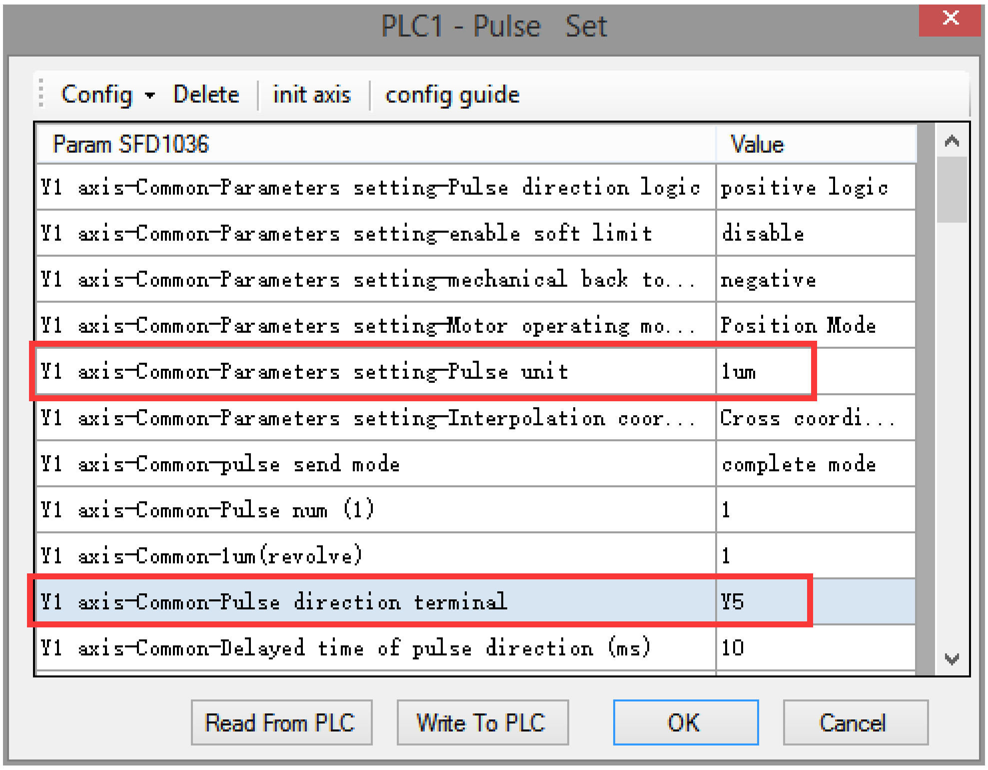

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle center of axis 1, D30 specifies the circle center of axis 2, D40 specifies the max speed.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 500Hz, when M0 rises, execute CCW command, move from the starting position (1000, 1000) to the target position at the max speed of 500Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000), the center position is (3000,1500), and D20 = 2000, D30 = 500.

(2) When the end point is in the relative mode, the target position is (6000,3000), the center position is (3500,2000), and D20 = 2500, D30 = 1000.

- When the CCW instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

## Mode 3: CCW anticlockwise VBEM

1. Instruction overview

Anticlockwise arc interpolation instruction, operate according to the set maximum synthetic speed, start speed and stop speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Anticlockwise arc interpolation [CCW] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CCW |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the center position of axis 1 (always relative to the starting coordinates) | Double words, 32-bit |
| S3 | Specify the center position of axis 2 (always relative to the starting coordinates) | Double words, 32-bit |
| S4 | Specify the starting speed at the starting point of the two axes | Double words, 32-bit |
| S5 | Specify the stop speed at the end point of the two axes | Double words, 32-bit |
| S6 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0~S6 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

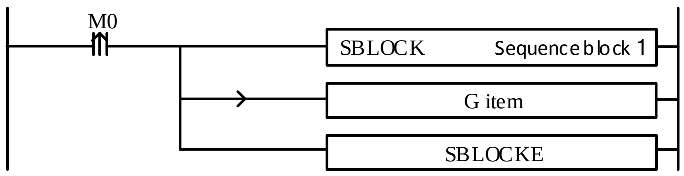
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

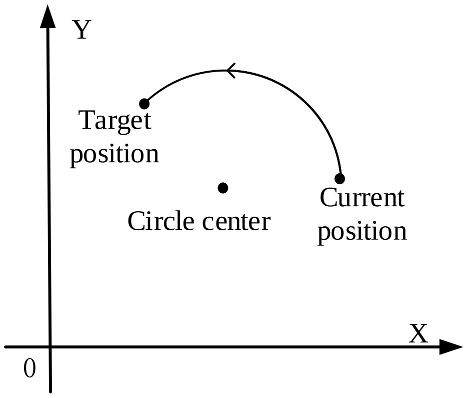
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Circle center position | The position of the center is determined by the position of the starting point and the end point | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Start speed | The start speed from the starting point | Must set |
| Stop speed | The stop speed at the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

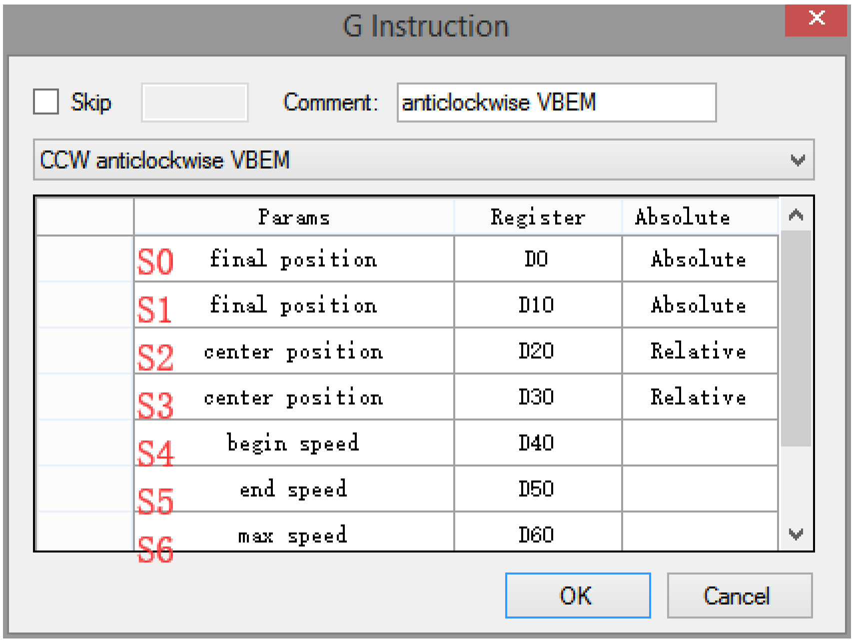


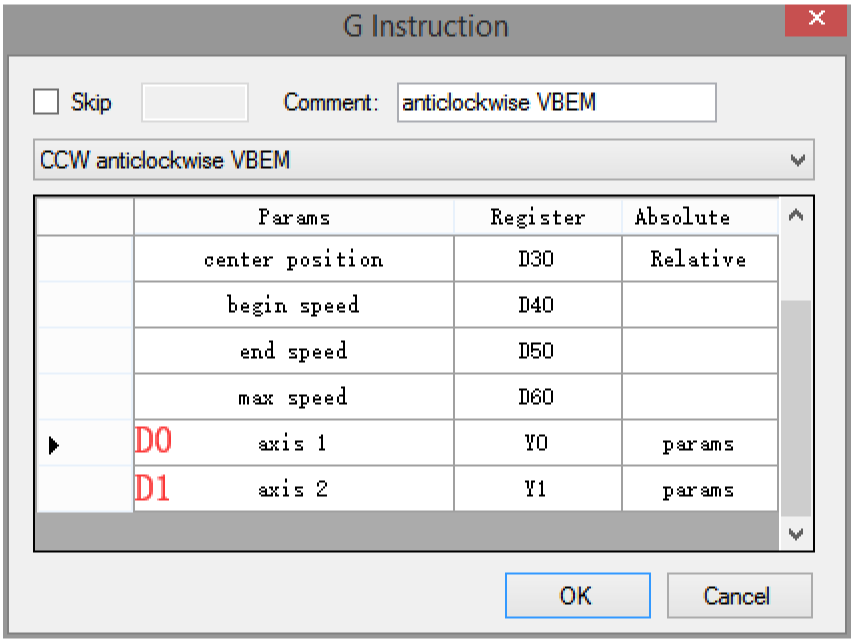

When the CCW instruction of arc interpolation (mode 3) is executed, the two axes will run at the set max synthesis speed, start speed and stop speed. As shown in the following figure:



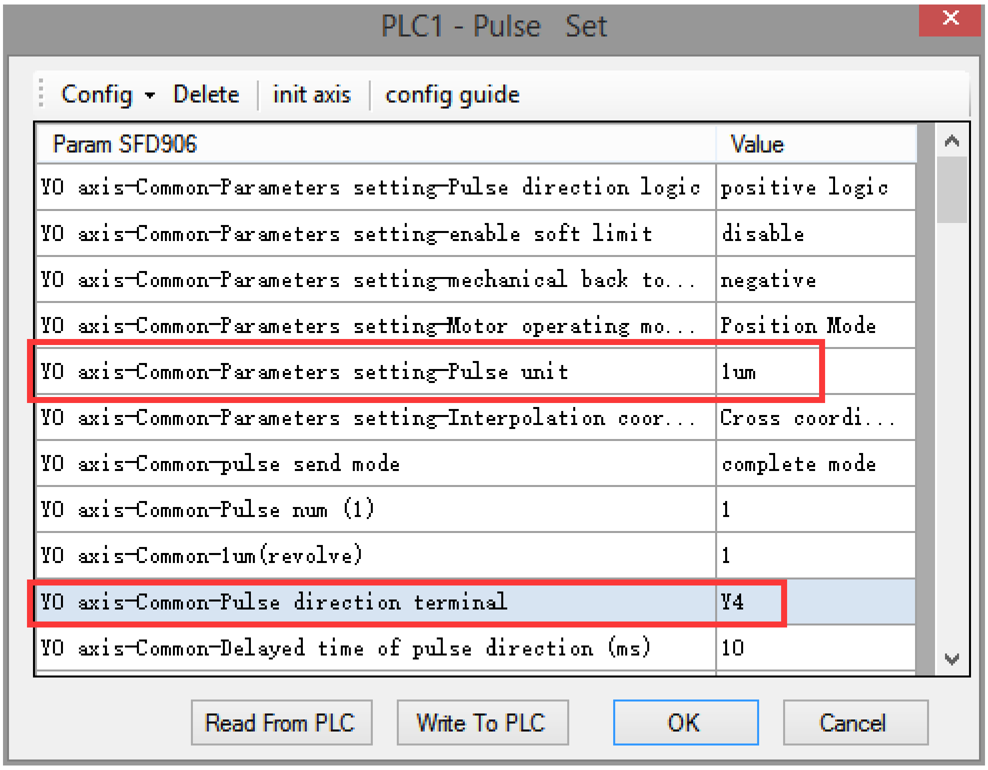

**CCW clockwise arc interpolation**

The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:

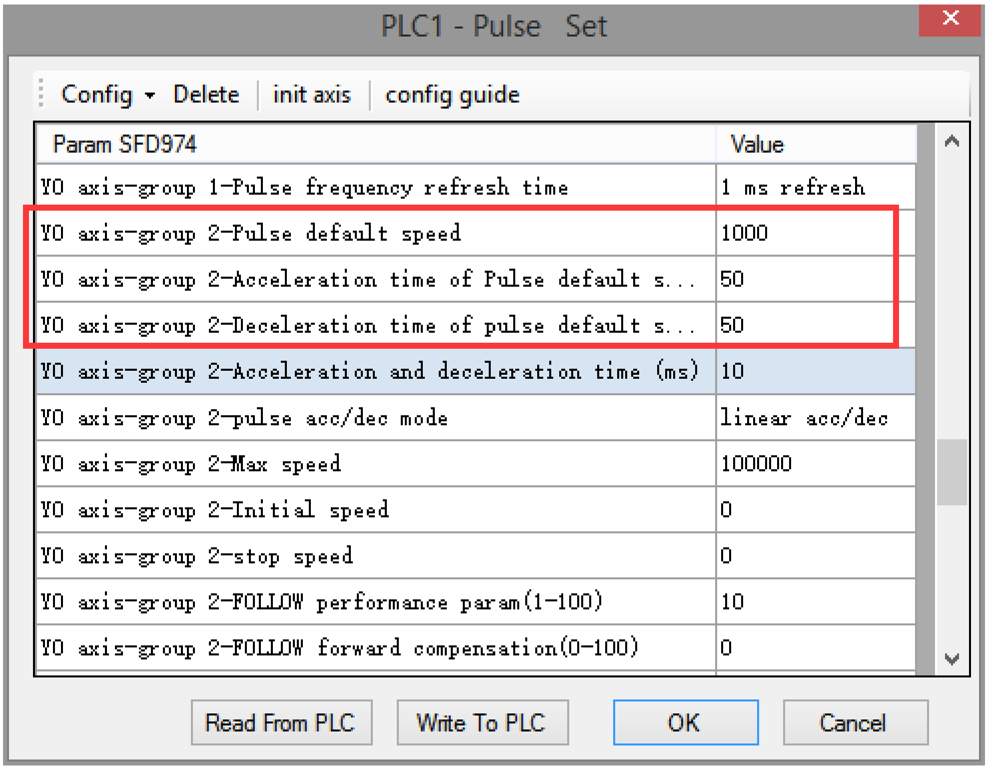




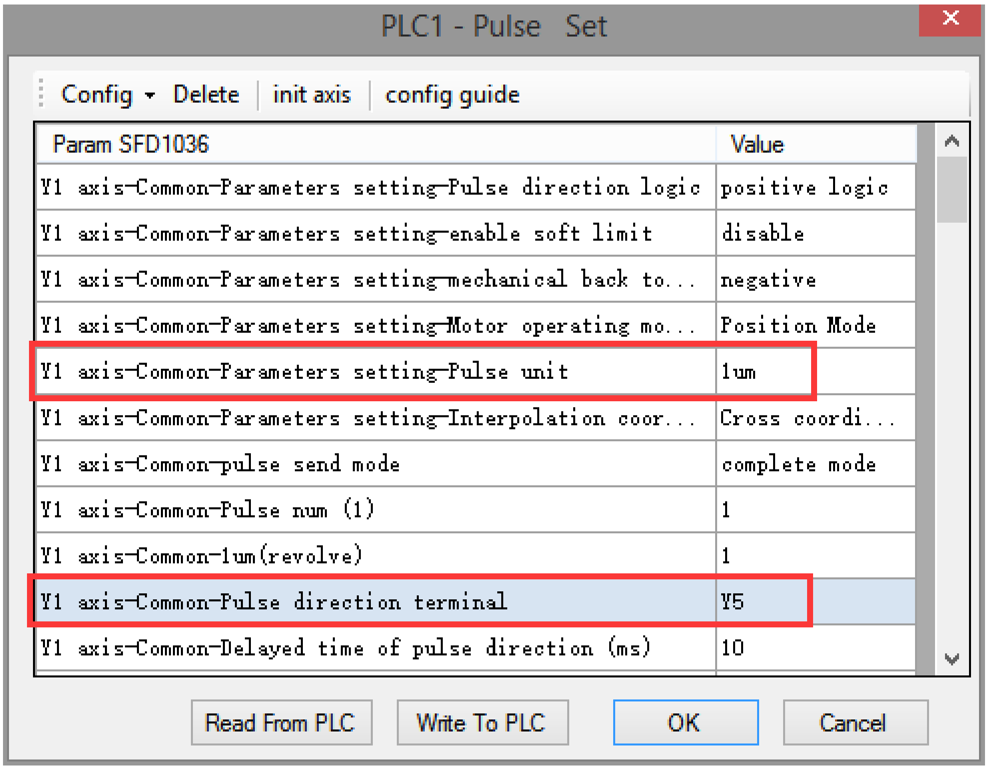

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle center of axis 1, D30 specifies the circle center of axis 2, D40 specifies the start speed, D50 specifies the stop speed, D60 specifies the max speed.

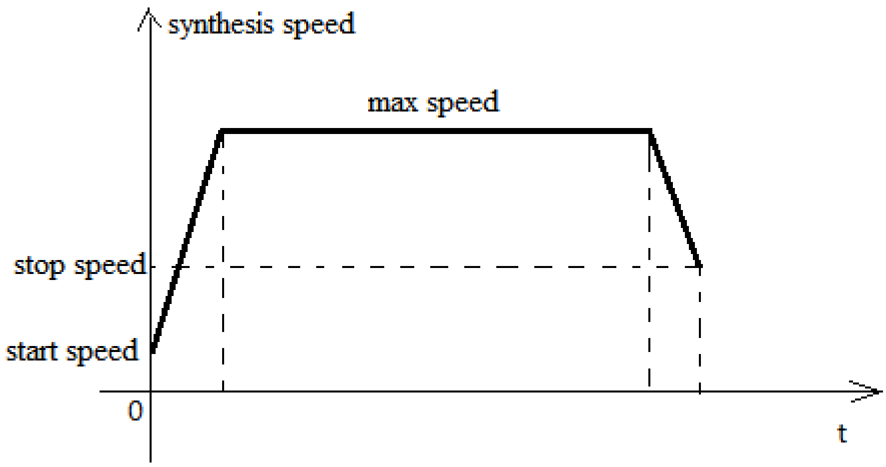
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 50Hz, D50 = 20, D60 = 2000, when M0 rises, execute CCW command, accelerate from the starting position (1000,1000) at speed 50Hz to the maximum speed (2000Hz), and stop at the end speed of 20Hz when moving to the target position.

(1) When the end point is in absolute mode, the target position is (5000,2000), the center position is (3000,1500), and D20 = 2000, D30 = 500.

(2) When the end point is in the relative mode, the target position is (6000,3000), the center position is (3500,2000), and D20 = 2500, D30 = 1000.

- When the CCW instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

Note: In this mode, the starting speed (S4), the ending speed (S5) and the maximum speed (S6) are all expressed as the two-axis synthesis speed, as shown in the following figure:

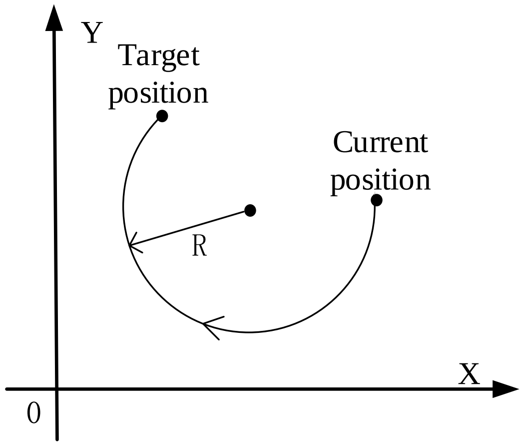



When there are multiple continuous linear/arc interpolation instructions and the speed between them needs to be constant and jump directly, the termination speed and maximum speed of the previous linear/arc interpolation can be set the same as the starting speed and maximum speed of the next segment.

When mode 3 is used, the starting and ending speed in the pulse parameter configuration tables of axis 1 and axis 2 are only effective for calculating the slope of pulse acceleration and deceleration.

## 2-4-6. Clockwise arc [CW_R]

Clockwise arc interpolation CW_R is mainly based on the current position of the arc, the target position and the length of the radius of the circle, clockwise to determine a section of the arc, as shown in the following figure:




With the above figure, when the target position is set at the same position as the current one, the next circle can not be determined, so this mode can not draw a whole circle. There are three modes of CW_R. The usage of CW_R is described below.

**Mode 1: CW_R clockwise arc**

1. Instruction overview

Clockwise arc interpolation instruction, operate according to the set default speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Clockwise arc interpolation [CW_R] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CW_R |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the radius of the arc | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

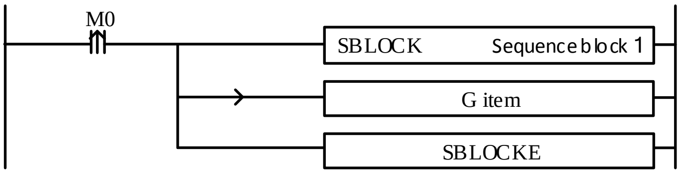
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

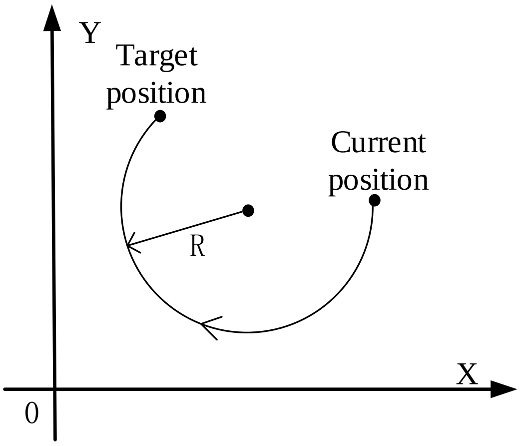
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Radius | The path of an arc varies with its radius. | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | Must set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

## Function and action

《Instruction format》

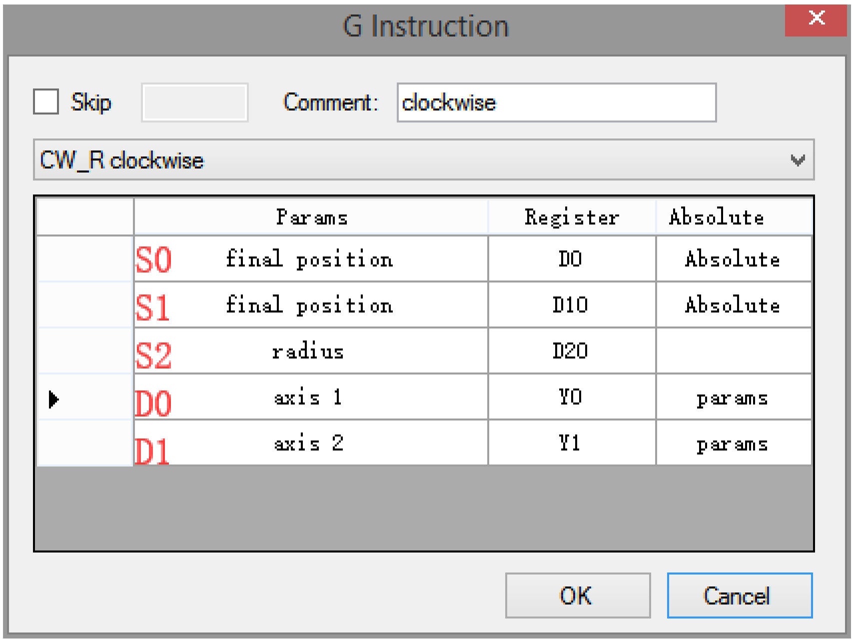



When the CW_R instruction of arc interpolation (mode 1) is executed, the two axes will run at the highest synthesis speed. As shown in the following figure:

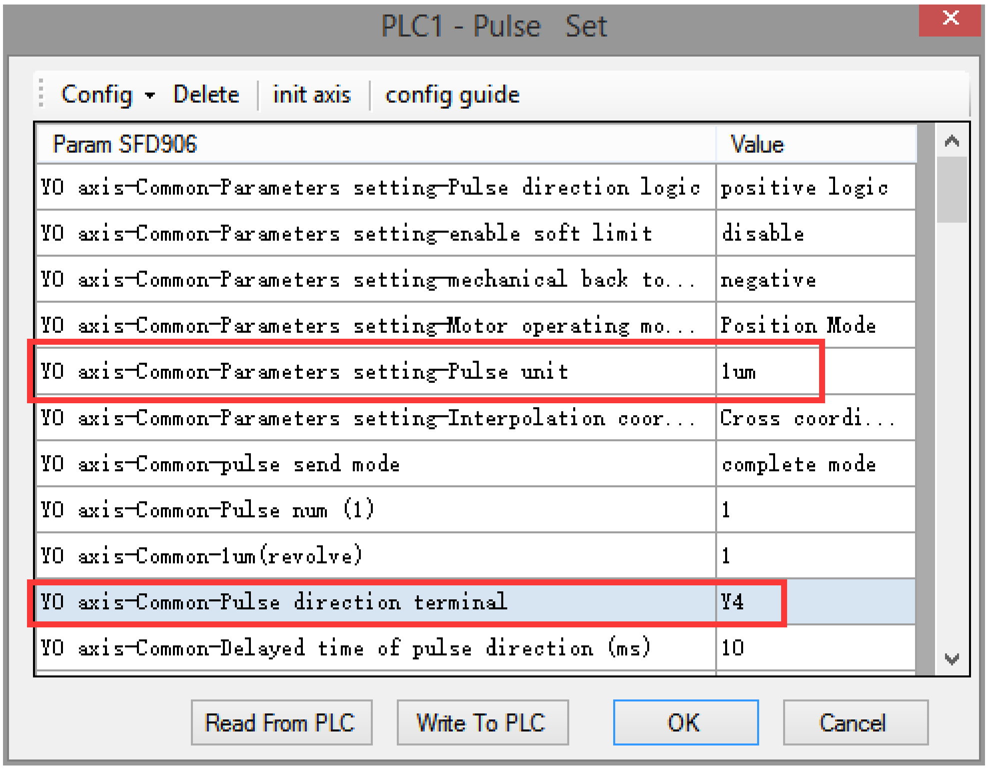



**CW_R clockwise arc interpolation**

The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:

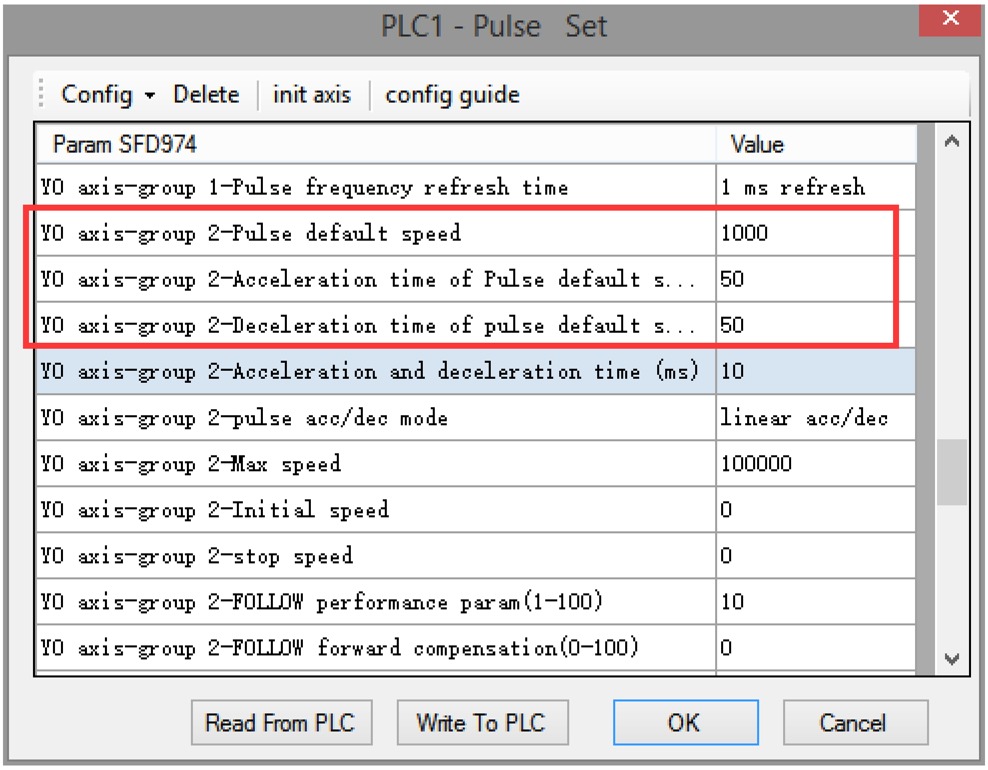


**Instruction configuration**



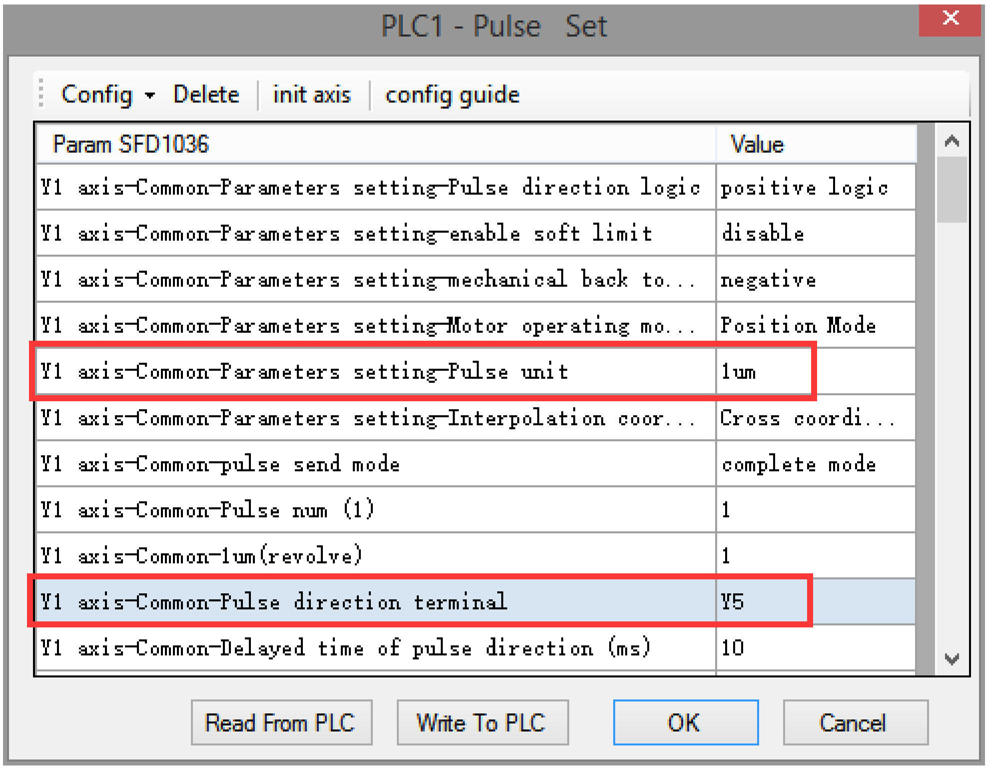

| Param SFD906 | Value |
|---|---|
| Y0 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y0 axis-Common-Parameters setting-enable soft limit | disable |
| Y0 axis-Common-Parameters setting-mechanical back to... | negative |
| Y0 axis-Common-Parameters setting-Motor operating mo... | Position Mode |
| Y0 axis-Common-Parameters setting-Pulse unit | 1um |
| Y0 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y0 axis-Common-pulse send mode | complete mode |
| Y0 axis-Common-Pulse num (1) | 1 |
| Y0 axis-Common-1um(revolve) | 1 |
| Y0 axis-Common-Pulse direction terminal | Y4 |
| Y0 axis-Common-Delayed time of pulse direction (ms) | 10 |

**Axis Y0 system parameters (1)**




| Param SFD974 | Value |
|---|---|
| Y0 axis-group 1-Pulse frequency refresh time | 1 ms refresh |
| Y0 axis-group 2-Pulse default speed | 1000 |
| Y0 axis-group 2-Acceleration time of Pulse default s... | 50 |
| Y0 axis-group 2-Deceleration time of pulse default s... | 50 |
| Y0 axis-group 2-Acceleration and deceleration time (ms) | 10 |
| Y0 axis-group 2-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 2-Max speed | 100000 |
| Y0 axis-group 2-Initial speed | 0 |
| Y0 axis-group 2-stop speed | 0 |
| Y0 axis-group 2-FOLLOW performance param(1-100) | 10 |
| Y0 axis-group 2-FOLLOW forward compensation(0-100) | 0 |

**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle radius. The path of an arc varies with its radius.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute CW_R command, move from the starting position (1000, 1000) to the target position at the default speed of 1000Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the CW_R instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.
- When the radius is positive, the arc is inferior; when the radius is negative, it is major arc.

**Mode 2: CW_R clockwise arc VM**

1. Instruction overview

Clockwise arc interpolation instruction, operate according to the set maximum synthetic speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Clockwise arc interpolation [CW_R] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CW_R |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the radius of the arc | Double words, 32-bit |
| S3 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

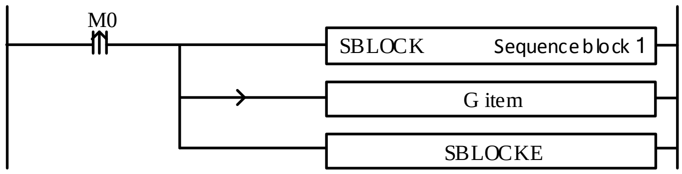
4. Parameter setting

| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |

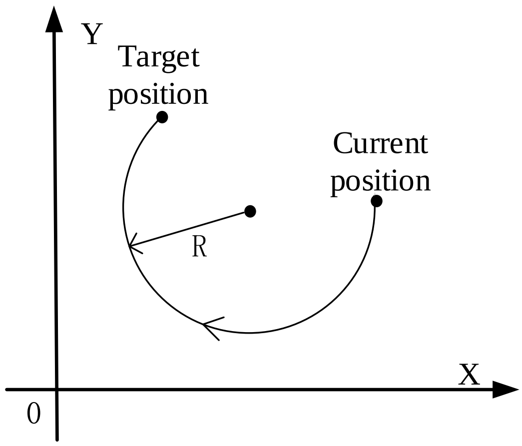
| | | |
|---|---|---|
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Radius | The path of an arc varies with its radius. | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

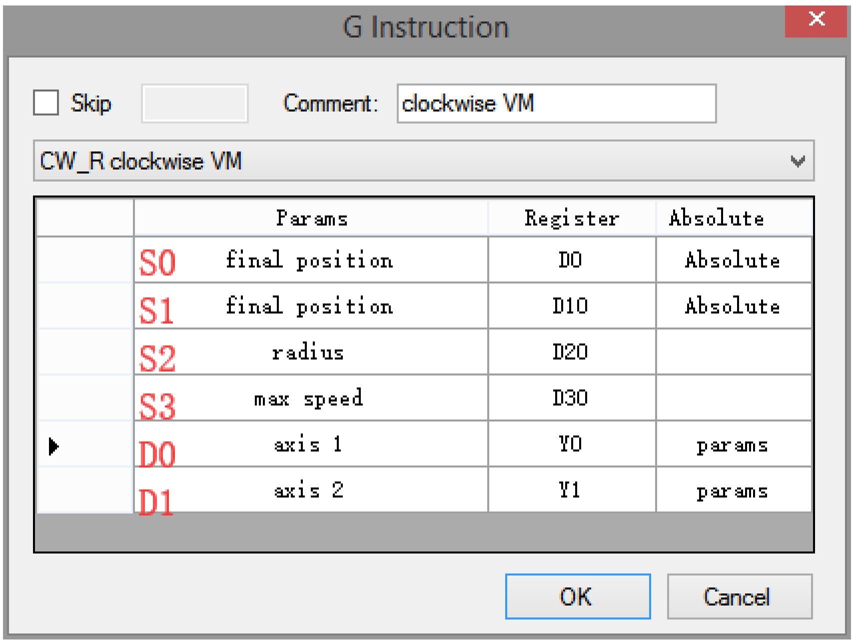



When the CW_R instruction of arc interpolation (mode 2) is executed, the two axes will run at the set max synthesis speed. As shown in the following figure:

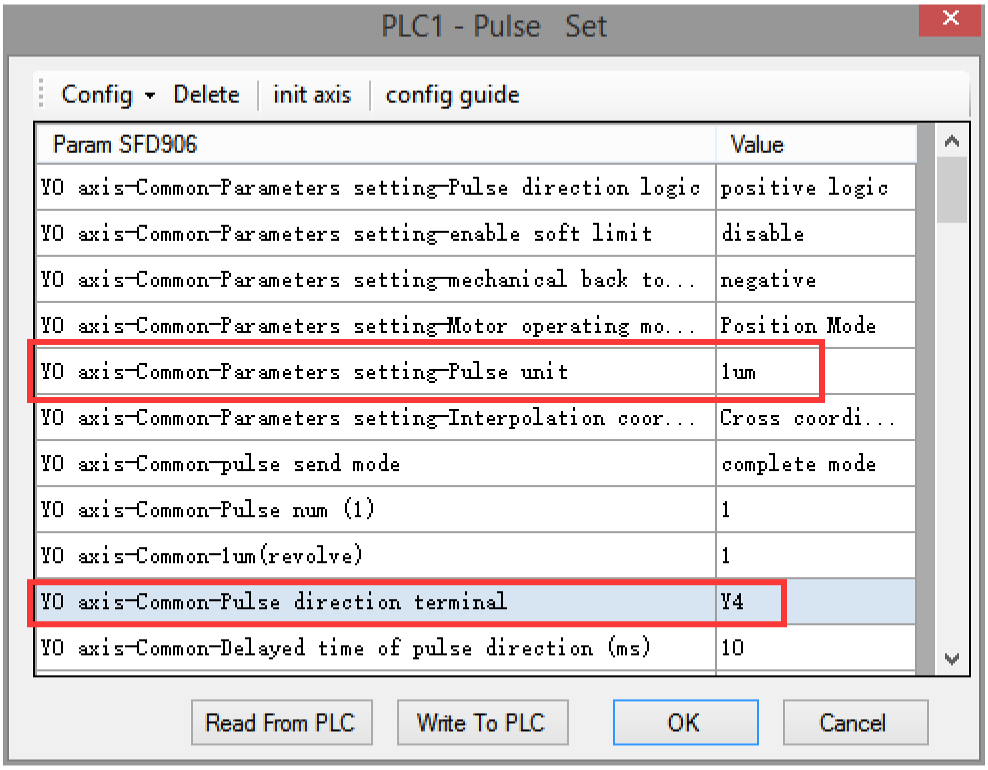



**CW_R clockwise arc interpolation**

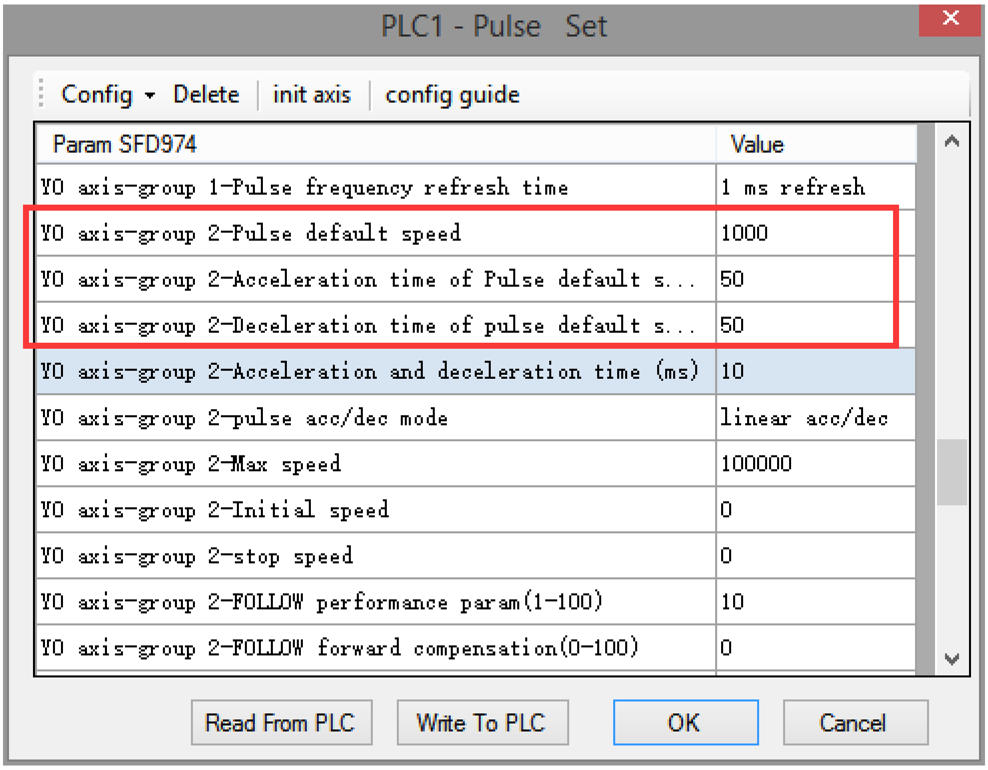
The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:



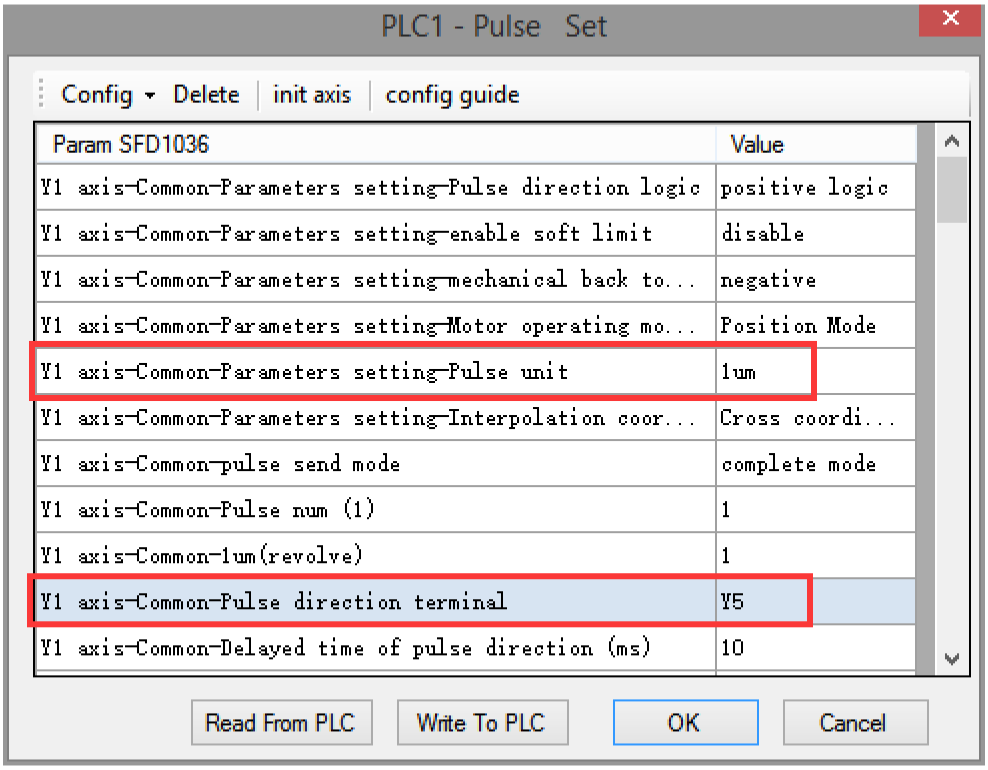

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the radius (the radius is different and the path is different), D30 specifies the max speed.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 500Hz, when M0 rises, execute CW_R command, move from the starting position (1000, 1000) to the target position at the max speed of 500Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the CW_R instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.
- When the radius is positive, the arc is inferior; when the radius is negative, it is major arc.

## Mode 3: CW_R clockwise arc VBEM

1. Instruction overview

Clockwise arc interpolation instruction, operate according to the set maximum synthetic speed, start speed and stop speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Clockwise arc interpolation [CW_R] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CW_R |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the radius of the arc | Double words, 32-bit |
| S3 | Specify the starting speed at the starting point of the two axes | Double words, 32-bit |
| S4 | Specify the stop speed at the end point of the two axes | Double words, 32-bit |
| S5 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0~S5 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

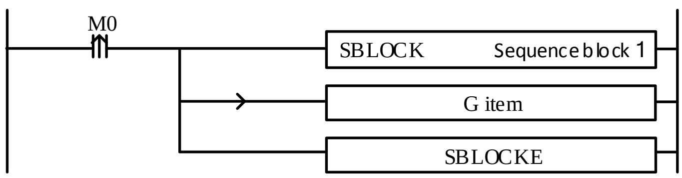
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

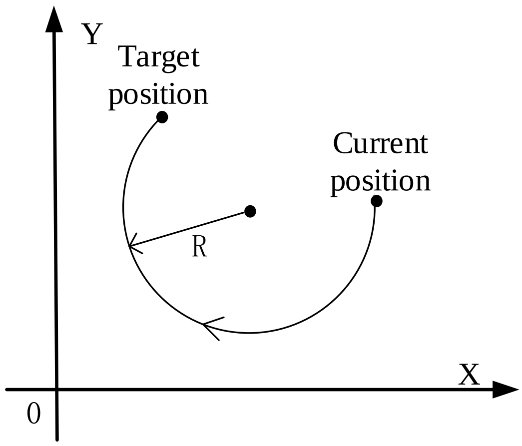
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| radius | The radius is different and the path is different | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Start speed | The start speed from the starting point | Must set |
| Stop speed | The stop speed at the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》

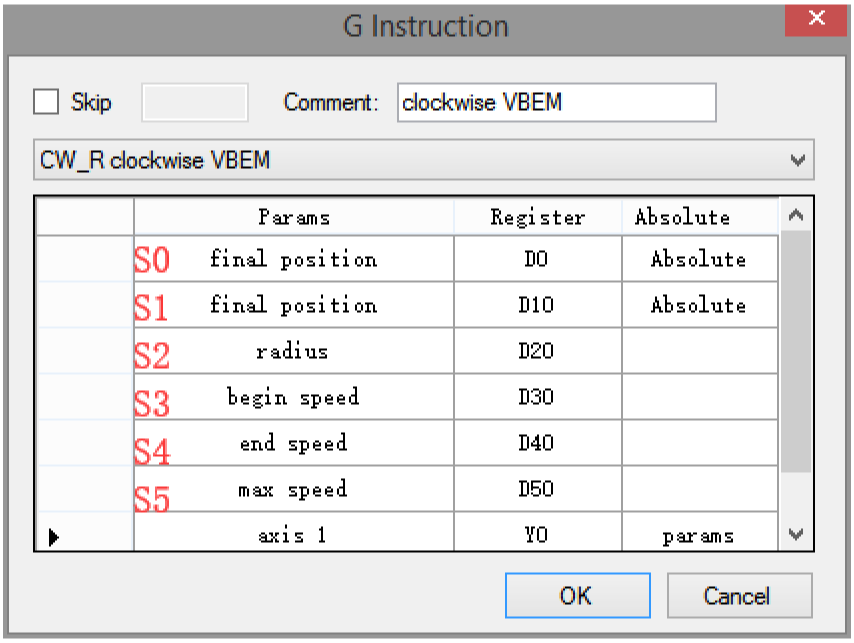


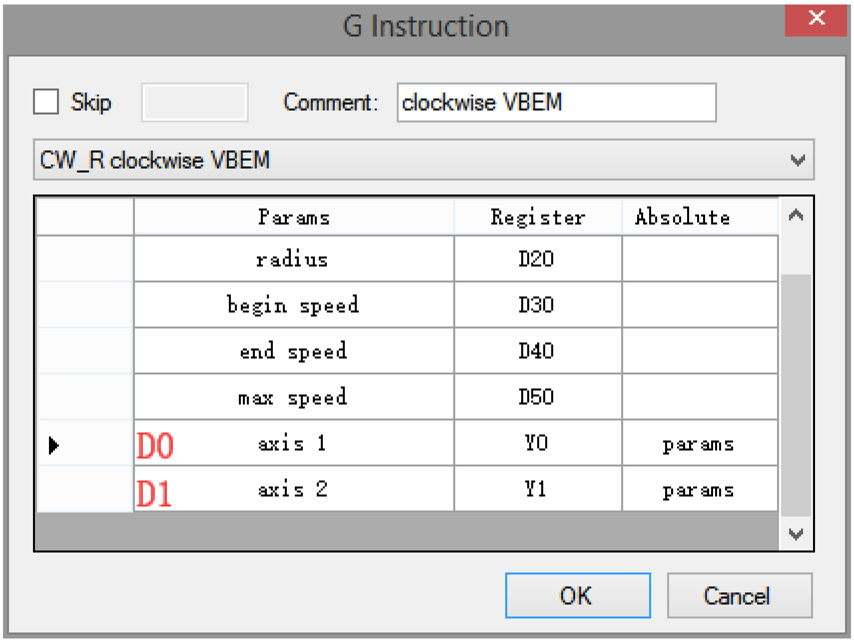

When the CW_R instruction of arc interpolation (mode 3) is executed, the two axes will run at the set max synthesis speed, start speed and stop speed. As shown in the following figure:



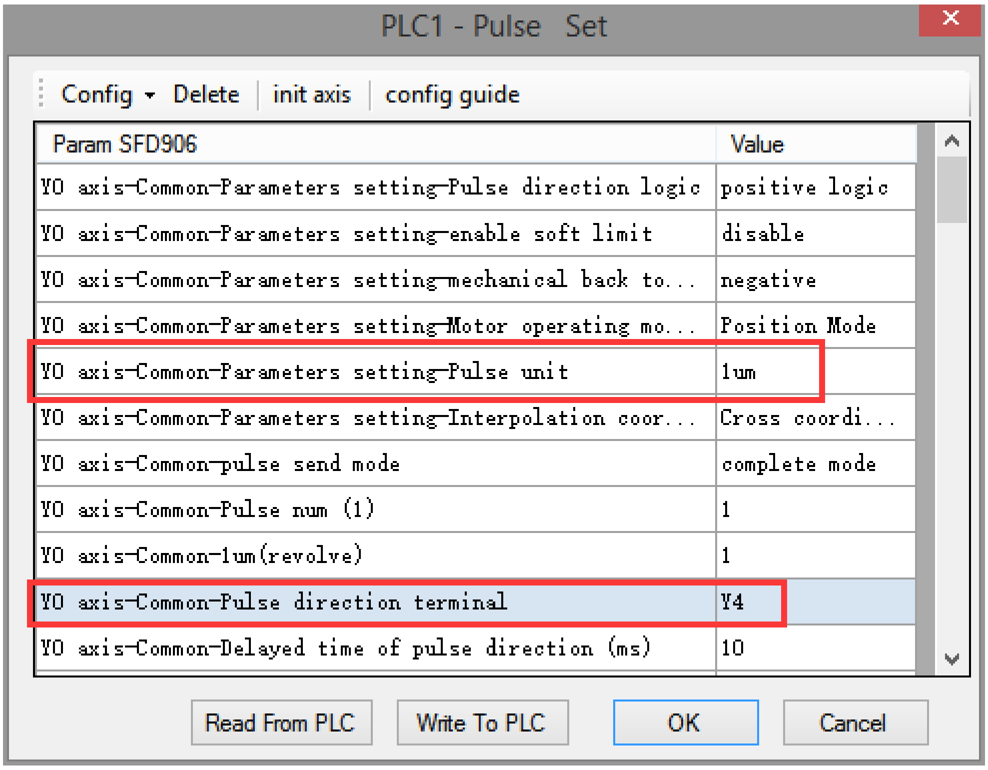

**CW_R clockwise arc interpolation**

The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:

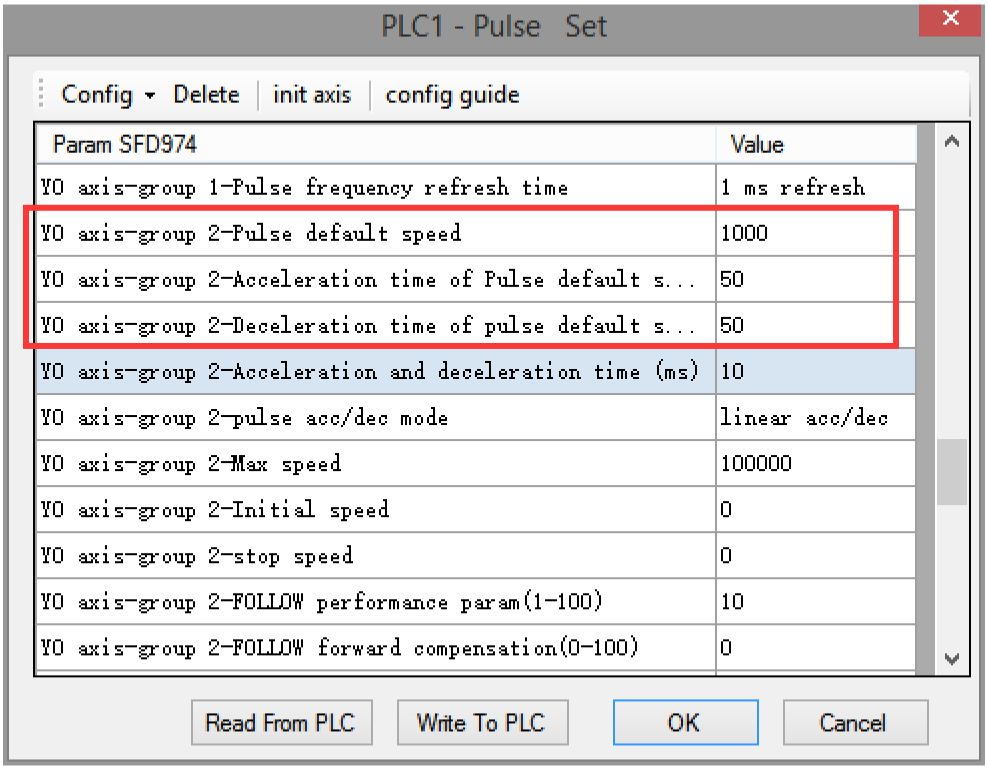




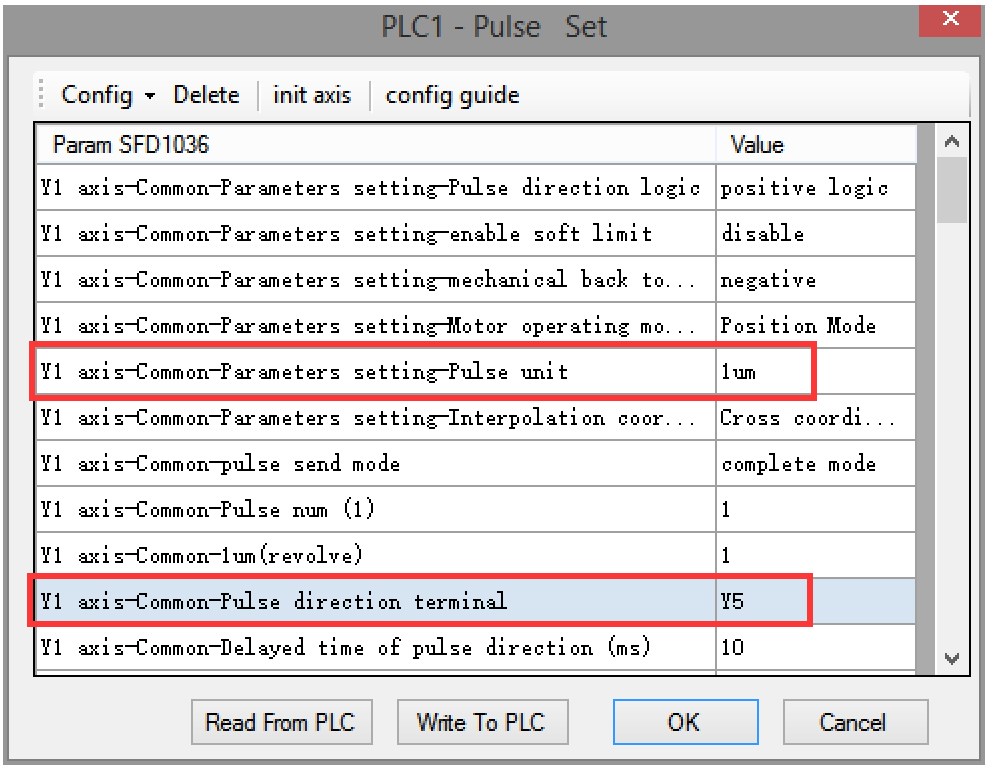

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the radius, D30 specifies the start speed, D40 specifies the stop speed, D50 specifies the max speed.

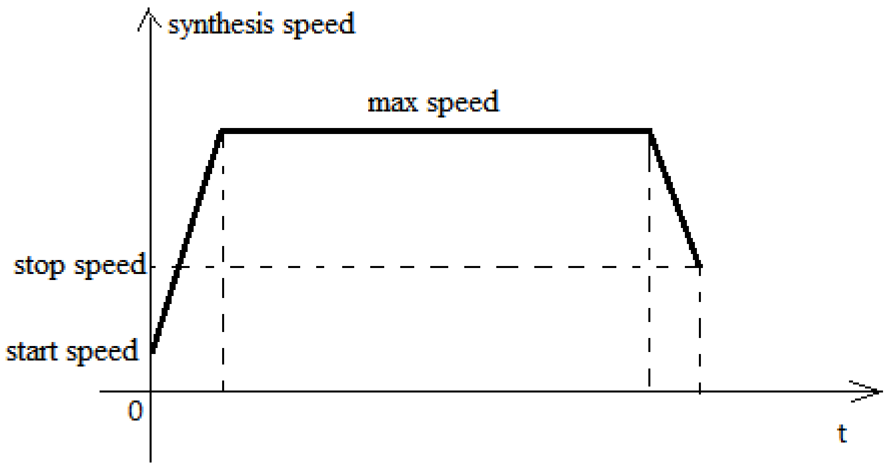
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 50Hz, D50 = 20, D60 = 2000, when M0 rises, execute CW_R command, accelerate from the starting position (1000,1000) at speed 50Hz to the maximum speed (2000Hz), and stop at the end speed of 20Hz when moving to the target position.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the CW_R instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.
- When the radius is positive, the arc is inferior; when the radius is negative, it is major arc.

Note: In this mode, the starting speed (S3), the ending speed (S4) and the maximum speed (S5) are all expressed as the two-axis synthesis speed, as shown in the following figure:

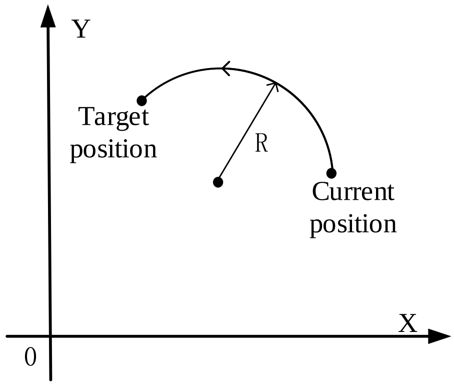



When there are multiple continuous linear/arc interpolation instructions and the speed between them needs to be constant and jump directly, the termination speed and maximum speed of the previous linear/arc interpolation can be set the same as the starting speed and maximum speed of the next segment.

When mode 3 is used, the starting and ending speed in the pulse parameter configuration tables of axis 1 and axis 2 are only effective for calculating the slope of pulse acceleration and deceleration.

## 2-4-7. Anticlockwise arc [CCW_R]

Anticlockwise arc interpolation CCW_R is mainly based on the current position of the arc, the target position and the length of the radius of the circle, clockwise to determine a section of the arc, as shown in the following figure:




With the above figure, when the target position is set at the same position as the current one, the next circle can not be determined, so this mode can not draw a whole circle. There are three modes of CCW_R. The usage of CCW_R is described below.

**Mode 1: CCW_R anticlockwise arc**

1. Instruction overview

Anticlockwise arc interpolation instruction, operate according to the set default speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Anticlockwise arc interpolation [CCW_R] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CCW_R |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the radius of the arc | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

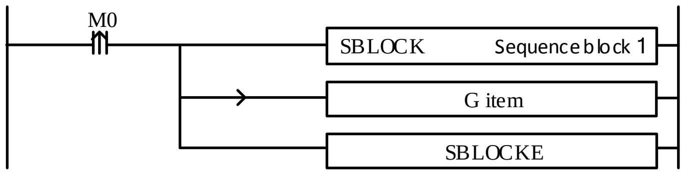
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

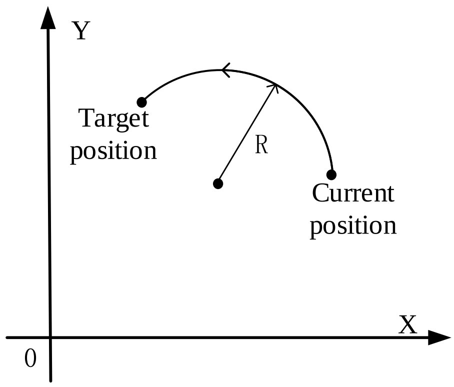
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Radius | The path of an arc varies with its radius. | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | Must set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

## Function and action

《Instruction format》

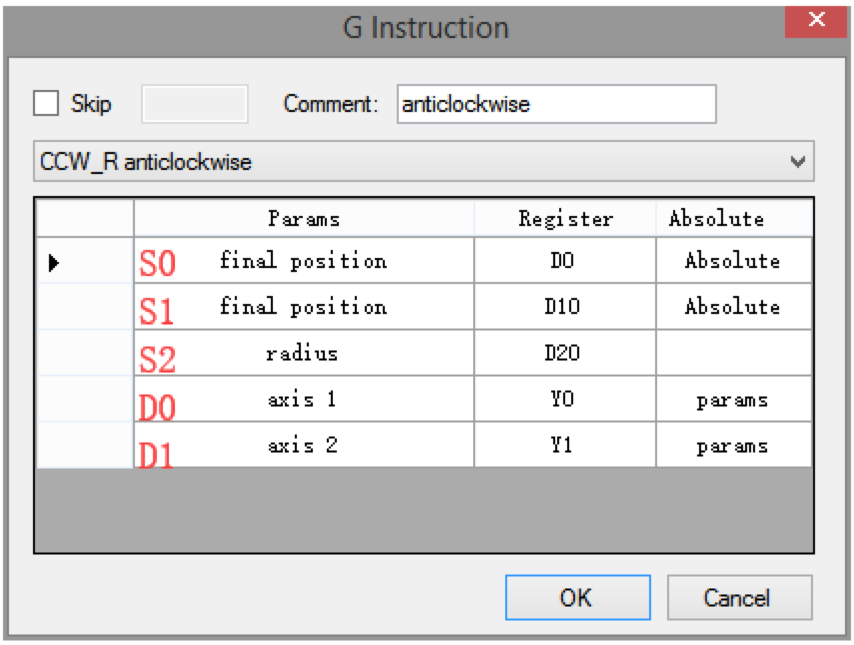



When the CCW_R instruction of arc interpolation (mode 1) is executed, the two axes will run at the highest synthesis speed. As shown in the following figure:

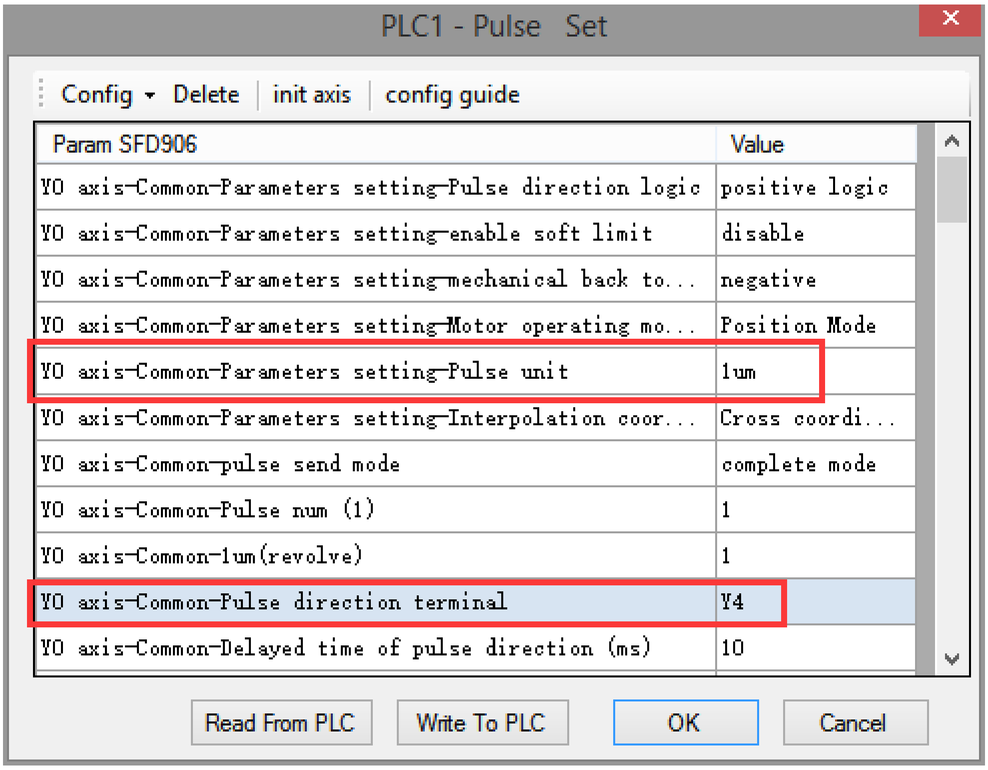



**CCW_R anticlockwise arc interpolation**

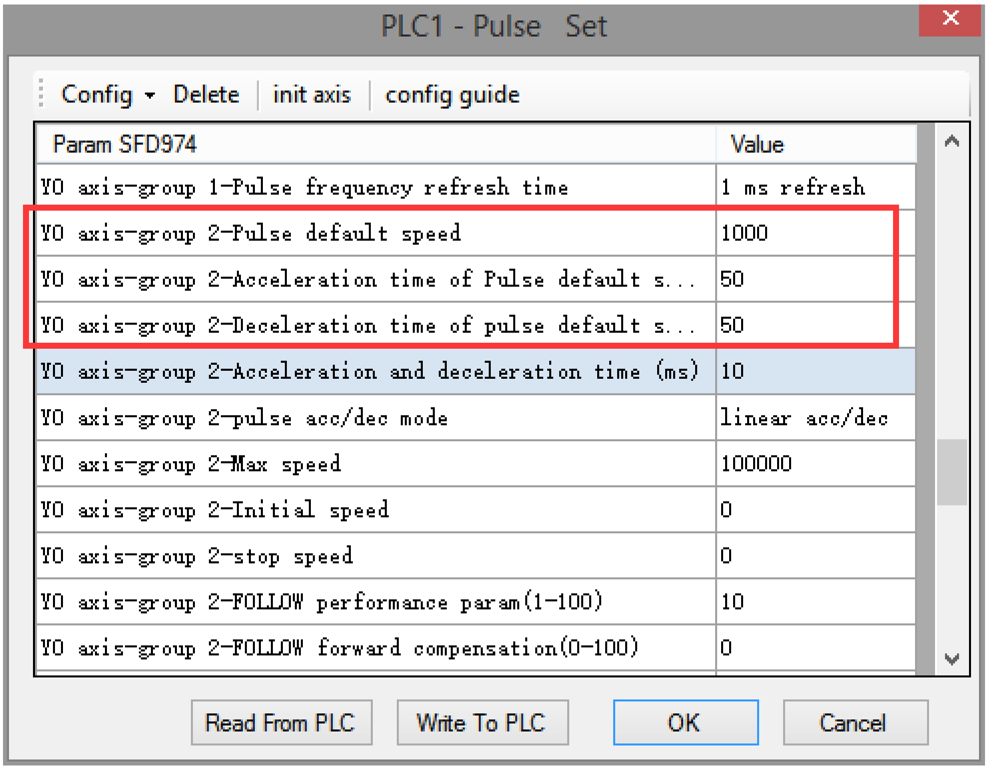
The parameter configuration is shown in the following figure:
Double-click G item and pop up the configuration panel. Set it as follows:



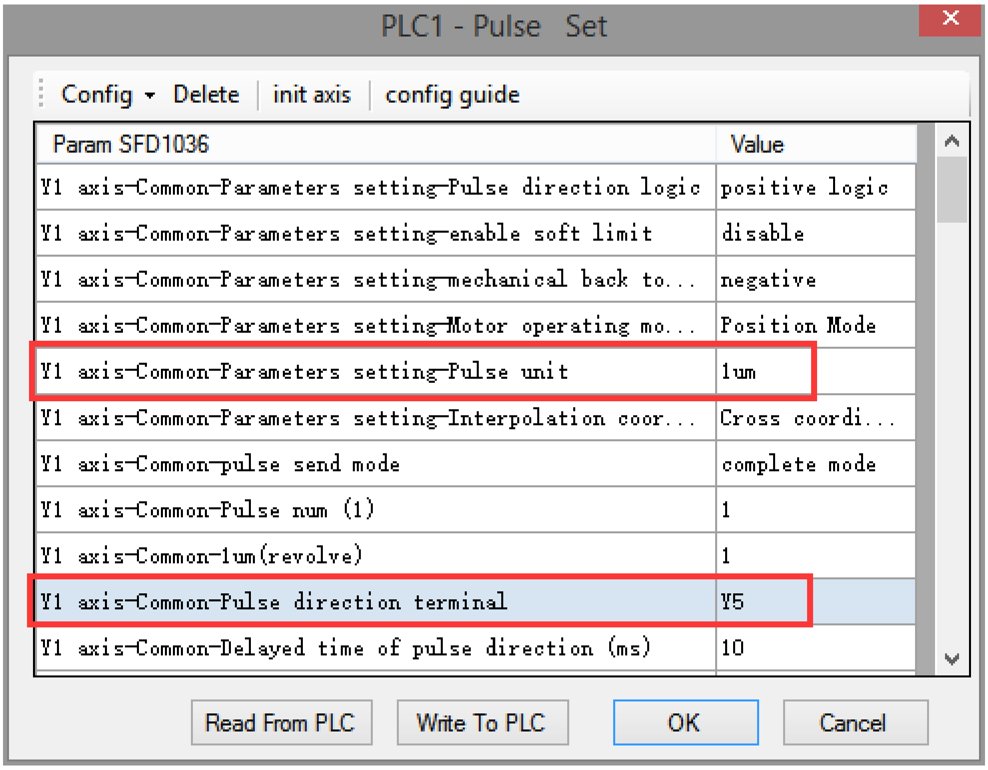

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the circle radius.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute CCW_R command, move from the starting position (1000, 1000) to the target position at the default speed of 1000Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the CCW_R instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.
- When the radius is positive, the arc is inferior; when the radius is negative, it is major arc.

**Mode 2: CCW_R anticlockwise arc VM**

1. Instruction overview

Anticlockwise arc interpolation instruction, operate according to the set maximum synthetic speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Anticlockwise arc interpolation [CCW_R] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CCW_R |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the radius of the arc | Double words, 32-bit |
| S3 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

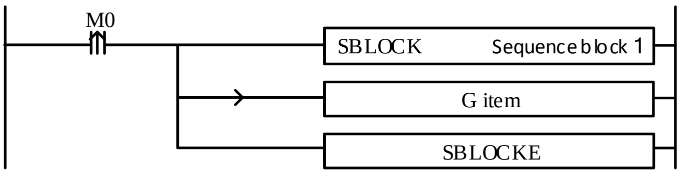
4. Parameter setting

| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |

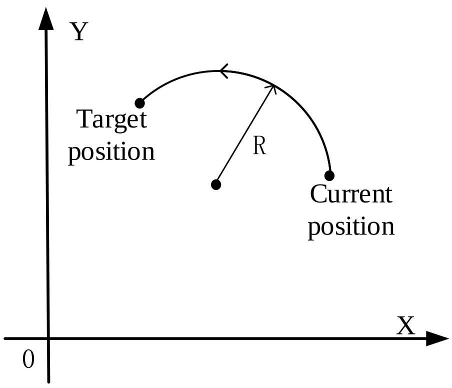
| | | |
|---|---|---|
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Radius | The path of an arc varies with its radius. | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



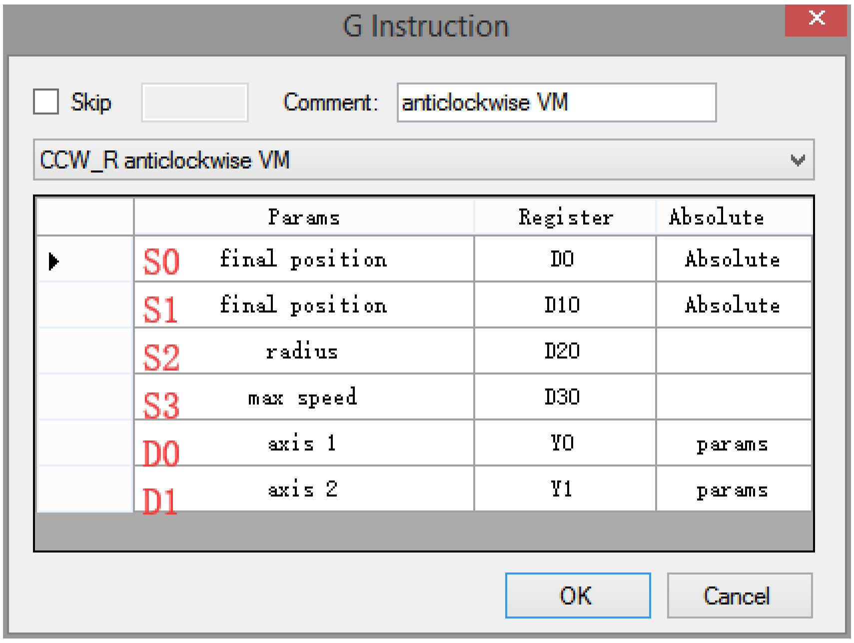

When the CCW_R instruction of arc interpolation (mode 2) is executed, the two axes will run at the set max synthesis speed. As shown in the following figure:



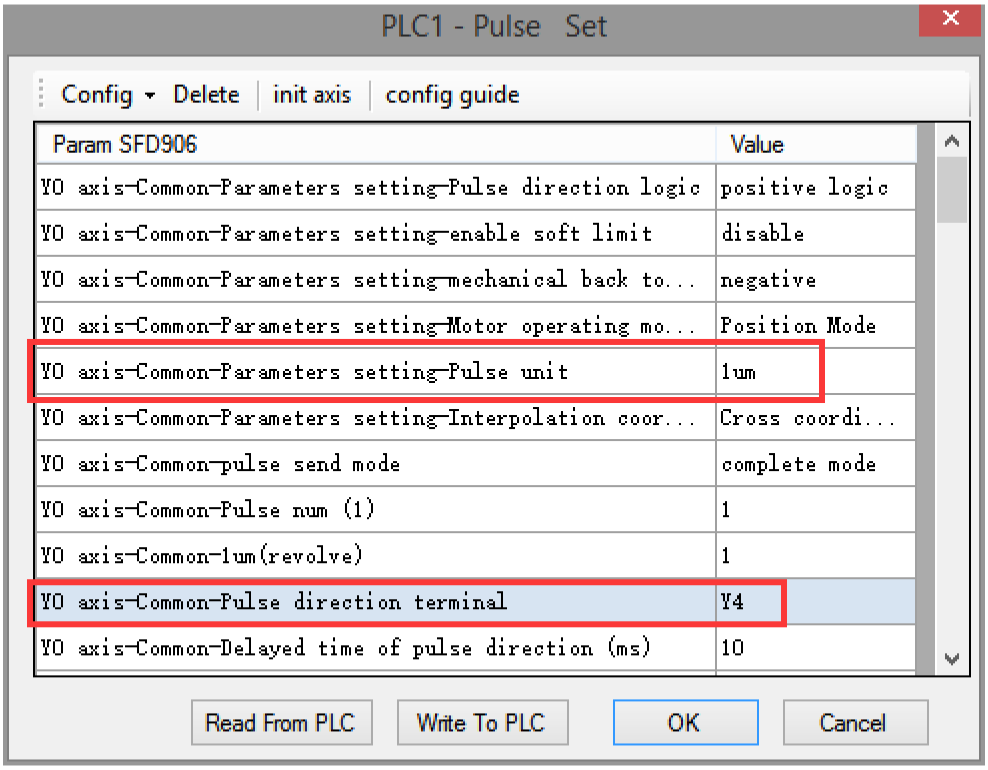

**CCW_R anticlockwise arc interpolation**

The parameter configuration is shown in the following figure:

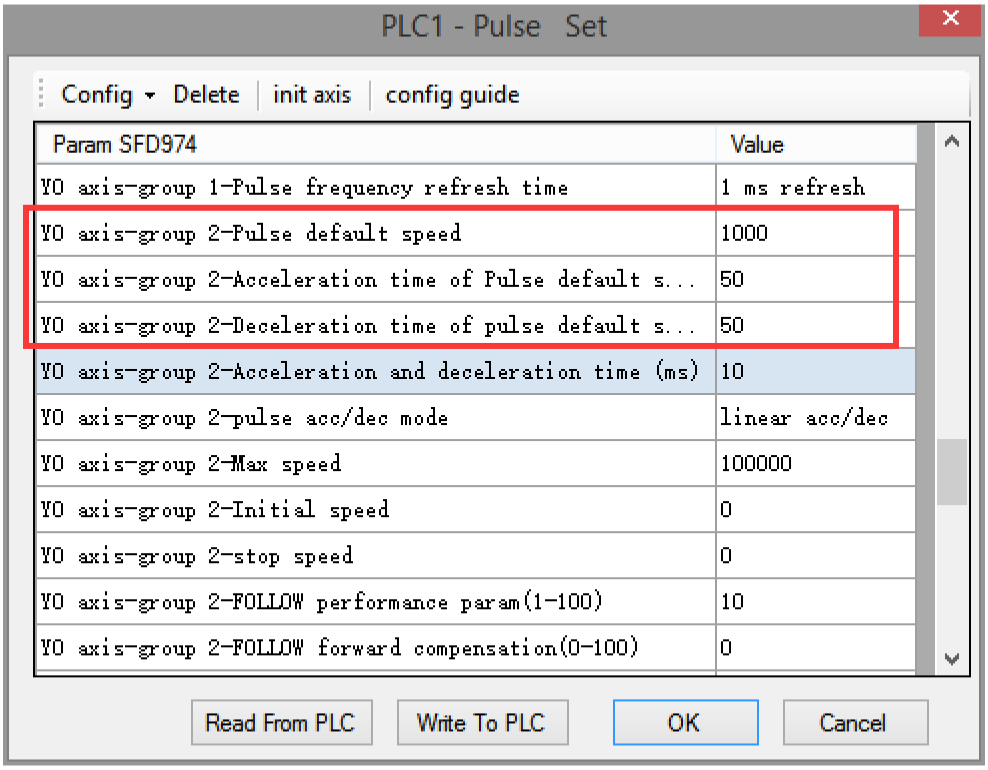
Double-click G item and pop up the configuration panel. Set it as follows:



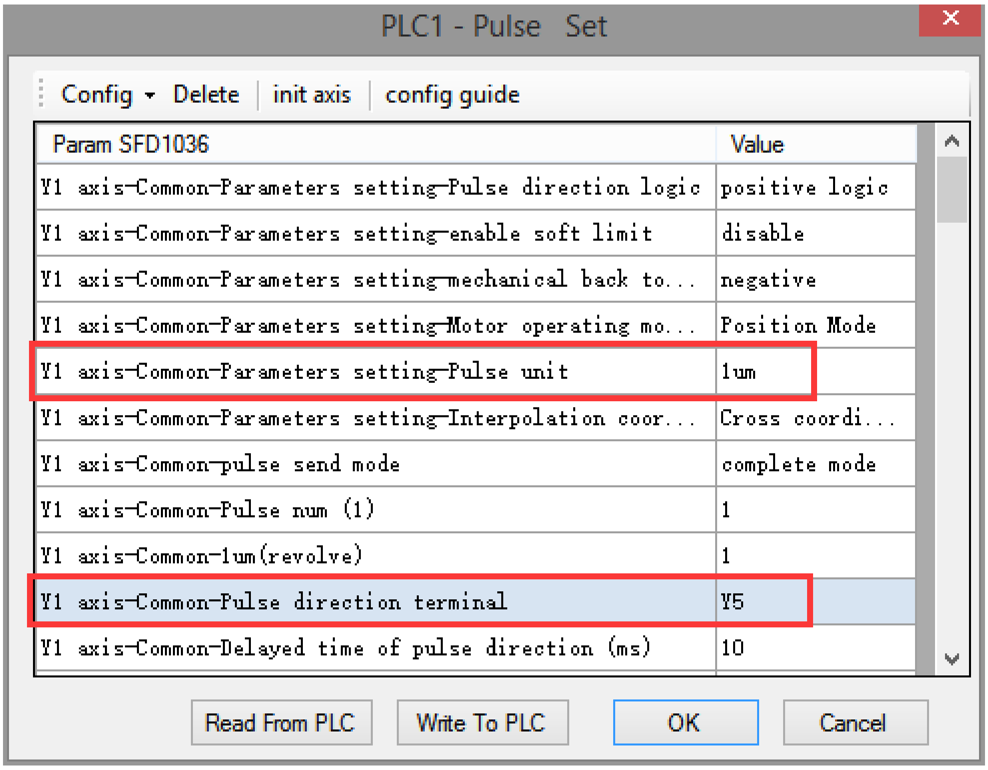

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the radius (the radius is different and the path is different), D30 specifies the max speed.

- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D30 = 500Hz, when M0 rises, execute CCW_R command, move from the starting position (1000, 1000) to the target position at the max speed of 500Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the CCW_R instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.
- When the radius is positive, the arc is inferior; when the radius is negative, it is major arc.

**Mode 3: CCW_R anticlockwise arc VBEM**

1. Instruction overview

Anticlockwise arc interpolation instruction, operate according to the set maximum synthetic speed, start speed and stop speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Anticlockwise arc interpolation [CCW_R] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | CCW_R |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the radius of the arc | Double words, 32-bit |
| S3 | Specify the starting speed at the starting point of the two axes | Double words, 32-bit |
| S4 | Specify the stop speed at the end point of the two axes | Double words, 32-bit |
| S5 | Max speed of the two axes | Double words, 32-bit |

| | | |
|---|---|---|
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0~S5 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

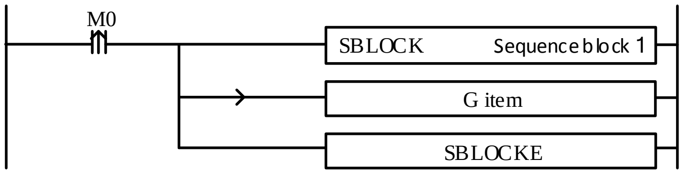
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

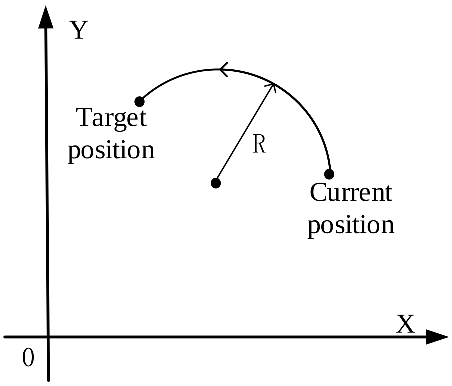
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| radius | The radius is different and the path is different | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Start speed | The start speed from the starting point | Must set |
| Stop speed | The stop speed at the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



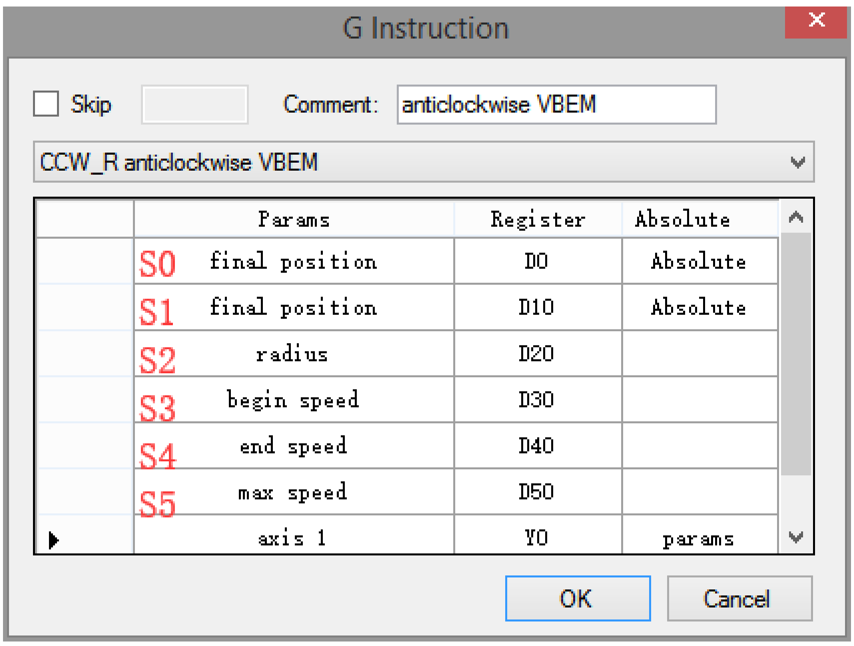

When the CCW_R instruction of arc interpolation (mode 3) is executed, the two axes will run at the set max synthesis speed, start speed and stop speed. As shown in the following figure:

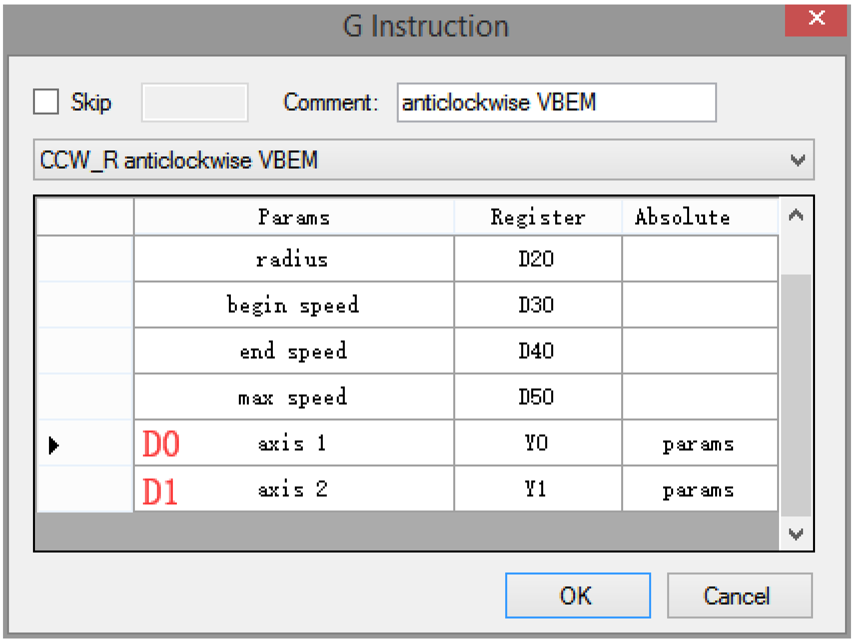



**CCW_R anticlockwise arc interpolation**

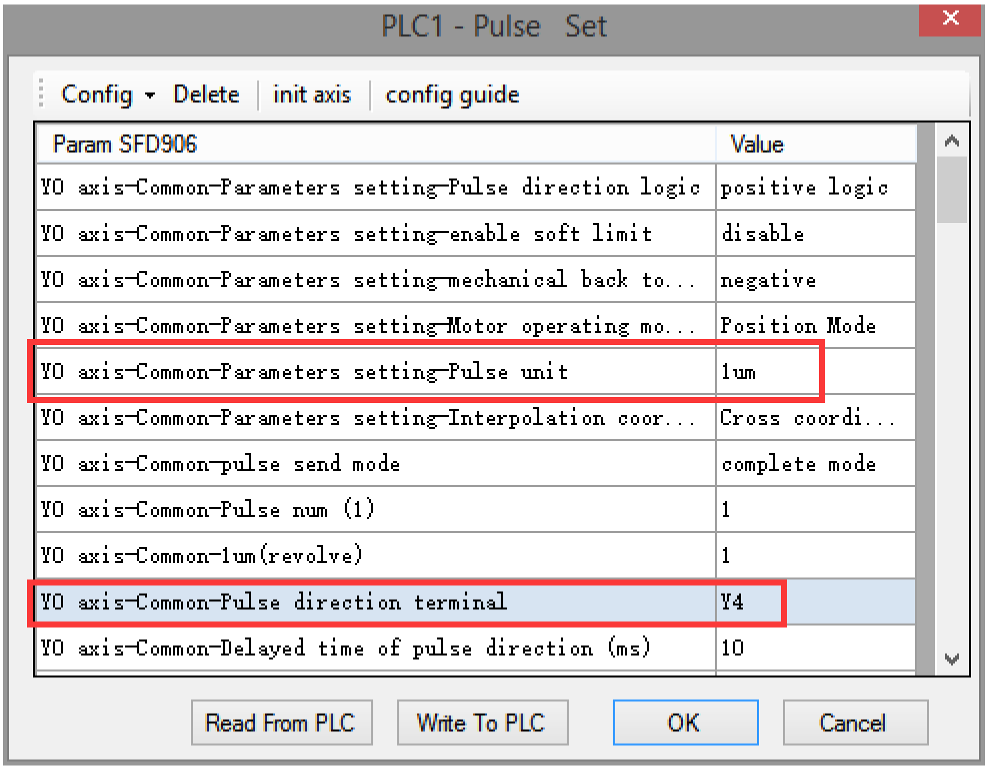
The parameter configuration is shown in the following figure:

Double-click G item and pop up the configuration panel. Set it as follows:

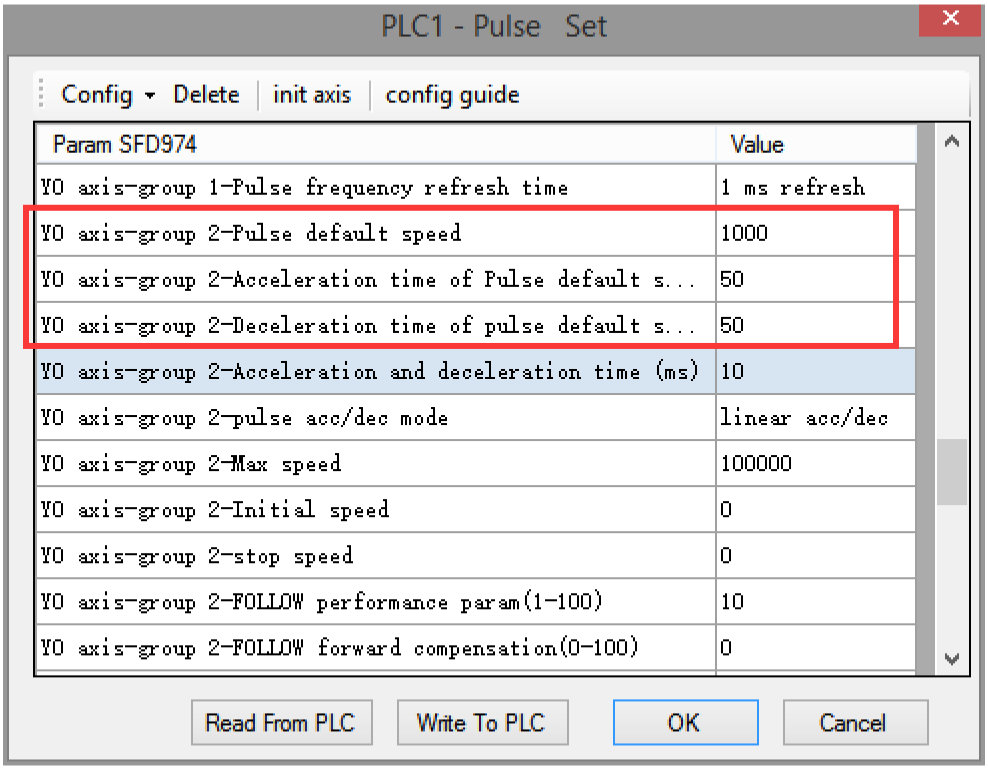





**Instruction configuration**

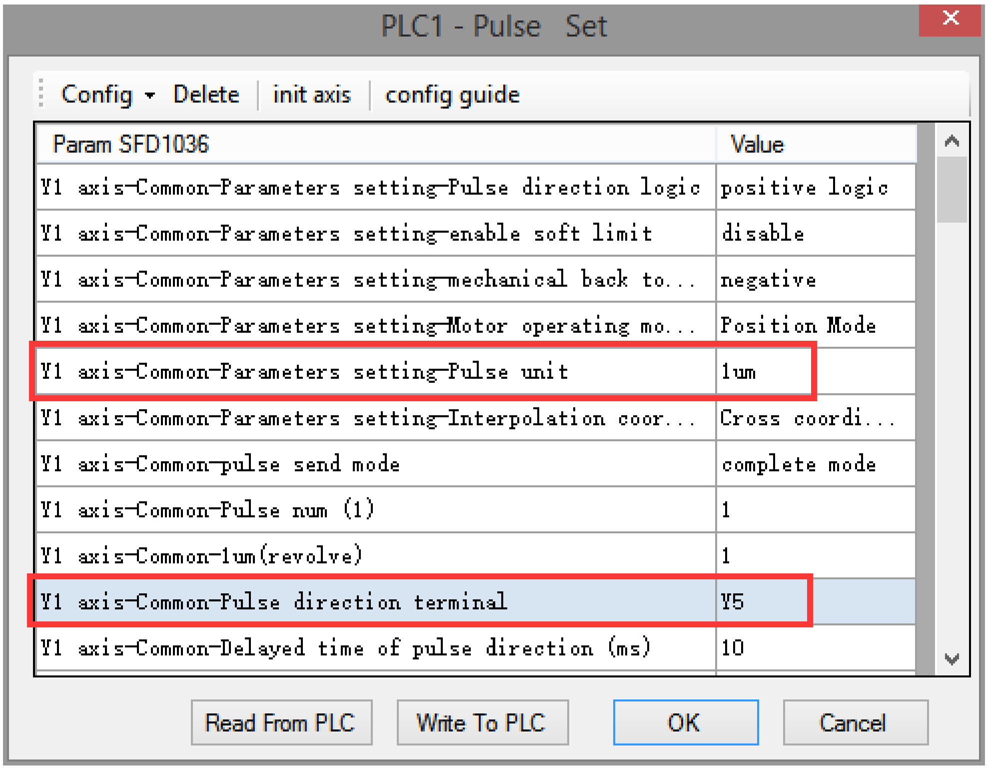



**Axis Y0 system parameters (1)**




| Param SFD974 | Value |
|---|---|
| Y0 axis-group 1-Pulse frequency refresh time | 1 ms refresh |
| Y0 axis-group 2-Pulse default speed | 1000 |
| Y0 axis-group 2-Acceleration time of Pulse default s... | 50 |
| Y0 axis-group 2-Deceleration time of pulse default s... | 50 |
| Y0 axis-group 2-Acceleration and deceleration time (ms) | 10 |
| Y0 axis-group 2-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 2-Max speed | 100000 |
| Y0 axis-group 2-Initial speed | 0 |
| Y0 axis-group 2-stop speed | 0 |
| Y0 axis-group 2-FOLLOW performance param(1-100) | 10 |
| Y0 axis-group 2-FOLLOW forward compensation(0-100) | 0 |

**Axis Y0 system parameters (2)**




| Param SFD1036 | Value |
|---|---|
| Y1 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y1 axis-Common-Parameters setting-enable soft limit | disable |
| Y1 axis-Common-Parameters setting-mechanical back to... | negative |
| Y1 axis-Common-Parameters setting-Motor operating mo... | Position Mode |
| Y1 axis-Common-Parameters setting-Pulse unit | 1um |
| Y1 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y1 axis-Common-pulse send mode | complete mode |
| Y1 axis-Common-Pulse num (1) | 1 |
| Y1 axis-Common-1um(revolve) | 1 |
| Y1 axis-Common-Pulse direction terminal | Y5 |
| Y1 axis-Common-Delayed time of pulse direction (ms) | 10 |

**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the radius, D30 specifies the start speed, D40 specifies the stop speed, D50 specifies the max speed.

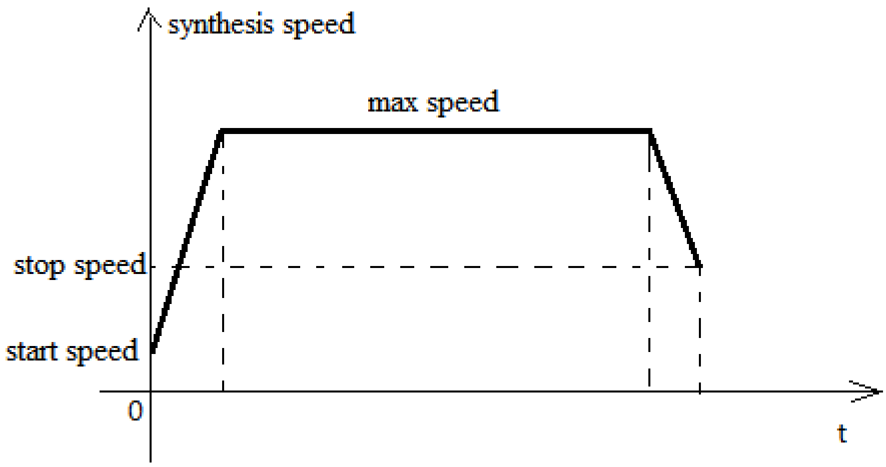
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D30 = 50Hz, D40 = 20, D50 = 2000, when M0 rises, execute CCW_R command, accelerate from the starting position (1000,1000) at speed 50Hz to the maximum speed (2000Hz), and stop at the end speed of 20Hz when moving to the target position.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the CCW_R instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.
- When the radius is positive, the arc is inferior; when the radius is negative, it is major arc.

Note: In this mode, the starting speed (S3), the ending speed (S4) and the maximum speed (S5) are all expressed as the two-axis synthesis speed, as shown in the following figure:



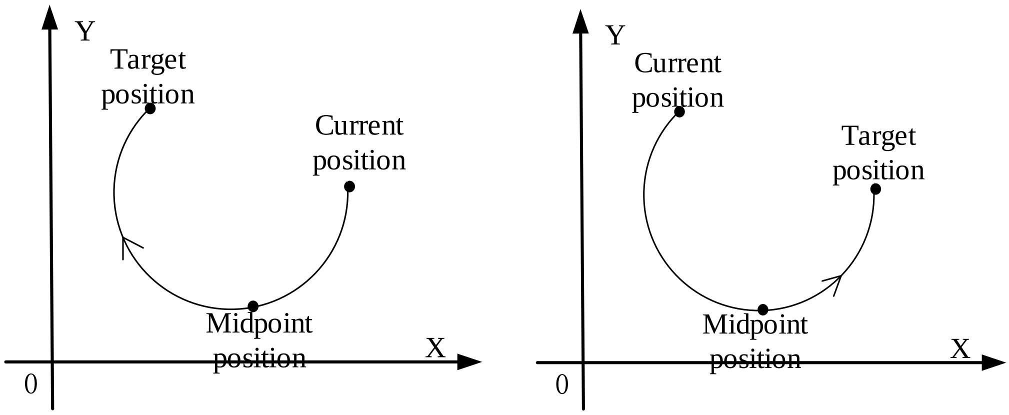

When there are multiple continuous linear/arc interpolation instructions and the speed between them needs to be constant and jump directly, the termination speed and maximum speed of the previous linear/arc interpolation can be set the same as the starting speed and maximum speed of the next segment.

When mode 3 is used, the starting and ending speed in the pulse parameter configuration tables of axis 1 and axis 2 are only effective for calculating the slope of pulse acceleration and deceleration.

## 2-4-8. Three points arc [ARC]

Three-point arc interpolation ARC mainly determines a section of arc clockwise or counter-clockwise through the current position of the arc, the target position and a midpoint position on the arc.

Note: The midpoint position on the arc refers to any point position between the current position and the target position on the drawn arc. As shown in the following figure:




When the target position is set to the same position as the current position (that is, two points become a point), the next circle can not be determined by two points (in three points, as long as two points coincide or three points are in a straight line, it can not form an arc), so this mode can not draw a whole circle. Three-point arc interpolation ARC has three modes, the following will be used one by one.

**Mode 1: ARC three-point arc**

1. Instruction overview

Three-point arc interpolation instruction, operate according to the set default speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Three-point arc interpolation [ARC] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | ARC |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Axis 1 midpoint position | Double words, 32-bit |
| S3 | Axis 2 midpoint position | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |

| | | |
|---|---|---|
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | ● | ● | ● | ● | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | | |
| S2 | ● | ● | ● | ● | | | | | | | |
| S3 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

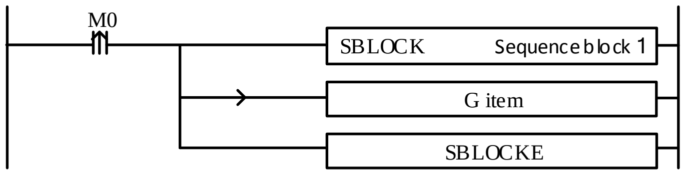
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

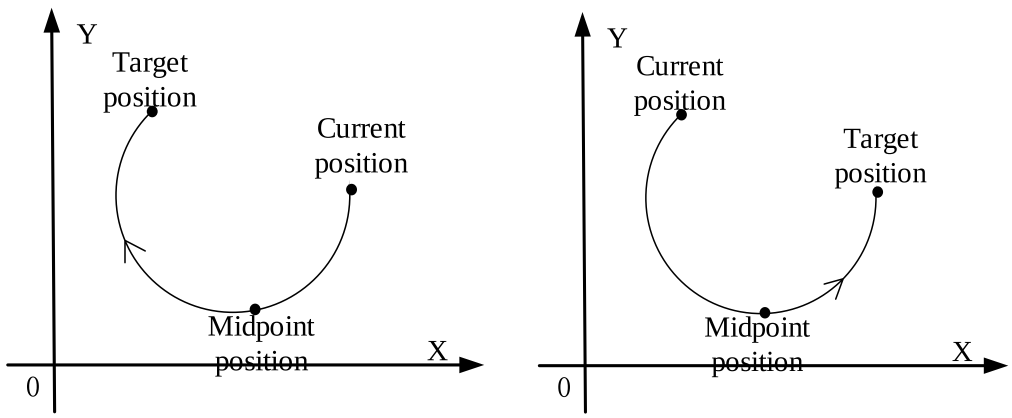
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Midpoint position | Determining the position of the midpoint of an arc according to its path | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | Must set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



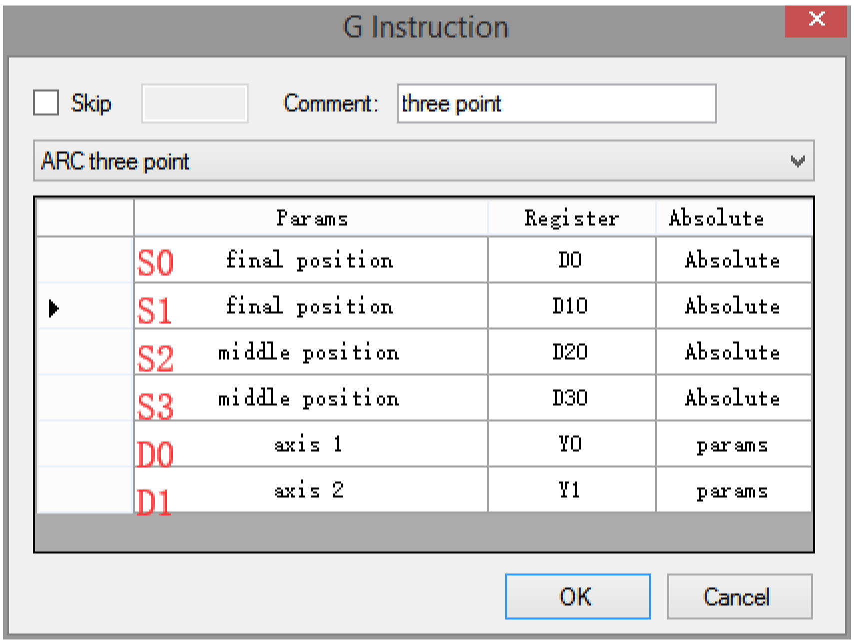

When the ARC instruction of arc interpolation (mode 1) is executed, the two axes will run at the highest synthesis speed. As shown in the following figure:



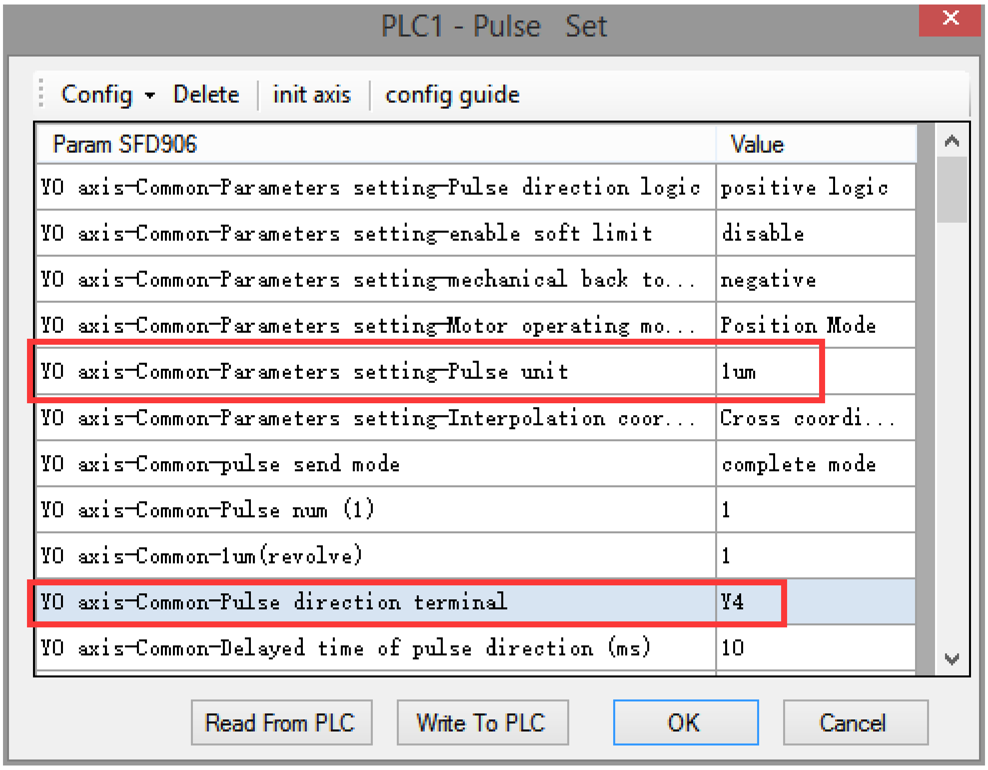

**ARC arc interpolation**

The parameter configuration is shown in the following figure:

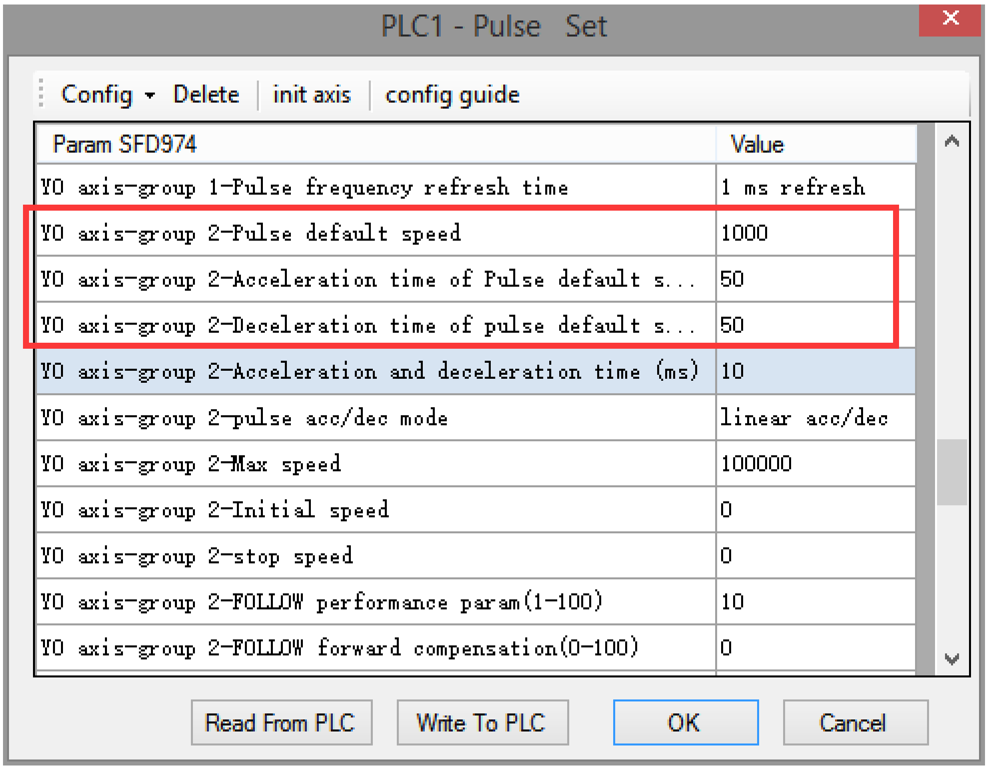
Double-click G item and pop up the configuration panel. Set it as follows:



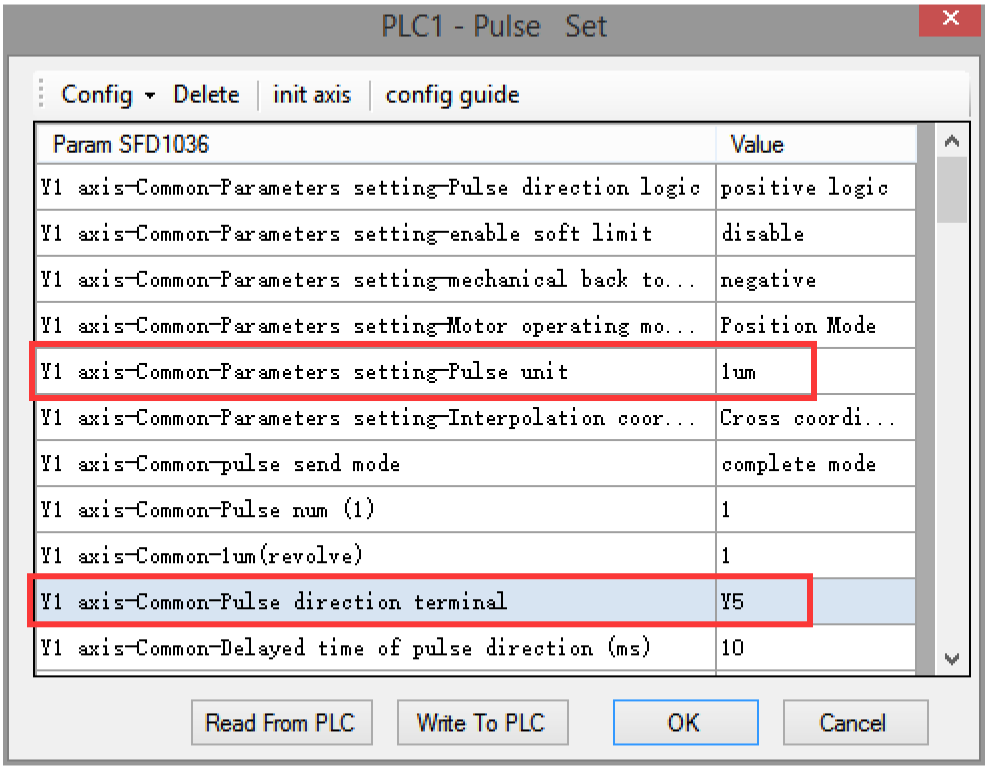
**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the midpoint of axis 1 and D30 specifies the midpoint of axis 2.
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, when M0 rises, execute ARC command, move from the starting position (1000, 1000) to the target position at the default speed of 1000Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the ARC instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

## Mode 2: ARC three-point arc VM

1. Instruction overview

Three-point arc interpolation instruction, operate according to the set maximum synthetic speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Three-point arc interpolation [ARC] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | ARC |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Specify the midpoint of axis 1 | Double words, 32-bit |
| S3 | Specify the midpoint of axis 2 | Double words, 32-bit |
| S4 | Max speed of the two axes | Double words, 32-bit |
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0~S4 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

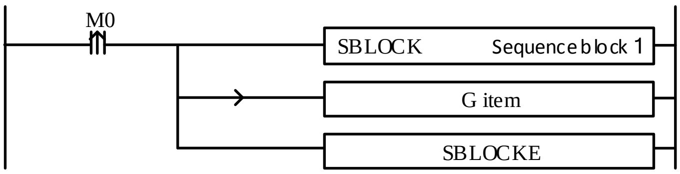
4. Parameter setting

| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |

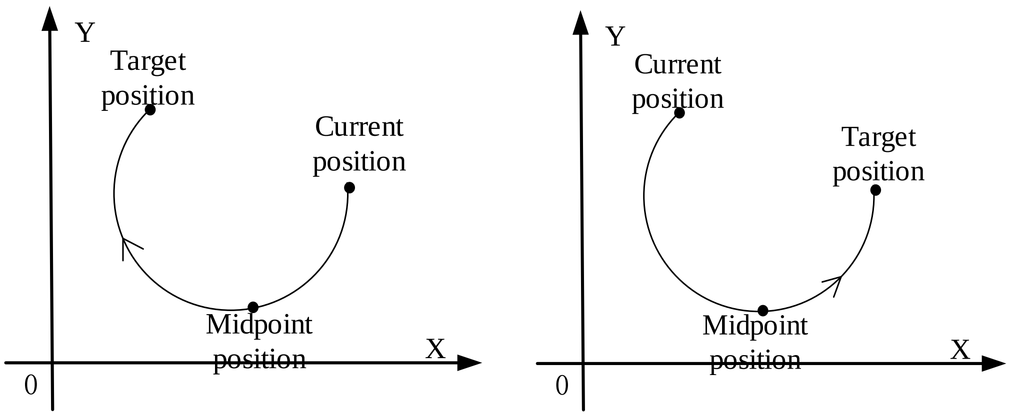
| | | |
|---|---|---|
| Midpoint position | Determining the midpoint position according to the arc path | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



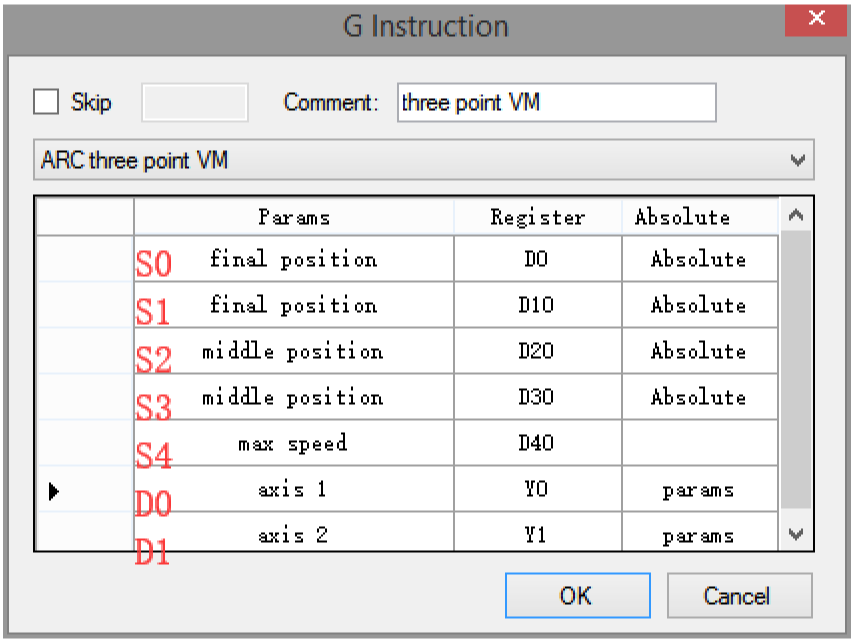

When the ARC instruction of arc interpolation (mode 2) is executed, the two axes will run at the set max synthesis speed. As shown in the following figure:



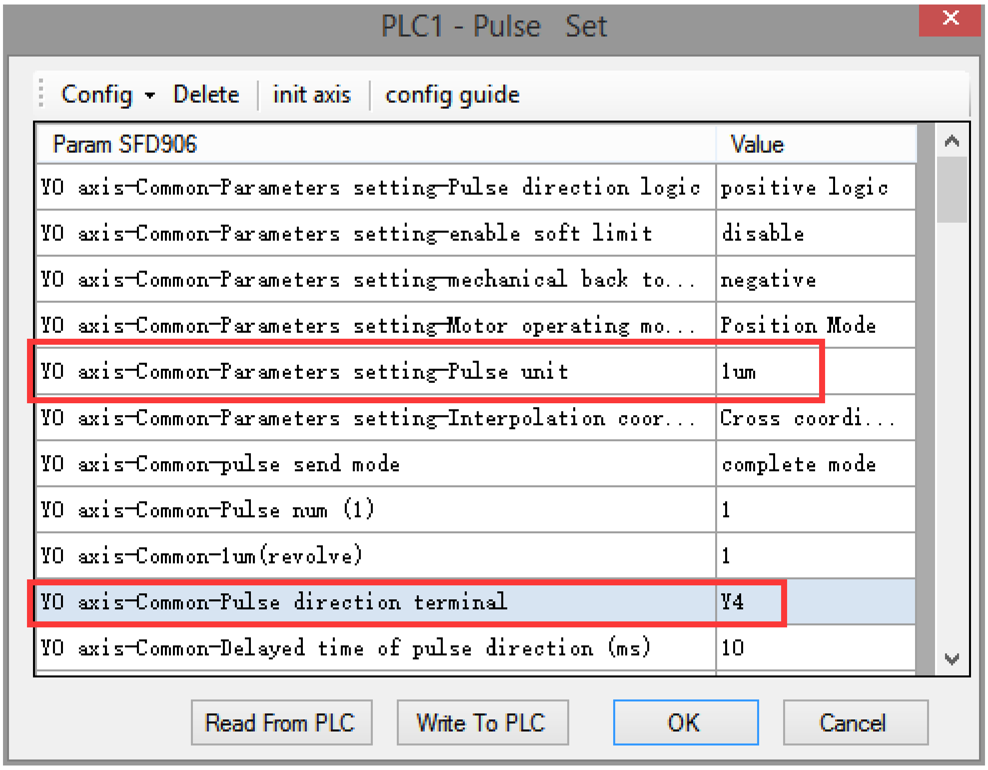

**ARC arc interpolation**

The parameter configuration is shown in the following figure:

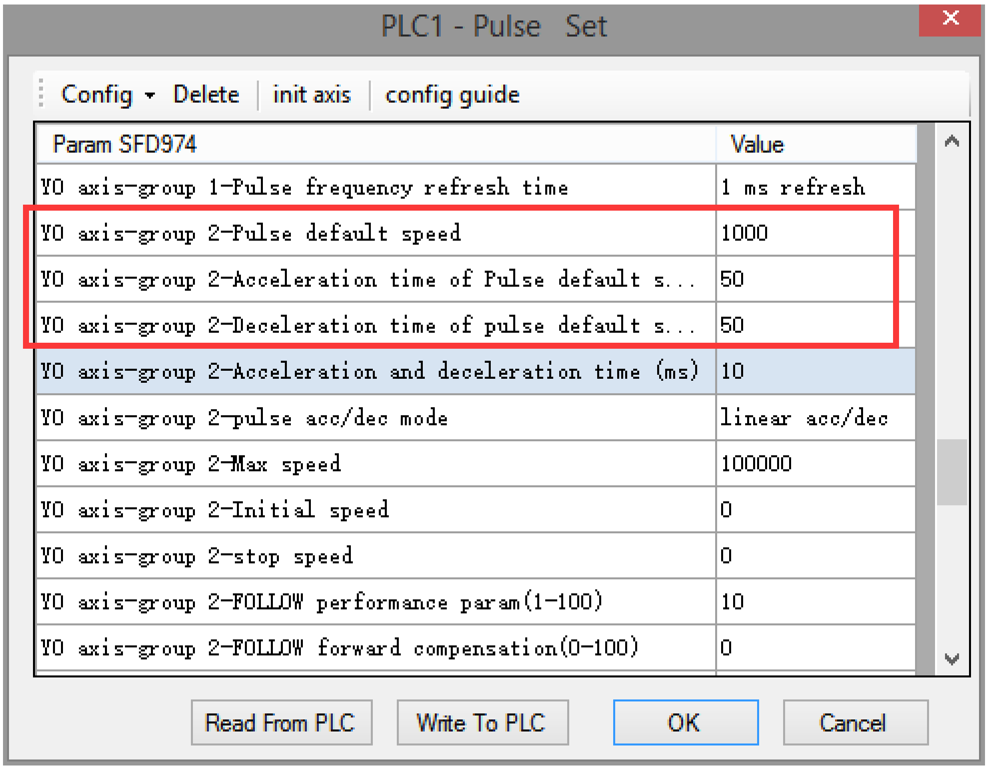
Double-click G item and pop up the configuration panel. Set it as follows:



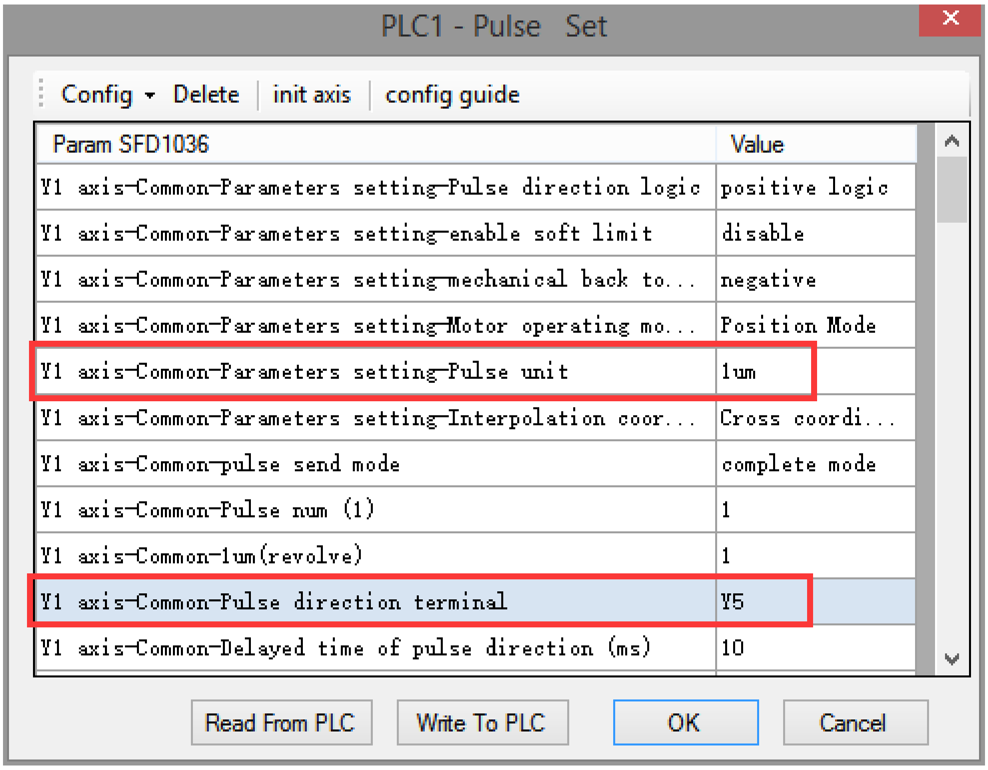

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the midpoint of axis 1 and D30 specifies the midpoint of axis 2, D40 specifies the max speed.

- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 500Hz, when M0 rises, execute ARC command, move from the starting position (1000, 1000) to the target position at the max speed of 500Hz.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the ARC instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

**Mode 3: ARC three-point arc VBEM**

1. Instruction overview

Three-point arc interpolation instruction, operate according to the set maximum synthetic speed, start speed and stop speed. This instruction can only be used in BLOCK. See Section 2-2 for specific usage.

| Three-point arc interpolation [ARC] | | | |
|---|---|---|---|
| 16-bit instruction | - | 32-bit instruction | ARC |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Axis 1 target position | Double words, 32-bit |
| S1 | Axis 2 target position | Double words, 32-bit |
| S2 | Axis 1 midpoint position | Double words, 32-bit |
| S3 | Axis 2 midpoint position | Double words, 32-bit |
| S4 | Specify the starting speed at the starting point of the two axes | Double words, 32-bit |
| S5 | Specify the stop speed at the end point of the two axes | Double words, 32-bit |
| S6 | Max speed of the two axes | Double words, 32-bit |

| | | |
|---|---|---|
| D0 | Pulse output port of axis 1 | Bit |
| D1 | Pulse output port of axis 2 | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0~S6 | ● | ● | ● | ● | | | | | | | |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D0 | | ● | | | | | |
| D1 | | ● | | | | | |

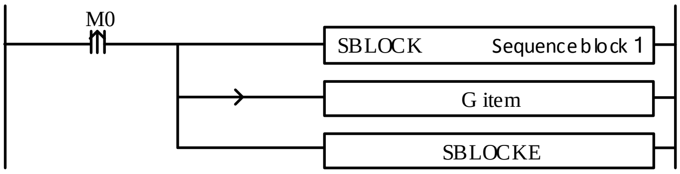
*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

4. Parameter setting

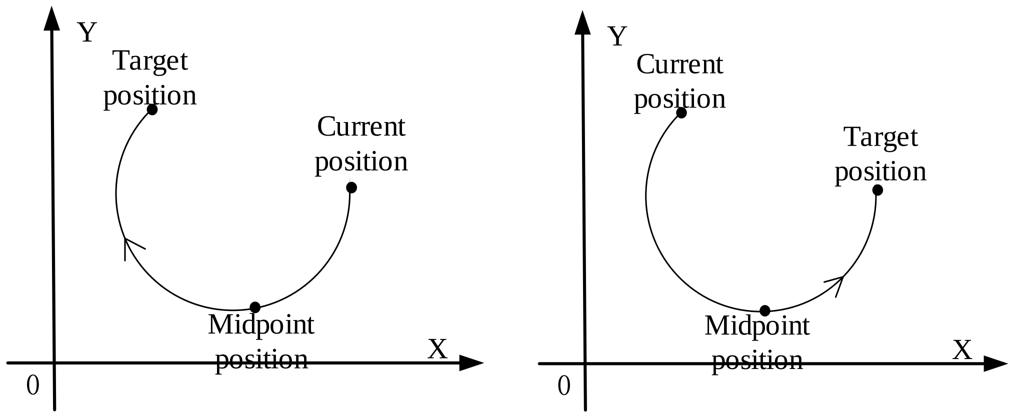
| Related parameters | Setting | Note |
|---|---|---|
| Final position | Determine the end point position according to relative/absolute mode | Must set |
| Relative/absolute | Relative: the above position as a reference; absolute: the origin as a reference | Must set |
| Midpoint position | Determine the midpoint position according to the shape of the arc | Must set |
| Max speed | Specify maximum smooth running speed of two axes | Must set |
| Start speed | The start speed from the starting point | Must set |
| Stop speed | The stop speed at the end point | Must set |
| Pulse output port of axis 1 | Arbitrary specify pulse output point | Must set |
| Pulse output port of axis 2 | Arbitrary specify pulse output point | Must set |
| Direction port of axis 1 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Direction port of axis 2 | Arbitrarily specify idle output points, set in system parameters | Must set |
| Pulse unit | The pulse number or equivalent are acceptable. Set in axis 1 system parameters | Must set |
| Default speed | set in axis 1 group 2 parameters | No need to set |
| Acceleration time | Set in axis 1 group 2 parameters | No need to set |
| Deceleration time | Set in axis 1 group 2 parameters | No need to set |

**Function and action**

《Instruction format》



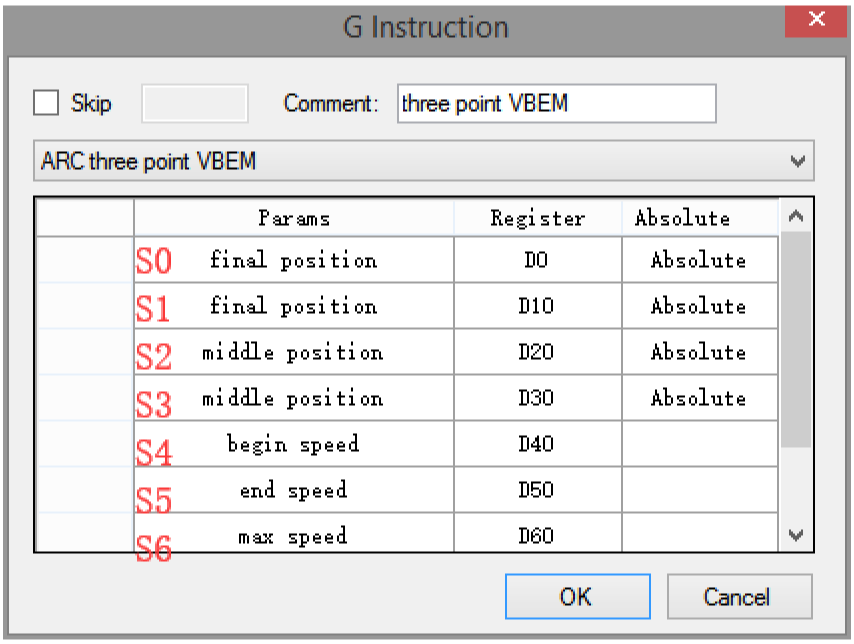

When the ARC instruction of arc interpolation (mode 3) is executed, the two axes will run at the set max synthesis speed, start speed and stop speed. As shown in the following figure:

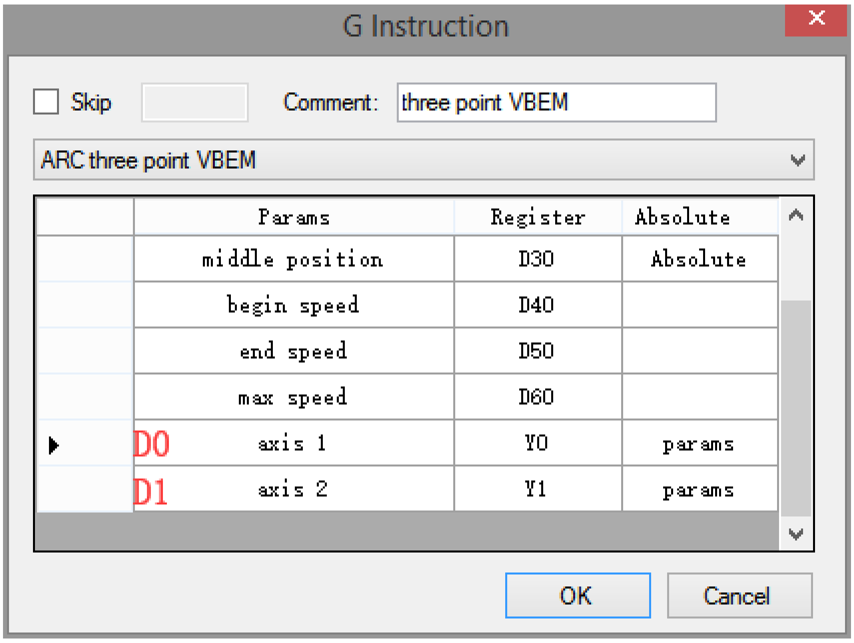



**ARC arc interpolation**

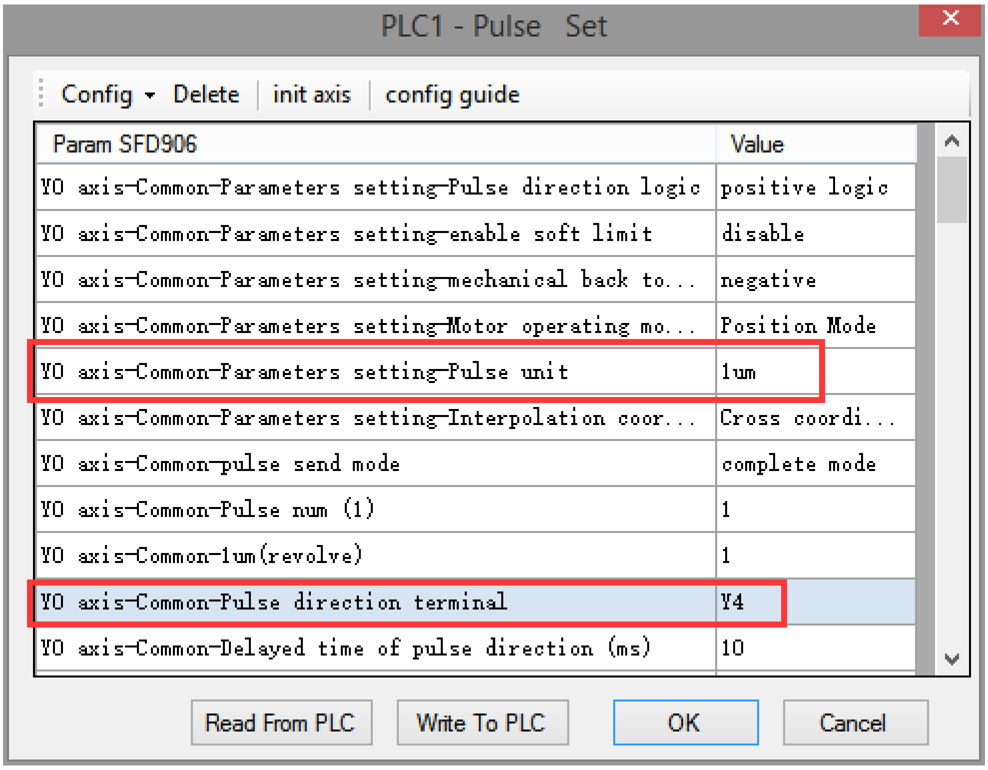
The parameter configuration is shown in the following figure:

Double-click G item and pop up the configuration panel. Set it as follows:

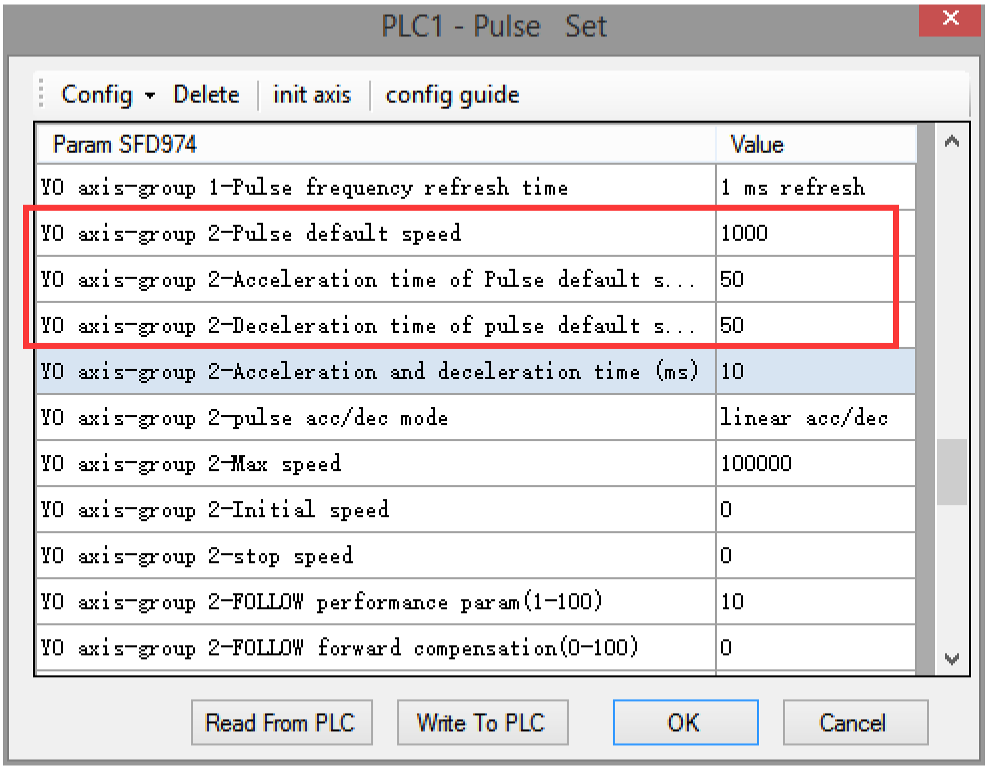




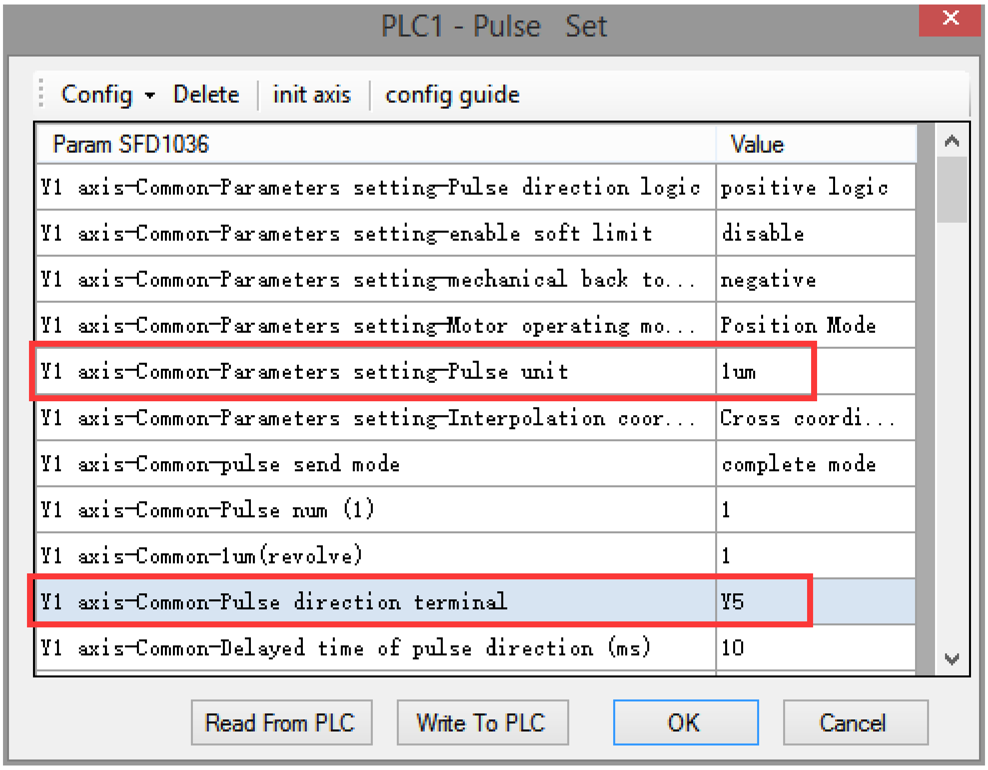

**Instruction configuration**




**Axis Y0 system parameters (1)**




**Axis Y0 system parameters (2)**




**Axis Y1 system parameters**

- As shown in the figure, D0 specifies the final position of axis 1 and D10 specifies the final position of axis 2, D20 specifies the midpoint position of axis 1, D30 specifies the midpoint position of axis 2, D40 specifies the start speed, D50 specifies the stop speed, D60 specifies the max speed.

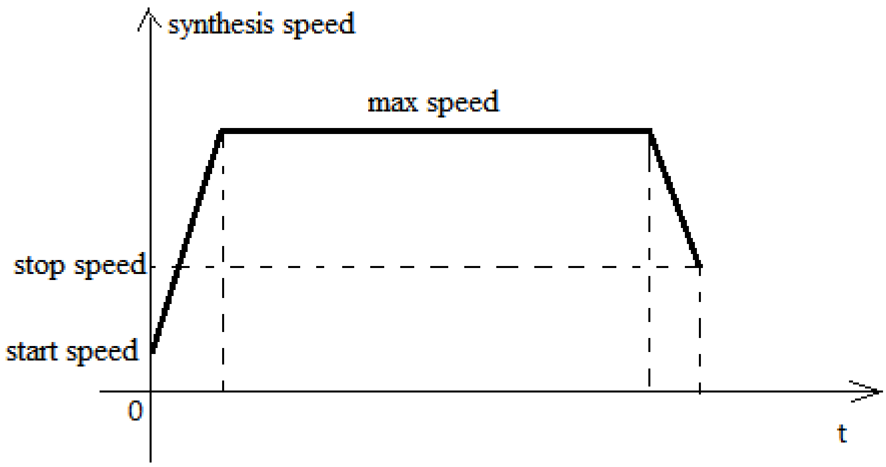
- Y0 is the pulse output port of axis 1 and Y1 is the pulse output port of axis 2. See Sections 2-3 for other optional ports.
- The directional terminals are Y4 and Y5, it is ON for the forward pulse and OFF for the reverse pulse.
- Pulse frequency range: 1Hz ~ 100KHz; Acceleration and deceleration time: 0 ~ 65535ms.
- Location movement can be viewed in equivalent cumulative registers HSD2 and HSD6.
- Assuming HSD2 = 1000, HSD6 = 1000, D0 = 5000, D10 = 2000, D40 = 50Hz, D50 = 20, D60 = 2000, when M0 rises, execute ARC command, accelerate from the starting position (1000,1000) at speed 50Hz to the maximum speed (2000Hz), and stop at the end speed of 20Hz when moving to the target position.

(1) When the end point is in absolute mode, the target position is (5000,2000)

(2) When the end point is in the relative mode, the target position is (6000,3000)

- When the ARC instruction is running, the pulse flag bit corresponding to its output port Y will be set on.
- The completion of the interpolation instruction can be judged by BLOCK executing flag bit. For example, the flag bit of BLOCK1 is SM300, when SM300 changes from ON to OFF, it means that BLOCK1 has finished executing.

Note: In this mode, the starting speed (S4), the ending speed (S5) and the maximum speed (S6) are all expressed as the two-axis synthesis speed, as shown in the following figure:




When there are multiple continuous linear/arc interpolation instructions and the speed between them needs to be constant and jump directly, the termination speed and maximum speed of the previous linear/arc interpolation can be set the same as the starting speed and maximum speed of the next segment.

When mode 3 is used, the starting and ending speed in the pulse parameter configuration tables of axis 1 and axis 2 are only effective for calculating the slope of pulse acceleration and deceleration.

## 2-4-9. Follow [FOLLOW] [FOLLOW_AB]

Follow-up instructions are divided into single-phase incremental follow-up [FOLLOW] and AB phase follow-up [FOLLOW_AB], which will be described in detail below.

1. Instruction overview

Single-phase/AB-phase high-speed counter follow instructions. The instructions can be written directly in the main program or process.

| Follow instruction [FOLLOW] [FOLLOW_AB] | | | |
|---|---|---|---|
| 16-bit instruction | FOLLOW, FOLLOW_AB | 32-bit instruction | - |
| Execution condition | Rise/fall edge of coil | Suitable model | XDM, XDME, XLME, XDH |
| Firmware | V3.3 and above | Software | V3.3 and above |

2. Operand

| Operand | Function | Type |
|---|---|---|
| S0 | Single-phase/AB phase high speed counter | Double words, 32-bit |
| S1 | Register address of multiplication coefficient | Single word, 16-bit |
| S2 | Register address of division coefficient | Single word, 16-bit |
| S3 | System parameter block number | Single word, 16-bit |
| D | Pulse output port | Bit |

3. Suitable soft component

Word

| Operand | System | | | | | | | | Constant | Module | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | D* | FD | TD* | CD* | DX | DY | DM* | DS* | K/H | ID | QD |
| S0 | Only can be High speed counter | | | | | | | | | | |
| S1 | ● | ● | ● | ● | | | | | | ● | ● |
| S2 | ● | ● | ● | ● | | | | | | ● | ● |
| S3 | ● | ● | ● | ● | | | | | ● | ● | ● |

Bit

| Operand | System | | | | | | |
|---|---|---|---|---|---|---|---|
| | X | Y | M* | S* | T* | C* | Dn.m |
| D | | ● | | | | | |

*** Note: D denotes D HD; TD denotes TD HTD; CD denotes CD HCD HSCD HSD; DM denotes DM DHM; DS denotes DS DHS; M denotes M HM SM; S denotes S HS; T denotes T HT; C denotes C HC.**

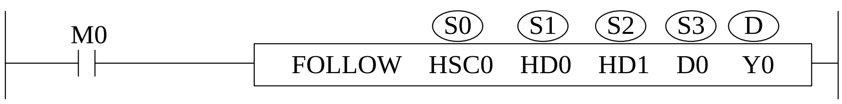
4. Parameter setting

| Related parameters | Settings | Note |
|---|---|---|
| High speed counter | The high-speed counter corresponding to FOLLOW must be single-phase incremental mode<br>The high-speed counter corresponding to FOLLOW_AB must be AB phase mode. | Must set |
| Multiplication coefficient/division coefficient | Range: -1000~1000 and not equal to 0 (follow-up instructions will not be executed when out of range). The multiplication coefficient/division coefficient is negative to indicate the positive count and send the reverse pulse. Dynamic modifications can take effect immediately. | Must set |
| System parameter block number | System parameters corresponding to pulse output axis, the range is 1~4 | Must set |
| Pulse output port | Arbitrary designated pulse output point | Must set |
| Pulse direction | It can be set in the selected system parameter block or set separately. | Must set |
| Pulse unit | Must set to pulse number, please set in the system parameter of the output axis | Must set |
| FOLLOW performance parameter | 1~100 (report error when out of range), default value is 50 | No need to set |
| FOLLOW feedforward compensation | 0~100 (report error when out of range), default value is 0 | No need to set |
| Positive/negative limit | Hard limit can be set in system parameters of output axis | No need to set |
| Positive/negative value of soft limit | Soft limit can be set in system parameters of output axis | No need to set |

**Function and action**

《Instruction format》

For single-phase incremental mode high speed counter:




For AB-phase mode high speed counter:

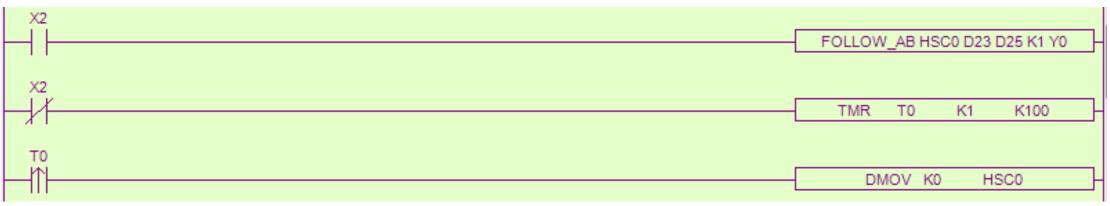
- FOLLOW/FOLLOW_AB instruction is a servo function. Through the pulse feedback of encoder or hand pulse generator, the frequency and number of input pulses are measured by PLC in real time. Through the proportional relationship between multiplication coefficient and division coefficient, the corresponding pulse frequency and the number of pulses are output to control the stepping or servo motor.
- This instruction is generally used for manual adjustment of CNC system, and it is used for advancing and retreating of the operating table of the pulse generator by hand. It can also be used in some special projects where precise synchronous control is needed.
- Pulse output is based on the variation of HSC0, that is to say, in 4-time mode, if the multiplier/divider coefficient is 1, the output of the pulse is equal to 4 times the input of the pulse. The number of pulses at the output port is stored in the pulse cumulative register, namely HSD0 (double word), HSD4 (double word)... And so on.
- For FOLLOW instructions, the high-speed counter inputs a single-phase pulse, so the number of Y-port pulses is increasing regardless of the input inversion, and the corresponding pulse direction terminal is always ON, which will not be OFF when inversion occurs.
- For FOLLOW_AB instruction, the input of high-speed counter is AB phase pulse. Y port will increase and decrease with the increase of input pulse, and the direction is the same as that of high-speed counter input.
- The forward and reverse flag bit of the follow-up instruction is the direction flag bit of the high-speed counter.
- When the Y0 port outputs the pulse, the SM1000 will be set on.
- Follow-up instruction supports hard limit, soft limit, emergency stop and slow stop functions. See the description of the parameters of the pulse system.
- XDM-24/32 supports 4 channels, XDM-60T10 supports 10 FOLLOW instructions, and can execute 4 or 10 FOLLOW instructions simultaneously.

**Note:**

(1) During operation, the corresponding HSCD and HSD can not be changed arbitrarily. If it needs to be cleared, it must be cleared at the same time.

(2) If the high-speed counter needs to be cleared, the clearing instruction must be executed after the condition of FOLLOW or FOLLOW_AB is disconnected and at least two scanning cycles are spaced.

For example, after disconnecting the condition X2, a short delay is made, and the clearing instruction is executed after the time is up.




(3) It is forbidden to write two (or more) follow-up instructions to the same high-speed counter

in the program.

(4) It is forbidden to have both FOLLOW (or FOLLOW_AB) and CNT (or CNT_AB) instructions for the same high-speed counter in the program.

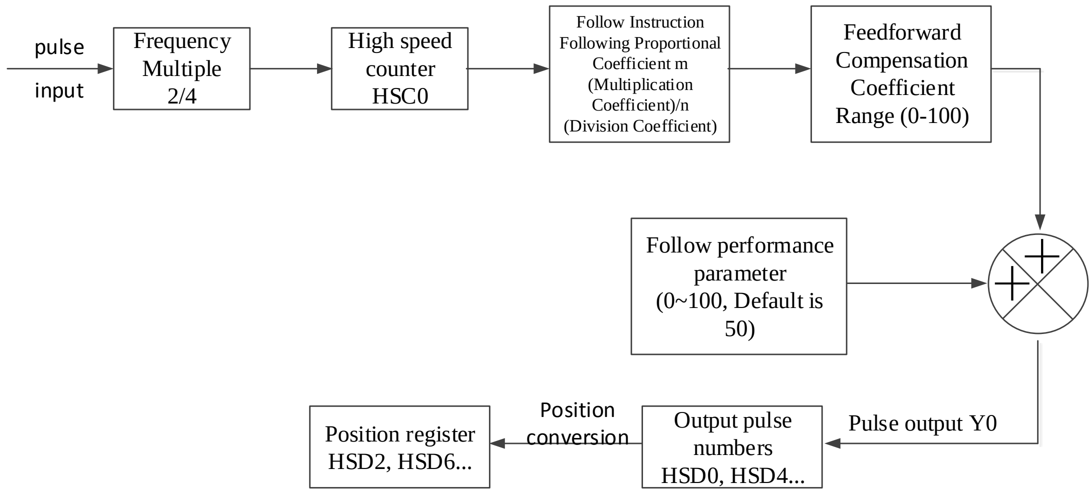
(5) The follow-up instruction can be executed simultaneously with the interpolation instruction, but the output port can not overlap.

(6) High-speed counting must be given pulse input by external input terminal, and can not be used by HSCW writing mode.

(7) Follow-up instructions cannot use the same high-speed counter as high-speed counting read-write instructions. When FOLLOW instructions need to write multiple instructions from the same high-speed counting source, they can be written in different processes, and only one process can be conducted at the same time.

(8) FOLLOW instruction resource conflict is corresponding to AB phase high-speed counting resource conflict.

The following is instruction diagram of FOLLOW/ FOLLOW_AB(take Y0 as an example):




**The relationship between follow-up instructions and motion control instructions:**

(1) The follow-up command can be used separately from the motion control command. However, when manual pulse generator is needed to adjust the coordinate position, it is necessary to establish the relationship between follow-up and motion control.

(2) When the pulse mode is equivalent, the change of the number of pulses is converted to the change of the position of the corresponding output axis, which is reflected in the HSD2 (double-word) register, so that the follow-up instructions and the motion control system constitute an organic whole. Therefore, the following changes can be directed either to axis 1 or to axis 2.

(3) The change of position is consistent with the change of pulse, which can only increase but not decrease.

**FOLLOW performance parameters:**

The function of this parameter is similar to the rigidity function of servo driver. The smaller the setting value of this parameter is, the smaller the servo rigidity will be (the greater the delay); the larger the setting value of this parameter is, the greater the servo rigidity will be (the smaller the delay will be). Setting range: 1 ~ 100 (error will be reported if exceeding range), default setting is 50.

**FOLLOW feedforward compensation:**

(1) There is always a certain delay between receiving and sending out pulses in PLC. In order to reduce the lag effect, the feedforward compensation parameters can be modified to compensate for the lag effect, so that the pulse output has a certain advance, to offset the lag effect. However, if the feedforward parameters are set large, it may lead to entering the compensation cycle, which will lead to the continuous jitter of the motor at the end of the follow-up. Setting range: 0-100 (error will be reported when exceeding the range), default is 0, equivalent to no feedforward compensation.

(2) Normally, this parameter does not need to be set.

**Limit bit description (fit for all motion instructions):**

(1) When the positive motion is detected, the rising edge of the positive limit is detected, and the deceleration begins until it stops. At this time, only the negative motion can be achieved. In the process of negative motion, only when the descending edge of positive limit is detected, can two-way motion be achieved.

(2) When the negative motion is detected, the rising edge of the negative limit is detected, and the deceleration begins until it stops. At this time, only the positive motion can be achieved. In the process of positive motion, only after the negative limit drop edge is detected, can the two-way motion be achieved.

(3) When the instruction starts to execute, it can only move negatively if it is in the positive limit. If it is in the negative limit, it can only move forward.

# 2-5. Hardware wiring and precautions

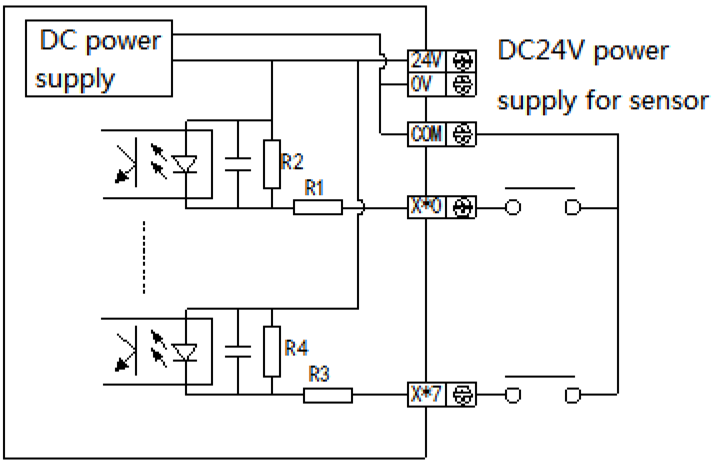
## 2-5-1. Input wiring

XD series PLC input is divided into NPN and PNP modes (XL series only supports NPN type wiring). The internal structure and wiring mode of the two modes are introduced below.

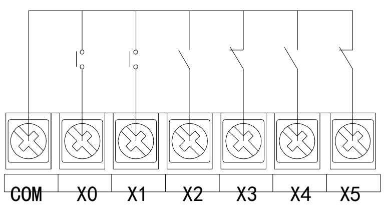
### 2-5-1-1. XD series PLC input wiring

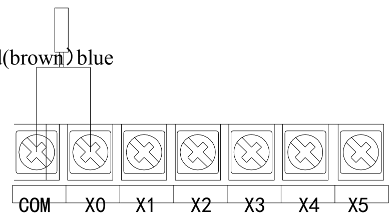
- **NPN mode**

| | |
|---|---|
| Input signal voltage | DC24V±10% |
| Input signal current | 7mA/DC24V |
| Input ON current | Below 4.5mA |
| Input OFF current | Below 1.5mA |
| Input response time | About 10ms |
| Input signal mode | Contact input or NPN open collector transistor |
| Circuit insulation | Photoelectric coupled insulation |
| Input action display | LED lights when input is ON |

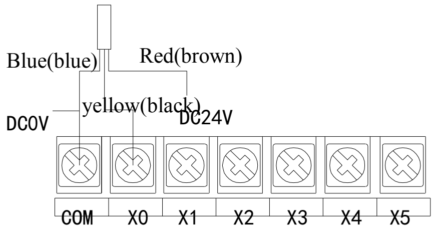



**XD series NPN wiring example**



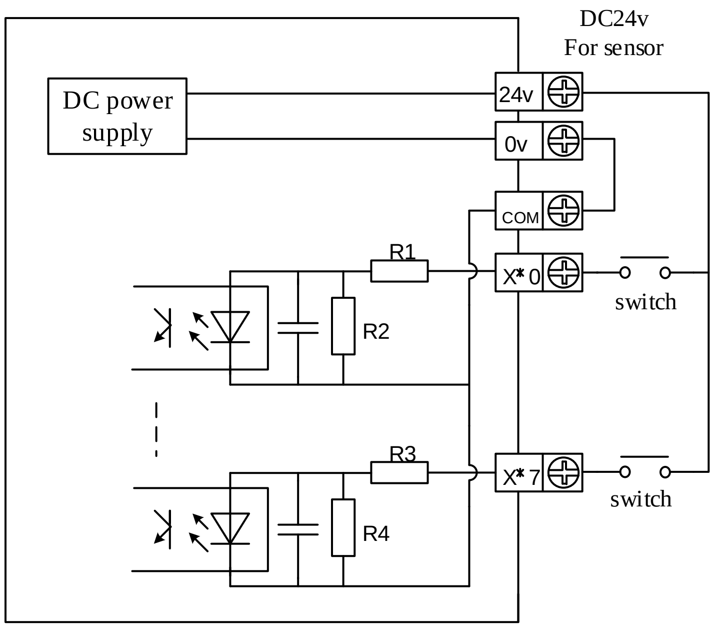

**Switch button wiring** **two-wire (NO or NC) proximity switch wiring**



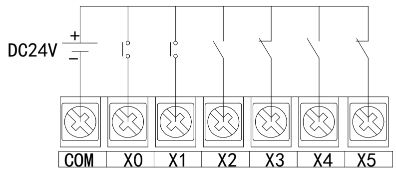

**Three-wire (NPN) proximity switch wiring**

- **PNP mode**

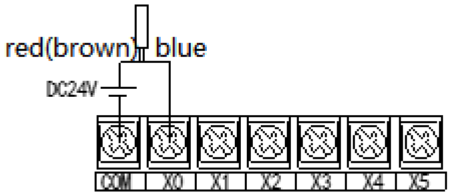
| | |
|---|---|
| Input signal voltage | DC24V±10% |
| Input signal current | 7mA/DC24V |
| Input ON current | Below 4.5mA |
| Input OFF current | Below 1.5mA |
| Input response time | About 10ms |
| Input signal mode | Contact input or PNP open collector transistor |
| Circuit insulation | Photoelectric coupled insulation |
| Input action display | LED lights when input is ON |



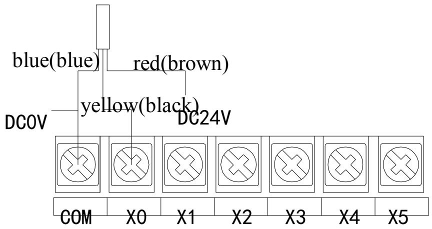
**PNP wiring example**




**Switch button wiring**




**two-wire(NO or NC) proximity switch wiring**




**Three-wire (PNP) proximity switch wiring**

### 2-5-1-2. XL series PLC input wiring

- **Input specifications (NPN mode)**

**XL general models:**

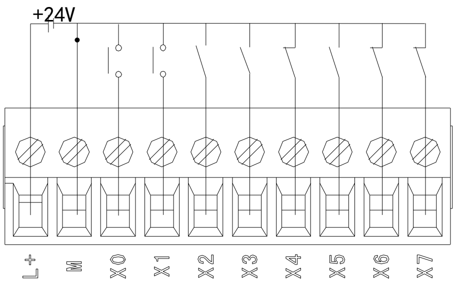
| | |
|---|---|
| Input signal voltage | DC24V±10% |
| Input signal current | 7mA/DC24V |
| Input ON current | Below 4.5mA |
| Input OFF current | Below 1.5mA |
| Input response time | About 10ms |
| Input signal mode | Contact input or NPN open collector transistor |
| Circuit insulation | Photoelectric coupled insulation |
| Input action display | LED lights when input is ON |

**XL5E-64T6:**

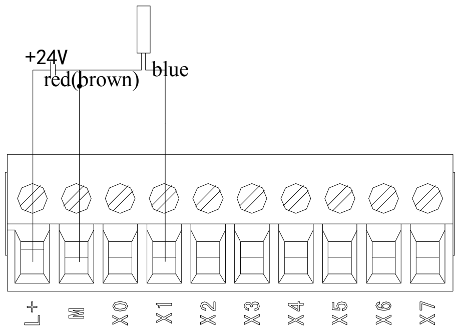
| | |
|---|---|
| Input signal voltage | DC24V±10% |
| Input signal current | 7mA/DC24V |
| Input ON voltage | Below 9V |
| Input OFF voltage | Above 19V |
| Input response time | About 10ms |
| Input signal mode | Contact input or NPN open collector transistor |
| Circuit insulation | Photoelectric coupled insulation |

| Input action display | LED lights when input is ON |
|---|---|

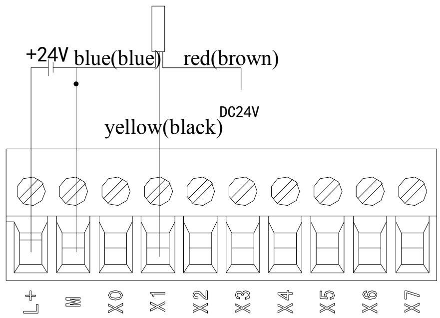
- **XL series PLC NPN input wiring example**




**Switch button wiring**




**two-wire(NO or NC) proximity switch wiring**




**Three-wire (NPN) proximity switch wiring**

### 2-5-1-3. Attentions for connection of input points

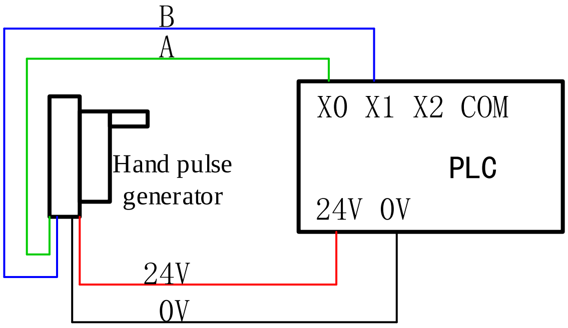
- The input type must be OC signal (collector open circuit signal).
- DC24 does not need to connect DC0V to COM of input point if it uses DC24V provided by PLC body; if it uses external power supply, it must be connected.

### 2-5-1-4. Hand pulse generator connection

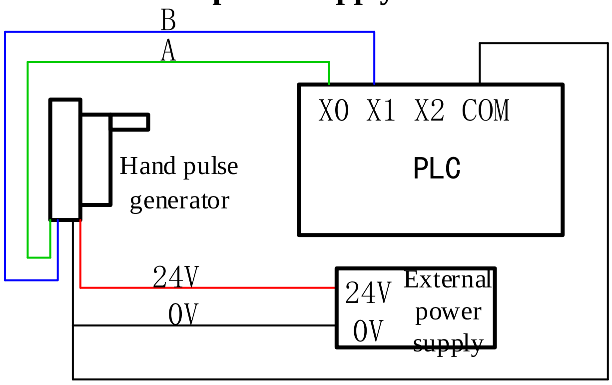
Hand pulse generator is also known as hand artery impulse generator, hand pulse, electronic handwheel and so on. It is used to zero correction and signal segmentation for CNC machine tools, printing machinery, etc. It works like an encoder.

The output signal of the hand pulse generator must be OC (collector open circuit signal) DC24V type. Generally, there will be five wires, three signal wires (A, B, Z), two power wires (24V, 0V), signal wires connected with the corresponding high-speed counting input port of the PLC. The power supply can be supplied by the output 24V of the PLC or by the switching power supply.

**Use the 24V from PLC**




**Use external 24V power supply**




Note: When using external switching power supply, the COM of PLC input should be short connected with 0V.

## 2-5-2. Output wiring

For XD/XL series PLC, the output terminal of motion control command needs high-speed pulse output terminal. Other transistors are ordinary optocouplers. For specifications and introduction, please refer to "XD/XL Series PLC Hardware User Manual".

### 2-5-2-1. High speed pulse output specification parameters

| Model | XDM-24T4/32T4/60T4/60T4L XDM-60T4, XDH-60T4, XLME-32T4 | XDM-60T10, XDME-60T10 |
|---|---|---|
| High speed pulse output port | Y0~Y3 | Y0~Y11 |

| | |
|---|---|
| External power supply | DC5~30V |
| Action display | LED light |
| Max current | 50mA |
| Pulse max output frequency | 100KHz |

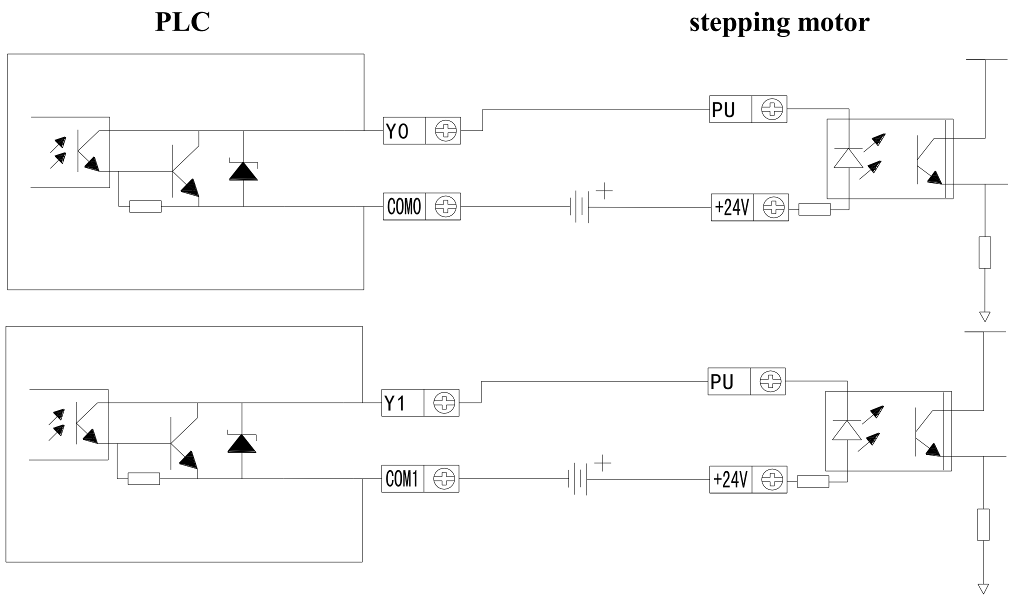
Note: PLC can output 100KHz ~ 200KHz pulses, but it can not guarantee the normal operation of all servos. Please connect about 500Ω resistance between the output and 24V power supply.

### 2-5-2-2. Cautions for output point connection

If it is XDM-60T10-E or XDME-60T10-E, the output point Y12-Y27 should be used when the output point of the photocoupler is connected with the power load.

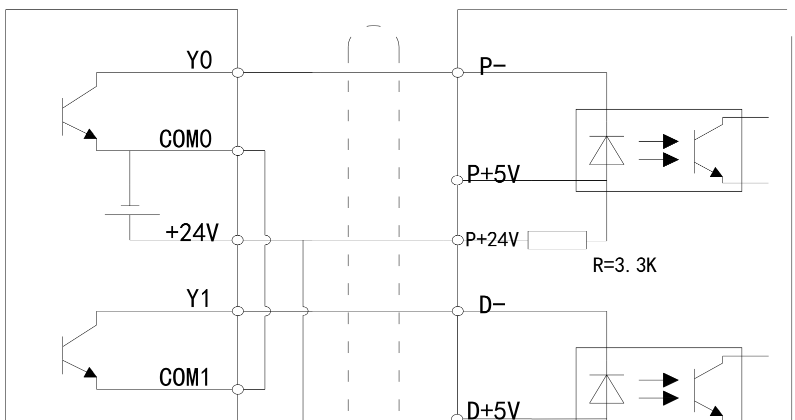
### 2-5-2-3. Connecting with stepping driver/servo driver

Below is the diagram of the connection between the T-type output terminal and the stepper motor driver.




Note: If the pulse and direction terminals of the stepper motor are driven by DC5V, please connect 2.2KΩ resistance behind the pulse and direction terminals.

Below is the diagram of the connection between the T-type output terminal and XINJE servo motor driver.



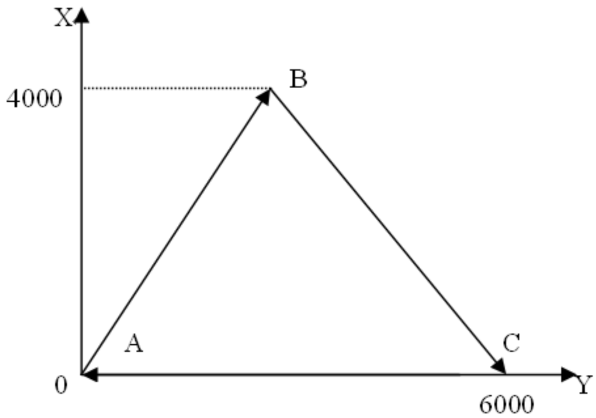
Note: Please suspend P+5V and D+5V.

Detailed hardware wiring diagram refers to "XD/XL Series PLC Hardware User Manual.

## 2-6. Examples

### 2-6-1. Isosceles triangle

Step out of an isosceles triangle with a side length of 5000 and a bottom of 6000. The starting point is A (0, 0), from A (0, 0) to B (3000, 4000), then from B (3000, 4000) to C (6000, 0), and finally from C (6000, 0) back to the starting point A (0, 0), as shown in the figure:




**Explain:**

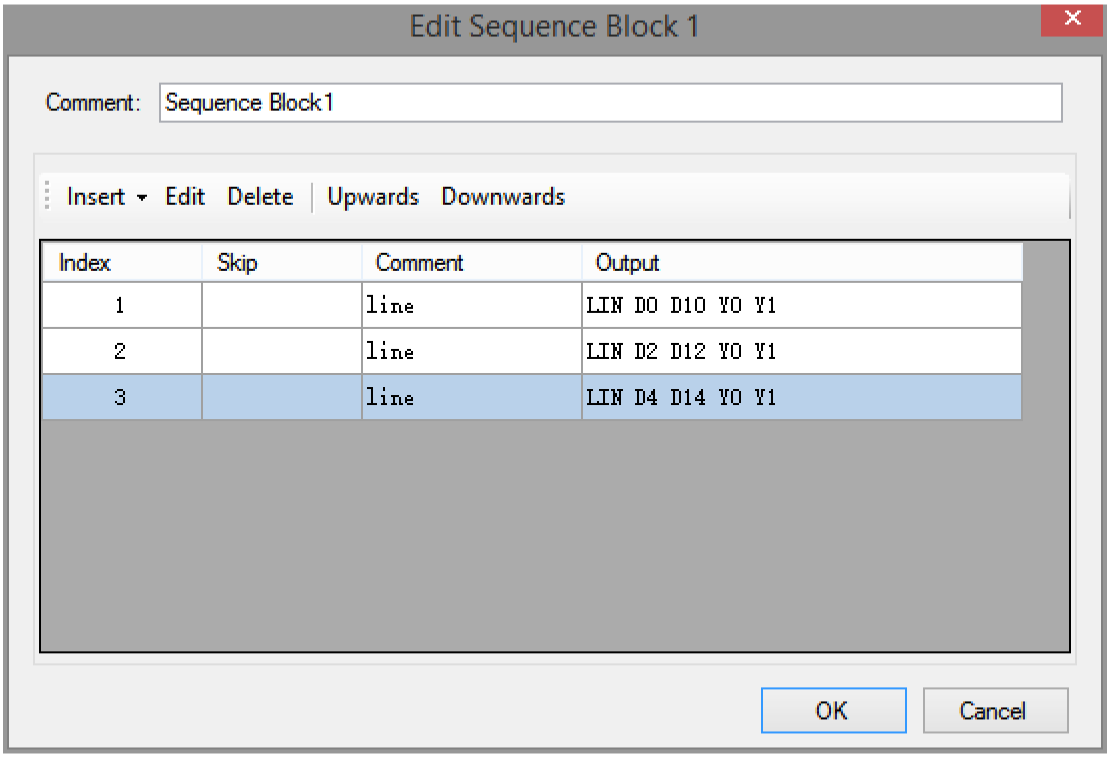
The two axes are designated Y0 (Y axis) and Y1 (X axis). The corresponding directional terminals are Y4 and Y5. The coordinates of B point are (D0, D10), C point are (D2, D12), A point is (D4, D14), the speed is 1000Hz, and the acceleration and deceleration time are 50ms. The relevant parameters are set as follows:

| coordinates | X axis address | X axis setting value | | Y axis address | Y axis setting value | |
|---|---|---|---|---|---|---|
| | | absolute | relative | | absolute | relative |
| B point | D0 | 3000 | 3000 | D10 | 4000 | 4000 |
| C point | D2 | 6000 | 3000 | D12 | 0 | -4000 |
| A point | D4 | 0 | -6000 | D14 | 0 | 0 |
| Default speed（Hz） | | 1000 | | | | |

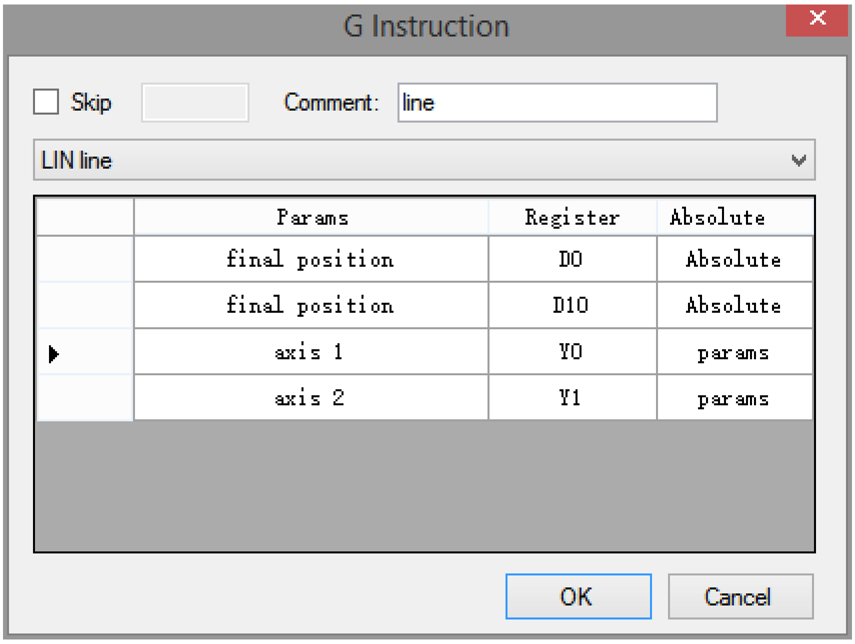
| | |
|---|---|
| Acceleration/deceleration time（ms） | 50 |
| X axis | Y0-pulse； Y4-direction |
| Y axis | Y1-pulse； Y5-direction |

**Program Ⅰ (absolute mode):**

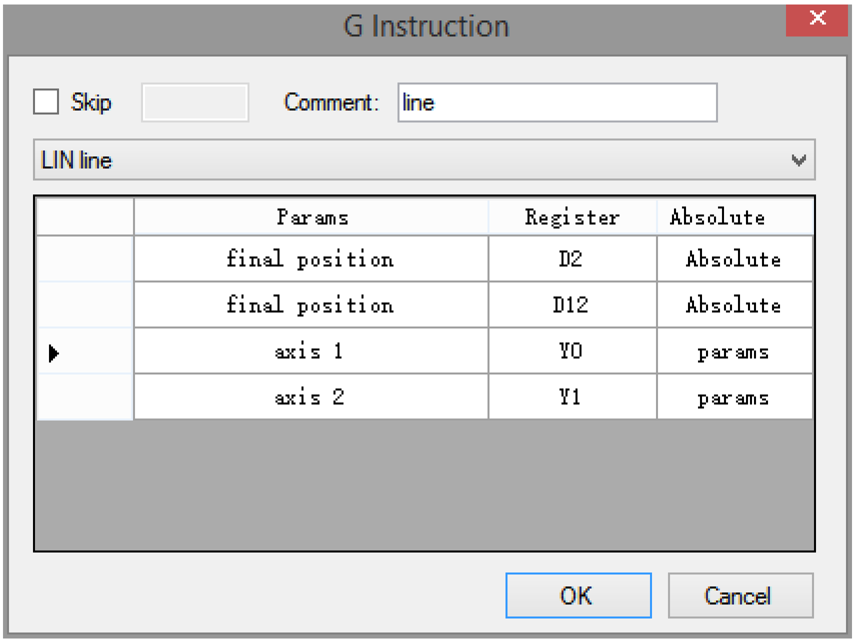
Add the G item in BLOCK, add three LIN instructions in it, as shown below:



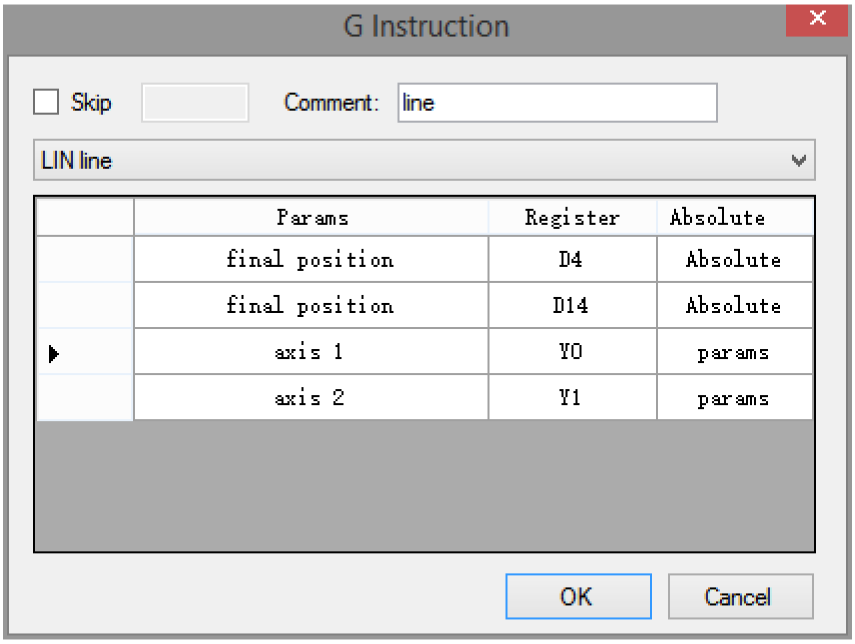

The configuration of the three instructions:




**The first one (A→B)**

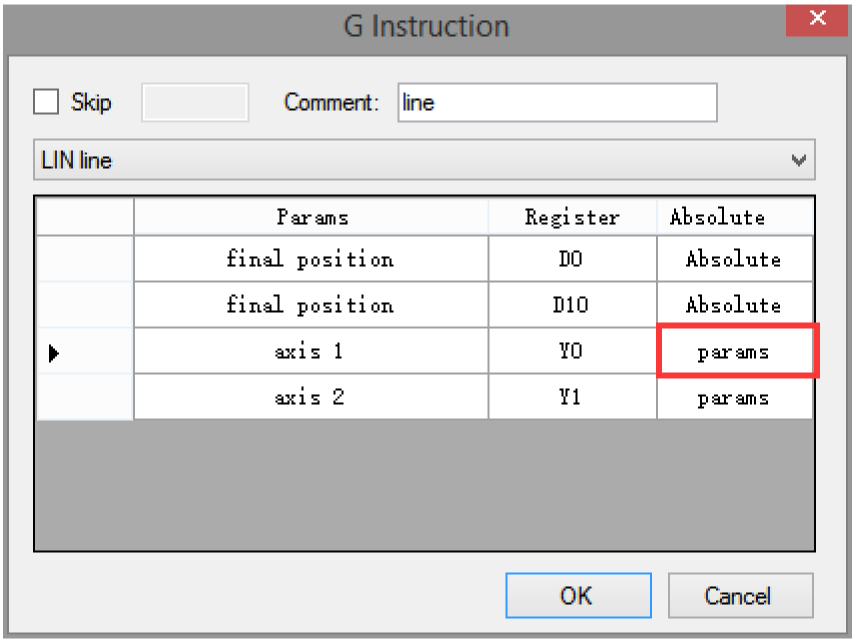


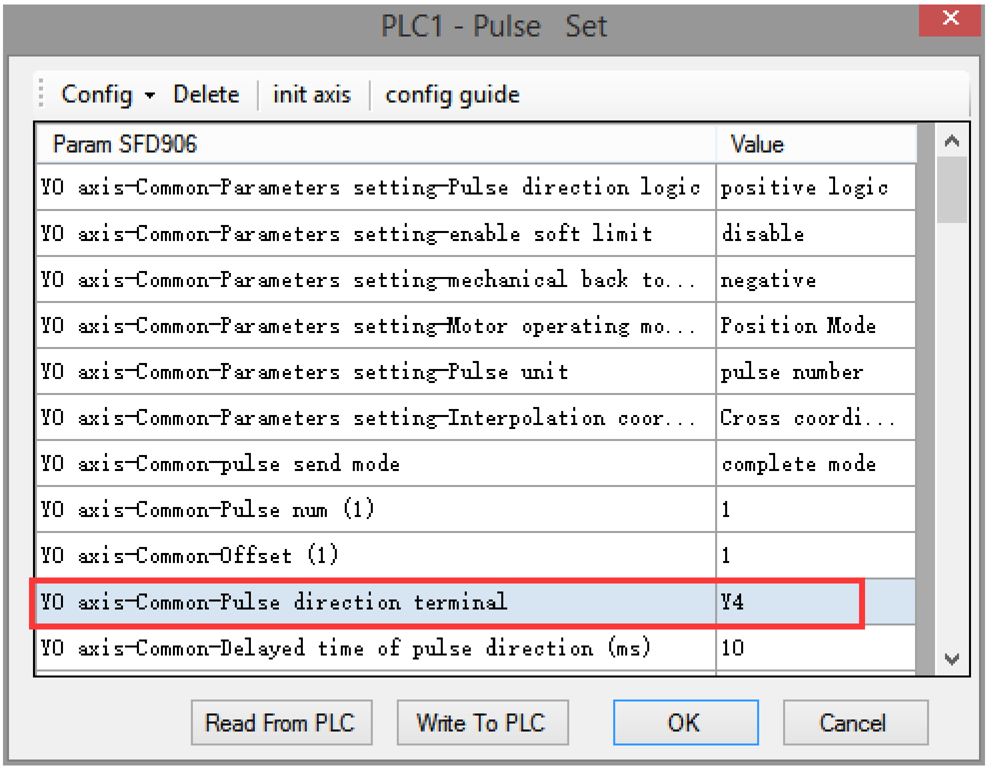

**The second one (B→C)**



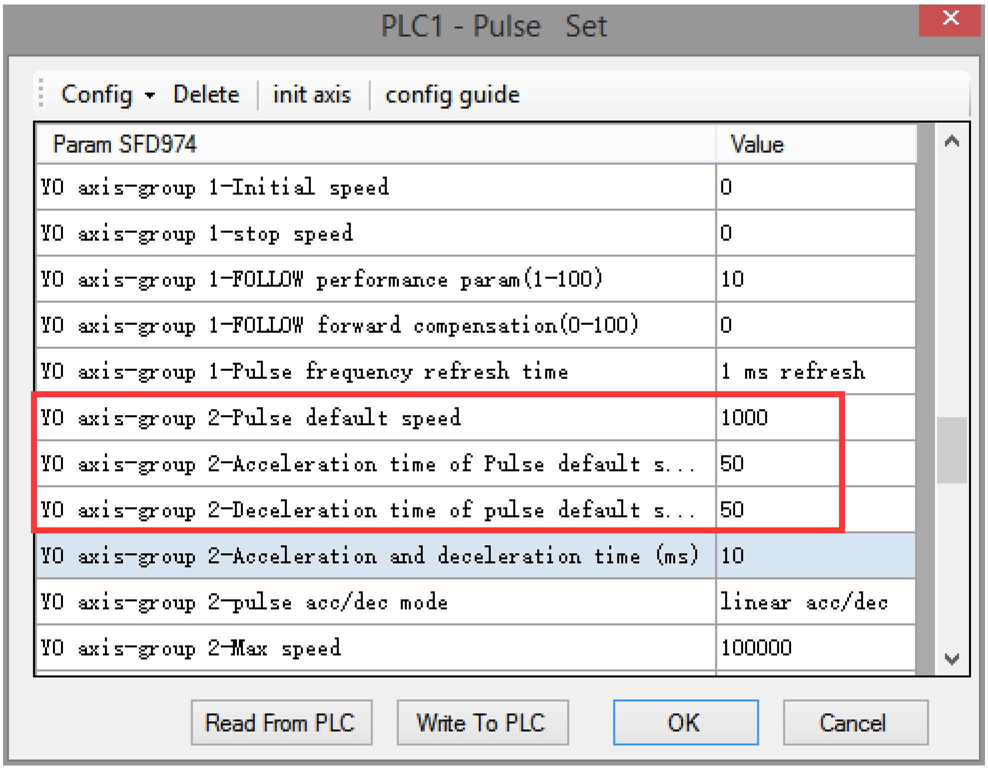

**The third one (C→A)**

Double click parameters, configure the Y0 axis parameters, as shown below:



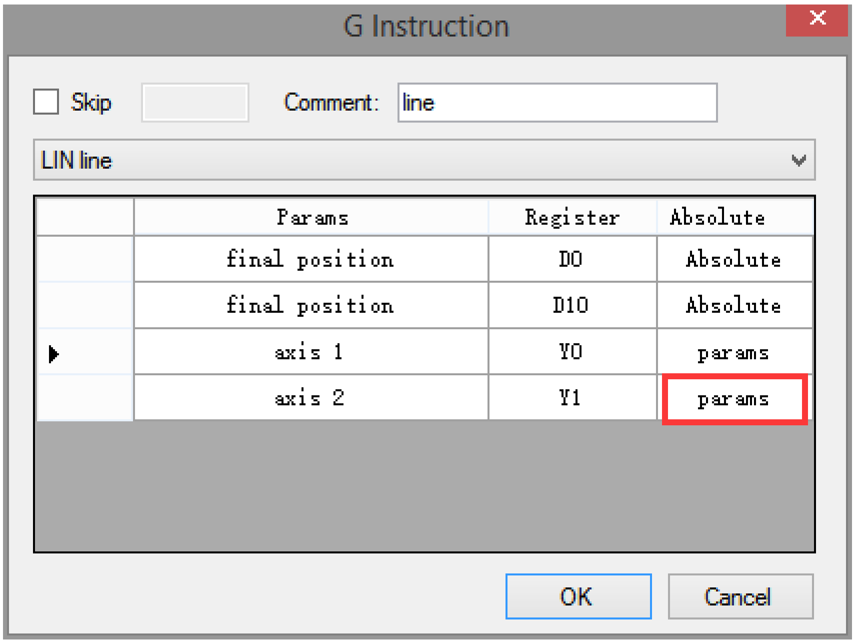



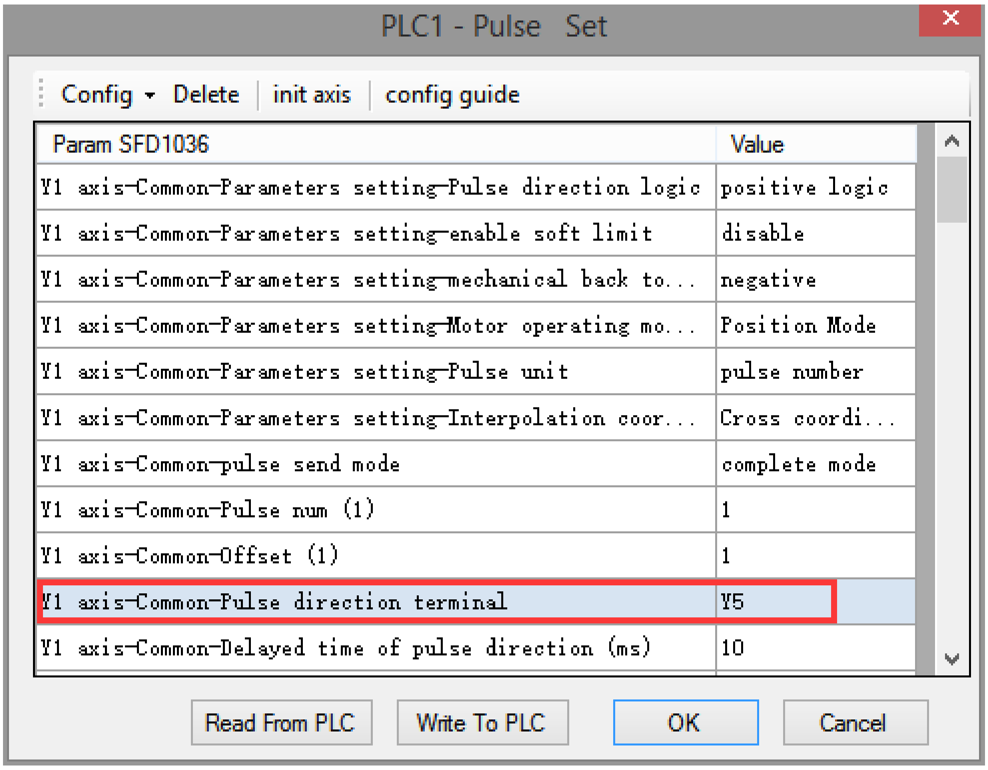

**Y0 axis pulse direction terminal is set to Y4**




**Y0 axis pulse default speed is set to 1000, acc/dec time is 50ms**

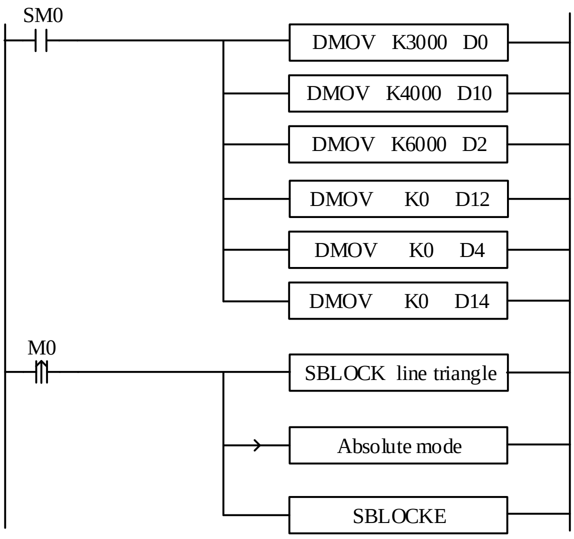
Double click parameters, configure the parameters of Y1 axis, as shown below:





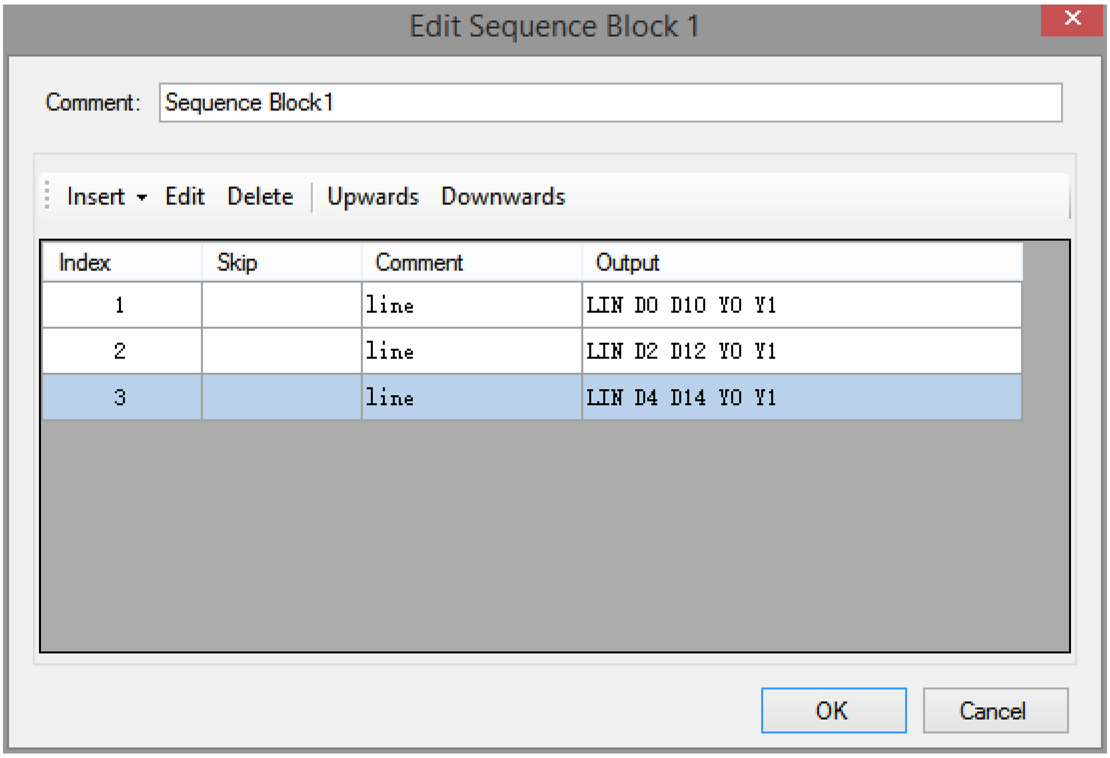

**Y1 axis pulse direction terminal is set to Y5**

After setting up, click OK to generate the program shown in the following figure in the ladder diagram. Write the set values in D0, D2, D4, D10, D12, D14. When M0 is turned on once, perform BLOCK once, and take a triangular route.

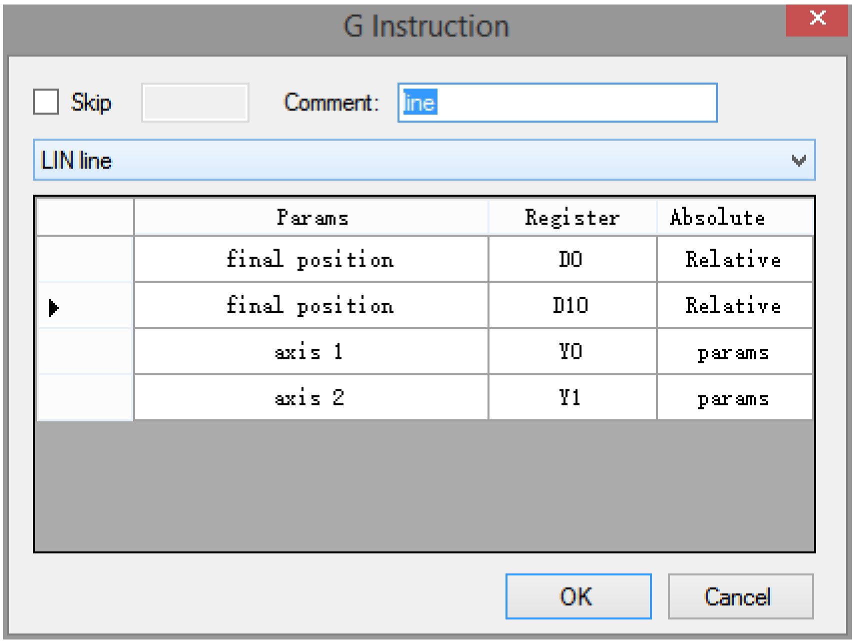


**Program Ⅱ (relative mode):**

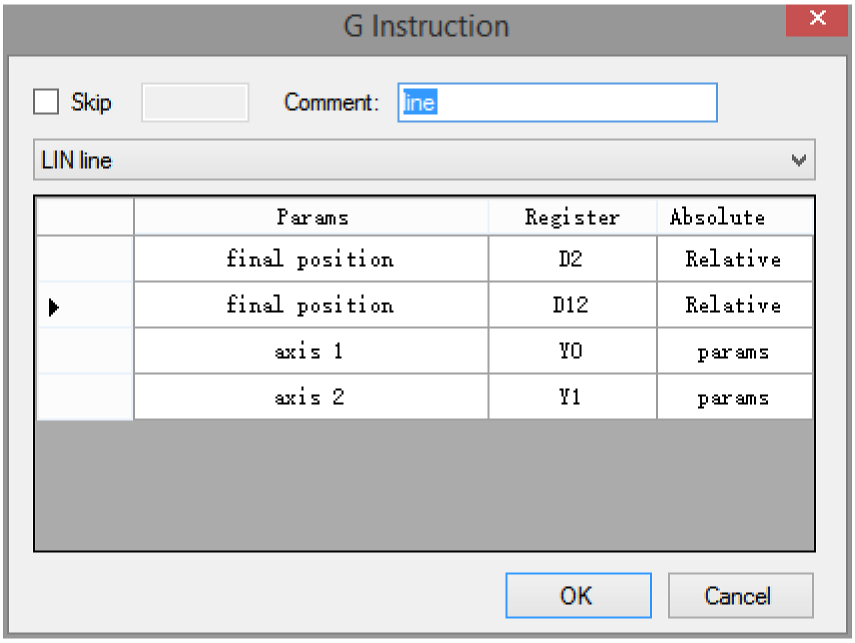
Three linear interpolation instructions [LIN] are added to the BLOCK by using the relative mode, as shown in the following figure:



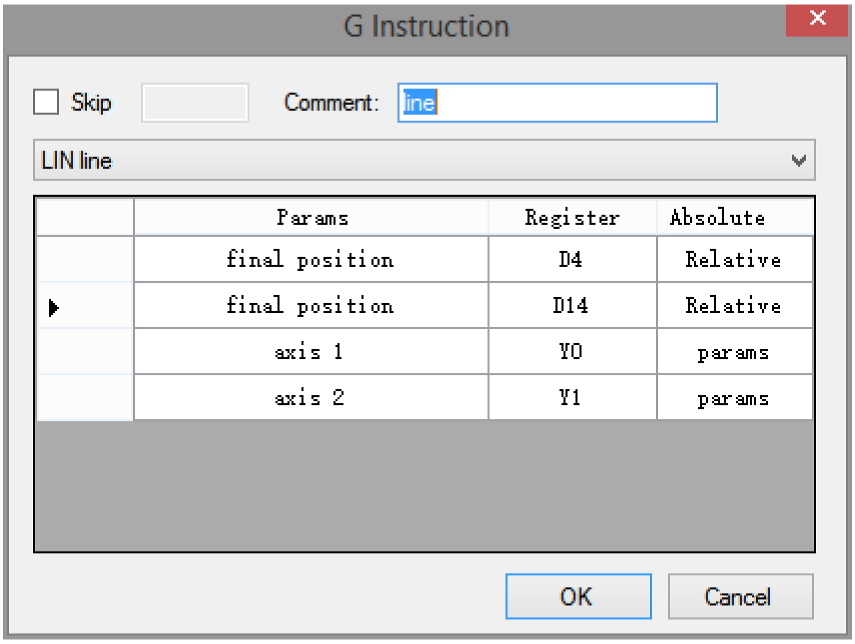

The three instructions are shown as below:




**First one（A→B）**



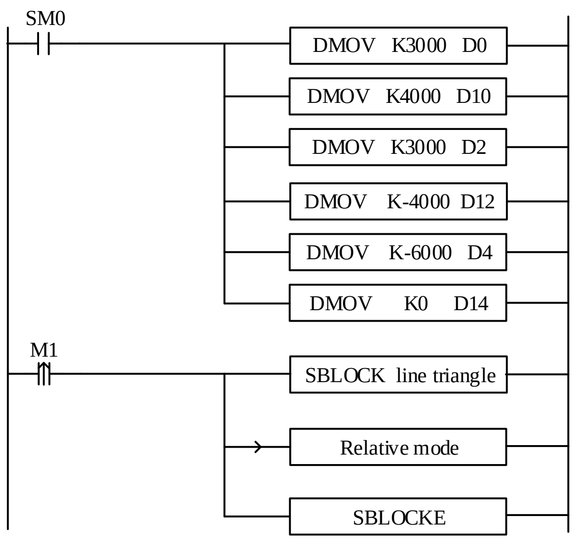

**The second one（B→C）**




**The third one（C→A）**

Double-click "parameters" to configure parameters of Y0 and Y1 axis [pulse direction terminal], [group 2 parameters - pulse default speed (Hz)], [group 2 parameters - pulse default speed acceleration time (ms)], [group 2 parameters - pulse default speed deceleration time (ms)] in the same absolute mode, which will not be described here.

After setting up, click OK to generate the program shown in the following figure in the ladder diagram. Assuming that the current values of HSD2 (double word) and HSD6 (double word) are all 0, the set values are written in D0, D2, D4, D10, D12 and D14. When M1 is set ON once, BLOCK is executed once, and a triangular line is taken.



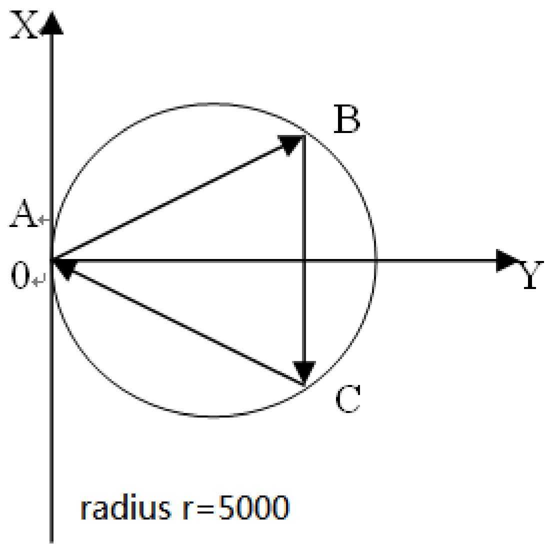

**Note:**

(1) The current position pulses of the two axes can be monitored by HSD2 (double word) and HSD6 (double word).

(2) The output terminals of the two axes correspond to Y0 and Y1 respectively, while the output terminals of the direction correspond to Y4 and Y5 respectively.

## 2-6-2. Circle + inscribed triangle

First step out of a circle with radius R = 5000 clockwise, and then follow the pattern of the inner regular triangle of the circle. The starting point is A (0, 0). First, follow the order of A (0, 0) →B (7500, 4285) →C (7500, - 4285) →A (0, 0) to form the circle, then from A(0, 0) to B (7500, 4285), and then from B (7500, 4285) to C(7500, -4285) points, and finally returns from C (7500, -4285) points to the starting point A (0, 0) and completes an inner regular triangle of a circle, as shown in the figure.



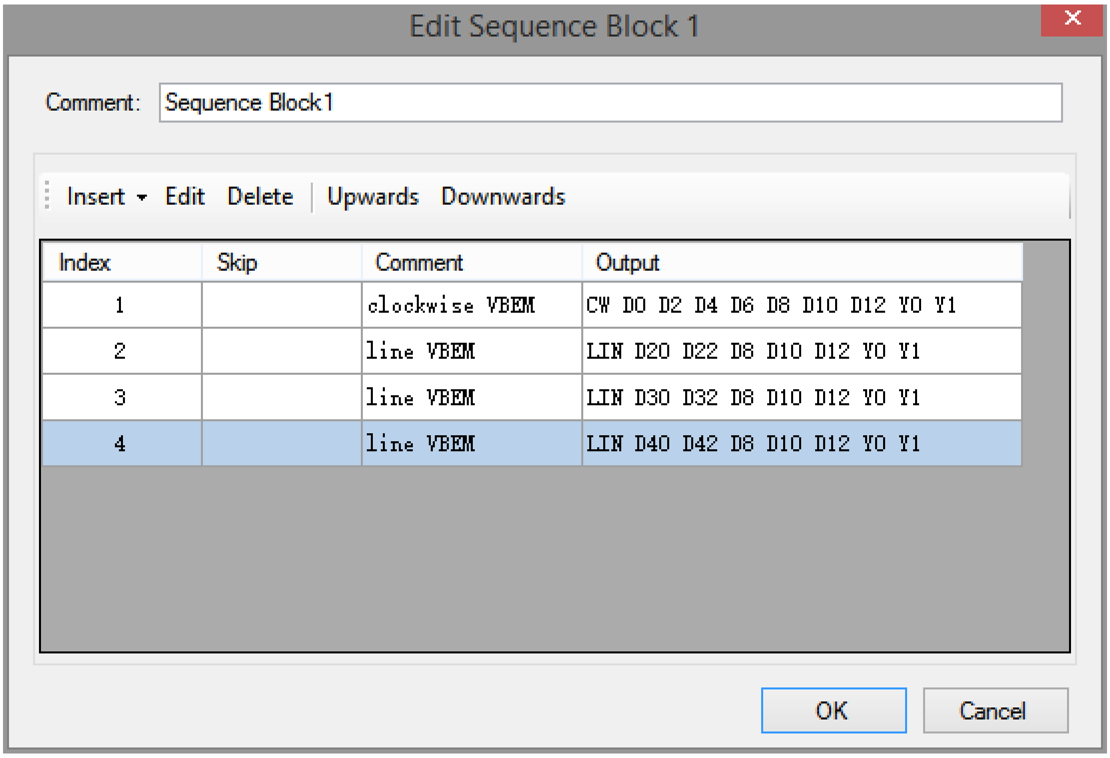
**Note:**

Two axes are designated as Y0 and Y1 axis, corresponding direction terminals are Y4 and Y5, B point coordinates are (D20, D22), C point coordinates are (D30, D32), A point coordinates are (D40, D42), starting speed is 50 Hz, stop speed is 50 Hz, maximum speed is 2000 Hz, default speed is 1000 Hz, acceleration and deceleration time is 50 ms, the specific parameters are set as follows:

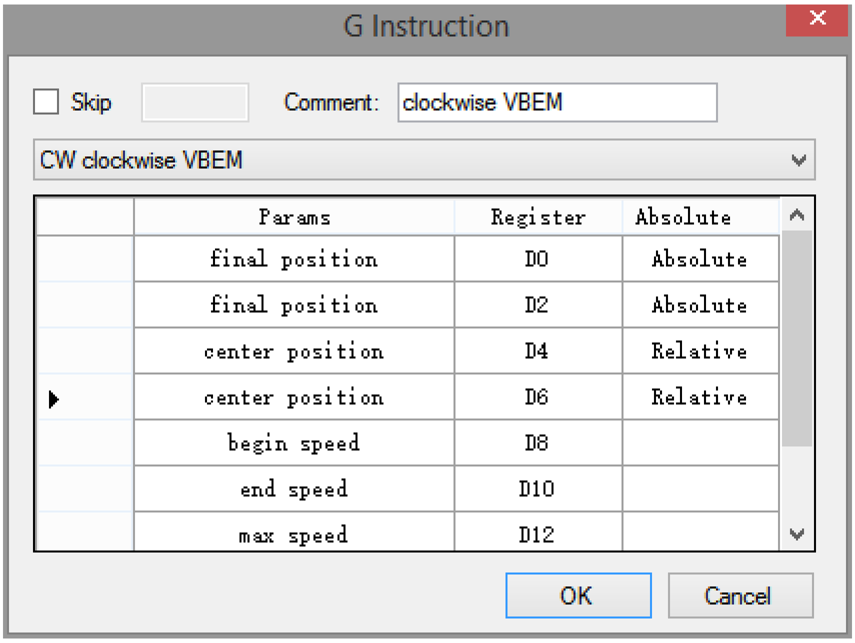
| Function | Register or coil address | Value |
|---|---|---|
| Endpoint coordinates of circular arcs | D0 | 0 |
| | D2 | 0 |
| Center coordinates | D4 | 5000 |
| | D6 | 0 |
| B point coordinates | D20 | 7500 |
| | D22 | 4285 |
| C point coordinates | D30 | 7500 |
| | D32 | -4285 |
| A point coordinates | D40 | 0 |
| | D42 | 0 |
| Starting speed（Hz） | D8 | 50 |
| Stop speed（Hz） | D10 | 50 |
| Max speed（Hz） | D12 | 2000 |
| Default speed（Hz） | - | 1000 |
| Acc/dec time（ms） | - | 50 |
| X aixs | Y0 pulse, Y4 direction | |
| Y axis | Y1 pulse, Y5 direction | |

**Program (absolute mode):**

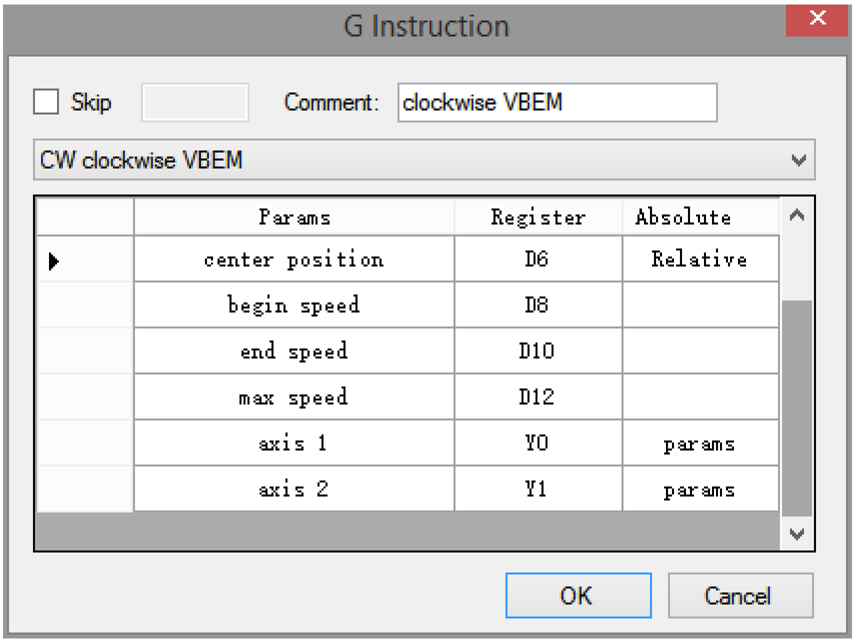
Because of the coincidence of the starting point and the end point, the command "CW clockwise arc VBEM" is chosen here, and the command "LIN line VBEM" is used in the triangle. Insert G instruction into BLOCK and write four interpolation instructions, as shown in the following figure:



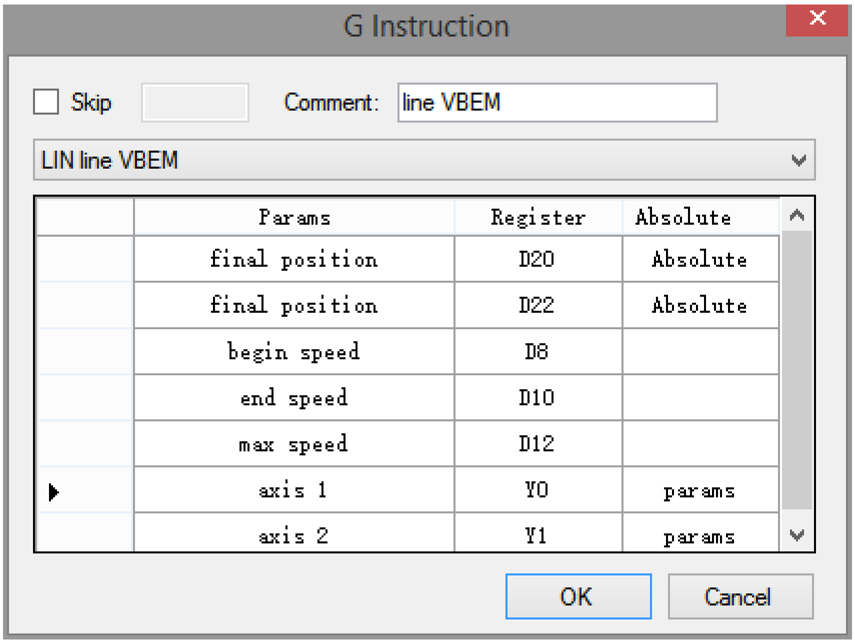

The four instructions are shown as below:



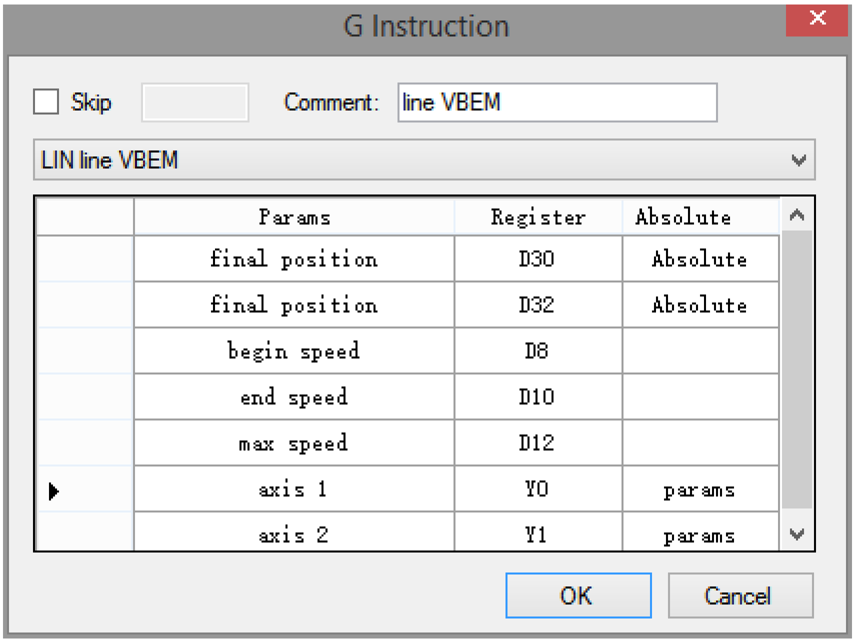

**Instruction ① settings（1）**



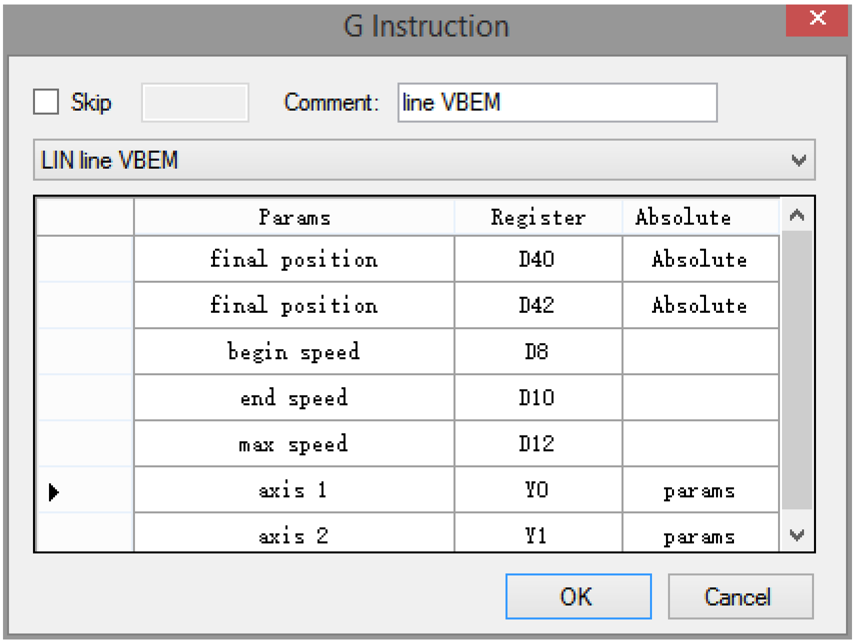

**Instruction ① settings（2）**




**Instruction ② settings**

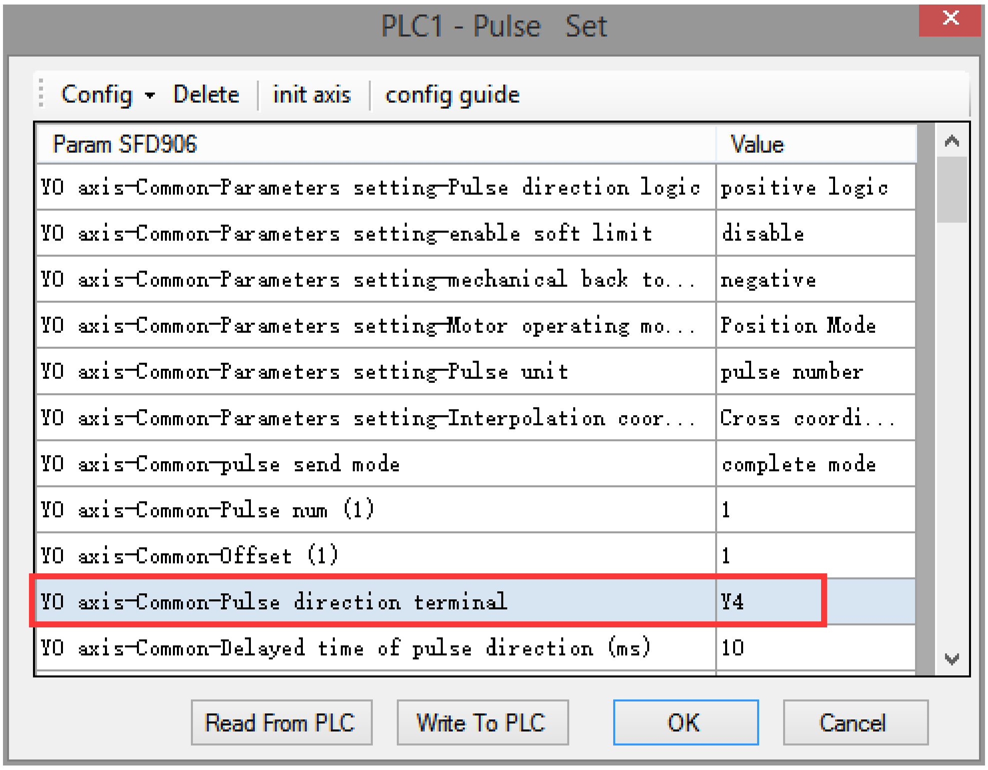



**Instruction ③ settings**

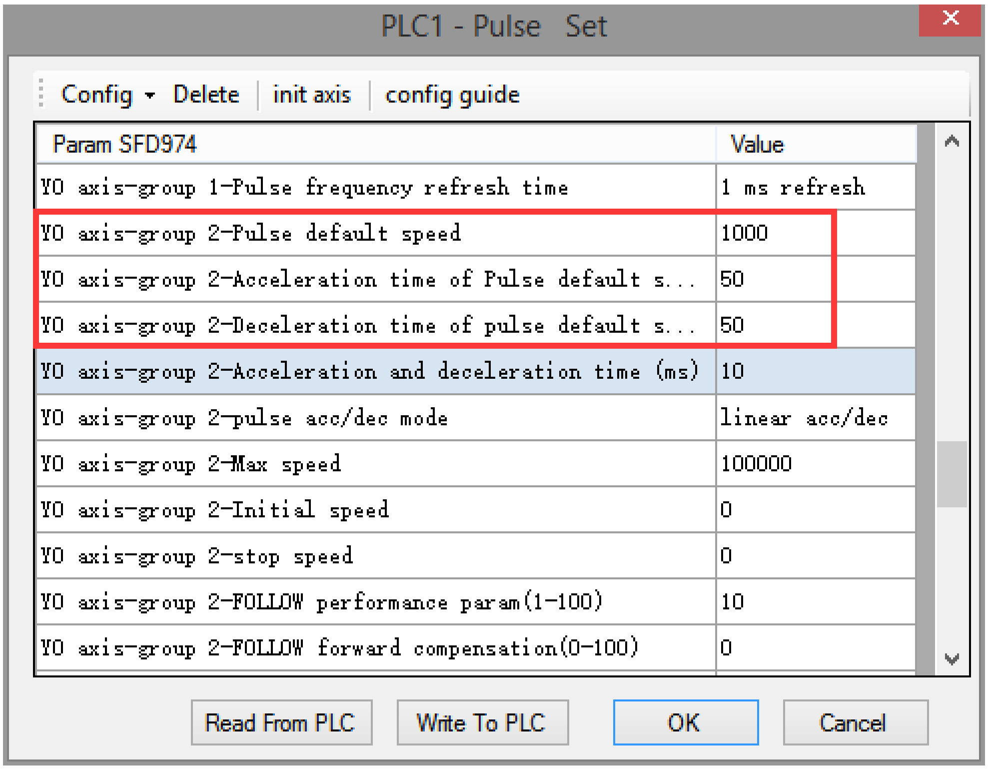



**Instruction ④ settings**

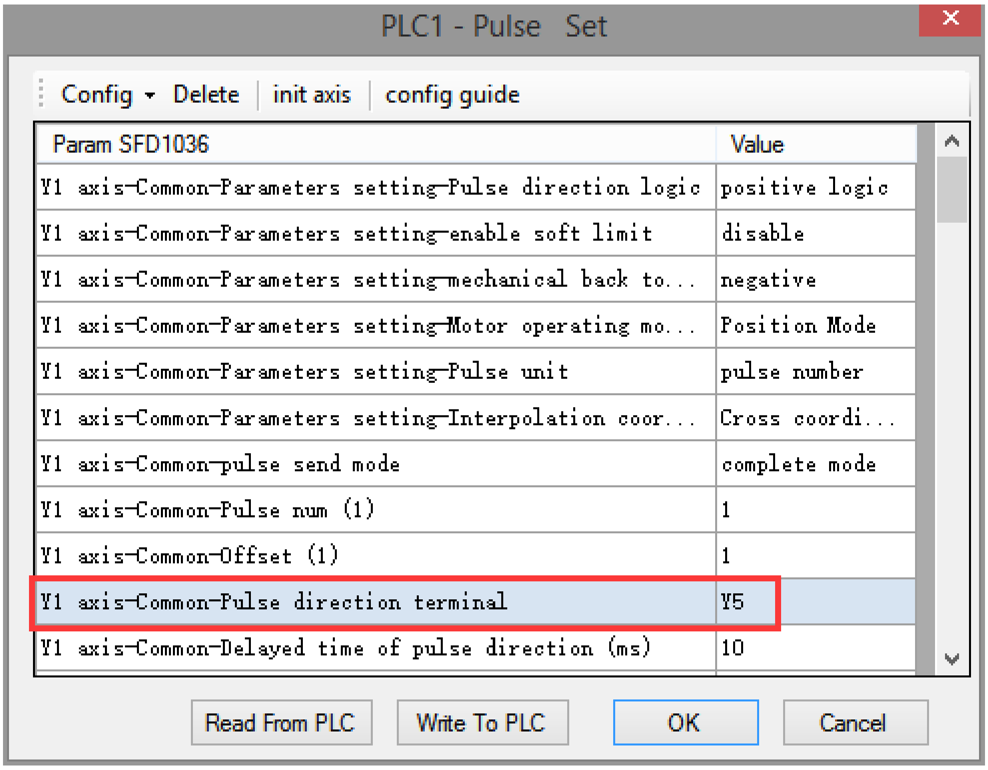
Double-click the "parameters" to configure the parameters of Y0 and Y1 axis [pulse direction terminal], [group 2 parameters - pulse default speed (Hz)], [group 2 parameters - pulse default speed acceleration time (ms)], [group 2 parameters - pulse default speed deceleration time (ms)], as follows:




**Y0 axis settings（1）**

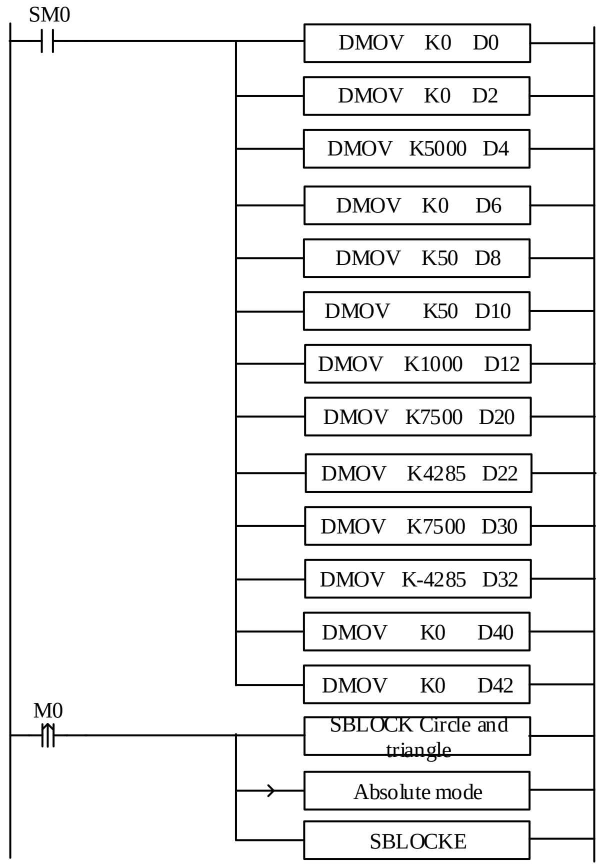



**Y0 axis settings（2）**




**Y1 axis settings（1）**

After setting up, click OK to generate the program shown in the following figure in the ladder diagram. Assuming that the current values of HSD2 (double-word) and HSD6 (double-word) are all 0, write the set values in the relevant registers. When M0 is turned on once, perform BLOCK once and take a triangle line once.




**Note:**

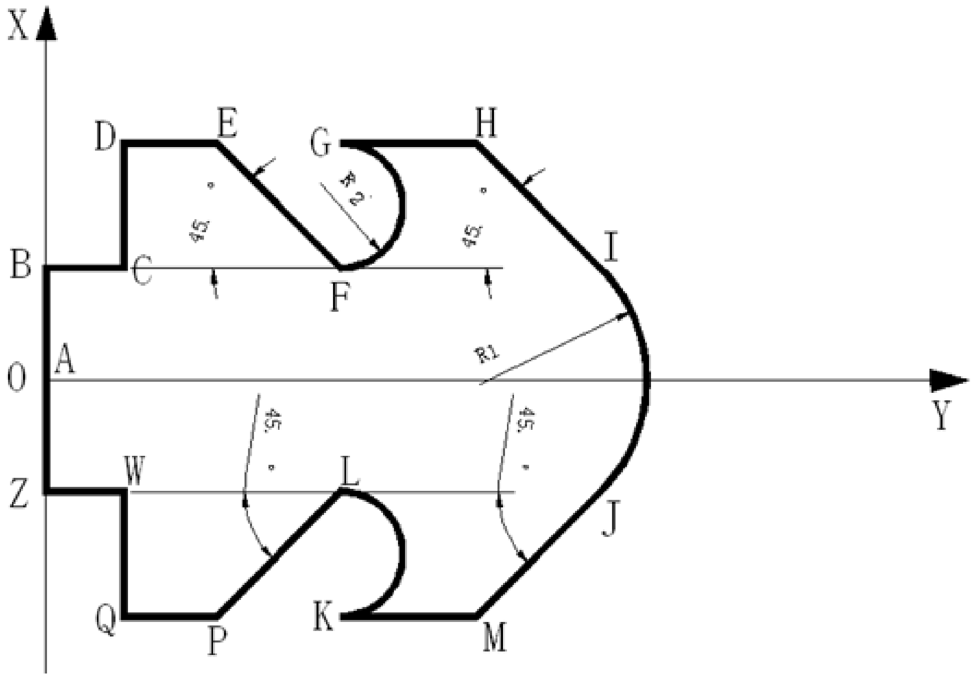
(1) The current position pulses of the two axes can be monitored by HSD2 (double word) and HSD6 (double word).

(2) The output terminals of the two axes correspond to Y0 and Y1 respectively, while the output terminals of the direction correspond to Y4 and Y5 respectively.

(3) When there are many points to go (if there are 1000 points), the ladder chart we write according to the above method will be very long, which is not conducive to the optimization of the program; therefore, we can use HMI to modify the values in the linear interpolation register to execute multiple linear interpolation instructions, in order to improve the readability of the program, optimize and reduce the scanning cycle of the program. The coordinates of each point can be set in the power-off retention register (the setting value of HMI register can be set by recipe function).

## 2-6-3. Line + Arc symmetric figure

As shown in following figure: starting from origin A (0, 0), and pass point B→C→D→E→F→G→H→I→J→M→K→L→P→Q→W→Z→A, the figure is symmetric with Y axis，AB=5000，BC=3000，CD=6000，DE=4000，R2=3000，GH=6000，R1=7070.




**Note:**

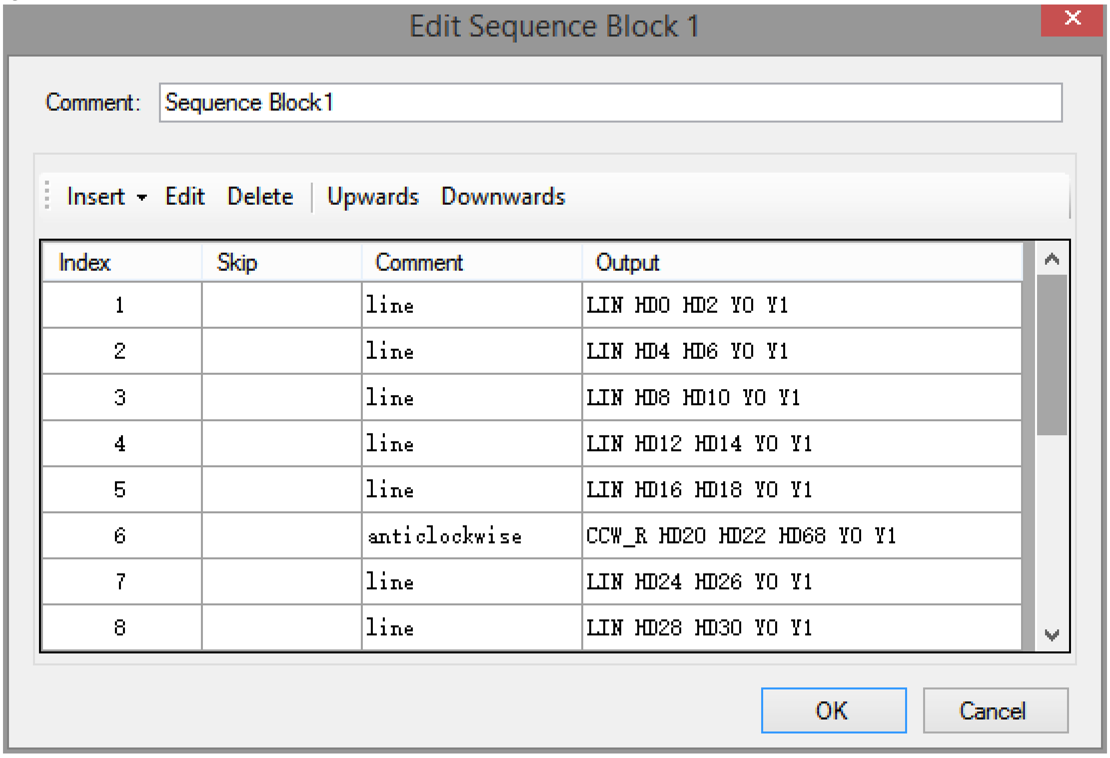
The two axes are designated as Y0 and Y1 axis, the corresponding directional terminals are Y4 and Y5, the default speed is 1000Hz, and the acceleration and deceleration time is 50ms, respectively. It is convenient to select the relative position mode according to the figure, so the specific parameters are set as follows:

| Function | Address | Value (relative) | Function | Address | Value (relative) |
|---|---|---|---|---|---|
| B point coordinates | HD0 | 0 | C point coordinates | HD4 | 3000 |
| | HD2 | 5000 | | HD6 | 0 |
| D point coordinates | HD8 | 0 | E point coordinates | HD12 | 4000 |
| | HD10 | 6000 | | HD14 | 0 |
| F point coordinates | HD16 | 6000 | G point coordinates | HD20 | 0 |
| | HD18 | -6000 | | HD22 | 6000 |
| H point coordinates | HD24 | 6000 | I point coordinates | HD28 | 6000 |
| | HD26 | 0 | | HD30 | -6000 |
| J point coordinates | HD32 | 0 | M point coordinates | HD36 | -6000 |
| | HD34 | -10000 | | HD38 | -6000 |
| K point coordinates | HD40 | -6000 | L point coordinates | HD44 | 0 |
| | HD42 | 0 | | HD46 | 6000 |
| P point coordinates | HD48 | -6000 | Q point coordinates | HD52 | -4000 |
| | HD50 | -6000 | | HD54 | 0 |

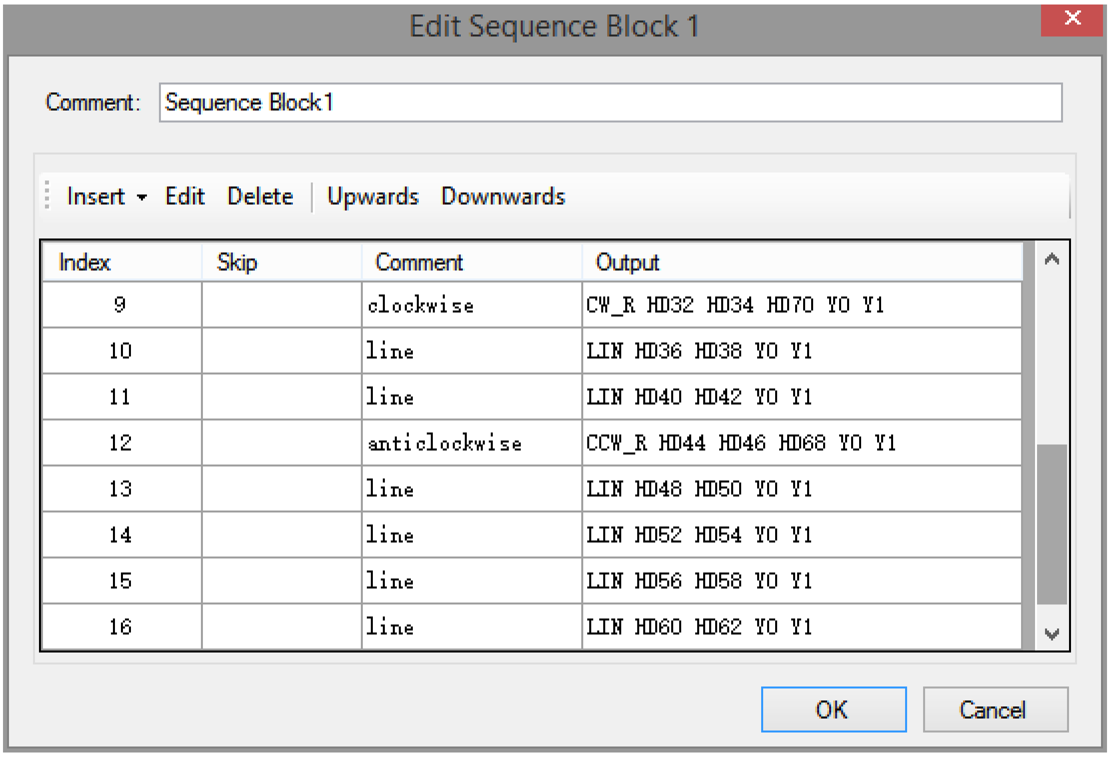
| | | | | | |
|---|---|---|---|---|---|
| W point coordinates | HD56 | 0 | Z point coordinates | HD60 | -3000 |
| | HD58 | 6000 | | HD62 | 0 |
| A point coordinates | HD64 | 0 | R2 radius | HD68 | 3000 |
| | HD66 | 5000 | R1 radius | HD70 | 7070 |
| Default speed | 1000Hz | | | | |
| Acc/dec time | 50ms | | | | |
| X axis | Y0 pulse, Y4 direction | | | | |
| Y axis | Y1 pulse, Y5 direction | | | | |

**Program (relative mode):**

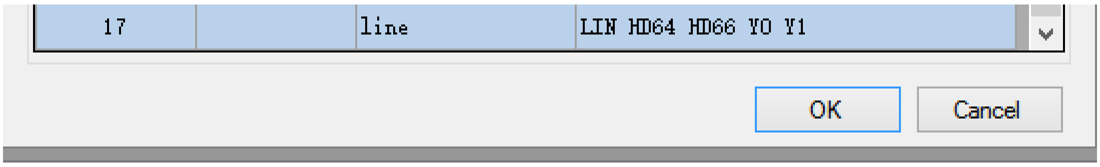
Since the figure is mainly composed of straight lines and arcs, the "LIN line" instruction is chosen here, and the "CCW_R anticlockwise arc" and "CW_R clockwise arc" instruction are used for arcs. Insert G instruction into BLOCK and write 17 interpolation instructions, as shown in the following figure:




**instruction（1）～（8）**

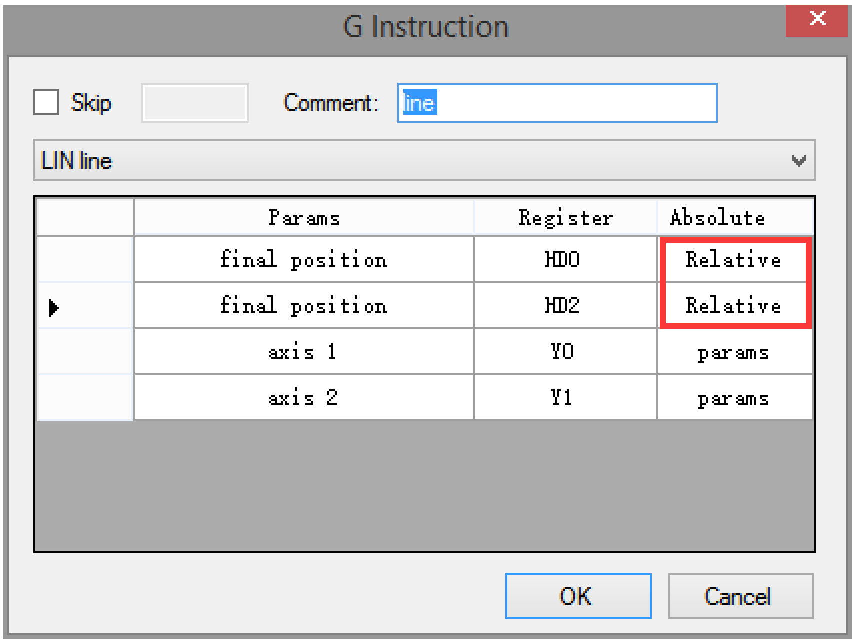


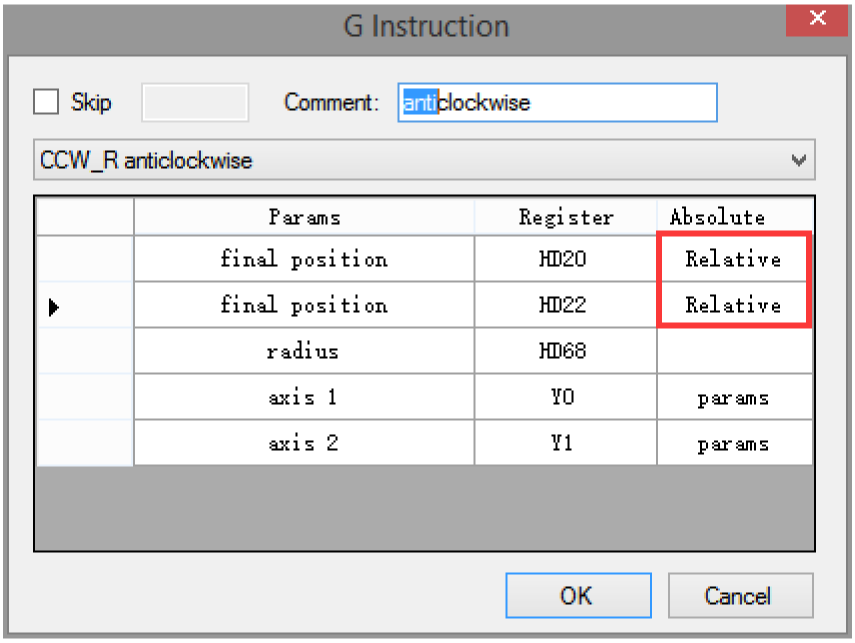

**Instruction** （9）～（16）

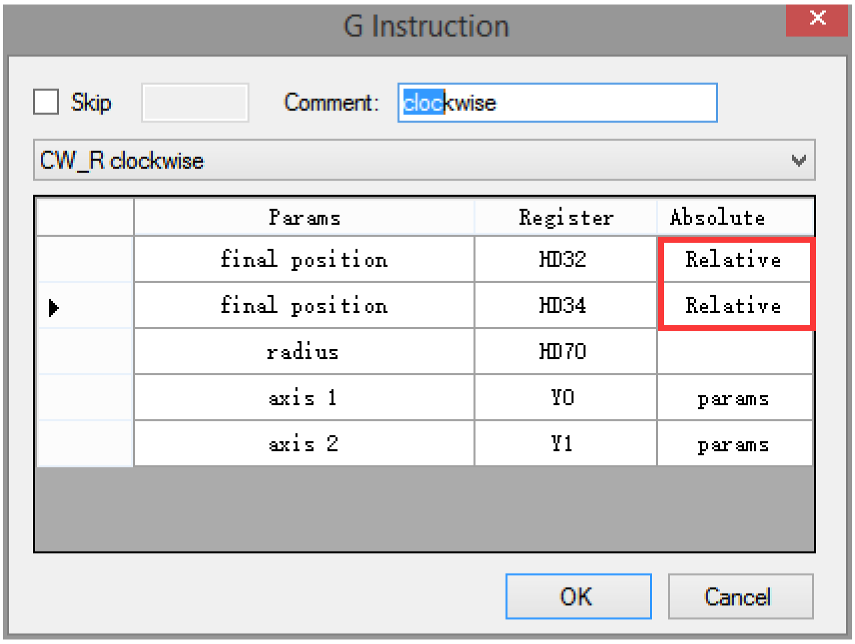



**instruction**（17）

The endpoint position of all the above instructions must be set to "relative mode", as shown in the following figure:

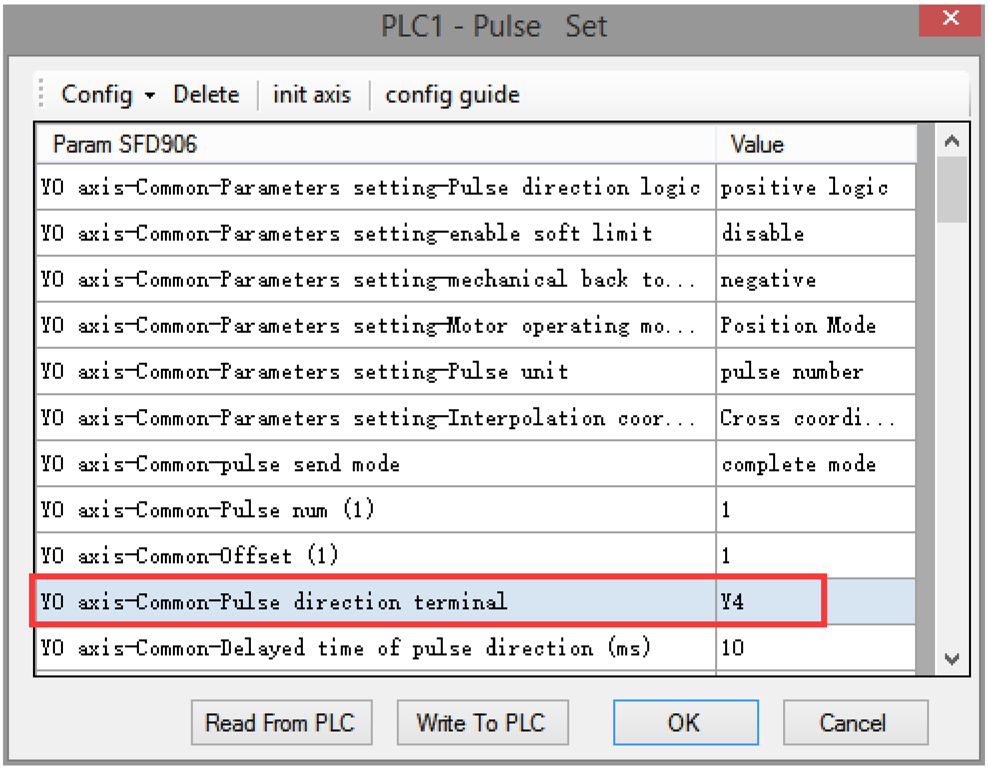




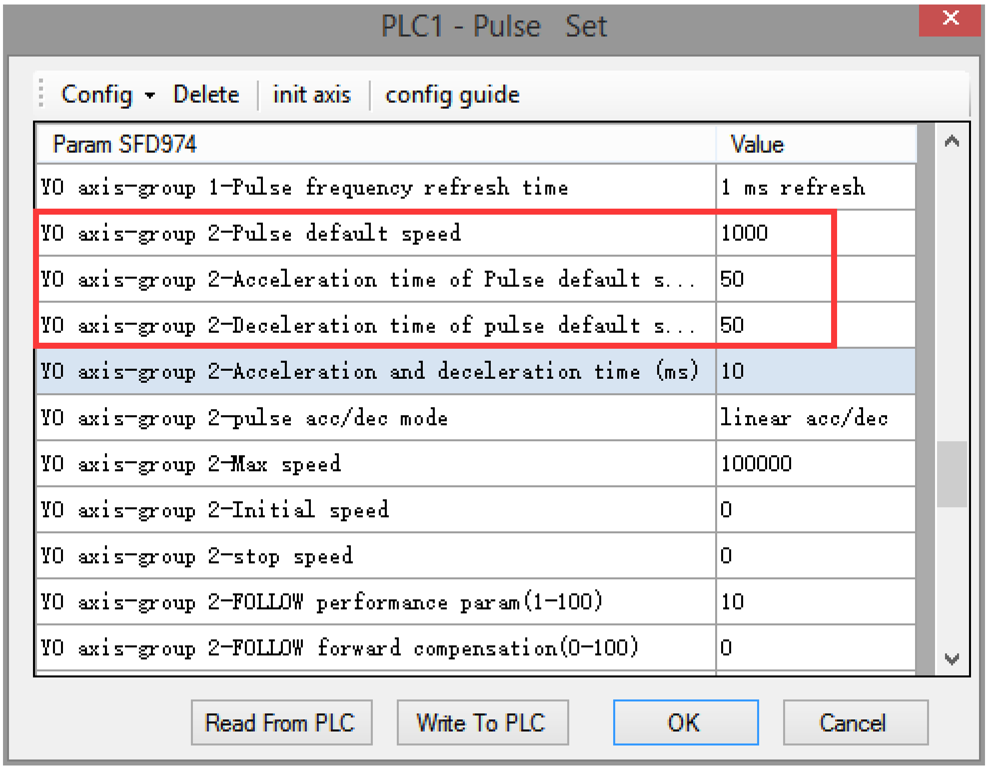




**Note: The radius of the clockwise and anticlockwise arcs can only be absolute mode, and can not be modified!**

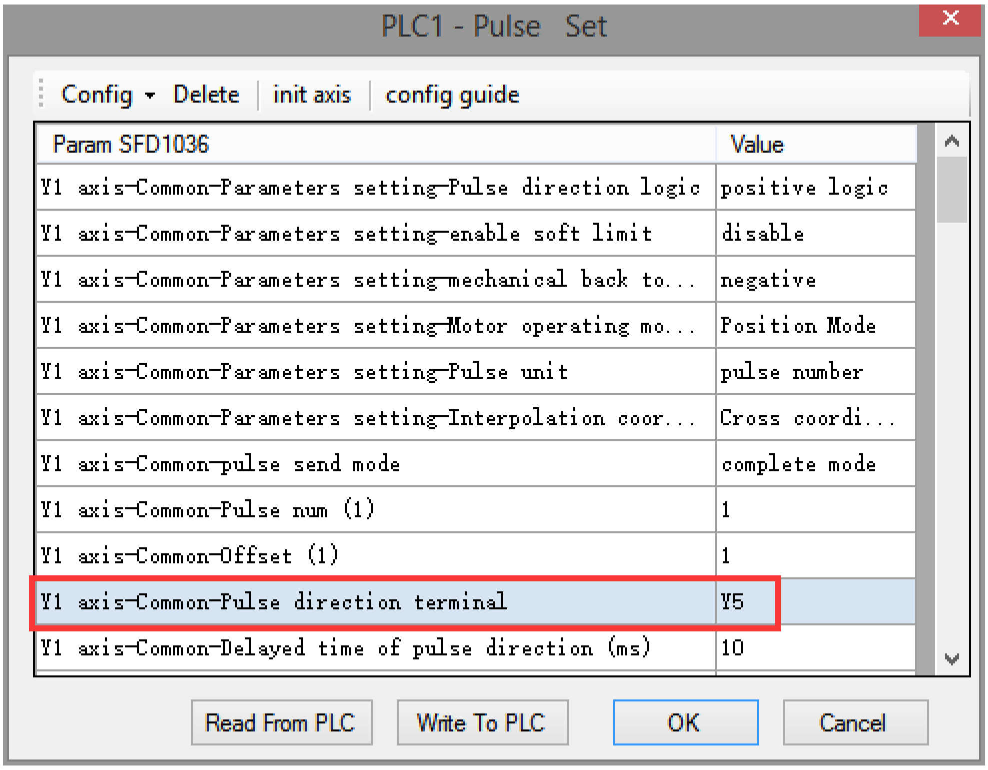
Double-click the "parameters" to configure the parameters of Y0 and Y1 axis [pulse direction terminal], [group 2 parameters - pulse default speed (Hz)], [group 2 parameters - pulse default speed acceleration time (ms)], [group 2 parameters - pulse default speed deceleration time (ms)], as follows:




**Y0 axis settings（1）**



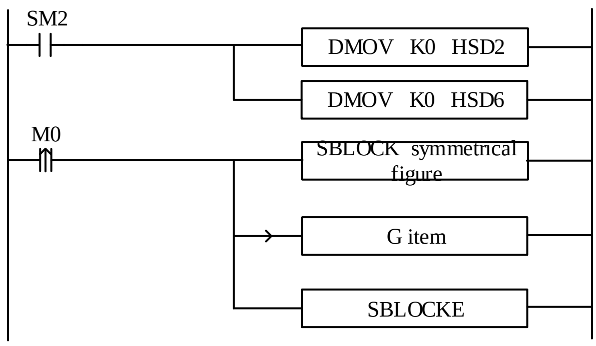

**Y0 axis settings（2）**




| Param SFD1036 | Value |
|---|---|
| Y1 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y1 axis-Common-Parameters setting-enable soft limit | disable |
| Y1 axis-Common-Parameters setting-mechanical back to... | negative |
| Y1 axis-Common-Parameters setting-Motor operating mo... | Position Mode |
| Y1 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y1 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y1 axis-Common-pulse send mode | complete mode |
| Y1 axis-Common-Pulse num (1) | 1 |
| Y1 axis-Common-Offset (1) | 1 |
| Y1 axis-Common-Pulse direction terminal | Y5 |
| Y1 axis-Common-Delayed time of pulse direction (ms) | 10 |

**Y1 axis settings（1）**

After setting up, click OK and write a complete program in the ladder diagram. As shown in the following figure, write the set value in the relevant register. When M0 is turned on once, execute BLOCK once, and walk the figure in this example once.



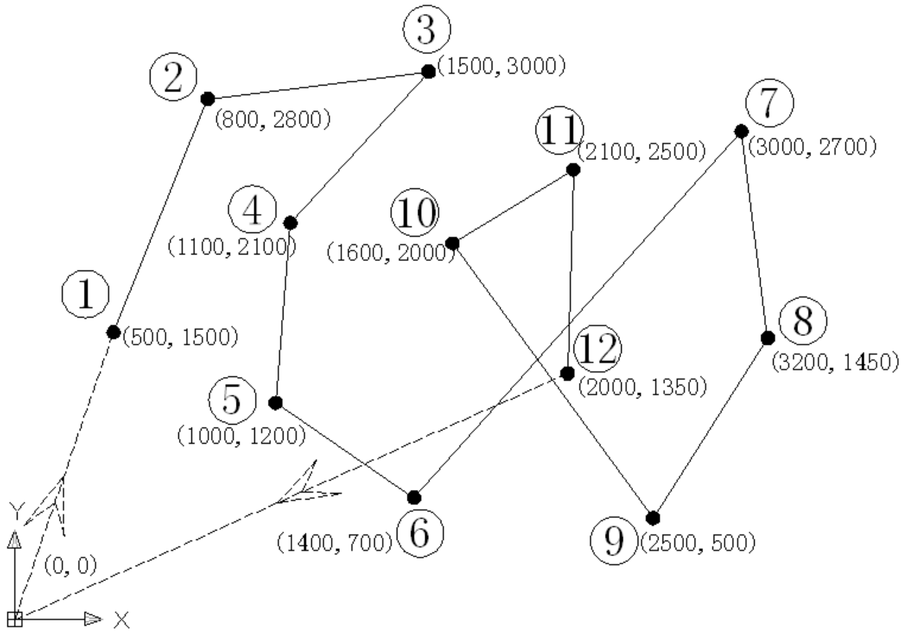

**Note:**

(1) The current position pulses of the two axes can be monitored by HSD2 (double word) and HSD4 (double word).

(2) The output terminals of the two axes correspond to Y0 and Y1 respectively, while the output terminals of the direction correspond to Y4 and Y5 respectively.

## 2-6-4. Disorder line segments

As shown in the figure, in the plane consisting of X-axis and Y-axis, the positioning of the equipment starts from the origin (0, 0), moves rapidly in the order of digital labeling (1-12) in the figure, and finally returns to the origin (0, 0) from the position of the 12th point (2000, 1350).




**Note:**

In this example, as the coordinates of each point are disorderly, so the lines connected sequentially by each point are slopes of arbitrary slope, so they can only be realized by the function of linear interpolation. From the graphics in the example, the coordinates of each point have been determined, so it is easier to choose absolute mode than relative mode.

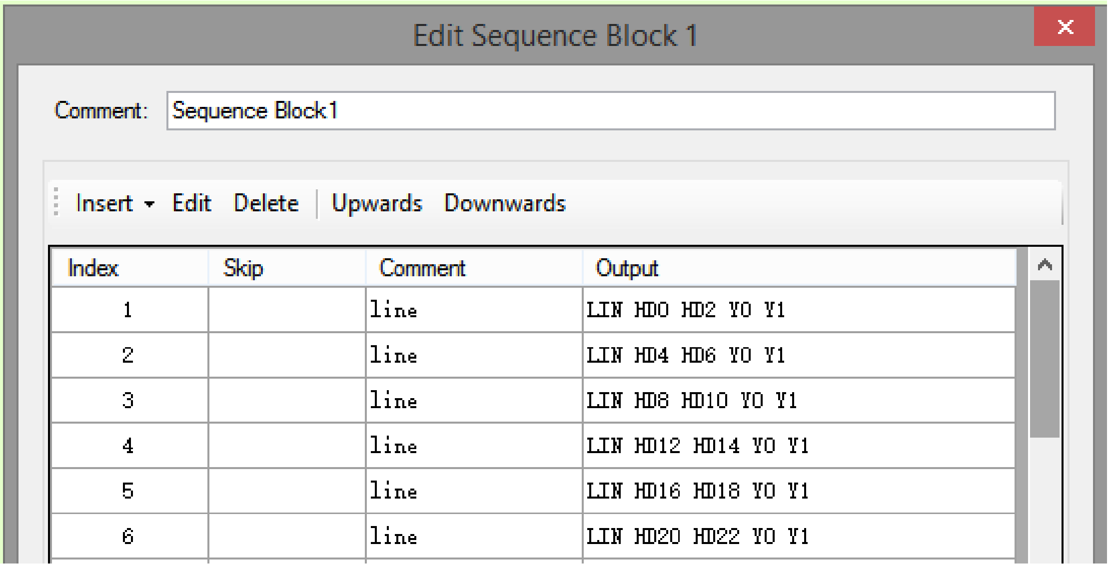
The two axes are designated Y0 (X axis) and Y1 (Y axis), the corresponding direction terminals are Y4 and Y5, the default speed is 1000Hz, the acceleration and deceleration time is 50ms, and all coordinate points are in absolute mode. Therefore, the specific parameters are set as follows:

| Point | X axis address | X axis setting value(absolute) | Y axis address | Y axis setting value(absolute) |
|---|---|---|---|---|
| Point 1 | HD0 | 500 | HD2 | 1500 |
| Point 2 | HD4 | 800 | HD6 | 2800 |
| Point 3 | HD8 | 1500 | HD10 | 3000 |
| Point 4 | HD12 | 1100 | HD14 | 2100 |
| Point 5 | HD16 | 1000 | HD18 | 1200 |
| Point 6 | HD20 | 1400 | HD22 | 700 |
| Point 7 | HD24 | 3000 | HD26 | 2700 |
| Point 8 | HD28 | 3200 | HD30 | 1450 |
| Point 9 | HD32 | 2500 | HD34 | 500 |
| Point 10 | HD36 | 1600 | HD38 | 2000 |
| Point 11 | HD40 | 2100 | HD42 | 2500 |

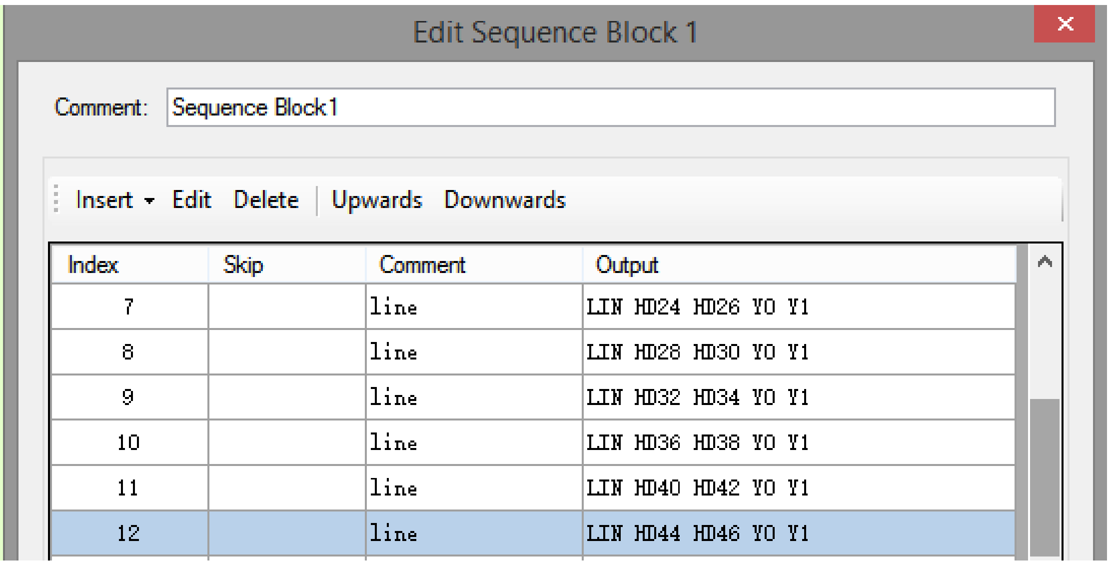
| | | | | |
|---|---|---|---|---|
| Point 12 | HD44 | 2000 | HD46 | 1350 |
| Default speed（Hz） | | 1000 | | |
| Acc/dec time（ms） | | 50 | | |
| X axis | | Y0-pulse； Y4-direction | | |
| Y axis | | Y1-pulse； Y5-direction | | |

**Program (absolute mode):**

Because the graphics are mainly composed of straight lines, the "LIN line" instruction is chosen here. Insert G instruction into BLOCK and write 12 interpolation instructions, as shown in the following figure:

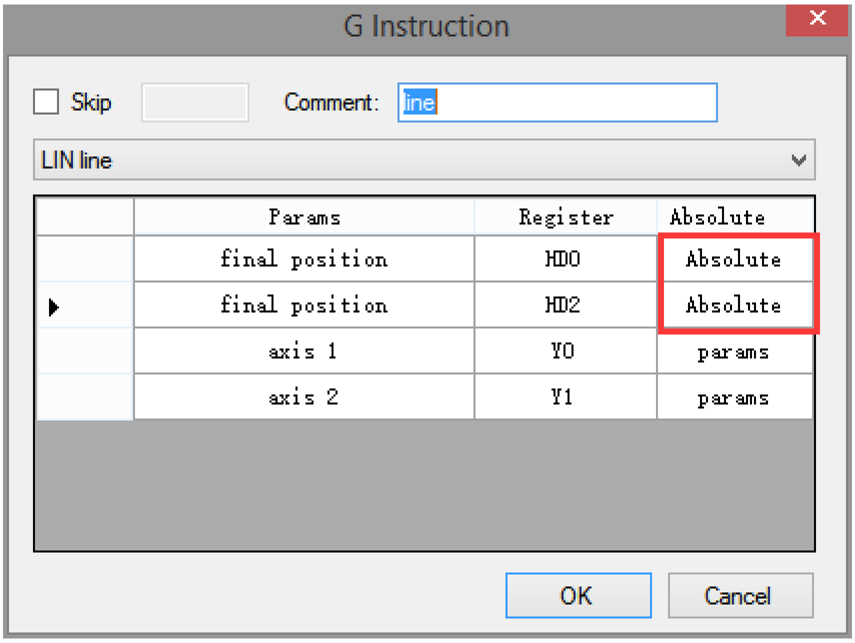



**Instruction（1）～（6）**

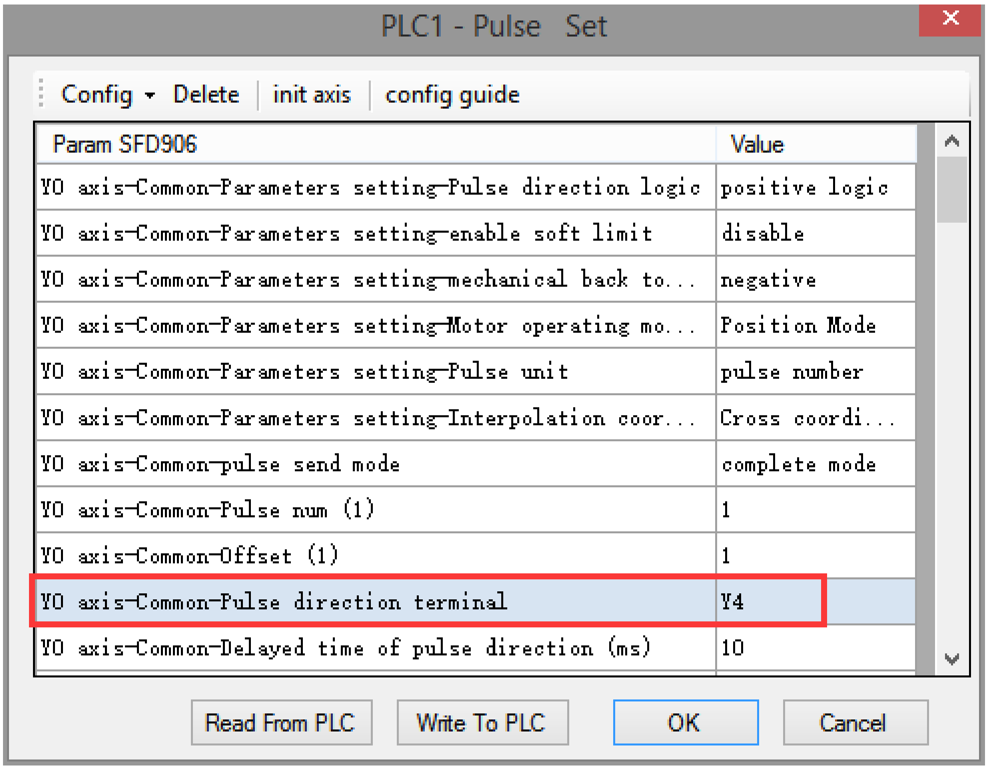



**Instruction（7）～（12）**

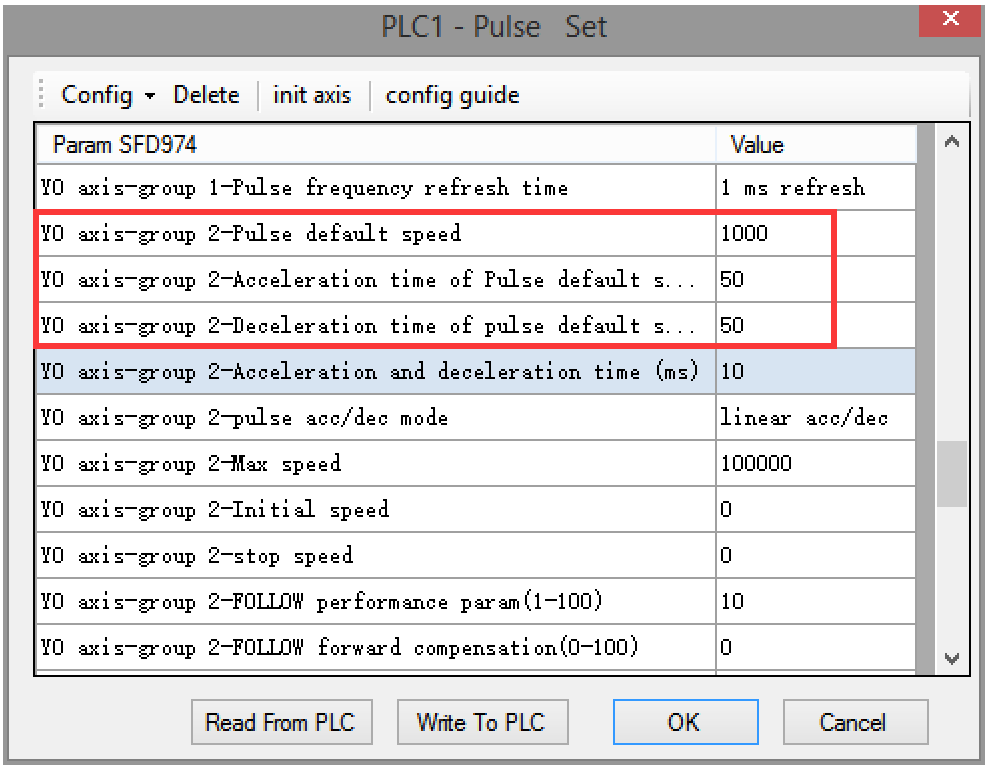
The endpoint position of all the above instructions must be set to "absolute mode", as shown in the following figure:




Double-click the "parameters" to configure the parameters of Y0 and Y1 axis [pulse direction terminal], [group 2 parameters - pulse default speed (Hz)], [group 2 parameters - pulse default speed acceleration time (ms)], [group 2 parameters - pulse default speed deceleration time (ms)], as follows:




**Y0 axis settings（1）**



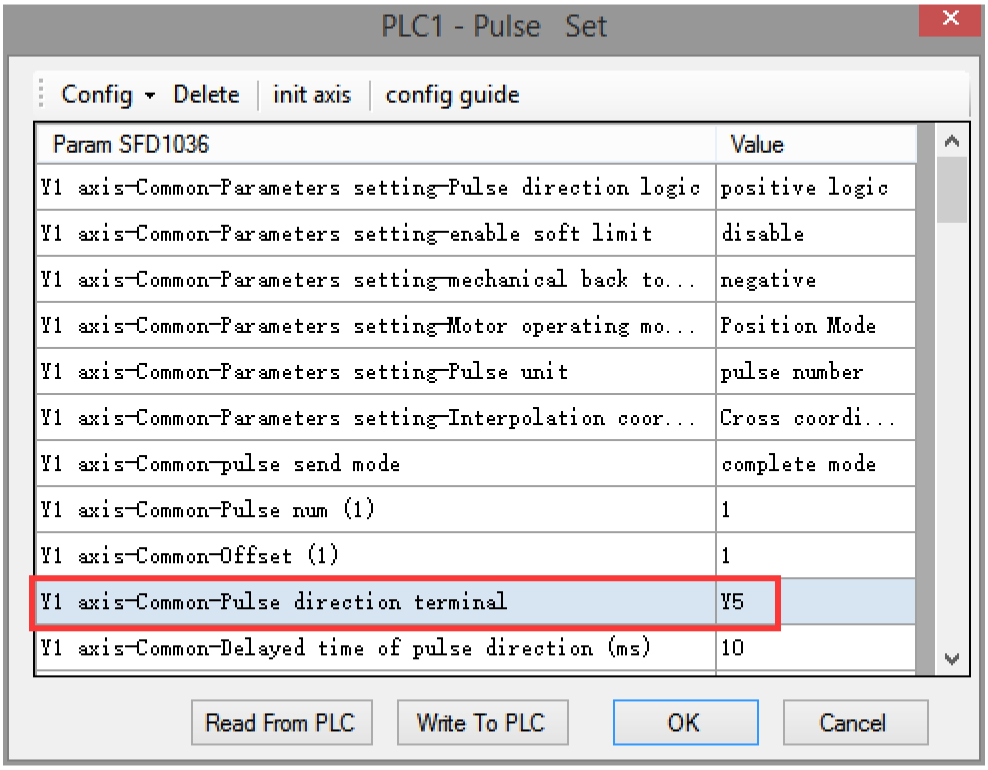
PLC1 - Pulse Set

Config Delete init axis config guide

| Param SFD974 | Value |
|---|---|
| Y0 axis-group 1-Pulse frequency refresh time | 1 ms refresh |
| Y0 axis-group 2-Pulse default speed | 1000 |
| Y0 axis-group 2-Acceleration time of Pulse default s... | 50 |
| Y0 axis-group 2-Deceleration time of pulse default s... | 50 |
| Y0 axis-group 2-Acceleration and deceleration time (ms) | 10 |
| Y0 axis-group 2-pulse acc/dec mode | linear acc/dec |
| Y0 axis-group 2-Max speed | 100000 |
| Y0 axis-group 2-Initial speed | 0 |
| Y0 axis-group 2-stop speed | 0 |
| Y0 axis-group 2-FOLLOW performance param(1-100) | 10 |
| Y0 axis-group 2-FOLLOW forward compensation(0-100) | 0 |

Read From PLC Write To PLC OK Cancel

**Y0 axis settings（2）**



PLC1 - Pulse Set

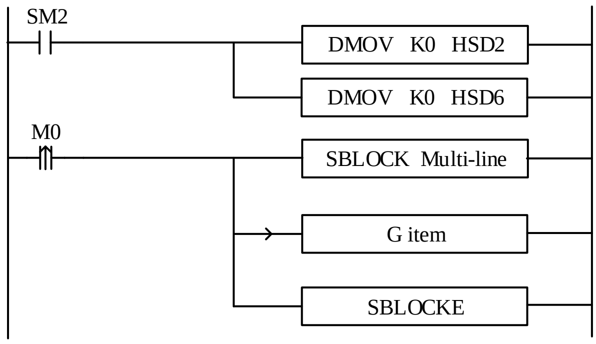
Config Delete init axis config guide

| Param SFD1036 | Value |
|---|---|
| Y1 axis-Common-Parameters setting-Pulse direction logic | positive logic |
| Y1 axis-Common-Parameters setting-enable soft limit | disable |
| Y1 axis-Common-Parameters setting-mechanical back to... | negative |
| Y1 axis-Common-Parameters setting-Motor operating mo... | Position Mode |
| Y1 axis-Common-Parameters setting-Pulse unit | pulse number |
| Y1 axis-Common-Parameters setting-Interpolation coor... | Cross coordi... |
| Y1 axis-Common-pulse send mode | complete mode |
| Y1 axis-Common-Pulse num (1) | 1 |
| Y1 axis-Common-Offset (1) | 1 |
| Y1 axis-Common-Pulse direction terminal | Y5 |
| Y1 axis-Common-Delayed time of pulse direction (ms) | 10 |

Read From PLC Write To PLC OK Cancel

**Y1 axis settings（1）**

After setting up, click OK and write a complete program in the ladder diagram. As shown in the following figure, write the set value in the relevant register. When M0 is turned on once, execute BLOCK once, and walk the figure in this example once.




**Note:**

When there are many points to go (if there are 1000 points), the ladder chart we write according to the above method will be very long, which is not conducive to the optimization of the program; therefore, we can implement multiple linear interpolation instructions by modifying the values in the linear interpolation register to improve the readability, optimize and reduce the scanning cycle of the program. For example, the user can set the coordinates of each point in the power-off retentive register through the HMI, as shown in the following table:

| Point | X axis register | X axis setting value | Y axis register | Y axis setting value |
|---|---|---|---|---|
| Point 1 | D4000 | 500 | D4100 | 1500 |
| Point 2 | D4002 | 800 | D4102 | 2800 |
| Point 3 | D4004 | 1500 | D4104 | 300 |
| Point 4 | D4006 | 1100 | D4106 | 2100 |
| Point 5 | D4008 | 1000 | D4108 | 200 |
| Point 6 | D4010 | 1400 | D4110 | 700 |
| Point 7 | D4012 | 3000 | D4112 | 2700 |
| Point 8 | D4014 | 3200 | D4114 | 1450 |
| Point 9 | D4016 | 2500 | D4116 | 500 |
| Point 10 | D4018 | 1600 | D4118 | 2000 |
| Point 11 | D4020 | 2100 | D4120 | 2500 |
| Point 12 | D4022 | 2000 | D4122 | 1350 |

Note: HMI register setting value (can be set by HMI recipe function).

# 3 Application examples

In this chapter, some main instructions with more usage are introduced in depth in the form of program examples. These programs focus on pulse output instructions and motion control instructions.

## 3-1. Application of pulse output

Example: Now we are going to send three consecutive pulses, the pulse terminal is Y0 and the pulse direction terminal is Y2. The pulse frequency, pulse number and acceleration and deceleration of each segment are shown in the table below.

| Pulse | Frequency setting value（Hz） | Pulse number setting value |
|---|---|---|
| Segment 1 | 3000 | 1000 |
| Segment 2 | 800 | 2000 |
| Segment 3 | 6000 | 8000 |
| Acc/dec time | Frequency changes 1000Hz every 100ms | |

Pulse data address assignment is as follows:

| Address | Notes | Value |
|---|---|---|
| HD0 (double word) | Pulse total segments (1 to 100) | 3 |
| HD2 (8 words) | Reserved | 0 |
| HD10 (double words) | Pulse frequency (#1) | 3000 |
| HD12 (double word) | Pulse number (#1) | 1000 |
| HD14 | bit15~bit8: waiting condition (#1)<br>H00: pulse sending completion<br>H01: wait time<br>H02: wait signal<br>H03: ACT time<br>H04: EXT signal<br>H05: EXT signal or pulse sending completion<br>bit7~bit0: waiting condition register type<br>H00: constant<br>H01: D | 0 |

| | | |
|---|---|---|
| | H02: HD<br>H03: FD<br>H04: X<br>H05: M<br>H06: HM | |
| HD15<br>(double word) | Constant value/ register no. (for waiting condition)(#1) | 0 |
| HD17 | bit7~bit0: jump register type<br>H00: constant value<br>H01: D<br>H02: HD<br>H03: FD | 0 |
| HD+18<br>(double word) | Constant value/register no. (for jump register)( #1) | 0 |
| HD+20<br>(double word) | Pulse frequency (#2) | 800 |
| HD+22<br>(double word) | Pulse number (#2) | 2000 |
| HD+24 | Waiting condition, waiting condition register type (#2) | 0 |
| HD+25<br>(double word) | Constant value or register no. (for waiting condition) (#2) | 0 |
| HD+27 | Jump type, jump register type (#2) | 0 |
| HD+28<br>(double word) | Constant value or register no. (for jump register) (#2) | 0 |
| HD+30<br>(double word) | Pulse frequency (#3) | 6000 |
| HD+32<br>(double word) | Pulse number (#3) | 8000 |
| HD+34 | Waiting condition, waiting condition register type (#3) | 0 |
| HD+35<br>(double word) | Constant value or register no. (for waiting condition) (#3) | 0 |
| HD+37 | Jump type, jump register type (for waiting condition) (#3) | 0 |
| HD+38<br>(double word) | Constant value or register no. (for jump register) (#3) | 0 |

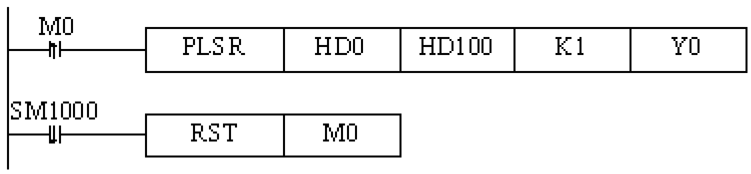
System parameters

| | | | | |
|---|---|---|---|---|
| SFD900 | Pulse parameter setting | Bit 1: pulse direction logic<br>0: positive logic 1: negative logic, default is 0<br>Bit 2: use soft limit function<br>0: not use 1: use default is 0<br>Bit 3: mechanical return to origin direction<br>0: negative direction 1: positive direction default is 0<br>Bit 10~8: pulse unit<br>Bit8: 0: pulse number 1: equivalent<br>000: pulse number<br>001: 1 um<br>011: 0.01mm<br>101: 0.1mm<br>111: 1 mm<br>Default is 000<br>Bit15: interpolation coordinate mode<br>0: cross coordinate 1: polar coordinate<br>Default is 0 | 0 | Common parameter |
| SFD901 | Pulse sending mode | Bit 0: pulse sending mode<br>0: complete mode 1: subsequence mode, default is 0 | 0 | |
| SFD902 | Pulse number/1 rotation low 16 bits | | 0 | |
| SFD903 | Pulse number/1 rotation high 16 bits | | 0 | |
| SFD904 | Motion quantity/1 rotation low 16 bits | | 0 | |
| SFD905 | Motion quantity/1 rotation high 16 bits | | 0 | |
| SFD906 | Pulse direction terminal | Y terminal no., 0xFF is no terminal | 2 | |
| SFD907 | Direction delay time | Default is 20, unit: ms | 20 | |
| SFD908 | Gear clearance positive compensation | | 0 | |
| SFD909 | Gear clearance negative compensation | | 0 | |
| SFD910 | Electrical origin low 16 bits | | 0 | |
| SFD911 | Electrical origin high 16 bits | | 0 | |

| | | | | |
|---|---|---|---|---|
| SFD912 | Signal terminal state setting | Bit0: origin signal switch state<br>Bit1: Z phase switch state<br>Bit2: positive limit switch state<br>Bit3: negative limit switch state<br>0: normally open(positive logic)<br>1: normally close(negative logic)<br>default is 0 | 0 | |
| SFD913 | Close point signal | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD914 | Z phase terminal setting | Bit0~bit7: set X terminal, 0xFF is no terminal(interruption) | 0xFF | |
| SFD915 | Limit terminal setting | Bit7~bit0: X terminal of positive limit, 0xFF is no terminal<br>Bit15~bit8: X terminal of negative limit, 0xFF is no terminal | FFFF | |
| SFD917 | Clear signal CLR output terminal | Bit0~Bit7: Y terminal, 0xFF is no terminal | 0xFF | |
| SFD918 | Returning speed VH low 16 bits | | 0 | |
| SFD919 | Returning speed VH high 16 bits | | 0 | |
| SFD922 | Crawling speed VC low 16 bits | | 0 | |
| SFD923 | Crawling speed VC high 16 bits | | 0 | |
| SFD924 | Mechanical origin position low 16 bits | | 0 | |
| SFD925 | Mechanical origin position high 16 bits | | 0 | |
| SFD926 | Z phase numbers | | 0 | |
| SFD927 | CLR signal delay time | Default 20, unit: ms | 20 | |
| SFD928 | Grinding wheel radius(polar coordinate) | Low 16 bits | 0 | |
| SFD929 | | High 16 bits | 0 | |
| SFD930 | Soft limit positive limit value | Low 16 bits | 0 | |
| SFD931 | | High 16 bits | 0 | |
| SFD932 | Soft limit negative limit value | Low 16 bits | 0 | |
| SFD933 | | High 16 bits | 0 | |
| … | | | | |
| SFD950 | Pulse default speed low 16 bits | It will send pulse with default speed when the speed is 0. | 1000 | Group 1 |
| SFD951 | Pulse default speed high 16 bits | | 0 | |

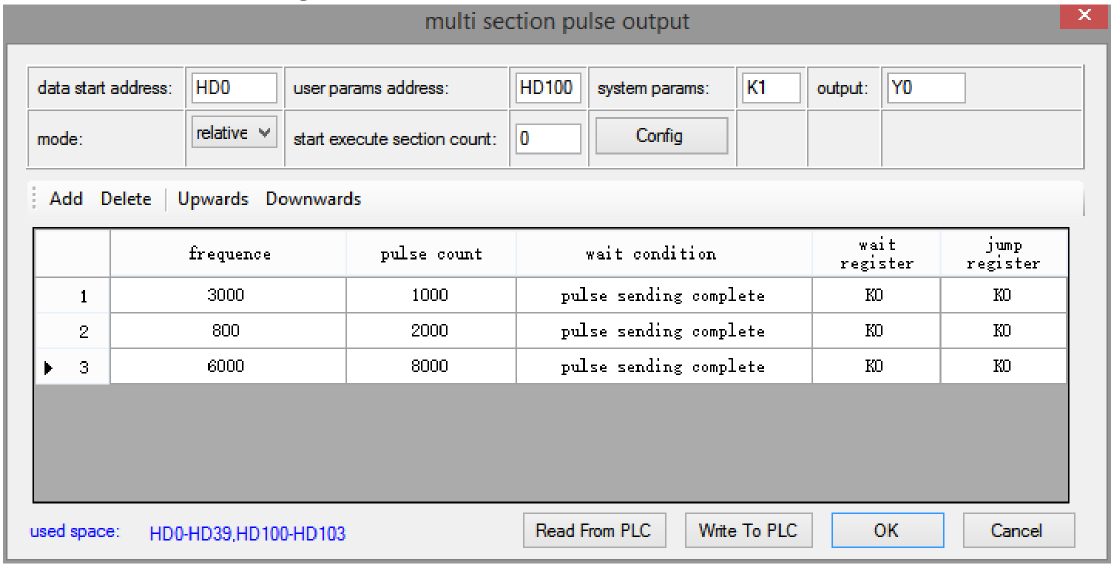
| | | | | |
|---|---|---|---|---|
| SFD952 | Pulse default speed acceleration time | | 100 | |
| SFD953 | Pulse default speed deceleration time | | 100 | |
| SFD954 | Acceleration and deceleration time | | 0 | |
| SFD955 | Pulse acceleration and deceleration mode | Bit 1~0: acc/dec mode<br>00: line<br>01: S curve<br>10: sine curve<br>11: reserved<br>Bit 15~2: reserved | | |
| SFD956 | Max speed limit low 16 bits | | 3392 | |
| SFD957 | Max speed limit high 16 bits | | 3 | |
| SFD958 | Initial speed low 16 bits | | 0 | |
| SFD959 | Initial speed high 16 bits | | 0 | |
| SFD960 | Stop speed low 16 bits | | 0 | |
| SFD961 | Stop speed high 16 bits | | 0 | |
| SFD962 | Follow performance parameters | 1~100, 100 means the time constant is one tick, 1 means the time constant is 100 tick. | | |
| SFD963 | Follow feedforward compensation | 0~100, percentage | | |
| … | | | | |

**Pulse instruction:**

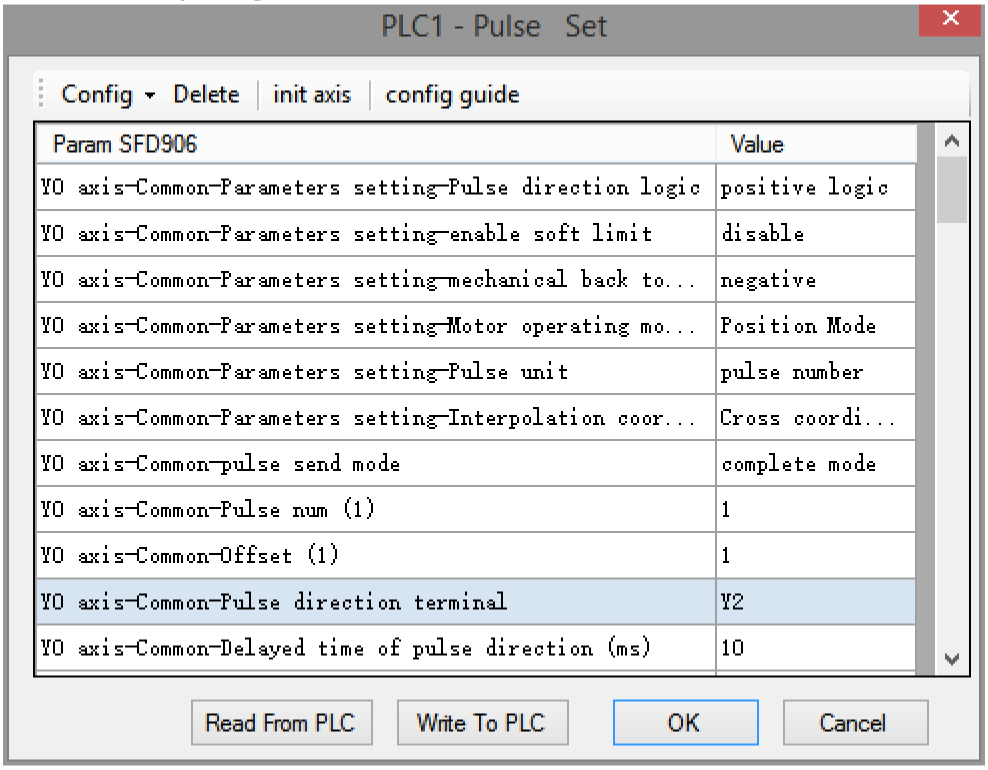


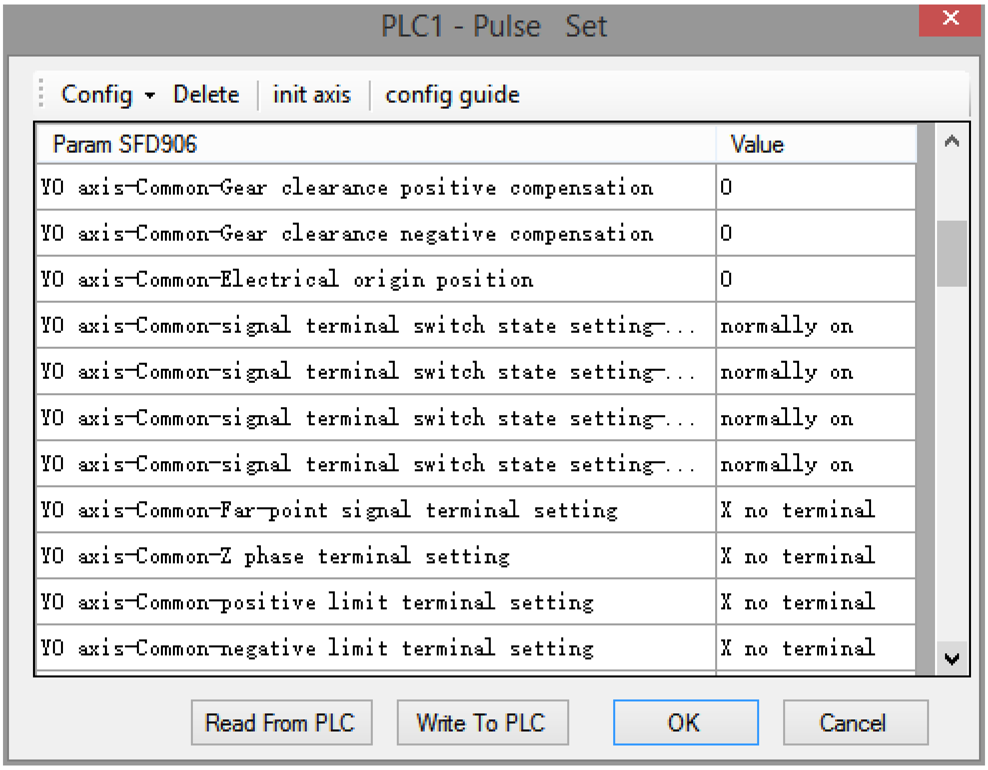
**Software configurations:**

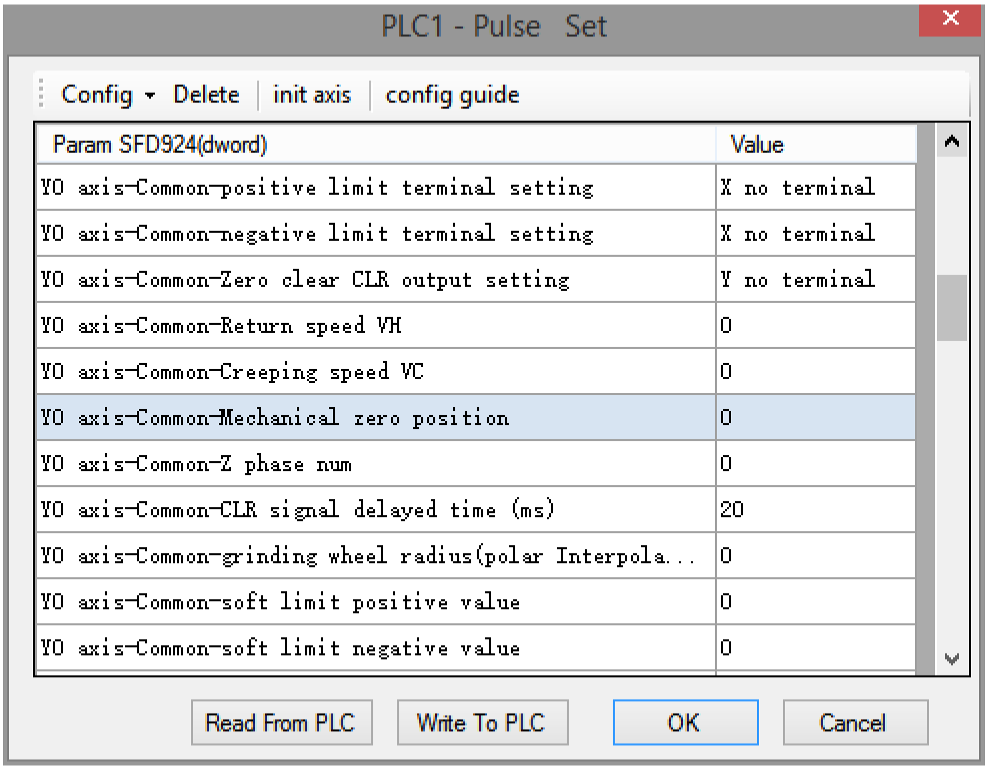
➢ Pulse configuration

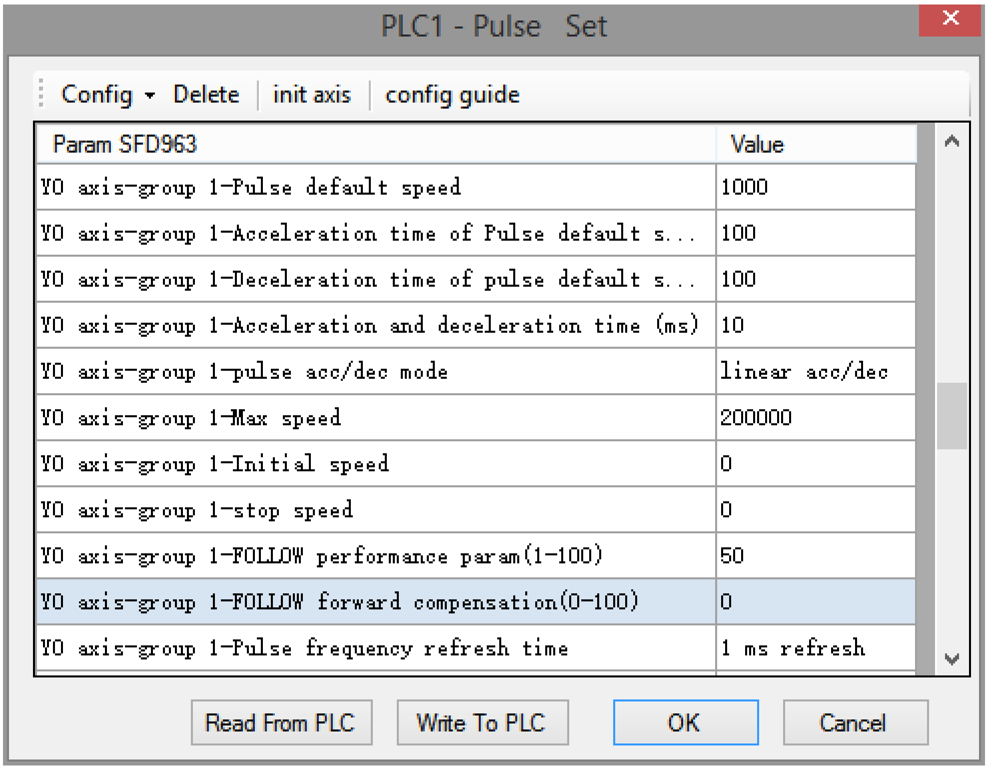



➢ Pulse system parameters

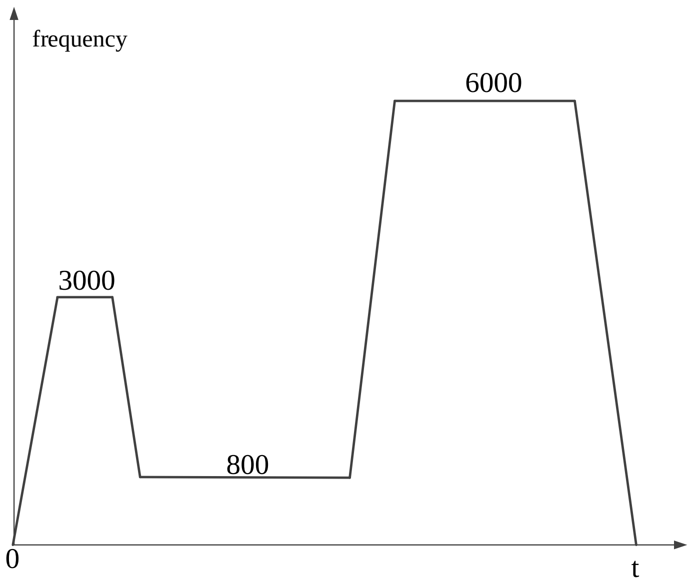



PLC1 - Pulse Set
Config
Delete
init axis
config guide
Param SFD906
Value
Y0 axis-Common-Gear clearance positive compensation
0
Y0 axis-Common-Gear clearance negative compensation
0
Y0 axis-Common-Electrical origin position
0
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-signal terminal switch state setting-...
normally on
Y0 axis-Common-Far-point signal terminal setting
X no terminal
Y0 axis-Common-Z phase terminal setting
X no terminal
Y0 axis-Common-positive limit terminal setting
X no terminal
Y0 axis-Common-negative limit terminal setting
X no terminal
Read From PLC
Write To PLC
OK
Cancel


PLC1 - Pulse Set
Config
Delete
init axis
config guide
Param SFD924(dword)
Value
Y0 axis-Common-positive limit terminal setting
X no terminal
Y0 axis-Common-negative limit terminal setting
X no terminal
Y0 axis-Common-Zero clear CLR output setting
Y no terminal
Y0 axis-Common-Return speed VH
0
Y0 axis-Common-Creeping speed VC
0
Y0 axis-Common-Mechanical zero position
0
Y0 axis-Common-Z phase num
0
Y0 axis-Common-CLR signal delayed time (ms)
20
Y0 axis-Common-grinding wheel radius(polar Interpola...
0
Y0 axis-Common-soft limit positive value
0
Y0 axis-Common-soft limit negative value
0
Read From PLC
Write To PLC
OK
Cancel




➢ Pulse sending oscillogram



## 3-2. Application of motion control in arc saw machining system

### 1. Introduction of arc saw technology

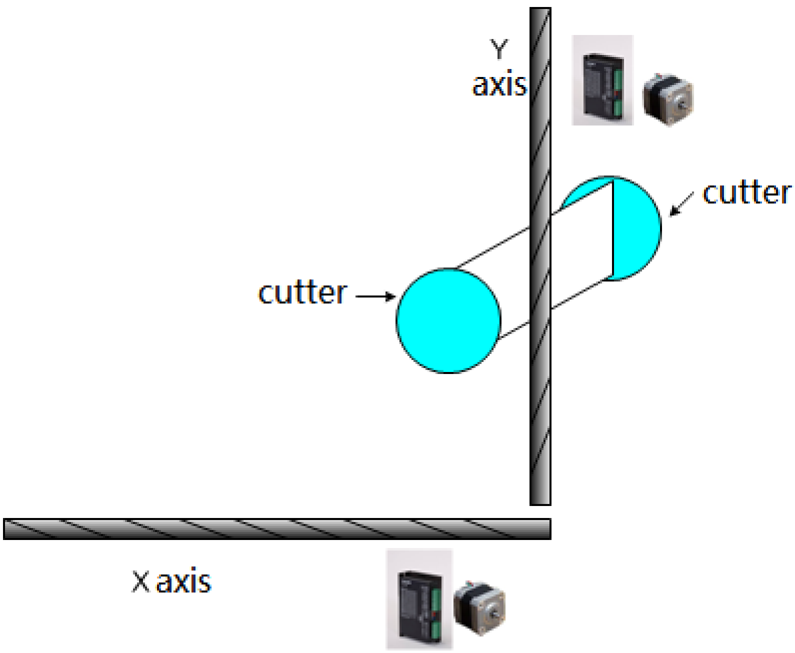
The arc saw is a machine used to cut arc boards. The mechanical characteristics are that the arc radius is large and the motor load is large.

### 2. Products applied in this system

| Product name | Model | Number |
|---|---|---|
| PLC | XDM-32T4-E | 1 |
| HMI | OP320-A | 1 |
| Stepper driver | DP-21P5 | 2 |

### 3. Composition of control system

**(1) The composition of system hardware**




As shown in the figure, two stepper motors control X and Y axis respectively, and use the arc interpolation instruction of XINJE XDM PLC to make X and Y axis coordinate and get out of the circular arc track. The relative distance of the cutter installed on the workbench determines the width of the plate cut by the cutter.

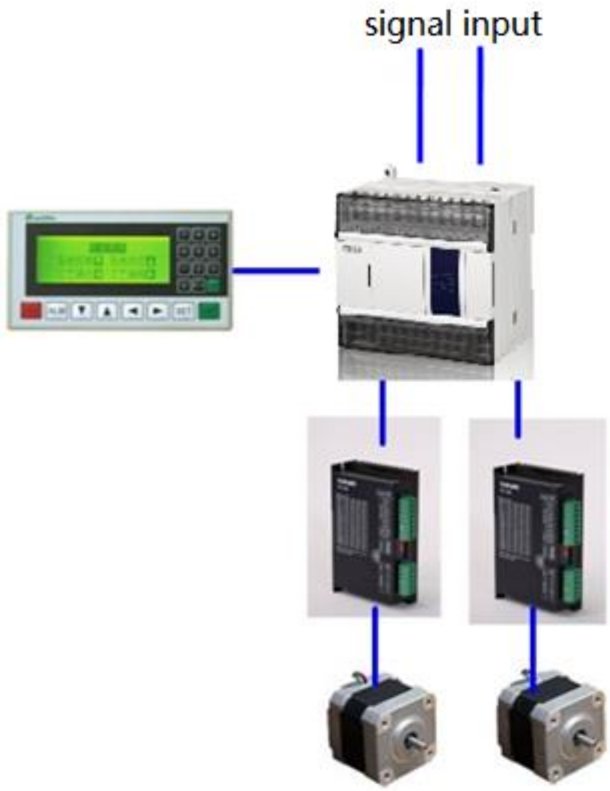
**(2) Technical difficulties**

- The processing arc radius is large, the pitch of the XY axis screw is large, the number of pulse and the amount of movement are difficult to configure, if the setting is not appropriate, the data calculation is easy to overflow.
- Due to the heavy load of the motor, it is easy to lose step or overshoot.

- The speed of returning to the mechanical origin should not be too fast.
- Owing to the ellipse of the processed arc board, the ellipse can not be cut directly by arc interpolation, otherwise the board can not be sawn through.

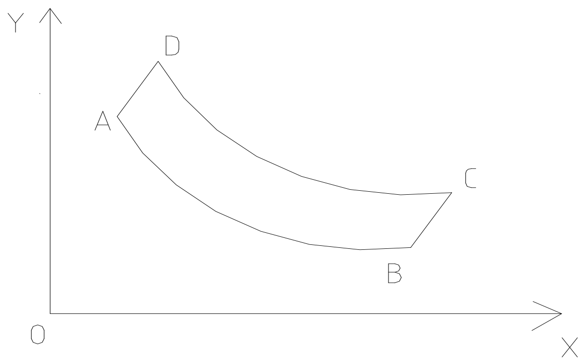
**(3) Control scheme**

This scheme adopts the motion-controlled PLC XDM, which has high-speed command operation, built-in four 100KHz high-speed pulse output, support motion control command arc interpolation, RS232, RS485 serial ports, convenient for various upper computer monitoring, powerful external interrupt function, greatly saves the electrical cost for customers.
In view of the above difficulties, we adopt the method of reducing the ratio of the number of pulses and the amount of movement to reduce the calculation value and prevent the calculation overflow. (For example, the number of pulses is 2400 and the amount of movement is 10000. When setting parameters, the amount of movement is reduced by 10 times to 1000, so the number of pulses per unit is increased by 10 times. When setting physical quantities, we will reduce by 10 times accordingly. For example, when setting 1000 millimeters, we only need to set 100 in the corresponding registers.) In order to ensure that the motor is not out of step or overshoot, it is necessary to set the acceleration and deceleration time a little longer and increase the driver current (note that the motor is easy to heat if the current is too large). Before the arc interpolation, the straight line cutting is carried out, and then the arc cutting is carried out, which solves the problem that the direct arc cutting can not be cut through.



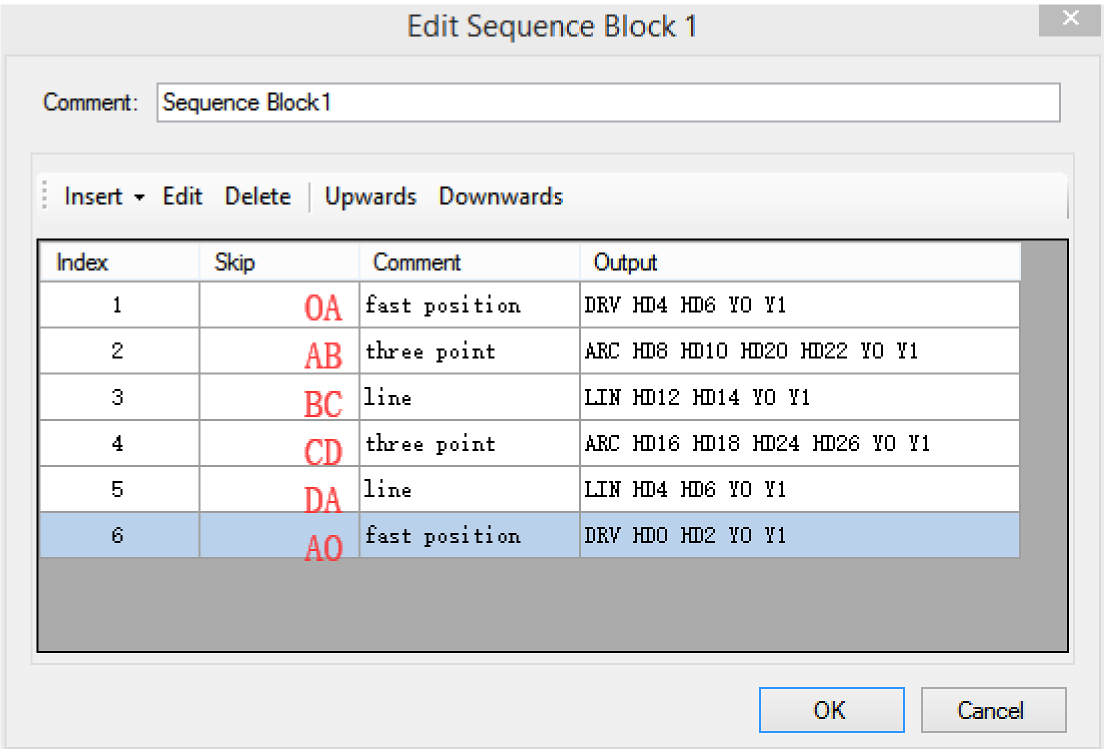

In positioning motion control, returning to mechanical origin is very important for control accuracy. However, some mechanical motors have a large load and only one origin signal. The control object is a stepper motor. There is no Z-phase signal output, and the requirement of returning to the origin is fast. In this case, we use the ZRN instruction in XD to configure the internal acceleration and deceleration time settings. The problem has been solved.

**(4) The operation diagram of the interpolation instructions in the system is as follows:**




The coordinates of the points in the figure are as follows: O(HD0, HD2), A(HD4, HD6), B(HD8, HD10), C(HD12, HD14), C(HD16, HD18), the midpoint coordinates of the AB arc are (HD20, HD22), the midpoint coordinates of the CD arc are (HD24, HD26).
Motion path: O→A→B→C→D→A→O.

5. **The interpolation instructions in the system are as follows:**




| Index | Skip | Comment | Output |
|---|---|---|---|
| 1 | OA | fast position | DRV HD4 HD6 Y0 Y1 |
| 2 | AB | three point | ARC HD8 HD10 HD20 HD22 Y0 Y1 |
| 3 | BC | line | LIN HD12 HD14 Y0 Y1 |
| 4 | CD | three point | ARC HD16 HD18 HD24 HD26 Y0 Y1 |
| 5 | DA | line | LIN HD4 HD6 Y0 Y1 |
| 6 | AO | fast position | DRV HD0 HD2 Y0 Y1 |

## 3-3. Application of motion control in hair planting machine

**1. Process introduction**

At present, the electric control system structure of hair planting machine is mainly divided into single chip computer control system or CNC numerical control system. Among them, the single-chip computer control system is based on the integrated service of automation system manufacturer, supplemented by the independent research and development of toothbrush equipment manufacturer.

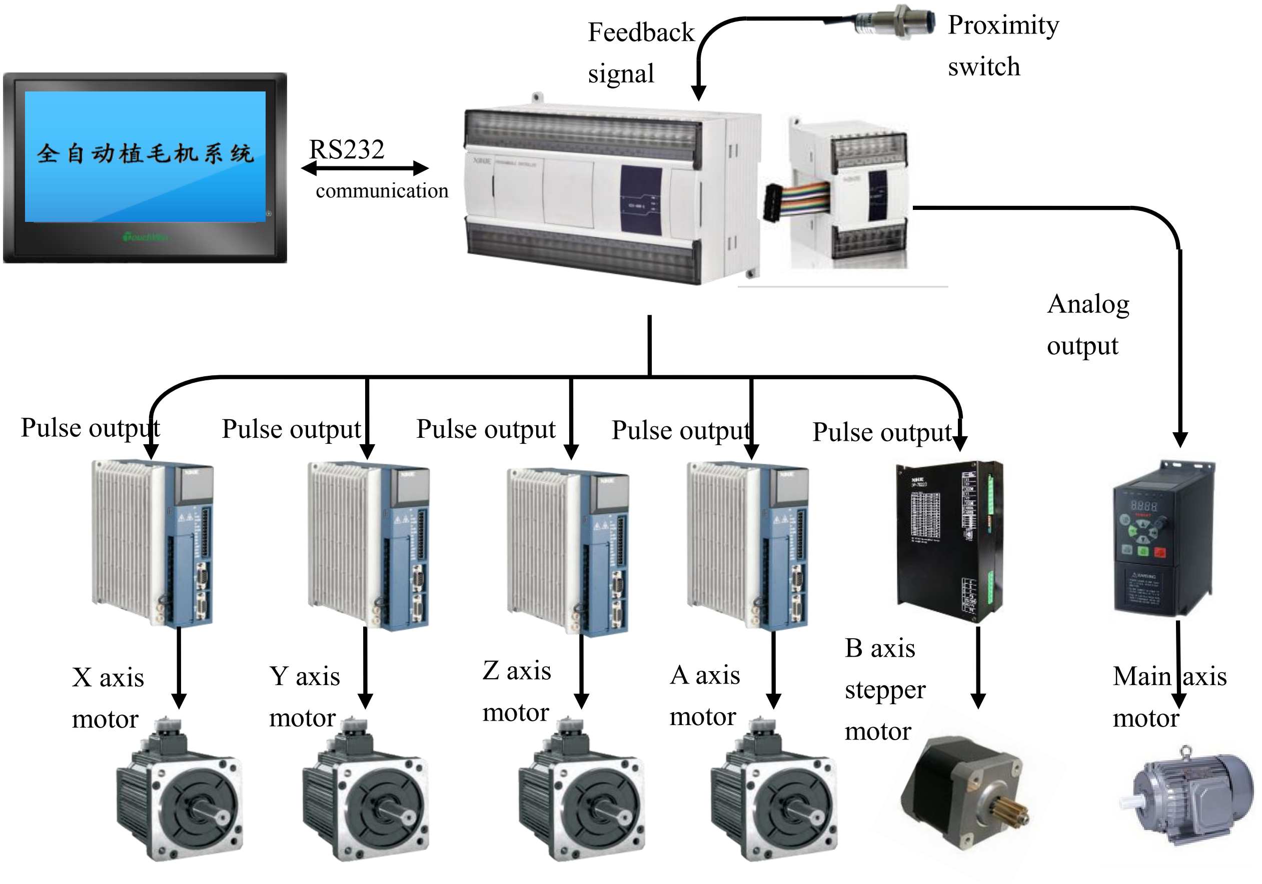
The drive structure of high-speed toothbrush hair planter is composed of main drive shaft and four servo drive shaft systems. The four servo axes are horizontal X-axis, vertical Y-axis, hair changing Z-axis and rotary A-axis. The position of the toothbrush hole is determined by the coordinates of the XY two axes. The A axis play the role of replacing the next toothbrush and the Z axis play the role of replacing the brush color. When the main shaft motor (frequency converter control) runs, the four electronically controlled servo shafts will run, while the other four shafts will stop when the main shaft stops. The speed of the main axis determines the speed of hair planting. The response of the four servo shafts need coordinated driving, otherwise, hair removal or hair irregularity will occur.

**2. the products required in the application**

| Product name | Model | Quantity |
|---|---|---|
| PLC | XDM-60T4-E | 1 |
| Extension module | XD-E2DA | 1 |
| HMI | TG865-MT（U） | 1 |
| Servo drive | DS3-20P7-PQA | 3 |
| Servo drive | DS3-20P4-PQA | 1 |

**3. Composition of Control System**

**(1) The Composition of System Hardware**




**(2) Finished toothbrush products**

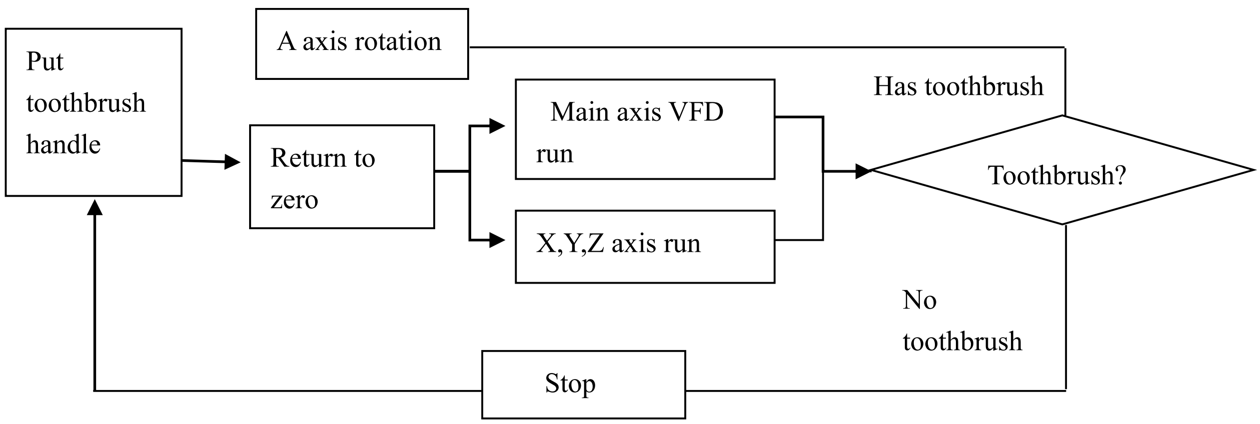
**(3) Technological difficulties**

The difficulty of developing servo solution is the joint debugging of electromechanical system, in which the adjustment of servo gain and the cooperation of PLC triangular function curve are the main problems. Among the four servo shafts, the mechanical inertia of X-axis and Y-axis is relatively stable due to the screw drive structure, and it is easy to debug, so it is possible to modify the speed gain. The Z-axis of the turning plate is a rotating axis. There is centrifugal force in high-speed rotation. If the gain of the turning plate is set very high, the motor will vibrate when it starts and stops. At this time, the position filtering time parameters can be modified to eliminate the vibration. Comparatively speaking, the structure of cam mechanism for changing hair U-axis makes debugging more difficult. In addition, the mechanical rigidity of U-axis is not good. When the motor runs, the inertia ratio varies greatly, the output current of the motor varies greatly, and the parameters can not be adjusted properly. When the motor runs around, the shaft either vibrates or screams, or reacts slowly. When the parameters are adjusted, the gain of the speed loop and the filtering time parameters and position loop gain need to be adjusted accordingly.

**(4) Control solution**

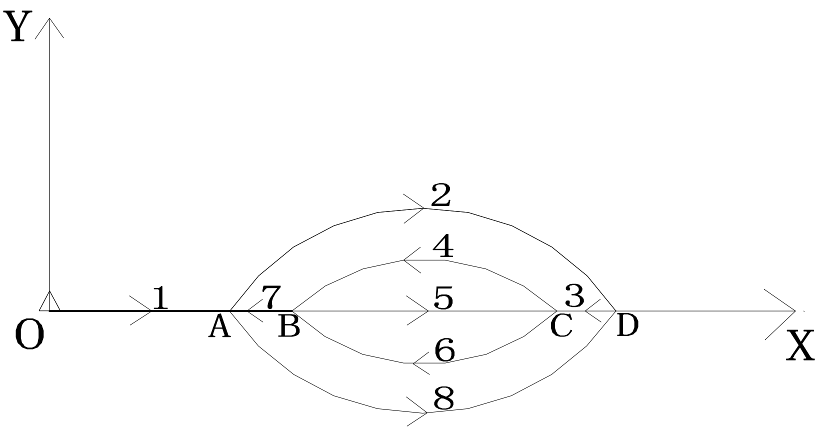
Mainly control axis pulse command signal to achieve servo drive, usually four-axis control output. The motion control type of PLC XDM-60T4-E is chosen. It has a response speed of 0.1ms and four high-speed pulses, which can realize the two-axis interpolation operation required by the toothbrush hair planter. The four sets of servo drivers are DS3 series AC servo system with power of 400W~750W. The driver has many functions, such as strong overload ability, strong anti-load disturbance ability, large starting moment, high dynamic response speed and short positioning time. The main axis motor frequency converter model is Xinje VB5N series, the power is 400 W.

**(5) action order**



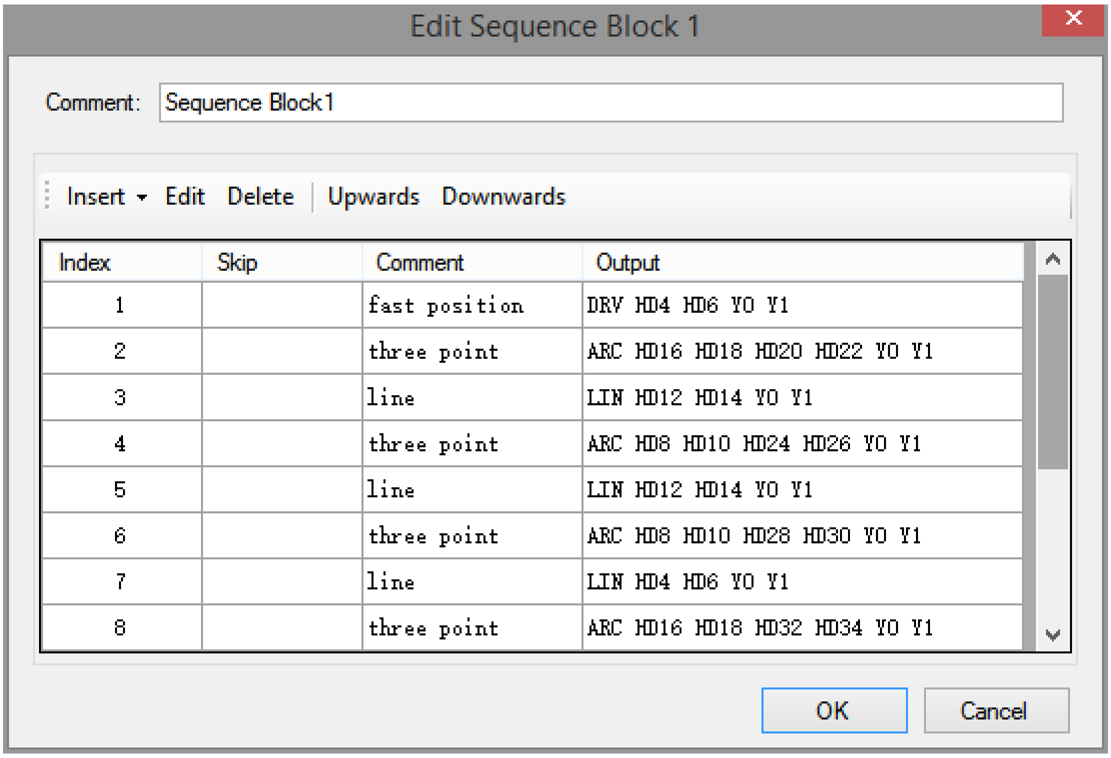

Action process: The clip holds the toothbrush handle from Y axis direction → 90 degrees positioning to Z axis direction → platform drives the clip to do X Y axis movement enables the brush hair to be hit into the hole of the toothbrush head → hair planting completes, the clip rotates downward 90 degrees → the clip loosens, and a toothbrush is produced. The application of Xinje XDM series PLC and DS5 servo system can achieve 900 times/minute hair planting speed. And at the same time of high-speed start and stop, the stability and softness of the overall movement is particularly prominent. Through the application of self-made pulse S curve in PLC, we can achieve hole skipping hair planting. When skipping, the machine is almost as smooth as usual without obvious jitter while ensuring the accuracy of skipping.

**4. The operation diagram of the interpolation instructions in the system is as follows.**




The coordinates of the points in the figure are as follows: O (HD0, HD2), A (HD4, HD6), B (HD8, HD10), C (HD12, HD14), D (HD16, HD18), the midpoint coordinates of the clockwise arc of AD segment (HD20, HD22), the midpoint coordinates of the anticlosewise arc of AD segment (HD32, HD34), the midpoint coordinates of the clockwise arc of BC segment (HD28, HD30), and the midpoint coordinates of the anticlockwise arc of BC segment (HD24, HD26). Path of particle: O→A→D→C→B→C→B→A→D→O.

**5. The interpolation instructions in the system.**

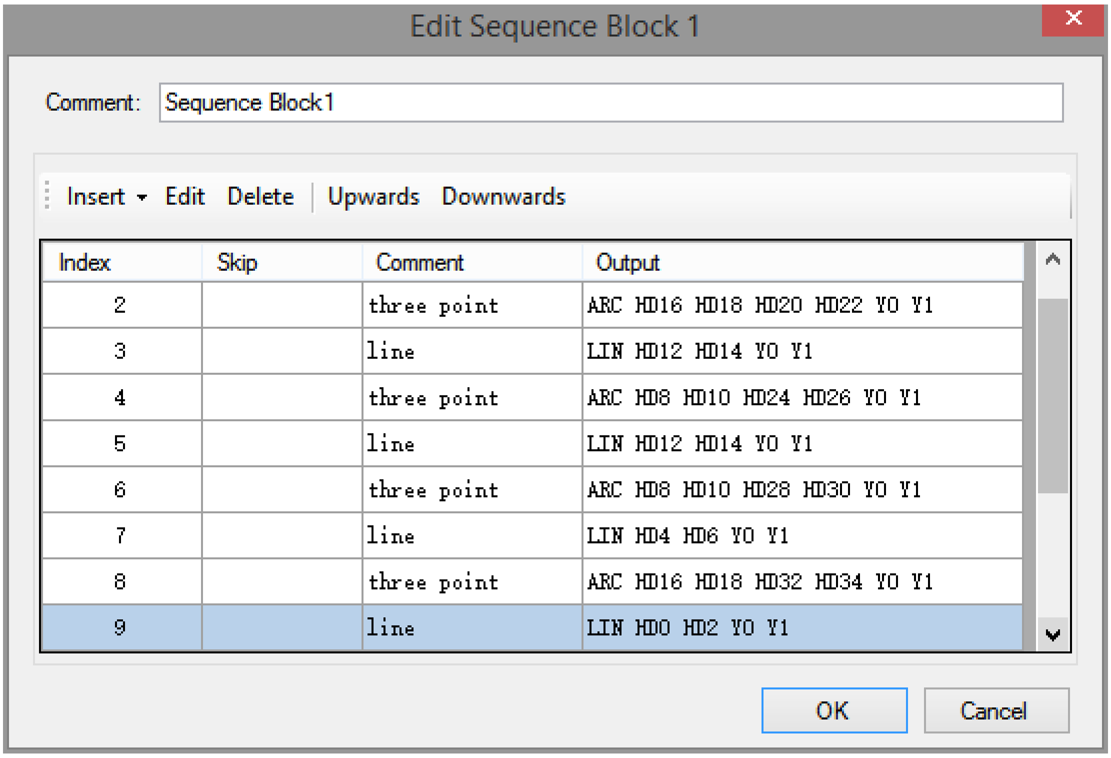

Edit Sequence Block 1

Comment: Sequence Block1

Insert Edit Delete Upwards Downwards

| Index | Skip | Comment | Output |
|---|---|---|---|
| 1 | | fast position | DRV HD4 HD6 Y0 Y1 |
| 2 | | three point | ARC HD16 HD18 HD20 HD22 Y0 Y1 |
| 3 | | line | LIN HD12 HD14 Y0 Y1 |
| 4 | | three point | ARC HD8 HD10 HD24 HD26 Y0 Y1 |
| 5 | | line | LIN HD12 HD14 Y0 Y1 |
| 6 | | three point | ARC HD8 HD10 HD28 HD30 Y0 Y1 |
| 7 | | line | LIN HD4 HD6 Y0 Y1 |
| 8 | | three point | ARC HD16 HD18 HD32 HD34 Y0 Y1 |

OK Cancel

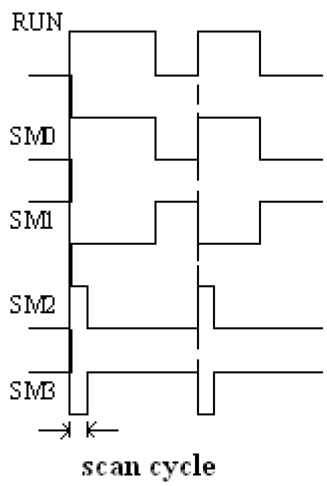

Edit Sequence Block 1
Comment: Sequence Block1
Insert Edit Delete Upwards Downwards
Index Skip Comment Output
2 three point ARC HD16 HD18 HD20 HD22 Y0 Y1
3 line LIN HD12 HD14 Y0 Y1
4 three point ARC HD8 HD10 HD24 HD26 Y0 Y1
5 line LIN HD12 HD14 Y0 Y1
6 three point ARC HD8 HD10 HD28 HD30 Y0 Y1
7 line LIN HD4 HD6 Y0 Y1
8 three point ARC HD16 HD18 HD32 HD34 Y0 Y1
9 line LIN HD0 HD2 Y0 Y1
OK
Cancel

# Appendix Special soft element list

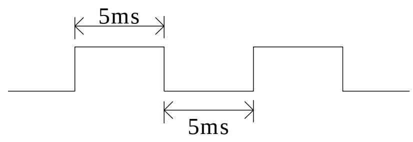
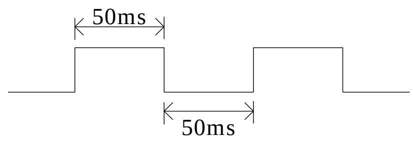
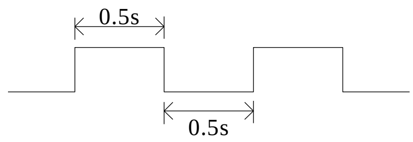
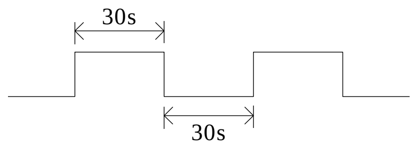
Appendix mainly introduces the functions of XD/XL series PLC special soft element, data register, FlashROM and the address distribution of expansions for users to search.

## Appendix 1. Special auxiliary relay

**Initial Status（SM0-SM7）**

| ID | Function | Description | |
|---|---|---|---|
| SM000 | Coil ON when running |  | SM000 keeps ON when PLC running |
| SM001 | Coil OFF when running | | SM001 keeps OFF when PLC running |
| SM002 | Initial positive pulse coil | | SM002 is ON in first scan cycle |
| SM003 | Initial negative pulse coil | | SM003 is OFF in first scan cycle |
| SM004 | PLC running error | When SM4 sets ON, it indicates that there is an error in the operation of PLC.<br>(Firmware version V3.4.5 and above supports this function by PLC) | |
| SM005 | Battery low alarm coil | When the battery voltage is less than 2.5V, SM5 will put ON (at this time, please replace the battery as soon as possible, otherwise the data will not be maintained) | |
| SM007 | Power-off memory data error | | |

**Clock（SM11-SM14）**

| ID | Function | Description |
|---|---|---|
| SM011 | 10ms frequency cycle |  |
| SM012 | 100ms frequency cycle |  |
| SM013 | 1s frequency cycle |  |
| SM014 | 1min frequency cycle |  |

**Mark（SM20-SM22）**

| **ID** | **Function** | **Description** |
|---|---|---|
| SM020 | Zero bit | SM020 is ON when plus/minus operation result is 0 |
| SM021 | Borrow bit | SM021 is ON when minus operation overflows |
| SM022 | Carry bit | SM022 is ON when plus operation overflows |

**PC Mode（SM32-SM34）**

| **ID** | **Function** | **Description** |
|---|---|---|
| SM032 | Retentive register reset | When SM032 is ON, ON/OFF mapping memory of HM, HS and current values of HT, HC, HD will be reset. |
| SM033 | Clear user's program | When SM033 is ON, all PLC user's program will be cleared. |
| SM034 | All output forbidden | When SM034 is ON, all PLC external contacts will be set |

| | | |
|---|---|---|
| | | OFF. |

## Stepping Ladder

| ID | Function | Description |
|---|---|---|
| SM040 | The process is running | Set ON when the process is running |

## Interruption ban（SM50-SM90）

| ID | Address | Function | Description |
|---|---|---|---|
| SM050 | I0000/I0001 | Forbid input interruption 0 | After executing EI instruction, the input interruption couldn't act independently when M acts, even if the interruption is allowed. E.g.： when SM050 is ON, I0000/I0001 is forbidden. |
| SM051 | I0100/I0101 | Forbid input interruption 1 | |
| SM052 | I0200/I0201 | Forbid input interruption 2 | |
| SM053 | I0300/I0301 | Forbid input interruption 3 | |
| SM054 | I0400/I0401 | Forbid input interruption 4 | |
| …… | …… | …… | |
| SM069 | I1900/I1901 | Forbid input interruption 19 | |
| SM070 | I40** | Forbid timing interruption 0 | After executing EI instruction, the timing interruption couldn't act independently when M acts, even if the interruption is allowed. |
| SM071 | I41** | Forbid timing interruption 1 | |
| SM072 | I42** | Forbid timing interruption 2 | |
| SM073 | I43** | Forbid timing interruption 3 | |
| SM074 | I44** | Forbid timing interruption 4 | |
| …… | …… | …… | |
| SM089 | I59** | Forbid timing interruption 19 | |
| SM090 | | Forbid all interruptions | Forbid all interruptions |

## High Speed Ring Counter（SM99）

| address | Function | Note |
|---|---|---|
| SM099 | High Speed Ring Counting enable | SM99 set ON，SD99 add one per 0.1ms, cycle between 0 and 32767 |

**High speed count complete（SM100-SM109）**

| Address | Function | Note |
|---|---|---|
| SM100 | HSC0 count complete flag（100 segments） | |
| SM101 | HSC2 count complete flag（100 segments） | |
| SM102 | HSC4 count complete flag（100 segments） | |
| SM103 | HSC6 count complete flag（100 segments） | |
| SM104 | HSC8 count complete flag（100 segments） | |
| SM105 | HSC10 count complete flag（100 segments） | |
| SM106 | HSC12 count complete flag（100 segments） | |
| SM107 | HSC14 count complete flag（100 segments） | |
| SM108 | HSC16 count complete flag（100 segments） | |
| SM109 | HSC18 count complete flag（100 segments） | |

**High speed counter direction（SM110-SM119）**

| Address | Function | Note |
|---|---|---|
| SM110 | HSC0 direction flag | |
| SM111 | HSC2 direction flag | |
| SM112 | HSC4 direction flag | |
| SM113 | HSC6 direction flag | |
| SM114 | HSC8 direction flag | |
| SM115 | HSC10 direction flag | |
| SM116 | HSC12 direction flag | |
| SM117 | HSC14 direction flag | |
| SM118 | HSC16 direction flag | |
| SM119 | HSC18 direction flag | |

**High speed counter error（SM120-SM129）**

| address | Function | Note |
|---|---|---|
| SM120 | HSC0 error flag | |
| SM121 | HSC2 error flag | |
| SM122 | HSC4 error flag | |
| SM123 | HSC6 error flag | |
| SM124 | HSC8 error flag | |
| SM125 | HSC10 error flag | |
| SM126 | HSC12 error flag | |
| SM127 | HSC14 error flag | |
| SM128 | HSC16 error flag | |
| SM129 | HSC18 error flag | |

**Communication（SM140-SM193）**

| | Address | Function | Note |
|---|---|---|---|
| Serial port 0 | SM140 | Modbus instruction execution flag | When the instruction starts to execute, set ON<br>When execution is complete, set OFF |
| | SM141 | X-NET instruction execution flag | When the instruction starts to execute, set ON<br>When execution is complete, set OFF |
| | SM142 | Free format communication sending flag | When the instruction starts to execute, set ON<br>When execution is complete, set OFF |
| | SM143 | Free format communication receive complete flag | When receiving a frame of data or receiving data timeout, set ON.<br>Require user program to set OFF |
| Serial port 1 | SM150 | Modbus instruction execution flag | Same to SM140 |
| | SM151 | X-NET instruction execution flag | Same to SM141 |
| | SM152 | Free format communication sending flag | Same to SM142 |
| | SM153 | Free format communication receive complete flag | Same to SM143 |
| Serial port 2 | SM160 | Modbus instruction execution flag | Same to SM140 |
| | SM161 | X-NET instruction execution flag | Same to SM141 |
| | SM162 | Free format communication sending flag | Same to SM142 |
| | SM163 | Free format communication receive complete flag | Same to SM143 |
| Serial port 3 | SM170 | Modbus instruction execution flag | Same to SM140 |
| | SM171 | X-NET instruction execution flag | Same to SM141 |
| | SM172 | Free format communication sending flag | Same to SM142 |
| | SM173 | Free format communication receive complete flag | Same to SM143 |
| Serial port 4 | SM180 | Modbus instruction execution flag | Same to SM140 |
| | SM181 | X-NET instruction execution flag | Same to SM141 |
| | SM182 | Free format communication sending flag | Same to SM142 |
| | SM183 | Free format communication receive complete flag | Same to SM143 |
| Serial | SM190 | Modbus instruction execution flag | Same to SM140 |

| | | | |
|---|---|---|---|
| port 5 | SM191 | X-NET instruction execution flag | Same to SM141 |
| | SM192 | Free format communication sending flag | Same to SM142 |
| | SM193 | Free format communication receive complete flag | Same to SM143 |

**Sequence Function BLOCK（SM240-SM349）**

| ID | Function | Description |
|---|---|---|
| SM300 | BLOCK1 running flag | SM300 will be ON when block1 is running |
| SM301 | BLOCK2 running flag | SM301 will be ON when block2 is running |
| SM302 | BLOCK3 running flag | SM302 will be ON when block3 is running |
| SM303 | BLOCK4 running flag | SM303 will be ON when block4 is running |
| SM304 | BLOCK5 running flag | SM304 will be ON when block5 is running |
| SM305 | BLOCK6 running flag | SM305 will be ON when block6 is running |
| …… | …… | |
| SM346 | BLOCK47 running flag | SM346 will be ON when block47is running |
| SM347 | BLOCK48 running flag | SM347 will be ON when block48 is running |
| SM348 | BLOCK49 running flag | SM348 will be ON when block49 is running |
| SM349 | BLOCK50 running flag | SM349 will be ON when block50 is running |

**Error check（SM400-SM413）**

| ID | Function | Description |
|---|---|---|
| SM400 | I/O error | ERR LED keeps ON, PLC don not run and output, check when power on |
| SM401 | Expansion module communication error | |
| SM402 | BD communication error | |
| …… | | |
| SM405 | No user program | Internal code check wrong |
| SM406 | User program error | Implement code or configuration table check wrong |
| SM407 | SSFD check error | ERR LED keeps ON, PLC don not run and output, check when power on |
| SM408 | Memory error | Can not erase or write Flash |
| SM409 | Calculation error | |
| SM410 | Offset overflow | Offset exceeds soft element range |
| SM411 | FOR-NEXT | Reset when power on or users can also reset by hand. |

| | | |
|---|---|---|
| | overflow | |
| SM412 | Invalid data fill | When offset of register overflows, the return value will be SM372 value |

**Error Message（SM450-SM452）**

| ID | Function | Description |
|---|---|---|
| SM450 | System error check | |
| SM451 | Hardfault interrupt flag | |
| SM452 | | |
| SM453 | SD card error | |
| SM454 | Power supply is cut off | |
| …… | | |
| SM460 | Extension module ID not match | |
| SM461 | BD/ED module ID not match | |
| SM462 | Extension module communication overtime | |
| SM463 | BD/ED module communication overtime | |

**Expansion Modules, BD Status（SM500）**

| ID | Function | Description |
|---|---|---|
| SM500 | Module status read is finished | |

**High speed pulse（SM1000-SM1190）**

| ID | Function | Explanation | Output point |
|---|---|---|---|
| SM1000 | Pulse sending flag | ON: Pulse is sending | Y0 |
| SM1001 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1002 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1003 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1004 | | | |
| SM1005 | | | |
| SM1006 | | | |
| SM1007 | | | |
| SM1008 | | | |
| SM1009 | | | |

| | | | |
|---|---|---|---|
| SM1010 | Pulse error flag | ON: error | |
| SM1020 | Pulse sending flag | ON: Pulse is sending | Y1 |
| SM1021 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1022 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1023 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1024 | | | |
| SM1025 | | | |
| SM1026 | | | |
| SM1027 | | | |
| SM1028 | | | |
| SM1029 | | | |
| SM1030 | Pulse error flag | ON: error | |
| SM1040 | Pulse sending flag | ON: Pulse is sending | Y2 |
| SM1041 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1042 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1043 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1044 | | | |
| SM1045 | | | |
| SM1046 | | | |
| SM1047 | | | |
| SM1048 | | | |
| SM1049 | | | |
| SM1050 | Pulse error flag | ON: error | |
| SM1060 | Pulse sending flag | ON: Pulse is sending | Y3 |
| SM1061 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1062 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1063 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1064 | | | |
| SM1065 | | | |
| SM1066 | | | |
| SM1067 | | | |
| SM1068 | | | |
| SM1069 | | | |
| SM1070 | Pulse error flag | ON: error | |

| | | | |
|---|---|---|---|
| SM1080 | Pulse sending flag | ON: Pulse is sending | Y4 |
| SM1081 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1082 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1083 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1084 | | | |
| SM1085 | | | |
| SM1086 | | | |
| SM1087 | | | |
| SM1088 | | | |
| SM1089 | | | |
| SM1090 | Pulse error flag | ON: error | |
| SM1100 | Pulse sending flag | ON: Pulse is sending | Y5 |
| SM1101 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1102 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1103 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1104 | | | |
| SM1105 | | | |
| SM1106 | | | |
| SM1107 | | | |
| SM1108 | | | |
| SM1109 | | | |
| M1110 | Pulse error flag | ON: error | |
| SM1120 | Pulse sending flag | ON: Pulse is sending | Y6 |
| SM1121 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1122 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1123 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1124 | | | |
| SM1125 | | | |
| SM1126 | | | |
| SM1127 | | | |
| SM1128 | | | |
| SM1129 | | | |
| SM1130 | Pulse error flag | ON: error | |
| SM1140 | Pulse sending flag | ON: Pulse is sending | Y7 |

| | | | |
|---|---|---|---|
| SM1141 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1142 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1143 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1144 | | | |
| SM1145 | | | |
| SM1146 | | | |
| SM1147 | | | |
| SM1148 | | | |
| SM1149 | | | |
| SM1150 | Pulse error flag | ON: error | |
| SM1160 | Pulse sending flag | ON: Pulse is sending | Y10 |
| SM1161 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1162 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1163 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1164 | | | |
| SM1165 | | | |
| SM1166 | | | |
| SM1167 | | | |
| SM1168 | | | |
| SM1169 | | | |
| SM1170 | Pulse error flag | ON: error | |
| SM1180 | Pulse sending flag | ON: Pulse is sending | Y11 |
| SM1181 | Direction flag | 1 is positive direction, related direction signal is ON | |
| SM1182 | Accumulated pulse number overflow flag | 1 is overflow | |
| SM1183 | Accumulated pulse equivalent overflow flag | 1 is overflow | |
| SM1184 | | | |
| SM1185 | | | |
| SM1186 | | | |
| SM1187 | | | |
| SM1188 | | | |
| SM1189 | | | |
| SM1190 | Pulse error flag | ON: error | |

# Appendix 2. Special data reigster list

**Battery （SD5~SD7）**

| ID | Function | Description |
|---|---|---|
| SD005 | Battery register | It will display 100 when the battery voltage is 3V, if the battery voltaeg is lower than 2.5V, it will display 0, it means please change new battery at once, otherwise the data will lose when PLC power off. |
| SD007 | Power-off memory data error type | |

**Clock（SD10-SD019）**

| ID | Function | Description |
|---|---|---|
| SD010 | Current scan cycle | 100us，us is the unit |
| SD011 | Min scan time | 100us，us is the unit |
| SD012 | Max scan time | 100us，us is the unit |
| SD013 | Second (clock) | 0~59 (BCD code) |
| SD014 | Minute (clock) | 0~59 (BCD code) |
| SD015 | Hour (clock) | 0~23 (BCD code) |
| SD016 | Day (clock) | 0~31 (BCD code) |
| SD017 | Month (clock) | 0~12 (BCD code) |
| SD018 | Year (clock) | 2000~2099 (BCD code) |
| SD019 | Week (clock) | 0(Sunday)~6(Saturday)(BCD code) |

**Flag （SD020-SD031）**

| ID | Function | Note |
|---|---|---|
| SD020 | Model type | |
| SD021 | model（low-8）series（high-8） | |
| SD022 | Compatiable system version（low）system version（high） | |
| SD023 | Compatiable model version（low）model version（high） | |
| SD024 | Model info | |
| SD025 | Model info | |
| SD026 | Model info | |
| SD027 | Model info | |
| SD028 | Suitable software version | |
| SD029 | Suitable software version | |
| SD030 | Suitable software version | |
| SD031 | Suitable software version | |

**Step ladder（SD040）**

| ID | Function | Description |
|---|---|---|
| SD40 | Flag of the executing process S | |

**High Speed Counting（SD100-SD109）**

| ID | Function | Description | |
|---|---|---|---|
| SD100 | Current segment (No. n segment) | | HSC00 |
| SD101 | Current segment (No. n segment) | | HSC02 |
| SD102 | Current segment (No. n segment) | | HSC04 |
| SD103 | Current segment (No. n segment) | | HSC06 |
| SD104 | Current segment (No. n segment) | | HSC08 |
| SD105 | Current segment (No. n segment) | | HSC10 |
| SD106 | Current segment (No. n segment) | | HSC12 |
| SD107 | Current segment (No. n segment ) | | HSC14 |
| SD108 | Current segment (No. n segment) | | HSC16 |
| SD109 | Current segment (No. n segment) | | HSC18 |

**High speed counter error（SD120-SD129）**

| ID | Function | Note |
|---|---|---|
| SD120 | HSC0 error info | |
| SD121 | HSC2 error info | |
| SD122 | HSC4 error info | |
| SD123 | HSC6 error info | |
| SD124 | HSC8 error info | |
| SD125 | HSC10 error info | |
| SD126 | HSC12 error info | |
| SD127 | HSC14 error info | |
| SD128 | HSC16 error info | |
| SD129 | HSC18 error info | |

**communication（SD140~SD199）**

| | ID | Function | Note |
|---|---|---|---|
| | SD140 | Modbus read write instruction execution result | 0: correct<br>100: receive error<br>101: receive overtime |

| | | | |
|---|---|---|---|
| Serial port 0 | | | 180: CRC error<br>181: LRC error<br>182: station error<br>183: send buffer overflow<br>400: function code error<br>401: address error<br>402: length error<br>403: data error<br>404: slave station busy<br>405: memory error（erase FLASH） |
| | SD141 | X-Net communication result | 0: correct<br>1: communication overtime<br>2: memory error<br>3: receive CRC error |
| | SD142 | Free format communication send result | 0: correct<br>410: free format send buffer overflow |
| | SD143 | Free format communication receive result | 0: correct<br>410: send data length overflow<br>411: receive data short<br>412: receive data long<br>413: receive error<br>414: receive overtime<br>415: no start character<br>416: no end character |
| | SD144 | Free format communication receive data numbers | In bytes, there are no start and stop characters |
| | …… | | |
| | SD149 | | |
| Serial port 1 | SD150 | Modbus read write instruction execution result | 0: correct<br>100: receive error<br>101: receive overtime<br>180: CRC error<br>181: LRC error<br>182: station error<br>183: send buffer overflow<br>400: function code error<br>401: address error<br>402: length error<br>403: data error<br>404: slave station busy<br>405: memory error（erase FLASH） |
| | SD151 | X-Net communication result | 0: correct<br>1: communication overtime<br>2: memory error |

| | | | |
|---|---|---|---|
| | | | 3: receive CRC error |
| | SD152 | Free format communication send result | 0: correct<br>410: free format send buffer overflow |
| | SD153 | Free format communication receive result | 0: correct<br>410: send data length overflow<br>411: receive data short<br>412: receive data long<br>413: receive error<br>414: receive overtime<br>415: no start character<br>416: no end character |
| | SD154 | Free format communication receive data numbers | In bytes, there are no start and stop characters |
| | …… | | |
| | SD159 | | |
| Serial port 2 | SD160 | Modbus read write instruction execution result | 0: correct<br>100: receive error<br>101: receive overtime<br>180: CRC error<br>181: LRC error<br>182: station error<br>183: send buffer overflow<br>400: function code error<br>401: address error<br>402: length error<br>403: data error<br>404: slave station busy<br>405: memory error（erase FLASH） |
| | SD161 | X-Net communication result | 0: correct<br>1: communication overtime<br>2: memory error<br>3: receive CRC error |
| | SD162 | Free format communication send result | 0: correct<br>410: free format send buffer overflow |
| | SD163 | Free format communication receive result | 0: correct<br>410: send data length overflow<br>411: receive data short<br>412: receive data long<br>413: receive error<br>414: receive overtime<br>415: no start character<br>416: no end character |
| | SD164 | Free format communication receive data numbers | In bytes, there are no start and stop characters |

| | | | |
|---|---|---|---|
| | …… | | |
| | SD169 | | |
| Serial port 3 | SD170~SD179 | | |
| Serial port 4 | SD180~SD189 | | |
| Serial port 5 | SD190~SD199 | | |

**Sequence Function Block（SD300-SD399）**

| ID | Function | Description |
|---|---|---|
| SD300 | Executing instruction of BLOCK1 | The value will be used when BLOCK monitors |
| SD301 | Executing instruction of BLOCK2 | The value will be used when BLOCK monitors |
| SD302 | Executing instruction of BLOCK3 | The value will be used when BLOCK monitors |
| SD303 | Executing instruction of BLOCK4 | The value will be used when BLOCK monitors |
| SD304 | Executing instruction of BLOCK5 | The value will be used when BLOCK monitors |
| SD305 | Executing instruction of BLOCK6 | The value will be used when BLOCK monitors |
| …… | …… | …… |
| SD396 | Executing instruction of BLOCK97 | The value will be used when BLOCK monitors |
| SD397 | Executing instruction of BLOCK98 | The value will be used when BLOCK monitors |
| SD398 | Executing instruction of BLOCK99 | The value will be used when BLOCK monitors |
| SD399 | Executing instruction of BLOCK100 | The value will be used when BLOCK monitors |

**Error Check（SD400-SD413）**

| ID | Function | Note |
|---|---|---|
| SD400 | | |
| SD401 | Extension module no. of communication error | Means module no.n is error |
| SD402 | BD/ED module no. of communication error | |
| SD403 | FROM/TO error type | |
| SD404 | PID error type | |
| …… | | |
| SD409 | Calculation error code | 1: divide by 0 error<br>2: MRST, MSET front operand address less than back operand |

| | | |
|---|---|---|
| | | 3: ENCO, DECO data bits of encoding and decoding instructions exceed the limit.<br>4: BDC code error<br>7: Radical sign error |
| SD410 | The number of offset register D when offset crosses the boundary | |
| SD411 | | |
| SD412 | Invalid data fill value (low 16 bits) | |
| SD413 | Invalid data fill value (high 16 bits) | |

**Error Check（SD450-SD452）**

| ID | Function | Description |
|---|---|---|
| SD450 | 1：Watchdog act (Default 200ms)<br>2：Control block application fail<br>3：Visit illegal address | |
| SD451 | Hardware error type:<br>1：Register error<br>2：Bus error<br>3：Usage error | |
| SD452 | Hardware error | |
| SD453 | SD card error | |
| SD454 | Power-off time | |
| SD460 | Extension module ID not match | |
| SD461 | BD/ED module ID not match | |
| SD462 | Extension module communication overtime | |
| SD463 | BD/ED module communication overtime | |

**Expansion Modules, BD Status（SD500-SD516）**

| ID | Function | Description | |
|---|---|---|---|
| SD500 | Module number<br>Expansion modules：#10000～10015<br>BD：#20000～20001<br>ED: #30000 | | |
| SD501~516 | Expansion module, BD /ED status | | 16 registers |

**Module info（SD520-SD823）**

| ID | Function | Explanation | Note |
|---|---|---|---|
| SD520~SD535 | Extension module info | Extension module 1 | Each extension module, BD, ED occupies 16 registers |
| …… | …… | …… | |
| SD760~SD775 | Extension module info | Extension module 16 | |
| SD776~SD791 | BD module info | BD module 1 | |
| SD792~SD807 | BD module info | BD module 2 | |
| SD808~SD823 | ED module info | ED module 1 | |

**Expansion Module Error Information**

| ID | Function | Description | |
|---|---|---|---|
| SD860 | Error times of module read | | Expansion module 1 |
| SD861 | Error types of module read | Module address error.<br>Module accepted data length error.<br>Module CRC parity error when PLC is accepting data.<br>Module ID error.<br>Module overtime error. | |
| SD862 | Error times of module write | | |
| SD863 | Error types of module write | | |
| SD864 | Error times of module read | | Expansion module 2 |
| SD865 | Error types of module read | Module address error.<br>Module accepted data length error.<br>Module CRC parity error when PLC is accepting data.<br>Module ID error.<br>Module overtime error. | |
| SD866 | Error times of module write | | |
| SD867 | Error types of module write | | |
| …… | | | |
| SD920 | Error times of module read | | Expansion module 16 |
| SD921 | Error types of module read | Module address error.<br>Module accepted data length error.<br>Module CRC parity error when PLC is accepting data.<br>Module ID error.<br>Module overtime error. | |
| SD922 | Error times of module write | | |

| | | | |
|---|---|---|---|
| SD923 | Error types of module write | | |
| SD924 | Error times of module read | | BD module 1 |
| SD925 | Error types of module read | | |
| SD926 | Error times of module write | | |
| SD927 | Error types of module write | | |
| SD928 | Error times of module read | | BD module 2 |
| SD929 | Error types of module read | | |
| SD930 | Error times of module write | | |
| SD931 | Error types of module write | | |
| SD932 | Error times of module read | | ED module 1 |
| SD933 | Error types of module read | | |
| SD934 | Error times of module write | | |
| SD935 | Error types of module write | | |

**Version info（SD990~SD993）**

| ID | Function | Explanation | Note |
|---|---|---|---|
| SD990 | Firmware version date | Low 16-bit | |
| SD991 | Firmware version compilation date | High 16-bit | |
| SD992 | FPGA version compilation date | Low 16-bit | |
| SD993 | FPGA version compilation date | High 16-bit | |

**High speed pulse（SD1000-SD1099）**

| ID | Function | Explanation | Output point |
|---|---|---|---|
| SD1000 | Present segment (segment n) | | Y0 |
| SD1001 | | | |
| SD1002 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1003 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1004 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1005 | Present pulse number high | (the unit is pulse equivalent) | |

| | | | |
|---|---|---|---|
| | 16-bit | | |
| SD1006 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1007 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1008 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1009 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1010 | Pulse error information | 1: pulse data segment configuration error<br>2: In equivalent mode, the number of pulses per turn and the movement per 1 turn is 0.<br>3: System parameter block number error<br>4: Pulse parameter block number exceeding maximum limit<br>5: Stop after encountering positive limit signal<br>6: Stop after meeting the negative limit signal<br>10: No origin signal is set for origin regression<br>11:Velocity of origin regression VH is 0<br>12: Origin regression crawling speed VC is 0 or VC ⩾ VH)<br>13: Origin regression signal error<br>15:Follow Performance Parameters ⩽ 0 or >100<br>16:Follow Feedforward Compensation < 0 or >100<br>17:Follow Multiplication Coefficient and Division Coefficient Ratio ⩽ 0 or >100<br>20: Interpolation Direction Terminal Not Set or Set Error<br>21: The default maximum interpolation speed is 0<br>22: Arc interpolation data error<br>23: Arc radius data error<br>24:Three-point Arc Data Error<br>25: In polar coordinate mode, the current position is (0, 0)<br>26: Control block allocation failed | |
| SD1011 | error pulse data block number | | |
| | | | |
| SD1020 | Present segment<br>(segment n) | | Y1 |
| SD1021 | | | |
| SD1022 | Present pulse number low 16-bit | (the unit is pulse number) | |

| | | | |
|---|---|---|---|
| SD1023 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1024 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1025 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1026 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1027 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1028 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1029 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1030 | Pulse error information | Same to SD1010 | |
| SD1031 | error pulse data block number | | |
| | | | |
| SD1040 | Present segment (segment n) | | Y2 |
| SD1041 | | | |
| SD1042 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1043 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1044 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1045 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1046 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1047 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1048 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1049 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1050 | Pulse error information | Same to SD1010 | |
| SD1051 | error pulse data block number | | |
| | | | |
| SD1060 | Present segment | | Y3 |

| | | | |
|---|---|---|---|
| | (segment n) | | |
| SD1061 | | | |
| SD1062 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1063 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1064 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1065 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1066 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1067 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1068 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1069 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1070 | Pulse error information | Same to SD1010 | |
| SD1071 | error pulse data block number | | |
| | | | |
| SD1080 | Present segment (segment n) | | Y4 |
| | | | |
| SD1082 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1083 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1084 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1085 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1086 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1087 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1088 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1089 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1090 | Pulse error information | Same to SD1010 | |

| | | | |
|---|---|---|---|
| SD1091 | error pulse data block number | | |
| | | | |
| SD1100 | Present segment (segment n) | | |
| | | | |
| SD1102 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1103 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1104 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1105 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1106 | Present output frequency low 16-bit | (the unit is pulse number) | Y5 |
| SD1107 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1108 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1109 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1110 | Pulse error information | Same to SD1010 | |
| SD1111 | error pulse data block number | | |
| | | | |
| SD1120 | Present segment (segment n) | | |
| | | | |
| SD1122 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1123 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1124 | Present pulse number low 16-bit | (the unit is pulse equivalent) | Y6 |
| SD1125 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1126 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1127 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1128 | Present output frequency | (the unit is pulse equivalent) | |

| | | | |
|---|---|---|---|
| | low 16-bit | | |
| SD1129 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1130 | Pulse error information | Same to SD1010 | |
| SD1131 | error pulse data block number | | |
| | | | |
| SD1140 | Present segment (segment n) | | Y7 |
| | | | |
| SD1142 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1143 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1144 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1145 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1146 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1147 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1148 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1149 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1150 | Pulse error information | Same to SD1010 | |
| SD1151 | error pulse data block number | | |
| | | | |
| SD1160 | Present segment (segment n) | | Y10 |
| | | | |
| SD1162 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1163 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1164 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1165 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1166 | Present output frequency | (the unit is pulse number) | |

| | | | |
|---|---|---|---|
| | low 16-bit | | |
| SD1167 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1168 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1169 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1170 | Pulse error information | Same to SD1010 | |
| SD1171 | error pulse data block number | | |
| | | | |
| SD1180 | Present segment (segment n) | | Y11 |
| | | | |
| SD1182 | Present pulse number low 16-bit | (the unit is pulse number) | |
| SD1183 | Present pulse number high 16-bit | (the unit is pulse number) | |
| SD1184 | Present pulse number low 16-bit | (the unit is pulse equivalent) | |
| SD1185 | Present pulse number high 16-bit | (the unit is pulse equivalent) | |
| SD1186 | Present output frequency low 16-bit | (the unit is pulse number) | |
| SD1187 | Present output frequency high 16-bit | (the unit is pulse number) | |
| SD1188 | Present output frequency low 16-bit | (the unit is pulse equivalent) | |
| SD1189 | Present output frequency high 16-bit | (the unit is pulse equivalent) | |
| SD1190 | Pulse error information | Same to SD1010 | |
| SD1191 | error pulse data block number | | |
| | | | |

## Special data register HSD (power-off retentive)

High speed pulse

| ID | Function | Explanation | Output point |
|---|---|---|---|
| HSD0 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y0 |
| HSD1 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD2 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD3 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD4 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y1 |
| HSD5 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD6 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD7 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD8 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y2 |
| HSD9 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD10 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD11 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD12 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y3 |
| HSD13 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD14 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD15 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD16 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y4 |
| HSD17 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD18 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |

| | | | |
|---|---|---|---|
| HSD19 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD20 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y5 |
| HSD21 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD22 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD23 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD24 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y6 |
| HSD25 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD26 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD27 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD28 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y7 |
| HSD29 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD30 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD31 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD32 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y10 |
| HSD33 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD34 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD35 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |
| HSD36 | Accumulated pulse number low 16-bit (the unit is pulse number) | | Y11 |
| HSD37 | Accumulated pulse number high 16-bit (the unit is pulse number) | | |
| HSD38 | Accumulated pulse number low 16-bit (the unit is pulse equivalent) | | |
| HSD39 | Accumulated pulse number high 16-bit (the unit is pulse equivalent) | | |

# Appendix 3. Special FLASH register list

## Special FLASH data register SFD

*** means it works only after repower on the PLC**

**I filtering**

| ID | Function | Description |
|---|---|---|
| SFD0* | Input filter time | |
| SFD2* | Watchdog run-up time, default value is 200ms | |

**I Mapping**

| ID | Function | Description | |
|---|---|---|---|
| SFD10* | I00 corresponds to X** | Input terminal 0 corresponds to X** number | 0xFF means terminal bad，0xFE means terminal idle |
| SFD11* | I01 corresponds to X** | | |
| SFD12* | I02 corresponds to X** | | |
| …… | …… | | |
| SFD73* | I77 corresponds to X** | Default value is 77（Octonary） | |

**O Mapping**

| ID | Function | Description | |
|---|---|---|---|
| SFD74* | O00 corresponds to Y** | Output terminal 0 correspond to Y** number | 0xFF means terminal bad，0xFE means terminal idle |
| | | Default value is 0 | |
| …… | …… | | |
| SFD134* | O77 corresponds to Y** | Default value is 77（Octonary） | |

**I Attribute**

| ID | Function | Description | |
|---|---|---|---|
| SFD138* | I00 attribute | Attribute of input terminal 0 | 0： positive logic<br>others：negative logic |
| SFD139* | I01 attribute | | |
| …… | …… | | |
| SFD201* | I77 attribute | | |

**High Speed Counting**

| ID | Function | Description |
|---|---|---|
| SFD320 | HSC0 frequency times | 2：2 times frequency; 4: 4 times frequency(effective at AB phase counting mode) |
| SFD321 | HSC2 frequency times | Ditto |
| SFD322 | HSC4 frequency times | Ditto |
| SFD323 | HSC6 frequency times | Ditto |
| SFD324 | HSC8 frequency times | Ditto |
| SFD325 | HSC10 frequency times | Ditto |
| SFD326 | HSC12 frequency times | Ditto |
| SFD327 | HSC14 frequency times | Ditto |
| SFD328 | HSC16 frequency times | Ditto |
| SFD329 | HSC18 frequency times | Ditto |
| SFD330 | Bit selection of HSC absolute and relative（24 segment） | bit0 corresponds to HSC0， bit1corresponds to HSC2，and so on, bit9 corresponds to HSC18<br>0：relative<br>1：absolute |
| SFD331 | Interrupt circulating of 24 segments high speed counting | bit0 corresponds to HSC0， bit1corresponds to HSC2，and so on, bit9 corresponds to HSC18<br>0：single<br>1：loop |
| SFD332 | CAM function | bit0 corresponds to HSC0， bit1corresponds to HSC2，and so on, bit9 corresponds to HSC18<br>0：do not support CAM function<br>1：support CAM function |

**Expansion Module Configuration**

| ID | Function | Explanation |
|---|---|---|
| SFD340 | Extension module configuration status（#1#2） | Configuration Status of Extension Modules 1 and 2 |
| SFD341 | Extension module configuration status（#3#4） | Configuration Status of Extension Modules 3 and 4 |
| …… | …… | …… |
| SFD347 | Extension module configuration status（#15#16） | Configuration Status of Extension Modules 15 and 16 |
| SFD348 | BD module configuration status（#1#2） | Configuration Status of BD Modules 1 and 2 |
| SFD349 | ED module configuration status（#1） | Configuration Status of ED Module 1 |
| SFD350 | Extension module configuration | Configuration of Extension Module 1 |
| : | | |
| SFD359 | | |
| SFD360 | Extension module configuration | Configuration of Extension Module 2 |
| : | | |

| | | |
|---|---|---|
| SFD369 | | |
| : | : | |
| SFD500<br>:<br>SFD509 | Extension module configuration | Configuration of Extension Module 16 |
| SFD510<br>:<br>SFD519 | BD module configuration | Configuration of BD Module 1 |
| SFD520<br>:<br>SFD529 | BD module configuration | Configuration of BD Module 2 |
| SFD530<br>:<br>SFD539 | ED module configuration | Configuration of ED Module 1 |

**Communication**

| ID | Function | Note |
|---|---|---|
| SFD600 | COM1 free format communication buffer bit numbers | 0: 8-bit 1: 16-bit |
| SFD610 | COM2 free format communication buffer bit numbers | 0: 8-bit 1: 16-bit |
| SFD620 | COM3 free format communication buffer bit numbers | 0: 8-bit 1: 16-bit |
| SFD630 | COM4 free format communication buffer bit numbers | 0: 8-bit 1: 16-bit |
| SFD640 | COM5 free format communication buffer bit numbers | 0: 8-bit 1: 16-bit |

**Motion control**

| ID | function | Explanation |
|---|---|---|
| **Y0 (common parameters)** | | |
| SFD900 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD901 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD902 | Pulse number/1 rotation low 16-bit | |
| SFD903 | Pulse number/1 rotation high 16-bit | |
| SFD904 | Moving amount/1 rotation low 16-bit | |
| SFD905 | Moving amount/1 rotation high 16-bit | |
| SFD906 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD907 | Direction delay time | Default is 20, unit: ms |
| SFD908 | Gear clearance positive compensation | |
| SFD909 | Gear clearance negative compensation | |
| SFD910 | Electrical origin position low 16-bit | |
| SFD911 | Electrical origin position high 16-bit | |
| SFD912 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD913 | Near-point signal terminal setting | |

| | | |
|---|---|---|
| SFD914 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |
| SFD915 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD917 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD918 | Return speed VH low 16-bit | |
| SFD919 | Return speed VH high 16-bit | |
| SFD922 | Creeping speed VC low 16-bit | |
| SFD923 | Creeping speed VC high 16-bit | |
| SFD924 | Mechanical origin position low 16-bit | |
| SFD925 | Mechanical origin position high 16-bit | |
| SFD926 | Z phase number | |
| SFD927 | CLR signal delay time | Default is 20, unit: ms |
| SFD928 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD929 | | High 16-bit |
| SFD930 | Soft limit positive value | Low 16-bit |
| SFD931 | | High 16-bit |
| SFD932 | Soft limit negative value | Low 16-bit |
| SFD933 | | High 16-bit |
| … | | |
| **Y0 (group 1 parameters)** | | |
| SFD950 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD951 | Pulse default speed high 16-bit | |
| SFD952 | Acceleration time of pulse default speed | |
| SFD953 | deceleration time of pulse default speed | |
| SFD954 | Accerlation and deceleration time | |
| SFD955 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD956 | Max speed low 16-bit | |
| SFD957 | Max speed high 16-bit | |
| SFD958 | Initial speed low 16-bit | |
| SFD959 | Initial speed high 16-bit | |

| | | |
|---|---|---|
| SFD960 | Stop speed low 16-bit | |
| SFD961 | Stop speed high 16-bit | |
| SFD962 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD963 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y0 (group 2 parameters)** | | |
| SFD970 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD971 | Pulse default speed high 16-bit | |
| SFD972 | Acceleration time of pulse default speed | |
| SFD973 | deceleration time of pulse default speed | |
| SFD974 | Accerlation and deceleration time | |
| SFD975 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD976 | Max speed low 16-bit | |
| SFD977 | Max speed high 16-bit | |
| SFD978 | Initial speed low 16-bit | |
| SFD979 | Initial speed high 16-bit | |
| SFD980 | Stop speed low 16-bit | |
| SFD981 | Stop speed high 16-bit | |
| SFD982 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD983 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y0 (group 3 parameters)** | | |
| SFD990 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD991 | Pulse default speed high 16-bit | |
| SFD992 | Acceleration time of pulse default speed | |
| SFD993 | deceleration time of pulse default speed | |
| SFD994 | Accerlation and deceleration time | |

| | | |
|---|---|---|
| SFD995 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD996 | Max speed low 16-bit | |
| SFD997 | Max speed high 16-bit | |
| SFD998 | Initial speed low 16-bit | |
| SFD999 | Initial speed high 16-bit | |
| SFD1000 | Stop speed low 16-bit | |
| SFD1001 | Stop speed high 16-bit | |
| SFD1002 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1003 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y0 (group 4 parameters)** | | |
| SFD1010 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1011 | Pulse default speed high 16-bit | |
| SFD1012 | Acceleration time of pulse default speed | |
| SFD1013 | deceleration time of pulse default speed | |
| SFD1014 | Accerlation and deceleration time | |
| SFD1015 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1016 | Max speed low 16-bit | |
| SFD1017 | Max speed high 16-bit | |
| SFD1018 | Initial speed low 16-bit | |
| SFD1019 | Initial speed high 16-bit | |
| SFD1020 | Stop speed low 16-bit | |
| SFD1021 | Stop speed high 16-bit | |
| SFD1022 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1023 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y1 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1030 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1031 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1032 | Pulse number/1 rotation low 16-bit | |
| SFD1033 | Pulse number/1 rotation high 16-bit | |
| SFD1034 | Moving amount/1 rotation low 16-bit | |
| SFD1035 | Moving amount/1 rotation high 16-bit | |
| SFD1036 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1037 | Direction delay time | Default is 20, unit: ms |
| SFD1038 | Gear clearance positive compensation | |
| SFD1039 | Gear clearance negative compensation | |
| SFD1040 | Electrical origin position low 16-bit | |
| SFD1041 | Electrical origin position high 16-bit | |
| SFD1042 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1044 | Near-point signal terminal setting | |
| SFD1045 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1047 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1048 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1049 | Return speed VH low 16-bit | |
| SFD1052 | Return speed VH high 16-bit | |
| SFD1053 | Creeping speed VC low 16-bit | |
| SFD1054 | Creeping speed VC high 16-bit | |
| SFD1055 | Mechanical origin position low 16-bit | |
| SFD1056 | Mechanical origin position high 16-bit | |
| SFD1057 | Z phase number | |
| SFD1058 | CLR signal delay time | Default is 20, unit: ms |
| SFD1059 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1060 | | High 16-bit |
| SFD1061 | Soft limit positive value | Low 16-bit |
| SFD1062 | | High 16-bit |
| SFD1063 | Soft limit negative value | Low 16-bit |
| … | | |
| **Y1 (group 1 parameters)** | | |
| SFD1080 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1081 | Pulse default speed high 16-bit | |
| SFD1082 | Acceleration time of pulse default speed | |
| SFD1083 | deceleration time of pulse default speed | |
| SFD1084 | Accerlation and deceleration time | |
| SFD1085 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1086 | Max speed low 16-bit | |
| SFD1087 | Max speed high 16-bit | |
| SFD1088 | Initial speed low 16-bit | |
| SFD1089 | Initial speed high 16-bit | |
| SFD1090 | Stop speed low 16-bit | |
| SFD1091 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1092 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1093 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y1 (group 2 parameters)** | | |
| SFD1100 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1101 | Pulse default speed high 16-bit | |
| SFD1102 | Acceleration time of pulse default speed | |
| SFD1103 | deceleration time of pulse default speed | |
| SFD1104 | Accerlation and deceleration time | |
| SFD1105 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1106 | Max speed low 16-bit | |
| SFD1107 | Max speed high 16-bit | |
| SFD1108 | Initial speed low 16-bit | |
| SFD1109 | Initial speed high 16-bit | |
| SFD1110 | Stop speed low 16-bit | |
| SFD1111 | Stop speed high 16-bit | |
| SFD1112 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1113 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y1 (group 3 parameters)** | | |
| SFD1120 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1121 | Pulse default speed high 16-bit | |
| SFD1122 | Acceleration time of pulse default speed | |
| SFD1123 | deceleration time of pulse default speed | |
| SFD1124 | Accerlation and deceleration time | |
| SFD1125 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1126 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1127 | Max speed high 16-bit | |
| SFD1128 | Initial speed low 16-bit | |
| SFD1129 | Initial speed high 16-bit | |
| SFD1130 | Stop speed low 16-bit | |
| SFD1131 | Stop speed high 16-bit | |
| SFD1132 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1133 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y1 (group 4 parameters)** | | |
| SFD1140 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1141 | Pulse default speed high 16-bit | |
| SFD1142 | Acceleration time of pulse default speed | |
| SFD1143 | deceleration time of pulse default speed | |
| SFD1144 | Accerlation and deceleration time | |
| SFD1145 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1146 | Max speed low 16-bit | |
| SFD1147 | Max speed high 16-bit | |
| SFD1148 | Initial speed low 16-bit | |
| SFD1149 | Initial speed high 16-bit | |
| SFD1150 | Stop speed low 16-bit | |
| SFD1151 | Stop speed high 16-bit | |
| SFD1152 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1153 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y2 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1160 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1161 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1162 | Pulse number/1 rotation low 16-bit | |
| SFD1163 | Pulse number/1 rotation high 16-bit | |
| SFD1164 | Moving amount/1 rotation low 16-bit | |
| SFD1165 | Moving amount/1 rotation high 16-bit | |
| SFD1166 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1167 | Direction delay time | Default is 20, unit: ms |
| SFD1168 | Gear clearance positive compensation | |
| SFD1169 | Gear clearance negative compensation | |
| SFD1170 | Electrical origin position low 16-bit | |
| SFD1171 | Electrical origin position high 16-bit | |
| SFD1172 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1174 | Near-point signal terminal setting | |
| SFD1175 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1177 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1178 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1179 | Return speed VH low 16-bit | |
| SFD1182 | Return speed VH high 16-bit | |
| SFD1183 | Creeping speed VC low 16-bit | |
| SFD1184 | Creeping speed VC high 16-bit | |
| SFD1185 | Mechanical origin position low 16-bit | |
| SFD1186 | Mechanical origin position high 16-bit | |
| SFD1187 | Z phase number | |
| SFD1188 | CLR signal delay time | Default is 20, unit: ms |
| SFD1189 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1190 | Soft limit positive value | High 16-bit |
| SFD1191 | | Low 16-bit |
| SFD1192 | Soft limit negative value | High 16-bit |
| SFD1193 | | Low 16-bit |
| … | | |
| **Y2 (group 1 parameters)** | | |
| SFD1210 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1211 | Pulse default speed high 16-bit | |
| SFD1212 | Acceleration time of pulse default speed | |
| SFD1213 | deceleration time of pulse default speed | |
| SFD1214 | Accerlation and deceleration time | |
| SFD1215 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1216 | Max speed low 16-bit | |
| SFD1217 | Max speed high 16-bit | |
| SFD1218 | Initial speed low 16-bit | |
| SFD1219 | Initial speed high 16-bit | |
| SFD1220 | Stop speed low 16-bit | |
| SFD1221 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1222 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1223 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y2 (group 2 parameters)** | | |
| SFD1230 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1231 | Pulse default speed high 16-bit | |
| SFD1232 | Acceleration time of pulse default speed | |
| SFD1233 | deceleration time of pulse default speed | |
| SFD1234 | Accerlation and deceleration time | |
| SFD1235 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1236 | Max speed low 16-bit | |
| SFD1237 | Max speed high 16-bit | |
| SFD1238 | Initial speed low 16-bit | |
| SFD1239 | Initial speed high 16-bit | |
| SFD1240 | Stop speed low 16-bit | |
| SFD1241 | Stop speed high 16-bit | |
| SFD1242 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1243 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y2 (group 3 parameters)** | | |
| SFD1250 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1251 | Pulse default speed high 16-bit | |
| SFD1252 | Acceleration time of pulse default speed | |
| SFD1253 | deceleration time of pulse default speed | |
| SFD1254 | Accerlation and deceleration time | |
| SFD1255 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1256 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1257 | Max speed high 16-bit | |
| SFD1258 | Initial speed low 16-bit | |
| SFD1259 | Initial speed high 16-bit | |
| SFD1260 | Stop speed low 16-bit | |
| SFD1261 | Stop speed high 16-bit | |
| SFD1262 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1263 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y2 (group 4 parameters)** | | |
| SFD1270 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1271 | Pulse default speed high 16-bit | |
| SFD1272 | Acceleration time of pulse default speed | |
| SFD1273 | deceleration time of pulse default speed | |
| SFD1274 | Accerlation and deceleration time | |
| SFD1275 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1276 | Max speed low 16-bit | |
| SFD1277 | Max speed high 16-bit | |
| SFD1278 | Initial speed low 16-bit | |
| SFD1279 | Initial speed high 16-bit | |
| SFD1280 | Stop speed low 16-bit | |
| SFD1281 | Stop speed high 16-bit | |
| SFD1282 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1283 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y3 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1290 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1291 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1292 | Pulse number/1 rotation low 16-bit | |
| SFD1293 | Pulse number/1 rotation high 16-bit | |
| SFD1294 | Moving amount/1 rotation low 16-bit | |
| SFD1295 | Moving amount/1 rotation high 16-bit | |
| SFD1296 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1297 | Direction delay time | Default is 20, unit: ms |
| SFD1298 | Gear clearance positive compensation | |
| SFD1299 | Gear clearance negative compensation | |
| SFD1300 | Electrical origin position low 16-bit | |
| SFD1301 | Electrical origin position high 16-bit | |
| SFD1302 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1304 | Near-point signal terminal setting | |
| SFD1305 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1307 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1308 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1309 | Return speed VH low 16-bit | |
| SFD1312 | Return speed VH high 16-bit | |
| SFD1313 | Creeping speed VC low 16-bit | |
| SFD1314 | Creeping speed VC high 16-bit | |
| SFD1315 | Mechanical origin position low 16-bit | |
| SFD1316 | Mechanical origin position high 16-bit | |
| SFD1317 | Z phase number | |
| SFD1318 | CLR signal delay time | Default is 20, unit: ms |
| SFD1319 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1320 | | High 16-bit |
| SFD1321 | Soft limit positive value | Low 16-bit |
| SFD1322 | | High 16-bit |
| SFD1323 | Soft limit negative value | Low 16-bit |
| … | | |
| **Y3 (group 1 parameters)** | | |
| SFD1340 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1341 | Pulse default speed high 16-bit | |
| SFD1342 | Acceleration time of pulse default speed | |
| SFD1343 | deceleration time of pulse default speed | |
| SFD1344 | Accerlation and deceleration time | |
| SFD1345 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1346 | Max speed low 16-bit | |
| SFD1347 | Max speed high 16-bit | |
| SFD1348 | Initial speed low 16-bit | |
| SFD1349 | Initial speed high 16-bit | |
| SFD1350 | Stop speed low 16-bit | |
| SFD1351 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1352 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1353 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y3 (group 2 parameters)** | | |
| SFD1360 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1361 | Pulse default speed high 16-bit | |
| SFD1362 | Acceleration time of pulse default speed | |
| SFD1363 | deceleration time of pulse default speed | |
| SFD1364 | Accerlation and deceleration time | |
| SFD1365 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1366 | Max speed low 16-bit | |
| SFD1367 | Max speed high 16-bit | |
| SFD1368 | Initial speed low 16-bit | |
| SFD1369 | Initial speed high 16-bit | |
| SFD1370 | Stop speed low 16-bit | |
| SFD1371 | Stop speed high 16-bit | |
| SFD1372 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1373 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y3 (group 3 parameters)** | | |
| SFD1380 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1381 | Pulse default speed high 16-bit | |
| SFD1382 | Acceleration time of pulse default speed | |
| SFD1383 | deceleration time of pulse default speed | |
| SFD1384 | Accerlation and deceleration time | |
| SFD1385 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1386 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1387 | Max speed high 16-bit | |
| SFD1388 | Initial speed low 16-bit | |
| SFD1389 | Initial speed high 16-bit | |
| SFD1390 | Stop speed low 16-bit | |
| SFD1391 | Stop speed high 16-bit | |
| SFD1392 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1393 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y3 (group 4 parameters)** | | |
| SFD1400 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1401 | Pulse default speed high 16-bit | |
| SFD1402 | Acceleration time of pulse default speed | |
| SFD1403 | deceleration time of pulse default speed | |
| SFD1404 | Accerlation and deceleration time | |
| SFD1405 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1406 | Max speed low 16-bit | |
| SFD1407 | Max speed high 16-bit | |
| SFD1408 | Initial speed low 16-bit | |
| SFD1409 | Initial speed high 16-bit | |
| SFD1410 | Stop speed low 16-bit | |
| SFD1411 | Stop speed high 16-bit | |
| SFD1412 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1413 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y4 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1420 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1421 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1422 | Pulse number/1 rotation low 16-bit | |
| SFD1423 | Pulse number/1 rotation high 16-bit | |
| SFD1424 | Moving amount/1 rotation low 16-bit | |
| SFD1425 | Moving amount/1 rotation high 16-bit | |
| SFD1426 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1427 | Direction delay time | Default is 20, unit: ms |
| SFD1428 | Gear clearance positive compensation | |
| SFD1429 | Gear clearance negative compensation | |
| SFD1430 | Electrical origin position low 16-bit | |
| SFD1431 | Electrical origin position high 16-bit | |
| SFD1432 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1434 | Near-point signal terminal setting | |
| SFD1435 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1437 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1438 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1439 | Return speed VH low 16-bit | |
| SFD1442 | Return speed VH high 16-bit | |
| SFD1443 | Creeping speed VC low 16-bit | |
| SFD1444 | Creeping speed VC high 16-bit | |
| SFD1445 | Mechanical origin position low 16-bit | |
| SFD1446 | Mechanical origin position high 16-bit | |
| SFD1447 | Z phase number | |
| SFD1448 | CLR signal delay time | Default is 20, unit: ms |
| SFD1449 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1450 | | High 16-bit |
| SFD1451 | Soft limit positive value | Low 16-bit |
| SFD1452 | | High 16-bit |
| SFD1453 | Soft limit negative value | Low 16-bit |
| … | | |
| **Y4 (group 1 parameters)** | | |
| SFD1470 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1471 | Pulse default speed high 16-bit | |
| SFD1472 | Acceleration time of pulse default speed | |
| SFD1473 | deceleration time of pulse default speed | |
| SFD1474 | Accerlation and deceleration time | |
| SFD1475 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1476 | Max speed low 16-bit | |
| SFD1477 | Max speed high 16-bit | |
| SFD1478 | Initial speed low 16-bit | |
| SFD1479 | Initial speed high 16-bit | |
| SFD1480 | Stop speed low 16-bit | |
| SFD1481 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1482 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1483 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y4 (group 2 parameters)** | | |
| SFD1490 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1491 | Pulse default speed high 16-bit | |
| SFD1492 | Acceleration time of pulse default speed | |
| SFD1493 | deceleration time of pulse default speed | |
| SFD1494 | Accerlation and deceleration time | |
| SFD1495 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1496 | Max speed low 16-bit | |
| SFD1497 | Max speed high 16-bit | |
| SFD1498 | Initial speed low 16-bit | |
| SFD1499 | Initial speed high 16-bit | |
| SFD1500 | Stop speed low 16-bit | |
| SFD1501 | Stop speed high 16-bit | |
| SFD1502 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1503 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y4 (group 3 parameters)** | | |
| SFD1510 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1511 | Pulse default speed high 16-bit | |
| SFD1512 | Acceleration time of pulse default speed | |
| SFD1513 | deceleration time of pulse default speed | |
| SFD1514 | Accerlation and deceleration time | |
| SFD1515 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1516 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1517 | Max speed high 16-bit | |
| SFD1518 | Initial speed low 16-bit | |
| SFD1519 | Initial speed high 16-bit | |
| SFD1520 | Stop speed low 16-bit | |
| SFD1521 | Stop speed high 16-bit | |
| SFD1522 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1523 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y4 (group 4 parameters)** | | |
| SFD1530 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1531 | Pulse default speed high 16-bit | |
| SFD1532 | Acceleration time of pulse default speed | |
| SFD1533 | deceleration time of pulse default speed | |
| SFD1534 | Accerlation and deceleration time | |
| SFD1535 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1536 | Max speed low 16-bit | |
| SFD1537 | Max speed high 16-bit | |
| SFD1538 | Initial speed low 16-bit | |
| SFD1539 | Initial speed high 16-bit | |
| SFD1540 | Stop speed low 16-bit | |
| SFD1541 | Stop speed high 16-bit | |
| SFD1542 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1543 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y5 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1550 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1551 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1552 | Pulse number/1 rotation low 16-bit | |
| SFD1553 | Pulse number/1 rotation high 16-bit | |
| SFD1554 | Moving amount/1 rotation low 16-bit | |
| SFD1555 | Moving amount/1 rotation high 16-bit | |
| SFD1556 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1557 | Direction delay time | Default is 20, unit: ms |
| SFD1558 | Gear clearance positive compensation | |
| SFD1559 | Gear clearance negative compensation | |
| SFD1560 | Electrical origin position low 16-bit | |
| SFD1561 | Electrical origin position high 16-bit | |
| SFD1562 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1564 | Near-point signal terminal setting | |
| SFD1565 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1567 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1568 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1569 | Return speed VH low 16-bit | |
| SFD1572 | Return speed VH high 16-bit | |
| SFD1573 | Creeping speed VC low 16-bit | |
| SFD1574 | Creeping speed VC high 16-bit | |
| SFD1575 | Mechanical origin position low 16-bit | |
| SFD1576 | Mechanical origin position high 16-bit | |
| SFD1577 | Z phase number | |
| SFD1578 | CLR signal delay time | Default is 20, unit: ms |
| SFD1579 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1580 | Soft limit positive value | High 16-bit |
| SFD1581 | | Low 16-bit |
| SFD1582 | Soft limit negative value | High 16-bit |
| SFD1583 | | Low 16-bit |
| … | | |
| **Y5 (group 1 parameters)** | | |
| SFD1600 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1601 | Pulse default speed high 16-bit | |
| SFD1602 | Acceleration time of pulse default speed | |
| SFD1603 | deceleration time of pulse default speed | |
| SFD1604 | Accerlation and deceleration time | |
| SFD1605 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1606 | Max speed low 16-bit | |
| SFD1607 | Max speed high 16-bit | |
| SFD1608 | Initial speed low 16-bit | |
| SFD1609 | Initial speed high 16-bit | |
| SFD1610 | Stop speed low 16-bit | |
| SFD1611 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1612 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1613 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y5 (group 2 parameters)** | | |
| SFD1620 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1621 | Pulse default speed high 16-bit | |
| SFD1622 | Acceleration time of pulse default speed | |
| SFD1623 | deceleration time of pulse default speed | |
| SFD1624 | Accerlation and deceleration time | |
| SFD1625 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1626 | Max speed low 16-bit | |
| SFD1627 | Max speed high 16-bit | |
| SFD1628 | Initial speed low 16-bit | |
| SFD1629 | Initial speed high 16-bit | |
| SFD1630 | Stop speed low 16-bit | |
| SFD1631 | Stop speed high 16-bit | |
| SFD1632 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1633 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y5 (group 3 parameters)** | | |
| SFD1640 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1641 | Pulse default speed high 16-bit | |
| SFD1642 | Acceleration time of pulse default speed | |
| SFD1643 | deceleration time of pulse default speed | |
| SFD1644 | Accerlation and deceleration time | |
| SFD1645 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1646 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1647 | Max speed high 16-bit | |
| SFD1648 | Initial speed low 16-bit | |
| SFD1649 | Initial speed high 16-bit | |
| SFD1650 | Stop speed low 16-bit | |
| SFD1651 | Stop speed high 16-bit | |
| SFD1652 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1653 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y5 (group 4 parameters)** | | |
| SFD1660 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1661 | Pulse default speed high 16-bit | |
| SFD1662 | Acceleration time of pulse default speed | |
| SFD1663 | deceleration time of pulse default speed | |
| SFD1664 | Accerlation and deceleration time | |
| SFD1665 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1666 | Max speed low 16-bit | |
| SFD1667 | Max speed high 16-bit | |
| SFD1668 | Initial speed low 16-bit | |
| SFD1669 | Initial speed high 16-bit | |
| SFD1670 | Stop speed low 16-bit | |
| SFD1671 | Stop speed high 16-bit | |
| SFD1672 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1673 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y6 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1680 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1681 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1682 | Pulse number/1 rotation low 16-bit | |
| SFD1683 | Pulse number/1 rotation high 16-bit | |
| SFD1684 | Moving amount/1 rotation low 16-bit | |
| SFD1685 | Moving amount/1 rotation high 16-bit | |
| SFD1686 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1687 | Direction delay time | Default is 20, unit: ms |
| SFD1688 | Gear clearance positive compensation | |
| SFD1689 | Gear clearance negative compensation | |
| SFD1690 | Electrical origin position low 16-bit | |
| SFD1691 | Electrical origin position high 16-bit | |
| SFD1692 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1694 | Near-point signal terminal setting | |
| SFD1695 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1697 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1698 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1699 | Return speed VH low 16-bit | |
| SFD1702 | Return speed VH high 16-bit | |
| SFD1703 | Creeping speed VC low 16-bit | |
| SFD1704 | Creeping speed VC high 16-bit | |
| SFD1705 | Mechanical origin position low 16-bit | |
| SFD1706 | Mechanical origin position high 16-bit | |
| SFD1707 | Z phase number | |
| SFD1708 | CLR signal delay time | Default is 20, unit: ms |
| SFD1709 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1710 | Soft limit positive value | High 16-bit |
| SFD1711 | | Low 16-bit |
| SFD1712 | Soft limit negative value | High 16-bit |
| SFD1713 | | Low 16-bit |
| … | | |
| **Y6 (group 1 parameters)** | | |
| SFD1730 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1731 | Pulse default speed high 16-bit | |
| SFD1732 | Acceleration time of pulse default speed | |
| SFD1733 | deceleration time of pulse default speed | |
| SFD1734 | Accerlation and deceleration time | |
| SFD1735 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1736 | Max speed low 16-bit | |
| SFD1737 | Max speed high 16-bit | |
| SFD1738 | Initial speed low 16-bit | |
| SFD1739 | Initial speed high 16-bit | |
| SFD1740 | Stop speed low 16-bit | |
| SFD1741 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1742 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1743 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y6 (group 2 parameters)** | | |
| SFD1750 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1751 | Pulse default speed high 16-bit | |
| SFD1752 | Acceleration time of pulse default speed | |
| SFD1753 | deceleration time of pulse default speed | |
| SFD1754 | Accerlation and deceleration time | |
| SFD1755 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1756 | Max speed low 16-bit | |
| SFD1757 | Max speed high 16-bit | |
| SFD1758 | Initial speed low 16-bit | |
| SFD1759 | Initial speed high 16-bit | |
| SFD1760 | Stop speed low 16-bit | |
| SFD1761 | Stop speed high 16-bit | |
| SFD1762 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1763 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y6 (group 3 parameters)** | | |
| SFD1770 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1771 | Pulse default speed high 16-bit | |
| SFD1772 | Acceleration time of pulse default speed | |
| SFD1773 | deceleration time of pulse default speed | |
| SFD1774 | Accerlation and deceleration time | |
| SFD1775 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1776 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1777 | Max speed high 16-bit | |
| SFD1778 | Initial speed low 16-bit | |
| SFD1779 | Initial speed high 16-bit | |
| SFD1780 | Stop speed low 16-bit | |
| SFD1781 | Stop speed high 16-bit | |
| SFD1782 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1783 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y6 (group 4 parameters)** | | |
| SFD1790 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1791 | Pulse default speed high 16-bit | |
| SFD1792 | Acceleration time of pulse default speed | |
| SFD1793 | deceleration time of pulse default speed | |
| SFD1794 | Accerlation and deceleration time | |
| SFD1795 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1796 | Max speed low 16-bit | |
| SFD1797 | Max speed high 16-bit | |
| SFD1798 | Initial speed low 16-bit | |
| SFD1799 | Initial speed high 16-bit | |
| SFD1800 | Stop speed low 16-bit | |
| SFD1801 | Stop speed high 16-bit | |
| SFD1802 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1803 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y7 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1810 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1811 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1812 | Pulse number/1 rotation low 16-bit | |
| SFD1813 | Pulse number/1 rotation high 16-bit | |
| SFD1814 | Moving amount/1 rotation low 16-bit | |
| SFD1815 | Moving amount/1 rotation high 16-bit | |
| SFD1816 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1817 | Direction delay time | Default is 20, unit: ms |
| SFD1818 | Gear clearance positive compensation | |
| SFD1819 | Gear clearance negative compensation | |
| SFD1820 | Electrical origin position low 16-bit | |
| SFD1821 | Electrical origin position high 16-bit | |
| SFD1822 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1824 | Near-point signal terminal setting | |
| SFD1825 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1827 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1828 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1829 | Return speed VH low 16-bit | |
| SFD1832 | Return speed VH high 16-bit | |
| SFD1833 | Creeping speed VC low 16-bit | |
| SFD1834 | Creeping speed VC high 16-bit | |
| SFD1835 | Mechanical origin position low 16-bit | |
| SFD1836 | Mechanical origin position high 16-bit | |
| SFD1837 | Z phase number | |
| SFD1838 | CLR signal delay time | Default is 20, unit: ms |
| SFD1839 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1840 | | High 16-bit |
| SFD1841 | Soft limit positive value | Low 16-bit |
| SFD1842 | | High 16-bit |
| SFD1843 | Soft limit negative value | Low 16-bit |
| … | | |
| **Y7 (group 1 parameters)** | | |
| SFD1860 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1861 | Pulse default speed high 16-bit | |
| SFD1862 | Acceleration time of pulse default speed | |
| SFD1863 | deceleration time of pulse default speed | |
| SFD1864 | Accerlation and deceleration time | |
| SFD1865 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1866 | Max speed low 16-bit | |
| SFD1867 | Max speed high 16-bit | |
| SFD1868 | Initial speed low 16-bit | |
| SFD1869 | Initial speed high 16-bit | |
| SFD1870 | Stop speed low 16-bit | |
| SFD1871 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD1872 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1873 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y7 (group 2 parameters)** | | |
| SFD1880 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1881 | Pulse default speed high 16-bit | |
| SFD1882 | Acceleration time of pulse default speed | |
| SFD1883 | deceleration time of pulse default speed | |
| SFD1884 | Accerlation and deceleration time | |
| SFD1885 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1886 | Max speed low 16-bit | |
| SFD1887 | Max speed high 16-bit | |
| SFD1888 | Initial speed low 16-bit | |
| SFD1889 | Initial speed high 16-bit | |
| SFD1890 | Stop speed low 16-bit | |
| SFD1891 | Stop speed high 16-bit | |
| SFD1892 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1893 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y7 (group 3 parameters)** | | |
| SFD1900 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1901 | Pulse default speed high 16-bit | |
| SFD1902 | Acceleration time of pulse default speed | |
| SFD1903 | deceleration time of pulse default speed | |
| SFD1904 | Accerlation and deceleration time | |
| SFD1905 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1906 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD1907 | Max speed high 16-bit | |
| SFD1908 | Initial speed low 16-bit | |
| SFD1909 | Initial speed high 16-bit | |
| SFD1910 | Stop speed low 16-bit | |
| SFD1911 | Stop speed high 16-bit | |
| SFD1912 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1913 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y7 (group 4 parameters)** | | |
| SFD1920 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1921 | Pulse default speed high 16-bit | |
| SFD1922 | Acceleration time of pulse default speed | |
| SFD1923 | deceleration time of pulse default speed | |
| SFD1924 | Accerlation and deceleration time | |
| SFD1925 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1926 | Max speed low 16-bit | |
| SFD1927 | Max speed high 16-bit | |
| SFD1928 | Initial speed low 16-bit | |
| SFD1929 | Initial speed high 16-bit | |
| SFD1930 | Stop speed low 16-bit | |
| SFD1931 | Stop speed high 16-bit | |
| SFD1932 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD1933 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y10 (common parameters)** | | |

| | | |
|---|---|---|
| SFD1940 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD1941 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD1942 | Pulse number/1 rotation low 16-bit | |
| SFD1943 | Pulse number/1 rotation high 16-bit | |
| SFD1944 | Moving amount/1 rotation low 16-bit | |
| SFD1945 | Moving amount/1 rotation high 16-bit | |
| SFD1946 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD1947 | Direction delay time | Default is 20, unit: ms |
| SFD1948 | Gear clearance positive compensation | |
| SFD1949 | Gear clearance negative compensation | |
| SFD1950 | Electrical origin position low 16-bit | |
| SFD1951 | Electrical origin position high 16-bit | |
| SFD1952 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD1954 | Near-point signal terminal setting | |
| SFD1955 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD1957 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD1958 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD1959 | Return speed VH low 16-bit | |
| SFD1962 | Return speed VH high 16-bit | |
| SFD1963 | Creeping speed VC low 16-bit | |
| SFD1964 | Creeping speed VC high 16-bit | |
| SFD1965 | Mechanical origin position low 16-bit | |
| SFD1966 | Mechanical origin position high 16-bit | |
| SFD1967 | Z phase number | |
| SFD1968 | CLR signal delay time | Default is 20, unit: ms |
| SFD1969 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD1970 | | High 16-bit |
| SFD1971 | Soft limit positive value | Low 16-bit |
| SFD1972 | | High 16-bit |
| SFD1973 | Soft limit negative value | Low 16-bit |
| … | | |
| **Y10 (group 1 parameters)** | | |
| SFD1990 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD1991 | Pulse default speed high 16-bit | |
| SFD1992 | Acceleration time of pulse default speed | |
| SFD1993 | deceleration time of pulse default speed | |
| SFD1994 | Accerlation and deceleration time | |
| SFD1995 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD1996 | Max speed low 16-bit | |
| SFD1997 | Max speed high 16-bit | |
| SFD1998 | Initial speed low 16-bit | |
| SFD1999 | Initial speed high 16-bit | |
| SFD2000 | Stop speed low 16-bit | |
| SFD2001 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD2002 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2003 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y10 (group 2 parameters)** | | |
| SFD2010 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2011 | Pulse default speed high 16-bit | |
| SFD2012 | Acceleration time of pulse default speed | |
| SFD2013 | deceleration time of pulse default speed | |
| SFD2014 | Accerlation and deceleration time | |
| SFD2015 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2016 | Max speed low 16-bit | |
| SFD2017 | Max speed high 16-bit | |
| SFD2018 | Initial speed low 16-bit | |
| SFD2019 | Initial speed high 16-bit | |
| SFD2020 | Stop speed low 16-bit | |
| SFD2021 | Stop speed high 16-bit | |
| SFD2022 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2023 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y10 (group 3 parameters)** | | |
| SFD2030 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2031 | Pulse default speed high 16-bit | |
| SFD2032 | Acceleration time of pulse default speed | |
| SFD2033 | deceleration time of pulse default speed | |
| SFD2034 | Accerlation and deceleration time | |
| SFD2035 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2036 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD2037 | Max speed high 16-bit | |
| SFD2038 | Initial speed low 16-bit | |
| SFD2039 | Initial speed high 16-bit | |
| SFD2040 | Stop speed low 16-bit | |
| SFD2041 | Stop speed high 16-bit | |
| SFD2042 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2043 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y10 (group 4 parameters)** | | |
| SFD2050 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2051 | Pulse default speed high 16-bit | |
| SFD2052 | Acceleration time of pulse default speed | |
| SFD2053 | deceleration time of pulse default speed | |
| SFD2054 | Accerlation and deceleration time | |
| SFD2055 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2056 | Max speed low 16-bit | |
| SFD2057 | Max speed high 16-bit | |
| SFD2058 | Initial speed low 16-bit | |
| SFD2059 | Initial speed high 16-bit | |
| SFD2060 | Stop speed low 16-bit | |
| SFD2061 | Stop speed high 16-bit | |
| SFD2062 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2063 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y11 (common parameters)** | | |

| | | |
|---|---|---|
| SFD2070 | Pulse parameters | Bit 1: Pulse Direction Logic<br>0: positive logic, 1: negative logic; default is 0<br>Bit 2: Soft Limit<br>0: Not enabled, 1: enabled; default is 0<br>Bit 3: direction of mechanical return to origin<br>0: Negative, 1: Positive; Default is 0<br>Bit 10~8: Pulse Unit<br>Bit 8: 0: Number of Pulses, 1:Equivalent<br>000: Number of pulses<br>001: 1 μm<br>011: 0.01 μm<br>101: 0.1 μm<br>111: 1 mm<br>The default is 000.<br>Bit15: Interpolated coordinate mode<br>0: Cross coordinates, 1: Polar coordinates;<br>The default is 0. |
| SFD2071 | Pulse sending mode | Bit 0：pulse sending mode<br>0：complete mode；1：continue mode<br>Default is 0 |
| SFD2072 | Pulse number/1 rotation low 16-bit | |
| SFD2073 | Pulse number/1 rotation high 16-bit | |
| SFD2074 | Moving amount/1 rotation low 16-bit | |
| SFD2075 | Moving amount/1 rotation high 16-bit | |
| SFD2076 | Pulse direction terminal | Appoint to Y terminal, 0xFF is no terminal |
| SFD2077 | Direction delay time | Default is 20, unit: ms |
| SFD2078 | Gear clearance positive compensation | |
| SFD2079 | Gear clearance negative compensation | |
| SFD2080 | Electrical origin position low 16-bit | |
| SFD2081 | Electrical origin position high 16-bit | |
| SFD2082 | Signal terminal switch state | Bit0: Origin Signal Switch State Settings<br>Bit1:Z Phase Switch State Settings<br>Bit2: Positive Limit Switching State Settings<br>Bit3: Negative Limit Switching State Settings<br>0: Normally open (positive logic), 1: Normally closed (negative logic); default is 0 |
| SFD2084 | Near-point signal terminal setting | |
| SFD2085 | Z phase terminal setting | Bit0~Bit7：Specify the number of the X terminal, 0xFF is no terminal |

| | | |
|---|---|---|
| SFD2087 | Limit terminal setting | Bit7~Bit0：Specifies the X terminal number of the positive limit, and 0xFF is no terminal.<br>Bit15~Bit8：Specifies the X terminal number of the negative limit, and 0xFF is no terminal. |
| SFD2088 | Zero clear CLR output signal | Bit0~Bit7：Specify the number of the Y terminal, 0xFF is no terminal |
| SFD2089 | Return speed VH low 16-bit | |
| SFD2092 | Return speed VH high 16-bit | |
| SFD2093 | Creeping speed VC low 16-bit | |
| SFD2094 | Creeping speed VC high 16-bit | |
| SFD2095 | Mechanical origin position low 16-bit | |
| SFD2096 | Mechanical origin position high 16-bit | |
| SFD2097 | Z phase number | |
| SFD2098 | CLR signal delay time | Default is 20, unit: ms |
| SFD2099 | Grinding wheel radius (polar coordinates) | Low 16-bit |
| SFD2100 | Soft limit positive value | High 16-bit |
| SFD2101 | | Low 16-bit |
| SFD2102 | Soft limit negative value | High 16-bit |
| SFD2103 | | Low 16-bit |
| … | | |
| **Y11 (group 1 parameters)** | | |
| SFD2120 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2121 | Pulse default speed high 16-bit | |
| SFD2122 | Acceleration time of pulse default speed | |
| SFD2123 | deceleration time of pulse default speed | |
| SFD2124 | Accerlation and deceleration time | |
| SFD2125 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2126 | Max speed low 16-bit | |
| SFD2127 | Max speed high 16-bit | |
| SFD2128 | Initial speed low 16-bit | |
| SFD2129 | Initial speed high 16-bit | |
| SFD2130 | Stop speed low 16-bit | |
| SFD2131 | Stop speed high 16-bit | |

| | | |
|---|---|---|
| SFD2132 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2133 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y11 (group 2 parameters)** | | |
| SFD2140 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2141 | Pulse default speed high 16-bit | |
| SFD2142 | Acceleration time of pulse default speed | |
| SFD2143 | deceleration time of pulse default speed | |
| SFD2144 | Accerlation and deceleration time | |
| SFD2145 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2146 | Max speed low 16-bit | |
| SFD2147 | Max speed high 16-bit | |
| SFD2148 | Initial speed low 16-bit | |
| SFD2149 | Initial speed high 16-bit | |
| SFD2150 | Stop speed low 16-bit | |
| SFD2151 | Stop speed high 16-bit | |
| SFD2152 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2153 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y11 (group 3 parameters)** | | |
| SFD2160 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2161 | Pulse default speed high 16-bit | |
| SFD2162 | Acceleration time of pulse default speed | |
| SFD2163 | deceleration time of pulse default speed | |
| SFD2164 | Accerlation and deceleration time | |
| SFD2165 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2166 | Max speed low 16-bit | |

| | | |
|---|---|---|
| SFD2167 | Max speed high 16-bit | |
| SFD2168 | Initial speed low 16-bit | |
| SFD2169 | Initial speed high 16-bit | |
| SFD2170 | Stop speed low 16-bit | |
| SFD2171 | Stop speed high 16-bit | |
| SFD2172 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2173 | Follow feedforward compensation | 0~100, % |
| … | | |
| **Y11 (group 4 parameters)** | | |
| SFD2180 | Pulse default speed low 16-bit | Pulse is sent at the default speed when the speed is 0. |
| SFD2181 | Pulse default speed high 16-bit | |
| SFD2182 | Acceleration time of pulse default speed | |
| SFD2183 | deceleration time of pulse default speed | |
| SFD2184 | Accerlation and deceleration time | |
| SFD2185 | Acceleration/deceleration mode | Bit1~Bit0：acc/dec mode<br>00：linear acc/dec<br>01：S curve acc/dec<br>10：sine curve acc/dec<br>11：reserved<br>Bit15~Bit2：reserved |
| SFD2186 | Max speed low 16-bit | |
| SFD2187 | Max speed high 16-bit | |
| SFD2188 | Initial speed low 16-bit | |
| SFD2189 | Initial speed high 16-bit | |
| SFD2190 | Stop speed low 16-bit | |
| SFD2191 | Stop speed high 16-bit | |
| SFD2192 | Follow performance | 1~100, 100 means the time constant is 1 Tick, 1 means the time constant is 100 Ticks |
| SFD2193 | Follow feedforward compensation | 0~100, % |
| … | | |

# Appendix 4. External interruption terminal list

XD series PLC external interrupt terminal allocation is as follows:

**XD/XL series 10 I/O**

| Input terminal | Pointer | | Disable interruption instruction |
|---|---|---|---|
| | Rising interruption | Falling interruption | |
| X2 | I0000 | I0001 | SM050 |
| X3 | I0100 | I0101 | SM051 |
| X4 | I0200 | I0201 | SM052 |

**XD/XL series 16 I/O**

| Input terminal | Pointer | | Disable interruption instruction |
|---|---|---|---|
| | Rising interruption | Falling interruption | |
| X2 | I0000 | I0001 | SM050 |
| X3 | I0100 | I0101 | SM051 |
| X4 | I0200 | I0201 | SM052 |
| X5 | I0300 | I0301 | SM053 |
| X6 | I0400 | I0401 | SM054 |
| X7 | I0500 | I0501 | SM055 |

**XD/XL series 24~64 I/O**

| Input terminal | Pointer | | Disable interruption instruction |
|---|---|---|---|
| | Rising interruption | Falling interruption | |
| X2 | I0000 | I0001 | SM050 |
| X3 | I0100 | I0101 | SM051 |
| X4 | I0200 | I0201 | SM052 |
| X5 | I0300 | I0301 | SM053 |
| X6 | I0400 | I0401 | SM054 |
| X7 | I0500 | I0501 | SM055 |
| X10 | I0600 | I0601 | SM056 |
| X11 | I0700 | I0701 | SM057 |
| X12 | I0800 | I0801 | SM058 |
| X13 | I0900 | I0901 | SM059 |

# Appendix 5. PLC resource conflict table

When PLC is used in practice, conflicts may arise due to the simultaneous use of some resources. This section will list the resources that may cause conflicts in each PLC model. This part mainly refers to high-speed counting, accurate timing and pulse output.

| | Precise timing | High speed counter | | | | Pulse output | |
|---|---|---|---|---|---|---|---|
| XD2-16, XD3-16, XD5-16, XL3-16, XL5-16, XL5E-16 | | | | | | | |
| | ET0 | - | - | - | - | - | - |
| | ET2 | | | | | | |
| | ET4 | | | | | | |
| | ET6 | | | | | | |
| | ET8 | HSC0 | | | | | |
| | ET10 | | HSC2 | | | | |
| | ET12 | | | HSC4 | | | |
| | ET14 | | | | | Y0 | |
| | ET16 | | | | | Y0 | |
| | ET18 | | | | | Y1 | |
| | ET20 | | | | | Y1 | |
| | ET22 | | | | | | |
| | ET24 | | | | | | |
| XD3-24/32/48/60, ZG3-30 | | | | | | | |
| | ET0 | | | | | | |
| | ET2 | | | | | | |
| | ET4 | | | | | | |
| | ET6 | | | | | | |
| | ET8 | | | | | | |
| | ET10 | | | | | | |
| | ET12 | HSC0 | | | | | |
| | ET14 | | HSC2 | | | | |
| | ET16 | | | HSC4 | | | |
| | ET18 | | | | | Y0 | |
| | ET20 | | | | | Y0 | |
| | ET22 | | | | | Y1 | |
| | ET24 | | | | | Y1 | |
| XD5-24/32/48/60, XDM-24/32/48/60, XD5E-30/60, XDME-60, XL5-32, XL5E-32, XLME-32 | | | | | | | |
| | ET0 | - | - | - | - | - | - |
| | ET2 | | | | HSC6 | | |
| | ET4 | | | HSC4 | | | |
| | ET6 | | HSC2 | | | | |
| | ET8 | HSC0 | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ET10 | | | | | Y3 | |
| | ET12 | | | | | Y3 | |
| | ET14 | | | | | Y2 | |
| | ET16 | | | | | Y2 | |
| | ET18 | | | | | Y1 | |
| | ET20 | | | | | Y1 | |
| | ET22 | | | | | Y0 | |
| | ET24 | | | | | Y0 | |
| XDC-24/32/48/60 | | | | | | | |
| | ET0 | - | - | - | HSC6 | - | - |
| | ET2 | | | HSC4 | | | |
| | ET4 | | HSC2 | | | | |
| | ET6 | HSC0 | | | | | |
| | ET8 | | | | | Y3 | |
| | ET10 | | | | | Y3 | |
| | ET12 | | | | | Y2 | |
| | ET14 | | | | | Y2 | |
| | ET16 | | | | | Y1 | |
| | ET18 | | | | | Y1 | |
| | ET20 | | | | | Y0 | |
| | ET22 | | | | | Y0 | |
| | ET24 | | | | | | |

※1: This form should be read horizontally. Any two resources in each row cannot be used at the same time. Otherwise, it will cause conflict.

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