PAC10DM Automation control

User's Manual

Version 1.02

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Table of Contents

1. Specifications

PAC10DM Press Controller		
	Power supply	DC24V±10%，1A
	EMC	Up to GB/T17626，GB/T18268 standard
	Shock and vibration	Up to JB/T8832-2001 standard
	Temperature	Up to GB/T2423.3-93 standard
	Working temperature	0~50℃
	Humidity	30~85%
	Display	Angle display：0~359°; Stroke speed：0~1000 SPM.
	PLS settings	0~359°

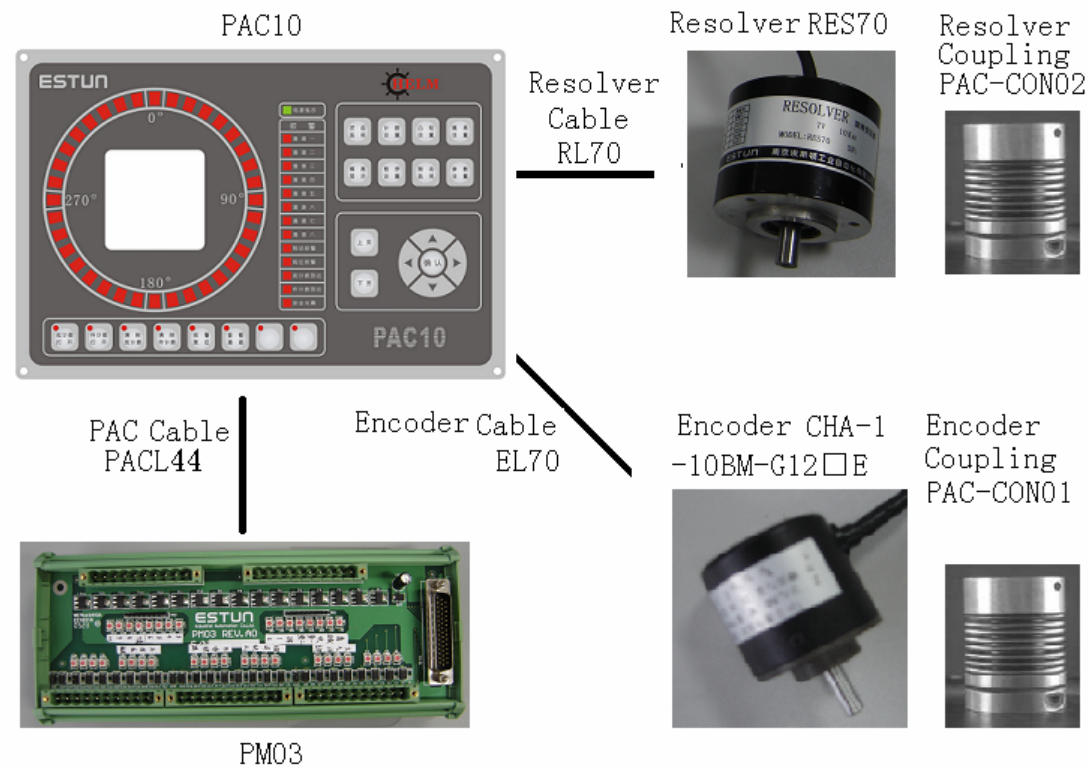
PM03 Module		
	Input channel	24 points photo couplers separate input; input voltage: DC24V±10%; maximum input electrical current: 20mA
	Output channel	16 points transistor output： supplied voltage: +24V; output voltage: +24V; maximum output electrical current: 0.5A

Resolver		
	Power supply voltage/frequency	7Vrms 10KHz
	Change rate	0.5±5%
	Angle deviation	±10’
	Drive coil input resistance	100+140j

Increment encoder

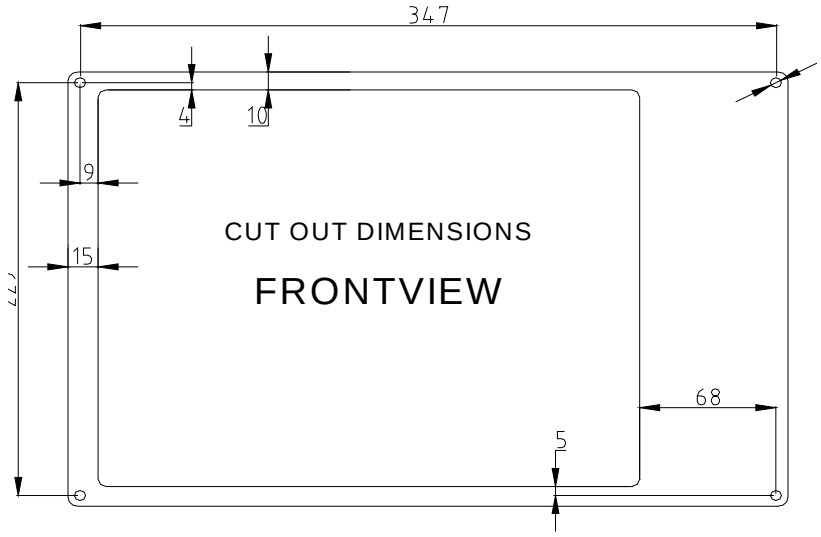
Specification	Power supply voltage	12V DC
	Consumed electric current	≤80mA
	Output type	Voltage output
	Response frequency	0~100KHz
	Pulse quantity per cycle	100~300 lines

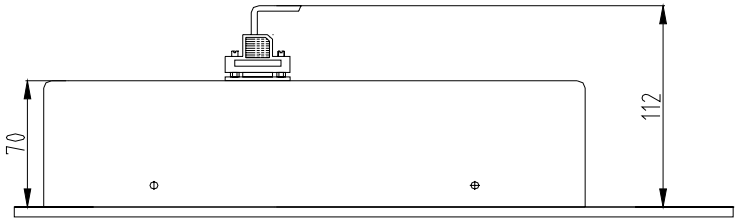
2. Installation

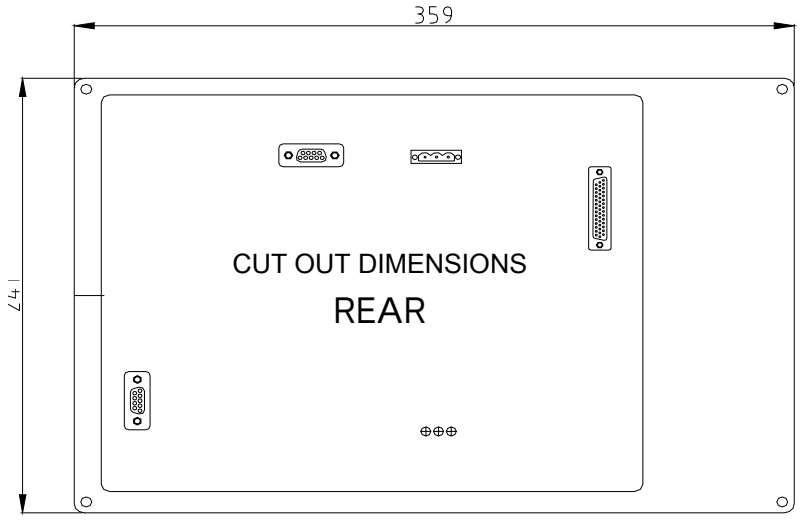


Name	Type	Description
Mainframe	●PAC10DM - V ●PAC10DM - H	“V” stands for vertical mounting; “H” stands for horizontal mounting.
Module	PM03	IO module
PAC cable	PACL44 -	Cable for connection of mainframe and modules 07 - 7 m， 10 - 10 m，15 - 15 m
Power supply interface	MSTB2,5/3-STF-5.08	24V system power supply interface
Resolver	●RES70 ●RES70B	Slide position/crankshaft angle feedback C - Common, F - Flange. Refer to the dimension chart.
Resolver cable	RL70	07 - 7m， 10 - 10m，15 - 15m
Resolver axis connector	PAC-CON02	CON02：both apertures are 10mm
Increment encoder	CHA-1-10BM-G12□E	Die height feedback
Encoder cable	EL70	□□：07 - 7m， 10 - 10m，15 - 15m
Encoder axis connector	PAC-CON01	CON01：aperture of End 1: 6mm aperture of End 2: 10mm

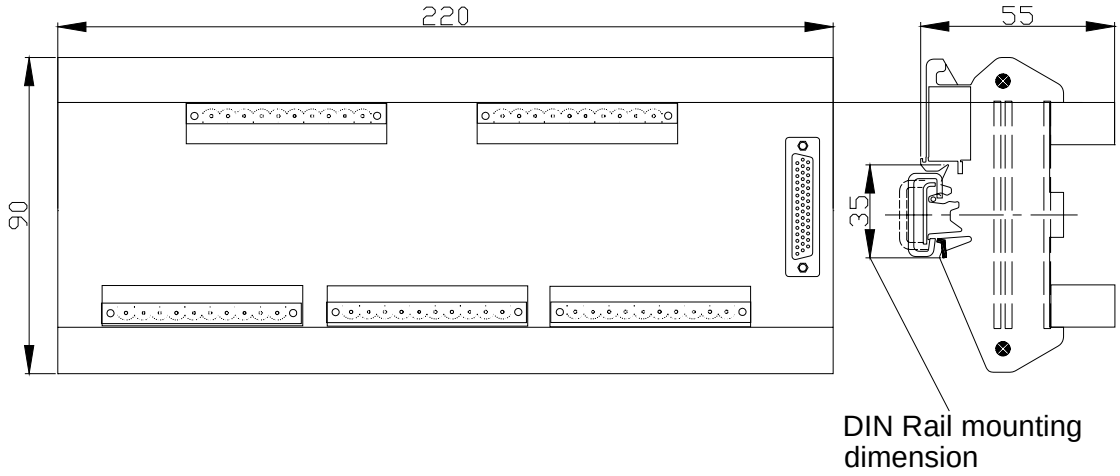
2.1 PAC10DM Dimensions





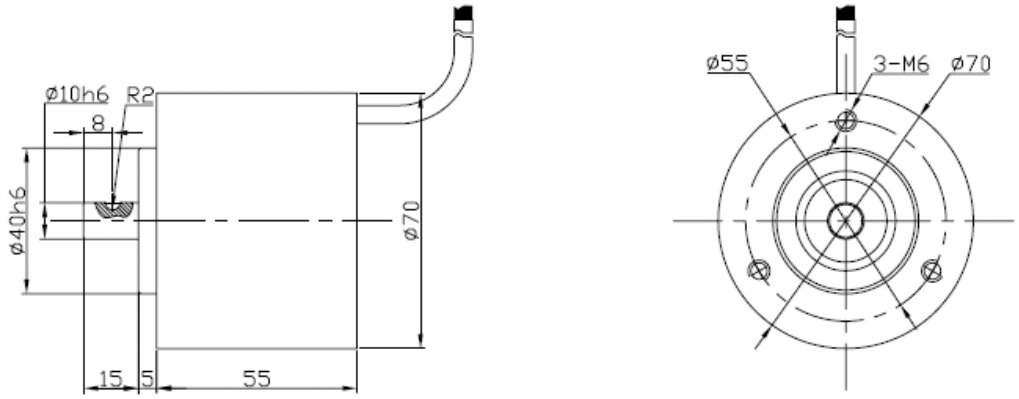


2.2 PM03 Module Installation Dimension (DIN rail mounting)

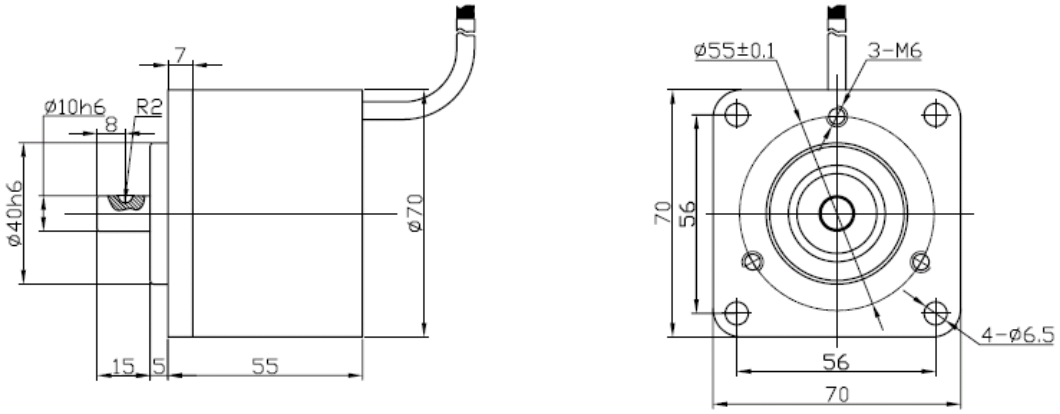


2.3 Resolver Installation Dimension

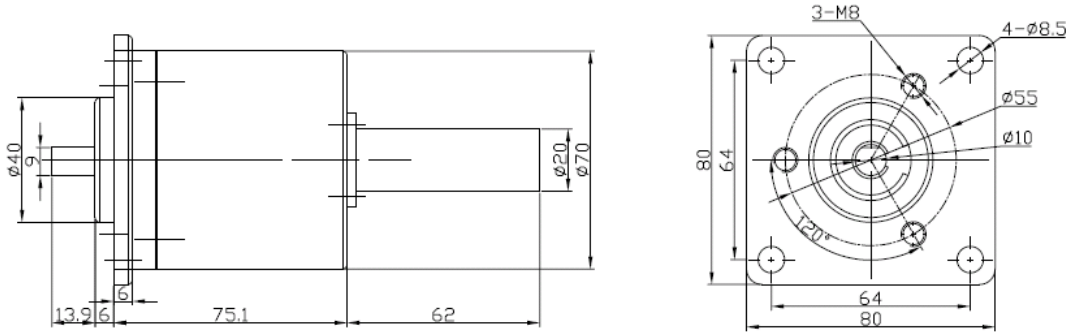
■Type： RES70 - C, RES70 - F and RES70B



RES70 - C



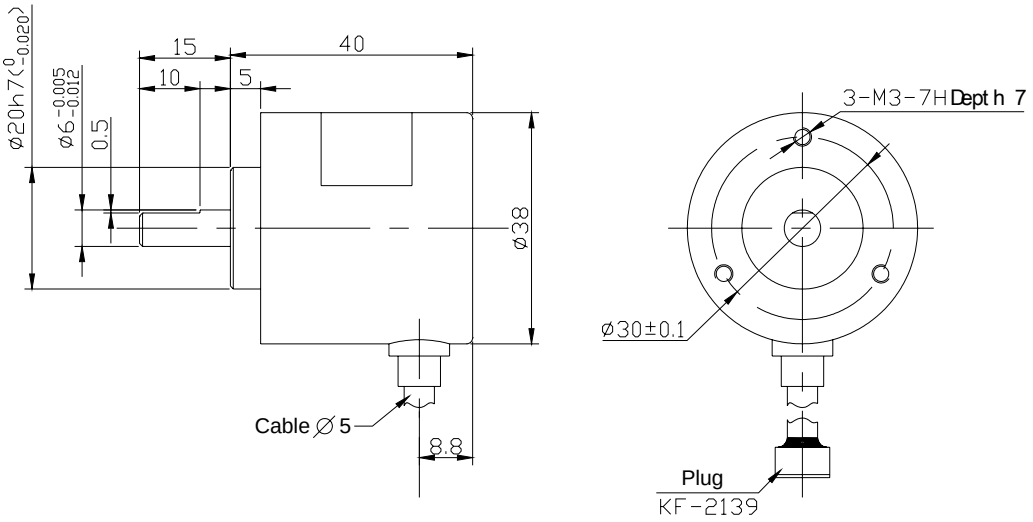
RES70 - F



RES70B

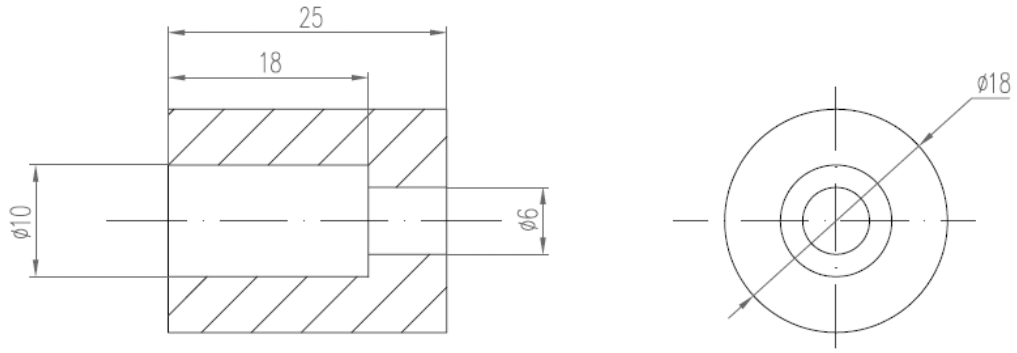
2.4 Increment Encoder Installation Dimension

■ Type：CHA-1-10BM-G12□E

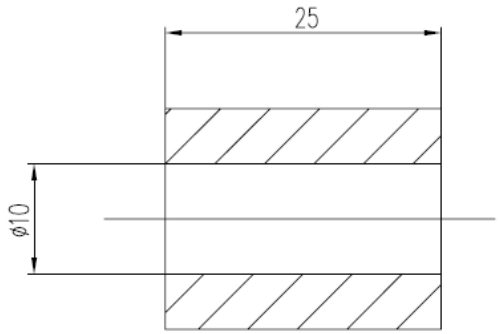


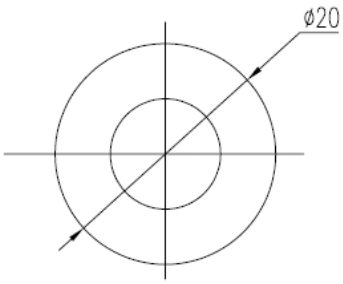
2.5 Coupler Installation Dimension

■Type：PAC-CON01

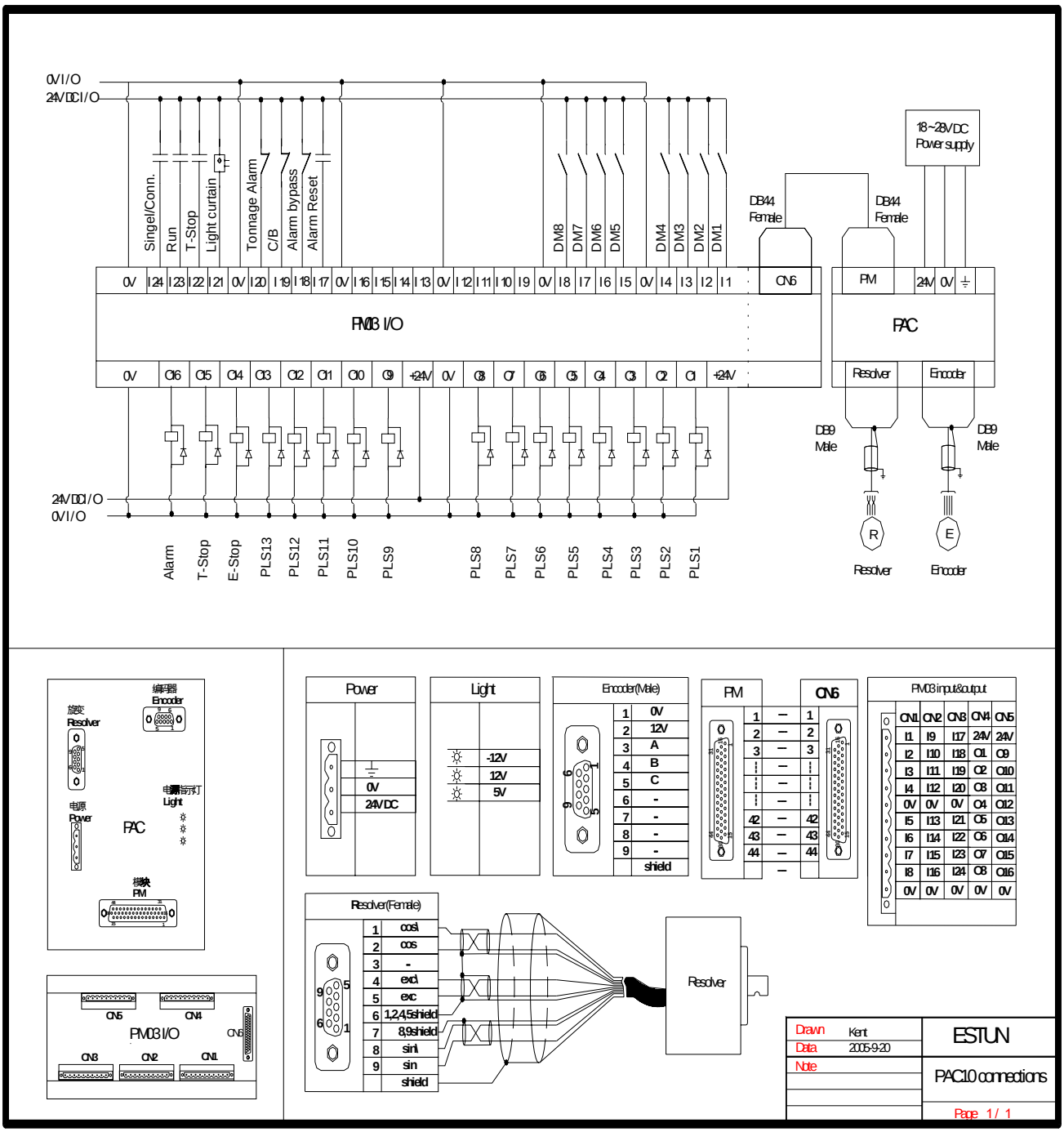


■Type：PAC-CON02





2.6 System Connections



2.7 Die Monitoring Channels DM1~DM8

Die/Automation Monitor software is used to monitor sensors that report correct part movement relative to the crankshaft angle of a stamping press, and to detect a variety of deviant conditions. Use die monitoring inputs to detect the absence, mis-alignment, or the unwanted presence of parts moving through an automated stamping process. When the software detects a fault, it responds according to what you selected as the fault response:

Following options are available when an error happens:

- Alarm
- Top stop
- Emergency stop
- Bypass

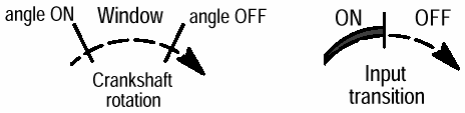
DM1~DM8 may be one of the following modes:

- Static (STC)
- Cyclic(CYC)
- Intermittent Cyclic (ICYC)
- In-position (POS)
- Intermittent In-position (IPOS)

Definition of Window

Input signals for these modes are synchronized with the rotation of the crankshaft and must be detected within a zone of crankshaft rotation. We call this zone of crankshaft rotation a window.
For example, a part-detect signal would be expected within a window of 80-110º to indicate that a part was inside a die before the press stroke.

When the input signals detected differ from those expected, the software generates a fault signal. We graphically define these (window) inputs as follows:



Static mode

This mode is used for monitoring the extraneous events which have nothing to do with the press strokes. When a static-mode input turns Off, the programmed output is turned On. For example, use it to detect end of stock.

Cyclic (CYC)

Use this mode to verify that a pulse from the sensor (OFF-ON-OFF) occurred within the window once each stroke. For example, use it to detect that a part moved past a monitor.

Intermittent Cyclic (ICYC)

Use this mode to verify that a pulse from the sensor (OFF-ON-OFF) occurred within the window once after a preset number of press cycles.

In-position (POS)

Use this mode to verify that the sensor signal remained OFF within the entire window once each stroke. Use it to detect if an ejector and other automation parts are retracted to home position.

Intermittent In-position (IPOS)

Use this mode to verify that the sensor signal remained OFF within the entire window once after a preset number of press cycles.

Notes:

The voltage of external signal may be defined as “Signal Type ” .

Signal which is defined as “Normal On” shows On is of high level.

Signal which is defined as “Normal Off” shows On is of low level.

The following diagram helps you to select DM channel mode according to applications：

When Input Signals Are:	Mode:	Used For Example To:
Synchronized with crankshaft rotation, and detected within a zone or rotation (window)	Cyclic or In-position	Detect parts in position, or parts ejected.
Synchronized with crankshaft rotation, and detected within a zone or rotation (window) after a specified number of machine cycles	Intermittent Cyclic or Intermittent In-position	
Independent of press stroke	Static	Detect the end of stock, oil level, external buttons such as emergency stop and unconventional photoelectric signal.

2.8.2 Clutch Signal

Use to detect the clutch status. When a high level of the clutch signal is detected, it means the clutch is in the Closed position.

- When clutch signal is of high level, the key is inactive.
- When clutch signal is of low level, the key is active.

2.8.3 Alarm Bypass

When alarm bypass input is of low level, the alarm signal is ignored. No matter whether there is an alarm signal of die protection or not, there is no output of emergency stop, top stop and alarm signal. When alarm bypass input is of low level, it shows the alarm bypass is in effect.

2.8.4 Top Stop

When top stop input is of low level, the system uses the internal top stop calculation function.
When the top stop input is of high level, top stop out will fire immediately and maintain until reset.

2.8.5 Running Signal

An external device gives the run command. A signal of high level shows the press is ready for running, and when the signal changes to low level, the press needs a stop.

2.8.6 Single/Continuous

There is some difference on the stop angle calculation between single and continuous running. When the calculation function for top stop is selected, the single mode and continuous mode are differentiated. A high level of signal means the press is in continuous mode, and a low level of signal means the press is in single mode.

2.8.7 Alarm Reset

Alarm reset input must be of high level. When opened, alarm will reset.
Note: Button contact must be normally closed.

2.8.8 PLS1~PLS13 Output

How a PLS output works

The Programmable Limit Switch software is designed to turn outputs ON and OFF at precise crankshaft positions synchronized with crankshaft rotation monitored with a resolver. You can preset up to 16 ON/OFF settings at angles from 0-359°. You can also turn the output OFF with a timer. Timer settings are 010 to 10.0 seconds.

PLS outputs can be one of the following modes:

- timer
- angle
- intermittent time
- intermittent angle

Timer

Output signal starts at ON Angle and will not close until the ON Time arrives.

Angle

Output signal starts to make the output at Angle On and will not close until the Angle OFF arrives.

Intermittent time

After passing the intermittent cycle (a preset number of press strokes), output signal starts to make the output at Angle On and will not close until the ON Time arrives.

Intermittent angle

After passing the intermittent cycles, that is, after a specified number of press strokes, output signal starts to make the output at Angle On and won't shut until the Angle off arrives.

When output signals are:	mode：	Use For Example to:
Synchronized with crankshaft rotation, make outputs once each stroke	Angle	Electronic PLS signal, shearing and cutting, blowing material
Synchronized with crankshaft rotation, make outputs after several strokes	Intermittent angle	Shearing and cutting
Make outputs at a certain angle and close after remaining on for preset time	Time	
Make outputs after several strokes and close after remaining on for preset time	Intermittent time	According to lubrication of stroke times

2.8.9 Top Stop Output

When DM input signal defines the top stop output:

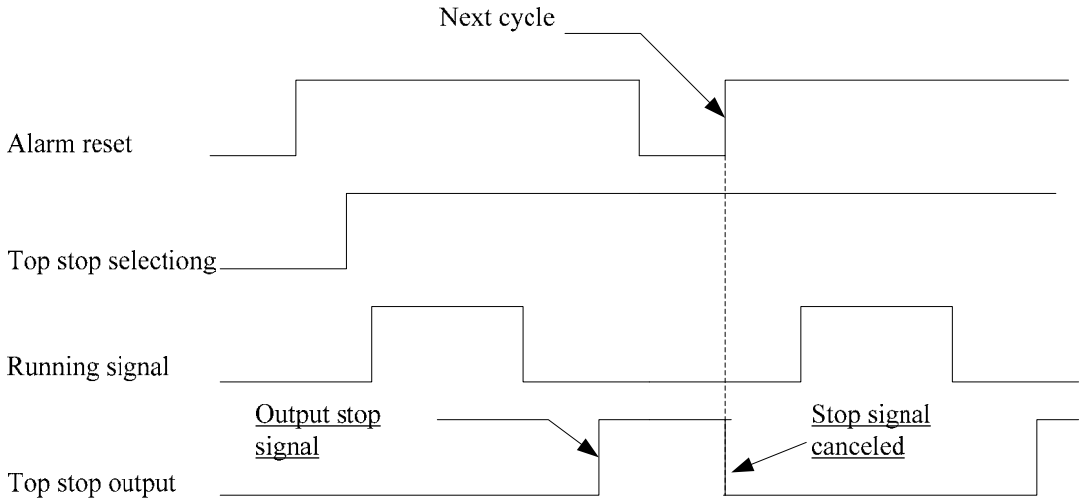
If the top stop calculation function is selected, the top stop signal will not make an output until the calculated angle arrives.

If the top stop calculation function is not selected, the output of the top stop signal is given immediately once the DM alarm occurs.

2.8.10 Connection Signal Time Sequence of PLC and PAC10DM

The following description is applicable when top stop calculation function is selected.

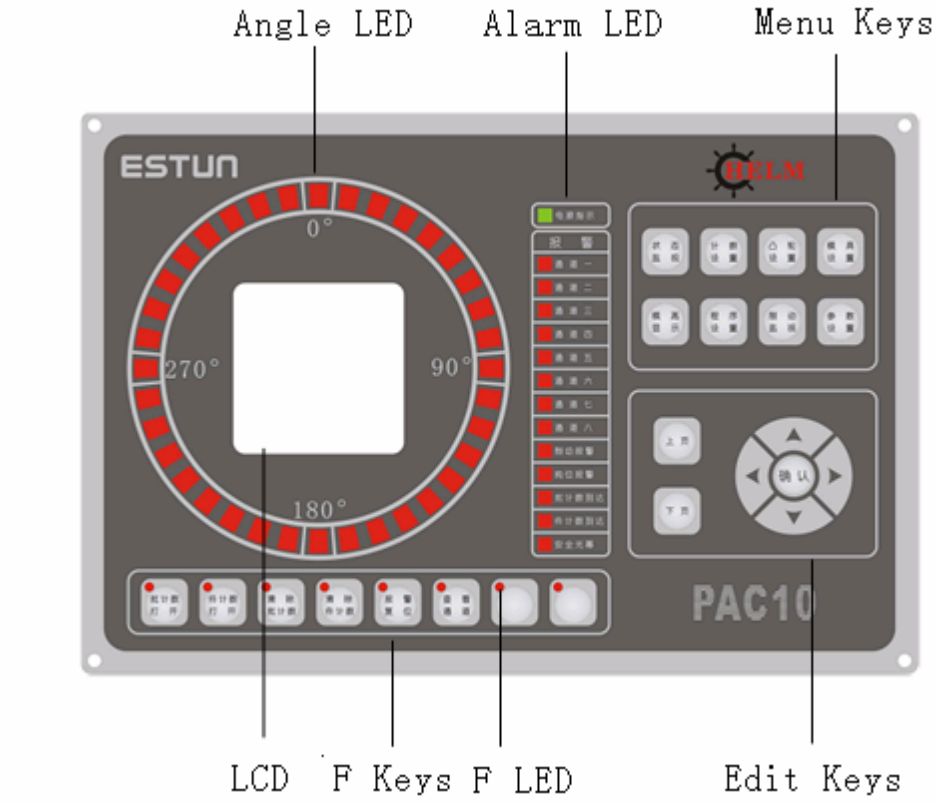
1. The top stop input interface receives input signal of high level, the internal calculation of PAC10DM is used for the top stop calculation.
2. PLC gives PAC10DM a reset signal, the output of PAC10DM's top stop signal is cleared.
3. When the run signal of PAC10DM is changing from high to low level, PAC10DM starts to calculate the stop angle.
4. When the stop angle arrives, PAC10DM makes the output signal of top stop. The PLC deactivates the clutch immediately when it receives the output signal.



Notes: The above diagram is for reference only, please refer to the manufacturer's electrical cabinet drawings before connection and wiring.

3 Operation and Settings

3.1 Operation Panel

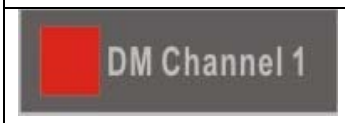
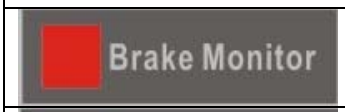


3.1.1 Angle Indication

Each indicator light represents 10°.

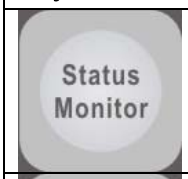
3.1.2 Status Indicators

When an alarm occurs, the corresponding indicator light is on to indicate alarm status. After the alarm condition is cleared, press “Reset alarm” or “Reset” button.

Status Name	Description
	There are 8 die monitoring channels (DM1 to DM8). The indicator light is on while the signal detected by DM input channel is not consistent with the preset parameter.
	The light is on while braking stroke exceeds preset brake stroke or braking time exceeds preset time.
	The light is on when the electric level at the interface of the tonnage detection input is low.
	The light is on when preset batch count is reached.
	The light is on when preset part count is reached..
	The light is on when the electric level at the interface of the safety light curtain input is low.

3.1.3 Menu Shortcut Keys

Press a shortcut key to enter the setup parameters.

Key name	Description
	Check angle display at main interface, stroke speed display, counters status of input interface.
	Set part counter and batch counter presets.
	Set output mode of PLS, Angle On/Off, time, intermittent time and intermittent angle parameters.

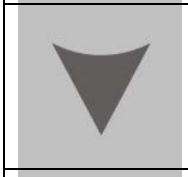
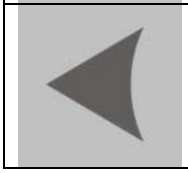
	Set parameters of DM input channels.
	Display die mounting height, preset die height.
	Recall and download job parameters.
	Display run time counter, brake angle, brake stop time and alarm of the clutch.
	Set job recipe parameters.

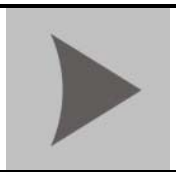
3.1.4 Function Keys

Key name	Descriptions
	Press to enable or disable Batch Counter. Light is on when batch counter is enabled.
	Press to enable or disable Part Counter. Light is on when batch counter is enabled.
	Reset batch counter to zero.

	Reset part counter to zero.
	Indicates an alarm when lit, press to clear alarm indication.
	When lit, which means the status indicating lamp is displaying the status of signal electric level at input port. Light is off, which means the status indicating lamp is displaying the alarm status.

3.1.5 Edit Keys

	Go to the previous page.
	Go to the next page.
	1：select previous parameter 2：parameter value increases by 1
	1：select next parameter 2：parameter value decreases by 1
	1：select the left parameter 2：parameter moves left by 1 digit

	1：select the right parameter 2：parameter moves right by 1 digit.
	1：enter into parameter 2：confirm modifications

3.1.6 Key application examples

1) Press 

to enter Counter Setting menu:

Counters
Accu. Parts : 40 Preset Parts : 100 Curr. Parts : 20
Page 1/2

2) Press  select Preset Parts

Counters
Accu. Parts : 40 Preset Parts : 100 Curr. Parts : 20
Page 1/2

3) Press to change counter.

Counters
Accu. Parts : 40 Preset Parts : 100 Curr. Parts : 20
Page 1/2

4) Press  to modify the values

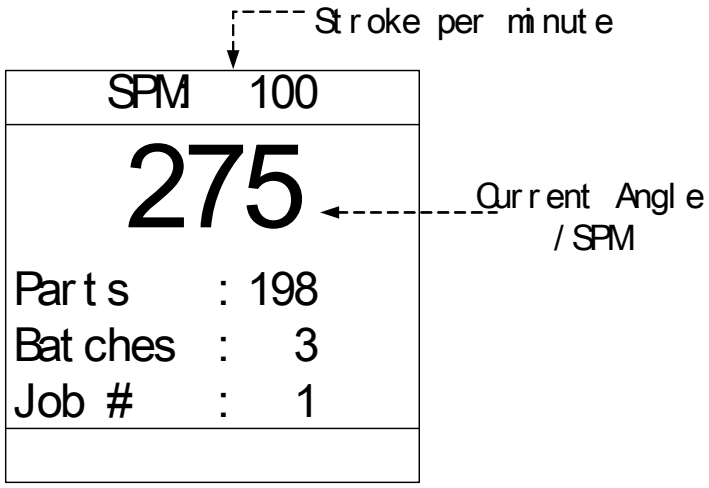
Counters
Accu. Parts : 40 Preset Parts : 200 Curr. Parts : 20
Page 1/2

5) Press to confirm the modifications

Counters
Accu. Parts : 40 Preset Parts : 200 Curr. Parts : 20
Page 1/2

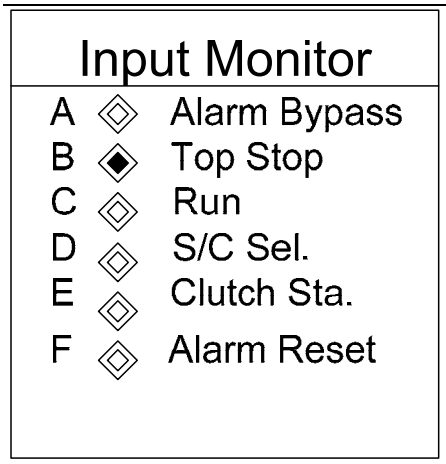
3.2 LCD screen

The menu screen is shown on power up



On this screen, press 

to display the status of I/O signals.



◆ : This symbol shows the signals are activated;

◇ : This symbol shows the signals are of no effect.

The above diagram shows top stop input signal is in effect, that is, the calculating function for top stop is selected.

4. Programming parameters

4.1 Counting

4.1.1 Accumulative Parts

Refers to the accumulative number of processed parts.

The accumulative parts = processed batches × preset parts per batch + processed parts of current batch.

Range：0~999999999

Default：0

Counters
Accu. Parts : 40 Preset Parts : 100 Curr. Parts : 20
Page 1/2

4.1.2 Preset parts

Refers to preset number of parts to be processed per batch.

Range：0~99999

Default 0

4.1.3 Current parts

It means number of processed parts.

Range: 0~99999

Default : 0

4.1.4 Preset batches

It means preset batches to be processed.

Range：0~99999

Default：0

4.1.5 Current batch

It means processed batches. When preset number of batches arrive, system will generate a signal to declutch.

Range: 0~99999

Default 0

4.2 PLS Settings

There are totally 13 PLS outputs in PLS settings.

4.2.1 Mode selection

There are 4 kinds of different output modes.

Range: 0~3

0：angle

1：time

2：intermittent time

3：intermittent angle

Default : 0

4.2.2 Angle On

It's active in any of the modes, and it means the output signal goes to high level when the crankshaft arrives this angle.

Range: 0~359 degree

Default：100 degree

4.2.3 Angle Off

It's only active in Angle mode and Intermittent Angle mode, and it means the output signal goes to low level when the crankshaft arrives this angle

Range：0~359 degree

Default：200 degree

4.2.4 Keep On Time

It's only active in time mode and intermittent time mode, and it means the turn on time of signal.

Range：0~99999ms

Default：1000ms

4.2.5 Intermittent cycle

It is only active in intermittent time mode and intermittent angle mode, and it means for every how many stroke times the signal output is made.

Range：0~999

Default：3

4.3 Die monitoring settings

There are 8 monitoring channels (DM1~DM8).

4.3.1 Mode selection

It refers to the ways of signal input.

Range：0~4

0：Static (STC)

1：Cyclic (CYC)

2：Intermittent Cyclic (ICYC)

3：In-position (POS)

4：Intermittent In-position (IPOS)

Default is 3 (POS)

4.3.2 Signal types

This refers to the definition of the status while signal is ON. Please see the Connection section for reference.

Range：0~1

0：Normal OFF，signal being defined as Normal OFF means ON is of low level;

1：Normal ON，signal being defined as Normal ON means ON is of high level;

Default：1

4.3.3 Angle On

It's active in any mode, and it means when the crankshaft arrives this angle, PAC10DM starts to detect DM input signal.

Range：0~359 degree

Default：100 degree

4.3.4 Angle Off

It's only active in angle mode and intermittent angle mode, and it means when the crankshaft arrives this angle, PAC10DM stops the detection of DM input signal.

Range：0~359 degree

Default：200 degree

4.3.5 Output options

It refers to the controller's reaction upon receipt of unconventional DM signals.

Range：0~3

0：Emergency stop

1：Top stop

2： Alarm

3： Ignore

Default：3

4.3.6 Intermittent cycle

For every how many cycles there is a signal.

Range：0~999

Default：3

4.4 Die height

The display of current die height.

Position increment of die height = 4× pulse number of Encoder per cycle × Factor 2÷Factor 1

4.4.1 Current position

It shows the current die height.

Range：0.00~999.99

Default：0

4.4.2 Position setting

This refers to the right position of die height adjustment. This parameter is saved into the programs,

when a different program is loaded, the corresponding die height settings is loaded at the same time.

Range：0~999.99

Default： -

4.5 Program operations

There are 100 programs in total. Each program contains 8 DM channel settings, 13 PLS settings and the die height setting. Each program is one-to-one correspondence with a set of die, which makes it easily to change the die quickly.

4.5.1Correspoding operations

Range：0~3

0：select the program as current processing program;

1：save the current parameter settings to a program;

2：delete the saved program;

3：return, without doing anything.

Default value： -

4.6 Brake monitor

Press “Brake monitor” key to view the accumulative movement times of clutch, and alarm records for the last machine stop.

Items	Descriptions
accumulative movement times of clutch	This cannot be reset
last braking angle	
last braking time	
Input Channel from 1 to 8	Alarm status of DM1~DM8
Tonnage monitoring	Tonnage fault is detected
Safety light curtain	Light curtain fault is detected
Overrun	Slide doesn’t stop within the range of overrun setting

Die height exceeds the limit	Die height adjustment exceeds the limit
Batches arrive	Number of batches arrives
Parts arrive	Number of parts arrives
Top stop	Last machine stop is Top stop
E-stop	Last machine stop is E-stop

5. Machine Tool Parameters

5.1 Enter into parameter settings

1) Press 

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2) Press by turns the following keys :  、 

、 

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and then press

to enter into parameter setting menu.

5.2 Parameter instructions

5.2.1 Maximum braking angle

It refers to the allowed maximum braking angle of clutch. If the braking angle exceeds this angle limit, system will alarm for brake fault. When setting this parameter, you may do the 90° test at the actual stroke speed to work out the actual braking angle and braking time, and then, you may set the maximum braking angle and braking time with reference to the actual angle and time.

Range：0~9999 degree

Default：80 degree

5.2.2 Maximum braking time

It refers to the allowed maximum braking time of clutch.

Range：0~9999 ms

Default value：900ms

5.2.3 Resolver direction

It means the counting direction of the resolver. You can select increase by clockwise or decrease by counterclockwise.

Range：0~1

Default：0

5.2.4 Bottom dead center setting

This is to set the position of B.D.C.
Range：180 degree
Default：180 degree

5.2.5 Detection angle range of photoelectric signals

It refers to detect angle range of photoelectric signals and to see if the light curtain signal is normal or not.
Range：0~359 degree
Default：0~0 degree

5.2.6 Overrun angle setting

Use resolver angle to set the range of Top dead center.
Range：0~359—0~359 degree
Default：0—0 degree

5.2.7 Encoder direction

It means the counting direction of the encoder, and it is used to decide the displayed value is changing towards the increasing direction or decreasing direction when the encoder is rotating clockwise.
Range：0 ~ 1
0：Clockwise
1：counterclockwise
Default：1

5.2.8 Current position setting

This refers to set current die height.

Range：0~99999

Default value：0

5.2.9 Factor 1

It is a factor which is used to calculate the pulse number and the die height.

Range：1~9999

Default：1

5.2.10 Factor 2

It is a factor which is used to calculate the pulse number and the die height.

Range：1~9999

Default：1

5.2.11 Upper limit

It refers to the upper position limit of die height adjustment.

Range：0~99999

Default：99999

5.2.12 Lower limit

It refers to the lower position limit of die height adjustment.

Range：0~99999

Default：1

5.2.13 Restore to factory settings

All parameters restore to factory settings.

Range：0~1

0：no change

1：restore

Default：0

5.2.14 Language options

It means to select the menu language.

Range：0~1

0：Chinese

1：English

Default：0

6. Commissioning

6.1 Preparation and checking before running

6.1.1 Check electrical connections

Warning:

Before using, please check the machine according to operation instructions from the machine tool manufacturer, and make sure the operation is safe.

Refer to Appendix 1 and use I/O diagnostic program to check connections. Once system connections are verified, cycle power off and on.

6.2 Quick Start

- Set direction of resolver
- Set B.D.C.
- Set parameters of the machine tool
- Set PLS output
- Set DM input channel
- Set shut-height (optional)
- Save the job (program)

6.3 Commissioning of T.D.C. Stop for machine tools with speed adjustment

PAC controllers can be applied to make the speed adjustment to the machine tools. After adjustment, different working strokes can stop in the range of top dead center.

Adjustment:

1. Enter into parameter menu, and set overrun angle as from 190 degree to 170 degree.
2. From the lowest working speed to the highest working speed, every 8 SPM is an interval. Let the system run in Single mode and Continuous Mode and let it make an automatic compensation until it stops at top dead center.
3. Set overrun angle as from 330 degree to 30 degree.

7. Trouble Shooting

7.1 Description

When an alarm occurs, the indicator lights on the controller and LCD screen will display alarm events. If the machine stops, you can view the alarm records in the Brake Monitor menu page.

Once alarm conditions are resolved, press 

or the Reset button on the panel to release the alarm.

7.2 Fault Table

Name	Reasons	Solutions
Error report upon system power up	Mistake occurs when system switches on and begins to verify parameters	Enter into machine tool parameter settings and make the settings again
DM channel 1~8	Input signal is not consistent with setting	
Tonnage alarm	Tonnage detection signal is of low level	
Safety light curtain	Photoelectric detection signal is of low level	
Overrun	Slide does not stop within the angle range of the overrun setting	Check overrun parameter settings and have the slide stop within the angle range
Die height exceeds the limit	Die height is not within the range of settings	Check upper and lower limit parameter of die height setting. Adjust the die height until it's within the range of settings
Batch Counter Full		Clear and reset one by one
Part Counter Full		Clear and reset one by one
T-stop	Last machine stop is top stop	
E-stop	Last machine stop is emergency stop	
Resolver offline		Check resolver connection
Abnormal braking	Braking angle or time exceeds set values (maximum braking angle, maximum braking time)	1. Check parameter settings; 2. Friction plate may need to be replaced

8. Maintenance

Items	Repair Schedule	Contents of repair	Treatment for unconventional events
Loose or tight bolt installation	Once 3 months	Panel, resolver and bolts on the encoders	fasten
Cable Connectors	Once 3 months	Cable connections to the sensors, PM module and PAC10DM	fasten

Appendix 1： Hardware Diagnosis

- LED diagnosis

When system is powered on, all LED are lit for 2 seconds.

- LCD diagnosis

On power up, the software version number and manufacturer info is displayed on the screen.

Notes

When making I/O diagnosis, refer to the operation instructions in the machine tool manual, make sure the main motor is stopped and there is no danger.

Diagnosis of Input ports:

- Turn the mode selecting switch to OFF status;
- Press 

;
- Press in sequence the following keys: 

, 

, 

, 
;
- Press to confirm and press 

to enter into output diagnosis menu.

Diagnosis of output ports

In diagnostic menu of input ports, press 

and enter output ports diagnosis. Select the output interface by pressing 
or 
key , then press Enter key once to confirm.

Press 
or 
key to select output indicator light in correspondence with 0 on and the indicator on the output board is off.

Appendix 2：System Parameter Backup

Parameter names	Explanation	Range	User's value	Unit
Max. braking angle	Maximum braking angle	0~9999		degree
Max. braking time	Maximum braking time	0~9999		ms
Resolver direction	Counting direction of resolver	0~1		
B.D.C. setting	Confirm current crankshaft is at an angle of 180 degree	0~180		Degree
Photoelectric detection angle range	To detect photoelectric signal within this range	0~359		degree
Overrun angle setting	Use internal sensors to detect Overrun angle range	0~359		degree
Encoder direction	Counting direction of die height encoder	1		
Current position	Set current position of die height	0~99999		
Factor 1	Factor 1 set by die height encoder	1 ~ 9999		
Factor 2	Factor 2 set by die height encoder	1 ~ 9999		
Upper limit	Allowed maximum die height when mounting	1000.00		
Lower limit	Allowed minimum die height when mounting	0.00		
Restore to factory settings	All parameters are restored to factory settings	0：no change 1：restore		
Language options	To select language of menu	0：Chinese 1：English		