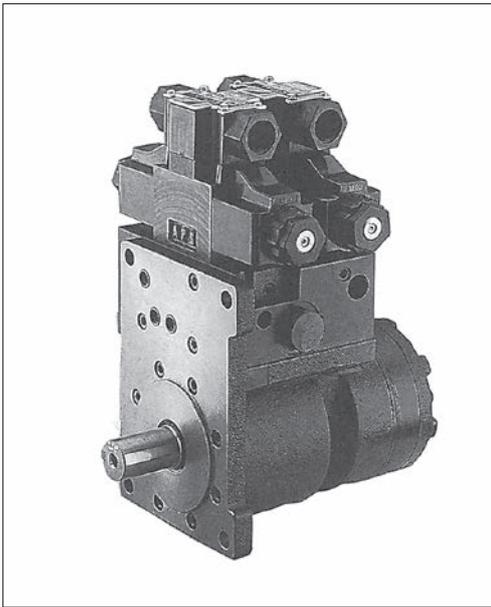


TM Series Positioning Motors



<Applications>

Machining centers' ATC units, NC lathes' turrets, automatic loaders, pallet changers, constant feed devices, etc.

Features

- **Hydromechanical positioning**
These positioning motors integrate DAIKIN's original hydromechanical rotary positioning system developed based on orbit motors known for low noise and high-torque at the low-speed range.
- **Integrated compact unit**
All the components for the required mechanisms of rotation, deceleration, and rotary positioning are joined with no piping and integrated into one compact unit.
- **Quick positioning**
Adoption of a deceleration cam system and mechanical valves, in addition to quick response features, achieves appropriate speed reduction under the load conditions, enabling shockless stops in a short time without indexing errors.
- **High-accuracy positioning**
The number of indexing positions can be selected from three options - 1 position, 2 positions or 3 positions over a full revolution - while the positioning cam groove can be selected from two options: highly accurate ($\pm 0.1^\circ$) groove V and groove R with backlash for supplementary positioning.
- **Simple control & easy operation**
Simple on/off control of solenoid valves achieves easy operation of the positioning motor.
- **Flexible feed pitch selection**
The capability to set the feed pitch as required enables smooth multi-pitch feed.

Nomenclature

TM ✕ ✕ ✕ ✕ - ✕ ✕ ✕ ✕ - ✕ ✕ ✕ ✕ - 20
 1 2 3 4 5 6 7 8 9 10 11 12

1 Model No.

TM: TM series positioning motor

2 Motor capacity

05: 54 cm²/rev
 10: 96 cm²/rev
 13: 129 cm²/rev
 19: 184 cm²/rev

3 Flange

A: SAE A
 B: SAE B
 F: Flange piping

4 Shaft diameter

S: $\phi 20.0$ (key width: 6.00 mm) *1
 M: $\phi 25.0$ (key width: 7.00 mm)
 I: $\phi 25.4$ (key width: 6.35 mm)

5 Number of indexing positions

1: One indexing position over a full revolution
 2: Two indexing positions over a full revolution
 3: Three indexing positions over a full revolution

6 Cam groove

R: Groove R (Supplementary positioning, with backlash)
 V: Groove V (Sharp positioning with accuracy: $\pm 0.1^\circ$)

7 Control port

0: None
 2: With UN, CL
 3: With UN, CL, CO

8 Operating pressure

1: 3.5 MPa { 35 kgf/cm² } maximum
 2: 3.6 to 5 MPa { 36 to 50 kgf/cm² }
 3: 5.1 to 7 MPa { 51 to 70 kgf/cm² }

9 Solenoid valve type *2

Code	For rotation	For pin disengagement
AT	KSO-G02-2CA-30-EN	KSO-G02-9CA-30-EN
AF	KSO-G02-2CA-30-CE	KSO-G02-9CA-30-CE
BT	KSO-G02-2CB-30-N	KSO-G02-9CB-30-N
PT	KSO-G02-2CP-30-EN	KSO-G02-9CP-30-EN
XT	LS-G02-2CA-30-EN	LS-G02-9CA-30-EN
XF	LS-G02-2CA-30-CE	LS-G02-9CA-30-CE

10 CL port throttle code *3

0: $\phi 1.0$ 1: $\phi 2.0$
 2: $\phi 1.2$ 3: $\phi 2.2$
 4: $\phi 1.4$ 5: $\phi 2.4$
 6: $\phi 1.6$
 8: $\phi 1.8$ N: Not featured

11 Proximity switch

K: Equipped
 N: None
 S: None (with detection rod)

12 Design No. (The design No. is subject to change.)

Note: *1 Shaft diameter S is only applicable to TM05.

*2 Refer to KSO-G02 on Page G-16 or LS-G02 on Page G-4 for the solenoid specifications.

*3 CL port throttle codes 0 to 8 are only applicable when the setting for 7 Control port is 2 or 3. Only "N" is selectable when the control port code "0" (no control port) is selected.

Contact Details

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Specifications

Model No.		TM05			TM10			TM13			TM19		
Motor capacity	cm ² /rev	54			98.5			129			189.8		
Maximum load	kg·m ² (GD2: N·m ² {kgf·m ² })	0.125 (5 {0.5})			0.50 (20 {2})			0.75 (30 {3})			1.25 (50 {5})		1 (40 {4})
Number of indexing positions	rev ⁻¹	1	2	3	1	2	3	1	2	3	1	2	3
Maximum rotational speed	min ⁻¹	200		150	200		150	150			100		
Required flow rate	L/min	13		10	22		17	22			21		
Indexing time	s ^{*3}	0.50	0.35	0.30	0.70	0.50	0.40	0.80	0.60	0.50	1.00	0.70	0.60
Deceleration signal output angle		120° near side		100° near side	120° near side		100° near side	120° near side		100° near side	90° near side		
Rated pressure	MPa {kgf/cm ² }	1st pattern: 3.5 {35}, 2nd pattern: 5 {50}, 3rd pattern: 7 {70}											
Permissible back pressure	MPa {kgf/cm ² }	1 {10}											
Indexing accuracy		±0.1											
Backlash		Groove R: ±0.1°, Groove V: 0°											
Radial load	kN {kgf}	2.25 {225}			4.5 {450}								
Thrust load	kN {kgf}	2.25 {225}			3.5 {350}								
Minimum operating pressure	MPa {kgf/cm ² }	1.5 {15}											
Paint color		Black (Munsell code N1.5, semigloss)											

Note: *3 The indexing time indicates the value at a pressure of 3.5 MPa {35 kgf/cm²}.

● Specifications of proximity switch

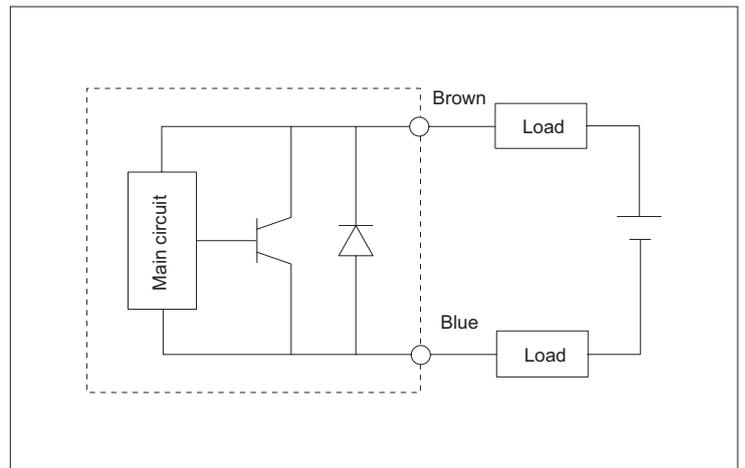
Manufacturer: Azbil Corporation

Model: FL2R-4J6SD

Item	Specifications
Detection method	High-frequency oscillation
Rated operation distance	4 ±0.4 mm
Rated power supply voltage	Common to DC 12 V and DC 24 V
Operating voltage range	DC 10 to 30 V
Leak current	1 mA maximum
Operation configuration	Normally open Loaded (operating) at positioning
Output configuration	DC 2-line type Transistor output
Control output	Switching current: 4 to 100 mA Residual voltage: 3.3 V maximum
Withstand voltage	AC 500 V, 1 minute
Insulation resistance	50 MΩ minimum (DC 500 VM)
Response frequency	1.5 kHz minimum
Operating ambient temperature	-25 to 70°C
Dust-/water-proof property	IEC 529 IP67

Output section circuit diagram

Proximity switch circuit diagram



Note: The load shown in the output section circuit diagram can be connected in either the positive or negative polarity of the power supply.

Handling

● Electric wiring and operation

Solenoid valve		SOL No.	Operation at solenoid excitation
For pin engagement/ disengagement	KSO-G02-9CA-30-EN LS-G02-9CA-30-EN	SOL.1b	Positioning cancelation, preparing for rotation
		SOL.1a	Deceleration start → positioning complete
For rotation	KSO-G02-2CA-30-EN LS-G02-2CA-30-EN	SOL.2a	Counterclockwise rotation (viewed from the end of motor's output shaft)
		SOL.2b	Clockwise rotation (viewed from the end of motor's output shaft)

Operation description

• The table below shows on/off timing of solenoid valve and status of rotation and of main machine.

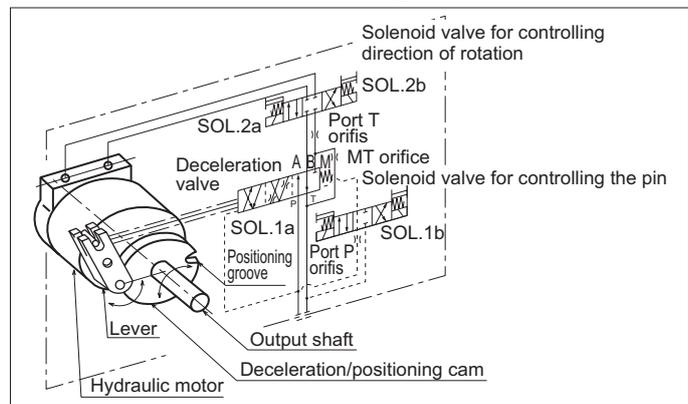
● Operation sequence (0 → 1 → 2 → 3 → 4 → 0) <Example: When using ports UN and CL for a lathe>

Solenoid valve Operation sequence	For pin operation		For rotation 2a or 2b	Turret	For rotation	Positional relationship between cam and pin	Mechanical valve symbol
	1a	1b					
0	OFF	OFF	OFF	Clamp	Stop	Within the positioning groove	P → A B → T M block
1	↑	ON	↑	Unclamp	Preparing	Leaving the positioning groove	P → B M → T A → T
2	↑	↑	ON	↑	Start	↑	↑
3	ON	OFF	↑	↑	Deceleration	Pin coming onto the cam and decelerating Approaching the positioning groove (target position) along cam shape	P → B M → T A → T Area of opening being reduced in proportion to the decelerating curve (meter-out)
4	OFF	↑	↑	Clamp	Stop	Entering the positioning groove	P → A B → T M block
0	↑	↑	OFF	↑	↑	Within the positioning groove	↑

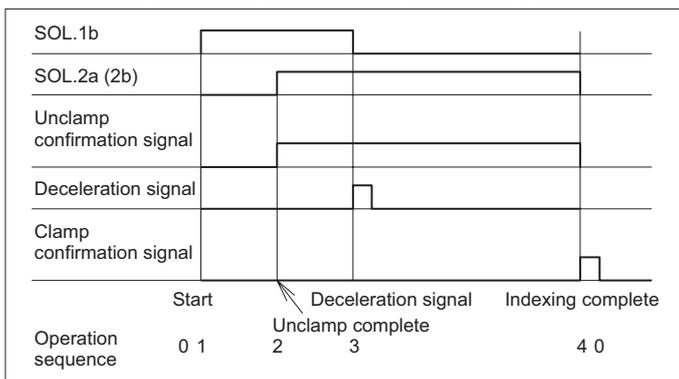
• The on/off operation of the solenoid valve for pin operation provides the pilot pressure to move the mechanical valve's spool. At deceleration, the spool is returned by the lever following the profile of the cam mechanism.

• The spool of the mechanical valve is connected to the pin by the lever, so once the pin comes onto the cam the spool moves along the cam geometry and reduces the opening area.

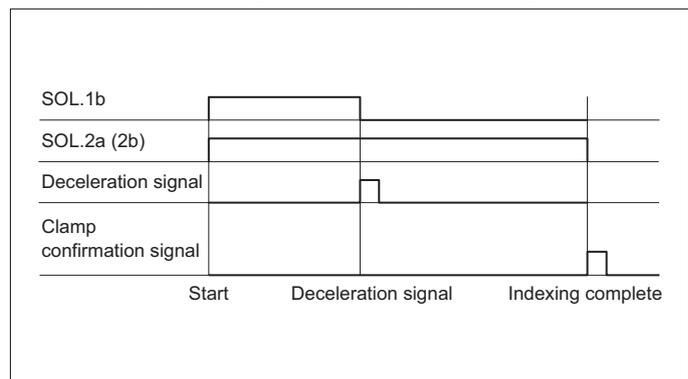
Structure diagram



Example timing chart for 2-port configuration



Example timing chart for 3-port configuration



Deceleration signal: Signal emitted at reduction signal output angle from an encoder or another device on the main machine (SOL.1b: OFF, SOL.1a: ON)

Clamp confirmation signal: Clamp signal from the proximity switch of a curvic coupling or another device on the main machine (This signal is not from the optional proximity switch.)

● **Handling of the control ports**

The positioning motor is provided with control ports to operate a hydraulic cylinder (for operating curvic couplings, magazine indexing, etc.). The port configuration can be selected from two options: 2-port (CL, UN) and 3-port (CL, UN, CO). The following figures show an example application of each type.

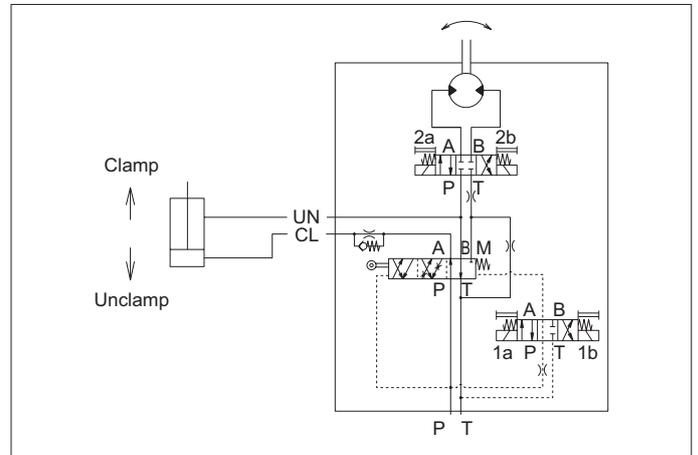
○ 2-port (CL, UN)

Used to control the cylinder for magazine indexing, for example.

[Connection] Port CL: Clamp side
Port UN: Unclamp side

SOL.1b and SOL.2a: Simultaneous excitation not possible
Be sure to excite SOL.2a (2b) after confirming completion of the unclamping operation, otherwise the motor starts to rotate while carrying out the unclamping.

2-port (CL, UN)



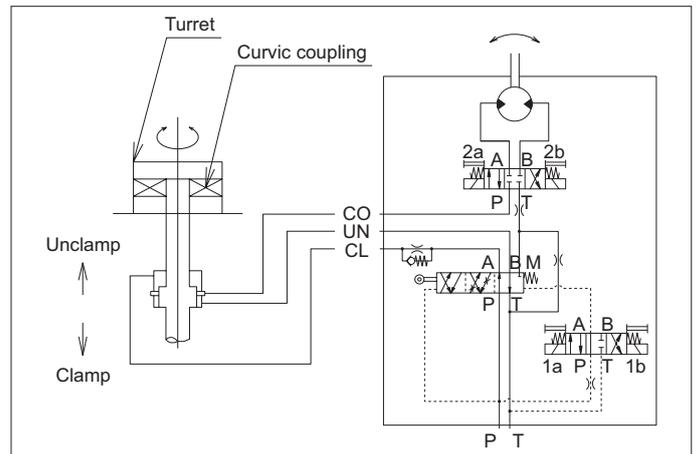
○ 3-port (CL, UN, CO)

Used for interlocked cylinders such as for curvic couplings.

[Connection] Port CL: Clamp side
Port UN: Unclamp side
Port CO: Common side

SOL.1b and SOL.2a: Simultaneous excitation possible
Simultaneous excitation will not cause a problem because the motor does not rotate (fluid is not supplied at port CO) unless the unclamping operation is completed.

3-port (CL, UN, CO)



If operation fails

More than 90% of operation failures are caused by the fixed throttle becoming clogged with contamination. (See the sectional structural diagram for the location of orifice.)

- **Motor not rotating or rotating slowly**

- Clean each orifice with clean oil and blow it with compressed air. (Do not wrap orifices with sealing tape when reassembling.)
- Replace the solenoid valve for rotation (spool type/operation type: 2C).

- **Indexing error**

- Clean each orifice with clean oil and blow it with compressed air. (Do not wrap orifices with sealing tape when reassembling.)
- Replace the solenoid valve for pin engagement/disengagement (spool type/operation type: 9C).

Handling

- **Installation**

- Avoid crosswise drive of a belt, chain, etc. because it will cause large radial loads. Always drive the load via bearing support by using pillow blocks, for example.
- When driving a motor with a spur gear fitted at the end of the shaft, keep the load within 4.5 kN {450 kgf} (2.25 kN {225 kgf} for TM05) including the radial load.
If the load exceeds this limit, drive it via bearing support by using pillow blocks, for example.
- Ensure that the eccentricity of the drive shaft and motor shaft is no greater than 0.05 mm (TIR).
- Tighten the screw in the M8 tapped hole (depth of 20 mm) at the shaft end within a tightening torque of 2.5 to 3 N·m {250 to 300 kgf·cm}.
- Before replacing the motor, be sure to stop the hydraulic supply and check that there is no remaining pressure within the hydraulic circuit.
Never disassemble the motor.
- Never use damaged hoses or old hoses for piping. Use hoses with sufficient pressure endurance range.
- When mounting the motor, securely fix it to the flange or base while being careful not to drop it and avoiding subjecting it to any impact with a hammer, etc.
In addition, do not use the motor as a step.
- When connecting fittings on the motor, tighten them with an appropriate torque. Tightening them with an excessive torque may cause breakage of the block or other parts.
- Set the key on the motor shaft without any looseness. Ensure that the clearance between the key and the side wall of the key groove is no greater than 0.03 mm and securely fix the top part of the key using a screw or other means.
- Do not apply any load exceeding the permissible radial load (4.5 kN {450 kgf}) or the permissible thrust load (3.5 kN {350 kgf}) on the motor shaft. Do not hit the motor with a hammer, especially on the motor shaft. It will cause fluid leakage from the shaft sealing or damage to other parts.
- When using the front mount type, take care not to trap the O-ring.
- During piping work, take necessary measures to prevent dust or cutting chips getting inside the piping or motor.
Flush pipes before using them in piping work.
- When connecting the motor directly to a load part, accurate centering is required.
- Do not expose valves and sensors to water or impacts.
- Do not pull the detection rod or proximity plate with excessive force, or bend them.
- Be careful to connect motor pipes correctly.
- Do not use the products in an environment susceptible to rust.

- **Hydraulic oil**

- Use a petroleum-based hydraulic fluid. Do not use other types of hydraulic fluid or mix different types of hydraulic fluid.
Use hydraulic fluid within parameters where all of its specification conditions are satisfied at the same time.
- Positioning motors are not designed to handle combustible fluids or hazardous fluids.
If such fluids are used and leak, the potential hazards include fire, disease, and environmental contamination.
 - Recommended hydraulic fluid: Fluid equivalent to ISO VG32 to 56
 - Recommended viscosity range: 15 to 400 mm²/s {cSt}
 - Permissible fluid temperature range: 0 to 60°C
 - Contamination: Within NAS class 12 (Use a line filter with a filtration accuracy of 25 μ or better.)

- **Running**

- Do not touch the rotating part while the motor is rotating because it is very dangerous. Be sure to provide a guard for the rotating part.
- If an abnormal pressure that exceeds the maximum operating pressure of the motor can be expected, install a safety valve together with the motor and set it to lower than the maximum operating pressure. Otherwise, the seal may be damaged and fluid may leak.
- Do not touch surface of the motor while it is running. You may sustain burns.
- If an abnormality such as fluid leakage, lowered torque, increased noise, or lowered speed is observed, stop operation immediately and take the necessary steps to prevent secondary accidents.
- Do not operate the motor only with a key attached. Otherwise the key may fly out.
- Maintain the back pressure at no greater than 1 MPa {10 kgf/cm²}.

- **Others**

- Use the motor in compliance with the specification conditions stated in the brochure or drawings.
- Products modified by the customer are not covered by the warranty and DAIKIN will accept no responsibility for them.

Contact Details

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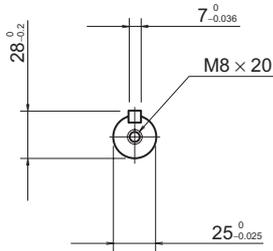
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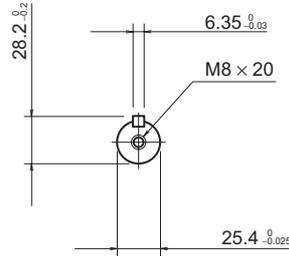
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External dimension diagram

TM××^A_B××0××T×N-20

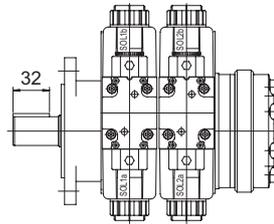


Shaft diameter M



Shaft diameter I

Solenoid valve	C
KSO (AC solenoid valve)	190
KSO (DC solenoid valve)	208
LS (AC solenoid valve)	153
LS (DC solenoid valve)	216

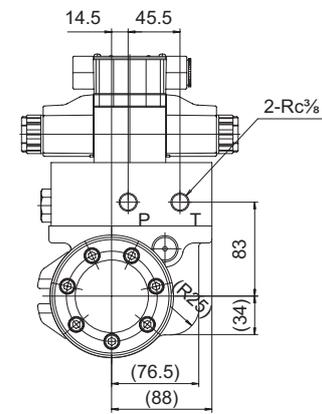
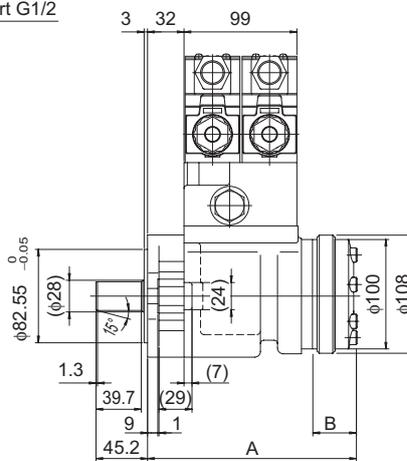
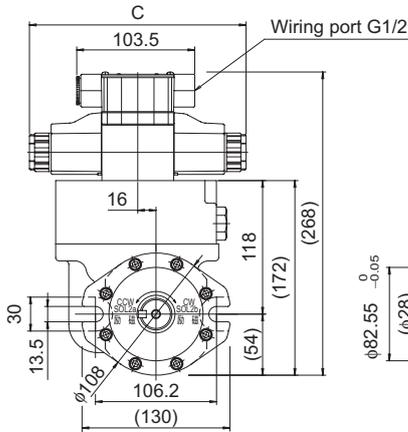


Type A flange

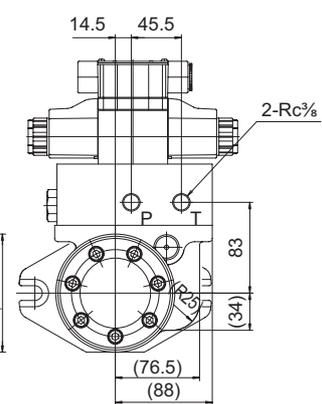
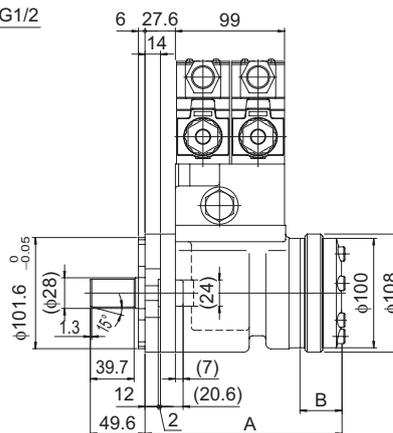
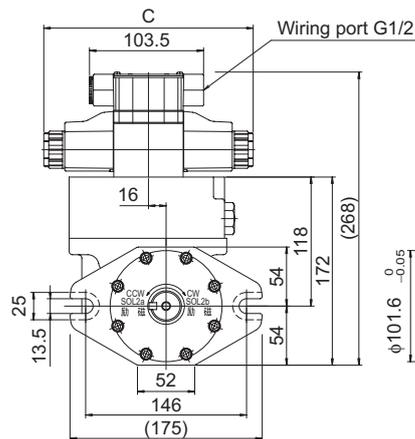
Model No.	A	B	Mass kg
TM05	176.9	31.9	19.5
TM10	183.9	38.9	19.9
TM13	188.6	43.6	20.2
TM19	198.1	53.1	20.6

Type B flange

Model No.	A	B	Mass kg
TM05	172.5	31.9	19.5
TM10	179.5	38.9	20.1
TM13	184.2	43.6	20.4
TM19	193.7	53.1	20.8



Type A flange



Type B flange

Contact Details

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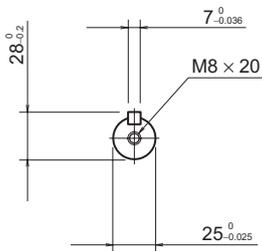
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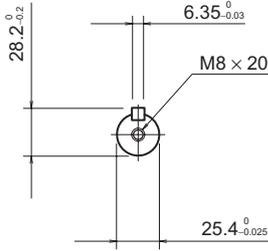
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External dimension diagram

TM**F**-** $\frac{0}{3}$ **2**-**T**N-20



Shaft diameter M

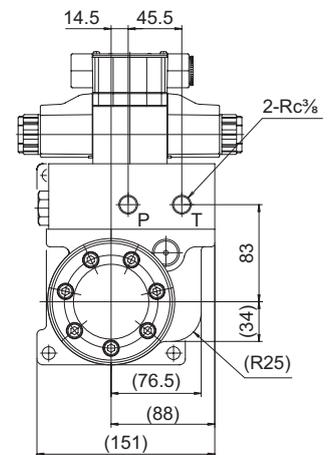
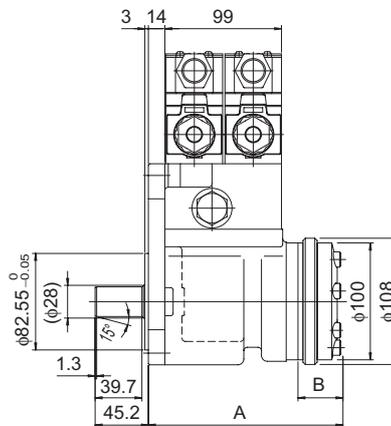
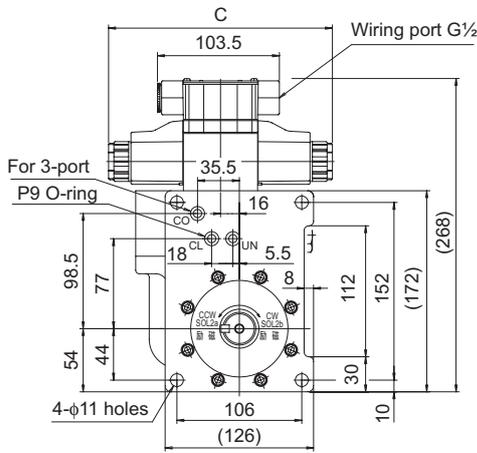
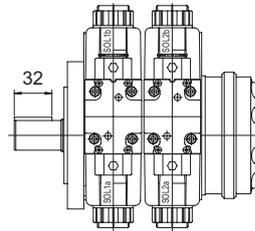


Shaft diameter I

Type F flange

Model No.	A	B	Mass kg
TM05	158.9	31.9	19.8
TM10	165.9	38.9	20.1
TM13	170.6	43.6	20.4
TM19	180.1	53.1	20.8

Solenoid valve	C
KSO (AC solenoid valve)	190
KSO (DC solenoid valve)	208
LS (AC solenoid valve)	153
LS (DC solenoid valve)	216



Type F flange

Contact Details

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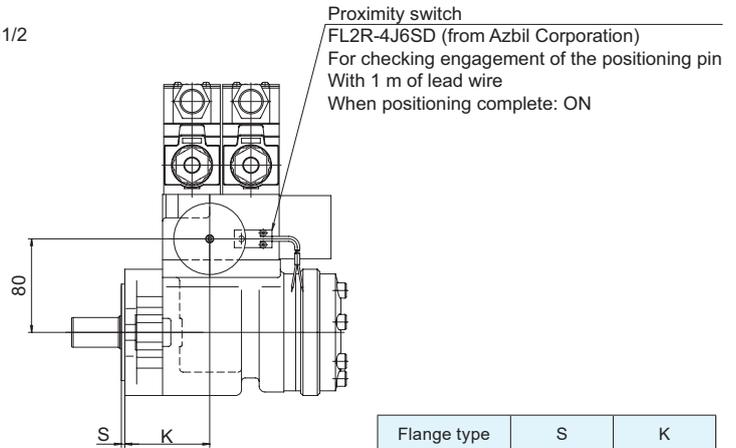
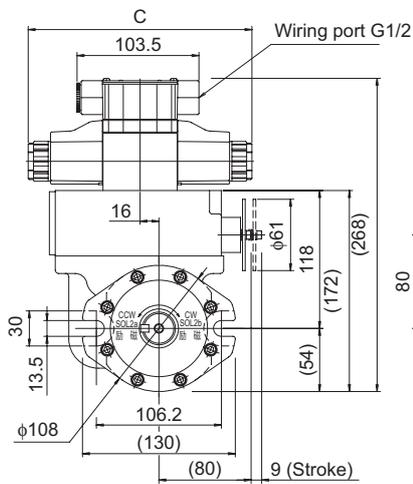
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External dimension diagram

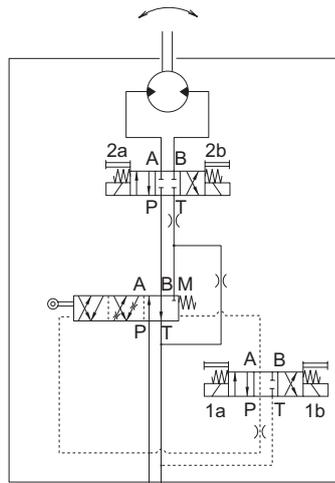
TM****-****-*** with K-20 proximity switch

Solenoid valve	C
KSO (AC solenoid valve)	190
KSO (DC solenoid valve)	208
LS (AC solenoid valve)	153
LS (DC solenoid valve)	216

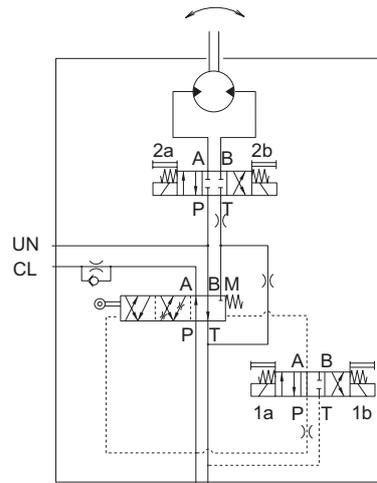


Flange type	S	K
A	3.0	72.0
B	6.0	67.6
F	3.0	54.0

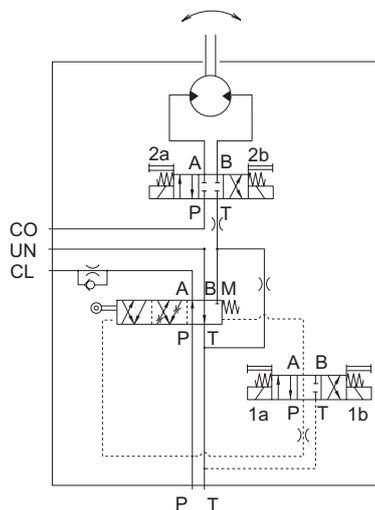
Circuit diagram



No control port



2-port specifications



3-port specifications

Contact Details

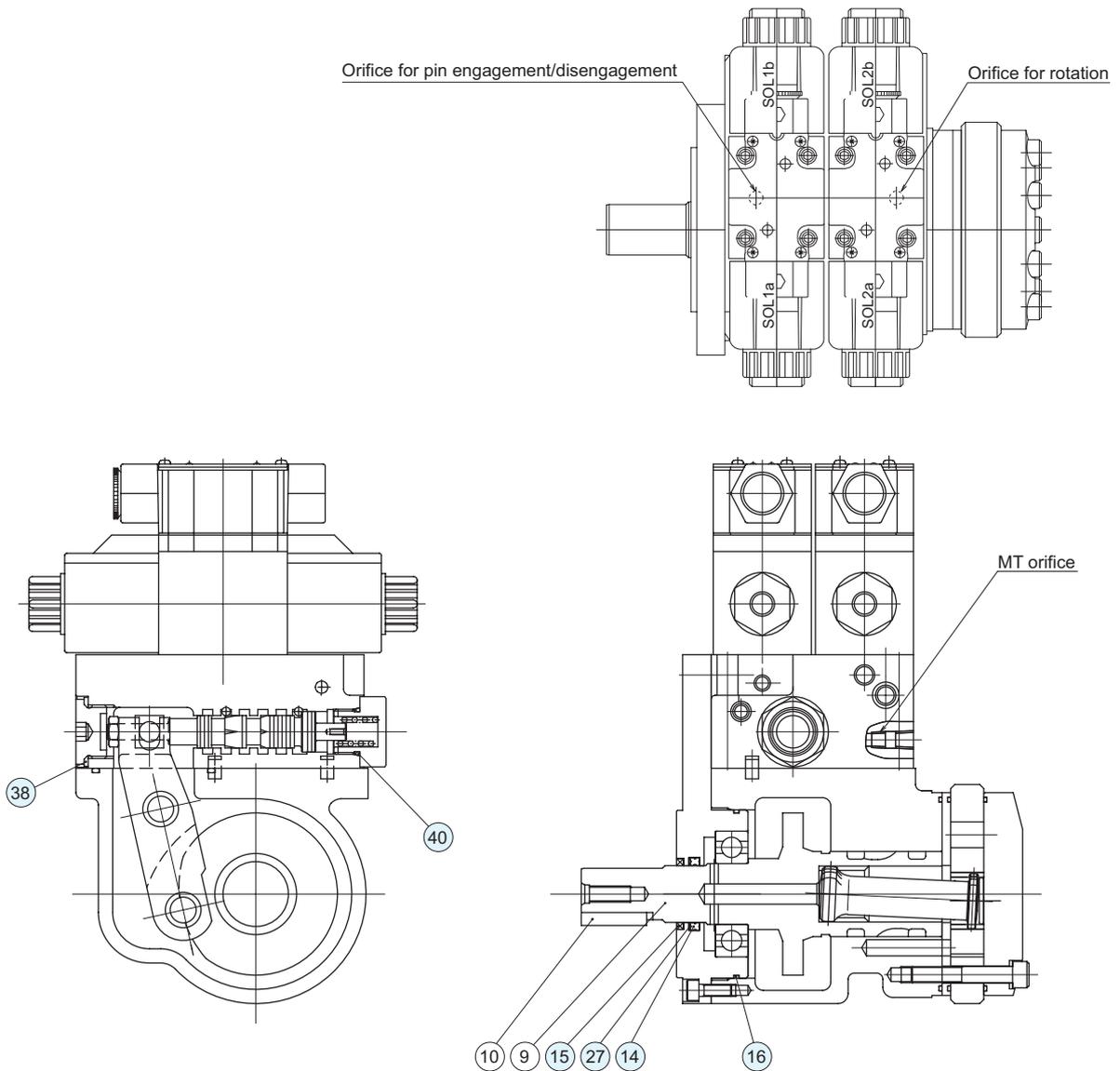
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Sectional structural diagram



Sealing part table

Part No.	Name	Quantity	Part specifications
14	X-ring	1	Seal kit (PP01632-01)
15	Dust seal	1	
16	O-ring	1	
27	Backup ring	1	
38	Sealing washer	1	LBF060345E
40	O-ring	1	AS568-910