

Vacuum Compatible Motorized Stage Guide | VSGSP Guide

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For use in vacuum environments, the vacuum compatible stage series offers replacement with a stainless steel or machined aluminum body as well as replacement with vacuum grease, and uses a vacuum rated motor and a contact type or mechanical driven type switch, and Teflon coated cables for signal wires.

The series is suited for positioning in environments where the degree of vacuum is between 10^{-4} and 10^{-5} Pa. For the vacuum characteristics, see the measurement data of outgas volume, degree of vacuum, and mass component ratio.

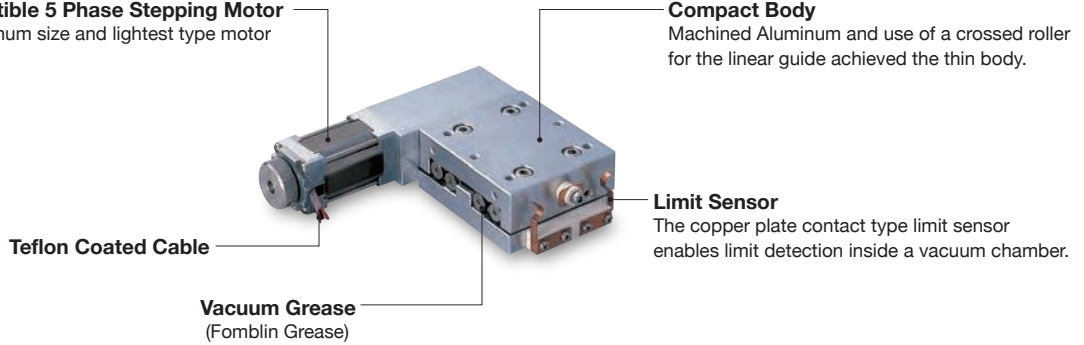
- In addition to the standard lineup, motor replacement, sensor replacement, special specifications such as vacuum compatible large mirror holders, and replacement of grease to vacuum grease for the guides or feed screws of standard specification stages to deal with low vacuum specifications are available. Contact our International Sales Division for more information.

Vacuum Compatible 5 Phase Stepping Motor

The □24mm minimum size and lightest type motor saves space.

Compact Body

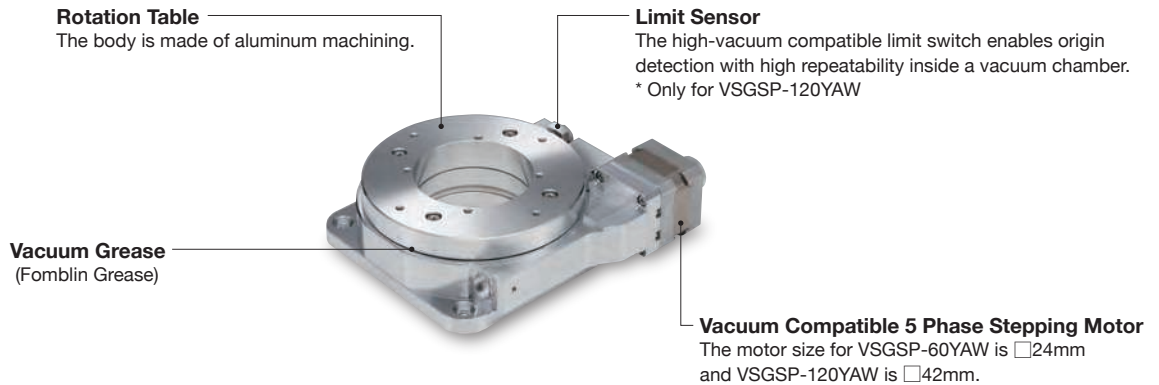
Machined Aluminum and use of a crossed roller for the linear guide achieved the thin body.



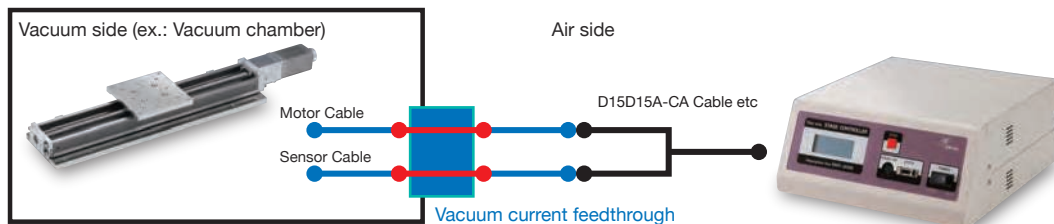
Rotation Table

The body is made of aluminum machining.

Limit Sensor
The high-vacuum compatible limit switch enables origin detection with high repeatability inside a vacuum chamber.
* Only for VSGSP-120YAW



[Attention] To use a vacuum compatible stage in a vacuum chamber, the connection cables between the vacuum side and the atmosphere side need to be relayed using a vacuum current feedthrough or the like. Prepare the feedthrough according to the vacuum chamber specifications.

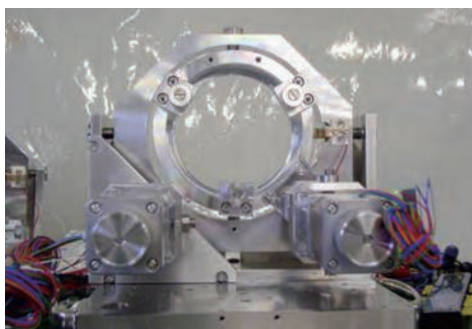


- X Translation
- Theta Rotation
- Goniometer

Vacuum

Options

- 40mm
- 60mm
- 80mm
- 85mm
- 100mm
- 120mm
- Others



[Example of Special Order]
Vacuum Compatible Large Mirror Holder

Guide

- ▶ Because heat dissipation generally deteriorates in vacuum, specification temperature conditions are stricter than those for atmosphere. Check the usage conditions such as stage operation to make sure that the motor case temperature does not exceed 80°C.

●Emitted amount of gas

Part Number	Emitted Amount of Gas Q (after 40 minutes of emission)	
	(Torr·ℓ/s/unit)	(Pa·ℓ/s/unit)
VSGSP26-200	4.77×10^{-4}	6.36×10^{-2}
VSGSP-60	6.75×10^{-5}	9.00×10^{-3}
VSGSP-120YAW	4.78×10^{-4}	6.37×10^{-2}

Emitted amount of gas is found by the following equation:

$$Q = \frac{(P - P') \times V}{t \times N}$$

P : Vacuum immediately after seal off
P' : Vacuum after seal-off time has elapsed
N : Number of stage units (1unit)

V : Vacuum chamber volume (ℓ)
t : Seal-off time (600s)

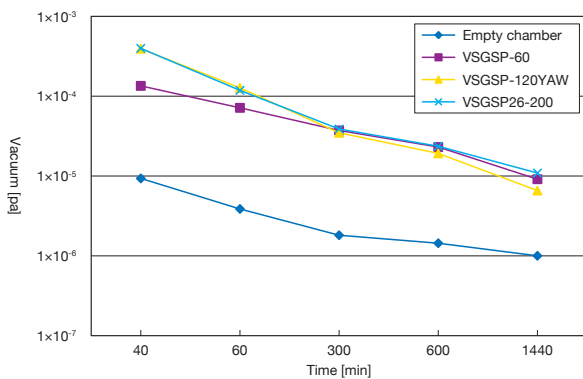
Evaluation and Device Specifications

Exhaust system: Turbo-Molecular Pump STP-301
Seiyu Instruments Inc. (Now Edwards Japan Limited)
Pumping speed: 300ℓ/sec
Mass spectroscope: Quad Mass Spectrometer QME200
Pfeiffer Vacuum
Mass range: 1 – 200amu

From the measurement results of gas volume discharged from a vacuum compatible motorized stage

The main components of outgas are water and nitrogen. This is because the gas was caused by residual air on the stage surface, and grease used for drive components is considered to have little impact on the amount of gas.

●Vacuum of Vacuum Chamber



●Mass Component Ratio

Mass Number	Component Ratio [%]			Ion	Gas Molecule
	VSGSP-60	VSGSP26-200	VSGSP-120YAW		
1	19.58	19.96	17.90	H ⁺	H ₂ , water vapor, hydrocarbon
2	2.81	5.28	3.34	H ₂ ⁺	H ₂ , water vapor, hydrocarbon
12	0.60	0.85	0.79	C ⁺	CO, CO ₂ , hydrocarbon
13	0.17	—	—	CH ⁺	Hydrocarbon
14	0.79	1.26	0.91	N ⁺ , CO ²⁺ , CH ₂ ⁺	N ₂ , NH ₃ , CO, hydrocarbon
15	—	2.37	—	CH ₃ ⁺ , NH ⁺	Hydrocarbon, NH ₃
16	3.03	—	2.98	O ⁺ , CH ₄ ⁺ , NH ₂ ⁺	O ₂ , CH ₄ , NH ₃
17	15.77	—	14.48	OH ⁺ , NH ₃ ⁺	H ₂ O, NH ₃
18	48.02	17.30	43.89	H ₂ O ⁺	H ₂ O
20	0.22	—	0.29	HF ⁺ , Ar ²⁺	HF, Ar
26	0.33	—	0.53	C ₂ H ₂ ⁺	Hydrocarbon
27	0.83	4.53	1.52	C ₂ H ₃ ⁺	Hydrocarbon
28	2.17	2.49	2.76	CO ⁺ , N ₂ ⁺ , C ₂ H ₄ ⁺	CO, CO ₂ , N ₂ , hydrocarbon
29	0.73	6.08	1.44	C ₂ H ₅ ⁺	Hydrocarbon
30	0.08	—	—	C ₂ H ₆ ⁺ , NO ⁺	C ₂ H ₆ , NO
31	0.14	0.31	0.27	C ₂ H ₇ OH ⁺	C ₂ H ₅ OH
32	0.26	—	0.27	O ₂ ⁺ , S ⁺	O ₂ , H ₂ S, SO ₂
39	0.39	2.57	0.78	C ₃ H ₃ ⁺	Hydrocarbon
41	0.51	7.44	1.07	C ₃ H ₅ ⁺	Hydrocarbon
42	—	—	0.41	C ₃ H ₆ ⁺	Hydrocarbon
43	0.74	8.00	1.01	C ₃ H ₇ ⁺	Hydrocarbon
44	0.40	—	0.66	C ₃ H ₈ ⁺ , CO ₂ ⁺ , NO ⁺ , C ₂ H ₅ OH ⁺	C ₂ H ₆ , CO ₂ , N ₂ O, C ₂ H ₅ OH
45	—	0.31	0.31	C ₂ H ₅ O ⁺	C ₂ H ₅ OH
50	—	0.23	—	C ₄ H ₂ ⁺	Hydrocarbon

Data

●Interpretation of Mass Peak

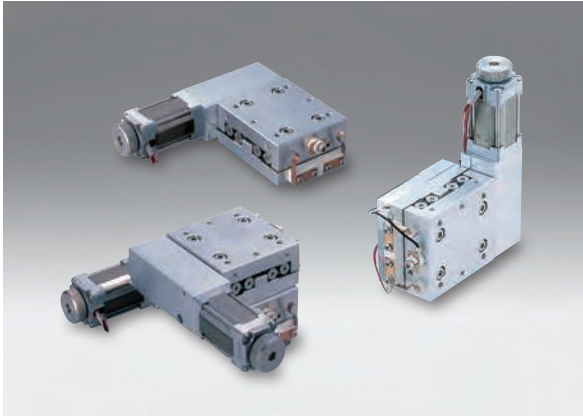
The following list shows major gases that appear for each mass number when mass peaks (mass spectra) of residual gas are measured, and their interpretations.

List of Residual Gas Spectra

Mass Number	Ion	Remarks	Mass Number	Ion	Remarks
1	H ⁺	H ₂ , H ₂ O, hydrocarbons, etc	30	NO ⁺	Appears immediately after emission of dirty vacuum system.
2	H ₂ ⁺	H ₂ , H ₂ O, hydrocarbons, etc	31	CH ₃ O ⁺	Alcohol
3	HD ⁺	Abundance ratio of D is about 0.01%.	32	O ₂ ⁺	Becomes N ₂₃ : O ₃₂ = 4 : 1 when air leak occurs.
4	He ⁺		35	Cl ⁺	
12	C ⁺	CO, CO ₂ , hydrocarbons	37	Cl ⁺	Cl ₃₅ : Cl ₃₇ = 3 : 1
14	N ⁺ , CH ₂ ⁺ , CO ₂ ⁺	N ₂ , CO ₂ , hydrocarbons	39	K ⁺ , C ₃ H ₃ ⁺	K ⁺ dissociates from filament.
15	CH ₃ ⁺	Molecule that has CH ₄ , CH ₃	40	Ar ⁺ , C ₃ H ₄ ⁺	Ar makes up 1% of the atmosphere.
16	C ⁺ , CH ₄ ⁺	O ₂ , CH ₄ , oxygen compounds	41	C ₃ H ₅ ⁺	Hydrocarbon
17	OH ⁺	H ₂ O	42	C ₃ H ₆ ⁺	Hydrocarbon
18	H ₂ O ⁺	H ₂ O, OH ⁺ : H ₂ O ₃ ≅ 1 : 5	43	C ₃ H ₇ ⁺	Hydrocarbon
19	F ⁺	Sometimes adsorbed to filaments and electrode surface.	44	CO ₂ ⁺	
20	Ar ⁺ , H ₂ O ⁺ , Ne ⁺	H ₂ O(20) is present about 0.2% of abundance ratio of O ₁₅ .	50	C ₄ H ₂ ⁺	Hydrocarbon
22	CO ₂ ²⁺ , Ne ⁺	Abundance ratio of NE ₂₂ is 8.8%.	51	C ₄ H ₃ ⁺	Hydrocarbon
23	Na ⁺	Sometimes adsorbed to filaments and electrode surface.	55	C ₄ H ₇ ⁺	Hydrocarbon
27	C ₂ H ₃ ⁺	Hydrocarbon	56	C ₄ H ₈ ⁺	Hydrocarbon
28	N ₂ ⁺ , CO ⁺	Remain till the last.	57	C ₄ H ₉ ⁺	Hydrocarbon
29	C ₂ H ₅ ⁺ , N ₂ ⁺ , CO ⁺	Abundance ratio of N ₁₅ is 0.7%, and that of C ₁₃ is 1.1%.			

Vacuum Applications Miniature Motorized Stages | VSGSP-60

Compact motorized stages used for experiments and inside a chamber of measuring instrument. Compact slim body is effective for space-saving.



Guide

- Fitted with 1m teflon coated cable to directly connect the vacuum motor or vacuum limit switch to the connector of chamber.

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Others

Specifications

Part Number		VSGSP-60(X)	VSGSP-60(XY)	VSGSP-60(Z)
Mechanical Specifications	Travel [mm]	20	20	20
	Table Size [mm]	55×60	55×60	55×60
	Feed Screw	Precision ground screw ϕ 4mm, 0.5mm lead	Precision ground screw ϕ 4mm, 0.5mm lead	Precision ground screw ϕ 4mm, 0.5mm lead
	Positioning Slide	Crossed roller guide	Crossed roller guide	Crossed roller guide
	Stage Material	Aluminum	Aluminum	Aluminum
	Finish	None	None	None
	Weight [kg]	0.55	1.1	0.6
Accuracy Specifications	Resolution	(Full) [μ m]	1	1
		(Half) [μ m]	0.5	0.5
	MAX Speed [mm/sec]	5	5	—
	Positional Repeatability [μ m]	6	6	6
	Load Capacity [N]	29.4 (3.0kgf)	19.6 (2.0kgf)	14.7 (1.5kgf)
Lost Motion [μ m]	5	5	5	
Sensor	Type	Vacuum limit switch	Vacuum limit switch	Vacuum limit switch
	Limit Sensor	Contact type	Contact type	Contact type
	Origin Sensor	None	None	None
	Proximity Origin Sensor	None	None	None

Motor / Sensor Specifications

Motor	Type	Vacuum compatible 5-phase stepping motor 0.66A/phase (Tamagawa Seiki Co., Ltd.)		
	Motor Part Number	TS3664N5 (□24mm)		
	Step Angle	0.72°		
Sensor	Control Output	Contact type	Contact type	Contact type
	Output Logic	NORMAL OPEN	NORMAL OPEN	NORMAL OPEN

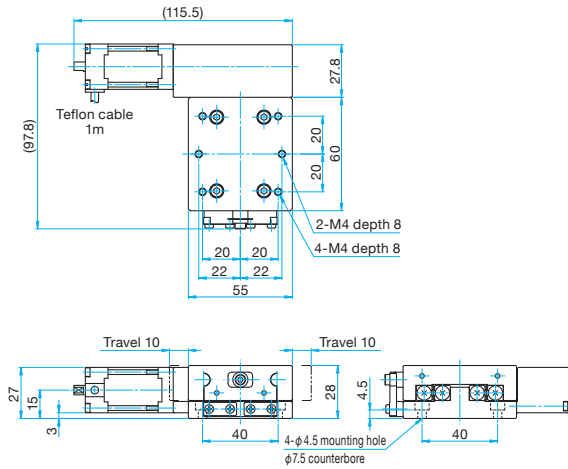
Compatible Driver / Controller

Control System	Compatible Driver	SG-5M, SG-55M, SG-514MSC, MC-7514PCL
	Compatible Controller	GSC-01, GSC-02, SHOT-702, GIP-101, SHOT-302GS, SHOT-304GS, HIT-M·HIT-S, PGC-04

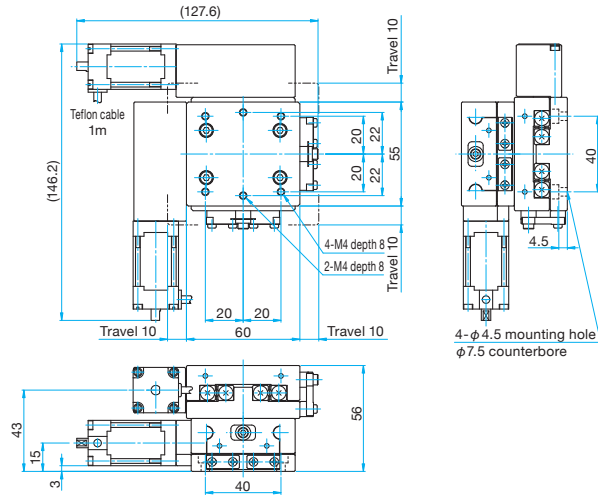


Outline Drawing

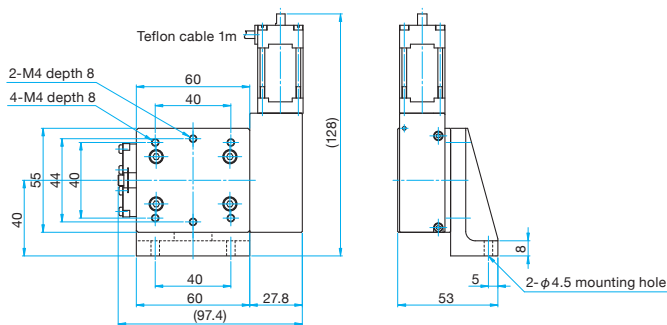
VSGSP-60(X) Hexagonal socket head cap screw M4x10...4 screws



VSGSP-60(XY) Hexagonal socket head cap screw M4x10...4 screws



VSGSP-60(Z) Hexagonal socket head cap screw M4x15...2 screws

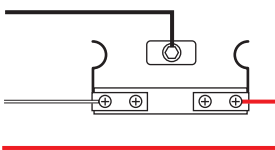


Vacuum Limit Switch

GND (0V) black lead

Motor side (+) limit switch
LS (+) white lead

Opposite side (-) limit switch
LS (-) red lead



* Use the motor side and opposite side limit switches as normal open.

Wiring of Vacuum Stages

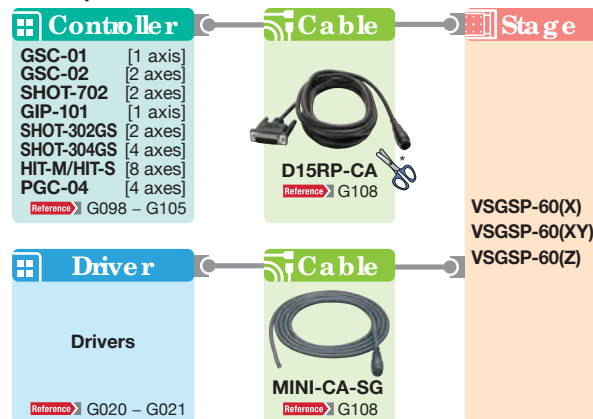
The vacuum compatible stepping motor TS3664N5 used for vacuum stages has five bare lead wires.

For wiring, they correspond to the motor lead colors shown in the wiring diagrams of driver or cable as follows.

(The motor leads shown in the connection diagrams of driver or cable indicate wiring of stepping motors used for normal stages.)

	Vacuum stage motor lead color	Motor lead color shown in driver or cable connection diagram
Corresponding connection	1 Blue	Blue
	2 Red	Red
	3 Red White	Orange
	4 Yellow	Green
	5 Black	Black
	Vacuum compatible stage motor connection diagram	5-phase stepping motor connection diagram

Compatible Controllers / Drivers and Cables



* Make the cable into bare wire specification after purchase.

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□ 40mm

□ 60mm

□ 80mm

□ 85mm

□ 100mm

□ 120mm

Others

Vacuum Compatible Motorized Stages | VSGSP-(X)

Motorized stages fitted with a limit sensor compatible with vacuum environments.

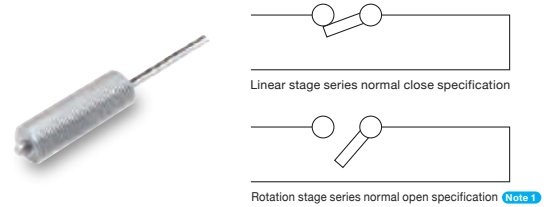
- Linear system has a long travel between 35 – 200mm, and is as compact as the conventional SGSP series.



Guide

- ▶ Motor cables and sensor cables are 1m bare wires.

■ Limit Sensor (high vacuum compatible switch)



Note 1 Set the controller of vacuum compatible motorized rotation stages to normal open.

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□40mm

□60mm

□80mm

□85mm

□100mm

□120mm

Others

Specifications

Part Number		VSGSP20-35(X)	VSGSP20-85(X)	VSGSP26-200(X)
Mechanical Specifications	Travel [mm]	35	85	200
	Table Size [mm]	60×60	60×60	80×80
	Feed Screw	Ball screw diameter ϕ 6mm, 1mm lead	Ball screw diameter ϕ 6mm, 1mm lead	Ball screw diameter ϕ 8mm, 2mm lead
	Positioning Slide	Outer rail structure	Outer rail structure	Outer rail structure
	Stage Material	Aluminum / Stainless steel	Aluminum / Stainless steel	Aluminum / Stainless steel
	Finish	None	None	None
	Weight [kg]	1.0	1.1	2.5
Accuracy Specifications	Resolution	(Full) [μ m]	2	4
		(Half) [μ m]	1	2
	MAX Speed [mm/sec]	10	10	20
	Positional Repeatability [μ m]	5	5	10
	Load Capacity [N]	39.2(4.0kgf)	39.2(4.0kgf)	58.8(6.0kgf)
Lost Motion [μ m]	3	3	10	
Sensor	Sensor Part Number	GN-PT5M3B-1 (Metrol Co., Ltd.)	GN-PT5M3B-1 (Metrol Co., Ltd.)	GN-PT5M3B-1 (Metrol Co., Ltd.)
	Limit Sensor	Vacuum touch sensor (NORMAL CLOSE)	Vacuum touch sensor (NORMAL CLOSE)	Vacuum touch sensor (NORMAL CLOSE)
	Origin Sensor	None	None	None
	Proximity Origin Sensor	None	None	None

Motor / Sensor Specifications

Motor	Type	Vacuum compatible 5-phase stepping motor 0.75A/phase (Oriental Motor Co., Ltd.)		
	Motor Part Number	A7298-90215KV (□28mm)	A7298-90215KV (□28mm)	A7298-90215KV (□28mm)
	Step Angle	0.72°		
Sensor	Power Voltage	DC5-24V		
	Current Consumption	10mA(Max 20mA)		
	Control Output	Mechanical		
	Output Logic	NORMAL CLOSE	NORMAL CLOSE	NORMAL CLOSE

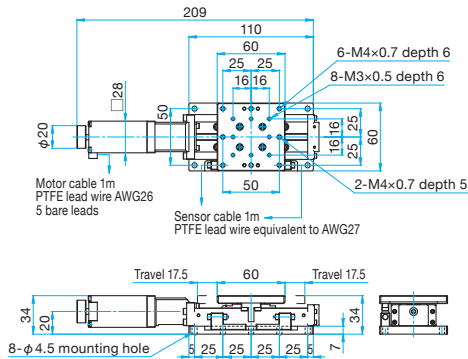
Compatible Driver / Controller

Control System	Compatible Driver	SG-5M, SG-55M, SG-514MSC, MC-7514PCL
	Compatible Controller	GSC-01, GSC-02, SHOT-702, GIP-101, SHOT-302GS, SHOT-304GS, HIT-M·HIT-S, PGC-04

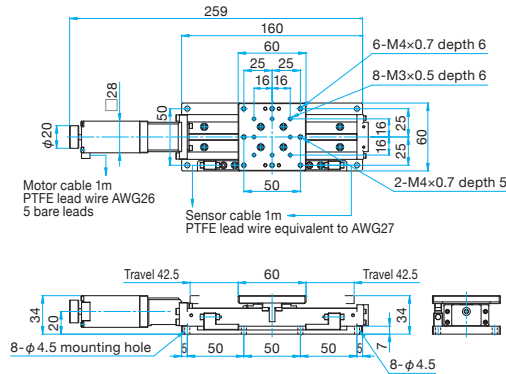


Outline Drawing

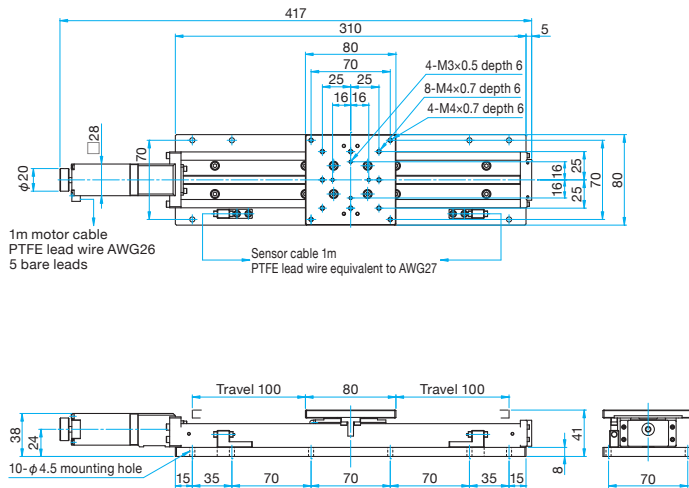
VSGSP20-35(X) Hexagonal socket head cap screw M4×12...4 screws



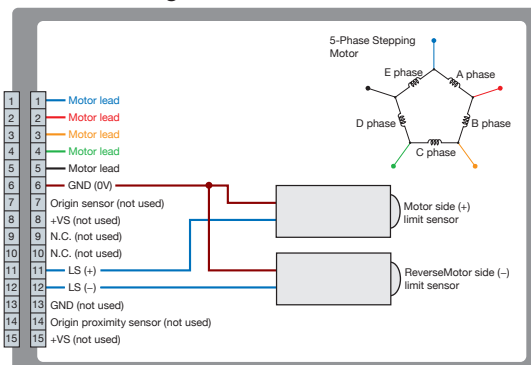
VSGSP20-85(X) Hexagonal socket head cap screw M4×12...4 screws



VSGSP26-200(X) Hexagonal socket head cap screw M4×12...8 screws

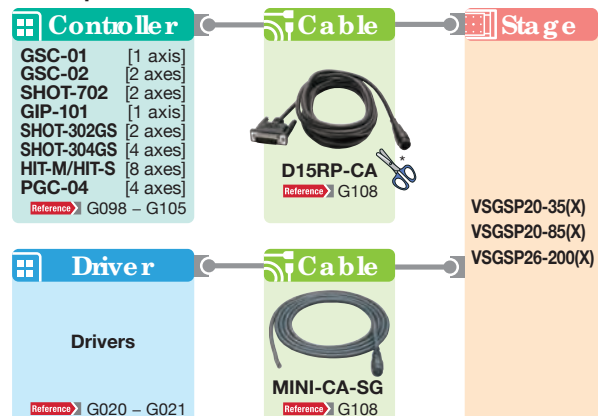


Connection Diagram



* Motor cables and sensor cables are bare wires.

Compatible Controllers / Drivers and Cables



* Make the cable into bare wire specification after purchase.

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□ 40mm

□ 60mm

□ 80mm

□ 85mm

□ 100mm

□ 120mm

Others

Vacuum Compatible Rotation Motorized Stage | VSGSP-YAW

Rotation motorized stages for vacuum environment.

The $\phi 60\text{mm}$ compact type is space saving, and best suited for experiments and use in chambers of inspection equipment.

The $\phi 120\text{mm}$ type is equipped with a limit sensor compatible with vacuum environments. It is thin but has high load capacity because of its $\square 42\text{mm}$ large motor.



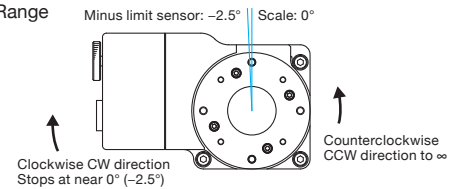
Guide

- ▶ Motor cables and sensor cables are 1m bare wires.



Guide

- ▶ Rotation Range



- ▶ Homing of rotation motorized stages is performed using the CW limit sensor as the origin sensor.
- ▶ Origin detection is adjusted so that the stage stops at 0 degrees when homing is performed in the MINI system at half step.

Specifications

Part Number		VSGSP-60YAW	VSGSP-120YAW	
Mechanical Specifications	Rotation Range	In the CW or CCW direction to ∞	Counterclockwise CCW direction to ∞ , Clockwise CW direction stops at near 0 degree (-2.5°)	
	Table Size [mm]	$\phi 60$	$\phi 120$	
	Feed Screw	Worm and worm wheel	Worm and worm wheel	
	Positioning Slide	Bearing	Crossed roller	
	Stage Material	Aluminum	Aluminum / Stainless steel	
	Finish	None	None	
	Weight [kg]	0.45	1.7	
Accuracy Specifications	Resolution [°]	(Full) [°]	0.005	0.005
		(Half) [°]	0.0025	0.0025
	MAX Speed [°/sec]	20	20	
	Positional Repeatability [°]	0.02	0.02	
	Load Capacity [N]	29.4 (3.0kgf)	98.0 (10.0kgf)	
Lost Motion [°]	0.05	0.05		
Sensor	Type	None	GN-STM35A-1 (Metrol Co., Ltd.)	
	Limit Sensor	None	Vacuum touch sensor (NORMAL OPEN)	
	Origin Sensor	None	None	
	Proximity Origin Sensor	None	None	

Motor / Sensor Specifications

Motor	Type	Vacuum compatible 5-phase stepping motor 0.66A/phase (Tamagawa Seiki Co., Ltd.)	Vacuum compatible 5-phase stepping motor 0.75A/phase (Oriental Motor Co., Ltd.)
	Motor Part Number	TS3664N5 ($\square 24\text{mm}$)	PK543V-NB ($\square 42\text{mm}$)
	Step Angle	0.72°	0.72°
Sensor	Control Output	—	DC5-24V
	Output Logic	—	Current Consumption 10mA(Max 20mA)
	Control Output	Contact type	Mechanical
	Output Logic	NORMAL OPEN	NORMAL OPEN

Compatible Driver / Controller

Control System	Compatible Driver	SG-5M, SG-55M, SG-514MSC, MC-7514PCL
	Compatible Controller	GSC-01, GSC-02, SHOT-702, GIP-101, SHOT-302GS, SHOT-304GS, HIT-M·HIT-S, PGC-04

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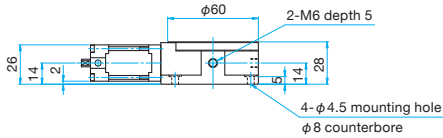
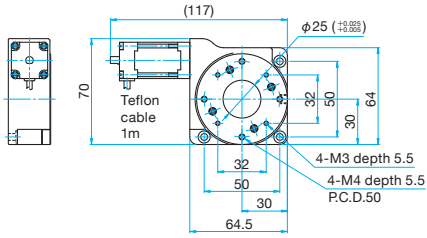
 40mm 60mm 80mm 85mm 100mm 120mm

Others

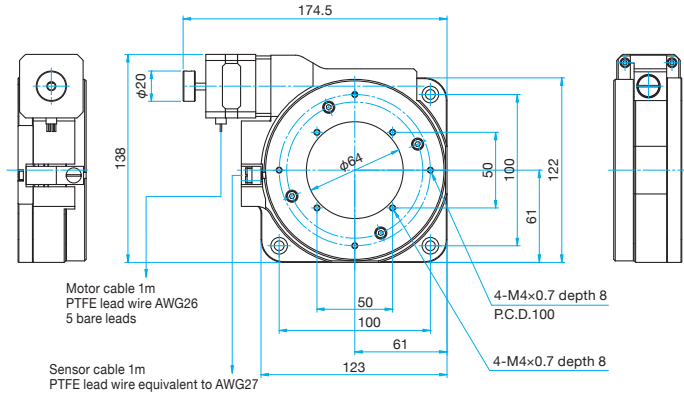


Outline Drawing

VSGSP-60YAW Hexagonal socket head cap screw M4×10...3 screws



VSGSP-120YAW Hexagon socket head cap screw M6×10...3 screws

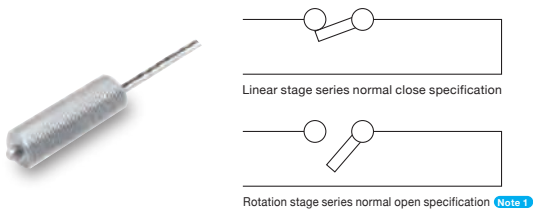


Wiring of Vacuum Stages

The vacuum compatible stepping motor TS3664N5 used for vacuum stages has five bare lead wires. For wiring, they correspond to the motor lead colors shown in the wiring diagrams of driver or cable as follows. (The motor leads shown in the connection diagrams of driver or cable indicate wiring of stepping motors used for normal stages.)

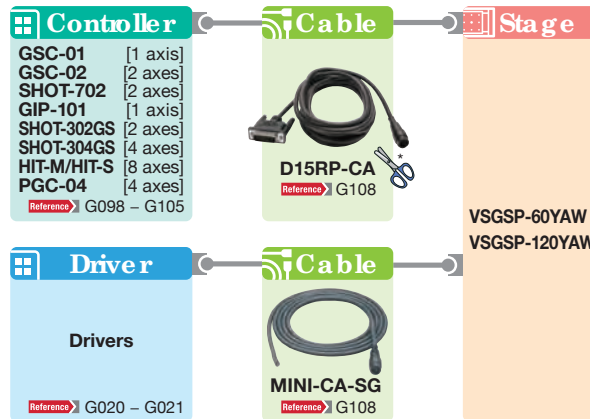
	Vacuum stage motor lead color	Motor lead color shown in driver or cable connection diagram
Conventional Controller	1 Blue	Blue
	2 Red	Red
	3 Red White	Orange
	4 Yellow	Green
	5 Black	Black
	Vacuum compatible stage motor connection diagram	5-phase stepping motor connection diagram (SGSP series)

Limit Sensor (high vacuum compatible switch)



Note 1 Set the controller of vacuum compatible motorized rotation stages to normal open.

Compatible Controllers / Drivers and Cables



* Make the cable into bare wire specification after purchase.

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