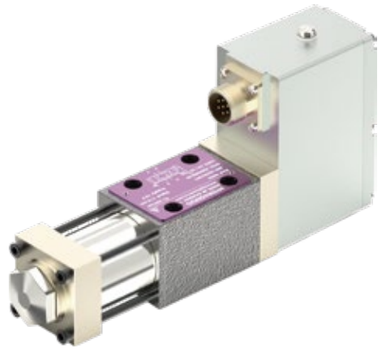
SH633
Direct Drive Servo Valve

SH633 Direct Drive Servo Valve

SH633 Series are Direct Drive Valves (DDV) equipped with integrated electronics and closed-loop position control of the spool.

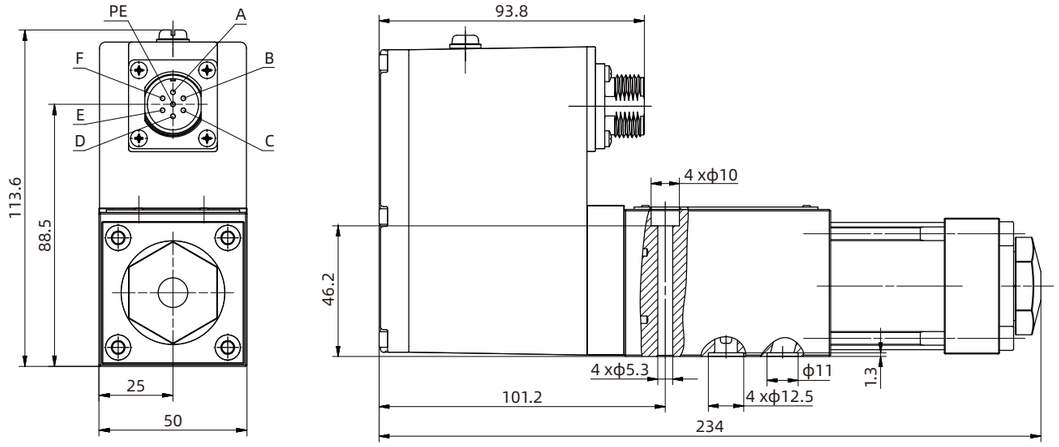
The neutral function can be customized as 3-way, 4-way or 2*2-way. The valve spool is monitored by an LVDT displacement sensor. The valve integrates a closed-loop control circuit for the valve spool, an external shaft signal receiving circuit, and a pulse width modulation (PWM) drive circuit internally.



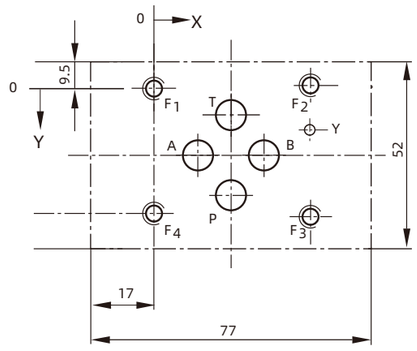
- Driven directly by a high-force permanent magnet linear force motor;
- No pilot oil source is required;
- The dynamic performance is not affected by pressure;
- Low hysteresis and high resolution;
- Low energy consumption at and near hydraulic null;
- Electrical zero position adjustment;
- Standardized valve spool position detection signals can be used to obtain the system operation status;
- Digital circuit drive, anti-interference, higher frequency response, and adjustable parameters;

O-rings（Included in the standard supply）	NBR / FKM	
For ports P、T、A、B	4 pieces Inner diameter： ϕ9.25 * ϕ1.78mm	
For port Y	1 piece Inner diameter： ϕ7.65 * ϕ1.80mm	
Mating connector，In accordance with IP65(Included in the standard supply) In accordance with EN 175201-804, type R, metal, IP65, crimp contact Ø 0.75 to 1.5 mm², conus Ø 12.2 mm, cable Ø 9 to 12 mm , sealing element Ø 9 to 13 mm.		6+PE
Mounting screws（Included in the standard supply）	tightening torque	Quantity
M5 x 55 DIN EN ISO 4762 - 10.9	8.5 Nm	4 pieces

Unit Dimensions（mm）



Port Pattern of Mounting Surface※



The mounting surface must conform to ISO 4401-03-03-0-05. Observe mounting length of minimum 77 mm and O-ring recesses for Y.
Evenness of connecting surface has to be 0.01 mm over 100 mm, average surface finish Ra better than 0.8 µm.

※（Installation surface drawing in coordination with the valve）

The installation interface complies with ISO 4401-03-03-0-05									
	P	A	B	T	Y	F1	F2	F3	F4
dia.ϕ mm	7.5	7.5	7.5	7.5	3.3	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

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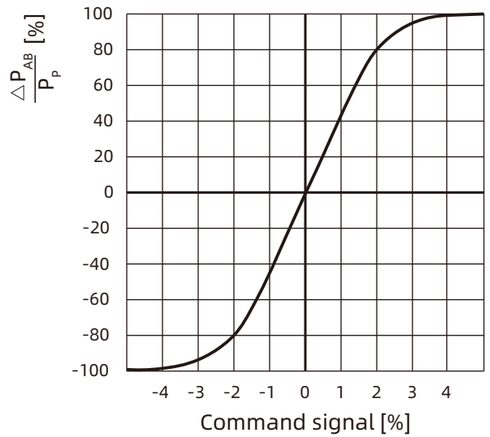
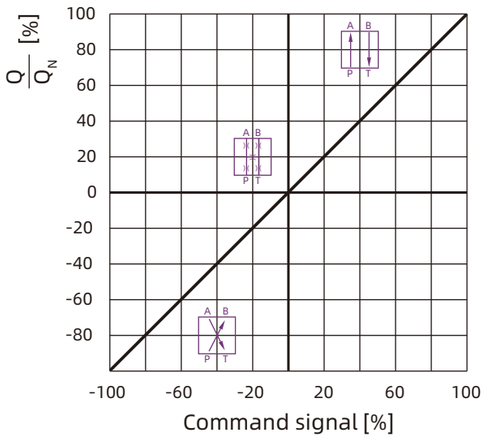
Characteristic Curves

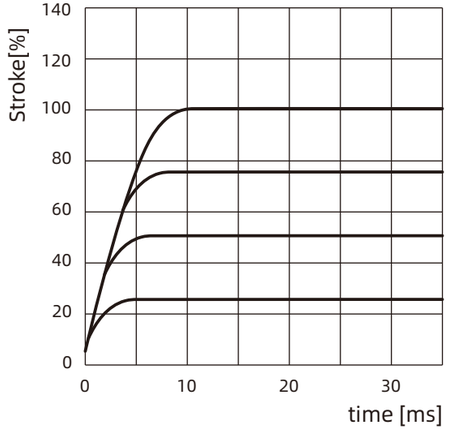
Pressure Signal



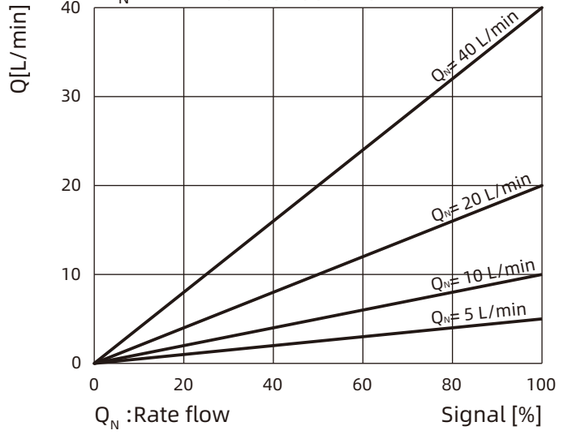
Flow Signal



Step Response

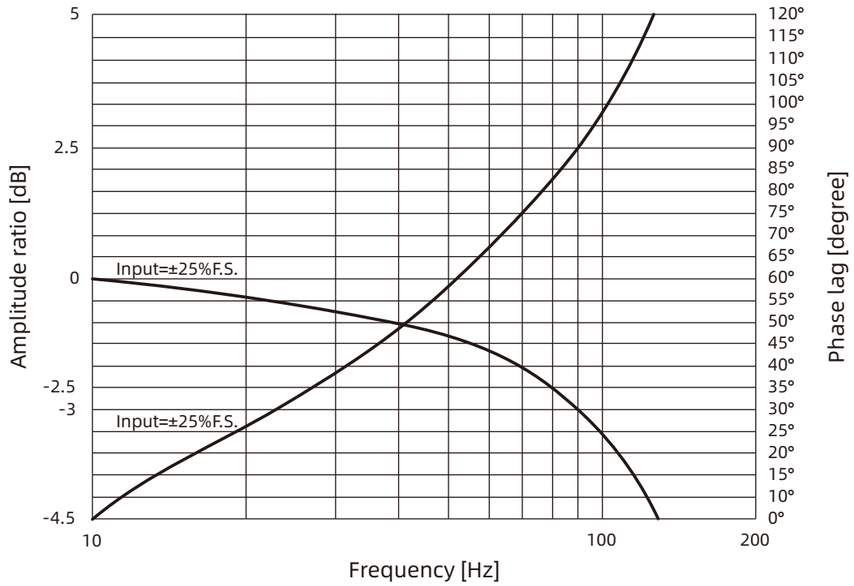


Flow Signal Curves at ΔP_N = 35 bar (500 psi) per Spool Land



Characteristic Curves

Frequency Response



FLOW CALCULATION

The actual load flow rate of the valve is determined by the displacement of the valve spool and the pressure differential across the two throttling edges of the valve orifice.

When a 100% command signal is applied (e.g., +10 V DC corresponding to fully open valve position), the load flow rate under the rated pressure differential (ΔP_N = 35 bar across each throttling edge) is defined as the nominal flow rate Q_N. For operating conditions involving pressure differentials other than the rated value, the load flow rate is proportional to the square root of the pressure differential at the sharp-edged throttle orifice.

$$Q = Q_N \cdot \sqrt{\frac{\triangle P}{\triangle P_N}}$$

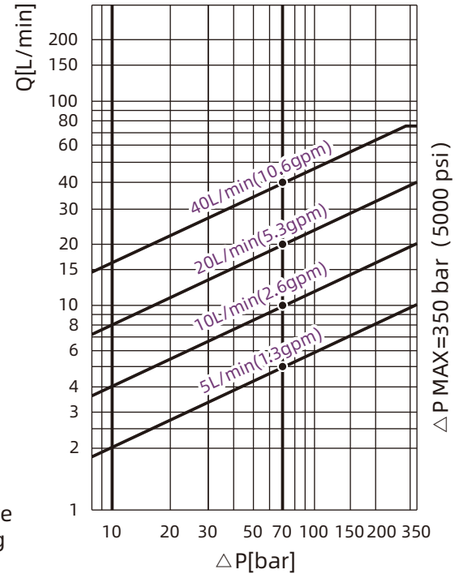
Q [l/min]=actual flow

Q_N [l/min]=rated flow

$\triangle P$ [l/min]=actual pressure drop per spool land

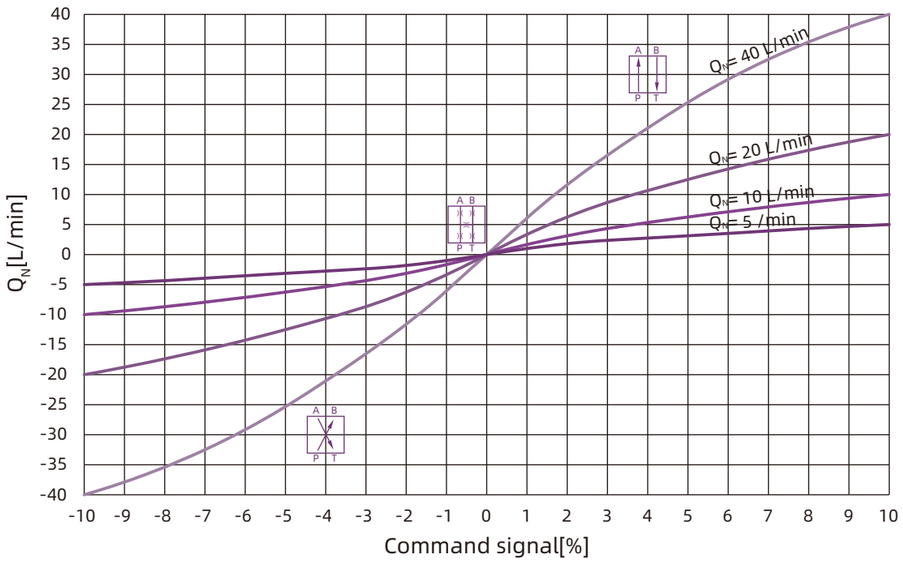
$\triangle P_N$ [l/min]=rated pressure drop per spool land

When the average flow velocity at ports P, A, B, or T of the valve is below 30 m/s, the load flow rate Q can be determined using this method.

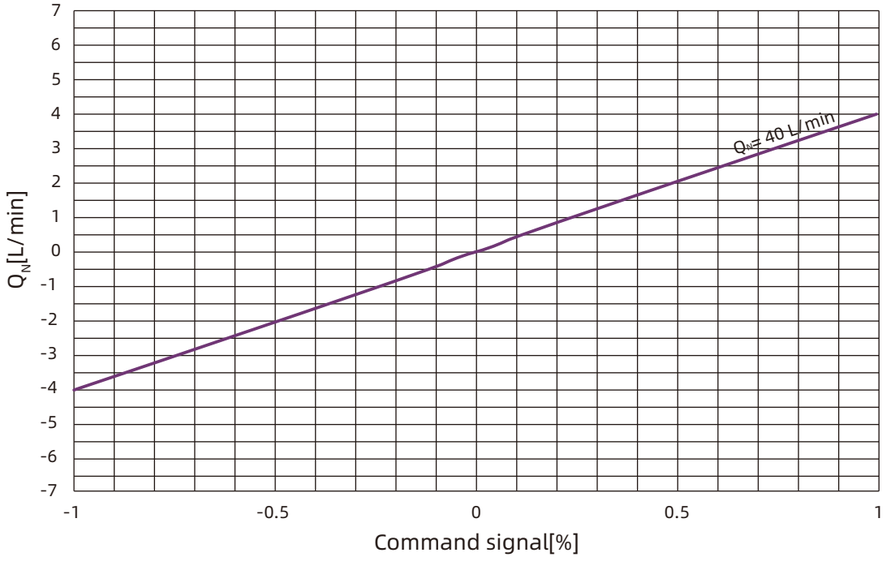


Characteristic Curves

Static flow test curve (full range, each throttling edge $\triangle P_N$=35bar)



Static flow test curve (10% signal test, each throttling edge $\triangle P_N$=35bar)



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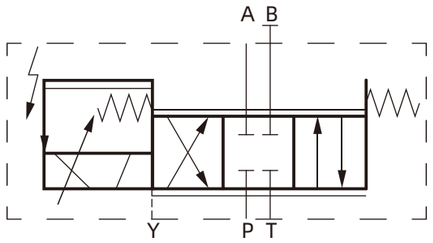
Technical Date

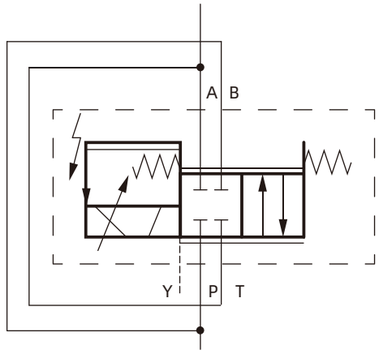
4 Way Valve Hydraulic Symbols



4 way Operation

In 4-way operation the servo valves can be used to control the flow in ports A and B (used as 4/3-way throttle valves). Port B must be closed in order to obtain 3-way operation. Leakage port Y must be used if the pressure in tank port T exceeds a value of 50 bar (725 psi). The valves are available with zero lap, less than 3 % or 10 % positive overlap.

2x2 Way Valve Hydraulic Symbols



2x2 way Operation

(The valve port Y must be used for oil discharge)
Valve port A is used as the valve port for flow control (throttle valve).
The valve port Y must be used for oil discharge.
Connect valve port P with valve port B, and valve port A with valve port T outside the valve.

Typical static and dynamic data[1)]

Step response time from 0 to 100% stroke	≤12ms
Frequency response	≥90Hz
Typical resolution	0.05%
Typical value of hysteresis	0.1%
Zero drift at ΔT = 55K(55℃)	< 1%

Note:

1)Measured with system pressure pp of 140 bar (2,000 psi), oil viscosity 32 mm2/s and oil temperature of 40 °C (104 °F).

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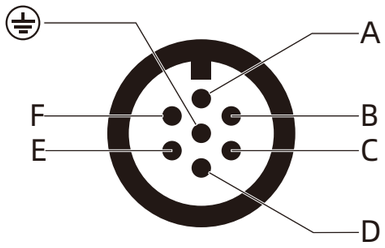
Electrical Interface Diagram

Pin Assignment for Valves

6-pole + PE Connector, Pin Contacts (X1)
According to EN 175201-804, mating connector (type R or S, metal) with leading protective earth pin(⏚)。



Electrical Data

Degree of protection according to IEC/EN 60529	IP65 with mounted mating connectors
Permissible ripple of supply voltage[1)]	$< \pm 2V_{RMS}$
Maximum current consumption[2)]	1.2 A
Power consumption of the motor in middle position	2.4W(0.1A@24V_{DC})
Power consumption maximum	28.8W（1.2A@24V_{DC}）
Fuse protection, external, per valve	1.6A（slow）
EM compatibility	Immunity to interference as per DIN EN 61000-6-2 (evaluation criterion A)

Note：

1) Frequency from 50 Hz to 10 kHz.
2) Measured at ambient temperature 25 °C (77 °F) and supply voltage 24 V.

Electrical Data

Pin	Pin Assignment	Signal Type[1)]	
		Voltage Floating	Current Floating[2)]
A	Supply voltage[3)]	U_{Supply} = 24V_{DC}(20 to 28V_{DC}),referenced to GND (reverse polarity protected against GND)	
B	GND	Power ground/signal ground	
C	Not used		
D	Command signal - spool position	$U_{in}=U_D-U_E$ R_{in}=10kΩ	$I_{in}=I_D=-I_E$ R_{in}=200Ω I_{max}=±25 mA
E	Reference point input rated command	Reference for pin D[4)]	
F	Actual value - spool position	U_{F-B} = 2 to 10 V; U_{F-B} is proportional to the spool position; 6 V corresponds to the spool center position;R_L = 500Ω。	I_{out} = 4 to 20 mA referenced to GND; I_{out} is proportional to the spool position; 12 mA corresponds to the spool center position; the output is short-circuit-proof;R_L = 0 至 500Ω。
⏚	Protective earth (PE)	Connected with valve body	

Note：

1)The signal range is shown in the order information.
2) The command signal I_{in} < 3mA (for example, due to cable disconnection) indicates that the 4 to 20mA signal is ineffective. Customers can customize and activate the valve's response to this fault.
3) All connected circuits must be isolated from the main power supply through "electrical isolation" in compliance with the IEC/EN 61558-1 and IEC/EN 61558-2-6 standards.
The voltage must be limited within the safe ultra-low voltage range specified in EN 60204-1.
We recommend using SELV/PELV power supply devices.
4) The potential difference between pin D or E and pin B must be between -15 and +28V.

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Technical Data

General	
Valve design	1 stage, with spool and bushing
Mounting pattern	ISO 4401-03-03-0-05
Installation position	Any
Dimensions	234 x 50 x 113.6mm
Weight	2500g
Storage temperature range	-40 - +80℃(-40 - +176℉)
Ambient temperature range	-20 - +60℃(-4 - +140℉)
Vibration resistance	30 g, 3 axis,10Hz to 2kHz
Shock resistance	50 g, 6 directions, 3 ms
Hydraulic Data	
Maximum operating pressure-Port P, A, B	350bar(5000psi)
Maximum operating pressure-Port T without Y	50bar(725psi)
Maximum operating pressure-Port T with Y	350bar(5000psi)
Maximum operating pressure-Port Y	Depressurized to tank[1)]
Rated flow at Δp_N 35 bar (500 psi) per spool land	5 L/min 10 L/min 20 L/min 40 L/min
Maximum flow	75 L/min
Hydraulic fluid	Hydraulic oil as per DIN 52524 parts 1 to 3 and ISO 11158. Other fluids upon request.
Leakage flow (rate) (≈ zero lap), typical[2)]	0.15L/min 0.3L/min 0.6L/min 1L/min
Temperature range	-20 - +80℃ (-4 - +176℉)
Viscosity range at 38 ℃ (100 ℉)-Recommended	15 - 100mm^2/s(cSt)
Viscosity range at 38 ℃ (100 ℉)-Maximum permissible	5 - 400mm^2/s(cSt)
Recommended cleanliness class according to ISO 4406, For functional safety	18 / 15 / 12
Recommended cleanliness class according to ISO 4406, For longer service life	17 / 14 / 11

Note:

1) In order to avoid an emptying of the return line, a back-pressure of 2 bar (29 psi) should be maintained on the T and Y connections.

2)Measured at 140 bar (2,000 psi) system pressure, oil viscosity 32 mm2/s and oil temperature 40 ℃ (104 ℉).

Ordering information

Model-Number: SH633 □□□□□

Type designation: □□ □ □ □ □ □ □ □

Factory code

	assigned at the factory

Rated Flow

	For Δp_N= 35 bar per spool land	For Δp_N= 5 bar per spool land
05	5 L/min	2 L/min
10	10 L/min	4 L/min
20	20 L/min	8 L/min
40	40 L/min	16 L/min
X	For other requirements, please consult	

	Command signal	Actual value
B	+/- 10V	4 to 20mA
C	+/- 10mA	4 to 20mA
S	4 to 20mA	4 to 20mA
X	For other requirements, please consult	

Bushing/Spool Design

O	4-way: zero overlap, linear flow characteristic
A	4-way: 1.5 to 3 % overlap, linear flow characteristic
D	4-way: 10 % overlap, linear flow characteristic
Z	2x2-way: P ≥ A, B ≥ T, with Y-port only
X	For other requirements, please consult

Seal Material

D	NBR
F	FKM
X	For other requirements, please consult

Supply Voltage

2	$24V_{DC}$ (20 - $28V_{DC}$)
X	For other requirements, please consult

Pressure range

Maximum Operating Pressure	
K	350bar
X	For other requirements, please consult

Spool Position Without Electric Supply

M	Center position
D	P→A, B→T connected (approximately 10 % open)
F	P→B, A→T connected (approximately 10 % open)
X	For other requirements, please consult

Regular model

Model	Factory code	Type	Rate flow	Input signal
SH633	303B	05BOMK2D	5 L/min	+/- 10V
SH633	317B	10BOMK2D	10 L/min	+/- 10V
SH633	308B	20BOMK2D	20 L/min	+/- 10V
SH633	313B	40BOMK2D	40 L/min	+/- 10V