CITIZEN

Linear Actuator

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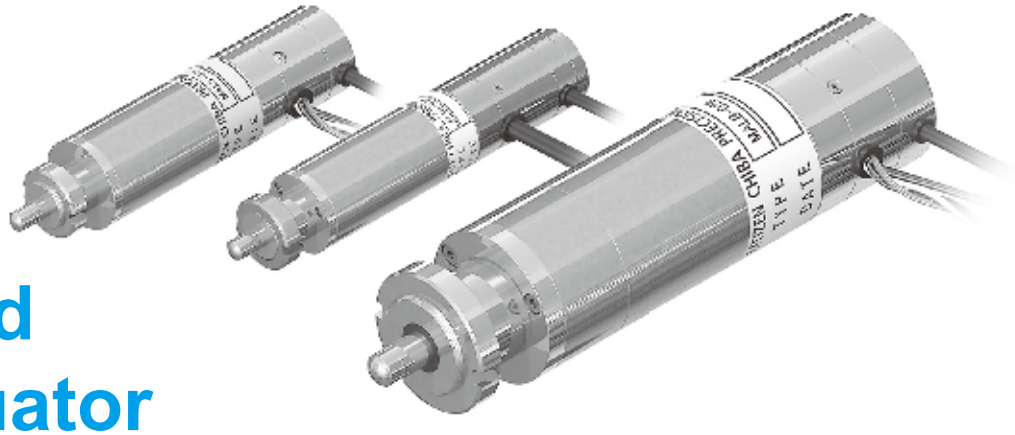


Miniaturized Linear Actuator

Small Diameter	Stroke	Rated Thrust	High Resolution
φ16～28 mm	6～30 mm	14.7～58.8 N	0.24～0.625 μm

Unidirectional Repeat Accuracy	Bidirectional Repeat Accuracy	Bidirectional Positioning Accuracy
3～20 μm	5～25 μm	10～50 μm

Features:

Our miniaturized AC Servo Linear Actuators are small, light weight, and straight-line type actuators that enable a high accuracy positioning.

We adopted a hollow structured AC servo motor for motor part and a small and high-resolution optical rotary encoder for encoder part. The direct design without gearheads or other items also achieved precise and high resolution positioning.

In addition to the above features, MAB and MALB Series use ball screws to achieve high speed and long life. MALS and MALB Series are the models with excellent cost-performance that accomplished significant cost reduction while maintaining a high accuracy positioning .

The driver we developed exclusively for these AC servo linear actuators is also compact, lightweight and multifunctional. Since it has a sine wave energization and GAIN LOW, it allows the smooth operation most required in linear actuator and zero vibration during positioning.

The actuator is relatively easy to adapt to be used in clean rooms and other special environments, and can also be applied to a wide range of applications such as production, inspection, and experimental equipment in optical and semiconductor industries.

Contents

Model Number

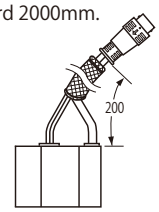
MAS - D23 H 25 - 03

Type
- S : Standard Type
- LS : Standard Type (Cost-effective Model)
- B : Ball Screw Type
- LB : Ball Screw Type (Cost-effective Model)
- SC : For Clean Room

Outer Diameter

Stroke

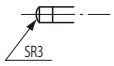
03: Cable length is 200mm
*If not stated, it will be the standard 2000mm.



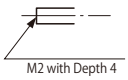
Tip Shape
- H : Tip with Flat Point
- R : Tip with Spherical Point
- N : Tip with Tapped Hole (For MAB, MALB and MALS only)

● Flat Tip : H Type

● Spherical Tip : R Type

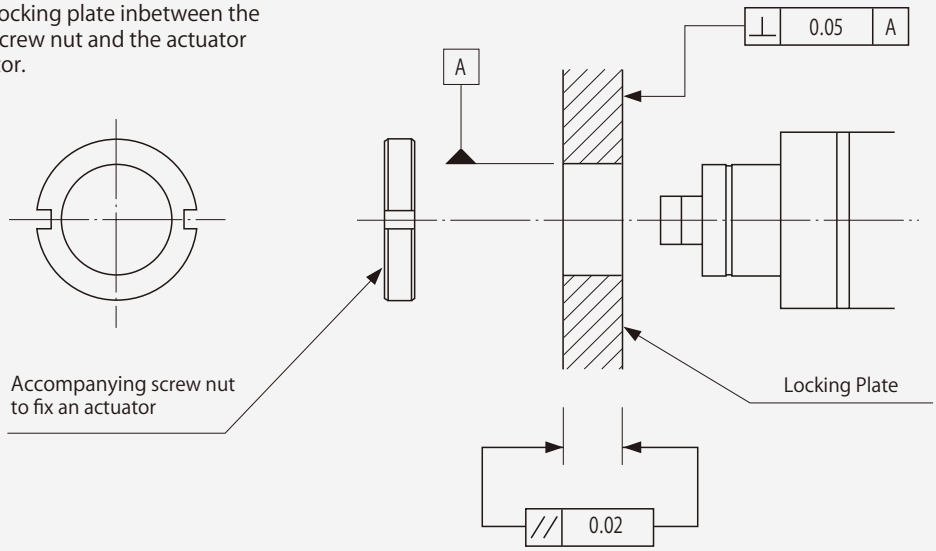


● Tapped Hole : N Type



Drawing for Fixing Actuator

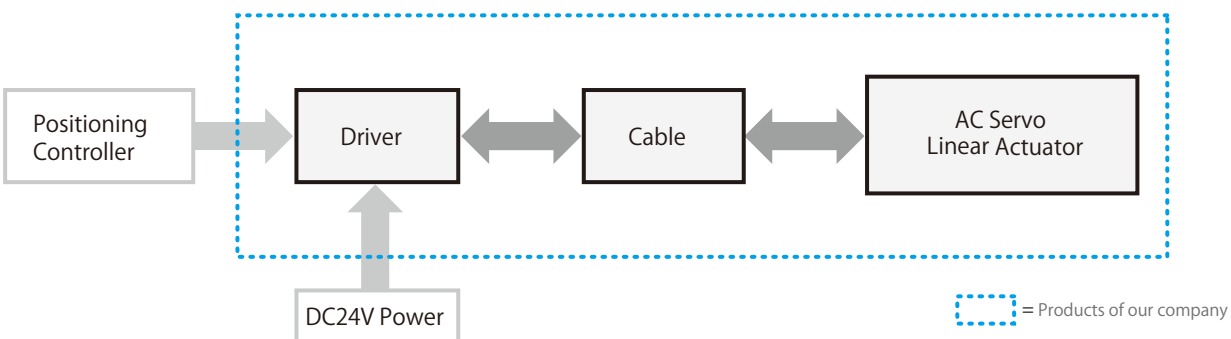
● Please put the locking plate inbetween the accompanying screw nut and the actuator to fix the actuator.



Note* 1: Please use the accompanying screw nut to fix the actuator to your equipment.
If the actuator housing is fixed too tight, it may reduce accuracy.

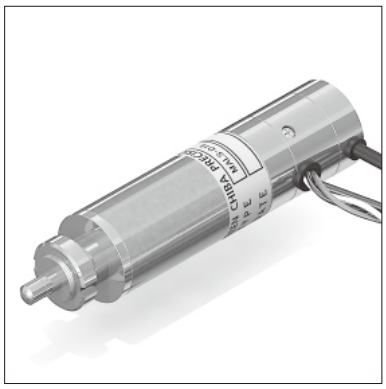
Note *2: If the screw nut is tightened too strong such as the actuator locking plate is significantly deformed, the sliding part may also be deformed and malfunction may occur.

System Configuration

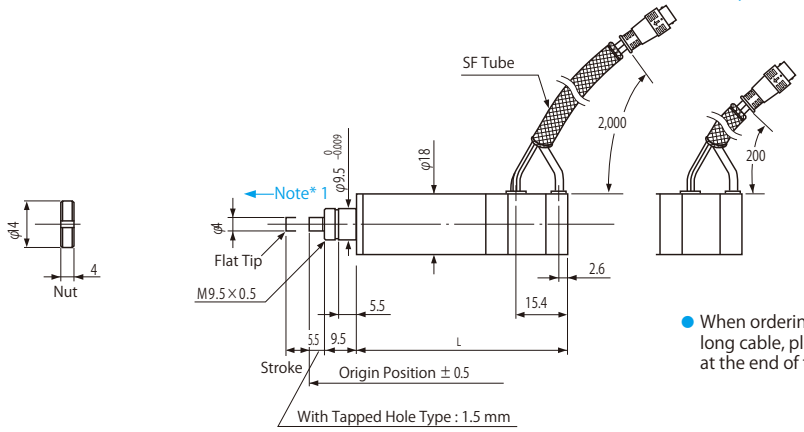


MALS-D18 Series

Cost-Effective Model



- Stroke : 6/ 10/ 20 mm
- Rated Thrust : 14.7 N
- Resolution : 0.5 μm



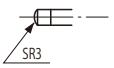
- When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

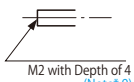
Items	Unit	Model		
		MALS-D18H06 MALS-D18R06 MALS-D18N06	MALS-D18H10 MALS-D18R10 MALS-D18N10	MALS-D18H20 MALS-D18R20 MALS-D18N20
Stroke	mm	6	10	20
Rated Thrust	N	14.7	14.7	14.7
Resolution	μm	0.5	0.5	0.5
Maximum Speed	mm/s	4	4	4
Screw Lead	mm	0.4	0.4	0.4
Unidirectional Repeat Accuracy	μm	10	12	15
Bidirectional Repeat Accuracy	μm	15	17	20
Bidirectional Positioning Accuracy	μm	30	35	50
Average Inverse Error	μm	10	10	15
Limit Sensor	–	Hall Sensor		
Length	mm	63	67	77
Weight	g	165	170	175
Diameter	mm	φ18	φ18	φ18

- Flat Tip : H Type

- Spherical Tip : R Type



- Tapped Hole : N Type



Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

Note* 8: The encoders of these models have 2 channels only and have no Z phase.

Note* 9: When attaching screws to the N type with screw holes, the torque applied to the actuator rod should be 1 Nm or less. If torque exceeding 1Nm is applied, the accuracy of the actuator may decrease.

Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end.

Compatibility

The mounting part is compatible with manual micrometer head.

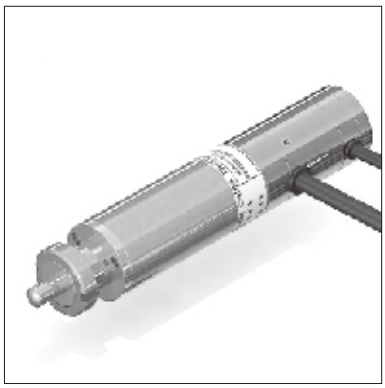
Special Driver

Please use our exclusive driver, LAD-01 Series, to drive actuators.

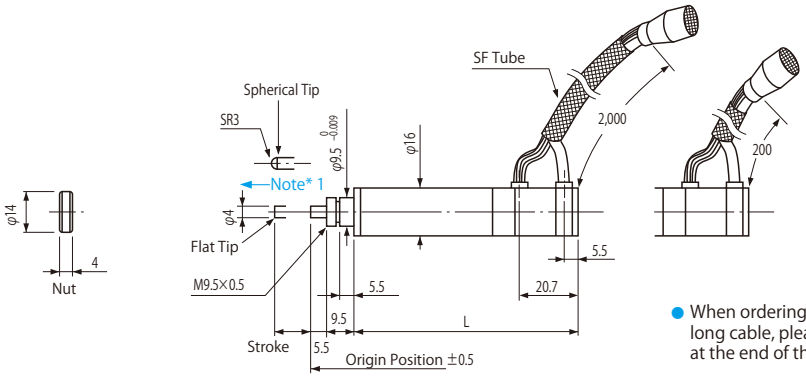
Extension Cable

The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

MAS-D16 Series



●Stroke：6/ 10/ 20 mm ●Rated Thrust：19.6 N ●Resolution： 0.25 μm



● When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

Items	Unit	Model		
		MAS-D16H06 MAS-D16R06	MAS-D16H10 MAS-D16R10	MAS-D16H20 MAS-D16R20
Stroke	mm	6	10	20
Rated Thrust	N	19.6	19.6	19.6
Resolution	μm	0.25	0.25	0.25
Maximum Speed	mm/s	4	4	4
Screw Lead	mm	0.4	0.4	0.4
Unidirectional Repeat Accuracy	μm	3	3	3
Bidirectional Repeat Accuracy	μm	5	5	8
Bidirectional Positioning Accuracy	μm	10	10	16
Average Inverse Error	μm	3	3	5
Limit Sensor	–	Hall Sensor		
Length	mm	68	72	82
Weight	g	150	155	160
Diameter	mm	φ16	φ16	φ16

Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

● Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end.

● Compatibility

The mounting part is compatible with manual micrometer head.

● Special Driver

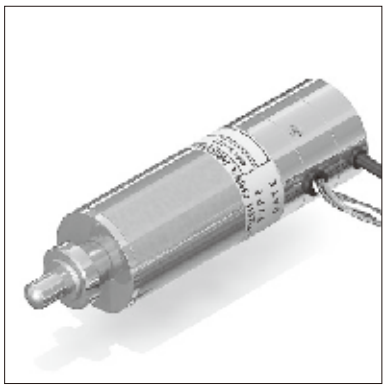
Please use our exclusive driver, LAD-01 Series, to drive actuators.

● Extension Cable

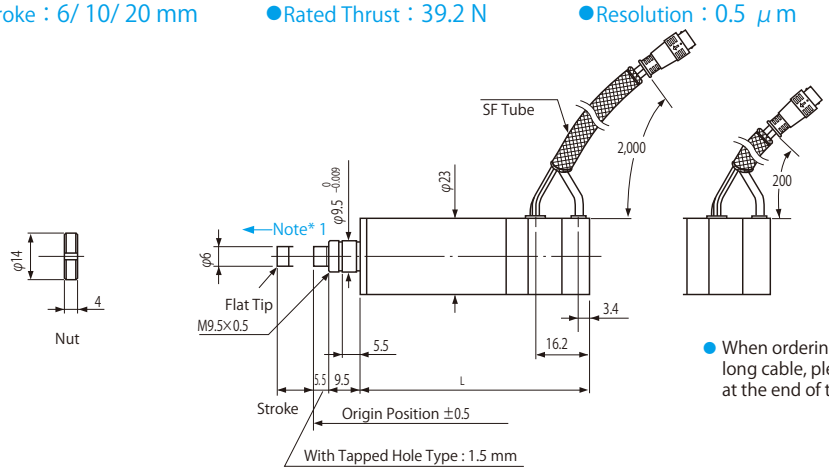
The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

MALS-D23 Series

Cost-Effective Model



- Stroke : 6/ 10/ 20 mm
- Rated Thrust : 39.2 N
- Resolution : 0.5 μm



- When ordering a 200 mm long cable, please add -03 at the end of the model number.

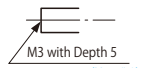
Specification

Items	Unit	Model		
		MALS-D23H10 MALS-D23R10 MALS-D23N10	MALS-D23H15 MALS-D23R15 MALS-D23N15	MALS-D23H25 MALS-D23R25 MALS-D23N25
Stroke	mm	10	15	25
Rated Thrust	N	39.2	39.2	39.2
Resolution	μm	0.5	0.5	0.5
Maximum Speed	mm/s	5	5	5
Screw Lead	mm	0.5	0.5	0.5
Unidirectional Repeat Accuracy	μm	10	12	15
Bidirectional Repeat Accuracy	μm	15	17	20
Bidirectional Positioning Accuracy	μm	30	35	50
Average Inverse Error	μm	10	10	15
Limit Sensor	–	Hall Sensor		
Length	mm	69	74	84
Weight	g	220	225	230
Diameter	mm	φ23	φ23	φ23

- Flat Tip : H type

- Spherical Tip : R type

- Tapped Hole : N type



Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

Note* 8: The encoders of these models have 2 channels only and have no Z phase.

Note* 9: When attaching screws to the N type with screw holes, the torque applied to the actuator rod should be 1 Nm or less. If torque exceeding 1Nm is applied, the accuracy of the actuator may decrease.

Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end.

Compatibility

The mounting part is compatible with manual micrometer head.

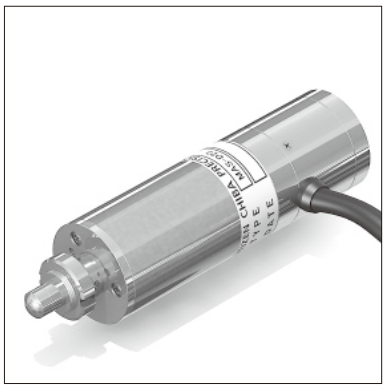
Special Driver

Please use our exclusive driver, LAD-01 Series, to drive actuators.

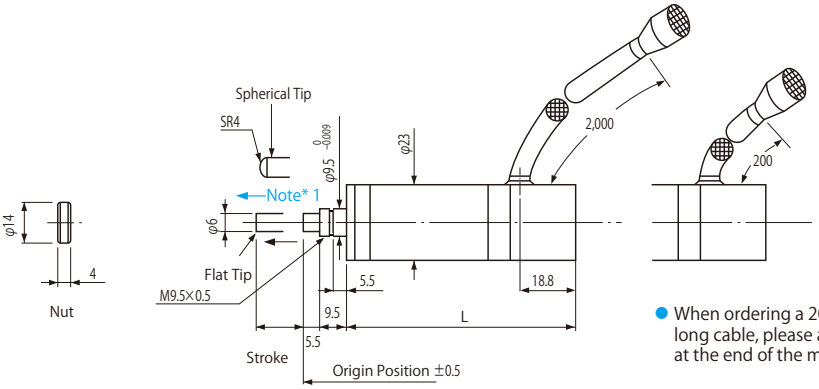
Extension Cable

The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

MAS-D23 Series



●Stroke ：10/ 15/ 25 mm ●Rated Thrust：58.8 N ●Resolution：0.25 μm



● When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

Items	Unit	Model		
		MAS-D23H10 MAS-D23R10	MAS-D23H15 MAS-D23R15	MAS-D23H25 MAS-D23R25
Stroke	mm	10	15	25
Rated Thrust	N	58.8	58.8	58.8
Resolution	μm	0.25	0.25	0.25
Maximum speed	mm/s	5	5	5
Screw Lead	mm	0.5	0.5	0.5
Unidirectional Repeat Accuracy	μm	3	3	3
Bidirectional Repeat Accuracy	μm	5	8	8
Bidirectional Positioning Accuracy	μm	10	13	20
Average Inverse Error	μm	3	4	5
Limit Sensor	–	Hall Sensor		
Length	mm	72	77	87
Weight	g	265	270	280
Diameter	mm	φ23	φ23	φ23

Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

● Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end.

● Compatibility

The mounting part is compatible with manual micrometer head.

● Special Driver

Please use our exclusive driver, LAD-01 Series, to drive actuators.

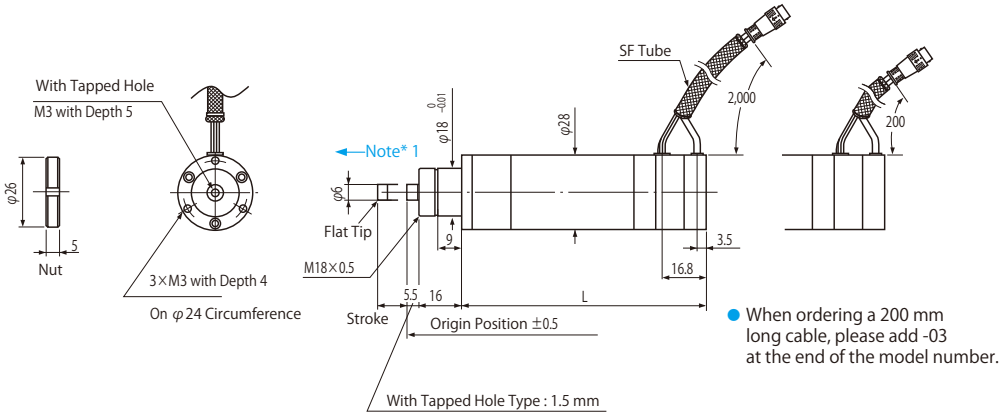
● Extension Cable

The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

MALB-D28 Series

Cost-Effective Model

- Stroke：10/ 30 mm
- Rated Thrust：49.0 N
- Resolution：0.625 μm



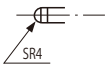
- When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

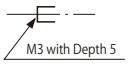
Items	Unit	Model	
		MALB-D28H10 MALB-D28R10 MALB-D28N10	MALB-D28H30 MALB-D28R30 MALB-D28N30
Stroke	mm	10	30
Rated Thrust	N	49.0	49.0
Maximum Thrust in a Short Time	N	78.4	78.4
Resolution	μm	0.625	0.625
Maximum Speed	mm/s	40	40
Screw Lead	mm	1.0	1.0
Unidirectional Repeat Accuracy	μm	10	20
Bidirectional Repeat Accuracy	μm	15	25
Bidirectional Positioning Accuracy	μm	30	40
Average Inverse Error	μm	10	20
Limit Sensor	–	Hall Sensor	
Length	mm	92	112
Weight	g	400	450
Diameter	mm	φ28	φ28

- Flat Tip : H Type

- Spherical Tip : R Type



- Tapped Hole : N Type



(Note* 10)

Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N gf is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

Note* 8: The encoders of these models have 2 channels only and have no Z phase.

Note* 9: The positional relationship between the M3 mounting screw holes and the cable is arbitrary.

Note* 10: When attaching screws to the N type with screw holes, the torque applied to the actuator rod should be 1 Nm or less. If torque exceeding 1Nm is applied, the accuracy of the actuator may decrease.

Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end. However, since they have no brake mechanism, the spindle will move if a load is applied to the spindle when the motor is not energized. Therefore, safety measures may be required for your equipment.

Compatibility

The mounting part is compatible with manual micrometer head.

Special Driver

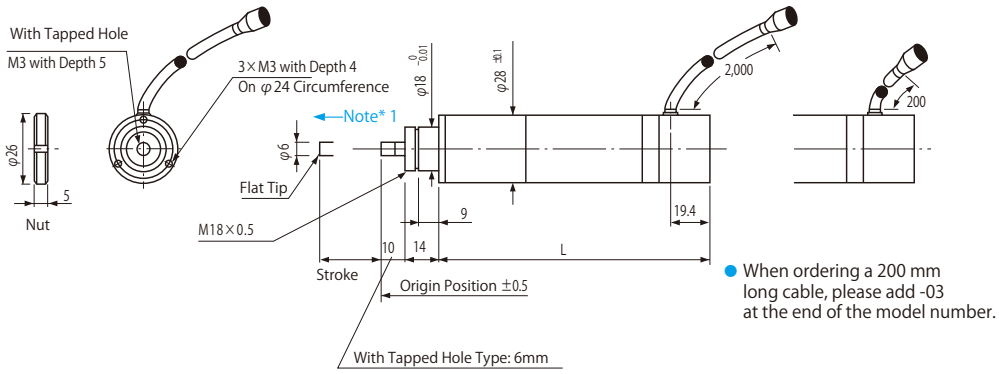
Please use our exclusive driver, LAD-01 Series, to drive actuators.

Extension Cable

The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

MAB-D28 Series

●Stroke：10/ 30 mm　●Rated Thrust：49.0 N　●Resolution：0.5 μm



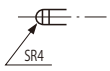
● When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

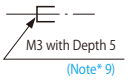
Items	Unit	Model	
		MAB-D28H10 MAB-D28R10 MAB-D28N10	MAB-D28H30 MAB-D28R30 MAB-D28N30
Stroke	mm	10	30
Rated Thrust	N	49.0	49.0
Maximum Thrust for a Short Time	N	98.0	98.0
Resolution	μm	0.5	0.5
Maximum Speed	mm/s	50	50
Screw Lead	mm	1	1
Unidirectional Repeat Accuracy	μm	3	3
Bidirectional Repeat Accuracy	μm	5	8
Bidirectional Positioning Accuracy	μm	10	20
Average Inverse Error	μm	3	5
Limit Sensor	–	Hall Sensor	
Length	mm	95	115
Weight	g	430	480
Diameter	mm	φ28	φ28

● Flat Tip : H Type

● Spherical Tip : R Type



● Tapped Hole : N Type



(Note* 9)

Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

Note* 8: The positional relationship between the M3 mounting screw holes and the cable is arbitrary.

Note* 9: When attaching screws to the N type with screw holes, the torque applied to the actuator rod should be 1 Nm or less. If torque exceeding 1Nm is applied, the accuracy of the actuator may decrease.

● Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end. However, since they have no brake mechanism, the spindle will move if a load is applied to the spindle when the motor is not energized. Therefore, safety measures may be required for your equipment.

● Compatibility

The mounting part is compatible with manual micrometer head.

● Special Driver

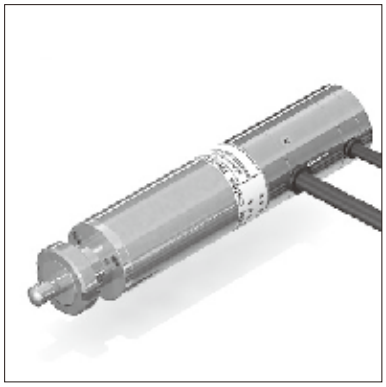
Please use our exclusive driver, LAD-01 Series, to drive actuators.

● Extension Cable

The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

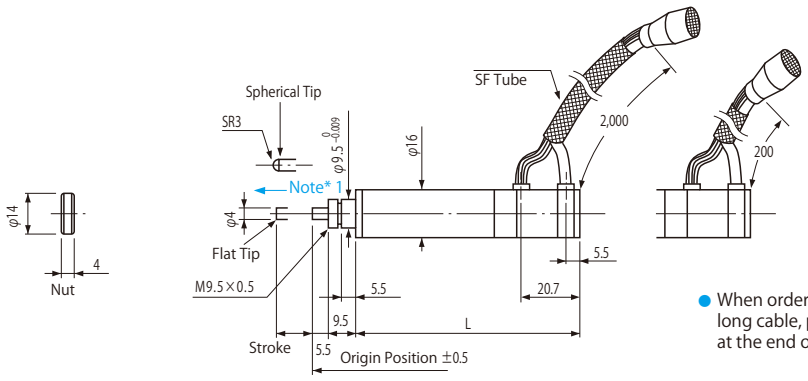
● Linear Actuator for Clean Room

MASC-D16 Series



Clean Applicable to Clean Class 100

● Stroke : 6/ 10/ 20 mm ● Rated Thrust : 14.7 N ● Resolution : 0.25 μm



● When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

Items	Unit	Model		
		MASC-D16H06 MASC-D16R06	MASC-D16H10 MASC-D16R10	MASC-D16H20 MASC-D16R20
Stroke	mm	6	10	20
Rated Thrust	N	14.7	14.7	14.7
Resolution	μm	0.25	0.25	0.25
Maximum Speed	mm/s	4	4	4
Screw Lead	mm	0.4	0.4	0.4
Unidirectional Repeat Accuracy	μm	3	3	3
Bidirectional Repeat Accuracy	μm	5	5	8
Bidirectional Positioning Accuracy	μm	10	10	16
Average Inverse Error	μm	3	3	5
Limit Sensor	–	Hall Sensor		
Length	mm	68	72	82
Weight	g	150	155	160
Diameter	mm	φ16	φ16	φ16

Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

● Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end.

● Compatibility

The mounting part is compatible with manual micrometer head.

● Special Driver

Please use our exclusive driver, LAD-01 Series, to drive actuators.

● Extension Cable

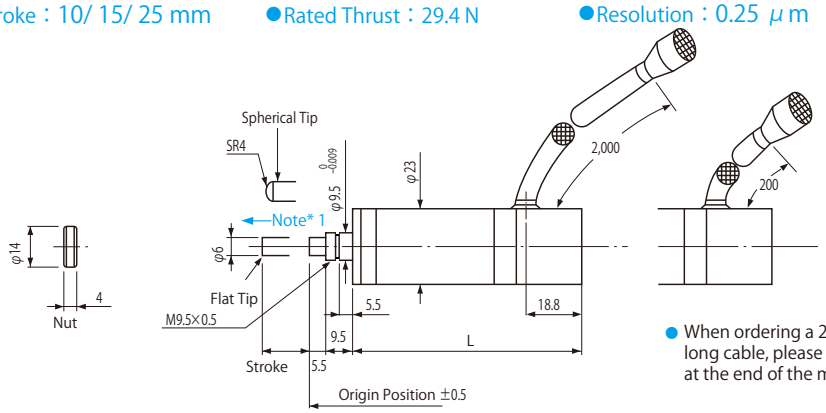
The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

● Linear Actuator for Clean Room

MASC-D23 Series

Clean Applicable to Clean Class 100

● Stroke：10/ 15/ 25 mm ● Rated Thrust：29.4 N ● Resolution：0.25 μm



● When ordering a 200 mm long cable, please add -03 at the end of the model number.

Specification

Items	Unit	Model		
		MASC-D23H10 MASC-D23R10	MASC-D23H15 MASC-D23R15	MASC-D23H25 MASC-D23R25
Stroke	mm	10	15	25
Rated Thrust	N	29.4	29.4	29.4
Resolution	μm	0.25	0.25	0.25
Maximum Speed	mm/s	5	5	5
Screw Lead	mm	0.5	0.5	0.5
Unidirectional Repeat Accuracy	μm	3	3	3
Bidirectional Repeat Accuracy	μm	5	8	8
Bidirectional Positioning Accuracy	μm	10	13	20
Average Inverse Error	μm	3	4	5
Limit Sensor	–	Hall Sensor		
Length	mm	72	77	87
Weight	g	265	270	280
Diameter	mm	φ23	φ23	φ23

Note* 1: When the motor rotates in the CW direction viewed from rod side, it moves to the direction of the arrow.

Note* 2: Please be sure to use the limit switch. If not used, the rod may get stuck in the back and cannot be restored.

Note* 3: The logic of limit switch is normally closed (NC). Please connect the limit switch to the upper controller and adjust to stop the pulse output when the switch is turned ON.

Note* 4: Please use the accompanying screw nut to fix the actuator to your equipment. If the actuator housing is fixed too tight, it may decrease accuracy.

Note* 5: The actuator rod can receive loads in both forward and backward thrust directions. Please use springs or other similar item to apply preload to the rod to make load apply one direction when driving the actuator. If no preload is applied, backlash may occur and it may decrease accuracy.

In the inspection before shipping, a preload of 9.8 N is applied to measure the accuracy. However, please be careful not to apply a load exceeding the rated thrust in the backward thrust direction when installing the actuator to your equipment.

Note* 6: The actuator cable is not a bending resistant cable. Please contact us if bending stress is applied repeatedly to the cable.

Note* 7: For details on Origin Position, please see 'Glossary' on page 15.

● Safety Mechanism

Our linear actuators have end limit sensor which also serves as a sensor for detecting the origin position at the backward end.

● Compatibility

The mounting part is compatible with manual micrometer head.

● Special Driver

Please use our exclusive driver, LAD-01 Series, to drive actuators.

● Extension Cable

The encoder has an open collector output, but the transmission distance can be extended by using LAD-01D-012, which is compatible with the line driver, and an extension cable with a line driver.

LAD-01 Series

LAD-01 Series

LAD-01C - 012 for Open Collector
LAD-01D - 012 for Line Driver

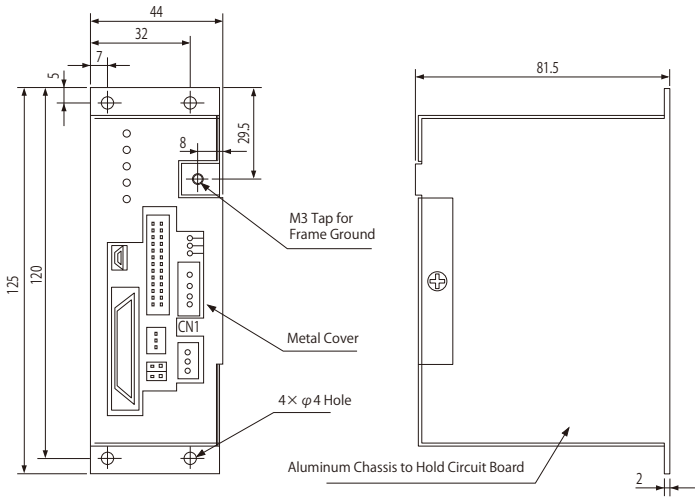
Parameters and gains can be set by serial communication through USB cable.

Features

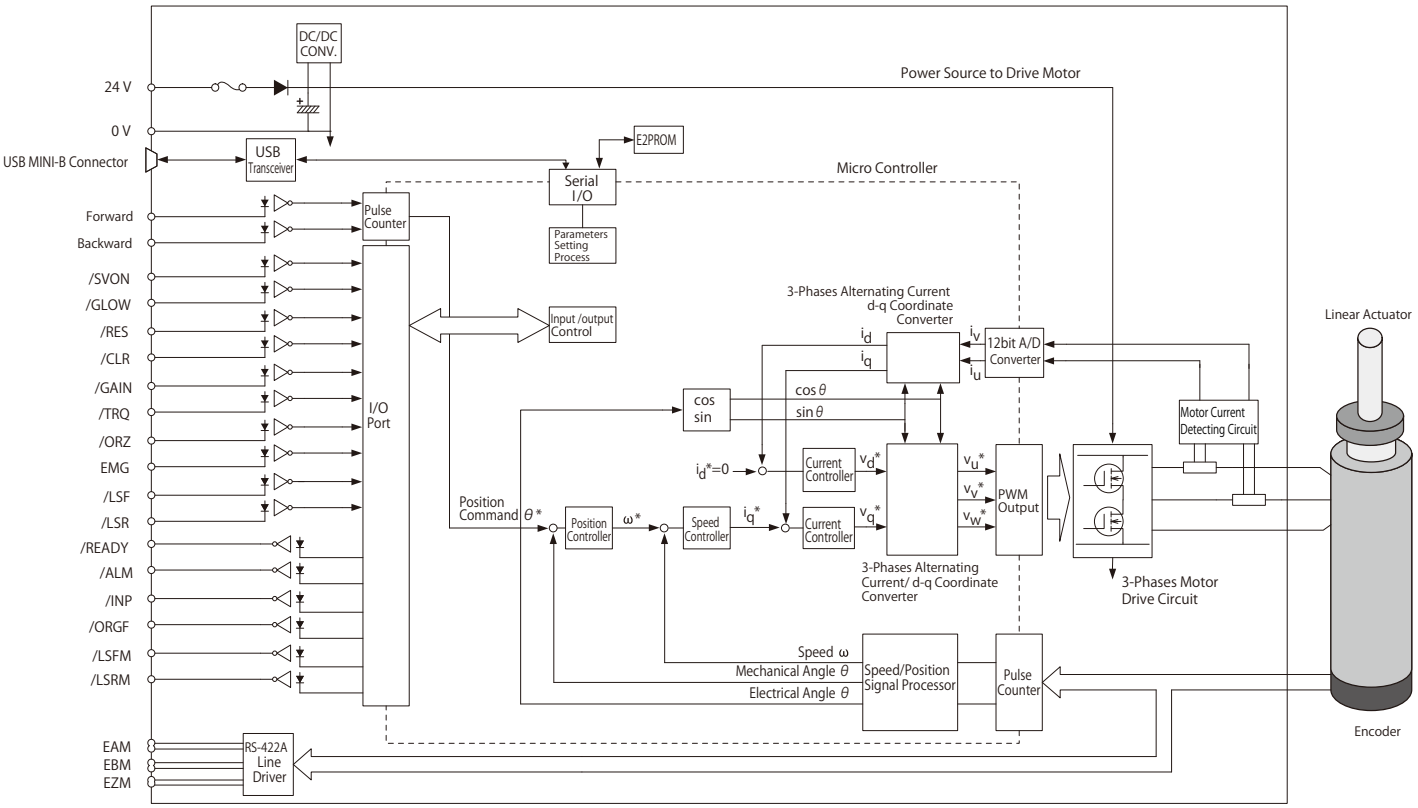
- This is a 3 phases sine wave PWM drive driver.
- This is the driver exclusive for Citizen Chiba Precision's miniaturized linear actuators.
- Two types of preprogrammed gain setting can be switched by input signal.

Outer Drawing & Mounting Dimension

(Unit: mm)



Circuit Configuration



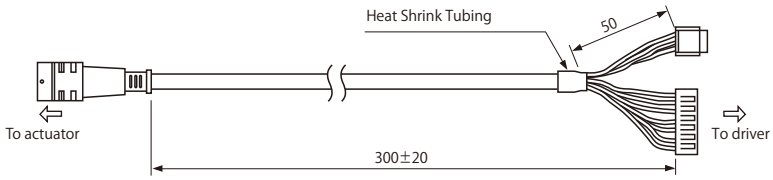
Specifications

Model	LAD-01 Series	
Input Power Source Voltage	DC 24V	
Continuous Rated Output Current	3 Arms	
Maximum Rated Output Current	10 A peak	
Control System	Position Control	
Encoder Input	φ A, φ B, φ Z (MALS / MALB Series has no Z phase.)	
Hall sensor	φ U, φ V, φ W (Hall IC)	
Input Maximum Frequency	MAS-D16 16kHz MASC-D16 16kHz MAS-D23 20kHz MASC-D23 20kHz	MAB-D28 100kHz MALS-D18 8kHz MALS-D23 10kHz MALB-D28 64kHz
Positioning Accuracy	± 1 pulse of encoder resolution	
Encoder Multiplication Function	× 4 multiplication	
Command Multiplication Function	Only for 2 pulse system: fixed to 4 multiplication, other systems: 1 multiplication	
Operating Ambient Temperature Range	0 ~ 50℃	
Operating Ambient Humidity Range	Below 85% RH without condensation	
Storage Condition	20 to 85 ℃ without condensation	
● Input Signals		
Pulse Input Signal	Please select one by parameter setting: 1.（2 Pulse System）CW or CCW Pulse System 2.（1 pulse system）Pulse, Direction System 3. 2-Phase Pulse System (Input is isolated by photocoupler)	
Reset Input	Alarm Output Reset and Residual Pulse Reset / Logic is Low Active	
Limit Sensor Input	LSF (CW prohibited), LSR (CCW prohibited)	
(Motor-Free Input)	Not available	
Gain-Low Input	Gain-Low (gain reduction to reduce vibration when stopped) / Logic is Low Active	
Deviation Clear	Residual Pulse Reset / Low Active	
Gain Switching	Switchable to 2 types of preprogrammed gain settings / Low Active	
Start Searching Origin Position	Execute searching origin position by preprogrammed mode / Low Active	
● Output Signals		
INP Output	In-Position Output can be set within a range from 0 to ±15 pulse by parameter setting / Low Active	
Alarm Output	It is output when Encoder disconnection, full torque, full count or overheat occured. (Encoder Disconnection Alarm is available only for a line driver type) Cause of the alarm at the time of error is indicated by the number of times LED blinks.	
Encoder Output	φ A, φ B, φ Z Equivalent to RS-422 Output	
Limit Output	The input of the limit sensor (LSF/ LSR mentioned above) is output by the photocoupler	
Finish Searching Origin Position	It is output when searching origin position is finished according to the input of Start Searching Origin Position	
Ready	It is output when command pulse is ready to be input after Servo is ON	
● Control Functions		
Power Source Gain	Adjustable by parameter setting	
Speed Proportional Gain		
Speed Integral Gain		
Position gain		
● Display Functions		
PWR	Power (+ 24V) / LED lights up when input	
SV	LED lights up when Servo is ON	
ALM	LED lights up when an alarm occurred	
INP	LED lights up when residual deviation is within in-position setting value	
ORZ	LED lights up when searching origin position is finished according to the input of Start Searching Origin Position	

MA-111-003

●Connector Conversion Cable

This is for open collector type

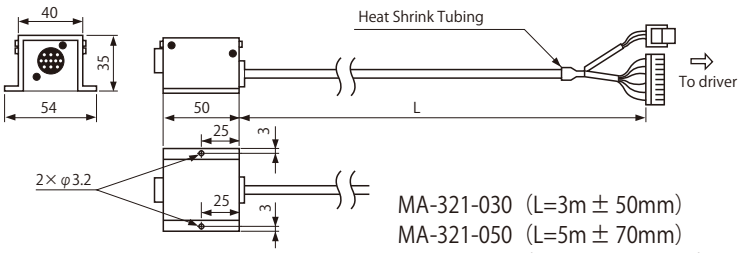


※ Since the actuator and driver have a receiving connector, it is possible to make it by yourself (connector shape would be different from the drawing.)

MA-321-XXX

●Extension Cable with Line Driver Box

This is for direct connection type to line driver compatible driver



MA-321-030 (L=3m ± 50mm)
MA-321-050 (L=5m ± 70mm)
MA-321-100 (L=10m ± 100mm)

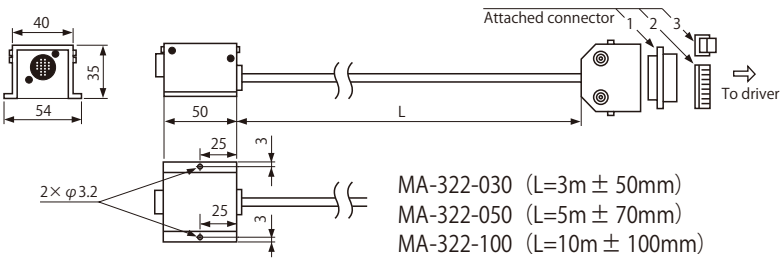
MA-322-XXX

●Extension Cable with Line Driver Box

This is for MA-322-XXX connector which is fixed to your product's panel unit.

This cannot be directly connected to the driver.

1. MRP-25F01 (HONDA TSUSHIN KOGYO CO., LTD.)
2. DF1B-24DS-2.5RC (HIROSE ELECTRIC CO., LTD.)
3. H4P-SHF-AA (J.S.T. Mfg. Co., Ltd.)



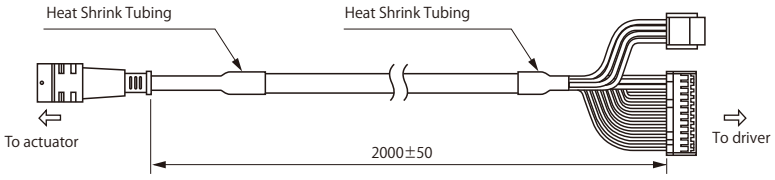
MA-322-030 (L=3m ± 50mm)
MA-322-050 (L=5m ± 70mm)
MA-322-100 (L=10m ± 100mm)

MA-171-020

●Robot Cable

This is for open collector driver direct connection type.

This cable can be used only for the linear actuator with the 200 mm long cable.

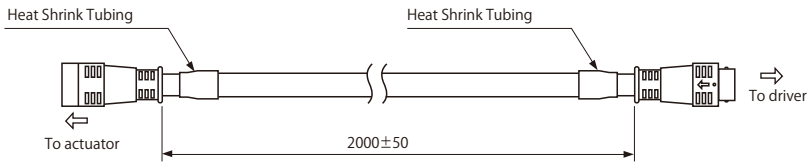


※ The length that can be guaranteed with the open collector type is up to 2.5 m. When ordering an open collector type actuator and selecting this MA-171-020, please specify the 200 mm long cable by adding 03 to the last digit of the model number.

MA-175-020

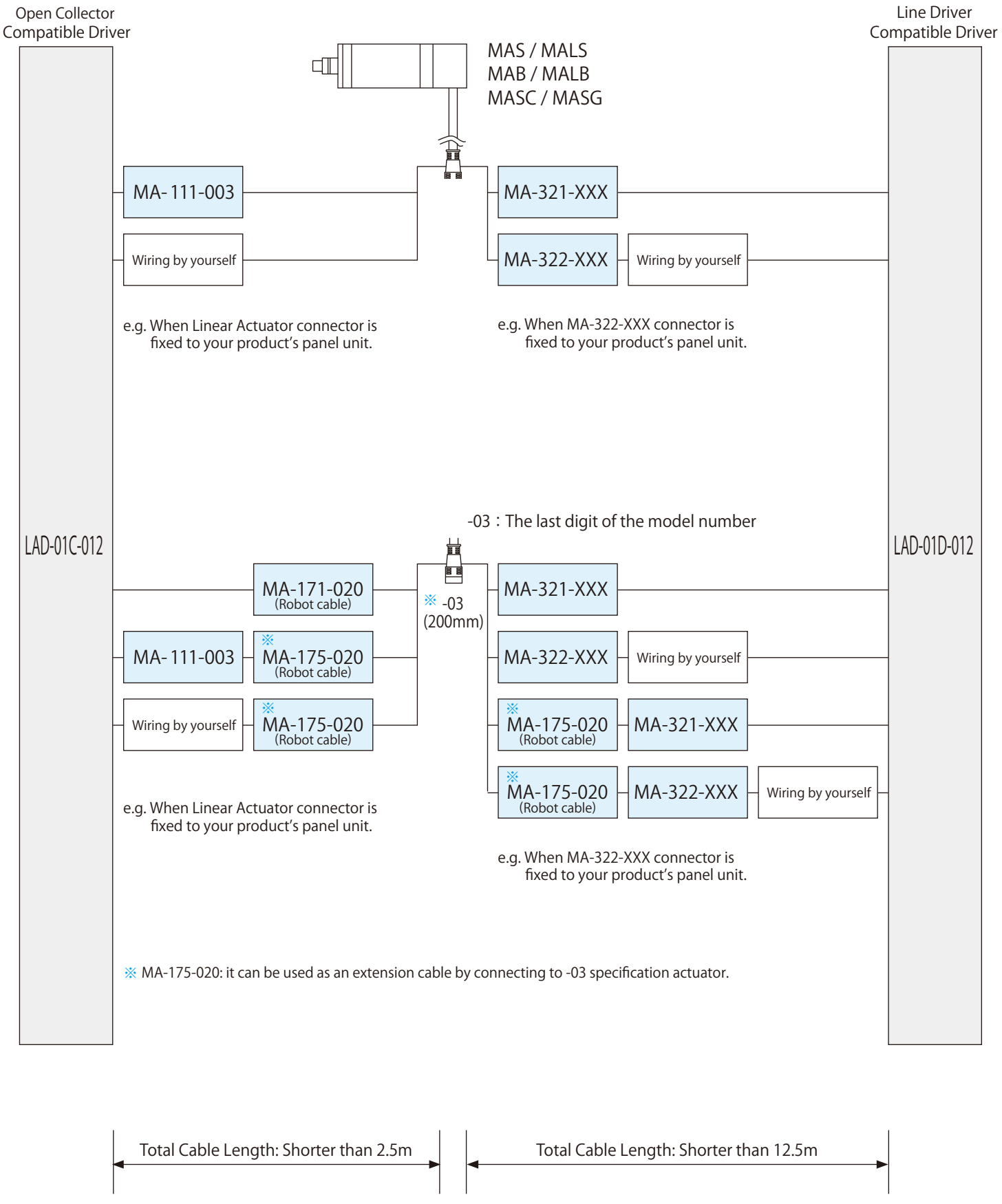
●Robot Cable

This cable can be used only for the linear actuator with the 200 mm long cable.



※ The length that can be guaranteed with the open collector type is up to 2.5 m. When ordering an open collector type actuator and selecting this MA-175-020, please specify the 200 mm long cable by adding 03 to the last digit of the model number.

Reference Diagram for Cable Combination



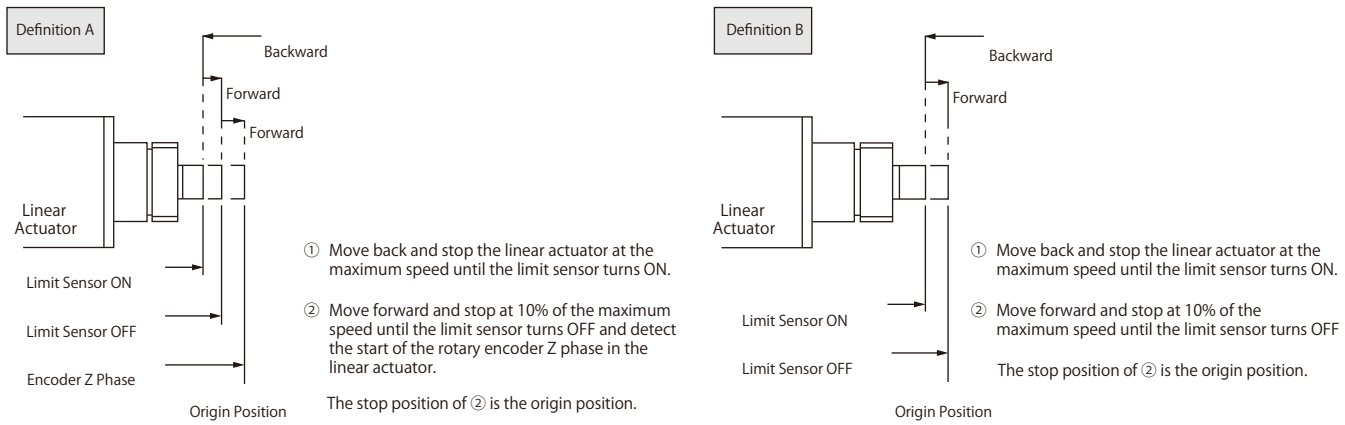
Glossary

- **Stroke**
  This is the range of movement that allows the rod (moving part) of a linear actuator to move forward and backward.
- **Rated Thrust**
  This is the maximum thrust including preload that can operate the linear actuator at maximum speed.
- **Resolution**
  This is the logical minimum positioning value, which is the amount of movement per command pulse from the controller. It is calculated by the number of pulse of encoder, encoder multiplication of the driver, and screw lead.

$$\text{Resolution } [\mu m] = \frac{L}{P \times m} \times 10^{-3}$$

L: Screw lead (mm), P: Encoder pulse (Pulse), m: Multiplication

- **Pre-load**
  This is the load to reduce axial clearance of screw lead or ball screw
- **Origin Position**
  In CITIZEN CHIBA PRECISION, the definition of the origin position differs depending on the model as shown below.

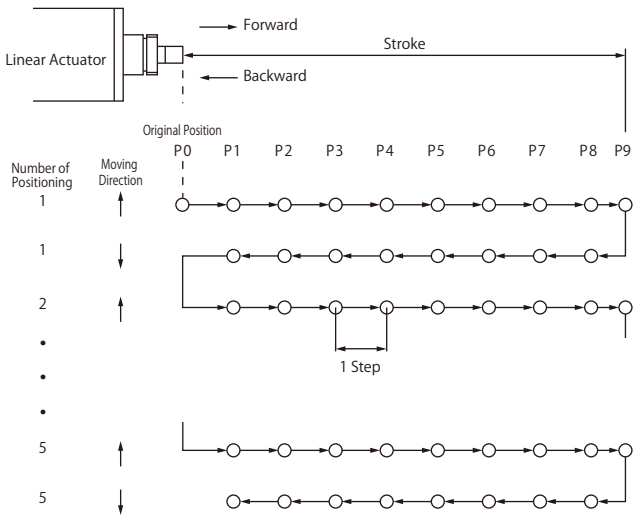


Definition	Model
A	MAS Series / MAB Series / MAR Series / MASC Series / MASG Series
B	MALS Series / MALB Series

- **Positioning Accuracy**
  This is the absolute error of the actual stop position against the target position. It is also the absolute accuracy including repeatability.
- **Repeat Accuracy**
  This is the position repeatability when it is repeatedly positioned at an arbitrary position.
- **Average Inverse Error**
  This is the average of the difference (inverse error) between the stop position from the forward and the backward directions when positioning each target position from the forward and backward directions.

Accuracy Measurement

CITIZEN CHIBA PRECSION has defined the accuracy measurement method and system in accordance with "JIS B-6201 (Machine Tool - Test Method General Rules)" as below:



Drawing 1

■ Accuracy Measurement Method :

According to the test cycle shown in "Drawing 1", we make a linear actuator to position for 5 times to the preset target position from the forward and backward directions.
Then, the error (deviation) of the actual stop position against each target position is calculated.

Furthermore, following four items, (1) Unidirectional Repeat Accuracy, (2) Bidirectional Repeat Accuracy, (3) Bidirectional Positioning Accuracy, and (4) Average Inverse Error, are calculated and evaluated.

The distance of one step from P0 to P8 is determined by the following formula:

$$\text{Distance of one step} = \frac{\text{Stroke} - 0.25\ \text{mm}}{8}\ [\text{mm}]$$

In the number of position command pulses equivarent to one step distance, less than 100 pulses are rounded down, and the step distance between P8 and P9 is calculated by following formura:

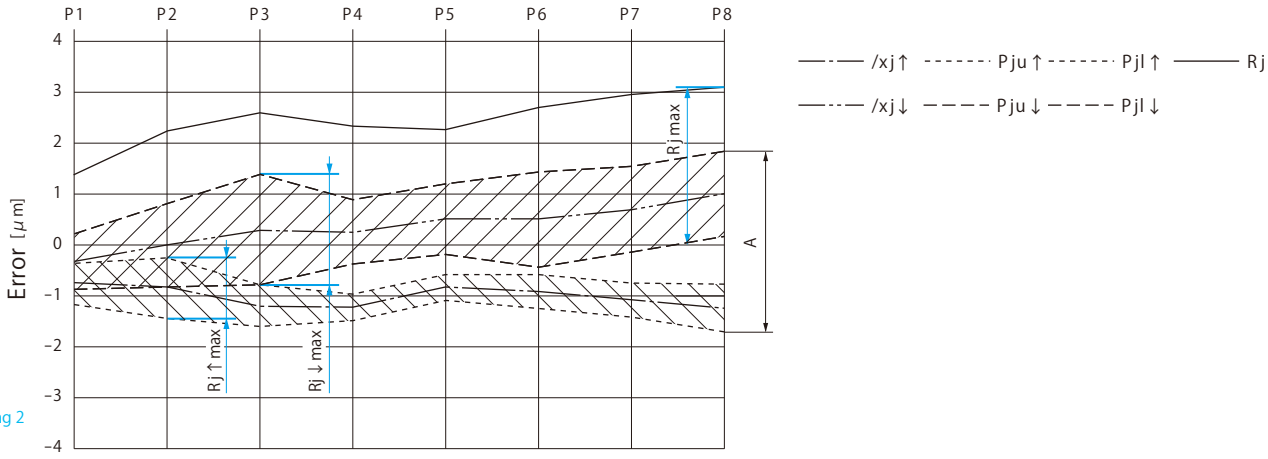
Stroke – (Distance of one step × 8)

In accordance with the formula in the Drawing 1 on page 15, (1) Unidirectional Repeat Accuracy , (2) Bidirectional Repeat Accuracy, (3) Bidirectional Positioning Accuracy, and (4) Average Inverse Error, are calculated by the error (deviation) of the actual stopped position against each target position.

Table-1

Number			Definition		Code	Definition Formula	
						Positioning Forward Direction ↑	Positioning Backward Direction ↓
1			Number of Target Stop Position		j	$j=1, 2, 3, \cdots\cdots, n$	
2			" j " th Target Position		Pj	Pj	
3			Stop Position in the Forward or Backward Direction at the " i " th Time Positioning in " j "		Pji ↑ or Pji ↓	Pji ↑	Pji ↓
4			Deviation Between the Stop Position and the Target Position in the Forward or Backward Direction of " i " th Time in " Pj "		xji ↑ or xji ↓	$xji\uparrow = Pji\uparrow - Pj$	$xji\downarrow = Pji\downarrow - Pj$
5			Average Deviation of 5 Times Stop Position to " Pj "		$\overline{xj}\uparrow$ or $\overline{xj}\downarrow$	$\overline{xj}\uparrow = \frac{1}{5}\sum_{i=1}^{5} xji\uparrow$	$\overline{xj}\downarrow = \frac{1}{5}\sum_{i=1}^{5} xji\downarrow$
6			Inverse Error in " Pj "		Bj	$Bj = \overline{xj}\uparrow - \overline{xj}\downarrow$	
7			Estimated Standard Deviation for Unidierctional Positioning in " Pj "	Calculating by Formula	sj ↑ or sj ↓	$sj\uparrow = \sqrt{\frac{1}{4}\sum_{i=1}^{5}(xji\uparrow - \overline{xj}\uparrow)^2}$	$sj\downarrow = \sqrt{\frac{1}{4}\sum_{i=1}^{5}(xji\downarrow - \overline{xj}\downarrow)^2}$
				Calculating by Width		$sj\uparrow = \frac{xji\uparrow \max - xji\uparrow \min}{2.326}$	$sj\downarrow = \frac{xji\downarrow \max - xji\downarrow \min}{2.326}$
Positioning Accuracy in " Pj "	8		Limit of Unidirectional Positioning Position	Upper Limit	Pju	$Pju = \overline{xj}\uparrow + 3sj\uparrow$	$Pju = \overline{xj}\downarrow + 3sj\downarrow$
				Lower Limit	Pjl	$Pjl = \overline{xj}\uparrow - 3sj\uparrow$	$Pjl = \overline{xj}\downarrow - 3sj\downarrow$
	9		Bidirectional Positioning Accuracy		Rj ↑ or Rj ↓	$Rj\uparrow = 6sj\uparrow$	$Rj\downarrow = 6sj\downarrow$
	10		Bidirectional Repeat Accuracy		Rj	Maximum value of $Rj\uparrow$, $Rj\downarrow$ or $3sj\uparrow + 3sj\downarrow + \lvert Bj \rvert$	
Positioning Accuracy of Kinetic Axis	11		Unidirectional Repeat Accuracy (of Kinetic Axis)		R ↑ or R ↓	$R\uparrow = (Rj\uparrow)$ maximum	$R\downarrow = (Rj\downarrow)$ maximum
	12		Bidirectional Repeat Accuracy (of Kinetic Axis)		R	R = (Rj) maximum	
	13		Bidirectional Positioning Accuracy (of Kinetic Axis)		A	A = (Pju) maximum − (Pjl) minimum	
	14		Average Inverse Error		$\overline{B}$	$\overline{B} = \frac{1}{n}\sum_{j=1}^{n} Bj$	

/xj, Pju, Pjl, Rj are calculated according to Table-1 above and become graph as shown in Drawing 2 below.
However, Rj in the graph is the calculation result of $3sj\uparrow + 3sj\downarrow + \lvert B \rvert$



Drawing 2

■ Definition of Accuracy

① Unidirectional Repeat Accuracy
This is the repeatability of the position when positioning from the forward or backward direction.
We define the maximum value of Rj ↑ or Rj ↓ in Drawing 2 as unidirectional repeat accuracy.

② Bidirectional Repeat Accuracy
We define the maximum value of Rj ↑ and Rj ↓ or Rj max in Drawing 2 as bidirectional repeat accuracy.

③ Bidirectional Positioning Accuracy
This is the maximum error between the target position and the actual stop position including bidirectional repeat accuracy.
We define A in Drawing 2 as bidirectional positioning accuracy.

④ Average Inverse Error
The average of inverse error " Bj "

According to the above definitions ① to ④, we inspect all the products before delivery.

Models for Special Environments

Model for Chemical Cleanliness

Model for Clean Room

Model for Vacuum

Based on the standard models, we can customize our products to meet our customers' requirement.

We customize our products not only for general environment but also for special environment such as vacuum environment and clean room which require countermeasures for dust, gas, and/or chemical substance.

Examples of Solution for Chemical Cleanliness

● We use the components which emit the limited amount of gas :

- Change grease of the bearings and gearheads to fluorine grease
- Use fluorine resin cable and lead wire
- Use special adhesive

● We can also customize the motor characteristics, shape, design etc. at the same time.

*Caution for Specification Change According to the Components Change

By changing the grease to fluorine type, the characteristics such as increase of current value and decrease of gear's allowable output / torque may change.
And also, bearing life may be significantly shortened by the deterioration in lubricity depending on the grease used.

■ Examples of Application for Chemical Cleanliness

- Semiconductor Equipments
- Electron Microscopes
- Other applications requiring low gas emission

Examples of Customized Product

Brushless Motors for
Chemical Cleanliness

AC Servomotors for
Clean Room

Linear Actuators for
Vacuum Environment

⚠ Cautions for Handling Products

Our linear actuator, encoder, driver, and accessories are precision-machined products and it is assumed that all the cautions and warnings listed below are correctly understood and handled.

Please do not install, operate, maintain, or inspect the product until you have a full knowledge on the product, safety information, and cautions.

The minimum cautions required for your safety are as follows.

【Caution When Unpacking】

● When you received the product, please check the package for damage and if it is the product you ordered.

【Cautions for Handling】

1. Be sure to check the wiring before turning on the power. Failure to follow this caution may result in mechanical damage and/or operation error.
2. The cables or lead wires should not be damaged, stressed excessively, loaded heavily, or pinched. Failure to follow this causion may result in malfuncition and/or the products would not operate correctly.
3. Since they are small precision products, there are many parts where strength is secured by adhesion. Please handle with care such as do not apply impact or stress to the joints of the gear and encoder. Failure to follow this caution may result in injury and/or malfunction.
4. Please do not apply impact or radial load to the shaft. Also please do not apply thrust load that exceeds the specified value. Failure to follow this caution may result in malfunction.
5. Hall sensor and encoder include semiconductor components. Please process the lead wire in an anti-static environment.
6. When installing the product, please use the specified number of screws by the torque specified in JIS. Please select the screws according to the dimensions shown in the external layout drawings. Failure to follow this caution, such as screws are too long or fixing torque excessive, may result in a malfunction for mechanical parts inside may be deformed or destroyed.
7. Please do not use or store the product in an environment subject to corrosive gas or any other hazardous gas. Also, please keep dust, water or oil out of the product.
8. If smoke, abnormal heat generation, strange odor, abnormal noise, abnormal vibration, etc. is generated, please stop operating immediately and turn off the power.
9. Linear actuators do not have a ground terminal. If you need to ground it, please use a housing.
10. When mounting the driver and other optional items, please use screws that conform to the specifications in the outline drawing. Especially, if the screw for fixing the driver is too long, it may damage the board, causing malfunction, short circuit, or fire.
11. Since the life of the linear actuator and its accessories varies greatly depending on the load conditions, operating mode and operating environment, please check the operation of the actual machine thoroughly.
12. For fixing linear actuator, please see "Drawing of Fixing Actuator" on page 2.

【Product Warranty】

1. Duration of the warranty is one year from the date of delivery. If the customer discovered a defect in material and workmanship within this period, we will repair the product for free only if the customer carry it in or return it to our company address by customer's expense.

   Please note that it would take several days to repair.
2. For the defect caused by "misuse" or "mishandling" by any party, or the defect caused later than one year from the date of delivery, the customer is responsible for repairing charges. We will repair the product only if the customer carry it in to our company address or the customer is responsible to all shipping charges.
3. We are not liable to the damages caused while in transit. Please pack the product with sufficient cushioning materials to prevent external vibration.

【Other】

1. If you got any problem with our product, please do not disassemble it and keep it as it is. Then please contact our sales representatives and return it. We will investigate and repair the product only if it is brought or sent to our company by a customer's expence.
2. Information listed above is subject to change without notice.
   For further information, please contact our sales representatives or our authorized distributors.

■ Product Lineup


Coreless DC Motors


Brushless Motors


AC Servomotors


Linear Actuators


Galvanometer Optical Scanners


Gearheads


Tachometer Generator/ Encoder

■ Application for Solution

● Please visit our website for more details.
https://ccj.citizen.co.jp/en/case

■ Semiconductor Equipment :
Lithography Machine / Wafer Inspection System / Turbo Molecular Pumps / Wafer Dicing Machine / Conveyance System for Semiconductor Factories

■ Medical and Clinical Equipment :
Denture Processing Machine / Down Flow Masks for Virus Protection / OCT / Ultrasonic Diagnostic System / Lens Edger / Cancer Treatment / Autoclavable Medical Equipment / Robotic Exoskeleton

■ Beauty and Cosmetic Equipment :
Handpieces for Nail Art

■ Measuring and Analyzing Equipment :
LiDAR / Electron Microscope / Confocal Microscope / Railway Track Measuring Device / Surface Roughness Tester

■ Factory Automation and Robots :
Laser Marking Machine / Motors for Robots / Grinding Machine / Optical Disk Equipment

* Technical data and products are subject to change without prior notice. For further information, please contact our sales representatives or authorized distributors.

CITIZEN

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2021.11