CAT.EUS100-58 B-UK

Electric Cylinders

Electric Cylinder

It can be operated like an air cylinder.

Series LZB

Series LZC

Model	Max. thrust	Max. speed	Lead screw (mm)	Stroke (mm)
LZB	196 N	200 mm/s	Slide screw: ø8, ø12 Lead: 2, 6, 12	25, 40, 50 100, 200
LZC				

Directional Control Driver for Electric Cylinder

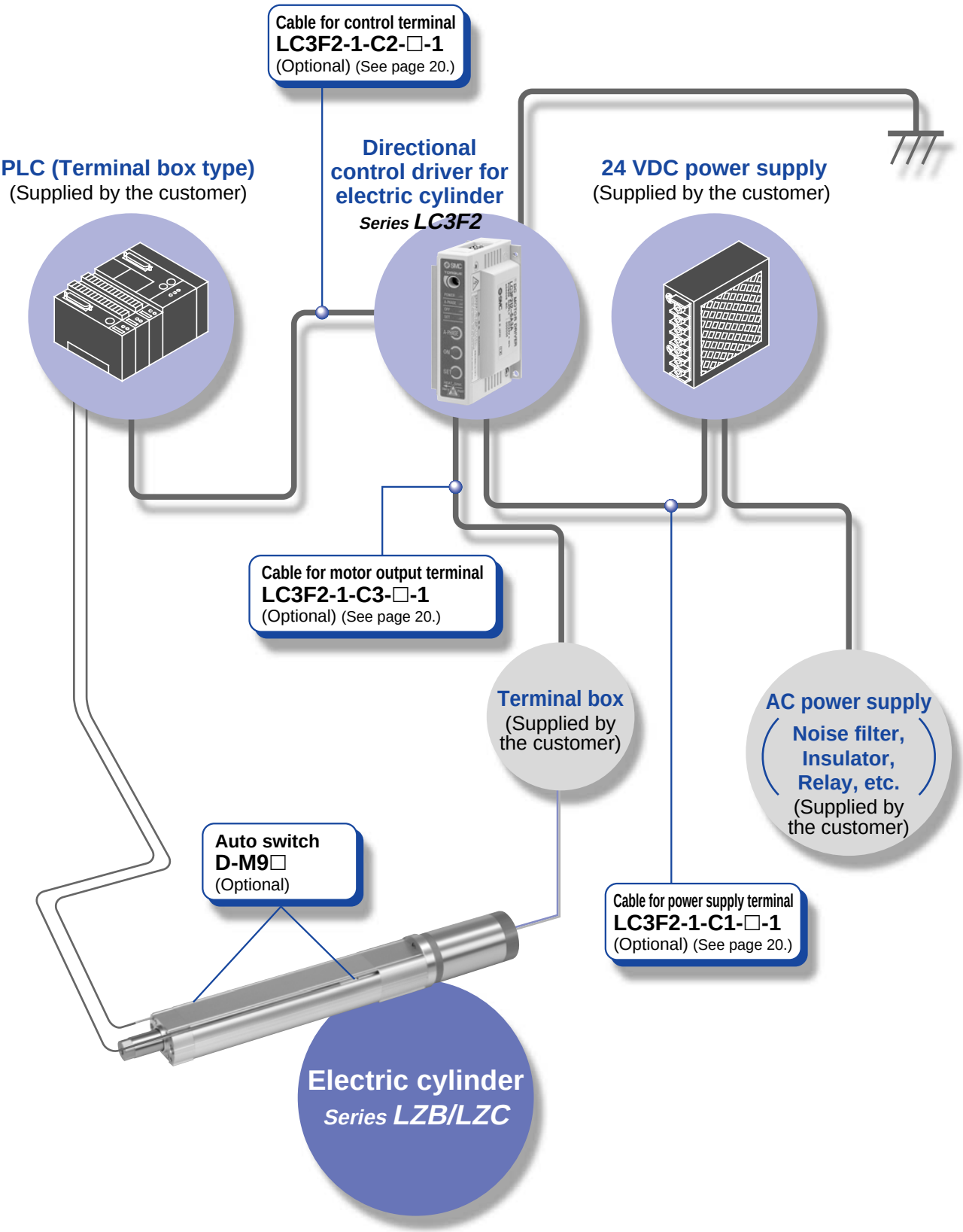
Directional control driver works like a solenoid valve

- Able to control the stroke with only ON/OFF signals.
- Current control protects the driver/motor from burning out.
- Able to control with only 3 different types of input signal.

1. **Directional control** (A-PHASE)
2. **Output ON/OFF** (ON)
3. **Thrust selection** (SET)
- **Can be operated manually.**

Series LC3F2

Series LZ□ System Chart



Series LZB/LZC
Model Selection

Note) These graphs are made using actual data. Therefore these graphs are to be used as a reference only and are not a guarantee of product's performance in any case. The graphs may change depending on the operating condition or environment.

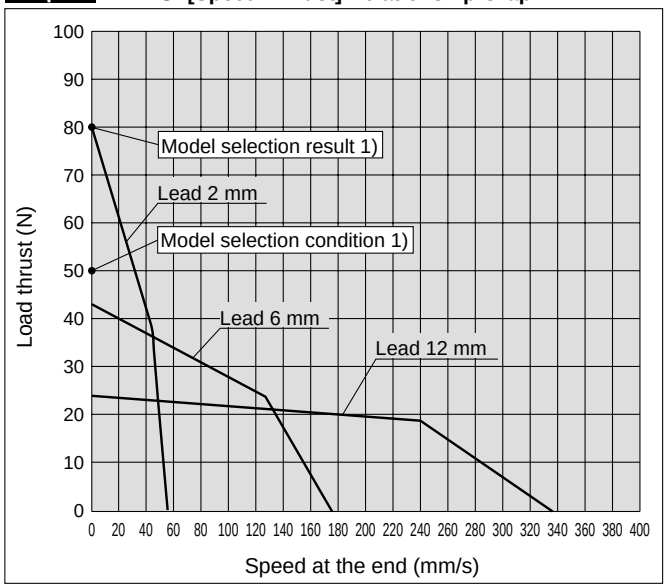
Motion of Pressing Force

Model selection condition 1)
Used as a force-pressing.
50 N or greater pressing

→

Model selection result 1)
From Graph 1, LZB/C□3's lead 2mm is applicable. (Pressing force: 80 N)

Graph 1 **LZ□3: [Speed-Thrust] Relationship Graph**



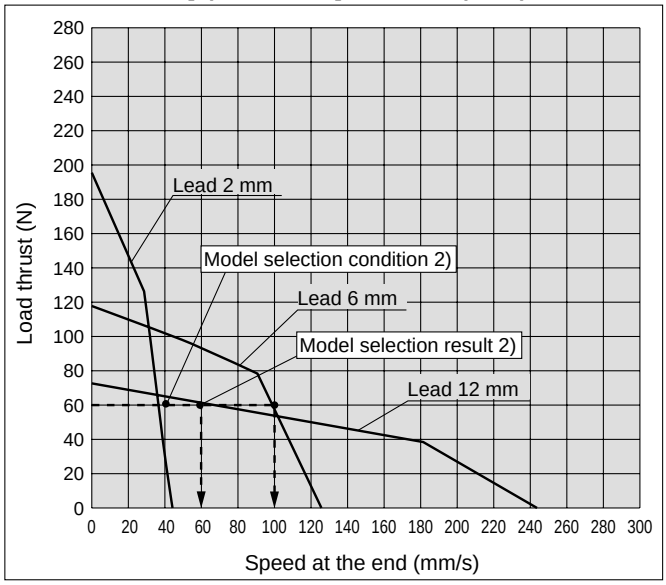
Transfer

Model selection condition 2)
Used as a transfer. 60 N transfer thrust and 40 mm/s transfer speed are required.

→

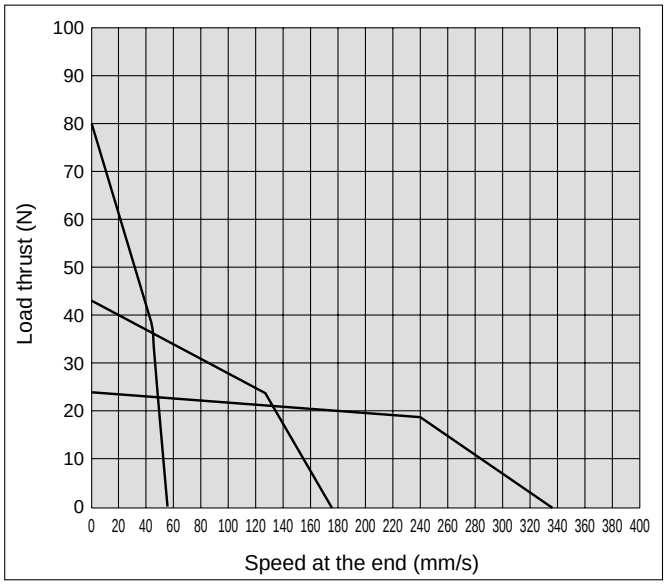
Model selection result 2)
From Graph 2, LZB/C□5's lead 6 mm and lead 12 mm are applicable. But, speed at the end with 60 N load will be 100 mm/s for lead 6 mm and 60 mm/s for lead 12 mm. Select a suitable product in accordance with the customer's equipment.

Graph 2 **LZ□5: [Speed-Thrust] Relationship Graph**

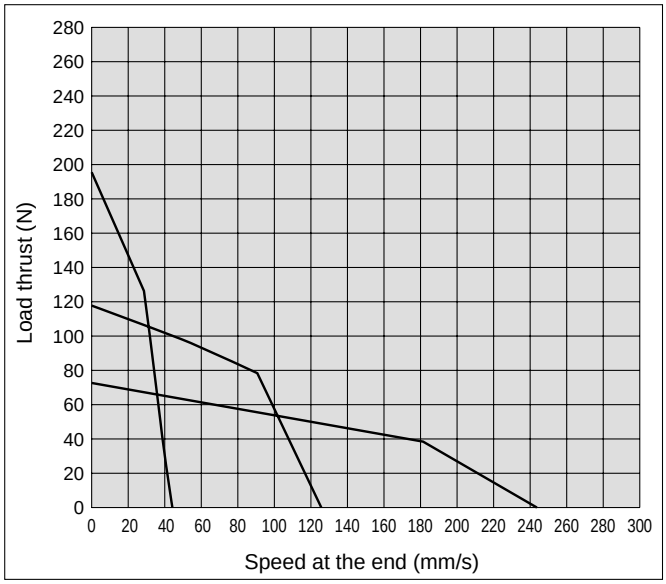


Speed-Thrust Graph

LZ□3



LZ□5



Electric Cylinder
Series LZB

How to Order

LZB **B** **3** **L** — **100** **A** **3** ☐

With auto switch **LDZB** **B** **3** **L** — **100** **A** **3** ☐ — **M9B** ☐

Built-in magnet

Mounting style

B	Basic style
L	Axial foot style
F	Rod flange style
U	Rod trunnion style

Cylinder size

3	Equivalent to ø16 cylinder Note)
5	Equivalent to ø25 cylinder Note)

Note) Equivalent to 0.4 MPa, theoretical output (lead 2mm)

Thread lead (mm)

L	Lead 2
M	Lead 6
H	Lead 12

Stroke (mm)
Refer to "Standard Stroke" table.

Motor type

A	DC motor

Motor size

3	Applicable cylinder size 3
5	Applicable cylinder size 5

Rod end thread

-	Female
L	Male

∗ When the cylinder is ordered with a male rod end thread, a rod end nut is included.

Auto switch

-	Without auto switch (Built-in magnet)

∗ Refer to the table below for auto switch model numbers.
∗ The auto switch is not mounted and is supplied separately at the time of shipment.

Number of auto switches

-	2 pcs.
S	1 pc.
n	n

Standard Stroke

Cylinder size	Standard stroke (mm) ∗
3, 5	25, 40, 50, 100, 200

∗ Other intermediate strokes can be manufactured upon receipt of order.
(Maximum manufacturable stroke: 200 mm)
Conditions for using a trunnion bracket are as follows:
• Maximum stroke: 150 mm
• Thread lead L (lead 2 mm) only

Applicable Auto Switches/For detailed auto switch specifications, refer to page 16 through to 18.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage			Auto switch model	Lead wire length (m) ∗			Pre-wired connector	Applicable load	
					DC		AC		0.5 (Nil)	3 (L)	5 (Z)			
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**M9N**	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9P**	●	●	○	○		
				2-wire		12 V		**M9B**	●	●	○	○	—	

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9N
3 m ····· L M9NL
5 m ····· Z M9NZ
∗ Solid state switches marked "○" are produced upon receipt of order.

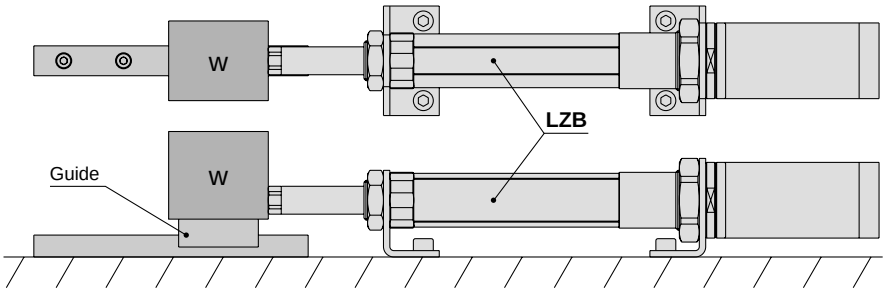
Specifications

Model		L□ZB□3L	L□ZB□3M	L□ZB□3H	L□ZB□5L	L□ZB□5M	L□ZB□5H
Size		3 (Equivalent to ø16 cylinder) Note 1)			5 (Equivalent to ø25 cylinder) Note 1)		
Lead screw	**Thread diameter**	ø8			ø12		
	Lead (mm)	2	6	12	2	6	12
Rated speed with no load (mm/s)		33	100	200	33	100	200
Rated thrust (N)		80	43	24	196	117	72
Stroke (mm)		25, 40, 50, 100, 200					
Main body (kg)∗		0.67 + (0.07/50 stroke)			1.74 + (0.16/50 stroke)		
Operating ambient temperature (°C)		5 to 40 (with no condensation)					
Tolerance of rod end thread		JIS class 2					
Allowable tolerance of stroke		$^{+1}_{0}$					
Motor		DC motor					
Applicable directional control driver model		LC3F212-5A3□			LC3F212-5A5□		
Applicable auto switch model		D-M9N, M9P, M9B					

Note 1) Equivalent to 0.4 MPa, theoretical output (lead 2mm)
Note 2) The table speeds are shown without a load, as a rated speed, and thrusts are shown as a rated thrust based on the pressure force.
Note 3) Speed will vary as they are affected by a load. Refer to page 1 for model selection.
∗ Refer to page 13 for mounting bracket weight.

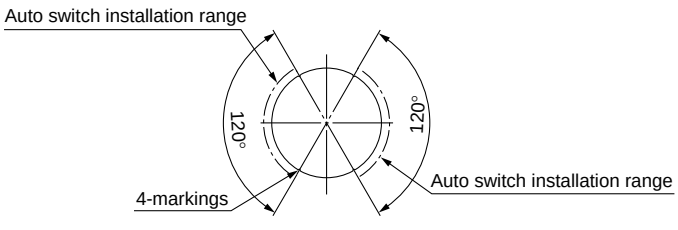
⚠ Specific Product Precautions

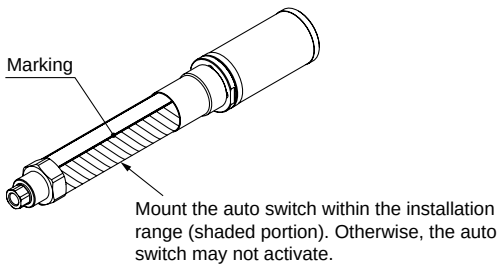
1. Do not apply any load to the rod end of LZB series. When applying a load, use a guide to avoid the load from being applied to the rod end.



2. Auto switch mounting

There are 4 markings on the outside surface of the cylinder tube, indicating the auto switch installation range. Mount the auto switches within the range shown below.





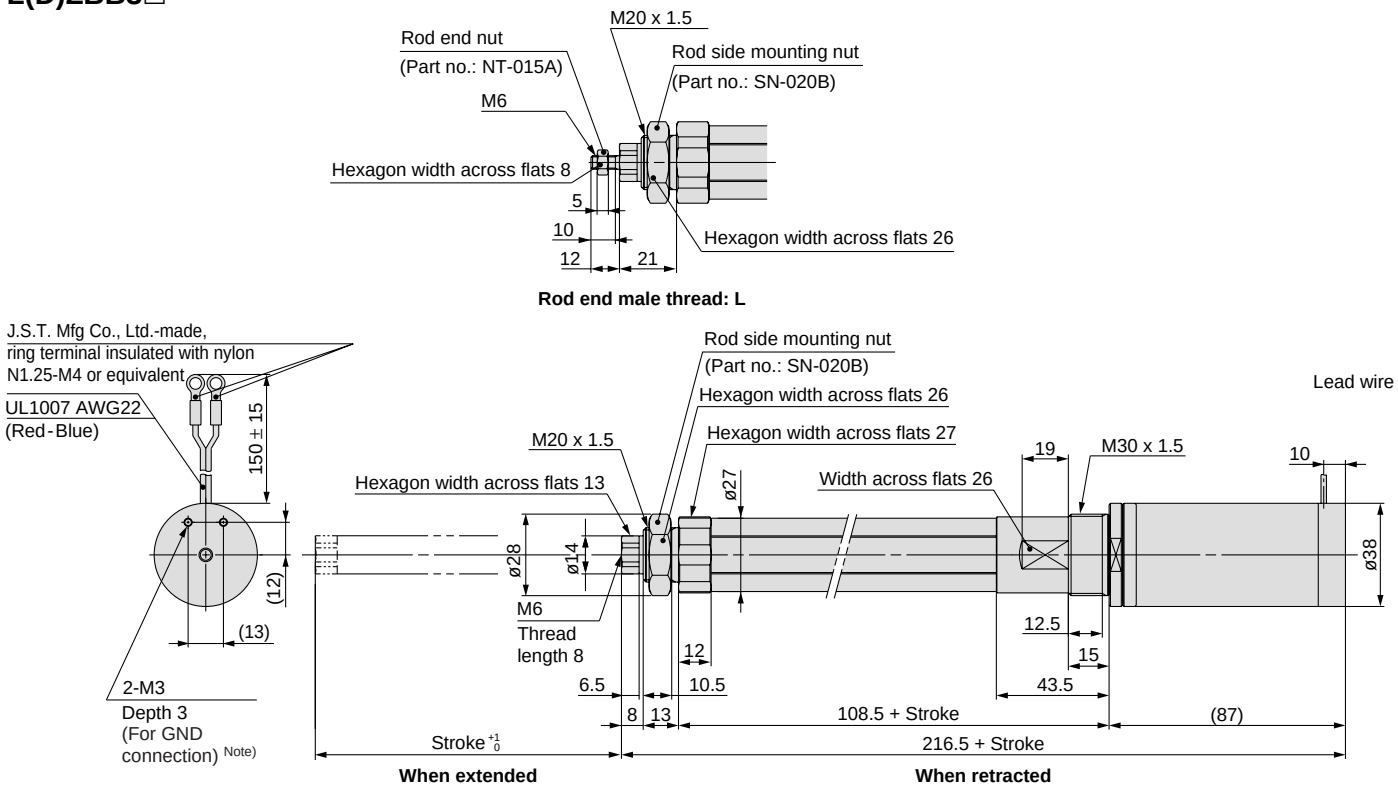
∗ Refer to page 15 for information on mounting an auto switch.

Dimensions

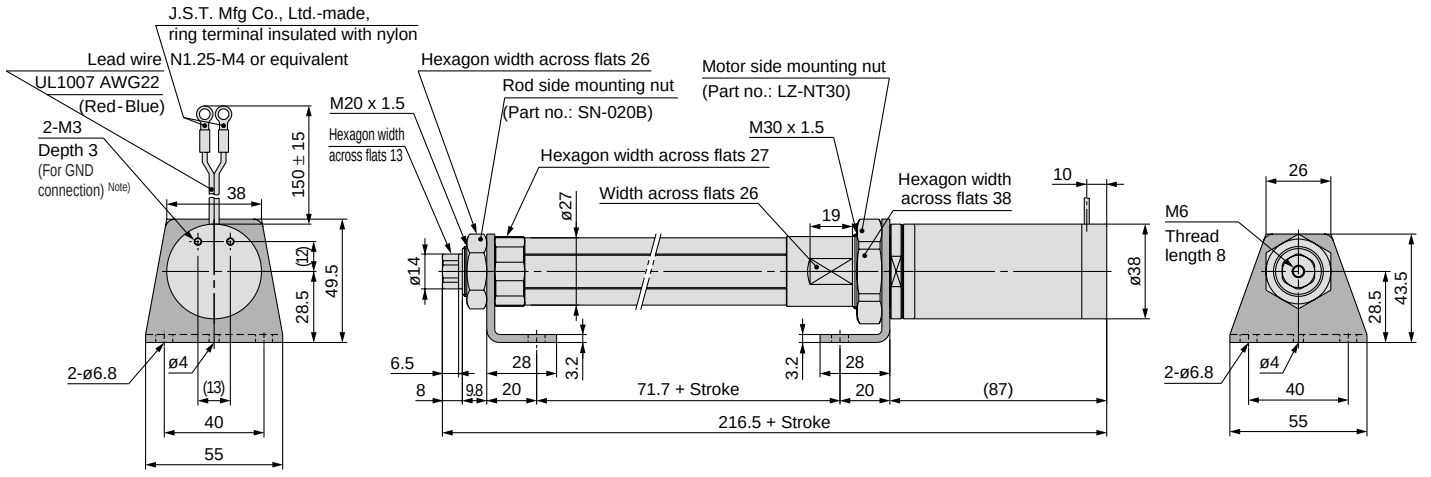
Note) Grounding must be performed. For details, refer to back page 2.

L(D)ZBB3□

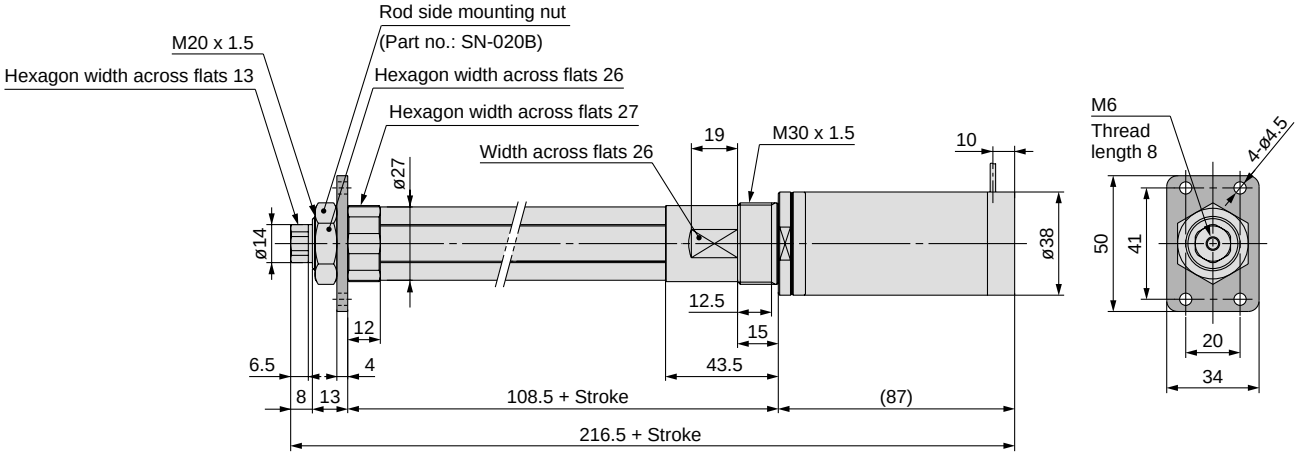
∗ The electrical entry direction is different depending on the product.



Axial foot style/L(D)ZBL3□

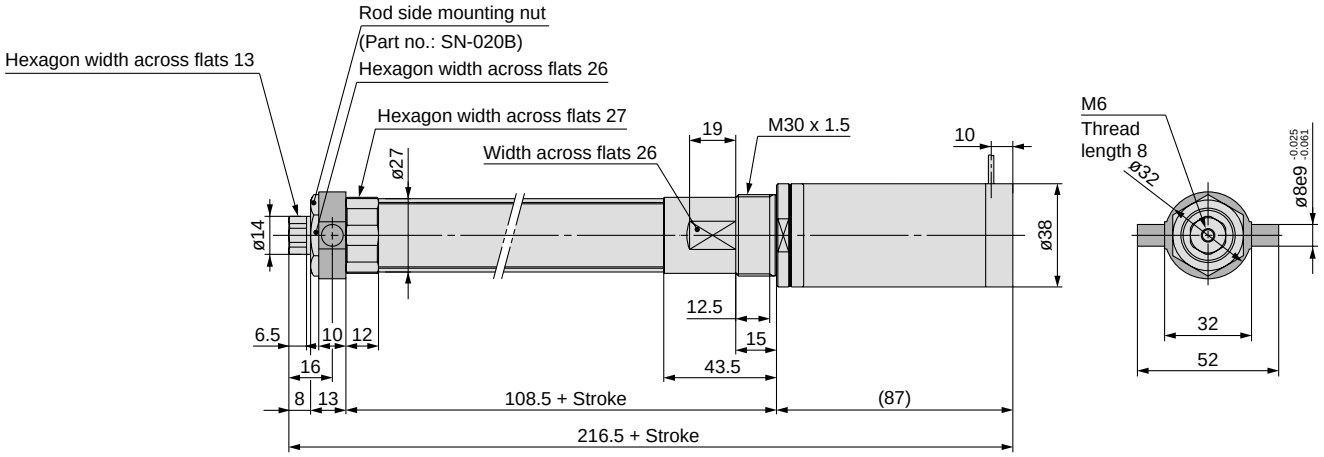


Rod flange style/L(D)ZBF3□



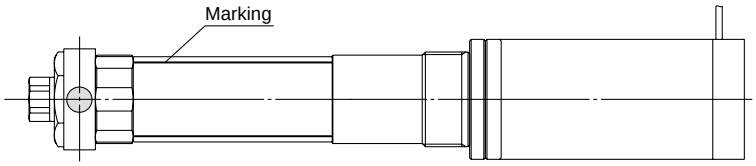
Dimensions

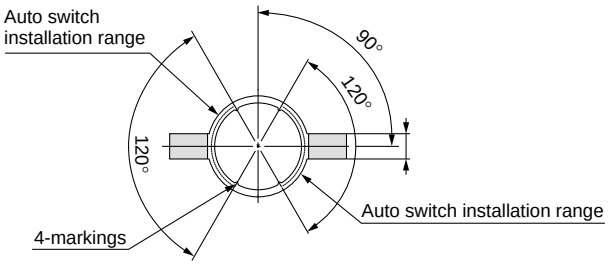
Rod trunnion style/L(D)ZBU3□



⚠Caution for using a trunnion bracket

In the event of mounting a trunnion bracket, fix it to the position illustrated below before using.





∗ Conditions for using a trunnion bracket are as follows:

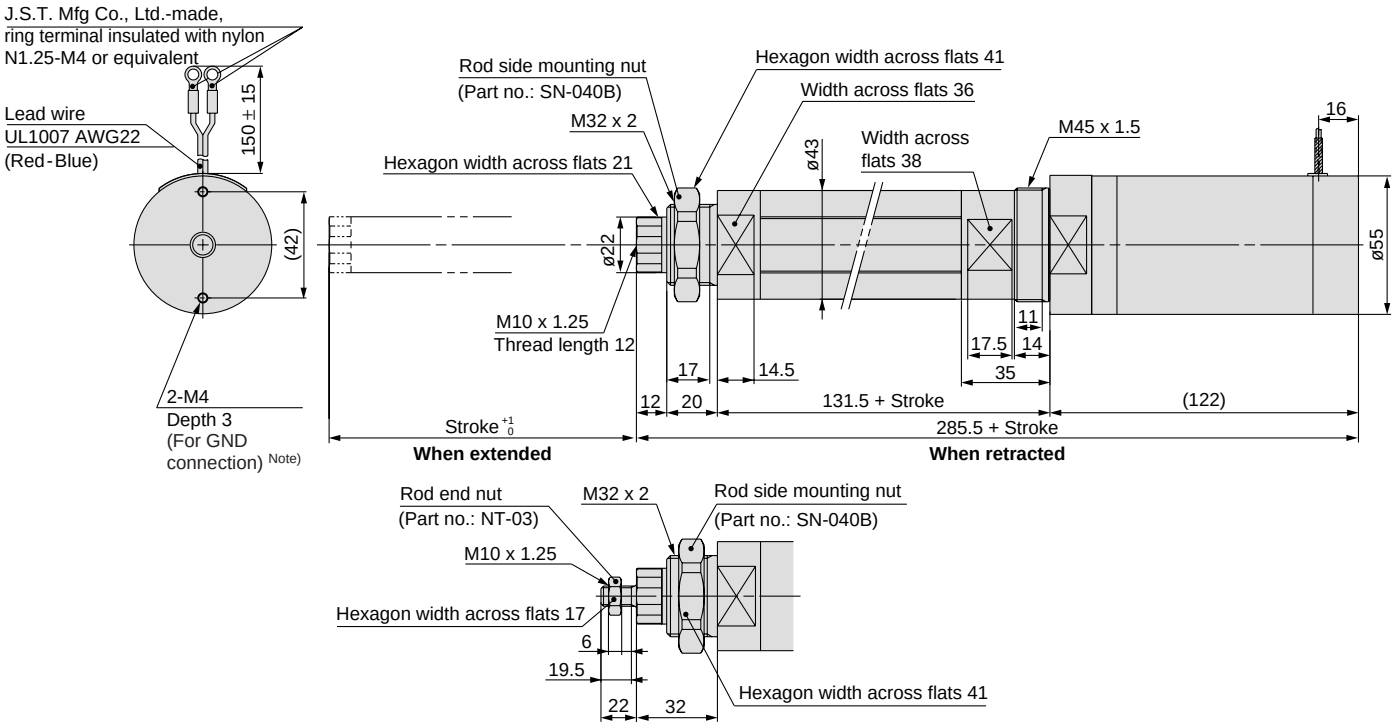
- Maximum stroke: 150 mm
- Thread lead L (lead 2 mm) only

Dimensions

Note) Grounding must be performed. For details, refer to back page 2.

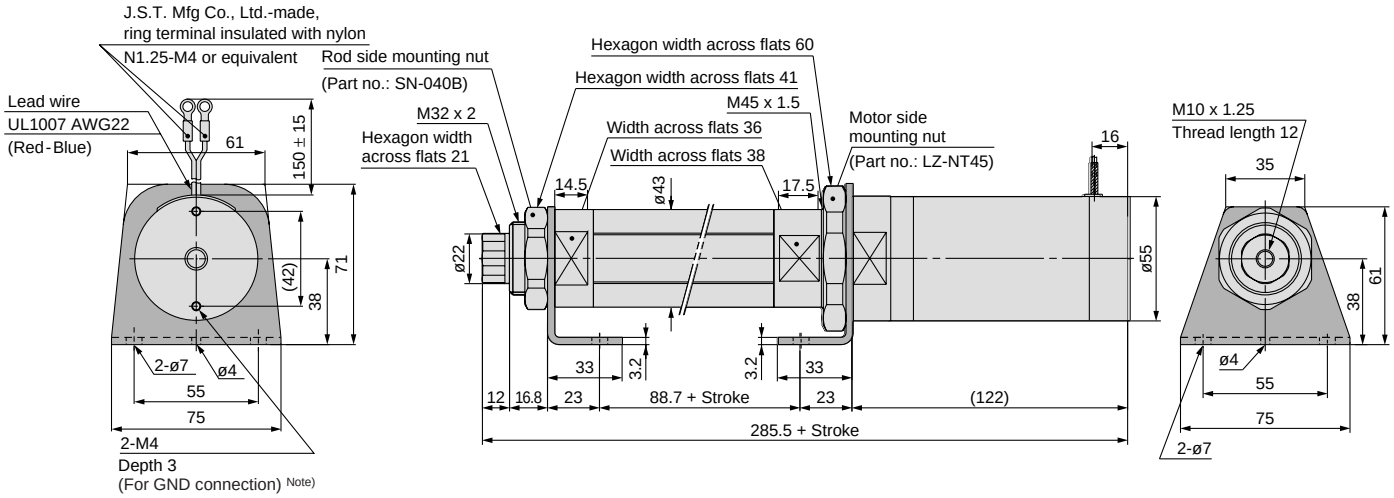
L(D)ZBB5□

∗ The electrical entry direction is different depending on a product.

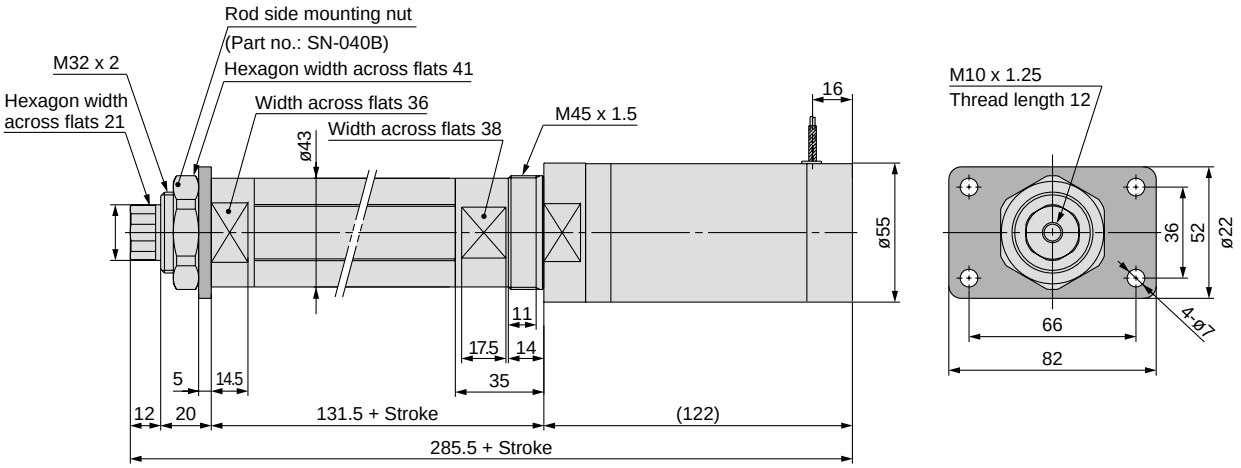


Rod end male thread: L

Axial foot style/L(D)ZBL5□

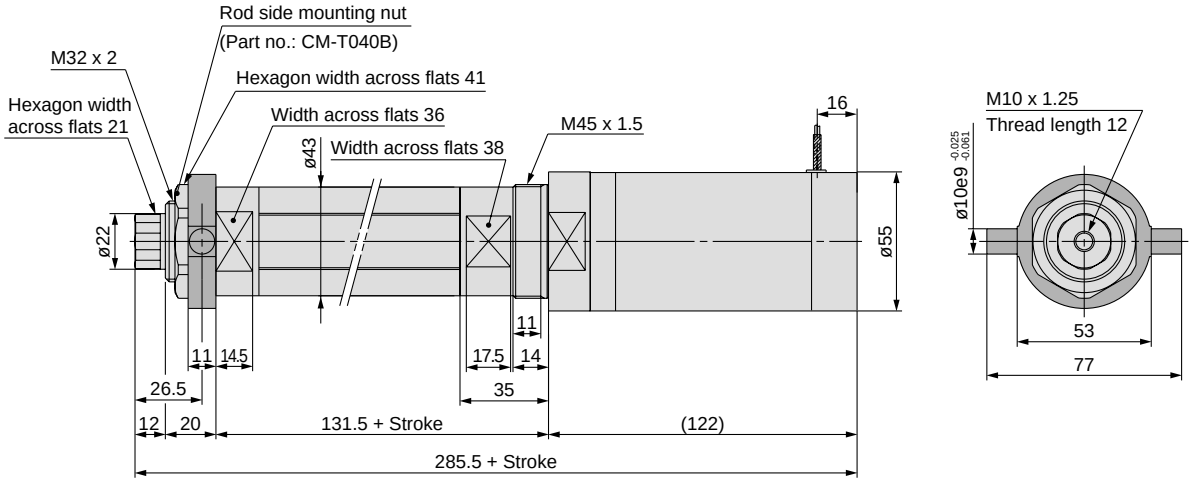


Rod flange style/L(D)ZBF5□



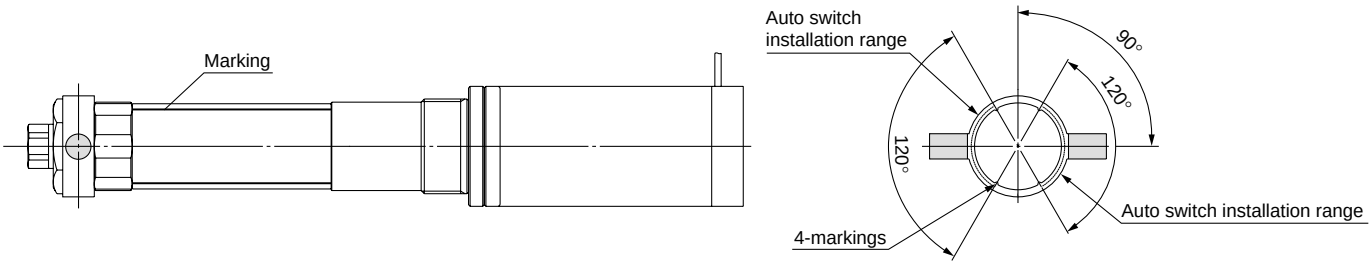
Dimensions

Rod trunnion style/L(D)ZBU5□



⚠Caution for using a trunnion bracket

In the event of mounting a trunnion bracket, fix it to the position illustrated below before using.



∗ Conditions for using a trunnion bracket are as follows:

- Maximum stroke: 150 mm
- Thread lead L (lead 2 mm) only

Electric Cylinder
Series LZC

How to Order

LZC **B** **3** **L** — **100** **A** **3** □ □

With auto switch **LDZC** **B** **3** **L** — **100** **A** **3** □ □ — **M9B** □

Built-in magnet

Mounting style

B	Basic style
L	Axial foot style

Cylinder size

3	Equivalent to ø16 cylinder Note)
5	Equivalent to ø25 cylinder Note)

Note) Equivalent to 0.4 MPa, theoretical output (lead 2mm)

Thread lead (mm)

L	Lead 2
M	Lead 6
H	Lead 12

Stroke (mm)
Refer to "Standard Stroke" table.

Motor type

A	DC motor

Motor size

3	Applicable cylinder size 3
5	Applicable cylinder size 5

Rod end thread

-	Female
L	Male

∗ When the cylinder is ordered with a male rod end thread, a rod end nut is included.

Cover specification

-	None
H	Partially covered
F	Fully covered

Auto switch

-	Without auto switch (Built-in magnet)

∗ Refer to the table below for auto switch model numbers.
∗ The auto switch is not mounted and is supplied separately at the time of shipment.

Number of auto switches

-	2 pcs.
S	1 pc.
n	n

Standard Stroke

Cylinder size	Standard stroke (mm) ∗
3, 5	25, 40, 50, 100, 200

∗ Other intermediate strokes can be manufactured upon receipt of order. (Maximum manufacturable stroke: 200 mm)

Applicable Auto Switches/For detailed auto switch specifications, refer to page 16 through to 18.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage		Auto switch model	Lead wire length (m) ∗			Pre-wired connector	Applicable load	
					DC	AC		0.5 (Nil)	3 (L)	5 (Z)			
Solid state switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	**M9N**	●	●	○	○	IC circuit	Relay PLC
				3-wire (PNP)			**M9P**	●	●	○	○		
				2-wire		12 V	**M9B**	●	●	○	○	—	

∗ Lead wire length symbols: 0.5 m ····· Nil (Example) M9N
3 m ····· L M9NL
5 m ····· Z M9NZ

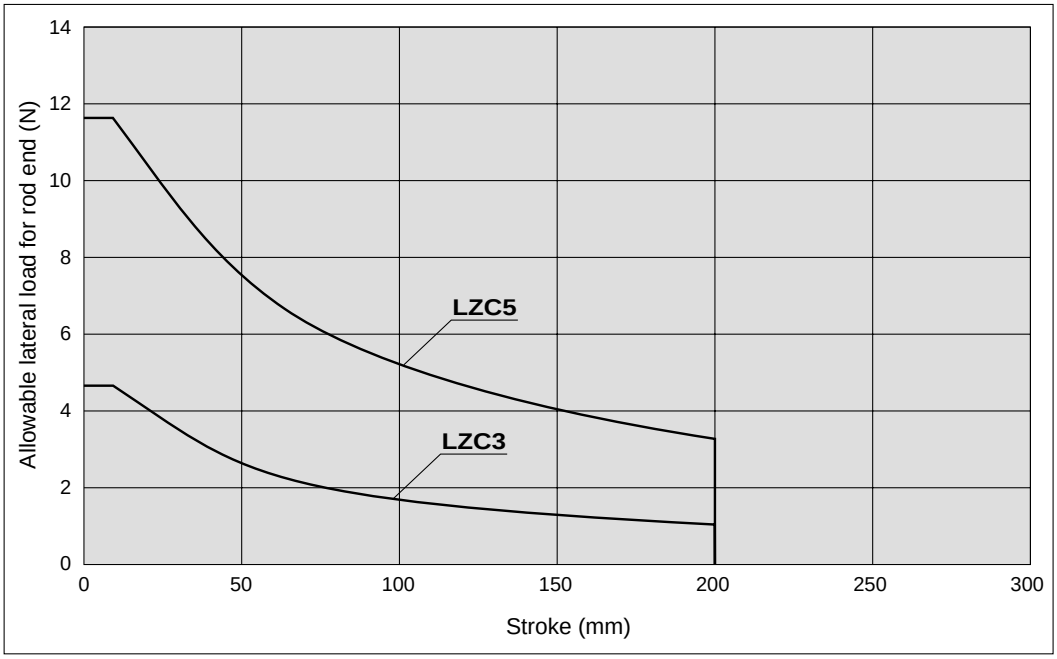
∗ Solid state switches marked "○" are produced upon receipt of order.

Specifications

Model		L□ZC□3L	L□ZC□3M	L□ZC□3H	L□ZC□5L	L□ZC□5M	L□ZC□5H
Size		3 (Equivalent to ø16 cylinder) Note 1)			5 (Equivalent to ø25 cylinder) Note 1)		
Lead screw	**Thread diameter**	ø8			ø12		
	Lead (mm)	2	6	12	2	6	12
Rated speed with no load (mm/s)		33	100	200	33	100	200
Rated thrust (N)		80	43	24	196	117	72
Stroke (mm)		25, 40, 50, 100, 200					
Main body (kg)*		0.72 + (0.03/50 stroke)			1.72 + (0.16/50 stroke)		
Lateral load for rod end (at maximum stroke) (kg)		0.1			0.24		
Operating ambient temperature (°C)		5 to 40 (with no condensation)					
Tolerance of rod end thread		JIS class 2					
Allowable tolerance of stroke		$^{+1}_{0}$					
Motor		DC motor					
Applicable directional control driver model		LC3F212-5A3□			LC3F212-5A5□		
Applicable auto switch model		D-M9N, M9P, M9B					

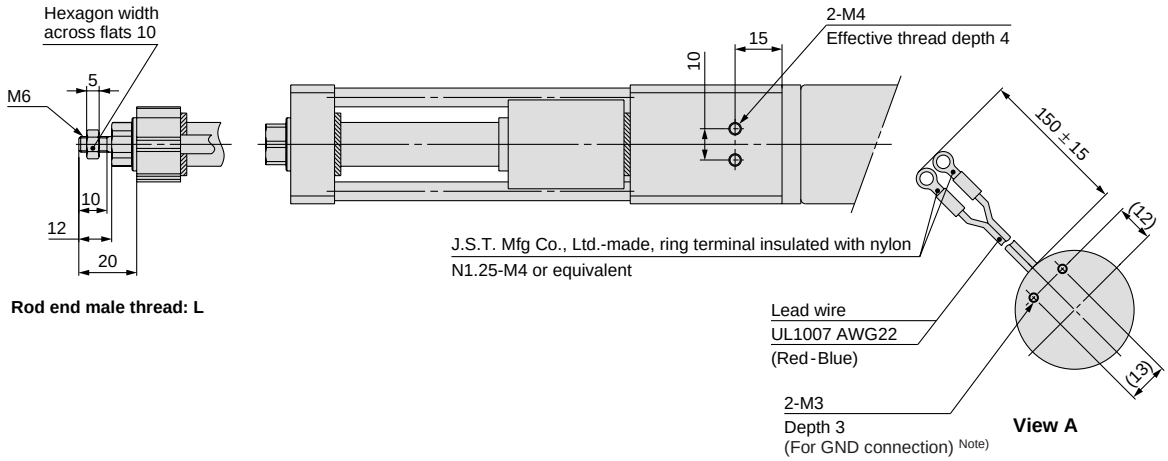
Note 1) Equivalent to 0.4 MPa, theoretical output (lead 2mm)
Note 2) The table speeds are shown without a load, as a rated speed, and thrusts are shown as a rated thrust based on the pressure force.
Note 3) Speed will vary as they are affected by a load. Refer to page 1 for model selection.
* Refer to page 13 for mounting bracket weight.

Allowable Lateral Load for Rod End

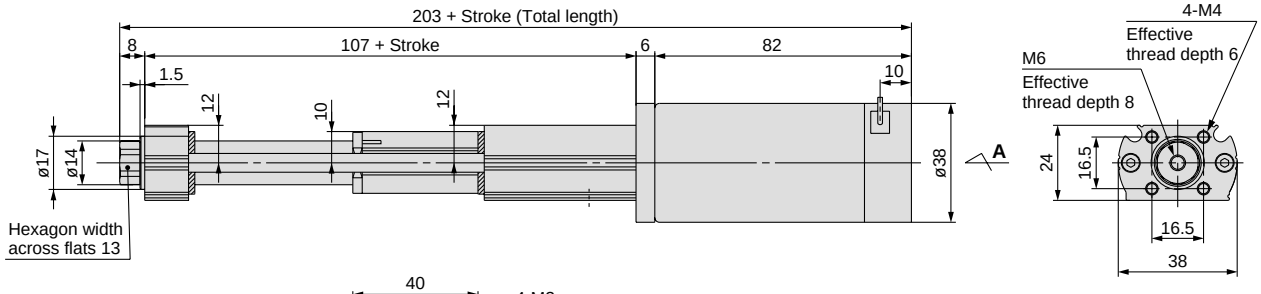


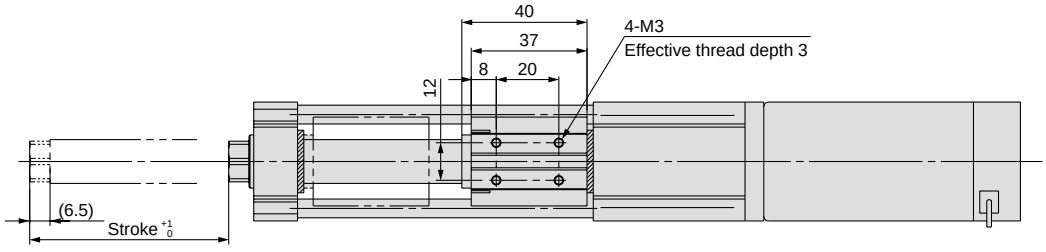
Dimensions
Note) Grounding must be performed. For details, refer to back page 2.

L(D)ZCB3□



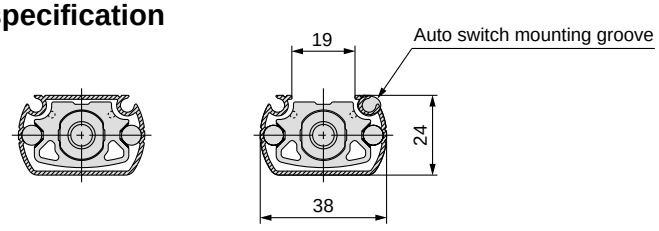
Rod end male thread: L





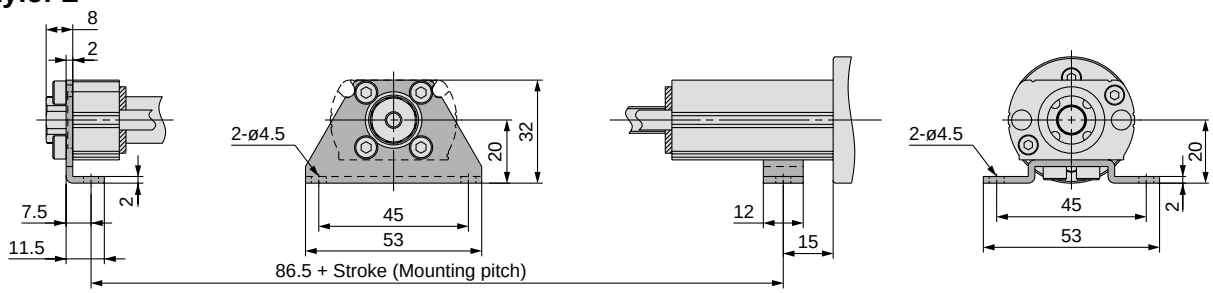
When extended When retracted

Cover specification



Fully covered: F Partially covered: H

Axial foot style: L

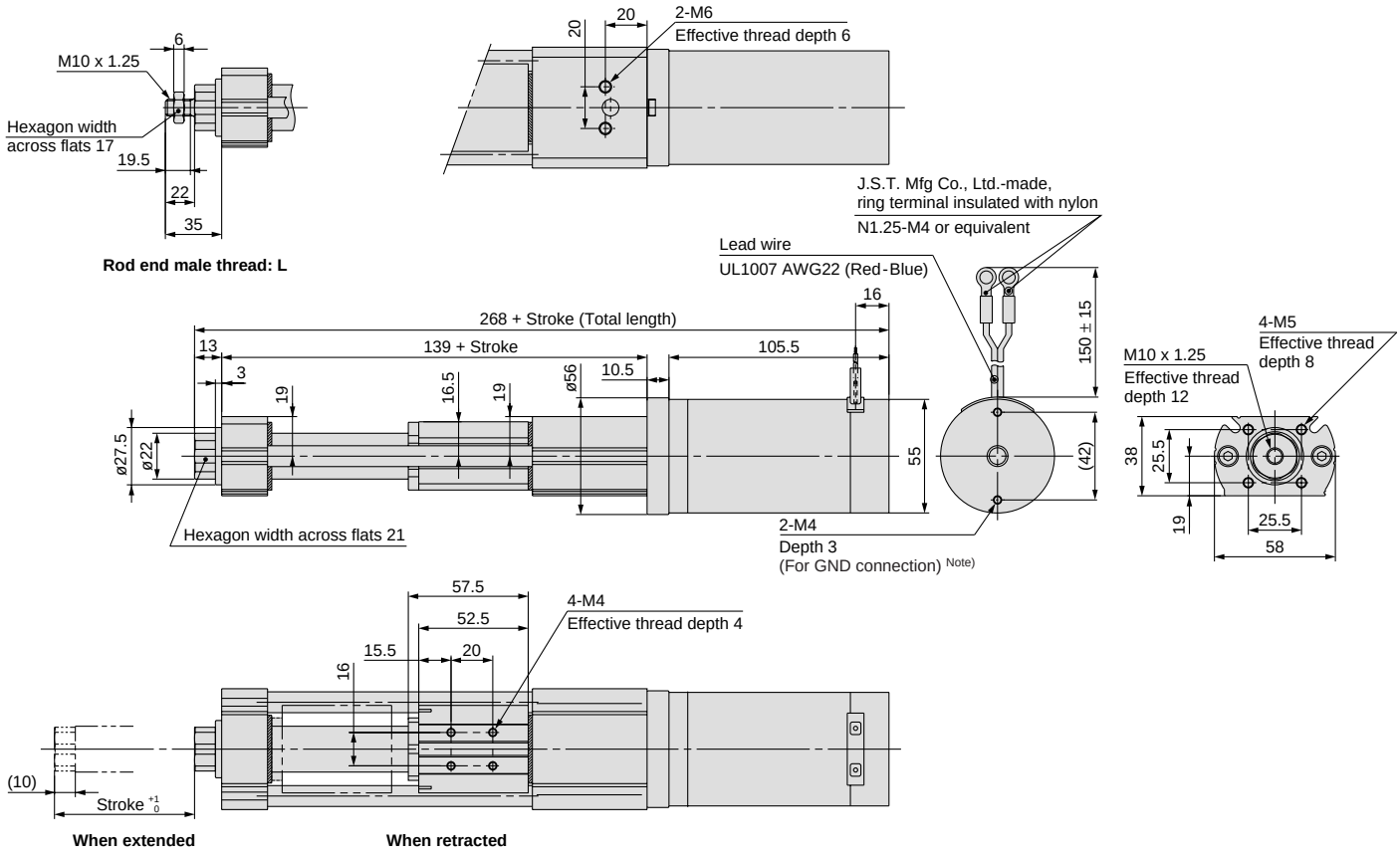


Foot (Rod cover side) Foot (Housing side)

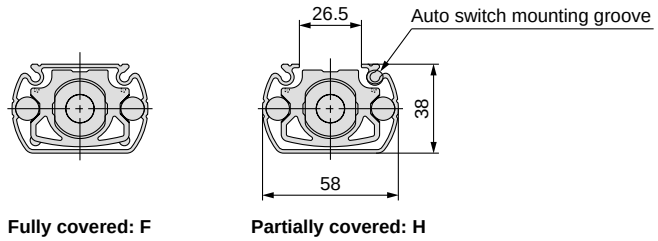
Dimensions

Note) Grounding must be performed. For details, refer to back page 2.

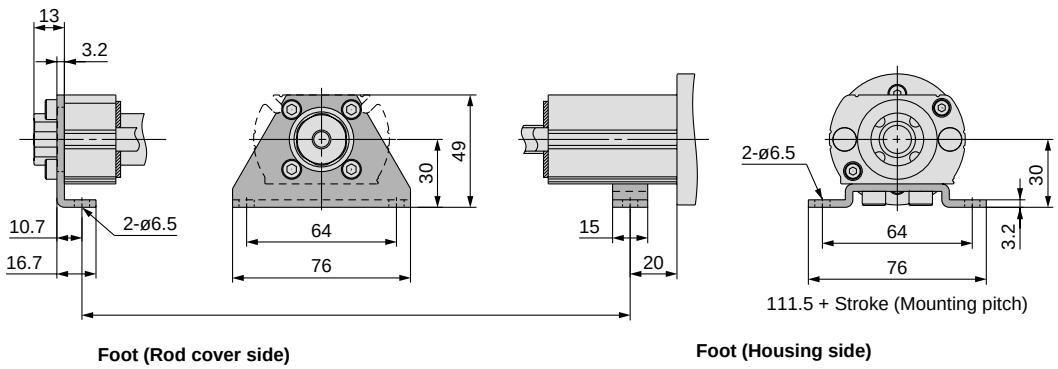
L(D)ZCB5□



Cover specification



Axial foot style: L



LZB/C Vertical Application Specifications

Some of the LZ series can be used in vertical applications.
However, please check before using vertically.

Never apply a force exceeding the prescribed force.
When a force exceeding the transfer thrust is applied, the cylinder and directional control driver (LC3F2) may be damaged.

Model which can be used vertically

- **L(D)ZB□3L-□A3□-□□**
- **L(D)ZC□3L-□A3□□-□□**
- **L(D)ZB□5L-□A5□-□□**
- **L(D)ZC□5L-□A5□□-□□**

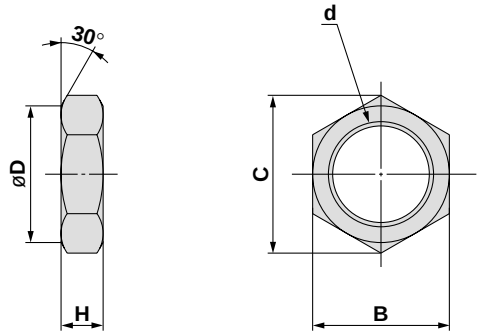
Specifications

Model	L(D)ZB□3L	L(D)ZC□3L	L(D)ZB□5L	L(D)ZC□5L
Speed (mm/s)	P.1 Refer to the graph on speed – thrust.			
Transfer thrust (Vertically) (N)	40		100	
Holding force* (N)				
Standard stroke (mm)	25, 40, 50, 100, 200			
Operating ambient temperature (°C)	5 to 40 (with no condensation)			
Motor	DC motor			
Applicable direcitonal control driver model	LC3F212-5A3□		LC3F212-5A5□	
Applicable auto switch model	D-M9N, D-M9P, D-M9B			

* Holding force
Holding force means the force which cannot be dropped even if a load should be applied vertically when a cylinder is stopped.
However, holding is not possible when turning off the power supply after a cylinder has been activated.
Additionally, a load may be dropped due to external impacts or vibrations.

Accessory Bracket

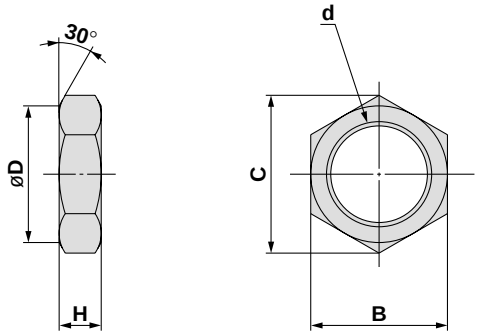
Mounting nut



(mm)

Name	Part no.	Applicable series	B	C	D	d	H
Rod side mounting nut	**SN-020B**	LZB3	26	30	25.5	M20 x 1.5	8
Motor side mounting nut	**LZ-NT30**	LZB3	38	42	38	M30 x 1.5	10
Rod side mounting nut	**SN-040B**	LZB5	41	47.3	40.5	M32 x 2.0	10
Motor side mounting nut	**LZ-NT45**	LZB5	60	64	60	M45 x 1.5	10

Rod end nut



(mm)

Part no.	Applicable series	B	C	D	d	H
NT-015A	LZ□3	10	11.5	9.8	M6	5
NT-03	LZ□5	17	19.6	16.5	M10 x 1.25	6

Mounting Bracket/Part No.

Series	**LZB3**	**LZB5**
Rod side foot	LZB-LR3 (64 g)	LZB-LR5 (112 g)
Motor side foot	LZB-LM3 (64 g)	LZB-LM5 (126 g)
Flange	LZB-F3 (40 g)	LZB-F5 (120 g)
Rod side trunnion	CM-T020B (40 g)	CM-T040B (100 g)

( ): Weight for bracket

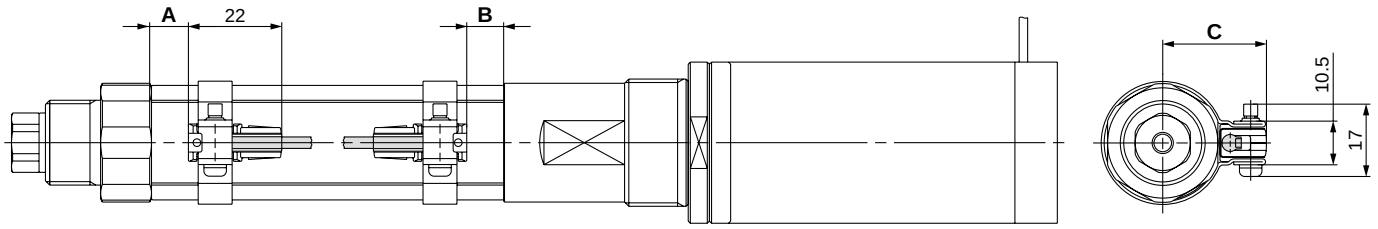
Series	**LZC3**	**LZC5**
Rod side foot	LZC-LR3 (21 g)	LZC-LR5 (71 g)
Motor side foot	LZC-LM3 (10 g)	LZC-LM5 (27 g)

( ): Weight for bracket
Note) Bolts for securing the feet to the mounting surface need to be supplied by the customer.

Auto Switch Proper Mounting Position for Stroke End Detection and Mounting Height

Solid state auto switch
D-M9□

LDZB



Auto Switch Mounting Position/Height

Model	A	B	C
LDZB□3	20	19	24
LDZB□5	33	33	32

Operating Range of Auto Switch *

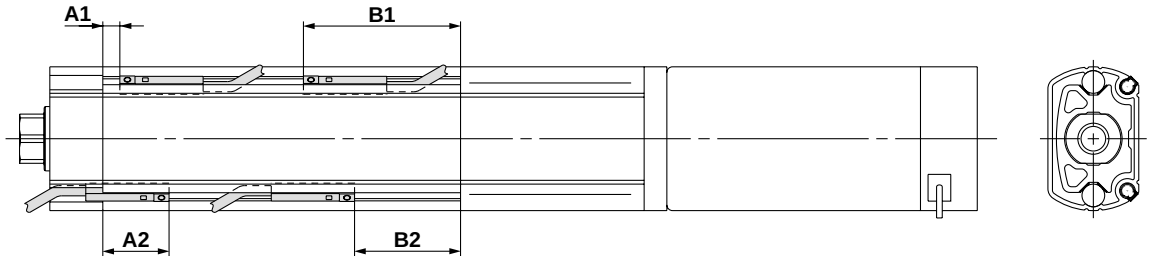
Model	A
LDZB□3	3
LDZB□5	5

* The operating range is a guide including hysteresis, but is not guaranteed. There may be substantial variation depending on the surrounding environment (assuming approximately ±30% dispersion).

Minimum Stroke for Auto Switch Mounting

Model	1 pc.	2 pcs. (Different sides)	2 pcs. (Same sides)
LDZB□3	10	15	45
LDZB□5	10	15	45

LDZC



Auto Switch Mounting Position for Stroke End Detection

Model	A1	A2	B1	B2
LDZC□3	4.5	17.5	41.5	28
LDZC□5	7	57	20	44

Operating Range of Auto Switch *

Model	A
LDZC□3	2
LDZC□5	2

* The operating range is a guide including hysteresis, but is not guaranteed. There may be substantial variation depending on the surrounding environment (assuming approximately ±30% dispersion).

Minimum Stroke for Auto Switch Mounting

Model	1 pc.	2 pcs.
LDZC□3	5	10
LDZC□5	5	10

Mounting and Moving Auto Switches (Series LDZB Only)

Mounting the Auto Switch

① Attach a switch bracket to the switch holder.
(Fit the switch bracket to the switch holder.)
② Mount an auto switch mounting band to the cylinder tube.
③ Set the switch holder ① between the reinforcing plates of the band mounted to the cylinder.
④ Insert a switch mounting screw in the hole of the reinforcing plate through the switch holder, and thread it into the other plate. Tighten the screw temporarily.
⑤ Remove the set screw attached to the auto switch.
⑥ Attach a switch spacer to the auto switch.
⑦ Insert the auto switch with the switch spacer from the back of the switch holder.
(Insert the auto switch with an angle of approximately 10 to 15°. See figure 1.)
⑧ To secure the auto switch, tighten the switch mounting screw with the specified torque (0.8 N•m to 1.0 N•m).

Adjusting the Switch Position

1. Unloosen the switch mounting screw 3 turns to adjust the switch set position.
2. Tighten the screw as described above ⑧ after adjustment.

Removing the Auto Switch

1. Remove the switch mounting screw from the switch holder.
2. Move the switch back towards the position where it stops at the lead wire side.
3. Hold up the lead wire side of the switch at the angle of around 45°.
4. Maintain the angle, and pull back the switch obliquely at the same angle.

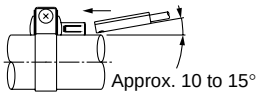
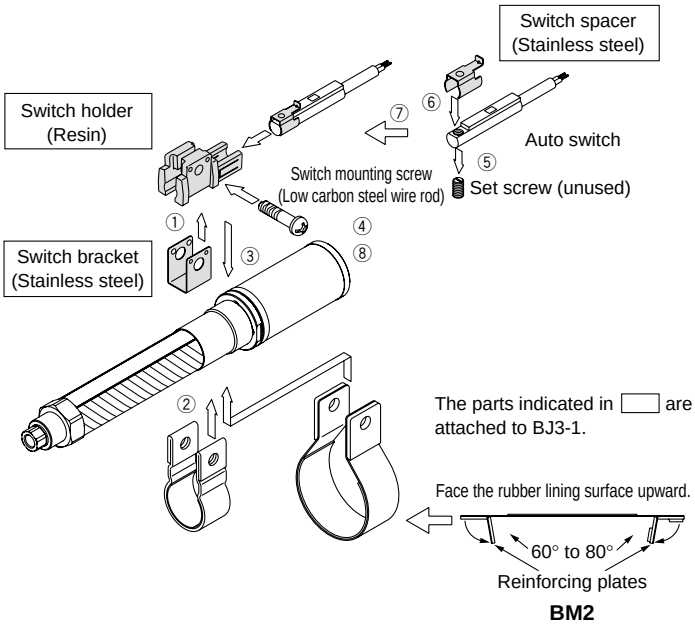


Figure 1. Switch insert angle



Auto Switch Mounting Bracket/Part No.

Applicable series	Mounting bracket	Mounting band
LDZB□3	BJ3-1 (Switch holder, Switch spacer, Switch bracket)	BM2-025
LDZB□5		L1ZB45-0318

Order one mounting bracket and one mounting band per auto switch.

⚠Specific Product Precautions

Be sure to read before handling. Refer to "SMC Best Pneumatics 2004" catalogue for Safety Instructions and Auto Switches Precautions.

⚠Caution

1. Mount the auto switches at the centre of the operating range.
Check ON and OFF points before setting auto switches so that positions can be detected at the centre of the operating range.
If mounted at the end of the operating range, the signal detection will be unstable.

2. Be aware of the environment temperature and thermal cycle.
Operate auto switches and auto switch cylinders within the operating temperature range.
The reliability of the auto switches may be adversely affected, especially, when they are exposed to thermal shock, severe temperature and humidity cycle etc.

3. Be aware of the suitability of oil, chemicals etc.
Resin and rubber materials are used for the auto switches and switch mounting brackets. Therefore, if there are chemicals such as oil or organic solvents in the environment, the resin and rubber materials may be adversely affected.

4. During maintenance, securely tighten the switch mounting screws periodically.
Use switch mounting brackets with the proper tightening torque. In addition, securely tighten the switch mounting screws periodically.

5. Be careful not to pull or strain the lead wires.
Be careful not to apply excess tensile force (over 10 N) to the auto switches. Also, adjust the position of the auto switches by sufficiently loosening the screws (3 turns or more).

6. Do not use the auto switches in environments with strong vibration and impact.
Do not use the auto switches in environments where excess vibration and impact force outside of the specifications are applied.

7. Be sure to use a switch spacer and a switch bracket.
Confirm that a switch spacer is mounted to the end of the auto switch before fastening the auto switch. If the switch bracket is not mounted, the auto switch may move after installation.

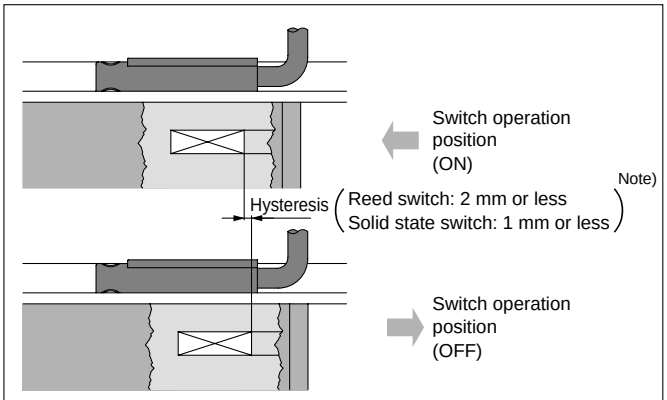
Auto Switch Specifications

Auto Switch Common Specifications

Type	**Solid state switch**
Leakage current	3-wire: 100 μA or less 2-wire: 0.8 mA or less
Operating time	1 ms or less
Impact resistance	1000 m/s^2
Insulation resistance	50 MΩ or more at 500 VDC Mega (between lead wire and case)
Withstand voltage	1000 VAC for 1 minute (between lead wire and case)
Ambient temperature	–10 to 60°C
Enclosure	IEC529 standard IP67, JIS C 0920 waterproof construction

Auto Switch Hysteresis

The hysteresis is the difference between the position of the auto switch as it turns “on” and as it turns “off”. A part of operating range (one side) includes this hysteresis.



Note) Hysteresis may fluctuate due to the operating environment. Contact SMC if hysteresis causes an operational problem.

Lead Wire Length

Lead wire length indication

(Example) **D-M9P L**

Lead wire length

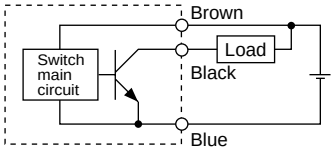
-	0.5 m
L	3 m
Z	5 m

Note 1) Applicable auto switch with 5 m lead wire “Z”
Solid state switch: Manufactured upon receipt of order as standard.

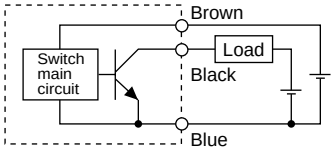
Series LZB/LZC
Auto Switch Connections and Examples

Basic Wiring

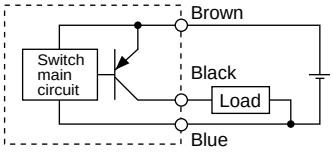
Solid state 3-wire, NPN



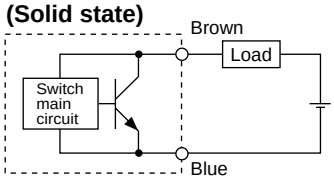
(Power supplies for switch and load are separate.)

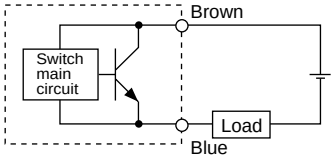


Solid state 3-wire, PNP



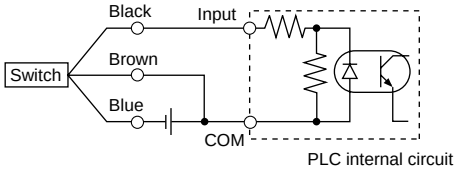
2-wire (Solid state)



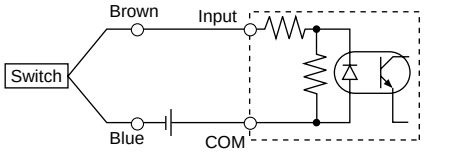


Example of Connection to PLC (Programmable Logic Controller)

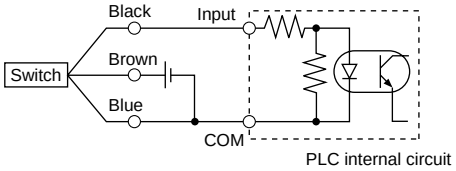
• Sink input specifications
3-wire, NPN



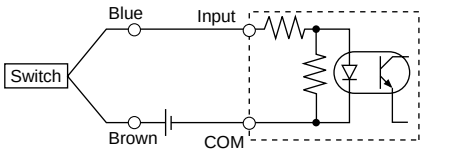
2-wire



• Source input specifications
3-wire, PNP



2-wire

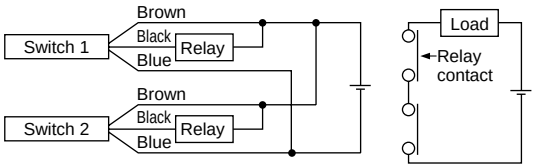


Connect according to the applicable PLC input specifications, as the connection method will vary depending on the PLC input specifications.

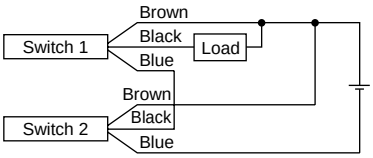
Example of AND (Serial) and OR (Parallel) Connection

● **3-wire**

AND connection for NPN output (using relays)

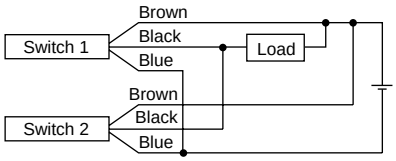


AND connection for NPN output (performed with switches only)

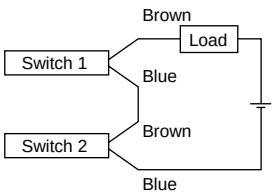


The indicator lights will light up when both switches are turned ON.

OR connection for NPN output



2-wire with 2-switch AND connection

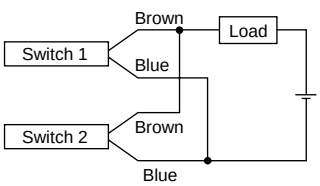


When two switches are connected in series, a load may malfunction because the load voltage will decline when in the ON state.
The indicator lights will light up if both of the switches are in the ON state.

Load voltage at ON = $\frac{\text{Power supply voltage}}{} - \frac{\text{Internal voltage drop}}{}$ x 2 pcs.
= 24 V - 4 V x 2 pcs.
= 16 V

Example: Power supply is 24 VDC.
Internal voltage drop in switch is 4 V.

2-wire with 2-switch OR connection



(Solid state)
When two switches are connected in parallel, a malfunction may occur because the load voltage will increase when in the OFF state.

Load voltage at OFF = Leakage current x 2 pcs.
x Load impedance
= 1 mA x 2 pcs. x 3 kΩ
= 6 V

Example: Load impedance is 3 kΩ.
Leakage current from switch is 1 mA.

Solid State Switch: Direct Mounting Style
D-M9N/D-M9P/D-M9B

Grommet

- **2-wire load current is reduced (2.5 to 40 mA)**
- **Lead-free**
- **UL certified (style 2844) lead cable is used.**

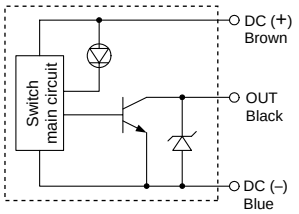
⚠Caution

Operating Precautions

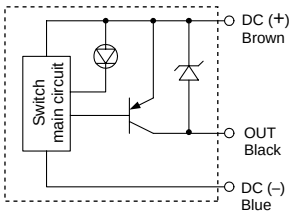
Fix the switch with the existing screw installed on the switch body. The switch may be damaged if a screw other than the one supplied, is used.

Auto Switch Internal Circuit

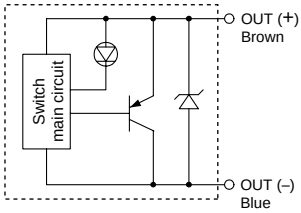
D-M9N



D-M9P



D-M9B



Auto Switch Specifications

For details about certified products conforming to international standards, visit us at www.smcworld.com.

PLC: Programmable Logic Controller

D-M9□ (With indicator light)			
Auto switch part no.	**D-M9N**	**D-M9P**	**D-M9B**
Electrical entry direction	In-line		
Wiring type	3-wire		2-wire
Output type	NPN	PNP	—
Applicable load	IC circuit, Relay, PLC		24 VDC relay, PLC
Power supply voltage	5, 12, 24 VDC (4.5 to 28 V)		—
Current consumption	10 mA or less		—
Load voltage	28 VDC or less	—	24 VDC (10 to 28 VDC)
Load current	40 mA or less		2.5 to 40 mA
Internal voltage drop	0.8 V or less		4 V or less
Leakage current	100 μA or less at 24 VDC		0.8 mA or less
Indicator light	Red LED illuminates when ON.		

- Lead wires
  Oilproof heavy duty vinyl cable: ø2.7 x 3.2 ellipse, 0.15 mm^2,
  D-M9B 0.15 mm^2 x 2 cores
  D-M9N, D-M9P 0.15 mm^2 x 3 cores

Note 1) Refer to page 16 for solid state switch common specifications.
Note 2) Refer to page 16 for lead wire lengths.

Weight

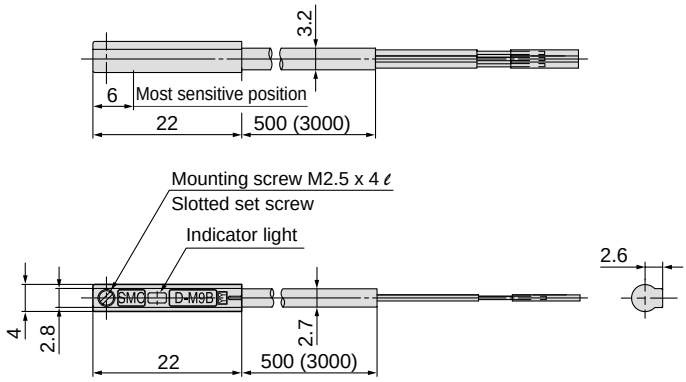
Unit: g

Auto switch part no.		**D-M9N**	**D-M9P**	**D-M9B**
Lead wire length (m)	0.5	8	8	7
	3	41	41	38
	5	68	68	63

Dimensions

Unit: mm

D-M9□



Directional Control Driver for Electric Cylinder

Series LC3F2

LC3F212-5A3□ *LC3F212-5A5□*

Able to control the stroke with only ON/OFF signals.

Directional control driver works like a solenoid valve

Able to optionally set the thrust.

Thrust can be adjusted by an adjustment trimmer.

Able to control with only 3 different types of input signal.

① Directional instruction ② Thrust selection ③ Output ON/OFF

Can be operated manually.

Easy maintenance performance for checking wiring.

Product Specifications

Model	LC3F212-5A3□	LC3F212-5A5□
Power supply voltage	24 VDC ± 10%	
	Max. 1.3 A	Max. 2.3 A
Front side label colour	Gray	Blue
Input signal	Photocoupler input 24 VDC ±10% Max. 8 mA/point	
Selction of thrust	100% or set value (setting range 10 to 70% F.S.)	
Operating temperature range	+5 to 40°C	
Operating humidity range	35 to 85% Rh (with no condensation)	
Environment	Indoor (Direct sunlight should be avoided.) No corrosive gas, inflammable gas, oil mist or dust particle	
Display LED	POWER, A-PHASE, OFF, SET	
Weight	145 g	

Directional Control Driver for Electric Cylinder

Series LC3F2

How to Order

LC3 F2 12 − 5 A3 B

Series

F2	Small sized DC motor driver

Power supply

5	24 VDC

Applicable motor

A3	DC motor (cylinder size 3)
A5	DC motor (cylinder size 5)

Housing set (Connector set)

A	Housing for CN1, 2, 3 (connector) & contact (connector pin) are included as an accessory.
B	Nothing included.

Option

● Cable for power supply terminal

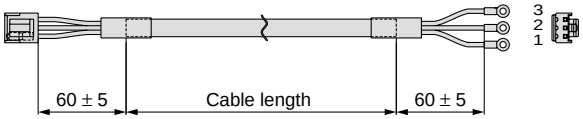
LC3F2 − 1 − C1 − 02 − 1

Cable type

C1	Cable for CN1 power supply terminal

Cable length

01	1 m
02	2 m



CN1 Power Supply Terminal Table

Terminal	Function	Pin number	Optional cable colour
FG	Frame ground	1	Yellow/Green
DC (+)	Driver power supply (+24 V)	2	Brown
DC (–)	Driver power supply (0 V)	3	Blue

● Cable for control terminal

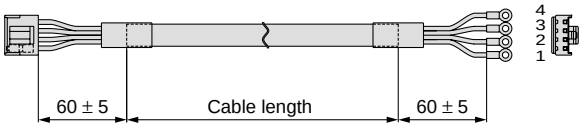
LC3F2 − 1 − C2 − 02 − 1

Cable type

C2	Cable for CN2 control terminal

Cable length

01	1 m
02	2 m



CN2 Control Terminal Table

Terminal	Function		Pin number	Optional cable colour
COM	Common terminal		1	White
ON	Output ON command input	ON: Motor output	2	Red
		OFF: No motor output		
SET	Adjusted thrust command input	ON: Adjusted thrust	3	Yellow
		OFF: 100% thrust (Max. thrust)		
A-PHASE	Traveling direction command input	ON: A-PHASE (Retracted side)	4	Orange
		OFF: B-PHASE (Extended side)		

● Cable for motor output terminal

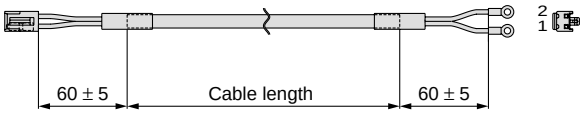
LC3F2 − 1 − C3 − 02 − 1

Cable type

C3	Cable for CN3 motor output terminal

Cable length

02	2 m
05	5 m



CN3 Motor Output Terminal Table

Terminal	Function	Pin number	Optional cable colour
OUTA	Motor output A (Blue)	1	Blue
OUTB	Motor output B (Red)	2	Red

● Housing set (Connector set)

LC3F2 − 1 − C0

Housing for power supply terminal (Connector)	1 pc.	VHR-3N: (J.S.T. Mfg Co., Ltd.)
Housing for control terminal (Connector)	1 pc.	VHR-4N: (J.S.T. Mfg Co., Ltd.)
Housing for motor output terminal (Connector)	1 pc.	VHR-2N: (J.S.T. Mfg Co., Ltd.)
Contact (Connector pin)	12 pcs.	BVH-21T-P1.1: (J.S.T. Mfg Co., Ltd.)

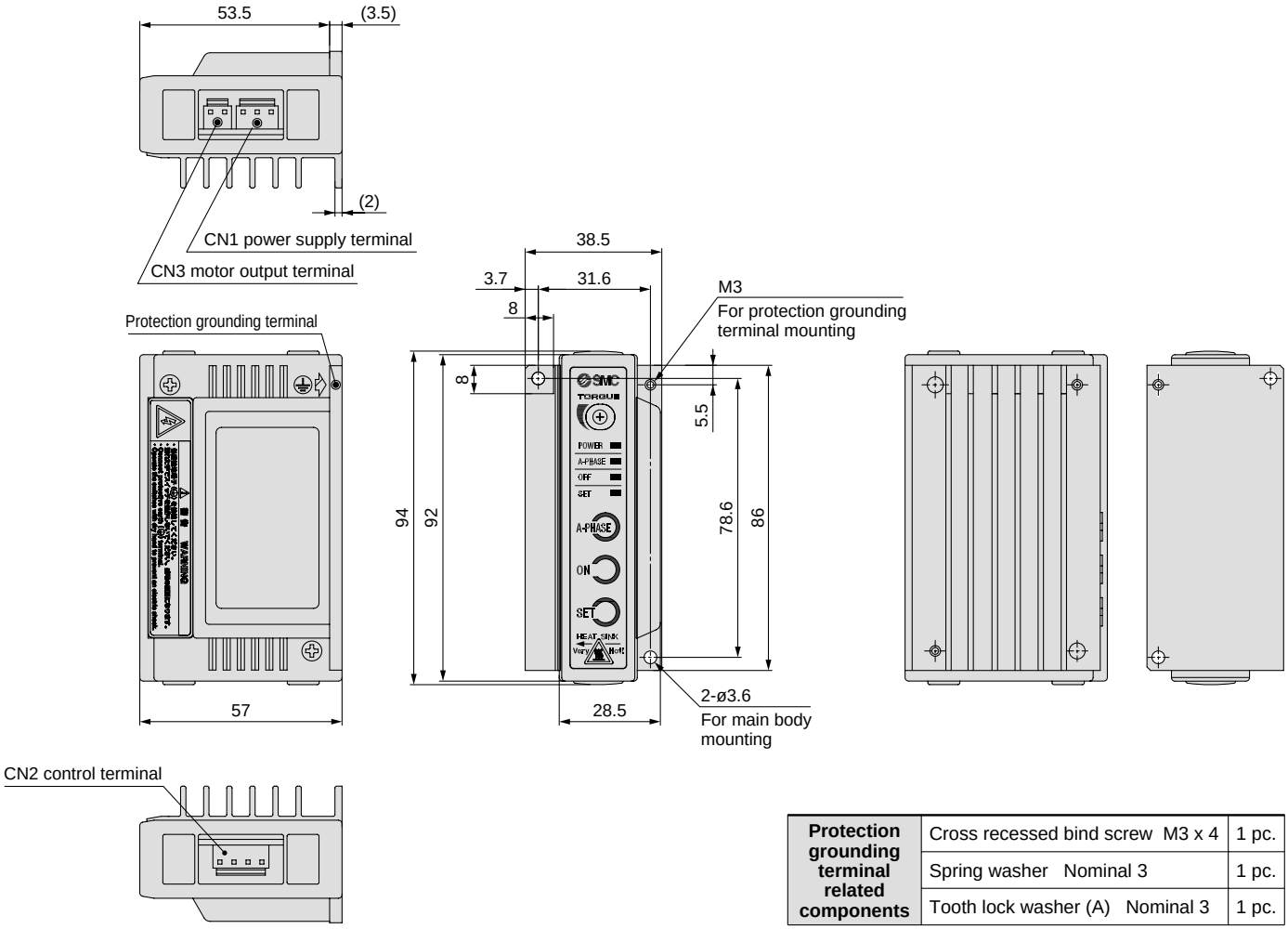
⚠ Caution

- **Do not apply repetitive bending or pulling stress to the cable.**
  Wiring with repetitive bending or pullling stress to the cable will likely cause the cable to break.
- **In the event of crimping the contact (connector pin) and wire, use the specified tools as well as the recommended cable.**
  Crimping tool: YC-160R (J.S.T. Mfg Co., Ltd.)
  Pulling tool: EJ-NV (J.S.T. Mfg Co., Ltd.)
  Recommended cable connection (common for individual cable) AWG21 (0.5 mm²), Insulated wire O.D. 1.7 to 3.0 mm with shield,
  Heat resistance is more than 80°C.
  Maximum cable length
  - CN1 cable for power supply terminal 2 m
  - CN2 cable for control terminal 2 m
  - CN3 cable for motor output terminal 5 m
- **Shield is attached with an optional cable for the LC3F2 series.**
  When grounding a shield, remove the sheath and use a metal U-crip or P-crip.

Applicable Cylinder Table

Cylinder part no.	Applicable directional control driver
L□Z□3□-□□□A3□□-□□□□	**LC3F212-5A3□**
L□Z□5□-□□□A5□□-□□□□	**LC3F212-5A5□**

Dimensions



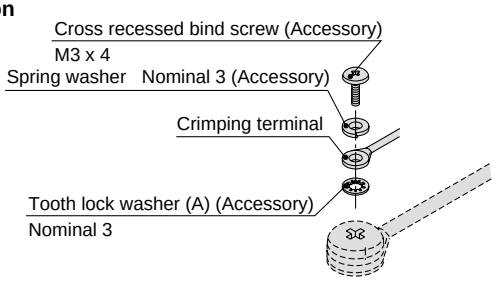
Protection grounding terminal related components	Cross recessed bind screw M3 x 4	1 pc.
	Spring washer Nominal 3	1 pc.
	Tooth lock washer (A) Nominal 3	1 pc.

Components for mounting the protection grounding terminal are provided together with the product.

How to Mount

Mount the directional control driver vertically against the wall, using two mounting screw holes, so that the front side (on which the adjustment trimmer and manual switch are located) is facing the operator.

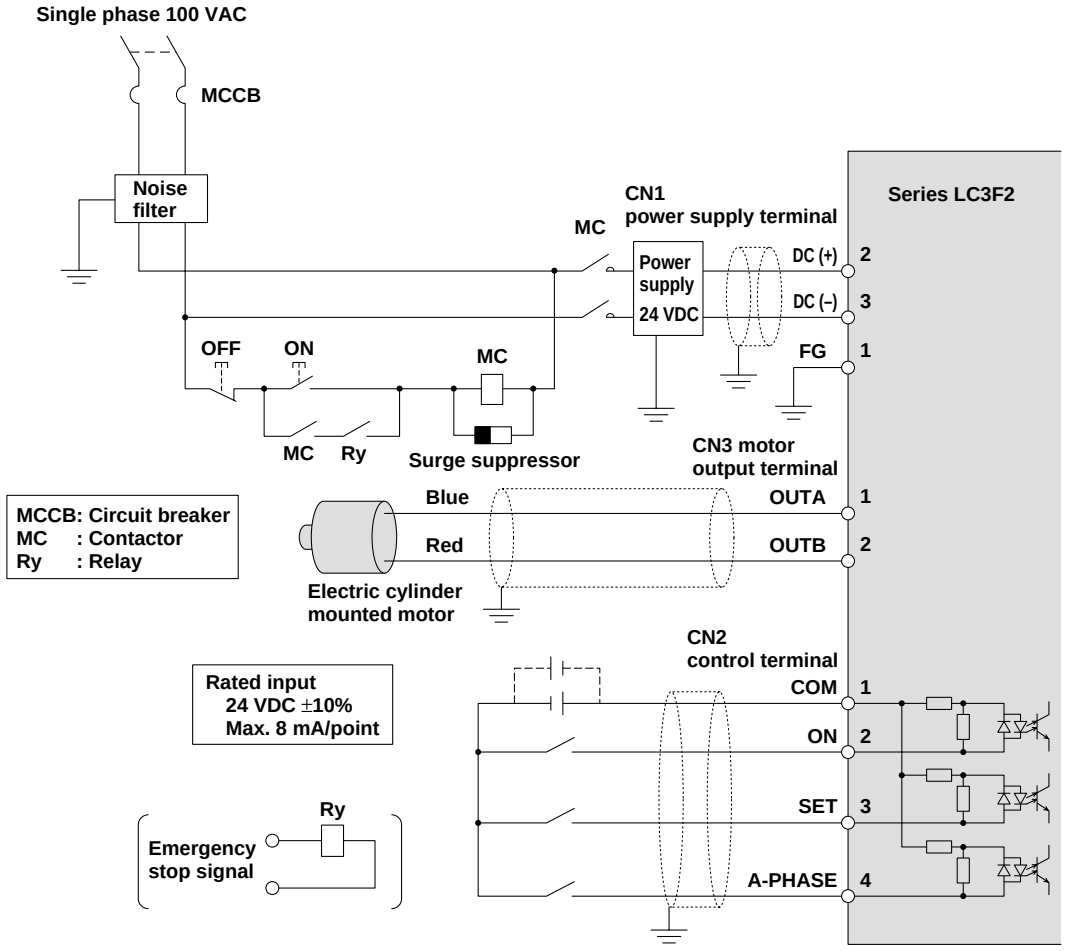
Applicable mounting screw: M3 (2 pcs.) [to be supplied by customer]



∗ **How to mount the protection grounding terminal**

Crimping terminal and grounding cable are supplied by customer.

Wiring Example

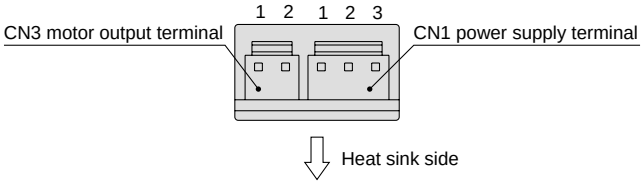


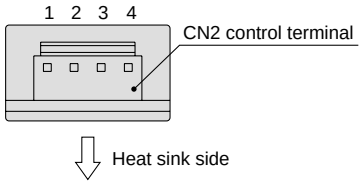
For System Chart, refer to Features 1.

⚠Caution

There is no emergency stop function or power supply switch in the directional control driver. Please be sure to provide an emergency stop and power supply insulation (insulator) device as part of the total machine equipment, referencing the above wiring examples. Also, please be sure to turn off the power supply for the whole equipment prior to wiring the directional control driver.

How to wire





CN1 Power Supply Terminal

Pin no.	Terminal	Function
1	FG	Frame ground
2	DC (+)	Driver power supply (+24 V)
3	DC (–)	Driver power supply (0 V)

Housing: VHR-3N (J.S.T. Mfg Co., Ltd.)
Contact: BVH-21T-P1.1 (J.S.T. Mfg Co., Ltd.)

CN3 Motor Output Terminal

Pin no.	Terminal	Function
1	OUTA	Motor output A (Blue wire)
2	OUTB	Motor output B (Red wire)

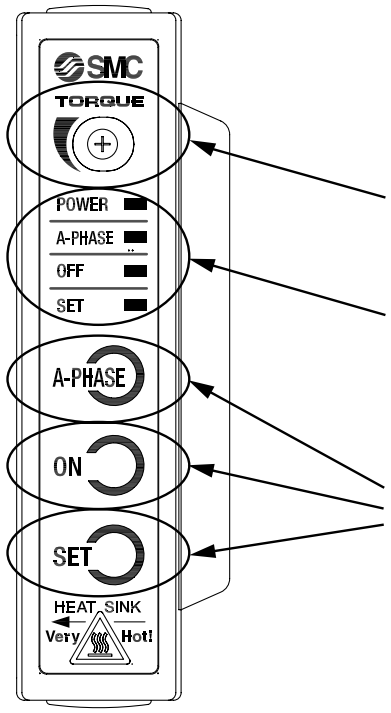
Housing: VHR-2N (J.S.T. Mfg Co., Ltd.)
Contact: BVH-21T-P1.1 (J.S.T. Mfg Co., Ltd.)

CN2 Control Terminal

Pin no.	Terminal	Function	
1	COM	Common terminal	
2	ON	Output ON command input	ON: Motor output
			OFF: No motor output
3	SET	Adjusted thrust command input	ON: Adjusted thrust
			OFF: 100% thrust (Max. thrust)
4	A-PHASE	Traveling direction command input	ON: A-PHASE (Retracted side) Note)
			OFF: B-PHASE (Extended side) Note)

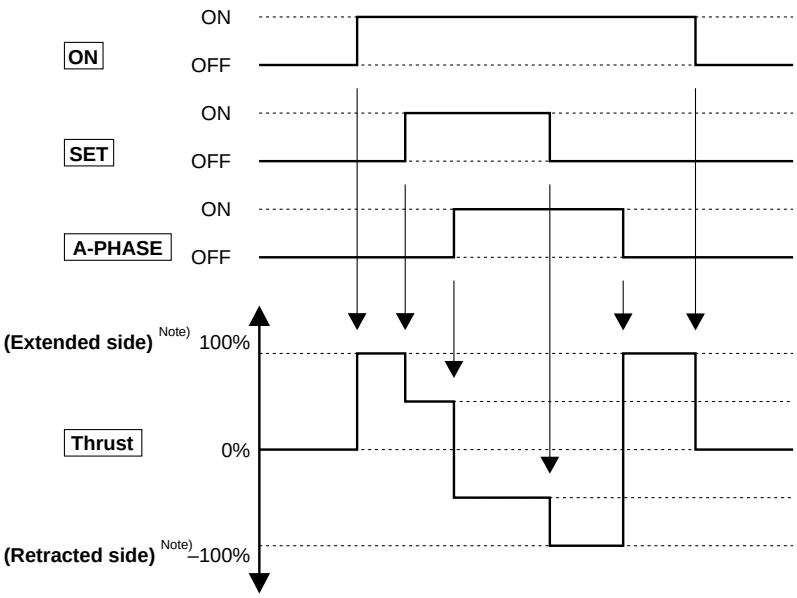
Housing: VHR-4N (J.S.T. Mfg Co., Ltd.)
Contact: BVH-21T-P1.1 (J.S.T. Mfg Co., Ltd.)
Note) For the travelling direction (retracted, extended side), refer to the dimensions on pages 4, 6, 10 and 11.

Description of Each Part and its Function



Category	Description	Details
Trimmer	**Thrust adjustment trimmer**	Thrust changes through adjustment.
Indicator light	**POWER**	Light illuminates when power is supplied.
	A-PHASE	Light illuminates by A-PHASE command. (Travelling to the retracted side when illuminated)
	OFF	Light illuminates when turning OFF. (No motor output is generated when illuminated.)
	SET	Light illuminates by SET command. (When illuminated, the thrust set by the thrust adjustment trimmer will be outroutted.)
Manual switch	**A-PHASE**	A-PHASE command while pressing (Travelling to the retracted side)
	ON	ON command while pressing (Motor output will be generated.)
	SET	SET command while pressing (Thrust set by the thrust adjustment trimmer will be outputted.)

Timing Chart



Note) For the travelling direction (retracted, extended side), refer to the dimensions on pages 4, 6, 10 and 11.

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Contact: BVH-21T-P1.1 (J.S.T. Mfg Co., Ltd.)
Note) For the travelling direction (retracted, extended side), refer to the dimensions on pages 4, 6, 10 and 11.

Electric Cylinders
Safety Instructions

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by labels of **"Caution"**, **"Warning"** or **"Danger"**. To ensure safety, be sure to observe ISO 10218-1992 Note 1), JIS B 8433-1993 Note 2) and other safety practices.

⚠ **Caution :** Operator error could result in injury or equipment damage.

⚠ **Warning :** Operator error could result in serious injury or loss of life.

⚠ **Danger :** In extreme conditions, there is a possibility of serious injury or loss of life.

Note 1) ISO 10218-1992: Manipulating industrial robots-Safety
Note 2) JIS B 8433-1993: Manipulating industrial robots--Safety

⚠ Warning

1. The compatibility of the electric cylinder with an application should be examined by the system planner, or by the person who determines the specifications.
Since the products specified here are used in various operating conditions, their compatibility with a specific system must be based on either specifications, post analysis and/or tests to meet a specific requirement. The expected performance and safety assurance is the responsibility of the person who has determined the compatibility between the cylinder and the system. This person should continuously review the suitability of all items specified, referring to the latest catalogue information with consideration towards any possible equipment failure when configuring the system.

2. Only trained personnel should operate pneumatically operated machinery and equipment.
Compressed air can be dangerous if handled incorrectly. Assembly, handling or repair of an electric cylinder should be performed by a trained and experienced operator.

3. Do not service machinery/equipment or attempt to remove components until safety is confirmed.
1. Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.
2. When equipment will be removed, confirm the safety process as mentioned above, and shut off the power supply for this equipment.
3. Before machinery/equipment is restarted, confirm that safety measures are in effect.

4. Contact SMC if the product will be used in any of the following conditions:
1. Conditions and environments beyond the given specifications, or if product is used outdoors.
2. Installation on equipment in conjunction with atomic energy, medical equipment, food and beverages, or safety equipment.
3. An application which has the possibility of having negative effects on people, property, or animals, requiring special safety analysis.

5. Review and confirm the product's documentation thoroughly before using the product, or contact our distributors, or SMC for confirmation for a problem free application.

6. Use the product after thoroughly reviewing and confirming the precautions in this catalogue.

7. Some products in this catalogue are for particular applications and sites only. Check and confirm with the distributor or SMC.

Electric Cylinder Precautions 1

Be sure to read this before handling.

General

Caution on Handling

⚠Caution

1. In order to ensure proper operation, be certain to read the instruction manual carefully. As a rule, handling or usage/operation other than those contained in the instruction manual are prohibited.

2. If the cylinder will be used in an environment where it will be exposed to chips, dust, cutting oil (water, liquids), etc., a cover or other protection should be provided.

3. Operate with cables secured. Avoid bending cables at sharp angles where they enter the cylinder, and also be sure that cables do not move easily.

Caution on Design

⚠Warning

1. In cases where dangerous conditions may result from power failure or malfunction of the product, install safety equipment to prevent damage to machinery and human injury. Consideration must also be given to drop prevention with regard to suspension equipment and lifting mechanisms.

2. Consider possible loss of power sources.

Take measures to protect against human injury and machine damage in the event that there is a loss of air pressure, electricity or hydraulic power.

3. Consider emergency stops.

Design so that human injury and/or damage to machinery and equipment will not be caused when machinery is stopped by a safety device under abnormal conditions such as a power outage or a manual emergency stop.

4. Consider the action when operation is restarted after an emergency stop or abnormal stop.

Design the machinery so that human injury or equipment damage will not occur upon restart of operation.

Selection

⚠Warning

1. Confirm the specifications.

The products in this catalogue should not be used outside of the range of specifications, since this may cause damage malfunction, etc. (Refer to the specifications.)

Mounting

⚠Caution

1. Make sure that the cables are not caught by the cylinder's movement.

2. Do not use in locations where there is vibration or impact shock. Contact SMC before using in this kind of environment, as damage may result.

3. Give adequate consideration to the arrangement of wiring, etc., when mounting. When wiring is forced into an inappropriate arrangement, it may lead to breaks in the wiring and result in malfunction.

Operating Environment

⚠Caution

1. Avoid use in the following environments.

1. Locations with a lot of debris or dust, or where chips may enter.
2. Locations where the ambient temperature exceeds the operating temperature range specified for each model. (Refer to the specifications.)
3. Locations where the ambient humidity exceeds the operating humidity range specified in each model. (Refer to the specifications.)
4. Locations where corrosive or combustible gases are generated.
5. Locations where strong magnetic or electric fields are generated.
6. Locations where direct vibration or impact shock, etc., will be applied to the cylinder unit.
7. Locations where a lot of dust, water drops and oil drops are applied to the product.

Maintenance

⚠Warning

1. Perform maintenance according to the procedures indicated in the instruction manual.

If handled improperly, malfunction and damage of machinery or equipment may occur.

2. Removal of equipment

When equipment is removed, first confirm that measures are in place to prevent dropping or runaway of driven objects, etc., and then proceed after shutting off the electric power. When starting up again, proceed with caution after confirming that conditions are safe.

Grounding

⚠Warning

1. Be sure to ground the electric cylinder.

2. Dedicated grounding should be used as much as possible. Grounding should be to a type 3 ground. (Ground resistance of 100 Ω or less.)

3. Grounding should be as close as possible to the electric cylinder, and the ground wires should be as short as possible.

Electric Cylinder Precautions 2

Be sure to read this before handling.

Cylinder

Caution on Design

⚠ Warning

1. There is a possibility of dangerous sudden action by cylinders if sliding parts of machinery are twisted due to external forces, etc.

In such cases, human injury may occur, e.g., by catching hands or feet in the machinery, or damage to the machinery itself may occur. Therefore, the machine should be adjusted for smooth operation and designed to avoid such dangers.

2. A protective cover is recommended to minimise the risk of human injury.

If a driven object and moving parts of a cylinder pose a danger of human injury, design the structure to avoid contact with the human body.

3. Securely tighten all stationary parts and connected parts of cylinders so that they will not become loose.

Avoid use in locations where direct vibration or impact shock, etc., will be applied to the body of the cylinder.

Operation

⚠ Caution

1. Conduct the following inspection before cylinder/directional control driver is operated.

a) Confirm that the power supply line or each signal line for cylinder/directional control driver is not broken.
b) Confirm that the power supply line or each signal line for cylinder/directional control driver is not loose.
c) Confirm that the cylinder/directional control driver is mounted securely.
d) Confirm that the cylinder/directional control driver is operated correctly.
e) Confirm the function of the emergency stop.

2. Take measures such as installing a fence, etc., to prevent any person from entering the operational area of the cylinder/directional control driver and related equipment.

3. If a person should enter an area as mentioned in point 2 above, take measures to ensure that the emergency stop is controlled by a sensor, etc.

4. In case the cylinder/directional control driver is stopped by abnormalities, take necessary measures to prevent danger from related equipment.

5. In case of abnormalities of related equipment, take necessary measures to prevent danger from a cylinder/directional control driver.

6. Take necessary measures to prevent broken or cut power lines or signal lines of the cylinder/directional control driver from pinching, shearing, curling, scratching and grazing.

7. In case there is abnormal heat, fume and flame, etc., in the cylinder/directional control driver, cut off the power supply immediately.

8. In the event of installation, adjustment, inspection or maintenance of a cylinder/directional control driver, as well as related equipment, be sure to cut off the power supply for the cylinder/directional control driver and related equipment and take measures such as locking or safety-lock, etc., so that persons other than workers are not able to restart the operation. Furthermore, display information while working on the job at places where anyone can easily see.

Operation

⚠ Caution

9. In case where several persons are working on the same job, determine the procedure, signs, measures against abnormality and restarting measures in advance. Then let a person who is not doing the job supervise the work.

Caution on Handling

⚠ Caution

1. The cylinder can be used with a load directly applied to it, as long as it is within the allowable range. However, it is necessary to design an appropriate connecting method and use careful alignment when a load with external support and guide mechanisms is connected. The longer the stroke is, the larger the variation in the axial centre becomes. Therefore, devise a connection method to absorb the variation.

2. The product can be used without lubrication. In case the product is lubricated, special grease is required. Contact the distributor or SMC.

Mounting

⚠ Caution

1. Do not use until you verify that the equipment can operate properly.

2. The product should be mounted and operated after thoroughly reading the instruction manual and understanding its contents.

3. Do not dent, scratch or cause other damage to the body and table mounting surfaces.

This may cause a loss of parallelism in the mounting surfaces, looseness in the guide unit, an increase in operating resistance or other problems.

4. When attaching a workpiece, do not apply strong impact shock or a large moment.

If an outside force exceeding the allowable moment is applied, this may cause looseness in the guide unit, an increase in sliding resistance or other problems.

5. When connecting a load having an external support or guide mechanism, be sure to select a suitable connection method and perform careful alignment.

6. Fix the cylinder's fixing part and connecting part securely.

If the cylinder is used at a highly frequency or in a location with a large amount of vibration, fix it securely using adhesives to prevent it from loosening.

Back page 3

Directional Control Driver Precautions 1

Be sure to read this before handling.

Directional Control Driver

Caution on Handling

⚠Warning

1. Never touch the insides of the directional control driver. It will likely lead to an electrical shock or other trouble.
2. Use only the designated combination between motor and directional control driver.

⚠Caution

1. Do not disassemble and modify. It may result in the trouble, malfunction, fire, etc.
2. Do not touch after it has been energised for a while or after cutting off the power source because of high temperature.
3. If fire or danger to a human being is expected by abnormal heat generation of the product, emitting fume and catching on fire, etc., cut off the power supply for the main body and the system immediately.

Power Supply

⚠Caution

1. In cases where voltage fluctuations greatly exceed the required voltage, a constant voltage transformer, etc., should be used to allow operation within the required range.
2. Use a power supply that has low noise between lines and between power and ground. In cases where noise is high, an isolation transformer should be used.
3. The power supply line and the interface power supply line must be wired separately in different systems.
4. To prevent surges from lightning, connect a varistor for lightning. Ground the surge absorber for lightning separately from the grounding of the derectional control driver.

Grounding

⚠Caution

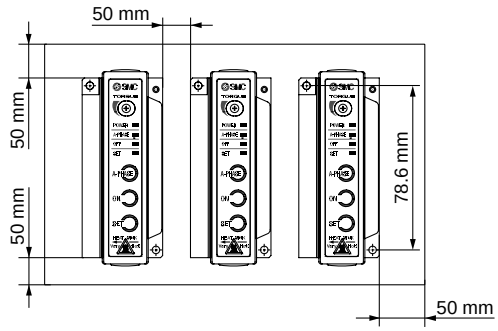
1. Be sure to carry out grounding in order to ensure the noise tolerance of the directional control driver.
2. Dedicated grounding should be used as much as possible. Grounding should be to a type 3 ground. (Ground resistance of 100 Ω or less.)
3. Grounding should be as close as possible to the directional control driver, and the ground wires should be as short as possible.
4. In the unlikely event that malfunction is caused by the ground, disconnect it from the ground.

Mounting

⚠Caution

1. Mount the directional control driver on incombustible materials. Mounting on combustible materials directly or mounting closely to it may lead to fire.
2. Consider the cooling period, so that the operating temperature of main body should be within the range of specifications. Also, allow enough distance from each side of the main body, construction and the parts.

   Cooling should be considered, so the surface temperature of a heat sink should not be more than 50°C even though the temperature is within the operating range.



3. Avoid placing along side large-sized solenoid contact apparatus or vibrating sources such as a no fuse insulator, make a separate panel or mount at a distance.
4. Mounting should enable the connectors to be inserted or removed after installation.
5. If there are concave or convex or distorted parts on the mounting face of a directional control driver, an unreasonable force can be applied to the frame or case, which can cause trouble. Mount on a flat face.

Wiring

⚠Danger

1. Adjustment, installation, or wiring changes should be conducted after power supply to this product is turned off. Otherwise, there is a possibility of an electrical shock.

⚠Caution

1. Wiring should be performed correctly.

   For each terminal, voltages other than those stipulated in the operation manual should not be applied. Otherwise, the product may break.
2. Connect the housing securely.
3. Treat the noise securely.

   If the noise is at the same wavelength as the signal lines, it will lead to malfunction. As a countermeasure, separate the high and low electrical lines and shorten the length of wiring, etc.
4. When using a cable made by oneself, confirm the electric wire is of a proper gauge as mentioned in the instruction manual and it is not affected by a

Directional Control Driver Precautions 2

Be sure to read this before handling.

Wiring

⚠Warning

1. Avoid repeatedly bending and/or stretching the cables.

Repeatedly applying bending stress and/or stretching force to the cables may result in broken lead wires.

2. Avoid incorrect wiring.

Depending on the type of incorrect wiring, the directional control driver may be damaged.

3. Perform wiring when the power is turned off.

The directional control driver may be damaged and malfunction.

4. Do not wire with power lines or high voltage lines.

Conduct wiring for a directional control driver separately from power lines or high voltage lines to avoid interference from the noise or surge of the power lines or high voltage lines. This may result in malfunction.

5. Confirm that the wiring is properly insulated.

Be certain that there is no faulty wiring insulation (contact with other circuits, improper insulation between terminals, etc.) because the directional control driver may be damaged due to excessively applied voltage or current flow to it.

Operating Environment

⚠Warning

1. Do not use in an environment subjected to temperature cycles.

If used in an environment where temperature cycling occurs, other than the usual temperature change, the internal directional control driver may be adversely affected.

2. Do not use in a place that has excessive electrical surge generation.

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in an area around the directional control driver, deterioration or damage may occur to the internal circuit elements of the directional control driver. Avoid sources of surge generation and crossed lines.

3. Select a product type that has built-in surge absorbing elements for a load, such as relays and solenoid valves employed for driving voltage generating load directly.

4. Avoid use in the following environments.

1. Locations with a lot of debris or dust, or where chips may enter.
2. Locations where the ambient temperature exceeds the operating temperature range specified in each model. (Refer to the specifications.)
3. Locations where the ambient humidity exceeds the operating humidity range specified for each model. (Refer to the specifications.)
4. Locations where corrosive or combustible gases are generated.
5. Locations where strong magnetic or electric fields are generated.
6. Locations where direct vibration or impact shock, etc., will be applied to the cylinder unit.
7. Locations where a lot of dust, water drops and oil drops are applied to the product.

Adjustment and Operation

⚠Warning

1. Do not short the loads.

Short on the load of the directional control driver indicates an error, but it may cause over current and damage the directional control driver.

2. Do not operate or conduct any settings with wet hands.

An electric shock may result from wet hands.

3. When operating the manual switch, avoid making contact with the workpiece.

Contact with the workpiece may cause injury.

⚠Caution

1. Do not push the manual switch with sharp pointed items.

Sharp pointed items may cause manual switch damage.

2. Do not touch the heat sink parts of the directional control driver.

Conduct operation after confirming that the machine is cool since it gets hot while in operation.

3. When adjusting the trimmer, the following conditions should be observed.

1. When adjusting the trimmer do not apply a pushing force greater than 4,9 N on the trimmer.
2. When adjusting the trimmer do not apply a torque greater than 68,5 mNm.

Maintenance

⚠Warning

1. Periodically perform maintenance of the product.

Confirm that the piping and bolts are securely tightened.

Unintentional malfunction of a system's components may occur as a result of a cylinder malfunction.

2. Do not disassemble, modify (including change of printed circuit board) or repair.

Disassembly or modification may result in injury or failure.

⚠Caution

1. Confirm the range of movement of a workpiece (a slider) before connecting the driving power supply or turning on the switch.

The movement of the work may cause an accident.

Directional Control Driver Precautions 3

Be sure to read this before handling.

Caution on Design and Selection

⚠ Warning

1. Conduct operation at the regulated voltage.

The product may not function correctly or the directional control driver section may be damaged if used with any other voltage than the specified regulated voltage.

2. Operate within the limit of the specification range.

If operated outside of the specification range, there is a possibility of fire, malfunction, and or cylinder damage. Operate after confirming the required specifications.

3. To prevent any damage by product failure or malfunction, plan and construct a backup system beforehand, such as multiplexing the components and equipment, employing failure free planning, etc.

4. Secure the space for maintenance.

When planning, consider the space to be required for product checkup and maintenance.

5. Provide a protective cover when there is a risk of human injury.

If a driven object and or moving parts of a cylinder pose a danger to human injury, design the structure to avoid contact with the human body.

Directional Control Driver Precautions 4

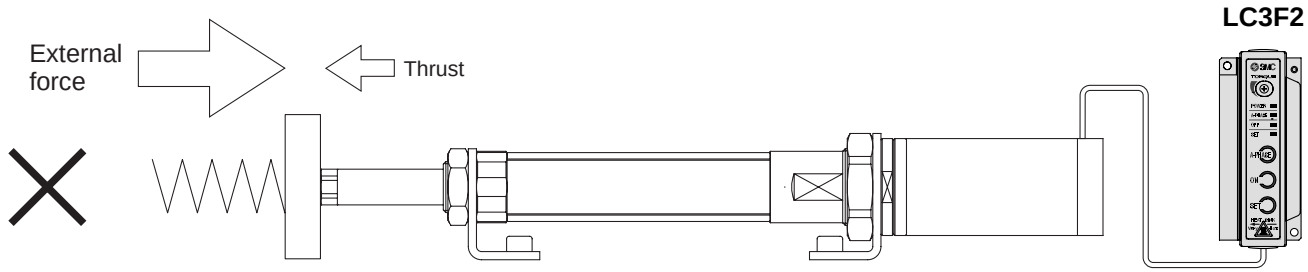
Be sure to read this before handling.

Caution on Design and Operation

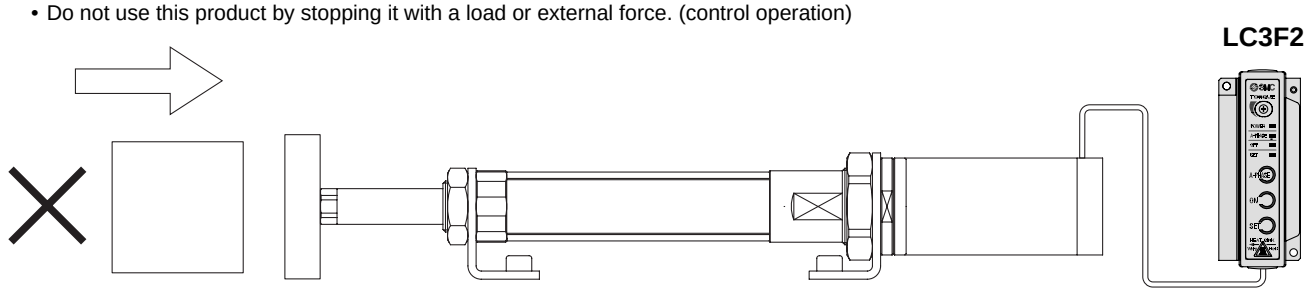
1. If the DC motor on the electric cylinder is rotated by an external force larger than the generated thrust, the reverse inrush voltage generated may cause adverse affects to the electric cylinders directional control driver and result in malfunction or damage to the product.

Example)

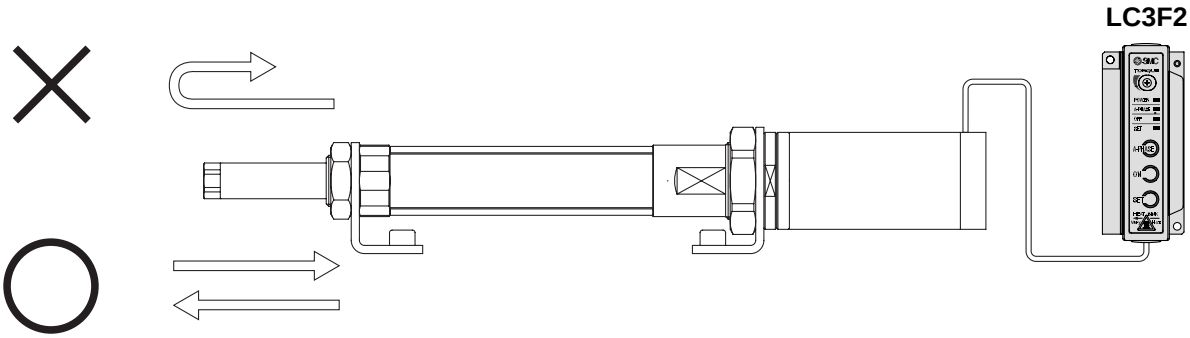
- Do not push or pull the cylinder rod, by applying a larger load than the generated thrust. (Please use caution when the generated thrust is to be switched over between a high thrust and a low thrust.)



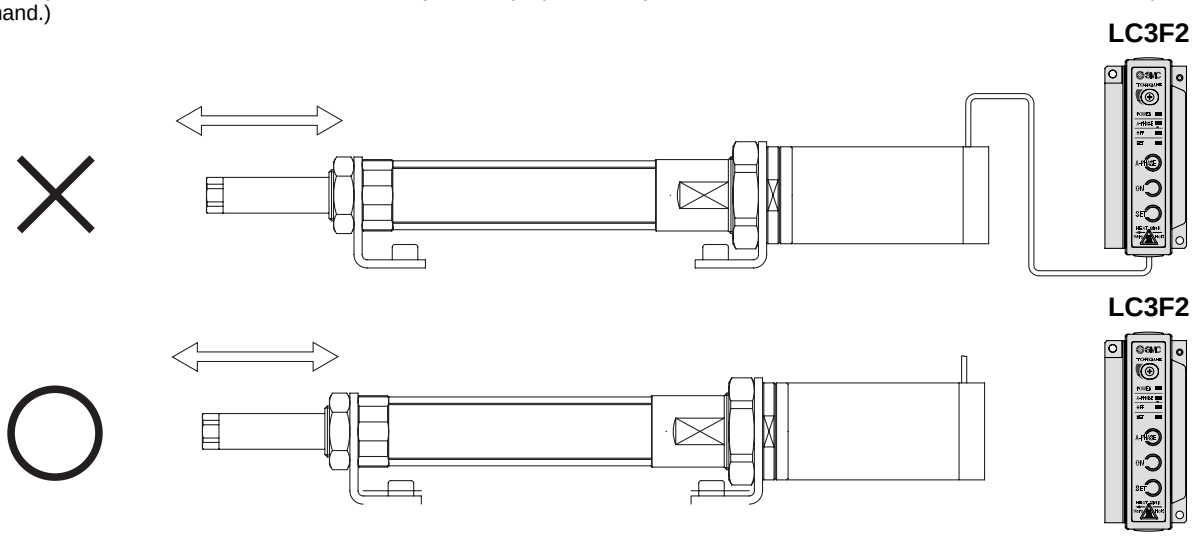
- Do not use this product by stopping it with a load or external force. (control operation)



- Command an operation in the reverse direction only after a cylinder rod stopped completely.



- Do not operate a cylinder rod with an external force when the electric cylinder directional control driver is turned off or output is in the off state. (If a cylinder rod needs to be moved manually for the purpose of adjustment, etc., be sure to remove the CN3 motor output terminal beforehand.)



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Auto Switch Precautions 1

Be sure to read this before handling.

Design and Selection

⚠Warning

1. Confirm the specifications.

Read the specifications carefully and use this product appropriately. The product may be damaged or malfunction if it is used outside the range of specifications of current load, voltage, temperature or impact.

2. Use caution when multiple actuators are used and close to each other.

When two or more auto switch actuators are lined up in close proximity to each other, magnetic field interference may cause the switches to malfunction. Maintain a minimum cylinder separation of 40 mm.

3. Pay attention to the length of time that a switch is ON at an intermediate stroke position.

When an auto switch is placed at an intermediate position of the stroke and a load is driven at the time the piston passes, the auto switch will operate, but if the speed is too great the operating time will be shortened and the load may not operate properly. The maximum detectable piston speed is:

$$V\ (mm/s) = \frac{\text{Auto switch operating range (mm)}}{\text{Time load applied (ms)}} \times 1000$$

4. Keep wiring as short as possible.

<Solid state switch>

Although wire length should not affect switch function, use a wire 100 m or shorter.

5. Take note of the internal voltage drop of the switch.

<Solid state switch>

Generally, the internal voltage drop will be greater with a 2-wire solid state auto switch than with a reed switch. Take the same precautions as in 1).

Also, note that a 12 VDC relay is not applicable.

6. Pay attention to leakage current.

<Solid state switch>

With a 2-wire solid state auto switch, current (leakage current) flows to the load to operate the internal circuit even when in the OFF state.

$$\text{Operating current of load (OFF condition)} > \text{Leakage current}$$

If the criteria given in the above formula are not met, it will not reset correctly (stays ON). Use a 3-wire switch if this specification will not be satisfied.

Moreover, leakage current flow to the load will be “n” times larger when “n” auto switches are connected in parallel.

7. Do not use a load that generates surge voltage.

<Solid state switch>

Although a zener diode for surge protection is connected at the output side of a solid state auto switch, damage may still occur if the surge is applied repeatedly. When a load, such as a relay or solenoid, which generates surge is directly driven, use a type of switch with a built-in surge absorbing element.

8 Cautions for use in an interlock circuit

When an auto switch is used for an interlock signal requiring high reliability, devise a double interlock system to avoid trouble by providing a mechanical protection function, or by also using another switch (sensor) together with the auto switch. Also perform periodic maintenance and confirm proper operation.

9. Ensure sufficient clearance for maintenance activities.

When designing an application, be sure to allow sufficient clearance for maintenance and inspections.

Auto Switch Precautions 2

Be sure to read this before handling.

Mounting & Adjustment

⚠Warning

1. Do not drop or bump.

Do not drop, bump or apply excessive impacts (300 m/s^2 or more for reed switches and 1000 m/s^2 or more for solid state switches) while handling. Although the body of the switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

2. Do not carry an actuator by the auto switch lead wires.

Never carry a cylinder (actuator) by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the switch to be damaged by the stress.

3. Mount switches using the proper fastening torque.

When a switch is tightened beyond the range of fastening torque, the mounting screws, mounting bracket or switch may be damaged. On the other hand, tightening below the range of fastening torque may allow the switch to slip out of position.

4. Mount a switch at the centre of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the centre of the operating range (the range in which a switch is ON).

(The mounting position shown in a catalogue indicates the optimum position at stroke end.) If mounted at the end of the operating range (around the borderline of ON and OFF), operation will be unstable.

<D-M9□>

When the D-M9□(V) auto switch is used to replace old series auto switch, it may not activate depending on operating condition because of its shorter operating range.

Such as

- **Application where the stop position of actuator may vary and exceed the operating range of the auto switch, for example, pushing, pressing, clamping operation, etc.**
- **Application where the auto switch is used for detecting an intermediate stop position of the actuator. (In this case the detecting time will be reduced.)**

In these applications, set the auto switch to the centre of the required detecting range.

⚠Caution

1. Fix the switch with appropriate screw installed on the switch body. If using other screws, switch may be damaged.

Wiring

⚠Warning

1. Avoid repeatedly bending or stretching lead wires.

Broken lead wires will result from applying bending stress or stretching force to the lead wires.

2. Be sure to connect the load before power is applied.

<2-wire type>

If the power is turned ON when an auto switch is not connected to a load, the switch will be instantly damaged because of excess current.

3. Confirm proper insulation of wiring.

Be certain that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into a switch.

4. Do not wire with power lines or high voltage lines.

Wire separately from power lines or high voltage lines, avoiding parallel wiring or wiring in the same conduit with these lines. Control circuits, including auto switches, may malfunction due to noise from these other lines.

5. Do not allow short circuit of loads.

<Solid state switch>

Model D-M9□ and all models of PNP output type switches do not have built-in short circuit prevention circuits. If loads are short circuited, the switches will be instantly damaged, as in the case of reed switches.

Take special care to avoid reverse wiring with the power supply line (brown) and the output line (black) on 3-wire type switches.

6. Avoid incorrect wiring.

<Solid state switch>

1) If connections are reversed on a 2-wire type switch, the switch will not be damaged if protected by a protection circuit, but the switch will always stay in an ON state. However, it is still necessary to avoid reversed connections, since the switch could be damaged by a load short circuit in this condition.

2) If connections are reversed (power supply line + and power supply line –) on a 3-wire type switch, the switch will be protected by a protection circuit. However, if the power supply line (+) is connected to the blue wire and the power supply line (–) is connected to the black wire, the switch will be damaged.

<D-M9□>

D-M9□ does not have built-in short circuit protection circuit. Be aware that if the power supply connection is reversed (e.g. (+) power supply wire and (–) power supply wire connection is reversed), the switch will be damaged.

∗ Lead wire colour changes

Lead wire colours of SMC auto switches have been changed in order to meet NECA Standard 0402 for production beginning September, 1996 and thereafter. Please refer to the tables provided.

2-wire

	Old	New
Output (+)	Red	Brown
Output (–)	Black	Blue

3-wire

	Old	New
Power supply (+)	Red	Brown
Power supply GND	Black	Blue
Output	White	Black

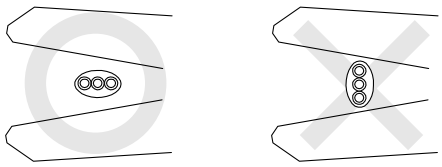
Auto Switch Precautions 3

Be sure to read this before handling.

Wiring

⚠Caution

5. When the cable sheath is stripped, confirm the stripping direction. The insulator may be split or damaged depending on the direction. (D-M9□ only)



Recommended Tool

Model name	Model no.
Wire stripper	D-M9N-SWY

∗ Stripper for a round cable (ø2.0) can be used for a 2-wire type cable.

Operating Environment

⚠Warning

1. Never use in an atmosphere of explosive gases.

The construction of auto switches is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2. Do not use in an area where a magnetic field is generated.

Auto switches will malfunction or magnets inside actuators will become demagnetised.

3. Do not use in an environment where the auto switch will be continually exposed to water.

Although switches, satisfy IEC standard IP67 construction (JIS C 0920: waterproof construction), do not use switches in applications where continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

4. Do not use in an environment with oil or chemicals.

Consult with SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

5. Do not use in an environment with temperature cycles.

Consult with SMC if switches are used where there are temperature cycles other than normal temperature changes, as they may be adversely affected internally.

6. Do not use in an environment where there is excessive impact shock.

Operating Environment

⚠Warning

7. Do not use in an area where surges are generated.

<Solid state switch>

When there are units (solenoid type lifter, high frequency induction furnace, motor, etc.) which generate a large amount of surge in the area around actuators with solid state auto switches, this may cause deterioration or damage to the switches. Avoid sources of surge generation and crossed lines.

8. Avoid accumulation of iron debris or close contact with magnetic substances.

When a large amount of ferrous debris such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch actuator, it may cause the auto switch (actuator) to malfunction due to a loss of the magnetic force inside the actuator.

Maintenance

⚠Warning

1. Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Securely tighten switch mounting screws.
If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

2) Confirm that there is no damage to lead wires.
To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

Other

⚠Warning

1. Consult with SMC concerning water resistance, elasticity of lead wires, usage at welding sites, etc.

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