HarmonicDrive

MECHATRONICS

FINE MECHANICS & TOTAL Motion CONTROL

DC伺服执行元件综合目录

General Catalog for DC Servo Actuators

- 旋转式执行元件 Rotary Actuators
- 线性执行元件 Linear Actuators
- 伺服驱动器 Servo Drivers

ISO 14001 TÜV SÜD ISO 9001

ISO14001
（穗高工厂）
Hotaka Plant
ISO9001

Harmonic Drive Systems的机电一体化高输出的执行元件，由精密控制用减速机和各种伺服电动机优化组合而成。

The mechanical electronic products of Harmonic Drive Systems and high-output actuators to guarantee the best match between reducers for precision control and servo motors.

主推产品有两种。一种是拥有超高分辨率、可高精度定位的带高性能电动机的旋转式执行元件，另一种是具备超级微量、可高精度定位的线性执行元件。
此外，还充实了很多能够将这些执行元件的性能和特点发挥到极致的控制仪器，使机械、设备的高精度运动控制得以实现。

Harmonic Drive Systems offers a versatile product range, focusing on rotary actuators that integrate a high-performance motor featuring ultrahigh resolution and high precision positioning. Linear actuators featuring high-precision positioning with a super fine pitch are also a major feature of the Harmonic Drive Systems product range.
The enhanced control equipment of Harmonic Drive Systems fully demonstrates the performance and features of its actuators, allowing high-precision motion control of your machines and equipment.

产品是高性能、
Harmonic Drive

are high-performance
Harmonic Drive speed

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旋转式执行元件
Rotary Actuators

由具备出色的角度传达精度、旋转精度的Harmonic Drive通过与能够充分发挥执行元件性能的专用伺服驱动器组合
High-torque actuators combining a HarmonicDrive that features excellent angular characteristics. Why not create a servo a system featuring precise rotational actuator performance?

	系列名称 Series	特点 Feature	产品 Product	型号 Model No.	Harmonic Drive 的减速比 Reduction Ratio	最高转速 Max. Rotational Speed (r/min)	最大转矩 Maximum Torque (Nm)
旋转式执行元件 Rotary Actuators	RH※1	●小型尺寸 Compact size ●高转矩 High torque		5	50	180	0.39
					80	110	0.59
					100	90	0.69
				8	50	100	2.7
					100	50	3.5
				11	50	100	4.9
					100	50	7.8
				14	50	100	14
					100	50	20

※1：RH系列和伺服驱动器HS-360系列组合使用时，执行元件采用差分规格。
In the event the RH series and servo driver HS-360 series are combined, the actuator specification of the actuator will change to that of the line driver.

线性执行元件
Linear Actuators

将精密螺钉和Harmonic Drive进行紧凑组合而成的线性执行测定设备、光学设备、半导体以及液晶板制造装置等的超精密
The linear actuators compactly combining a precision screw and HarmonicDrive. inspection equipment, measuring instruments, optical equipment, semiconductor equipment and systems and for high driving force positioning up to a level of

	系列名称 Series	特点 Feature	产品 Product	安装法兰尺寸 Mounting Flange Size (mm)	分辨率 Resolution (μm)	行程 Stroke (mm)	最大推力（N） Max. Driving Force
线性执行元件 Linear Actuators	LA	●高分辨率 High resolution ●高定位精度 High positional accuracy		□28	0.0174	10	49
				□36	0.0174	30	49
	LAH-46	●高分辨率 High resolution ●高定位精度 High positional accuracy		□47	0.069	10	390
					0.069	30	390

※：LA、LAH系列和伺服驱动器HS-360系列组合使用时，执行元件采用差分规格。
In the event the LA/LAH series and servo driver HS-360 are combined, the actuator specification will change to that of the line driver.

伺服驱动器
Servo Drivers

	系列名称 Series	产品 Product	电源电压 Power Supply Vol.	控制模式 Control Mode	支持编码器 Combined Encoder
DC伺服驱动器 DC servo Drivers	HS-360		AC100V	定位控制专用 Position control only	增量编码器 Incremental encoder

和具备卓越控制特性的伺服电动机组合而成的高转矩执行元件。
使用，创造出具备精密的旋转精度和位置精度的伺服系统。
transmission accuracy and rotational precision and a servo motor that excels in control accuracy and repeatability by combining special control unit that fully demonstrates the

分辨率※3※5（脉冲/转） Resolution※3※5 (Pulses/Resolution)	重量※3 Mass※3 （kg）	驱动电动机 Drive Motor	组合驱动器 Combined Driver	电源电压※3 Power supply voltage※3	登载页 Page in Catalog	用途 Application
100,000	0.09	DC伺服 DC servo	HS-360-1A-100	AC100V	6	半导体、FPD制造设备 ●搬运机器人 ●分度盘 ●微小进给 / Semiconductor and FPD manufacturing equipment ● Transfer robots ● Index tables ● Jogging 机器人 ●间接驱动 ●手动驱动 ●周边装置 / Robots ● Indirect drive ● Hand drive ● Peripheral equipment 机床 ●ATC驱动 ●转塔刀架分度 ●分度盘 ●装载机•卸载机 ●各轴驱动 ●工作台驱动 / Machine tools ● ATC drives ● Turret table indexing ● Index tables ● Loaders and unloaders ● Axis drive ● Work table drive 测定•检查装置 ●探测器驱动 ●分度盘 ●X-Y-Z工作台 / Measurement and inspection systems ● Probe drive ● Index tables ● X-Y-Z tables 医疗装置 ●工作台驱动 ●传感器定位 ●机械手 ●分度盘 / Medical systems ● Table drives ● Sensor positioning ● Manipulators ● Index tables 光学设备 / Optical equipment 电子回路制造装置 / Space and aviation Electric circuit manufacturing systems 其他FA周边设备 / Other factory automation peripheral equipment
160,000						
200,000						
200,000	0.3		HS-360-1B-100			
400,000						
200,000	0.5		HS-360-1C-100			
400,000						
200,000	0.77		HS-360-1D-100			
400,000						

元件。产品系列丰富，主要应用于需进行微米级定位的检查、
定位，以及10kN级别的高推力定位。
A versatile range available for ultra precision positioning within and liquid crystal panel manufacturing equipment and other 10kN level.

重复定位精度（μm/行程mm） Repeatability（μm/Stroke mm）	重量（kg） Mass	驱动电动机 Drive Motor	组合驱动器 Combined Driver	电源电压 Power Supply Vol.	登载页 Page in Catalog	用途 Application
±0.1以下/1mm ±0.1 or less/1mm	0.32	DC伺服 DC servo	HS-360-1A-100	AC100V	16	●半导体晶片定位 Semiconductor wafer positioning ●光学焦点装置 Optical focusing systems ●高精度载物台 High precision stages
	0.55					
±0.5以下/1mm ±0.5 or less/1mm	0.81		HS-360-1A-100	AC100V	19	●液晶面板定位 Alignment of liquid crystal panel ●检查·测定装置 Inspection equipment and measuring instruments ●图像测量装置 Image measuring instruments
	0.85					

参数操作 Parameter Operation	通信功能 Communication Function	组合执行元件/直驱电动机 Combined Actuator/Direct Drive Motor	登载页 Page in Catalog
• 驱动器面板的操作键 Operation key of the driver panel • 计算机专用通信软件 Special communication software on PC	搭载 Available	RH系列 RH series LA系列 LA series LAH系列（差分规格） LAH series (Line driver specification) RHS系列 RHS series	24

RH系列 RH Series

DC伺服执行元件
DC servo actuator

RH系列是将精密控制用减速机Harmonic Drive和DC伺服电动机组合而成的小型、高转矩、高旋转精度的DC伺服执行元件。通过与充分发挥该RH系列性能的专用伺服驱动器组合，使机械装置实现高旋转精度、小型化。

The RH series includes compact and high-torque DC servo actuators with a high rotational accuracy combining a speed reducer HarmonicDrive for precision control and a DC servo motor. A combination with a dedicated servo driver that fully demonstrates the performance of this RH series of implements; compact machines and equipment with a high rotational accuracy.

特点 Features

●高分辨率
High resolution
使用Harmonic Drive，实现最大400,000脉冲/转（0.0009°/脉冲）的高分辨率。
High resolution of maximum 400,000 pulses/revolution (0.0009°/pulse) combining a HarmonicDrive.

●高定位精度
High positional accuracy
Harmonic Drive不存在齿轮松动产生的齿隙，可以高精度定位。
The HarmonicDrive eliminates backlash caused by gear play, assuring high-accuracy positioning.

●小型、高输出扭矩
Compact body and high-output torque
最小型号RH-5A执行元件的外形尺寸为φ20×89mm，拥有0.69N•m（瞬时最大转矩）的高输出。
High output. 0.69Nm (maximum momentary torque achieved) by the smallest model RH-5A with outside dimensions of φ20mm in diameter x 89mm.

结构 Structure

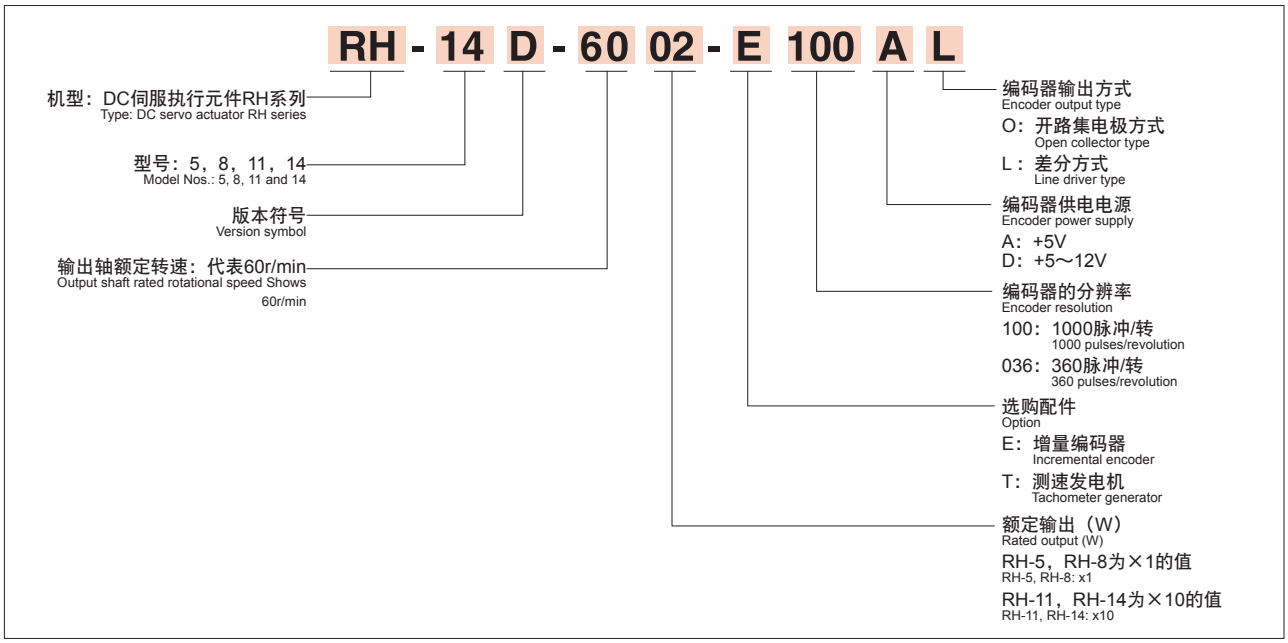
●高精度光学编码器
High-precision optical encoder
可将矩形输出信号分解至4倍频。
Rectangular output signal is dissolved up to x 4.

●小型•精密控制用减速机Harmonic Drive
Compact and speed reducer HarmonicDrive for precision control
拥有高定位精度和高分辨率。
还有独一无二的轻量小型化设计。
Features a high resolution and positional accuracy.
Unmatched light weight and compact properties.

●高性能DC伺服电动机
High-performance DC servo motor
以最佳磁性回路为追求目标而研发出的高响应DC伺服电动机。可缩短定位时间。
A fast-response DC servo motor developed through constant effort to optimize magnetic circuit. Positioning time is shortened.

●高刚性输出轴支撑轴承
Output shaft bearing with high stiffness
利用大型高精度轴承支撑输出轴。
可直接支撑大负载。
The output shaft is supported by a high-precision bearing. A large load is supported directly.

型号和符号 Models and Symbols



规格（带增量编码器） Specification (With an Incremental Encoder)

时间额定：连续
Time rating: Continuous

保护构造：全闭自冷
Protection: Totally enclosed self-cooled

环境温度：0～40℃
Ambient temperature: 0 to 40℃

环境湿度：35～80%（无结露）
Ambient humidity: 35 to 80% RH (Do not expose to condensation.)

项目 Item / 型号 Model			RH-5A			RH-8D		RH-11D		RH-14D	
			8802	5502	4402	6006	3006	6001	3001	6002	3002
额定输出 Rated Output		W	1.5	1.7	1.4	8.6	6.2	13.6	12.3	20.3	18.5
额定电压 Rated Voltage		V	12			24		24		24	
瞬时最大转矩 Maximum Momentary Torque		Nm	0.39	0.59	0.69	2.7	3.5	4.9	7.8	14	20
		kgfcm	4.0	6.0	7.0	27	36	50	80	140	200
最大连续失速转矩 Max. Continuous Stall Torque		Nm	0.24	0.39	0.43	1.5	2.3	2.5	4.4	5.4	7.8
		kgfcm	2.4	4.0	4.4	15	23	25	45	55	80
额定转矩 Rated Torque		Nm	0.16	0.29	0.29	1.4	2.0	2.2	3.9	3.2	5.9
		kgfcm	1.6	3.0	3.0	14	20	22	40	33	60
最高转速 Max. Rotational Speed		r/min	180	110	90	100	50	100	50	100	50
额定转速 Rated Rotational Speed		r/min	88	55	44	60	30	60	30	60	30
瞬时最大电流 Maximum Momentary Current		A	0.83	0.78	0.77	1.6	1.1	2.4	2.1	5.4	4.1
额定电流 Rated Current		A	0.5	0.5	0.5	1.0	0.8	1.3	1.3	1.8	1.8
转矩常数 Torque Constant		Nm/A	0.69	1.11	1.38	2.1	4.2	2.46	4.91	2.92	5.76
		kgfcm/A	7.06	11.3	14.1	21.4	42.9	25.1	50.1	29.8	58.8
转动惯量※5 Moment of Inertia※5	$GD^2/4$	kgm^2	6.3×10^{-4}	16×10^{-4}	25×10^{-4}	37×10^{-4}	150×10^{-4}	110×10^{-4}	430×10^{-4}	210×10^{-4}	810×10^{-4}
	J	$kgfcms^2$	0.007	0.016	0.026	0.04	0.15	0.11	0.44	0.21	0.83
容许径向负载 Permissible Radial Load		N	59			196		245		392	
		kgf	6.0			20		25		40	
容许轴向负载 Permissible Thrust Load		N	29			98		196		392	
		kgf	3.0			10		20		40	
减速比 Reduction Ratio			50	80	100	50	100	50	100	50	100
重量 Mass		kg	0.09			0.3		0.5		0.77	
组合驱动器 Combined Driver			HS-360-1A			HS-360-1B		HS-360-1C		HS-360-1D	

※1：上表中的数值表示输出轴的代表值。
Values shown inn the table above indicate representative values on the output shaft.

※2：与HS-360驱动器组合时的数值。
This is the value when the actuator is combined with the HS-360 driver.

※3：与HS-360驱动器组合使用时，编码器采用差分规格。
If you use the actuator by combining it with the HS-360 driver, chose an encoder that satisfies the line driver specification.

※4：执行元件规格为以下安装在铝制散热板上时的数值。
The actuator specification shows values when the actuator is installed on the following aluminum radiator plates.

RH-5A: 150×150×3 (mm)
RH-8D: 150×150×6 (mm)
RH-11D: 150×150×6 (mm)
RH-14D: 150×150×6 (mm)

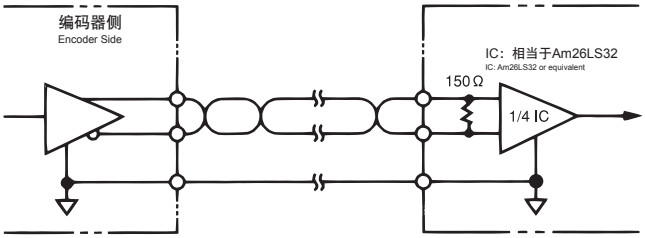
※5：转动惯量是将电动机轴和Harmonic Drive的转动惯量合计值换算成输出轴后得到的数值。
The inertia moment is the value converted to the output shaft from the total value of the inertia moments of the motor shaft and the HarmonicDrive.

※6：检测器分辨率是（电动机轴编码器4倍频时分辨率）×（减速比）的数值。
The resolution of the detector is the value obtained from ((motor shaft encoder resolution multiplied by 4) X (reduction ratio)).

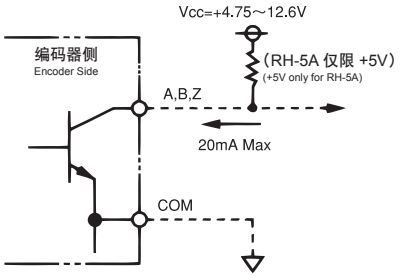
编码器规格 Encoder Specification

项目 Item / 型号 Model	RH-5A		RH-8D，11D，14D	
输出电路 Output Circuit	差分 Line Driver	开路集电极 Open Collector	差分 Line Driver	开路集电极 Open Collector
分辨率（脉冲/转） Resolution (Pulses / revolution)	360		1000	
电源电压（V） Power Supply (V)	DC＋5V±5%		DC＋5V±5%	DC＋4.75～12.6V
消耗电流（mA） Current Consumption (mA)	170max.	60max.	170max.	60max.
响应频率（kHz） Response Frequency (kHz)	100		125	

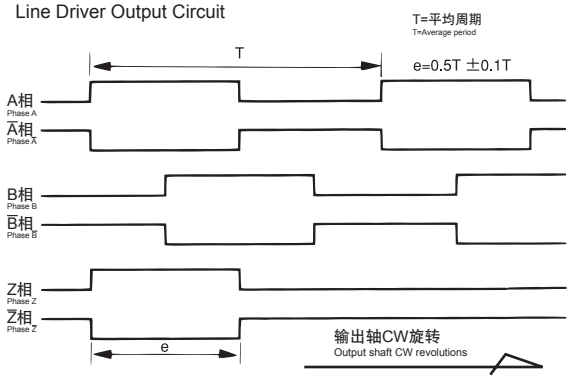
■差分输出电路
Line Driver Output Circuit



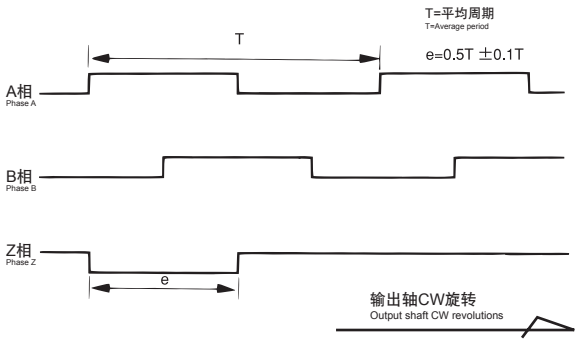
■开路集电极输出电路
Open Collector Output Circuit



■差分输出电路
Line Driver Output Circuit



■开路集电极输出电路
Open Collector Output Circuit



■编码器导线的颜色
Colors of Encoder Cables

输出电路 Output Circuit	RH-5A		RH-8D，11D，14D	
线色 Cable Color	差分 Line Driver	开路集电极 Open Collector	差分 Line Driver	开路集电极 Open Collector
茶色 Brown	信号A Signal A	信号A Signal A	信号A Signal A	信号A Signal A
蓝 Blue	信号Ā Signal Ā	—	信号Ā Signal Ā	COM
红 Red	信号B Signal B	信号B Signal B	信号B Signal B	信号B Signal B
绿 Green	信号B̄ Signal B̄	—	信号B̄ Signal B̄	COM
黄 Yellow	信号Z Signal Z	信号Z Signal Z	信号Z Signal Z	信号Z Signal Z
橙 Orange	信号Z̄ Signal Z̄	—	信号Z̄ Signal Z̄	COM
白 White	电源 Line Driver	电源 Line Driver	电源 Line Driver	电源 Line Driver
黑 Black	接地（公共点） Line Driver	接地（公共点） Line Driver	接地（公共点） Line Driver	接地（公共点） Line Driver
屏蔽 Shield	浮地 Line Driver	浮地 Line Driver	浮地 Line Driver	浮地 Line Driver

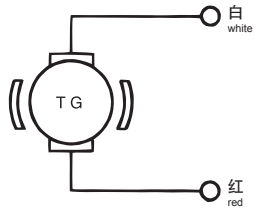
测速发电机规格 Tachometer Generator Specification

■规格
Specification

项目 Item		
发生电压（注1） Voltage Generated (Note1)	V/1000(r/min)	3±10%
直线性（注1） Linearity (Note 1)	%max	±1
波纹（注1） Ripple (Note 1)	%max	1 (RHS)/3 (P-P)
电机子电阻 Armature Resistance	Ω	45±10% (20℃)
电机子电感 Armature Inductance	mH	7±20%
转动惯量（注2） Moment of Inertia (Note 2)	gm^2	12×10^{-4}

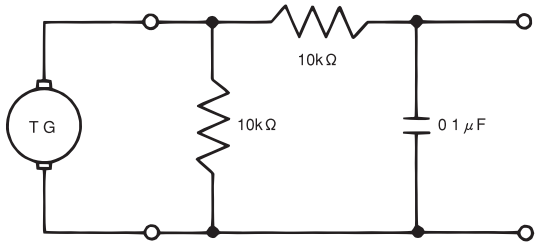
注1 测速发电机单机200rpm以上时的数值。
Note 1: Value of tachometer generator only at 200rpm or higher.
注2 电动机轴的转动惯量。换算成执行元件输出轴的转动惯量是Harmonic Drive的速比R的二次方。
Note 2: Moment of inertia on motor shaft. When converted in terms of an actuator output shaft, the moment of inertia can be calculated by multiplying the reduction ratio R of the HarmonicDrive by the square.

■极性
Polarity



从执行元件输出轴上看，CW旋转时，向白色导线输出（+），向红色导线输出（-）。
(+) and (-) will be output to white and red cables respectively in CW revolutions when viewed from the actuator output shaft.

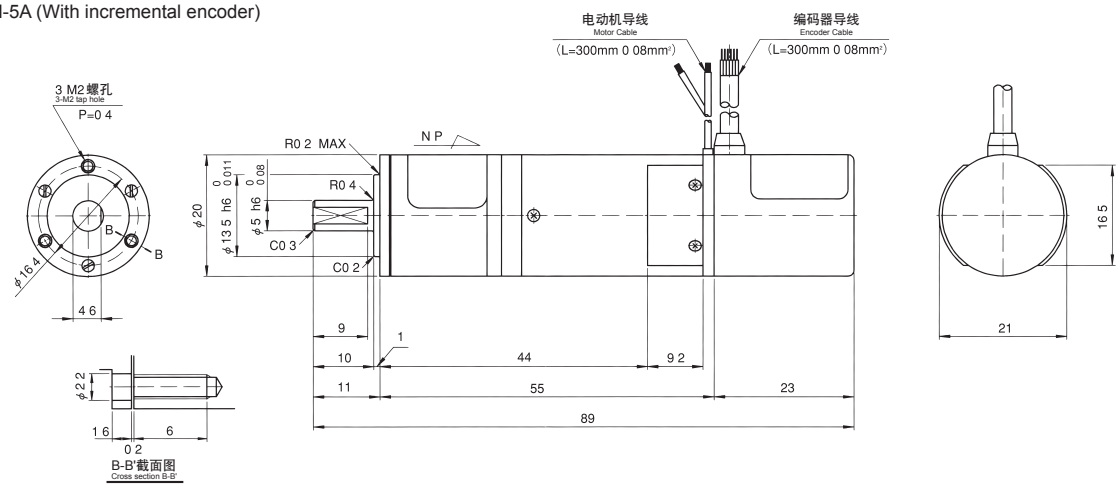
■发生电压、直线性、波纹的测定回路
Measurement circuit of generated voltage,linearity and ripple



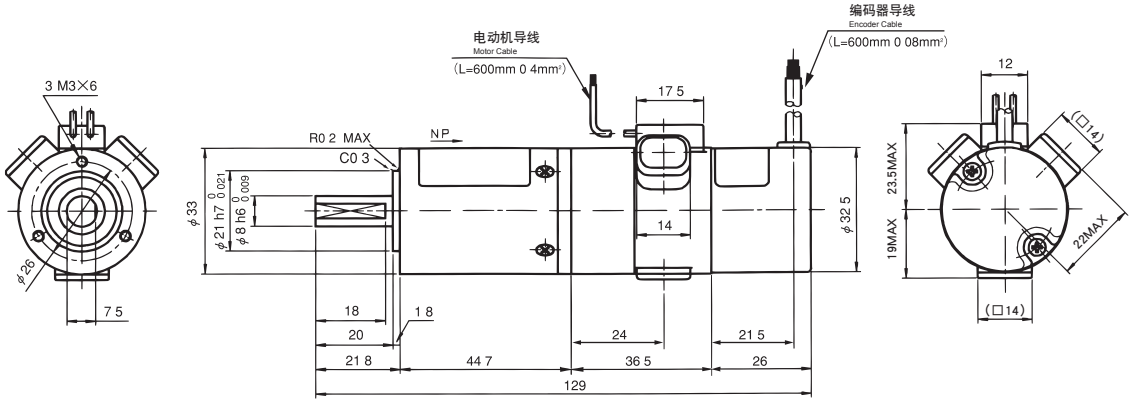
外形尺寸图 External Dimensions

■RH-5A（带增量编码器）
RH-5A (With incremental encoder)

单位：mm
Unit: mm



■RH-8D（带增量编码器）
RH-8D (With incremental encoder)

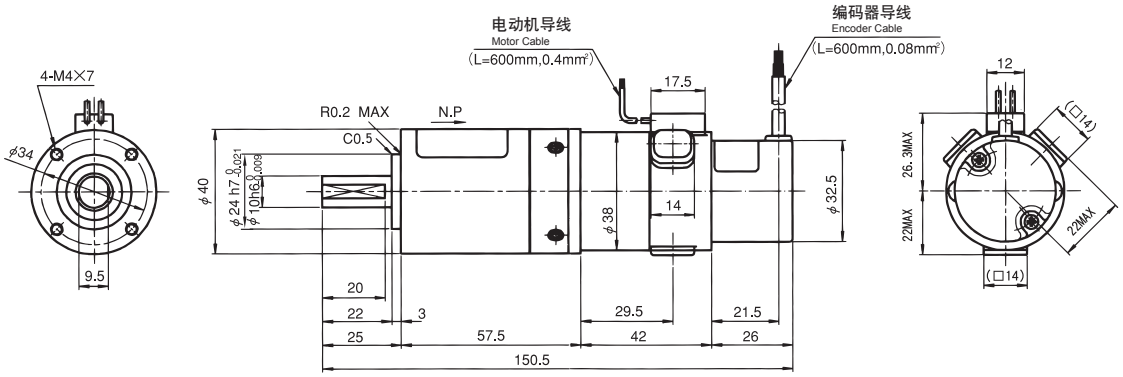


※尺寸及形状的详细情况，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

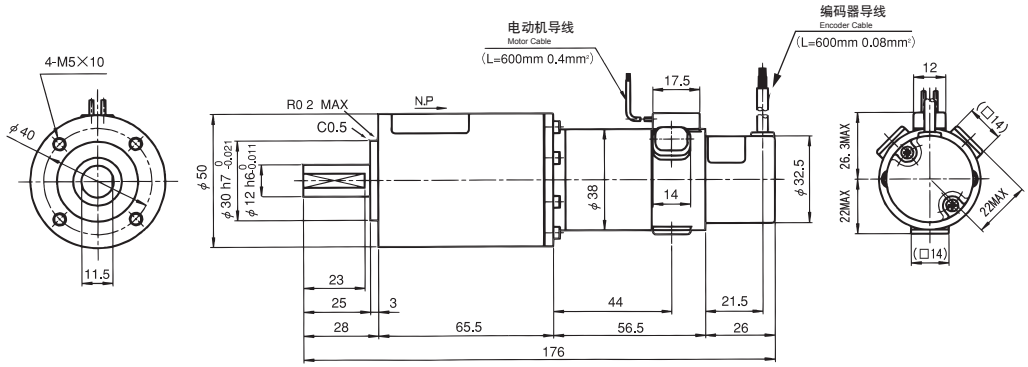
外形尺寸图 External Dimensions

■RH-11D（带增量编码器）
RH-11D (With incremental encoder)

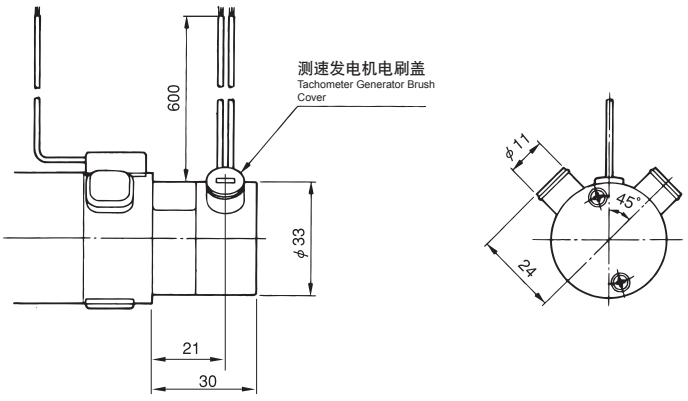
单位：mm
Unit: mm



■RH-14D（带增量编码器）
RH-14D (With incremental encoder)



■RH-8D、RH-11D、RH-14D（带测速发电机）
RH-8D, RH-11D, RH-14D (With tachometer generator)



※尺寸及形状的详细情况，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

可用区间 Positional Accuracy

“单方向定位精度”、“重复定位精度”、“反转定位精度”如下表所示。此外，下表的数值表示代表值。（JIS B-6201-1987）
The “uni-directional positional accuracy,” “repeatability” and “reverse positional accuracy” are shown below. The following values represent typical values. (Source: JIS [Japanese Industrial Standards] B-6201-1987).

RH 系列内部组装有精密控制用减速机 Harmonic Drive，因此，电动机轴的定位误差因减速而减少至 1/50 或 1/100，实际上减速机的角度传递误差决定了定位精度。因此，将减速机的角度传递误差的测定值用 RH 系列的定位精度表示。
The RH series contains a speed reducer harmonicDrive for precision control and positioning errors of the motor shaft are therefore compressed to 1/50 or 1/100 by speed reduction. In reality, angular transmission errors of the speed reducer determine the positional accuracy. The measured values of angular transmission errors of the speed reducer are therefore shown as the positional accuracies of the RH Series.

各型号的精度如下所示。
The accuracies of the individual models are shown below.

项目 Item / 型号 Model		RH-5A	RH-8D	RH-11D	RH-14D
单方向定位精度 Uni-directional Positional Accuracy	arc sec	290	150	120	120
	rad	1.31×10^{-3}	7.27×10^{-4}	5.82×10^{-4}	5.82×10^{-4}
重复定位精度 Repeatability	arc sec	±90	±60	±60	±60
	rad	$\pm4.36\times10^{-4}$	$\pm2.91\times10^{-4}$	$\pm2.91\times10^{-4}$	$\pm2.91\times10^{-4}$
反转定位精度 Reverse Positional Accuracy	arc sec	150	60	60	60
	rad	7.27×10^{-4}	2.91×10^{-4}	2.91×10^{-4}	2.91×10^{-4}

《测定条件、负载：无负载、转速：额定值》
Measurement conditions, Load: no load, rotational speed: rated value

机械精度 Specification (With an Incremental Encoder)

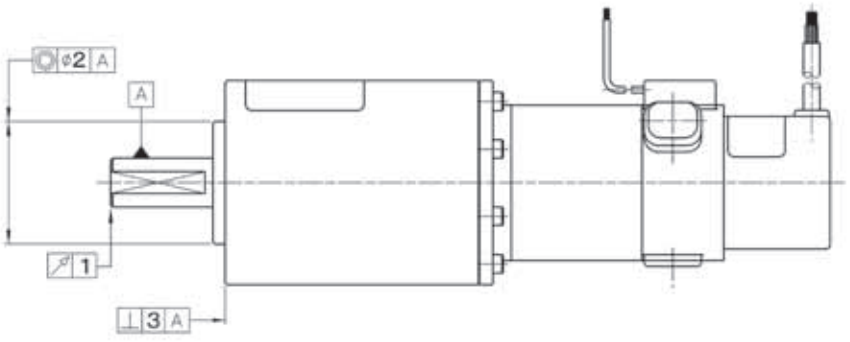
RH系列的输出轴以及安装法兰的机械精度如下。
The mechanical accuracies of the output shaft and mounting flange of the RH series are as follows.

机械精度
Mechanical Accuracy

单位：mm
Unit: mm

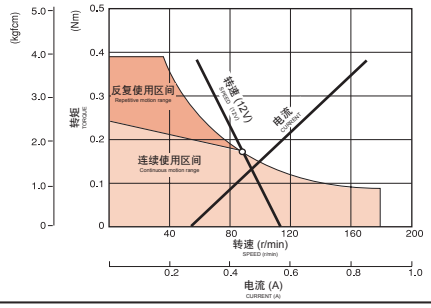
精度项目 Accuracy Item	RH-5A	RH-8D	RH-11D	RH-14D
1 输出轴轴跳动 Output shaft surface runout	0.03	0.03	0.03	0.03
2 输出轴和安装嵌合部之间的同轴度 Concentricity of output shaft and fitting part	0.04	0.04	0.04	0.04
3 输出轴和安装面之间的直角度 Perpendicularity between the output shaft and mounting surface	0.04	0.04	0.04	0.04

注）T.I.R（Total Indicator Reading）中的数值。
Note: The aforementioned values are TIR (total indicator reading) values.

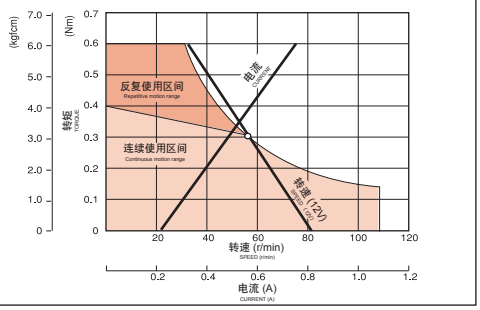


可用区间 Operable Range

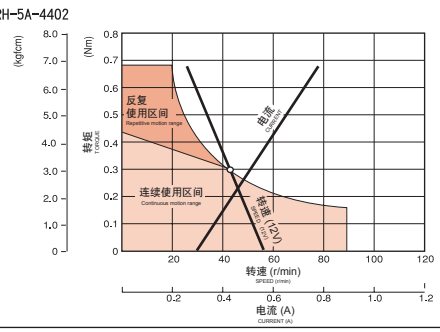
■RH-5A-8802



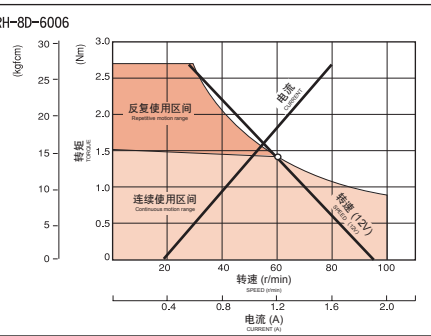
■RH-5A-5502



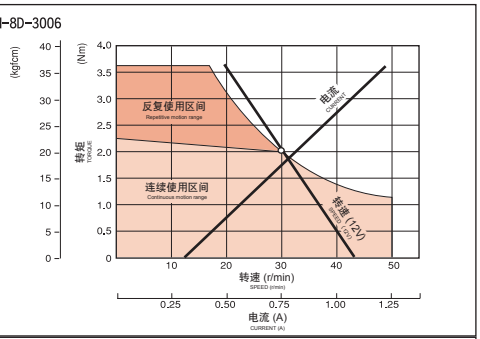
■RH-5A-4402



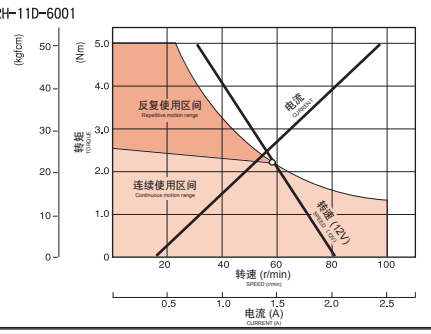
■RH-8D-6006



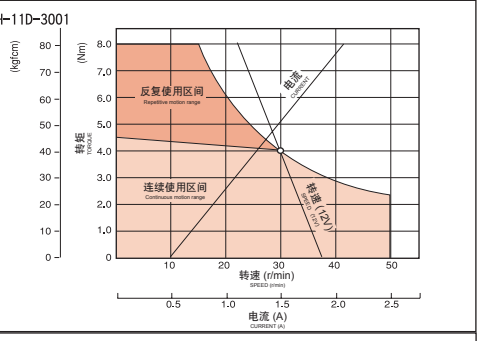
■RH-8D-3006



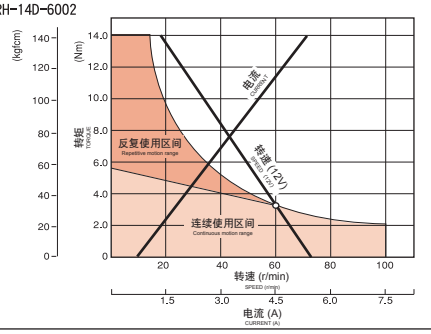
■RH-11D-6001



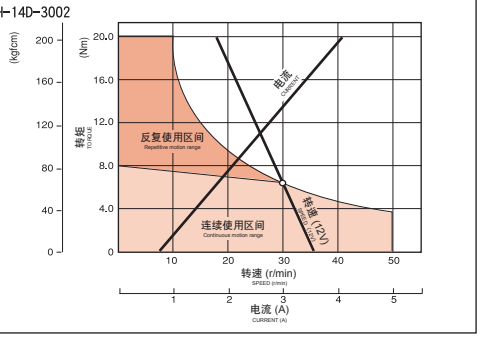
■RH-11D-3001



■RH-14D-6002



■RH-14D-3002



MEMO

旋转式执行元件的选定方法 Tips for Selecting the Rotary Actuator

选择执行元件时，请先使用执行元件和驱动器的技术资料确认详细规格。
Select an actuator after checking the detailed specifications in the technical information of actuators and drivers.

选定执行元件的流程图
Flowchart for Actuator Selection

确认伺服机构
（是旋转运动还是直线运动）
Check servo mechanism
(Rotational or linear motion)

↓

计算负载转矩（TL）、
转动惯量（JL）计算公式①
Calculate load torque (TL) and
moment of inertia (JL) Equation ①

↓

根据运转状况创建速度模式
Create a speed pattern based on operational status

↓

根据负载条件，暂选定执行元件
Tentatively select an actuator based on load conditions

↓

计算所需启动转矩（T1）计算公式②
Calculate required starting torque (T1) Equation ②

↓

所需启动转矩
是否低于执行元件的
瞬时最大转矩?
Is the required starting torque less
than the max. momentary torque
of the actuator?

NO → 回到“根据负载条件，暂选定执行元件”

↓ YES

创建转矩模式，计算有效转矩
（Trms）计算公式③
Create a torque pattern and calculate
effective torque (Trms) Equation ③

↓

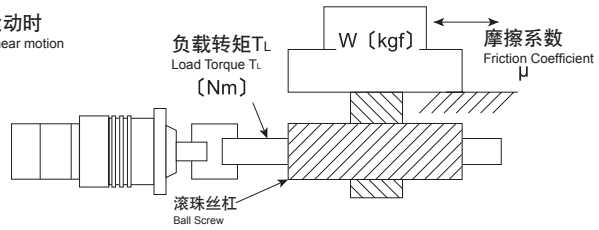
有效转矩是否低于
执行元件的额定转矩?
Is the effective torque smaller than
the rated torque of the actuator?

NO → 回到“根据负载条件，暂选定执行元件”

↓ YES

确定执行元件
Actuator is selected

● 水平直线运动时
For horizontal linear motion



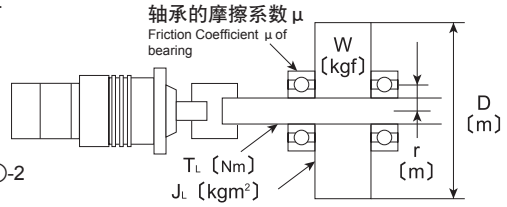
计算公式①-1
Equation ①-1

$J_L = J_S + w\left(\frac{P}{2\pi}\right)^2 〔kgm^2〕$

螺距P〔m〕功率 η
转动惯量Js〔kgm2〕
Pitch P [m] Efficiency η
Moment of inertia Js [kgm2]

$T_L = \frac{\mu W \cdot P}{2\pi \cdot \eta} 〔Nm〕$

● 旋转运动时
Rotation motion

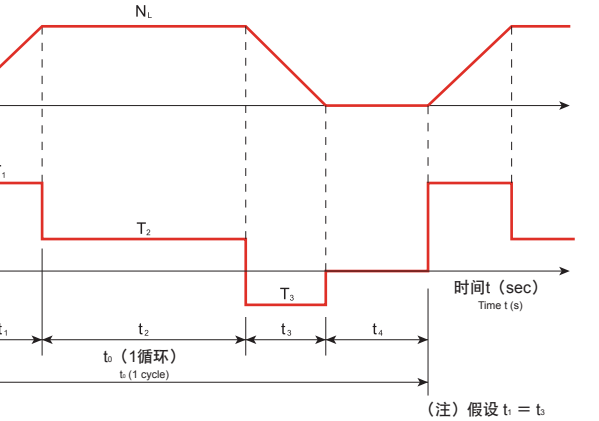


计算公式①-2
Equation ①-2

$J_L = J_S + \frac{W}{8} D^2 〔kgm^2〕$

$T_L = \mu W \cdot r [Nm]$

● 旋转运动时
Speed pattern



● 暂选定条件
Tentative selection

负载条件 Load Condition	确认 Check	产品目录值 Catalog Value	单位 Unit
负载转矩TL Load torque TL	⩽	额定转矩TR Rated torque TR	Nm
负载最高转速NL Max. rotational speed of load NL	⩽	额定转速NR Rated rotational speed NR	r/min
负载转动惯量JL Moment of inertia of load JL	⩽3JA*	转动惯量JA Moment of inertia JA	kgm²

*系统需要高伺服刚性（高响应性、高精度）时，最好是JL≤1JA
J1≤JA is desirable for a system requiring high servo stiffness (fast response and high precision)

计算公式②
Equation ②

$T_1 = T_L + \frac{2\pi}{60} \cdot \frac{(J_A + J_L) \cdot N_L}{t_1}$

计算公式③
Equation ③

$T_2 = T_L$

$T_3 = T_L - (T_1 - T_L)$

$T_{rms} = \sqrt{\frac{T_1^2 \cdot t_1 + T_2^2 \cdot t_2 + T_3^2 \cdot t_3}{t_0}}$

执行元件的选定示例
Actuator Selection Example

执行元件的选定示例如下所示。
An example of the actuator selection is shown below.

根据负载条件，按照暂选定执行元件的产品目录数值，RSF-11B-100 满足暂选定条件
Tentatively select an actuator based on the load conditions. RSF-11B-100 satisfies the tentative selection conditions based on catalog values

T_L＝2Nm	＜T_R＝4.0Nm
N_L＝25r/min	＜T_R＝30r/min
J_L＝0.02kgm^2	＜J_A＝0.02kgm^2

计算所需启动转矩（T1）计算公式①
TCalculate required starting torque (T1) Equation ①

$$T_1 = 2 + \frac{2\pi}{60} \cdot \frac{(0\ 02 + 0\ 02) \times 25}{0\ 1}$$

$$= 3.0\text{Nm}$$

确认所需启动转矩是否低于执行元件的瞬时最大转矩？
T_1＝3 0Nm ＜T_P＝11Nm，Yes
Check if the required starting torque is smaller than the maximum momentary torque of the actuator.
T1 = 3.0Nm < Tp = 11Nm will result. Yes

计算有效转矩（Trms）计算公式③
Calculate effective torque (Trms) Equation ③

T_1＝3 0Nm
T_2＝T_L＝2Nm
T_3＝T_L－（T_1－T_L）＝1Nm

$$T_{rms} = \sqrt{\frac{3^2 \times 0\ 1 + 2^2 \times 0\ 2 + 1^2 \times 0\ 1}{1}}$$

$$= 1\ 3\text{Nm}$$

确认有效转矩是否低于执行元件的额定转矩？由于
T_{rms}＝1 3Nm＜T_R＝4 0Nm，Yes
Check if the effective torque is smaller than the rated actuator torque.
Trms = 1.3Nm < TR = 4.0Nm will result. Yes

根据上述结果，确定执行元件的型号为 RSF-11B-100
Therefore, the actuator model is decided to be RSF-11B-100

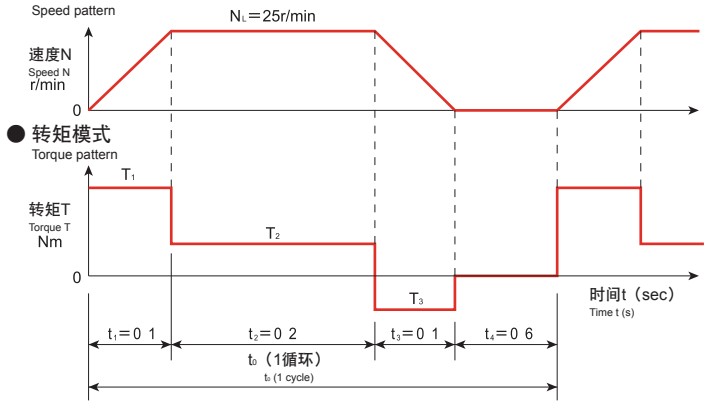
● 负载条件
Load Conditions

作为前提条件，伺服机构作水平直线运动时，执行元件呈轴形状（RSF系列）
Preconditions: The servo mechanism involves horizontal linear motion and the actuator is of a shaft type (RSF series)

负载转速 Load rotational speed	N_L	：25r/min
负载转矩 Load torque	T_L	：2Nm
负载转动惯量 Moment of load inertia	J_L	：0.02kgm^2
速度模式 Speed pattern	t_1＝t_3	：0.1sec
	t_2	：0.2sec
	t_4	：0.6sec

注）各特性值使用换算成执行元件输出轴的数值。
Note: Use characteristic values that are converted into those for the actuator output shaft.

● 速度模式
Speed pattern



LA系列 LA Series

超精密定位
Ultra Precision Positioning

LA系列是兼具小型、高分辨率、高推力的线性执行元件。本系列实现了最大推力49N、分辨率0.0174μm的高精度。

The LA series includes linear actuators featuring compactness, high resolution, a high driving force of 49N maximum, resolution of 0.0174μm and high accuracy.

特点 Features

●最大推力 Maximum driving force	49N（5kgf）
●分辨率 Resolution	0.0174μm
●行程 Stroke	10mm、30mm
●最大进给速度 Maximum feed speed	0.9mm/s
●重复定位精度 Repeatability	±0.1μm/行程1mm ±0.1μm/1mm stroke
●空转 Lost motion	5μm/行程1mm 5μm/1mm stroke

●可将驱动电动机变更为步进电动机。
The drive motor can be changed to a stepping motor.

型号和符号 Models and Symbols

LA - 30 B - 10 - F - L

- LA：LA系列 / LA series
- 30：尺寸 / Size
- B：版本符号 / Version symbol
- 10：行程（mm） / Stroke (mm)
- F：法兰安装型 / Flange mounting type
- L：省略：DC伺服电动机驱动（开路集电极方式）
L　：DC伺服电动机驱动（差分方式）
None: DC servo motor drive (Open collector type)
L　: DC servo motor drive (Line driver type)

规格 Specification

项目 Item / 型号 Model	LA-30B-10-F	LA-32-30-F
分辨率 Resolution	0.0174μm	
行程※1 Stroke※1	10mm	30mm
额定进给速度 Rated Feed Speed	0.5mm/s	
最大进给速度 Maximum Feed Speed	0.9mm/s	
最大推力※2 Maximum Driving Force※2	49N	
	5kgf	
重复定位精度※3 Repeatability※3	±0.1μm以下/行程1mm ±0.1μm or less/1mm stroke	
定位精度※3 Positional accuracy※3	2μm以下/行程40μm 2μm or less/stroke 40μm	
全行程定位精度※3 Full Stroke Positional accuracy※3	10μm以下 10μm or less	15μm以下 15μm or less
空转※3 Lost motion※3	5μm以下/行程1mm 5μm or less/1mm stroke	
负载条件 Load Condition	为确保精度，在轴端加压10N以上 Apply 10N or more to the shaft end to ensure accuracy	
驱动电动机 Drive Motor	DC伺服电动机 MDC02-IC22 DC servo motor 额定电压V 12V Rated voltage 额定电流 0.5A Rated current 编码器 Encoder 输出电路 开路集电极或差分 Output circuit Open collector or line driver 分辨率 360脉冲/转 Resolution 360 pulses/revolution 输出信号 开路集电极：A，B，Z Output signals Open collector: A, B, Z 差分：A，$\overline{A}$，B，$\overline{B}$，Z，$\overline{Z}$ Line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 电源 DC+5V±5%、170mA Max. Power supply ※与伺服驱动器HS-360组合时，编码器指令方式为差分方式。 The encoder will be a line driver encoder if combined with a servo driver (HS-360).	
组合驱动器 Combined Driver	DC伺服驱动器 HS-360-1A DC servo driver HS-360-1A 供电电源 AC100V±10% 50/60Hz Power supply AC100V±10%, 50/60Hz 控制功能 增量脉冲指令输入 Control system Incremental pulse command input 容许最大输入频率 100kp/s Permissible maximum input frequency 100kp/s 编码器只支持差分方式 Can be connected to an encoder of line driver type only （不能以开路集电极方式连接。） (Cannot be connected to the open collector type.)	
终端限位传感器 End Limit Sensor	无内置 Not contained	
安装方向 Installation Direction	水平、垂直向上 Horizontal, vertical upright	
重量 Mass	320g	550g
使用条件 Operating Conditions	可连续通电 Current can be transmitted continuously	
环境温度 Ambient Temperature	10℃～25℃	
润滑 Lubrication	润滑脂 Grease	

※1：两行程端无内置检测装置。即使在无负载状态下，也要将动作控制在顶出-引入界限内。如动作超出界限范围，可能导致故障、性能退化、使用寿命缩短。此外，不要触停输出杆。否则会导致性能退化、使用寿命缩短。
Detectors are not contained at both ends of the stroke. Motions must be limited within ejection and retraction limits, since any outside these limits will result in failures, performance degradation and shortened lifespan. Do not place any pad on the output rod, otherwise performance degradation and shortened lifespan may result.

※2：执行元件推杆顶端为球面端子，请在顶出方向上使用。将工作台向引入方向移动时，请在10N～最大推力范围内利用气缸的力和弹簧的回复力。
The tip of the ejector rod of the actuator is spherical in shape and the ejector must be used only in the ejection direction. Move the work piece in a retraction direction within a range between 10N and the maximum driving force using the restorative force of an air cylinder or spring.

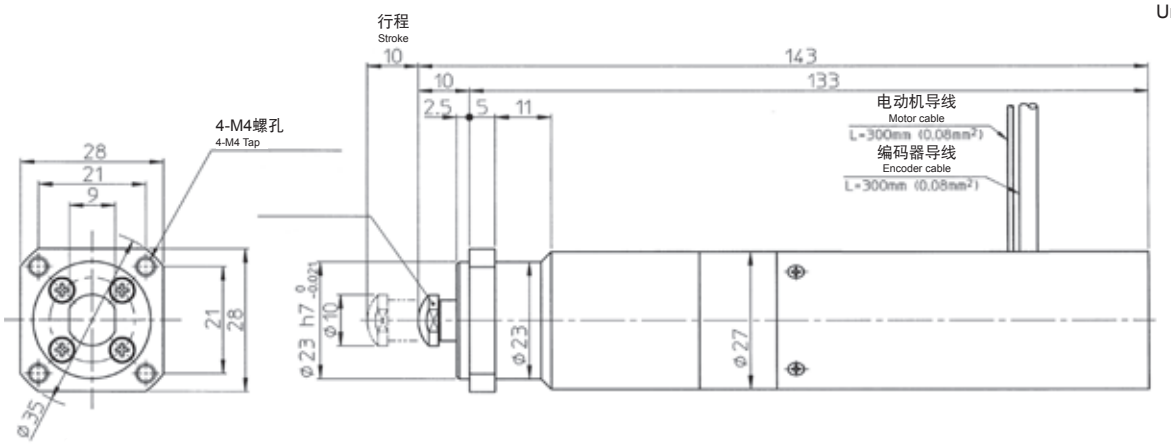
※3：以JIS B 6201为依据。测定温度：20℃±1℃、负荷负载：条件为10N～最大推力。
The actuators in the series conform to JIS B 6201 under measurement temperature of 20±1° C and load carrying capacity of 10N to maximum driving force.

※4：连续小幅动作使用时，易因润滑不足引起局部磨损，因此请参照技术资料使用。
Continuous micro jogging motions may cause local wear due to inadequate lubrication. Operate your actuators referring to technical information to obtain years of integral reliability and protection.

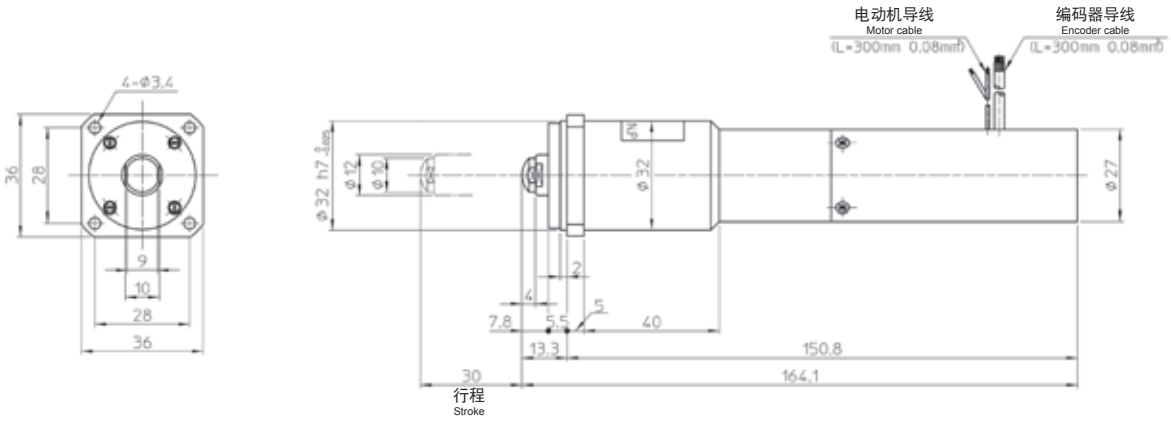
外形尺寸图 External Dimensions

■LA-30B-10-F

单位：mm
Unit: mm



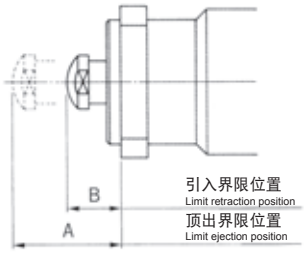
■LA-32-30-F



※关于尺寸及形状，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

使用注意事项 Operational Precautions

推拉连杆时，请在右图所示的机械界限位置内操作。
Limit rod ejection and retraction to within the mechanical limit positions illustrated on the right.



单位：mm
Unit: mm

型号 Model / 尺寸 Dimension	A尺寸 Dimension A	B尺寸 Dimension B
LA-30B-10-F	21.5	8.5
LA-32-30-F	44.3	12.3

LAH-46系列 LAH-46 Series

中推力
Medium Driving Force

LAH-46系列是拥有最大390N推力和0.069μm分辨率的线性执行元件。
驱动电动机可在DC伺服电动机或步进电动机中选择。

The LAH-46 series includes linear actuators featuring a maximum driving force of 390N and resolution of 0.069mm. A DC servo motor or a stepping motor can be selected as the drive motor.

特点 Features

●最大推力 Maximum driving force	390N（40kgf）
●分辨率 Resolution	0.069μm
●行程 Stroke	10mm、30mm
●最大进给速度 Maximum feed speed	3.7mm/s
●重复定位精度 Repeatability	±0.5μm/行程1mm ±0.5μm/1mm stroke
●空转 Lost motion	5μm/行程1mm 5μm/1mm stroke

●可将驱动电动机变更为步进电动机。
The drive motor can be changed to a stepping motor.

型号和符号 Models and Symbols

LAH - 46 - 10 02 - F - L

- LAH系列 LAH series
- 尺寸 Size
- 行程（mm） Stroke (mm)
- 额定推力（200N） Rated driving force (200N)
- 法兰安装型 Flange mounting type
- 省略：DC伺服电动机驱动（开路集电极方式）
  L　：DC伺服电动机驱动（差分方式）
  None: DC servo motor drive (Open collector type)
  L　: DC servo motor drive (Line driver type)

规格 Specification

项目 Item / 型号 Model	LAH-46-1002-F	LAH-46-3002-F
分辨率 Resolution	0.069μm	
行程※1 Stroke※1	10mm	30mm
额定进给速度 Rated Feed Speed	2mm/s	
最大进给速度 Maximum Feed Speed	3.7mm/s	
额定推力※2 Rated Driving Force※2	200N	
	20kgf	
最大推力※2 Maximum Driving Force※2	390N	
	40kgf	
重复定位精度※3 Repeatability※3	±0.5μm以下/行程1mm ±0.5μm or less/1mm stroke	
定位精度※3 Positional accuracy※3	4μm以下/行程0.2mm 4μm or less/stroke 0.2mm	
全行程定位精度※3 Full Stroke Positional accuracy※3	7μm以下 7μm or less	10μm以下 10μm or less
空转※3 Lost motion※3	5μm以下/行程1mm 5μm or less/1mm stroke	
负载条件 Load Condition	为确保精度，在轴端加压50N以上 Apply 50N or more to the shaft end to ensure accuracy	
驱动电动机 Drive Motor	DC伺服电动机 MDB02-IC22 DC servo motor 额定电压V 12V Rated voltage 额定电流 0.5A Rated current 编码器 Encoder 输出电路 开路集电极或差分 Output circuit Open collector or line driver 分辨率 360脉冲/转 Resolution 360 pulses/revolution 输出信号 开路集电极：A，B，Z Output signals Open collector: A, B, Z 差分：A，$\overline{A}$，B，$\overline{B}$，Z，$\overline{Z}$ Line driver: A, $\overline{A}$, B, $\overline{B}$, Z, $\overline{Z}$ 电源 DC+5V±5%、170mA Max. Power supply ※与伺服驱动器HS-360组合时，编码器指令方式为差分方式。 The encoder will be a line driver encoder if combined with a servo driver (HS-360).	
组合驱动器 Combined Driver	DC伺服驱动器 HS-360-1A DC servo driver HS-360-1A 供电电源 AC100V±10% 50/60Hz Power supply AC100V±10%, 50/60Hz 控制指令方式 增量脉冲指令输入 Control system Incremental pulse command input 容许最大输入频率 100kp/s Permissible maximum input frequency 100kp/s 编码器只支持差分方式 Can be connected to an encoder of line driver type only （不能以开路集电极方式连接。） (Cannot be connected to the open collector type.)	
终端限位开关 End Limit Sensor	内置松下电工（株）制造的FU开关 AV4024 FU switch AV4024 manufactured by Matsushita Electric Works contained	
安装方向 Installation Direction	全方向（垂直安装时注意保持力） All directions. (Must have adequate downward force when installed vertically)	
重量 Mass	810g	850g
使用条件 Operating Conditions	可连续通电 Current can be transmitted continuously	
环境温度 Ambient Temperature	10℃～25℃	
润滑 Lubrication	润滑脂 Grease	

※1：两行程端有内置检测装置，无内置机械止动器。即使在无负载状态下，也要将动作控制在顶出-引入界限内。如动作超出界限范围，可能导致故障、性能退化、使用寿命缩短。
Although detectors are included, mechanical stoppers are not contained at both ends of the stroke. Consequently, motions must be limited to ejection and retraction limits even when no load is applied. Any motion outside these limits may result in failures, performance degradation and shortened lifespan.

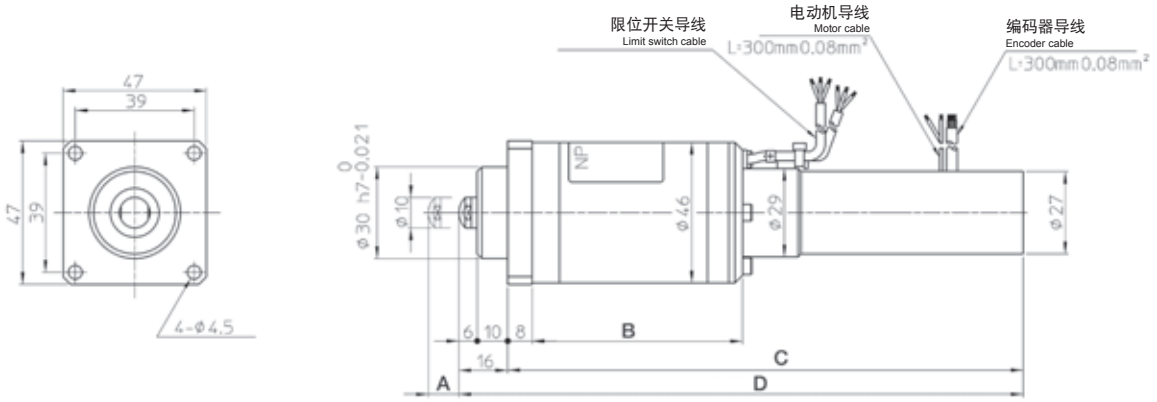
※2：执行元件推杆顶端为球面端子，请在顶出方向上使用。将工作台向引入方向移动时，请在10N～最大推力范围内利用气缸的力和弹簧的回复力。
The tip of the ejector rod of the actuator is spherical in shape. The ejector must be used only in the ejection direction. Move the work piece in a retraction direction within the range of 10N and the maximum driving force using the restorative force of an air cylinder or spring.

※3：以JIS B 6201为依据。测定温度：20℃±1℃、负荷负载：条件为49N～最大推力。
The actuators in the series conform to JIS B 6201 under a measurement temperature of 20±1° C and a load carrying capacity of 49N to maximum driving force.

※4：连续小幅动作使用时，易因润滑不足引起局部磨损，因此请参照技术资料使用。
Continuous micro jogging motions cause local wear due to inadequate lubrication. Operate your actuators referring to the technical information to obtain years of built-in reliability and protection.

外形尺寸图 External Dimensions

单位：mm
Unit: mm

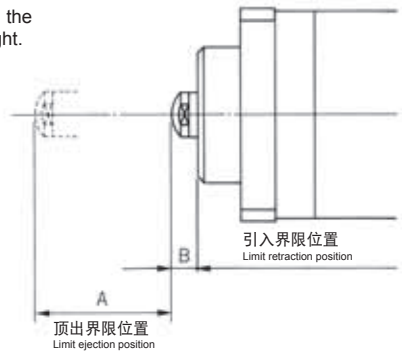


型号 Model / 尺寸 Dimension	A	B	C	D	重量 Mass
LAH-46-1002-F	10mm	69mm	169mm	185mm	0.81kg
LAH-46-3002-F	30mm	88mm	188mm	204mm	0.85kg

※尺寸及形状的详细情况，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

使用注意事项 Operational Precautions

推拉连杆时，请在右图所示的使用界限行程内操作。
Limit rod ejection and retraction to within the operable limit stroke illustrated on the right.



单位：mm
Unit: mm

型号 Model / 尺寸 Dimension	A尺寸 Dimension A	B尺寸 Dimension B
LAH-46-1002-F	12	5
LAH-46-3002-F	32	5

重复定位精度
Repeatability

表示针对某一目标点，相同条件下进行重复定位，位置保持一定的程度。
Represents a certain degree of positions when positioning is repeated at a target point under the same conditions.

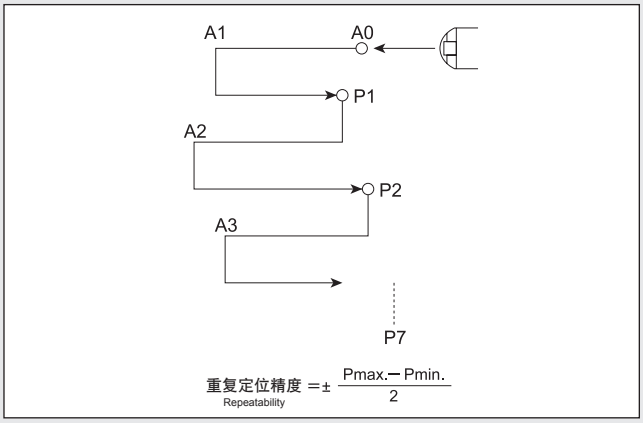
（1）将输出杆或载物台向顶出（+）方向移动至可动行程的中央附近（AO）停止。
An output rod or a stage is moved in an ejection (+) direction and is stopped in almost the center (A0) of the movable stroke.

（2）发送相当于规定行程量的动作信号，使其从AO点向（+）方向移动。设停止位置为A1。
The output rod or the stage is moved in an ejection (+) direction from Point A0 by a motion signal corresponding to the specified stroke. The stationary position is set as A1.

（3）发送相当于规定行程量的动作信号，使其从A1点向引入（-）方向移动。设停止位置为P1。
The output rod or the stage is moved in a retraction (-) direction from Point A1 by a motion signal corresponding to the specified stroke. The stationary position is set as P1.

（4）使其从P1点再度向（+）方向等量移动（A2点），同样向（-）方向等量移动（P2点）。
The output rod or the stage is moved in the (+) direction again from Point P1 by the same distance (Point A2) and is similarly moved in the (-) direction again by the same distance (Point P2).

（5）重复该动作共7次，得到P1～P7点，在最大差的1/2前添加符号（±），设为重复定位精度。
Repeat this process seven times in total to obtain Points P1 to P7. Mark "±" at 1/2 of the maximum difference and set it as the repeatability.



定位精度（微小行程）
Positional Accuracy (Fine Stroke)

用微小行程表示实际移动位置和指令位置的一致程度。
Represents a degree of coincidence between a position actually moved and a position commanded to move in a fine stroke.

（1）将输出杆或载物台向顶出（+）方向移动至可动行程的中央附近，设该位置为基准位置。
An output rod or a stage is moved in a (+) direction and is stopped in almost the center of the movable stroke. This position is set as a datum position.

（2）发送相当于规定脉冲移动距离量的动作信号，使其从基准位置向（+）方向移动，依次发送100波脉冲，测定各个位置。
Feed 100 steps in succession from the datum position in a (+) direction by a motion signal corresponding to the moving distance for the specified step. Measure the individual positions.

（3）从基准位置到各个位置的实际移动距离和应该移动距离之差作为误差，将误差的最大差设为定位精度。
The output rod Determine the difference in terms of the degree of error between the distance actually moved from the datum position and commanded distance in each position and set the maximum difference of errors as a positional accuracy.

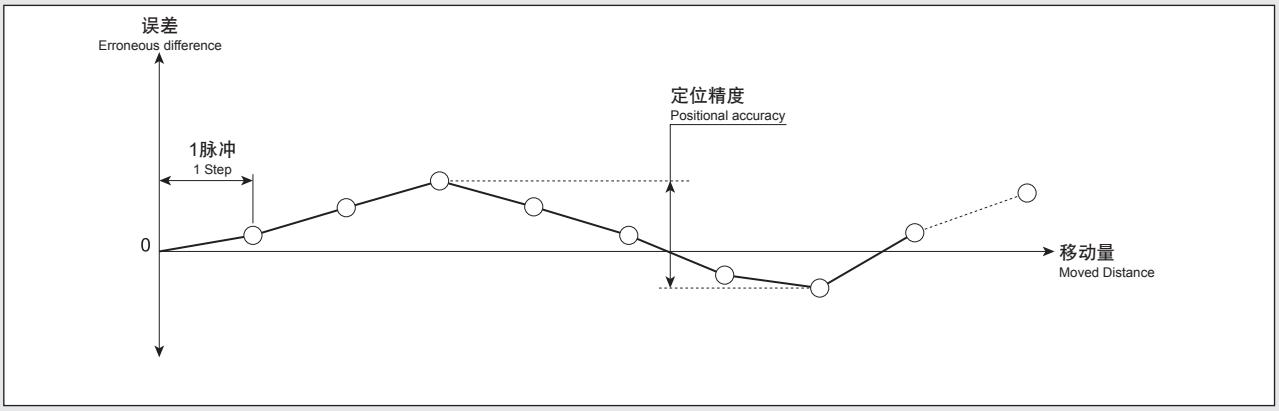
全行程定位精度
Full Stroke Positional Accuracy

用微小行程表示实际移动位置和指令位置的一致程度。
Represents the degree of coincidence between a position actually moved and a position commanded to move within a full stroke range.

（1）将输出杆或载物台移动至超过引入侧使用行程界限的位置，再使其向顶出方向（+）移动，停在行程界限位置附近，设该位置为基准位置。
An output rod or a stage is moved to a position beyond the limit for the stroke on the retraction side, moved in an ejection (+) direction from there and is stopped near the stroke limit position. This position is set as a datum position.

（2）发送相当于规定脉冲移动距离量（行程的 1/100）的动作信号，使其从基准位置向（+）方向移动，依次发送脉冲直至行程界限，测定各个位置。
Feed in succession from the datum position to the stroke limit in a (+) direction by a motion signal corresponding to a specified moving distance (1/100 of a stroke). Measure the individual positions.

（3）从基准位置到各个位置的实际移动距离和应该移动距离之差作为误差，将误差的最大差设为定位精度。
The output rod Determine the difference in terms of the degree of error between the distance actually moved from the datum position and the commanded distance respectively in each position and set the maximum erroneous difference as a positional accuracy.



空转
Lost Motion

表示向某位置正向（+）定位时停止位置和负向（-）定位时停止位置的差。
Represents the difference between a stationary position during positioning while moving to a position in a positive (+) direction and a stationary position during positioning while moving in a negative (-) direction.

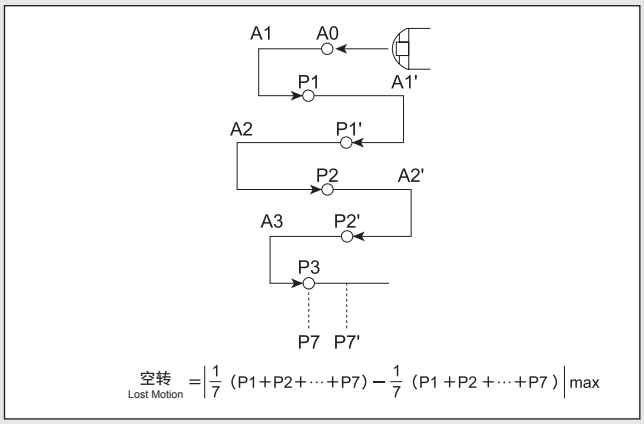
（1）将输出杆或载物台向顶出（+）方向移动至可动行程的中央附近（AO）停止。
An output rod or a stage is moved in an ejection (+) direction and is stopped almost in the center (A0) of the movable stroke.

（2）发送相当于规定行程量的动作信号，使其从 AO 点向（+）方向移动。设停止位置为 A1。
The output rod or the stage is then moved in a (+) direction from Point A0 by a motion signal corresponding to the specified stroke. The stationary position is set as A1.

（3）发送相当于规定行程量的动作信号，使其从 A1 点向引入（-）方向移动。设停止位置为 P1。
The output rod or the stage is moved in a retraction (-) direction from Point A1 by a motion signal corresponding to the specified stroke. The stationary position is set as P1.

（4）再使其从 P1 点再度向(-)方向等量移动(A1' 点)，同样向(+)方向等量移动（P1' 点），测定该位置。
The output rod or the stage is moved in the (-) direction again from Point P1 by the same distance (Point A') and is then similarly moved in the (+) direction again by the same distance (Point P1'). Measure this position.

（5）重复该动作共 7 次，将 P1 ～ P7 点的平均值和 P1' ～ P7' 的平均值之差设为空转值。
Repeat this process seven times in total and set the difference between the average of Points P1 to P7 and average of Points P1' to P7' as the lost motion.



HS-360系列 HS-360 Series

DC伺服驱动器
DC servo drivers

特点 Features

●简便的功能设定

Easy function setting

在产品出厂前，配套执行元件的各类参数已设定完成，不需要再行设定与执行元件相关的参数。
为了与上级系统和控制性达到最佳匹配，在设定本机的参数时，可以一边看“参数模式”7段LED显示一边设定，非常简便。

Individual parameters for actuators to be connected are already set during pre-shipment inspection at the factory. Parameter setting by the customer is therefore not required.
The parameters to optimally suit the actuator to your host system and controllability can be set easily while observing a 7-segment LED display in the parameter mode.

●丰富的运转状态显示

Versatile displays of operation states

可以始终通过“状态显示模式”和“数值监控模式”显示运转状态，监控所选项目的状态。作为伺服系统，可以监控特别重要的“指令状态”、“反馈状态”、“偏差计数器的状态”。而且，能够显示之前最多8次的“警报履历”，便于异常时的诊断作业。

The operational status is always displayed in the“status display” and “numeric monitor” modes to monitor the status of the desired items. The “Status of commands,” “status of feedback” and “status of deviation counter”that are especially important for a servo system can also be monitored. “Alarm history” displays up to eight previously triggered alarm events and is useful in trouble diagnosis.

●简单的试运转调试

Easy adjustment for trial run

在“JOG运转模式”下，操作面板上的按钮就可以使JOG运转，因此调试作业非常简单。

Jogging can be performed by keying the buttons on the panel in the “JOG run mode” for easy adjustment.

●适用机械系统的电子齿轮

Electronic gear suiting machine systems

利用“电子齿轮”功能，可令伺服系统的进给角度和进给螺距适配负载机械的减速比和进给装置的单位。

The “electronic gear” function enables adjustment of the feed angle and pitch of the servo system to the reduction ratio and feed mechanism unit of the load machine.

●3种位置指令输入

Three types of position command input

可指定“双脉冲方式”、“单脉冲方式”、“二相脉冲方式”中任一位置指令输入。

Position command input of a 1- or 2-pulse system or a 2-phase pulse system can be specified.

型号和符号 Models and Symbols

HS - 360 - 1 A

机型：DC伺服驱动器HS系列
Type: DC servo driver HS series

360系列
Series: 360

额定输出电流：
Rated current:

1	1.0A或1.4A 1.0A or 1.4A
3	3.2A

最大电流种类：
Symbol for max. current:

A	1.0A
B	2.6A
C	3.7A
D	4.2A

组合执行元件一览 Combined Actuators

HS-360系列共有5种，支持驱动器的额定输出电流和执行元件的瞬时最大电流。组合的执行元件如下。
（使用HS-360-1A时，需要在驱动器和执行元件间串联DC电抗器15mH。此外，DC电抗器15mH为驱动器的附属部件。尺寸等详细情况请参照技术资料。）
Five models are available in the HS-360 series in accordance with the driver rated output current and actuator maximum momentary current. The models of combined actuators are listed below.
(Serial connection of a DC reactor 15mH is required between the driver and actuator when using the HS-360-1A.A DC reactor 15mH will be supplied as an accessory. See the technical information for dimensions and other specifications.)

■RH系列
RH Series

驱动器型号 Driver model	HS-360-1A	HS-360-1B	HS-360-1C	HS-360-1D	HS-360-3
执行元件型号 Actuator model	RH-5A-8802 RH-5A-5502 RH-5A-4402	RH-8D-6006 RH-8D-3006	RH-11D-6001 RH-11D-3001 RHS-14-6003 RHS-14-3003	RH-14D-6002 RH-14D-3002 RHS-17-6006 RHS-17-3006	RHS-20 RHS-25※2

※1 组合的执行元件的编码器分辨率为1000P/R的差分规格。但RH-5A及线性系列的编码器分辨率为360P/R或500P/R的差分规格。
The encoder resolution of a combined actuator will be the line driver specification of 1000 pulses/revolution.The encoder resolution for RH-5A and the linear series will be the line driver specification of 360 or 500 pulses/revolution.
※2 RHS-25不支持部分机型。使用时请另行咨询。
RHS-25 cannot be combined with some models. Consult Harmonic Drive Systems beforehand when using RHS-25.

■线性系列
Linear Series

驱动器型号 Driver model	HS-360-1A
执行元件型号 Actuator model	LA-30B-10-F-L LA-32-30-F-L LAH-46-1002-F-L LAH-46-3002-F-L

规格 Specification

项目 Item / 型号 Model	HS-360-1A	HS-360-1B	HS-360-1C	HS-360-1D	HS-360-3
额定输出电流（rms）※2 Rated Output Curr. (rms)※2	1.0A	1.4A			3.2A
最大输出电流（rms）※3 Max. Output Current (rms)※3	1.0A	2.6A	3.7A	4.2A	10A
电源电压 Power Supply	AC100V（单相）±10% 50/60Hz AC100V (single phase) ±10% 50/60Hz				
控制方式 Control System	PWM控制方式（控制元件：IPM）、开关频率：12.5kHz PWM control system (control element IPM), switching frequency 12.5kHz				
适应位置传感器 Connected Position Sensor	增量编码器（A，B，Z相输出），差分方式 Incremental encoder (A-, B-, Z-phase output), line driver system				
构造/安装方法 Structure, Mounting Method	全闭自冷式/底座安装（壁面安装） Totally enclosed self-cooled type, base mount (wall mounting)				
控制模式 Control Mode	定位控制 Position control				
最大输入脉冲频率 Maximum Input Pulse Frequency	差分指令：400kp/s（Max） Line driver command: 400kp/s (max) 开路集电极指令：200kp/s（Max） Open collector command: 200kp/s (max)				
位置信号输出 Position Signal Output	A、B、Z相电压输出（+5V）Z相光耦合器输出 A-, B-, Z-phase voltage output (+5V), Z-phase photo coupler				
监控 Monitor	可监控动作状态、警报履历、I/O、参数等 通过专用软件可监控动作波形 Operation status, alarm history, I/O, parameters and other items can be monitored. Using dedicated software, operation waveforms can also be monitored.				
输入脉冲形态 Pulse Input Mode	单脉冲方式、双脉冲方式、二相脉冲方式 1-, 2-pulse systems and 2-phase pulse system				
控制输入信号 Control Input Signal	启用、警报重置、偏差计数器重置、正转限位、反转限位 Enable, alarm reset, deviation counter reset, forward and reverse limits				
控制输出信号 Control Output Signal	就绪、警报、到位 Ready, alarm, in position				
串行接口 Serial Interface	EIA232C＜RS-232＞（连接专用电缆线） EIA232C <RS-232> (Connection by dedicated cable)				
重量 Mass	0.8kg				1.1kg
保护功能 Protection Functions	内存异常、过负载、编码器异常、再生异常、过热、系统异常、过电流、偏差过大、IPM异常、过速度 Memory error, overload, encoder trouble, regeneration trouble, overheat, system trouble, overcurrent, excessively large deviation, IPM trouble, overspeed				
内置电路 Embedded Circuit	动力制动器电路、再生单元连接端子（※4） Dynamic brake circuit, regeneration unit connection terminal (※4)				
内置功能 Embedded Functions	手动操作（JOG运转、警报履历清除等） Manual operation (jogging, alarm history clear and others)				
环境条件 Environmental Conditions	使用温度：0～+50℃ Operating temperature: 0℃ to +50℃ 使用湿度：90%RH以下（无结露） Operating humidity: 90% RH or less (Do not expose to condensation) 工作气体：无金属粉、粉尘、油雾、腐蚀性气体 Ambience: Do not expose to metal powder, dust, oil mist or corrosive gas		保存温度：-20～+85℃ Storage temperature: -20℃ to +85℃ 保存湿度：90%RH以下（无结露） Storage humidity: 90% RH or less (Do not expose to condensation). 耐振动：4.9m/s^2（10～55Hz） 抗冲击：19.6m/s^2 Resistance to vibration: 4.9m/s^2 (frequency 10 to 55Hz), shock resistance: 19.6m/s^2		

※1：本产品在本公司出厂时与配套执行元件（电动机）共同进行参数设定。使用其他执行元件时，需要将其返还本公司再进行参数设定。
The parameters of this product are set during pre-shipment inspection at the factory in accordance with the specification of the combined actuator (motor). If another actuator is to be used, please return the product to Harmonic Drive Systems for resetting of parameters.

※2：额定输出电流表示驱动器的连续输出电流。该值由于与执行元件的组合而受到限制。
Rated output current represents the continuous output current of the driver. The value will be limited according to the combination of actuator.

※3：最大输出电流表示驱动器的瞬时最大电流。该值由于与执行元件的组合而受到限制。
Maximum output current represents the maximum momentary current of the driver. The value will be limited according to the combination of actuator.

※4：本驱动器未内置再生电路。
This driver does not contain a regeneration circuit.

※关于尺寸及形状，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

各部分名称和功能 Names and Functions of Components

按钮
Key Buttons

■在切换显示、各功能设定时输入或修改设定值、执行元件的手动JOG动作等情况下使用。
Key buttons for display mode selection, input and correction of set values when setting functions, for manual jogging of the actuator and for other functions

充电电压监控
Charge Voltage Monitor

■监控电源供电端子的电压状态。LED亮灯时为高电压，请绝对不要触碰端子。
Monitors voltage status of the power supply terminal. High voltage is transmitted while the LED lamp is lit. Never touch the terminal.

TB1：电源供电端子R,T
TB1: Power Supply Terminals R, T

■供电电源连接用AC100V电源供电端子。
The AC100V power supply terminal for connecting supply power.

TB1：接地端子E
TB1: Grounding Terminal E

■接地用端子。为防止发生触电事故，必须在此连接接地线。
A terminal for grounding. Be certain to connect the grounding wire here to prevent an electric shock.

TB1：外部再生单元连接用端子P，N
TB1: Terminals for Connecting External Regenerative Resistance Unit P, N

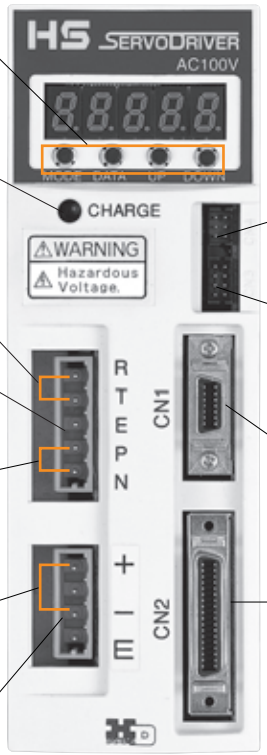
■在执行元件起动、停止频繁，需要连接外部再生单元时使用的端子。
Terminals in case connection of external regeneration unit is required due to frequent actuator starts and stops.

TB2：执行元件连接端子+，-
TB2: Terminals for Connecting Actuator +, -

■连接执行元件的导线。执行元件的线色和HA-360驱动器的符号正确匹配后再连接。错接容易导致驱动器及执行元件的损坏。
Terminals for connecting actuator cables. Correctly connect by matching the actuator cable color and the HS-360 driver symbol. Incorrect connection will damage the driver and actuator.

TB2：接地端子E
TB2: Grounding Terminal E

■在执行元件（周边）接地。
Connect this terminal to the periphery of the actuator.



LED显示部
LED Display

■HA-360驱动器的运转状况、各功能的设定值、警报等信息通过5位的7seg-LED进行显示。
Displays operation status, set values of functions, alarms and other information concerning the HS-360 driver using a 5-digit 7-segment LED display.

CN4：未使用
CN4: Not used

■未使用的接头。绝对不要使用。
This connector is not used. Never use this connector.

CN3：RS-232C串行端口接头
CN3: RS-232C Serial Port Connector

■连接计算机的接头。可进行各参数设定和变更，或状态监控。（※需要专用软件）
The connector for connecting to a personal computer, allowing parameter setting and modification, as well as status monitoring. (※Dedicated software is required)

CN1：外部输入输出接头
CN1: External Input/Output Connector

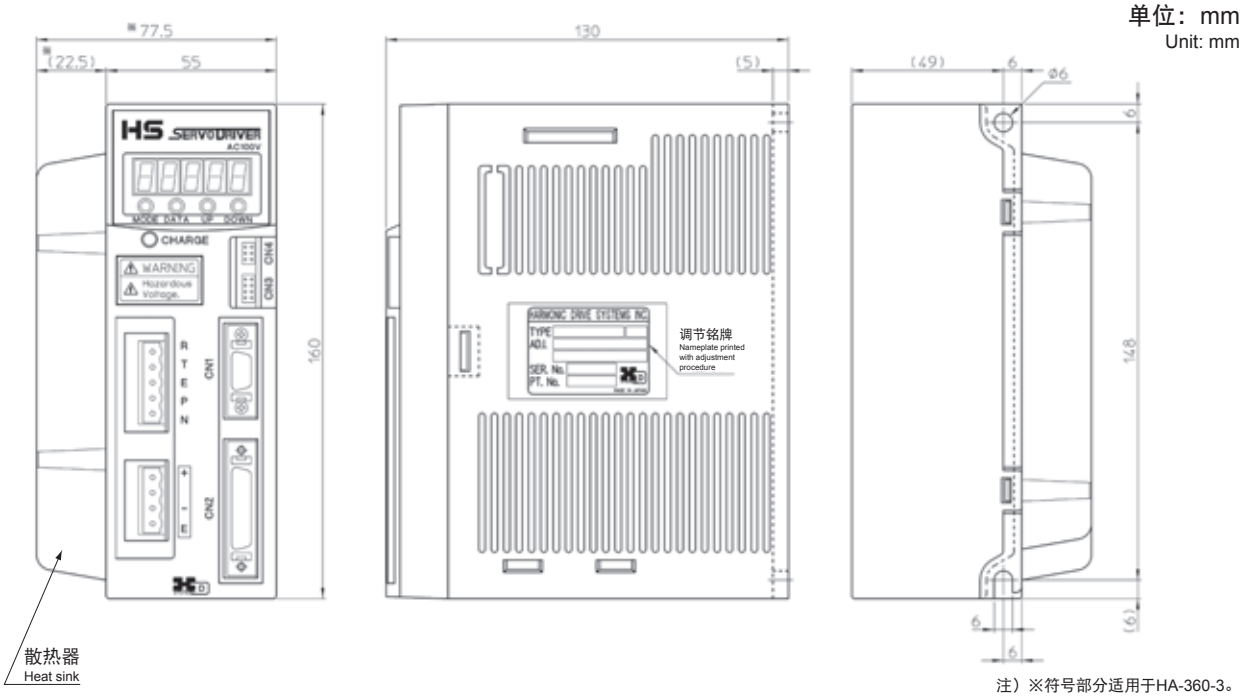
■用于与上一级控制器收发控制信号的接头。
The connector for control signal exchange with a host controller.

CN2：编码器接头
CN2: Encoder Connector

■连接执行元件位置检测用编码器的电缆线，和FWD、REV的限位传感器的电缆线的接头。（可监控编码器信号输出）
The connector to connect the encoder cable for actuator position detection and cables of the FWD and REV limit sensors.

外形尺寸图 External Dimensions

单位：mm
Unit: mm



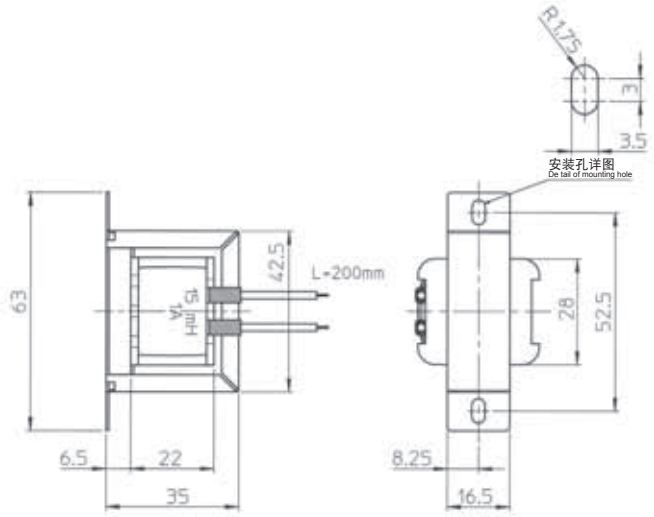
注）※符号部分适用于HA-360-3。
Note: Starred portions are for HA-360-3.

※关于尺寸及形状，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

外形尺寸图 External Dimensions

■DC电抗器15mH（附属部件）
DC Reactor 15mH (Accessory)

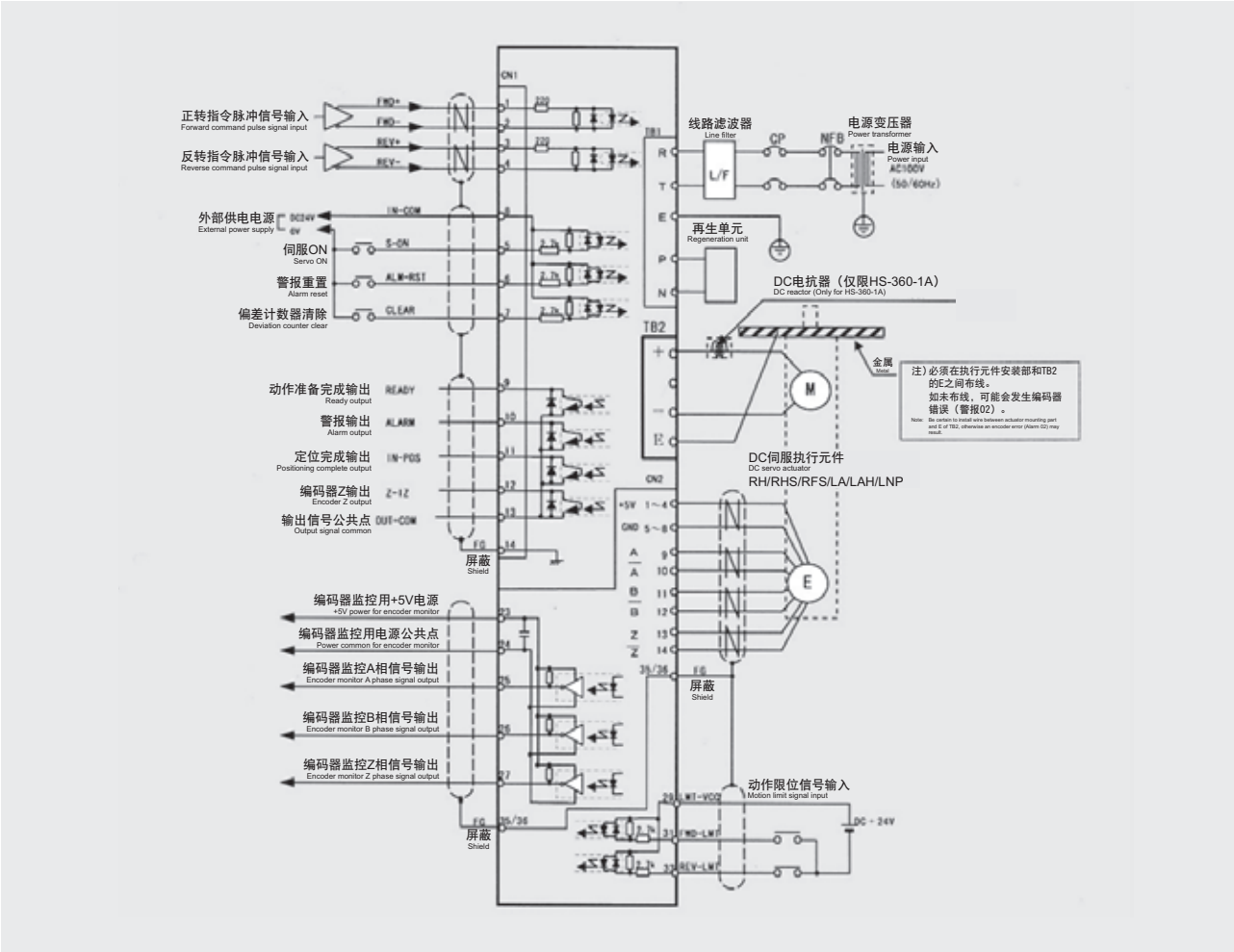
单位：mm
Unit: mm



■关于尺寸及形状，请使用本公司发行的交货规格图进行确认。
Please confirm dimensions and shape against the illustrated specifications issued by us accompanying the delivered product.

连接示例 Connection Examples

脉冲输出形态为“差分”时的连接示例如下所示。指令形态为“双脉冲方式”。
This is a connection example when the pulse output mode is “line driver.” The command mode is a “2-pulse system.”



注）连接的详细情况，请确认技术资料后再进行设计。
Note: Design connection details after checking the technical information.

关于保修 Warranty

本产品目录中记载的产品的保修期及保修范围规定如下。
Harmonic Drive Systems undertakes warranty of its products contained in this catalog for the following warranty period and scope.

●保修期
Warranty Period

在遵守技术资料、使用说明书以及本产品目录中记载的各项内容的前提下，保修期为交货后的一年时间或该产品运行时间达到2000小时，两者中最先达到的时间。
Under the condition that the products are handled, used and maintained properly followed each item of the technical materials, the manuals, and this catalog, all the products are warranted against defects in workmanship and materials for the shorter period of either one year after delivery or 2,000 hours of operation time.

●保修范围
Warranty Scope

在上述保修期内，因本公司产品缺陷导致故障时，由本公司负责对本产品进行维修或更换。
但以下情况不在保修范围内。
All the products are warranted against defects in workmanship and materials for the warranted period.
This limited warranty does not apply to any product that has been subject to:

①因客户不当操作或使用导致故障的
User's misapplication, improper installation, inadequate maintenance, or misuse
②非本公司实施的改造或修理导致故障的
Disassembling, modification or repair by others than Harmonic Drive Systems, Inc.
③非本产品原因导致故障的
Imperfection caused by the other than the products
④其它天灾等非本公司责任导致故障的
Disaster or others that does not belong to the responsibility of Harmonic Drive Systems, Inc.

而且，这里所说的保修是指对本产品的保修。
对于因本产品故障引发的其它损失、与设备上拆装相关的工时、费用等，不在本公司负责范围内。
Our liability shall be limited exclusively to repairing or replacing the product only found by Harmonic Drive Systems, Inc. to be defective. Harmonic Drive Systems, Inc. shall not be liable for consequential damages of other equipment caused by the defective products, and shall not be liable for the incidental and consequential expenses and the labor costs for detaching and installing to the driven equipment.

关于商标 Trademark

“Harmonic Drive”的学术、一般名称为“谐波齿轮传动”。
The academic and general nomenclature for “HarmonicDrive” is “wave motion gearing” .

本公司保留在不预先通知的情况下更改本产品目录中记载的规格、尺寸等的权利。
Specifications and dimensions on the catalog may change without notice.

以下商标在日本国内已注册。

HarmonicDrive® ハーモニックドライブ®	HarmonicPlanetary® ハーモニックプラネタリ	Harmonicsyn® ハーモニックシン
HarmonicLinear® ハーモニックリニア	AccuDrive® アキュドライブ®	BEAM SERVO® ビームサーボ

伺服系统安全使用注意事项
For Safe Use of Servo Systems

警告： 表示操作错误可能会导致人员死亡或负重伤。
Warning: Means that improper use or handling could result in a risk of death or serious injury.

注意： 表示操作错误可能会导致人员受伤及财产损失。
Caution: Means that improper use or handling could result in personal injury or damage to property.

用途限制 Limited Applications

本产品不能用于以下用途。
This product cannot be used for the following applications:

- *航天设备 Space equipment
- *航空器设备 Aircraft equipment
- *核设备 Nuclear power equipment
- *家庭设备、器具 Equipment and apparatus used in domestic homes
- *真空设备 Vacuum equipment
- *汽车设备 Automotive equipment
- *游戏设施 Game equipment
- *直接作用于人体的设备 Equipment that directly works on human bodies
- *以运送人为目的的设备 Equipment for transport of humans
- *特殊环境用设备 Equipment for use in a special environment

用于上述用途时，请预先咨询授权代理商。
Please consult Harmonic Drive Systems beforehand when intending to use one of its product for the aforementioned applications.

将本产品用于与人的生命相关的设备及可能会产生重大损失的设备时，
请安装即使因破坏而导致不能控制输出端，也不会发生事故的安全装置。
Install a safety device that avoids an accident even if output of this product becomes uncontrollable due to breakdown when using it in equipment that affects human lives and that may trigger serious damage.

执行元件使用注意事项 Actuator Safety Precautions

设计注意事项 进行设计时，请务必阅读技术资料。 Design Precaution: Be certain to read the technical information when designing the equipment.

注意 Caution

请在规定环境下使用。
Use only in a specified environment.
●执行元件是以室内使用为目标进行的设计。请遵守以下条件。
Actuators are designed and manufactured for indoor use. Please ensure the following environmental conditions are complied with:
- 环境温度：0～40℃ Ambient temperature 0 to 40°C
- 振动：24.5m/s²以下 Vibration 24.5m/s² or less
- 环境湿度：20～80%RH Ambient humidity 20 to 80% RH (Do not expose to condensation)
- 不溅到水、油等（无结露） No splashing of water or oil
- 无腐蚀性、爆炸性气体 Do not expose to corrosive or explosive gas

注意 Caution

请按规定精度安装。
Install the actuator at the specified accuracy.
●请按照技术资料要求准确地进行执行元件轴和被动机械定心。
Correctly align the centers of the actuator shaft and mating machine in accordance with the technical information.
●中心偏移可能会导致振动及输出轴损坏。
Any misalignment could cause vibration and fracture of the output shaft.

使用注意事项 执行运转时，请务必阅读使用说明书及技术资料。 Operational Precaution: Be certain to read the instruction manual and technical information before operating the actuator.

注意 Caution

请不要超出容许转矩。
Do not exceed the permissible torque.
●施加转矩请不要超出最大转矩。
Do not apply a torque larger than the maximum value.
●机械臂等直接附着到输出轴时，碰撞机械臂会导致输出轴不能控制。
If an arm or other part is connected directly to the output shaft, this latter may become uncontrollable if the arm or other part is collided.

警告 Warning

请不要直接插到插座上。
Do not plug directly into a socket.
●如果不连接专用控制单元，执行元件不能运转。
The actuator cannot be operated unless connected to a dedicated control unit.
●请坚决避免直接将其连接到商用电源。否则，执行元件会损坏，导致火灾。
Never connect directly to the AC power supply. The actuator may fracture and a fire may break out.

警告 Warning

请不要敲打执行元件。Do not pat the actuator.
●执行元件直接连接编码器，请不要敲打。
An encoder is coupled to the actuator. Do not pat the actuator.
●编码器损坏会导致执行元件失控。
A fractured encoder may cause the actuator to run out of control.

警告 Warning

请不要用力拉扯导线。
Do not pull the cables.
●用力扯拉导线会导致连接部损坏，执行元件失控。
Pulling a cable may damage the connecting part and cause the actuator to run out of control.

伺服驱动器使用注意事项 Servo Driver Safety Precautions

设计注意事项 进行设计时，请务必阅读技术资料。 Design Precaution: Be certain to read the technical information when designing the equipment.

注意 Caution

请在规定环境下使用。
Use only in a specified environment.
●驱动器会发热。请充分重视散热，在以下条件下使用。
The driver generates heat. Exercise reasonable care concerning heat radiation and operate under the following conditions.
- 装方向为垂直，留出足够空间 Install vertically and ensure sufficient space nearby
- 0～50℃、95%RH以下（无结露） 0 to 50°C and 95% RH (Do not expose to condensation)
- 无振动、冲击 Avoid vibration or shocks
- 无尘埃、腐蚀性、爆炸性气体 Do not expose to dust or corrosive or explosive gas

注意 Caution

请切实实施防干扰、接地处理。
Take adequate precautionary measures to damp noise and ground.
●信号线受到干扰容易产生振动及运行不良。请遵守以下条件。
Noise on signal wire may cause vibration and malfunction. Observe the following conditions:
- 将强弱电线隔开。 Separate strong and weak wires.
- 请尽量弄短配线的长度。 Minimize wiring distances and lengths.
- 执行元件和伺服驱动器请按3级以上标准进行1点接地。 Ground the actuator and servo driver to one point and in class 3 in grounding.
- 请不要在电动机电路中使用电源输入用过滤器。 Do not use a power input filter in the motor circuit.

注意 Caution

充分留意从负载侧旋转的运转。
Exercise reasonable care when rotating from load side.
●行元件在从负载侧旋转的同时进行运转时，伺服驱动器可能会损坏。
The servo driver may break if the actuator is run while being rotated from the load side.
●用于以上情况时，请向授权代理商咨询。
Consult Harmonic Drive Systems when the servo driver is operated in this mode.

注意 Caution

请使用变频器用漏电断路器。
Use an earth leakage breaker for the inverter.
●使用漏电断路器时，请使用变频器专用产品。不能使用延时型产品。
Use an earth leakage breaker for the inverter. A time-delay breaker cannot be used.

使用注意事项 执行运转时，请务必阅读使用说明书及技术资料。 Operational Precaution: Be certain to read the instruction manual and technical information before operating the actuator.

警告 Warning

通电状态下，请勿更改配线。
Do not change the wiring while the current is active.
●配线拆装、接头插拔等操作，请务必先切断电源再行实施。否则，会有触电及失控的危险。
Always turn the power off when removing any wire or connecting or disconnecting a connector, otherwise an electric shock or runway may result.

警告 Warning

电源断开后5分钟以内，请不要触碰端子部。
Do not touch the terminals for 5 min after turning it off.
●切断电源后，内部仍带电。为防止触电，请在电源断开5分钟后再行实施检查作业。
Residual electricity remains after turning the power off. Make checks more than 5 minutes after turning the power off to prevent any electric shock.
●安装时，请采取相应措施确保不会轻易触碰到内部的电气元件。
When installing a servo driver, design the structure so that the electric parts inside cannot be touched easily.

注意 Caution

请勿实施耐电压试验。
Do not conduct a withstand voltage test.
●请勿实施绝缘电阻测试及耐压试验。否则会破坏伺服驱动器的控制电路。
Do not conduct a megger or withstand voltage test, otherwise the control circuit of the servo driver may be damaged.

注意 Caution

不能利用电源的ON/OFF操作来执行运转。
Do not operate the servo driver by turning it on and off.
●频繁接通/断开电源会导致内部电路元件老化。
Frequent turning on and off of the power causes the internal circuit devices to deteriorate.
●请利用指令信号来执行执行元件的运转/停止操作。
Start and stop the actuator by issuing a command signal.

关于报废 执行元件及伺服驱动器的报废 When Discarding Actuator and Servo Driver

注意 Caution

请按工业废弃物标准进行处理。
Please discard as industrial waste.
●报废时，请按工业废弃物进行处理。
Please discard as industrial waste when discarding.

本公司产品的主要用途 Major Applications of Our Products

金属机床
Metal Working Machines

金属加工机械
Processing Machines

测定·分析·试验设备
Measurement, Analytical and Test Systems

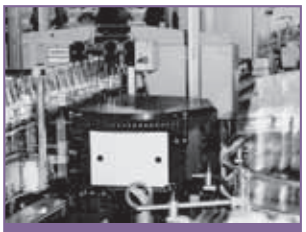
医疗机械
Medical Equipments

望远镜
Telescopes

提供：大学共同利用机关法人国立天文台
Inter-University Research Institute Corporation

能源相关
Energy

Courtesy of Haliiburton/Sperry Drilling Services



包装·装箱设备
Crating and Packaging Machines

通信设备
Communication Equipments

航天设备
Space Equipments

Rover image created by Dan Maas, copyrighted toCornell and provided courtesy NASA/ JPL-Caltech.

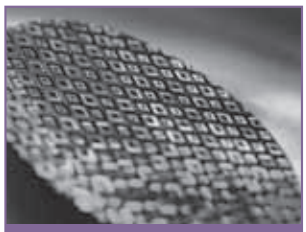
玻璃·陶瓷制造装置
Glass and Ceramic Manufacturing Systems

机器人
Robots

机器人
Humanoid Robots

提供：本田技研工业株式会社
Source: Honda Motor Co., Ltd.

印刷·装订·纸品加工机械
Printing, Bookbinding and Paper Machines



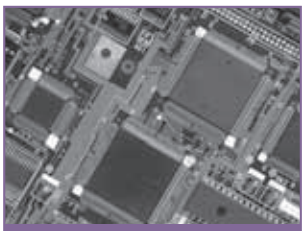
半导体制造装置
Semiconductor Manufacturing Systems

光学相关机械
Optical Machines

木材·轻金属·塑料加工机床
Wood, Light Metal and Plastic Machine Tools

制纸机械
Paper-making Machines

FPD制造装置
Flat Panel Display Manufacturing Systems



印刷电路制造装置
Printed Circuit Board Manufacturing Machines

航空器相关
Aircraft Technology

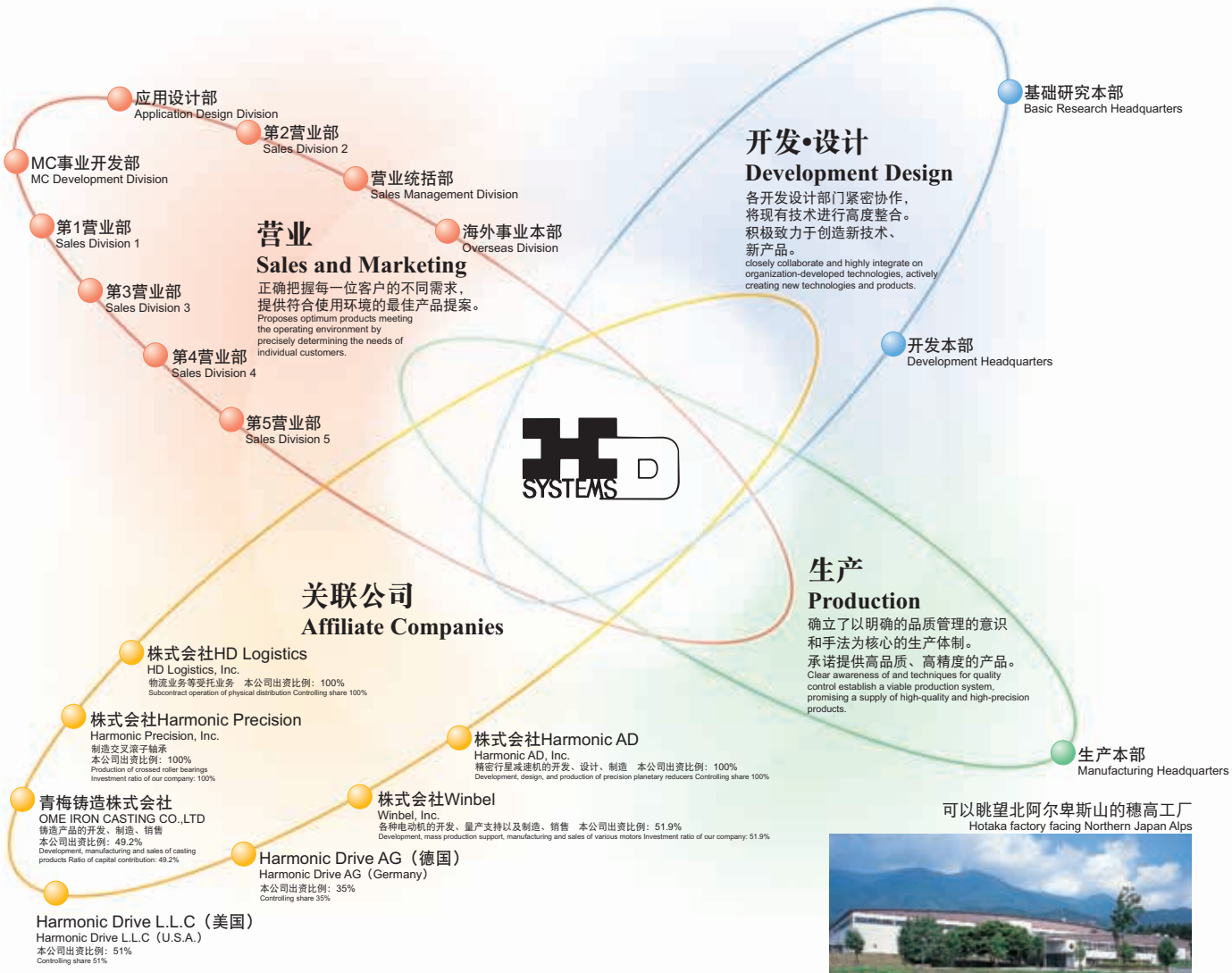
精密控制领域的专家
As a Specialist in Precision Control Field

开发、设计、生产、营业各部门紧密协作，
打造出满足客户需求且独具特色的产品。
Through close cooperation in areas of development, design, production and marketing, Harmonic Drive Systems creates unique products tailored to customer needs.

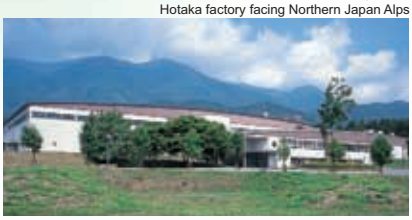
ISO 14001 TÜV SÜD ISO 9001

本公司在1995年获得了德国认证机构TUV Product Service的［ISO 9001］质量管理和质量保证的国际标准认证，并在1998年通过了TUV Product Service的［ISO14001］环境管理体系的国际标准认证。本公司的质量保证体制和环境管理体系得到世界各国广泛认可。

In 1995 and 1998, Harmonic Drive Systems respectively obtained approvals for ISO 9001 (International Quality Management Standard) and for ISO 14001 (International Environmental Management Systems) from TÜV Product Service, a German accreditation organization. The approvals signify global recognition of the quality assurance and environment management systems of Harmonic Drive Systems.



可以眺望北阿尔卑斯山的穗高工厂
Hotaka factory facing Northern Japan Alps

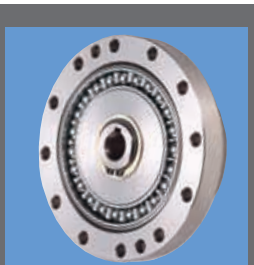


OTHER PRODUCTS

Harmonic Drive

仅由3个基本部件构成的Harmonic Drive减速机通过独特的机理实现了精密的运动控制。

Composed of only three basic components, the HarmonicDrive speed reducer features more precision motion control through a unique mechanism.



Harmonic Planetary®

将累积的Harmonic Drive精密加工技术运用到低减速比领域而研制出的高精度、高刚性的行星减速机Harmonic Planetary®。具备独特的齿隙去除机构，实现了较高的旋转精度。

Harmonic Planetary® is a planetary speed reducer featuring high precision and stiffness, created by utilizing expertise in precision machining technology of HarmonicDrives in the field of low speed reduction ratio. A high rotational accuracy is achieved by a unique backlash removal mechanism.

哈默纳科（上海）商贸有限公司
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电话：021-6237-5656　　传真：021-3250-7268
http://www.harmonicdrive.net.cn/

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PHONE: +81-(0)263-83-6935　FAX: +81-(0)263-83-6901
http://www.hds.co.jp/

ISO 14001（穗高工厂）/ 取得ISO 9001认证（TÜV SÜD Management Service GmbH）

“Harmonic Drive”的学术、一般名称为“谐波齿轮传动”，

本产品目录数据截止于2011年4月。

No.1209-02-DCSV