



FF-133 SERIES

direct drive servovalve



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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 . FF-133 series servo valves of AVIC Nanjing Servo Control Systems Co.,Ltd have been widely used in both military and industrial applications,such as aviation,aerospace ,radar, metallurgy,chemical industry,manufacture,geological exploration,construction,power generation,textiles,printing and various kinds of test equipment.Now we can deliver over 10000 pieces annually.FF-133 is an affordable equivalent to Moog 633 .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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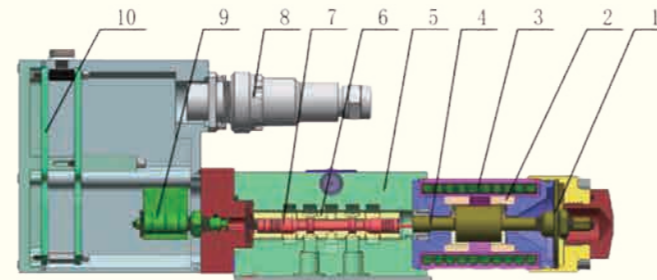
※ Characteristics

- Without pilot-stage leakage,low leakage and low power consumption;
- Without pilot-stage orifice,high contamination resistance;
- Low hysteresis,high threshold and excellent repeatability precision ;
- Spool is in spring -centred position at loss of power supply;
- External null adjustment;
- System supply reduction has small effect on valve dynamics;
- Stainless steel structure and high structure strength;

※ Structure

Valve consists of linear force motor, valve body and electronics.

Linear -force motor outputs linear position shift and force and consists of 2 permanent magnets(2),control coils(3),shaft assembly(4) and centred spring(1).Valve body ,hydraulic power stage,is made up of valve body (5),bushing(6) and spool(7);Electronics responsible for closed-loop control,consists of electrical connector(8),position transducer(9) and control electrical card(10).



※ Operation

FF-133 DDV mainly consists of linear-force motor, valve body and electronics. When an electrical command signal is applied to the valve, electronics produces corresponding control current which outputs to linear force motor. Linear force motor produces linear position shift and force and drives the spool and results in corresponding flow. Spool displacement is converted to corresponding voltage through position transducer and is fed to valve signal input terminal, which forms closed -loop control. Thus, the position of the main spool is proportional to the electrical command signal.

Performance

Working pressure: Rated supply pressure: 7MPa Supply pressure: 2MPa~35MPa

Temperature range: Ambient temperature: -20°C~+60°C Fluid temperature: -20°C~+80°C

Sealing material: NBR,FPM (other materials at request)

Working fluid: 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, recommend cSt 15

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 variable speed pump, outside system circulating filter is recommended.

Cleanliness level: for normal operation: ISO 4406: 15/12 for longer life: ISO 4406: 14/11

Note: contamination level affects servo valve performance greatly (spool null position, resolution) and wear (metering edges, pressure gain, leakage)

Filter rating: for normal operation $\beta_{10} \geq 75$ (10 μ absolute) for longer life $\beta_3 \geq 75$ (3 μ absolute)

Installation: It can be installed in any position or move with system.

Weight: 2.75kg

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 $\Delta P = 70$ bar (1020psi) and 100% command signal when valve spool moves furthest, valve no-load rated is defined as rated flow rate Q_N .

At non-rated pressure drop and given commander signal, valve no-load flow is proportional to square root of valve supply and return chamber.

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

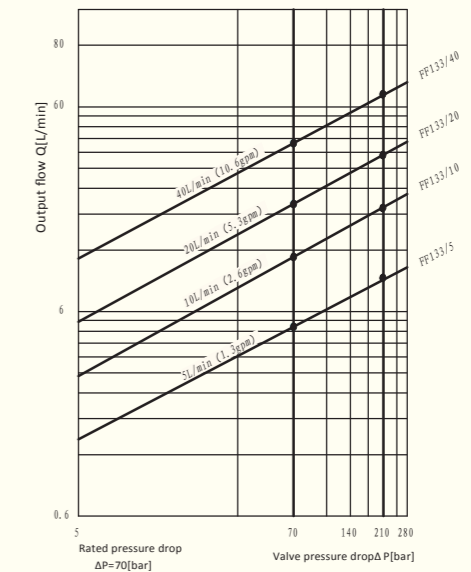
Q_N —valve rated flow rate (L/min)

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.

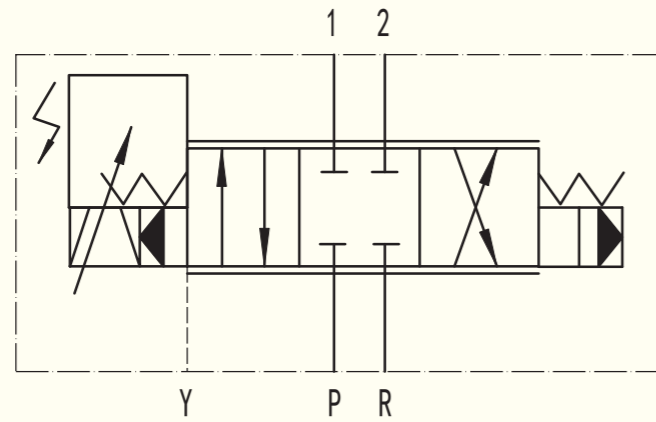


Flow Diagram

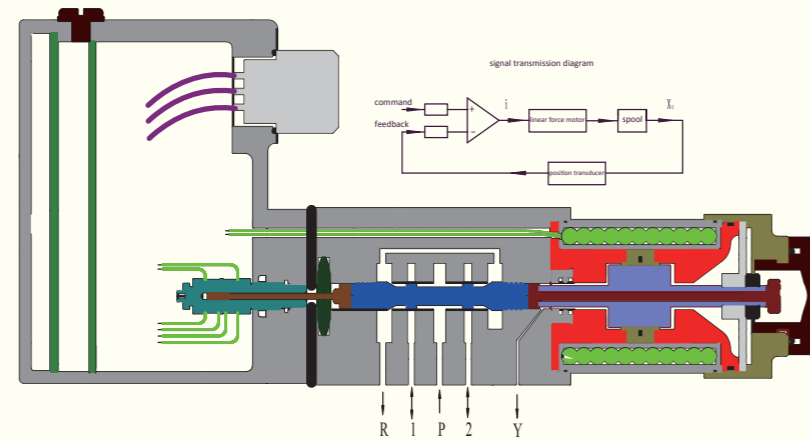
At 100% command signal, valve actual flow is linear with valve pressure drop.

Note: 210bar=3050psi. The curve demonstrates actual flow rate at different pressure drop. Users can pick up EHSV accordingly as per system supply pressure.

Hydraulic symbol

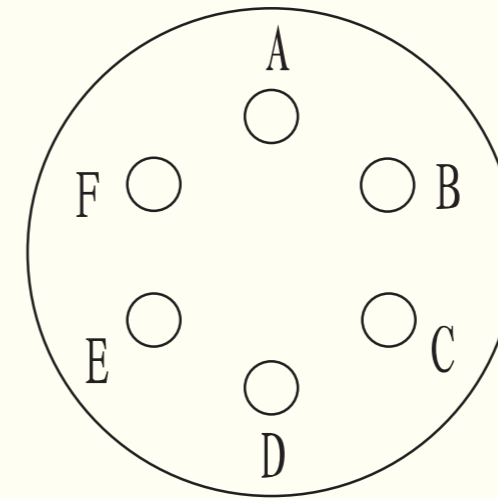


This symbol is for EHSV status with output flow at 0. (null bias as per customer's request)



Note: Supply pressure port P;
Return pressure port R (T) ;
Control port1 (A) ;
Control port 2 (B) 。
Leakage port Y (when return pressure ≥ 5 MPa, port Y must be connected separately with return tanker)

Electrical connection:



Electrical connector	
A	power +24V DC (22V DC~28V DC)
B	Power GND
C	Not used
D	Command signal: ①、-10V~+10V, ②、-10mA~+10mA, ③、+4mA~+20mA
E	Signal GND
F	Output actual spool position signal, (4~20) mA

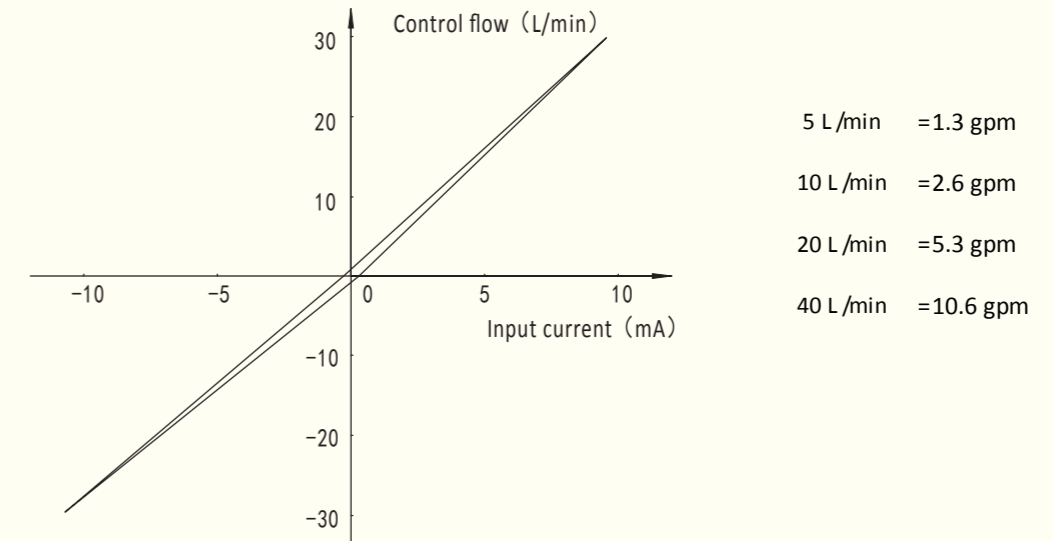
FF-133 series EHSV performance

Item	unit	FF-133			
		FF-133/5	FF-133/10	FF-133/20	FF-133/40
Supply pressure range	bar	20~350			
Rated supply pressure P_N	bar	70			
	psi	1020			
	MPa	7			
Rated flow Q_n	L/min	5	10	20	40
	gpm	1.3	2.6	5.3	10.6
Hysteresis	%	≤ 0.5			
Threshold	%	≤ 0.2			
Linearity	%	$\leq \pm 7.5$			
Symmetry	%	$\leq \pm 10$			
Pressure gain	%	≥ 30			
Internal leakage	L/min	≤ 0.15	≤ 0.30	≤ 0.60	≤ 1.20
	gpm	≤ 0.04	≤ 0.08	≤ 0.16	≤ 0.32
Null bias	%	$\leq \pm 2$			
Frequency response	Amplitude (-3dB)	Hz	≥ 50		
	Phase lag (-90°)	Hz	≥ 50		
	Rise time	ms	≤ 12		

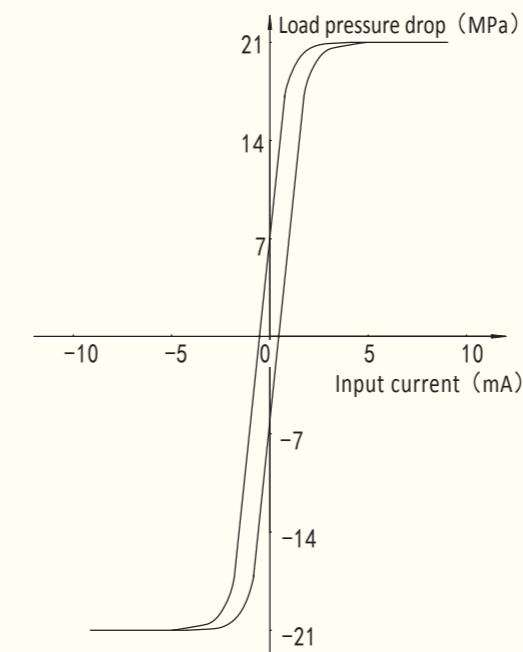
Note: Rated flow taken at supply pressure of 7MPa, internal leakage and frequency response taken at supply pressure of 14MPa, the rest taken at supply pressure of 21MPa;
 FF-133 is totally interchangeable with MOOG 633 in terms of technical data and dimension.
 And custom design is available at request.
 1bar=14.5psi;
 1gpm=3.785L/min.

Static performance curve: Flow performance curve, pressure performance curve and internal leakage curve are measured at supply pressure 70bar (1017psi)、210bar (3050psi)、140bar (2033psi) respectively and fluid viscosity 32mm²/s(1.26in²/s) and fluid temperature 40°C (104°F) .

Flow characteristic curve:

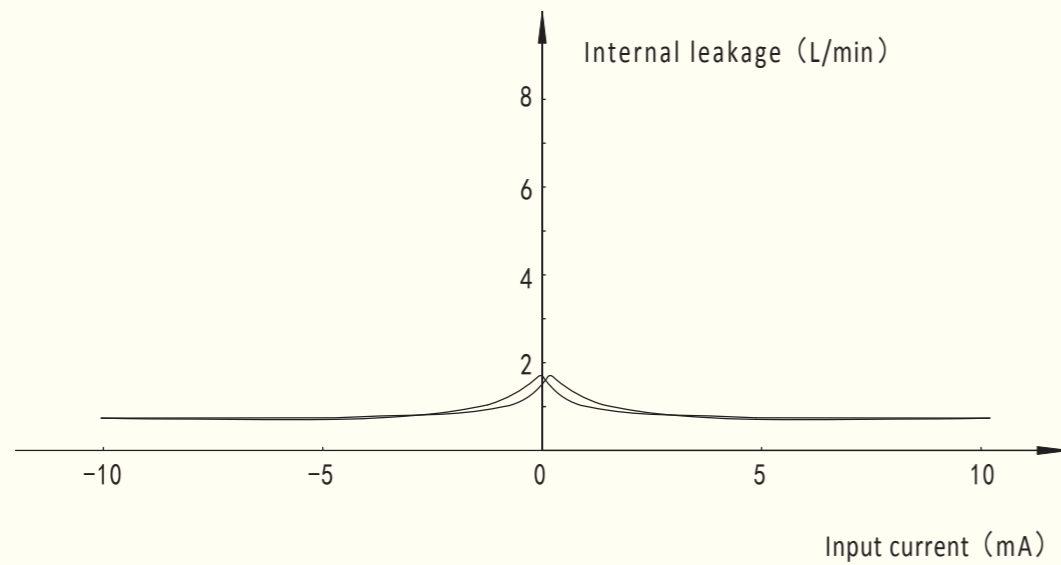


Pressure characteristic curve:



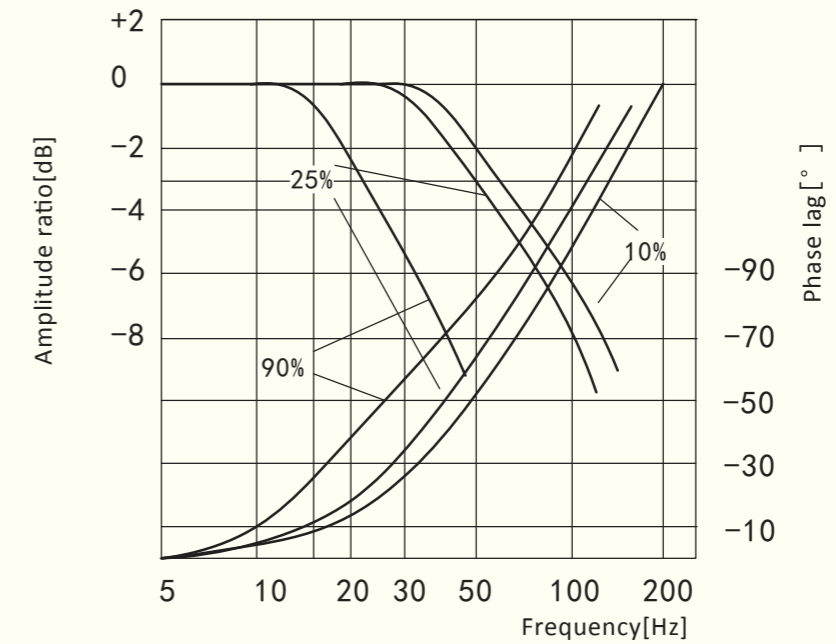
Internal leakage characteristics curve :

- 0.15 L/min =0.04 gpm
- 0.30 L/min =0.08 gpm
- 0.60 L/min =0.16 gpm
- 1.20 L/min =0.32 gpm

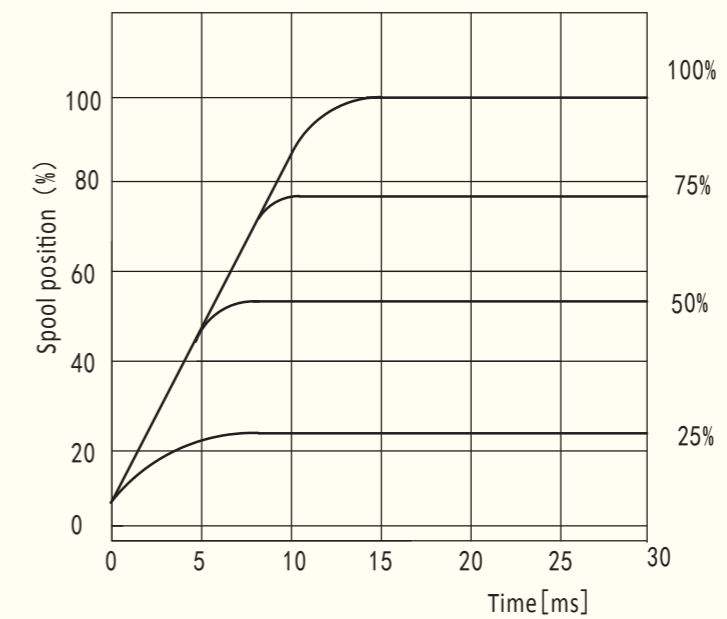


Dynamic performance curve: It is measured at system supply pressure of 140bar (2033psi), fluid viscosity of 32mm²/s(1.26in²/s) and fluid temperature of 40°C (104°F) .

Frequency response curve :

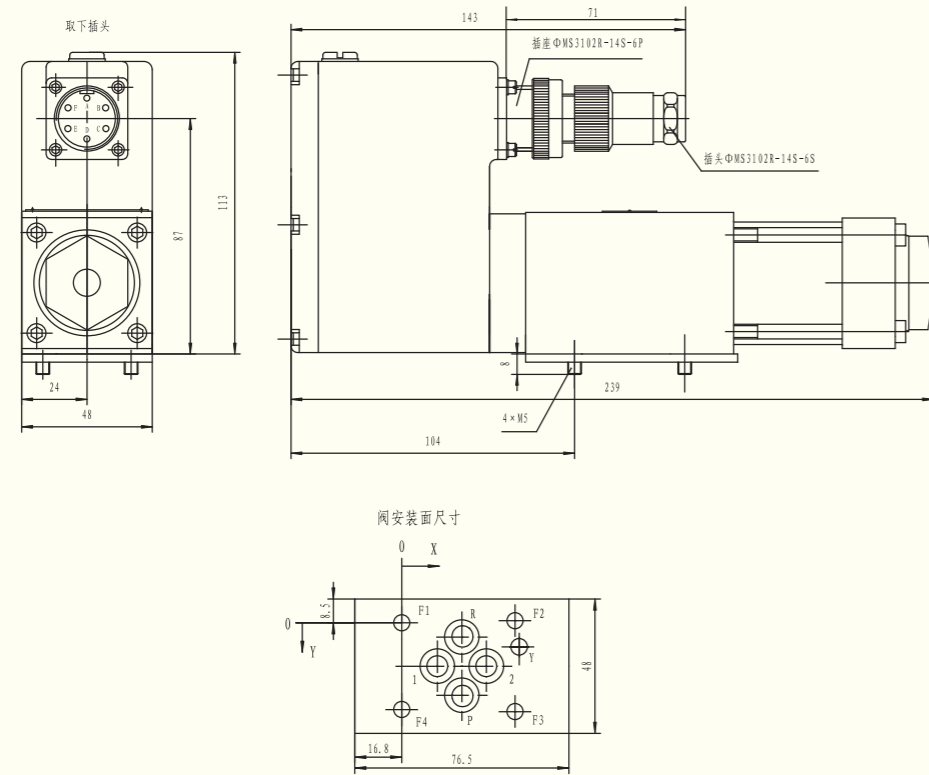


FF-133 frequency response at 10%、25%、90% signal



FF-133 step response at 25%、50%、70%、100% spool position

Installation drawing (metric system)



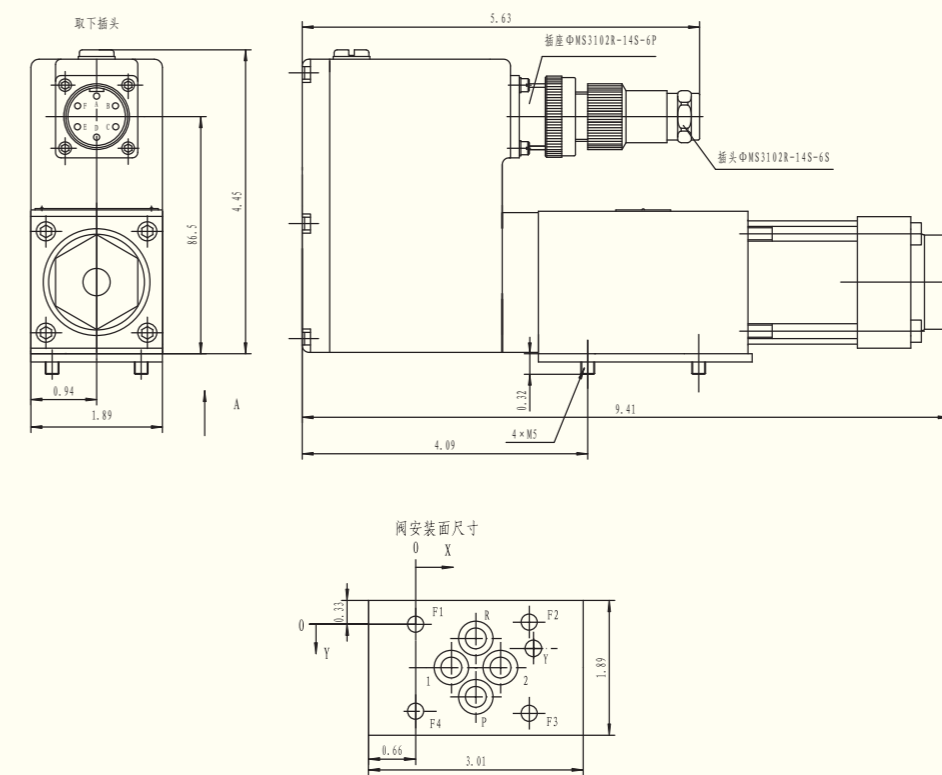
mm

	P	1	2	R	Y	F1	F2	F3	F3
	Φ7.5	Φ7.5	Φ7.5	Φ7.5	Φ3.3	M5	M5	M5	M5
x	21.5	12.7	30.2	21.5	40.5	0	40.5	40.5	0
y	25.9	15.5	15.5	5.1	9	0	-0.75	31.75	31

Spare parts and accessories

O ring (included in standard delivery)		NBR 75 Shore		FPM 75 Shore	
for Port P, R, 1, 2	4pieces, ID9.0×Φ1.8	5080、5176S		F370、F275	
for port Y	1piece, ID8.0×Φ1.8	5080、5176S		F370、F275	
Mating connector					
Available in ΦMS3106A-14S-6S(6 pin) and ΦMS3106A-14S-1S(7 pin)。					
Installation bolt (included in standard delivery)					
M5×65 ISO 4762-10.9	4 pieces				

Installation drawing (English system)



inch

	P	1	2	R	Y	F1	F2	F3	F4
	Φ0.30	Φ0.30	Φ0.30	Φ0.30	Φ0.13	M5	M5	M5	M5
x	0.85	0.50	1.19	0.85	1.59	0	1.59	1.59	0
y	1.02	0.61	0.61	0.20	0.35	0	-0.03	1.25	1.22

Spare parts and accessories

O ring (included in standard delivery)		NBR 75 Shore		FPM 75 Shore	
for port P, R, 1, 2	4pieces, ID0.35×Φ0.07	5080、5176S		F370、F275	
for port Y	1piece, ID0.32×Φ0.07	5080、5176S		F370、F275	
Mating connector					
It is available in ΦMS3106A-14S-6S (6 pin) and ΦMS3106A-14S-1S (7 pin)。					
Installation bolt (included in standard delivery)					
M5×65 ISO 4762-10.9	4 pieces				

FF-133 series type designation:

R	02	K	O	I	M	0	N	S	M	2
Valve model										
R	With integrated electronics									
Rated flow L/min, ΔP_N=7Mpa										
02	5									
04	10									
08	20									
16	40									
Maximum operation pressure										
K	35MPa									
Supply voltage										
2	24VDC (18~32VDC)									
Electrical signal at 100% opening										
Command output										
M	±10V	+4 ~ +20mA								
X	±10mA	+4 ~ +20mA								
S	(+4~+20)mA	(+4~+20)mA								
Custom design										
connector										
S	6 pin, DIN 43563									
Seal material										
N	NBR									
V	FPM									
Others at request										
Port Y										
0	Blocked with plug P _{Rmax} ≤ 5Mpa									
3	Open, with integrated electronics, P _R > 5Mpa									
Spool position without electric supply										
M	Mid position									
F	P→B, A→T (10% opening)									
D	P→A, B→T (10% opening)									
Others at request										
Spool and sleeve type										
O	4 way, 0 opening, linear gain									
A	4 way, 1.5%-3% overlap, linear gain									
D	4 way, 10% overlap, linear gain									
Z	2×2way, P→A, B→T; Y separately connected to return tanker									
X	Custom design									
Linear force motor										
1	standard FF-133									

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.