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Shandong Juxi Mechanical and Electrical Equipment Co., Ltd

1、Brief description

Shandong Juxi Mechanical and Electrical Equipment Company Limited, a key enterprise of china, specializes in the development and production of electric actuators. It's also the early enterprise to do that. And has so far a history of 15 years. There are rich technical human, including over hundreds technicians, senior engineers, engineers and skilled workers, At same time there are whole advanced (equipment)and measuring instrument.

We are certified ISO9001 in 2001.

This actuator are provided with advanced grade in the world. In JX range, there are three kinds of specification. Quarter-turn, linear and multi-turn actuators. The actuators can be to accomplish three kinds of operation modulating, integral control and on—off control. The offer special specification actuator also be supply. According to the need of users. At the moment, all the key elements are imported from abroad . The parts and elements are processed and chosen in accord with the standard and international standard strictly. The JX range has many kinds of specification, multiple function and top quality. It is very convenient for adjustment and maintenance. The products are extensively used in automatic control system in the process of production in nuclear facilities, power station, metallurgical, chemical, petroleum, building materials, light industry, and water treatment.

2. Specification and types.

The JX range of actuators feature is combined construction .It can be used the different parts of reducer and motor to combine the different specification of actuators. The output model has three in JX range.

1. Quarter-turn---output torque and 90° angle.
2. Linear----output thrust and line movement.
3. Multi-turn----output torque and over 3600 multi-turn rotation.

JX range have two kinds of mounting.

1. Direct-mounted model.

----By the flange of actuator and valve, mounted them each other. This the actuator can be mounted directly on the pipe-line. This model is often used for multi-turn, quarter-turn and liner actuator.

2. Footplate mounted Model.

By the output arm of actuator and connective lever, mounted them each other. The actuator should be mounted on a concrete foundation. It' s suited for the quarter-turn actuator.

JX range divided into three types according to modulating model.

1. **The proportional modulating type.**

The actuators receives signals(4—20mA) from the computer, the regulating units and so on. The turning angle (or displacement)of the output shaft is corresponding to the input signals in proportion and accomplishes its regulation task automatically.

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The proportional modulating divided into two types, according to the mounted model and construction.

(a) Integral control proportional modulating type : That is the actuators are made up with CR-2 positioner and mounted integrally on site for using.

(b) Separated mounted proportional modulating type: The actuators also composed of actuator and positioner. But the actuator and positioner CR-2 are mounted separately, actuator mounted on field, CR-2 positioner mounted indoors or others.

2. **Remote controlled type:** It receives switching order and only stop at open or closed limited position.

3. **On-off type or open—closed type:** It receives switching order and only stop at open or closed limited position.

The separated mounted, proportional modulating actuators also composed of remote controlled type and separated-model CR-2 positioner.

NOTE: No matter quarter-turn, multi-turn, or linear actuators, they are all the same in the circuit theory, the external connections and adjustment process. It is only pay attention whether the power supply, mounted model, output torque travel signals in according with user needs or not.

3. Application

The JX range Electric Actuator is a unit in the testing and regulating instrument of the combined electric units of the system. It receives signals

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4—20mA from transducing and regulating units, or hand-controlled signals from the operating unit , automatically operates the regulation mechanism, and accomplishes its regulation task. It is used in connection with a kinds valves and others , in the automatic control systems in the process of production in the fields of power stations, chemical industry , petroleum industry , metallurgy, mining, and light industry.

4. Main Technical data and perpormance

1. Input signal: 4—20mADC;

Input resistance: 250 Ω

2. Operating duty cycle: 100%

3. Input channel:1(separated model 3)

4. Nonlinear error: 1%, 2.5%

5. Return error: 1.5%

6. Deadband: 0.5—3% continue adjustable

7. Damping characteristic: no hunting

8. Power supply: 3 phase 380V~50Hz

1 phase 220V~50H

9. Operating environment temperature:

Integral model: -10—+55⁰C separated model - 25—+70⁰C

Humidity: $\leq 85\%$ around air no corrosive gas exists

10. Protection class: in according with IEC145

IP65(weatherproof) (separated model CR-2 indoors fixing except)

11. The number of starts of motor:1200—1800 per hour

12. Class of insulation: F class motor

5. Structure and features

Due to advanced technological development, these actuators offer to their users numerous advantages:

☐ Excellent price-performance ratio.

☐ Highly sensitive and accurate torque limited , thanks to a unique torque measurement device: a planetary gear system acting as first stage reduction provides a dynamometric balance allowing full power starts in either direction from any point of travel with complete safety.

☐ Easy to set travel limit system allows precise, continuous adjustment of all switches at any point of valve travel independently of each other.

☐ Lightweight construction and compact design minimize structural support and offer a high output relative to size.

ENCLOSURE PROTECTION

BERNARD electric actuators are supplied in 3 versions:

☐ Weatherproof.

☐ Weatherproof and explosive proof.

☐ Special construction the difficult environments: nuclear, marine etc.

5. 1 Actuators

Electric motors

1. Phase, 3 phase squirrel cage motors, which can be connected either star

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or delta for 220V 380V (400V) 50Hz, are standard.

These motors are designed either for intermittent or continuous duty depending on the application: on-off or modulating/position.

Motor with built-in thermal protection embedded in winding connected to terminals for use in control circuits. When motor becomes too hot, the contact is interrupted.

On request, actuators can be powered by single phase or DC motors. Gear design.

The gear drive system has typically two reduction stages:

□ The first stage, driven directly by a pinion on the motor drive shaft, is a planetary system.

□ The second stage, driven by the satellite wheels of the planetary gear, consists of a worm and wheel gear type for models OA, A and B. For models C to E1, one or two stages of helical spur gear provide further speed reduction.

Since the planetary system permits a high speed reduction with an excellent efficiency, the subsequent gear is driven at a relatively low speed which ensures a better overall efficiency than normal standard gear designs.

The gear design permits lifelong

lubrication by grease, thus simplifying maintenance and commissioning

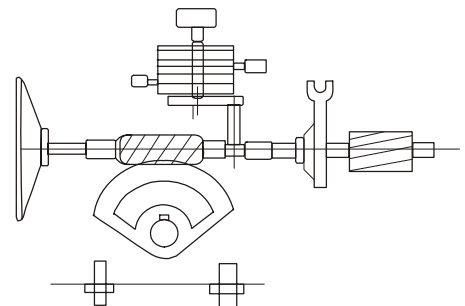


Fig 1 Schematic diagram of A machine seat transfer mechanism

considerably.

Torque limit system.

The planetary gear represents also a precise and reliable torque limiter. The output torque is permanently measured by the lever deflection of the external crown of the planetary gear. This crown is maintained in position by springs which can be set independently to a different torque value for each rotational direction.

In the event the adjusted torque is reached the crown lever compresses the spring to a point where a micro switch is tripped.

The inertia of the motor rotor is absorbed to a large extent by the springs, not by the driven valve.

This system is particularly suitable for valves requiring to be torque seated such as globe and wedge gate valves.

Travel limit switches.

The cams operating the limit switches are in a cylindrical block which is driven by a set of reduction gears ensuring rotation of less than one turn for the total travel of the driven equipment.

Adjustment is achieved quite easily with a simple screwdriver. No disassembly is required. All cam blocks contain 4 cams, each of which can be set independently of one another. After setting, the cam will be locked automatically by the cam block in the chosen position and will remain locked even in the case of vibration.

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It is quit easy to add extra limit switches or transmitters if this is requested once the unit is installed in set .

Position indication

All part turn actuators are supplied with continuous visual position indication, which is also available on request on multiturn and linear actuators.

Electrical indication of final positions is provided by the travel switches. If intermediate position indication is required, additional switches can be set in any intermediate position as wall as potentiometer or current transmitter for remote position.

Manual operation

All actuators are fitted with a hand-wheel for manual emergency operation which rotates at a low speed. Depending on the required torque, the hand-wheel is directly acting or has a reduction gear.

Several types of declutching hand-wheels are also available:

☐ declutching hand-wheel with priority to the electric motor: In case of motor start, the hand-wheel is automatically declutched.

☐ Declutching hand-wheel with electric safety: When the hand-wheel is operated, a switch prevents motor operation.

☐ Declutching hand-wheel with removable key: Efficient and simply.

Switches

Micro witches for travel limit and torque limit are normally single pole

double throw (SPDT) type.

They are standard micro switches readily available world-wide.

The quantity for standards is:

Travel limit: 2(1for each end positioning)

Torque limit: 2(1for each directional rotating)

Except Z3 and 0A

Rating:15A at 250V AC

0. 6a at 215V PC

Paint

All actuators are supplied with primer coating allowing final coating without problem. This is compatible with epoxy, polyurethane or vinyl finishing coating.

A finishing coating can be applied on request.

Lubrication

All actuators are grease lubricated for life(renew one grease for 100000—12000 hours).

If it becomes necessary to renew the grease user a product which is at least equivalent (see table below).

NOTE: When changing the grease, first remove all the old grease.

General characteristics of lubricant (for normal condition):

--Service temperature(grease): -20°C to +120°C

--Penetration ASTM at 25°C:265/295

--Drop point 170°C

EQUIVALENCE TABLE

(normal condition: -20°C--+70°C)

ELF	TOTAL	SHELL	MOBIL	ESSO
EPEXA2	MULTIS No2	ALVANIA No2	MOBILUX No2	BEACON No2

ELECTRICAL CONNECTION

A terminal strip with numbered screw clamps terminals permit connection of control and power cables. The terminals are in the control compartment of the actuator.

The cables are introduced through cable glands fitted to the actuator. In standard, there are 2 cable glands of PG16 size (not electric) provided corresponding to the specified protection class.

5.2. Positioner

It is only unit that receive signals or pulse from the regulating unite and computer. It is a multi-function power complifier after a comparision is made between input signals and the position feedback signals. It can be fitted with the actuators to control the position precisely. The device consists of a comparision, logic protection, driving and power amplifier circuit. The power amplifier is composed of the solid states relay and power driving circuit. It is used for the single motor controlled.

5.2.1 The electric positioner PM-2: It is connected with actuators and

consists of the integral-model modulating actuators . Refer to the block diagram of electric positioner.

5.2.2 Separated-model positioner CR-2:As a individual unit can be mounted with actuator separately. The detail refer to “The sample book of CR-2” .

6. Principle of actuators mechanism

1. The proportional modulating actuators is a kind of servo-mechanism used two-phase alternating-current servo-motor (signal phase) or three-phase servo- motor as the driving device.

The positioner CR-2 fitted with actuators , receive signals from regulating units or computer . This signals compare and amplify with feedback signals that come from the position transmitter. Output the enough power to drive the motor until the signals deviation within the deadband according to input signals. Now the output shaft of the actuator will stop in the corresponding point.

The separated-model proportional modulating actuators in fact is composed of remote-control actuators fitted with positioner mounted singly. the integral-model proportional modulating actuators is composed of CR-2 positioner assembled on the actuator, which is integral unit.

2. The remote-control actuator is operated by hand control switch. The actuators can be operation in angle or linear movement. It is composed of the reducer , switch control box of motor , torque and travel limit-device, position transmitter.

The angle of the output shaft can be stop in any midway by hand control switch.

The on-off actuators mechanical principle is the same as the remote-control model. It is the only difference in the control-circuit of the on-off control box from remote-control model . When pushing button control the actuator will be only stop in open or close limit position. (The actuator cannot stop in midway except the emergency stopping).

The principle diagram of remote-control actuators refer to Fig2.

The principle of remote-control actuators(1 phase):

When the actuators switch on, the contactor K1 and K2 is in action, the contact K1-1 and K2-1 in on-state. When the terminal 20 and 15 switch on, the reducer is driven by motor and the cam also turning. The actuators will stop until in the limit position . When switch S1 turns off , contactor

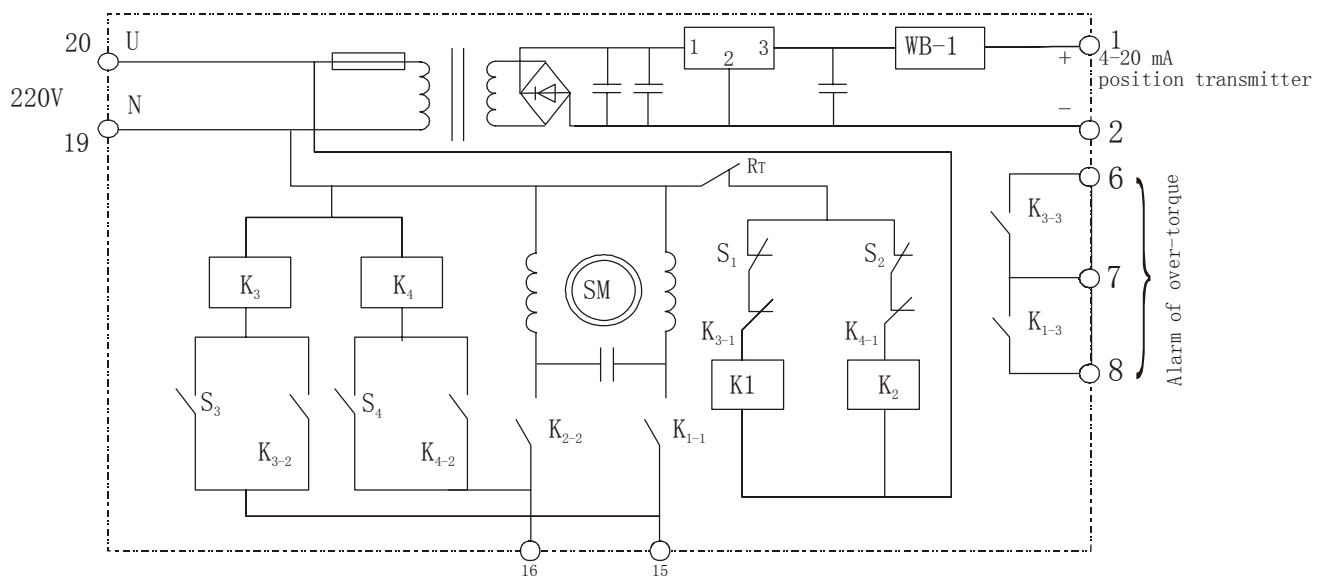


Fig 2 Basic circuit diagram diagram of remote controlled actuators(1 phase motor)

K1 releases . If the actuator over- torques , the switch S3 turns-on and K3

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relay acts. The contact K3-2 is changed from normal open to normal close, K3 is locked. At the same time, the contact K3-1 that connected with coil of K1 series open, the contactor K1 releases and the motor stops turning. Now contact K3-3 turns-on and over-torque alarm. In spite of the terminal 20 and 15 turn on, the motor can not rotate, only the terminal 15 and 20 turn-off, (that is the external push-button switch do not act. Or the external terminal 20 and 16 turn on) the relay K3 releases and K3-2 turns-off. The contact K3-1 turns-on, the contactor K1 will act. The control function will be restoration.

When terminal 20 and 16 turn on, the operation of actuators is counteraction as above mentioned. When the reducer turning, the cam is driven and potentiometer also turns. The feedback current of TAM is changed. This feedback current is regarded as the remote-control indication.

When terminal 15 and 20 switch on, the contactor K1 is in action. The reducer is turned by the motor, at the same time, the cam also turn. S1 switches off until in the travel limit position, and K1 releases. The motor stops turning. When the actuator operating, it is over-torque. S3 torque micro switch is close, relay K3 is in action. Contact K3-1 is close and keeps this state. In this case, K3 contactor that connected with coil of K1 in series is changed from normal close to normal open.

Now K1 contactor switches off and over-torque is in action, only the terminal 16 and 20 switch on, the contactor K2 is in action, the motor turning

in counter-direction.

K2 contactor that connected with coil of K3 in series. Contact is changed from normal close to open .K3 releases and unlocks .Now K1 is in normal working state . When terminal 16 and 20 switch on ,the operation of the actuator is in counter-action .As above mentioned . When the reducer turning ,

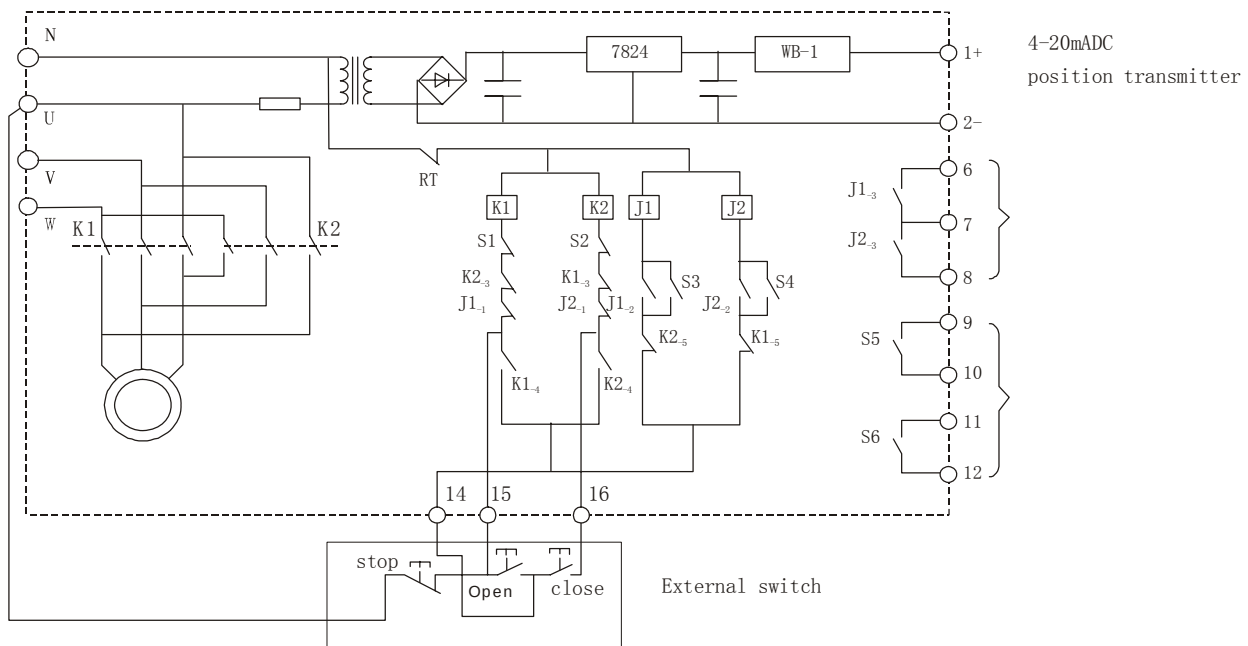


Fig 3 motor basic circuit diagram of on-off model actuators

the cam is driven and potentiometer also turns .The feedback current of TAM is changed . This feedback current is regarded as the remote - control indication of the actuator .

The basic circuit of **on-off** electrical actuator. Refer to Fig3 (1 phase)
 . The basic circuit diagram of the **on-off** electrical actuator.

7. Mounting and adjustment

7.1. Mounting .

JX range: The configuration and installation dimensions actuator .When the actuator is mounted ,it should have enough space to manual operation ,adjustment and inspection .

For flange mounted construction ,the actuator may be installed vertically, horizontally and inclinedly. The dimension of flange is keeping with the ISO5216 standard. If it' s non-standard, please consult with us.

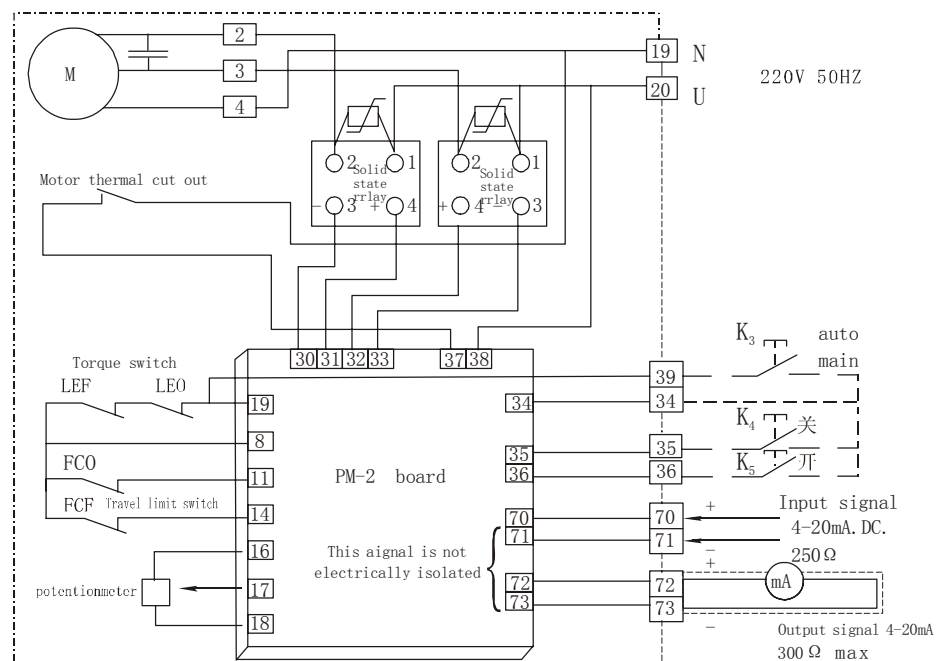
For foot-plate mounted construction , the actuator may be installed vertically, horizontally and inclinedly. The installation plane should be smooth. The connection of actuator with valve can be realized by means of link lever and ball-joints. To pay attention to the following notes:

▲ The valve

connective size of output arm in keeping with actuator' s.

▲ The two output

arms should be mounted to keep parallel and keep



in the same plane.

▲ The tension point of two ball-joints is keeping same plane, It is necessary to keep parallel with the plane of two output arms , to avoid the additional torque.

▲ For the rust proof and convenient maintenance to grease on the mounted plane when the actuator connected with valve .

7.2. Writing :

Switch off the power supply when the actuator is connecting .

The internal-connection has been done when the actuator leaves the factory .

The external—wiring can be connected with the terminals of positioner and remoted control box. The plug cable of separated model PM is weled and connected with remote control according to the wiring diagram by the user hemselves. The cables of power supply and signal should be separated each other. The cable of signal (including feedback signals)is the shielded cable and it' s connected with the earth of instrument signal. Externally connect the power supply wires according to the marked number of motor phase in the name plate.

It needs special noticing the phases order of 3 phases motor.U.V.W are corresponding to terminals 20.21.22.or 5.6.7.The user connects the wires after surveying the phase order of the 3 phases power supply. In the case of having no phase order sheet, firstly, make the valve turn to the mid-open

position. And then check the phase order and rotating direction according to the adjustment procedure.

7.3.The adjustment of integral—model proportional modulating actuators.

7.3.1 The adjustment of integral—model proportional modulating actuators.

First turn the hand-wheel to operate actuator, it should rotate smoothly and have no block and noise.

Then moved the cover of travel limit box and GAMK-D positioner' s of the actuator.

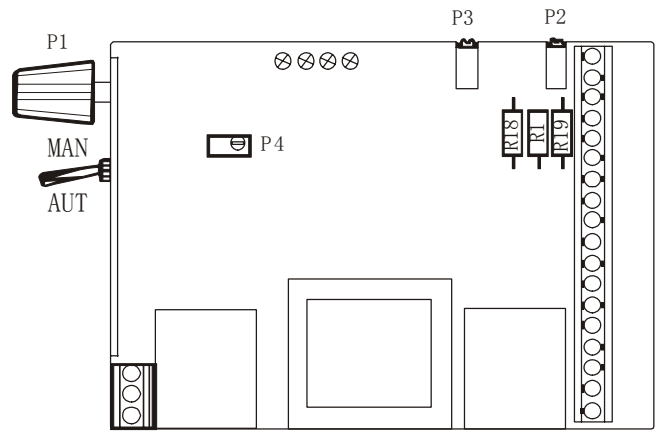
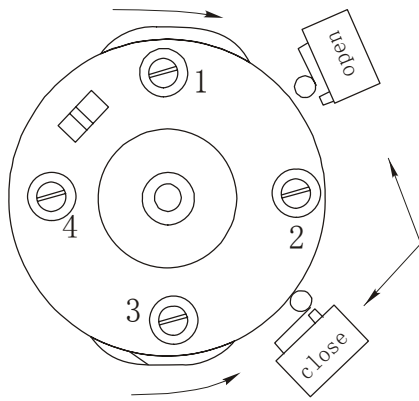
According to wiring diagram, connect the wires of the actuators.

It need to be explained that: It is possible to control the positioner PM-2 with an analogue signal, also with **on-off** signal. Furthermore it can supply an output signal for the position indication. The control cable for these signal has to be separated from the others . (Multi-turn 1 inch distance)or shielded, otherwise there could be risk of interference. The control cable for these signals can be used shielded cable. The shield of the shielded cable can be connected to terminal. I or the earth connection of signal. At the same time, it should be isolated from the earth of equipment.

7.3.1.1 Direction of rotation.

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The adjustment of integral—model modulating actuators has already setted in our factory. It' s not necessary to readjust, only according to zero



position of valve, fitting them together correctly. After connection, please inspect whether the direction of rotation is correct . The adjustment procedures is as following: Turn the hand-wheel to make the actuator at 50% mid-travel. Cut off the wires between terminal 39-34-35-36. Set change-over switch of the PM-2 positioner in manual position **MAN** Turn.. control knob P1 at the mid-travel in advance.

“The structure diagram of PM-2 position .”

Supply the power voltage, then with the incorporate manual control knob P1, make the actuator rotated for different direction.

When the actuator turn for open direction, the green LED on.

When the actuator turn for open direction , the red LED on.

In any other case, cut off the power supply immediately and check the wiring between the motor and the positioner.

A RED LED is twinkling when the torque limit switch is tripped. This protection state is effective even in the case of a wrong direction of

rotation.

7.3.1.2 Setting of deadband

This setting has been already. done in our factory, but it is possible to obtain a finer accuracy by regulating. potentiometer P3(dead band will decrease when P3 is turned CCW). If setting is too narrow, actuator is hunting.

Note: If dead hand is excessively narrow, actuator may operate in one direction only.

If it' s necessary to be resetting, use the potentiometer “P3” . (P3: Multi-turn-potentiometer)

7.3.1.3 End of travel setting(The end of position)

This setting has been already done in our factory.

The setting procedures is as follows: First switch off the power supply. To take the cover of the control box, then it can be seen that the cam and potentiometer mechanism.

Remove potentiometer support item 8 by loosening the 3 fixing screws item 7. The cam is below. The cam is equipped with 4 cams having different colours. The under-cams 4 and 3(blue and black)for controlling the beginning and the end of travel limits.

Turn the hand-wheel to operate the actuator until in the full close position, by means of a screw-driver press and rotate the cam 4 to the position in which it can trip the limit switch for close position, Lift the screwdriver, the cams are licked in this position at once. Proceed on the same way for

the open position.

After adjustment has completed, operate the actuator by hand-wheel to mid-travel; fix the potentiometer plate. Now we should put the driving pin of potentiometer item 10 into the slot of the cams.

The cams 1 and 2 for halfway of limits, it is can be adjusted according to the needs of the users.

7.3.1.4 Setting of 0%.

Above adjustment has completed, set changeover switch of the positioner in manual position **Man** and put the power supply **On**. Turn manual control knob P1 clockwise to the end position, actuator will operate for **close** direction.

If the actuator start to rotate for the close direction and stops before reaching the closed limit switch. Please loose the 3 fixing screws item 9 and turn carefully the potentiometer till the actuator reaches close travel limit switch and RED LED is off Retighten the 3 fixing screw item 9 .

If the actuator start to rotate for the close direction and doesn' t stop before reaching the closed travel limit switch (that is , the **close** limit switch is tripped and actuator doesn' t rotate, but **RED LED** is on). In this case , loosen the 3 'fixing screws item 9 in fig 28 and turn potentiometer to the other direction till **RED LED** is off . Retighten the 3 fixing screw item 9 .

7.3.1.5 Setting of 100% .

Turn the manual control knob P1 to the end of 100% position the actuator

starts to rotate for the open direction and stops in reaching **open** travel limit switch 100% mechanical position .

If actuator starts to rotate for the open direction and stops before reaching **open** travel limit switch (IED is off) .Turn potentiometer P2 counter clockwise until the actuator reaches open travel limit switch . If the actuator starts to rotate for the open direction and doesn' t stop before reaching **open** travel limit switch , in this case , turn potentiometer P2 counterclockwise until GREED LED is off .

After that setting , turn the changeover switch in “AUT” position .

--Connect the input signal .

The actuator is in the position at 4mA to 20mA to 100%.

Actuator is operation proportionally to all intermedicate signals

The 0% and 100%position of the actuator can be done much precisely by using a DC voltmeter . The procedure as follows :

Connect voltmeter between terminals 71 and 72 (terminals of the electronic board) . Turn control knob P1 to 0% , actuator will run for the closed direction . Loosen the 3fixing screws item 9 of potentiometer on the actuator and turn carefully potentiometer to area where the voltage reading 1 volt on the voltmeter .Set potentiometer at point just when voltage and resistance starts increasing .

Retighten the 3 fixing screws item 9 . When the position of the actuator is in **open** position, turn the potentiometer p2 to read exactly 5 volt in

voltmeter . The adjustment has been completed .

7.3.2 The notes of integral model PM-2 positioner.

7.3.2.1 How to use the output signal of the positioner.

Terminal 72+and 73- is the output signal of the actuator, no supply requested from outside.

The max output distance of load is 300Ω .

Important note: This signal is not electric isolated from the input signal .

If it' s need to be isolated from each other , please order the “isolated model board” .

7.3.2.2 The setting and modifying of the input signal .

The JX position can receive on the user' s request of the different input signals : 4-20 mA ; 0-10 V .

Put the switch from 1 to 5 in the different positions shown in the following table .

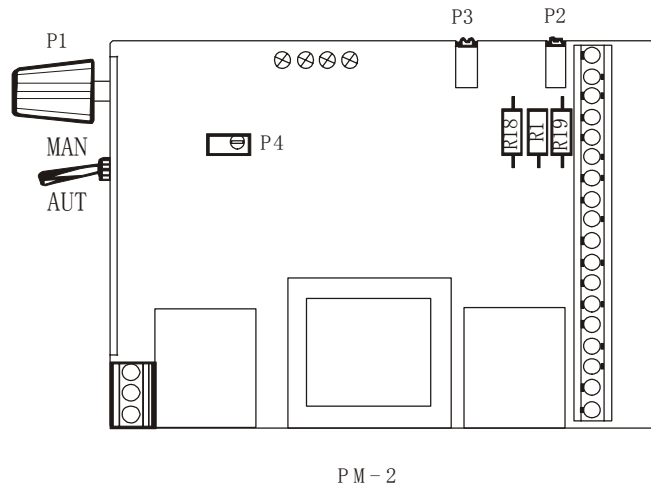
When the original input signal is 0~10 V , please replace R1 by a resistance 4.99K ohms(1%) .The method is :

Add another resistance 4.99K ohms (1%) at the allocated place of R18 and cut on the other side the circuit which is shown with an X .

Remarks :When you have an input signal of 0-10 V, the output indication is always in 0~20 mA .

7.3.2.3 Anticlockwise for the close direction .

According to the changing method shown as follow ,the actuator can excute anti-clock-wising for the close direction .



7.3.2.4 Wiring :

Compand to the standard wiring diagram Fig 21 (rotating for the clockwise direction 4 mA) , the following changes have to be made on terminals of the electronic card :

- Exchange 16 and 18 (potentiometer)
- Exchange 11 and 14 (travel limit switch)
- Exchange the rotational direction of the motor by inversing 2 cables of the motor supply or by inversing cable 31 and 32 . (2 solid relaies of the positioner)
- Exchange the labels opened and closed of the travel limit switches.
- Now the labeling **open/close** of hand-wheel is inversion.

Adjustment : The adjustment of the positioner is done in the same way as the standard units ahead.

The feed-back of the signal wire is in phase with the input.

-----Input signal 4 mA =output signal 4 mA.

7.3.2.5 Remote impulsional command.

It is possible to operate the PM-2 for open and close operation when you turn off the position.

Short-circuit terminals 39-34=the positioner is switched off.

Short-circuit terminals 39-35=close command.

Short-circuit 34-36=open command.

All protection circuit, signalling and position feedback signal are still in operation state. The feedback of the signal is in phase with the input . That is , input signal 4mA=output signal 4mA.

7.4.Adjustment of remote controlled operation for actuators(no positioner).

Turn the actuator to the mid-travel position by hand-wheel (To observe the position indicator)

Connect the motor with the power supply in phase (1 phase only connect termial 19 ,20) .The phase - sequence is U,V,W .

7.4.2 Adjustment

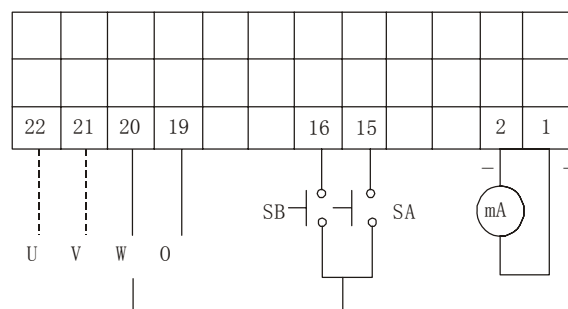
Put the goniometer on the output shaft of the actuator ; turn the actuator to **closed** position by hand-wheel (about 2° to the mechmical limit) . Adjust the cam item 4 to **close** direction until it can trip the **closed** travel limit switch . Loosen the 3 fixing screws item 9 ,and carefully turn the potentiometer to make the indication of the milliammeter 4 mA . (If the error is

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very small , a micro adjustment may be made by setting the 0% of TAM) . Retighten the 3 fixing screws . Setting the goniometer on the “0°” position . Turn the actuator rotated to 90° position by the hand-wheel . Adjust the cam item 3 to open direction until it can trip the **open** travel limit switch . To make the output signal at “20” mA by setting 100% , the indication of the milliammeter . After switching on the power supply , push “Sb” close push—button not , “Sa” open push—button to check, whether the “0” and “90” position , and 4~20mA feedback signal is correct or not . If it is not , a micro adjustment may be made once more .To check the function of problem. When the actuator is operating at open or close direction. (man-made) tripped the relative switch by man-made. Now the protection relay for over-torque is In action. When the actuator anti-rotates, the relay is unlocked. (switch off the power supply). If it is not, please inspect whether the connections is correct or not.

The other adjustment, please refer to the above mentioned procedure.

According to the open and close position of the actuator and the related position of the valve, completely install them tighter correctly. (Direct-mounted model and foot plate-mounted model). Switch on the power supply, the check whether the position for the open and close position is correct or not. Then made the actuator into operation.



7.4.3 The inversion function of actuators

For the remote-controlled actuator of inversion function , it is very easy to exchange connections. Normally terminal 15—**open** control terminal 16—**close** control.

When it is in antiaction: terminal 15—**close** control.

terminal 16—**open** control.