THINGET

XCM motion control type PLC

User manual

Xinje Electronic Co., Ltd.

Data number PC02 20080412 3.0

THINGET xinje electronic

XCM

Motion control type PLC

User manual

Catalog

The first edition

This manual includes some basic precautions which you should follow to keep you safe and protect the products. These precautions are underlined with warning triangles in the manual. About other manuals that we do not mention, please follow basic electric operating rules.

Precautions

Please follow the precautions. If not, it may lead the controlsystem incorrect or abnormal, even cause fortune lose.

Correct Application

The models could only be used according to the manual, and an only be used along with the peripheral equipments recognized or recommended by Xinje Electronic. They could only work normally in the condition of be transported, kept and installed correctly, also please operate and maintain them according to the recommendation.

Duty Declare

We have checked the manual, its content fits the hardware and software of the products.As mistakes are unavoidable, we couldn't promise all correct. However, we would check the data in the manual frequently, and in the next edition, we will correct the necessary information. Your recommendation would be highly appreciated

20008.06

Catalog

Foreword

—— Features of XCM motion control type PLC

XCM motion control type PLC with the following features:

- **The PLC integrate motion control function and ordinary PLC function in one**

  XCM motion contol type PLC not only support proprietary function, but also support majority functions of ordinary PLC, including high speed pulse, high speed count, interruption, PID control, etc.

- **Support at most 10-axes pulse output function**

  XCM series contains 4-axes pulse output in common, specific model XCM-48 support at most 10-axes pulse output, maximize meet the users' control demands.

- **Predominant motion control capability**

  Can realize double-axes linkage, support familiar motion contol instructions, such as circular, linear interpolation, etc.

- **Can do conversion on plane**

  Support plane conversion instruction PLAN, can do double-axes linkage conversion on X-Y, Y-Z, X-Z, etc.

- **Can expand XC series digital, analog module and BD board**

  Similar with XC series, XCM series the same support module and BD board expansion, including digital, temperature anolog, etc.

XCM serials including models:

- XCM-32RT-E：4-axes pulse output, transistor/relay mix type.
- XCM-48T-E：10-axes pulse output type.

Supplement explanation:

The instruction noted in this manual is motion control function instruction, for the rest instructions belong to XC series, such as generic order control, application or special function instruction, please see <<XC series PLC user manua>>.

Remark

1. XCM motion control type PLC summarize

The chapter focus on XCM series product general specifications, appearance and dimension, terminal arrangement and the definition of each communication pin.

1-1. Internal specification

General specification

Items	Specifications
Insulate voltage	Up to DC 500V 2MΩ
Anti-noise	1000V 1uS pulse per minute
Ambient temperature	0℃~60℃
Ambient humidity	5%~95%
COM 1	RS-232, connect with host machine、HMI program or debug
COM 2	RS-232/RS-485, connect with network or aptitude instrument、inverters etc.
COM 3	BD board COM port RS-232C/RS-485
Installation	Can use M3 screw to fix or install directly on DIN46277 (Width 35mm) orbit
Grounding	The third type grounding (can't public ground with strong power system.)

Performance & Specification

XCM performance & specification table:

Item		Specification	
		32 points	48 points
Program executing format		Loop scan format, timing scan format	
Program format		Instruction, C language, ladder chart	
Dispose speed		0.3us	
Power cut retentive		Use FlashROM and Li battery	
User program's capacity		8000 steps	
I/O points		Input 18 points Output 14 points	Input 28 points Output 20 points
Interior coil's points (M)		8512 points	
Timer（T）	Points	620 points	
	Spec.	100mS timer：Set time 0.1~3276.7 seconds 10mS timer：Set time 0.01~327.67 seconds 1mS timer：Set time 0.001~32.767 seconds	
Counter（C）	Points	635 points	
	Spec.	16 bits counter：set value K0~32767 32 bits counter：set value K0~2147483647	
Data Register（D）		4512 words	
FlashROM Register（FD）		576 words	
High speed dispose		High speed count、pulse output、external interrupt	
Setting of time scan space		0~99mS	
Password protection		6 bits ASCII	
Self diagnose function		Power on self-diagnose、Monitor timer、grammar check	

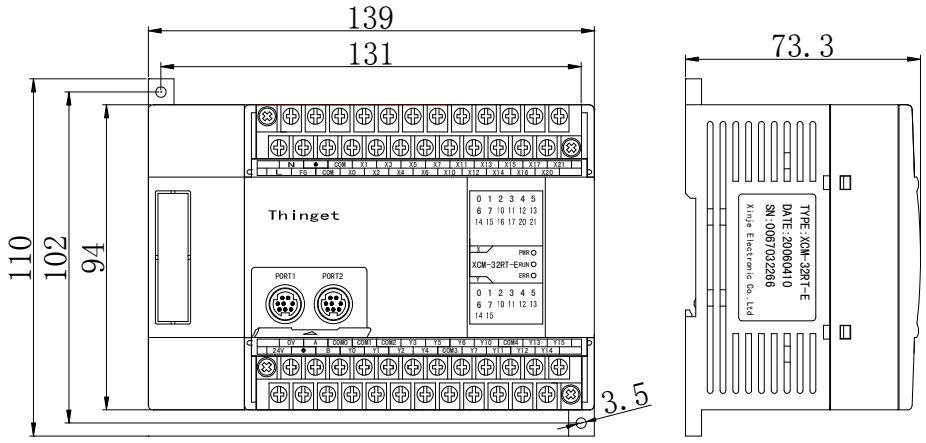
Note: If choose "PLC Operation--Secret Download", "user program capacity" could be larger.

1-2. Appearance & dimension

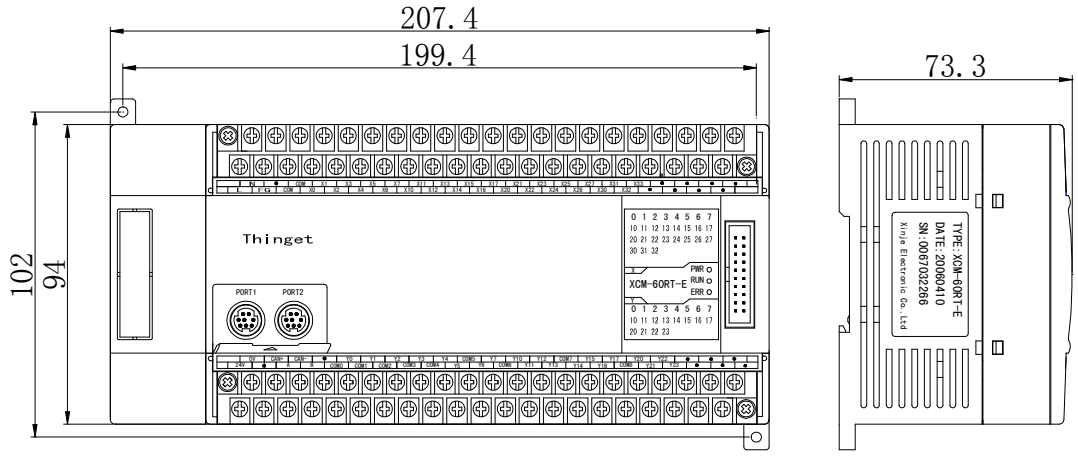
Appearance & Dimension

（Unit: mm）

XCM series 32-point main units

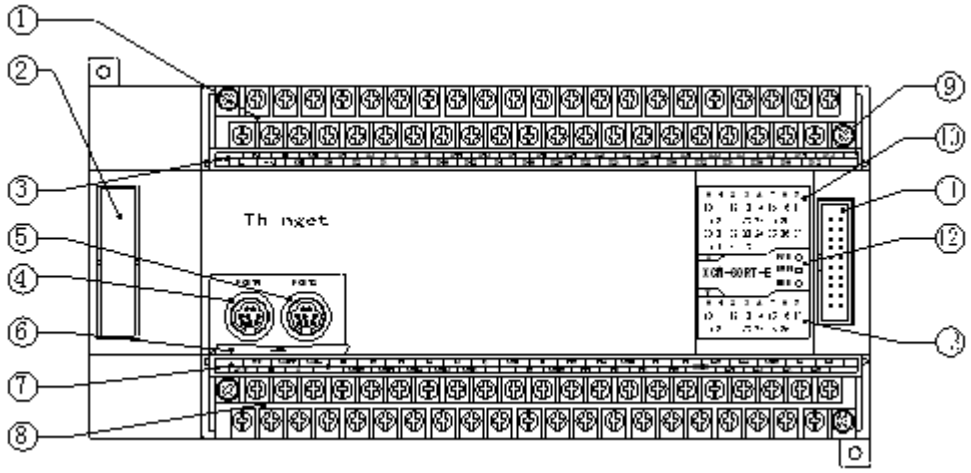


XCM series 48-point main units



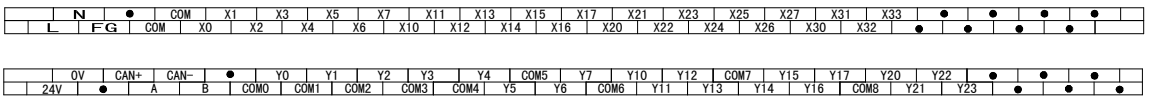
1-3. Terminal arrangement

Main units

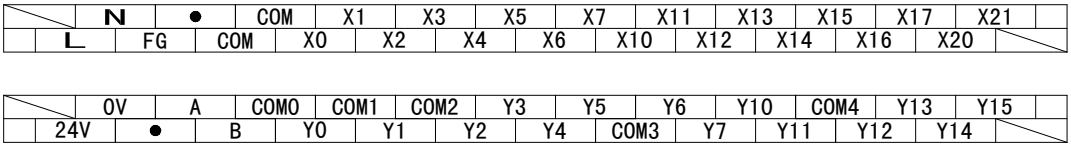


① Input terminals ② BD expansion ③ Input label
④ COM port ⑤ COM port ⑥ COM port's cover board
⑦ Output label ⑧Output terminals ⑨ Screws
⑩ Input indicate LED ⑪ Extension port
⑫Programming status indicate LED ⑬ Output indicate LED

XCM series 48-point main units：28 Input /20 Output

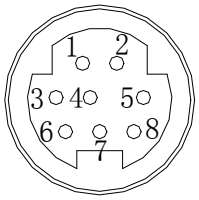


XCM series 32-point main units：18 Input /14 Output



1-4. COM Port definition

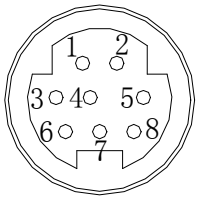
Port 1



2：PRG
4：RxD
5：TxD
6：VCC
8：GND

Mini Din 8 core socket (hole)

Port 2



4：RxD
5：TxD
8：GND

Mini Din 8 core socket (hole)

Program cable

Mini Din 8core socket (pin)　　DB 9 pin (hole)

2. Power circuit specification, input/output specification, external layout

This chapter focus on XCM PLC power composing, internal signal circuit composing, output circuit composing and external layout method.

2-1. Power specification

For the power specification of XCM motion control type PLC basic units, please see the following table：

AC power type

Rated voltage	AC100V~240V
Voltage allow bound	AC90V~265V
Rated frequency	50/60Hz
Allow momentary power-cut time	Interrupt time≤0.5 AC cycle，alternation≥1 sec
Impact current	Max 40A 5mS below/AC100V max 60A 5mS below /AC200V
Max power consumption	12W
Power for sensor use	24VDC±10%　max 400mA

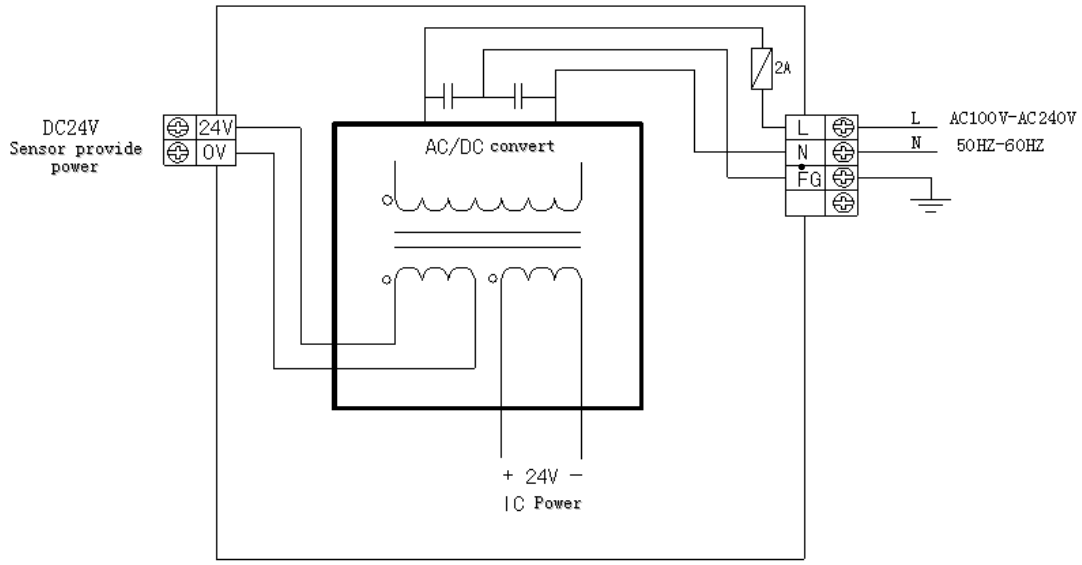
- To avoid voltage decrease, please use the power cable thicker than 2mm^2
- Even appear power cut within 10ms，PLC can still go on working. But if long time power cut or abnormal power decrease, PLC will stop working, output will also appear OFF status， when recover power supply, the PLC will auto start to work.
- Connect the grounding terminals of basic units and extend modules together, then ground

DC power type

Rated voltage	DC24V
Voltage allow bound	DC21.6V~26.4V
Input current (Only basic unit)	120mA　DC24V
Allow momentary power-cut time	10mS　DC24V
Impact current	10A　DC26.4V
Max power consumption	12W
Power for sensor use	24VDC±10%　Max 400mA

2-2. AC power supply、DC input type

Constitution and Connection

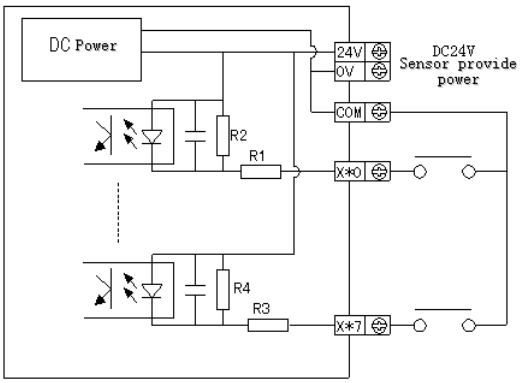


- The power is connected between L and N terminals.
- 24+、COM terminals can be used as power 400mA/DC24V which supply sensor. Besides, this terminal can't be given power from outside.
- [ ] terminal is vacant terminal，please don't go on exterior connection or use it as relay terminal.
- Please connect the basic unit with extend module's [COM] terminal.

2-3. Input specification

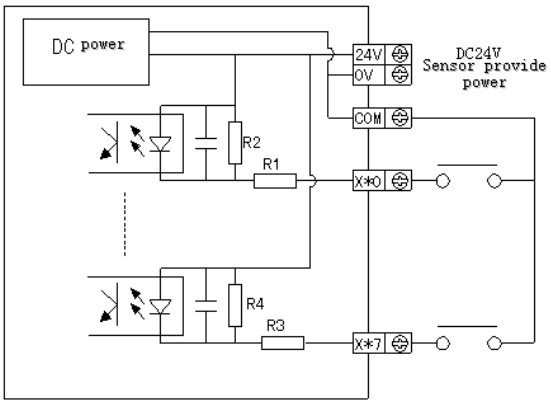
Basic Units

Model	XCM-32RT/XCM-48T
Input signal's voltage	DC24V±10%
Input signal's current	7mA/DC24V
Input ON current	Up to 4.5mA
Input OFF current	Low than 1.5mA
Input response time	About 10ms
Input signal's format	Contact input or NPN open collector transistor
Circuit insulation	Optical-coupled insulation
Input action's display	LED light when input ON



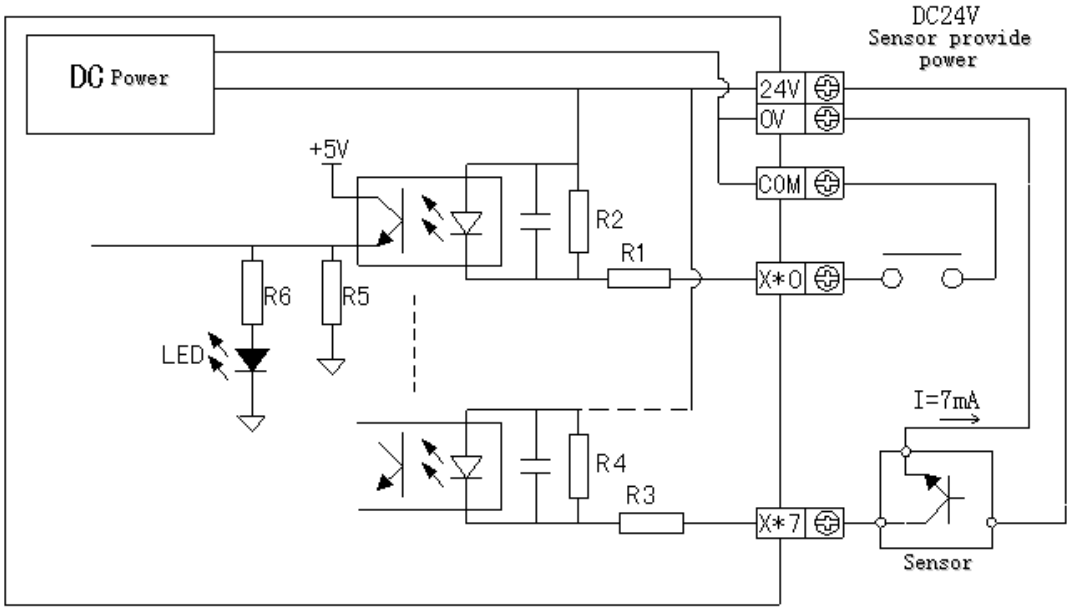
Expansions

Model	XCM-32RT/XCM-48T
Input signal's voltage	DC24V±10%
Input signal's current	7mA/DC24V
Input ON current	Up to 4.5mA
Input OFF current	Below 1.5mA
Input response time	About 10ms
Input signal's format	Contacts input or NPN open collector transistor
Circuit insulation	Optical-coupled insulation
Input action's display	LED light when input ON.



2-4. DC Input Signal's Disposal（AC Power Type）

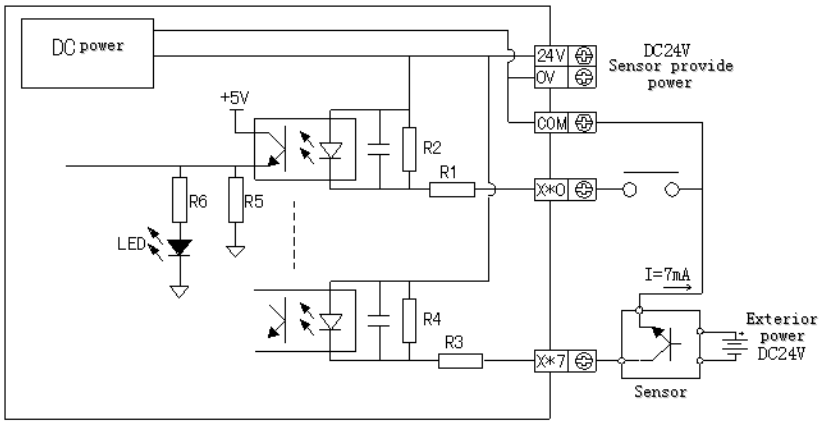
DC input signal



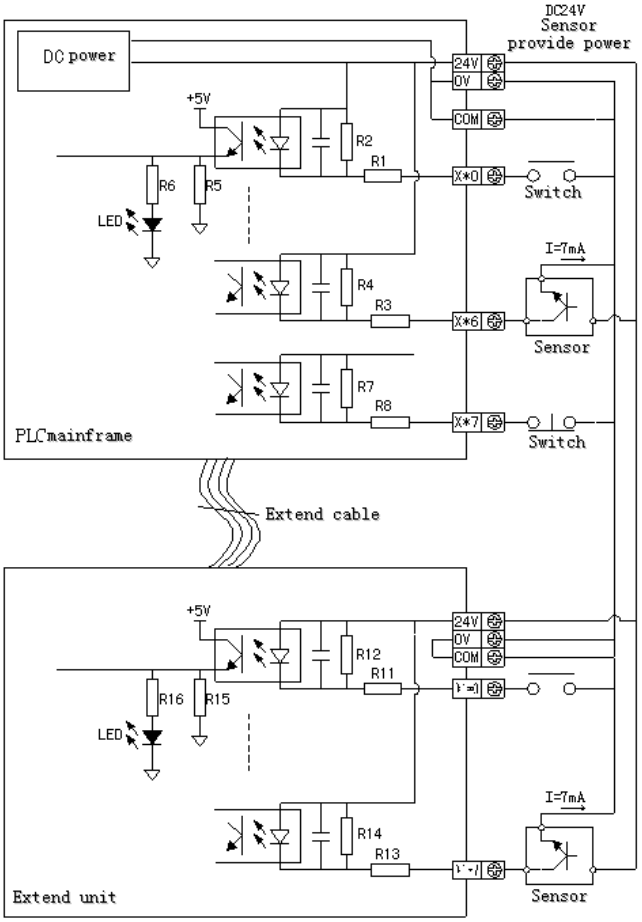
- Input terminal
  When connect input terminal and COM terminal with contacts without voltage or NPN open collector transistor, if input is ON，LED lamp lights, which indicates input。There are many COM terminals to connect in PLC.
- Input circuit
  Use optical coupling instrument to insulate the input once circuit and twice circuit，There's a C-R filter in the twice circuit。It is set to avoid wrong operation caused by vibration of input contacts or noise along with input signal. As the preceding reason, for the changing of input ON→OFF，OFF→ON，in PLC, the response time delays about 10ms。There's a digital filter inside X000~X015。This kind of filter can very from 0~15ms according to the special register (D8020).
- Input sensitive
  The PLC's input current is DC24V 7mA，but to be safe，it needs current up to 3.5mA when it's ON，lower than 1.5mA when it's OFF.

Exterior circuit used by sensors

XC series PLC's input power is supplied by its interior 24V power， so if use exterior power to drive photoelectricity sensor etc.,， this exterior power should be DC24V±4V， please use NPN open collector type for sensor's output transistor



Input Connection



2-5. Relay output specification and circuit

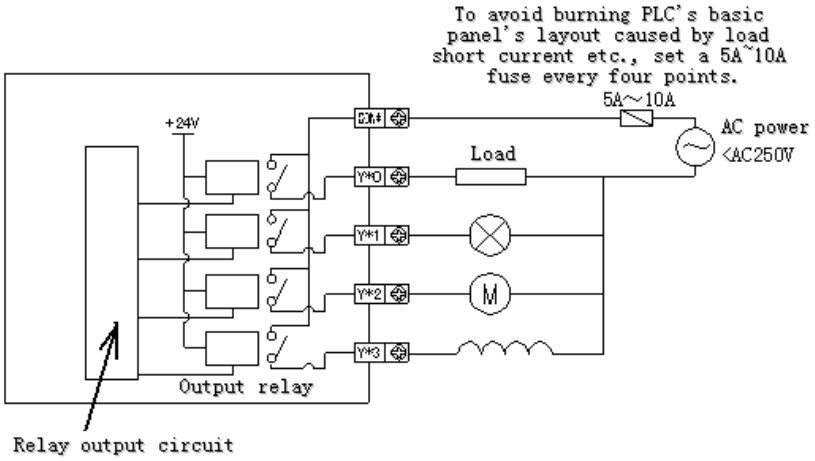
Relay output specification

Model		XCM-32RT	XCM-48T
Relay output bit		Y12，Y13，Y14，Y15	Blank
External power		AC250V、DC30V 以下	
Circuit insulation		Mechanism insulation	
Action denote		LED indicate lamp	
Maximum load	Resistant load	3A	
	Induce load	80VA	
	Lamp load	100W	
Minimum load		DC5V 2mA	
Response time	OFF→ON	10ms	
	ON→OFF	10ms	

Relay output circuit

- **Output terminals**
  Relay output type includes 2~4 public terminals. So each public-end unit can drive different power-voltage system's (E.g.：AC200V，AC100V，DC24V etc.) load.
- **Circuit's insulation**
  Between the relay output coils and contacts，PLC's interior circuits and exterior circuits, load circuits are electric insulation. Besides, each public-end blocks are separate.
- **Action display**
  LED lamp lights when output relay's coils galvanize, output contacts are ON.
- **Response time**
  From the output relay galvanize (or cut) to the output contacts be ON (or OFF), the response time is about 10ms
- **Output current**
  The current-voltage below AC250V can drive the load of pure resistace 2A/1 point、inductance load below 80VA（AC100V or AC200V） and lamp load below 100W（AC100V or AC200V）.
- **Open circuit's leak current**
  When the output contact be OFF and there's no leak current，can directly drive Ne lamp etc.
- **The life of relay output contacts**
  Standard life of induce AC load such as contactor、electromagnetism valve：5 million times for 20VA load. Cut power device's life according to the company's test: for 80VA load, the action life is up to 2 million times. But if the load parallel connect with surge absorber, the life will be greatly improved!

Output connection example

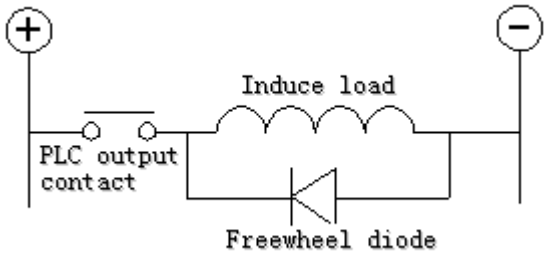


Note: XCM-32RT with relay output Y12, Y13,Y14, Y15; XCM-48T without relay output, so can't connect with 220V, otherwise it will cause short-circuit.

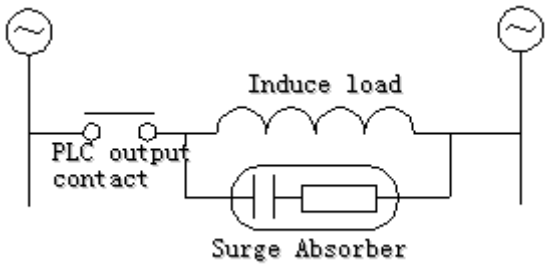
Output circuit composing

- For DC induce load, please parallel connect with commutate diode. If not connect with the commutate diode, the contact's life will be decreased greatly. Please choose the commutate diode which allow inverse voltage endurance up to 5~10 times of the load's voltage, ordinal current exceeds load current.
- Parallel connect AC induce load with surge absorber can reduce noise.

DC load



AC load



2-6. Transistor output specification and circuit

The transistor output can be divided into two types, high speed pulse output and generic transistor output.

High speed pulse output

Model	XCM-32RT	XCM-48T
High speed pulse output bit	Y0~Y3	Y0~Y11
External power	Below DC5~30V	
Action denote	LED indicate lamp	
Maximum current	50mA	
The maximum pulse output frequency	400KHZ	

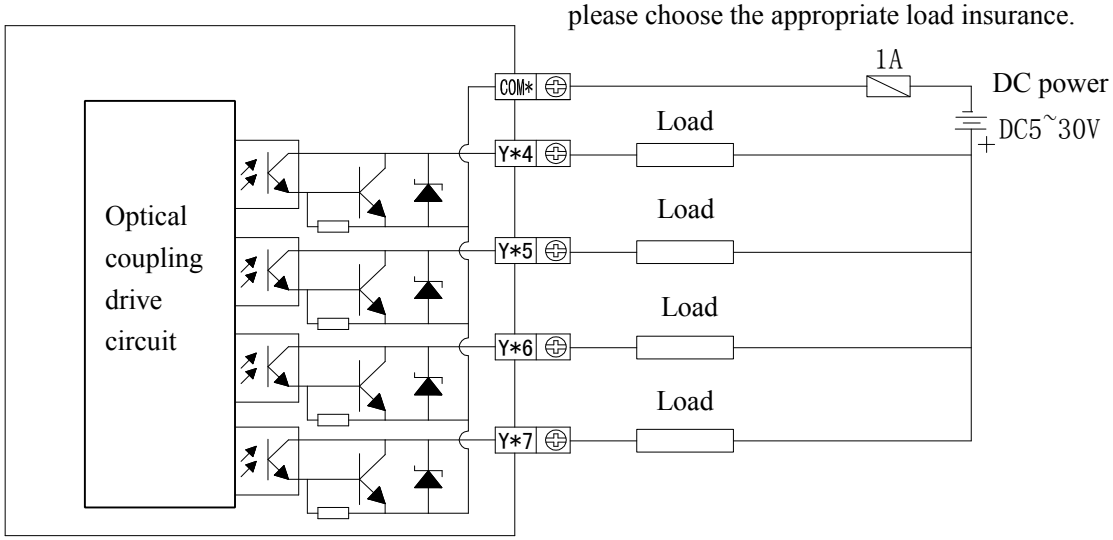
Generic transistor output

Model		XCM-32RT	XCM-48T
Transistor output bit		Y4~Y11	Y12~Y23
External power		Below DC5~30V	
Circuit insulation		Optical-coupled insulation	
Action denote		LED indicate lamp	
Maximum load	Resistant load	0.8A	
	Induce load	12W/DC24V	
	Lamp load	1.5W/DC24V	
Minimum load		DC5V 2mA	
Response time	OFF→ON	Below 0.2ms	
	ON→OFF	Below 0.2ms	

Generic transistor output circuit

- Output terminal
  The transistor of basic units with 1~4 public-end output.
- External power
  Please use DC5~30V steady-voltage to drive load.
- Circuit insulation
  Use the photoelectricity-coupling to insulate the PLC internal circuit and output transistor. Beside, every public block is separated.
- Action denote
  When driving optical-coupling, LED lights, output transistor is ON.
- Response time
  From photoelectricity coupling device drive (or cut) to transistor ON (or OFF), the time PLC uses is below 0.2ms.
- Output current
  The current is 0.5A per point。But as restrict of temperature rising, the current is 0.8A every four points.
- Open circuit current
  Below 0.1mA.

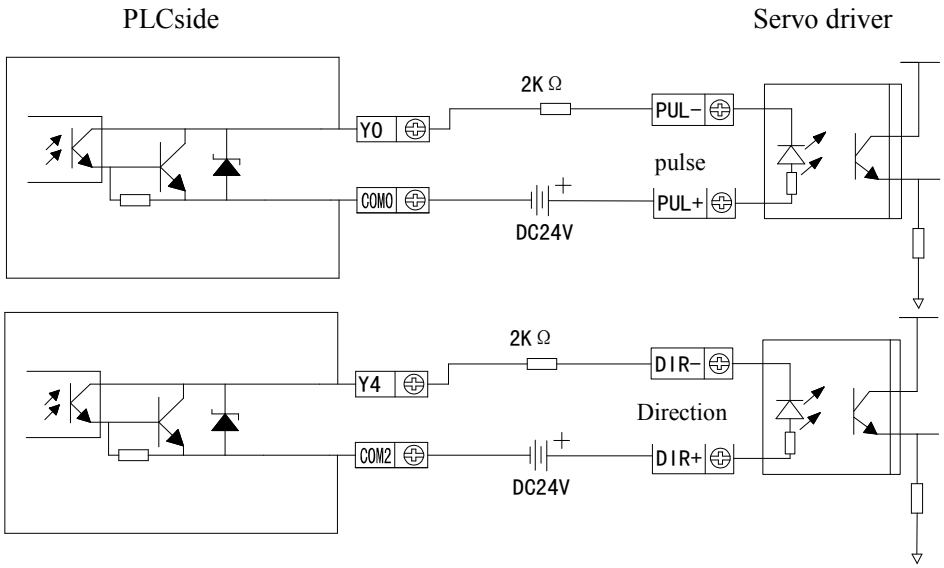
To avoid burning output unit, burning the PLC substrate wiring caused by load short-circuit, please choose the appropriate load insurance.



（**Note:** For XCM-48T, when optical coupling point connecting with power load, please use output point Y12~Y23).

Connect with servo driver

The following figure is an connection example of RT type PLC and servo driver.



（If external power supply is DC5V, then no need to connect 2KΩresistance.）

3． Motion control instruction, parameter, special data register and auxiliary relay explanation

The chapter focus on XCM motion control instruction function, motion control parameter, special data register and auxiliary relay. In the end chapter, we select two examples for reference.

3-1. Soft element ID list

XCM series soft element ID allocateddistribute as follows.

Besides, when connect input, output expansion device and special expansion device with basic units, for the input/output relay NO., please see user manual.

..

Mark	Name	Range		Points	
		32 points	48 points	32 points	48 points
X	Input point	X000~X021（Octal ）	X000~X033（Octal）	18 points	28 points
Y	Output point	Y000~Y015（Octal）	Y000~Y023（Octal）	14 points	20 points
M	Internal relay	M0~M2999【M3000~M7999】		8000	
		Special use M8000~M8511		512	
S	Flow	S0~S511 【S512~S1023】		1024	
T	Timer	T0~T99：100ms not cumulation		620	
		T100~T199：100ms cumulation			
		T200~T299：10ms not cumulation			
		T300~T399：10ms cumulation			
		T400~T499：1ms not cumulation			
		T500~T599：1ms cumulation			
		T600~T618：1ms with interruption, precise timing			
C	Counter	C0~C299：16 bits forth counter		635	
		C300~C598：32 bits forth/back counter			
		C600~C634：high speed counter			
D	Data register	D0~D2999 【D4000~D4999】		4000	
		Special use D8000~D8511		512	
FD	FlashROM register	FD0~FD63		64	
		Special use FD8000~FD8349，FD8890~FD8950		410	
ED	Expansion internal register	ED0~ED36863		36864	

◆ **NOTE：**

※1. The memorizer area in【 】is the defaulted power failure retentive area; soft elements D、M、S、T、C can be set to change the power failure retentive area. For the details, please see the following table

※2. FlashROM register needn't set power failure retentive, its data won't lose when power is cut (No battery).

※3. The serial No. of input coil、output relay are octal data, other memorizers' No. are all algorism data.

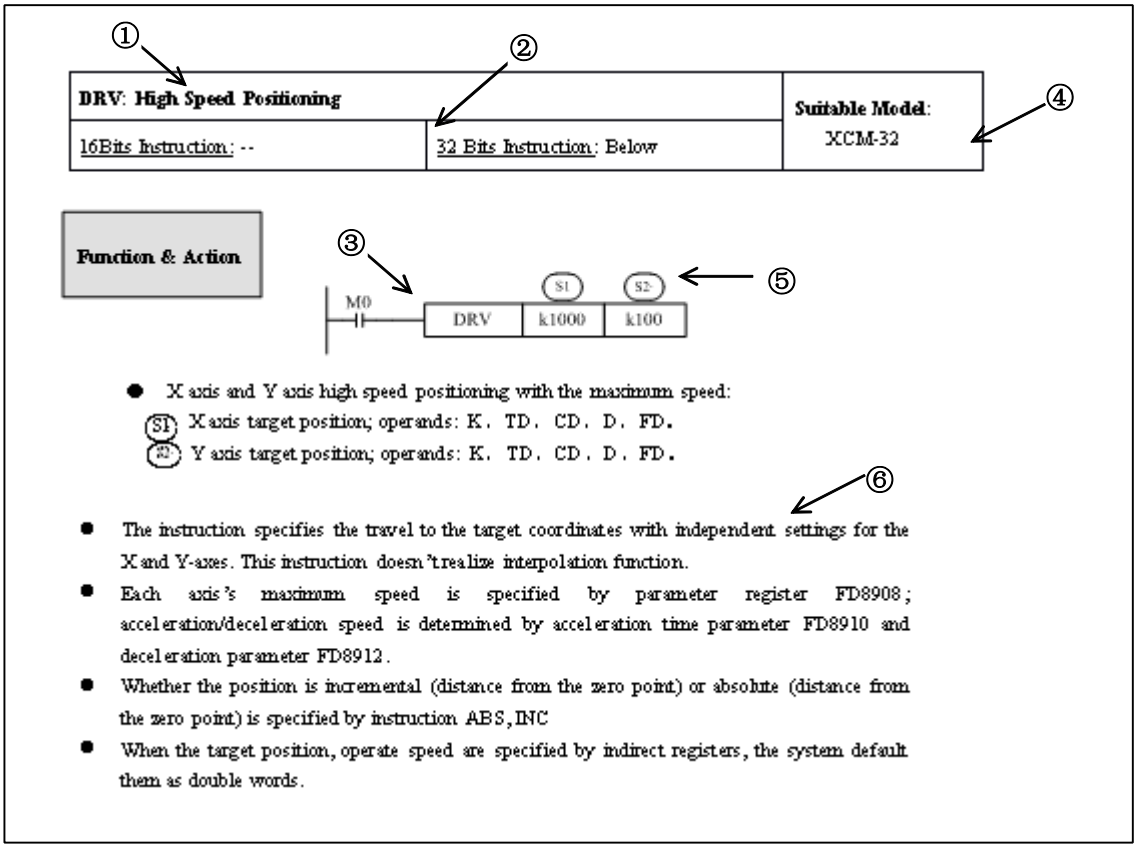
Soft element power-off retentive area settings

Name	Set area	Function	System default value	Power-off retentive range
D	FD8202	Start denotation of D power-off retentive area	4000	D4000~D4999
M	FD8203	Start denotation of M power-off retentive area	3000	M3000~M7999
T	FD8204	Start denotation of T power-off retentive area	620	Not setted
C	FD8205	Start denotation of C power-off retentive area	320	C320~C635
S	FD8206	Start denotation of S power-off retentive area	512	S512~S1023
ED	FD8207	Start denotation of ED power-off retentive area	0	ED0~ED36863

3-2. Motion control instruction list (Special for XCM series)

DRV	High speed positioning
LIN	Linear Interpolation Positioning
CW	Circular clockwise interpolation
CCW	Circular anticlockwise interpolation
DRVZ	Machine zero return
CHK	Servo end check
DRVR	Electrical zero return
SETR	Electrical zero settings
TIM	Delayed time
ABS	Absolute address
INC	Incremental address
SETP	Set reference frame
PLAN	Plane selection
FOLLOW	Following movement instruction

3-3. The reding note of application instruction



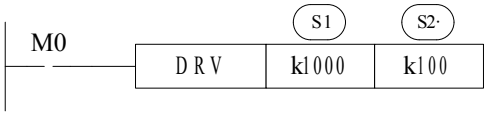
Note :

① Instruction name
② 16 bits instruction and 32 bits instruction
③ Ladder chart illustration
④ Applicable models
⑤ (S·) It denotes that the operand don't change with instruction implementation, called source operand.
(D·) It denotes that the operand change with instruction implementation, called target operand.
⑥ Successively explain the instruction's basic movement, use method, application example, expansion function, notice point, etc.

3-4. Motion Control Instructions

DRV: High Speed Positioning		Suitable Model:
16Bits Instruction: --	32 Bits Instruction: Below	XCM-32

Function & Action



- X axes and Y axes high speed positioning with the maximum speed:
  (S1·) X axes target position; operands: K、TD、CD、D、FD.
  (S2·) Y axes target position; operands: K、TD、CD、D、FD.

- The instruction specifies the travel to the target coordinates with independent settings for the X and Y-axes. This instruction doesn't realize interpolation function.
- Each axes's maximum speed is specified by parameter register FD8908; acceleration/deceleration speed is determined by acceleration time parameter FD8910 and deceleration parameter FD8912..
- Whether the position is incremental (distance from the zero point) or absolute (distance from the zero point) is specified by instruction ABS, INC.
- When the target position, operate speed are specified by indirect registers, the system default them as double words.

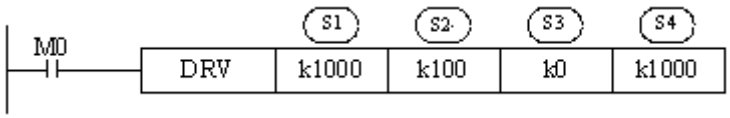
Program Example

```
INC                 ;Incremental Drive Method;
DRV K1000 K2000     ;High speed positioning with the maximum speed, the
                    target address is: (1000,2000);
```

LIN: Linear Interpolation Positioning		**Suitable Model:**
16bits instruction:--	32bits instruction: Below	XCM-32

Function & Action

The instruction moves the machine to the target coordinates (X, Y) in a linear route by using the both axes at the same time.



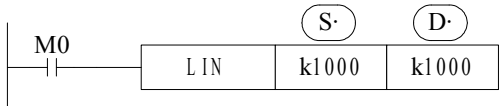
(S1) X axes target position. Operands: K、TD、CD、D、FD.

(S2·) Y axes target position. Operands: K、TD、CD、D、FD.

(S3·) The third axes target position. Operands: K、TD、CD、D、FD.

(Note: This instruction is not available for tri-axes control. The value set here is ignored, but this bit is reserved.)

(S4) Operation speed of linear interpolation positioning. Operands: K、TD、CD、D、FD.



(S·) X axes target position. Operands: K, TD, CD, D, FD.

(D·) Y axes target position. Operands: K, TD, C D, D, FD.

- This instruction moves the machine to the target coordinates (X, Y) in a linear route by using the both axes at the same time.
- Whether the target position is incremental (indicating the distance from the current position) or absolute (indicating the distance from the coordinate zero point) is set by INC or ABS.
- When the target position and operation speed are set by parameters, it is double digital operation.

Program example

```
ABS
LIN    K1000 K2000 K0 K5000
```

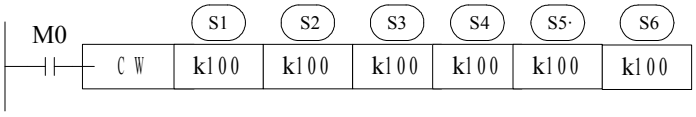
Absolute drive method;

This instruction moves the machine to the target position (1000,2000) in a linear route with the speed of 5KHz.

CW/CCW：Circular interpolation		**Applicable model**
16 digit instructions--	32 digit instructions：The following	XCM-32

Function & Action

Circular interpolation with center point specification



(S1·) X axes target position, operands: K、TD、CD、D、FD.

(S2·) Y axes target position, operands: K,TD、CD、D、FD.

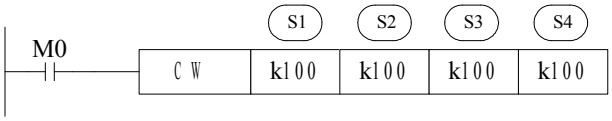
(S3) center point specification X axes position, operands: K、TD、CD、D、FD.

(S4·) center point specification Y axes position, operands：K、TD、CD、D、FD.

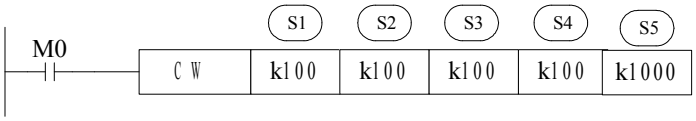
(S5) The third axes position, operands：K、TD、CD、D、FD.
(Notice: three axes's movement control is not open, so the setting value with no function but reverse it.)

(S6) Circular peripheral speed , operands: K、TD、CD、D、FD.

Without peripheral speed, takes specification highest speed, as following.



Circular interpolation, specification radius.



(S1·) X axes target position, operands：K、TD、CD、D、FD.

(S2·) Y axes target position , operands：K、TD、CD、D、FD.

(S3) Circular radius, operands：K、TD、CD、D、FD.

(S4·) The third axes movement control , operands: K、TD、CD、D、FD.
(Notice: three-axes movement control is not open, so the setting value with no function but reverse it.)

(S5) Circular peripheral speed , operands: K、TD、CD、D、FD.
Without peripheral speed, takes specification highest speed, as following.

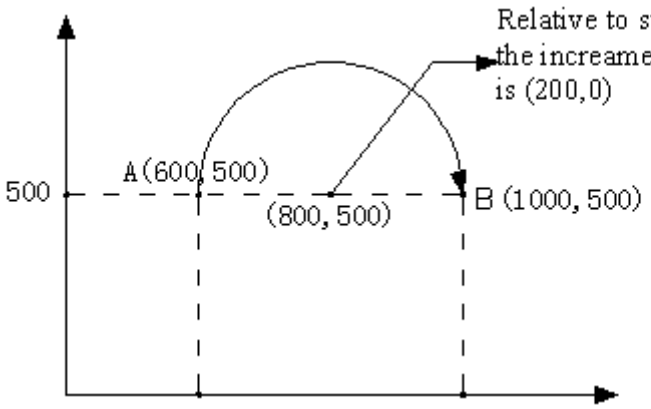
- CW is clockwise interpolation operation, CCW is anticlockwise interpolation operation.
- The radius is always treated as an incremental address from the center point of X/Y.
- the acceleration/deceleration time constant and the unit of peripheral speed are set by parameters of FD8910, FD8912.

- Whether the target position is an incremental or absolute is set by code INC or ABS.
- Target position, operation speed setting by parameters, specification unit is double operation.
- When the start point is equivalent to the end point or when the endpoint coordinates, the travel locus makes a complete circle.

Program example

ABS Specification absolute speed

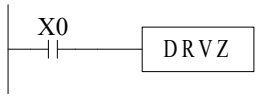
CW K1000 K500 K200 K0 K5000



This instruction specifies the travel to the target position (1000,500) from the start position (600,500) around the center incremental address (2000,0) at the peripheral speed 5KHz,the travel locus shown as blow.

DRVZ：Machine zero return		**Applicable models:** XCM-32
16-bit function：--	32-bit function：--	

Function & Action



- When the instruction is executed, a machine zero return is performed.
- When a machine zero return operation is completed, the special auxiliary relays M8269 and M8270 are return to on.
- In simultaneous 2-axis operation ,this instruction returns both the X and the Y axis to the zero point simultaneously. To return only one axis to the zero point, refer to the following program example.

Program example

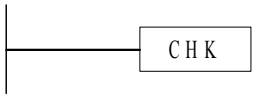
（Only X axes is returned to the point first, then the Y axes is return to the zero point）

```
SET    M8262  ;        Prohibits zero return operation of 1axes.
DRVZ;                  Returns X axes only to zero point.
RST    M8262;          Allows zero return operation of 1 axes.
SET    M8261;          Prohibit zero return operation of 0 axes.
DRVZ;                  Returns 1 axes only to zero point.
RST    M8261;          Allows zero return operation of 0 axes.
```

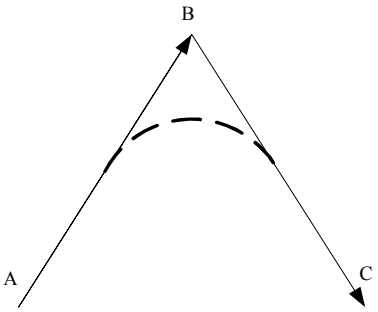
Notice: When both M8261 and M8262 are turned on or off, no operation is performed even if DRVZ is executed.

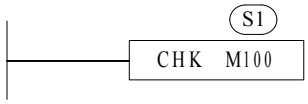
CHK：Servo end check		**Applicable models** XCM-32
16-bit instructions：--	32-bit instructions：--	

Function & Action



- When interposal the CHK in the two operation control instructions, the travel will stop at the specification point, when interpolation operation continues, the machine performs non-stop operation and inflection points make a smooth curve.
- When you would like to move the machine from the target position A to the B position and then to the C position, interposal the CHK instruction between the two LIN instructions, the travel curve shown by the figure in the below, otherwise it shown by broken line.



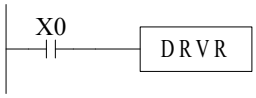


(S1·) ：CHK instruction operation winding, operands: X、Y、M、S、T、C.

- After the CHK takes with winding (such as specification winding M100), after execute CHK instruction, until specification winging is on, execute next control operation.
- If the specification winding is on, its function equal to the CHK instruction with out winding.

DRVR：Electrical zero return		**Applicable models**
16-bit instruction：--	32-bits instruction：--	XCM-32

Function & Action



- When this instruction is executed, the machine returns to the electrical zero point (set to the electrical zero point register) at high speed, and the servo end check is performed.
- The acceleration/deceleration time is determined by parameter FD8910 and parameter FD8912, and the operation speed is determined by parameter FD8912.

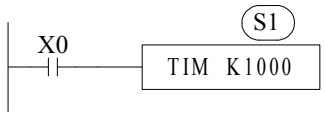
SETR：Electrical zero settings		**Applicable models**
16-bit instruction：--	32-bit instruction：--	XCM-32

Function & Action

- When this instruction is executed, the current place (saved in current register) will be writed into electrical zero register.

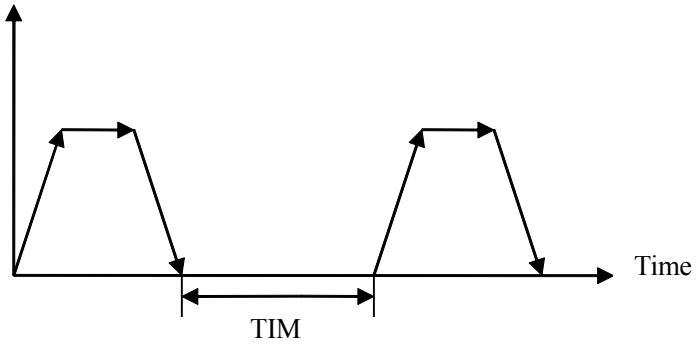
TIM：Delayed time (Dwell)		**Applicable models**
16-bit instruction：--	32-bit instruction: remarks	XCM-32

Function & Action



(S1) stabilization time(Dwell),operands：K、TD、CD、D、FD.

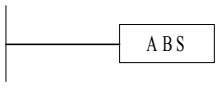
- Use this instruction to set the waiting time between completion of one instruction and execution of another.



- Unit is 1ms,such as K1000 stands for 1ms dwell.
- The value of dwell time set by data register indirectly. Default is double bits operation.

ABS：Absolute address		**Applicable models**
16-bit instruction：--	32-bit instruction：--	XCM-32

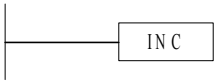
Function & Action



- The address coordinates(X,Y) used after the ABS instruction are regard as absolute values from the zero point(0,0).
- However, the coordinates of the arccenter point (I, j), the radius (r),the travel are always regarded as incremental values.
- An address is regard as an absolute value when specification is omitted.

INC：Incremental address		**Applicable models**
16-bit instruction：--	32-bit instruction：--	XCM-32

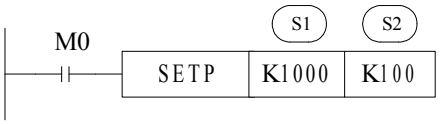
Function & Action



- The address coordinates (X, Y) used after the INC instruction are regarded as incremental values from the present position.

SETP：Set coordinate system	
16-bit instruction：--	32-bit instruction：The following

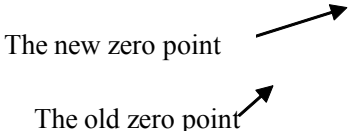
Function & Action



(S1·) Set new coordinate of X axes.
(S2·) Set new coordinate of Y axes.

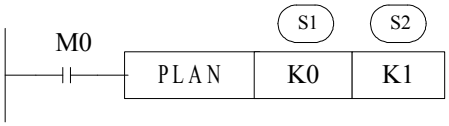
When this instruction is executed, the value in current register change into the appointed value.After that, both machine zero and eletrical zero have changed.

The current place is (200, 200)(absolute coordinate), after executing "SETP k100 k100" instruction, the new and old zero point changed as shown below:



PLAN：Plane or space selection	
16-bit instruction：--	32-bit instruction：The following

Function & Action



(S1·) Set the tab axes (K0 denote X0, K1 denote X1, Kn denote Xn) as X axes, the following motion control instructions will take this axes as operation axes.

(S2·) Set the tab axes (K0 denote Y0, K1 denote Y1, Kn denote Yn) as Y axes, the following motion control instructions will take this axes as operation axes.

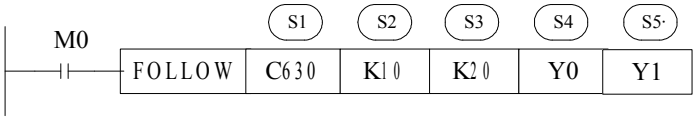
Program example

LD M0	
PLAN K1 K2	Respectively set Y1,Y2 as 1 axes and 2 axes
SETP K10000 K20000	Change the current register value of 1 axes and 2 axes into 10000 and 20000

（**Note:** without using PLAN instruction to appoint axes, the system default Y0,Y1 as operate axes.）

FOLLOW：Following movement instruction		**Applicable models** XCM-32
16-bit instruction：--	32-bit instruction：As follows	

Function & Action



(S1) : Stands for using high-speed counter, AB phase, single phase or direction +pulse
(S2) : Operand K10 is multiplicative coefficient ,operands : K、TD、CD、D、FD.
(S3) : Operand K20 is divided coefficient ,operands: K、TD、CD、D、FD
(S4) : Operand Y0 is output pulse terminal port NO.
(S5) : Operand Y1 is output pulse direction terminal port NO.

- This instruction is a high –speed counter input, output it after multiply it. The output frequency changes as input frequency changing, the tall number is calculate by multiplied and divided parameters.
- The instruction is used for multiply or divide the high-speed pulse then output it from port Y0 or Y1.

3-5. Motion control parameter

The motion control parameter settings are realized via modifying speical FLASH register. Each parameter correspond with XCM register address as follows:

PARA NO.	Special register	Name	Description	Default value
1	FD8892 FD8893	Pulse rate (0 axes)	Pulse number per revolution	0
2	FD8894 FD8895	Pulse rate (1 axes)	Pulse number per revolution	0
3	FD8896 FD8897	Pulse rate (2 axes)	Pulse number per revolution	0
4	FD8898 FD8899	Pulse rate (3 axes)	Pulse number per revolution	0
5	FD8900 FD8901	Motor resolution(0 axes)	Move distance per revolution	0
6	FD8902 FD8903	Motor resolution(1 axes)	Move distance per revolution	0
7	FD8904, FD8905	Motor resolution(2 axes)	Move distance per revolution	0
8	FD8906 FD8907	Motor resolution(3 axes)	Move distance per revolution	0
9	FD8908 FD8909	Assigned frequency	Unit: Hz	0
10	FD8910 FD8911	Accelerate time	Unit: ms	0
11	FD8912 FD8913	Decelerate time	Unit: ms	0
12	FD8914 FD8915	Electrical zero(0 axes)		0
13	FD8916 FD8917	Electrical zero(1 axes)		0
14	FD8918 FD8919	Electrical zero(2 axes)		0
15	FD8920 FD8921	Electrical zero(3 axes)		0
16	FD8922 FD8923	Machine zero(0 axes)		0
17	FD8924 FD8925	Machine zero point (1 axes)		0

18	FD8926 FD8927	Machine zero point(2 axes)		0
19	FD8928 FD8929	Machine zero point(3 axes)		0
20	FD8930 FD8931	Machine zero point frequency		0
21	FD8932 FD8933	Machine zero point return creep speed Interruption trigger	External input X2 （X axes） External input X10 （Y axes）	0
22	FD8934	0 axes creep speed The pulse number(Z phase) at zero point(which need to be count)	External input X5 （X axes） External input X11 （Y axes）	0
23	FD8935	1 axes creep speed The pulse number(Z phase) at zero point(which need to be count)		0
24	FD8936	2 axes creep speed The pulse number(Z phase) at zero point(which need to be count)		0
25	FD8937	3 axes creep speed The pulse number(Z phase) at zero point(which need to be count)		0
26	FD8938	Machine zero point return settings	See table (3-5-1)	0
27	FD8940	Zoom in ratio coefficient	(power of 2)	0

The following is the detailed explanation of motion control parameters:

PARA.1: Pulse rate

Set the number of pulses per revolution of the motor to be given to the drive unit.

Setting range: 1 to 65535 PLS (pulse)/REV(revolution)

When the servomotor is equipped with an electronic gear, its magnification should be taken into account. The relationship between the pulse rate and the electronic gear is as follows:

Pulse rate (PARA.1)=Resolution of encoder (positioning feedback pulse)/electronic gear

PARA.2, PARA.3, PARA.4 respectively set the number of pulses per rotation the motor to the drive unit of 1axes, 2axes, 3axes. The basic settings is the same as PARA.1.

PARA.5: Feed rate

Set the travel of the machine per rotation of the motor

Setting range :1~999999（um/REV，mdeg/REV，minch/REV）

PARA.6, PAARA.7, PARA.8 respectively set the travel of the machine rotation of the

specification 1 axes, 2 axes, 3 axes of the motor. The basic settings is the same as PARA.1.

PARA.9: Maximum speed

Set the maximum speed in this parameter. When the speed is not specified in a positioning program, the machine operates at the speed set here. Other speeds must be set to a value equivalent to or less than this maximum value.

Setting range: 0~20000 Hz

PARA.10: Acceleration time

Set the time required to achieve the maximum speed

Setting range: 0~5000ms

When PARA.10 is set to 0,the machine actually accelerates in 1 ms.

PARA.11: Deceleration time

Set the time required to stop the machine.

Setting range:0~5000ms

When PARA.11 is set to 0, the machine actually accelerates in 1 ms.

PARA.12: 0 axes electronic zero point address

The units of the set value are determined by DRVR instruction.

Setting range：-999999 to +999999

The value set here is treated as an absolute address.

PARA.13, PARA.14, PARA.15 set the machine zero point absolute addresses on 1axes,2 axes, 3 axes.

PARA.16: Machine zero point address

When the zero return operation is complete, set the present address at which the machine is placed.

Setting range:-999999 to +999999

PARA.17, PARA.18, PARA.19 set the machine zero point address on 1 axes, 2 axes, 3 axes.

PARA20: Machine zero return speed

Set the speed adopted when the machine is returning to the zero point, the set value must be equivalent to or less than the maximum speed set to PARA.9

Setting range:10 to 50000 Hz.

PARA.21: Machine zero return creep speed

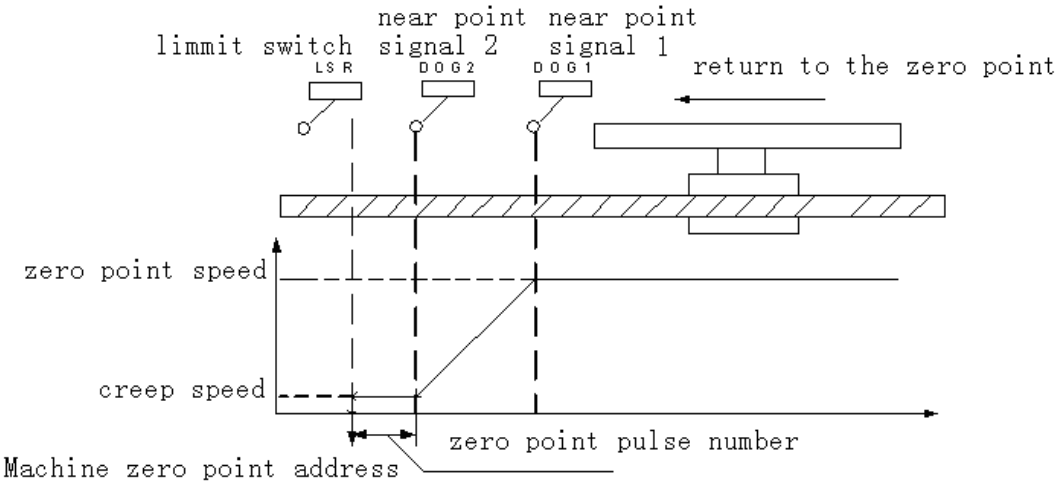
Set the low speed adopted after the near-point DOG1 signal is turn on.

Setting range: 10 to 50000 Hz

PARA.22: Zero point signal count(Z phase)

Set the number of zero point to be counted after the DOG2 signal (X11 switch input) is turned on, until the machine is stopped,

Setting range: 0 to 2147483647



PARA.23, PARA.24, PARA.25set the Zero point signal count(Z phase) on 1 axes, 2 axes, 3 axes. The basic settings is the same as PARA.22.

PARA.26: Machine zero return settings(FD8938)

(0~3 bit) Machine zero return direction

(4~7 bit) Whether or not to use proximity switch

If not use proximity switch, then machine zero return is the same as electronic zero return, directly decelerate stop.

(8~11 bit) Proximity switch state

0: normally open 1: normally closed

(12~15 bit) Proximity switch logic

0: rising edge effect 1: falling edge effect

0 bit	1 bit	2 bit	3 bit
0 axes machine zero return direction (0:positive 1:negative)	1 axes machine zero return direction (0:positive 1:negative)	2 axes machine zero return direction (0:positive 1:negative)	3 axes machine zero return direction (0:positive 1:negative)

4 bit	5 bit	6 bit	7 bit
0 axes whether or not to use proximity switch (0: use 1: not use)	1 axes whether or not to use proximity switch (0: use 1: not use)	2 axes whether or not to use proximity switch (0: use 1: not use)	3 axes whether or not to use proximity switch (0: use 1: not use)

8 bit	9 bit	10 bit	11 bit

0 axes proximity switch state (0: normally open 1: normally closed)	1 axes proximity switch state (0: normally open 1: normally closed)	2 axes proximity switch state (0: normally open 1: normally closed)	3 axes proximity switch state (0: normally open 1: normally closed)

12 bit	13 bit	14 bit	15 bit
0 axes proximity switch logic(0: rising 1: falling)	1 axes proximity switch logic(0: rising 1: falling)	2 axes proximity switch logic(0: rising 1: falling)	3 axes proximity switch logic(0: rising 1: falling)

PARA.27: Multiplying factor

The integral form data storage at the operation, so that the decimal part can be easily ignorant. Before the operation, we should multiply 2 to improve the operation precision, at the end of the operation, Division rate for multiplied result.

The more precision of the result, the bigger of the multiplying factor, but too big may cause register over output. Generally we set n equaled to 6.

3-6. Special data register list

No.	Special data register	Function	Explanation	Default value
1	D8482 D8483	Current place (0 axes)	Save the current 0 axes coordinate in the register	0
2	D8484 D8485	Current place (1 axes)	Save the current 1 axes coordinate in the register	0
3	D8486 D8487	Current place (2 axes)	Save the current 2 axes coordinate in the register	0
4	D8488 D8489	Current place (3 axes)	Save the current 3 axes coordinate in the register	0
`5	D8490 D8491	Current segment	Show the running motion control instruction NO., the NO. is distribute automaticaly.(Note: "current segment " only aim at motion control instruction, the ordinary instruction are not included.)	0

3-7. Special auxiliary relay list

NO.	Special data register	Function	Explanation	Default value
1	M8260	Flow control bit	See to note[1]	0
2	M8261	Forbid 0 axes return to machine zero bit	When this bit is set, the axes return to zero operation will not work.	0
3	M8262	Forbid 1 axes return to machine zero bit	When this bit is set, the axes return to zero operation will not work.	0
4	M8263	Forbid 2 axes return to machine zero bit	When this bit is set, the axes return to zero operation will not work.	0
5	M8264	Forbid 3 axes return to machine zero bit	When this bit is set, the axes return to zero operation will not work.	0
6	M8265	0 axes return to machine zero point finished bit	When administer DRVZ instruction (return to machine zero),M8265 will turn from ON to OFF. When machine reached, M8265 turn ON again. Please see to note[2].	0
7	M8266	1 axes return to machine zero point finished bit	When administer DRVZ instruction (return to machine zero), M8266 will turn from ON to OFF. When machine reached, M8266 turn ON again.	0
8	M8267	2 axes return to machine zero point finished bit	When administer DRVZ instruction (return to machine zero), M8267 will turn from ON to OFF. When machine reached, M8267 turn ON again.	0
9	M8268	3 axes return to machine zero point finished bit	When administer DRVZ instruction (return to machine zero), M8268 will turn from ON to OFF. When machine reached, M8268 turn ON again.	0

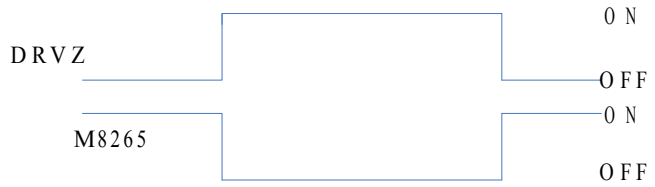
Note[1]：

When scan ladder chart in PLC, implement one after another. But motion control is based on process control, only when one instruction is completed, then implement the next one.

So, when instruction as follows, use a special M register (M8260) to show the state of the last position instruction. When implementing, set M8260 ON; when completed, set it OFF. So, the next instruction start to implement when receive the M8260 falling edge signal. When implementing, set M8260 ON; when completed, set OFF. Repeatedly, the program implement in order.

Note[2]：

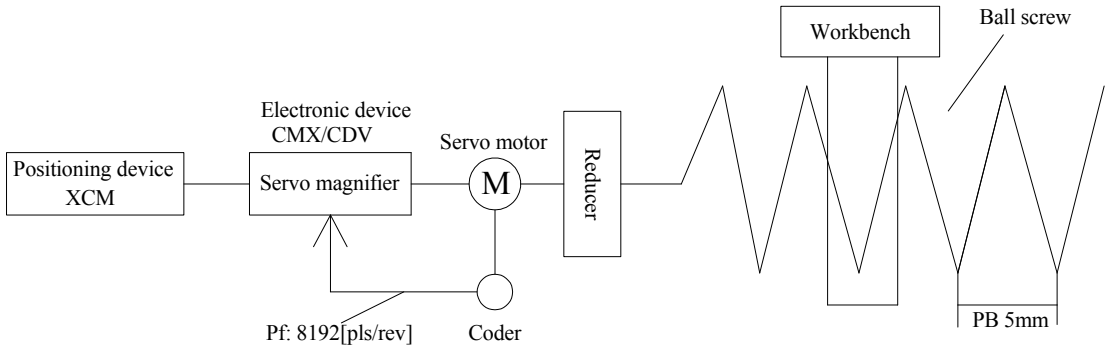
When administer DRVZ instruction, M8265 turn from ON to OFF. When machine reach to machine zero point, M8265 turn to ON again.



3-8. Application case

1. Model system

XCM type PLC through the servo motor control, to control the workbench place.



2. Parameter settings

(1) Servo driver parameter settings:

The rated speed of a certain servo motor is 3000[r/min], the feedback pulse of coder is 8192 [pls/rev]. As the speciality of servo motor, in a specific rotate speed, order the pulse frequency f_0 is the same as the feedback pulse frequency P_B, then you will educe the following equation：

$f_{0:}$ The order pulse frequency(HZ) (Issued by the XCM)

$P_{f:}$ Feedback pulse (orientation feedback pulse) amount [pls/rev]

$P_{B:}$ The flight lead of ball screw

N_0: The rotate speed of servo motor[r/min]

CMX: The magnification numerator of servo driver order pulse (electronic gear)

CDV: The magnification denominator of servo driver order pulse (electronic gear)

When the servo motor reach the rated rotate speed, XCM need to output the biggest order pulse frequency, here we select 200 KHz. Changes from the previous expressions:

$$\frac{CMX}{CDV} = P_f \times \frac{N0}{60} \times \frac{1}{f_0} = \frac{256}{125}$$

So, set "CMX=256，CDV=125" in servo magnifier.

(2) Pulse rate and feed rate

Educe pulse rate and feed rate according to the following steps.

1. Pulse rate refer to the pulse number of servo motor rotate a circle, it can calculate pulse rate on the follow formula:

$$A = P_f \times \frac{1}{\frac{CMX}{CDV}}$$

Take the previous value (CMX:256 CDV:125) to the last formula, then you will get the pulse rate.

Pulse rate: $A = 8192[pls/rev] \times \frac{1}{\frac{256}{125}} = 4000[pls/rev]$

2. Feed rate refer to the movement of servo motor axes run a cirle.

When ball screw run a flight lead P_B, motor rotate N2 circle, and the transmission ratio of motor and actuator—screw is N1,

Feed rate $B = N1 \times P_B \times \frac{1}{N2}$

N1: machine transmission ratio

N2: rotate turn number

P_B: the rotate speed of servo motor

For practical calculation as follows:

Feed rate $B = \frac{1}{1} \times 5[mm] \times \frac{1}{1[rev]} = 5[mm/rev]$

(3) Convert motion quantity to pulse quantity

$$\text{Pulse quantity} = \frac{\text{Machine quantity}}{\text{Motor corresponding motion quantity per roll (feed rate)}} \times \text{The need pulse quantity of motor rotate a roll (pulse rate)}$$

We need workpiece move 200mm, then convert it to pulse quantity:

Pulse quantity $ls) = \frac{200[mm]}{5[mm/rev]} \times 4000[pls/rev] = 160000[pls]$

So workpiece move 200mm, XCM need to send 160000 pulses.

If we need workpiece move at "30cm/min", then convert it to pulse frequency:

Pulse quantity $[z] = \frac{30[cm/min] \times 10 \times 1/60}{5[mm/rev]} \times 4000[pls/rev] = \frac{300 \times 1/60}{5} \times 4000 = 4000Hz$

So workpiece move at "30cm/min", we need XCM send pulse at the frequency of 400Hz.

3. Programme explaination

▲ axis position control operation

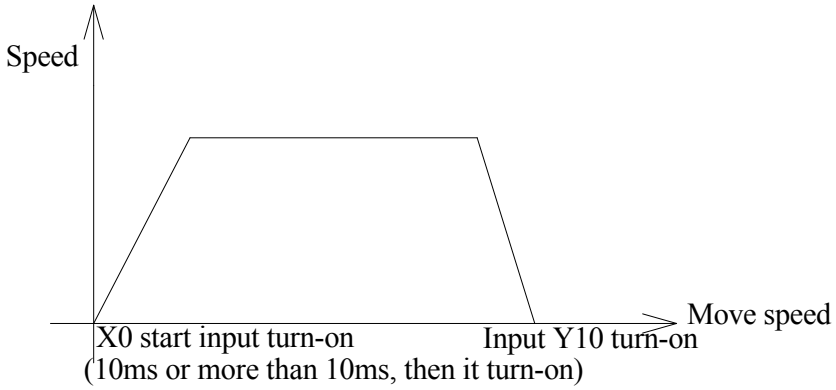
Position summarize: position device noly move at the current movement.

● Operate steps

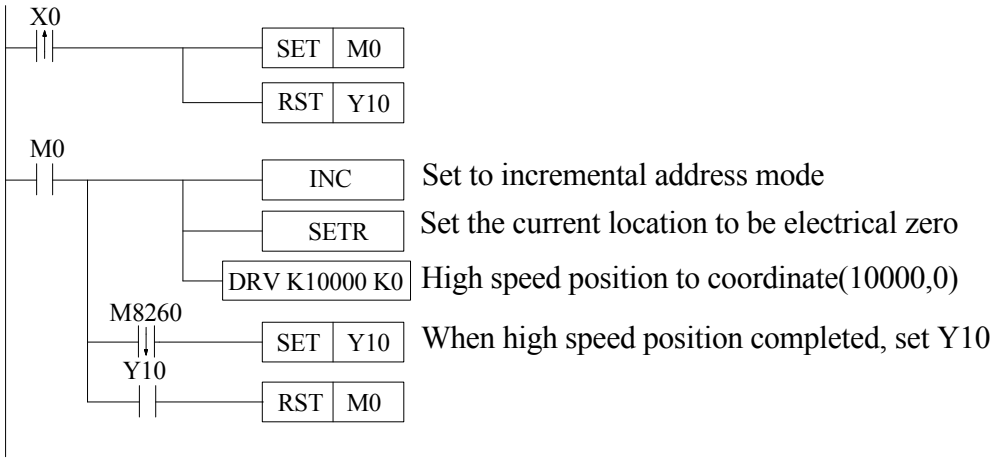
ⅰ： When position device receive startuo order from exterior, it will move in current quantity.

ⅱ： When motion completed, turn-on output Y10.

● Run figure



● Procedure



▲ orientation with reciprocating movement constant

● Position summarize

XCM control workpiece move from left to right, and control workpiece up-down move with eletromagnet.

- Operate steps

① Only the first time workpiece go back to zero relay to start order.

② Electromagnet for down move workpiece Y0. When lower-switch X0 turn-on, clamping electromagnet Y1 turn-on, clamp workpiece.

③ After 1.5s, down move electromagnet Y0 disconnect,workpiece move up.

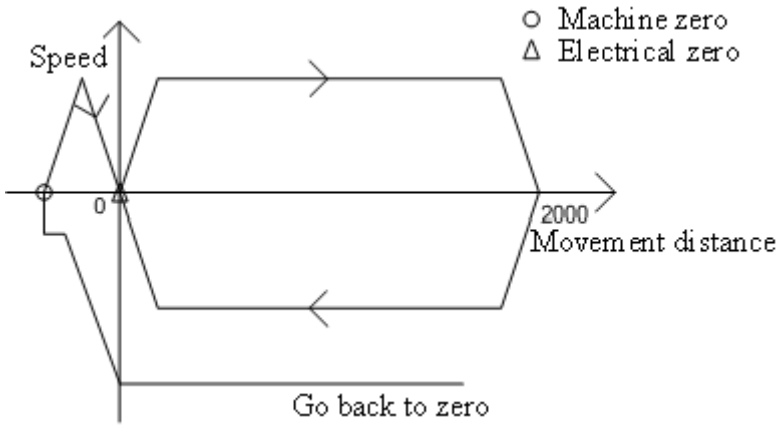
④ When cap-switch X1 turn-on, workpiece move right.

⑤ When position device achieve right workbench(X2000,Y0), down move electromagnet turn on, workpiece start to move down. When lower-switch X0 turn-on, clamping electromagnet Y1 diaconnect,collect release, put down the workpiece.

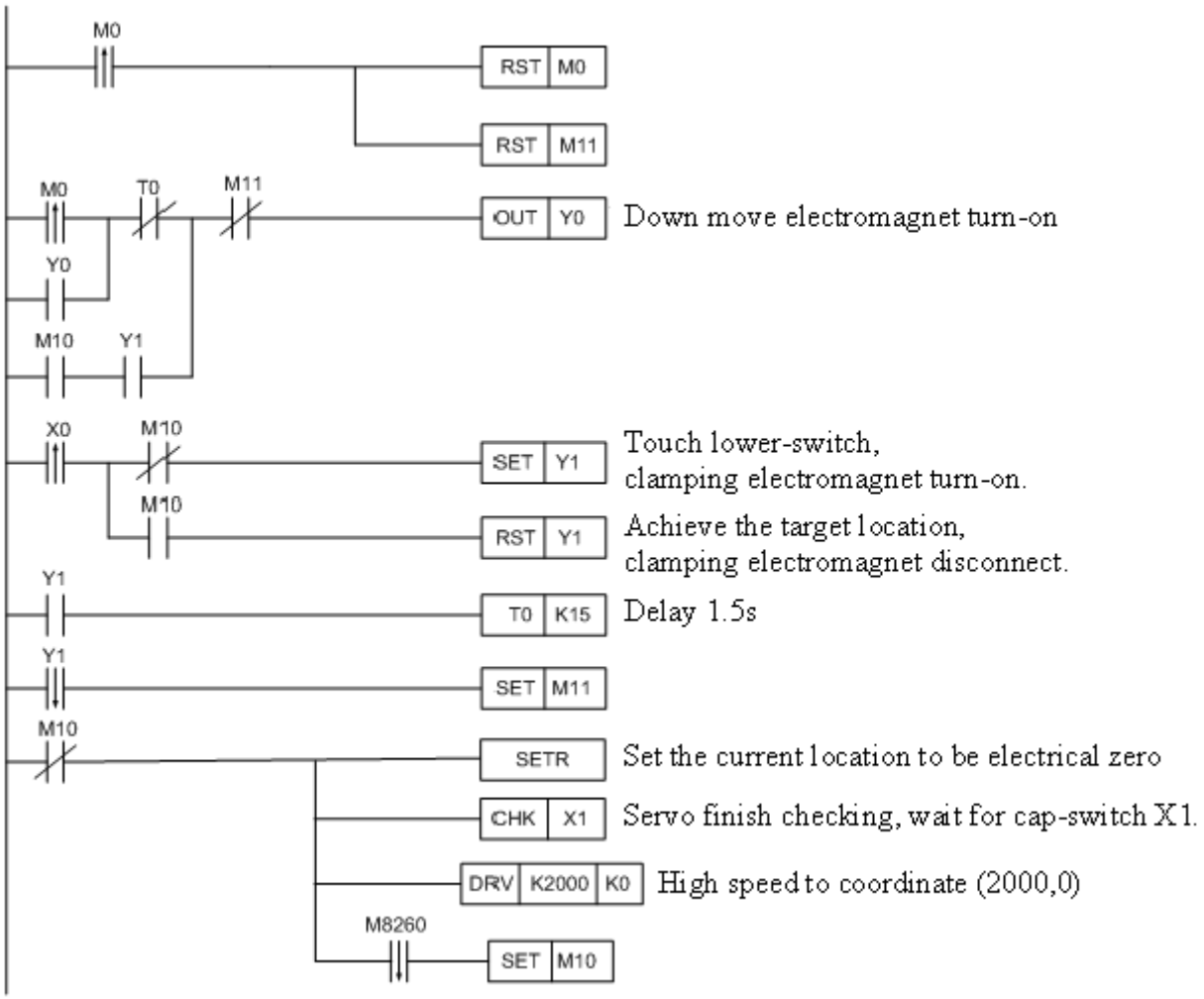
⑥ After 1.5s, down move electromagnet Y0 disconnect,workpiece move up.

⑦ When cap-switch X1 turn-on, workpiece go back to left workbench.

- Run figure



- Procedure


M0
RST M0
RST M11
M0 T0 M11
OUT Y0
Down move electromagnet turn-on
Y0
M10 Y1
X0 M10
SET Y1
Touch lower-switch,
clamping electromagnet turn-on.
M10
RST Y1
Achieve the target location,
clamping electromagnet disconnect.
Y1
T0 K15
Delay 1.5s
Y1
SET M11
M10
SETR
Set the current location to be electrical zero
CHK X1
Servo finish checking, wait for cap-switch X1.
DRV K2000 K0
High speed to coordinate (2000,0)
M8260
SET M10

4. Appendix

The chapter is appendix part, briefed the PLC's basic command-control and application instructions, and a summary of previous chapters movement command and control parameters, user-friendly access instructions.

4-1. Basic order control instruction list

Sign	Function	Usable soft element
LD	Initial logical operation contact type NO (normally open)	X、Y、M、S、T、C、Dn.m、FDn.m
LDD	Directly read state from contact	X
LDI	Initial logical operation contact type NC (normally closed)	X、Y、M、S、T、C、Dn.m、FDn.m
LDDI	Directly read NC(normally closed) contact	X
LDP	Initial logical operation-Rising edge pulse	X、Y、M、S、T、C、Dn.m、FDn.m
LDF	Initial logical operation-Falling /trailing edge pulse	X、Y、M、S、T、C、Dn.m、FDn.m
AND	Serial connection of NO (normally open) contacts	X、Y、M、S、T、C、Dn.m、FDn.m
ANDD	Directly read state from contact	X
ANI	Serial connection of NC (normally closed) contacts	X、Y、M、S、T、C、Dn.m、FDn.m
ANDDI	Directly read NC(normally closed) contact	X
ANDP	Serial connection of rising edge pulse	X、Y、M、S、T、C、Dn.m、FDn.m
ANDF	Serial connection of falling/trailing edge pulse	X、Y、M、S、T、C、Dn.m、FDn.m
OR	Parallel connection of NC (normally closed) contacts	X、Y、M、S、T、C、Dn.m、FDn.m
ORD	Directly read state from contact	X
ORI	Parallel connection of NC (normally closed) contacts	X、Y、M、S、T、C、Dn.m、FDn.m
ORDI	Directly read NC(normally closed) contact	X
ORP	Parallel connection of rising edge pulse	X、Y、M、S、T、C、Dn.m、FDn.m
ORF	Parallel connection of falling/trailing edge pulse	X、Y、M、S、T、C、Dn.m、FDn.m
ANB	Serial connection of multiply parallel circuits	None
ORB	Parallel connection of multiply parallel circuits	None
OUT	Final logic operation type coil drive	Y、M、S、T、C、Dn.m
OUTD	Directly output to loop	Y
SET	Set a bit device permanently ON	Y、M、S、T、C、Dn.m
RST	Reset a bit device permanently OFF	Y、M、S、T、C、Dn.m
PLS	Rising edge pulse	X、Y、M、S、T、C、Dn.m
PLF	Falling/trailing edge pulse	X、Y、M、S、T、C、Dn.m
MCS	Connect the public serial contacts	None
MCR	Clear the public serial contacts	None

ALT	The status of the assigned device is inverted on every operation of the instruction	X、Y、M、S、T、C、Dn.m
NOP	No operation or null step	None
END	Force the current program scan to end	None
GROUP	Start the fold of instruction group	None
GROUPE	End the fold of instruction group	None

（Note: particular description vide《XC series PLC user manual》）

4-2. Application instruction list

Application instruction kinds and corresponding kinds of each series shown as below:

Sort	Mnemonic	Function
Program Flow	CJ	Condition jump
	CALL	Call subroutine
	SRET	Subroutine return
	STL	Flow start
	STLE	Flow end
	SET	Open the assigned flow, close the current flow
	ST	Open the assigned flow, not close the current flow
	FOR	Start of a FOR-NEXT loop
	NEXT	End of a FOR-NEXT loop
	FEND	First end
Data Compare	LD＝	LD activates if (S1) = (S2)
	LD＞	LD activates if (S1) > (S2)
	LD＜	LD activates if (S1) =< (S2)
	LD＜＞	LD activates if（S1）≠（S2）
	LD＜＝	LD activates if（S1）≤（S2）
	LD＞＝	LD activates if（S1）≥（S2）
	AND＝	AND activates if（S1）＝（S2）
	AND＞	AND activates if（S1）＞（S2）
	AND＜	AND activates if（S1）＜（S2）
	AND＜＞	AND activates if（S1）≠（S2）
	AND＜＝	AND activates if（S1）≤（S2）
	AND＞＝	AND activates if（S1）≥（S2）
	OR＝	OR activates if（S1）＝（S2）
	OR＞	OR activates if（S1）＞（S2）
	OR＜	OR activates if（S1）＜（S2）
	OR＜＞	OR activates if（S1）≠（S2）
	OR＜＝	OR activates if（S1）≤（S2）
	OR＞＝	OR activates if（S1）≥（S2）
Data Move	CMP	Data compare
	ZCP	Data zone compare
	MOV	Move
	BMOV	Block move
	FMOV	Fill move
	FWRT	FlashROM written
	MSET	Zone set
	ZRST	Zone reset
	SWAP	The high and low byte of the destinated devices are

		exchanged
	XCH	Exchange
Data Operation	ADD	Addition
	SUB	Subtraction
	MUL	Multiplication
	DIV	Division
	INC	Increment
	DEC	Decrement
	MEAN	Mean
	WAND	Word And
	WOR	Word OR
	WXOR	Word exclusive OR
	CML	Compliment
	NEG	Negative

Data Shift	SHL	Arithmetic Shift Left
	SHR	Arithmetic Shift Right
	LSL	Logic shift left
	LSR	Logic shift right
	ROL	Rotation shift left
	ROR	Rotation shift right
	SFTL	Bit shift left
	SFTR	Bit shift right
	WSFL	Word shift left
	WSFR	Word shift right
Data Convert Float Point Operation	WTD	Single word integer converts to double word integer
	FLT	32 bits integer converts to float point
	FLTD	64 bits integer converts to float point
	INT	Float point converts to binary
	BIN	BCD converts to binary
	BCD	Binary converts to BCD
	ASC	Hex. converts to ASCII
	HEX	ASCII converts to Hex
	DECO	Coding
	ENCO	High bit coding
	ENCOL	Low bit coding
	ECMP	Float compare
	EZCP	Float Zone compare
	EADD	Float Add
	ESUB	Float Subtract
	EMUL	Float Multiplication
	EDIV	Float division
	ESQR	Float Square Root

	SIN	Sine
	COS	Cosine
	TAN	Tangent
	ASIN	Anti-sine
	ACOS	Anti-cosine
	ATAN	Anti-tangent
Clock Operation	TRD	Read RTC data
	TWR	Set RTC data

（Note: particular description vide《XC series PLC user manual》）

4-3．Special function instruction list

Generic special instruction list

Instruction sign	Instruction name
PLSY	Single segment pulse output without accelerate/decelerate
PLSR	Single/multiple segment, with accelerate/decelerate, single/double way pulse output
PLSF	Variable frequency pulse output
PLSNEXT/PLSNT	Pulse segment switch
PLSMV	Save pulse number into register
STOP	Pulse stop
COLR	Modbus loop read
INPR	Modbus input loop read
COLW	Modbus single loop write
MCLW	Modbus multiple loops write
REGR	Modbus register read
INRR	Modbus input register write
REGW	Modbus single register write
MRGW	Modbus multiple registers wrirte
SEND	Free format data send
RCV	Free format data incept
CCOLR	CAN-bus loop read
CCOLW	CAN-bus loop write
CREGR	CAN-bus register read
CREGW	CAN-bus register write
PWM	Pulse width modulate
FRQM	Frequency measurement
STR	Precise timing
EI	Allow interruption
DI	Forbid interruption
IRET	Interruption return
PID	PID operation control
ZRN	Zero point return
DRVA	Absolute position
DRVI	Opposite position

（**Note:** detailed description vide《XC series PLC user manual 》）

4-4. High speed counter assignment

XCM high speed count input distribution as follows:

XCM-32RT

	Increase mode										Pulse+direction mode					AB phase mode		
	C600	C602	C604	C606	C608	C610	C612	C614	C616	C618	C620	C622	C624	C626	C628	C630	C632	C634
X000	U										U					B		
X001											Dir					A		
X002																		
X003		U																

XCM-48T

4-5. External input interruption assignment

XCM external interruption definition:

XCM-32RT：

Input terminal	Index NO.		Forbid interruption instruction
	Rising interruption	Falling interruption	
X2	I0000	I0001	M8050
X5	I0100	I0101	M8051
X10	I0200	I0201	M8052
X11	I0300	I0301	M8053

XCM-48T

Remark

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