

IMC Series Intelligent Electric Multi-turn Valve Actuator

IMC Series Explosion-proof Type of Intelligent Multi-turn Valve Actuator



Content

Part I Summary of the Intelligent Electric Actuator and Setting

1. Summary.....	1
2. Primary technical parameters.....	2
3. Primary protective function.....	3
4. Setting.....	3
5. Lubrication and maintenance.....	4
6. Electric wiring.....	4
7. Note.....	5

Part II Setting and Debugging for the Intelligent Electric Actuator

1. Operation methods of electric actuator.....	6
2. Status display instruction.....	8
3. Debugging for the electric actuator.....	11
4. Setting for the actuator's function and parameter.....	12
5. Methods of control wiring.....	20
6. Referenced schematic diagram.....	21

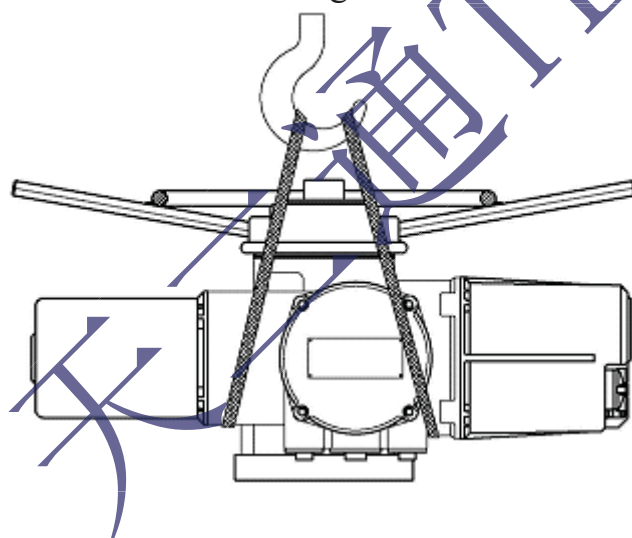
Part III Additional Information for IMC Explosion-proof Type of Intelligent Electric Valve Actuator

1. Summary.....	22
2. Note for usage and maintenance.....	22
3. Electric wiring and notes: refer to the related content in Part I.....	22
4. Inlet wire port of the wiring box.....	22

Part I Summary of the Intelligent Electric Actuator and Setting

Safety instructions

- The work refer to transporting, assembling, mounting, commissioning, maintenance and repairing must be done by qualified persons.
- The qualified persons who are referred in the safety instructions are all trained and experience. They are able to complete the required tasks follow the safety technical standard, and can find and avoid potential risk. They must be very familiar with the warning label on the equipment and operating instructions, and work according with the Operation Manual.
- No working under the actuator when it is mounted higher place.
- After mounting the actuator to the valve, then the user should make sure protecting the naked stem.
- The user should be according the parameters of nameplate to choose the overcurrent protection before using the actuator.
- Before slinging products, please using the rope surrounding the controlling cover and motor, and the crane can sling more than 0.5 ton



1. Summary

IMC series intelligent multi-turn electric valve actuator (“Electric actuator” is for short in the followings) is used to operate gate valve, globe valve, diaphragm valve and other similar multi-turn valves which make linear movement. Also, IMC series electric actuator can be combined with reducers, which make a combined group of multi-turn or quarter-turn electric actuator.

This 《Operation Manual》 is applied for IMC basic type and IMC Explosion-proof type. If there are special functions, then additional information is provided.

- Main features
 - a. Control buttons are non-transfixion structure, which improves the product’s protective performance and explosion-proof grade.
 - b. Absolute valve position value encoder
 - c. The operating torque is displayed in real-time and it can be set in the range from 50% to 100%.
 - d. Valve position can be displayed when power is off.
 - e. LCD Display with Chinese/English versions.

- f. Separate double sealing wiring box.
- g. Parameters can be set up by infrared setter or control buttons.
- h. Automatically phase sequence rectification and protection for phase loss. (Actuator with single phase motor does not own this function.)

- Safety problem

Electric mounting, maintenance and usage of electric actuator should comply with the national's related laws and regulations.

Forbid to use electric conduction and thermal conductor to connect electric actuator in some explosive hazardous areas. When maintenance or repair is required, please first cut off the power and follow the Operation Manual.

- Warning

Temperature of motor: the surface temperature of the motor can be up to 135°C.

If user sets ESD as the priority against motor over-heated protection, any other certificate in explosive area is invalidated in ESD mode

- Storage

Electric actuator should be kept in a dry condition.

Don't need to open any electric box cover while debugging the electric actuator. If user opens electric box cover and this influence the actuator's performance, our Company will not bear any responsibility for this.

Every unit of electric actuator has been totally examined before delivery. If it is set, debugged properly and sealed in right ways, then the actuator can be used for several years without any malfunction.

2. Primary technical parameters

The product complies with GB/T 28270 《Intelligent Valve Electric Actuator》.

2.1 Power supply: 380V 50Hz three-phase three-wire system, sine AC;

Special power supply (power supply is assured when user places order; please refer to the nameplate for power supply)

2.2 Control signal: dry contact or active contact: 24VDC; each contact is up to 10mA; pulse width is larger than and equal to 100ms; remote positioning control signal: 4~20mA ($R_i \leq 250\Omega$)

2.3 Output signal: valve position signal 4~20mA ($R_o \leq 600\Omega$);

Dry contact signal for status: 250VAC/0.5A, 24VDC/3A

2.4 System configuration:

a. Local control switching value and remote control switching value

b. Valve position output: 4-20mA

c. One monitoring relay; 8 configurable status relays

d. 4-20mA remote positioning control or field bus control(Profibus DP or Modbus are also provided if place order.)

2.5 Enclosure protection grade: IP67 (IP68 can be provided if place order)

2.6 Working ambient temperature: -20°C ~ +70°C (if user's requirement is not in this range, please notify when ordering.)

2.7 Ambient relative humidity: be up to 90% (at 25°C)

2.8 Altitude: be up to 1000m (if user's requirement is not in this range, please notify when ordering.)

2.9 Working system: S2 working system for on-off type; S4 or S5 for adjusting type

2.10 Working environment: without strong corrosive medium and explosive mixed gas (please refer to Part III for explosive-proof products)

2.11 Setting methods: local magnetic knob or infrared setter

2.12 Repeated deviation of stroke position: $\leq \pm 5^\circ$

2.13 Repeated precision of torque: actuator's torque $\leq 100\text{N}\cdot\text{m}$

repeated precision:±10% ;

actuator's torque 100~1200N.m

repeated precision≤±7%;

actuator's torque >1200N.m

repeated precision ≤±5%

3. Primary protection function

Rated torque protection: when the motor is locked-rotor (valve position is smaller than 1% in 7 seconds), the operation direction is forbidden. Handwheel operation and contrary direction operation can remove the protection.

Phase-loss protection: three-phase power supply is of phase loss, and then the actuator is forbidden to be operated.

Switching protection for operating direction: reversed direction protection has been set up in order to protect electric actuator and valve. The operating actuator will stop working at the time when it received an order of switching protection for operating direction. The actuator will go to reversed direction during the protection time (at least 0.5s).

Torque protection*: When the set torque value is exceeded in the operating direction, the operating will be prohibited. Release such protection by reverse operating or operating with handwheel.

Over-heated protection*: the motor is working successfully for a long time or, the motor is getting over-heated due to other reasons; then, The operating will be prohibited when the embedded temperature switch in the motor trips until it is reset.

Over-current protection*: The motor will be prohibited to run when it is subjected to over current for long as this indicates some faults existing with the motor.

Notice (Items with *): ESD (emergency shutdown) should be given priority when it meets these protection functions with “*”. Please refer to ESD for more details.

4. Setting up

Warning

- The actuator should be placed appropriately before actuator's shaft sleeve meshes with valve stem or, before actuator connects with flange.
- For the actuators coupled with valve, please sling the valve rather than the actuator while handling or connecting with pipes.

◎ Preparation before setting

* Please check if the size of the actuator's flange is suitable with the valve's flange size so as to make sure the two can be connected properly.

* Please clean and wash up valve stem and apply lubricating grease.

* For those rising stem valve, the protrusion length of valve stem is smaller than the height of inner bore of handwheel cover of the actuator.

* Please pay attention to the actuator's position on the valve so as to leave some space for actuator debugging and maintenance.

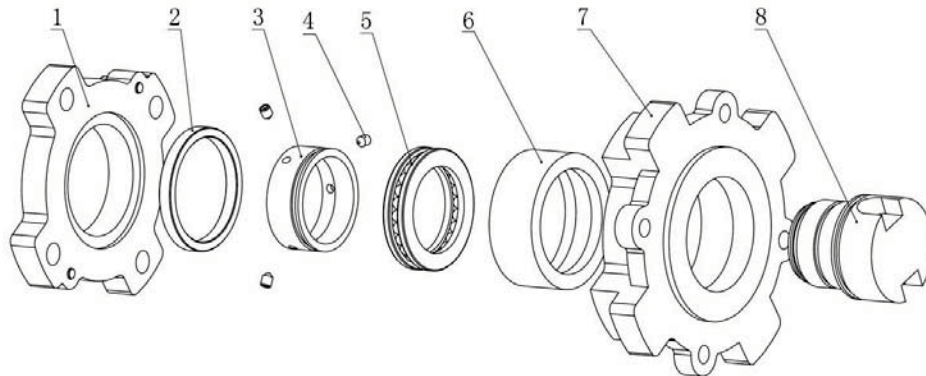
◎ Setting

* Jaw-style connection(shaft key): make the actuator in manual-operation status, and connect the actuator with valve's flange so as to make the valve stem into the driving shaft sleeve or to make the driving shaft sleeve's jaw to mesh with valve's jaw(or to make inner bore of the driving shaft sleeve mesh with valve's shaft key). Turn the handwheel in the opening direction to make the actuator close to valve's flange, and then rotate handwheel for two rounds. Last, mount the fastening screw firmly.

* Thread-style connection: make the actuator in manual-operation status; connect the actuator with valve's flange; the thread hole of the driving shaft sleeve should face up to valve stem; turn the handwheel in the opening direction to make the driving shaft sleeve correctly mount against the valve stem through thread; turn the handwheel to make the actuator close to valve's flange, and then rotate handwheel for two

rounds. Last, mount the fastening screw firmly.

© If user process the inner bore of the driving shaft sleeve, user should first remove driving shaft sleeve before process it. Reassemble after processing, and then begin to mount according to the steps above.(The detailed steps of disassembly are shown in Fig.1)



1.flange base 2.connecting shaft sleeve C 3. connecting shaft sleeve B 4.set screw(three)
5.thrust bearing 6. connecting shaft sleeve A 7.flange plate 8.drive bearing

Fig.1

5. Lubricating and maintenance

5.1 After the product maintenance, please take care of the lubricating grease's oxidability, heat resistance, anti-rust property, mechanical stability, ... to keep the product's in a good lubricating property with a good performance of transmission efficiency(specialized lubricating grease is recommended).

5.2 Inject lubricating grease without any foreign matter and then seal the injecting parts.

5.3 Regular maintenance for actuator should include:

- Fasten the bolt set between the actuator and the valve every six-operation months.
- Keep the valve stem and driving shaft sleeve clean and lubricated.
- If the valve is seldom operated, please actuate periodically (usually three or four months at intervals).
- When the power is off, the bar of power is left only one case and user need to replace battery.

6. Electric wiring

Warning:

- Make sure all the power is off before remove the actuator's wiring box shield case.
- Check if the supply power value is the same as the one showed on the actuator's nameplate.

6.1 Ground wire connection: there is a M8 thread hole, which is with a grounding signboard, near the hand shank on the actuator. This is used to connect external grounding wire; the internal grounding terminal is set on the wiring terminal (wiring terminal marked by grounding sign).

6.2 Open the "Wiring box cover" and back out the seal lock.

Note: When dismantle the wiring box and seal lock, do not damage the o-ring, locating spigot and sealing surface.

6.3 Cable entry: to select a proper cable outlet device

according to the cable's material and the thread hole's dimension so as to make sure the cable is fit with the device. Sealing work should be done to make sure the product's enclosure protection degree.

In the explosive hazardous area, explosion-proof -verification inlet wire joint should be applied in the

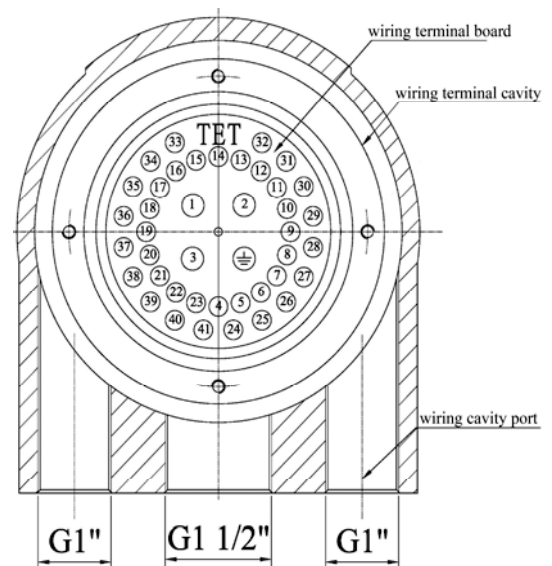


Fig.2

cable entry. The inlet wire joint should be fastened, water-proof. Unused cable entry should be sealed by using steel plug.

There are three inlet ports on the product's wiring box. Two of them are G1" holes which are for the power cable and control cable; and one inlet port is G1 1/2" for spare use (shown in Fig.2).

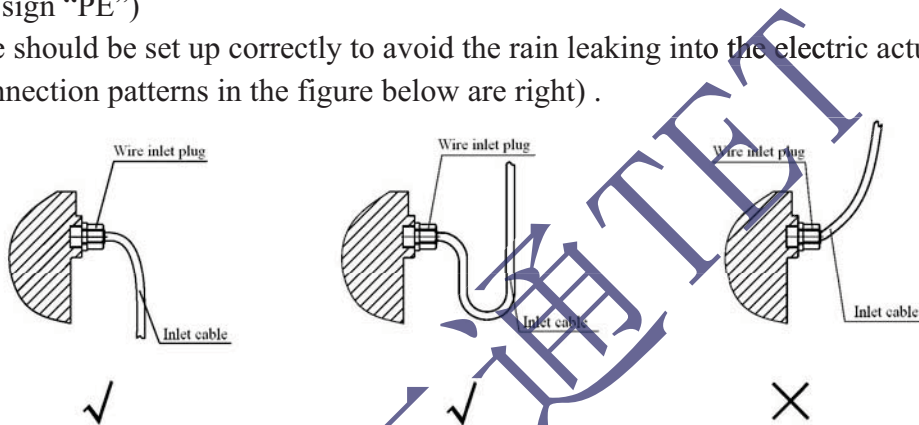
6.4 Apply specialized electric instrument to connect "lug plate" with cable's core wires.

6.5 Make a reference to the schematic diagram in the attachment; connect the core wires which are with "lug plate" with corresponding terminals, according to the No. on the diagram. The lug plate should bent up. No.1, No.2, No.3 terminals are used to connect power cable; M5 bolt; No.4-No.41 terminals are used for remote control and feedback signal, M4bolt; users could select lug plate according to the bolt's dimension.

6.6 Mount "wiring box cover"; keep sure the o-ring and its port part are clean before mounting. User should fasten the bolts to keep a good sealing property.

Warning:

- User should apply shield multi-core wires, shielding layer should be single-end earthed. Must make sure the input signal control cable, output signal control cable and power cable are separately laid in grooves.
- Please make sure the PE terminal on the actuator case is safely connected.(which with a ground sign "PE")
- Cable should be set up correctly to avoid the rain leaking into the electric actuator (the first two connection patterns in the figure below are right) .



7. Notice

7.1 Protect the display window glass and local control switch button from impact.

7.2 The cap of the electric actuator should be fastened. When it is removed due to maintenance, it should be capped by something in case of foreign matters go into it.

7.3 Forbid to mount or open wiring box in a bad weather outside.

7.4 Cut off power before open the wiring box case.

7.5 The selection of motor's power should comply with actuator's output torque and speed. User cannot change at one's will.

7.6 Each part of the actuator should be fastened firmly.

7.7 Actuator should be reset before it will mount against valve.

7.8 In manual operation mode, it is forbidden to add a case or insert a stick to turn the handwheel.

7.9 When the valve is seldom used, a system of regular inspection should be established if permitted by pipeline system.

7.10 Unused electric actuator should be placed in dry environment without corrosive material.

7.11 The design service life of actuator is 8000 times.

7.12 According to the regulations on the recycling and treatment of waste electrical and electronic products, please comply with the relevant national regulations and properly dispose of waste products. Or call our after-sales service department for recycling. Tel: 022-26740033.

7.13 Service commitment: When the equipment breaks down, please contact the technical responsible person appointed by our company at first, and we will provide processing opinions and technical support within 24 hours. If necessary, we will send technical personnel to the user site within 72 hours in the city, 3-5 days reaches the user site according to the distance outside the city until the problem is solved.

Complaints Tel: 022-26740033; Hotline: 022-26740033.

Part II Setting and Debugging for the Intelligent Electric Actuator

1. Operation methods of electric actuator

1.1 Local operation

1.1.1 Electric operation

Shown in Fig.3, select button is on the left corner and operation button is on the right side. Select button: Local-Stop-Remote; turn the operation button clockwise is to close the valve and turn the operation button counterclockwise is to open the valve. Turn the select button to 'Local', and then counterclockwise turn the operation button, so the actuator will working in the direction of opening the valve. Turn the operation button clockwise and the actuator will work in the direction of closing the valve. Unclench the button and the actuator will stop working.

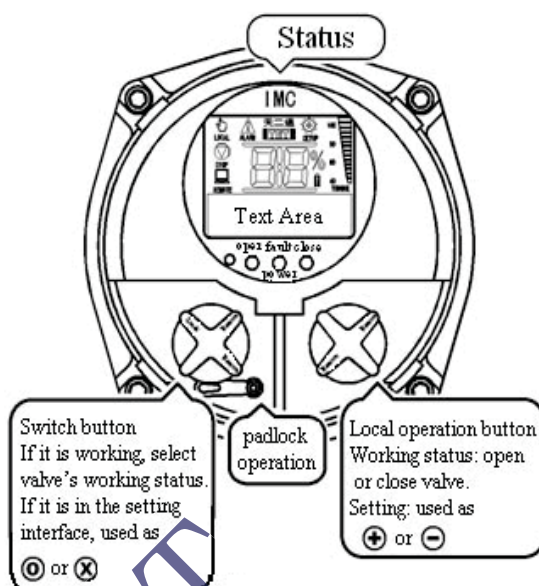


Fig.3

1.1.2 Manual operation

Turn the select button to “Stop” before start manual operation. Push the switch handle to manual operation according to the arrow (turn the handwheel slowly when push the switch handle so as to make the clutch engage with the gear). At that time, handwheel manual operation is achieved.

Manual/Electric switch operation applies semi-auto electric design. The clutch will automatically switch into electric operation at the time when the motor is rotating.

1.2 Remote operation (see Fig.4)

1.2.1 Basic performance of the setter:

Ambient temperature: $-20^{\circ}\text{C} \sim +60^{\circ}\text{C}$

Explosion-proof grade: Ex ib II C T6

Effective distance for usage: be shorter than 1 meter

1.2.2 Change of remote setter's battery

Please check if the remote setter has run out of the battery before usage. Push any key, if battery has full power, the red indicator is on; if the battery is out of power, red indicator is off or flash lightly, then user needs to change the battery.

Note: Forbid to open case box! Please change the battery in a safety place.

1.3 Function of remote setter and buttons

Setup and operation can be achieved both by remote setter and buttons on the actuator.

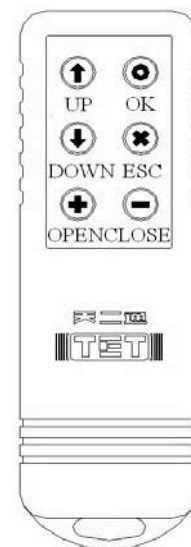


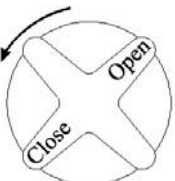


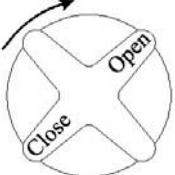

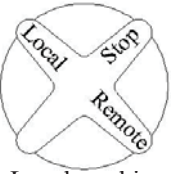
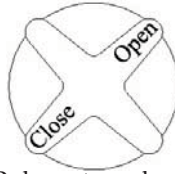




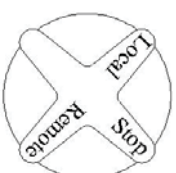
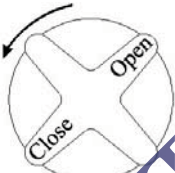


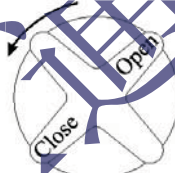


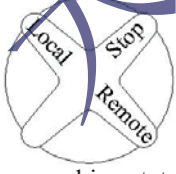
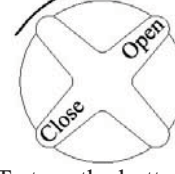


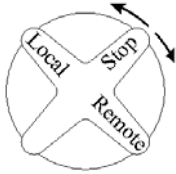

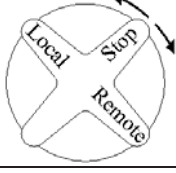
Fig.4

1.3.1 Operation

Keys on remote setter	Schematic plot of knob operation	Function
Plus/Open:  (Local working)	 Local working  Turn counterclockwise	In the opening direction

Minus/Close:  (Local working)	  Local working Turn counterclockwise	In the closing direction
Esc/Stop:  (Local working)	  Local working Release to make it to the former position	Stop working

1.3.2 Parameters Setup

Keys on remote setter	Schematic plot of knob operation	Function
 or  (Stop working status)	  Stop working status To turn the button counterclockwise for 5 seconds and then restore it	Set up the system's parameters
Down: 	  Stop working status To turn the button counterclockwise and restore; if keep the button unmoved, this function will continue	In the setting interface, to see the next function
Plus/Open: 		In the setting interface, to add one more value
Up: 	  Stop working status To turn the button clockwise and restore; if keep the button unmoved, this function will continue	In the setting interface, to see the previous function
Minus/Close: 		In the setting interface, to minus one more value
Esc/Stop: 	 to turn counterclockwise before reset; if it is not reset in 5 seconds, the system will exit from the setting interface.	In the setting interface, to return to the previous menu or exit from setting interface or restore the setting value to the previous value.
OK: 	 to turn clockwise before reset; if it is not reset in 5 seconds, the system will exit from the setting interface.	In the setting interface, to confirm a newly set function or value.

2. Instruction for status display

2.1 Instruction for start-up status (Fig.5)

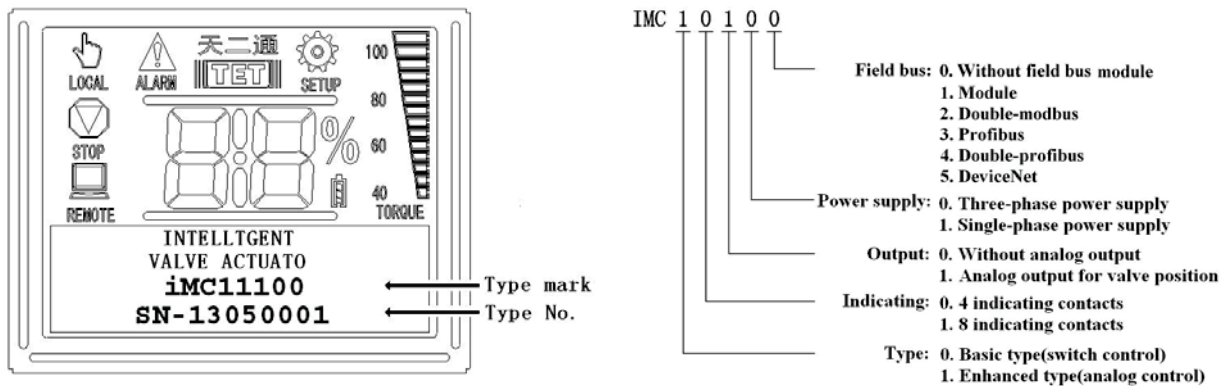


Fig.5

Note: Actuator's function would be added or reduced according to different IMC Model. User should check and confirm before setup.

2.2 Summary of actuator display

Display component : (shown in Fig.6)

- Valve position torque and working status are in the LCD Display (valve position can be shown when power is off.)
 - Working parameters and status LCD Display
 - Infrared receiving sensor
 - Valve opening (red) indicator
 - Malfunction (red)/Power supply (green) indicator
 - Valve closing (green) indicator
 - Battery bar display (Displayed only when power is off)
- When power is nearly out of power, user should change the battery.)

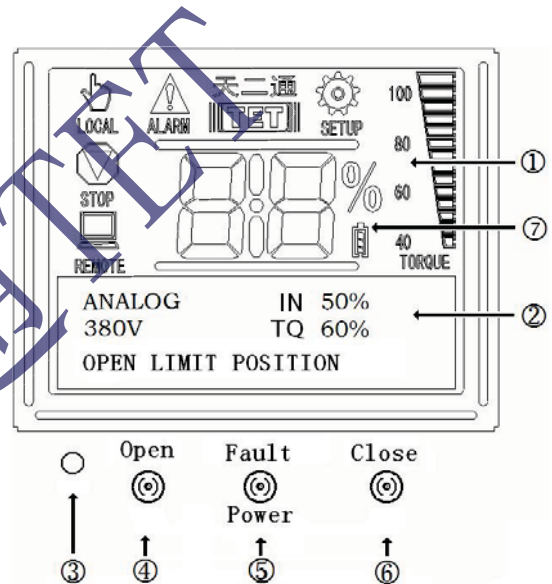


Fig.6

Definition for three indicators: open (red); malfunction (red); power (green); close (green). Open or close indicator is on, which refers to open limit position or close limit position. Open or close indicator is flashing, which refers to the actuator is working. Open or close indicator and malfunction are on at the same time, which refers to the malfunction in corresponding direction. Malfunction indicator is always lighting, which means valve cannot work properly; malfunction indicator is flashing, which means a common warning malfunction, but can also perform part of the function and maintenance is needed.

When power is nearly out of power, user should change the battery.)

2.3 Indicator definition

Legend: off ○ Flashing ◐ On ●

2.3.1 Malfunction indicator (red)/ power supply (green)

Malfunction indicator is off, and power supply is on---normal

Malfunction indicator is flashing, and power supply is flashing---phase loss (alternative flashing)

Malfunction indicator is on, and power supply is off---over torque/ stalled/jammed (valve opening/ valve closing is flashing)

Malfunction indicator is on, power indicator is off---encoder is fail

Malfunction indicator is flashing; power indicator is off---powered off/ESD/motor over-current

Malfunction indicator is flashing; power indicator is off---over-heated

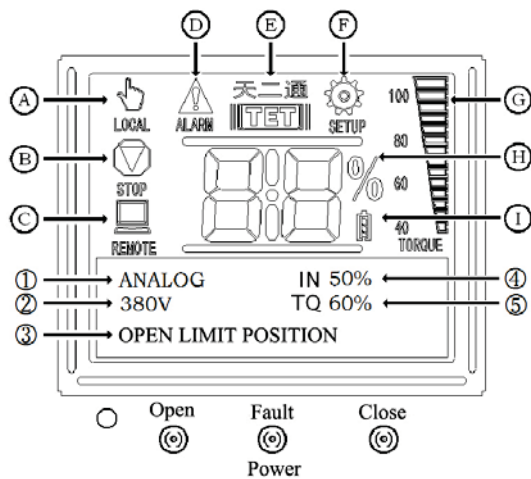
2.3.2 Valve opening indicator status (red)

- Open indicator off---not on the open limit position and without any fault
- Open indicator on---on the open limit position and without any fault
- Open indicator flashes---open over-torque/ open stalled
- Open indicator flashes---in the valve opening process

2.3.3 Valve closing indicator status (green)

- Close indicator off---not on the close limit position and without any fault
- Close indicator on---on the close limit position and without any fault
- Close indicator flashes---close over-torque/ open stalled
- Close indicator flashes---in the valve closing process

2.4 LCD Display component



① Display for control signal source or working system and operating current (only displayed when valve stops working)

- ANALOG: Remote positioning control
- Analog: Remote local positioning
- ON-OFF: Remote switch control (normal operating)
- ON/OFF: Remote switch control (intermittent operating)
- STOP: Stop working
- LOCAL: Local working
- (Only displayed when valve is working)
- 0.10(~25.5A): Current value of motor

② Display for power supply, phase sequence, over-current and phase loss

- (Only displayed when it is out of malfunction)
- 380V: three-phase power supply
- 220V: single-phase power supply
- (Only displayed when it is in malfunction)
- M-LOSE: phase-loss on motor side
- P-LOSE: phase-loss on power supply
- 1.5XCR: 1.5 times of over-current
- 2.0XCR: 2 times of over-current
- 3.0XCR: 3 times of over-current

③ Display for status

Working status, alarm status and fault condition alternatively display

④ Display for remote control signal

(Only display when controlled by remote positioning)

0 (~100%): remote positioning signal value

Low: control signal is offline

High: control signal is transfinite

(only display when it is remote switch control)

OPEN: efficient open signal

CLOSE: efficient close signal

STOP: efficient stop signal

ESD: efficient ESD signal

⑤ Display for torque value

(Only display when valve stops)

$\pm 40 \sim \pm 150\%$: the previous torque value

("+/-" is the torque in the clockwise /counterclockwise direction)

(only display when valve is operating)

$\pm 40 \sim \pm 150\%$: immediate torque value

A~C working system sign

A:local, B:stop, C:remote

D Fault status or alarm condition sign

The sign will be displayed when there is fault or alarm condition.

E Factory trademark

Chinese and English trademark can be respectively showed.

F Setup for status sign

This sign is displayed when doing setup.

G Analog torque value display

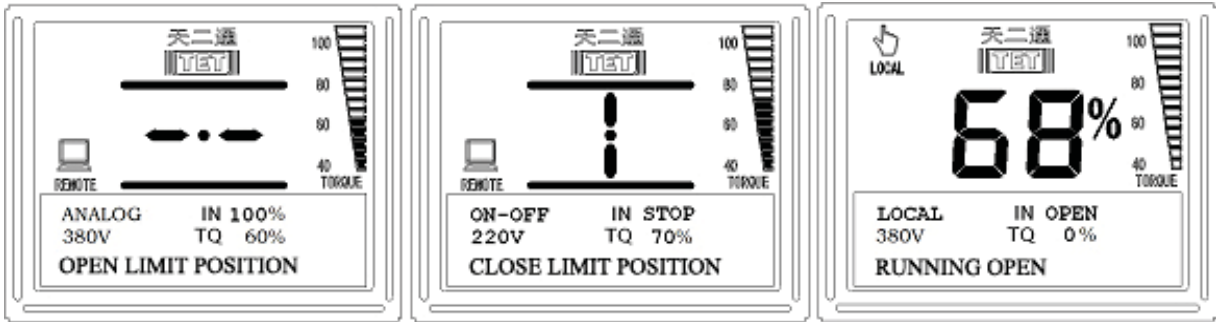
Torque value range: 40%~100%

H Analog openness display

Openness range: -9%~110%

I Battery bar display

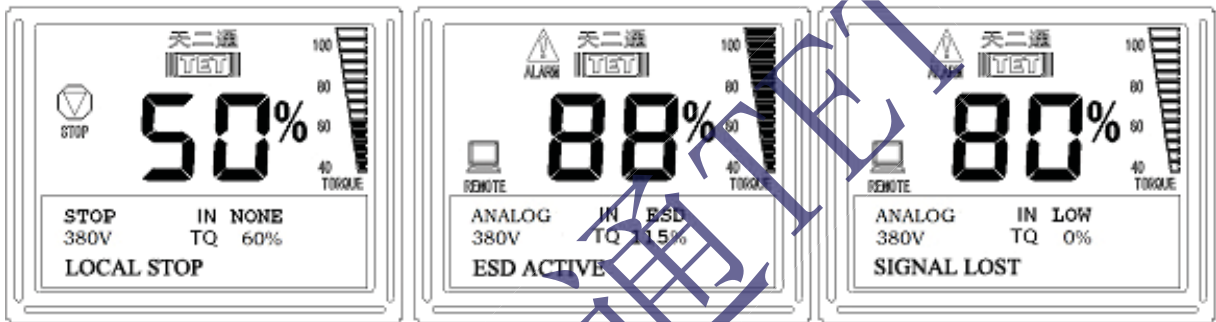
2.5 Examples of display



Working system:
Remote position control
Input: 20mA(100%)
Valve position: Open limit position
Torque value: 60%
Voltage: 380V

Working system:
Remote switch control
Input: Stop
Valve position: close limit position
Torque value: 70%
Voltage: 220V

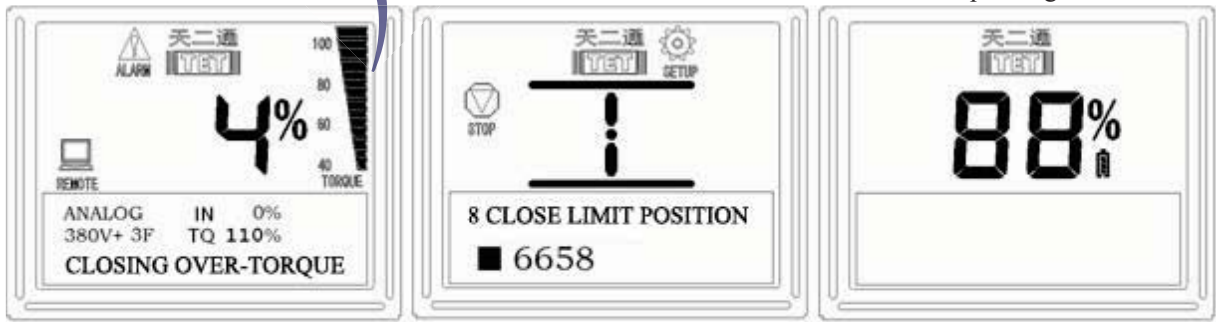
Working system: Local control
Input: Open
Valve position: 68%
Torque value: 0%
Voltage: 380V



Working system: Stop
Input: No
Valve position: 50%
Status: Not operating

Working system:
Remote position control
Input: ESD
Valve position: 88%
Torque value: 115%
Status: Stop

Working system:
Remote position control
Input: Signal lost
Valve position: 80%
Torque value: 0%
Status: Not operating



Working system:
Remote position control
Input: 4mA (0%)
Valve position: 4%
Torque value: 110%
Alarm condition: Close over-torque
Status: Not operating

Working system:
Parameters have been set up
Set up: Close limit position
Status: To make the valve , electrically or manually, at the close limit position for setup

Working system: Power outage
Valve position: 88%
Status: Turn the handwheel to check the updated valve position

3. Debugging for the electric actuator

3.1 Confirm the direction

User should first confirm if valve's rotation direction is the same as that of actuator. Factory settings of the closing direction of the actuator is clockwise. If they are not the same, please go to set the closing direction of the actuator the same as that of the valve.

Here are the steps:

To turn the select button at the "stop" position. Press "up" or "down" key to go into the setting interface; press "up" or "down" key to select <setup parameter>; press "OK" to enter <input password>; press "open" or "close" to change the number value and then again press "OK". Make repeated operation to enter the password "1234" set upon delivery to enter system setting interface. Press "OK" to go into the subordinate interface; Press "up" or "down" key to choose <closing direction> and press "OK" to go into the subordinate interface; press "open" or "close" to choose "close counterclockwise" and press "OK". Setting is finished. Last, press "ESC" to exit until where you want.

3.2 Setting up the open limit position and close limit position:

There is requirement on the setting sequence of open limit position and close limit position. User could either first set up close limit position or open limit position.

3.2.1 Setting up for open limit position

To turn the select button at the "stop" position. Press "up" or "down" key to go into the setting interface; press "up" or "down" key to select <setup parameter>; press "OK" to enter <input password>; press "open" or "close" to change the number value and then again press "OK". Make repeated operation to enter the password "1234" set upon delivery to enter system setting interface. Press "up" or "down" key to choose <basic setup> and press "up" or "down" key to choose <open limit position> and then press "OK" to go into calibration interface ; press "OK", and "◆" begins to flash. At present, user could manually turn the knob to the "open" position to make the valve at the open limit position. Again, press "OK" to set up this position as the valve's open limit position (Calibration could be made many times.). Last, press "ESC" to exit to where you want.

3.2.2 Setting up for close limit position

It's the same as the above. To choose <close limit position> and then press "OK" to go into calibration interface; press "OK", and "◆" begins to flash. At present, user could manually turn the knob to the "close" position to make the valve at the close limit position. Again, press "OK" to set up this position as the valve's close limit position (Calibration could be made many times.)Last, press "ESC" to exit to where you want or, it will automatically exit from setting interface if there is not any operation in one minute.

Note: 1. Setting steps for operation button are the same as those above. Please refer to 1.3.2 Parameters Setup for button operation.

2. If the system shows that "Position Setup Error" and refuse to exit from setting interface. At that time, user needs to reset open limit position and close limit position which should be confirmed in the allowable range. If user performs a forcible exit (cut off the power), the system will show "any operation is forbidden" and forbid to perform any electrical operation at the next startup. Reset effective open/close limit position until it can resume normal. If there is no problem with setup and "Position Setup Error" cannot be transformed, please contact the supplier.

3.2.3 Electrical verification

Set up valve's open/close limit position before exit from the system. To turn the select button to "Local", and then rotate the operation button to testify whether the valve could be operated to the open/close limit position. Repeat this step for several times until it meets the requirement.

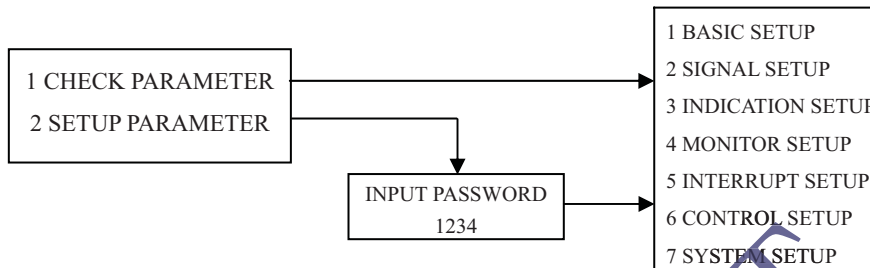
4. Setting for the actuator's function and parameter

System parameters of actuators can be checked and set by operating the remote setter (for operating methods of remote setter and knobs, please refer to 1.3). To enter system setting turn the selection knob to STOP position first. Use the attached remote controller to handle the device, hereinafter the same. Enter the interface of checking or setting system parameters. If there is no response after one minute, press the key on the remote controller again, the system will return to running state and display running interface.

Note: 1. All those with star mark (*) in the diagrams are default parameters set upon delivery.

2. Some parameters could not be displayed due to different users' orders.

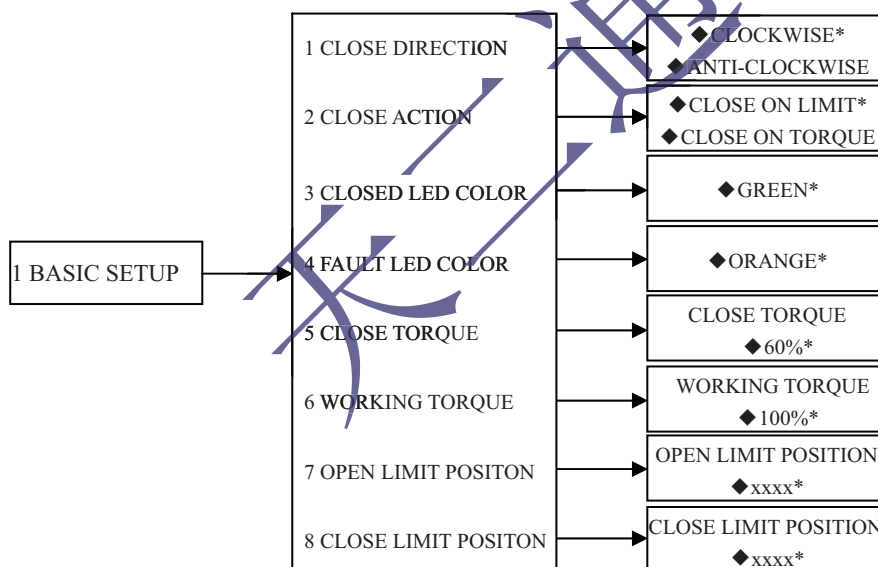
4.1 Check and set up parameters



4.1.1 Check parameters: only for check when you go into **Check Parameter**. Modification is not allowed.

4.1.2 Parameter setup: only for modification when you go into **Parameter Setup**. It is need to input password before go into it. (Factory setting for the password is 1234 and the modified password should be saved properly. If it is lost, it cannot be reset or modified.)

4.2 Basic setup



4.2.1 Direction to close setting: The factory setting is clockwise closing valve, which should accord with that of the valve. If they do not match, you can make a change. When changing direction to close, be sure to change rotation mark for hand wheel.

4.2.2 Close action: user could set up close on limit method or close on torque methods. Factory setting of this is Close on limit. If the valve is closed by torque, the close torque should be first set. The open limit position should be set at this position at the same time.

4.2.3 Close LED color: it cannot be set up. Factory setting of this is green.

4.2.4 Faulted color: it cannot be set up. Factory setting of this is red.

4.2.5 Close torque: If it is set that the valve is closed by torque, and if the valve actuates in the closing direction of $\pm 3\%$ range and closing torque value is more larger than the torque at the present, the actuator

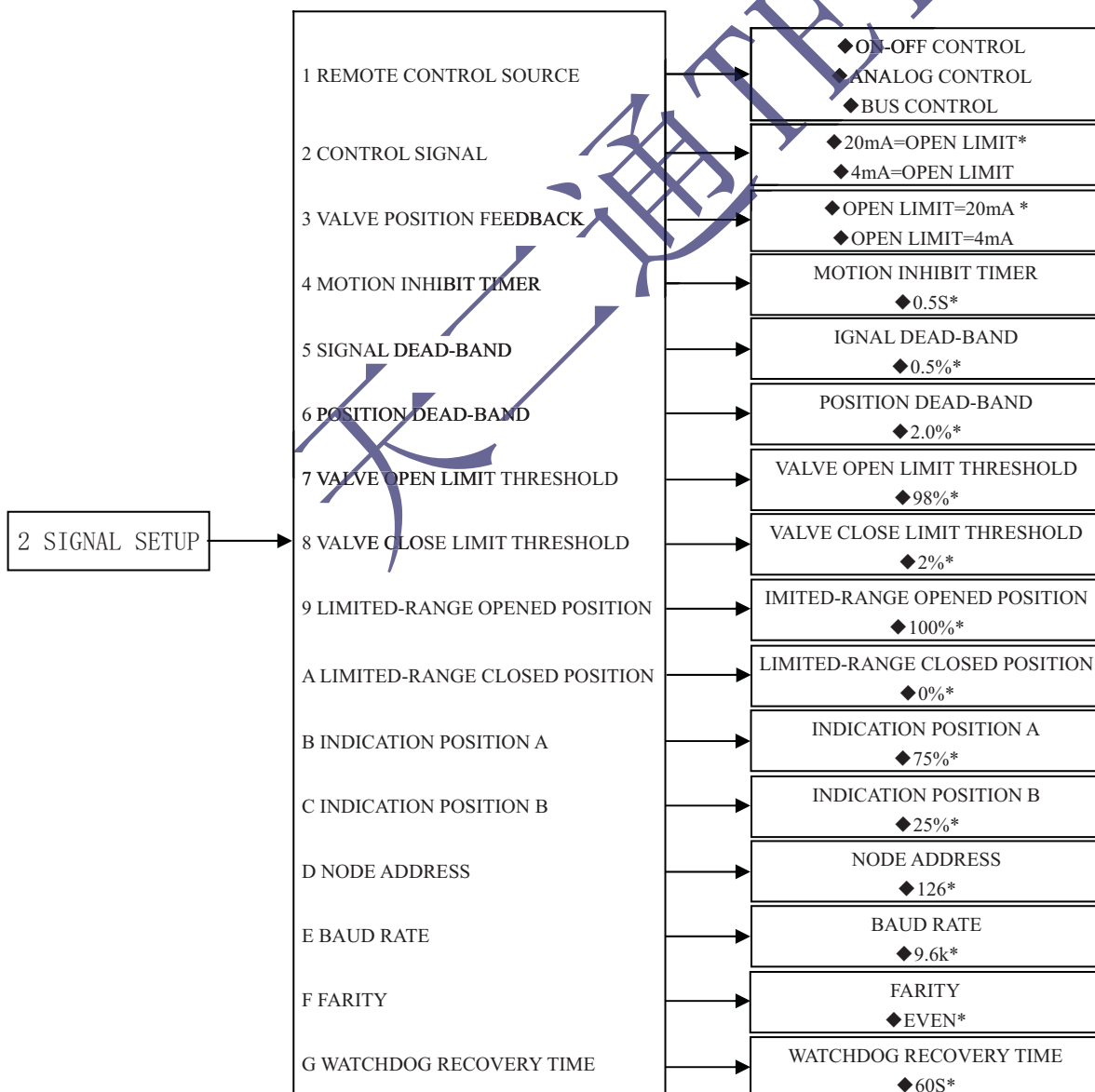
will stop working and close limit position is achieved. Parameter range is 50%-100% and factory setting is 60%.

4.2.6 Working torque: to protect torque parameters. When the torque value in the closing direction is larger than the torque value at this moment, actuator will stop and output open/close over-torque signal. However, in the valve opening section (actuate in the opening direction, be smaller than 10% valve position), in the valve closing section (actuate in the closing direction, be larger than 90% valve position) or in ESD mode, torque parameter protection will fail. This parameter's setting range is from 50% to 100% and factory setting is 100%. Note: close torque should be larger than working torque; otherwise, actuator will be protected and stop working, so that the valve could be closed.

4.2.7 Open limit position setting: in the setting mode(former open/close limit position allows actuator to act), manually turn the valve to the user-required maximum opening position and press yes key to set this position as the valve open limit position. Factory setting of this is at will. It cannot be transformed when it is resumed factory setting.

4.2.8 Close limit position setting: in the setting mode(former open/close limit position allows actuator to act), manually turn the valve to the user-required closing position and press yes key to set this position as the valve close limit position. Factory setting of this is at will. It cannot be transformed when it is resumed factory setting.

4.3 Signal setup



4.3.1 Remote control source setting: It is the working manner of remote control. The final control manner depends on No.11,12,13 terminals' connection wiring methods.

4.3.2 Control signal correspondence: For analog/positioning control low signal (4mA) is normally defined as close and high signal (20mA) as opening-valve. Or, adversely, low signal (4mA) is defined as opening-valve and high signal (20mA) as closing-valve. The factory setting is high to open.

4.3.3 Valve position feedback correspondence: If you select high to open limit, the output for open limit position is 20mA. If you select low to open limit, the output for open limit position is 4mA. Or, adversely, low signal (4mA) is defined as opening-valve and high signal (20mA) as closing-valve. The factory setting is high to open limit.

4.3.4 Motion Inhibition time (MIT): MIT is set to protect the actuator. A delay time set for limiting the times of motion of the motor, ranging from 0 to 25.5 seconds. The factory setting is 0.5s.

4.3.5 Signal dead-band setting: This is effective in the analog mode. To avoid actuator's too sensitive response to the change of analog signal, we define a definite range of analog signal, within which the actuator does not respond to it. The range is 0%-10% and the factory setting is 0.5%.

4.3.6 Positioning dead band setting: This is effective in the analog mode. The range of error allowed by user is called positioning dead band, 0%-10%. The factory setting is 2%. Increasing the setting on an allowed basis will prolong the service life of the actuator and valve. (Normally, the above two dead bands superpose instead of composing. The signal dead band relates to signal interference (wave filtering), while positioning dead band relates to the precision of valve positioning including restraining vibration and fluid medium disturbance.)

4.3.7 Valve open limit threshold: Caused by control signal source, 100% signal could fall short of 20mA, say, only 98% or more, at this time, we could let the actuator to take it as 100% signal and actuate open limit position operation. The range of such a threshold is 90%-100% and the factory setting is 98%.

4.3.8 Valve close limit threshold: The reason for setting such threshold is the same as above.. The range of the threshold is 10%-0% and the factory setting is 2%.

4.3.9 Limited range opened position: The signal for open limit position in limited range positioning control is set from 0% to 100% and factory setting is 100%.

4.3.10 Limited-range closed position: The signal for close limit position in limited range positioning control is set from 100% to 0% and factory setting is 0%.

Note: remote limited positioning: a range could be set as limited positioning during the whole control range (factory setting is 0%-100%). Actuator will calculate according to the limited positioning which is set up by user, which makes the valve's position to accord with 4-20mA. If the system presents valve open analog signal, the valve will actuate to the limited range opened position; on the contrary, if the system presents the valve closing analog signal, the valve will actuate to the limited range closed position. Remote on-off control and local control are not influenced by limited range positioning. The actuating range is influenced by valve open and valve close.

4.3.11 Indication position A: Valve position could be showed by the contacts on status relay RL1-RL8. If it is larger than this position A, then certain relay will be activated. A range of 0%-100%. The factory setting is larger than 75%. Users can set the position as required.

4.3.12 Indication position B: Valve position could be showed by the contacts on status relay RL1-RL8. If it is smaller than this position B, then certain relay will be activated. A range of 0%-100%. The factory setting is smaller than 25%. Users can set the position as required.

4.3.13 Node address: Node address. (Profibus) or address (Modbus) of the device. Range: 0-255. Factory setting: 50. Different range according to different field bus protocol.

4.3.14 Baud rate: Communication Baud rate for Modbus bus mode. Range: 300-57.6K. Factory setting: 9.6K.

4.3.15 Parity bit: Communication parity bit for Modbus bus mode. Range: ODD, EVEN and NONE. Factory setting: EVEN.

4.3.16 Watchdog recovery time: The watchdog recovery interval for the system in static state (no electric operation). If the parameter is set to 0 second there will be no watchdog recovery function. Range: 0-255 second. Factory setting: 60second.

4.4 Indication setup(see Fig.7)

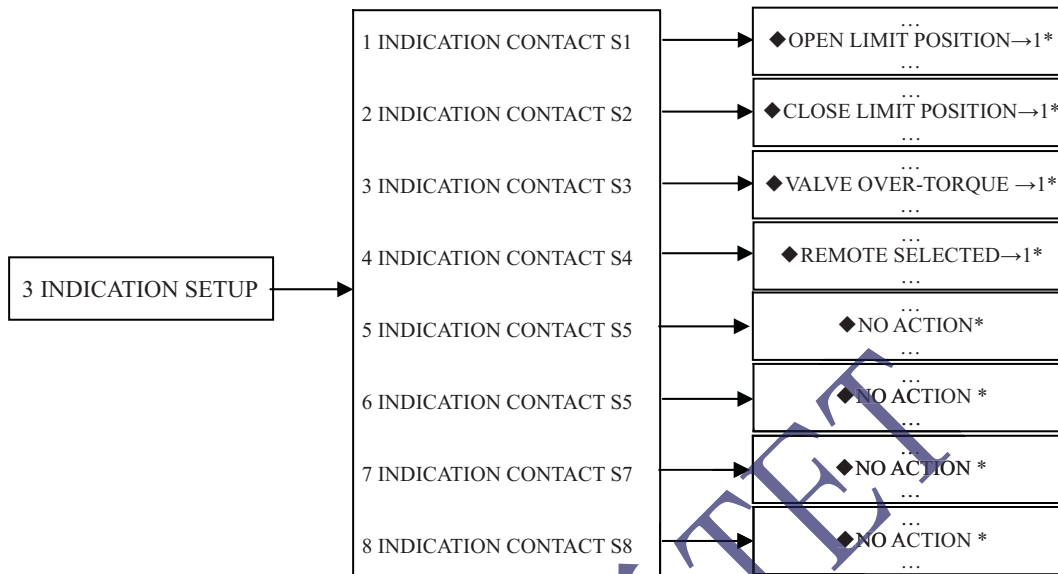


Fig.7

4.4.1 The indication contacts 1~8 are contacts of RL1~RL8. Each indication contact can indicate one type of state (in table 3-1) only. To excite or not could be selected in setting menu of contact functions. The use method for the alternative RL5~RL8 is the same as that for RL1~RL4, users can select different contact functions according to their demands. The factory setting are: RL1: open limit→ activated; RL2: close limit→activated; RL3: over-torque→activated; RL4: remote selected→activated.

4.4.2 Applicable actions for status relay RL1~RL8 are in the following diagrams (any applicable actions has both excitation and non-excitation status)

4.5 Monitoring setup (see Fig.8)

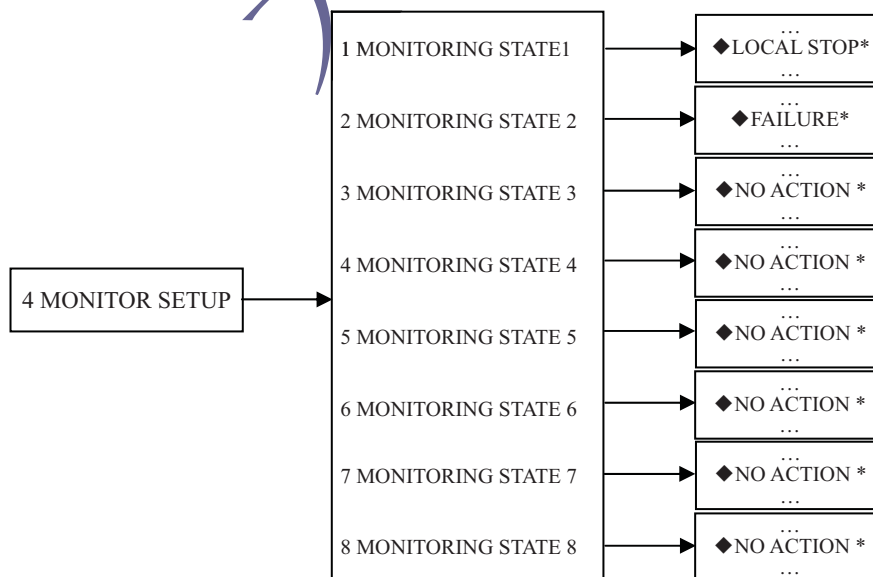


Fig.8

4.5.1 Generally, that the monitor relay RLO is activated means the electric actuator is in service. The 8 monitoring states are in OR relationship. If one of them is effective, the monitor relay will be released. The monitoring states 1 and 2 had been set upon delivery and they can be modified by users. The monitoring states 3 to 8 can be set by users according to their demands. See table 4-1 for alternative monitoring statuses. The factory settings are local stop and fault alarm state.

4.5.2 Applicable actions for monitoring relay RL0 are in the following diagrams.

Statuses to be set for contacts of status indication relays RL1-RL8 and contacts of monitor relay RLO include: (The relay will pick up when activated)

No.	State	Explanation
0	NO ACTION	
1	LOCAL SELECTED	Control manner of actuator (position of selection knob)
2	REMOTE SELECTED	
3	LOCAL STOP	
4	ESD ACTIVE	ESD active
5	ACTUATOR RUNNING	(6 or 7)
6	RUNNING OPEN	Actuator is moving to opening direction
7	RUNNING CLOSE	Actuator is moving to closing direction
8	MOVING BY HAND	above 2%
9	MOVING IN HIBITED	(10 or 11)
10	M.I.T	Motion inhibited timer enabled
11	INT.TIMER	Interrupter timer enabled
12	OPEN LIMIT POSITION	Open limit position of a valve. A logical limit position. It can be set by users themselves as required by valve.
13	CLOSE LIMIT POSITION	Close limit position of a valve. A logical limit position. It can be set by users themselves as required by valve.
14	LMT-RANGE OPENED	Open in limited range operation manner of a valve
15	LMT-RANGE CLOSED	Close in limited range operation manner of a valve
16	GREAT THAN POSITION A	The setting is enabled when the opening is greater than indication position A, which will be set by users according to checking position requirement.
17	LESS THAN POSITION B	The setting is enabled when the opening is smaller than indication position B, which will be set by users according to checking position requirement.
18	OPEN LIMIT SW REACHED	It is a physical limit position on which the open limit switch acts and no electric operation can exceed it.
19	CLOSE LIMIT SW REACHED	It is a physical limit position on which the close limit switch acts and no electric operation can exceed it.
20	MID-TRAVEL POSITION	Any position between open limit position and close limit positions for a valve
21	ALARM	Caution type failures (22-35). After this type of failure occurs the control signals can still control electric actuator's operation under certain condition.
22	CONTROL ALARM	Control signal alarm (23-26).
23	SIGNAL LOST	Loss state of remote 4-20mA positioning control signal or site bus control signal.
24	SIGNAL OVERRUN	To exceed certain range of control signal.
25	OPENNING OVERRUN	To exceed open limit position.(valve position \geq 103%)
26	CLOSING OVERRUN	To exceed close limit position.(valve position \leq -3%)
27	VALVE BLOCKED	(28 or 29)
28	OPENING BLOCKED	Jam state occurs in opening direction of a valve.
29	CLOSING BLOCKED	Jam state occurs in closing direction of a valve.
30	VALVE OVER-TORQUE	(31 or 32)
31	OPENING OVER-TORQUE	Over-torque state occurs in opening direction of a valve.

32	CLOSING OVER-TORQUE	Over-torque state occurs in closing direction of a valve.
33	MOTOR ALARM	(34 or 35)
34	MOTOR OVERHEAT	Motor temperature is too high and the switch trips off.
35	MOTOR OVERCURRENT	Range of allowable time for motor to exceed limit rated current.
36	FAILURES	Fatal failures (37-48). After this type of failure occurs, electric operation of an actuator is completely prohibited until the failure is removed or the device enters into setting mode or the valve opening/closing knob is turned to opening position for more than 15 seconds.
37	POWER FAILURES	(38 or 39)
38	POWER PHASE LOST	Power supply phase lost.
39	MOTOR PHASE LOST	Motor phase lost caused by motor winding failure or contactor failure.
40	ENCODER FAILURES	Encoder failure(41,42)
41	VALVE ENCODER	Valve encoder failure
42	ENCODER ROTATION	Valve position encoder rotation failure(due to encoder mounting or phase demodulation)
43	MOTION FAILURES	(44 or 45)
44	MOTION OBSTRUCTED	A valve failed to reach objective position. Note: The reason for motion obstructed will decide the failure type (caution failure or fatal failure).
45	VALVE JAMMED	Valve Blocked occurs in both directions.
46	POSITION SETUP ERROR	Setup error of open limit position and close limit position (refer to 3.2.2 note3)
47	BUS FAILUREAL	Bus interface module failure
48	ERROR XX	Other system failure (XX: 00~99)

4.6 Interrupter setup (see Fig.9)

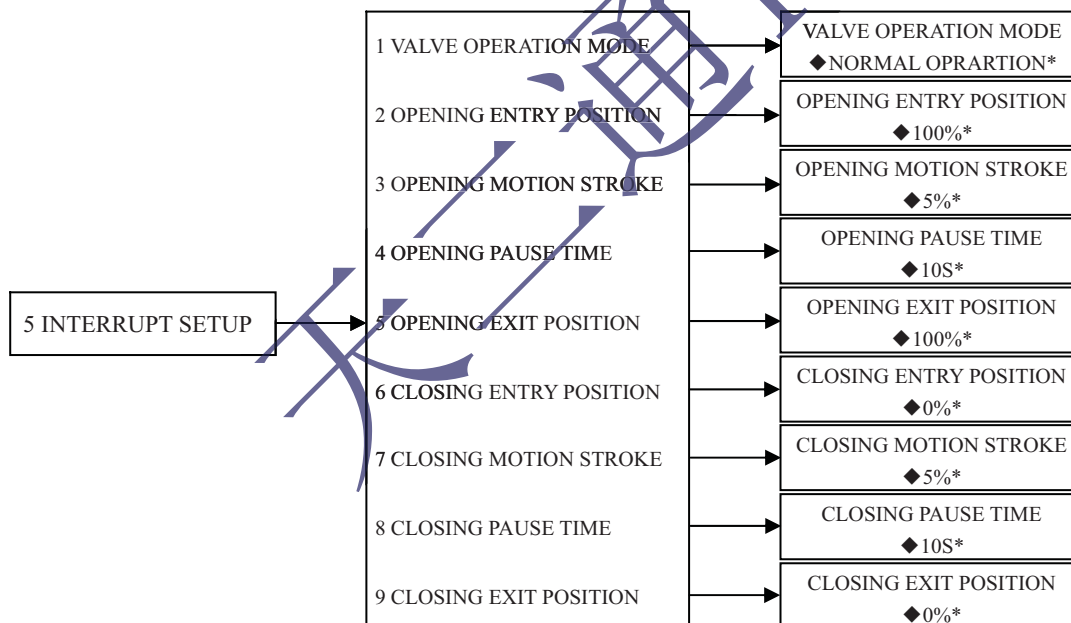


Fig.9

4.6.1 Valve operation mode: The factory setting is normal operation.

Normal operation: The action of electric actuator to drive valve is in the manner of continues motion.

Interrupter operation: To avoid water hammer or reduce the rate of pressure change in pipe, some applications require the device to slow down on its valve closing/opening operation. Actuator can perform interrupt motion during interrupter operation. This function is effective only in on-off control mode.

4.6.2 Opening entry position: When actuator works on interrupter operation manner, users need to set the start position of opening interrupter operation in the range of 0%~100%. The factory setting is 100%. (There will be no interrupter operation if 100% is set.)

4.6.3 Opening motion stroke: It is the stroke setting, in the range of 5%~100%, for each motion of the valve in opening direction when the actuator works on interrupter operation manner. The factory setting is 5%.

4.6.4 Opening pause time: It is the interval setting, in the range of 1~255 seconds, for each motion of the valve in opening direction when the actuator works on interrupter operation manner. The factory setting is 10 seconds.

4.6.5 Opening exit position: When actuator works on interrupter operation manner, users need to set the stop position of opening interrupter operation in the range of 0%~100%. The factory setting is 100%. (There will be no interrupter operation if the setting is \leq the opening start position.)

4.6.6 Closing entry position: When actuator works on interrupter operation manner, users need to set the start position of closing interrupter operation in the range of 0%~100%. The factory setting is 0%. (There will be no interrupter operation if 0% is set.)

4.6.7 Closing motion stroke: It is the stroke setting, in the range of 5%~100%, for each motion of the valve in closing direction when the actuator works on interrupter operation manner. The factory setting is 5%.

4.6.8 Closing pause time: It is the interval setting, in the range of 1~255 seconds, for each motion of the valve in closing direction when the actuator works on interrupter operation manner. The factory setting is 10 seconds.

4.6.9 Closing exit position: When actuator works on interrupter operation manner, users need to set the stop position of closing interrupter operation in the range of 0%~100%. The factory setting is 0%. (There will be no interrupter operation if the setting is \geq the closing start position.)

4.7 Control setup (see Fig.10)

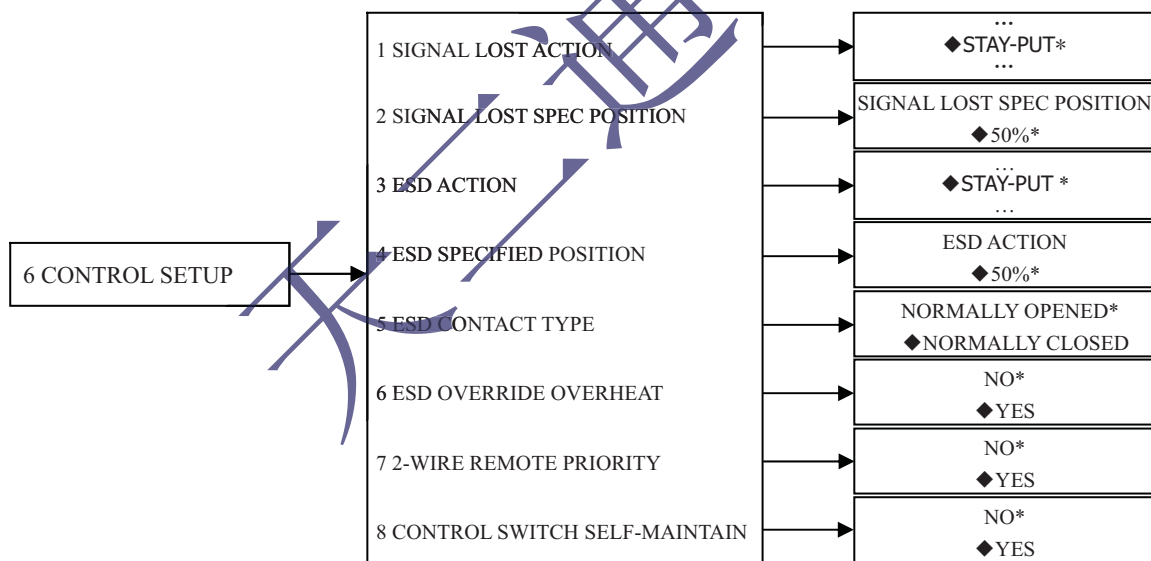


Fig.10

4.7.1 Control signal lost action: During system operation positioning control analog signals or bus control signals might be lost, which is considered by the system as control signal lost and leads to an uncontrolled actuator. In order to ensure safety the system can instruct valve to stay put, or move to open, close or a specified position. The factory setting is to stay put.

4.7.2 Specified position: This setting is effective on control signal lost failure (4.7.1). When signal is lost, users can set the specified position of valve according to their needs in the stroke range of 0%~100%. The factory setting is 50%.

4.7.3 ESD action: This is a signal for emergency protection. When an emergency occurs, it can instruct the valve to move to open/close or a specified position. The factory setting is to stay put. ESD signal can override motor failures, such as overheating, over-torque and over-current etc. The operation manner and

failures which the system can override can be set.

4.7.4 ESD position: this is only effective in 4.7.3. When ESD is effective, valve will actuate to this appointed position. User can set up the appointed position during the stroke 0%-100%. Factory setting:50%.

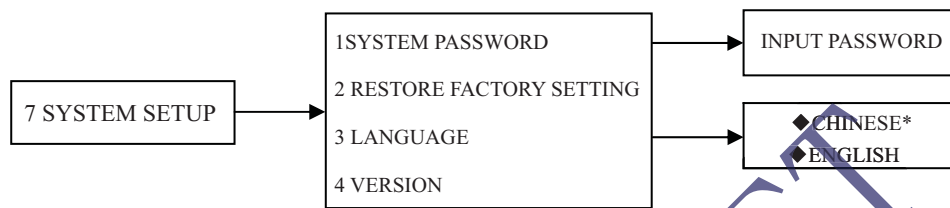
4.7.5 ESD contact type: The setting of contact state for emergency protection ESD. The factory setting is normally open. When the contact is closed, ESD becomes effective.

4.7.6 ESD override overheat: ESD can override overheating protection. The factory setting is ESD override overheat.

4.7.7 ESD override local: ESD can override local operation. The factory setting is ESD override local.

4.7.8 ESD override interrupter: ESD can override interrupter operation. The factory setting is ESD override interrupter.

4.8 System setup



4.8.1 Set system password: To enter into secondary setting needs to input password to avoid mishandling. The password set upon delivery is 1234. You should save the revised password properly. Otherwise, you will not be able to reset the system parameters if you have lost the password.

4.8.2 Restore factory setting: Each item of setting has its factory default. When users need to change the purpose of actuator or reset system parameters, they can select *restore factory setting*.

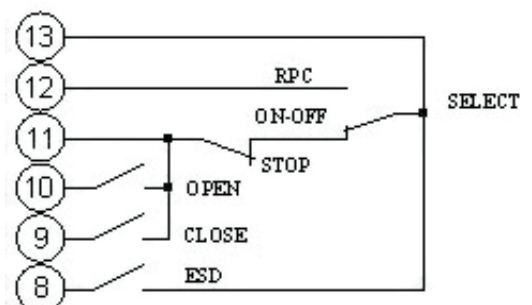
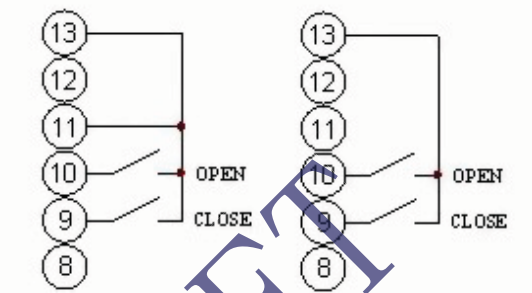
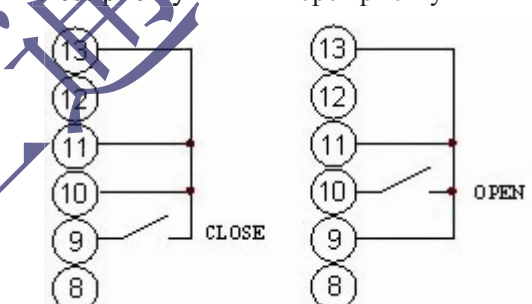
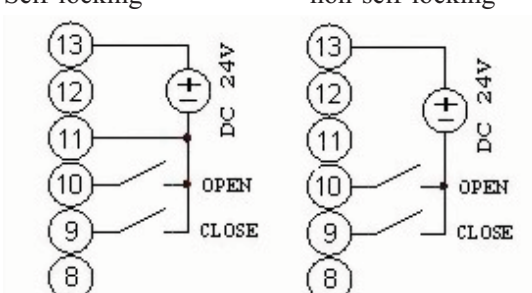
If maintenance is required, open limit position and close limit position should be reset after or before mounting to the valve.

Note: The function *restore factory setting* should be used with extreme caution! After performing *restore factory setting* all parameters set by a user will be replaced by factory setting and many parameters including valve open and close limit position need to be reset. After users reset various parameters they should keep the relevant records properly.

4.8.3 Language setting: Select Chinese or English for display language you desired.

4.8.4 Version: The version number is displayed on the start-up interface. See the Instruction for Display.

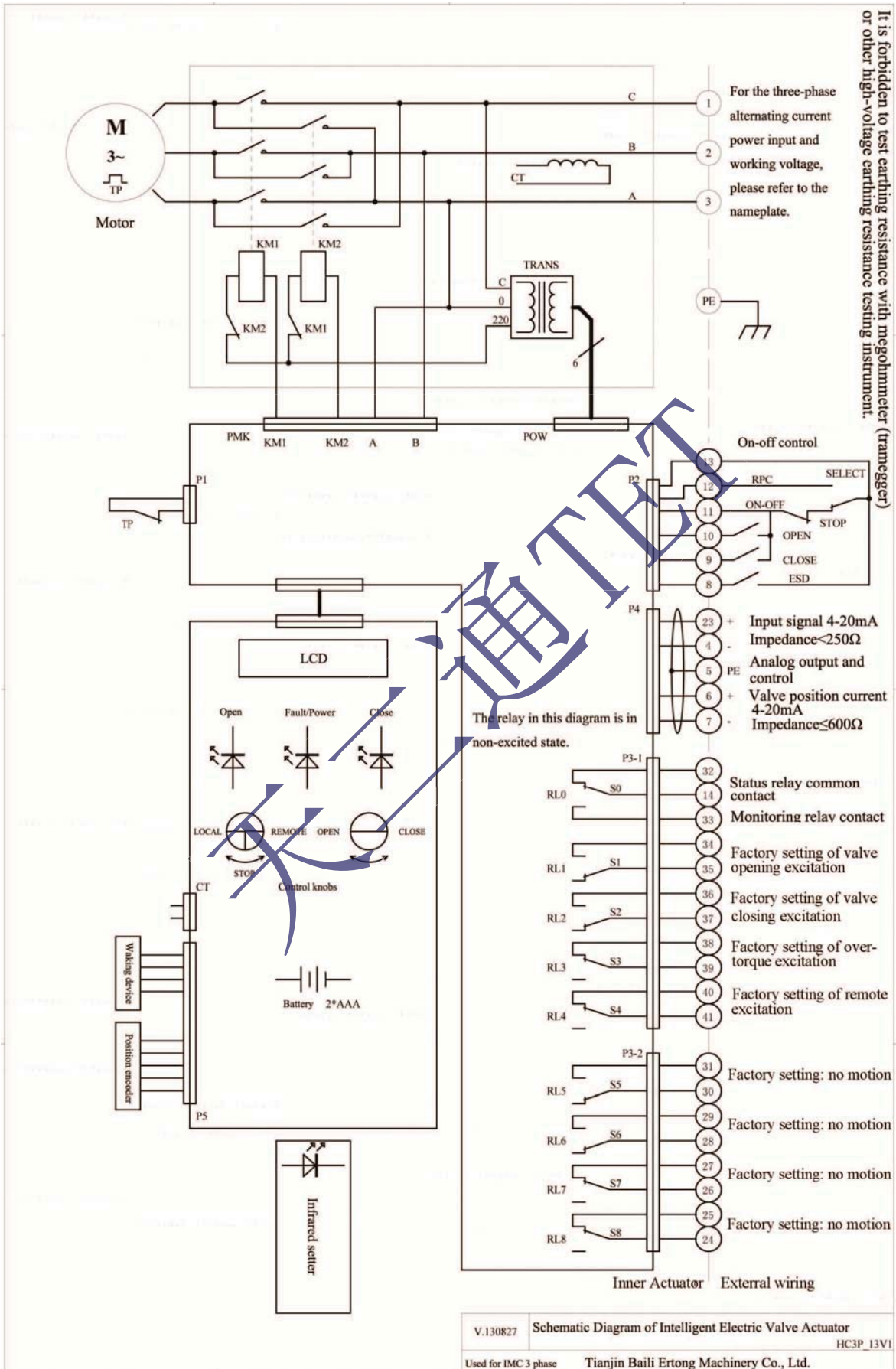
5 .Wiring methods

<p>Common terminal Selection of remote positioning control (RPC) or field bus control Selection of remote ON-OFF control or STOP Opening- valve (OPEN) Closing- valve (CLOSE) ESD input</p>	<p>Standard: remote positioning/switching value methods</p> 
<p>Manner of on-off control Under on-off operation manner, you can select self-locking or non self-locking mode. On non self- locking mode the system operates with the OPEN and CLOSE contacts closed. On self- locking mode the actuator will get self- locking after the OPEN or CLOSE contact is closed and run to open limit position or close limit position in a specified direction unless an adverse switch is closed and, at this time, the actuator will stop running and then it will get self- locking and run according to a new on-off instruction.</p>	<p>Self-locking non-self-locking</p>  <p>When actuator is running under the self-locking mode, should an adverse switch is closed, the actuator will stop running and then it will get self- locking and run according to a new on-off instruction.</p>
<p>Manner of on-off control Under on-off operation manner, open/close is in priority service.</p>	<p>Close priority open priority</p> 
<p>Outside supply DC 24V</p>	<p>Self-locking non-self-locking</p>  <p>When actuator is running under the self-locking mode, should an adverse switch is closed, the actuator will stop running and then it will get self- locking and run according to a new on-off instruction.</p>

Note:

- 1. Remote positioning control could be in the manner of remote current 4~20mA positioning or via site bus control.
- 2. If remote positioning control is not used, SELECT could be set to short circuit and terminal ⑫ set to open circuit.

6. Referenced schematic diagram



Part III Additional Information for IMC Explosion-proof Type of Intelligent Electric Valve Actuator

1. Summary

IMCEx series explosion-proof type is produced on the basis of GB/T 3836.1 《General Requirement for the Equipment Used in Explosive Environment, Part I》 and GB/T 3836.2 《The Equipment Protected by Explosion-proof Enclosure “d” Used in Explosive Environment, Part II》. Meanwhile, this series have been tested, experimented and finally verified by the national verified explosion-proof organization and get Conformity Certificate of Explosion-Proof.

The explosion-proof grade of IMC explosion-proof type is Ex db IIC T4 Gb. The sign “Ex” shows that the electric apparatus comply with the Explosion-proof Standard; “db” shows that the explosion-proof type is enclosure explosion-proof; II class represents that electric apparatus used in explosive gas environment except for gas made from coal; IIC represents that the gas is hydrogen; T4 indicates that the permissible surface temperature is 135℃; Gb is apparatus protection degree.

Product seating No. Includes: IMC15Ex、IMC25Ex、IMC60Ex、IMC100Ex、IMC300Ex.

2. Notes for usage

- 2.1 Power must be cut off when actuator’s any cover is open. (Please see the warning plate: “Forbid to open the box cover when the power is on.”)
- 2.2 Don’t hit the openness window glass and glass crack is forbidden.
- 2.3 Keep the nameplate and warning plate being fixed on actuator and the words on them should be recognized.
- 2.4 Don’t open the electric box cover outdoors in rainy day or windy day.
- 2.5 The product’s explosion-proof cover cannot be knocked or scratched during maintenance or debugging.
- 2.6 Apply anti-rust painting 204-1 after debugging or maintenance and before assembling.
- 2.7 Please notify the company to change the broken explosion-proof elements. The products cannot be powered on until it is renewed with qualified element.
- 2.8 Fasten the screws on the control box cover and wiring box cover after product debugging. After some strong vibration, please make regular check to make sure whether it is reliable.
- 2.9 Keep o-ring safely, and change a new one after it is damaged
- 2.10 External ground wiring should be reliable, which should be placed on the side of main case.(with the sign “PE”)

3. Notes for electrical wiring, please refer to Part I

4. Wiring inlet position

There are three inlet ports on the wiring case and they are two G1” and one G1 1/2". One of The G1 is power cable and the other is control cable. G1 1/2" is the spare part.

There are three seal locks. User should take it out before use the holes. And then select a proper dimension of outlet wire thread (outlet wiring application should comply with GB/T 3836.1 and GB/T 3836.2). Enclosure protection should be confirmed. User select outlet wiring application. When there is unused outlet hole, it should be kept in factory setting status.

Special Cautions

In order to ensure the protective performance of the case of the whole electric actuator, users must strictly follow the requirements in the *Operation Manual* and in this *Special Cautions* while performing relevant operations when they set and service the actuators. If users failed to follow the regulations in the *Operation Manual* and the *Special Cautions* while performing relevant operation and have resulted in fail-safe protection of the case of the electric actuators, the users shall bear the responsibility.

Before delivery all locations related to case protection of the products have been strictly inspected to ensure that the case is airtight. If users need to open the following locations for setting, service or any other reasons:

- 1 Case of control box
- 2 Case of connection box
- 3 At places where wire comes in and goes out, it must be ensured that

User must ensure the following points after open the case:

1. There is no affect of adverse elements such as rain, snow, hail, damp and dust, etc. as the electric actuator will lose original protection function in the above conditions.
2. At the end of operation, replace the cover. When fastening the clamp nuts at wire inlet and outlet, make sure that no adverse elements (such as severe damp, water and dust, etc.) that could weaken protective performance left in the inner space.
3. After usage, make sure that rubber seal rings are not damaged and fasteners are securely screwed down without any omission. At the same time, user should make sure the the o-ring between the case and body is out of damage and then, apply calcium grease
4. Select a proper cable outlet application according to the dimensions of cable and thread holes. Make sure the cable with thread is firmly mounted and sealed in order to make sure the product's protection degree.
5. Other parts, say, openness window, switch hand and handwheel are reset due to some reason. The user should make sure that they do not make any bad effect on.

Tianjin Baili Ertong Machinery Co., Ltd.

Address: No. 19, Taikang road, Dongditou industrial zone, Xiditou town, Beichen district, Tianjin

Tel: 86 22 26750313, 84911766, 84911866, 26154275

Zip code: 300408

<http://www.tet.cn>

Email: scb@tet.cn

Our Company reserves the right to amend this operation manual.