PAC10 Automation Controller

Operator Manual

Version 1.03

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Safety Considerations

For safety and proper operation of this controller all operating personnel should read this manual carefully before running the controller.

Warning

1. The functionality may be destabilized if this controller is not repaired or maintained by a professional service technician. The installation and maintenance of the controller should only be carried out by authorized professional service personnel.
2. For safety purposes, this controller requires a fixed mounting. The cables should be put in conduit to prevent cables from being pressed or grinded.
3. The power supply is required to have at least one breaking method through a switch or a circuit breaker. The breaker must be close to the equipment, and easy to use by operators. There must be an obvious sign when an open circuit occurs.
4. To reduce the possibility of accidents which may cause harm to personnel or mechanical equipment, the operators must follow the instructions and operation procedures as described in this manual. Operators must also comply with the factory's safety standards.
5. Make sure power is switched off before checking, wiring or testing.
6. Make sure the power supply of the main motor is turned off before testing any outputs of PAC10 controller.
7. It is prohibited to dismantle the controller while power is switched on.

Note on Circuit Design

1. It is suggested the system should be supplied with separate DC24V/1A power, that is, the I/O power supply should be separate from system power supply.
2. The controller grounding cannot be at the same point with the motor or the transformer, which has to be made separately.

3. Both the controller and the machine must be well grounded.
4. To prevent the controller from disturbance or interference, please install a filter between the heavy load and inductance load. Impedance absorber device should also be used for AC contactor and AC electromagnetism valve. Resistance is to be 220Ω/2W, and the capacitor is to be 0.1μF/3KV. Absorber devices must be mounted closely to contactor coils or beside the valve coils.
5. Please use specially matched cables.
6. The cables connected with the controller should be as short as possible, and they can not run parallel with AC power cables. You may pull on the wires through metal conduits and then ground the conduits separately.

Encoder Position

If the slide position is adjusted while system power is switched off, the position displayed on the system startup may be incorrect. To correct the position error, let the slide run for at least one complete stroke after PAC10 is powered on.

Chapter 1 Functions and Specifications

The PAC10 controller combined with the PLC is very suitable for control of mechanical presses. It has following features:

1. SPM/Angle display
   If the SPM is over 10, the SPM is displayed.
   If the SPM is below or equal to 10, the angle is displayed.

2. Current part count display: 6 digits

3. Electronic cam setting: 10 channels

4. Bottom dead center setting

5. The second angle setting: detect failures like encoder slippage

6. Encoder's FW/REV rotate setting: easy connection

7. High/low speed limit setting: Controller gives an alarm if speed exceeds the limit

8. Brake monitoring: Controller gives an alarm if the maximum set value is exceeded.

9. Brake stop time check: system sends an alarm when the preset maximum value is exceeded.

10. Displays output of TDC positioning signal at a specified angle.

11. Production counter setting: 6 digits, for control of the output signals when enabled.

12. Parameter access is password protected.

13. Top dead center positioning: automatic compensation of offset during TDC positioning.

14. Clutch movements counter.

15. Self diagnostics: when an error occurs, the controller displays an error code that identifies the problem area.

16. Status monitoring of I/O ports.

17. Self correction of shaft position.

NOTE: If the slide position is adjusted while system power is switched off, the position displayed on the system startup may be incorrect. To correct the position error, let the slide run for at least one complete stroke after PAC10 is powered on.

Item	Specification
Power supply	DC24V ± 10%，1A
EMC	Conform to GB/T17626，GB/T18268 standard
Shock or vibration	Conform to JB/T8832-2001 standard
Temperature	Conform to GB/T2423.3-93 standard
Working temperature	0～40℃
Storage temperature	－20～70℃
Humidity	30～85 %
Angle display	0～359°
Angle setting	0～359°
Strokes	0～2000 SPM (360P/R)
Angle sensor	360 lines incremental encoder (5V, differential voltage output, input with reference)
Angle resolution	0.25 degree
Indicators	32 indicators for crank position
Display	Angle/speed (4 digit LED indicator) Production counting (4 digit LED indicator)
Keys	4 toggle switch keys
Cam output	0～359°　10 channels
Input	5 channels (optically coupled isolator)　DC24V ± 10%, maximum input current 20mA
Output	12 channels (optically coupled isolator)　DC24V ± 10%, maximum input current 20mA

Chapter 2 Operation and Settings

2.1 Operation Panel

There are 32 angle indicators in total. Parameter settings and production counter can be set via a key on the panel. The information; angle, strokes and system status is displayed by the LED indicators on the panel.

Icons of Keys	Name	Function description
	F key	Press this key to select Display, Status monitoring, Production part parameter setting, CAM parameters and machine parameters. Parameter setting can be canceled during operation by pressing this key
	UP	1：select previous parameter 2：value goes up by 1
	DOWN	1：select next parameter 2：value goes down by 1
	Enter	1：enter into parameter 2：confirm modifications 3：in the production counter setting menu, press the ENTER key to move the entry field to the left. Press and hold the Enter key for 1 second to confirm change

2.2 Switching between basic modes

By switching between the basic modes on the operation panel, user can make such operations as parameters setting, stroke speed display and status display, etc. Basic modes consist of status mode display, monitoring mode, production counter setting, CAM setting, and machine parameter mode. Press F key to scroll through modes.

See Appendix 2 for more details on the order of Menu display.

2.3 Status display mode

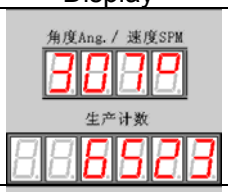
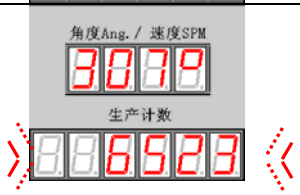
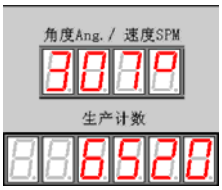
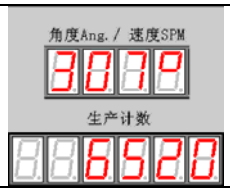
Current angle or position of crank is displayed upon PAC10 being switched on or when SPM ≤ 10 when running.

When SPM ＞ 10，SPM is displayed:

If there's a system alarm, an error code for the alarm is displayed:

2.3.1 Procedure to change current production counter

NOTE: Current production counter cannot be changed when an alarm condition is present.
Following is an example showing the procedure to change current production counter from 6523 to 6520.

Steps	Display	Description
1		Press F key to enter into status mode. (If there is an alarm, it must be cleared first.)
2		Press Enter key and hold for 1 second. The rightmost digit of the production counter display will flash to indicate production counter change mode is available now.
3		Press UP or DOWN, change value to required 6520. Press Enter key to move entry field left.
4		Press and hold Enter key to save changes. The Production counter display returns to normal state. Changes are then saved. If F key is pressed while in change, the system will exit without saving any changes.

To clear current counter to 0, press Enter key and hold for 3 seconds; or press "Counter Clear" button for 1 second when the slide is stopped.

2.4 Status monitoring mode

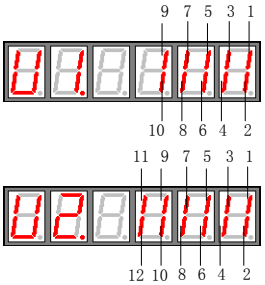
In status monitoring mode, user can monitor the following:

- Power level status of I/O ports
- Brake angle

When user enters monitoring mode, the decimal point of Line 2's last LED on the left will flash to indicate current mode.

2.4.1 Display of contents in monitoring mode

Monitoring No.	Contents
U1	Power level status of input port
U2	Power level status of output port
U3	Real braking angle (degree)
U4	Last SPM when braking happens
U5	Real second angle (degree)
U6	TDC positioning signal output counter
U7	PAC10 version info
U8	Real braking time (ms)
Following modes are for production test use (protected)	
U9	Output diagnostics
UA	RAM diagnostics
Ub	LED diagnostics
UC	Maximum set braking angle (degree)
Ud	TDC positioning/TDC stop output angle
UE	Alarm history



Warning:

User must follow the machine manufacturer's operation instructions when diagnosing U8 output port or U9 storage RAM. Make sure the main motor is stopped and power supply of main motor is switched off before any operation to avoid a dangerous situation.

Monitoring No.	Digit No.	Contents	Relative signals
U1	1	Second angle input	X 1
	2	Run input	X 2
	3	Start TDC compensation input	X 3
	4	Production counter clear input	X 4
	5	Alarm reset	X 5
	6	Encoder offline detection	

	7	Encoder A phase	
	8	Encoder B phase	
	9	Encoder C phase	
	10	Power supply detection of normal input	

Monitoring No.	Digit No.	Contents	Relative signals
U2	1	Top positioning	Y 1
	2	Controller gets ready	Y 2
	3	CAM 1 output	Y 3
	4	CAM 2 output	Y 4
	5	CAM 3 output	Y 5
	6	CAM 4 output	Y 6
	7	CAM 5 output	Y 7
	8	CAM 6 output	Y 8
	9	CAM 7 output	Y 9
	10	CAM 8 output	Y 10
	11	CAM 9 output	Y 11
	12	CAM 10/output upon arrival of production counter	Y 12

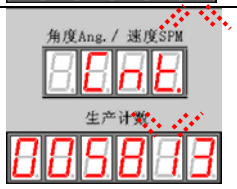
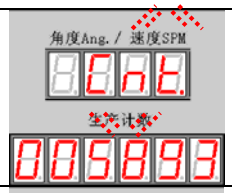
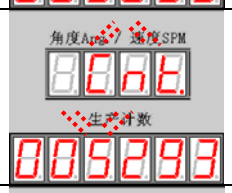
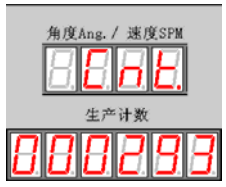
2.4.2 Procedure to clear counter for movement times of TDC positioning signals

Steps	Interface	Operation instructions
1		Press F key to enter monitoring mode.
2		Press Up or Down key to select Monitoring number U6.
3		Press Enter once, the 7-segment LED for top positioning signal output will flash.
4		Press Enter key and hold on for 1 second, the TDC positioning signal output counter is cleared to zero.

2.5 Production counter settings

When making the settings, Up and Down keys are used to change values, a short press on Enter key moves the entry position to the left. Press and hold the Enter key to save changes and exit. Press the F key to exit without saving the changes.

The following table shows an example of how to change production counter preset value from 5814 to 293.

Steps	Display	Description
1		Press F key and select production counter setting mode. The LED in Line 2 is the current production counter preset value.
2		Press Enter key. The first number from the right will flash to allow edit of the production counter preset value.
3		Press UP/DOWN, change the value to 3, then press Enter key. The second number from the right will flash to allow edit of the next digit.
4		Press UP/DOWN, change the value to 9, then press Enter key. The third light from the right will flash to allow edit of the next digit.
5		Press UP/DOWN, change the value to 2, then press Enter key. The fourth light from the right will flash to allow edit of the next digit.
6		Press UP/DOWN, change the value to 0, then press Enter key. The fourth light from the right will flash to allow edit of the next digit.
7		When finished, press and hold the Enter key. All the LED's will flash. When Enter key is released the LED's will return to normal state and the changes are saved.

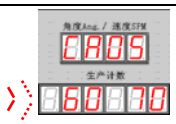
To change the values again, repeat Step 2 to Step 7.

NOTE: If the F key is pressed during Production Counter edit, system will exit without saving any changes.

2.6 Cam setting mode

CAM parameters are password protected to prevent unauthorized change. User can confirm machine parameters and the change range in the attached table of CAM parameters overview.

The following table shows the procedure to change ON angle of CAM CA05 from 60 degree to 70 degree, and to change OFF angle from 70 degree to 80 degree.

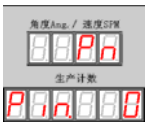
Steps	interface	Operation instructions
1		Press F key, select Cam setting mode (CA) and enter into password verification status (Pin). Press Up or Down key to input password as 980.
2		Press Enter key to display cam angle mode.
3		Press Up or Down key to select CA05 for this example.
4		Press Enter key, CA05 On angle (the leftmost three digits) will flash. User can now edit CA05 ON angle. Press Up or Down keys to set the value to 70. Press Enter key. CAM05 ON angle is saved.
5		CA05 OFF Angle (the rightmost three digits) will flash. User can now edit CA05 OFF angle.
6		Press Up or Down keys to set the value to 80. Press Enter key. CAM05 OFF angle is saved.

2.7 Machine parameter settings

Machine parameters are password protected.
User can confirm machine parameters and review the range of settings in Section 3.

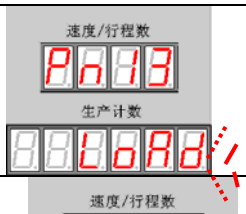
2.7.1 Procedure to change parameter data

The following table shows the procedure to change Maximum SPM from 2000 to 1500.

Steps	Interface	Operation instruction
1		Press F key, select machine parameter mode (Pn) and enter into password verification status. Press Up or Down key to input password as 980. Press Enter key.

2		Press Up or Down key to select machine parameter mode (Pn01 through Pn14).
3		Press Up or Down key to select parameter number Pn03. Press Enter key again and the current Maximum SPM value will flash, indicating edit mode.
4		Press Up or Down key to change value to 1500. Press and hold the key to change the number faster. Press Enter key to save the change and return to parameter edit mode.

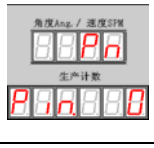
2.7.2 Restore to factory default values

Steps	interface	Operation instruction
1		Enter into machine parameter menu, press Up or Down key and select Pn13, press Enter key. The LED's in Line 2 will flash.
2		Press and hold Enter key for 1 second. Release and press Enter key again. When “End” appears, system is restored to default values.

Warning:

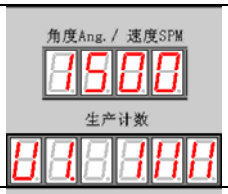
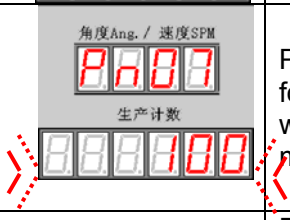
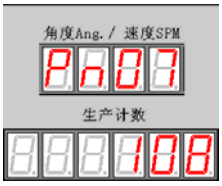
When restoring operation is done, controller generates alarm A.11 (bottom dead center is not set). User must clear the alarm first and then reset the bottom dead center.

2.7.3 Set bottom dead center

Steps	interface	Operation instruction
1		Press F key, select machine parameter mode and enter into password verification. Press Up or Down key to input password as 980.
2		Press Enter key to select Pn01, current crank angle is displayed in Line 2.

3		Press Enter key to enter machine parameter editing mode. The current crank angle display will flash.
4		Press Enter key for over 1 second, set current slide position as bottom dead center, current angle as 180 degree, then release Enter key to save the settings and exit machine parameter editing mode.

2.7.4 Set second angle – Top Stop Compensation

Steps	Display	Operation instruction
1		Run the slide for one stroke. The PAC10 will detect the position of second angle switch.
2		Enter into machine parameter display mode. Press Up or Down key to select Pn07. The set value of second angle is displayed in line 2.
3		Press Enter key. The LED's for the second angle setting will flash indicating edit mode.
4		Press Enter key for over 1 second. The detected value of second angle is displayed, release Enter key to save the settings and exit machine parameter editing mode.

Chapter 3 Parameters and Description

3.1 Preset production counter

Pn.	Name and Function	Unit	Range	Default
Cnt.	Preset production counter 0：counter disabled 1：enable counter display, but without output of counter arrival signal. ≥2：enable counter display, and with output of counter arrival signal.	Piece	0~999,999	0

NOTE:
The same output port Y12 is used for both counter arrival signal and CAM10;
When preset production counter is set as 0, Y12 is used as CAM 10 output.
When preset production counter is set equal to or over 2, Y12 is used as output for counter arrival signal.

3.2 CAM

Pn.	Name and Function	Unit	Range	Default
CA01	CAM01 On Angle	degree	0~359	0
	CAM01 Off Angle	degree	0~359	135
◦◦◦	◦◦◦			
	◦◦◦			
CA10	CAM10 On Angle	degree	0~359	181
	CAM10 Off Angle	degree	0~359	200

See Appendix 4 for details about Cam table.

NOTE:
If CAM X On/Off Angles are both set as zero, CAM X will always output OFF status.
If CAM X On/Off Angles are both set as θ（θ≠0）, CAM X will always output ON status.

3.3 Machine parameters

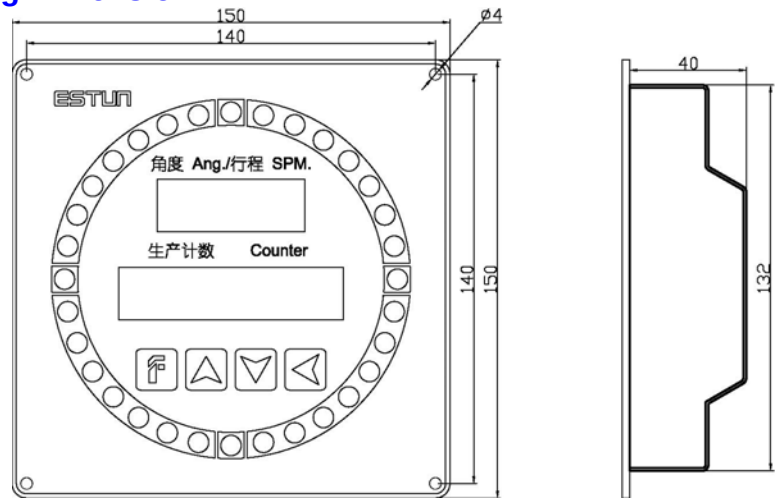
Pn.	Name and function	Unit	Range	Default
Pn01	BDC setting	—	—	—
Pn02	Minimum allowable SPM	SPM	0~2000	0
Pn03	Maximum allowable SPM	SPM	0~2000	2000
Pn04	Encoder counter direction [0] increase clockwise [1] increase counterclockwise	—	0~1	0

Pn05	Maximum allowable braking angle. Maximum allowable braking angle = Pn05*SPM If braking angle exceeds maxi. allowable braking angle, system will generate an alarm for abnormal braking.	degree/SPM	0.01~9.99	9.99
Pn06	Second angle detection [0] disable [1] enable	—	0~1	0
Pn07	Second angle setting	—	—	—
Pn08	Output TDC positioning at fixed angle [0] disable [1] enable	—	0~1	0
Pn09	Output angle at fixed TDC positioning	degree	0~359	0
Pn10	Movement times limit of TDC positioning signals [=0] disable [>0] enable	—	0~999,000	999,000
Pn11	Range of Top stop without compensation	degree	0~20	5
Pn12	Machine stop angle limit in single mode [0] disable [1] enable	—	0~1	1
Pn13	Restore to factory settings	—	—	—
Pn14	Maximum allowable braking time of the clutch	ms	0~50000	50000

NOTE:
Pn05 setting: Pn05 should be a bit more than U3÷U4.
Pn10 movement times of TDC positioning signals: it reflects generally the clutch movement times; it's only required to detect this function when Power is on.
Pn11 Range of Top stop without compensation: when the angle stops within the range from －Pn11 to ＋Pn11, PAC10 makes no compensation to machine stop angle.
Pn12 Machine stop angle limit in single mode: when it is enabled in single mode, stop angle should never be smaller than 190 degree, otherwise system will generate error A.10.

Chapter 4 Installation and Connection

4.1 PAC10 Mounting Dimension

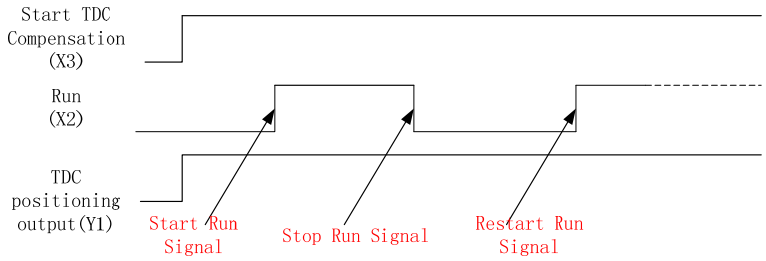


4.2 Connection diagram

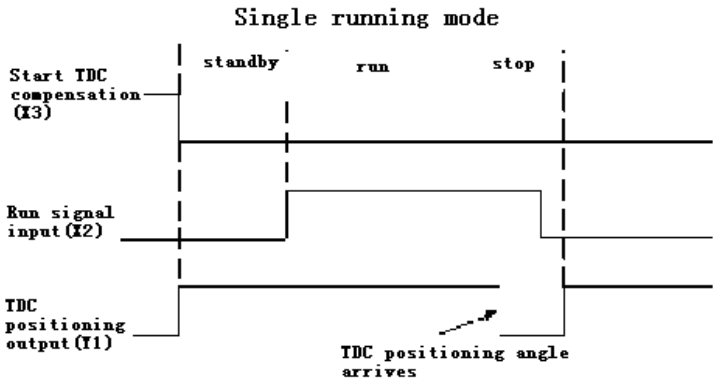
See Appendix 5 for the connection diagram.

4.3 Top positioning movement sequence figure

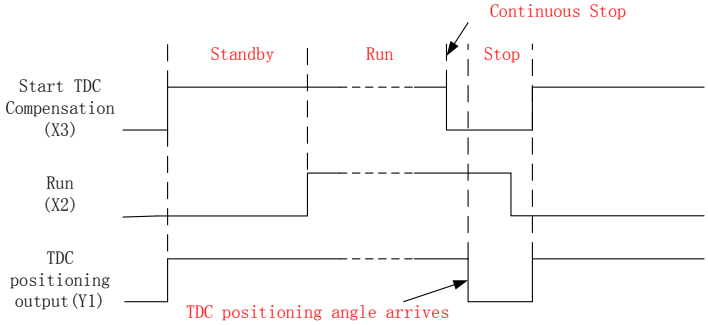
Inch



Single running mode



Continuous



Notice:

1. X3 ON（Inch mode）：no TDC compensation（Y1 always output ON）
2. X3 OFF，X2 ON（Single mode）or X3 ON-> OFF，X2 ON（continuous mode）：with TDC compensation （When TDC positioning angle arrives, Y1 ON -> OFF ， wait until X2 OFF，Y1 OFF> ON ）

Chapter 5 Commissioning

5.1 Preparation and checking before running

It's required to check wiring and connection when connection is finished.
U1 and U2 in PAC10 controller's monitoring mode provides the connection test function.

Warning

To make sure the operation is safe, user must do the checks according to machine manufacturer's operation instructions before running.

5.2 Set encoder direction

When displayed angle counting direction is different from rotate direction of the main motor, user can change this parameter to adjust angle display of the controller. Use the machine parameter menu (Pn04) for changing the encoder direction.

5.3 Set bottom dead center

See 2.7.3 for details.

5.4 Set and enable second angle

1. The press runs over one stroke in inch, single or continuous mode;
2. Press F key and enter into machine parameter mode, input password, and goes to parameter setting menu;
3. Press Up key, enter into Pn07, and then press Enter key;
4. Press Enter key again for a second to confirm the second angle;
5. Enter into Pn06, press Enter key;
6. Press Up key or Down key, set value as 1 to enable second angle; to disable the function, set value to 0.
7. Press Enter key again;

Please see 2.7.4 for detailed info about second angle setting.

NOTE:

Second angle setting must be performed after bottom dead center setting is complete.

5.5 Suggestions on commissioning

1. Y3 is for Cam 1 output, it can be used to estimate 135 degree. Parameters of Cam 1 should be set as follows:

   ON Angle is set at 0 degree;
   OFF Angle is set at 130 degrees.

2. Y4 is for Cam 2 output, it can be used to estimate top dead center. Parameters of Cam 2 should be set as follows:

   ON Angle is set at 330 degrees
   OFF Angle is set at 30 degrees.

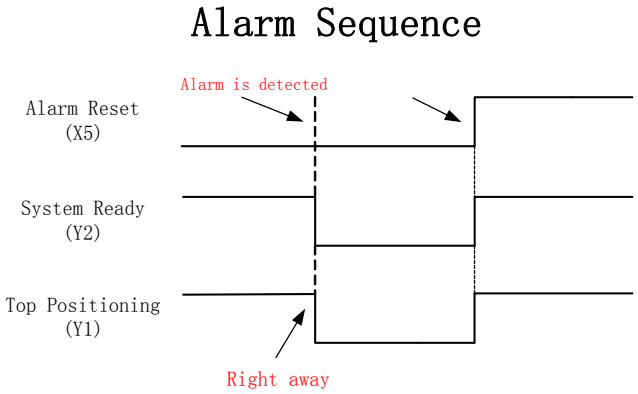
3. When PAC10 is installed on the press, adjustment is required. To make PAC10 adaptive to the machine quickly, it's suggested that the user run the press with gradually increasing 100SPM every time in continuous or single mode, and machine should stop at top dead center every time. For example, user can run the press by starting with 100spm and then to 200spm, 300spm and in this way, user can run the press until allowed maximum stokes is achieved.

Chapter 6 Alarm Handling

6.1 Alarm sequence

Controller will turn off system ready signal (Y2) immediately when some abnormal situation is detected during machine running. The controller will output a machine stop signal (Y1), the relative error codes will be displayed.

Time sequence of alarm progress is shown as below:



When an alarm is displayed, press and hold the Enter key to clear current alarm. The user can also use the alarm reset input signal to clear the alarm.

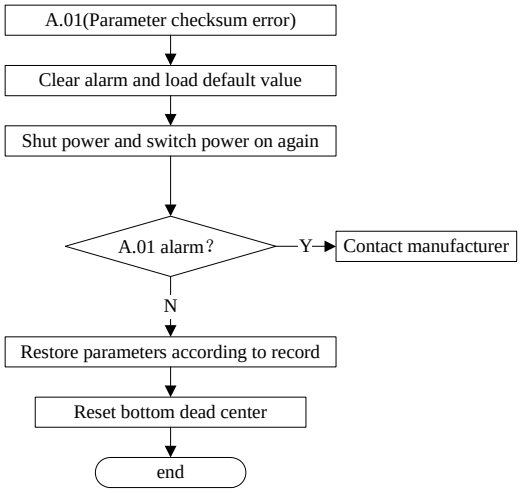
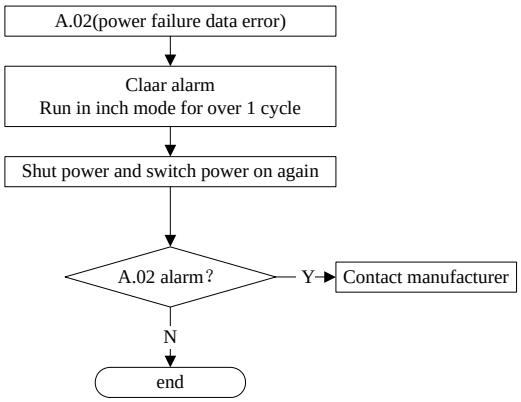
NOTE:

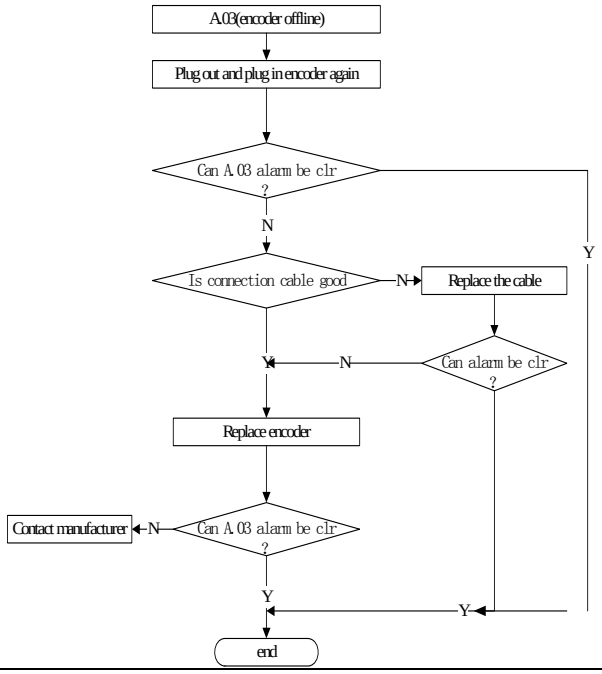
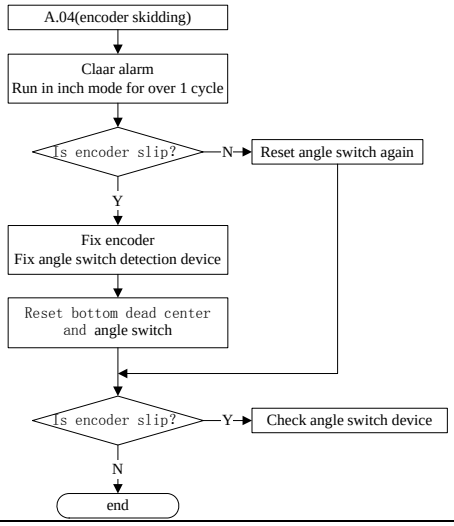
When an alarm occurs, please remove the alarm reasons first before clearing the alarm.

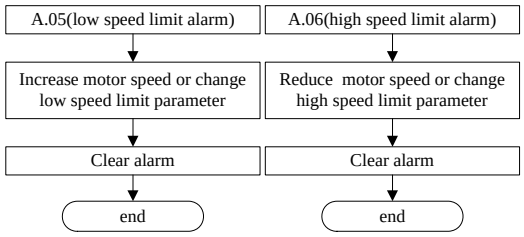
After alarm reasons and the alarm are cleared, it's required to go to inch mode first, and then user can switch to single or continuous mode.

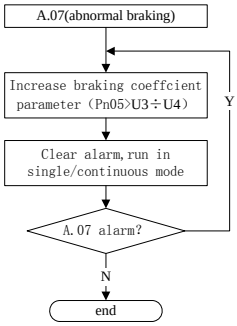
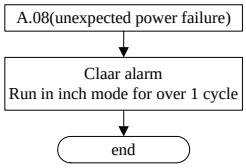
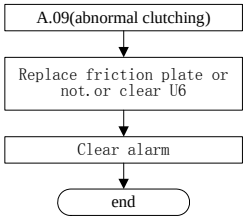
See Appendix 3 for the table of failures.

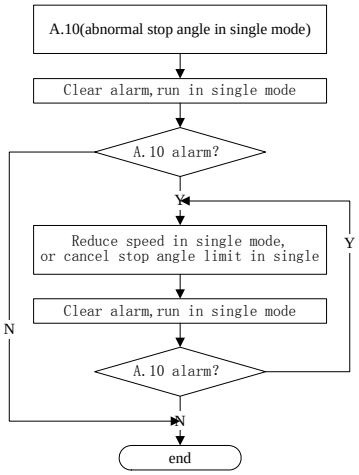
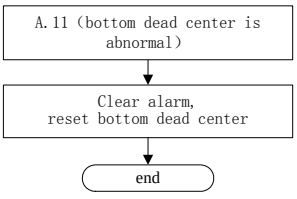
6.2 Alarm information and troubleshooting

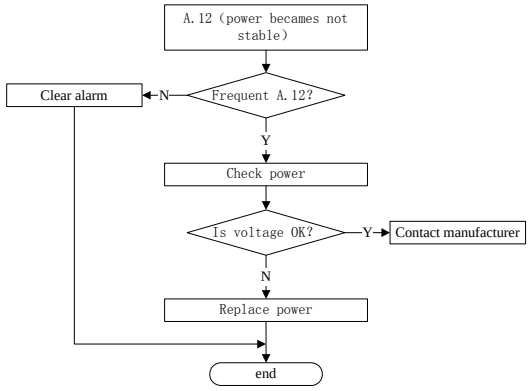
Code	Name	Troubleshooting
01	Parameter and verifying error	
02	Power failure data error	

Code	Name	Troubleshooting
03	Encoder offline	
04	Encoder slippage	

Code	Name	Troubleshooting
05 / 06	Low/high speed limit alarm	

07	Abnormal braking	
08	Unexpected power failure alarm	
09	Abnormal clutch	

Code	Name	Troubleshooting
10	Abnormal stop angle in single mode	
11	Abnormal bottom dead center	

12	Power supply not stable	

Appendix 1：Hardware Diagnostics

Warning

When making diagnosis of U8 output port or U9 storage RAM, please refer strictly to the operation instructions in the machine manufacturer's manual, make sure the main motor is stopped, main motor power is switched off and there is no dangerous situation.

- **Output port diagnostics**

Enter into U9 in monitoring mode, press Enter key for over 1 second to go into output port diagnosis mode, user can use Up or Down key to select the port which is to be tested. Press Enter key to switch the power level status of the output port. Press F key or press Enter key for 1 second to leave output port diagnosis.

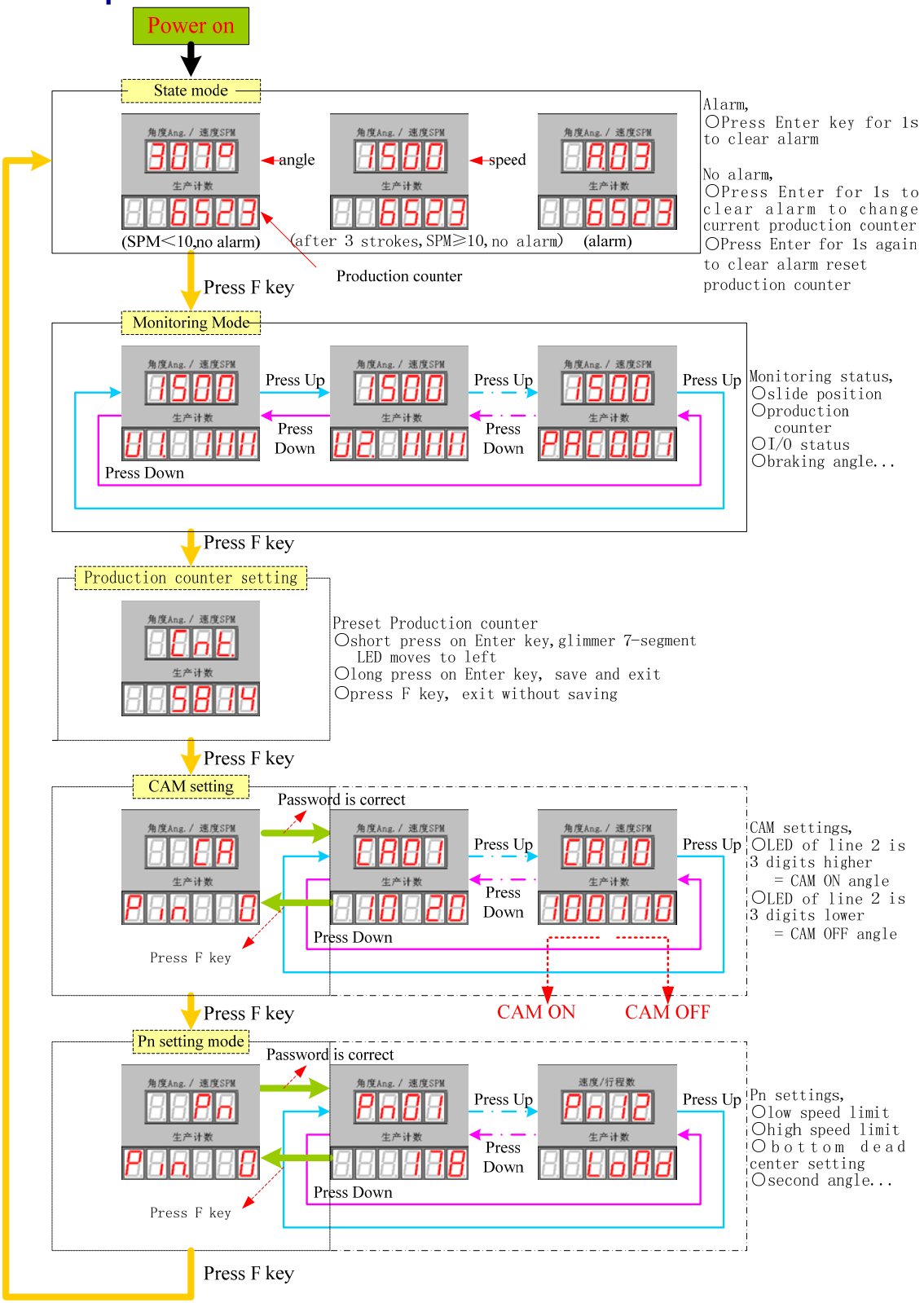
- **Storage diagnostics**

Enter into UA in monitoring mode, press Enter key and go to storage diagnosis mode, if it says "good" , it means storage is in good condition, if it says "bAd", it means the storage is already damaged. Press F key or Enter key to exit the storage diagnosis.

- **Diagnostics of angle indicators and 7-segment LED's**

Enter into Ub in monitoring mode, press Enter key and go into diagnosis of angle indicators and 7-segment LED's. The 7-segment LED's are then lit one by one. Press F key or Enter to exit this diagnosis.

Appendix 2: Operational Flowchart



Appendix 3: Fault Table

Alarm No.	Description	Reason	Troubleshooting
A.01	Parameter error and verifying error	Storage becomes abnormal	Restore to default value
A.02	Power failure data error	Storage becomes abnormal or power failure detection circuit is abnormal	After clearing the alarm, run in inch mode for over 1 cycle, shut the power and then power on again
A.03	Encoder error	Encoder is offline or C pulse position error	Replace encoder, reset BDC or check wiring and connection
A.04	Encoder slippage (sleek)	Encoder slippage	Fix encoder and reset bottom dead center and second angle
A.05	Lower than minimum SPM limit	Lower than minimum SPM limit	Increase motor rotate speed or change parameter for lowest SPM limit
A.06	Higher than maximum SPM limit	Higher than maximum SPM limit	Reduce motor rotate speed or change parameter for maximum SPM limit
A.07	Abnormal braking	Abnormal braking	Change parameter for braking angle or replace clutch
A.08	Unexpected power failure alarm	PAC10 power off unexpectedly	After clearing the alarm, run in inch mode for over 1 cycle
A.09	Abnormal clutch	Clutch lifetime expires	Remove top positioning output counter manually, or check clutch performance and replace it if necessary
A.10	In single mode, stop angle is abnormal	In single mode, stop angle is smaller than 180 degree.	Lower down running speed in single mode or set machine parameter Pn12 as 0
A.11	Bottom dead center is abnormal	Bottom dead center is not set	Set bottom dead center or second angle
A.12	Power supply not stable	Switch power becomes abnormal	Replace switch power
A.13	Mechanical error	Axis connector is loose	Check running circuit, check if axis connector is loose

Appendix 4: Parameter list

Parameter No.	Name and function description	Unit	Range of settings	Default value	User set value 1	User set value 2
Cnt.	Preset production counter 0：no counting 1：counter displays, but gives no output when counter is achieved ≥2： production counter enabled, and gives output when production counter is achieved	piece	0～999,999	0		

Parameter No.	Name and function description	Unit	Range of settings	Default value	User set value 1	User set value 2
CA01	Cam 1 ON Angle	degree	0～359	0		
	Cam 1 OFF Angle	degree	0～359	135		
CA02	Cam 2 ON Angle	degree	0～359	330		
	Cam 2 OFF Angle	degree	0～359	30		
CA03	Cam 3 ON Angle	degree	0～359	41		
	Cam 3 OFF Angle	degree	0～359	60		
CA04	Cam 4 ON Angle	degree	0～359	61		
	Cam 4 OFF Angle	degree	0～359	80		
CA05	Cam 5 ON Angle	degree	0～359	81		
	Cam 5 OFF Angle	degree	0～359	100		
CA06	Cam 6 ON Angle	degree	0～359	101		
	Cam 6 OFF Angle	degree	0～359	120		
CA07	Cam 7 ON Angle	degree	0～359	121		
	Cam 7 OFF Angle	degree	0～359	140		
CA08	Cam 8 ON Angle	degree	0～359	141		
	Cam 8 OFF Angle	degree	0～359	160		
CA09	Cam 9 ON Angle	degree	0～359	161		
	Cam 9 OFF Angle	degree	0～359	180		
CA10	Cam 10 ON Angle	degree	0～359	181		
	Cam 10 OFF Angle	degree	0～359	200		

Parameter No.	Name and function description	Unit	Range of settings	Default value	User set value 1	User set value 2
Pn01	Bottom dead center setting	—	—	—	—	—
Pn02	Allowed minimum SPM	SPM	0～2000	0		
Pn03	Allowed maximum SPM	SPM	0～2000	2000		
Pn04	Encoder counting direction [0] increase clockwise [1] decrease counterclockwise	—	0～1	0		
Pn05	Allowed maximum braking angle of clutch/ SPM. Allowed maximum braking angle = Pn05*SPM If braking angle exceeds maximum value, system gives an alarm.	degree/SPM	0.01～9.99	9.99		
Pn06	Second angle detection enabled [0] disable [1] enable	—	0～1	0		
Pn07	Second angle setting	—	—	—		
Pn08	Fixed angle output top positioning [0] disable [1] enable	—	0～1	0		
Pn09	Fixed top positioning output angle	degree	0～359	0		
Pn10	Movements limit of top positioning signals [=0] disable [>0] enable	—	0～999,000	999,000		
Pn11	Top stop without compensation	degree	0～20	5		
Pn12	Stop angle limit in single mode [0] disable [1] enable	—	0～1	1		
Pn13	Restore to factory settings	—	—	—		
Pn14	Maximum allowable braking time	ms	0~50000	50000		
Pn15	Filtering time for second angle input signal	ms	0~100	5		

NOTE:
Setting of Pn05: Pn05 is a little higher than U3÷U4.

Pn10 Movements of top positioning signals: it can reflect approximately the clutch movement times, detection of this function is only performed while system is power on.

Pn11 Top stop without compensation: when angle stops within the range from –Pn11 to +Pn11 (for example, from -10 degree to +10 degree), the controller will not make compensation on stop angle.

Pn12 stop angle limit in single mode: when braking angle limit in single mode is enabled, stop angle should be not less than 190 degree, otherwise machine is stopped by force at 190 degree, and system gives alarm error A.10.

Appendix 5: System Connection Diagram