CHEMSUN Electric Actuators

CSR / L - G03 Series Flameproof and Heavy-load style

Suitable for petrochemical, electric-power, metallurgy, nonferrous metals, light industry, Water-treatment and HVAC industry

Unique functions DC Motor, Super-large output torque,
Power Fail-safe Actuator Position (FL/FC/FO/FS)
Multi-turn absolute encoder, Optional split structure

Transducer Sensitivity 0.1%

Actuator Accuracy ≤0.5%

Rotary Output Torque 180 – 250000 Nm

Linear Output Thrust 20 - 200KN（On request）

General Technical Parameters

- Supply Power 220 VAC; 380VAC (50/60Hz)
- Explosion Protected ATEX Exd IIC T5 / T6; Non Ex
- Degree of protection IP67; IP68
- Ambient Temperature -60 to +80℃
- Input/output Signal
  Control type： 4 –20 mA / 0 –10(5)V
  On/off type： ON/OFF (Dry contact switch)
- Alarm Way 3 – 6 Ways
- Electrical connection 2 – M32/20 x1.5
- Full Stroke time 7 – 300 Seconds
- Rotary output Torque 180-250000 Nm
- Linear output Thrust 20-200 KN (On request)
- Rotary Stroke 90°/ Multi-turn
- Linear Stroke 40/65/135/315 mm

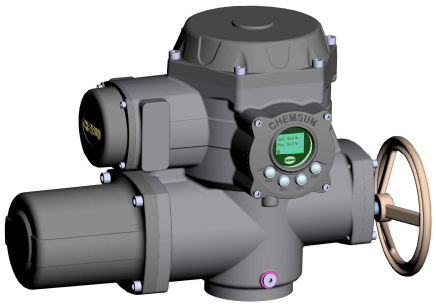


Fig.1: Type CSR-G03 Series Heavy-load E-Actuator

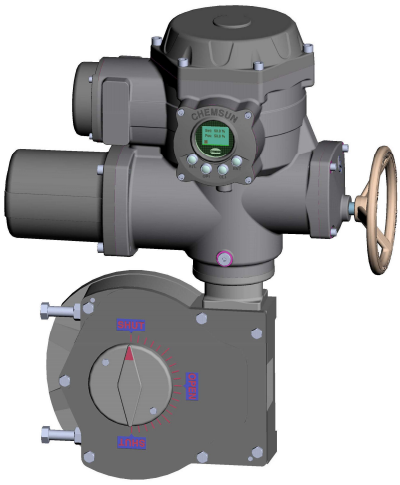


Fig2: CSR-G03 Series Heavy-load E-Act.
With Gearbox Output 6000Nm

Universal design standards

- American society of mechanical engineers (ASME)
- The fire protection association (NFPA)
- National Electrical Code (NEC)
- The electrical and electronic engineers (IEEE)
- ANSI/IEEE472

Structural Features

- Supply Power：220 VAC; 380VAC (50/60Hz).
  Special optional 400/460VAC
- High sensitivity and Low system deviation：0.1% transducer sensitivity, ≤0.5% actuator accuracy.
- Selecting valve position when power fail: FL/FC/FO/Any Position (On request).
- High Power DC Motor: Optional 400/8001200W, Maintenance free operation, continuous and unlimited regulation.
- Characteristic selecting: Linear/Equal percent/Quick open/ Self-definition.
- PID operation of built-in process is optional to realize closed-loop control of process loop.
- Independent structure of main engine room, configuration warehouse and wiring warehouse, double-sealing.
- The overall explosion-proof design, its type is ATEX Exd IICT5 / T6; the protection grade can reach IP67 / 68.
- Use Bluetooth or PC for non immersion configuration, calibration and parameter modification.
- Optional split structure. It can keep the operation position away from high temperature, high risk or other harsh working conditions.
- Optional HART, FF, Profibus.

Standard Functions

- Non immersion modular design without removing cover: it is unnecessary to open the cover of the main compartment, and complete the parameter setting, initialization, parameter adjustment and modification through the local operation panel button of configuration warehouse, Bluetooth or PC, etc.
- Diversified display functions: input, output, alarm, fault, etc. All menus can be displayed in English, German or Chinese.
- Mechanical transmission features: Planetary gear transmission, smooth operation, small mechanical impact, mechanical life and transmission error far better than worm gear or straight gear transmission structure.
- The control of motor driving mode and running speed: the DC motor is driven by FOC software algorithm. Through PID calculation, the valve position can be slowly opened, fast accelerated close to the set valve position, and then slowly accelerated to the set valve position. The opening and closing time of the regulating valve can be realized by setting or modifying the operating speed.
- The output torque is adjustable: within the maximum rated output torque of the actuator, the output torque that best matches the valve can be set, and the overload protection value can be set within the range of ± 0 ~ 100%.
- Flow Characteristics Compensation: you can optimize the flow characteristics of the valve, to achieve the best process control quality.
- Stroke limit: two ways to work, mechanical limit and software limit. The mechanical limit is adjusting the stroke switch in the main cabin, to realize the reliable and safe operation of the actuator. The software limit is completed by parameter configuration.
- Self-diagnosis function: automatic identification and protection for blocking, operation fault, power or signal failure, over current, over temperature, phase sequence, etc. Chemsun operating software can be selected to add diagnosis contents such as valve operation and spare parts replacement prediction.
- Self-inspection and alarm function: fault self-diagnosis and display alarm.
- High positioning precision and frictionless electronic brake technology: when the actuator receives the opening or closing signal, the control unit performs PID calculation to accelerate the running. When approaching the signal position, it slows down the running speed and starts braking to avoid over adjustment or emergency braking, so as to ensure the positioning accuracy.
- The electronic commutation technology is applied to ensure smooth operation and adjustable speed.
- Blocking and overload protection: when the valve is blocked, the valve can not normally reach the valve position of the input signal, and the actuator will automatically try to impact the position for three times. If the automatic impact operation is not successful, the alarm will be given.

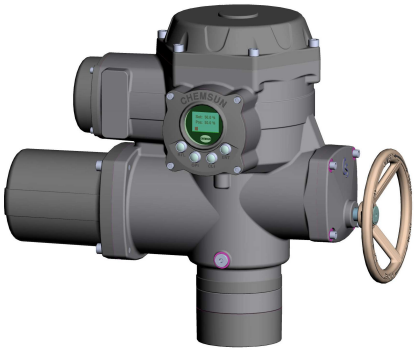


Fig.3: CSR-G03Series Heavy-load E-Act.
With Gearbox Output 800Nm

Fig.4: CSR-G03Series Heavy-load E-Act.
With Multi-tur Gearbox

Fig.5: CSR-G03Series Heavy-load E-Act.
With High PressureBall valve

Powerful fault diagnosis and protection function

- **Diagnosis and protection of input control signal failure:** it can automatically identify the fault of input signal, including line drop, short circuit, signal beyond normal range, etc. It can send out and display alarm immediately when the fault occurs, and can automatically run to the designated position according to the user's selected signal fault processing mode (full open, full close, hold, any position) .
- **Diagnosis and protection of position feedback signal failure:** automatic judgment of position sensor fault. Once the fault occurs, it outputs the diagnostic alarm signal to avoid miss-operation due to the fault of detection signal.
- **Torque detection and over torque protection：** accurate measurement of actuator output torque through torque sensor is the basis and guarantee for torque protection. At the same time, double detection technology is used to analyze and calculate the measured values of working current and voltage to ensure accurate setting of torque and torque limit and protection. When the actuator is initializing, the over force protection is set. Once the torque is over, the control circuit will stop the motor immediately and send out and display alarm to ensure that the actuator and the driven object are not damaged by excessive torque.
- **Motor over-current and over temperature protection：** Although the starting current and working current of BLDC motor are much smaller than that of AC motor, CHEMSUN has set protection for possible over-current of DC motor and configured with output alarm signal. The temperature sensor is built into the motor to monitor the temperature and temperature rise of the motor anytime. In case of over temperature or abnormal temperature rise, an alarm will be sent and displayed immediately, and the motor power supply will be cut off. When the temperature drops to the set value, the motor will automatically resume normal operation.
- **Automatic blockage removal function:** when the valve is stuck or other mechanical fault causes, the valve to stop moving, the actuator will automatically try three impact actions according to the setting. In case of jam, the control unit instructs the motor to rotate in reverse direction for a small step, and then operate in the original direction. Each impact torque does not exceed the torque protection value, so it is repeated three times. If the jam disappears, the actuator will return to normal operation; if the jam still exists, the motor power will be shut off automatically, and an alarm will be sent out and displayed.
- **Emergency situation handling (ESD) function:** in case of emergency, under the intervention of ESD command, the actuator can directly run to the set position: full open, close, hold or set to any position.
- **Dual protection of valve position limit:** (1) software protection: the upper and lower valve position limits are set through the panel configuration, and the alarm, jump action and motor power cut-off are output when the position is over. (2) Hardware protection: when the upper and lower valve position reaches the limit, the contact switch will interlock alarm, jump action, cut off the motor power supply, etc.
- **Operation of handwheel mechanism:** The handwheel of G03 series is equipped with a clutch, which needs to switch the handwheel. It can be operated manually directly and has a HW locking device..

Detection and feedback of valve position

The multi gear absolute encoder ensures that the valve position can be reliably detected when the power is off. Even if the handwheel is turned after the power failure, the valve position can be accurately detected and feed back.

The encoder is composed of at least three Hall chips and detection gears, which measure the rotation angle of their own gears. In the case of normally power supply, the absolute angle and the number of running turns are detected by the main gear and its Hall chip, and the signal is transmitted to the CPU of the main control board, which is converted into the valve position data. In the case of power failure, the encoder's main gear and three driven gears have absolute angle difference due to the different number of teeth. The current position data of the valve can be calculated effectively through the specific software algorithm based on the difference between the two angles. And the encoder redundancy design, even if there is a gear or hall fault, it can also ensure the correct detection of valve position.

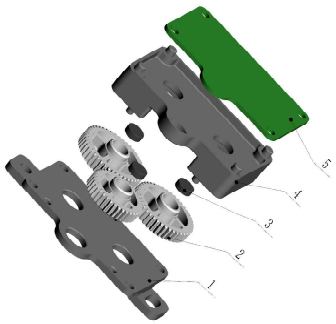
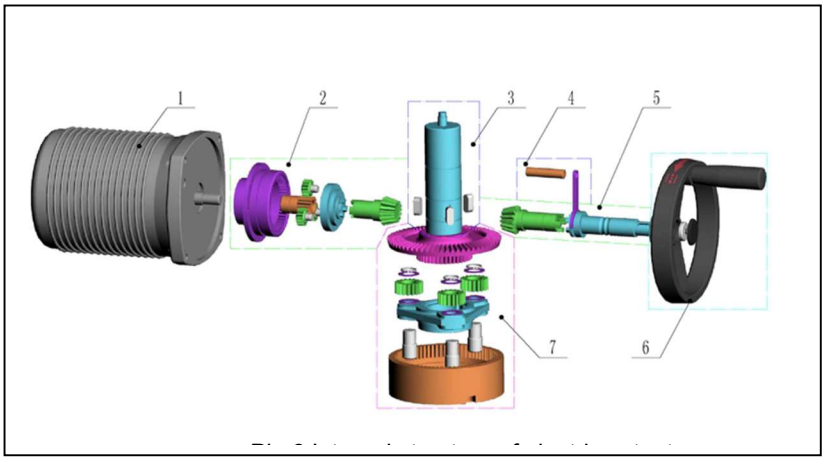


Fig.6: The multi gear absolute encoder

Internal structure of electric actuator (Fig.7)

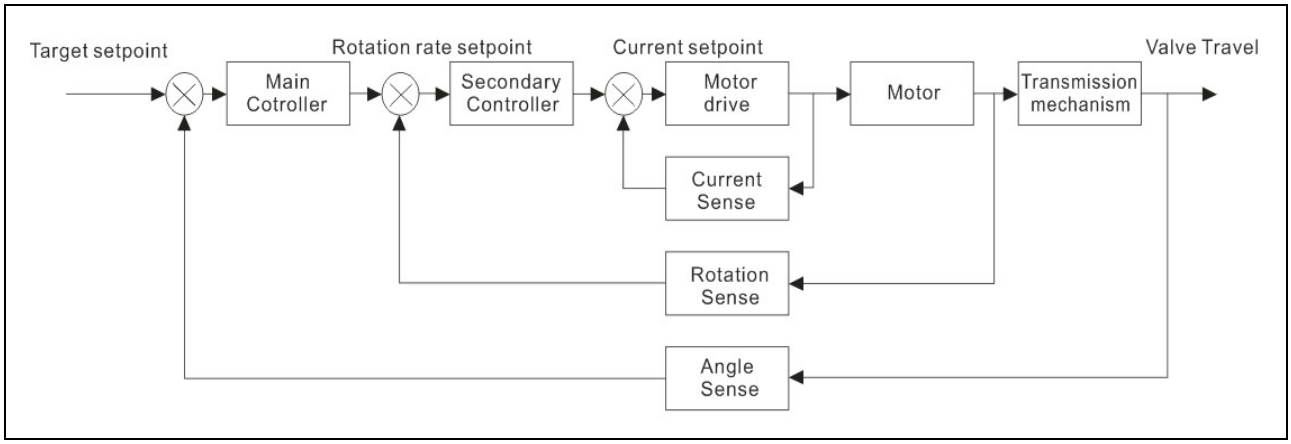
1. Motor
2. Reduction gear
3. Center shaft (output shaft)
4. The handwheel clutch switching mechanism
5. Hand wheel clutch
6. Hand wheel
7. Planetary gear reduction



Control principle and main control module

Three stage cascade PID control: drive motor control circuit + motor operation control circuit + final position output control circuit. Customers can adjust the parameters of each control loop according to the site process and working condition requirements, so as to achieve the optimal control quality and control accuracy.

Note: Due to the mutual coupling of each loop of cascade control, the change and adjustment of PID coefficient must be completed under the guidance of professionals or manufacturers.



Alarm settings

Generally, there are three groups, and at most six groups of alarm outputs can be selected. Each output is a normally open / closed dry node. The alarm content can be configured arbitrarily, and the alarm common terminal is independent, which is suitable for connecting different alarm power supplies.

Control signals types

- Valve position control: According to the control signal (4 – 20mA or 0 – 10V, etc.) output by the controller, PLC or DCS, the actuator automatically and accurately runs to the corresponding valve position.
- Emergency control of ESD: In case of emergency and abnormal conditions, the actuator shall perform actions according to the settings (open, close or other positions) to meet the safety requirements of on-site process.
- On/off control: the actuator implements corresponding switch action according to the input switch signal, and the switch signal can be defined as inching or automatic holding type.
- Various communication modes can be selected: Mod bus, M-BUS, Nb, Loar, 4G and other optional control modes.

Simple and humanized operation

- Configuration button: The four operation buttons on the panel can complete all parameter setting, configuration and adjustment, and check fault information and diagnosis reasons. The information is directly displayed on the screen as intuitive text. English / German / Chinese can be switched freely.
- Optional infrared remote control: the infrared remote controller can replace all functions of panel buttons within 10 meters to set and configure parameters.
- Setting of PC terminal: wireless connection with PC terminal via Bluetooth, setting and configuration of actuator parameters.

Fig 9: G03 Series Main Control Band

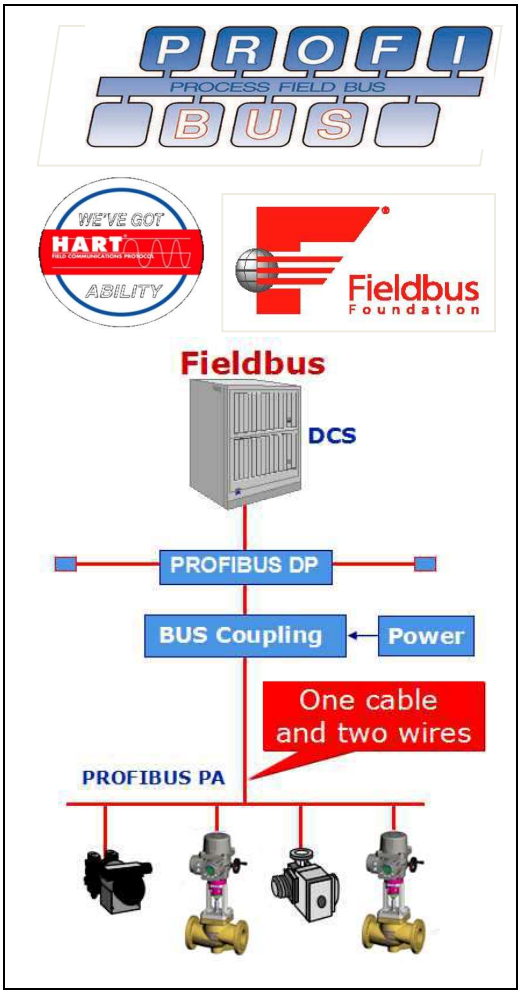
Fig 10: G03Series Operating Plate

HART and Bus communication technology

HART Communication protocol

HART(Highway Addressable Remote Transducer) is based on the Bell202 standard FSK frequency shift keying signal, the low-frequency 4-20mA analog signal be superimposed on the amplitude of 0.5mA audio digital signal for two-way digital communication, data transmission rate is 1.2kbps. Since the average value of the FSK signal is 0, it does not affect the size of the analog signal transmitted to the control system. In the HART protocol communication, the main variables and control information are transmitted by 4-20mA. In the case of need, the other measurement, process parameters, equipment configuration, calibration and diagnostic information are accessed through the HART protocol.

CHEMSUN products comply with the HART communication protocol, can easily access any accord with the agreement of the network system, can provide reliable data transmission.



PROFIBUS DP

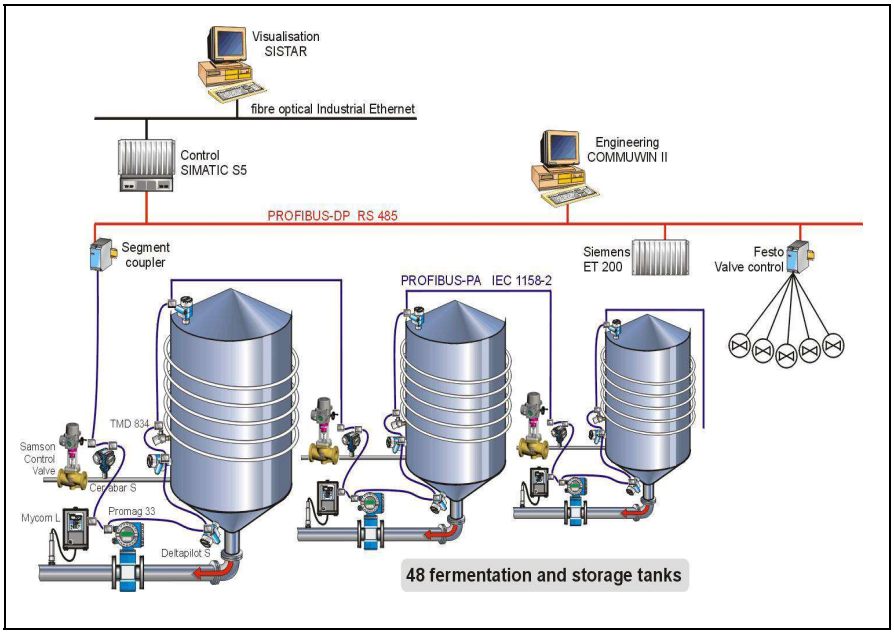
PROFIBUS-DP (Decentralized Periphery) It is suitable for communication between equipment level control system and distributed I/O. The master station manages and controls the entire DP network through a standard PROFIBUS-DP dedicated cable, which commu. with the scattered field devices (remote I/O, actuators, valves, smart sensors, or lower level networks). Most of the data exchange in PROFIBUS-DP is periodic, and the first kind of master station (Master) reads the input inform. of each slave station (Slave) circularly, and sends the output information to them. Use PROFIBUS-DP to replace 24VDC or 4-20mA transmission.

The central controller, the programmable controller, the host computer and so on are input or output by binary or analog input by a high speed serial interface, as well as peripheral devices. Periodic data exchange equipment rooms, all connected with the PROFIBUS product support V1 service functions, to achieve non periodic

data exchange.

The master station periodically sends information to the slave station and receives its output information periodically from the slave station. In addition to image processing, PROFIBUS-DP has a powerful diagnostic and debugging function. At the same time, the master station and slave station have monitoring function for monitoring data transmission。

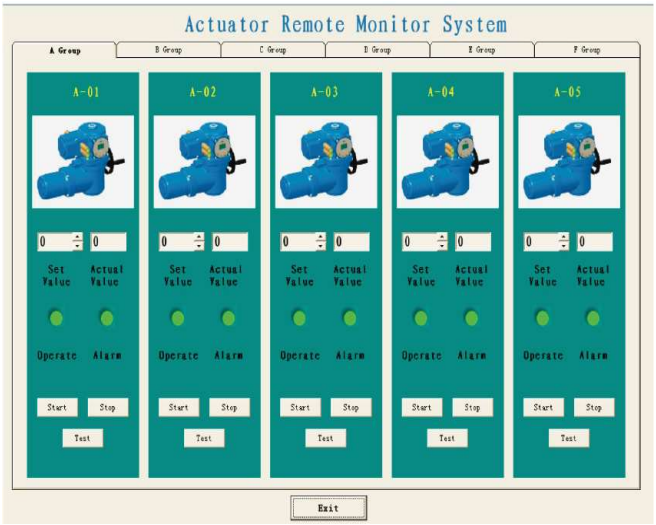
GSD file contains the parameters configuration and other related content, users can use the GSD file structure, content and code standards. GSD file is suitable for the electric actuator PROFIBUS DP interface: DRGSD, GSD. Each table of the PROFIBUS-DP bus device has its own identification number.



CHEMSUN series actuator can be easily integrated into any PROFIBUS fieldbus control system, fieldbus components not only through the PROFIBUS user organization (PNO) certification and testing, but also can be equipped with other bus interface, compatible with other bus technology.

Advantages

- Save hardware cost。
- Design, configuration, installation, debugging become more simpler.
- Good system security and reliability, reduce downtime.
- System maintenance, equipment replacement, system expansion become more simpler.
- The user's system configuration, equipment selection has the greatest autonomy.
- Improve enterprise information system and realize enterprise integrated automation.

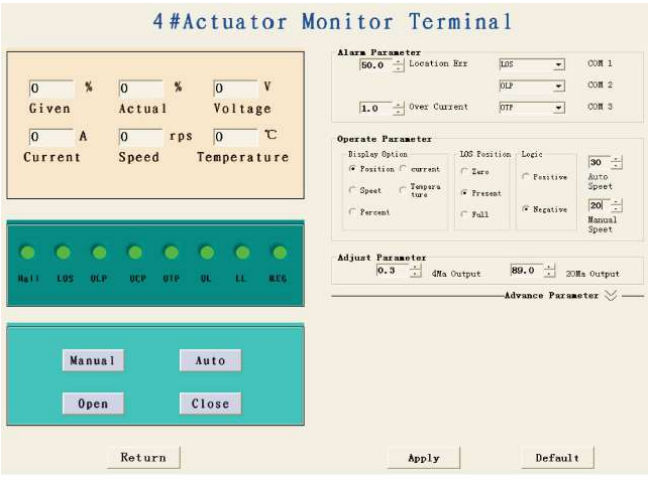


MODBUS RTU

MODBUS RTU code is the first to promote a soft communication protocol MODICOM, in the RS232/RS485 communication process, it is widely used in this statute.

Through the MODBUS communication protocol, the controller can communicate with other devices through the network. It has become a common industry standard.

CHEMSUN products comply with the standard MODBUS communication protocol, and can easily access any network system in accordance with this Agreement.



Product database

The perfect product information management is the key link of CHEMSUN product quality tracking, and it is also the important means and guarantee of product quality management. Each of CHEMSUN products and accessories are recorded in a central database, the information of all production and processing, assembly and sales operation and other related products can be traced back to the original

data query, and maintenance of the products are available through remote consultation system operation (PDA) feedback to the central database, without losing any information, and can be traceability management of product quality.

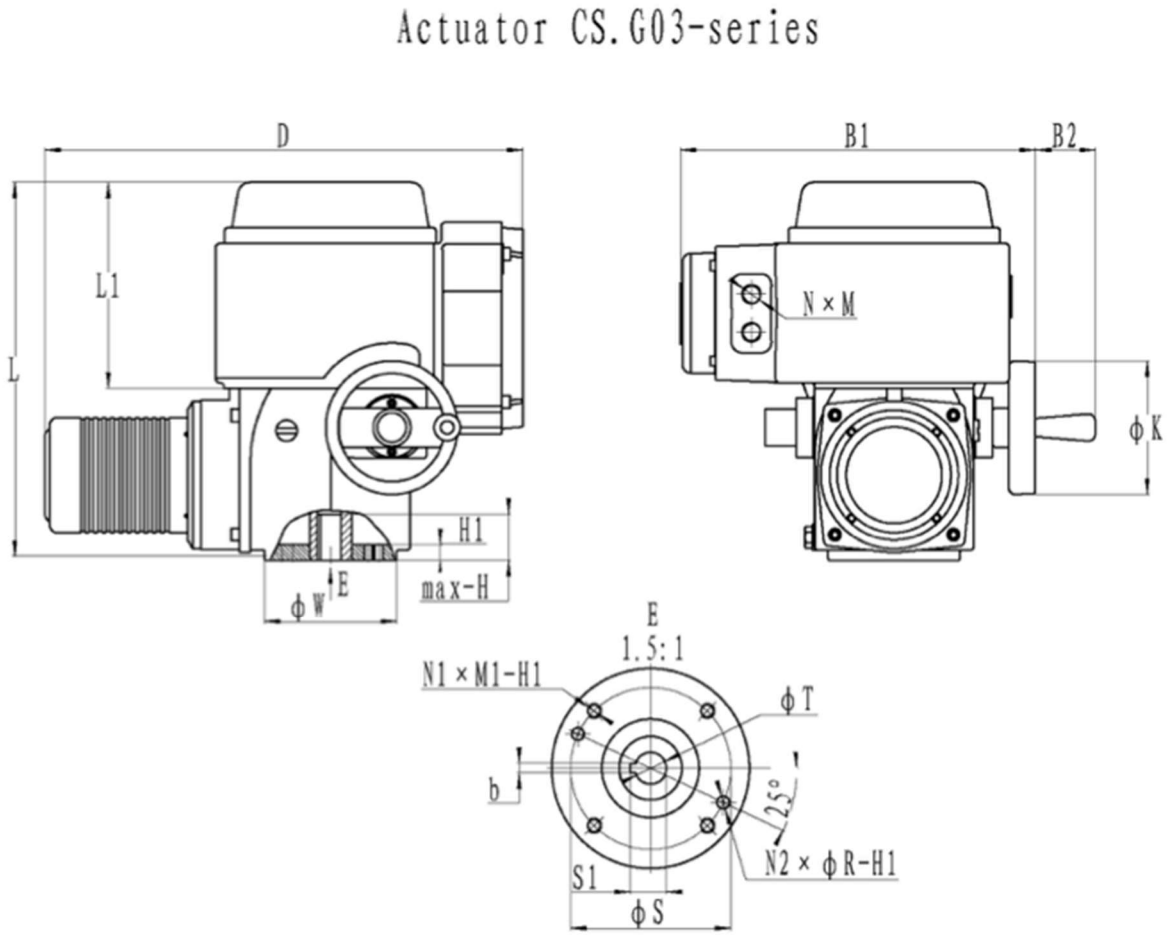
Table 1: Technical data

CHEMSUN CSR - G03 Series Heavy-load E-Actuator	
Rotary stroke output torque range	180-250000 Nm
Linear stroke output thrust range	20 – 200 KN
Stroke range	90° /Multi-turn； 40 / 65 / 135 mm
Supply power	220 / 380 VAC (50/60 Hz), Special optional 400/460VAC
Shell material	Cast Al. 3.2373
Explosion-proof type	ATEX Ex d IIC T6; Non Ex
Protection grade	IP67 / 68
Input signal	4 – 20mA; 0 – 10(5)V; Dry contacts, Switch
Output signal	4 – 20mA; 0 – 10(5)V; Dry contacts, Switch
Power fail safe position	FL (Fail Lock) ; Special optional FC/FO/FS
Ambient temperature	Standard -25 to +80℃ ; Low temp. -40 to +70℃
Transducer Sensitivity	0.5 %
Actuator Accuracy	≤ 1.0 %
Response time	200 ms
Alarm configuration	3 – 6 Paths
Communication protocol	HART, PROFIBUS, MODBUS
Ambient humidity	100% RH
Adjusting speed range	15 – 100%
Torque adjustment range	10 – 100%
Seismic capacity	3 axis 6 g

Table 2: Basic parameters

CHEMSUN CSR / L - G03 Series Heavy-load E-Actuato		
Sell material		Cast Al. 3.2373
Motor Data	Type	Alternating current Motor
	Body material	Cast Al. 3.2373
	Rated power	0.4/0.8/1.2 KW
	Rotation rate	500 – 3000 rpm Cast Al. 3.2373
	Cooling mode	Air coolling
	Temp. class	About 70℃
	Protection grade	IP 67
	Structural chara.	Alternating current Motor
	Insulation grade	Class H
	Moment of inertia	60 g·cm2
Mechanical drive		Mechanical drive
Hand wheel		Standard
Position feedback		The multi gear absolute encoder

CSR - G03 Series E-Actuators Dimension drawing



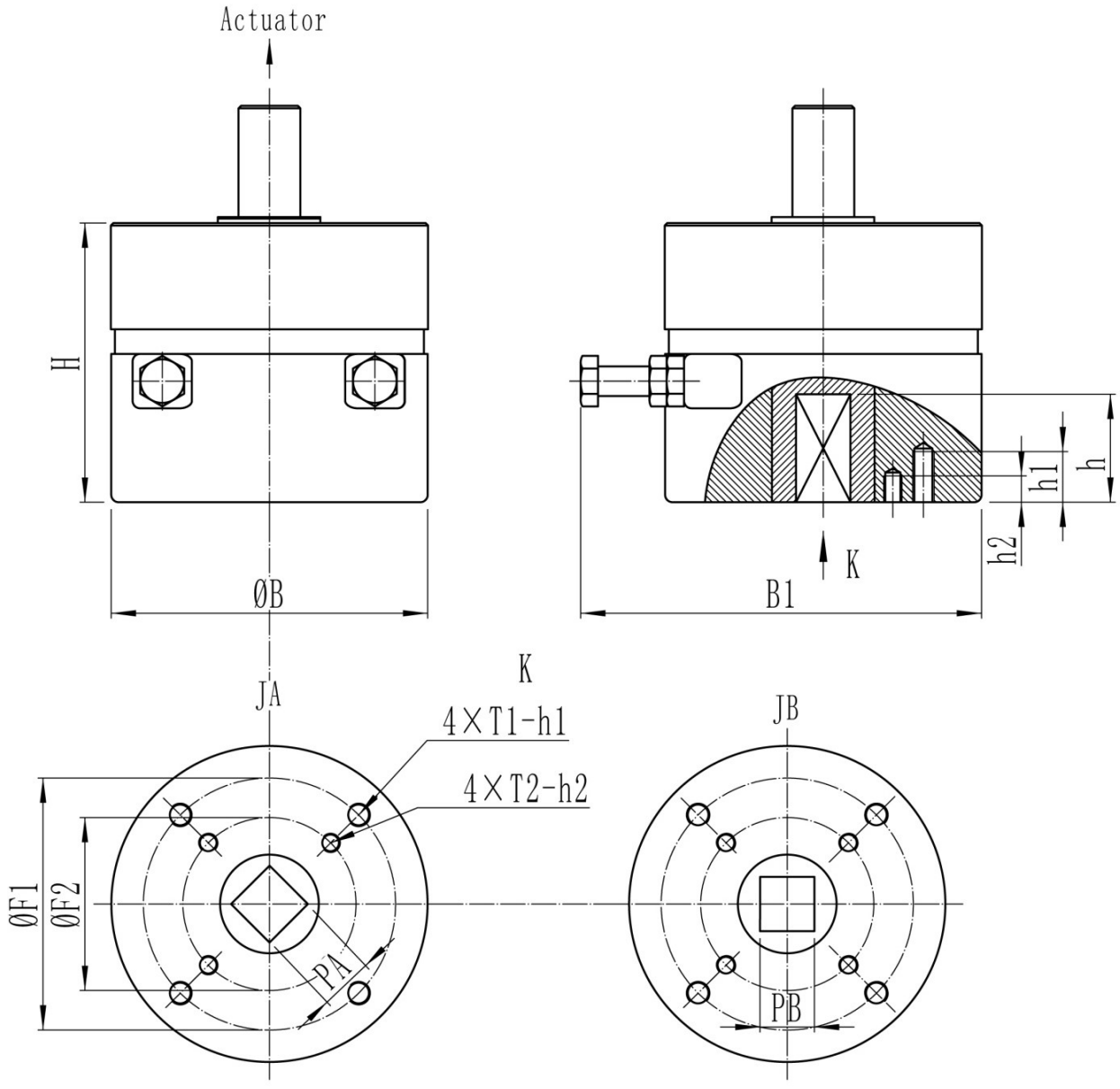
Main dimensions Unit:mm

Type	D	L	L1	B1	B2	K	W	N×M	N1×M1	N2×R	S	S1	b	T	H	H1	Flange size
G03	457	354	195	340	55	125	126	2×M20×1.5	4×M10	2×∅8	102	22.8	6	20	63	15	F10

Note: Flange standard according to DIN ISO 5211.

Quarter-turn gearbox dimensions

Quarter-turn gearbox A



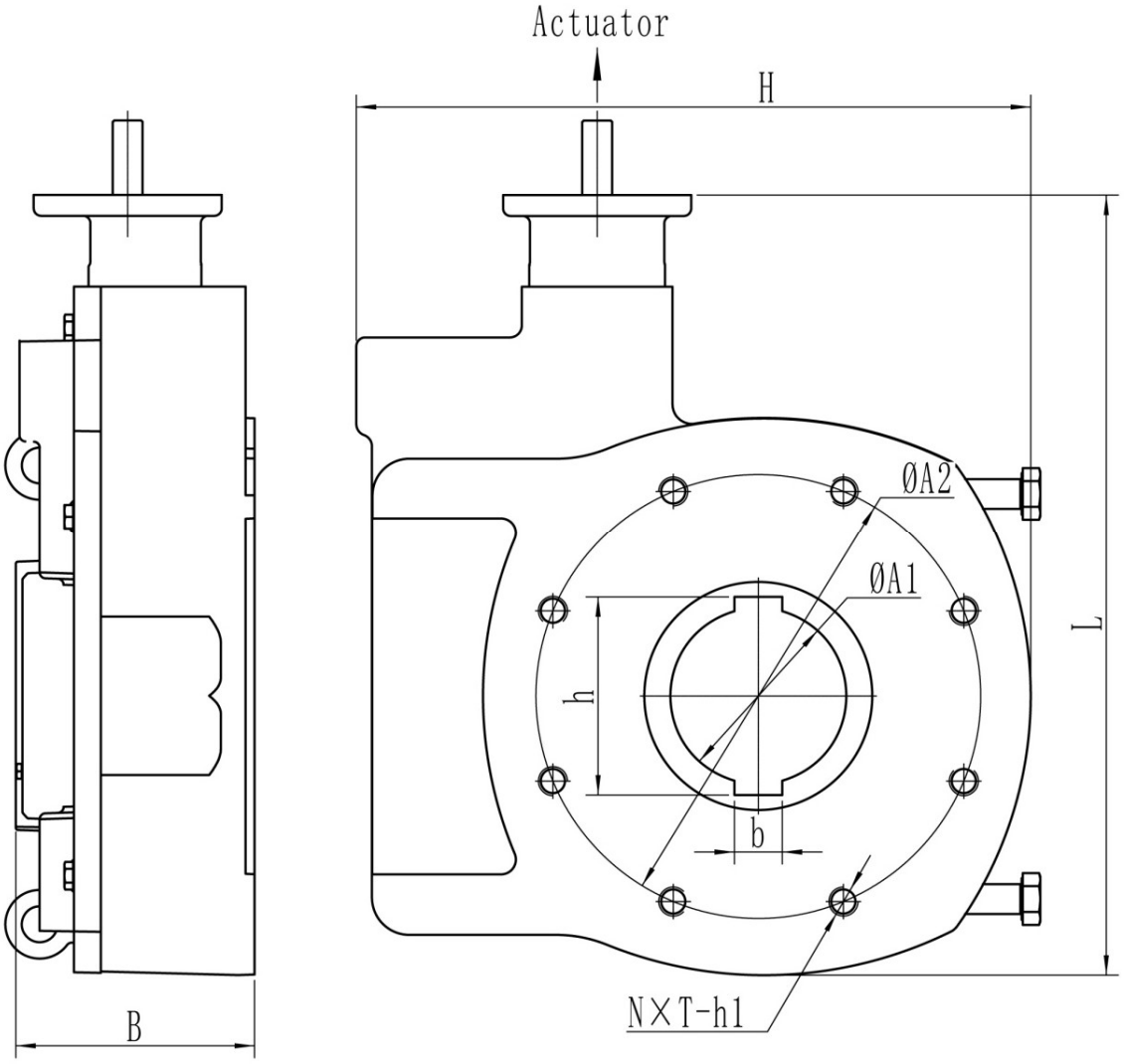
Main dimensions Unit:mm

Type	H	B	B1	PA	PB	h	h1	h2	T1	T2	F1	F2	Flange size
A1	113	128	165	22	22	35	25	20	M10	M8	102	70	F07/F10
A2	128	154	175	27	27	46	30	25	M12	M10	125	102	F10/F12

Note: Flange standard according to DIN ISO 5211.

Quarter-turn gearbox dimensions

Quarter-turn gearbox B



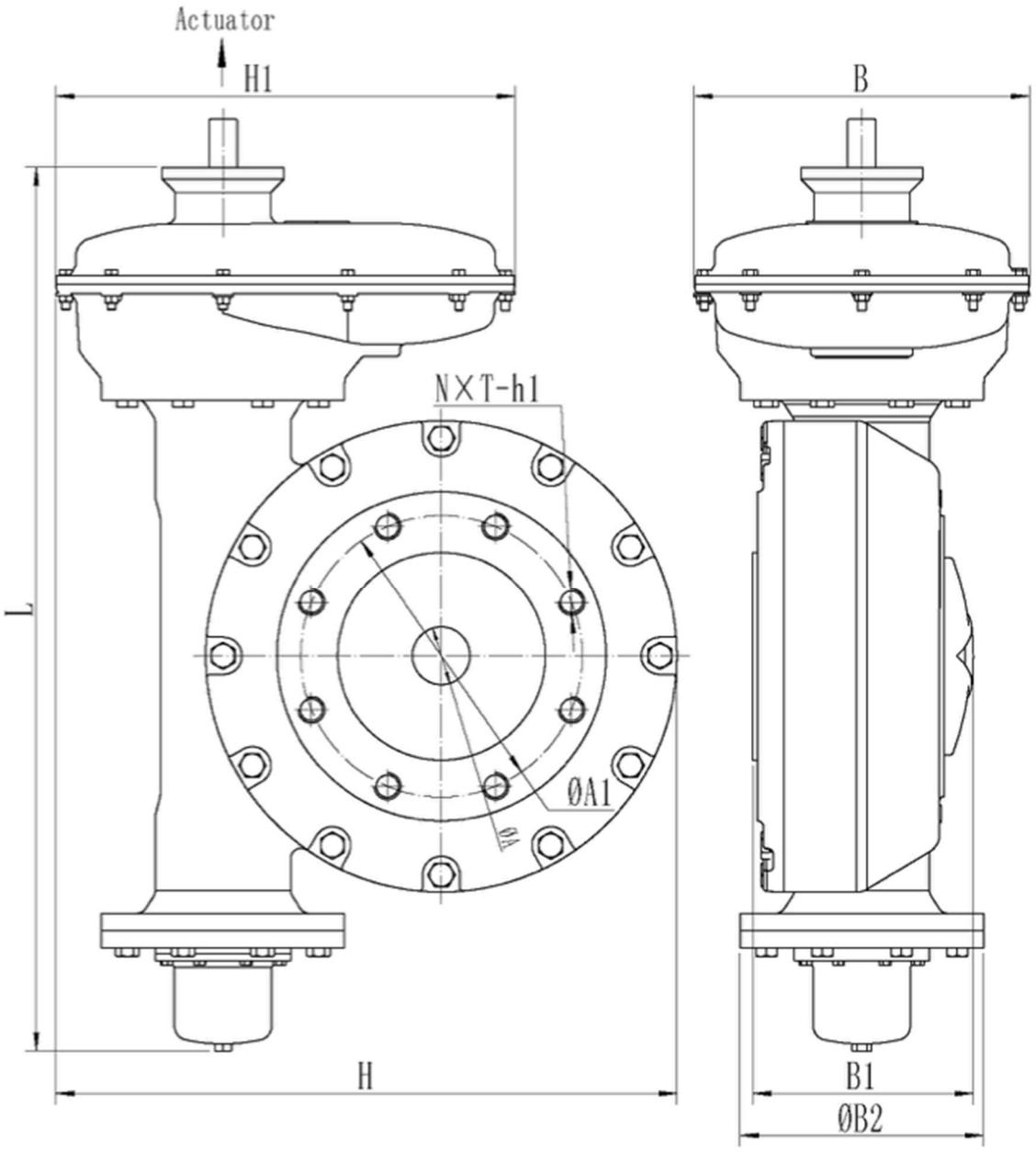
Main dimensions Unit:mm

Type\	H	B	L	A1	A2	N	T	b	h	h1	Flange size
B1	248	96	252	66	140	4	M16	20	75.8	18	F14
B2	304	110	303	90	140	4	M16	25	100.8	23	F14
B3	363	108	343	95	165	4	M20	25	103	18	F16
B4	361	110	446	95	165	4	M18	25	105	18	F16
B5	450	160	523	118	298	8	M18	32	132.8	18	F30
B6	563	230	692	166	406	8	M20	40	184.8	35	F40

Note: Flange standard according to DIN ISO 5211.

Quarter-turn gearbox dimensions

Quarter-turn gearbox C



Main dimensions Unit:mm

Type	H	H1	B	B1	B2	L	A	A1	N	T	h1	Flange size
C1	897	663	483	318	350	1274	Custom-made	406	8	M36	48	F40

Note (1): Flange standard according to DIN ISO 5211.

Note (2): For at least 16 weeks ahead of time for Super-large torque gear box.

CHEMSUN E-Actuators CSR - G03 Series Rotary E-Actuator Selection type table

CHEMSUN E-Actuator Type CSR-G03-	X	X	X	X	X	X	X	X	X	X
Rotary Stroke										
90°（≤95°）	**1**									
Multi-Turn	**2**									
Special Angle (On request)	**9**									
Explosion-proof type										
ATEX, IEC Ex Exd IICT6, IP67/68		**1**								
Non Ex , IP67		**2**								
Supply power										
230 V AC			**2**							
380 V AC			**4**							
Special type (on request)			**9**							
Input signal type										
4 – 20 mA				**1**						
0 – 10(5) V				**2**						
On/off switch (Dry contacts)				**3**						
Communication mode（Mod-Bus/M-Bus/NB/LOAR/4G/5G）				**4**						
Special type（On request / Detailed instructions）				**9**						
Feedback signal type										
4 – 20 mA					**1**					
0 – 10(5) V					**2**					
On/off switch (Dry contacts)					**3**					
Communication mode（Mod-Bus/M-Bus/NB/LOAR/4G/5G）					**4**					
Special type（On request / Detailed instructions）					**9**					
Power fail safe position										
FL（Fail Lock/Hold）						**0**				
FC（Fail Close）						**1**				
FO（Fail Open）						**2**				
FS（Fail Any Position）						**3**				
Max. Output torque. Nm（Gear Box A1; B1-B6; C1-C2）										
NON	180						**0**			
A1	600						**1**			
B1	1800						**2**			
B2	3000						**3**			
B3	4500						**4**			
B4	6000						**5**			
B5	8000						**6**			
B6	16000						**7**			
B7	35000						**8**			
C1	65000						**9**			
C2	130000						**A**			
Special	> 130000 (On request)						**S**			
Number of alarm terminals										
NON（Standard）								**0**		
3 Groups（Standard）								**3**		
> 3 Groups (On request / Max. 6 Groups, Detailed instructions are required when ordering.)								**9**		
The environment temperature										
Standard： -25 ～ +80℃									**0**	
Lower Temp.：-40 ～ +70℃									**1**	
Extrem-low Temp.：-60 ～ +70℃									**2**	
Other Special Functions										
Without										**0**
HART; FF; PID loop, Flow chara. compensation, etc. (On request, Detailed instructions are required when ordering.)										**9**

CHEMSUN E-Actuators

CSL - G03 Series Linear E-Actuator Selection type table

CHEMSUN E-Actuator **Type CSL- G03-**	X	X	X	X	X	X	X	X	X	X
Linear Stroke										
20mm	**1**									
40mm	**2**									
65mm	**3**									
135mm	**4**									
315mm	**5**									
Special Line (On request)	**9**									
Explosion-proof type										
ATEX, IEC Ex Exd IICT6, IP67/68		**1**								
Non Ex , IP67		**2**								
Supply power										
230 V AC			**2**							
380 V AC			**4**							
Special type（On request / Detailed instructions, when ordering）			**9**							
Input signal type										
4 – 20 mA				**1**						
0 – 10(5) V				**2**						
On/off switch (Dry contacts)				**3**						
Communication mode（Mod-Bus/M-Bus/NB/LOAR/4G/5G; Detailed instructions）				**4**						
Special type（On request / Detailed instructions, when ordering）				**9**						
Feedback signal type										
4 – 20 mA					**1**					
0 – 10(5) V					**2**					
On/off switch (Dry contacts)					**3**					
Communication mode（Mod-Bus/M-Bus/NB/LOAR/4G/5G; Detailed instructions）					**4**					
Special type（On request / Detailed instructions, when ordering）					**9**					
Power fail safe position										
FL（Fail Lock/Hold）						**0**				
FC（Fail Close）						**1**				
FO（Fail Open）						**2**				
FS（Fail Any Position）						**3**				
Positioning Force (KN)										
≤8.0							**0**			
12							**1**			
25							**2**			
48							**3**			
65							**4**			
80							**5**			
120							**6**			
＞120 (On request)							**9**			
Number of alarm terminals										
NON（Standard）								**0**		
3 Groups（Standard）								**3**		
> 3 Groups (On request / Max. 6 Groups, and Detailed instructions are required when ordering.)								**9**		
The environment temperature										
Standard： -25 ～ +80℃									**0**	
Lower Temp.：-40 ～ +70℃									**1**	
Extrem-low Temp.：-60 ～ +70℃									**2**	
Special Function										
Without										**0**
HART; FF; PID loop; With temperature or pressure sensor; Flow characteristic compensation; With Mechanical Moment Switch, etc										**9**

Output mechanical connection

The connection design conforms to the ISO5211 international standard, and suitable for each kind of form mechanical connection, guarantees with all valves reliable connection。

CHEMSUN all electric actuators can be used in different assembly objects, there are different forms of terminal output mode, can be based on customer requirements to provide special output terminal size。

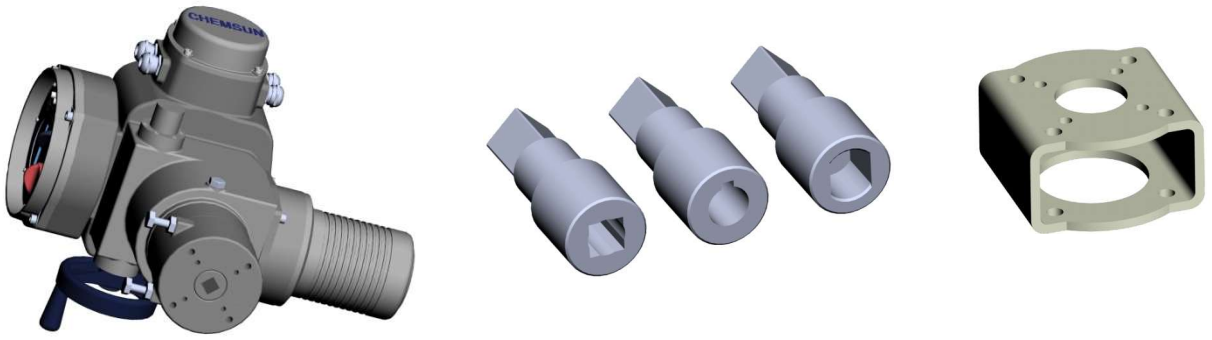


Fig.15: Actuator output shaft and connecting bracket

Ordering text 01

Rotary E-Actuator	Type CSR-G03- …
Explosion-proof type	ATEX Exd IIC T6; Non Ex
Max. Torque	250000Nm, A1/A2/B1/B2/B3/B4/B5/B6/C1/C2
Supply Power	220/380VAC (50/60Hz); Special optional 400/460VAC
Input / Output Signal	4 -20mA ; 0 – 10(5)V ; On-off Switch; Communication mode
Power Fail Safe Position	FL/FC/FO/FS
Valve Type	V-Ball Control Valve; Rotary-plug Valve; Butterfly Valve; O-Ball Valve …

Ordering text 02

Linear E-Actuator	Type CSL-G03- …
Explosion-proof type	ATEX Exd IIC T6; Non Ex
Max. Stroke	H=20,40,65,135,315mm
Max. Thrust	20 - 120KN
Supply Power	230/380VAC (50/60Hz); Special optional 400/460VAC
Input / Output Signal	4 -20mA ; 0 – 10(5)V ; On-off Switch; Communication mode
Power Fail Safe Position	FL/FC/FO/FS
Valve Type	Globe Valve; Knife Gate Valve; Gate Valve …

*** Specifications subject to change without notice.