

I. General Description

DKJ-BD series explosion-proof electronic angular travel electric actuator is the terminal control device of industrial process measurement and control system, which can transfer the control signals of the system to the location of angular displacement control valve's closure pieces of the output shaft or other regulating mechanism and make the controlled media to work according to the system-prescriptive state.

DKJ-BD series explosion-proof electronic angular travel electric actuator is composed of servo motor, reducer, position transmitter with the servo amplifier, which can compare the control symbols of the systems with the feedback symbols of the location of response output shaft (closed-loop control) so as to change the trip of output shaft and become proportional relationship with the output signal.

The undisturbed switching of the "automatically - manual" work state of the control system can be realized according to utilize the automatic control system of the electric actuator and DFD series electric operators.

The explosive-proof grade of DKJ-BD series explosion-proof electronic angular travel electric actuator is Exd II BT3 which can used in the prescriptive explosive atmosphere (the usage scope can refer to GB3836.1-2000 General requirements of Electrical apparatus for explosive gas atmospheres standard and GB3836.2-2000 Electrical apparatus flame-proof type "d,, for explosive gas atmospheres standard.

This series electric actuator is safe and reliable, easy installation, commissioning, operation and convenient maintenance, which has been widely used in electricity, chemical industry, petroleum, metallurgy, building materials, light industry and plays an important role in industrial process measurement and control systems.

II. Specifications and Models

See the specifications and models of DKJ-BD series explosion-proof electronic angular travel electric actuator in the following table 1.

Table 1

Model	DKJ-2100BD	DKJ-3100BD	DKJ-4100BD	DKJ-S100BD	DKJ-6100ABD	DKJ-6100BD	DKJ-7100BD	DKJ-8100BD
Operating signal	4-20mADC							
Output torque Nm	100	250	600	1600	2500	4000	6000	10000
Travel time S	25				40	60	100	100
Rated travel	90"							
Motor power	16W	25W	60W	160W	160W	350W	800W	1000W

III. Working Conditions

Read this chapter thoroughly before operating.

1. Power conditions

Single-phase alternating current

Voltage: 220 V \pm 10 % Frequency: 50 Hz \pm 1 %

2. Environmental condition

2. 1Temperature, relative humidity Temperature: - 10°C , , + 55°C Relative humidity: no more than 95 %

2. Atmospheric pressure: 86106 KPa

3. It is allowed to contain the explosive gas whose booster capacity is not more than class-11 grade-B group-T3 but does not contain the corrosive gas.

IV. Main Technical Performance

Industrial-process Measurement and Control Systems, whose main technical performance is as follows:

1. See the rated load, rated travel and rated travel time of the output shaft in table 1;
2. See the range of the working signal of the electric actuator in table 1;
3. Reference performance:

Limit of intrinsic error: no more than $\pm 2.5\%$ of the rated travel;

Return difference: no more than 1.5% of the rated travel;

Time error of the rated travel: no more than $\pm 20\%$ of the rated travel;

Skip area: no more than 3% of the input range; damping characteristic: no more than 3 times half-period swing;

4. Power supply: single-phase voltage $220V \pm 10\%$, frequency is $50Hz \pm 1\%$;

5. Dielectric resistance:

When the Temperature is $15^{\circ}C \sim 35^{\circ}C$ and the relative humidity is 45% 75%:

The dielectric resistance between power supply terminal and case is not less than 50 M Ω ;

The dielectric resistance between power supply terminal and input terminal is not less than 50 M Ω ;

The dielectric resistance between input terminal and case is not less than 20 M Ω ;

V. Working Principle and Structure Statement

DKJ-BD series explosion-proof electronic angular travel electric actuator is a positional servomechanism with Single-phase AC servo motor as the prime motor, whose system block diagram see table 1.

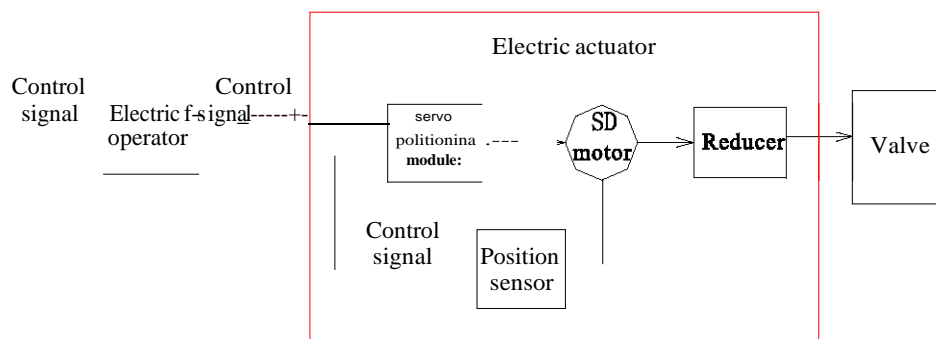


Table 1 The system block diagram of electric actuator

As shown in the figure, when there is input signal in the servo positioning module, it can compare with the position feedback signal from position sensor. If there is signal error, the servo positioning module will make the servo motor rotate so as to make the output shaft of the reducer to move towards the direction of reducing the deviation (position sensor will change the actual position of the output shaft to the position feedback signal of servo positioning module constantly) according to amplify the conduction corresponding circuit until the signal deviation less than dead area and then the output shaft will be stabilized on the position of the corresponding position with input signal. Trip of the output shaft is proportional to the input signal.

Electrical motor is squirrel-cage single-phase AC servo motor. The rotor resistance of this motor is larger which has larger starting torque and softer mechanical properties. It equipped with a braking device in the end of the servo motor which can brake rapidly after the power failure of the electrical motor, limit the inertia coasting operation of the output shaft and the influence of load reaction torque effectively, make the output shaft stop in the specific position, improve the system stability. Electrical actuator utilizes AC capacitor as the split-phase capacitor of single-phase AC servo motor which improves the reliability of the product. The motor is explosion-proof design with the explosion-proof level as Exd II Bt3.

Reducer is driven by first-level cylindrical gear and first-level involute teeth planetary gear which has the feature of big transmission ratio, small size, high efficiency, low noise, long life etc. There is hand wheel to proceed local adjustment and operation in the reducer and the rotation direction of hand wheel and the output shaft are the same.

Servo motors is installed in the reducer and there is a handle in the rear cover which can be turned from side to side to switch between the state of "electric" and "manual". When installation and commissioning, system or line are at fault, you can disconnect the power, pull out the hand wheel to the "Manual" position (the handle of the motor can pull to the "manual" position) and proceed the local operation.

The hand wheel and the motor handle must be put into the "electric" position except proceeding manual and local operation under the condition of power disconnection.

The end closure of the reducer is equipped with two brake pads fastened by T-slot screws and nuts which is the mechanical inhibiting device of angular travel actuator.

Integrated Servo position sensor is composed of micro switches, such as gear device, the sensing components, power supplies, servo positioning circuits and cam etc. The angle changes of the output shaft will rotate through the gear drive cam angle and conductive plastic potentiometer. The resistance changes of the potentiometer will be outputted through transforming the amplifying circuit position feedback current signal as position signal output. There are two potentiometers in the amplifier circuit PCB: "0%" potentiometer and "100%" potentiometer which are used to adjust the lower and upper limit of the position feedback current.

The shaft which drives the conductive plastic potentiometer to rotate is equipped with two adjustable cams which can make the two micro switches to operate respectively. The cam micro switch close to the conductive plastic potentiometer can cut off the motor circuit which makes the output shaft rotate clockwise (observe facing the output shaft) and the other cam micro switch can cut off the motor circuit which makes the output shaft rotate counterclockwise. These two groups of cam micro switches form the electrical inhibiting device of the actuator.

Position feedback signal can be adjusted to two states: positive effect or adverse effect.

When the output shaft of the executive body rotates clockwise, the position feedback current increases is called as positive effect.

When the output shaft of the executive body rotates clockwise, the position feedback current decreases is called as positive effect.

VI. Checking and Debugging

Every motor actuator has been tested strictly before leaving the factory according to the criteria. Please the users to carry out the following checking and debugging operation before the installation to ensure the use security taking into account the impact of transport and storage:

Checking:

1. Dynamic conditions and environmental conditions of the site should comply with the provisions of Chapter III of this manual.
2. The content nameplated in the executive body should comply with the requirements of the normal operation of system and valve.
3. Check the insulation resistance.

Use 500V megohm meter to measure the insulation resistance between each group terminals and cases described in chapter IV of this manual.

4.1 fastener check

The fasteners cannot be loose, please screw down if loose.

4.2 Movable part check

The hand wheel and the handle (abbreviated as motor handle) of the motor's end cover can be switched between the position of "manual" and "electric" flexibly, which can be positioned reliably by the internal steel ball in the prescribed position (the steel ball pressure of the hand wheel can be adjusted by the clamp screw before the hand wheel). In the position of "electric", the idle run of the hand wheel should be flexible.

Reset the hand wheel or the handle of the motor to "electric" after checking.

5. Wiring

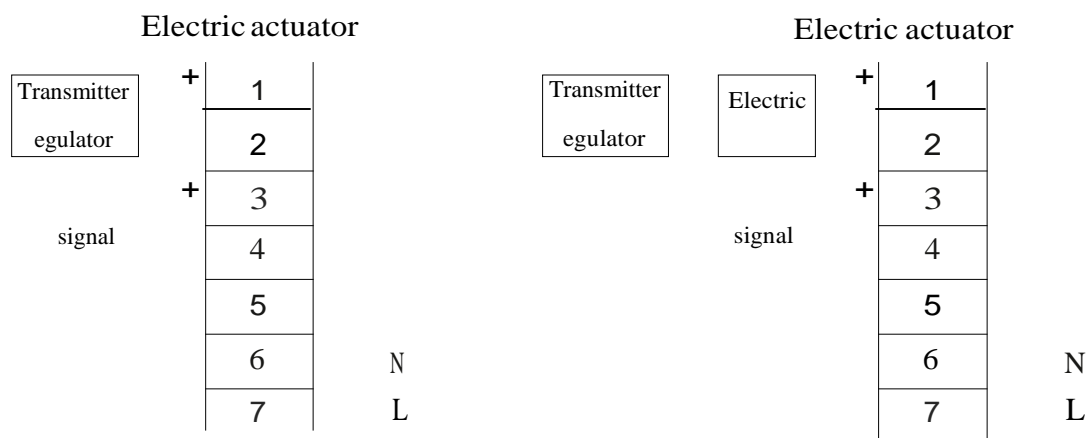


Figure 2-A Electronic actuator wiring diagram of the electric actuator without wiring

Figure 2-B Electronic actuator wiring diagram of the electric actuator with wiring

the fire wire and zero line of the power supply cannot be wrong. The grounding must be solid and reliable. Use shielded cable at the position of input signal line and the position of feedback signal line.

Debugging:

1. Wring according to the wring diagram 3.
2. Electrify after inspecting to be faultless.
3. Set the switch to be "manual" status.
4. Correct the opening and closing direction of the travel: when the operation status is open, the motor should be stopped after the terminal switch is open; when the operation status is close, the motor should be stopped after the terminal switch is open. **If the actual fact is not the same with the above-mentioned situation, please exchange the terminal switch 8 and 9, 7 and 10 simultaneously.**

If the direction of the motor switch is not same with the manual operation direction, please exchange the terminal switch 15 and 16.

5. Correct 4 - 20 mA: make the actuator to rotate to the close direction manually. When the terminal switch is close after being pushed open, the potentiometer in the rotary position make the feedback current as 4 mA and show as "0%" .

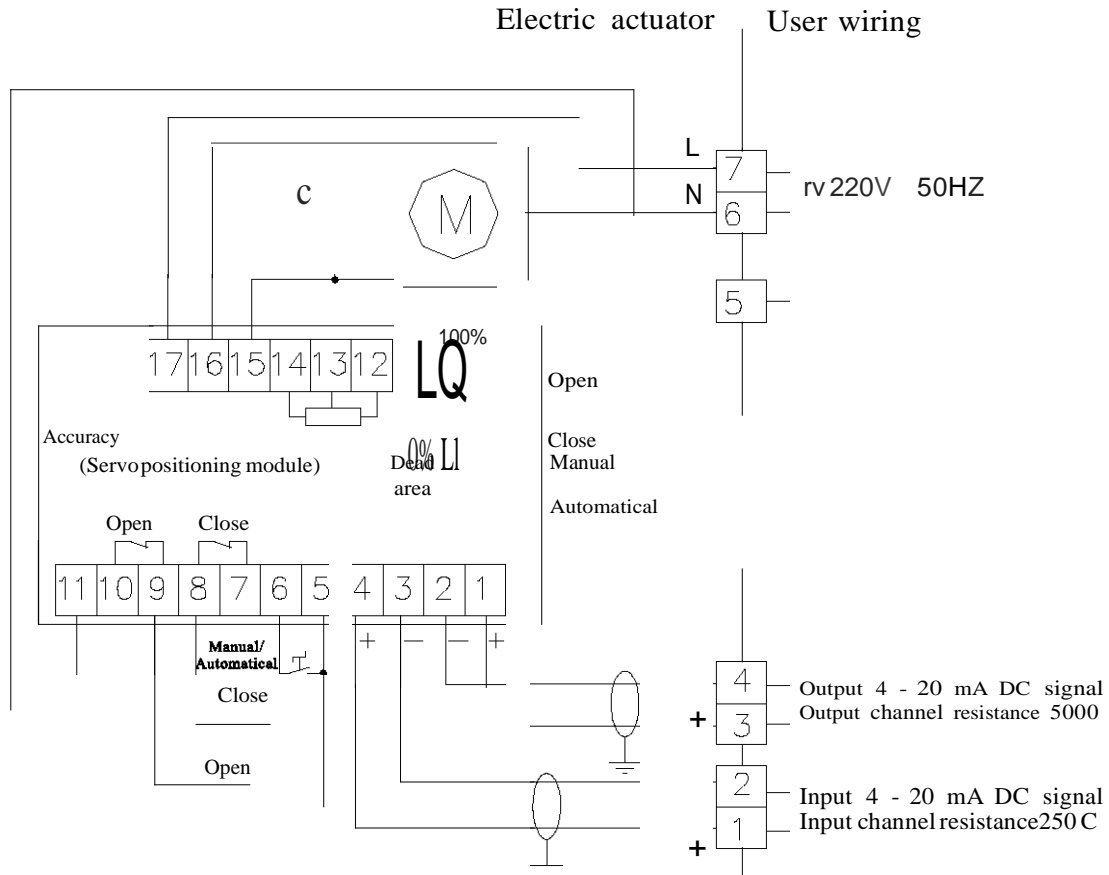
Make the actuator to rotate towards the open direction. When the terminal switch is close after being pushed open, adjust the 100% potentiometer to 20 mA and show as "100%" . Repeat twice usually.

6. Set the switch to automatic mode and connect the output signal 3 and 4 to the system (or connect to the ammeter or short circuiting). Input the given signal 4 - 20 mA to the terminal 1 and 2. Input the signal in the position of 4, 8, 12, 16, 20 mA and observe the display deviation which is shown as 0%, 25%, 50%, 75% and 100% (the deviation is not less than 1%).

Please adjust the potentiometer of the dead area to increase the dead area if the shock occurs (counterclockwise rotary dead area should increase).

7. The final test break signal protection will break the given signal or the feedback signal. The actuator in operating should stop immediately.
8. Observe whether the actuator function is clear-cut or not and no stopping.
9. The actuator is adjusted according to the travel at the time of leaving the factory. If the site needs the return trace, please exchange the terminal switch 8 and 9, 7 and 10 simultaneously; position potentiometer terminal 12 and 14, motor terminal 15 and 16 simultaneously.

Pay special attention to: the wire splice of 15, 16 and motors cannot concatenate any switches, otherwise, the solid state relay will be ignited or damaged easily.



Note:

- 1.The wiring between 15, 16 and motor cannot concatenate any switches; otherwise, solid-state relay (SSR) is easy to be burned down.
- 2.There are the operation of "manual /automatic" switch, manual "open" and "close" etc. The same function in the terminals is provided to the distance location.
- 3.The two groups of signal wire must use shielded wire and the shielded layer must be earth connection!

Figure 3 The actual wiring diagram of electrical actuator

VII. Installation, Adjustment, Utilization and Maintenance of Electrical Actuators

1. Installation

Explosion-proof electronic electric actuator cannot be installed in the circumstance with ambient temperature as -10°C \rightarrow 55°C , relative humidity as less than 95%, the explosion level as no more than II B-class, and the self-ignition temperature of combustible material as no less than that of area 1 or area 2 of the group T3 dangerous places. While there is not corrosive gas around. The actuator should be installed at the base of concrete or metal frame and tightened with anchor bolts. The output arm terminal can be connected with the actuator with connecting rod and the special joint.

There have been added enough lubricant grease into the actuator before leaving the factory. When it needs to supplement lubricant grease or annual overhaul, the eye bolt at the top of the reducer can be removed and inject the lubricant grease from the bolt.

See the outline overall and installing dimensions of DKJ-BD series explosion-proof electronic angular travel electric actuator in diagram 4 and the wiring terminal in diagram 5.

2. Adjustment of operation location

Loosen the nut of tightening brake block, remove the transmitter covers, place the hand wheel and the handle of the motor in the position of "manual", and shake the hand wheel to rotate the output shaft to the lower limit position of the corresponding feedback current (hereinafter referred to as lower position). Make the brake block close to the output arm and tighten the bolt used for fixing the brake block according to the fact that the working state is positive effect or adverse effect. Rotate the hand wheel (when it is positive effect, rotate clockwise; when it is adverse effect, rotate counterclockwise) and make the output shaft rotate 90° (hereinafter referred to as upper position). Make the other brake block close to the other side of the output arm and tighten the bolt. Adjust the cam according to the description of micro switch cam in Chapter V and utilize the relative micro switch when the output shaft is placed in the two limit positions and fasten the round nut in the camshaft. Place the hand wheel and the handle of the motor in the position of "electric", switch on, rotate the output shaft repeatedly and observe the correctness of the adjustment. Rotate the output shaft to the lower position, loosen the bolt on the plate of fastening conductive plastic potentiometer pressure, hold the potentiometer and move it slowly into the lower position with the position feedback current as the range of working signal and fasten the bolts on the plate. Adjust the "0%" potentiometer in the adjustable printed board; if the output shaft is rotated to the upper limit direction, the position feedback current should increase (if the position feedback current increases suddenly when it decreases to a certain value, and then it began to decrease again, it needs to exchange the wiring 1 and 3 of the conductive plastic potentiometer and re-adjust the lower limit of position feedback current.) When the output shaft rotate to the upper limit position, adjust the "100%" potentiometer on the PCB and make position feedback signal to be the upper limit of working signal range.

Please tighten the cover of location transmitter after adjustment is completed.

3. Utilization

Check whether the wiring is correct or not and the hand wheel and electrical handle are set at the "manual" position before powering and operating.

Add the corresponding protection device in the electrical circuit, such as the circuit breakers according to the rated power, rated current of the motor on the spot.

Check whether the field voltage coincides with the nameplate or not, all the wirings are reliable or not according to the wiring diagram and the case earth is good or not. Mount on the cover of the junction box and tighten the screws. Switch on after ensuring that all the bolts of the explosion-proof surfaces are tightened. Pay special attention not to open any flame-proof shell and cover in the dangerous sites with explosive gas. Cut off the power if it is necessary to open.

This series of actuators have the following three operation modes:

- a. "Automatic" operation automatic operation after receiving the control signal of the systems.
- b. "Manual" operation realizing electric operation of the actuators after giving signal manually.
- c. Local operation cut off the power and the operator can rotate the hand wheel to proceed local operation to the actuators.

Automatic operation: the automatic operation can be completed through rotating the switch handle of the operators to the automatic position after the electric operator is connected.

Manual operation: operate with the button in the operator panel after rotate the switch of the electric operator to the "manual" position.

Local operation: it is used when the system and circuit are broken down or at the time of installation or debugging. Rotate the electrical operator to the middle position and place the motor handle and hand wheel to the "manual" position at the time of using hand wheel to carry out the local operation.

After completing the local operation, reset the hand wheel and handle to "electric" position.

4. Maintenance

The actuators should always be maintained.

Check whether the fasteners are loose or not, locking is reliable or not and maintain timely in the area of vibration. Overhaul the frequently-used actuators every one and half year.

Clean the parts carefully and change all the fasteners and worn parts.

Remove all the lubricant grease and refill new lubricant grease.

Dismount the rear cover and the cuttings between brake discs and the brake wheels. Adjust the gap and the braking force between brake discs and the brake wheels.

Pay attention to change the damaged parts and aging wires and change all the micro switches at the time of overhauling all the electric devices.

Pay attention to make the sealing element work effectively at the time of mounting the position transmitter on the reducer.

Check all the insulating resistance between the wires and cases using 500V megohm meter.

Inject the machine oil into the reducer.

Specify the wiring, adjustment and installation of actuators according to this instruction manual.

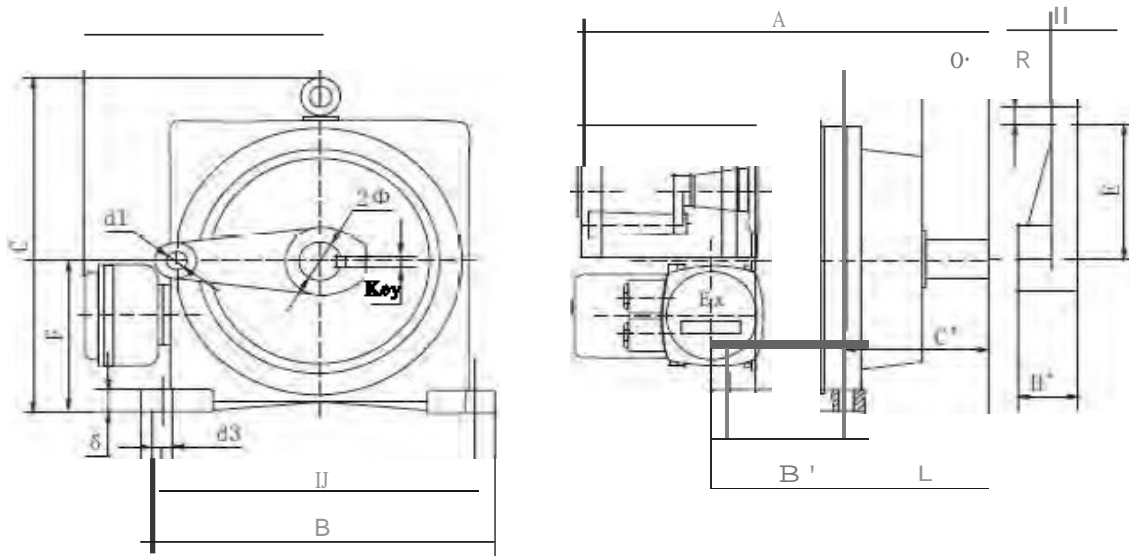


Figure 4 The diagram of outline overall and installing dimensions

Model	A	B	C	D	E	II'	G	d1	4-dS	H
DKJ-2100BO	400	250	280	220	1110	12S	180	14	12	15
DKJ-310080	440	3110	300	260	120	13.S	JPj	16	14	24
DKJ-410080	520	36S	360	320	150	170	US	18	14	23
DKJ-5100BO	670	440	440	390	170	196	190	20	14	25
DKJ-6100ABO	750	440	440	390	2110	196	190	30	14	2S
DKJ-6100BO	760	480	SOD	420	220	230	200	3S	18	35
DKJ-7100BO	780	550	540	410	280	250	213	3S	20	35
DKJ-810080	780	S.S0	540	410	280	250	213	3.5	20	35
Model	R	K	H'	L	II	B'	C'	O'	H	Key
DKJ-2100BO	15	130	35	85	25	U2	PS	3.5	25	835
DKJ-3100BO	17	1110	50	100	25	130	120	50	35	1050
DKJ-410080	24	no	100	120	30	114	142	60	40	1260
DKJ-5100BO	22	180	80	110	40	240	115	B8	78	1870
DKJ-6100ABD	33	180	80	75	35	240	110	90	SB	188.S
DKJ-6100BD	3.5	2110	80	14.S	3S	260	170	78	70	2080
DKJ-7100BO	35	2110	80	170	3S	270	200	16	78	2080
DKJ-810080	35	2110	80	170	3S	270	200	16	78	2080

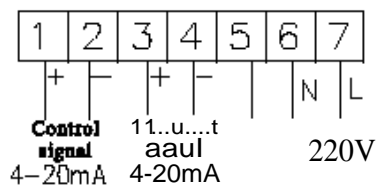


Figure 5