

Series HKM Electric Actuator Selection and Use Instructions

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1: Summarizing

HKM actuator is the world leader in the field of electrical actuator products for the petroleum, gas, power, water, waste treatment and so on industries. The series HKM actuator have two kinds of menu, one is the Chinese menu, the other one is the English menu. Here we only explain the Chinese menu actuator, if you want to know the English menu actuator, you can access our website: www.hurko.cn.

To Hurko HKM actuator, we enjoy an unparalleled reputation for our imaginative and effective use of advance technologies, and the quality and proven reliability of our products.

HKM actuator has the expertise to take on virtually any actuator challenge—including equipment for use in hazardous extreme cold and sub-sea conditions.

Customers choose HKM actuator for our ongoing commitment to:

Technological innovation: at Hurko we pride ourselves on developing leading-edge actuation solution through on-going research and development.

Flexibility: every HKM actuator is precision-built using pre-manufactured modules of the finest materials to meet a vast range of specification quickly and efficiently.

Quality: every HKM actuators are hanging assembled and fully rig tested to stringent standards prior to dispatch.

Reliability: every HKM actuators use advanced lubrication, electrical, and sealing techniques, to be virtually maintenance free.

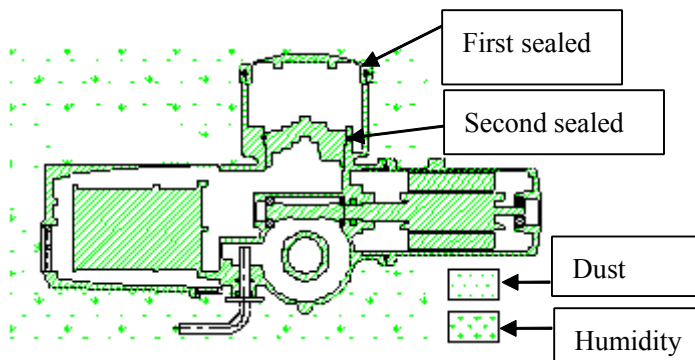


Diagram 3-1

2: Main Technique Parameters

■ Input signals:

4mA~20mA;1VDC~5VDC;

2mA~10mA;0.5VDC~2.5VDC;

20V~60VDC or 30V~220 VAC electricity signal;

■ Power supply:

380VAC/50Hz;220VAC/50Hz

■ Accuracy: $\leq 1\%$

■ Deadband: 0.1~9.9% of travel between open and close limit positions

■ Enclosure: IP68

■ Anti explosion mark: Exd II CT4

■ Ambient temperature: $-40^{\circ}\text{C} \sim +70^{\circ}\text{C}$

■ Ambient humidity: $\leq 95\%$

3: Features Specification

3.1 The working principle of actuator

Motor spin to pass unite axle organization directly drive worm turn , worm drives worm gear to turn , and then drives output shaft through clutch to turn. When switch handle turns , in the location of by hand , on clutch, move , take off open worm gear and handwheel coupling, turn handwheel drive output shaft turn. Electric operation is prior always, unless operating handle has been locked , in the files of by hand. When output shaft turns , drives a pair of bevel gear to turn , and changes through valve position sensor detection valve position.

3.2 The function characteristic of actuator

3.2.1 Double sealed

All HKM actuator are double sealed watertight enclosure to IP68 (3 meters—48hours) and provide complete protection on the internal equipment even if the cable gland are opened. Refer to Fig. 3-1.

3.2.2 Non-intrusive design

Non-intrusive switching:

The HKM electric actuator employs magnetic induction mode switching

Non-intrusive setting:

Can be instantly set, checked and actuator non-intrusively using the hand held infra-red setting tool.

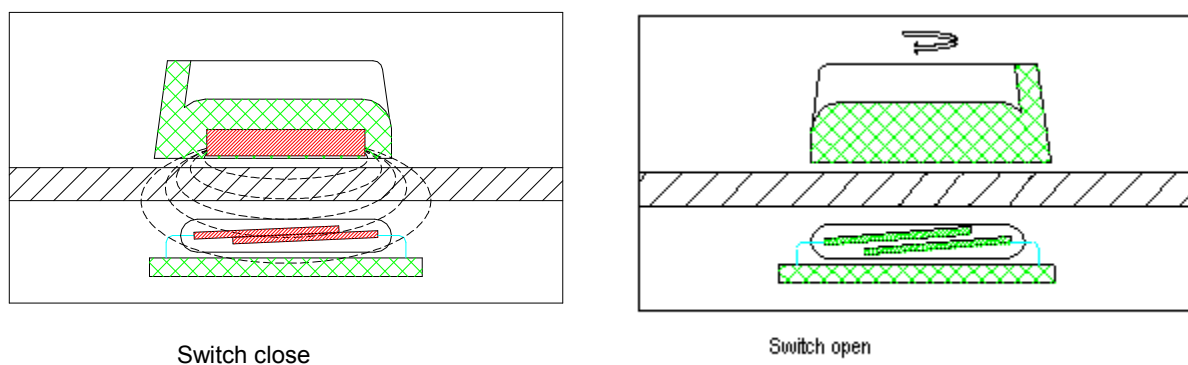


Fig. 3-1 Non-intrusive designs

3.2.3 Protection features

3.2.3.1 Torque protection

The torque protection values are independently configurable in the range 40 ~ 120% of rated torque ,serve as over-torque protection for the entire valve travel.

3.2.3.2 Limit protection

When the actuator runs to close limit position or opening limit position, it will stop(if limit position protect setting is “有”).

3.2.3.3 Automatically phase order adjustment

HKM actuator automaticly detect the phase order of the three-phase power supply , encourages the switch of which one through proper logic operation when deciding actuator's operation in order to guarantee the correct phase order of the motor. If no this function the motor maybe damage the valve because of the phase order mistake of wiring. With this function the actuator need not consider the phase order.

3.2.3.4 It is instant to turn on the contrary to protect

When actuator accepts to the order of opposite direction movement, adds a time voluntarily to

postpone , prevents producing the unnecessary abrasion for valve shaft and gearbox..

3.2.3.5 Power supply losing-phase protection

HKM actuator has the losing-phase protection function. It adopts to watch on the voltage and the electric current, can detect the power supply loses phase or not, also can detect that if the power supply loses phase or not when the motor is in the operation course, so, can prohibit the motor start the operation, avoid to execute the running instruction to the motor when losing phase .

3.2.3.6 Protection when valve is locked

Regardless of actuator to open direction or close direction movement still, sending the signal that encourages motor after seconds time from 5s to 10s , temporarily, prohibit torque to be protected (if the actuator in the above-mentioned second time of 5-10 have no movement, control circuit can cut off the power supply of motor).

3.2.3.7 Motor over temperature protection

Two thermostats are embedded in the motor stator end windings that will trip and de-energise the motor if the temperature exceeds its rating. The thermostats can be overridden during an ESD operation.

3.2.4 Checking for valve position and torque

The actuator has a pair of bevel gear to pick up the turn of the output shaft , drives a circular magnetic flat on the circumference has many N poles and S poles, makes its two environmental magnetic quick switches produce pulse signal, let the pulse signal be sentenced and counted so as to calculate the valve position. Valve position detection resolution capacity is 11.5° output shaft corner, output shaft revolution amount to value upper limit reaches 2040 turns , this stroke scope signifies HKM actuator is great.

The detection of torque comes to get from the detection of the electric current and magnetic flux, this has realized the continuous measure for output torque, makes adjustment of the torque protection value can be accomplished with the setting-tool easily.

3.2.5 Solid state relay and function of inertia braking

With solid state relay, substitute AC contactor has raised the working frequency of regulation type , and has prolonged service life.

To satisfy the requirement of higher positional accuracy, HKM actuator has offered inertia braking function. If client needs when ordering goods the function of inertia braking, we offer the product that has this function. Whether use this function can pass by user to setting tool, select in scene. The function of inertia braking takes effect under various electric mode of operations.

What needs pay attention is that have used the function of inertia braking and have increased motor winding give out heat to measure. Therefore we suggest the condition in necessity to use the function of inertia braking.

3.2.6Intermittent timing operation

Intermittent timing operation means that actuator will execute a period of time opening and execute a period of time closing and a period of time opening again, and so on. The motion time and stopping time may be setting by the infra-red setting. This effectively increases the valve stroke time and can be adjusted to prevent hydraulic shock (water hammer) and flow surge in pipelines.

3.2.7 Network communication

HKM actuator provided full compatibility with proprietary remote supervisory control

system as well as all current network communication protocols, including Modbus, Profibus and Foundation Fieldbus.

3.2.8 Actuator's setting and check

All HKM actuator functions can be rapidly set and checked without removing the actuator covers (even in wet or hazardous conditions) using the free, infra-red setting tool supplied. Intrinsically safe-certified and watertight, this handy device can also be used to control the actuator locally. Actuator setting such as the following functions with infra-red setting tool.

- the rotary orientation of output shaft during the close stroke
- protection function of open limit position and close limit position
- protection values for torque during the open or close stroke
- setting open or close limit position
- push to run or maintain for local control
- setting ESD Optional function
- setting analogue control signal
- setting interlocks function
- setting the four state indication relay

3.2.9 Display of the actuator

A back-lit liquid crystal display gives digital indication from fully open to fully close in 1% increments. Two LED's colored red, green for indication of close and open. The liquid crystal could display menu, alarm and valve position in the same panel. And the alarm includes valve alarm, actuator alarm, control system alarm and actuator battery status. The back-lit will lighting as long as main power was supplied. The local display can be rotated to suit actuator orientation. Refer to Diagram 3-5.

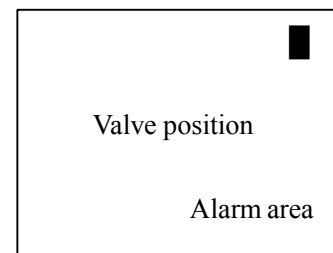


Diagram 3-5

3.2.10 Operation of the actuator

The mode of operation of actuator divides into the electric operation and hand operation. Actuator has handwheel used in operating by hand. Hand / electric switch handle is used to get actuator switch to hand operation, when the motor of actuator operates, switches organization because of having designed electric prior operation, actuator can return to electric mode of operation voluntarily.

HKM actuator standard handwheel is top pack handwheel, at the same time, we can offer the side that can be chosen to pack handwheel, lean to pack handwheel turn by deceleration gear biography go to output shaft, make by hand operating and more economical.

3.2.11 Structure of the actuator

a. Even if opening terminal cover in scene, the alone sealed terminal case can also guarantee the integrity of the electric equipment.

b. The control switch and working way of field work encourage way with the magnetism of isolation, have avoided needing sealed link up axle.

c. Show window on the spot can alternate different position, in order to meet the installation position of actuator. Additionally pass seal up show window, the infrared ware of the use for special purpose is set and diagnosed for actuator, need not open electrical case in scene and expose

built-in control circuit , this can prevent the control circuit from dust and moisture's corrode.

d. Low inertia high torque motor. After starting , motor can reach the torque of peak value promptly, if the motor has no excitation, it will not nearly exceed restricted transport move , in motor coil, there are some accurate temperature switches , these can avoid efficiently that motor is in overheat state.

e. The torque detection circuit of special design has avoided to use lever and the spring switch of torque control.

f. Worm drives worm gear in oil bath, this can raise the actuator's life farthest in the different environments.

g. Valve position counter can measure and control the stroke of actuator accurately, even if the power supply shuts off and electrifies the power supply again , the actuator can also guarantee the enumerated accuracy of valve position.

h. Directly drive handwheel but in power source appearance fault , offer reliable urgent hand operation.

i. The hand/ electric clutch can also be operated safely even if the motor is running.

Notice: When motor turns , clutch will automatically switch to electric mode, unless handle is locked in the location of hand intentionally.

j. To raise life and be easy to dismantle , the thrust of design that can be lubricated , can unload actuator under not change the condition of valve position.

k. To be convenient for suiting with valve , detachable drive bushing can be compound processing with valve rod.

l. To change the output speed of actuator easily, motor axle and worm axle are mutually independent.

m. Support the bus line on-the-spot of open : Modbus, CAN, Profibus and FF etc.

3.2.12 The organization of explosion proof of actuator designs

The structural design of explosion proof of actuator is basis: GB3836.1-2000 《Electrical equipment for explosive gas atmosphere use the first part general requirement》 and GB3836.1-2000 《Electrical equipment for explosive gas atmosphere use the second part separating explode type》 in which the relevant stipulation and requirement are used to design the separating explode products, separating explode sign is ExdIICT4. It applies to 1,2 environments of work area that contain II A, II B level and the T1-T4 level explosive mixture, atmosphere force 86 Kpa-106 Kpa, environmental temperature - 40 °C~ + 70 °C.

3.2.12.1 Good sealing

The combination surface of main housing and coordinate element is long , has little gap, this is advantageous to the separating explode, at the same time, with the fine O model sealing circle and the skeleton revolving oil sealing of import, it is satisfied with the sealing requirement.

3.2.12.2 Equipment for inducing the cable into actuator

Equipment for inducing the cable is designed according to GB 3836.2 and appendix D 《the supplementary requirement that equipment for inducing the cable of separating explode type and gasket》, it is the separating explode structure. Thread combines length and sealing ring with the combination width of cable is suitable to the requirement of separating explode standard.

3.2.12.3 The inducing link of the explosive proof type actuator

Wire lead into structure have adopted outside thread coordination, the method and organization that fills with fluid sealant have ensured the equipment of the separating explode performance.

3.2.12.4 The window structure of the explosion proof type actuator

Transparent window and housing have joined with O model weather strip and fluid sealant fill (this place must not open , otherwise can destroy to separating explode surface), double-deck transparent material presses to surround the structural installation that compressed tightly , have satisfied the requirement of 5.4, 5.5 and 8.1 in GB 3836.2.

To guarantee that the installation of actuator in difference has normal liquid crystal on direction to show direction, character shows normally that the liquid crystal of direction and actuator shows that screen has offered 4 kinds installation:

- a. Actuator horizontal direction installation (handwheel upturns), liquid crystal shows that screen is installed according to normal location;
- b. Under actuator dynasty lean direction installation (handwheel adown), liquid crystal shows that screen is installed according to normal location, can use setting tool to make the show way as show on the contrary;
- c. The actuator direction of left side installation (handwheel leftward), liquid crystal shows that screen is installed near flange a side;
- d. The actuator direction of right side installation (handwheel rightward), liquid crystal shows that screen is installed near flange a side, can use setting tool to make the show way as show on the contrary;

The installation direction that offers actuator more by user, we show the correctly installation supply of screen according to liquid crystal. If user does not offer the installation of actuator direction easily, we can send the staff to the spot to set the direction of the liquid crystal screen.

3.2.13 Electronic latch function

Actuator has arisen the phenomenon of over torque very easily when starting high inertia load. To be able to start high inertia load successfully, HKM actuator prohibits torque temporarily in sending some seconds of times after signal that encourage motor to protect function. This is electronic latch function. If have sent the signal that encourages motor for some seconds actuator can not move, control circuit can break the power source of motor. Electronic latch function for open the valve that is in closed position for a long time very effective.

3.2.14 Protect data function when main power source falls

When main power source loses electricity, from battery, supplies power to valve position detection circuit, and preserve valve position in EEPROM. Battery still supplies power to LCD (but do not sustain to be shaded) and supplies power to 4 state instruction relaies, the service life of battery can reach 2 years. Suggest to change battery when main power source has electricity.

3.2.15 Application range

HKM actuators are suitable for proportional control in automatic control loops that the system rate of change is relatively high, and high accuracy continuous modulation is necessary. When modulating applications require increased rates of starts per hour, the HKM actuator ranges can be operated up to a rate of 1200 starts per hour providing the average torque required by the valve in mid stroke does not exceed 50% of the rated torque of the selected actuator.

HKM actuator with W gear-box could drive quarter turn modulating valve. And this combination output rated torque from 470 to 51500 N•M. For more detail information about gearbox please send message to our company.

4: Actuator Data

The Table 4-1, Table 4-2, Table 4-3, Table4-4 and Table4-5 is also suitable for the HKE series

actuator.

Table 4 –1 Parameters of the multi-turn actuator (380VAC/50Hz)

Actuator rpm		18	24	36	48	72	96	144	192
HKM03 HKE03	Modulation torque N.m	17	17	15.6	13.6				
	Max torque N.m	44	44	39	35				
	Motor power kW	0.07	0.07	0.13	0.14				
	Rated current A Δ	0.75	0.75	1	1.1				
	Modulation thrust KN	7.14	7.14	6.55	5.71				
	Max thrust KN	14.2	14.2	12.6	8.4				
	Liner speed mm/s	1.5	2	3	4				
HKM05 HKE05	Modulation torque N.m	34	34	30	27				
	Max torque N.m	80	70	70	63				
	Motor power kW	0.12	0.13	0.19	0.23				
	Rated current A Δ	0.85	1	0.5	2.1				
	Modulation thrust KN	14.2	14.2	12.6	8.4				
	Max thrust KN	25.6	22.6	22.6	20.1				
	Liner speed mm/s	1.5	2	3	4				
HKM10 HKE10	Modulation torque N.m	81	81	68	54	47			
	Max torque N.m	159	142	106	89	71			
	Motor power kW	0.3	0.3	0.35	0.35	0.47			
	Rated current A Δ	2.3	2.3	2.8	2.8	3.6			
	Liner speed mm/s	1.8	2.4	3.6	4.8	7.2			
HKM20 HKE20	Modulation torque N.m	152	152	129	102	102			
	Max torque N.m	266	266	212	177	177			
	Motor power kW	0.47	0.47	0.58	0.68	0.7			
	Rated current A Δ	3.6	3.6	4.6	5.5	5.5			
	Modulation thrust KN	25	25	21	16.7	14.5			
	Max thrust KN	33.7	33.7	25	21	16.7			
	Liner speed mm/s	1.8	2.4	3.6	4.8	7.2			
HKM55 HKE55	Modulation torque N.m	27	271	253	203	203			
	Max torque N.m	708	708	531	407	284			
	Motor power kW	0.9	1.05	1.27	1.2	1.35			
	Rated current A Δ	6	7	9	7.8	8.2			
	Modulation thrust KN	27	271	253	203	203			
	Max thrust KN	708	708	531	407	284			
	Liner speed mm/s	2.4	3.2	4.8	6.4	9.6			

Table 4 - 2 Parameters of the multi-turn

actuator (220VAC/50Hz)

Actuator rpm		18	24	36	48	72	96	144	192
HKM03 HKE03	Modulation torque N.m	12	12	10	10				
	Max torque N.m	24	24	21	20				
	Motor power kW	0.06	0.08	0.08	0.1				
	Rated current A Δ	1.6	1.8	1.8	1.9				
	Modulation thrust KN	5	5	4.4	4.1				
	Max thrust KN	7.1	7.1	6.6	5.7				
	Liner speed mm/s	1.5	2	3	4				
HKM05 HKE05	Modulation torque N.m	20	18	15	13				
	Max torque N.m	42	38	33	27				
	Motor power kW	0.12	0.12	0.12	0.12				
	Rated current A Δ	2	2	2	2				
	Modulation thrust KN	8.4	7.6	6.3	5.5				
	Max thrust KN	12.6	11.3	9.7	8				
	Liner speed mm/s	1.5	2	3	4				

HKM10 HKE10	Modulation torque N.m	40	32	26	25	18			
	Max torque N.m	85	77	58	55	38			
	Motor power kW	0.19	0.21	0.23	0.25	0.28			
	Rated current A A	2.3	2.45	2.8	3.2	3.4			
	Modulation thrust KN	12.4	9.9	8.1	7.8	5.6			
	Max thrust KN	18.9	17.1	12.7	12.1	8.4			
	Liner speed mm/s	1.8	2.4	3.6	4.8	7.2			

Table 4 - 2 Parameters of the multi-turn actuator (220VAC/50Hz)
(continue)

Actuator rpm		18	24	36	48	72	96	144	192
HKM20 HKE20	Modulation torque N.m	70	70	55	42	42			
	Max torque N.m	133	133	107	89	89			
	Motor power kW	0.28	0.35	0.32	0.35	0.37			
	Rated current A A	3.4	3.75	3.6	3.75	3.9			
	Modulation thrust KN	21.7	21.7	17.1	13	13			
	Max thrust KN	31.6	31.6	25.4	21.1	21.1			
	Liner speed mm/s	1.8	2.4	3.6	4.8	7.2			
HKM55 HKE55	Modulation torque N.m	180	150	130	102	72			
	Max torque N.m	343	328	265	204	142			
	Motor power kW	0.8	0.8	0.75	0.8	0.8			
	Rated current A A	2.4	3.2	4.8	6.4	9.6			
	Modulation thrust KN	57.6	48	41.6	32.6	23			
	Max thrust KN	87	81	65	50.2	34.9			
	Liner speed mm/s	57.6	48	41.6	32.6	23			

Table 4-3 dimension table of the interface

Actuator type		HKM03/HKM05	HKM10/HKM20	HKM55
Type A				
Rated thrust KN		44	100	150
Max bore				
Outside bore	mm	32	51	67
Inside bore	mm	26	38	57
Type B				
B1	mm	42	60	80
B3	mm	20	30	40
B4	mm	20	30	44
Hand-wheel gearbox ratio				
Standard		Directly	Directly	Directly
Extra option		—	—	—
Flange size		F10	F14	F16
Net weight		33	55	80

Table 4-4 Parameters of the linear-travel actuator (380VAC/50Hz)

Type	Output rev rpm	18	24	36	48	72
HKML03 HKELO3	The diameter of drive screw rod	26/3				-
	Max.liner stroke mm	115				-
	Flange type(ISO 5210)	F10				-
	Regulate thrust KN	9.20	9.20	8.45	7.37	

	Liner speed mm/sec	0.9	1.2	1.8	2.4	
	Rated close thrust KN	18.43	18.43	16.26	14.63	
HKML05 HKEL05	The diameter of drive screw rod	26/3				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F10				
	Regulate thrust KN	18.43	18.43	16.26	14.63	
	Liner speed mm/sec	0.9	1.2	1.8	2.4	
	Rated close thrust KN	33.06	29.27	29.27	26.02	
HKML10 HKEL10	The diameter of drive screw rod	32/6				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	31.15	31.15	26.12	20.74	18.06
	Liner speed mm/sec	1.8	2.4	3.6	4.8	7.2
	Rated close thrust KN	46.87	41.87	31.15	26.12	20.74
HKML10 HKEL10	The diameter of drive screw rod	38/14				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	18.91	18.91	15.88	12.61	10.97
	Liner speed mm/sec	4.2	5.6	8.4	11.2	16.8
	Rated close thrust KN	28.49	25.45	18.91	15.88	12.61
HKML20 HKEL20	The diameter of drive screw rod	32/6				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	58.39	58.39	49.56	39.18	39.18
	Liner speed mm/sec	1.8	2.4	3.6	4.8	7.2
	Rated close thrust KN	78.37	78.37	62.62	52.25	52.25
HKML20 HKEL20	The diameter of drive screw rod	38/14				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	35.49	35.49	30.12	23.82	23.82
	Liner speed mm/sec	4.2	5.6	8.4	11.2	16.8
	Rated close thrust KN	47.64	47.64	38.06	31.76	31.76

Table4-5 Parameters of the liner-travel
actuator(220VAC/50Hz)

Type	Output rev rpm	18	24	36	48	72
HKML03 HKEL03	The diameter of drive screw rod	26/3				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F10				
	Regulate thrust KN	6.50	6.50	5.42	5.42	
	Liner speed mm/sec	0.9	1.2	1.8	2.4	

	Rated close thrust KN	13.00	13.00	11.38	10.84	
HKML05 HKEL05	The diameter of drive screw rod	26/3				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F10				
	Regulate thrust KN	10.84	9.76	8.13	7.05	
	Liner speed mm/sec	0.9	1.2	1.8	2.4	
	Rated close thrust KN	22.76	20.60	17.89	14.63	
HKML10 HKEL10	The diameter of drive screw rod	32/6				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	15.37	12.29	9.99	9.60	6.91
	Liner speed mm/sec	1.8	2.4	3.6	4.8	7.2
	Rated close thrust KN	32.65	29.58	22.28	21.19	14.60
HKML10 HKEL10	The diameter of drive screw rod	38/14				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	9.34	7.47	6.07	5.84	4.20
	Liner speed mm/sec	4.2	5.6	8.4	11.2	16.8
	Rated close thrust KN	19.85	17.98	13.54	12.84	8.87
HKML20 HKEL20	The diameter of drive screw rod	32/6				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	26.89	26.89	21.13	16.13	16.13
	Liner speed mm/sec	1.8	2.4	3.6	4.8	7.2
	Rated close thrust KN	51.09	51.09	41.10	34.19	34.19
HKML20 HKEL20	The diameter of drive screw rod	38/14				
	Max.liner stroke mm	115				
	Flange type(ISO 5210)	F14				
	Regulate thrust KN	16.35	16.35	12.84	9.81	9.81
	Liner speed mm/sec	4.2	5.6	8.4	11.2	16.8
	Rated close thrust KN	31.06	31.06	24.99	20.78	20.78

5: Actuator Performance

5.1 Torque and turning range

■ position setting range: 3.5 to 2040 turns, with a minimum angular resolution to 11.5° of actuator output center column.

■ torque switch setting: 40% to 120% rated torque.

5.2 Cable entry and connecting terminals

The sizes of three cable entries are double M25 and M40. make cable entries appropriate to the cable type and size. The sizes of four power terminals are M5. The sizes of control terminals are M4. Check that supply voltage is the same as that, marked on the actuator nameplate begin by connecting these cables.

5.3 Interface for machine installation

The actuator contains thrust type and non-thrust type. The thrust type is:A type, the non-thrust type is made of B1,B3,B4. The drive bush's shape for every link types please refer to diagram 5-1 and diagram 5-2.

5.3.1 Type A drive bush

The type A thrust bush suit the position of the valve-mounting flange.

5.3.2 Type B drive bush

Driving shaft bored and keyed to ISO 5210 standard. And the type B non-thrust bush has three basic form as follows B1, B3 and B4.

5.3.3 Type B1

The B1 is supplied a big key and shaft to drive the valve.

5.3.4 Type B3

The B3 is supplied a small key and shaft to drive the valve.

5.3.5 Type B4

B4 is supplied blank and must be machined to suit the input shaft of the gearbox or valve that it will drive.

a. Thrust type:

Diagram 5-1: Links of basic-base drive-bush for HKM03~HKM55 actuator

b. Non-thrust type:

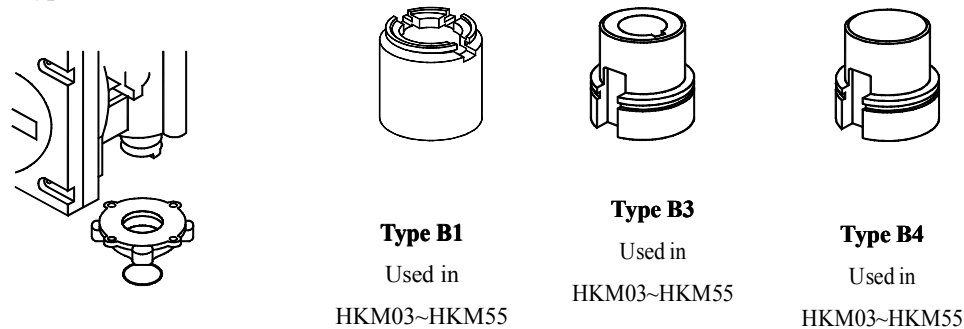


Diagram 5-2: Links of non-thrust type drive-bush for type HKM03~HKM55

5.4 Additional gear-box

You can use the gear-box to make the HKM linear stroke actuator as the angular stroke actuator, please see table 5-2.

5.5 Oscillation

The normal oscillation frequency and intensity for rang HKM is during the 10Hz ~ 200Hz and 0.5 times acceleration of gravity.

5.6 Shielding and flameproof

Water-proof type: accord with <<GB4208-84>> IP68 proof grade

Explosion-proof type: accord with <<GB3836.1.2-2000>> d II CT4 proof grade

Table 5-2 HKM actuator/W gearbox combination data

Combination	Rated Torque (N.m)	Stroke Time (s)	Actuator RPM (rpm)	Gearbox Ratio	Max Bore (mm)	Combination	Rated Torque (N.m)	Stroke Time (s)	Actuator RPM (rpm)	Gearbox Ratio	Max Bore (mm)
HKM03B4/ W4	410	29	36	70:1	64	HKM10B4/ W6	1770	29	36	70:1	102
HKM03B4/ W4	280	25	24	40:1	64	HKM10B4/ W6	2052	44	24	70:1	102
HKM03B4/ W4	267	33	18	40:1	64	HKM20B4/ W6	2734	22	48	70:1	102
HKM03B4/ W4	418	44	24	70:1	64	HKM10B4/ W6R	2537	29	72	140:1	102
HKM05B4/ W4	558	25	24	40:1	64	HKM10B4/ W6R	2750	44	48	140:1	102
HKM05B4/ W4	723	22	48	70:1	64	HKM10B4/ W7	2016	38	24	60:1	127
HKM05B4/ W4	535	33	18	40:1	64	HKM20B4/ W7	3328	25	36	60:1	127
HKM05B4/ W4	789	29	36	70:1	64	HKM20B4/ W7	3784	38	24	60:1	127
HKM03B4/ W4R	447	25	48	80:1	64	HKM10B4/ W7R	2690	38	48	120:1	127
HKM03B4/ W4R	503	33	36	80:1	64	HKM10B4/ W7R	3640	38	72	180:1	127
HKM05B4/ W5	438	25	24	40:1	76	HKM20B4/ W8	3800	38	24	60:1	153
HKM05B4/ W5	842	22	48	70:1	76	HKM55B4/ W8	6370	25	36	60:1	153
HKM05B4/ W5	417	33	18	40:1	76	HKM55B4/ W8	6830	38	24	60:1	153
HKM05B4/ W5	915	29	36	70:1	76	HKM20B4/ W8R	4880	38	48	120:1	153
HKM05B4/ W5	1014	44	24	70:1	76	HKM20B4/ W8R	7325	38	72	180:1	153
HKM03B4/ W5R	525	38	48	120:1	76	HKM20B4/ W8R	6072	38	36	60:1	153
HKM05B4/ W5R	695	25	48	80	76	HKM55B4/ W9	6211	25	24	60:1	178
HKM05B4/ W5R	760	33	36	80	76	HKM55B4/ W9	15412	38	72	180:1	178
HKM05B4/ W5R	1618	44	48	140	76	HKM55B4/ W9R	17004	38	24	60:1	203.2
HKM05B4/ W6R	1618	44	48	140	102	HKM55B4/ W10	17148	38	72	180:1	203.2

5.7 Coupling interface

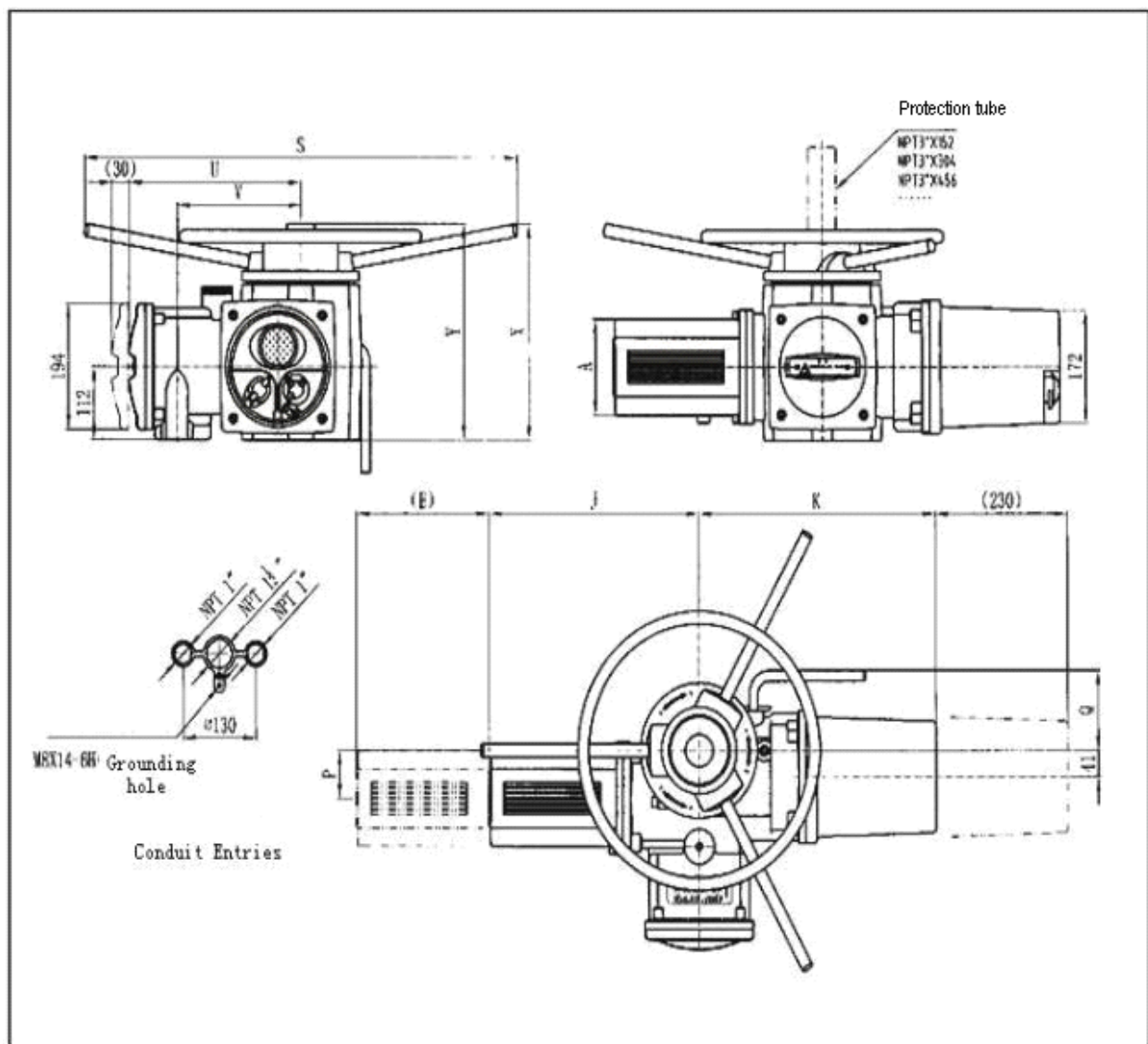
5.7.1 Coupling interface for HKM/HKML

HKM/HKML Coupling Interface Table:

Actuator type	HKM(L)03/HKM(L)05	HKM(L)10/HKM(L)20	HKM55
A thrust coupling			
Rated thrust(KN)	44	100	150
Type A max valve-shaft diameter			
Basset shaft (mm)	32	51	67
Hidden shaft(mm)	26	38	57
Type B Non-thrust connection hole diameter			
B1(fixed bore) mm	42	60	80
B3(fixed bore) mm	20	30	40
B4 (max) mm	20	30	44

Handwheel reduction ratio			
Standard type	Direct	Direct	Direct
Choice type	-	-	-
Flange standard	F10	F14	F16
Net-weight (Kg)	33	55	80

5.7.2 HKM03~HKM55 / HKML03~HKML20 actuator dimension data

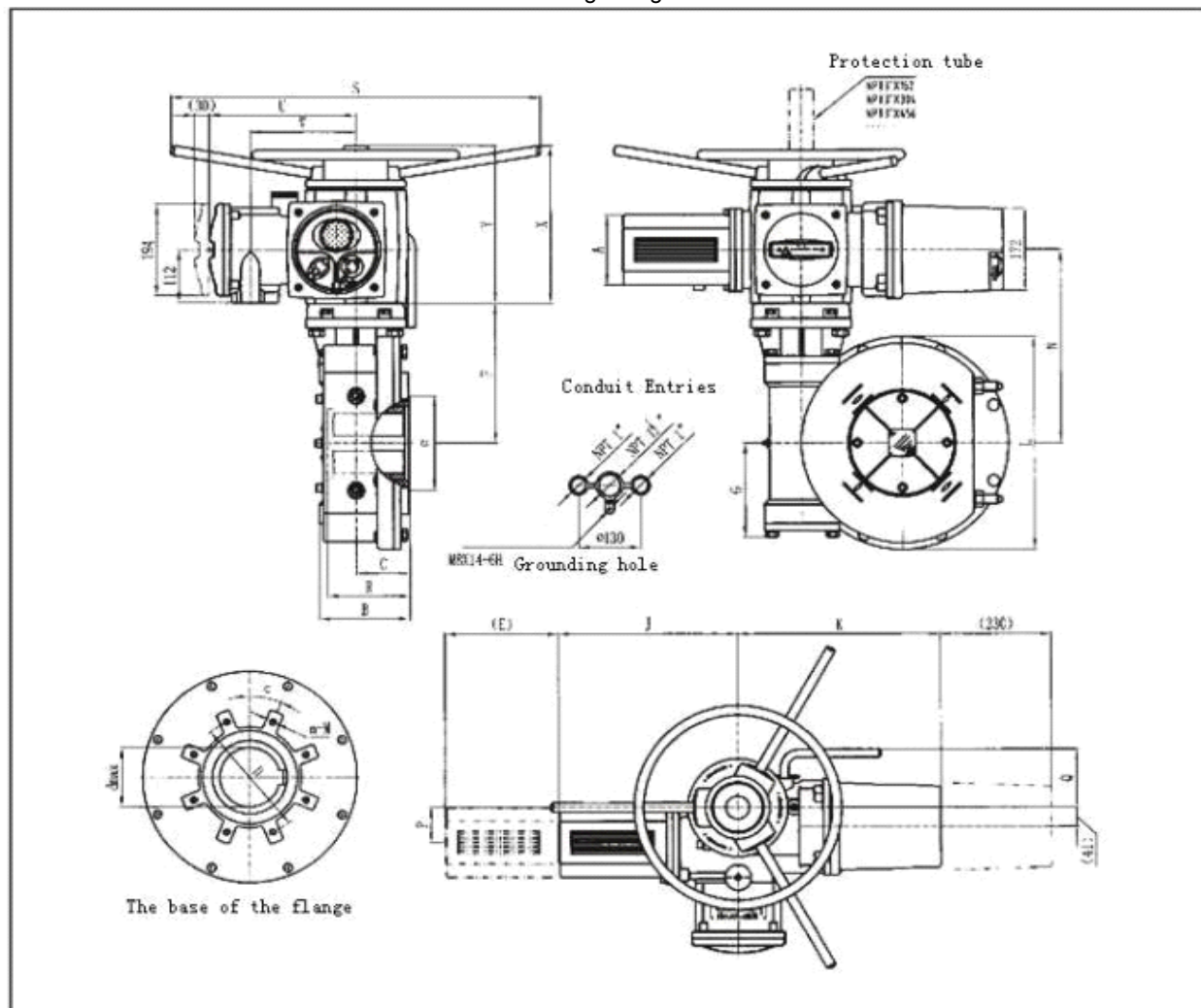


Parameter	A	E	J	K	Q	P	S	U	V	Y	X
Standard											
HKM(L)03 HKM(L)05	102	198	264	373	110	41	Φ 300	260	167	222	264
HKM(L)10 HKM(L)20	134	210	297	390	110	60	Φ 666	286	198.5	305	288

HKM55	148	270	376	424	125	75	Φ784	310	222	334	335

*** If you change the string "HKM" into "HKE", the above data is also suitable for the HKE range.**

5.7.3 Series HKM actuator combined with D/W one grade gear-box



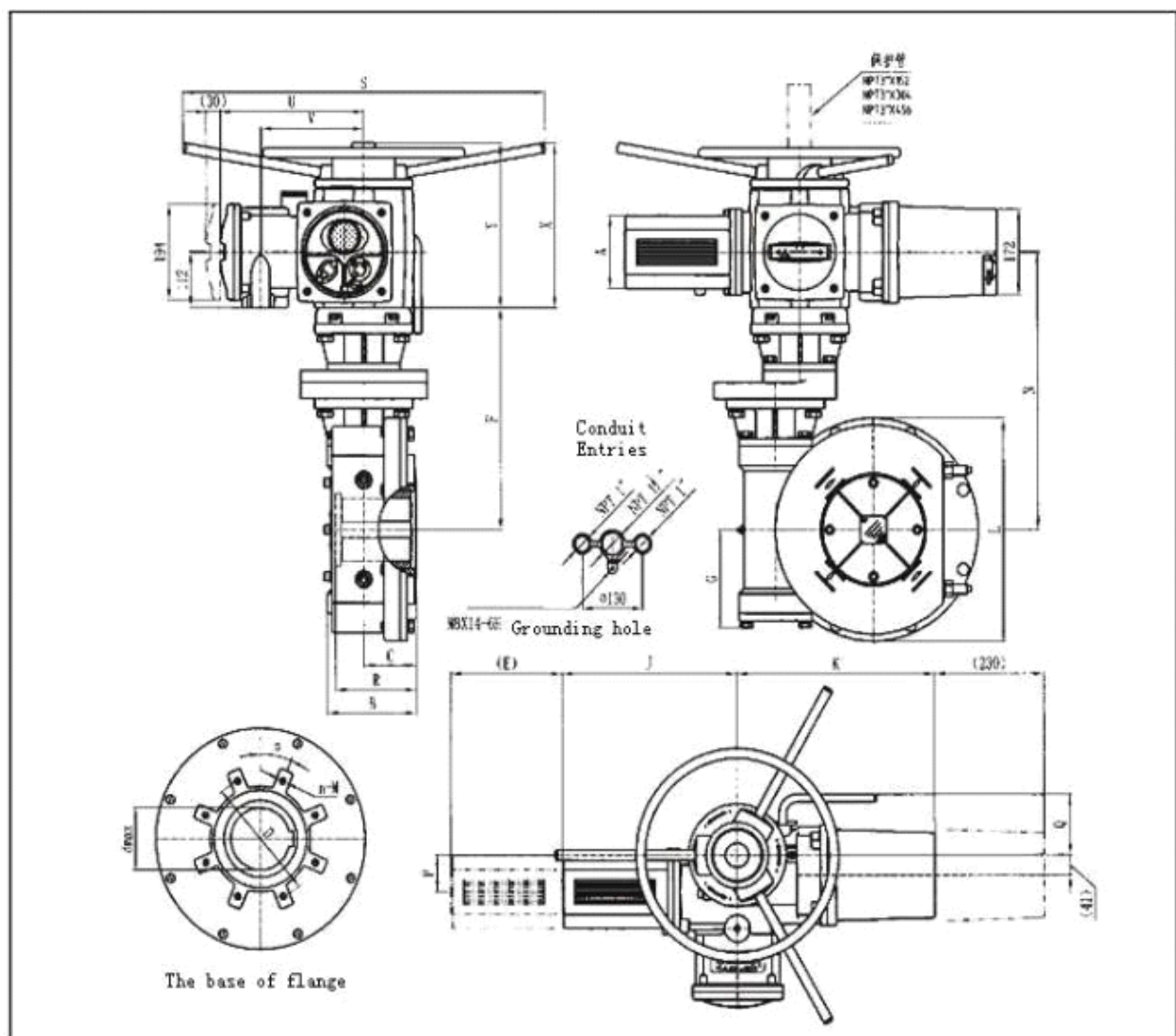
Parameter Standard	A	E	-	J	K	Q	P	S	U	V	Y	X
HKM03-05/H4	102	198	-	264	373	110	41	Φ300	260	167	222	264
HKM10-20/H4	134	210	-	297	390	110	60	Φ666	286	198.5	305	288
HKM20-40/H5												
HKM10/H6												
HKM10/H7												
HKM55/H7	148	270	-	376	424	125	75	Φ785	310	222	334	335
Parameter Standard	dmax	D	B	α	C	R	n-M	F	H	G	L	N
HKM03-05/H4	Φ64	Φ140	106	45°	50	93	4-M16	147	101.6	108	Φ218	230
HKM10-20/H4					65	120	4-M20	197	135.89	134	Φ285	248
HKM10-20/H5					65	120	4-M20	197	135.89	134	Φ285	298

HKM10/H6	Φ 102	Φ 254	147	22.5°	70	130	8-M16	186	177.8	144	Φ 375	303
HKM10/H7	Φ 127		181		87	160		276	209.55	196	Φ 450	377
HKM55/H7												289

*** If you change the string "HKM" into "HKE", the above data is also suitable for the HKE range.**

The character "H" include series D or W gear-box in the above data table.

5.7.4 Series HKM actuator combined with DR/WR two grades gear-box



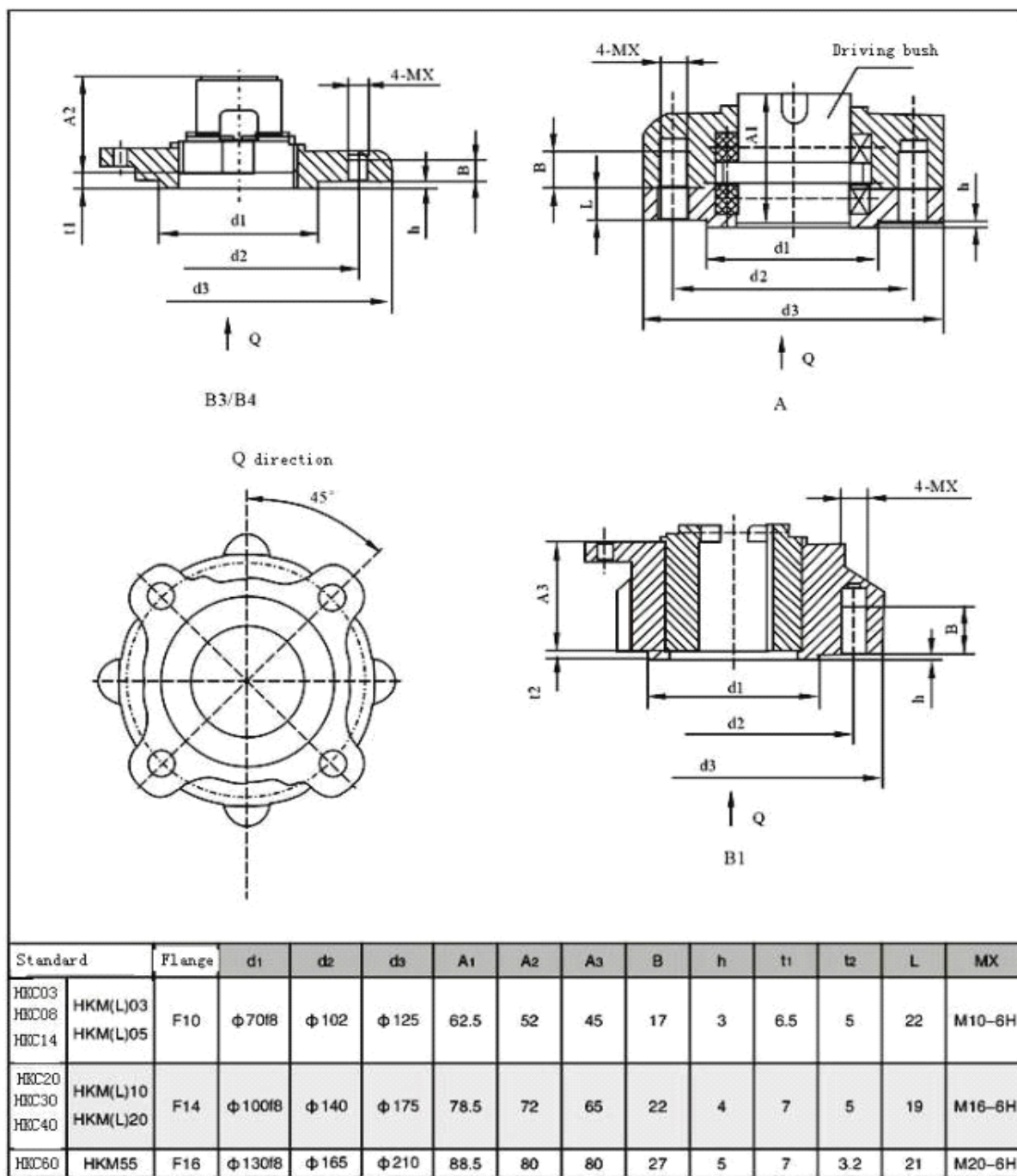
Parameter Standard	A	E	-	J	K	Q	P	S	U	V	Y	X
HKM03-05/W4R	102	198	-	264	373	110	41	Φ300	260	167	222	264
HKM10-20/W5R HKM10-20/W6R HKM10/W7R HKM10/W8R	134	210	-	297	390	110	60	Φ666	286	198.5	305	288
HKM55/W8R	148	270	-	376	424	125	75	Φ785	310	222	334	335
Parameter Standard	dmax	D	B	α	C	R	n-M	F	H	G	L	N
HK03M-05/W4R	Φ64	Φ140	106	45°	50	93	4-M16	274	101.6	108	Φ218	341

HKM10-20/W5R		Φ 165	134		65	120	4-M20	324	135.89	134	Φ 285	425
HKM10-20/W6R	Φ 76	Φ 254	147	22.5°	65	120	8-M16		177.8	144	Φ 375	425
HKM10/W7R	Φ 127		181		70	130		466	209.55	196	Φ 450	578
HKM10/W8R	Φ 153		194		87	160		496	246.38	226	Φ 520	597
HK55/W8R												608

5.7.5

F10 / F14 / F16 Coupling flange

HKC03-HKC60 / HKM03-HKM55 / HKML03-HKML20



* If you change the string "HKM" into "HKE", the above data is also suitable for the HKE range.

6:Actuator Control and wiring (this section is suitable for HKC range)

The wiring code card fixed in the terminal cover is particular to each actuator. The HKM actuator wiring code, please refer to diagram 7. The means of each terminal refer to the diagram 6-1.

6.1 Local controls

Non-intrusive selectors are provided on the actuator electrical control cover, one for local/stop/remote selection, pad-lockable in each position, and the other open/close control. Local control may be configured for maintained or push to run operation.

6.2 Remote manual controls

The power supply of remote control circuits can be provided as DC 24V by actuator internal supply or DC/AC 24V~60V, AC 120~220V by external supply.

Refer to the circuit diagram 6-1 to 6-3.

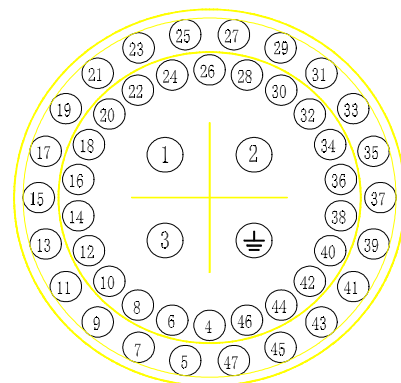


Diagram 6-1

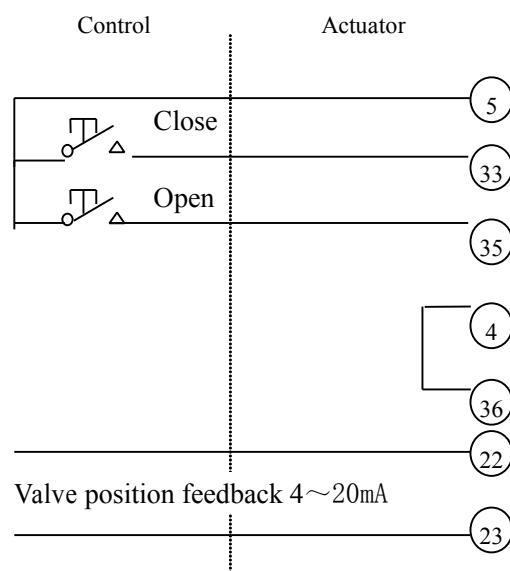
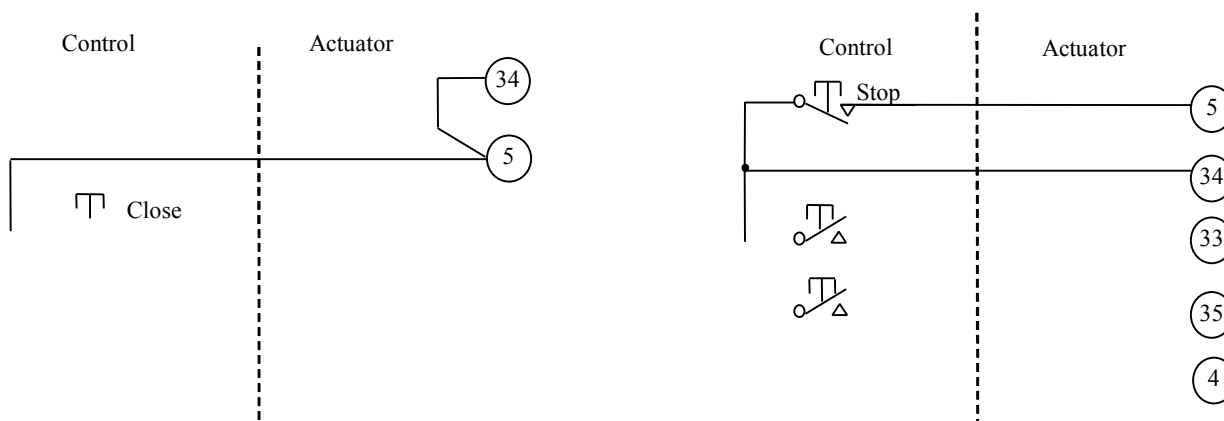


Diagram 6-1 push to run open/close control



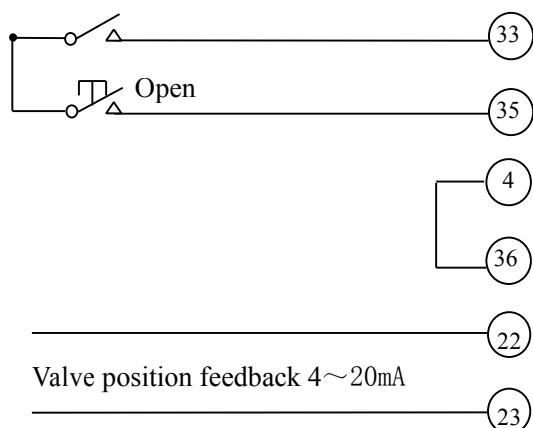


Diagram 6-2 maintain open/close control, support reversion, intermediate position impossible

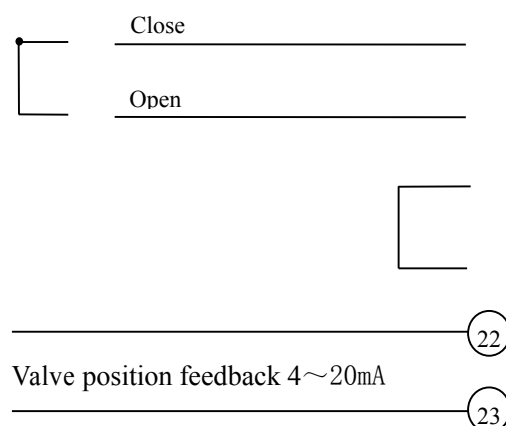


Diagram 6-3 maintain open/close/stop control

Table 6-1 terminals description

NO	NAME	OPERATION
	Connect with crust	Connect with grounding
1	Power supply terminal	380VAC(or 220VAC) input terminal
2	Power supply terminal	380VAC(or 220VAC) input terminal
3	Power supply terminal	380VAC(or void) input terminal
4	DC 0V	DC 24V “-” output
5	DC 24V	DC 24V “+” output
6	S1 relay terminal 1	Indication S1 relay terminal 1
7	S1 relay terminal 2	Indication S1 relay terminal 2
8	S2 relay terminal 1	Indication S2 relay terminal 1
9	S2 relay terminal 2	Indication S2 relay terminal 2
10	S3 relay terminal 1	Indication S3 relay terminal 1
11	S3 relay terminal 1	Indication S3 relay terminal 2
12	S4 relay terminal 1	Indication S4 relay terminal 1
13	S4 relay terminal 2	Indication S4 relay terminal 2
14	Battery relay terminal 1	Indicate battery power is too low ,the relay contact 1
15	Battery relay terminal2	Indicate battery power is too low , the relay contact 2
16	Temperature relay terminal 1	Indicate motor temperature is high, the relay contact 1
17	Temperature relay terminal 2	Indicate motor temperature is high, the relay contact 2
18		
19	Remote relay terminal 1	Remote position indication relay , common terminal
20	Remote relay terminal 2	Remote position indication relay , normally close terminal
21	Remote relay terminal 3	Remote position indication relay , normally open terminal
22	Valve position feedback signal +	Valve position current analogue signal feedback terminal +
23	feedback signal common terminal	Valve position current analogue signal feedback terminal +
24	Torque feedback signal +	Torque current analogue signal feedback terminal 1
25	ESD	Emergent (ESD) active signal input terminal
26	Valve position input signal +	Valve position current analogue signal input terminal +
27	Valve position input signal -	Valve position current analogue signal input terminal -
28		
29	Open position relay terminal 1	Valve position fully open indication relay terminal 1
30	Open position relay terminal 2	Valve position fully open indication relay terminal 2

31	Interlock low voltage terminal	Interlock low voltage common-terminal
32	Interlock high voltage terminal	Interlock high voltage common-terminal
33	Remote close	Remote close input terminal
34	Stop/maintain	Stop/maintain input terminal
35	Remote open	Remote open input terminal
36	Remote low voltage terminal	ESD, remote open/close, stop/maintain low voltage common-terminal
37	Open interlock	Open interlock input terminal
38	Close interlock	Close interlock input terminal
39	Manual/automatic terminal	Manual/automatic signal input terminal
40	Remote high voltage terminal	ESD, remote open/close, stop/maintain high voltage common-terminal
41	Manual/auto low voltage terminal	Manual/automatic low voltage common-terminal
42	Monitor relay terminal 1	Monitor relay common terminal
43	Monitor relay terminal 2	Monitor relay normally close terminal
44	Monitor relay terminal 3	Monitor relay normally open terminal
45	Manual/auto high voltage terminal	Manual/automatic high voltage input terminal
46	Close position relay terminal 1	Valve position fully close indication relay terminal 1
47	Close position relay terminal 2	Valve position fully close indication relay terminal 2

6.3 State indication relay

Four state indication relay are provided, each one independently configurable using the HKM setting tool to signal one of the following:

- valve position

Fully open, fully close or any intermediate positions

- status

Valve opening, closing, moving

- valve alarms

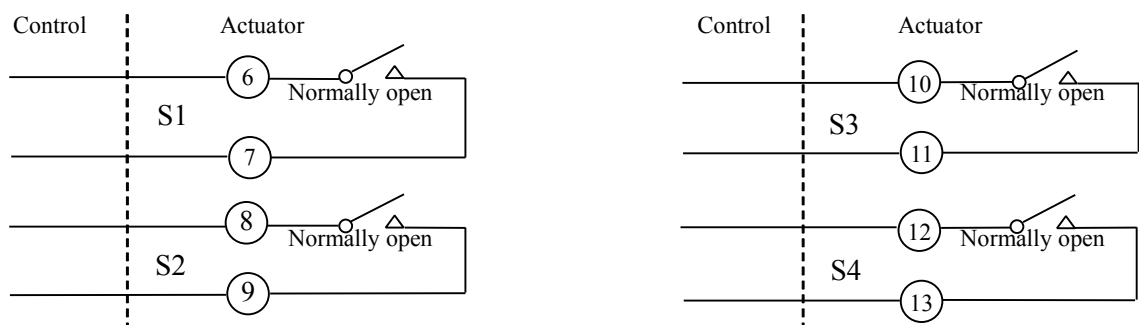


Diagram 6-10 state indication relays

Motor tripped on torque going open, going close, valve jammed

- actuators alarms

Battery low

Each contact can be configured to either “normally open” or “normally close”. Contacts are rated at 5A/250VAC or 5A/30VAC.

Refer to diagram 6-5.

6.4 Monitor relay

An independent relay with a volt-free changeover contact used for monitoring actuator electrical availability. Contact rating 5A/250VAC or 5A/30VAC.

The relay will de-energise under a one, or combination, of the following conditions:

- loss of one or more of the power supply phases
- main control circuit is error
- motor thermostat tripped
 - mode switch is not at the remote position

Refer to diagram 6-11.

6.5 Emergency shut down - ESD

An active ESD signal will override any local or remote control signal. The ESD input operates from a separate common to that used for open, close.

The following ESD options can be configured: ■ ESD signal

Active high, active low

- ESD action

Close, open

- ESD override

Motor thermostat

6.6 Interlocks

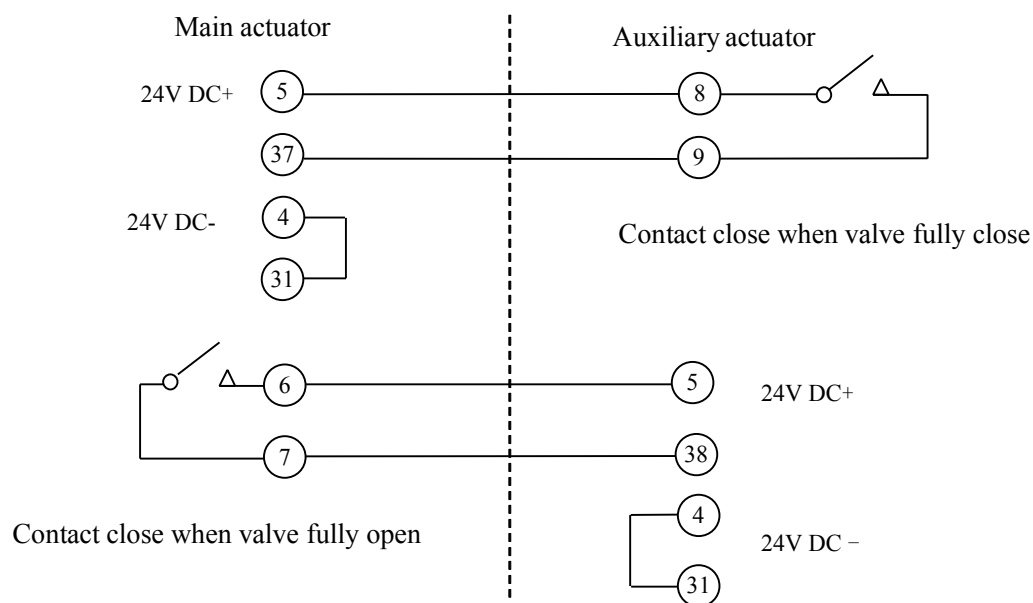


Diagram 6-12 interlock

Close interlock

External hardwired interlocks for opening, closing or both directions can be configured to inhibit local and remote operation until the external contacts are made. Interlock circuits may be added with any of the remote control circuits. The interlock inputs operate from a separate common allowing for isolation between the safety system and operation control system.

Refer to Diagram 6-12.

6.7 HKM/HKC actuator extra functions option

Refer to Table 6-2.

Table 6-2 HKM/HKC actuator addition circuit and wiring diagram number

Item	Extra functions					Wiring diagram number
	1	2	3	4	5	
Base Circuit	Battery low, remote control select and thermostat tripped alarm relay	Valve position fully open and valve position fully close indication relay	Analogue signal input	Valve position signal feedback	Torque signal output	
√	—	—	—	—	—	100-00
√	√	—	×	×	×	101-xx
√	—	√	×	×	×	102-xx
√	√	√	×	×	×	103-xx
√	×	×	√	—	—	1xx-01
√	×	×	—	√	—	1xx-02
√	×	×	√	√	—	1xx-03
√	×	×	—	—	√	1xx-04
√	×	×	√	—	√	1xx-05
√	×	×	—	√	√	1xx-06
√	×	×	√	√	√	1xx-07

NOTE: “—” means you do not select; “√” means you already select; “×” means you can select.

Example: If you selected 1,3,4 functions, the wiring diagram number is 101-03.

6.7.1 Alarm relay

The extra alarm relay option provides five additional changeover relays. The extra alarm relay functions are show below:

- valve position fully open
- valve position fully close
- battery low
- remote control select
- thermostat tripped

6.7.2 Analogue signal input/output Module

The analogue signal input/output board provides a non-contacting internally fed 4 ~ 20mA analogue signal prointerfaceional to valve position. Available at terminals 22 and 23, the maximum external impedance that may be connected to the signal is 500 ohms at nominal supply voltage.

Analogue signal input impedance:

4mA ~ 20mA/250 ohm; 1VDC ~ 5VDC/1M ohm; 2mA ~ 10mA/250 ohm; 0.5VDC ~ 2.5VDC/1M ohm

6.8 Analogue signal control

The HKM actuator analogue signal prointerfaceional controllers enable the actuator to automatically position a valve in prointerfaceion to an analogue current or voltage. A signal derived

from the actuator non-contacting position sensor is electronically compared with a signal proportional to the input signal. The difference between them triggers the open or close contactor in the direction that will cancel the error. Valve position is therefore automatically adjusted in proportion to analogue signal. Unnecessary frequent operation can be prevented by the adjustable deadband and the Motion inhibits Timer features.

- Position corresponding to low input signal: close limit or percentage open
- Position corresponding to high input signal: open limit or percentage open
- deadband: 0.1~9.9% of travel between open and closed limit positions
- motion inhibit time: 0.1~9.9 sec between actuator movements
- action on loss of input signal: stay-put, move to high or low signal position. Response on loss of signal will occur if signal falls below 50% of set “low” signal.

6.9 Pulse control

In the computer control system, the user may be used the pulse control the actuator. HKM actuators are fitted this control mode.

Please refer to diagram 6-14

$$\frac{18 \times 10^4}{32N} > \text{Pulse length} > \frac{6 \times 10^4}{32N} \text{ ms}$$

- the interval of pulse must according to maximum 1200 starts per hour and 50% working time.
- Pulse width according to the output rpm N

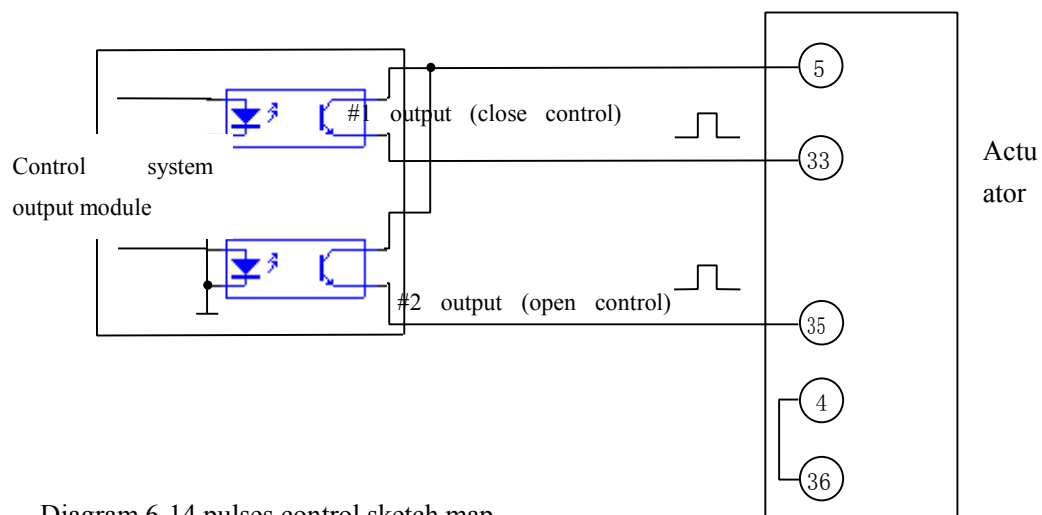


Diagram 6-14 pulses control sketch map

6.11 Field bus control

6.11.1 Modbus communication

Signal or dual MODBUS modules may be included in the HKM actuator to provide remote serial communication to the control functions and for status feedback data. The field network uses

an RS485 data highway, either 2 or 4 wires, and can be duplicated where redundancy is required. The communication is half duplex and the protocol used is Modbus RTU with data rates up to 38 K baud. The actuator variables necessary to set up the system are programmable over the infra-red data link.

Modbus module advantages:

- cable cost reduction
- installation cost reduction
- simple to configure
- simple to use
- widespread open standard protocol
- many compatible devices available
- redundant configuration available

6.11.2 CAN bus communication

The CAN bus uses CAN2.0B protocol, it is based on ISO/OSI. The signal transmission medium is the twisted-pair, the great communication speed is 1Mbit/s, the great distance of the communication is 10Km (5kbps), the bus can link 110 actuators maximally.

6.11.3 Profibus communication

Profibus connectivity is possible by fitting the DP interface module within the HKM actuator, this allows the HKM actuator to be integrated into a standard Profibus network. Full compatibility with the fieldbus standard EN 50170 is provided and the module carries Profibus certification for inter-operability. The network allows full control of the actuator and feedback of status data to the host. The HKM actuator Profibus module has two communication interfaces to facilitate redundant fieldbus wiring where reliability is paramount, data rates up to 1.5 M baud are supinterfaced.

Profibus module advantage

- cable cost reduction
- installation cost reduction
- simple to configure and use
- devices independently approved
- widespread open standard protocol
- large number of compatible devices available
- redundant configuration available

6.11.4 Foundation Fieldbus communication

HKM actuator may be connected to a Foundation Fieldbus network by the inclusion of a HKM actuator FF module. The device complies with fieldbus standard IEC 61158-2, using a 2 wire electrical connection to the highway and has been certified for inter-operability. The foundation highway exchanges data and control between devices and full actuator functionality is available. Each actuator has full link scheduler capability and function blocks for analogue and digital inputs and outputs as well as PID and the standard transducer block. Foundation Fieldbus networks are capable of operating without a host system as a supervisor, the field devices communicating directly between themselves.

Foundation fieldbus module advantages:

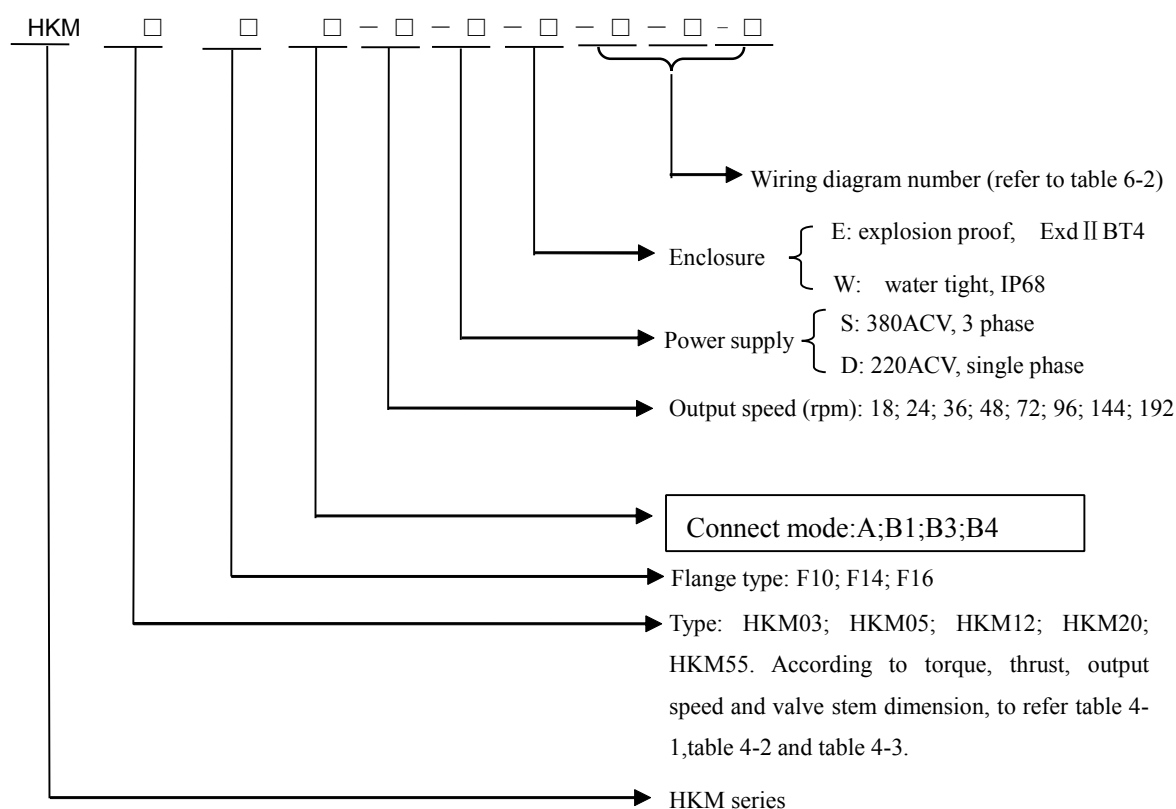
- open standard protocol
- cable cost reduction
- installation cost reduction

- simple to configure and use
- access to the transducer block provides comprehensive diagnostic data
- simple communications on plug and play basis

7 Order Introduces

Model designation must be noted the each item, for example the wiring diagram number means the actuators versions, and if you require order a gearbox, you need to fill upon its model number.

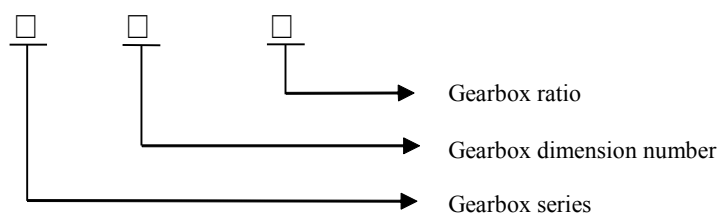
- Actuator model number



Example: HKM20F14A-24-S-W-101-03

Means: actuator modulating torque: 152N.M; flange type: F14; drive bush type: A; output speed: 24; Power supply: 380ACV; enclosure: IP68 water tight; appending analogue signal input, valve position signal feedback, battery low alarm relay, remote control select alarm relay and thermostat tripped alarm relay.

- Gearbox



Detail information can be found on the corresponding technical data sheets.

Example: W5- 40: 1

Means: W series; dimension number: 5;gearbox ratio: 40:1.

Even if the actuator and gearbox are provided all together, the model of the gearbox is not marked on the identification plate of the actuator. There is an individual identification plate on the gearbox; on it marked with model of the gearbox and so on.

Important notice: in order to advance the orientation precision, popularly you do not select the exorbitant output rotate speed. Here's a advice : the stroke time is not less than 25 seconds.