



Instruction Manual

M03/04 Series Intelligent Electric Actuator



Chongqing Chuan Yi Automation Co., LTD. Actuator Filiale

V041409

Preface

■ About this Operation Manual

- (1) This Operation Manual will be delivered to and used by end user. Please keep it carefully;
- (2) Please read this Operation Manual carefully to understand fully the method of product operation before operation;
- (3) This Operation Manual describes the product functions perfectly, but we can not ensure these functions satisfy the special purpose of user.
- (4) Extracting or copying part of or the whole Operation Manual is forbidden without permission;
- (5) The content of this Operation Manual may be changed without prior notice;
- (6) We have endeavored to ensure its correctness during the preparation of this Operation Manual. Any mistake or omission, please contact with Marketing Department.

■ Safety Cautions

(1) In order to protect and ensure safety of this product and the system controlled thereby, follow the safety instruction and cautions in this Operation Manual when using the product. We are not responsible for any bad consequence due to noncompliance with the Manual.

(2) If any independent protective unit or safety circuit is going to be installed on the product or the system controlled thereby, make sure such equipments are installed on the outside of the product. Please do not attempt to change this product or install such circuit in this product.

(3) When replacing spare parts or consumables of the product, please use the parts recommended by our factory.

(4) The screw must be tighten after the installation of the cover cap!

(5) Please use the M25*1.5 type metal water-proof cable joint and use the suitable cables of the external diameter, strongly recommended use the shield conductor connection!

■ Disclaimer for the Product

- (1) We don't provide any guarantee except for those mentioned in the Warranty otherwise provided;
- (2) We are not responsible for compensation of any losses to the concerned party caused by unpredictable product flaw during direct or indirect using process.

■ Enviromental protection item

For your own health and that of others ,Please do all the waste materials from the actuator in a proper way on the basis of the requirements of the local enviromental protection and occupational health.

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1 Overview

1.1 Character

M03/04 series intelligent electric actuator is build-in servo controller, the execution unit instrument with output angle stroke. Mainly used to rotation regulating mechanism such as control butterfly valve, globe valve, plug valve and damper etc. and realize automatic control of process. Widely apply to industry pipeline fluid control system such as electric power, metallurgy, petrification, light industry and sewage treatment etc..

It receives 4~20mAd.c. signal of the upper control unit or control of passive switch signal, output 0~90° corner and corresponding torque, drive opening or closing of rotary regulating mechanism. It has advantages of small cubage, light weight, strong function, convenient operation, tighten structure, stable operation, high precision, flexible reaction etc..

1.2 Types and Specifications

Table 1

Model	Output torque (Nm)	Stroke time (s/90 °)	Max.shaft diameter (mm)	Motor power(W)	Rated current(A)		Handwheel turns (r)	Weight (Kg)
					220V	380V		
M0□11-□	100	28	φ22	40	0.9	0.3	11	21
M0□21-□	200	28	φ22	40	0.9	0.3	11	21
M0□30-□	300	34	φ35	60	1	0.6	13.5	30.5
M0□60-□	600	34	φ35	90	1.7	0.6	13.5	31.5

Types and specifications see table 1.

Model explanation: The first □ in model means control signal, there are 3 and 4 options, 3 means passive digital control, 4 means 4~20mAd.c. analog signal control. Second □ means power voltage, there are S and vacancy options, S means 220V, 50Hz single-phase power supply, vacancy is 380V, 50Hz three-phase power supply. Additionally c means switch mode with 4mA~20mA. Middle two digits mean output torque etc., see table 1.

1.3 Main technical parameters

1. Input signal: **M03 series:** Three active 24Vd.c. or passive switch signal, that is opening operation, closing operation and stop operation. High level or connection is valid, high level 18-30V, low level -2V~+2V. Digital min. lasting pulse width is 50ms. Operation mode can be inching or self-holding mode.
M04 series: Except receiving same digital input signal with M03 series, it also receives 4~20mAd.c. analog signal control.
2. Output signal: a. Passive switch, four: there are trouble alarm, remote/local working condition, full-open of valve position, full-close of valve position. It's connection with output and it's breaking without output. Capacity: 220V, 3Aa.c..
b. Optional analog signal output: 4~20mAd.c., load capacity 0~750Ω.

3. Orientation precision: $\pm 1.5\%$ F.S.;
4. Dead zone: $(0.5\% \sim 5\%)$ F.S.;
5. Motor working mode: S4;
6. Power supply: three-phase $380V \pm 10\%$, $50Hz \pm 1\%$ or single-phase $220V \pm 10\%$ $50Hz \pm 1\%$; harmonic content: less than 5%;
7. Environmental condition :
 Environmental temperature: $-25^{\circ}\text{C} \sim +70^{\circ}\text{C}$;
 Relative humidity: No more than 95%;
 Atmosphere pressure: $86\text{kPa} \sim 106\text{kPa}$;
 No corrosive medium and flammable substance in environmental air.

2. Structure features and operation principle

2.1 Overall structure and operation principle

Operation principle: Drive skew wheel via motor, the meshing of skew wheel and clutch drive the transmission of worm and second stage skew wheel, finally finish the external transmission output.

Basic characteristic: Output is part turn mode, the structure is tighten and weight is light.

Cover: Excellent aluminum alloy, light weight and high intension. Painting outside and anti-erosion is strong.

Motor: Adopt sensitive motor, high torque and low inertia and build-in overheating protector to protect the damage of overheating.

Manual units clutch system: Put the clutch handle, do manual operation by handwheel arm. After loosen clutch handle, clutch reset to electric position automatically. Electric and manual operations are sole.

Stroke switch: It is used to limit the operation range of actuator, simple regulating units can set the position of stroke switch accurately and conveniently.

Position self-lock: With self-lock function, no need to use motor or other stop way.

Position indicator: Position indicator installed on the output center shaft, synchronized with output, you can observe the movement position directly.

Connection and installation: Output installation flange dimension should according to ISO5211 standard, driving sleeve can disassemble and process according to requirement, strong adaptability. The actuator can be installed uprightly or horizontally.

Wiring terminal: Collocation is compact and reasonable, big terminal pressure, shockproof and stable wiring.

2.2 Operation principle of electrical control unit

Operation principle of electrical control unit see fig 1, regard MPU microprocessor as core, receive three control digital input and drive opening or closing of valve via rotation of solid switch driving motor. Only one is valid when three control input switches are at the same time. When there are two or three valid at the same time,

please regard as invalid order. Valve is sampling via high-reliable .conductive plastics potentiometer and transform to digital signal via A/D, the operation direction of motor is determined by control signal and current valve position. After reaching appointed valve position, output corresponding digital output contact signal. Stroke switch restrict the rotation limit position of output shaft, torque switch restrict output torque. When reach or exceed setting position or torque, motor current is cut off to protect overload and product.

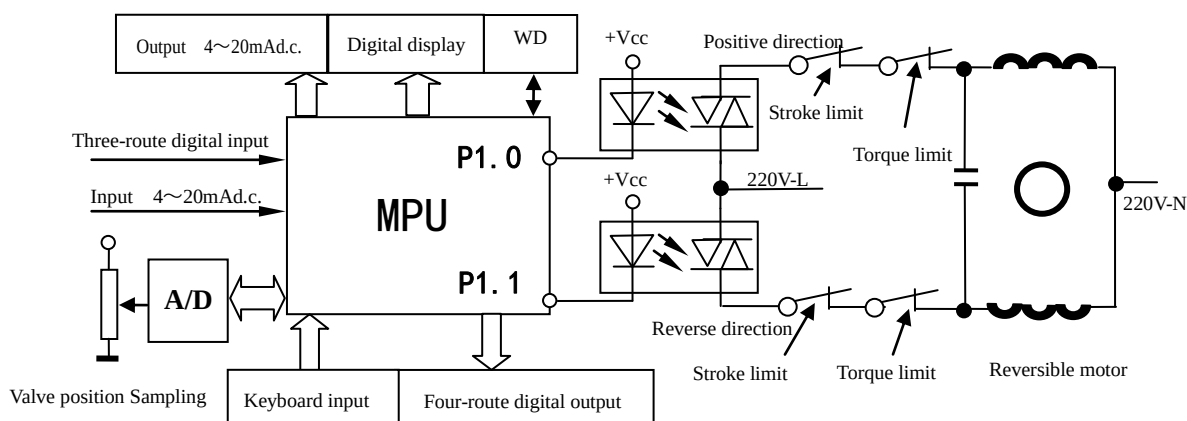


Fig 1 Electrical control principle

3. Installation and external wiring

3.1 Outline dimension of direct connection type

Outline dimension of electric actuator with direct connection type see fig 2:

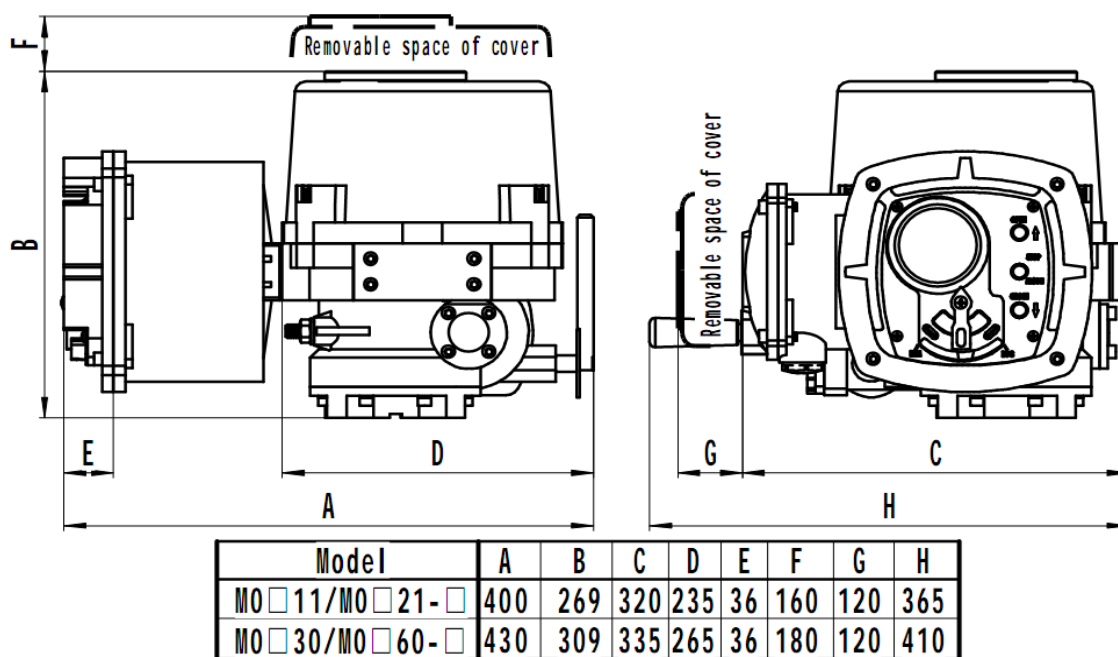
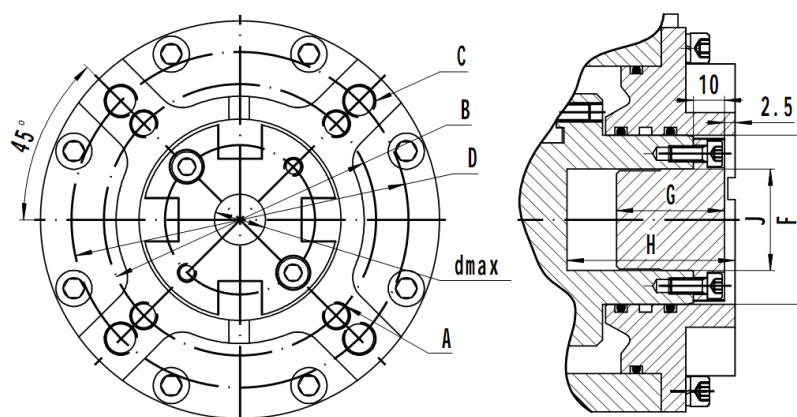


Fig 2 Outline dimension of direct connection type

3.2 Dimension of connection flange

Connection flange: Flange is according to ISO5211 standard, meet the connection of global valve or butterfly valve, based on the torque requirement of actuator transmission, standard F07~F12 of the combined flange see fig 3. The output shaft joint can be disassembled(M5 six angle screws), the center can be processed needed bore according to connection dimension of valve. If user doesn't supply needed dimension, user should process connection bore himself. Max. dimension of center bore shouldn't exceed d_{max} in the table.

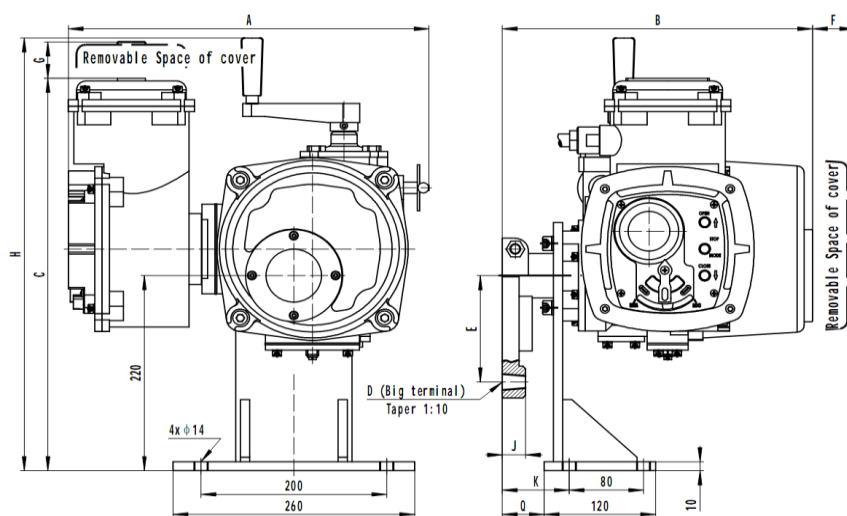


Model	A	B	C	D	F	G	H	J	d_{max}
M0□11/M0□21□	4×M8	Φ70(F07)	4×M10	Φ102(F10)	Φ55	35	41	Φ32	Φ22
M0□30/M0□60□	4×M10	Φ102(F10)	4×M12	Φ125(F12)	Φ75	41	55	Φ47	Φ35

Fig 3 Dimension of connection flange

3.3 Outline dimension of lever type

Outline dimension of electric actuator with direct connection mode. see fig 2.:



Model	A	B	C	D	E	F	G	H	J	K	Q
M0□11/M0□21-d□	400	335	420	Φ18H7	120	160	120	488	20	72	45
M0□30/M0□60-d□	430	375	425	Φ22H7	150	180	120	505	22	82	55

Fig 4 Outline dimension of lever mode

3.4 External wiring of actuator

(1) Wire diameter choice

Power cord: $1.0 \sim 1.5\text{mm}^2$ hard wire or soft wire. Signal line: $0.25 \sim 1.0\text{mm}^2$ hard wire or soft wire.

Installation screw thread dimension of cable inlet sleeve is $2\text{-M}25 \times 1.5$, recommended outer diameter of cable is 12mm .

During transportation the threaded hole of cable sealing entry is blocked by screw plug. The protection degree is guaranteed by cable entry sealing after spot installation. To reach the specified protection degree, strongly recommended use the M25*1.5 type metal water-proof cable joint and use the suitable cables of the external diameter, tight the screw after installation to guarantee the specified protection degree. Do not upturn the inlet wire mouth.



Fig5 metal water-proof cable joint

(2) External wiring

External wiring terminal of actuator see fig 6, recommending basic wiring see fig 7, system wiring see fig 8.

Signal terminal

Terminal No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	+	-	+	-	Analog	Open	Close	Stop	COM	24V+	Trouble alarm		Remote/Local		Full-open		Full-close	
	Modulating input		Feedback output		Digital input positive terminal			Common terminal	24V+	Digital output								

Power terminal

Terminal No.	L1	L2	L3	
380V Power supply	L1	L2	L3	Protective earthing
220V Power supply	N	L	Unused	

Fig 6 External wiring

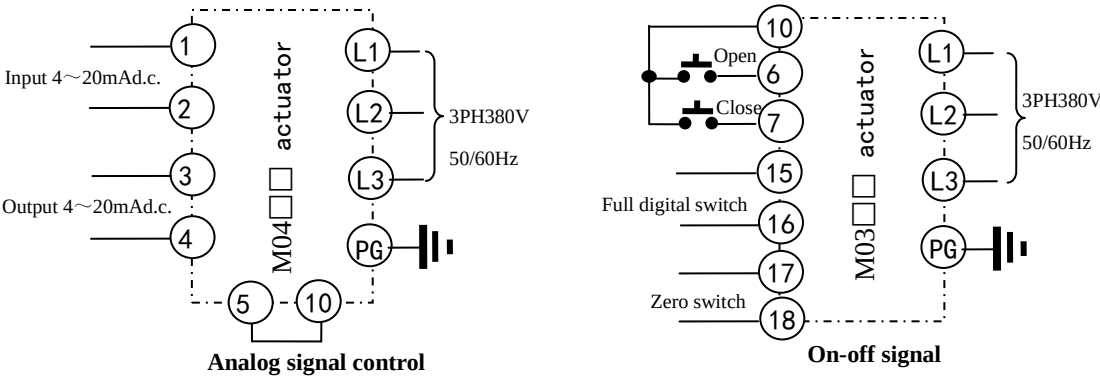


Fig 7 Recommending basic wiring

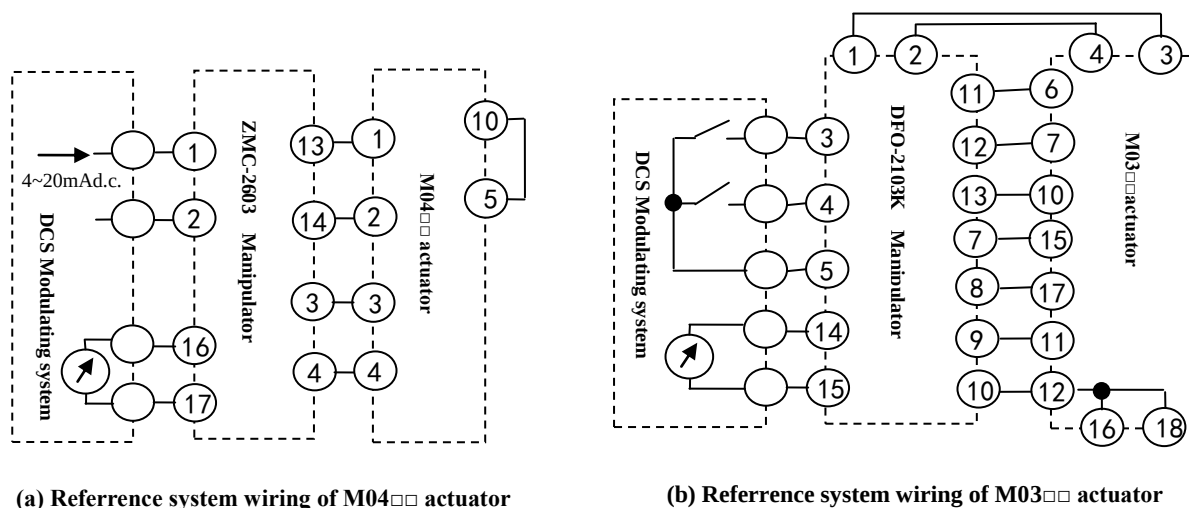


Fig 8 System wiring for reference

3.5 Adjustment of limit switch and torque switch

circuit principle see fig 1, usually the switch is open, once the switch cut off the motor current in corresponding direction, the motor will stop operating.

(1) Adjustment of limit switch:

The cam on driving shaft of potentiometer is used to drive limit switch, it can limit the rotation range of output shaft via adjusting cam, see fig 9.



Fig 9 Adjustment of torque switch

(2) Adjustment of torque switch:

Unless the special requirements from the users, the standard actuator in our company has no over torque devices. In usual situation torque have been set according to contract requirement when leaving factory. If not necessary, please do not readjust. If adjustment is needed, please be careful. Torque should be set 1.2 times than rated value. Cut-off torque is less if cam is more approaching micro switch, cut-off torque is more if cam is more far away from micro switch. Reducing cut-off torque will cause abnormal startup, exceeding range will burn motor or damage valve and actuator. See fig 10 to adjust torque.

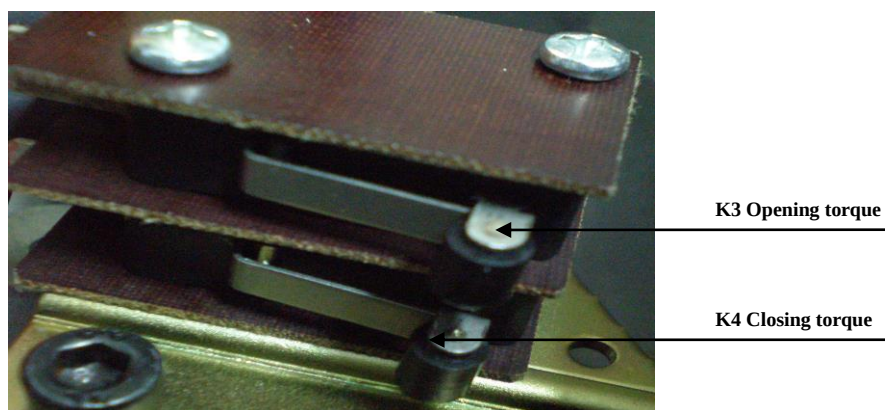


Fig 10 Adjustment of torque switch

4. Parameter set and operation

4.1 Definition of operation key-press

The meanings of control panel see fig 11.

- ① Digital display window
- ② Open (increase) key-Press
- ③ Stop (mode, setup, confirm key-press)
- ④ Close (decrease) key-press
- ⑤ Turn select function key in remote or local

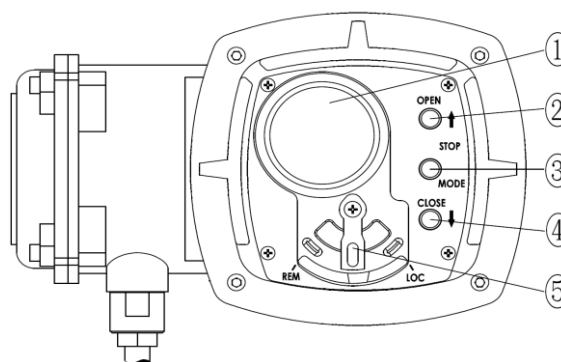


Fig 11 Diagram of control panel

The working condition is confirmed by conversion button, it's divided into (LOC), (REM) and (O/S) mode. Local working condition can manual operate valve and can also enter into setup. Remote working condition is divided into remote on-off control and remote analog signal 4~20mA d.c control. And it's determined by discrete input 1. In remote on-off control condition, open or close of actuator is operated by discrete input 2 and 3.

Parameter setup and revision is done by OPEN、MODE、CLOSE button of panel. If open electric cover, SK、MK、XK button on controller PCB also can realize. The mode selection is realized by jumper thread on PCB. There are three positions for jumper thread: JRE is remote, JOS is forbid, JLOC is local. Put to JLOC in setup and put jumper thread to JOS for installing electric cover.

The function description of OPEN、MODE、CLOSE (corresponding with adding key, mode key and reducing key):

MODE key: In working mode LOC, press MODE key for five seconds, setup mode can be entered. In setup mode inching turning MODE can orderly switch between menus, press MODE key can exit setup mode.

OPEN、CLOSE key: Operation is invalid in remote condition. Press OPEN, valve position in increasing and press CLOSE, valve position is decreasing in local condition. It is used for increasing or decreasing parameter in setup mode.

4.2. Regulation of display information

Parameter is shown in display and display see fig 12.

Left indicator shows remote, local, setup and alarm, four working modes. Digital tubes in upper line show the signal of valve opening, it also shows the menu or trouble alarm information in setup mode or failure. Digital tubes in lower line show modulating signal, it also shows the menu or trouble alarm information in setup mode or failure. When trouble appears, alarm indicator of display is ON and concerned trouble information need to scan in menu.

The display regulation of every working mode is following :

- a) Indicator is remote, local, setup and alarm
- b) Remote control (REM)
 - i. Remote indication display
 - ii. Upper line show feedback capacity, lower line show “STCH” in remote discrete control
 - iii. Upper line show feedback capacity, lower line show modulating capacity in remote adjustment control.
 - iv. If there is trouble to press increasing key, the failure information will be shown in lower lone. Press decreasing key to show software edition.
- c) Invalid control
 - i. Upper line show feedback capacity and lower line show “VOID”
 - ii. If there is trouble to press increasing key, the failure information will be shown in lower lone. Press decreasing key to show software edition.
- d) Local control (LOC)
 - i. Local indication displayed in local operation. Upper line shows feedback capacity and lower line shows “HAND” .
 - ii. Indication display is set in local operation, upper and lower line show parameter setup or code.

4.3 Menu setup

In local mode press MODE key for five second and enter main menu, main menu is shown on the digital tube of lower line with approximate English letter, total 9 main menus, the order and meanings see fig 13 and table 3. After entering into menu, next menu can be switched with inching turning MODE, use increasing or decreasing key to revise menu. After finishing revision, please switch to YES menu , press MODE key to exit and confirm present setup. If present setup should be given up, press MODE key in other menu and exit setup. Input 0、35、135 in CODE area and you can enter alarm information check, high-level setup and calibration menu separately. Trouble alarm information see table 4, high-level setup menu see table 5, calibration menu see table 6.

Setup of null position and full position

Null position and full position of actuator output shaft have been set out of factory, no need to set again after installation. If the regulating range of local adjusting device is not consistent with the setting range of output shaft for whole product or action way is not same, resetting can be done in menu.

When leaving factory actuator should according to valve position indicator, anticlockwise rotation is the increasing direction of valve position, if no change to the direction, please operate actuator to CLOSE position during installation and connect with mechanical zero of regulating device. If you need to change the direction of opening valve to be clockwise direction, operate actuator to OPEN position and connect with mechanical zero of regulating device.

Press mode key in local condition and enter into zero menu, drive rotation of output shaft via increasing or decreasing key, it stops when output shaft reach mechanical zero, enter into full-span setup menu with inching MODE, output shaft stop to required mechanical full-span via increasing or decreasing key, enter next menu with inching MODE key again. If some menu setup needn't change, no need to press increasing key or decreasing key. Until YES menu, press MODE key to confirm present setup and exit to local mode. In zero and full bit menu setup, digital tube of upper line shows AD conversion output value of current valve position sampling, usually between 200 to 3900, corner difference. When full bit is set and this difference is more than min. allowable value, display value of upper line will flash. Only min. difference value is satisfied, inching MODE key can switch to next menu.

Zero bit should be set around the terminal in mechanical rotation range of output shaft, but in small distance to mechanical limit stop, you can operate to terminal and withdraw to point. If sampling of upper line can change continuously, you can regard it as zero bit. If the function of output shaft after setup is changed, viz. increasing for clockwise direction, please change 4 and 5 wirings of internal wiring terminal to keep limit position switch consistent with original position.

Operate valve to CLOSE position in local mode, adjust closing stroke switch to make it just move, then operate valve to OPEN position, adjust opening stroke switch to make it just move.

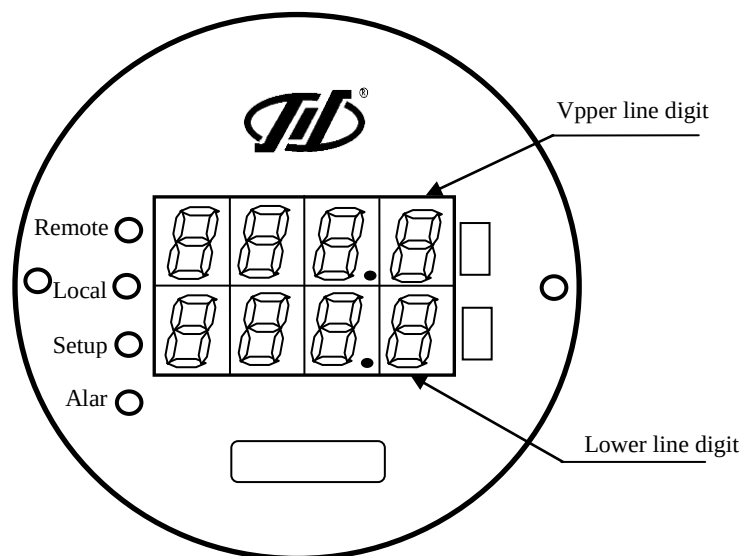


Fig 12 Display diagram

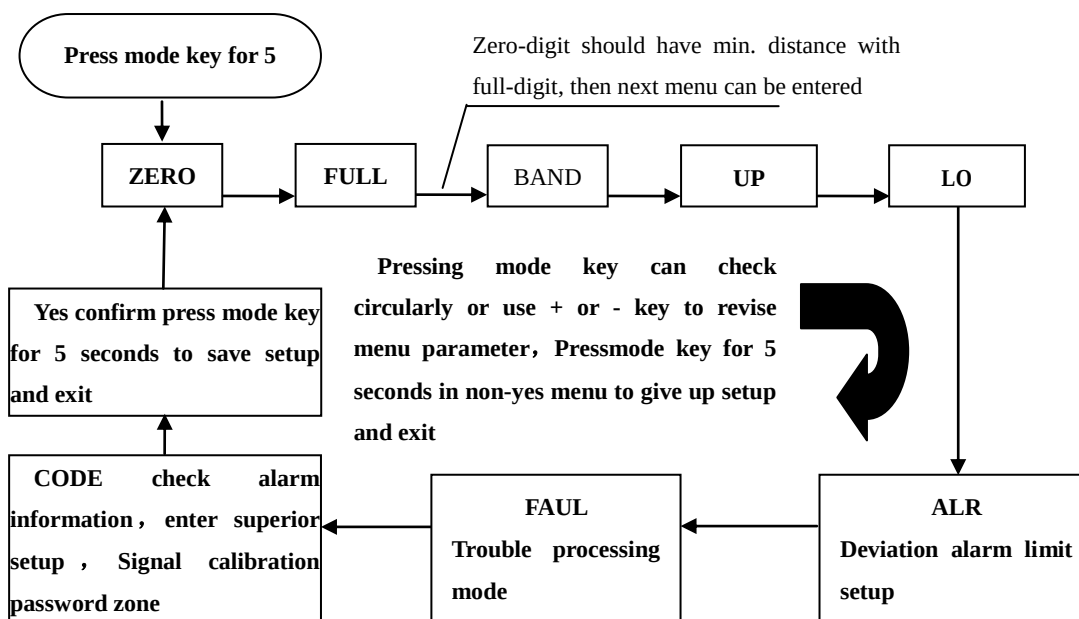


Fig 13 Main menu cycle diagram

Table 3 Main menu

Item	Menu display	Setup range	Description	Default	Description
1	ZERO		Set mechanical zero	Show present sampling of valve position	Output shaft rotate to needed mechanical zero or full bit via increasing or decreasing key. Sampling should change between 200 and 3900, otherwise turn slipping gearwheel which meshed with gearwheel of potentiometer to satisfy above condition. There is min. distance between zero
2	FULL		Set mechanical full		

					and full bit, when it is satisfied, sampling is flashing.
3	BAND	0.4%~5%	Dead zone	1.5%	Dead zone is less, orientation precision is more, but stability is going down.
4	UP	55%~100%	Upper limitation	100%	When valve reach upper or lower limit value, actuator will stop. The difference value between upper and lower limit should be more than 15% of full stroke.
5	LO	0%~45%	Lower limitation	0%	
6	ALR	5%~105%	Alarm limitation	105%	When the difference value between modulating signal and actual valve signal is more than this value, the operation of actuator should be bi-locked.
8	FAUL	Hold/on/off	Trouble processing	hold	Hold is holding, on is full open, off is full close.
10	CODE	0~255	Password	1	0 check alarm information, 35 enter high-level setup, 135 enter calibration menu.
11	YES		Confirm and exit		Press SD key to confirm present setup and back to local manual mode.

Table 4 Trouble alarm information

Lower display	Upper display	Description	Trouble reason and measure
Display present trouble order ER01~12	PC	Difference alarm	The difference value between input signal and feedback signal exceed allowable value
	FOFF	Feedback break off	AD adapter is defective
	FOVE	Feedback over limit	AD conversing benchmark is defective, sensing potentiometer is defective
	AOFF	Adjustment break off	Trouble in modulating signal and AD adapter is defective
	AOVE	Adjustment over limit	Trouble in modulating signal and AD adapter is defective
	CLIN	Closing limitation	Reach to closing limitation point
	OLIN	Opening limitation	Reach to opening limitation point
	CSTA	Closing stalling	Closing mechanism block or overload out of limitation, motor is defective
	OSTA	Opening stalling	Closing mechanism block or overload out of limitation, motor is defective
	EEP	E ² PROM is wrong	Reset parameter or return for repairment
	ADC	Invalid AD read-write	AD adapter is defective

Table 5 High-level setup

Alarm: Non-professional technician better not enter this menu

Item	Menu display	Setting range	Setting content	Default	Description
1	STAL	2 s~20s	Installation time	5 s	Judge the stalling time of system

2	INHO	Step/Hold	Inching self-holding	Step	Characteristic of discrete input: Step is inching, Hold is holding
3	SOFT		Software revision no.		

Table 6 Calibration menu

Alarm: Non-professional technician better not enter this menu.

Item	Menu display	Calibration content	Description
1	AD_Z	Zero bit of calibration signal	Give modulating signal 0%, it's possible that sampling value has error, jog control SX key and show 0%.
2	AD_F	Full bit of modulating signal	Give modulating signal 100%, it's possible that sampling value has error, jog control SX key and show 100%.
3	FE_Z	Zero bit of feedback signal	Test actual value of feedback output, calibrate to 4mA via SX or XX key.
4	FE_F	Full bit of feedback signal	Test actual value of feedback output, calibrate to 20mA via SX or XX key.

4.4 Acceptance test after installation and adjustment

Test the following points after installation and adjustment:

- 1、 Installation fastness of actuator: Shake bracket and actuator by hand. Check the screws on cover with screwdriver, check the fastness of arm and joints.
- 2、 The correctness of actuator: Put power and signal on installed actuator, observe if the operation of actuator is according to presetting way and valve closing or opening reached requirements.

5. Usage and operation

Check installation reliability again according to 4.5 before usage and test if modulating signal within input range. Power voltage should be consistent with nameplate.

Operator should receive operation training. Operate actuator with certificates.

Operator should wear special protection gloves to avoid the accident caused by heating of metal parts.

Please wash gearwheel and housing with coal oil during exchanging grease. Add stipulated grease after it is dry. Please wipe all around to avoid accident.

Operator should observe operation rules. Cut off signal and then power, open cover to repair.

Operator should execute regulations, record the operation, trouble and disposal.

Operation step:

1. For local operation please switch condition knob to "LOC" position. In inching mode press OPEN, valve position increase towards opening and operate in reverse direction. Press CLOSE, valve position operate in opening decreasing direction. In self-holding mode press OPEN, valve increase towards opening and operate in reverse direction until full-open, then stop. Press CLOSE, valve position operate in opening

decreasing direction and stop until full-close. Press MODE/STOP key during operation and it will stop immediately. Current valve position value will be shown on the upper display.

2. For remote operation please switch condition knob to “REM” position, opening or closing of valve is controlled by 4~20mA d.c. signal from the upper control unit or digital input signal.
3. Menu setup refer to this instruction manual 4.3.
4. For manual operation please switch condition knob to “LOC”, after confirm the motor doesn't operate, turn manual shift lever clockwise, then shake manual arm. It's forbidden to press key in handwheel operation! When operation is over, manual shift lever will back to electric position automatically.
5. Emergency disposal: In emergency cut off signal and power, then operate by handwheel.

6. Trouble analyse and trouble shooting

Electric parts of actuator has trouble analysis function. Some reasons of trouble and solutions can be seen according to alarm information, see fig 4. Common trouble analysis can be done according to fig 14.

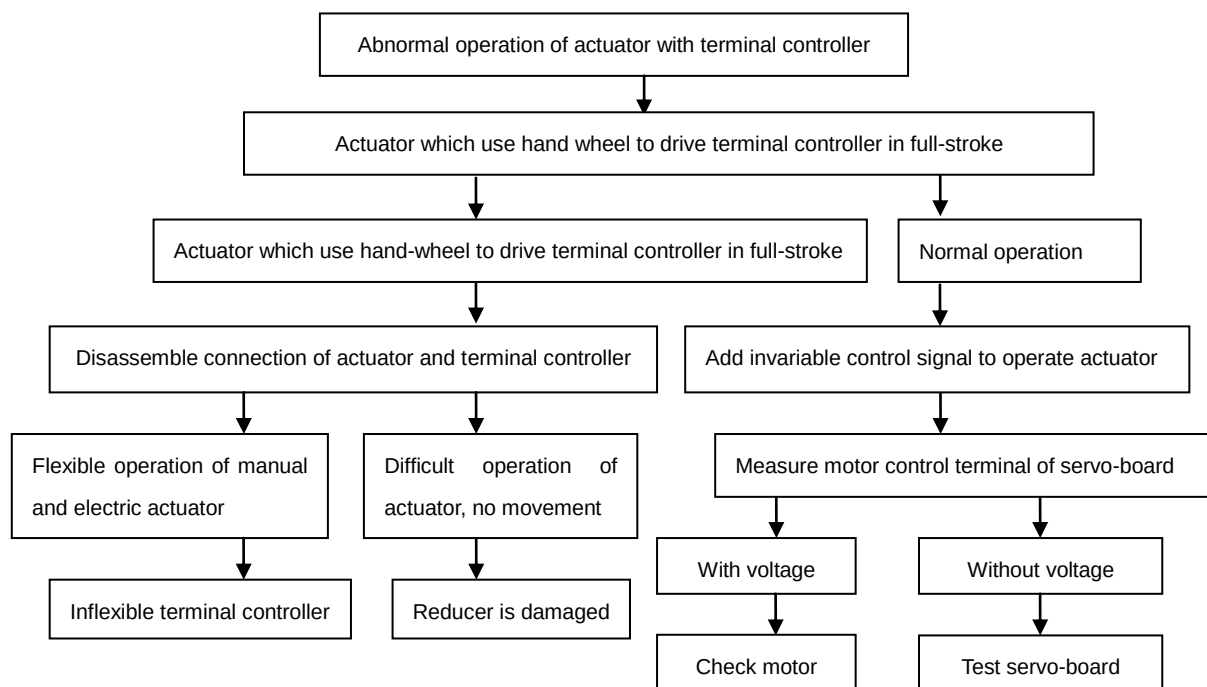


Fig 14 Trouble diagnosis flow

7. Safeguard attentions and trouble disposal

7.1 Safeguard attentions

There is no flammable and explosive air or corrosive air in circumstance.

There is excellent grounding for power supply, grounding resistance $\leq 2\Omega$.

Hand wheel operation should switch to “LOC” condition, shake hand wheel after confirm motor doesn't operate, it's forbidden to press key in hand wheel operation to avoid injuring.

7.2 Disposal process and method in trouble

When no operation or abnormal operation of actuator or terminal controller, please cut off signal and power first, then check actuator according to fig 14.

8. Maintenance

8.1 Daily maintenance and calibration

Check appearance by eyes.

Check the tightness of screws.

Check if figure on display window is accordant with control signal input.

Observe if display have alarm indication and check reason.

Observe if valve position display is consistent with setting mechanical position and calibrate periodically.

Operation of reducer mechanical structure depends on the grease (common grease: Great Wall lithium base grease no. 3 Q/SH303 357-2004. Low temperature grease: extreme pressure lithium base grease no.2), suggest to exchange grease interval two or three years to prolong the lifetime of actuator.

9. Transportation and storage

The temperature of transportation and storage is $-30^{\circ}\text{C}\sim+50^{\circ}\text{C}$. To avoid shortening using period, storage temperature shouldn't exceed 40°C .

Under no special package situation, please place in dry room to avoid condensation.

Transportation or storage in humid and corrosive atmosphere, suitable package and desiccant are needed. Please check if the desiccant is valid periodically.

10. Unpacking and check

Every actuator is checked strictly before leaving factory. User should ensure unpacking direction is accordant with the indication on package. Then unpack box to check the following:

Check if actuator is damaged during transportation.

Check if the mode is same with data on package, goods inside are accordant with packing list.

编制：朱大邦

校对：

苏常东

审核：

标准化：

批准：

2013 年 7 月

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