



FF-260 SERIES

jet deflector EHSV



Add:6 Lanhui Road,Nanjing New&Hightech Development Zone
Tel:+86 25 58055995 58055996 58055997
Fax:+86 25 58840205
Post Code: 210061
Website:www.njservo.com



609伺服阀

AVIC NANJING SERVO CONTROL SYSTEM CO.,LTD

航空工业南京伺服控制系统有限公司

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AVIC Nanjing Servo Control Systems Co.,Ltd has been manufacturing servo valves for over 50 years .Due to its compact size,light weight,great contamination resistance,high reliability, FF-260 series servo valves have been widely used in both military and industrial applications,such as aviation,aerospace ,navigation, hydraulic system and fuel system of civilian aircraft.FF-260 is an affordable equivalent to Moog 260 .It boasts a large share of domestic market and enjoys great reputation among users both at home and abroad.



Servo valves in this catalog are in conformity with GJB3370-1998 of China military standard for servo valves used for aviation.



Our quality management system has passed ISO 9001:2000 quality assurance system.

Note

Please clear the whole hydraulic system before installing servo valve as per ISO 6072.
Please refer to general technical data and electrical performance.

This catalog is for users with professional knowledge.Please refer to this catalog to ensure the safety and every function of system.We reserve the right to change the specifications in this catalog before notice.Please contact AVIC Nanjing Servo Control Systems Co.,Ltd in case of any doubt.



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※ Characteristics

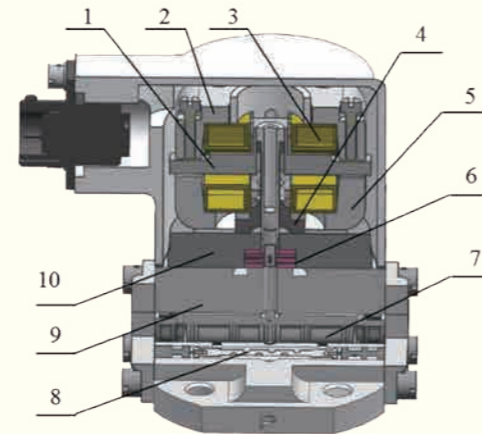
- High precision control,fast dynamic response and ease of operation ;
- Stainless steel body,high structure strength;
- Compact structure,small size and light weight ;
- Stable performance,high reliability and long working life ;
- Low internal leakage and low power consumption ;
- Low hysteresis,high threshold and high repeatability precision ;
- Excellent linearity,driving force and small null shift.

※ Structure

Servo valve consists of permanent magnetic torque motor,deflector jet hydraulic amplifier and output sliding valve.

Permanent magnetic torque motor consists of armature assembly (1) ,upper polepiece (2) ,2 permanent magnets,left and right coils (3) and lower polepiece (5) .The armature assembly (1) is made up of armature,flexture tube(4) and feedback spring.They are connected by soldering and crimping and installed on the first-stage support(10). The armature assembly is fixed on the valve body (8) by 2 bolts.

Deflector jet hydraulic amplifier is made of jet disc(6) and deflector with flow guide.Jet disc is fixed on the first stage support (10).Output stage amplifier is made up of spool (7) ,valve body(9) and other parts.Deflector is fixed to spring feedback.



※ Operation

FF-260 EHSV consists of permanent magnetic torque motor,deflector jet hydraulic amplifier, spool and valve body.Deflector jet hydraulic amplifier is made of jet disc and deflector.Permanent magnetic torque motor consists of armature assembly,upper polepiece,2 permanent magnetic,left and right coils and lower polepiece .The armature assembly is made up of armature,flexture tube and feedback spring.They are connected by laser soldering and crimping .Deflector is fixed to spring feedback.The deflector of the first stage hydraulic amplifier extends from flexture tube and inserts in the middle of jet disc.Hydraulic fluid continuously flows from internal oil filter,jet disc and deflector.Output flow acts on both ends of the second stage four way sliding valve. The second stage amplifier is made up of 4 way spool without sleeve.There are 2 rectangular-shaped orifices on the valve body,which correspond to 2 working lobes of spools with 4 lobes.A feedback spring extends from flapper inner and inserts its ball end in the small slot of the spool.

As an electrical signal is applied to the motor coils,a torque is developed on the armature causing it to pivot about the flexure tube support. The resulting motion of deflector from the fixed single inlet moves the jet of the fluidic amplifier towards one or the other of the receiver opening. The unbalance in jet momentum recovery between the receivers produces a pressure differential which causes spool motion. As the spool moves,a torque proportional to spool displacement is applied to the armature by the feedback spring.This torque opposes that developed by the motor and a condition of torque equilibrium will exist when the feedback spring torque equals the electrical motor torque.Therefore,spool displacement is proportional to input current.

Performance

- Working pressure: Rated supply pressure: 21MPa Return pressure: ≤0.6MPa
- Temperature and humidity: Ambient temperature: -55°C~+150°C Fuel temperature: -30°C~+150°C
- Relative humidity: 10%~90%
- Sealing material: NBR,FPM(other material at request)
- Working fluid: Mineral petrol based hydraulic fluid per DIN 51524 or hydraulic fluid viscosity 10~400mm²/s at 38°C as per clients. Recommend yh-15 or yh-10 aircraft fluid .
- Fluid viscosity: cSt 5~400, cSt 15 recommended
- System filtration: High pressure filter, mounted in the main flow without by-pass, but with dirt indicator. If possible, directly upstream of valve.For system with a fast regulating VD-pump, outside system circulating filter is recommended.
- Cleanliness level: for normal operation: level 8 of GJB 420B(level17/14of GB/T 14039-2002)
- for longer life: level 6 of GJB 420B(15/12of GB/T 14039-2002)
- for normal operation: ISO 4406: 19/13 for longer life: ISO 4406: 13/10
- Note: contamination level affects servo valve performance greatly(spool null position, resolution) and wear (metering edges, pressure gain, leakage)
- Filter rating: for normal operation $\beta_{10} \geq 75$ (10μabsolute) for longer life $\beta_3 \geq 75$ (3μabsolute)
- Installation: any position or move with system.
- Vibration: 30g, (3 axis), 5Hz~2KHz
- Weight: 0.4kg
- Protection plate: Included in standard delivery

Flow calculation

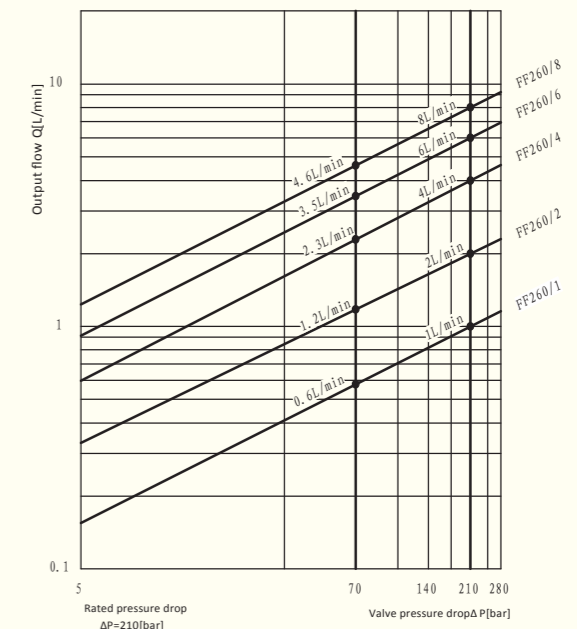
Valve actual flow will be decided by spool position and pressure drop between valve supply and return chambers.Under rated pressure drop $\Delta P=210\text{bar}$ (3050psi) and 100% command signal when valve spool moves furthest, valve no-load rated is defined as rated flow rated Q_N .

At non-rated pressure drop and given commander signal, valve actual flow is proportional to square root of valve supply and return chamber.

$$Q = Q_N \sqrt{\frac{\Delta P}{\Delta P_N}}$$

- Q_N —valve rated flow rate (L/min)
- ΔP —valve actual pressure drop (MPa)
- ΔP_N —valve rated pressure drop (MPa)
- Q —valve actual flow rate (L/min)

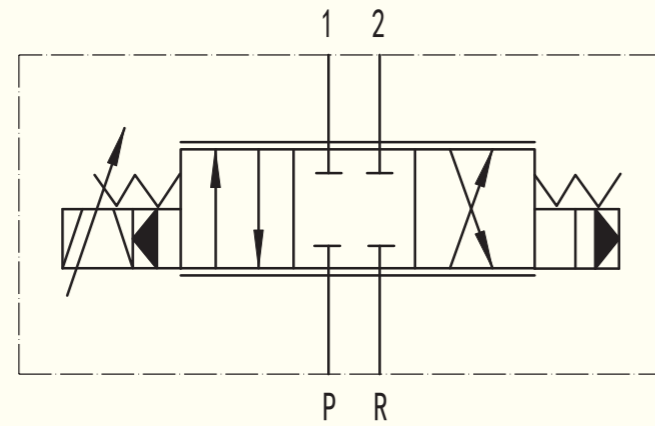
When the average flow rate of P,1,2 or R is less than 30m/s(98ft/s),valve volume flow Q can be calculated using this method.



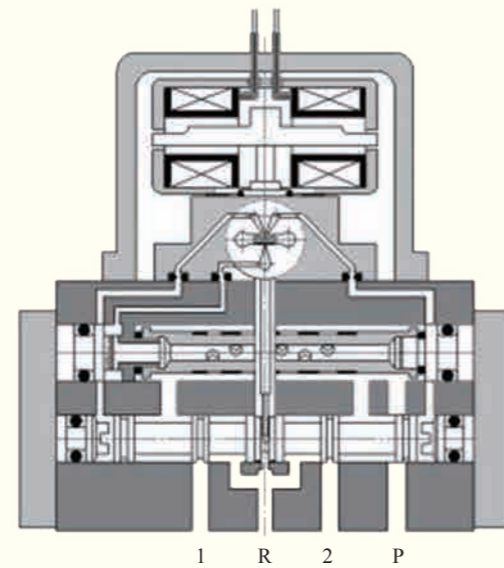
Flow Diagram

At 100% command signal, valve flow is linear with valve pressure drop.Note: 70bar=1017psi.The curve demonstrates actual flow rate at different pressure drop.Users can pick up EHSV accordingly as per system supply pressure.

Hydraulic symbol

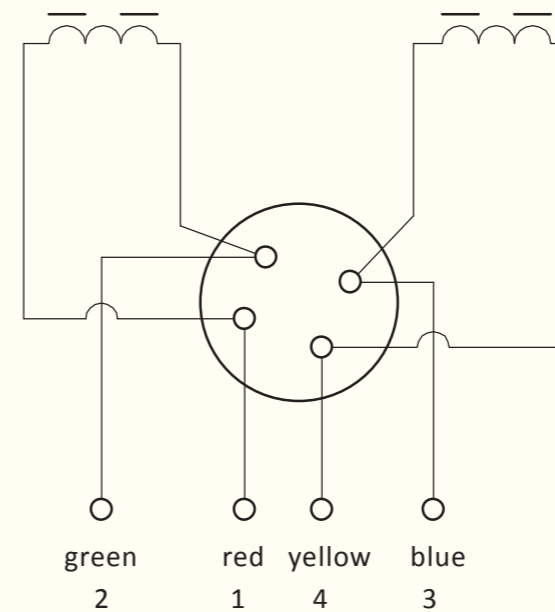


This symbol is for EHSV status with supply pressure and command signal at 0.



Note: Supply pressure port P;
Return pressure port R(T);
Control port 1(control port A);
Control port 2(control port B).

Electrical connection:



Polarity: current from green+ to red-,flow outputs from port 1,
Polarity:current from blue+ to yellow-,flow outputs from port 2.

Rated current,coil resistance and inductance:

Resistance of each coil at 20° (Ω)	Rated current (mA)		Coil inductance approx (H)			
	Differential,parallel or individual	Series	Differential	Series	Individual	Parallel
50	40	20	0.28	0.57	0.15	0.13
40	46	23	0.22	0.42	0.13	0.10
60	37	18.5	0.34	0.66	0.20	0.16
98	28	14	0.58	1.1	0.34	0.27
180	20	10	1.1	2.2	0.69	0.54
356	15	7.5	2.1	4.1	1.3	1.0
500	12	6	3.1	5.9	1.8	1.4
1000	8	4	7.7	14.5	4.5	3.5

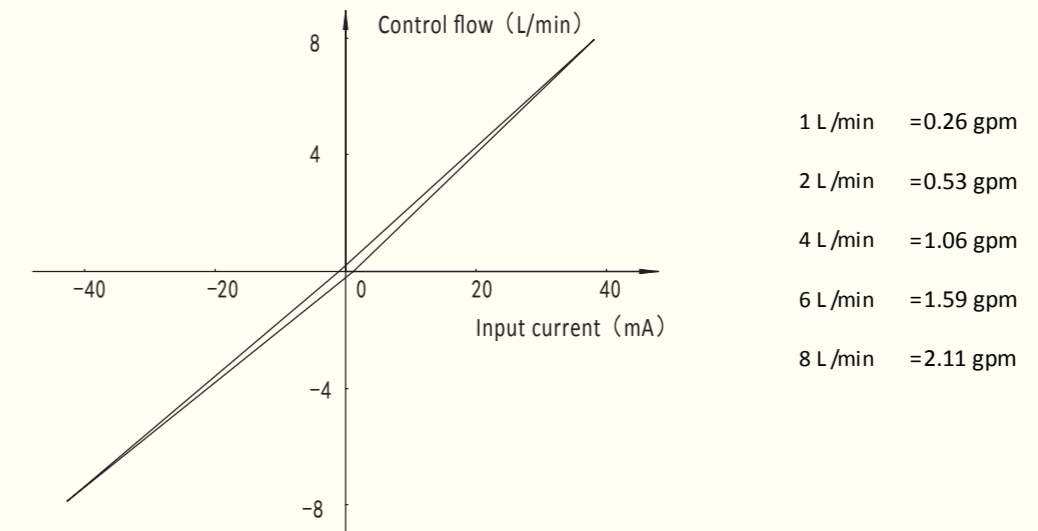
FF-260 series EHSV performance

Item	unit	FF-260							
		FF-260/1	FF-260/2	FF-260/4	FF-260/6	FF-260/8			
Supply pressure range	bar	20~280							
Rated supply pressure P _N	bar	210							
	psi	3050							
	MPa	21							
Rated flow Q _n	L/min	1	2	4	6	8			
	gpm	0.26	0.53	1.06	1.59	2.11			
Rated current I _n	mA	46	40	37	28	20	15	12	8
Coil resistance	Ω	40	50	60	98	180	356	500	1000
Insulation resistance	MΩ	≥50							
Hysteresis	%	≤3							
Threshold	%	≤1							
Linearity	%	≤7							
Symmetry	%	≤5							
Pressure gain	%	≥30							
Internal leakage	L/min	≤0.49	≤0.53	≤0.61	≤0.69	≤0.77			
	(gpm)	≤0.13	≤0.14	≤0.16	≤0.18	≤0.20			
Null bias	%	≤±3							
Lap	%	≤±2.5							
Null shift with supply pressure (60%P _s ~110%P _s)	%	≤±4							
Null shift with return pressure (2%P _s ~20%P _s)	%	≤±4							
Null shift with temperature (-20℃~+100℃)	%	≤±4							
Frequency response	Amplitude ratio (-3dB)	Hz	≥100						
	Phase lag (-90°)	Hz	≥100						
Working temperature	℃	-55~+150							
Net weight	Kg	≤0.4							

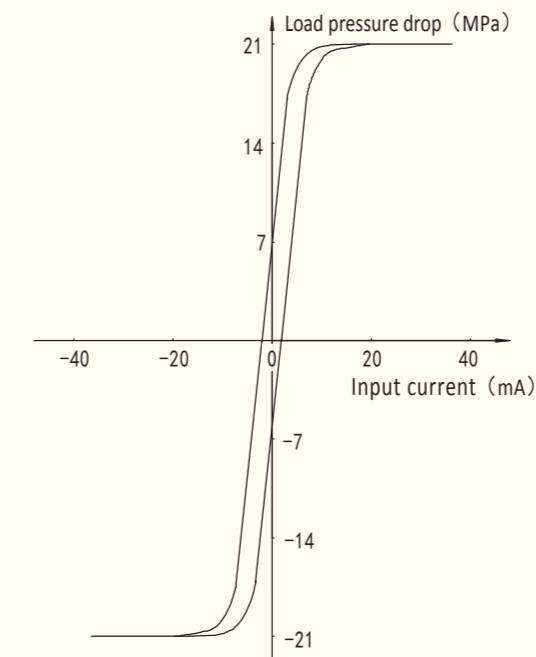
Note: FF-260 is totally interchangeable with MOOG 260 in terms of technical data and dimension. And custom design is available at request.
 1bar=14.5psi;
 1gpm=3.785L/min.

Static performance curve: It is measured at system supply pressure of 210bar (3050psi), fluid viscosity of 32mm²/s(1.26in²/s) and fluid temperature of 40°C (104°F).

Flow characteristic curve:

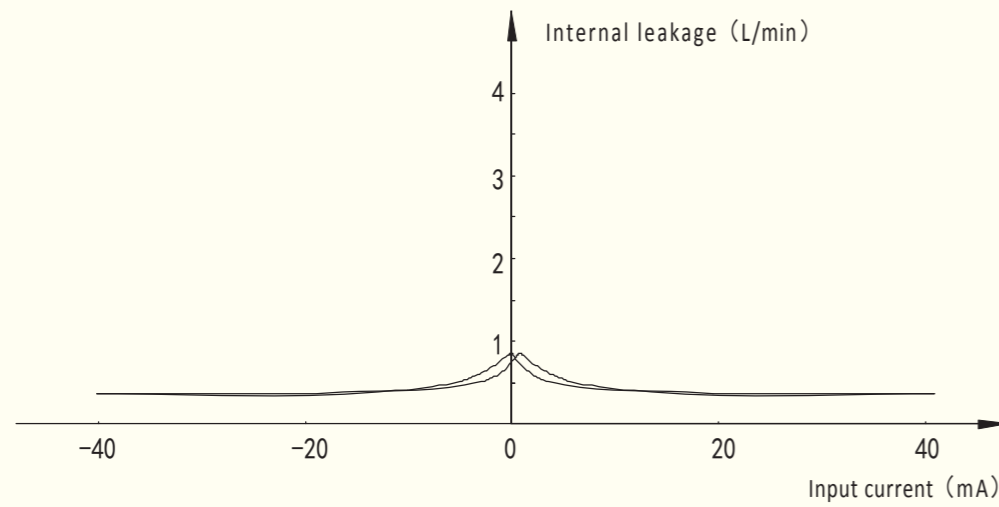


Pressure characteristic curve:



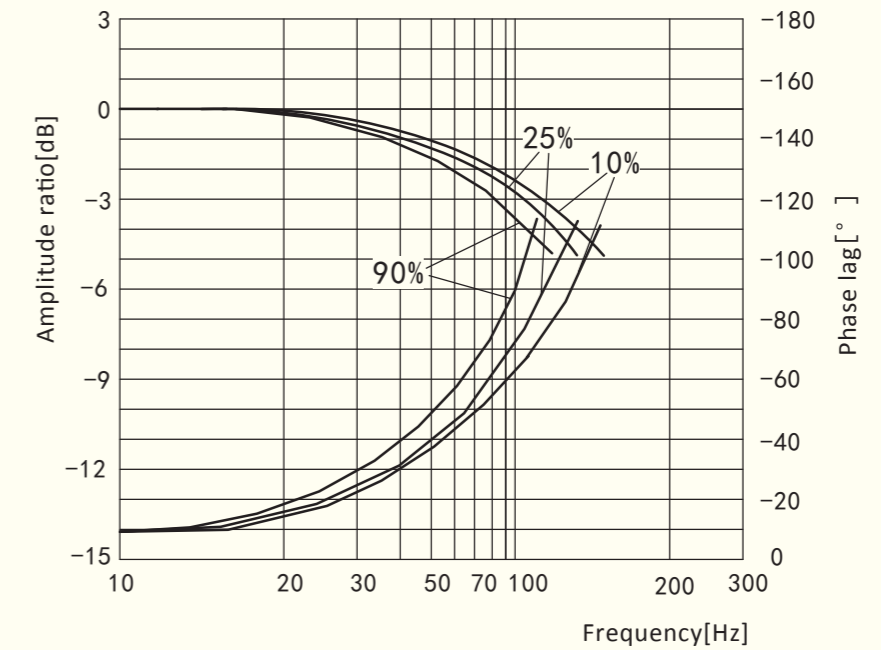
Internal leakage curve :

- 0.49 L/min =0.13 gpm
- 0.53 L/min =0.14 gpm
- 0.61 L/min =0.16 gpm
- 0.69 L/min =0.18 gpm
- 0.77 L/min =0.20 gpm



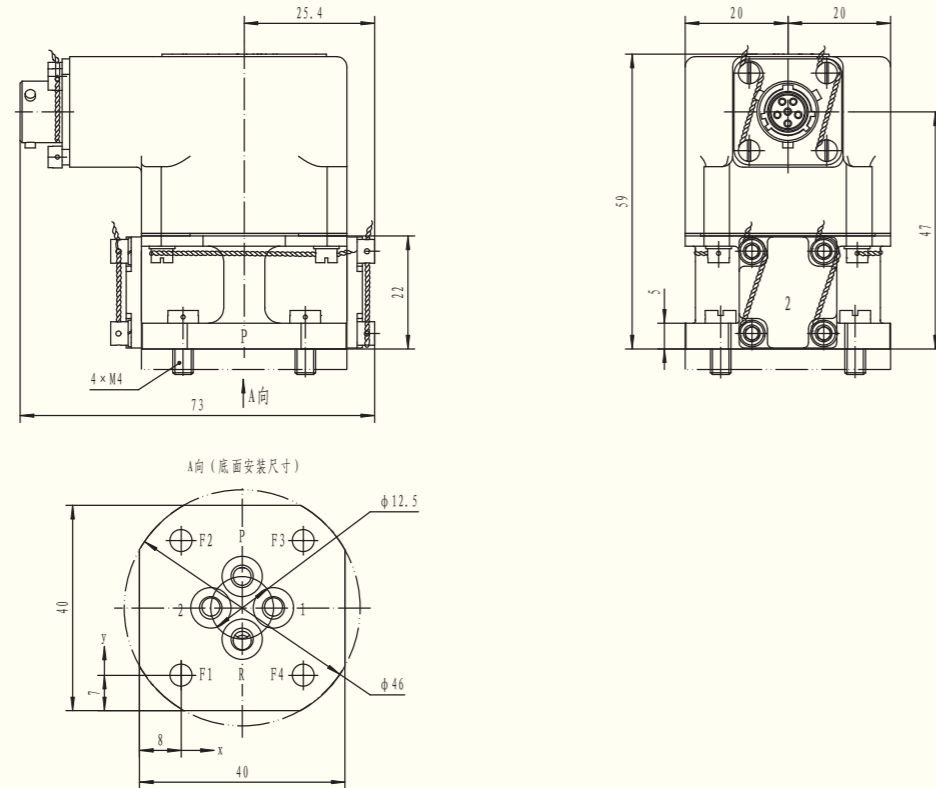
Dynamic performance curve: It is measured at system supply pressure of 210bar (3050psi), fluid viscosity of 32mm²/s(1.26in²/s) and fluid temperature of 40°C (104°F) .

Frequency response curve :



FF-260/6 frequency response at 10%、25%、90%In

Installation drawing (metric system)



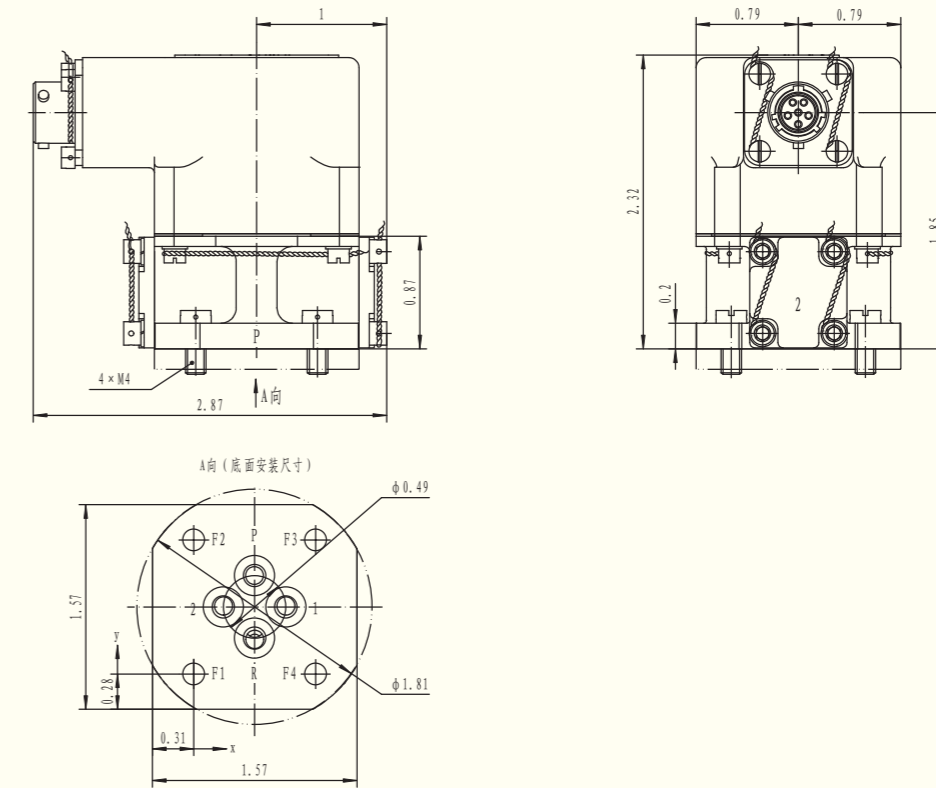
mm

	P	1	R	2	F1	F2	F3	F4
	Φ3.5	Φ3.8	Φ3.5	Φ3.8	M4	M4	M4	M4
x	12	18.25	12	5.75	0	0	24	24
y	19.25	13	6.75	13	0	26	26	0

Spare parts and accessories

O ring (included in standard delivery)	NBR75 Shore FPM 75 Shore	
for port P、R、1、2	4pieces, ID 5×Φ1.5	5080、5176S F370、F275
Mating connector	Its available in JY27473T08B35SN	
Installation bolt (included in standard delivery)	M4×10.5 ISO 4762-10.9 4pieces	
Replaceable filter	for pilot stage, installed before orifice $\beta_{25} \geq 75$ (corresponding to filtration 25μm absolute)	

Installation drawing (English system)

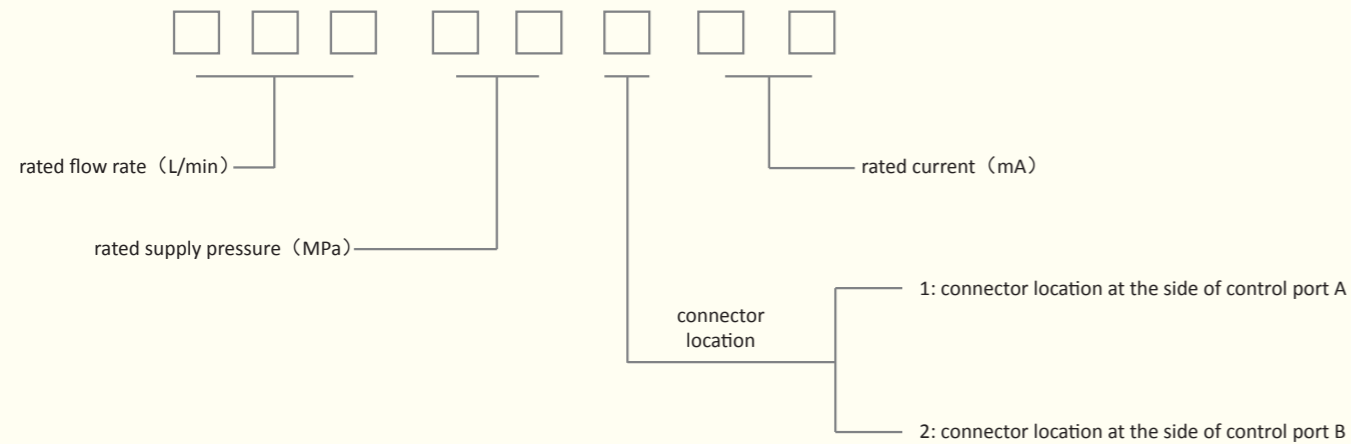


inch

	P	1	R	2	F1	F2	F3	F4
	Φ0.14	Φ0.15	Φ0.14	Φ0.15	M4	M4	M4	M4
x	0.47	0.72	0.47	0.23	0	0	0.94	0.94
y	0.76	0.51	0.27	0.51	0	1.02	1.02	0

Spare parts and accessories

O ring (included in standard delivery)	NBR75 Shore FPM 75 Shore	
for port P、R、1、2	4pieces, ID 0.20in×Φ0.06in	5080、5176S F370、F275
Mating connector	Its available in JY27473T08B35SN	
Installation bolt (included in standard delivery)	M4×10.5 ISO 4762-10.9 4pieces	
Replaceable filter	for pilot stage, installed before orifice 984μin absolute	



For example part No.00821140 means rated flow 8L/min, rated supply pressure 21MPa, connector is installed at the side of port A, rated current 40mA.

Custom design is also available in terms of rated flow, rated current, coil resistance, rated supply pressure, installation and connector.

Standard connector is installed at the side of port B.

ENTERPRISE PROFILE

AVIC Nanjing Servo Control System Co.,Ltd, a subsidiary of Nanjing Engineering Institute Of Aircraft Systems(former AVIC 609 Research Institute), is the national leader in the research and development, manufacture of electro-hydraulic servo valves(EHSV in short) with the longest history(since 1968), the largest size and the most advanced level in China. AVIC also has invested in the company. Our company is mainly engaged in the research and development, manufacture, test and delivery and repairs of EHSV and also has the ability to develop servo systems and non-standard equipment for industrial applications.

We have a staff of over 200 people with 29 of them being engineers or senior engineers and 51 being senior technicians. Our factory covers an area of 10000 m² and our lab covers an area of 4000 m². We have over 300 sets of equipment and machines, with fixed assets valued at USD 25 million. We are the only one in China to carry out performance test and environment test and validation with working fluid of mineral based hydraulic fuel, phosphate fuel and fuel.

Our EHSV are widely used in aeronautics, space, navigation, metallurgy, machine manufacture, geological exploration, construction machines and all kinds of test equipment. In aeronautics applications, EHSV are used in rudder actuation system, front wheel control system, inlet control system, electronic anti-skid system, radar servo system, cargo door retraction system, engine digital control system, APS and APU.

Our product line covers over 200 models, including force-feedback single stage servo valve, nozzle-flapper two stage servo valve, jet pipe EHSV (jet pipe and jet deflector type), DDV and RDDV, combined control valve, electro-magnetic hydraulic lock, pressure-reducing valve, hydraulic pump, servo amplifier and EHSV static and dynamic test bench. EHSV's working fluid covers mineral based hydraulic fuel, phosphate fuel and fuel.

We are also the national leader in terms of EHSV performance test and environment test and validation using hydraulic fluid and fuel. Our test bench includes static and dynamic test, high and low temperature, vibration and shock, temperature-altitude environment test. Temperature test bench can go as far as fluid temperature: -55°C~+150°C, environment temperature: -55°C~+250°C.



Now we are setting 2 national military standards and one industrial standard. We have 28 technical patents covering EHSV design, measurement and process and test method for whole valve and parts. We also have state of art equipment for hydraulic grinding, deburring etc.

AVIC Nanjing Servo Control System Co. boasts itself in its complete quality management system, advanced manufacture and development level. We are the national leader working towards the digitization, intelligization and high pressuration of EHSV. We will strive to keep our clients happy.