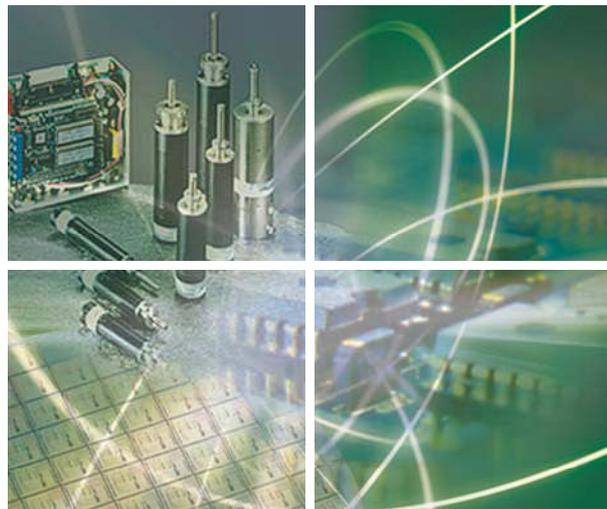


微型直线单元

Linear Actuator

一般环境应用型 Model for General Environment	真空环境应用型 Model for Vacuum
洁净环境应用型 Model for Clean Room	化工洁净环境应用型 Model for Chemical Cleanliness



NEW

低成本型

Cost-Effective Model

高分辨率型

High Resolution Type

符合
RoHS标准

RoHS Directive
Compliance

<http://www.citizen-cpc.jp/>

Challenge to Highest Precision

挑战最高精度

超小型 直线单元

Ultra Miniaturized Linear Actuator



超小型 Ultra Compact φ 16~28 mm	行程 Stroke 6~30 mm	额定推力 Rated Thrust 2~6 kgf	高分辨率 High Resolution 0.015~0.625 μm
单向重复定位精度 Unidirectional Repeatable Accuracy 3~20 μm	双向重复定位精度 Bidirectional Repeatable Accuracy 5~25 μm	双向绝对定位精度 Bidirectional Positioning Accuracy 10~50 μm	

简介

此款产品为超小型化伺服驱动的微型/轻便/高精度定位的直线单元。

电机选择中空结构的直驱电机, 编码选择微型高精度光电编码器。这样的组合, 可以不用减速机, 从而实现高分辨率及高精度定位。

MAB系列采用滚珠丝杠, 以实现高速及长使用寿命。MALS和MALB系列虽然是经济型, 可以节省很大一部份成本。但同样保持了高精度定位。

微型直线单元所采用的驱动器, 是专门为此微型/轻便直线单元开发的。因为采用了正弦波及低增益, 使直线单元运行平稳及无振动定位。一这也是这款驱动器最大的特点。

此款微型直线单元, 非常适合真空及洁净环境使用。另外, 在工业生产设备上也得到了广泛的使用, 如: 检测和实验设备, 光学和半导体行业等。

Special Features

Ultra miniaturized AC servo linear actuators are the compact and light linear actuators, which enable precision positioning.

The motor section adapts an AC servo motor of hollow structure and the encoder section adopts an optical rotary encoder with ultra miniaturization and high resolution. Together with these devices, the direct design without gearhead achieves the precision positioning of high resolution.

MAB series utilizes ball screw to accomplish high speed and long life. MALS and MALB series are cost-effective models, which largely reduce the prices, but maintain the high precision positioning.

The compact and light multifunctional driver was specially developed for this AC servo linear actuator. With the sinusoidal wave and gain low, this actuator has a smooth motion and positions itself without vibration, — the most crucial for the linear actuator.

The actuator is easily adaptable to be used in vacuum chambers or clean rooms, and can also be applied to a wide range of applications, such as production, inspection and experimental equipment in optical and semiconductor industries.

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直线单元

● 一般环境应用型

● MALS-D18 Series **NEW**

● MAS-D16 Series

● MALS-D23 Series **NEW**

● MAS-D23 Series

● MALB-D28 Series **NEW**

● MAB-D28 Series

● MASM-D23 Series **NEW**

● MASAU-D23 Series

■ 特殊产品选型注意事项

● 特殊环境应用型

● MASC-D16 Series 洁净环境应用型

● MASC-D23 Series 洁净环境应用型

● MAVB-D28 Series 高真空环境应用型

● MASG-D23 Series 化工洁净环境应用型

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Linear Actuator

for General Environment

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Standard Type P.6

High Speed / Long Life Type(Cost-effective Model) P.7

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定货型号参考说明 Model No.

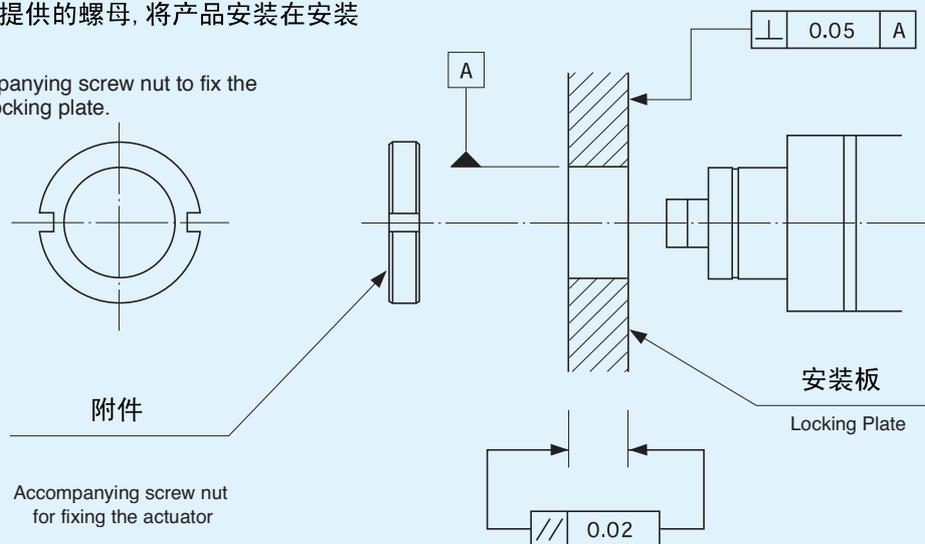
MAS - D23 H 25 - 03

<p>种类</p> <p>S : 标准型 LS : 标准型(低成本型) B : 滚珠丝杠型 LB : 滚珠丝杠型(低成本型) SM : 高分辨率型 SAU : 连接器型 SC : 洁净环境应用型 VB : 真空环境应用型 SG : 化工洁净环境应用型</p> <p>Type</p> <p>S : Standard type LS : Standard type(Cost-effective Model) B : Ball screw type LB : Ball screw type(Cost-effective Model) SM : High resolution type SAU : Connector type SC : for clean room VB : for vacuum condition SG : for chemical cleanliness</p>	<p>外径 (mm) Outer diameter</p>	<p>03: 电缆长度200mm 如果此处不填写数字, 标配电缆长度2m.</p> <p>03: cable length is 200mm Standard cable length is 2m when no code is written at this position.</p>
	<p>轴端形状 Tip shape</p>	<p>行程 (mm) Stroke</p> <p>H: 平面形轴端 R: 球形轴端 N: 螺孔形轴端(仅MAB系列)</p> <p>H : Tip with flat point R : Tip with spherical point N : Tip with screw hole (For MAB- Only)</p>

安装示意图 Drawing of Actuator Fixing

- 使用随商品提供的螺母, 将产品安装在安装板上.

Use an accompanying screw nut to fix the actuator to a locking plate.



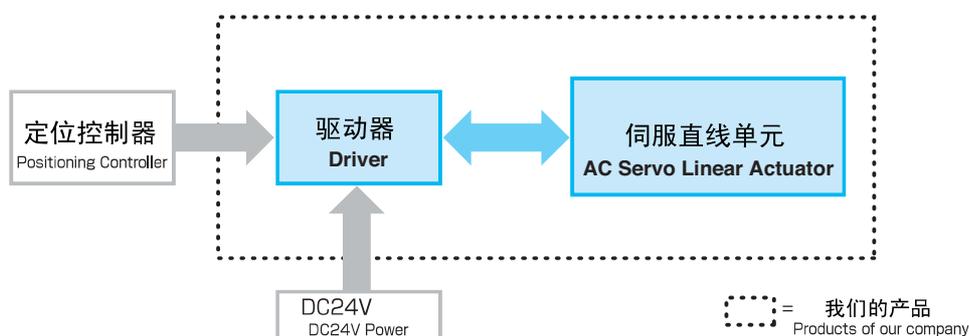
注意:

- 1) 请使用随商品提供的螺母将产品固定在您的设备上. 如果安装的不够牢固, 产品的精度将不能得到保证.
- 2) 请采用足够硬度的安装板, 否则可能发生滑动等故障.

Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.

Note 2) The malfunction of shaft slide is concerned when the hardness of locking plate is insufficient and the screw nut is tightened too strongly.

系统构成图 System Configuration



MALSD18Series

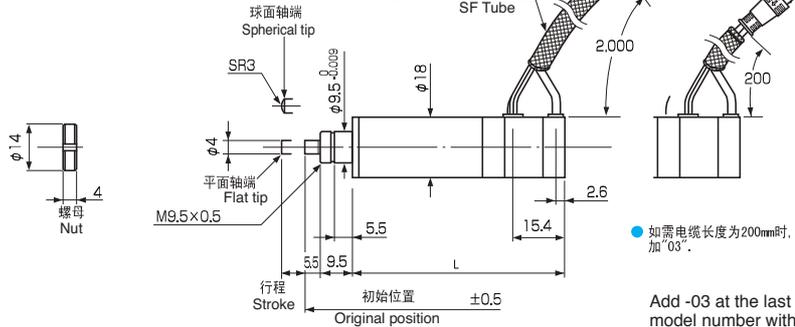


- 行程 : 6/ 10/ 20 mm
Stroke
- 额定推力 : 1.5 kgf
Rated thrust
- 分辨率 : 0.5 μm
Resolution

经济型
Cost-Effective Model

标准型
Standard Type

符合
RoHS标准
RoHS Directive
Compliance
Products



● 如需电缆长度为200mm时, 请在型号后加“03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

参数 Specification

参数	Parameter	Unit	Model		
			MALS - D18H06 MALS - D18R06	MALS - D18H10 MALS - D18R10	MALS - D18H20 MALS - D18R20
行程	Stroke	mm	6	10	20
额定推力	Rated thrust	kgf	1.5	1.5	1.5
分辨率	Resolution	μm	0.5	0.5	0.5
最大速度	Max speed	mm/s	4	4	4
丝杠导程	Screw lead	mm	0.4	0.4	0.4
单向重复定位精度	Unidirectional repeatable accuracy	μm	10	12	15
双向重复定位精度	Bidirectional repeatable accuracy	μm	15	17	20
双向绝对定位精度	Bidirectional positioning accuracy	μm	30	35	50
平均反转误差	Average reversal error	μm	10	10	15
限位传感器	Limit sensor	-	霍尔传感器	ホールセンサ	Hall sensor
长度	Length	mm	63	67	77
重量	Weight	g	165	170	175
外径	Diameter	mm	φ 18	φ 18	φ 18

注意:

- 1) 请使用配套螺母, 将本产品安在您设备的安装板上。如果本产品安装不牢固, 将无法保证预期精度。
- 2) 本产品可以安装于可安装在正向及反向负载力的方向, 请在轴运动的正向或反向的任意方向, 安装弹簧或类似部份做预载, 以此来消除背隙带来的精度损失。以上产品的精度, 在800gf的预载情况下测得。
- 3) 此产品所配电缆不能适应频繁折弯应力, 如有此类应用, 请与我们联系, 以配置适合应用电缆等。
- 4) 此产品采用编码器为2相信号输出, 无Z相信号输出。
- 5) 关于原始位置, 请参考术语定义页面。P21。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.
- Note 4) The encoders of these models have 2 channels only and have no Z phase.
- Note 5) As to the original position, refer to the page of term definition.

● 安全装置

行程前端装有阻尼器, 后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸, 由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-06系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出。如需较长距离时, 请使用BSD-06D-012 (适合长线驱动型) 及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver BSD-06 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-06D-012 (good for line driver type) with an extension cable.

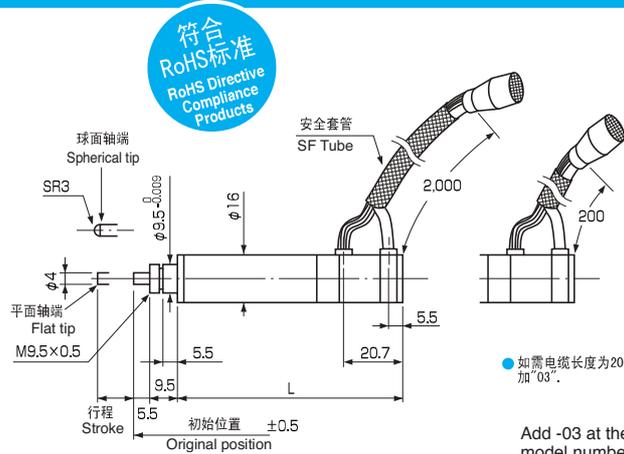
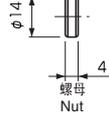
MAS-D16 Series

标准型(超精密) Standard Type (Extra Fine)



注：微型直线机构的外壳从原来的黑色，改为现在的银色，以适应RoHS标准。
The color of actuator housing is changed from black to silver for being compliance with RoHS directive.

- 行程 : 6/ 10/ 20 mm
Stroke
- 额定推力 : 2 kgf
Rated thrust
- 分辨率 : 0.25 μm
Resolution



● 如需电缆长度为200mm时，请在型号后加“03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

参数 Specification

参数	Parameter	Unit	Model		
			MAS - D16H06 MAS - D16R06	MAS - D16H10 MAS - D16R10	MAS - D16H20 MAS - D16R20
行程	Stroke	mm	6	10	20
额定推力	Rated thrust	kgf	2	2	2
分辨率	Resolution	μm	0,25	0,25	0,25
最大速度	Max speed	mm/s	4	4	4
丝杠导程	Screw lead	mm	0,4	0,4	0,4
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	5	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	10	16
平均反转误差	Average reversal error	μm	3	3	5
限位传感器	Limit sensor	-	霍尔传感器 ホールセンサ Hall sensor		
长度	Length	mm	68	72	82
重量	Weight	g	150	155	160
外径	Diameter	mm	φ 16	φ 16	φ 16

注意：

- 1) 请使用配套螺母，将本产品安在您设备的安装板上。
如果本产品安装不牢固，将无法保证预期精度。
- 2) 本产品可以安装于可安装在正向及反向负载力的方向。
请在轴运动的正向或反向的任意方向，安装弹簧或类似部份做预载，以此来消除背隙带来的精度损失。以上产品的精度，在800gf的预载情况下测得。
- 3) 此产品所配电缆不能适应频繁折弯应力。如有此类应用，请与我们联系，以配置适合应用电缆等。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.

● 安全装置

行程前端装有阻尼器，后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸，由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-11系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出。如需较长距离时，请使用BSD-11D-012 (适合长线驱动型) 及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver **BSD-11** series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of **BSD-11D-012** (good for line driver type) with an extension cable.

MALSD23 Series

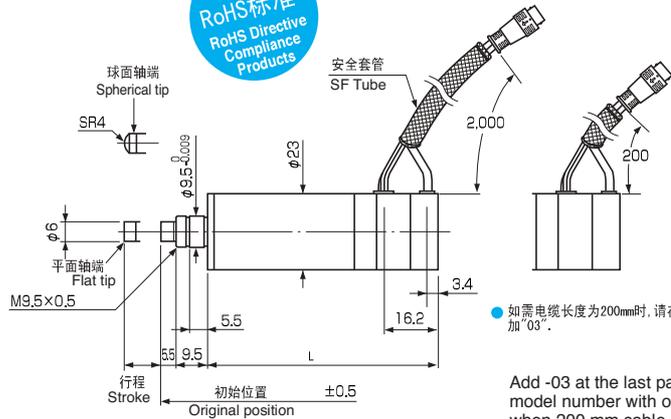
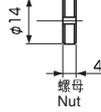


- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 4 kgf
Rated thrust
- 分辨率 : 0.5 μm
Resolution

经济型
Cost-Effective Model

标准型 Standard Type

符合
RoHS标准
RoHS Directive
Compliance
Products



● 如需电缆长度为200mm时, 请在型号后加“03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

参数 Specification

参数	Parameter	Unit	Model		
			MALS - D23H10 MALS - D23R10	MALS - D23H15 MALS - D23R15	MALS - D23H25 MALS - D23R25
行程	Stroke	mm	10	15	25
额定推力	Rated thrust	kgf	4	4	4
分辨率	Resolution	μm	0.5	0.5	0.5
最大速度	Max speed	mm/s	5	5	5
丝杠导程	Screw lead	mm	0.5	0.5	0.5
单向重复定位精度	Unidirectional repeatable accuracy	μm	10	12	15
双向重复定位精度	Bidirectional repeatable accuracy	μm	15	17	20
双向绝对定位精度	Bidirectional positioning accuracy	μm	30	35	50
平均反转误差	Average reversal error	μm	10	10	15
限位传感器	Limit sensor	-	霍尔传感器	ホールセンサ	Hall sensor
长度	Length	mm	69	74	84
重量	Weight	g	220	225	230
外径	Diameter	mm	φ 23	φ 23	φ 23

注意:

- 1) 请使用配套螺母, 将本产品安在您设备的安装板上。如果本产品安装不牢固, 将无法保证预期精度。
- 2) 本产品可以安装于可安装于正向及反向负载力的方向, 请在轴运动的正向或反向的任意方向, 安装弹簧或类似部份做预载, 以此来消除背隙带来的精度损失。以上产品的精度, 在800gf的预载情况下测得。
- 3) 此产品所配电缆不能适应频繁折弯应力。如有此类应用, 请与我们联系, 以配置适合应用电缆等。
- 4) 此产品采用编码器为2相信号输出, 无Z相信号输出。
- 5) 关于原始位置, 请参考术语定义页面, P21。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.
- Note 4) The encoders of these models have 2 channels only and have no Z phase.
- Note 5) As to the original position, refer to the page of term definition.

● 安全装置

行程前端装有阻尼器, 后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸, 由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-06系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出。如需较长距离时, 请使用BSD-06D-012 (适合长线驱动型) 及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver BSD-06 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-06D-012 (good for line driver type) with an extension cable.

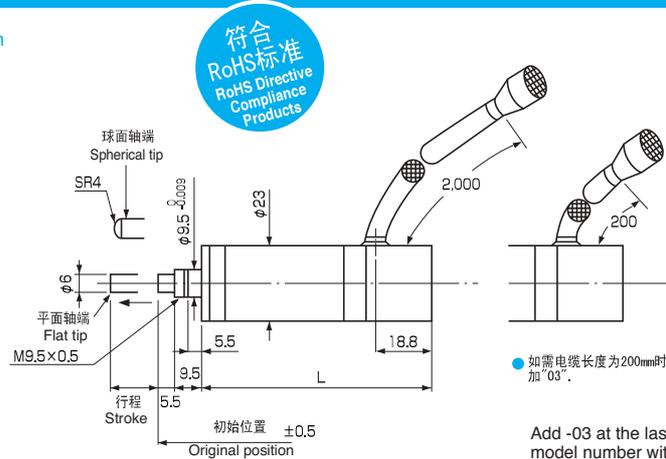
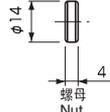
MAS-D23 Series

标准型 Standard Type



注：微型直线机构的外壳从原来的黑色，改为现在的银色，以适应RoHS标准。
The color of actuator housing is changed from black to silver for being compliance with RoHS directive.

- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 6 kgf
Rated thrust
- 分辨率 : 0.25 μm
Resolution



● 如需电缆长度为200mm时, 请在型号后加'03'。
Add -03 at the last part of model number with order when 200 mm cable length is required.



参数 Specification

参数	Parameter	Unit	Model		
			MAS - D23H10 MAS - D23R10	MAS - D23H15 MAS - D23R15	MAS - D23H25 MAS - D23R25
行程	Stroke	mm	10	15	25
额定推力	Rated thrust	kgf	6	6	6
分辨率	Resolution	μm	0.25	0.25	0.25
最大速度	Max speed	mm/s	5	5	5
丝杠导程	Screw lead	mm	0.5	0.5	0.5
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	8	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	13	20
平均反转误差	Average reversal error	μm	3	4	5
限位传感器	Limit sensor	-	霍尔传感器 ホールセンサ Hall sensor		
长度	Length	mm	72	77	87
重量	Weight	g	265	270	280
外径	Diameter	mm	φ 23	φ 23	φ 23

注意：

- 1) 请使用配套螺母, 将本产品安在您设备的安装板上。
如果本产品安装不牢固, 将无法保证预期精度。
- 2) 本产品可以安装于可安装在正向及反向负载力的方向。
请在轴运动的正向或反向的任意方向, 安装弹簧或类似部份做预载, 以此来消除背隙带来的精度损失。以上产品的精度, 在800gf的预载情况下测得。
- 3) 此产品所配电缆不能适应频繁折弯应力。如有此类应用, 请与我们联系, 以配置适合应用电缆等。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.

● 安全装置

行程前端装有阻尼器, 后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸, 由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-11系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出, 如需较长距离时, 请使用BSD-11D-012 (适合长线驱动型) 及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver **BSD-11** series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of **BSD-11D-012** (good for line driver type) with an extension cable.

MALB D28 Series

高速/长寿命型

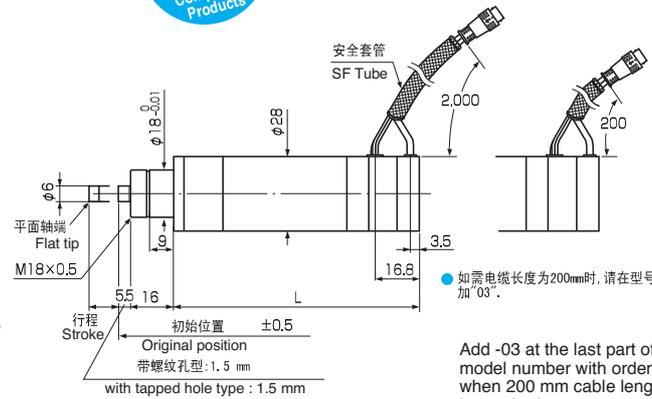
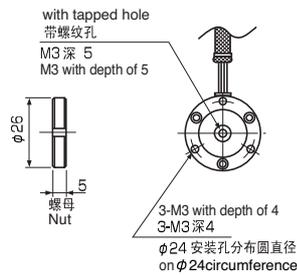
经济型
Cost-Effective Model

High Speed/ Long Life Type



- 行程 : 10/ 30 mm
Stroke
- 额定推力 : 5 kgf
Rated thrust
- 分辨率 : 0.625 μm
Resolution

符合
RoHS标准
RoHS Directive
Compliance
Products



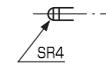
● 如需电缆长度为200mm时, 请在型号后加'-03'.

Add -03 at the last part of model number with order when 200 mm cable length is required.

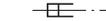
参数 Specification

参数	Parameter	Unit	Model	
			MALB - D28H10 MALB - D28R10 MALB - D28N10	MALB - D28H30 MALB - D28R30 MALB - D28N30
行程	Stroke	mm	10	30
额定推力	Rated thrust	kgf	5	5
瞬间最大推力	Short time max thrust	kgf	8	8
分辨率	Resolution	μm	0.625	0.625
最大速度	Max speed	mm/s	40	40
丝杠导程	Screw lead	mm	1.0	1.0
单向重复定位精度	Unidirectional repeatable accuracy	μm	10	20
双向重复定位精度	Bidirectional repeatable accuracy	μm	15	25
双向绝对定位精度	Bidirectional positioning accuracy	μm	30	40
平均反转误差	Average reversal error	μm	10	20
限位传感器	Limit sensor	-	霍尔传感器 ホールセンサ Hall sensor	Hall sensor
长度	Length	mm	92	112
重量	Weight	g	400	450
外径	Diameter	mm	φ 28	φ 28

● 球面轴端: R 型
Spherical tip: R type



● 平面轴端: H 型
Flat tip: H type



● 带螺纹孔型: N 型
Tapped hole: N type



注意:

- 1) 请使用配套螺母, 将本产品安在您设备的安装板上. 如果本产品安装不牢固, 将无法保证预期精度.
- 2) 本产品可以安装于可安装于正向及反向负载力的方向. 请在轴运动的正向或反向的任意方向, 安装弹簧或类似部份做预载. 以此来消除背隙带来的精度损失. 以上产品的精度, 在800gf的预载情况下测得.
- 3) 此产品所配电缆不能适应频繁折弯应力. 如有此类应用, 请与我们联系, 以配置适合应用电缆等.
- 4) 如上图中, 3个M3螺纹孔的位置, 与出线的相对位置是任意的.
- 5) 此产品采用编码器为2相信号输出, 无Z相信号输出.
- 6) 关于原始位置, 请参考术语定义页面. P21.

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.
- Note 4) The relative position between the tapped hole for M3 set-screw and the cable is arbitrary.
- Note 5) The encoders of these models have 2 channels only and have no Z phase.
- Note 6) As to the original position, refer to the page of term definition.

● 安全装置

行程前端装有阻尼器, 后端装有限位传感器. 做Z轴使用时, 当本产品断电后, 负载可能会产生运动. 因此本产品无内置抱闸. 所以, 客户需做一些安全措施, 以保证设备安全.

● 高速, 长使用寿命

采用了滚珠丝杠, 以实现高速, 长使用寿命等特点.

● 专用驱动器

请使用为本产品专门开发的BSD-06系列驱动器.

● 延长电缆

本产品的编码器为集电极开路输出. 如需较长距离时, 请使用BSD-06D-012(适合长线驱动型)及延长电缆.

● Safety Mechanism

The damper systems are set at the both ends of stroke and limit sensor is installed at the lower end.

The actuator shaft may move when a load is applied to it under the condition of no current since the actuator is unequipped with a built-in brake mechanism. Therefore, the customer may need safety measures to protect the equipment.

● High speed and long life

High speed and long life operation is realized by the application of ball screw.

● Special Driver

Please use the driver BSD-06 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-06D-012 (good for line driver type) with an extension cable.

MAB-D28 Series

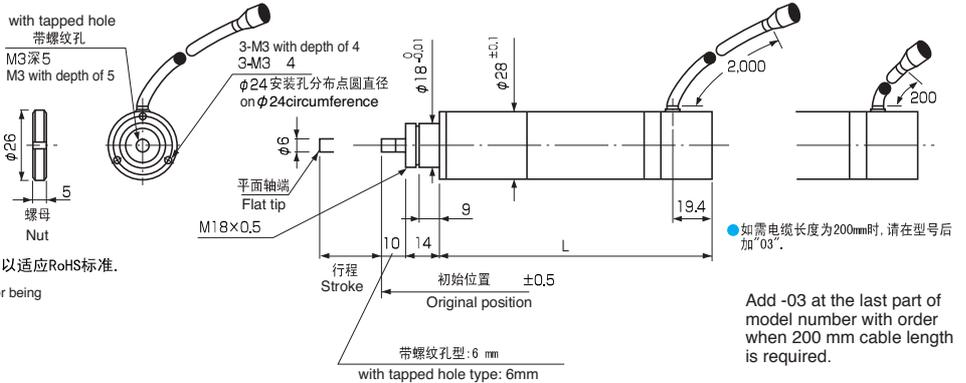
高速/长寿命型

High Speed / Long Life Type



注：微型直线机构的外壳从原来的黑色，改为现在的银色，以适应RoHS标准。
The color of actuator housing is changed from black to silver for being compliance with RoHS directive.

- 行程 Stroke : 10/30 mm
- 额定推力 Rated thrust : 5 kgf
- 分辨率 Resolution : 0.5 μm



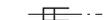
参数 Specification

参数	Parameter	Unit	Model	
			MAB-D28H10 MAB-D28R10 MAB-D28N10	MAB-D28H30 MAB-D28R30 MAB-D28N30
行程	Stroke	mm	10	30
额定推力	Rated thrust	kgf	5	5
瞬间最大推力	Short time max thrust	kgf	10	10
分辨率	Resolution	μm	0.5	0.5
最大速度	Max speed	mm/s	50	50
丝杠导程	Screw lead	mm	1	1
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	20
平均反转误差	Average reversal error	μm	3	5
限位传感器	Limit sensor	-	霍尔传感器 ホールセンサ Hall sensor	
长度	Length	mm	95	115
重量	Weight	g	430	480
外径	Diameter	mm	φ 28	φ 28

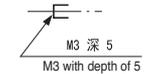
- 球面轴端: R 型
Spherical tip: R type



- 平面轴端: H 型
Flat tip: H type



- 带螺纹孔型: N 型
Topped hole: N type



注意:

- 请使用配套螺母，将本产品安在您设备的安装板上。如果本产品安装不牢固，将无法保证预期精度。
- 本产品可以安装于可安装于正向及反向负载力的方向，请在轴运动的正向或反向的任意方向，安装弹簧或类似部份做预载，以此来消除背隙带来的精度损失。以上产品的精度，在800gf的预载情况下测得。
- 此产品所配电缆不能适应频繁折弯应力。如有此类应用，请与我们联系，以配置适合应用电缆等。
- 如上图3个M3螺纹孔的位置与出线的相对位置是任意的。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment. Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.
- Note 4) The relative position between the tapped hole for M3 set-screw and the cable is arbitrary.

● 安全装置

行程前端装有阻尼器，后端装有限位传感器。做Z轴使用时，当本产品断电后，负载可能会产生运动。因此本产品无内置抱闸。所以，客户需做一些安全措施，以保证设备安全。

● 高速,长使用寿命

采用了滚珠丝杠，以实现高速，长使用寿命等特点。

● 专用驱动器

请使用为本产品专门开发的BSD-11系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出。如需较长距离时，请使用BSD-11D-012(适合长线驱动型)及延长电缆。

● Safety Mechanism

The damper systems are set at the both ends of stroke and limit sensor is installed at the lower end.

The actuator shaft may move when a load is applied to it under the condition of no current since the actuator is unequipped with a built-in brake mechanism. Therefore, the customer may need safety measures to protect the equipment.

● High speed and long life

High speed and long life operation is realized by the application of ball screw.

● Special Driver

Please use the driver BSD-11 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-11D-012 (good for line driver type) with an extension cable.

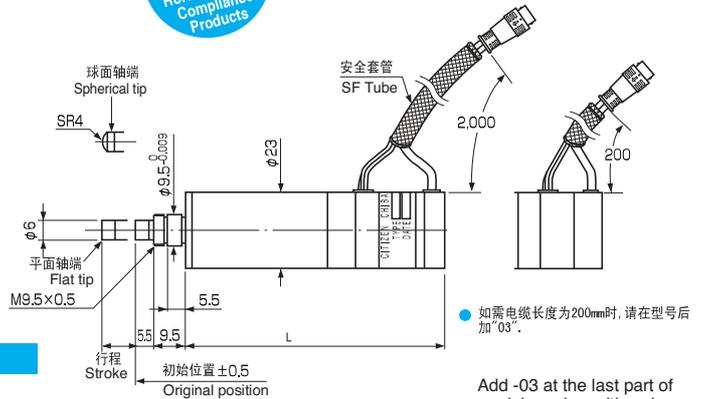
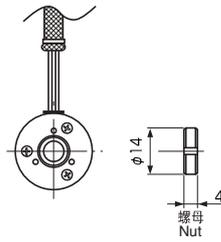
MASMD23 Series

高分辨率型

High Resolution Type



- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 6 kgf
Rated thrust
- 分辨率 : 0.015625 μ m
Resolution



● 如需电缆长度为200mm时, 请在型号后加“-03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

2010年上市新品 Sale in 2010

● 尺寸和主要参数可能有变化, 详细资料请联系我们索取。
Please contact us for the release date. The dimensions and other specifications are subject to change.

参数

Specification

参数	Parameter	Unit	Model		
			MASM - D23H10 MASM - D23R10	MASM - D23H15 MASM - D23R15	MASM - D23H25 MASM - D23R25
行程	Stroke	mm	10	15	25
额定推力	Rated thrust	kgf	6	6	6
分辨率	Resolution	μ m	0.015625	0.015625	0.015625
最大速度	Max speed	mm/s	5	5	5
丝杠导程	Screw lead	mm	0.5	0.5	0.5
单向重复定位精度	Unidirectional repeatable accuracy	μ m	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μ m	5	8	8
双向绝对定位精度	Bidirectional positioning accuracy	μ m	10	13	20
平均反转误差	Average reversal error	μ m	3	4	5
限位传感器	Limit sensor	-	霍尔 IC (常开)	霍尔 IC (normally-closed)	Hall IC (Normal Close)
长度	Length	mm	70	75	85
重量	Weight	g	232	237	247
编码器类型	Encoder		光电增量式编码器	光学式インクリメンタル	Optical Incremental Encoder
电机类型	Type of motor		无刷电机 (交流伺服)	ブラシレスモータ (AC サーボ)	Brushless Motor (AC Servo)
外径	Diameter	mm	ϕ 23	ϕ 23	ϕ 23

注意:

- 1) 请使用配套螺母, 将本产品安在您设备的安装板上。
如果本产品安装不牢固, 将无法保证预期精度。
- 2) 本产品可以安装于可安装在正向及反向负载力的方向。
请在轴运动的正向或反向的任意方向, 安装弹簧或类似部份做预载, 以此来消除背隙带来的精度损失。以上产品的精度, 在800gf的预载情况下测得。
- 3) 此产品所配电缆不能适应频繁折弯应力。如有此类应用, 请与我们联系, 以配置适合应用电缆等。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment.
Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 3) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.

● 安全装置

行程前端装有阻尼器, 后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸, 由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-05系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出。如需较长距离时, 请使用BSD-05D-012 (适合长线驱动型) 及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver BSD-05 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-05D-012 (good for line driver type) with an extension cable.

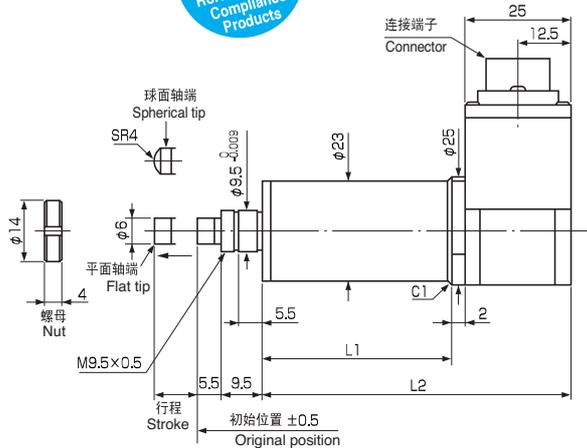
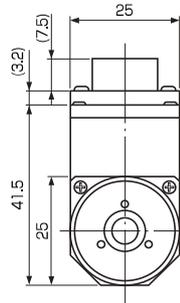
MAR-D23系列终止销售公告

Announcement of Sale Discontinuation of MAR-D23 Series

我们将于2010年10月, 停止MAR-D23系列(高分辨率型)的生产。详细规格请登陆我们的网站, 或在旧资料中查看。

We discontinue the manufacturing of MAR-D23 series (High Resolution Type) on October, 2010.
Please refer to our HP or old catalog for the detailed specifications.

- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 6 kgf
Rated thrust
- 分辨率 : 0.25 μm
Resolution



注：微型直线机构的外壳从原来的黑色，改为现在的银色，以适应RoHS标准。
The color of actuator housing is changed from black to silver for being compliance with RoHS directive.

参数 Specification

参数	Parameter	Unit	Model		
			MASAU - D23H10 MASAU - D23R10	MASAU - D23H15 MASAU - D23R15	MASAU - D23H25 MASAU - D23R25
行程	Stroke	mm	10	15	25
额定推力	Rated thrust	kgf	6	6	6
分辨率	Resolution	μm	0.25	0.25	0.25
最大速度	Max speed	mm/s	5	5	5
丝杠导程	Screw lead	mm	0.5	0.5	0.5
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	8	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	13	20
平均反转误差	Average reversal error	μm	3	4	5
限位传感器	Limit sensor	-	霍尔传感器	ホールセンサ Hall sensor	
长度L1	Length	mm	45	50	60
重量L2	Length	mm	72	77	87
重量	Weight	g	200	205	215
外径	Diameter	mm	φ 23	φ 23	φ 23

注意：

- 1) 请使用配套螺母，将本产品安在您设备的安装板上。
如果本产品安装不牢固，将无法保证预期精度。
- 2) 本产品可以安装于可安装在正向及反向负载力的方向。
请在轴运动的正向或反向的任意方向，安装弹簧或类似部份做预载，以此来消除背隙带来的精度损失。以上产品的精度，在800gf的预载情况下测得。

- Note 1) Use the accompanying screw nut to fix the actuator to your equipment.
Desired accuracy may not be obtained when the actuator housing is clenched for fixing.
- Note 2) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.

- 此型号是为装备特殊线缆准备的，请参考P17的详细说明。

The special cable is prepared for this model. Please refer to P. 17 for the detailed specifications.

- 线缆的连接和断开在直线单元的末端，所以布线和维修比以前更简单。

The connection and disconnection of cable is possible at the rear side of actuator, and the wiring and maintenance can be performed more easily than before.



产品使用注意事项

Cautions for Handling Products

此产品及其附件为高精度产品。所以下面的警告应正确理解及遵守。

使用产品前请充分掌握产品知识及确认安全搬运。

基本安全使用注意事项如下：

开箱注意事项

- 收到产品后，请检查包装是否完好，型号是否正确。

使用注意事项

- 首先检查接线。避免因接线错误引起的异常运行或故障。
- 不要拉扯电缆或折弯电缆根部。这样有可能会造成电缆损坏，引起异常运行或故障。
- 产品本身无接地端子。如贵方案例需接地，请将电机外壳接地。
- 请不要敲击负载轴，或在负载轴径向施加负载。轴向推力请不要超过额定推力。以上情况，可能造成产品故障或损坏。
- 安装方法，请参照P2, [产品安装示意图]。
- 请按驱动器安装尺寸图纸选用螺丝。螺丝过长，会损坏电路板。可能造成电路板故障或引起火灾。
- 直线单元及其附件的使用寿命，受负载情况，运行情况，周围环境等因素影响。请做好充分的机械运行测试。
-
- 当产品发生，如：过热/异常气味/冒烟/异常声音/异常振动等异常情况时，请及时断电，停止运行。

警告

- 当产品发生故障或异常时，请不要自行拆开本产品。我们将只对正常返厂的产品提供检测和维修服务。

Products and other accompanying items are high precision products. All the cautions and warnings listed below should be properly understood and observed.

Use the products after fully acquiring the product knowledge and confirming the safety handlings.

Minimal cautions for safety use are followings.

Caution at unpacking

- Perform visual inspection and confirm the model number when receiving the products.

Cautions for handling

- Check the wire connection firstly. Faulty wiring shall cause malfunctions and defects.
- Do not pull the actuator cable and bend the root of cable. It may cause defects.
- Our actuator does not have ground terminals. Use the motor housing for the earth ground.
- Do not hit or add radial overload to the shaft. Do not add impermissible thrust overload to the shaft. It shall damage the products.
- Refer to 『Actuator Fixing』 on P. 2 for the method.
- Use the screws, which are prescribed in the drawings, for driver and accompanying items. It shall damage the boards and cause malfunction, electric leakage and ignition, especially when excessively long screws are used for the driver.
- The life of actuator and accompanying items shall be affected by the load condition, operation mode and use environment. Fully perform the machine operation test.
- Do not use and store the products under the environment, which stores the materials of corrosive or poisonous gas. Avoid the intrusion of dust, droplet and oil into the products.
- Stop the operation and turn off the power when smoke, excess heat, abnormal smell, abnormal sound and abnormal vibration are perceived.

Additional Caution

- Do not disassemble the products, but report it and return them when you find troubles.

We perform the investigation and repair only when the products are returned properly.

特殊环境应用系列

Models for Special Environments



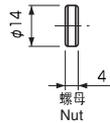
MASC-D16 Series 洁净环境下应用的直线单元 Linear Actuator for Clean Room

● 洁净等级100环境应用

Applicable to Clean Class 100

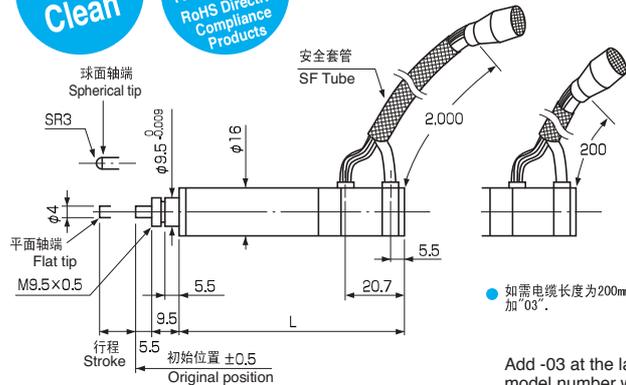


- 行程 : 6/ 10/ 20 mm
Stroke
- 额定推力 : 1.5 kgf
Rated thrust
- 分辨率 : 0.25 μm
Resolution



注：微型直线机构的外壳从原来的黑色，改为现在的银色，以适应RoHS标准。

The color of actuator housing is changed from black to silver for being compliance with RoHS directive.



● 如需电缆长度为200mm时，请在型号后加“-03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

参数

Specification

参数	Parameter	Unit	MASC - D16H06	MASC - D16H10	MASC - D16H20
			MASC - D16R06	MASC - D16R10	MASC - D16R20
行程	Stroke	mm	6	10	20
额定推力	Rated thrust	kgf	1.5	1.5	1.5
分辨率	Resolution	μm	0.25	0.25	0.25
最大速度	Max speed	mm/s	4	4	4
丝杠导程	Screw lead	mm	0.4	0.4	0.4
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	5	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	10	16
平均反转误差	Average reversal error	μm	3	3	5
限位传感器	Limit sensor	-	霍尔传感器	霍尔传感器	Hall sensor
长度	Length	mm	68	72	82
重量	Weight	g	150	155	160
外径	Diameter	mm	φ 16	φ 16	φ 16

注意：

- 1) 请使用配套螺母，将本产品安在您设备的安装板上。如果本产品安装不牢固，将无法保证预期精度。
- 2) 本产品可以安装于可安装在正向及反向负载力的方向。请在轴运动的正向或反向的任意方向，安装弹簧或类似部份做预载，以此来消除背隙带来的精度损失。以上产品的精度，在800gf的预载情况下测得。
- 3) 此产品所配电缆不能适应频繁折弯应力。如有此类应用，请与我们联系，以配置适合应用电缆等。
- 4) 如上图中3个M3螺纹孔的位置与出线的相对位置是任意的。

- Note 1) The shaft moves in the direction of the arrow when the motor rotates in CW direction.
- Note 2) Always use the limit switch. If not, the shaft may retrieve too deeply and never come out.
- Note 3) The Logic of the limit switch is normally " Close ". Please connect the limit switch to the higher rank controller and adjust the switch so as to stop the pulse output when the signal is ON.
- Note 4) The actuator shaft can receive a load in the both of forward and backward directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 5) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.

● 安全装置

行程前端装有阻尼器，后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸，由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-11系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出。如需较长距离时，请使用BSD-11D-012 (适合长线驱动型) 及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver BSD-11 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-11D-012 (good for line driver type) with an extension cable.

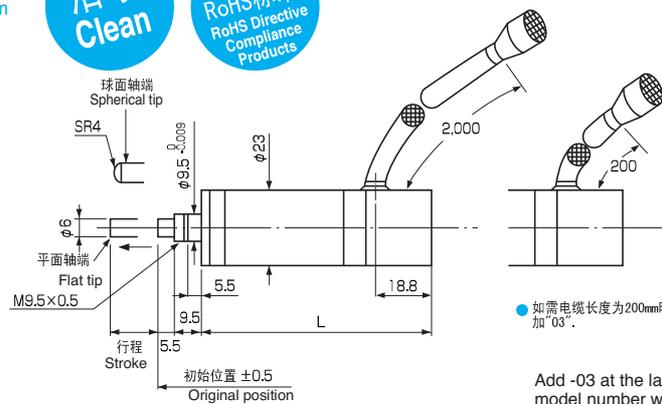
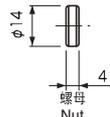
MASC-D23 Series 洁净环境下应用的直线单元 Linear Actuator for Clean Room

● 洁净等级100环境应用

Applicable to Clean Class 100



- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 3 kgf
Rated thrust
- 分辨率 : 0.25 μm
Resolution



● 如需电缆长度为200mm时,请在型号后加“03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

注: 微型直线机构的外壳从原来的黑色,改为现在的银色,以适应RoHS标准。

The color of actuator housing is changed from black to silver for being compliance with RoHS directive.

参数

Specification

参数	Parameter	Unit	MASC - D23H10	MASC - D23H15	MASC - D23H25
			MASC - D23R10	MASC - D23R15	MASC - D23R25
行程	Stroke	mm	10	15	25
额定推力	Rated thrust	kgf	3	3	3
分辨率	Resolution	μm	0.25	0.25	0.25
最大速度	Max speed	mm/s	5	5	5
丝杠导程	Screw lead	mm	0.5	0.5	0.5
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	8	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	13	20
平均反转误差	Average reversal error	μm	3	4	5
限位传感器	Limit sensor	-	霍尔传感器 Hall sensor		
长度	Length	mm	72	77	87
重量	Weight	g	265	270	280
外径	Diameter	mm	φ 23	φ 23	φ 23

注意:

- 1) 当电机顺时针方向旋转时,轴端向箭头方向移动。
- 2) 限位开关的逻辑为常开, 请将限位开关与更高一级的控制器或调节开关,以便信号为“ON”时,停止脉冲输出。
- 3) 此产品所配电缆不能适应频繁折弯应力,如有此类应用,请与我们联系,以配置适合应用电缆等。
- 4) 本产品可以安装于可安装在正向及反向负载力的方向,请在轴运动的正向或反向的任意方向,安装弹簧或类似部份做预载,以此来消除背隙带来的精度损失,以上产品的精度,在800gf的预载情况下测得。
- 5) 此产品所配电缆不能适应频繁折弯应力,如有此类应用,请与我们联系,以配置适合应用电缆等。

- Note 1) The shaft moves in the direction of the arrow when the motor rotates in CW direction.
- Note 2) Always use the limit switch. If not, the shaft may retrieve too deeply and never come out.
- Note 3) The Logic of the limit switch is normally " Close ". Please connect the limit switch to the higher rank controller and adjust the switch so as to stop the pulse output when the signal is ON.
- Note 4) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 5) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.

● 安全装置

行程前端装有阻尼器,后端装有限位传感器。

● 适应能力

安装此微型直线单元的安装部份尺寸,由手动千分尺测得即可。

● 专用驱动器

请使用为本产品专门开发的BSD-11系列驱动器。

● 延长电缆

本产品的编码器为集电极开路输出,如需较长距离时,请使用BSD-11D-012(适合长线驱动型)及延长电缆。

● Safety Mechanism

The damper system is set at the upper end of stroke and limit sensor is installed at the lower end.

● Compatibility

The mounting section of this linear actuator is compatible with manual micrometer.

● Special Driver

Please use the driver BSD-11 series which was specially developed for this actuator.

● Extension Cable

The encoder is open collector type. The transmission distance may be extended by the use of BSD-11D-012 (good for line driver type) with an extension cable.

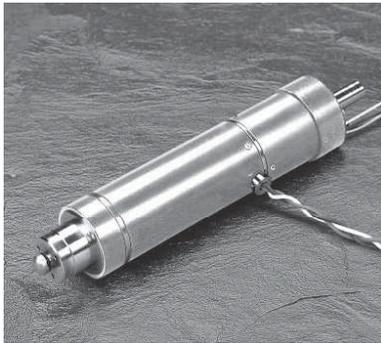
MAVB-D28 Series 真空环境下应用的直线单元 Linear Actuator for Vacuum

● 真空度 10^{-6} Pa

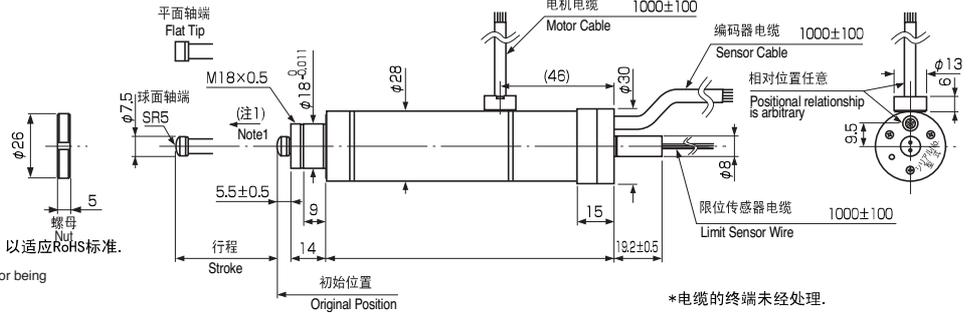
Correspondence Pressure : 10^{-6} Pa

高真空度
High Vacuum

符合
RoHS标准
Compliance
Products



- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 2 kgf
Rated thrust
- 分辨率 : 0.2442 μ m
Resolution



注：微型直线机构的外壳从原来的黑色，改为现在的银色，以适应RoHS标准。

The color of actuator housing is changed from black to silver for being compliance with RoHS directive.

*电缆的终端未经处理。
The cable ends are not fabricated.

参数

Specification

参数	Parameter	Unit	MAVB - D28H10	MAVB - D28H15	MAVB - D28H25
			行程	Stroke	mm
额定推力	Rated thrust	kgf	2	2	2
分辨率	Resolution	μ m	0.2442	0.2442	0.2442
最大速度	Max speed	mm/s	1	1	1
丝杠导程	Screw lead	mm	1	1	1
单向重复定位精度	Unidirectional repeatable accuracy	μ m	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μ m	5	8	8
双向绝对定位精度	Bidirectional positioning accuracy	μ m	10	13	20
平均反转误差	Average reversal error	μ m	3	4	5
限位传感器	Limit sensor	-	Contact CS Touch Sensor (Normal Close)		
传感器	Sensor	-	Resolver (Excitation to 1 phase Outputs from 2 phases)		
工作环境温度	Allowable temperature limit	$^{\circ}$ C	150		
气体排放速度	Emitted Gas Speed (Note 5)	Pa · m ³ /sec	27×10^{-8}		
长度	Length	mm	116	121	131
外径	Diameter	mm	ϕ 28	ϕ 28	ϕ 28

注意：

- 1) 当电机顺时针方向旋转时，轴端向箭头方向移动。
- 2) 通常情况下要使用限位开关。如果不使用的话，请注意：负载轴可能进入产品内部不再出来。
- 3) 限位开关的逻辑为常开。
请将限位开关与更高一级的控制器或调节开关，以便信号为“ON”时，停止脉冲输出。
- 4) 本产品可以安装于可安装在正向及反向负载力的方向。
请在轴运动的正向或反向的任意方向，安装弹簧或类似部份做预载，以此来消除背隙带来的精度损失。以上产品的精度，在800gf的预载情况下测得。
- 5) 此值不是绝对的值，但是具有代表意义的值。 $1\text{Pa} = 10\text{E}-3\text{Torr}$

- Note 1) The shaft moves in the direction of the arrow when the motor rotates in CW direction.
- Note 2) Always use the limit switch. If not, the shaft may retrieve too deeply and never come out.
- Note 3) The Logic of the limit switch is normally " Close ".
Please connect the limit switch to the higher rank controller and adjust the switch so as to stop the pulse output when the signal is ON.
- Note 4) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 5) This is not guaranteed value but representative value. $1\text{Pa} \approx 7.5 \times 10^{-3}\text{Torr}$

电缆颜色

Wiring Color

Motor Cable	
U相 U Phase	赤 Red 红
V相 V Phase	黑 Black 黑
W相 W Phase	白 White 白

Resolver Cable	
R1	白 White 白
R2	绿 Green 绿
S1	赤 Red 红
S2	青 Blue 蓝
S3	黑 Black 黑
S4	黄 Yellow 黄

驱动器

Driver

- 关于驱动器的详细配置信息，请向我方咨询。

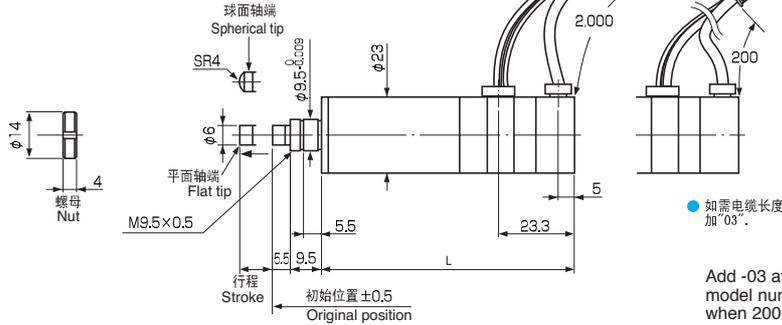
Please contact us for the details about the driver.

MASG-D23 Series 化工清洁环境下应用的直线单元

Chemical Cleanliness



- 行程 : 10/ 15/ 25 mm
Stroke
- 额定推力 : 3 kgf
Rated thrust
- 分辨率 : 0.25 μm
Resolution



● 如需电缆长度为200mm时, 请在型号后加“03”。

Add -03 at the last part of model number with order when 200 mm cable length is required.

参数 Specification

参数	Parameter	Unit	Model		
			MASG - D23H10 MASG - D23R10	MASG - D23H15 MASG - D23R15	MASG - D23H25 MASG - D23R25
行程	Stroke	mm	10	15	25
额定推力	Rated thrust	kgf	3	3	3
分辨率	Resolution	μm	0.25	0.25	0.25
最大速度	Max speed	mm/s	5	5	5
丝杠导程	Screw lead	mm	0.5	0.5	0.5
单向重复定位精度	Unidirectional repeatable accuracy	μm	3	3	3
双向重复定位精度	Bidirectional repeatable accuracy	μm	5	8	8
双向绝对定位精度	Bidirectional positioning accuracy	μm	10	13	20
平均反转误差	Average reversal error	μm	3	4	5
限位传感器	Limit sensor	-	霍尔传感器 Hall sensor		
长度	Length	mm	77	82	92
重量	Weight	g	285	290	300
外径	Diameter	mm	φ 23	φ 23	φ 23

注意:

- 1) 当电机顺时针方向旋转时, 轴端向箭头方向移动。
- 2) 限位开关的逻辑为常开。
请将限位开关与更高一级的控制器或调节开关, 以便信号为“ON”时, 停止脉冲输出。
- 3) 此产品所配电缆不能适应频繁折弯应力, 如有此类应用, 请与我们联系, 以配置适合应用电缆等。
- 4) 本产品可以安装于可安装在正向及反向负载力的方向。
请在轴运动的正向或反方向的任意方向, 安装弹簧或类似部份做预载, 以此来消除背隙带来的精度损失, 以上产品的精度, 在800gf的预载情况下测得。
- 5) 此产品所配电缆不能适应频繁折弯应力, 如有此类应用, 请与我们联系, 以配置适合应用电缆等。

- Note 1) The shaft moves in the direction of the arrow when the motor rotates in CW direction.
- Note 2) Always use the limit switch. If not, the shaft may retrieve too deeply and never come out.
- Note 3) The Logic of the limit switch is normally " Close ".
Please connect the limit switch to the higher rank controller and adjust the switch so as to stop the pulse output when the signal is ON.
- Note 4) The actuator shaft can receive a load in the both of forward and backward thrust directions. Use springs or something similar to apply pre-load to the shaft in either one direction at the operation. Backlash is concerned and desired accuracy may not be obtained when no pre-load is applied to the shaft. We perform the accuracy measurements by applying the pre-load of 800gf in the backward thrust direction at our shipping inspection.
- Note 5) The actuator cable is not designed to withstand repeated bending stress. Please contact us if the cable receives repeated bending stress.

可选配件

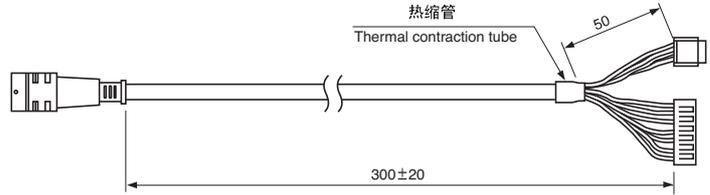
Option

MA-111-003

- 装置连接电缆
适用于集电极开路编码器型

Actuator connection cable

This cable is used for open collector type.



电缆连接器随微型直线单元和驱动器一起提供。这样您就可以自己制作电缆。(连接器形状与以上图纸不同。)

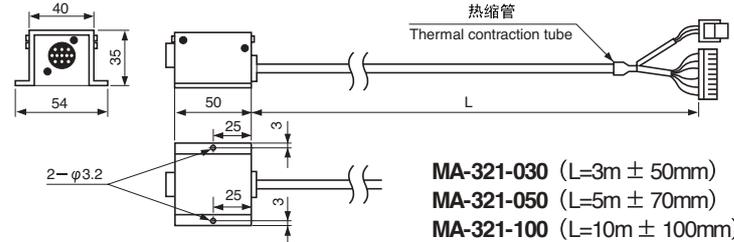
Connectors for cable are accompanied with actuator and driver so that you can make your own cable by yourself (The shapes of connectors are different from the drawing).

MA-321-XXX

- 长线驱动盒及延长电缆
可直接与BSD-11D驱动器连接

Extension cable with line driver box

Direct connection type to BSD-11D



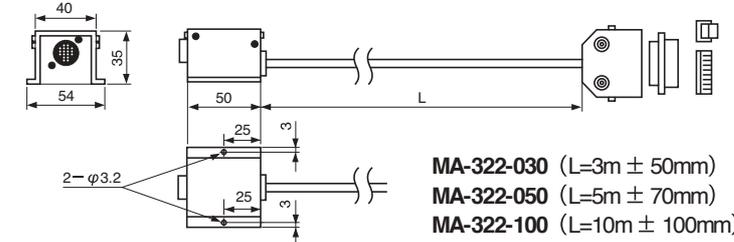
MA-322-XXX

- 长线驱动盒及延长电缆

此种适用于, 当BSD-11D-012驱动器安装于控制盒内使用, 连接器无法与驱动器直接连接的情况使用。

Extension cable with line driver box

This is used when BSD-11D-012 is inserted in the box, etc. and used. This cannot be directly connected to the driver.



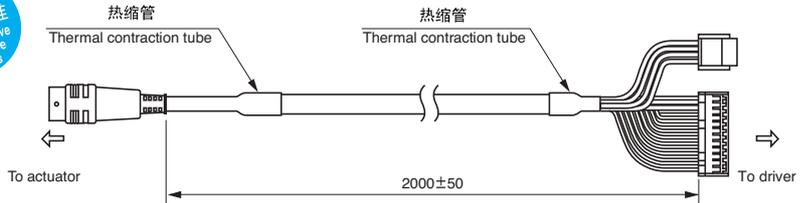
MA-171-020

- 机器人用等电缆

此电缆用于与集电极开路型驱动直接连接使用。当直线单元出线选择200mm时, 可使用此电缆。

Robot cable

This cable is connected directly to the open collector type driver. This cable can be used only when the actuator, whose cable length is 200mm, is selected.



集电极开路型所使用的连接电缆, 长度要在2m ± 50mm以内, 以保证电流和信号的良好传播。

The prompt transmission of electric current and signals is guaranteed only when the total cable length is within 2m50cm for open collector.

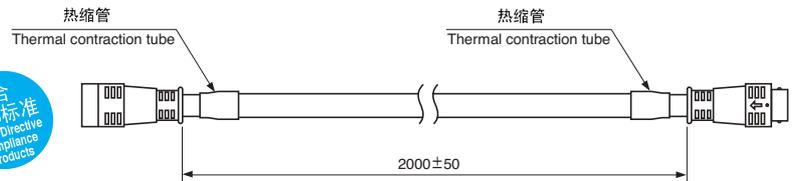
MA-175-020

- 机器人用等电缆

此电缆适用于, 当直线单元出线选择200mm时使用。

Robot cable

This cable can be used only when the actuator, whose cable length is 200mm, is selected.



集电极开路型所使用的连接电缆, 长度要在2m ± 50mm以内, 以保证电流和信号的良好传播。

The prompt transmission of electric current and signals is guaranteed only when the total cable length is within 2m50cm for open collector.

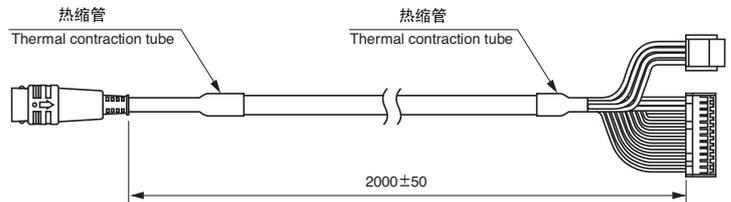
MA-471-020

- 适用于MASAU型连接电缆

此电缆与集电极开路型驱动器直接连接。

Connection cable only used for MASAU model

This cable is connected directly to the open collector type driver.



集电极开路型所使用的连接电缆, 长度要在2m ± 50mm以内, 以保证电流和信号的良好传播。

The prompt transmission of electric current and signals is guaranteed only when the total cable length is within 2m50cm for open collector.

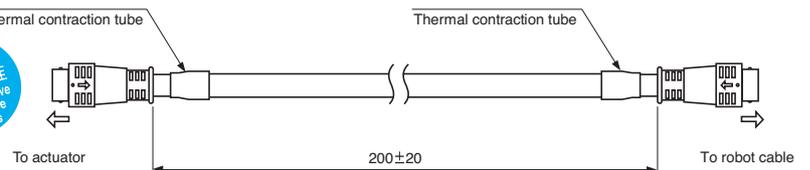
MA-415-002

- 适用于MASAU型连接电缆

此电缆用于与长线驱动型驱动器或机器人用等电缆连接。

Connection cable only used for MASAU model

This cable is used for the connection to the line driver system or robot cable.



集电极开路型所使用的连接电缆, 长度要在2m ± 50mm以内, 以保证电流和信号的良好传播。

The prompt transmission of electric current and signals is guaranteed only when the total cable length is within 2m50cm for open collector.

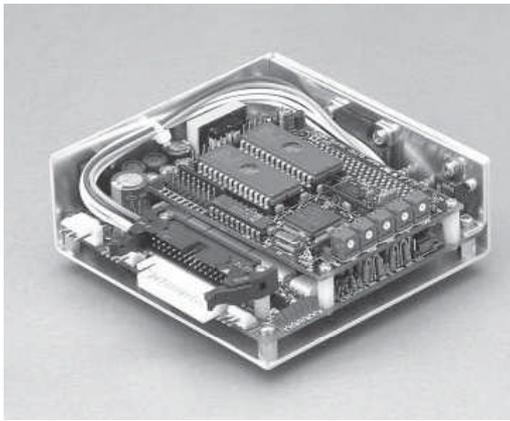
驱动器

BSD-11 / BSD-05 / BSD-06 Series 系列

Control Driver

For Linear Actuator

RoHS Directive
Compliance
Products



BSD-11 Series

- BSD-11C-012 适用于集电极开路型 for Open Collector
- BSD-11D-012 适用于长线驱动型 for Line Driver

BSD-05 Series

(适用于MASM高分辨率直线单元系列)
(for MASM Series, High Resolution Type Linear Actuator)

- BSD-05C-012 适用于集电极开路型 for Open Collector
- BSD-05D-012 适用于长线驱动型 for Line Driver

BSD-06 Series

(适用于MALS/MALB等经济型直线单元系列)
(for Cost-effective models, MALS/MALB Series)

- BSD-06C-012 适用于集电极开路型 for Open Collector
- BSD-06D-012 适用于长线驱动型 for Line Driver

特点

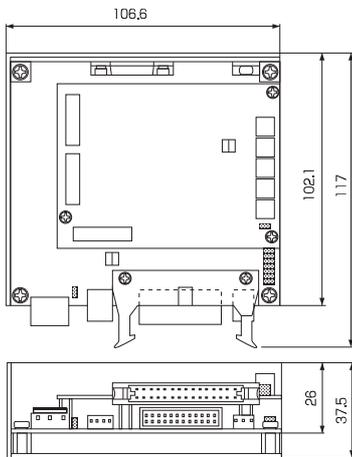
- 通过3相PWM驱动。
- 此驱动是专为微型直线单元开发设计的。
- 内置CPU/ASIC, 虽然小巧, 但实现了全数字式控制。
- 用单独的DC24V供电即可。(内置电源控制.)

Special Features

- Driven by 3-phase sine wave PWM.
- Driver specially designed for our ultra compact actuator.
- Compact size attained by the full digital servo control where ASIC and CPU are incorporated.
- DC 24V single power supply. (built-in power control)

外形尺寸 (单位: mm)

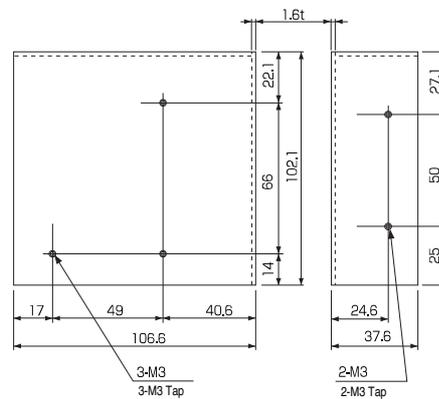
Outside Configuration (Unit: mm)



安装尺寸

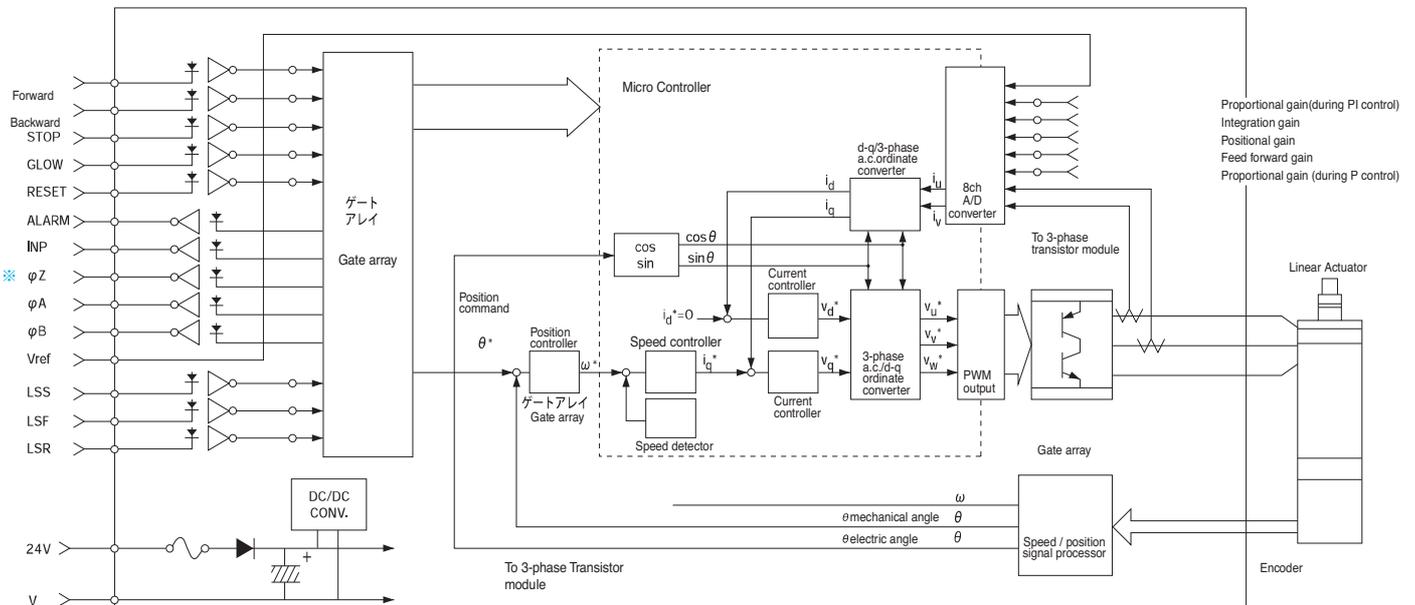
(单位: mm)

Install Dimension (Unit: mm)



电路组成结构

Circuit Configuration



* MALS/MALB series has no Z phase and you do not connect the pin.

参数规格 Specification

型号	BSD-11	BSD-05	BSD-06
供电电压	DC24V		
连续额定电流	1.2Arms 跟据散热条件, 可能有所改变		
最大电流	2.1Arms		
控制系统	定位控制		
编码器输入	φA、φB、φZ MALS/MALB系列无Z相信号		
霍尔传感器	φU、φV、φW 霍尔IC		
最大输入频率	MAS-D16 16kHz MASC-D16 16kHz MAS-D23 20kHz MASC-D23 20kHz MAR-D23 320kHz MAB-D28 100kHz	MASM-D23 320kHz	MALS-D18 8kHz MALS-D23 10kHz MALB-D28 64kHz
定位精度	编码器分辨率的±1个脉冲内.		
倍频功能	×1、×2、×4 倍频功能		
倍频控制	×1、×2、×4 倍频功能 (X4仅当2相输入时有效.)		
运行环境温度	0~40℃		
运行环境湿度	85%RH以下 无结露		
储存环境	-20~85℃ 无结露		

● 输入信号

脉冲输入系统 (通过跳线选择)	1. (2 脉冲系统) W or CCW pulse system 2. (1 脉冲系统) Pulse, Direction, Input 3. 2相脉冲系统 (输入信号通过光耦隔离)
REST输入	报警输出复位, 剩余脉冲复位, 低电平有效.
限位信号输入 (电机自动运行信号输入)	LSF (CW禁止), LSR (CCW禁止), LSS (电机自动运行) 通过跳线改变LSF或LSR输入逻辑
G-LOW输入	增益降低 (当停止发生振动时, 降低增益) 低电平有效 重新设置时.

● 输出信号

INP信号输出	到达定位位置信号输出范围, 0~15个脉冲以内, 低电平有效.
报警信号输出	编码器异常/超过扭矩限制/偏差溢出/过热等时, 输出报警信号. LED显示报警号. 低电平有效.
编码器信号输出	φA、φB、φZ A/B相输出需要外接5V电源. (MALS/MALB系列无Z相信号)
限位信号输出	通过光耦合器将输入的限位信号输出.

● 控制功能

LOOP	环路增益 (通过比例/积分时间常数调节)
P	比例增益调节
POS	位置环增益调节
GAIN	增益降低调节

● 显示功能

PWR	供电电压 (+24V)
EE	编码器异常: 霍尔IC/长线驱动A/B相脉冲错误
FT	过载报警: 超过最大电流范围1秒
FC	偏差溢出报警: 超过偏差计数范围±32767
OH	过热报警: 超过75 (±5)℃
IP	INP信号输出超出设置范围
PL	偏差方向显示 (+时显示, -时不显示)
Z	φZ相信号

Model	BSD-11 Series	BSD-05 Series	BSD-06 Series
Input Power Supply	DC24V		
Continuous Rated Output Current	1.2Arms Changeable by adjustment of heat radiation		
Max Rated Output Current	2.1 Arms		
Control System	Positioning 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 Max Frequency	MAS-D16 16kHz MASC-D16 16kHz MAS-D23 20kHz MASC-D23 20kHz MAR-D23 320kHz MAB-D28 100kHz	MASM-D23 320kHz	MALS-D18 8kHz MALS-D23 10kHz MALB-D28 64kHz
Positioning Accuracy	± 1 pulse of encoder resolution		
Multiplication function of encoder	× 1, × 2, × 4 multiplication function		
Control multiplication function	× 1, × 2, × 4 multiplication function (× 4 is applicable only by 2-phase input)		
Operating temperature	0 ~ 40℃		
Operating humidity	Below 85%RH without bedewing		
Storage temperature	- 20 to 85℃ without bedewing		

● Input Signals

Pulse input system (chosen by jumper circuit)	1. (2 pulse system) CW or CCW pulse system 2. (1 pulse system) Pulse, Direction, Input 3. 2-phase pulse system (Input is isolated by photocoupler)
Reset input	Alarm output reset, Residual pulse reset, LOW active logic.
Limit sensor input (motor-free input)	LSF (CW prohibition), LSR (CCW prohibition), LSS (motor free) Input logic of LSF or LSR is changeable by jumper circuit
G-LOW input	LOW active is the logic of Gain Low (gain lowering due to the reduction of vibration at stoppage) Gain at gain LOW is re-settable by volume

● Output Signals

INP Output	In-position output, which can be set within a range from 0 to ± 15 pulse, Low active
Alarm output	Alarm for encoder disconnection or full torque or full count or fin overheat. Alarm display on LED. Logic of low active
Encoder output	φ A, φ B, φ Z Another 5V power to φ A and φ B is required. (MALS / MALB series has no Z phase.)
Limit output	Input from limit sensor is output by photocoupler

● Control Functions

LOOP	Loop Gain (adjustment for integral TC and proportional gain)
P	Adjustment for proportional gain
POS	Adjustment for position loop gain
GAIN	Adjustment for gain low

● Display Functions

PWR	Power (+ 24V)
EE	Encoder disconnection: Either phase of IC Hall / Either A or B phase of Line Driver
FT	Full torque alarm: Max current runs longer than 1 second
FC	Full count alarm: Overflows of deviation counters (± 32767 counts)
OH	Overheat alarm: Over 75 (± 5)℃ at heat radiate fin
IP	Residual deviation is within in-position setting point
PL	Deviation polarity (residual deviation + : display, - : no display)
Z	φ Z-phase

使用术语说明 Term Definition

- **行程**
正向或反向运动时, 微型直线单元负载轴的运动范围。
- **额定推力**
最大速度时, 包括预载在内, 输出的最大功率时的推力。
- **分辨率**
逻辑上, 驱动器收到一个脉冲后, 驱动微型直线单元运行的最小定位距离。通过编码器脉冲数乘驱动比例及丝杠导程计算。

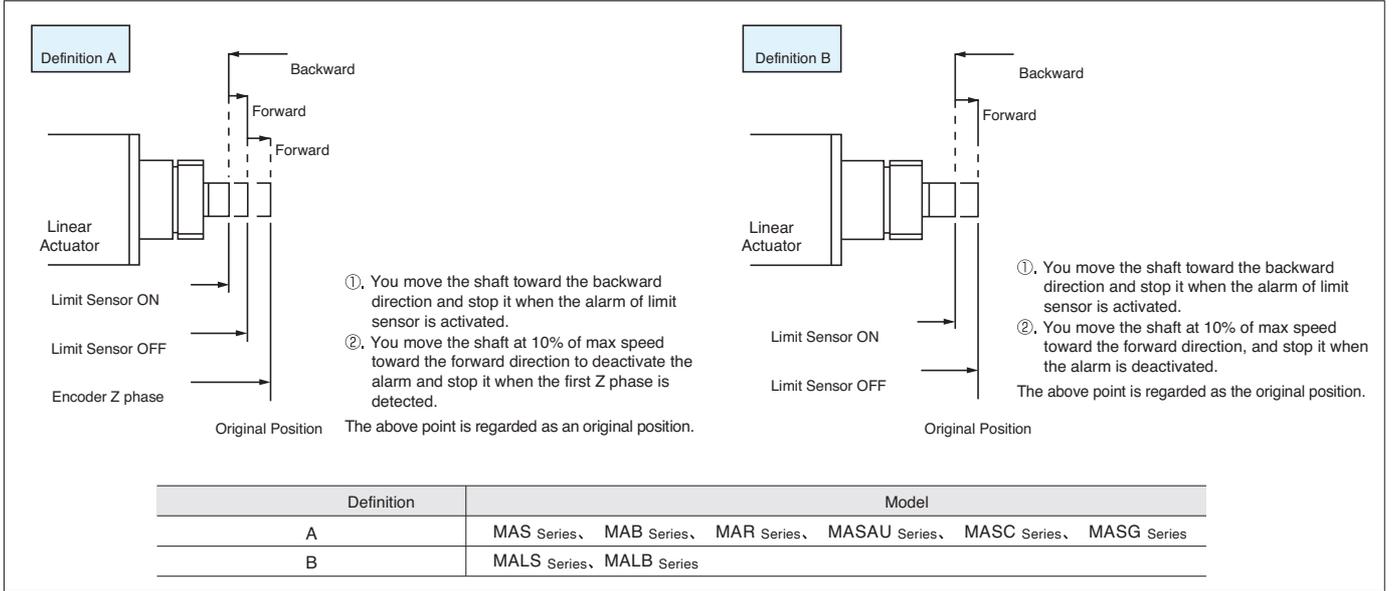
$$\text{分辨率} [\mu\text{m}] = \frac{L}{P \times m} \times 10^{-3}$$

L: 丝杠导程 [mm], P: 编码器脉冲数 [Pulse], m: 倍数

- **预载**
正向(或反向)于推力方向, 用于消除丝杠背隙所加载的力。
- **初始位置**
我公司通过以下两种方式设置初始位置值。

- **Stroke**
Traveling range of linear actuator shaft at forward and backward movements
- **Rated Thrust**
Max thrust power including pre-load amount at the max speed of linear actuator
- **Resolution**
This is a minimum traveling distance per 1 pulse transmitted from the driver, which is logically attained for the position control. It is calculated by the pulse train number of encoder, multiplying rate of driver and lead length of screw.
$$\text{Resolution} [\mu\text{m}] = \frac{L}{P \times m} \times 10^{-3}$$

L: Screw Lead (mm), P: Encoder pulse train (Pulse), m: Multiplication
- **Pre-load**
Load toward the thrust (backward) direction to reduce the gaps in lead screw and ball screw of shaft.
- **Original Position**
Our company defines two ways of original position settings as followings.



- **定位精度**
此值为负载轴停止位置与预定位位置的绝对误差值。包括绝对定位精度和重复定位精度。
- **重复定位精度**
此值表示重复性定位时, 误差的重复性。
- **背隙(平均反转误差)**
此值表示当定位方向与上次定位方向相反时, 实际停止的位置和预定位位置的差值。

- **Positioning Accuracy**
This indicates an absolute error at the position where the shaft stops at the target position. It is synonymous with absolute accuracy including repeatable accuracy.
- **Repeatable Accuracy**
This means repeatability when you perform the positioning repeatedly.
- **Average Reversal Error**
This is an average difference of stop positions when you operate the positioning to the target position from the forward and backward directions.

精度检测方法 Accuracy Measurement

按照日本“JIS B 6201”(机床行业检测方法条例)检测, 代表了西铁城千叶精密有限公司产品的精度定义及检测方法的准确性。

In accordance with “JIS B 6201” (Machine Tool - General Rule of Test Method), CITIZEN CHIBA PRECISION performs the accuracy measurement and defines the accuracy.

精度测量方法

从图1中, 可以看出, 我们从正向及反向进行5次定位, 通过停止位置和预定位位置的偏差进行计算:

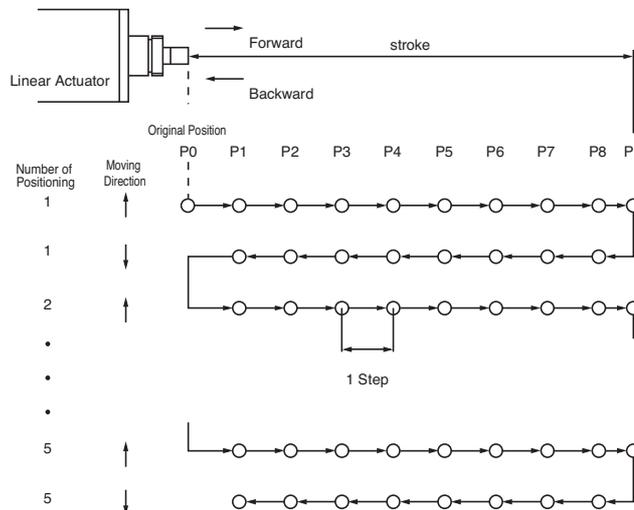
- “单向重复定位精度”
- “双向重复定位精度”
- “双向定位精度”和
- “平均反转误差”

通过下面公式, 计算从P0-8每一步的偏差。

$$1 \text{ 步偏差值} = \frac{\text{stroke} - 0.25 \text{ mm}}{8} [\text{mm}]$$

我们截取的每一步的值, 都小于100个脉冲。

以下为P8-P9的行程(1步x8的量)



Accuracy Measurement

As indicated in “Drawing 1”, we operate the positioning to the target positions from the forward and backward directions five times. By investigating the difference (deviation) of target and actual stop positions, we calculate “Unidirectional Repeatable Accuracy”, “Bidirectional Repeatable Accuracy”, “Bidirectional Positioning Accuracy” and “Average Reversal Error”.

The following formula calculates the distance of 1 step from P.0-8.

$$\text{Distance of 1 step} = \frac{\text{stroke} - 0.25 \text{ mm}}{8} [\text{mm}]$$

We truncate less than 100 pulses from the number of pulse trains, which is transmitted from the amount of 1 step. The following is the amount between P8-P9; stroke - (amount of 1 step x 8)

Drawing 1

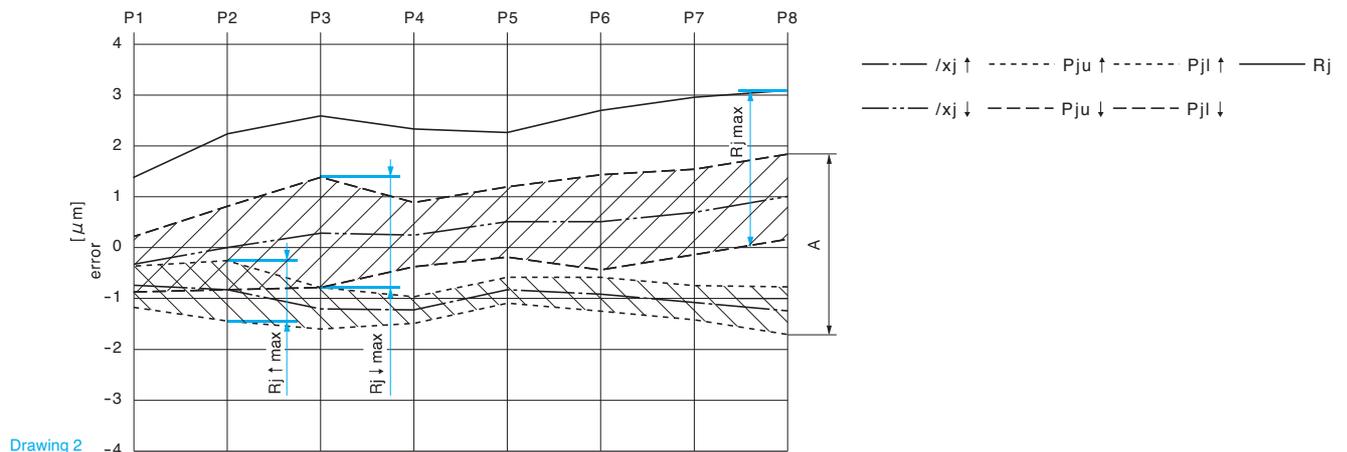
按照上面图1的方法, 通过停止位置和预定位置的偏差进行计算: “单向重复定位精度”, “双向重复定位精度”, “双向定位精度”和“平均反转误差”

In accordance with the above formula in the Drawing 1 and the difference (deviation) of target and actual stop positions, we calculate “Unidirectional Repeatable Accuracy”, “Birectional Repeatable Accuracy”, “Bidirectional Positioning Accuracy” and “Average Reversal Error”.

Table-1

编号 Number	定义	Definition	記号 Code	定義式 Definitional Identity		
				正の向き的位置決め↑ Positioning from Forward Direction	負の向き的位置決め↓ Positioning from Backward Direction	
1	定位点编号	Number of Target Stop Position	j	j = 1, 2, 3, ..., n		
2	第“j”个定位点	“j” th target position	Pj	Pj		
3	从正向或反向到达第“j”个定位点的第“i”次定位	Actual stop point to the target position “j” on “i” th positionings from forward or backward direction	Pji ↑ or Pji ↓	Pji ↑	Pji ↓	
4	第“i”次定位的位置, 和第“j”个定位点位置间的偏差	Deviation between actual and target stop positions at “Pj” point on “i” th positionings from forward or backward direction	xji ↑ or xji ↓	xji ↑ = Pji ↑ - Pj	xji ↓ = Pji ↓ - Pj	
5		Average deviation of actual stop positions to “Pj” point on 5 positionings	\bar{x}_j ↑ or \bar{x}_j ↓	$\bar{x}_j \uparrow = \frac{1}{5} \sum_{i=1}^5 x_{ji} \uparrow$	$\bar{x}_j \downarrow = \frac{1}{5} \sum_{i=1}^5 x_{ji} \downarrow$	
6	“Pj”点的反转误差值.	Reversal error at “Pj” point	Bj	Bj = $\bar{x}_j \uparrow - \bar{x}_j \downarrow$		
7	“Pj”点平均单向偏差值.	计算公式	Calculating Formula	$s_j \uparrow$ or $s_j \downarrow$	$s_j \uparrow = \sqrt{\frac{1}{4} \sum_{i=1}^5 (x_{ji} \uparrow - \bar{x}_j \uparrow)^2}$	$s_j \downarrow = \sqrt{\frac{1}{4} \sum_{i=1}^5 (x_{ji} \downarrow - \bar{x}_j \downarrow)^2}$
		波动幅度计算方法	Calculation from width		$s_j \uparrow = \frac{x_{ji} \uparrow \max - x_{ji} \uparrow \min}{2.326}$	$s_j \downarrow = \frac{x_{ji} \downarrow \max - x_{ji} \downarrow \min}{2.326}$
8	单向限位定位精度	上限位	Upper Limit	Pju	Pju = $\bar{x}_j \uparrow + 3s_j \uparrow$	Pju = $\bar{x}_j \downarrow + 3s_j \downarrow$
		下限位	Lower Limit	Pjl	Pjl = $\bar{x}_j \uparrow - 3s_j \uparrow$	Pjl = $\bar{x}_j \downarrow - 3s_j \downarrow$
9		Bidirectional Positioning Accuracy	Rj ↑ or Rj ↓	Rj ↑ = 6s_j ↑	Rj ↓ = 6s_j ↓	
10	双向重复定位精度	Bidirectional Repeatable Accuracy	Rj	Rj ↑、Rj ↓、又は 3s_j ↑ + 3s_j ↓ + Bj のうち最大値 Maximum value of Rj ↑, Rj ↓ or 3s_j ↑ + 3s_j ↓ + Bj		
11	单向重复定位精度 (负载轴)	Unidirectional Repeatable Accuracy (of Kinetic Axis)	R ↑ or R ↓	R ↑ = (Rj ↑) max	R ↓ = (Rj ↓) max	
12	双向重复定位精度 (负载轴)	Bidirectional Repeatable Accuracy (of Kinetic Axis)	R	R = (Rj) max		
13	双向绝对定位精度 (负载轴)	Bidirectional Positioning Accuracy (of Kinetic Axis)	A	A = (Pju) max - (Pjl) max		
14	平均反转误差	Average Reversal Error	\bar{B}	$\bar{B} = \frac{1}{n} \sum_{j=1}^n B_j$		

The drawing -2 is the graph, which is calculated from /xj, Pju, Pjl, Rj of Table-1. Rj is a figure, which is calculated from 3s_j ↑ + 3s_j ↓ + |Bj| in the graph



Drawing 2

- ① 单向重复定位精度**
此值表示正向定位或反向定位时误差的重复性的最大值。在表2中, 用Rj ↑ 或Rj ↓ 表示此单向重复定位精度。
- ② 双向重复定位精度**
表2中以Rj ↑ 和Rj ↓ 或Rjmax n 表示双向重复定位精度。
- ③ 双向绝对定位精度**
此值表示运动停止点和预定定位点之间的最大偏差值, 包括了双向重复定位精度。表2中用A表示双向绝对定位精度。
- ④ 平均反转误差**
反转偏差“Bj”的平均值。

以上关于偏差的①-④点说明, 包含了我们所有产品的出厂检测值。

Accuracy Definition

- ① Unidirectional Repeatable Accuracy**
This indicates the repeatability, which is attained by positioning from the forward or backward direction. We define the maximum value of Rj ↑ or Rj ↓ in Table -2 as unidirectional repeatable accuracy.
- ② Bidirectional Repeatable Accuracy**
We define the maximum value of Rj ↑ and Rj ↓ or Rjmax in Table -2 as bidirectional repeatable accuracy
- ③ Bidirectional Positioning Accuracy**
This is the maximum difference between the target and actual stop positions and it includes bidirectional repeatable accuracy. We define A in Table-2 as bidirectional positioning accuracy.
- ④ Average Reversal Error**
The average value of reversal error “Bj”
Regarding the above definitions ①~④, we investigate all the products at the shipping inspection.

行业应用

- 半导体设备:** 步进光刻机, 切割设备, 涂装设备, 涡轮分子泵设备, 清洗设备, 模具焊接机, 检查设备(包括真空环境下的检测及高精度运动控制设备)等
- 光学及磁盘存储设备:** 光盘初始器, 光盘检测系统, 光盘存储区域确认机构等
- 数码影像设备:** 激光振荡镜/多边形, 高端激光打印机, 图像采集及其它高性能纺织产品扫描仪等
- 医疗设备:** 牙科高速微粉碎机, 超声波诊断, 人工心脏, X射线仪器和离心分离器
- 激光/光学设备:** 激光打标, 激光扫描, 激光测量设备, 图像处理, 光纤熔接机, 激光显微镜, 线路板焊接设备等
- 机床/FA及检测设备:** 机器人, 促动器, 读卡器, PCB等高速钻孔机, 研磨机, 镜面抛光设备, 焊接机, 隐形眼镜起泡设备, 3-D检测设备, 高速绕线机等

Product Lineup



直流空心杯电机
Coreless DC Motor



无刷电机
Brushless Motor



交流伺服电机
AC Servomotor



直线机构
Linear Actuator



编码器和测速发电机
Encoder & Tacho



主轴电机
Spindle Motor



基于检流器的光学扫描仪
Galvanometers Optical Scanner



减速机
Gearhead

Applications

Semiconductor Equipment: Stepper aligner, spincoater, dicing saw, turbo molecular pump, cleaning equipment, die bonder, equipment for test, inspection and high accuracy motion control including use in vacuum condition. **Optical and Magnetic Disk Storage Equipment:** Optical disk initializer, optical disk testing system, optical disk storage media certifiers. **Digital Imaging Equipment:** Laser scanner with mirror / polygons, high-end laser printer, image setter and other high performance spinning scanning products. **Medical Equipment:** High-speed dental micro grinder, ultrasonic diagnosis, artificial heart, X-ray instruments and centrifugal separator. **Laser and Optical Equipment:** Laser marker, laser scanner, optical measuring equipment, image processor, optical fiber splicing machine, laser microscope, optical connector equipment and electron microscope. **Machine Tools, FA and Inspection Equipment:** Robots, actuator, card-reader, high speed drilling machine, grinding machine, mirror polishing equipment, welding machine, contact lens lathers, 3-D measuring equipment and high speed winding machine.

详细资料请向我们或我们的代理商索取。

For further information, please contact us or our authorized agent at any time.

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Micro HumanTech

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