09 Electronic cam

last modified by Joey

on 2022/06/14 17:30

Table of Contents

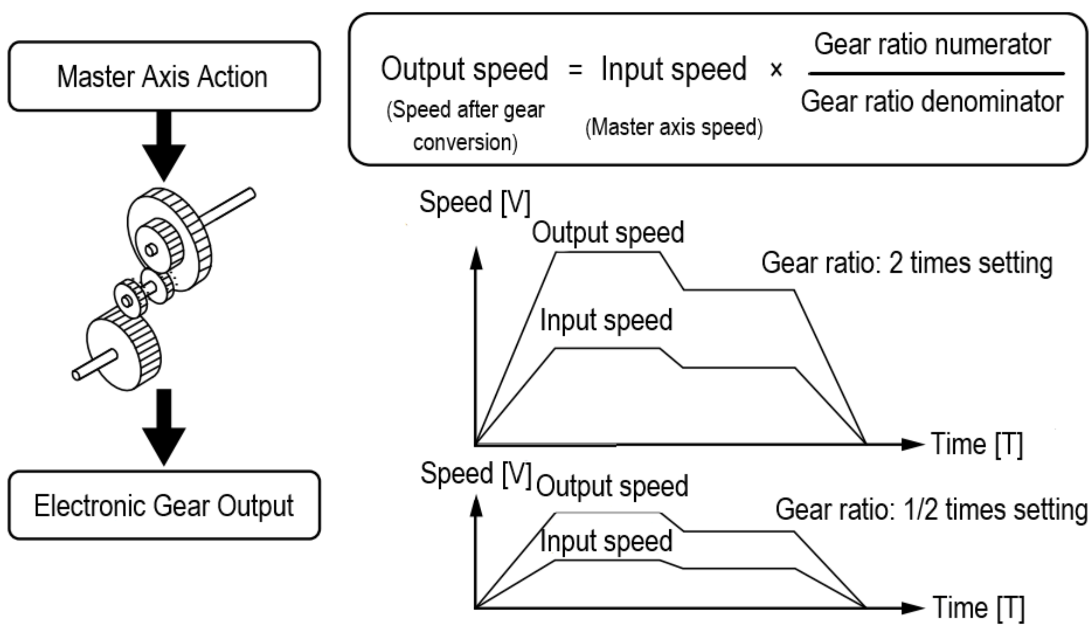
Electronic CAM (ECAM) instruction

DEGEAR/Electronic gear/32 bit hand wheel instruction

DEGEAR

Electronic gear function refers to the function of multiplying the speed of the driving shaft by the set gear ratio and outputting to the driven shaft at this speed to control the mechanical operation.

-[DEGEAR (s1) (s2) (s3) (d1) (d2)]



Content, range and data type

Parameter	Content
(s1)	Specify the high-speed counter or ordinary double-word counter that receives the master axis pulse
(s2)	Specify the data buffer of the electronic gear command
(s3)	Response time, that is, how often the gear calculation is performed
(d1)	Specify pulse output axis
(d2)	Specify direction output shaft

Device used

Instruction	Parameter	Device	Offset	Pulse

		Y	M	S	D.b	D	R	LC	HSC	K	H	[D] modification	XXP extension
DECAM	Parameter 1							●	●				
	Parameter 2					●	●						
	Parameter 3					●	●			●	●		
	Parameter 4	●											
	Parameter 5	●	●	●	●								

Features

•When the instruction is turned on, the PLC obtains the number of pulses of the master axis (s1) according to the set response time (s2), calculates the average frequency within the response time, and calculates the output of the driven axis according to the set gear ratio Frequency and output pulse number, and output pulse (d1) and direction (d2). When the frequency of the driven shaft is greater than the set maximum frequency, it will output according to the set maximum frequency.

•When the master axis (s1) uses the high-speed counter (HSC), the PLC internally obtains the number of external input pulses. Modifying the value of the HSC counter does not affect the judgment of the input pulse.

•When the master axis (s1) uses an ordinary double-word counter (LC), the PLC directly obtains the number of pulses from the LC register, and modifying the value of the register directly affects the judgment of the input pulse.

• Electronic gear data buffer (s2) table:

Electronic gear instruction parameter description table

Offset	Content	Instruction	Range	Read and write permission
0	Electronic gear ratio (numerator)	Number of outputs =	0 to 32767	Read/write
1	Electronic gear ratio (denominator)	Number of inputs in response time*numerator/ denominator	1 to 32767	
2	Maximum output frequency (low word)	Max frequency	1 to 200000	Read/write
3	Maximum output frequency (high word)	Max frequency		Read/write
4	Average spindle frequency (low word)	Hand crank input frequency	-	Read-only
5	Average spindle frequency (high word)	Hand crank input frequency		Read-only
6	Accumulative electronic gear input pulse number (low word)	Cumulative number of electronic gear input pulses	-	Read-only
7	Cumulative number of electronic gear input pulses(High word)			
8	Sign	After the electronic gear is initialized, the flag is equal to 1	Reserved	Reserved
9	interval	Confirmation value	-	Read-only
10	Electronic gear ratio (numerator)	Confirmation value	-	Read-only

11	Electronic gear ratio (denominator)	Confirmation value	-	Read-only
12	Maximum output frequency (low word)	Confirmation value	1 to 200000	Read/write
13	Maximum output frequency (high word)			Read/write
14	Dynamically switch gear ratio	1: Switch to the newly set gear ratio immediately. And set the address back to 0. 2: The cycle is completed and the gear ratio is switched, and the value is set back to 0 after the switching is completed. (The value of the spindle count reaching the denominator is regarded as a cycle)	0 to 2	Read/write
15	16-bit gear ratio and 32-bit gear ratio switch	0: Use 16-bit gear ratio 1: Use 32-bit gear ratio **#Note:** After changing this bit, it will only take effect after the DEGEAR command is re-enabled or the dynamic gear ratio function is used.	0 to 1	Read/write
16	32-bit electronic gear ratio numerator (low word)	Number of inputs = Spindle input number within response time*numerator/ denominator	0 to 214748647	Read/write
17	32-bit electronic gear ratio numerator (high word)			
18	32-bit electronic gear ratio denominator (low word)		1 to 214748647	Read/write
19	32-bit electronic gear ratio denominator (high word)			
20	32-bit electronic gear ratio numerator (low word)	Confirmation value	-	Read-only
21	32-bit electronic gear ratio numerator (high word)			
22	32-bit electronic gear ratio denominator (low word)		-	Read-only
23	32-bit electronic gear ratio denominator (high word)			

#Note:

• When the output pulse axis (d1) is used by this instruction, other high-speed pulse instructions can no longer use the output axis. Otherwise, an operation error will occur and pulse output will not be performed.

• The cycle of calculating the electronic gear inside the PLC is 100us once. If multiple electronic gear/electronic cam commands are used at the same time, The computing interval is unchanged, that is, the 8-axis electronic gear instruction is executed at the same time, and the computing interval is also 100us.

• The electronic gear commands can only be enabled at most 8 (Y0 ~ Y7) at the same time.

• The electronic gear command is used, and the data buffer (s2) will occupy 24 consecutive devices. Note that the address cannot exceed the range of the device and reuse.

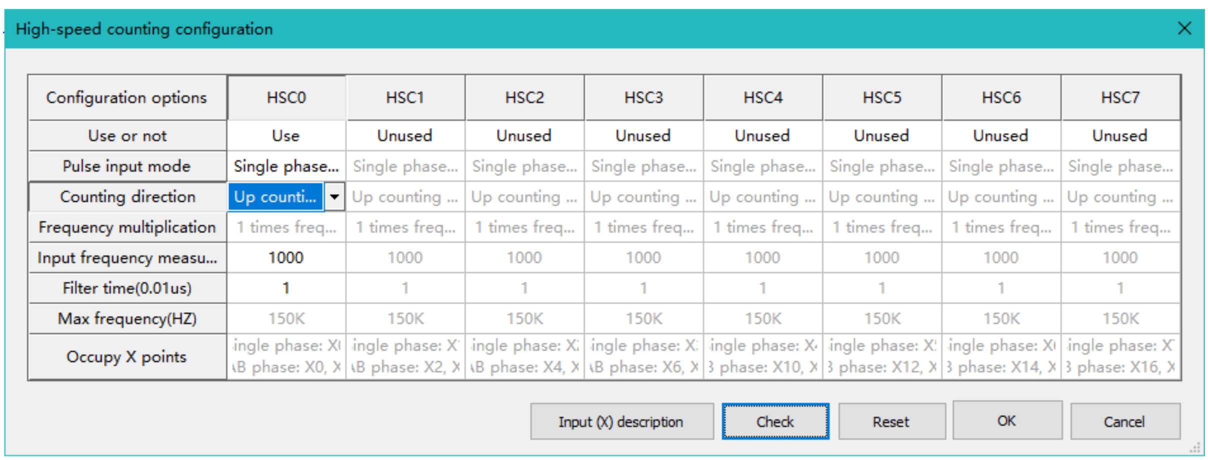
Error code

Error code	Content
4085H	The read address of (s1), (s2) and (s3) exceeds the device range
4084H	The data exceeds the settable range
4EC0H	Electronic gear ratio setting error
4088H	High-speed pulse instructions use the same output shaft (d1)

Example

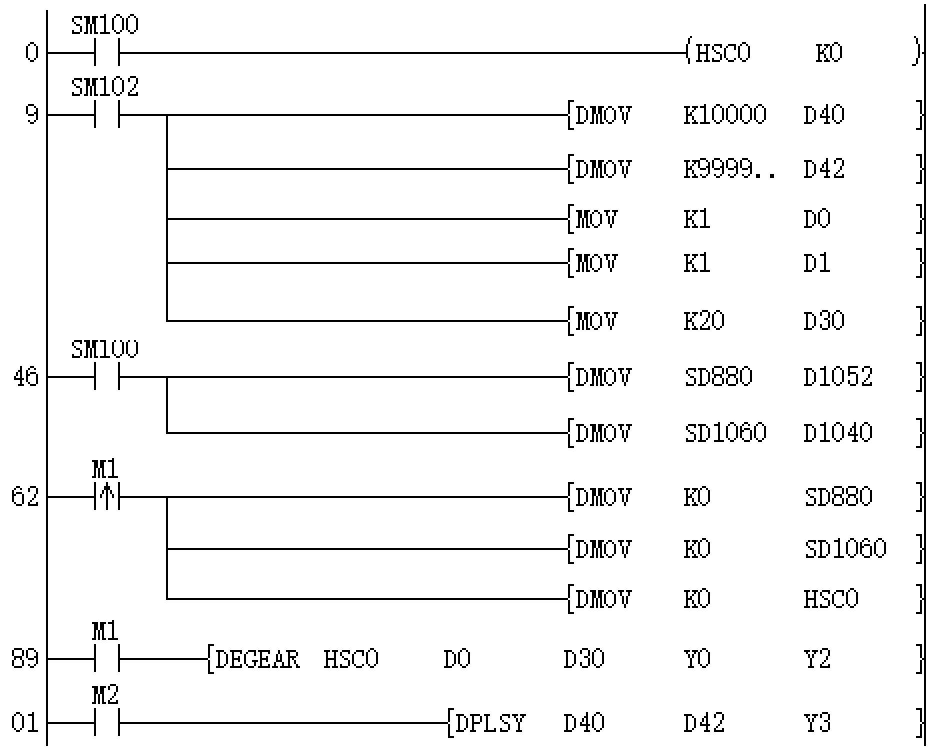
(1) Realize the 1:1 follow function of Y0 output pulse to Y3 output pulse.

1) Configure the high-speed counter, enable HSC0, and configure it as one-way output and count-up mode.



Configuration options	HSC0	HSC1	HSC2	HSC3	HSC4	HSC5	HSC6	HSC7
Use or not	Use	Unused	Unused	Unused	Unused	Unused	Unused	Unused
Pulse input mode	Single phase...	Single phase...	Single phase...	Single phase...	Single phase...	Single phase...	Single phase...	Single phase...
Counting direction	Up counti...	Up counting ...	Up counting ...	Up counting ...	Up counting ...	Up counting ...	Up counting ...	Up counting ...
Frequency multiplication	1 times freq...	1 times freq...	1 times freq...	1 times freq...	1 times freq...	1 times freq...	1 times freq...	1 times freq...
Input frequency measu...	1000	1000	1000	1000	1000	1000	1000	1000
Filter time(0.01us)	1	1	1	1	1	1	1	1
Max frequency(HZ)	150K	150K	150K	150K	150K	150K	150K	150K
Occupy X points	ingle phase: X B phase: X0, X	ingle phase: X B phase: X2, X	ingle phase: X B phase: X4, X	ingle phase: X B phase: X6, X	ingle phase: X B phase: X10, X	ingle phase: X B phase: X12, X	ingle phase: X B phase: X14, X	ingle phase: X B phase: X16, X

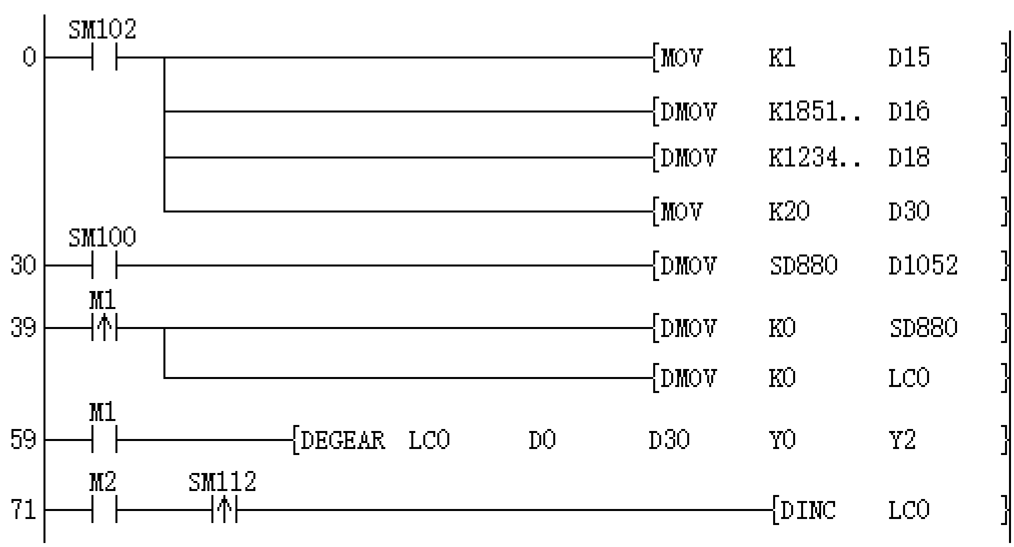
2) Ladder



Connect the Y3 output of the PLC to the X0 input.

Turn on M1, start M2, and Y3 for output. At this time, Y0 will follow Y3 1:1 (SD880 = SD1060).

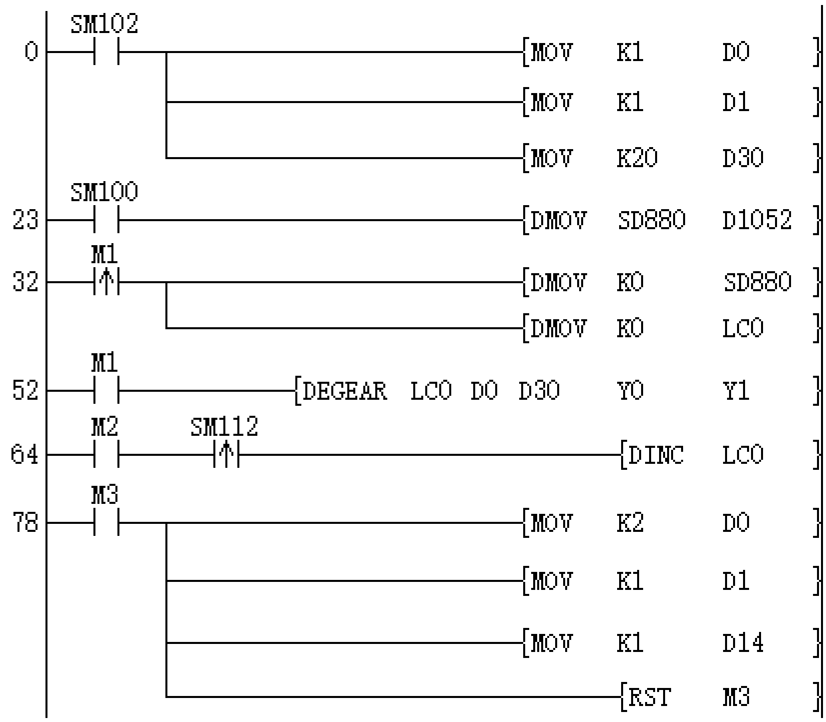
(2) Use of 32-bit gear ratio.



Set the 32-bit gear ratio: 18518517: 12345678, set the 15 address of the data buffer to 1, and enable the 32-bit gear ratio function.

M1 turns ON to turn on the electronic gear command, M2 turns ON, LC0 will increase by 1 every 100ms, at this time SD880:LC0 always = 18518517:12345678.

(3) Use of gear ratio switching function



Set the gear ratio to 1:1.

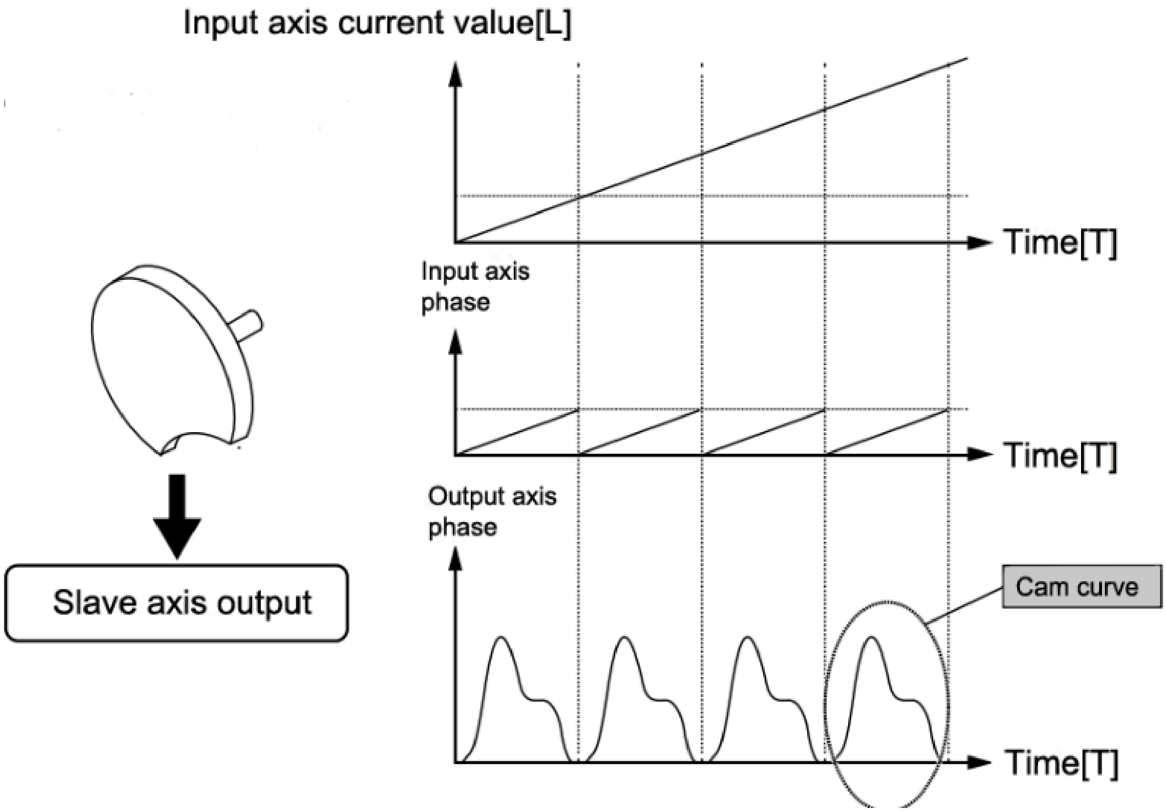
M1 turns ON to turn on the electronic gear instruction, M2 turns ON, LC0 will increase by 1 every 100ms, at this time SD880:LC0 always = 1:1. When M3 is turned on, change the gear ratio to 2:1 and enable the switch gear ratio function. After that, the increment of SD880 and the increment of LC0 are always 2:1.

DECAM/32-bit electronic cam instruction

DECAM

The electronic cam function uses the preset cam curve to determine the slave axis movement amount according to the spindle movement (phase information) and the cam curve, and output. The cam curve refers to each phase (rotation angle (Degree) and CAM curve refers master axis rotation 1 cycle as the movement benchmark. The displacement of the slave axis can be set by the ECAMTBX instruction.

-[DECAM (s1) (s2) (s3) (d1) (d2)]



Content, range and data type

Parameter	Content
(S1)	Specify to receive the input pulse of the master axis
(S2)	Specify the data buffer of the electronic cam instruction
(S3)	The external start signal of the electronic cam needs to be enabled in the data buffer area to be effective.
(D1)	Specify pulse output axis
(D2)	Specify direction output shaft

Device used

Instruction	Parameter	Devices											Offset modification	Pulse extension
		X	Y	M	S	D.b	D	R	LC	HSC	K	H	[D]	XXP
DECAM	Parameter 1								●	●	●	●		

Parameter 2						●	●
Parameter 3	●		●	●	●		
Parameter 4		●					
Parameter 5							

Features

When the instruction is turned on, the PLC obtains the number of pulses of the master axis (s1), calculates the number of pulses that the slave axis needs to output for this calculation according to the set cam curve, and performs the pulse (d1) and direction (d2) Output. When the frequency of the driven shaft is greater than the set maximum frequency, it will output according to the set maximum frequency.

• When the master axis (s1) uses the high-speed counter (HSC), the PLC internally obtains the number of external input pulses. Modifying the value of the HSC counter does not affect the judgment of the input pulse.

• When the master axis (s1) uses an ordinary double-word counter (LC), the PLC directly obtains the number of pulses from the LC register, and modifying the value of the register directly affects the judgment of the input pulse.

• When the master axis (s1) uses the constant K/H, the number of input pulses is the time axis. If it is K1, the number of input pulses will increase by 1 every 100 us.

• Electronic cam data buffer (s2) table:

Offset address	Name	Instruction	Initial value	Range
0	Form version number		5200	
1	Flag register	Bit0-Initialization complete flag After the electronic cam permission signal is activated, calculate the related Data, automatically set to ON after initialization, users need to clear this flag state by themselves	0	—
		Bit1-Cycle complete flag Electronic cam completion	0	—

flag. When the periodic electronic cam is executed After completion, this flag will be automatically set to ON; if you want to restart the periodic electronic cam, the user needs to clear this flag state first.		
Bit2-Pulse transmission delayed flag bit Bit3-Error electronic cam stop running flag bit Bit4-Parameter error error, electronic cam stop running flag bit Bit5-Table error, electronic cam stop running flag Bit6-Periodic electronic cam flag Bit7-Aperiodic electronic cam flag Bit9-Stop flag for	0	—

		current cycle completion Bit10- synchronization zone flag Bit11- Time axis flag Bit12- New form loading complete flag Bit13- Periodic delay electronic cam flag Bit14- Delayed start function, delayed waiting flag bit		
2	Error register	Operation error condition (check Bit3 of address 1): Display Error code. Parameter error condition (check Bit4 of address 1): Display the offset address of the error parameter register. Table error condition (check Bit5 of address 1): display Incorrect table	0	—

		segment number.		
3	Function register (Confirm before using electronic cam)	Bit0-Delayed start enable Bit1-Start at specified position Bit2-Spindle zoom Bit3-zoom from axis Bit5-Use external start signal Bit6-Start from current position *Bit1 and Bit6 cannot both be 1.	0	—
4	Function register (can be changed while the electronic cam is running)	Bit0-Sync signal enable Bit1-Stop the electronic cam after the current cycle is completed Bit2-Switch the table after the cycle is completed, the bit will automatically change back to 0 after the switch is completed	0	—

#Note:

When the output pulse axis (d1) is used by this instruction, other high-speed pulse instructions can no longer use the output axis. Otherwise, an operation error will occur and pulse output will not be performed.

The cycle of calculating the electronic gear inside the PLC is 100us once. If multiple electronic gear/electronic cam commands are used at the same time, the time will increase accordingly. If the 8-axis electronic gear command is executed at the same time, the calculation cycle will become 800us.

The electronic gear commands can only be enabled at most 8 (Y0 ~ Y7) at the same time.

The electronic gear command is used, and the data buffer (s2) will occupy 24 consecutive devices. Note that the address cannot exceed the range of the device and reuse.

Error code

Error code	Content
4E80H	E-cam table loading error
4E81H	The currently numbered form has a cam in use
4E82H	E-cam table address error
4E83H	The electronic cam table exceeds the device range

Example

For details, please refer to "9.2 Instruction manual of Electronic CAM (ECAM)".

ECAMCUT/Electronic cam table switching instruction

ECAMCUT

This instruction needs to be used in conjunction with the electronic cam instruction (DECAM) to specify the newly defined table address to realize the function of switching the electronic cam table periodically during the operation of the electronic cam.

-[ECAMCUT (s1) (s2)]

Content, range and data type

Parameter	Content	Range	Data type	Data type (label)
(s1)	Specify the table number, currently only supports one table	1 to 2 (LX5VT: 1 to 16)	Signed BIN 16 bit	ANY16
(s2)	Specify the first address of the data buffer area of the electronic cam table	-	Form type	LIST

Device used

Instruction	Parameter	Devices				Offset modification	Pulse extension
		D	R	K	H	[D]	XXP
ECAMCUT	Parameter 1	●	●	●	●		
	Parameter 2	●	●				

Features

Table format definition:

Offset	Instruction
0	Number of table segments
1	Table version
2 to 3	Spindle section 0 (double word)
4 to 5	Section 0 slave axis (double word)
6 to 7	Spindle section 1
8 to 9	Section 1 slave axis
......	

Instruction function description

(1) In the (s1) parameter, only K1 or K2 can be used to specify the location of the table. The format of the table must be as above.

K1 means Form 1

K2 means Form 2

Form 0 is the original form of the cam (optional)

(2) When the instruction is running, check the table data in the start address specified by (s2) and verify the correctness of the data. After the operation is successful, the table with the specified table number should point to the starting address of (s2). In the process of command pointing, if the corresponding numbered table is in the current cam operation, an operation error will be reported.

Before using the table, you need to run this command to configure the address where the table is located. After the table address is specified, it will not be saved after power off.

(3) Related registers and flags

•Electronic cam buffer offset 1 (flag bit register)

bit12 --- table switching completed flag

•Electronic cam buffer offset 4 (function register)

After bit2-cycle is completed, switch to the specified table operation

•Electronic cam buffer offset 31

Number of the table to be run in the next cycle (0 ~ 2)

•Electronic cam buffer offset 32

The table number of current cycle operation (0 ~ 2)

#Note:

Table 0 is the self-contained table of the electronic cam, that is, the continuous address starting at offset 38 of the electronic cam data buffer. Therefore, the electronic cam can specify up to 3 tables at the same time, which can be switched freely during operation.

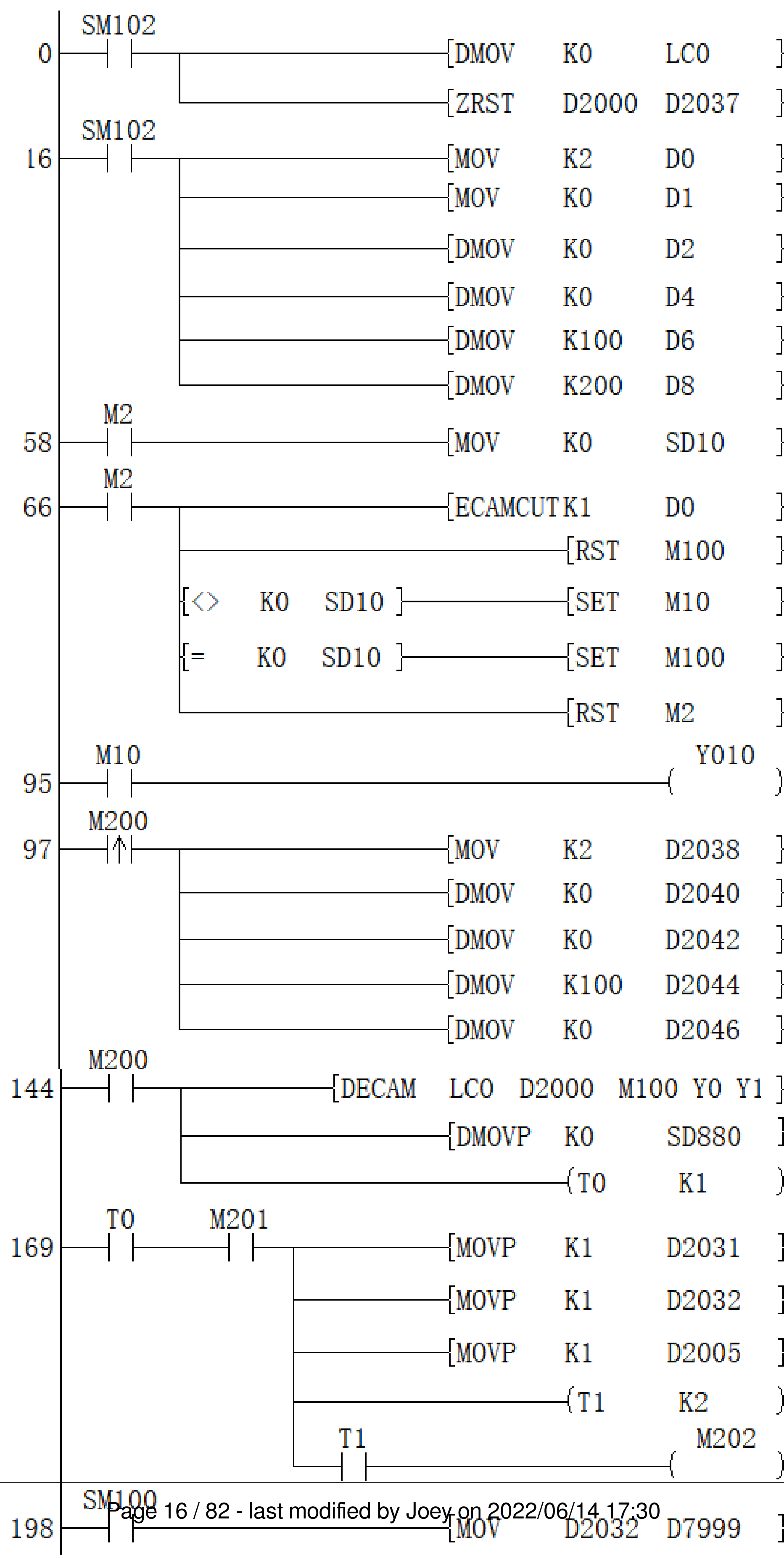
If the curve generated by the electronic cam table generation command ECAMTBX is used, the data buffer of the ECAMTBX generated table should be offset by 38 addresses and then specified.

Error code

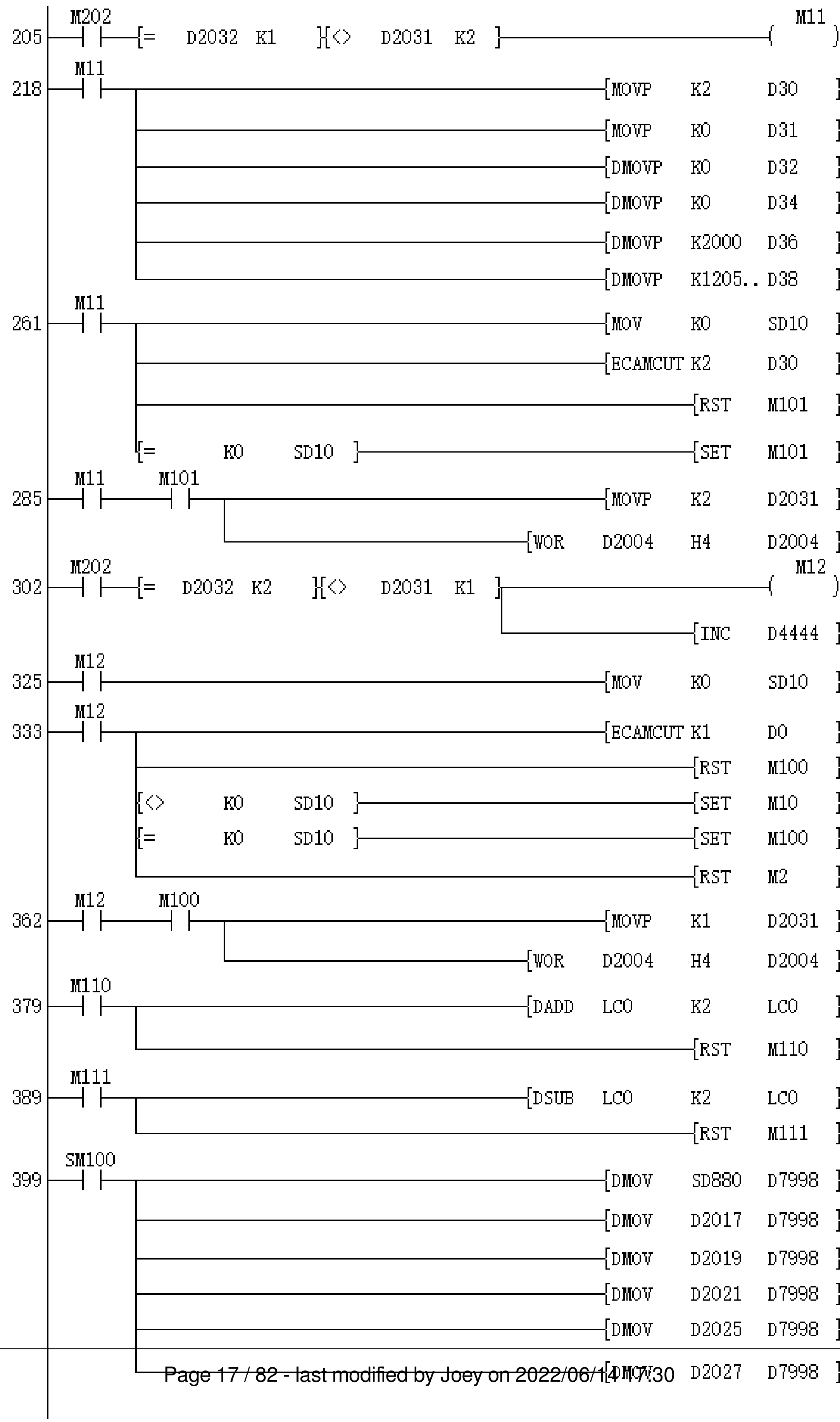
Error code	Content
4E80H	E-cam table loading error
4E81H	The currently numbered form has a cam in use
4084H	Data exceeding 1 to 2 is specified in (s1)
4085H	The (s2) table exceeds the device range

Example

Realize the mutual switching between electronic cam form 1 and form 2



0 SM102
DMOV K0 LC0
ZRST D2000 D2037
16 SM102
MOV K2 D0
MOV K0 D1
DMOV K0 D2
DMOV K0 D4
DMOV K100 D6
DMOV K200 D8
58 M2
MOV K0 SD10
66 M2
ECAMCUT K1 D0
RST M100
<> K0 SD10
SET M10
= K0 SD10
SET M100
RST M2
95 M10
Y010
97 M200
MOV K2 D2038
DMOV K0 D2040
DMOV K0 D2042
DMOV K100 D2044
DMOV K0 D2046
144 M200
DECAM LC0 D2000 M100 Y0 Y1
DMOVP K0 SD880
T0 K1
169 T0 M201
MOVP K1 D2031
MOVP K1 D2032
MOVP K1 D2005
T1 K2
T1
M202
198 SM100
MOV D2032 D7999


205 M202 [= D2032 K1][<> D2031 K2] (M11)
218 M11 [MOVP K2 D30]
[MOVP K0 D31]
[DMOVP K0 D32]
[DMOVP K0 D34]
[DMOVP K2000 D36]
[DMOVP K1205.. D38]
261 M11 [MOV K0 SD10]
[ECAMCUT K2 D30]
[RST M101]
[= K0 SD10] [SET M101]
285 M11 M101 [MOVP K2 D2031]
[WOR D2004 H4 D2004]
302 M202 [= D2032 K2][<> D2031 K1] (M12)
[INC D4444]
325 M12 [MOV K0 SD10]
333 M12 [ECAMCUT K1 D0]
[RST M100]
[<> K0 SD10] [SET M10]
[= K0 SD10] [SET M100]
[RST M2]
362 M12 M100 [MOVP K1 D2031]
[WOR D2004 H4 D2004]
379 M110 [DADD LC0 K2 LC0]
[RST M110]
389 M111 [DSUB LC0 K2 LC0]
[RST M111]
399 SM100 [DMOV SD880 D7998]
[DMOV D2017 D7998]
[DMOV D2019 D7998]
[DMOV D2021 D7998]
[DMOV D2025 D7998]
[DMOV D2027 D7998]

#Note:

1. According to the above Circuit program, first set M2, configure table 1 data, and use ECAMCUT to designate table 1 as electronic cam operation table 1.
2. Set M200 to configure the cam running command DECAM.
3. Set M201 to enable electronic cam operation. And automatically prepare table 2 data, and assign table 2 data as electronic cam operation table 2.
4. Set the second position of D2004 to 1 to turn on the electronic cam switching table function. At this time, table 1 is run in the current cycle, and table 2 is run in the next cycle.
5. Use manual addition (M110) to change the master axis (LC0), and the slave axis pulse number SD880 will also change, and the ratio is the ratio of Table 1 (1:2).
6. When LC0 = 100, the program automatically switches to Table 2 to run, LC0 increment: SD880 increment = 2000:120500. And currently running table 2 and next cycle running table 1. When LC0 = 2100, switch back to Table 1 to run.

ECAMTBX/Electronic cam table generation instruction

ECAMTBX

This instruction is used to generate the table data of the electronic cam.

-[ECAMTBX (S0) (S1) (D0) (D1)]

Content, range and data type

Parameter	Content
(S0)	Specify the first address of the electronic cam table parameter
(S1)	Specify the curve type of the electronic cam
(D0)	Specify the first address of the data buffer area of the E-cam table
(D1)	Table generation results

Device used

Instruction	Parameter	Devices				Offset modification	Pulse extension
		D	R	K	H	[D]	XXP
ECAMTBX	Parameter 1	●	●				
	Parameter 2	●	●	●	●		
	Parameter 3	●	●				
	Parameter 4	●	●				

Features

S0--parameter address, allowable Devices: D, R.

Description: Indicate the parameters to be set to generate the curve.

S1--curve type, allowable Devicess: D, R, H, K.

Description: Indicates the type of curve to be generated.

K1: Generate S type acceleration/deceleration curve with a spindle of 1ms

K2: Customize the designated key point to generate a table

K100: Generate flying shear curve

K101: Generate chase curve

D0--The first address of cam parameters, allowable devices: D, R

Description: The generated table data is stored at the beginning of [D0 + 40], and the number of table segments is stored in [D0 + 38].

D1-table generation result, allowable Devices: D, R

D1 <0 generates a table error;

D1> 0 The table is successfully generated. D1 represents the total number of segments in the current table.

Error code

ECAMTBX instruction generates curve Error code:

Error code	Content
-1	Condition parameter error
-2	The spindle pulse number is too few, not enough for synchronization area
-3	Unknown cam curve type
-4	Resolution range error
-5	Too many pulses of the slave axis calculated
-6	The calculated number of pulses from the slave axis is too small
-7	The calculated number of spindle pulses exceeds the set length
-8	The pulse number of the slave axis is set to 0
-10	S type acceleration and deceleration curve calculation error
-11	Unknown curve type
-12	Curve left wrong
-13	The number of slave axes exceeds the range

Key point generating curve Error code:

Error code	Content
-21	The number of key points is out of range
-22	Total resolution exceeds range
-23	Incorrect relationship between spindle size
-24	The resolution setting of each segment is incorrect
-25	When calculating, the number of control points is insufficient
-26	Unknown acceleration curve type
-27	Spindle pulse number is negative

S-type acceleration and deceleration generated curve Error code:

Error code	Content
-31	The number of pulses exceeds the range
-32	Maximum frequency out of range
-33	Acceleration and deceleration time out of range
-34	The number of pulses or frequency settings cannot meet the curve generation conditions

#Note:

After the curve is successfully generated by the ECAMTBX instruction, the cam table can be uploaded to the upper computer for viewing in the PLC of the PLC Edit upper computer software.

Example

For details, please refer to "9.2 Instruction manual of Electronic CAM (ECAM)".

Instruction manual of Electronic CAM (ECAM)

Principle of ECAM

The traditional mechanical cam is composed of cam, follower and frame. A mechanical cam is an irregular part, generally an input part with a constant speed, which can transmit motion to a follower through direct contact, so that the action moves according to a set law. The follower is a passive part driven by a mechanical cam, and is generally an output part that produces unequal speed, discontinuous, and irregular motion.

ECAM is a software system that uses the constructed concave wheel curve to simulate mechanical cam to achieve the same relative motion between the camshaft and the main shaft of the mechanical cam system.

Compared with mechanical cams, ECAM makes the design of mechanical and electrical parts more and more simple. ECAM allows the equipment to be flexibly used in different templates and plate styles, and also allows the operation process and cycle of the equipment to be modified, either during the design phase of the equipment or after the equipment is formed. It reduces the complexity of the equipment, makes the equipment run more smoothly and doubles the production efficiency.

Description of ECAM function

A.Establish ECAM data

LX5V provides 3 ways to establish ECAM data:

① Write table data to the table data area by DMOV instruction.

② Generate ECAM data automatically by ECAMTBX instruction.

③ Draw ECAM data with PLC Editor software.

B.Spindle pulse selection

The selectable spindles of LX5V series PLC are HSC, LC type and virtual time axis K.

Among them, external high-speed input uses high-speed counter, which supports single-phase single-count input \single-phase double-count input and biphase double-count input. As for the assignment of counters, refer to the instructions for high-speed counters in the PLC help.

When using HSC register (high-speed counter), the pulse of spindle is obtained internally. Modifying the value of the counter does not affect the cam to judge the actual pulse input quantity.

When using the normal counter LC, the pulse of spindle is obtained from devices. Modifying the value of the register will affect the judgment of the pulse of spindle .

When using the K type register, it means to use the internal virtual time axis, and the minimum unit is 100us, K1=100us, K10=1ms.

C.Enable ECAM configuration

Use the DECAM instruction to configure the ECAM function of PLC.

Name	Function	Bits	Whether pulse type	Instruction format	Step number
DECAM	ECAM configuration	32	No	DECAM s1 s2 s3 d1 d2	10

Ladder :

```
    M0
|---| |-------[DECAM  HSC0  D1000  X0  Y0  Y1 ]
```

(1) Parameters

Parameter	Content
(S1)	Specify to receive the input pulse of the master axis
(S2)	Specify the data buffer area of the ECAM instruction
(S3)	The external start signal of ECAM needs to be enabled in the data buffer area to be effective.
(D1)	Specify pulse output axis
(D2)	Specify direction output axis

Device used:

Instruction	Parameter	Device											Offset modification	Pulse extension
		X	Y	M	S	D.b	D	R	LC	HSC	K	H	[D]	XXP
DECAM	Parameter 1								●	●	●	●		
	Parameter 2													
	Parameter 3	●		●	●	●	●	●						
	Parameter 4		●											
	Parameter 5		●	●		●								

(2) Function description

When the contact M0 is turned on, the PLC activates ECAM function, but the ECAM function is not yet running at this time, it just initializes the parameters of the cam. It includes that D1000 to D1005, D1031, D1032 will be cleared and check whether the cam table is correct. After initialization, these registers still need to be set for control.

This instruction configures the relevant registers and required data for cam operation, and enables the function of ECAM, but the cam does not actually run. To actually enable the ECAM function, the relevant device in the cache address of the instruction (such as D1000 in the instruction) is also needed to control the start and stop of the cam.

If the instruction is disconnected, the cam stops working.

Refer to the description of "9.2.2.5 ECAM function register" for the definition of cam parameter devices.

(3) Instruction error description

When the instruction is running, PLC will check the relevant cam parameters in the cache address and prompt the corresponding error. You can find the error according to the prompt [PLC Error code information]:

Error code	Content

4084H	The parameter set in the instruction exceeds the limit
4085H	The device used in the instruction exceeds the maximum device number
4088H	Multiple application instructions use the same output axis for pulse output
4E80H	ECAM table loading error
4E81H	The currently numbered form has a cam in use
4E82H	ECAM table address error
4E83H	The electronic cam table exceeds the device range

When an error occurs, the ECAM function is not enabled at this time.

(4) Devices involved in instruction execution

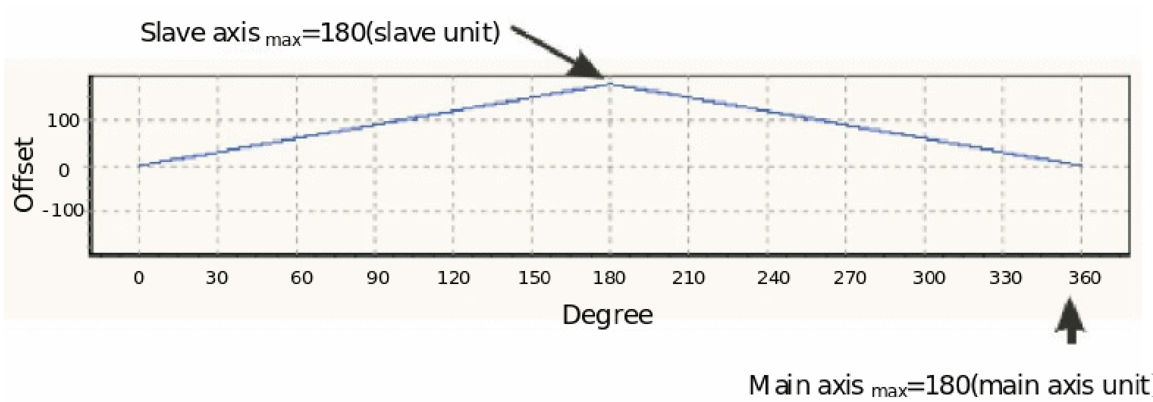
Devices	Content
SD881 (high byte), SD880 (low byte)	Y000 Output pulse number. Decrease when reversed. (Use 32 bits)
SD941 (high byte), SD940 (low byte)	Y001 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1001 (high byte), SD1000 (low byte)	Y002 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1061 (high byte), SD1060 (low byte)	Y003 output pulse number. Decrease when reversed. (Use 32 bits)
SD1121 (high byte), SD1120 (low byte)	Y004 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1181 (high byte), SD1180 (low byte)	Y005 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1241 (high byte), SD1240 (low byte)	Y006 Number of output pulses. Decrease when reversed. (Use 32 bits)
SD1301 (high byte), SD1300 (low byte)	Y007 Output pulse number. Decrease when reversed. (Use 32 bits)

Devices	Content	Devices	Content
SM882	Y000 Pulse output stop (stop immediately)	SM880	Y000 monitoring during pulse output (BUSY/READY)
SM942	Y001 Pulse output stop (stop immediately)	SM940	Y001 Monitoring during pulse output (BUSY/READY)
SM1002	Y002 Pulse output stop (stop immediately)	SM1000	Y002 Monitoring during pulse output (BUSY/READY)
SM1062	Y003 Pulse output stop (stop immediately)	SM1060	Y003 Monitoring during pulse output (BUSY/READY)
SM1122	Y004 Pulse output stop (stop immediately)	SM1120	Y004 Monitoring during pulse output (BUSY/READY)
SM1182	Y005 Pulse output stop (stop immediately)	SM1180	Y005 Monitoring during pulse output (BUSY/READY)
SM1242	Y006 Pulse output stop (stop immediately)	SM1240	Y006 Monitoring during pulse output (BUSY/READY)
SM1302	Y007 Pulse output stop (stop immediately)	SM1300	Y007 Monitoring during pulse output (BUSY/READY)

D.ECAM start/stop

(1) Periodic ECAM start/stop

Periodic ECAM means that while the main axis is continuously advancing, the cam axis will realize the corresponding position according to the "ECAM curve table (table)", but the table only defines one period of data, so the positional relationship of master/slave axis in this mode is the continuous repetitive extension of the table.



1) Periodic ECAM start

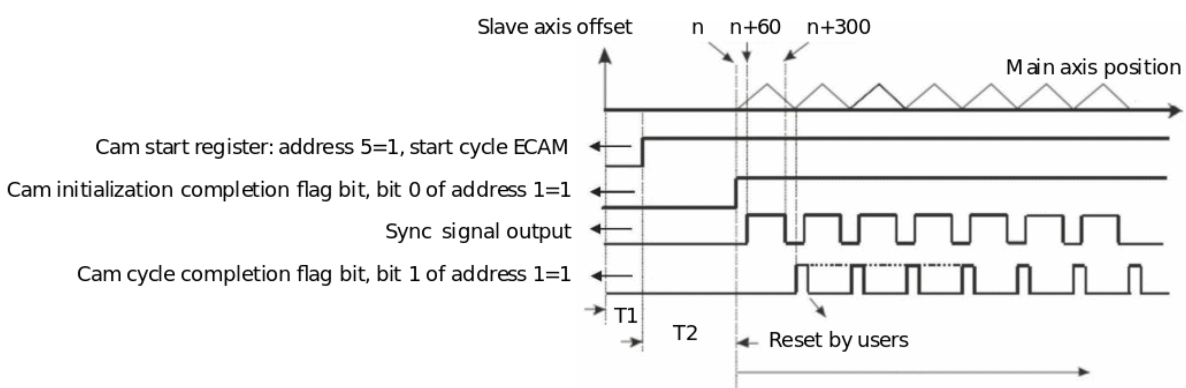
Periodic ECAM start sequence is as below.

#At time T1, address 5=1, start periodic electronic cam.

#After the time T2 has elapsed, the PLC takes the initiative to set address 1-bit0 (ECAM initialization complete flag).

#During time T3, ECAM initialization is completed and the periodic action is started. The slave axis follows the movement of the spindle according to the position relationship in the table, and the synchronization signal terminal is output according to the synchronization point range.

#When a cycle is completed, ECAM cycle completion flag address 1-bit1 turns ON, and the user clears the completion flag by itself, and then continues to judge the next cycle.

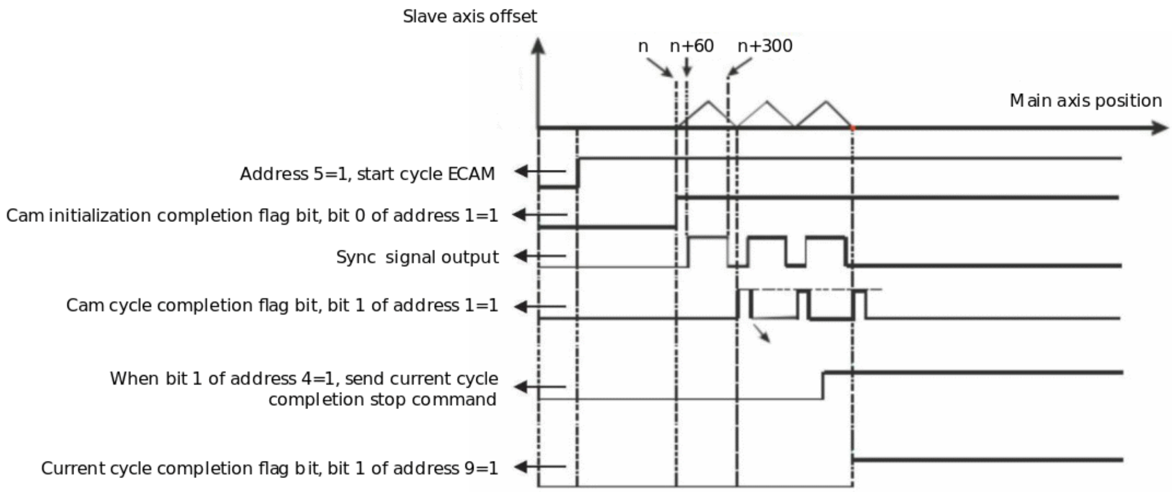


2) Periodic ECAM stop

The periodic ECAM stop sequence is as below.

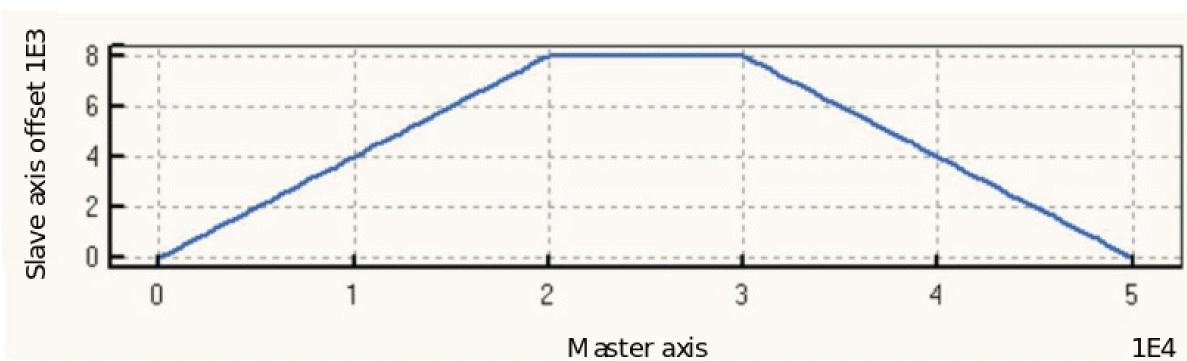
#When ECAM starts register (address 5) = 0, the ECAM stops operating immediately.

#When the periodic ECAM is operating, the system receives the completion stop flag ((address 4-bit1), the periodic ECAM will continue until the current table is executed, the slave axis will stop operating, as shown in the figure below. If you want to start the periodic cam again, you need to write 0 to address 5 and keep it more than 100us, and then you can start the periodic cam through address 5 again.



3) Example description

The following figure shows the ECAM data, where the spindle length is 50000, the output unit is the number of pulses, and the synchronization range is 20000 to 30000. When running into the synchronization zone, the synchronization terminal output can be used as a control signal. To create ECAM data, please refer to the ECAM data. Hardware circuit Y1 outputs pulse to connect to X0, and it means that the spindle input terminal receives the output pulse of Y1.



This example is to use the software PLC Editor2 to set the table.

Instructions

① When executing the program, the special register is set first. The set parameters are as follows:

A. Double word is composed of SD881 and SD880, the current position of Y0 is cleared to 0,

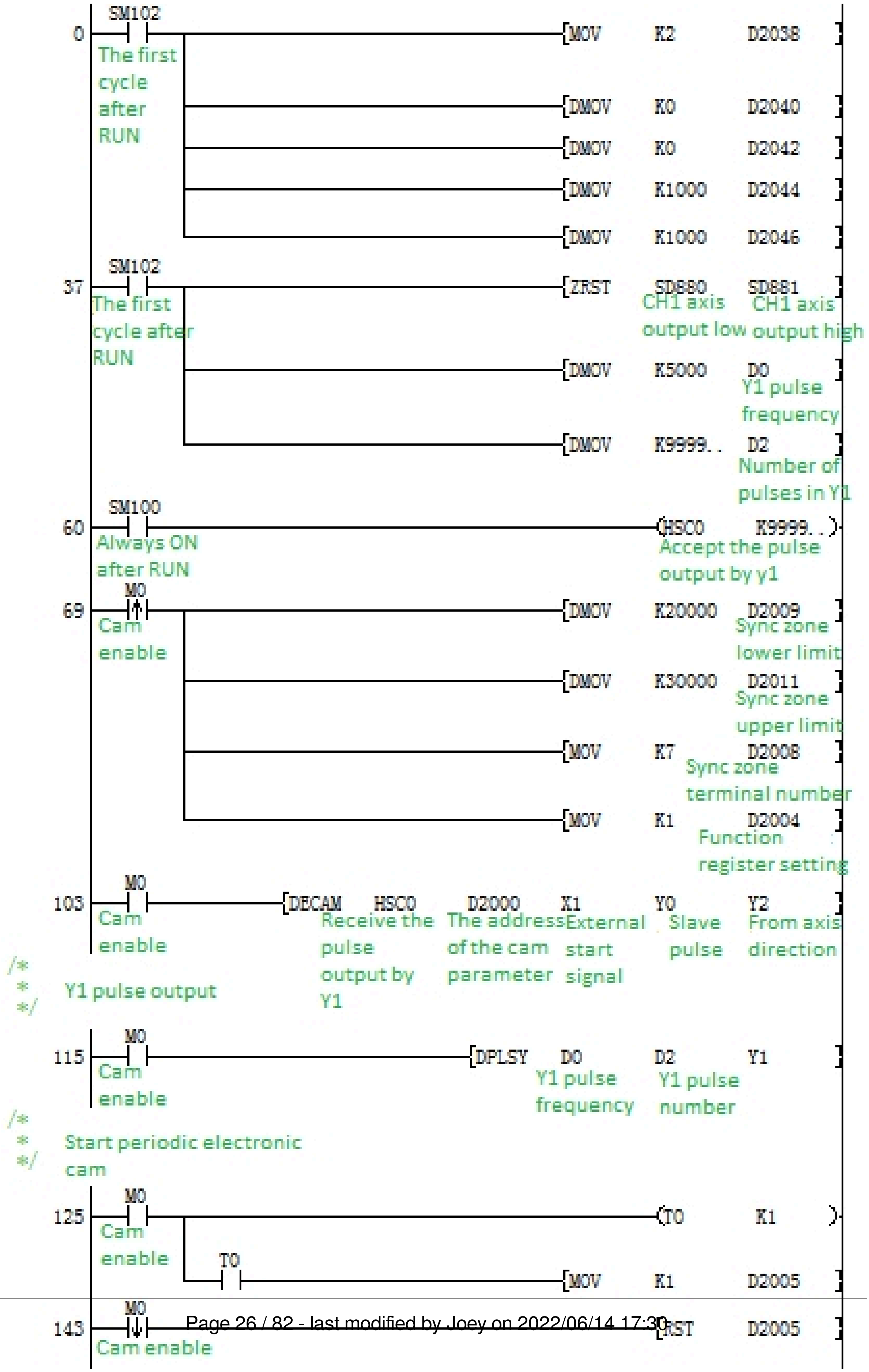
B. Start the high-speed counter HSC0 and configure it as a single-phase input to receive the high-speed pulse input of X0 (in this case, the pulse of X0 comes from the output pulse of Y1).

② SET M0 to start the ECAM, Y axis starts to perform variable speed movement. The main axis receives variable speed input pulse of Y axis, the slave axis outputs pulse according to the ECAM curve, and when the main axis position is 20000-30000 in each cycle, Y7 is ON state.

#Note: Special registers must be set before the ECAM is started. Set the upper and lower limits of the synchronization position of the ECAM D2009 = 20000, D2011 = 30000; and set the number of the synchronization terminal Y D2008, and the synchronization output enable D2004-BIT0, an ECAM cycle is 50000 pulses and when the spindle position is 20000-30000 pulses (monitored by D2025 and D2026), the synchronization terminal is ON.

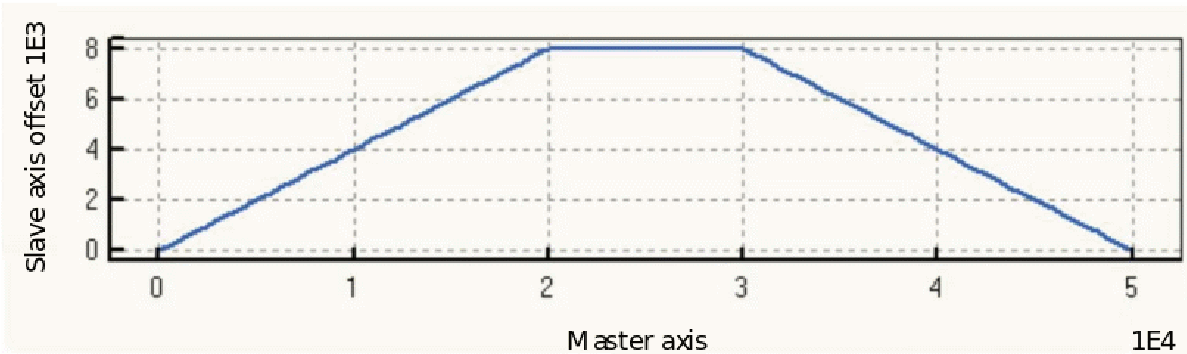
③ RST M0, the cam stops running.

PLC program


0 SM102 The first cycle after RUN
[MOV K2 D2038]
[DMOV K0 D2040]
[DMOV K0 D2042]
[DMOV K1000 D2044]
[DMOV K1000 D2046]
37 SM102 The first cycle after RUN
[ZRST SD880 SD881]
CH1 axis output low
CH1 axis output high
[DMOV K5000 D0]
Y1 pulse frequency
[DMOV K9999.. D2]
Number of pulses in Y1
60 SM100 Always ON after RUN
(HSC0 K9999..)
Accept the pulse output by y1
69 M0 Cam enable
[DMOV K20000 D2009]
Sync zone lower limit
[DMOV K30000 D2011]
Sync zone upper limit
[MOV K7 D2008]
Sync zone terminal number
[MOV K1 D2004]
Function register setting
103 M0 Cam enable
[DECAM HSC0 D2000 X1 Y0 Y2]
Receive the pulse output by Y1
The address of the cam parameter
External start signal
Slave pulse
From axis direction
/* * Y1 pulse output */
115 M0 Cam enable
[DPLSY D0 D2 Y1]
Y1 pulse frequency
Y1 pulse number
/* * Start periodic electronic cam */
125 M0 Cam enable
(T0 K1)
T0
[MOV K1 D2005]
143 M0 Cam enable
[RST D2005]

(2) Aperiodic ECAM start/stop

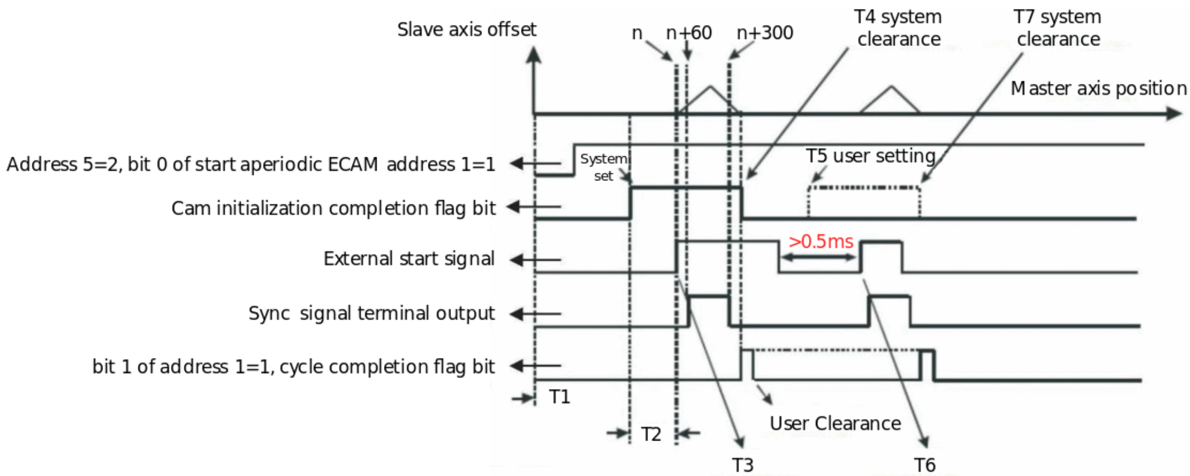
Aperiodic ECAM refers to the timing when the camshaft starts to realize the corresponding position according to the table while the main shaft is continuously advancing after the cam start signal is input. Different from the periodic ECAM, The position relationship of the master/slave axis in this mode actually only runs for one cycle, that is, the table only moves once.



1) Aperiodic ECAM start

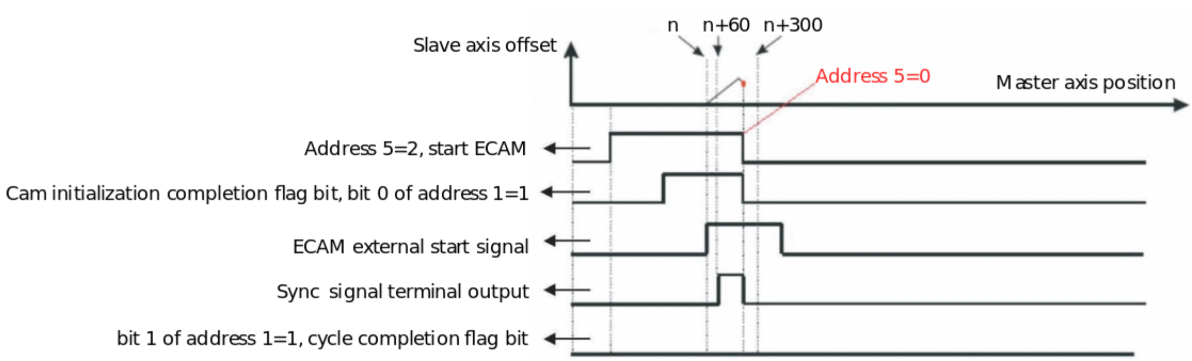
The aperiodic ECAM stop sequence is as below.

1. At time T1, address 5=2, and aperiodic ECAM is started.
2. After the calculation of the time T2, the PLC actively sets the address 1-bit0=ON (the initialization of aperiodic ECAM is completed). At this time, the slave axis will not follow the movement of the master axis.
3. At time T3, the ECAM start signal is turned ON (when the external start signal is used), the slave axis will follow the spindle movement for one cycle according to the position relationship in the table.
4. After the cycle is completed at the position of time T4, the PLC will actively clear the state of address 1-bit0=ON, and the user can also judge whether the cycle is completed according to the state of address 1-bit1 to .
5. During the time T5, the user can choose whether to set the address 1-bit0=ON again through the program , for the purpose of completing the judgment next time.
6. Time T6/T7 position is to repeat the action of T3 to T4 again. **#Note:** The interval between the rising edges of the cam start signal must be more than 0.5ms.
7. Sync signal terminal output.

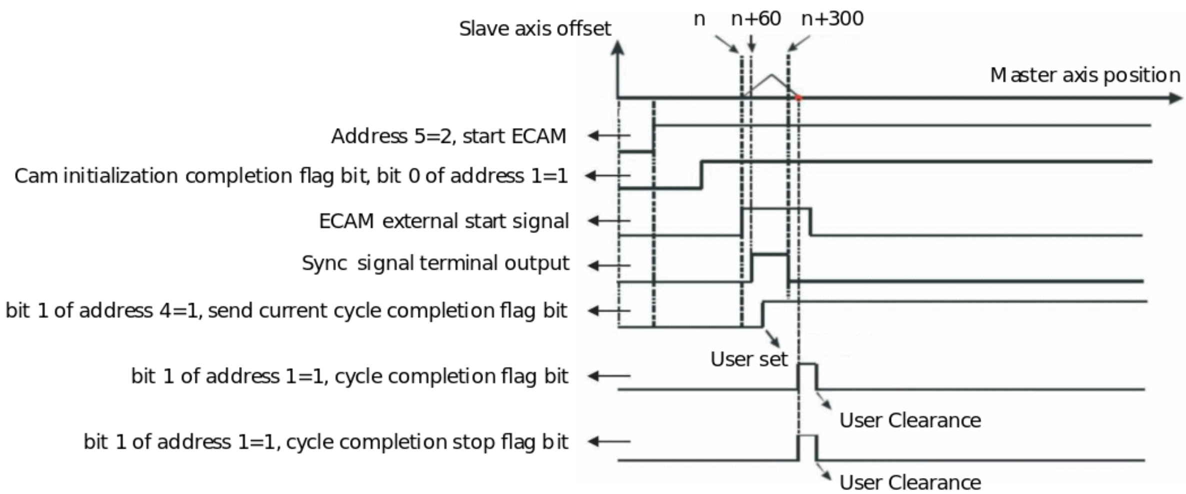


2) Aperiodic electronic cam stop

1. When starting the ECAM register address 5=0, the ECAM slave axis stops operating immediately, as shown in the figure below.

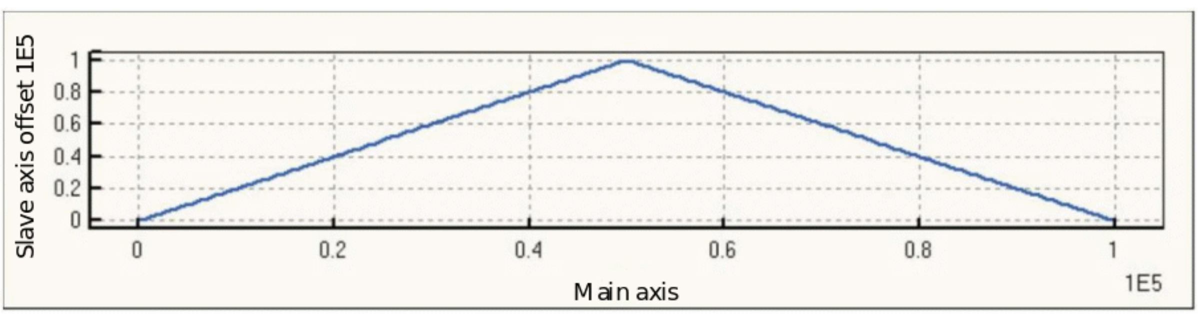


2. When the aperiodic ECAM is running, address 4-BIT1=1 (stop after the current cycle is completed), the aperiodic ECAM will continue to run through the table and then the slave axis will stop operating, as shown in the figure below.



3) Example explanation

The following figure shows the ECAM running table (the spindle length is 0 to 100000 for a cycle), and its output is the number of pulses. When the external signal X2 is triggered by the rising edge, execute two consecutive tables (D1014=2), and wait for the X2 rising edge Trigger again, and execute two consecutive tables again, and so on.



This example uses the software PLC EDITOR to ECam0. Please refer to 9.2.2.5 for the detailed steps of creating an ECAM curve. The Y1 axis of the hardware circuit outputs pulse and connects to the X0 axis input terminal, indicating that input terminal position of master axis is to receive the pulse output of Y1 axis as input.

Operation steps

① When the program is executed, set special registers first, and the set parameters are as follows:

A. The contents of SD880, SD881 and SD940, SD941 are cleared to 0

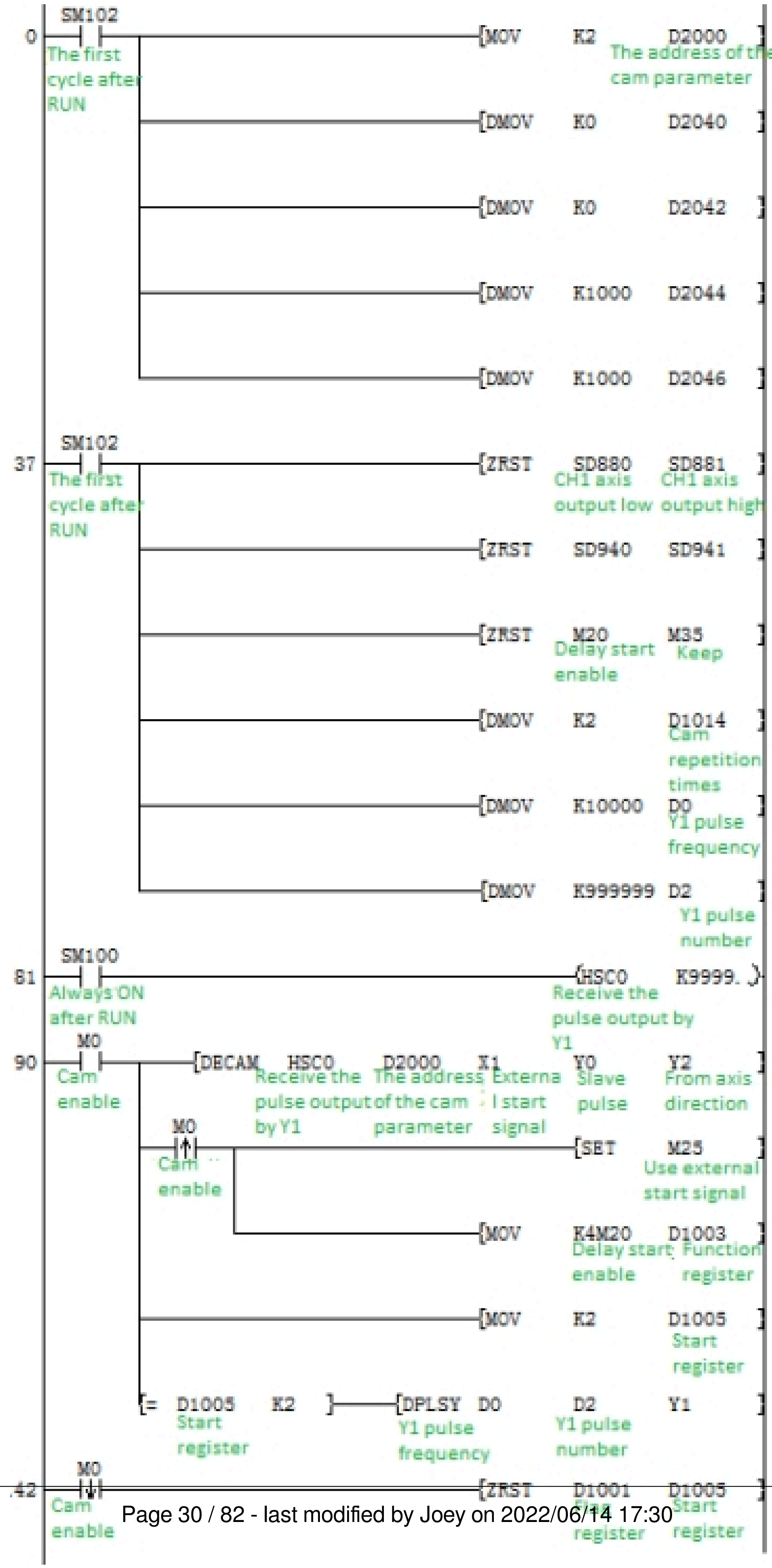
B. Set D1014=2 (repeat the form twice)

② Set M0: Configure and start the cam. When M0 is the rising edge, set D1003-Bit5 to use an external start signal; when D1005=2, Y1 outputs pulses, and Y0 axis has not output yet at this time.

③ The external signal X2 is triggered, and Y0 axis is output with the ECAM curve; the output stops after 2 cycles.

④ RST M0: Close the ECAM mode; if runs RST M0 when the ECAM is running, Y0 axis will stop output immediately.

[PLC program]


0 SM102 The first cycle after RUN
[MOV K2 D2000] The address of the cam parameter
[DMOV K0 D2040]
[DMOV K0 D2042]
[DMOV K1000 D2044]
[DMOV K1000 D2046]
37 SM102 The first cycle after RUN
[ZRST SD880 SD881] CH1 axis output low CH1 axis output high
[ZRST SD940 SD941]
[ZRST M20 M35] Delay start enable Keep
[DMOV K2 D1014] Cam repetition times
[DMOV K10000 D0] Y1 pulse frequency
[DMOV K999999 D2] Y1 pulse number
81 SM100 Always ON after RUN
(HSC0 K9999.) Receive the pulse output by Y1
90 M0 Cam enable
[DECAM HSC0 D2000 X1 Y0 Y2] Receive the pulse output by Y1 The address of the cam parameter External start signal Slave pulse From axis direction
M0 Cam enable
[SET M25] Use external start signal
[MOV K4M20 D1003] Delay start enable Function register
[MOV K2 D1005] Start register
[= D1005 K2] Start register
[DPLSY D0 D2 Y1] Y1 pulse frequency Y1 pulse number
142 M0 Cam enable
[ZRST D1001 D1005] Flag register Start register

Electronic cam function register

Offset address	Name	Function
0	Form version number	
1	Flag register	Bit0: Initialization complete flag After the ECAM permission signal is activated, calculate the related data, and automatically set to ON after initialization. Users need to clear the sta Bit1: Cycle completion flag ECAM completion flag. When the periodic ECAM is executed, this flag will be automatically set to ON; if you want to restart the periodic ECAM, clea Bit2: Pulse sending delayed flag Bit3: ECAM error stop running flag Bit4: Parameter error, ECAM stop running flag Bit5: Table error, electronic cam stop running flag Bit6: Periodic ECAM flag Bit7: Aperiodic ECAM flag Bit9: Current cycle completion stop flag Bit10: synchronization zone flag Bit11: Time axis flag Bit12: New form load completion flag Bit13: Periodic delay ECAM flag Bit14: Delayed start function, delayed waiting flag bit
2	Register error	Operation error condition (check Bit3 of address 1): Display Error code. Parameter error condition (check Bit4 of address 1): Display the offset address of the error parameter register. Table error condition (check Bit5 of address 1): display error Incorrect table segment number. **#Note:** Bit3 of address 1 must be set with Bit4 and Bit5
3	Function register (Confirm before using electronic cam)	Bit0: Delayed start enable Bit1: Start at specified position Bit2: Spindle zoom Bit3: zoom from axis Bit5: Use external start signal Bit6: Start from current position
4	Function register (Can be changed while the ECAM is running)	Bit0: Sync signal enable Bit1: Stop the electronic cam after the current cycle is completed Bit2: Switch the table after the cycle is completed, the bit will automatically change back to 0 after the switch is completed
5	ECAM start register	0: Stop the electronic cam immediately 1: Periodic electronic cam (start) 2: Aperiodic electronic cam (start)

		3: Stop after the cycle is completed, this register automatically becomes 3 4: Periodic delay electronic cam (start) Other: reserved, not available
6	Maximum output frequency setting of ECAM	Maximum output frequency setting of electronic cam; When the frequency is less than 0 or greater than 200K, it is 200K
7	The highest ECAM output frequency setting	
8	Sync signal Y terminal number	Output terminal number: Set the Y number of the synchronization output terminal, the range is 0 to 1777 (octal), when the synchronization output function is enabled, when i the upper and lower limits of the synchronization position first .
9	CAM synchronization position lower limit (Low word)	The synchronization position upper/lower limit setting of the electronic cam, When the synchronization position lower limit ≤ spindle position ≤ position upper limit And the synchronization signal terminal Y output is ON when the synchronization signal is enabled (address 4, BIT0). When the lower limit> the upper limit, the upper and lower limit values will be exchanged.
10	CAM synchronization position lower limit (High word)	
11	CAM synchronization position upper limit (Low word)	
12	CAM synchronization position upper limit (High word)	
13	Electronic cam pulse remainder distribution setting (reserved)	Reserved
14	Aperiodic ECAM	Periodic electronic cam: reserved; Aperiodic electronic cam: control table execution times; when the value is H0001, the electronic cam will stop after executing once;

	execution times	When the value is HFFFF, it will become a periodic electronic cam execution.
15	ECAM start delay pulse setting (low word)	Periodic electronic cam: reserved Aperiodic electronic cams and periodic delay electronic cams: the delayed start function can be enabled through (Address 3, Bit0-delayed start ena executed immediately, but the spindle rotates for a few pulses, the table is run. At this time, this register sets the number of delayed pulses.
16	ECAM start delay pulse setting (high word)	
17	Spindle specified position start (Low word)	Periodic electronic cam: reserved Aperiodic electronic cam: It can be enabled by (address 3, Bit1-specified location start enable), To enable the function of the specified location. The starting position is set by this address. The setting value must be within the table period.
18	Spindle specified position start (high word)	
19	Current position of slave axis (low word)	Output shaft: current position of slave shaft (after conversion) The position of the slave axis during the current cam execution, after scaling
20	Current position of slave axis (high word)	
21	Current position of slave axis (low word)	Output shaft: current position of slave shaft (before conversion) The position of the slave axis during the current cam execution, before scaling
22	Current position of slave axis (high word)	
23	Denominator of slave axis magnification	

24	Slave magnification numerator	
25	Spindle current position (low word)	Main axis: the current position of the spindle (after conversion) The position of the main axis during the current cam execution, after scaling
26	Spindle current position (high word)	
27	Spindle current position (low word)	Main axis: the current position of the spindle (before conversion) The position of the main axis during the current cam execution, before scaling
28	Spindle current position (high word)	
29	Denominator of spindle magnification	Spindle zoom
30	Spindle magnification numerator	
31	Specify the table to be run in the next cycle	Switch to use in the table function after the cycle is completed. 0: Use the default table 1: Use the data in Table 1 (ECAMCUT specifies the address) 2: Use the data in Table 2 (ECAMCUT specifies the address)
32	Table running in current cycle	Switch to use in the table function after the cycle is completed. Indicates the current week Periodically run form.
33	Reserved	
34	Reserved	
35	Reserved	
36	Reserved	
37	Reserved	
38	Number of segments in the table	Total data segment of cam table data
39	Start offset of	Specify the offset address of the cam table, fixed to 40

	the table	
40	Spindle segment 0 (low word)	Spindle position of segment 0
41	Spindle segment 0 (high word)	
42	Section 0 slave axis (low word)	Slave axis position of segment 0
43	Section 0 slave axis (high word)	
44	Spindle section 1 (low word)	Spindle position of segment 1
45	Spindle section 1 (high word)	
46	Section 1 slave axis (low word)	Slave axis position of segment 1
47	Section 1 slave axis (high word)	
40+ N*4	Nth spindle (low word)	Nth segment spindle position
40+ N*4+1	Nth spindle (high word)	

40+N*4+2	Nth segment slave axis(low word)	Nth segment slave axis position
40+N*4+3	Nth segment slave axis(high word)	

Description of cam register

(1) Address 2 - Error register:

Operation error (check Bit3 of address 1) error code description:

Error code	Content
-1	Form number is out of range
-2	The table is not initialized properly
-3	The number of table segments is too short
1	Spindle input error, pulse change is too large, 100us exceeds 200
3	Too many slave axes calculated
5	The spindle has too many unprocessed pulses in the current cycle
8	Calculate the number of pulses that the slave axis currently needs to output is too much
9	The cam master is 2 cycles ahead of the slave
Parameter error (check Bit4 of address 1)	Display the offset address of the error parameter register.
Form error (check Bit5 of address 1)	The wrong table segment number is displayed.

(2) Address 3—function register before ECAM is enabled

Start the corresponding function register of the cam. When the corresponding setting is 1, the corresponding function of the cam is enabled.

BIT6: start from current position

You can set the starting point of the master and slave when the cam starts.

When this function is enabled, the initial position of the spindle is obtained from [Address 27, 28 — current position of the spindle (before conversion)];

The initial position of the slave axis is obtained from [Address 19, 20 — current position of the slave axis (after conversion)].

(3) Address 4—function register in ECAM operation

Bit0-Sync signal enable

When the address 4-Bit0=1, when the spindle position is at the lower limit of the synchronous position ≤ the spindle position ≤ the upper limit of the synchronous position, the synchronous terminal outputs.

Bit1-Stop when the current cycle is completed

When address 4-BIT1 = 1, the cam will stop immediately after the execution of the current table is completed. After stopping, address 5 will automatically change to 3, reset to 1, and the periodic electronic cam can be started again. The same applies to non-periodic electronic cams.

(4) Address 5—electronic cam start register

Periodic electronic cam start: when address 5=1, start periodic electronic cam: when address 5=0, stop electronic cam.

Periodic delay electronic cam start: when address 5=2, start the first period delay pulse set by address 15, 16 and execute according to periodic electronic cam; address 5=0, stop electronic cam.

When switching between periodic electronic cam and non-periodic electronic cam, the data switching between address 5=1→address 5=0→address 5=2 requires an interval of more than 100us.

(5) Address 8—synchronization signal Y terminal number

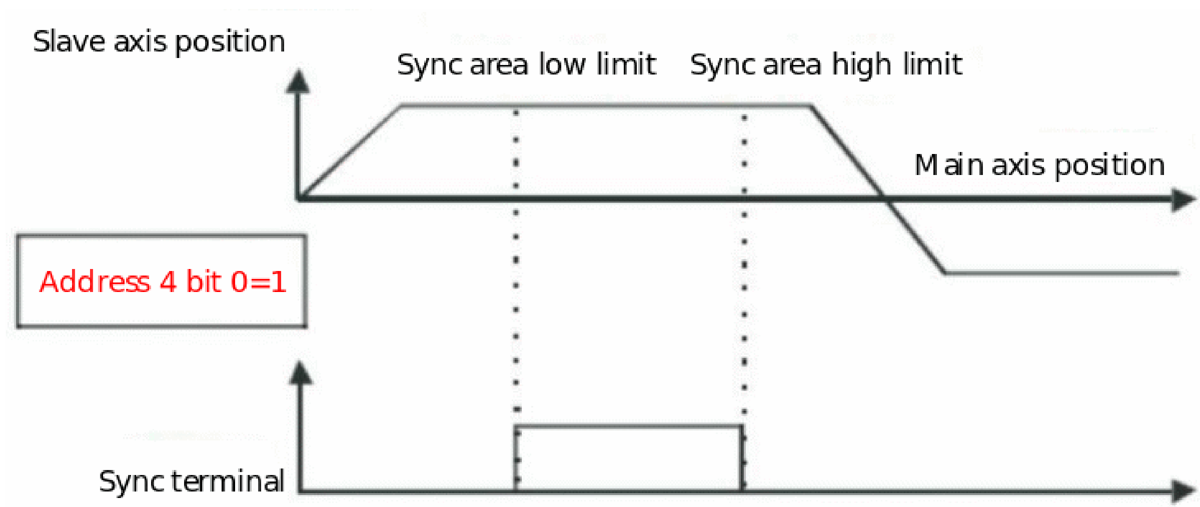
This register is used to set the terminal number of the synchronization signal output.

When the address 4-Bit0=1, when the spindle position is at the lower limit of the synchronous position≦the spindle position≦the upper limit of the synchronous position, the synchronous terminal outputs.

(6) Address 9-12—synchronization position upper and lower limit

Address	Features	Range
Address 9	CAM synchronization position lower limit (LOW WORD)	0 to 2147483647
Address 10	CAM synchronization position lower limit (HIGH WORD)	
Address 11	CAM synchronization LOW WORD)	0 to 2147483647
Address 12	CAM synchronization position upper limit (HIGH WORD)	

The synchronization position upper/lower limit of the electronic cam is set. When the synchronization position lower limit ≤ spindle position ≤ position upper limit and the synchronization signal is enabled (address 4, BIT0), the synchronization signal terminal Y is output.

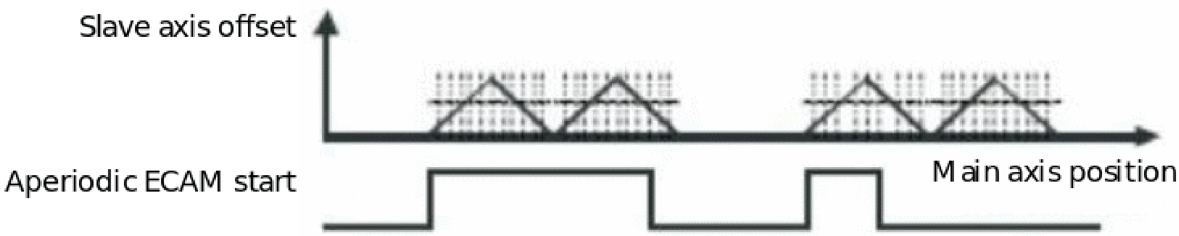


(7) Address 14—Aperiodic electronic cam execution times setting

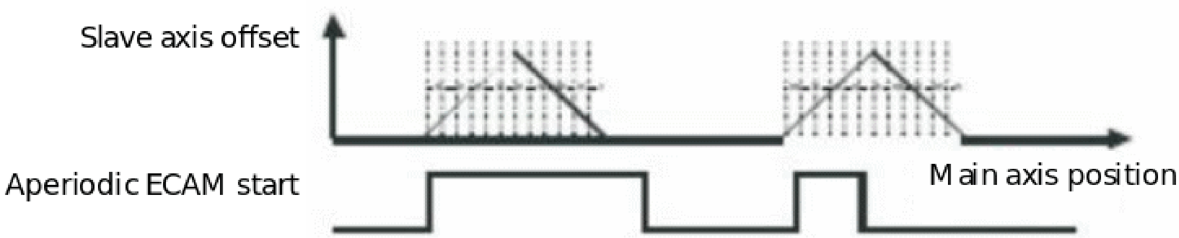
Address	Features	Range
Address 14	Periodic electronic cam-reserved Non-periodic electronic cam-control the number of times the electronic cam is executed	1 to 65535

When the non-periodic electronic cam mode is selected, the address 14 controls the execution times of the electronic cam. The current address is set to the number of times the cam repeats the table. When the value is HFFFF, it will become periodic cam execution. When the value is 0, the current address will automatically become 1 if it exceeds the range.

Number of repetitions=0



Number of repetitions=1



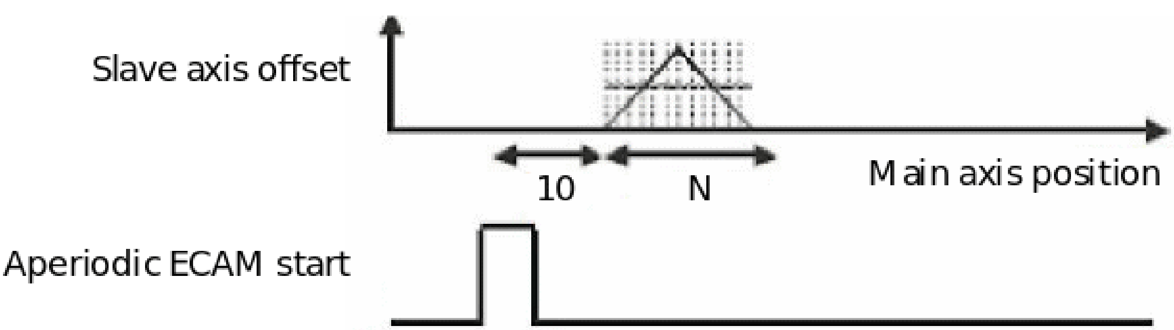
(8) Address 15-16—Electronic cam start delay pulse setting

Address	Features
Address 15	Aperiodic electronic cams or periodic delay electronic cams. The electronic cam table will be executed immediate
Address 16	

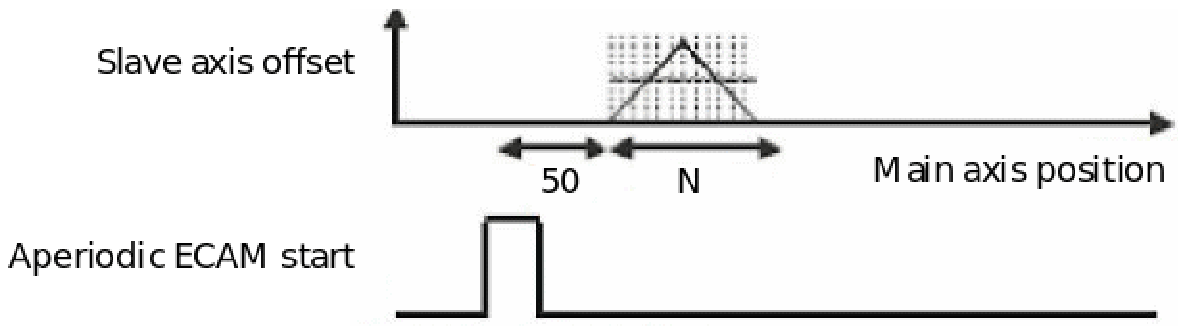
When executing aperiodic electronic cams or periodic delayed electronic cams, if address 3 (Bit0-delayed start enable) is set, the delayed start function is enabled. The slave axis receives a cam start signal. If the electronic cam table is not executed immediately, the table is run after delaying the spindle rotation for several pulses. At this time, the number of delayed pulses must be set for address 16.

As shown in the figure below: When the system receives a cam start signal, the electronic cam table will be executed immediately after the spindle rotates the set number of pulses.

Delayed start pulse=10

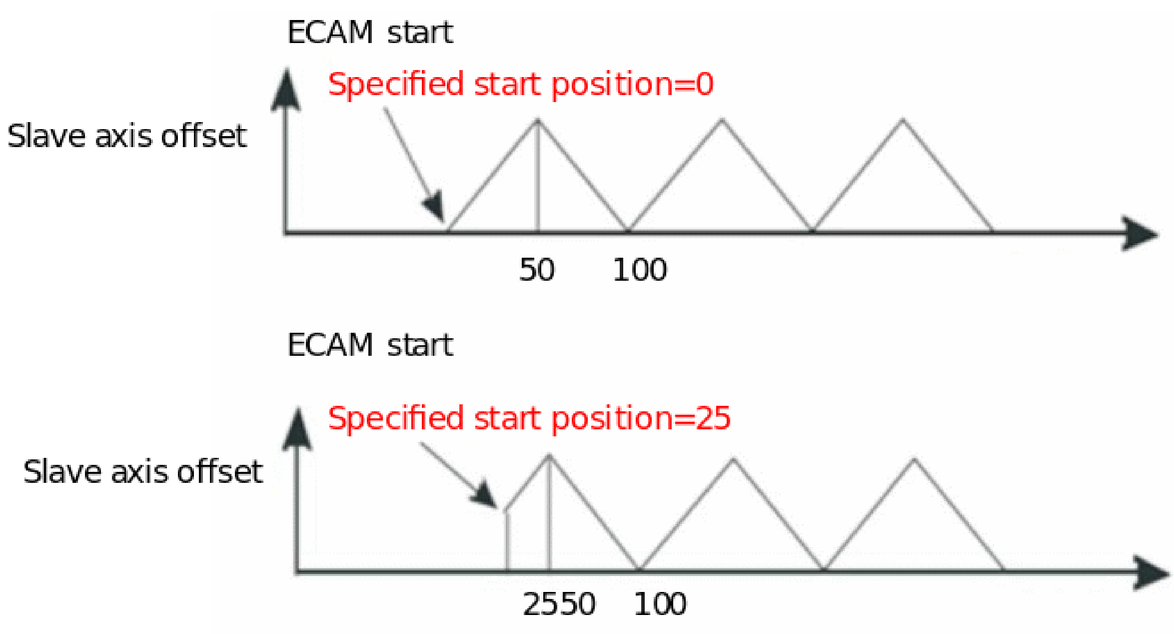


Delayed start pulse=50



(9) Address 17-18—start at the specified position of the spindle

Address	**Features**
Address 17	The non-periodic electronic cam can be started at the specified position by address 3 (Bit1-specified position start ena
Address 18	

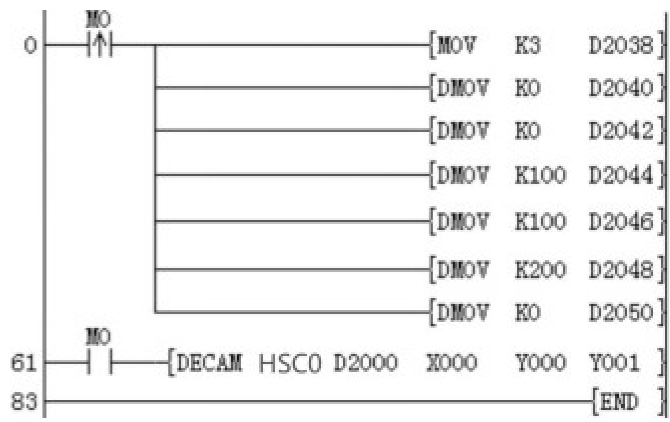


9.2.2.6 E-cam spreadsheet data creation

(1) Single table data change setting

Each electronic cam table can create 512 points of data, which are set using offset address 40-address [40+n*4+4] respectively. Every 4 points of data is a group of ECAM data, which is composed of master axis position and slave axis position.

Use DMOV instruction to manipulate table data:



Set the total data segment of the spreadsheet data to 3

The spindle position of segment 0 is 0

The position of the 0th segment slave axis is 0

The spindle position of the first segment is 100

The first segment slave axis position is 100

The second stage spindle position is 200

The second segment slave axis position is 0

Configure electronic cam

(2) Use PLC Editor to generate table data

Define the relationship between master axis and slave axis, which is called electronic cam table data. In the data input, the electronic cam table has two ways to express:

Method 1: The functional relationship between the adopter

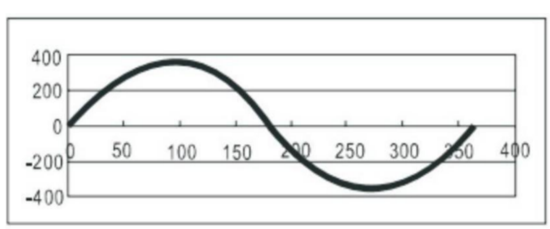
Method 2: Use the point-to-point relationship of X and Y to obtain the electronic cam table in two ways:

Approach 1: According to the standard function relationship of the master and slave axis

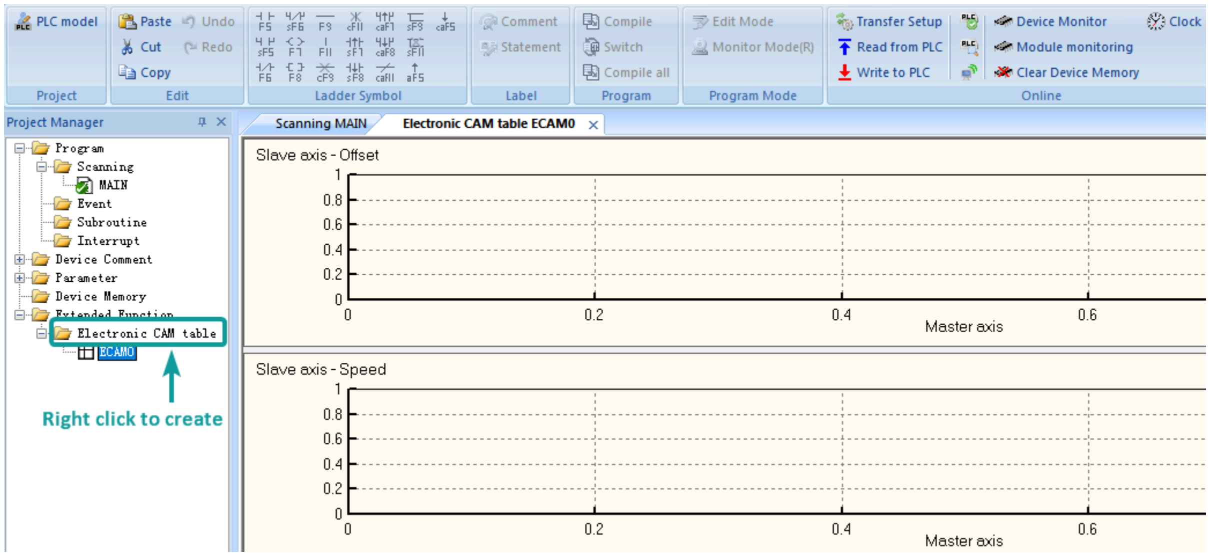
Approach 2: According to the corresponding relationship between points measured in actual work.

The cam table can define multiple CAM curves. After the relationship is determined, the position of the slave axis can be obtained according to the position of the master axis.

For example, the cam table for sinusoidal signals:



The electronic cam table is called electronic cam table in PLC Editor. Select [electronic cam table] in [Project Properties]-[Protection Function], right click to add and delete the table.

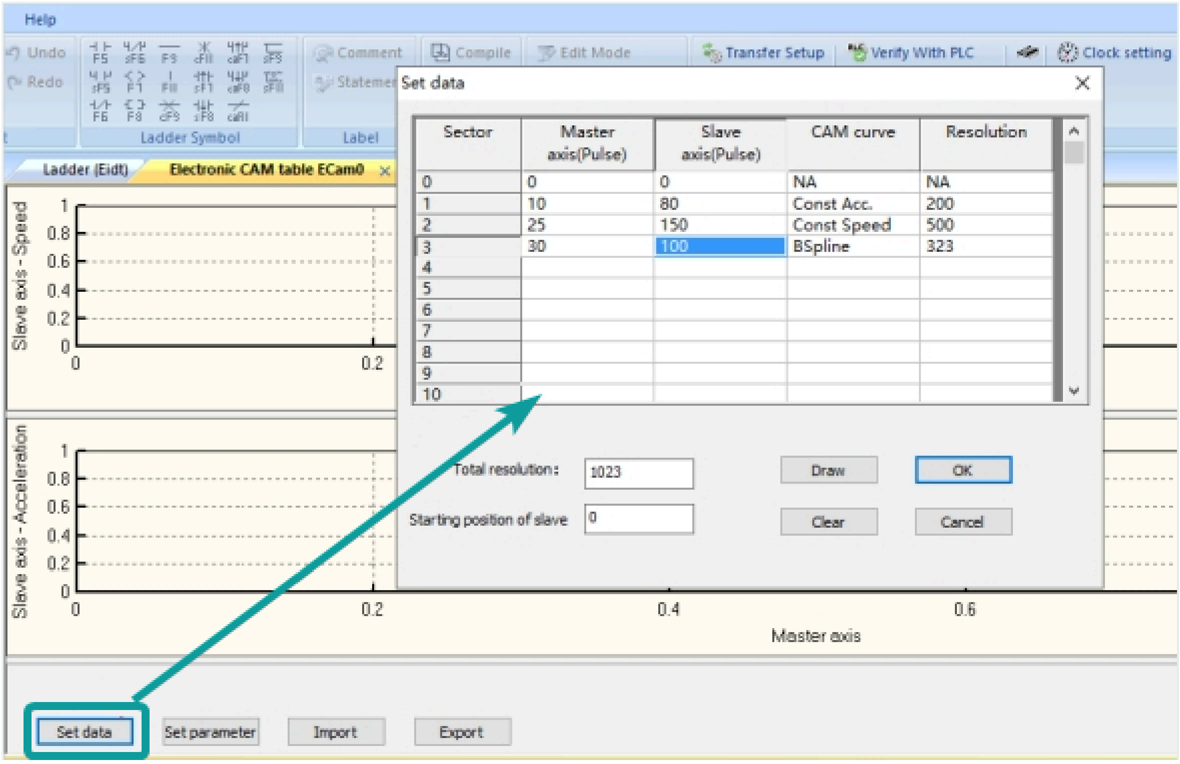


The chart is mainly divided into 4 parts, namely the relative position of the master/slave axis, the relative speed of the master/slave axis, the relative acceleration of the master/slave axis, and the bottom data setting. The first three parts are used to display the CAM data set by the user. The horizontal axis is the main axis, and the vertical axis is the position of the slave axis, the speed ratio of the slave axis to the master axis, and the acceleration ratio of the slave axis to the master axis. The data setting area is introduced as follows:

1. Displacement resolution: Provide users to set the total number of data points occupied by the table, and the setting range is from 10 to 512, one point occupies 4 WORD Devicess.
2. Data setting: Describe the displacement change of the master/slave axis by function.
3. Import: describe the displacement change of the master/slave axis through a point-to-point method.
4. Export: Export and archive the change relationship of the master/slave axis in a point-to-point manner.

1) Functionally describe the position changes of the master and slave axes

Select [Data Setting] in the data setting area and the "Data Setting Window" will appear, which allows the user to describe the curve of the entire cam in a function, rather than a point-to-point description. At present, Wecon PLC provides 3 cam curve modes for users to choose, namely: Const Speed (constant speed), Const Acc (uniform acceleration), BSpline (cycloid).



[Data Setting] The window is composed of sections, each section provides the user to set a section of cam curve, and then the entire section composes the cam curve. Each section is composed of master axis, slave axis, CAM curve and resolution, as explained below:

Main shaft: the displacement of the main shaft, the displacement of the main shaft must be greater than a value of 0, and increase;

Slave axis: the displacement of the slave axis, which is positive or negative;

CAM curve: the function used in the current section;

Resolution: The number of points used in the current section. The entire table can be set in the range 10-512. 1 point occupies 4 WORDs. If not set, the remaining points will be divided equally. The resolution is set according to the requirements of the device. The higher the resolution, the smoother the device runs, but the larger the device.

2) Describe the position changes of the master and slave axes in a point-to-point manner

Directly add data to the electronic cam table in a point-to-point mode. A cam table can input up to 512 points of data.

[Export]Export the current table data in a point-to-point manner and store it in the specified file.

[Import] Import the current table data in a point-to-point manner.

(3) Use ECAM TBX to generate tables

Name	Features	Bits (bits)	Whether pulse type	Instruction format	Step count
ECAMTBX	Generate spreadsheet data	16	No	ECAMTBXS0 S1 D0 D1	9

S0--parameter address, allowable device: D, R.

For the setting parameters when generating the curve, please refer to the description in [Appendix]-[Parameter List]

S1--curve type, allowable Devicess: D, R, H, K.

Indicates the type of curve to be generated.

K1: Generate S type acceleration/deceleration curve with a spindle of 1ms

K2: Customize the specified key point to generate a table

K100: Generate rotary saw curve

K101: Generate chase curve

D0--the first address of cam parameters,

Allowed devices: D, R

The generated table data is stored at the beginning of [D0 + 40], and the number of table segments is stored in [D0 + 38].

D1--form generation result

Allowed devices: D, R

D1 <0 generates a table error;

D1> 0 The table is successfully generated. D1 represents the total number of segments in the current table.

ECAMTBX instruction generating curve error code:

Error code	**Content**
-1	Condition parameter error
-2	The spindle pulse number is too few, not enough for synchronization area
-3	Unknown cam curve type
-4	Resolution range error
-5	Too many pulses of the slave axis calculated
-6	The calculated number of pulses from the slave axis is too small
-7	The calculated number of spindle pulses exceeds the set length
-8	The pulse number of the slave axis is set to 0
-10	S type acceleration and deceleration curve calculation error
-11	Unknown curve type
-12	Curve left wrong
-13	The number of slave axes that exceeds the range

Key point generating curve Error code:

Error code	**Content**
-21	The number of key points is out of range
-22	Total resolution exceeds range
-23	Incorrect relationship between spindle size
-24	The resolution setting of each segment is incorrect
-25	When calculating, the number of control points is insufficient
-26	Unknown acceleration curve type
-27	Spindle pulse number is negative

S-type acceleration and deceleration generated curve Error code:

Error code	**Content**

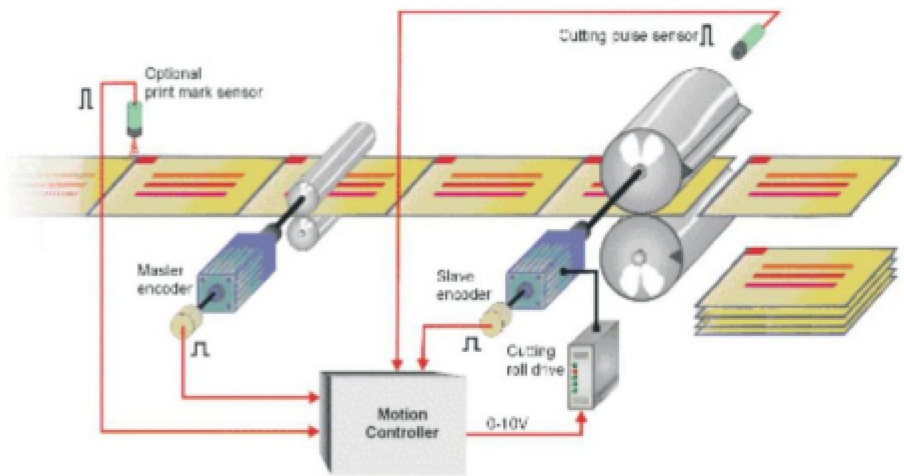
-31	The number of pulses exceeds the range
-32	Maximum frequency out of range
-33	Acceleration and deceleration time out of range
-34	The number of pulses or frequency settings cannot meet the curve generation conditions

#Note: After the curve is successfully generated by the ECAMTBX instruction, the cam table can be uploaded to the upper computer for viewing in the PLC of the PLC Edit upper computer software.

The application of ECAM

A.Rotary saw application

In the feeding and cutting application, the traditional method is to use the stop-and-go method. The feeding shaft first walks to a fixed length, and then the cutting shaft moves again, and then the process of "feeding stop" and "cutting stop" is repeated. Disadvantages of the medium method. In the process of feeding shaft stop and stop, the required acceleration and deceleration can not improve the production efficiency. Therefore, the new method is to use the non-stop feeding method. Generally, there are two feeding and cutting methods: rotary saw and flying saw. The difference between the two is that rotary saw moves in the same direction, while flying saw moves back and forth, and the set CAM table curves are also different.



(1) Description of rotary saw action

1) Rotary saws control the cutting axis to rotate in the same direction, and cut when the tool touches the material. During this period, the feeding axis will continue to feed at a constant speed without stopping. The action and output stroke of rotary saw control are shown in the figure below:

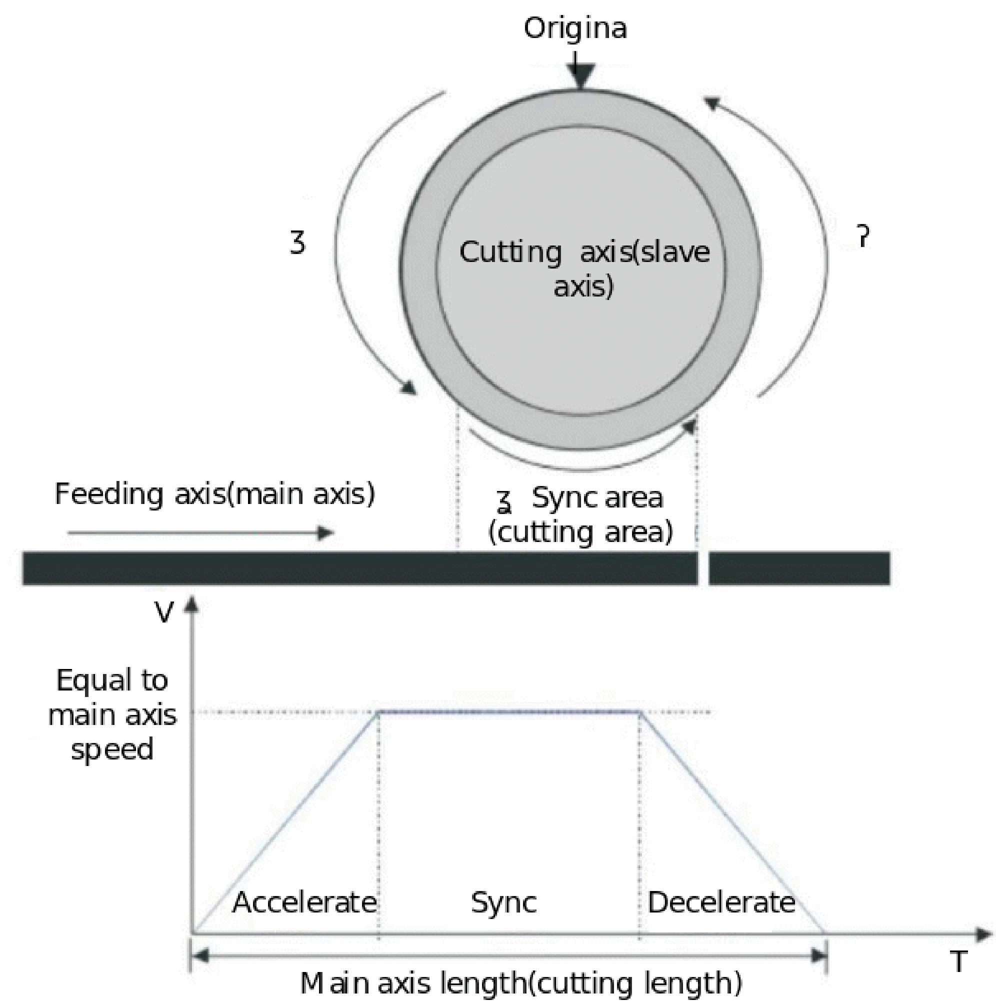
①. Accelerate and move to the synchronization area from the beginning of the axis;

②. In the synchronization zone and the spindle at the same speed and output the cutting signal (CLR0);

③. After leaving the synchronization zone, the slave axis will decelerate and move back to the origin to complete a cycle of cutting. After knowing the stroke, the speed relationship can be drawn.

2) In the peeling process, the most important thing is speed synchronization. For example, when the cutting knife contacts the material, it must be synchronized with the material speed. If the cutting knife speed is greater than the synchronous speed during contact, a force that pulls the material forward will cause the material to be uneven. If the speed is lower than the material speed, it will appear. Blocking phenomenon.

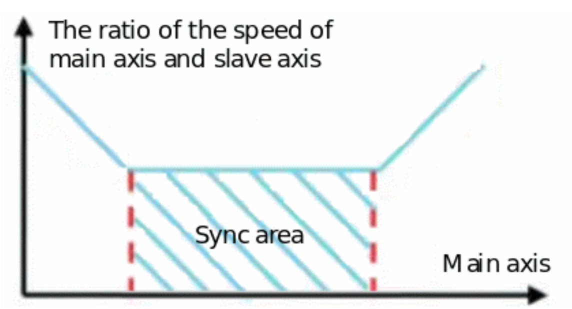
3) The planning of the synchronization area will affect the operation of the actual equipment. If the synchronization area is larger in a cutting cycle, the acceleration and deceleration time will be smaller, which means that the equipment needs to be accelerated and decelerated in a short time. For motors and machines The impact of the cutter is very large, and it is easy to cause the servo over-current alarm and the equipment cannot operate normally.



4) The relationship between cutting length and cutter circumference:

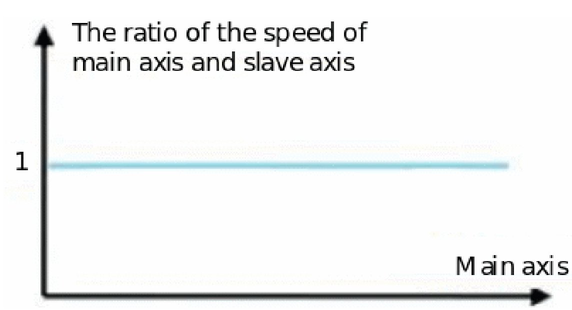
Cutting length <cutter circumference:

In the synchronization zone, the cutter linear speed is synchronized with the feeding speed. After the synchronization zone, in order to catch up with the next cutting, the cutting axis is accelerated, as shown in the figure.

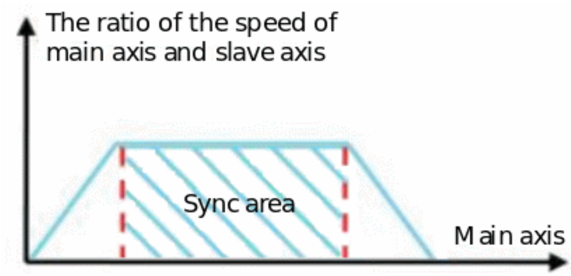


Cutting length = cutter circumference:

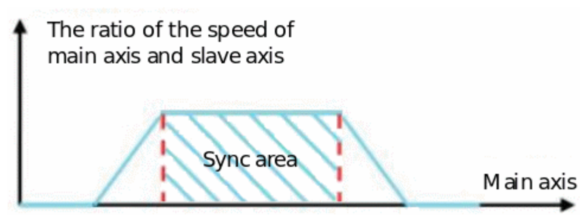
Average speed of cutting axis



1 times cutter circumference <cutting length <2 times cutter circumference:After the cutting action in the synchronization zone is completed, the cutting axis decelerates, then speed up to synchronize the next cutting, as shown in the figure.



Cutting length> 2 times the circumference of the cutter:When the cutting length is greater than 2 times the knife circumference (this is also the most common situation), in a cycle, after the cutting of the knife edge in the synchronization zone is completed, it decelerates to a stop, waits for a certain length to pass, and then starts the next cutting .



(2) Rotary saw generation

The PLC built-in rotary saw curve automatically generates instructions. For the parameters needed to generate the curve, please refer to the "Rotary saw Parameter Table". The CAM curve in depth 6 has 5 forms. The combination of these 5 forms can generate the required rotary saw curve. ,As shown below.

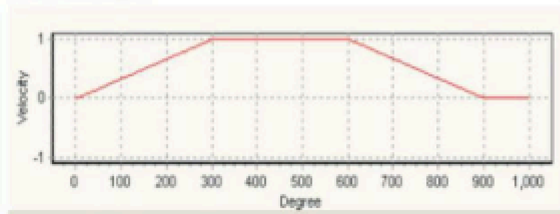
Rotary saw curve parameter setting

Parameter	**Offset address**	**Name**	**Format**	**Instruction**
Parameter 1	Address 0 Address 1	Spindle length	32 Bits Integer	The cutting length of the feeding axis moving, the unit is Pulse.
Parameter 2	Address 2 Address 3	Slave length	32-bit integer	The circumference of the cutting axis (including the tool length), the unit is Pulse. Range [-2000000000, 2000000000]
Parameter 3	Address 4 Address 5	Slave axis sync length	32-bit integer	The length of the slave axis synchronization zone is smaller than the slave axis length, generally set to 1/3 of the slave axis length. (When the new S-type rotary saw is selected, the value satisfies 40 *synchronization ratio<=synchronization length<slave axis Length-2.), synchronization area range: 0＜ synchronization area length＜∣slave axis length∣
Parameter 4	Address 6 Address 7	Slave axis synchronization magnification	Floating	Calculation method 1: In the synchronization zone, the speed of the master axis and the slave axis are equal, and the calculation method

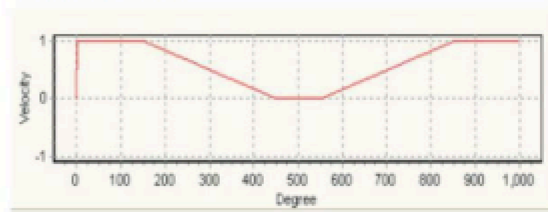
				of synchronization magnification: $v1=v2 \Rightarrow \frac{F_1*3.14*D_1}{R_1}=\frac{F_2*3.14*D_2}{R_2}$ $\Rightarrow \frac{F_2}{F_1}=\frac{R_2/D_2}{R_1/D_1}$ among them V1(V2)=Master (slave) axis speed F1(F2)=Master (slave) axis speed (Hz) D1(D2)=Master (slave) shaft diameter R1 (R2) = master (slave) axis pulse number per revolution Calculation method two: Slave axis synchronization magnification=1mm The number of pulses required by the slave axis/ Number of pulses required by 1mm spindle
Parameter 5	Address 8 Address 9	Slave axis maximum magnification limit	Floating	Maximum magnification= Maximum speed of slave axis/maximum speed of main axis
Parameter 6	Address 10	Acceleration curve	Integer	0: constant acceleration curve, the speed curve is T type 1: Constant jerk curve, speed curve is S type 2: reserved 3: reserved 4: New S type rotary saw curve (the synchronization zone is in the middle),Please refer to the appendix for details. The current curve only supports CAM curve 0
Parameter 7	Address 11	CAM curve	Integer	Start, stop, and various curve selections of different synchronization zone positions: 0: LeftCAM synchronization area is located on the front curve;

				1: MidCAMall; 2: MidCAMBegin initial curve; 3: MidCAMEnd end curve; 4: RightCAM sync area is located at the back curve; BIT[15]=1: continue the previous data, used for splicing curves, such as setting the subdivision of the curve, the total resolution range of all splicing curves is 31 to 1024, and the two rotary saw curves are spliced into a shearing curve
Parameter 8	Address 12	Resolution	Integer	Range [31,511], of which 20 synchronization areas; When CAM curve is selected as MdiCAMall (resolution range is [54, 511])
	Address 13	Reserved	Retained	Reserved
Parameter 9	Address 14 Address 15	Synchronization zone start position	32-bit integer	After the curve is generated correctly, the calculated starting position of the spindle synchronization area can be used to set the lower limit of the synchronization area.
Parameter 10	Address 16 Address 17	End of synchronization zone	32-bit integer	After the curve is correctly generated, the calculated end position of the spindle synchronization area can be used to set the lower limit of the synchronization area.
Parameter 11	Address 18 Address 19	Slave axis minimum limit operation magnification	Floating	It is valid only when parameter 6 acceleration curve is set to 4. Make sure that the actual maximum speed of the slave axis cannot be less than the speed corresponding to this value. Thereby adjusting the slope of the deceleration section.

0: leftCAM

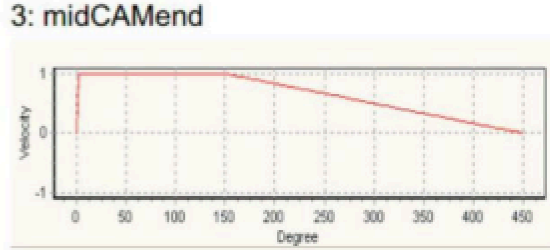


1: midCAMall

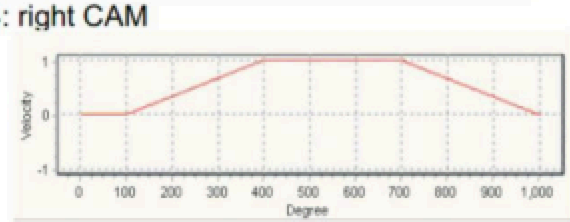


2: midCAMbegin

3: midCAMend



4: right CAM



(3) Rotary saw configuration

1) Overview

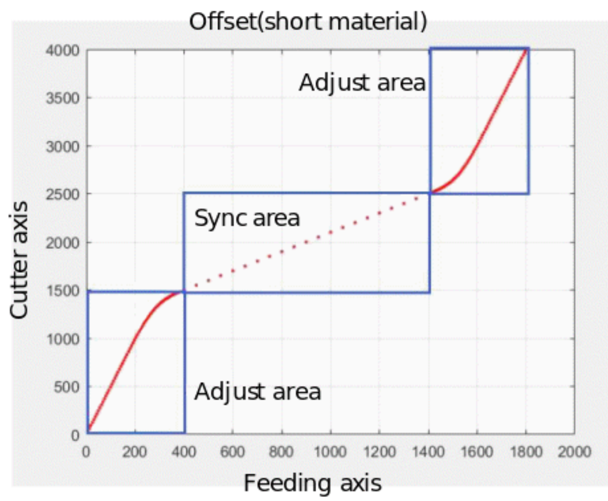
Synchronization zone: At this time, the feeding axis and the cutter axis rotate at a fixed speed ratio (the linear velocity of the cutter head is equal to the linear velocity of the cutting surface), and the cutting of the material occurs in the synchronous zone.

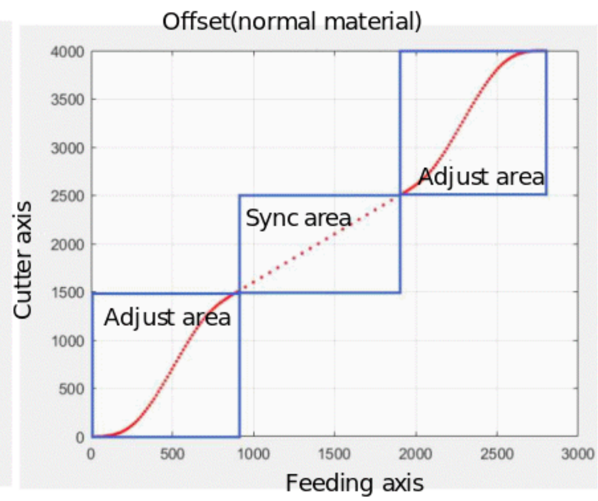
Adjustment area: due to different cutting lengths, corresponding displacement adjustments are required. According to the cutting length adjustment zone, it can be divided into the following three situations.

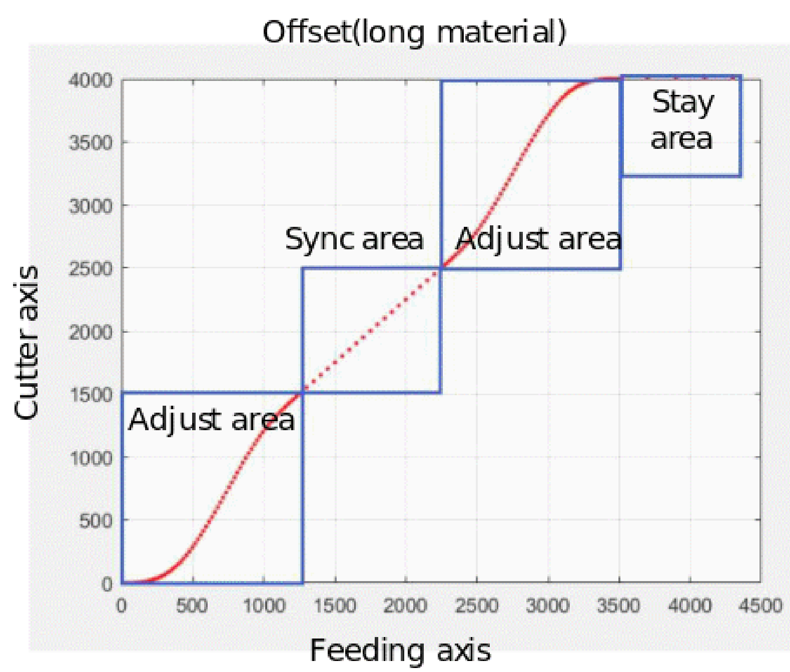
Short material cutting: the cutter shaft first has a uniform speed in the adjustment area, and then decelerates to the synchronous speed.

Normal material cutting: In this case, the cutter axis accelerates first in the adjustment zone. Then decelerate to synchronous speed.

Long material cutting: In this case, the cutter shaft first accelerates to the minimum limit operating speed in the adjustment area, and then decelerates to the synchronous speed. After the cutter shaft makes one revolution, the cutter shaft decelerates to zero and stays for a while, then speed up and cycle operation. The longer the material length, the longer the residence time.



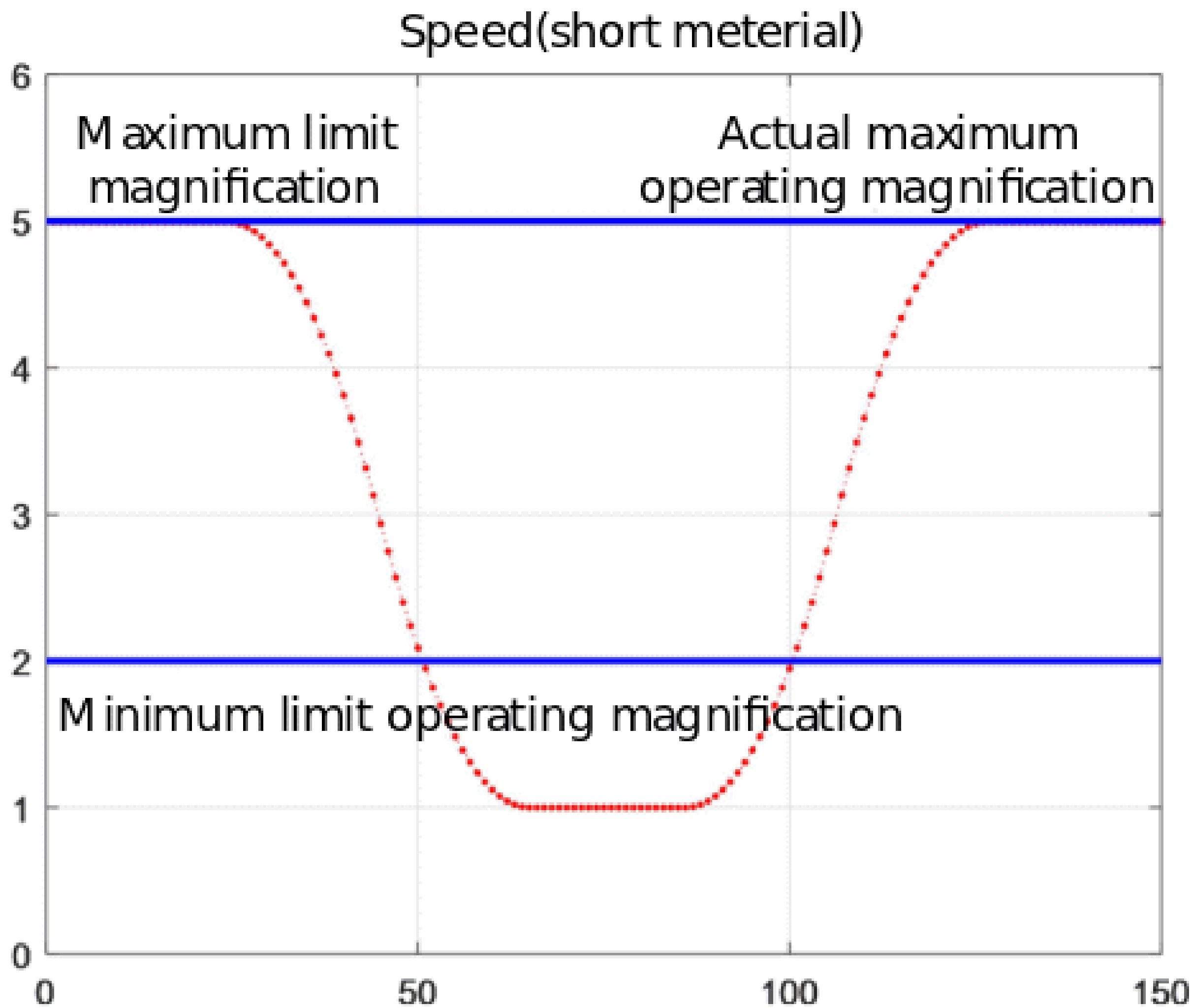




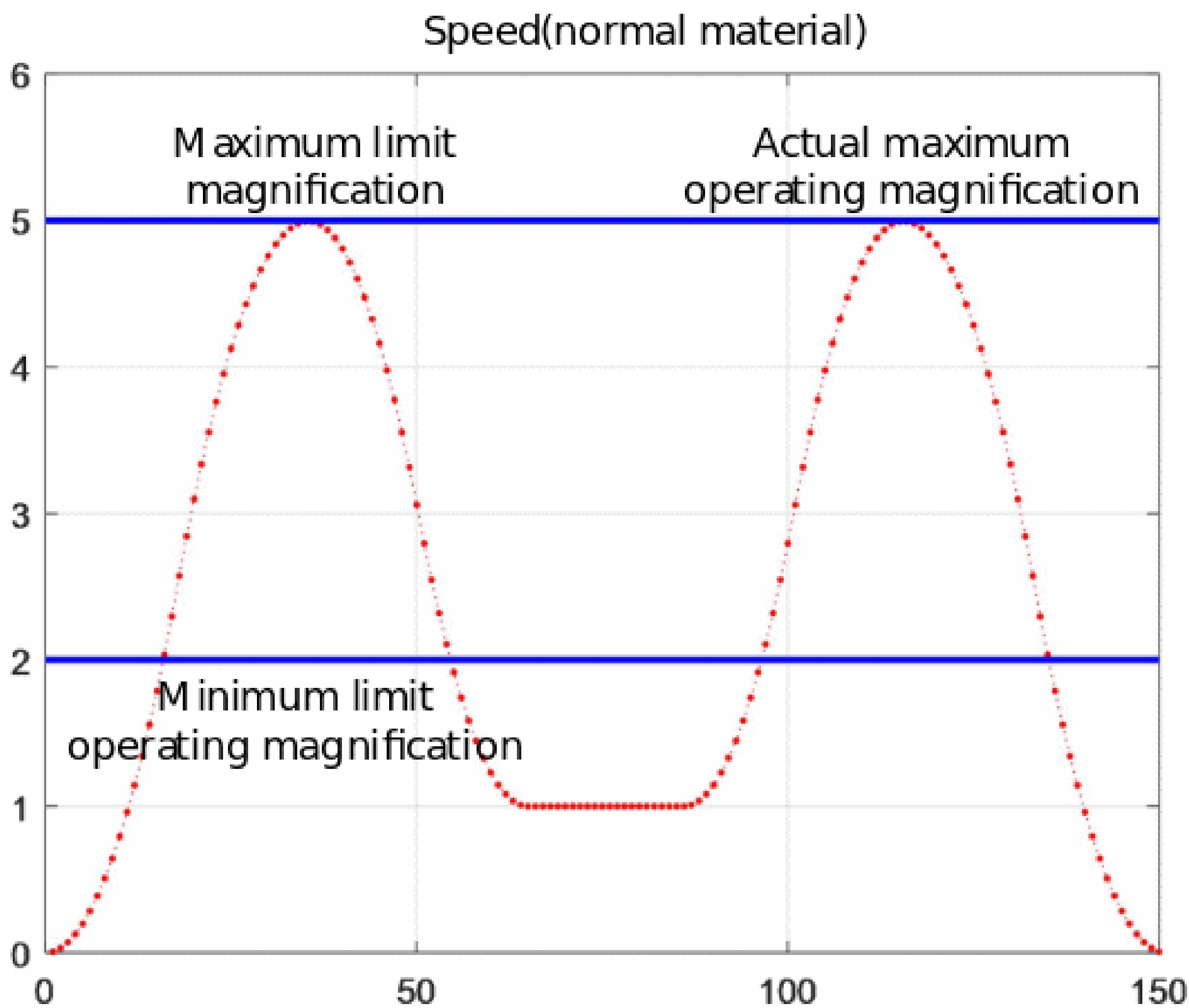
#Note:

When setting the maximum limit magnification, synchronization magnification, and minimum limit operation magnification, the material length boundary is also determined. Several limit values are as follows:

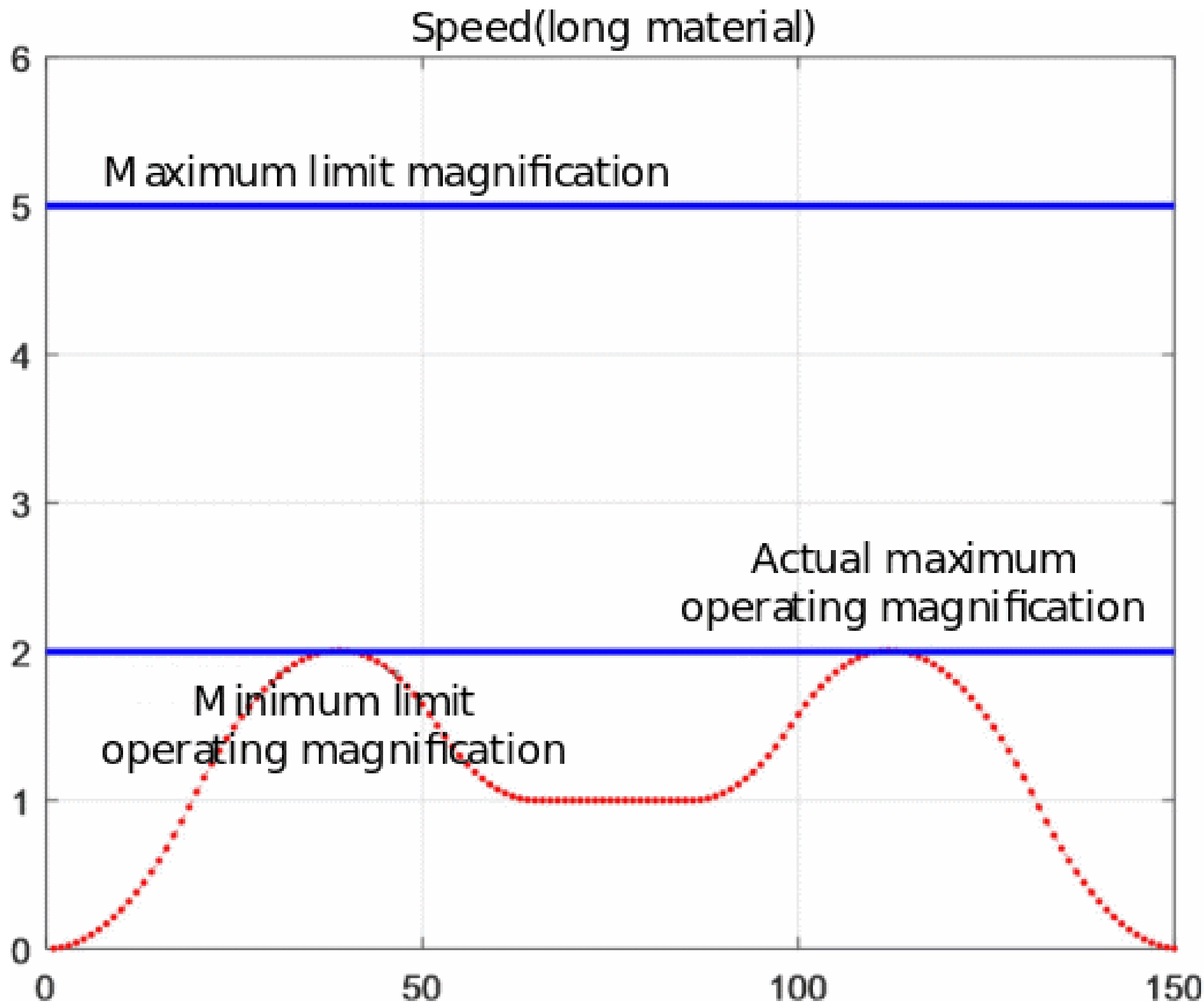
①The speed of the shortest material (Lm1) satisfies: the actual maximum operating magnification = the maximum limit magnification, and the adjustment area is a constant speed + deceleration process.



②The shortest normal material (Lm2): the actual maximum operating magnification = the maximum limit magnification, the adjustment area is the acceleration + deceleration process.



③The shortest length of material (Lm3): the actual maximum operating magnification = the minimum limit operating magnification, the adjustment area is acceleration + deceleration + dwell process.



Therefore, the length of the material determines the type of operation of the slave axis:

① When Lm1 ≤ L <Lm2, this is a short material, and its 0 ≤ actual maximum operating magnification ≤ maximum limit magnification

② When Lm2 ≤ L <Lm3, this is a normal material, and its minimum limit operation magnification ≤ actual maximum operation magnification ≤ maximum limit magnification

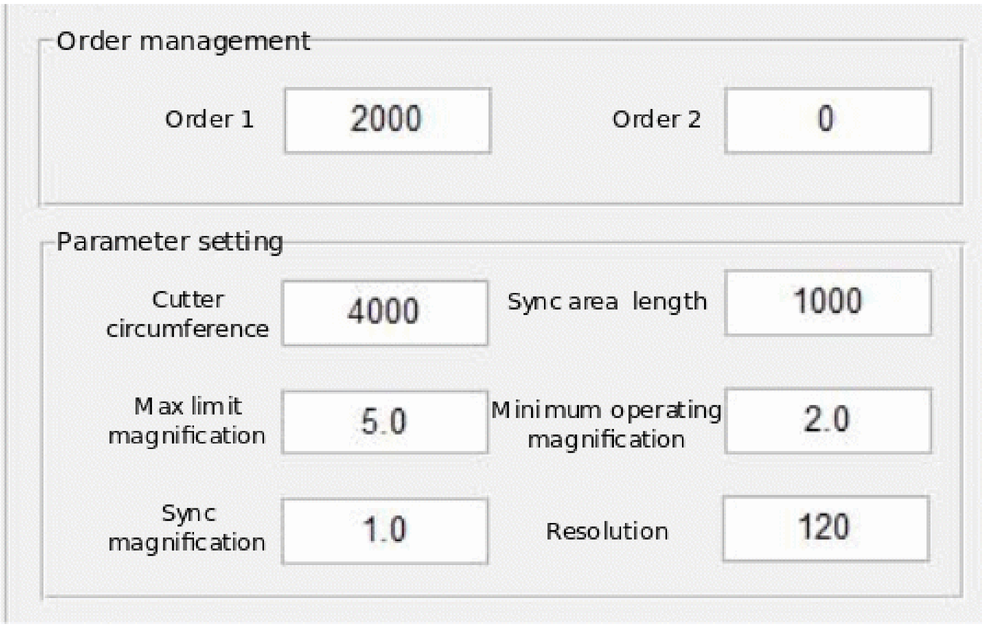
③ When L ≥ Lm3, this is a long material, and the actual maximum operating magnification = minimum limit magnification. There is a residence zone, the longer the material, the longer the residence time.

2) Example

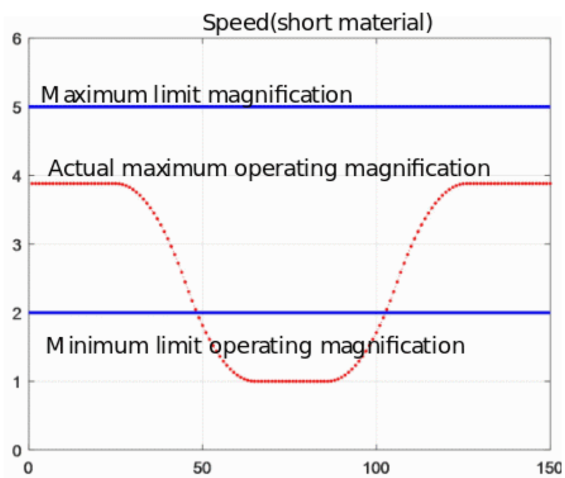
The process result will be different according to the difference of the maximum limit magnification, synchronization magnification and minimum limit operation magnification.

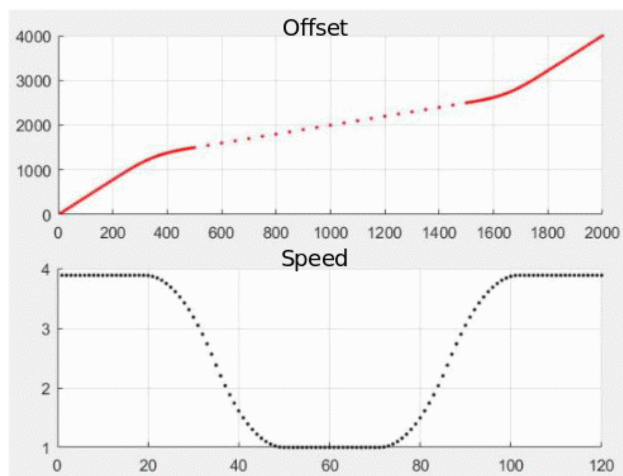
① Synchronous magnification <minimum limit operation magnification <maximum limit magnification

The parameter settings are as follows:

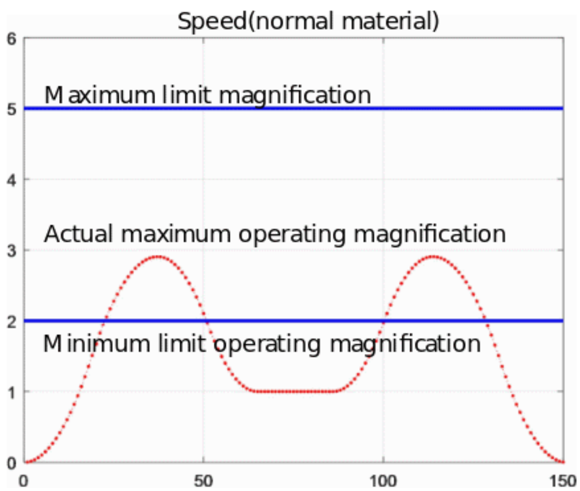


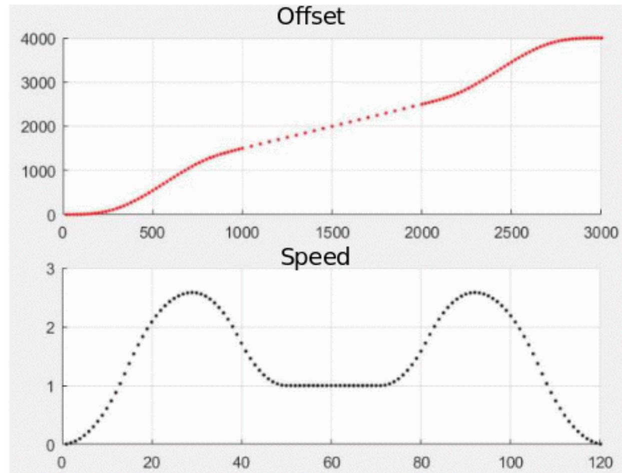
Short material:



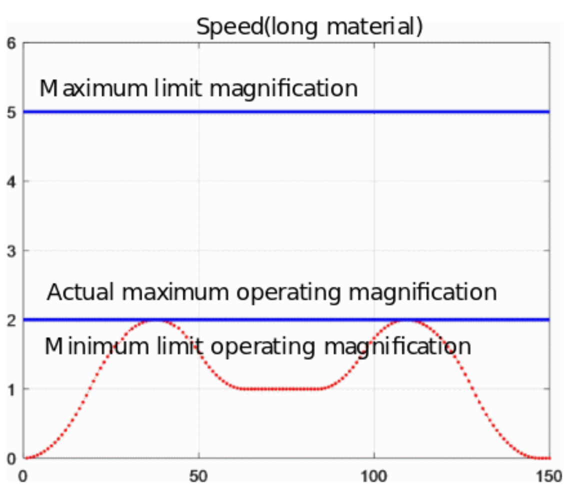


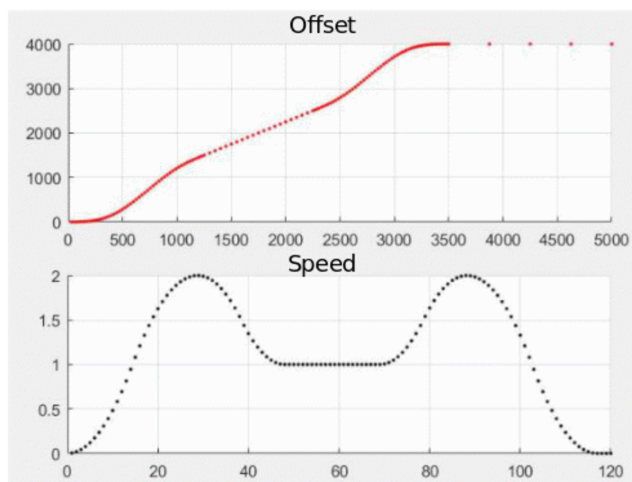
Normal materials:





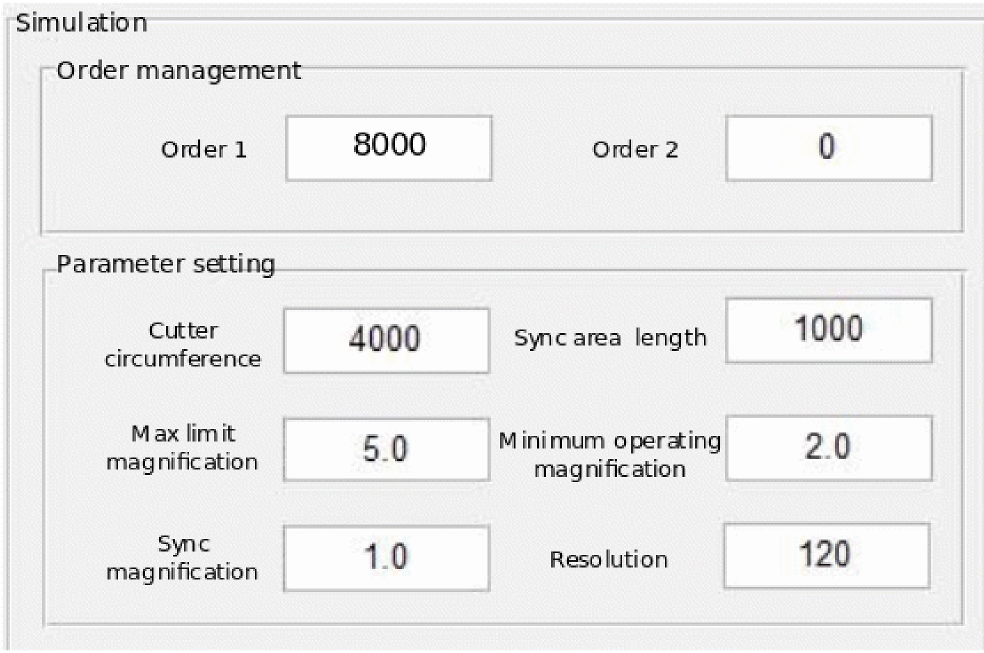
Long material:





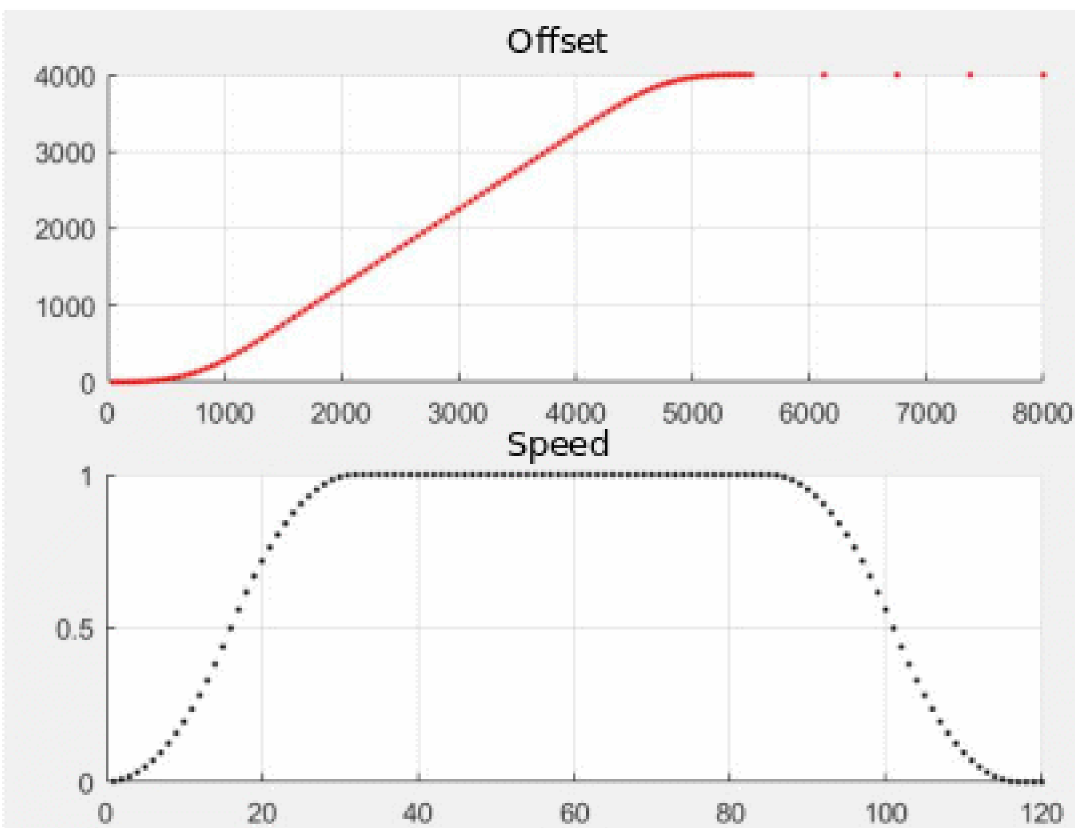
② Synchronous magnification = minimum limit operation magnification <maximum limit magnification

In this case, when the material is long, there is no deceleration into the synchronization zone. The parameter settings are as follows:



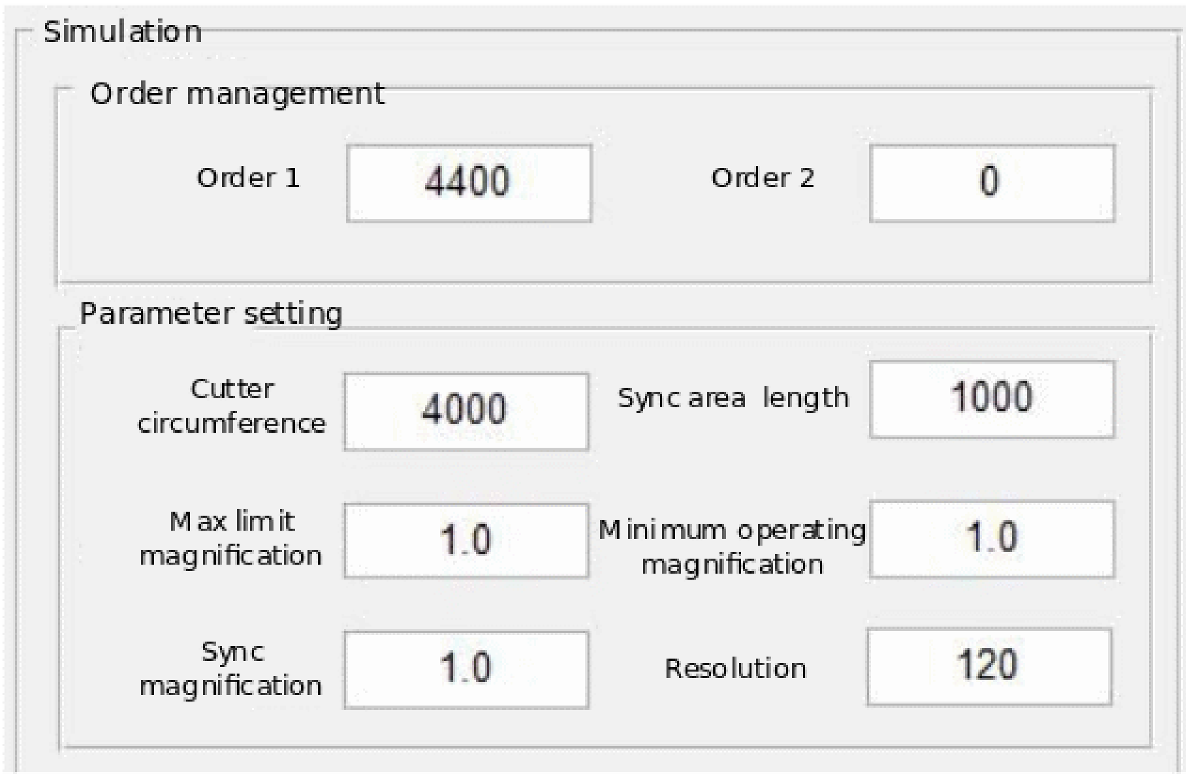
The situation of short material and normal material is the same as described in 2.1.

Long material: (no deceleration process in the adjustment zone)

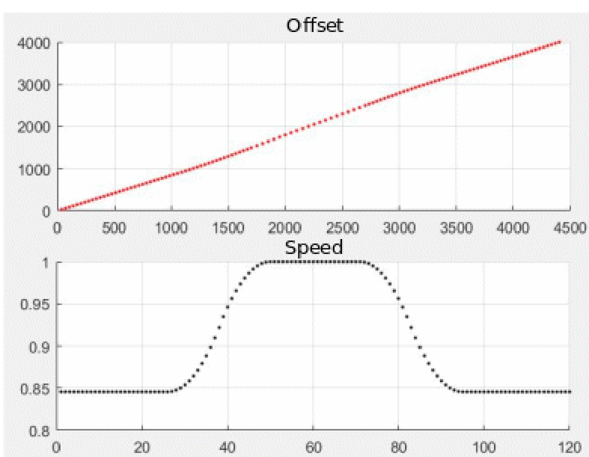


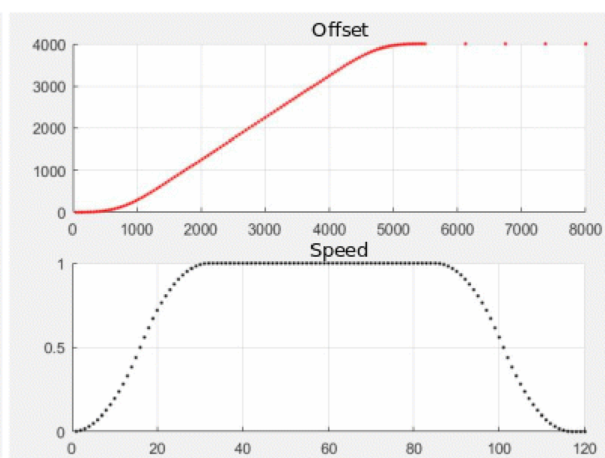
③ Synchronous magnification = minimum limit operation magnification = maximum limit magnification

In this case, there are no normal materials, only short materials and long materials. The parameter settings are as follows:



Short material **Long material**





(4) Case

1) Control requirements:

①. Use rotary saw curve to automatically generate cam table.

②. For the equipment matched with the cutting axis and the feeding axis, the servo parameter is 1,000 pulse/rev.

③. Related parameters:

Cutting material length is 1000 mm, cutting shaft circumference is 60πmm, feeding shaft circumference is 100πmm, and feeding shaft speed is 1,000 Hz

2) Parameters required to establish rotary saw curve

Parameter 1: You eed to input the length of the spindle cutting material because the cutting material length is 1000mm, it is converted to pulse

1000*1000/100Pi=3183 (pulse)

Parameter 2: The circumference of the slave shaft, that is, the number of pulses required for one revolution of the slave shaft 1000 pulse

Parameter 3: The synchronization length of the slave axis is set to approximately 1/3 of the circumference of the slave axis as 1000/3=333 pulse.

Parameter 4: During synchronization, the speed ratio of master and slave

$$\frac{F2}{F1}=\frac{RD2/D2}{R1/D1}=\frac{1000/60}{1000/100}=\frac{5}{3}$$

Parameter 5: The maximum magnification limit is: set to 10 times the synchronization magnification as 50/3 (floating point number).

Parameter 6: Low WORD is set to 0 - uniform acceleration

High WORD set to 0 - LEFTCAM

Parameter 7: Set the curve generation result to 0

Using curve generation instructions, ECAMTBX generates curves.

Circuit program corresponding to the case:

Spindle length

Slave length

Slave synchronization length

Slave axis synchronization magnification

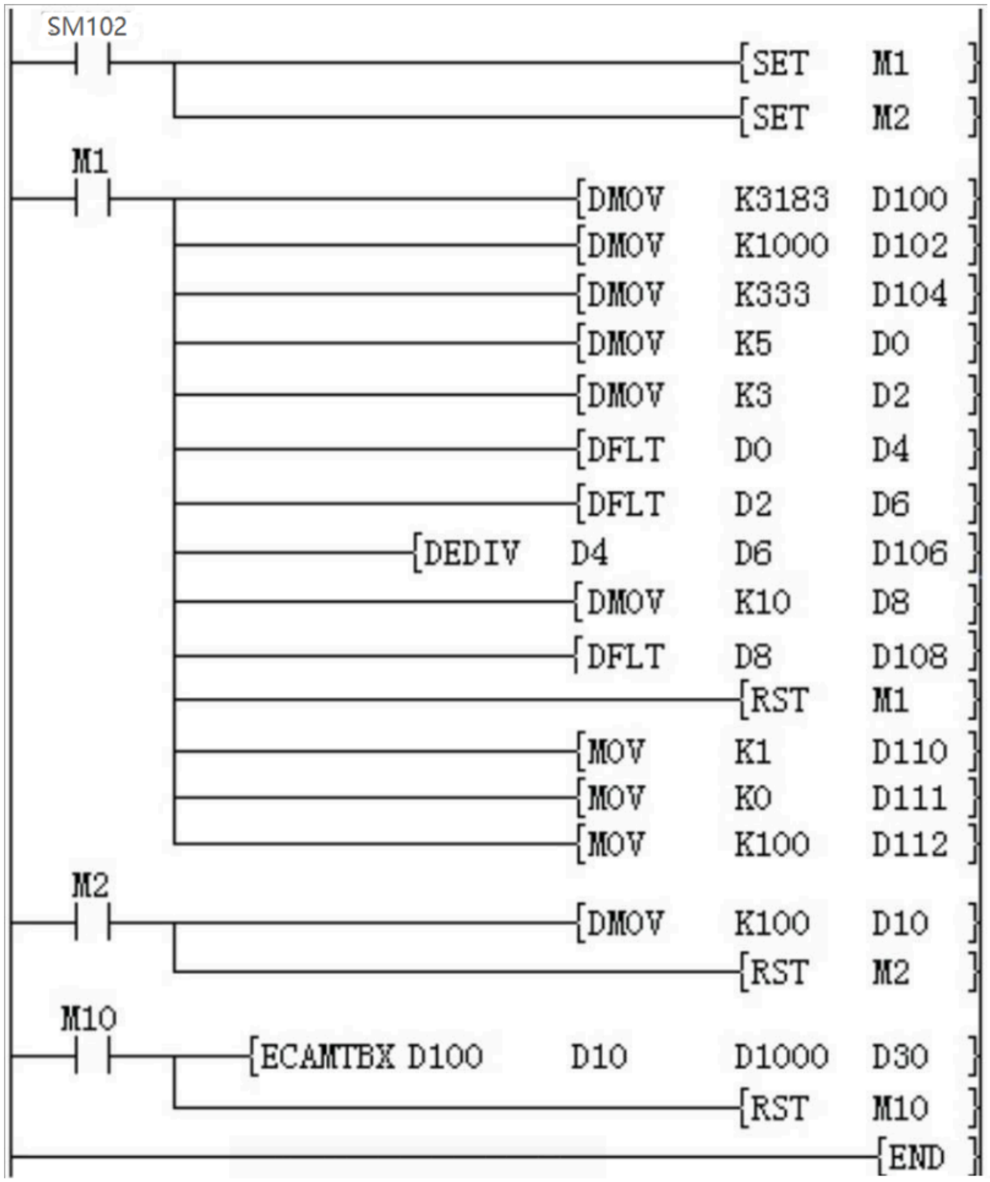
Slave axis maximum magnification limit

Acceleration curve

CAM curve solution resolution

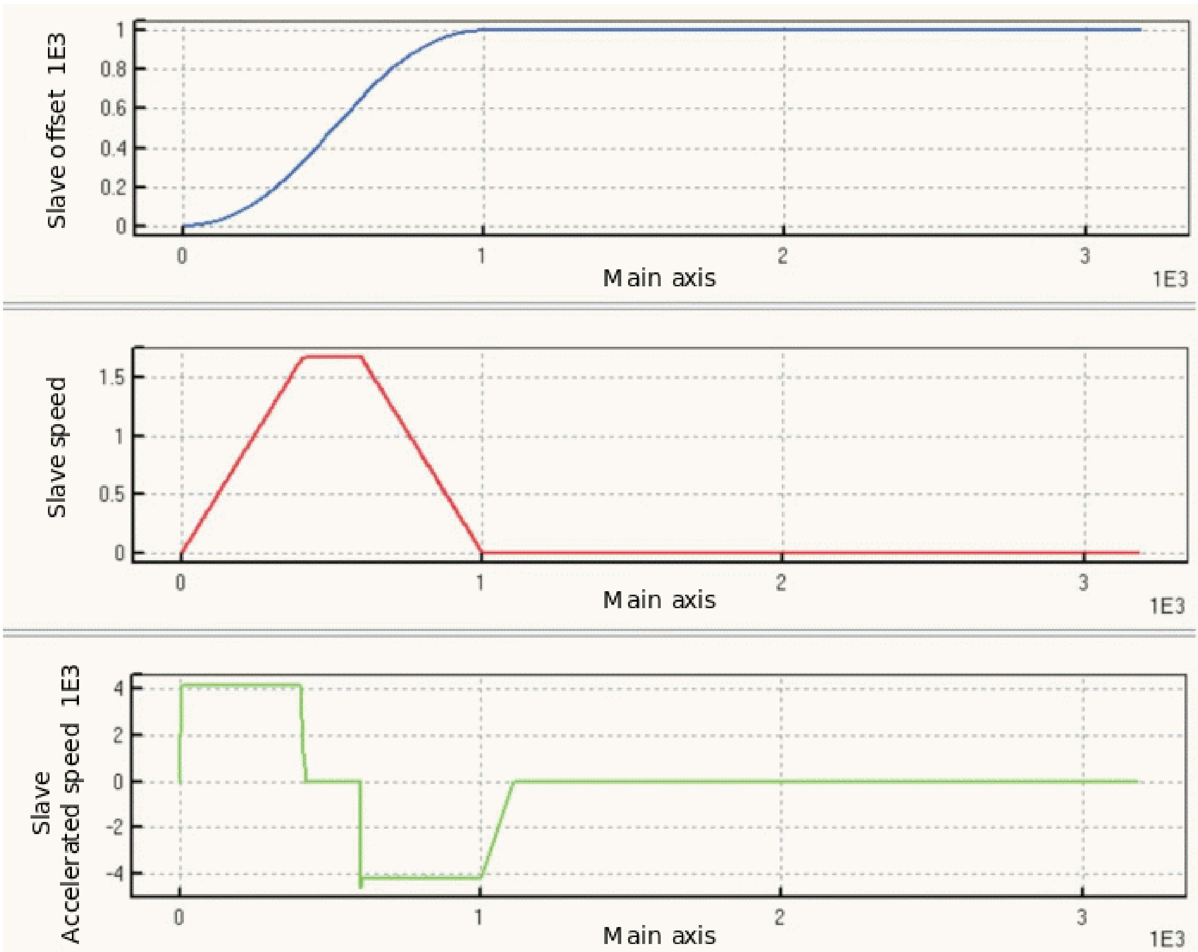
Set as rotary saw curve

Curve generation instruction



The curve corresponding to the Circuit program:

Upload via PLC, check the electronic cam table, set the table address, and upload the generated cam curve.

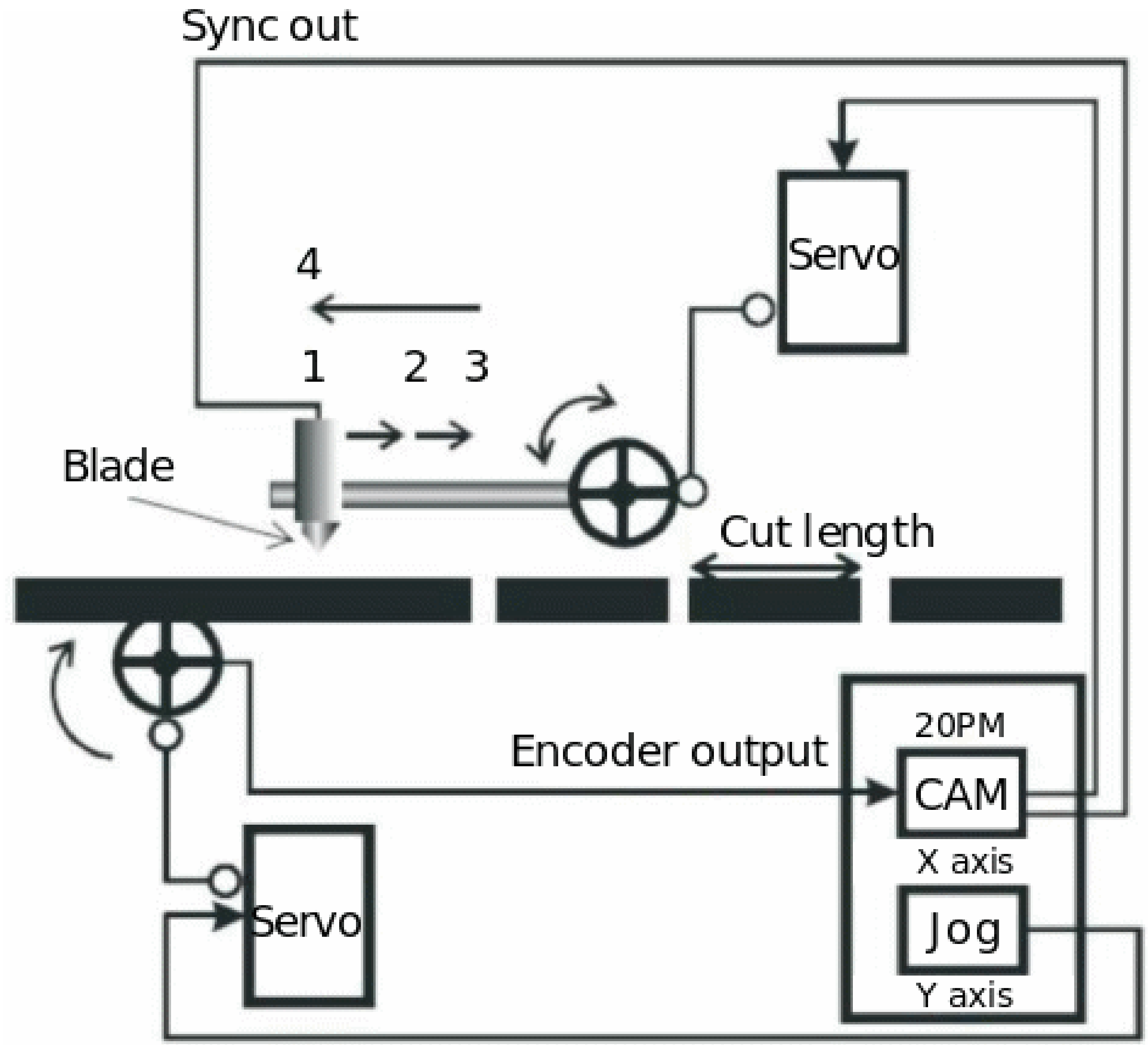


Flying saw application

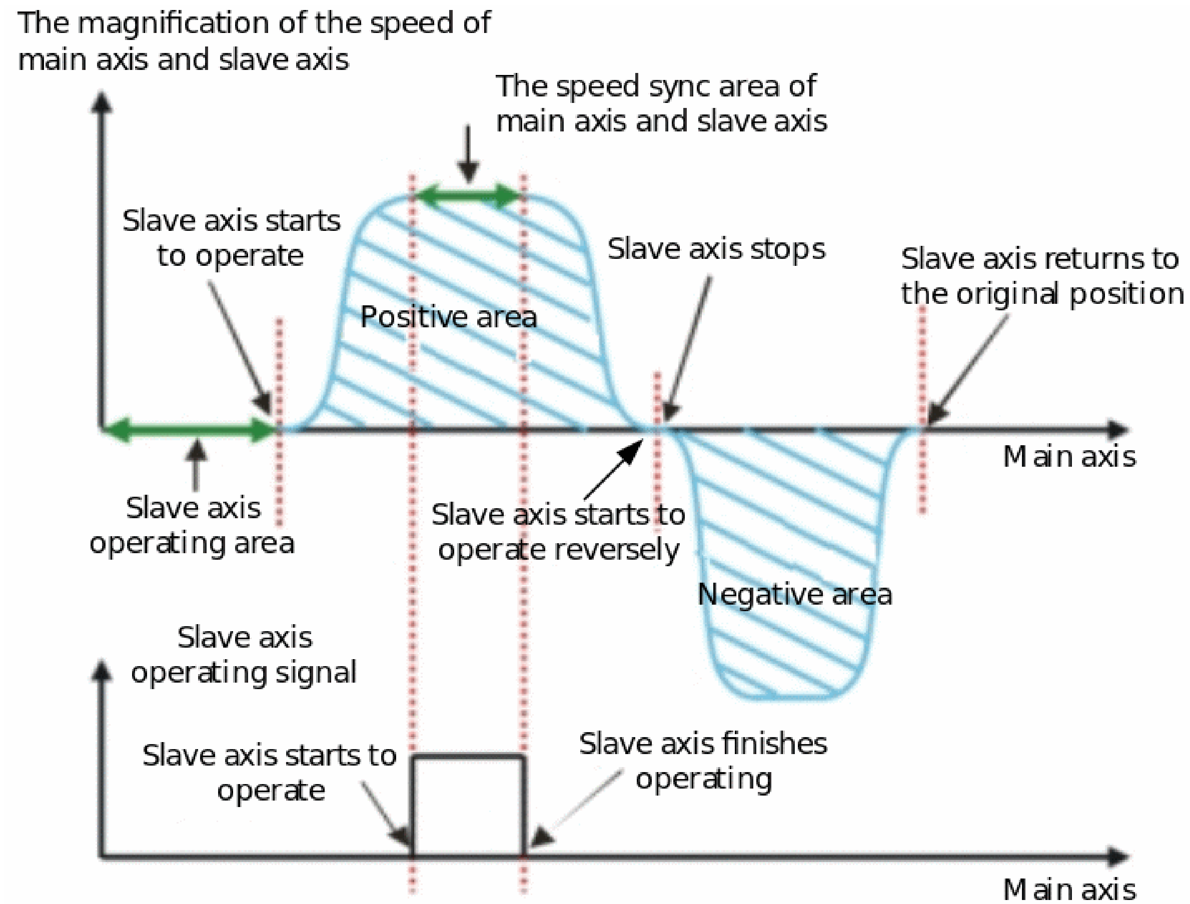
The flying saw system means that the feeding shaft will not stop while the system is cutting, so the camshaft must keep the same speed with the feeding shaft when cutting, and the same speed time must be enough for the cutter to complete the cutting and detach to safety s position. The flying saw camshaft will drive the cutter and the entire group of cutting mechanisms to move, so that it can maintain the same speed with the main shaft during cutting.

(1) Description of flying saw action

Suppose the wiring is as shown in the figure below, where 1, 2, 3, 4 are the waiting point (starting point), synchronization point, synchronization departure point, and waiting point (starting point), and its actions will follow the movement of the spindle. At the beginning, the camshaft stops at position 1, and then accelerates forward to position 2 to achieve speed synchronization, and continues to position 3, then decelerates and returns to position 4 in the opposite direction (assuming position 1 and position 4 are the same), and then repeat this action .



Flying saw control is used in pipe cutting machines, beverage filling and other equipment that needs to move with the processed product; its action is to add axis (slave axis)-start to accelerate and follow the processed product, and after moving to the synchronization zone, it will contact the processed product Start processing at a constant speed. After leaving the synchronization zone, the speed will decrease and stop, and then return to the starting position. All the stroke feeding axes (spindles) have been feeding at a constant speed. As shown below.



The stroke of the flying saw is divided into two parts: the following part and the returning part. The two moving distances must be the same. From the speed stroke point of view, that is, positive area = negative area.

During flying saw, you need to pay attention that the feeding will not stop during processing, so the processing axis must keep the same speed with the feeding axis, and the synchronization time must be enough for the equipment to complete processing and move to a safe position.

The stroke length of the synchronization area is also the processing time, which can be considered when planning the synchronization area. In addition, the planning of the synchronization area will affect the operation of the actual equipment. If the synchronization area is large in a cutting cycle, the acceleration and deceleration time will be smaller, indicating that the equipment needs to be accelerated and decelerated in a short time. For motors, machines, and cutters The impact is very large, and it is easy to cause the servo over-current alarm, and the equipment cannot operate normally.

(2) Flying saw parameter table

Parameter setting of flying saw curve

Parameter	Offset address	Name	Format	Instruction
Parameter 1	Address 0 Address 1	Spindle length	32-bit integer	The cutting length of the feeding axis moving, the unit is Pulse.
Parameter 2	Address 2 Address 3	Slave length	32-bit integer	The circumference of the cutting axis (including the tool length), the unit is Pulse. Range [-2000000000, 2000000000]

Parameter 3	Address 4 Address 5	Slave synchronization length	32-bit integer	The length of the slave axis synchronization zone. Synchronization area range: 0＜ synchronization area length＜|slave axis length/2|
Parameter 4	Address 6 Address 7	Slave axis synchronization magnification	Floating	Calculation method one: In the synchronization zone, the speed of the master axis and the slave axis are equal, and the synchronization magnification calculation method: V1(V2)=Master (slave) axis speed F1(F2)=Master (slave) axis speed (Hz) D1(D2)=Master (slave) shaft diameter R1 (R2) = master (slave) axis pulse number per revolution Calculation method two: Slave axis synchronization magnification=1mm The number of pulses required by the slave axis/1mm Number of pulses required by the spindle
Parameter 5	Address 8 Address 9	Slave axis maximum magnification limit	Floating	Maximum magnification = maximum speed of slave axis/maximum speed of main axis
Parameter 6	Address 10	Acceleration curve	Integer	0: constant acceleration curve, the speed curve is T type 1: Constant jerk curve, the speed curve is S type
	Address 11	CAM curve	Integer	Start, stop, and various curve selections for different synchronization zone positions: (currently only one type is supported, the default tracking RightCam, and the return LeftCam curve type. May not be set)
Parameter 7	Address 12	Resolution	Integer	Range [62,511]
	Address 13	Reserved	Retained	Reserved

Parameter 8	Address 14 Address 15	synchronization zone start position	32-bit integer	After the curve is generated correctly, the calculated starting position of the spindle synchronization area can be used to set the lower limit of the synchronization area.
Parameter 9	Address 16 Address 17	End of synchronization zone	32-bit integer	After the curve is correctly generated, the calculated end position of the spindle synchronization area can be used to set the lower limit of the synchronization area.
Parameter 10	Address 18 Address 19	Reserved	Reserved	Reserved
Parameter 11	Address 20 Address 21	The maximum magnification of the actual operation of slave axis	Floating	The maximum magnification of the actual operation of slave axis: It is sync magnification when it is long material, and it is between sync magnification and maximum limit magnification when it is short material.

(3) Case

1) Control parameters

①. The servo parameter is 1000 pulse/rev.

②. Related parameters

The processing length of the feeding shaft is 660 mm, and the circumference of the feeding shaft is 60πmm

The machining length of the machining shaft is 40 mm

One rotation of the machining axis is 20 mm

The feed shaft speed is 1000 Hz

2) Establish flying saw curve by rotary saw curve

The parameters needed to establish rotary saw curve

Spindle length (processing length): Assuming that the spindle servo parameter is 1000 pulse/rev and the mechanism parameter is 60π mm/rev, then 1pulse is 0.188mm. If the actual processing length is 660mm→convert to 660/0.188=3501 pulse.

Slave axis length(machining axis length):

First consider that the slave axis servo parameter is 1000 pulse/rev and the mechanism parameter is 20mm/rev, then 1pulse=0.01mm can be obtained.

The actual measured slave shaft machining length is 40 mm → converted to 2000 Pulse.

The location of the synchronization zone;

The lower limit of the synchronization zone is when the actual START0 signal is triggered, the slave axis goes from 0 to the position 200 where it catches up with the spindle speed;

The upper limit of the synchronization zone is the position 500 where the processing time ends and the processing equipment also leaves.

The speed ratio of master and slave axis in synchronization zone: the speed ratio of the master axis and slave axis in the synchronization zone.

The speed ratio of master and slave axis when returning:

After the total length of the stroke subtracts the stroke of the following movement, the return stroke length can be obtained, and then use the following stroke distance = return stroke distance to know the speed ratio when returning = 3.

3) Establish flying saw curve automatically by rotary saw curve

① Establish a positive area curve

Parameter 1: It needs to input the processing length of the spindle feeding shaft to be 660mm, which is converted to pulse 660*1000/60pi=3501 pulse; Since the chase shear needs to return to the origin after the machining is completed, the pulse of the spindle = 3501/2 =1750 pulse;

Parameter 2: Slave shaft processing length is 40mm, conversion 40*1000/20=2000 pulse;

Parameter 3: Slave axis synchronization length setting agrees that 1/3 of the slave axis circumference is 2000/3 = 667 pulse;

Parameter 4:

$$\text{Sync rate} \quad \frac{\text{Pulse for slave axis 1mm}}{\text{Pulse for main axis 1mm}} = \frac{\frac{1000}{20}}{\frac{1000}{60\pi}} = 3\pi \text{ (Float)}$$

Parameter 5: the highest synchronization magnification 10 (floating point number);

Parameter 6: Low word setting 0: uniform acceleration;

High word setting 0: LeftCam.

② Establish a negative area curve

Parameter 1: Need to input the processing length of the spindle feeding shaft to be 660mm, which is converted to pulse 660*1000/60pi=3501 pulse; Since the chase shear needs to return to the origin after the machining is completed, the pulse of the spindle =3501/2 =1750 pulse;

Parameter 2: Reverse running size is -2000;

Parameter 3: Same;

Parameter 4: Same;

Parameter 5: Same;

Parameter 6: Low word setting 0: uniform acceleration;

High word setting H8000: LeftCam continues the existing table data.

4) Generate tables with the function of flying saw

Parameter 1: Need to input the processing length of the spindle feeding shaft to be 660mm, which is converted to pulse 660*1000/60pi=3501 pulse;

Parameter 2: Slave shaft processing length is 40mm, conversion 40*1000/20=2000 pulse;

Parameter 3: Slave axis synchronization length setting agrees that 1/3 of the slave axis circumference is 2000/3=667 pulse;

Parameter 4:

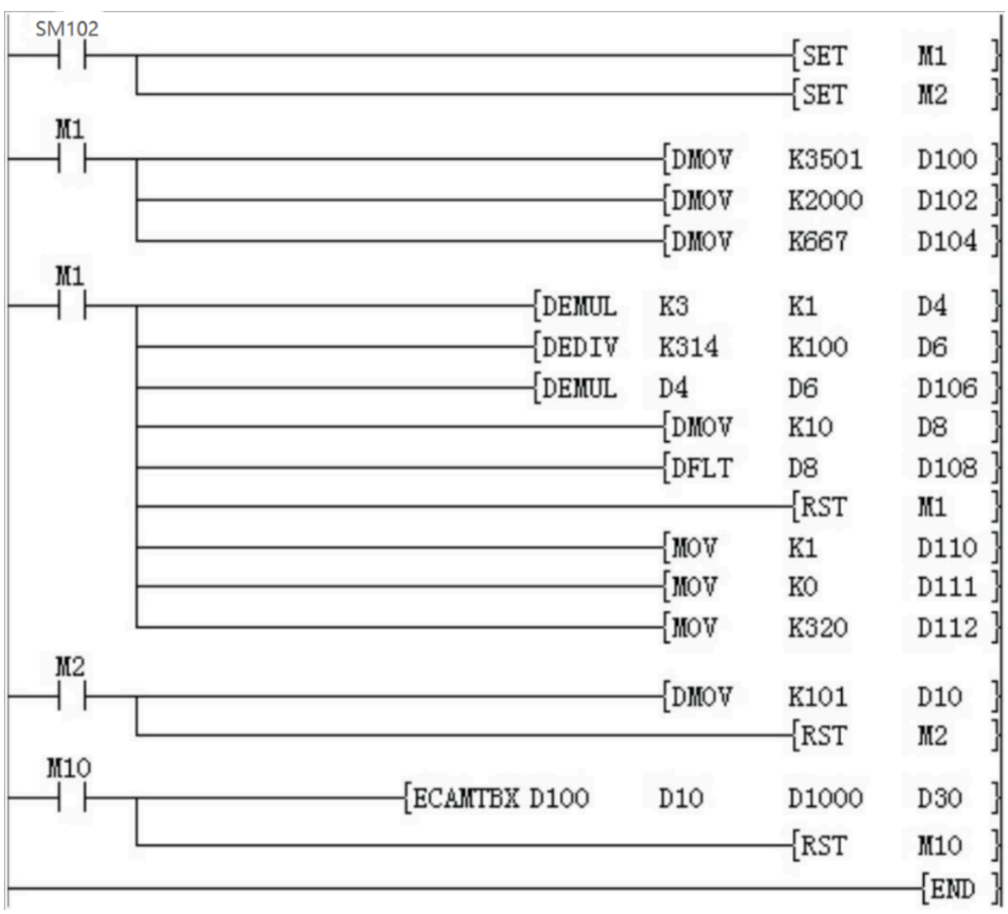
$$\text{Sync rate}\ \frac{\text{Pulse for slave axis 1mm}}{\text{Pulse for main axis 1mm}} = \frac{\frac{1000}{20}}{\frac{1000}{60\pi}} = 3\pi\ (\text{Float})$$

Parameter 5: the highest synchronization magnification 10 (floating point number)

Parameter 6: Low word setting 1: Uniform acceleration;

High word setting 0: invalid.

Use ECAMTBX to generate curves:



Spindle length

Slave length

Slave synchronization length

Slave axis synchronization magnification

Slave axis maximum magnification limit

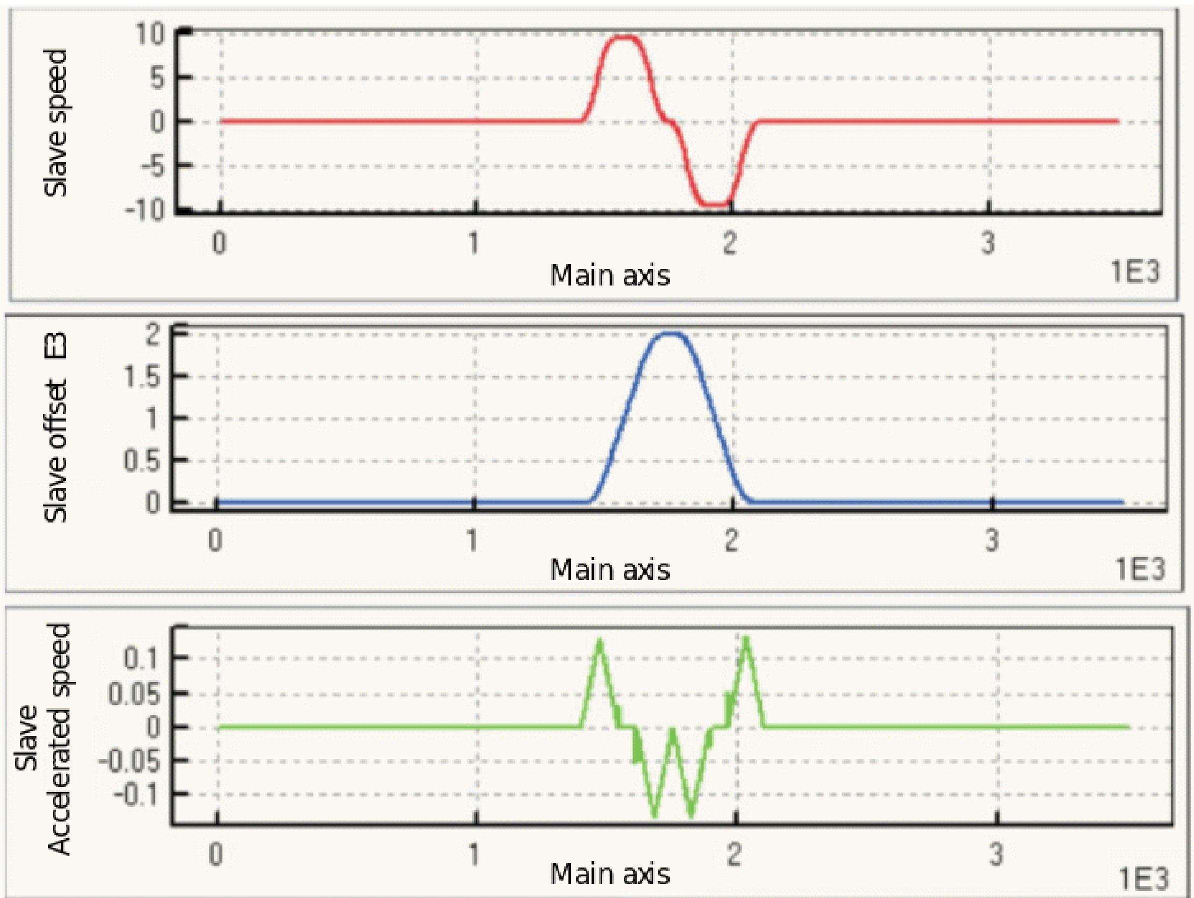
Acceleration curve

CAM curve solution resolution

Set as rotary saw curve

Curve generation instruction

Obtain the curve according to the ladder program:



S type acceleration and deceleration curve establishment

(1) S type acceleration and deceleration curve table parameters

S type acceleration and deceleration curve parameter setting

Parameter	**Offset address**	**Name**	**Format**	**Instruction**	**Unit**	**Range**
Parameter 1	Address 0 Address 1	Total number of pulses (length)	32-bit integer	Total number of output pulses	Pulse	1 to 2147483647
Parameter 2	Address 2 Address 3	Set the maximum speed of pulse	32-bit integer	Set the highest frequency of pulses	Hz	1 to 200000
Parameter 3	Address 4 Address 5	Reserved	Retained	Reserved		

Parameter 4	Address 6	Accelerated Time	16-bit integer	Pulse acceleration time	ms	2 to 32767
Parameter 5	Address 7	deceleration time	16-bit integer	Pulse deceleration time	ms	2 to 32767
Parameter 6	Address 8	Resolution	16-bit integer	Pulse resolution	Length	50 to 511
Parameter 7	Address 9	Reserved	Retained	Reserved		
Parameter 8	Address 10 Address 11	Number of spindle pulses in the last segment	32-bit integer	Number of spindle pulses in the last segment (high and low)	Pulse	Internally generated
Parameter 9	Address 12 Address 13	Number of slave axis pulses in the last segment	32-bit integer	Number of pulses from the last segment of the slave axis (high and low bits)	Pulse	
Parameter 10	Address 14 Address 15	Uniform time	32-bit integer	The length of the pulse at a constant speed	Pulse	
Parameter 11	Address 16 Address 17	Maximum speed	32-bit integer	Maximum speed of curve results during operation	Hz	
Parameter 12	Address 18	Reserved				
Parameter 13	Address 19	Curve generation result				

#Note:

Generate S type acceleration and deceleration curve (table) with the given acceleration time, deceleration time, and the highest speed. When calculating, the spindle uses the pulse input frequency of 1K (1ms) as the calculation basis.

(2) Case

1) Related control parameters

Calculation case:

Total number of pulses (length): 10000 pulses

Acceleration time: 100ms

Deceleration time: 100ms Resolution: 200

2) 2. Curve parameters:

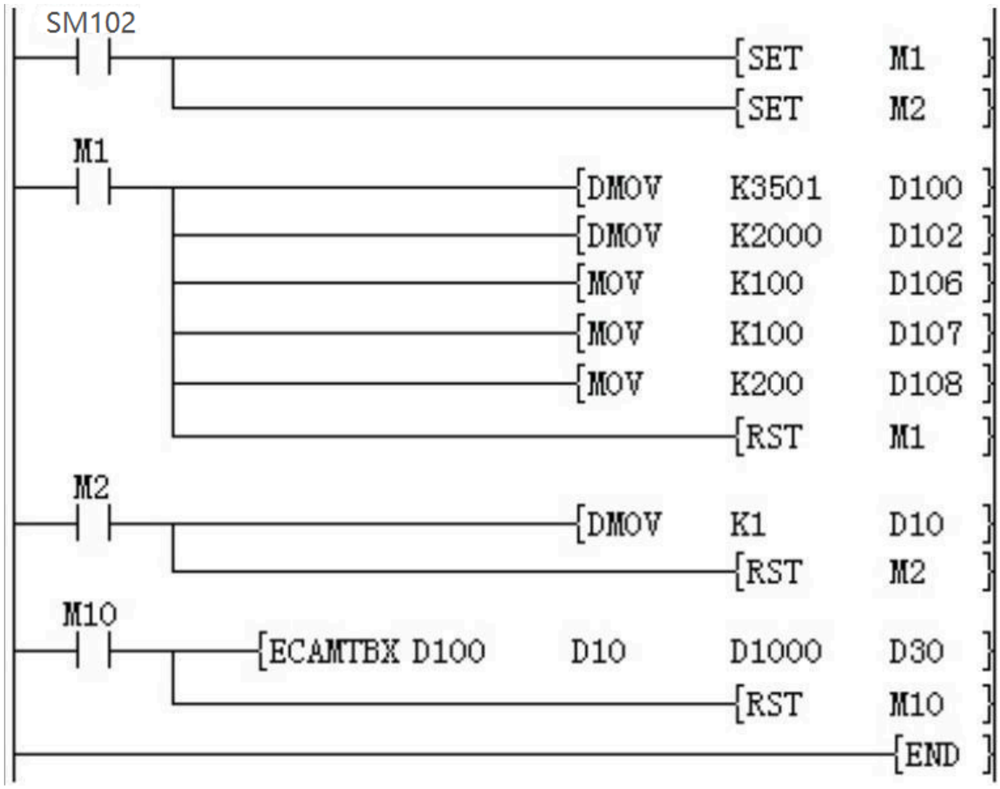
Parameter 1: The total number of output pulses 10000

Parameter 2: Maximum speed 50000

Parameter 6: acceleration time 100

Parameter 7: acceleration time 100

Parameter 8: Resolution 200



Pulse maximum speed

Total pulse number

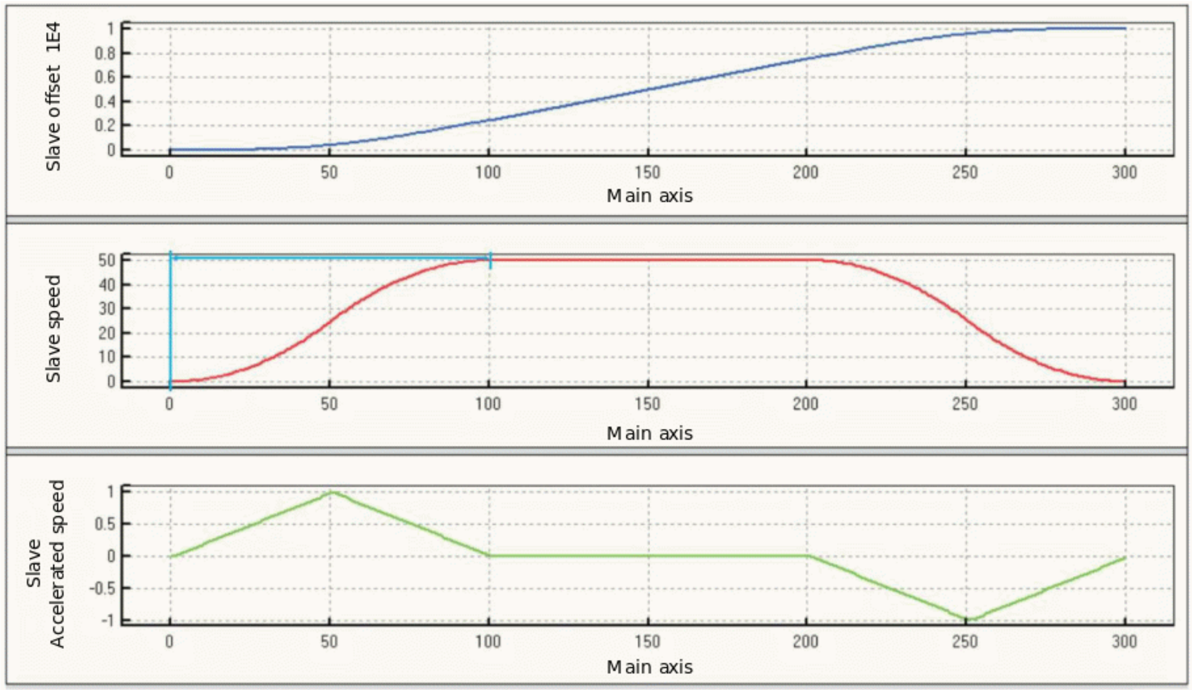
Acceleration time

Deceleration time

Resolution

Set S type acceleration and deceleration curve

Curve generation instruction



C.Customize specified key points to generate a table

(1) Specified key points generate table parameters

Specified key points generate table parameters

Address		Name	Length	Instruction	Range
S0		Curve result	Single word	>0: The curve is generated successfully <0: Failed to generate curve	
S0+1		Error parameter position	Single word		
S0+2		Total resolution	Single word		10 to 511
S0+3		Number of key points	Single word		1 to 10
S0+4 S0+5		The initial position of slave axis	Double word	Set the initial offset position of slave axis	Reserved
S0+6		Spindle segment 0	Single word	The master/slave axis segment 0 is always 0	Reserved
S0+7		Slave axis segment 0	Single word		
Key point 1	S0+8 S0+9	Spindle segment 1	Double word	Number of pulses of spindle segment 1	32-bit integer
	S0+10 S0+11	Slave axis segment 1	Double word	Number of pulses of slave axis segment 1	32-bit integer
	S0+12	Curve type of segment 1	Single word	*1	
	S0+13	Resolution of segment 1	Single word	*2	

Key point 2	S0+14 S0+15	Spindle segment 2	Double word	Number of pulses of spindle segment 2	32-bit integer
	S0+16 S0+17	Slave axis segment 2	Double word	Number of pulses of slave axis segment 2	32-bit integer
	S0+18	Curve type of segment 2	Single word	*1	
	S0+19	Resolution of segment 2	Single word	*2	
	......	......	.....	......	......
Key point N	S0+n*6+2 S0+n*6+3	Spindle segment N	Double word	Number of pulses of spindle segment N	32-bit integer
	S0+n*6+4 S0+n*6+5	Slave axis segment N	Double word	Number of pulses of slave axis segment N	32-bit integer
	S0+n*6+6	Curve type of segment N	Single word	*1	
	S0+n*6+7	Resolution of segment N	Single word	*2	

Curve type: Different values represent different curve types.

0 = uniform acceleration, 1 = S acceleration and deceleration (uniform acceleration), 2 = cycloid, 3 = uniform speed.

The resolution range is 0-511, the total resolution of all segments does not exceed the total resolution set by [S0]. if the resolution of all segments is set to 0, the total resolution set by [S0] split equally. When the curve type is cycloid, the corresponding resolution range is 3-511.W

Refer to the setting method of PLC Editor to generate a table based on the given key points and the given function relationship. The parameter setting is the same as the setting method of the upper computer. The editing interface of the upper computer is shown below. When the table is generated in K2 mode, The generated result is similar to the table result set by the relevant parameters of the upper computer. This mode expands the function of the table generated by the lower computer through the key points. In the key point curve, the spindle must have an increasing relationship, that is, the spindle pulse number of the next point must be greater than the spindle pulse number of the previous point, otherwise an error will be reported.

(2) Case

1) Specified key points parameters

When the spindle has 0-600 pulses, the slave axis stops at position 0;

When the spindle has 600-1500 pulses, the slave axis moves to the position 2000;

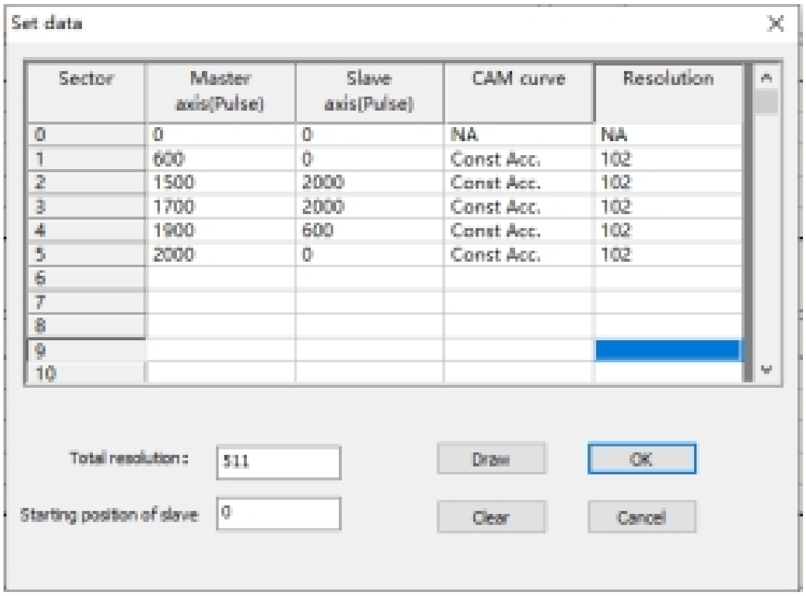
When the spindle is 1500-1700 pulses, the slave axis stops at position 2000;

When the spindle has 1700-1900 pulses, the slave axis will return to position 600;

When the spindle has 1900-2000 pulses, the slave axis returns to position 0.

2) Specified key points for tabulation

Use PLC Editor software to create ECAM table, and set the parameter value of each key point in the table.



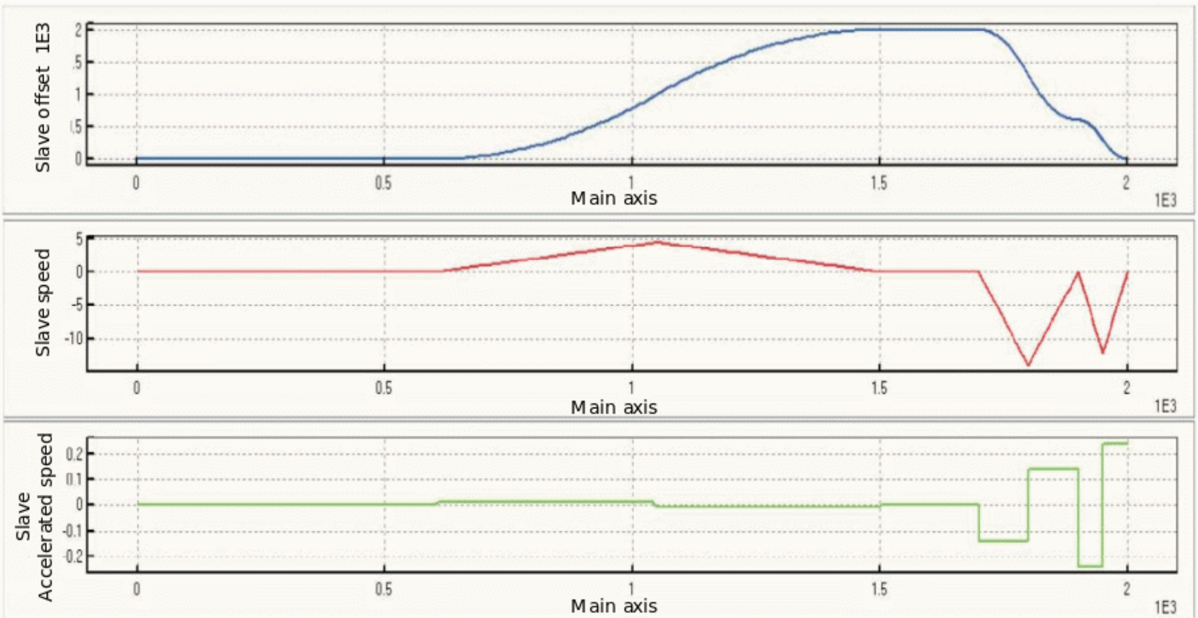
Then set the starting address of the parameter, check the ECam0 form in [Electronic Cam] when downloading, the system will automatically fill in the data of the above form into the corresponding parameter address.

3) Specified key point parameters table

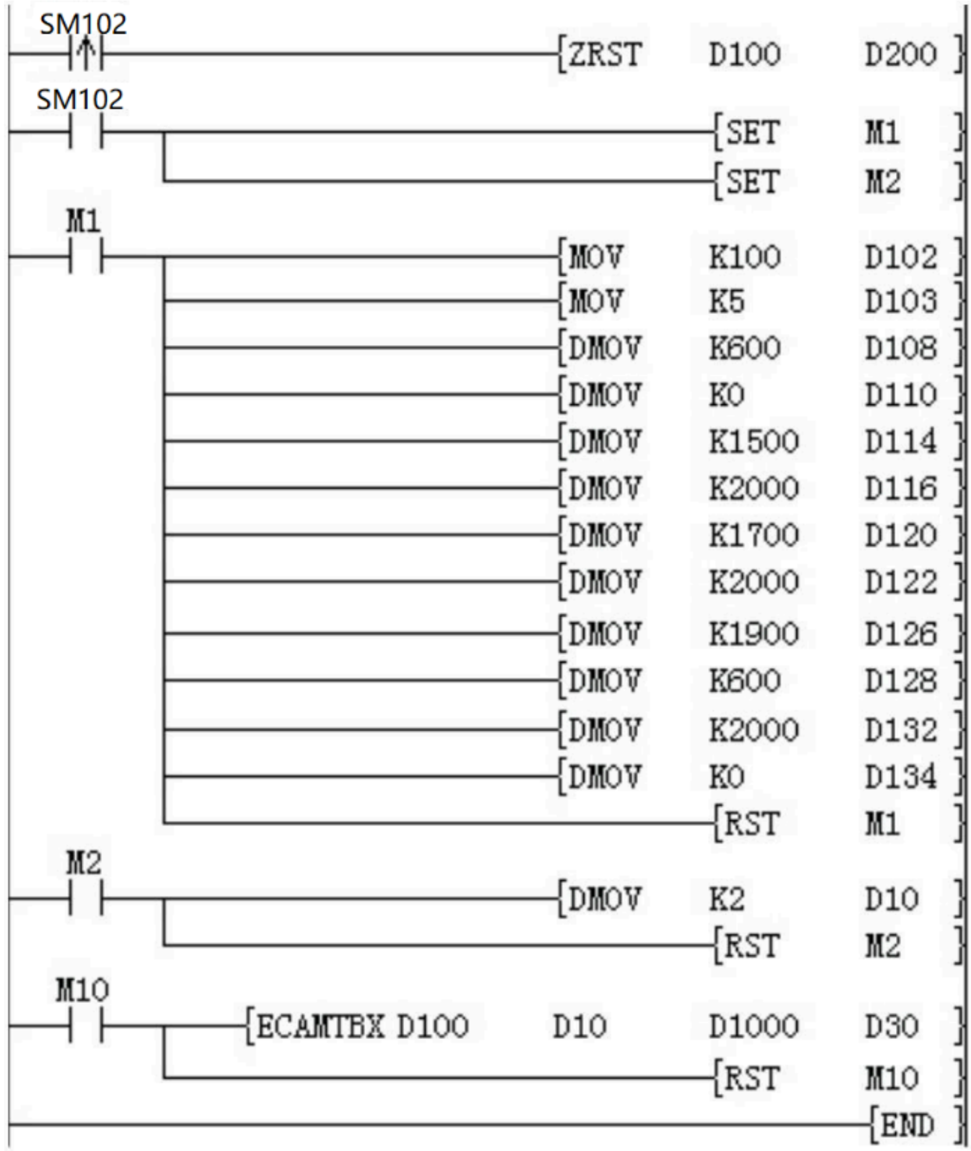
Address	**Instruction**	**Set value**	**Address**	**Instruction**	**Set value**
S0	Curve generation result		S0+19	Resolution of segment 2	0
S0+1	Error parameter location		S0+20	Spindle position of segment 3	1700
S0+2	Total resolution	100	S0+21		
S0+3	Number of key point	1-10	S0+22	Slave axis position of segment 3	2000
S0+4	Initial position of slave axis	——	S0+23		
S0+5			S0+24	Curve type of segment 3	0
S0+6	Spindle position of segment 0	Reserved	S0+25	Resolution of segment 3	0
S0+7	Slave axis position of segment 0	Reserved	S0+26	Spindle position of segment 4	1900
S0+8	Spindle position of segment 1	600	S0+27		
S0+9			S0+28	Slave axis position of segment 4	600
S0+10	Slave axis position of segment 1	0	S0+29		
S0+11			S0+30	Curve type of segment 4	0
S0+12	Curve type of segment 1	0	S0+31	Resolution of segment 4	0
S0+13	Resolution of segment 1	0	S0+32	Spindle position of segment 5	2000
S0+14	Spindle position of segment 2	1500	S0+33		
S0+15			S0+34	Slave axis position of segment 5	0
S0+16	Slave axis position of segment 2	1200	S0+35		
S0+17			S0+36	Curve type of segment 5	0

S0+18	Curve type of segment 2	0	S0+37	Resolution of segment 5	0

4) The table generated by specified key points is shown as below.



5) If you do not need to fill in the data in the form, you can use the Circuit program to replace the form data:


SM102
[ZRST D100 D200]
SM102
[SET M1]
[SET M2]
M1
[MOV K100 D102]
[MOV K5 D103]
[DMOV K600 D108]
[DMOV K0 D110]
[DMOV K1500 D114]
[DMOV K2000 D116]
[DMOV K1700 D120]
[DMOV K2000 D122]
[DMOV K1900 D126]
[DMOV K600 D128]
[DMOV K2000 D132]
[DMOV K0 D134]
[RST M1]
M2
[DMOV K2 D10]
[RST M2]
M10
[ECAMTBX D100 D10 D1000 D30]
[RST M10]
[END]

Total resolution
5 key points
Spindle position of segment 1
Slave axis position of segment 1
Spindle position of segment 2
Slave axis position of segment 2
Spindle position of segment 3
Slave axis position of segment 3
Spindle position of segment 4
Slave axis position of segment 4
Spindle position of segment 5
Slave axis position of segment

Special address

Devices	Content
SD881 (high byte), SD880 (low byte)	Y000 Output pulse number. Decrease when reversed. (Use 32 bits)
SD941 (high byte), SD940 (low byte)	Y001 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1001 (high byte), SD1000 (low byte)	Y002 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1061 (high byte), SD1060 (low byte)	Y003 output pulse number. Decrease when reversed. (Use 32 bits)
SD1121 (high byte), SD1120 (low byte)	Y004 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1181 (high byte), SD1180 (low byte)	Y005 Output pulse number. Decrease when reversed. (Use 32 bits)
SD1241 (high byte), SD1240 (low byte)	Y006 Number of output pulses. Decrease when reversed. (Use 32 bits)
SD1301 (high byte), SD1300 (low byte)	Y007 Output pulse number. Decrease when reversed. (Use 32 bits)

Devices	Content	Devices	Content
SM882	Y000 Pulse output stop (stop immediately)	SM880	Y000 monitoring during pulse output (BUSY/READY)
SM942	Y001 Pulse output stop (stop immediately)	SM940	Y001 Monitoring during pulse output (BUSY/READY)
SM1002	Y002 Pulse output stop (stop immediately)	SM1000	Y002 Monitoring during pulse output (BUSY/READY)
SM1062	Y003 Pulse output stop (stop immediately)	SM1060	Y003 Monitoring during pulse output (BUSY/READY)
SM1122	Y004 Pulse output stop (stop immediately)	SM1120	Y004 Monitoring during pulse output (BUSY/READY)
SM1182	Y005 Pulse output stop (stop immediately)	SM1180	Y005 Monitoring during pulse output (BUSY/READY)
SM1242	Y006 Pulse output stop (stop immediately)	SM1240	Y006 Monitoring during pulse output (BUSY/READY)

SM1302	Y007 Pulse output stop (stop immediately)	SM1300	Y007 Monitoring during pulse output (BUSY/READY)

Appendix

Rotary saw parameter table

Rotary saw curve parameter setting

Parameter	Offset address	Name	Format	Instruction
Parameter 1	Address 0 Address 1	Spindle length	32-bit integer	The moving cut length of the feeding axis moving. Unit: pulse.
Parameter 2	Address 2 Address 3	Slave length	32-bit integer	The circumference of the cutting axis (including the tool length). Unit: pulse. Range [-2,000,000,000, 2,000,000,000]
Parameter 3	Address 4 Address 5	Slave sync length	32-bit integer	The length of the slave axis synchronization zone is smaller than the slave axis length, generally set to 1/3 of the slave axis length. (When the new S type rotary saw is selected, the value satisfies 40 *sync ratio<=sync length< slave axis length-2.). Sync area range: 0＜sync area length＜｜slave axis length|
Parameter 4	Address 6 Address 7	Slave axis sync magnification	Floating	Calculation method one: In the synchronization zone, the speed of the master axis and the slave axis are equal, and the sync magnification calculation method: V1(V2)=Master (slave) axis speed F1(F2)=Master (slave) axis speed (Hz) D1(D2)=Master (slave) axis diameter R1 (R2) = master (slave) axis pulse number per revolution Calculation method two: Slave axis sync magnification=the number of pulses required by 1mm slave axis/the number of

				pulses required by 1mm spindle
Parameter 5	Address 8 Address 9	Slave axis maximum magnification limit	Floating	Maximum magnification = maximum speed of slave axis/maximum speed of spindle
Parameter 6	Address 10	Acceleration curve	Integer	0: Constant acceleration curve, the speed curve is T type 1: Constant jerk curve, the speed curve is S type 2: reserved 3: reserved 4: New S rotary saw curve (synchronization zone is in the middle), see appendix for details. Current curve only supports CAM curve as 0.
Parameter 7	Address 11	CAM curve	Integer	Start, stop, and various curve selections of different synchronization zone positions: 0: LeftCAM synchronization area is on the front curve; 1: MidCAMall; 2: MidCAMBegin start curve; 3: MidCAMEnd end curve; 4: RightCAM synchronization area is on the back curve; BIT[15]=1: Continuing the previous data, used for splicing curves, such as setting the subdivision of the curve, the total resolution range of all splicing curves is 31 to 1024, and the two rotary saw curves are spliced into a shearing curve
Parameter 8	Address 12	Resolution	Integer	Range [31,511], of which 20 synchronization areas; When CAM curve is selected as MdiCAMall (resolution range is [54, 511])
	Address 13	Reserved	Retained	Reserved

Parameter 9	Address 14 Address 15	Synchronization zone start position	32-bit integer	After the curve is generated correctly, the calculated start position of the spindle synchronization area could be used to set the lower limit of the synchronization area.
Parameter 10	Address 16 Address 17	End of synchronization zone	32-bit integer	After the curve is correctly generated, the calculated end position of the spindle synchronization area could be used to set the lower limit of the synchronization area.
Parameter 11	Address 18 Address 19	Slave axis minimum limit operation magnification	Floating	It is valid only when parameter 6 acceleration curve is set to 4. Make sure that the actual maximum speed of the slave axis cannot be less than this value magnification corresponds to the speed so as to adjust the slope of the deceleration section.
Parameter 11	Address 20 Address 21	The maximum magnification of the actual operation of slave axis	Floating	The maximum magnification of the actual operation of slave axis: It is sync magnification when it is long material, and it is between sync magnification and maximum limit magnification when it is short material.

9.2.5.2 Flying saw parameter table

Parameter setting of flying saw curve

Parameter	Offset address	Name	Format	Instruction
Parameter 1	Address 0 Address 1	Spindle length	32-bit integer	The cutting length of the feeding axis moving. Unit: Pulse.
Parameter 2	Address 2 Address 3	Slave length	32-bit integer	The circumference of the cutting axis (including the tool length). Unit: Pulse. Range [-2,000,000,000, 2,000,000,000]
Parameter 3	Address 4 Address 5	Slave synchronization length	32-bit integer	The length of the slave axis synchronization zone. Synchronization area range: 0＜ synchronization

					area length＜|slave axis length/2|
Parameter 4	Address 6 Address 7	Slave axis synchronization magnification	Floating		Calculation method one: In the synchronization zone, the speed of master axis and the slave axis are equal, and the synchronization magnification calculation method is as below. $v1=v2 \Rightarrow \frac{F_1*3.14*D_1}{R_1}=\frac{F_2*3.14*D_2}{R_2}$ $\Rightarrow \frac{F_2}{F_1}=\frac{R_2/D_2}{R_1/D_1}$ among them V1(V2)=Master (slave) axis speed F1(F2)=Master (slave) axis speed (Hz) D1(D2)=Master (slave) axis diameter R1 (R2) = master (slave) axis pulse number per revolution Calculation method two: Slave axis synchronization magnification=1mm The number of pulses required by the slave axis/1mm The number of pulses required by the spindle
Parameter 5	Address 8 Address 9	Slave axis maximum magnification limit	Floating		Maximum magnification = maximum speed of slave axis/maximum speed of main axis
Parameter 6	Address 10	Acceleration curve	Integer		0: constant acceleration curve, the speed curve is T type 1: Constant jerk curve, the speed curve is S type
	Address 11	CAM curve	Integer		Start, stop, and various curve selections for different synchronization

					zone positions: (currently only one type is supported, the tracking RightCam and the return LeftCam curve type are defaulted and can not be set)
Parameter 7	Address 12	Resolution	Integer		Range [62,511]
	Address 13	Reserved	Reserved		Reserved
Parameter 8	Address 14 Address 15	Synchronization zone start position	32-bit integer		After the curve is generated correctly, the calculated starting position of the spindle synchronization area can be used to set the lower limit of the synchronization area.
Parameter 9	Address 16 Address 17	End of synchronization zone		32-bit integer	After the curve is correctly generated, the calculated end position of the spindle synchronization area can be used to set the lower limit of the synchronization area.
Parameter 11	Address 20 Address 21	The maximum magnification of the actual operation of slave axis		Floating	The maximum magnification of the actual operation of slave axis: It is sync magnification when it is long material, and it is between sync magnification and maximum limit magnification when it is short material.

S type acceleration and deceleration curve parameter table

S type acceleration and deceleration curve parameter setting

Parameter	Offset address	Name	Format	Instruction	Unit	Range
Parameter 1	Address 0 Address 1	Total number of pulses (length)	32-bit integer	Total number of output pulses	Pulse	1 to 2147483647
Parameter 2	Address 2 Address 3	Set the maximum speed of pulse	32-bit integer	Set the highest frequency of pulses	Hz	1 to 200000
Parameter 3	Address 4 Address 5	Reserved	Retained	Reserved		2 to 32767
Parameter 4	Address 6	Accelerated time	16-bit integer	Pulse acceleration time	ms	2 to 32767
Parameter 5	Address 7	Deceleration time	16-bit integer	Pulse deceleration time	ms	50 to 511
Parameter 6	Address 8	Resolution	16-bit integer	Pulse resolution	Length	51 to 512

Parameter 7	Address 9	Reserved	Reserved	Reserved		
Parameter 8	Address 10 Address 11	Number of pulses of spindle in the last segment	32-bit integer	Number of pulses of spindle in the last segment (high and low)	Pulse	Internally generated
Parameter 9	Address 12 Address 13	Number of pulses of slave axis in the last segment	32-bit integer	Number of pulses of slave axis in the last segment(high and low)	Pulse	
Parameter 10	Address 14 Address 15	Uniform time	32-bit integer	The time span when outputting pulses at a constant speed	Pulse	
Parameter 11	Address 16 Address 17	Maximum speed	32-bit integer	The maximum speed of curve during operation	Hz	
Parameter 12	Address 18	Reserved				
Parameter 13	Address 19	Curve generation result				

4 Specified key points generate a table

Specified key points generate table parameters

Address		Name	Length	Instruction	Range
S0		Curve generation result	Single word	>0: The curve is generated successfully <0: Failed to generate the curve	
S0+1		Error parameter location	Single word		
S0+2		Total resolution	Single word		10 to 511
S0+3		Number of key points	Single word		1 to 10
S0+4 S0+5		Start position of slave axis	Double word	Set the start offset position of slave axis	Reserved
S0+6		Spindle segment 0	Single word	The master/slave axis of segment 0 is always 0	Reserved
S0+7		Slave axis segment 0	Single word		
Key point 1	S0+8 S0+9	Spindle segment 1	Double word	The number of pulse of spindle segment 1	32-bit integer
	S0+10 S0+11	Slave axis segment 1	Double word	The number of pulse of slave axis segment 1	32-bit integer
	S0+12	Curve type of segment 1	Single word	*1	
	S0+13	Resolution of segment 1	Single word	*2	
Key Point 2	S0+14 S0+15	Spindle segment 2	Double word	The number of pulse of spindle segment 2	32-bit integer

	S0+16 S0+17	Slave axis segment 2	Double word	The number of pulse of slave axis segment 2	32-bit integer
	S0+18	Curve type of segment 2	Single word	*1	
	S0+19	Resolution of segment 2	Single word	*2	
	......	......	....	......	......
Key point N	S0+n*6+2 S0+n*6+3	Spindle segment N	Double word	The number of pulse of spindle segment N	32-bit integer
	S0+n*6+4 S0+n*6+5	Slave axis segment N	Double word	The number of pulse of slave axis segment N	32-bit integer
	S0+n*6+6	Curve type of segment N	Single word	*1	
	S0+n*6+7	Resolution of segment N	Single word	*2	