

# Magnescale

SPEED X PRECISION

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Leading Edge Technology  
for Leading Edge Manufacturing

## Digital Gauge

Digital Gauge General Catalog



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Magnescale Co., Ltd.

# 摺動力。

The power of superior engineering design

Legendary reliability, quality and Magnescale technology are all part of the Digital Gauge products.

The Magnescale Digital Gauge products use a high-grade magnetic recording and detecting principle which has been developed over 50 years.

The Digital Gauge products embody the reliability and quality that Magnescale is known for. Magnescale Digital Gauges feature high resolution and high accuracy, along with environmental, shock and vibration resistance that are a unique feature to our magnetic detecting principle.

Sub-micron repeatability and improved torsion resistance comes from an innovative spindle design that enables environmental protection up IP67, allowing for a wide range of applications.



## Detection Principle MR Sensor

- ▶ Unique magnetic detecting principle
- ▶ High speed sampling (20MHz)
- ▶ No thermal drift

## Spindle Design Ball Spline Spindle Construction

- ▶ 250 Million cycles in testing
- ▶ 5 times greater radial load strength
- ▶ High shock and vibration resistance

## National measurement standards Traceability

- ▶ Accuracy inspection and calibration to national standards completed on certified equipment.
- ▶ Calibration certificates issued on-site

■ Wide variety of PLC fieldbus interfaces available

■ USB interface gauge with free software

■ Wide product lineup for various applications

■ Nationwide service & support network

■ Excellent resistance to harsh environments **IP67 versions available**

The magnetic technology of the Digital Gauge makes it highly resistant to water, oil and condensation.

Leading Edge Technology  
for Leading Edge Manufacturing

# Digital Gauge

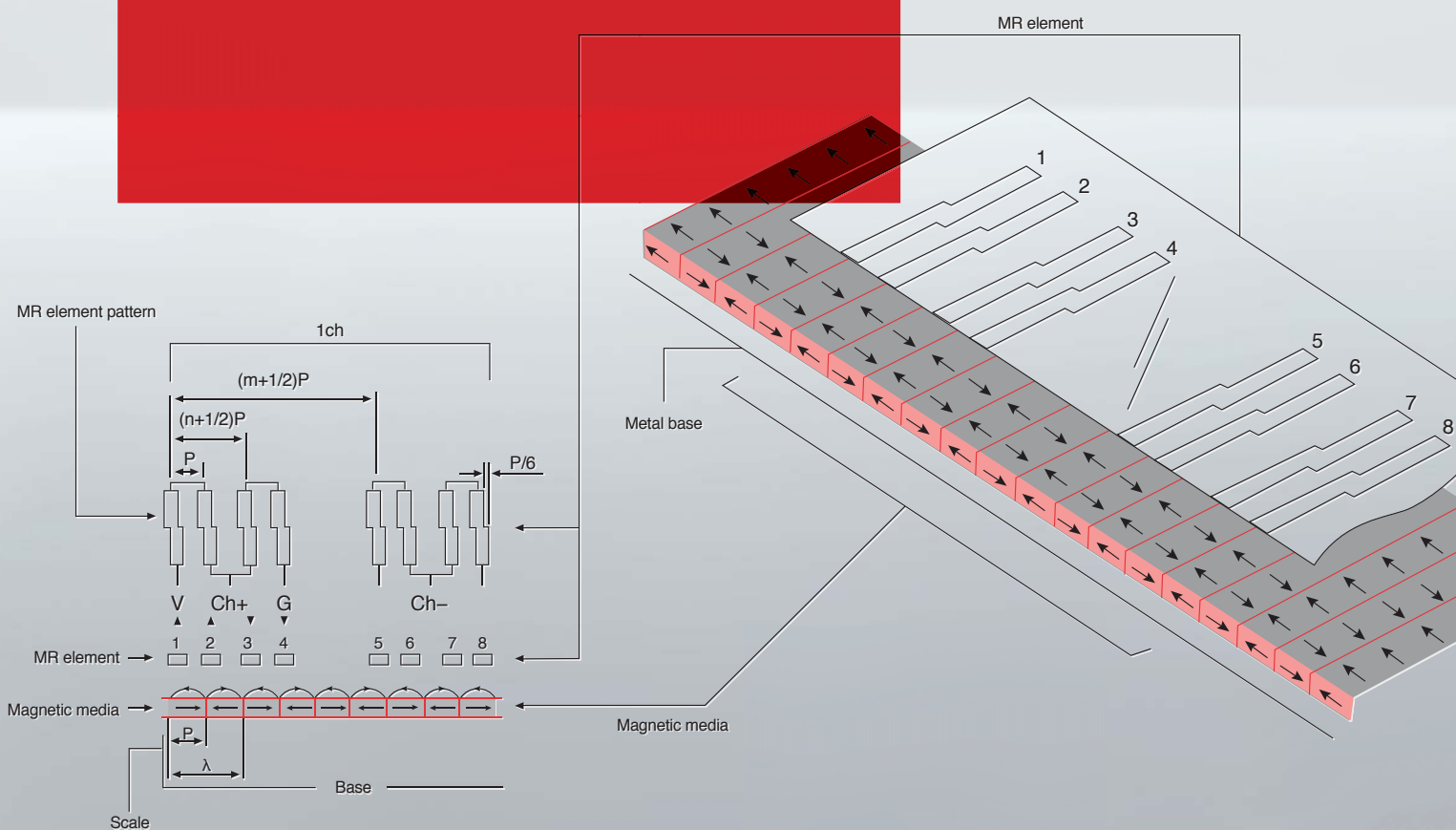
Using a magnetic detecting principle allows for both high accuracy and high environmental resistance.

<Detecting Principle>

# MR Sensor

Precise magnetic recordings are applied to a special proprietary magnetic material.

Using a MR (Magneto Resistive) sensor with a unique detecting pattern allows for high accuracy, and also allows for high environmental resistance and strong resistance to temperature changes.



High Response Speed

- ▶ Over 20 million readings per second
- No tracking errors with high speed sampling

Repeatability of  $\pm 0.1 \mu\text{m}$  or better ( $2\sigma$ )

- ▶ Uses a continuous processing circuit
- A quadrature signal (sine/cosine) from the sensor and processing via a proprietary sequential processing circuit fulfills  $0.1 \mu\text{m}$  resolution and  $\pm 0.1 \mu\text{m}$  repeatability.

No Calibration

- ▶ Digital signal processing
- The signal is processed digitally, which does not require signal calibration like an differential transformer method.

No warm up time

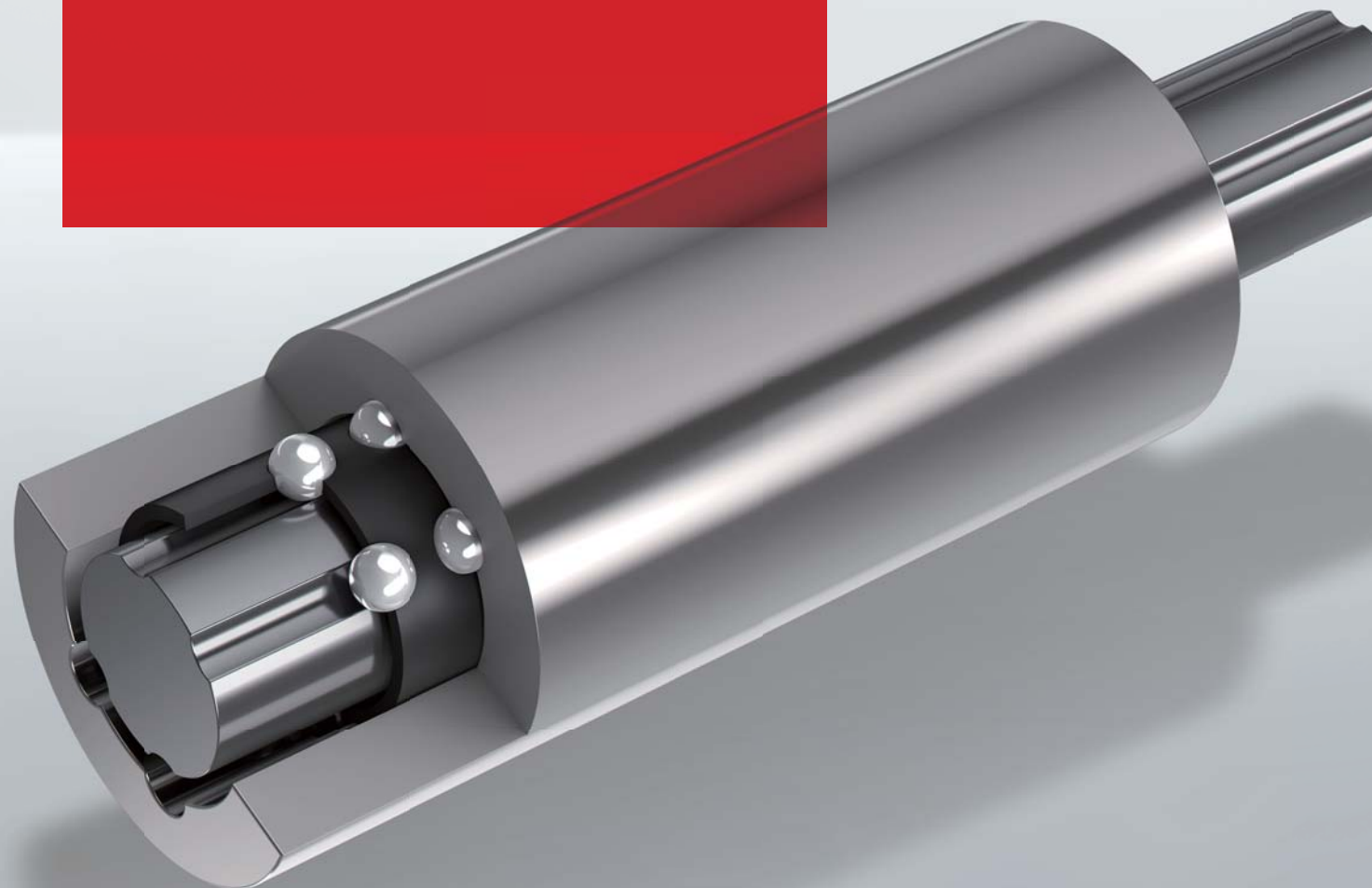
- ▶ Excellent temperature characteristics
- There is no required warm-up time or stand-by time. The Digital Gauge can be used immediately upon power-up.

<Spindle Design>

# Ball Spline Spindle Construction

The Digital Gauge has been improved with both repeatability and spindle performance due to the ball spline spindle construction. Long operational life, with excellent shock and vibration resistance help reduce overall maintenance costs.

(As of August 2018, the gauges have reached 210 million strokes in an on going evaluation.)



## Improved performance to 250 million cycles

### High Durability

#### ▶ Lower lifetime cost

The number of cycles has reached 210 million, with a theoretical value of 250 million cycles. High durability, excellent vibration and shock resistance, along with the ball spline spindle construction contribute to a long operational life for a wide variety of applications.

### Lower the fluctuation of spindle resistance

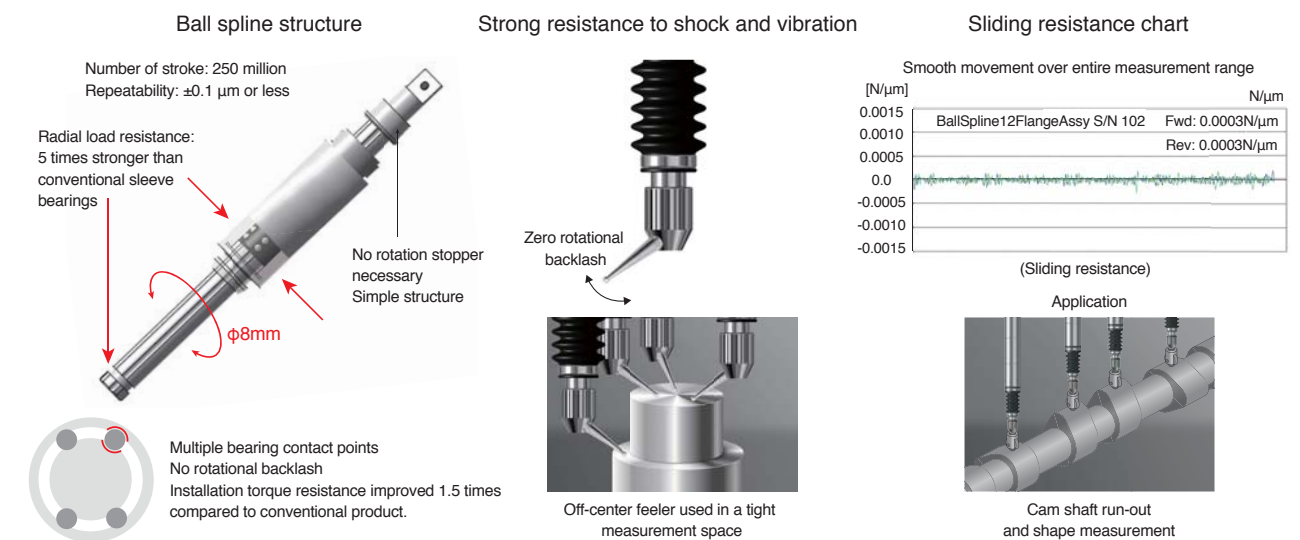
#### ▶ Improve high repeatability by stable spindle resistance

Repeatability has reached  $\pm 0.1 \mu\text{m}$  or better due to the ball spline spindle design with optimized pre-load control and precision cut groove.

### Strength against radial loads

#### ▶ The bearing structure strengthens the entire spindle

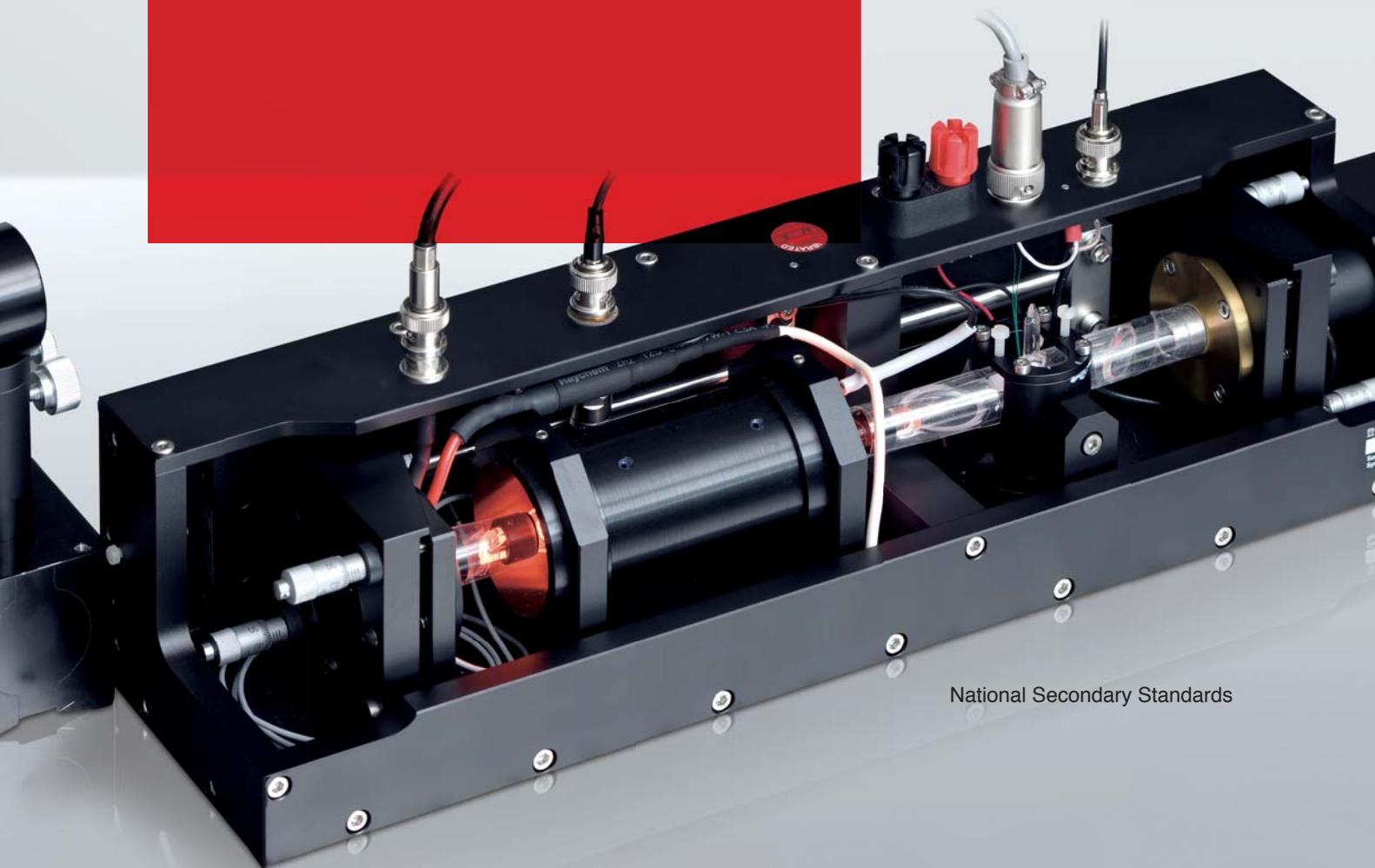
Due to the multiple points where the bearings come into contact with the spindle splines, the radial load capability is 5 times stronger than linear bush type, and allows for accurate measurements even at an angle and installation torque resistance improved 1.5 times.



<National measurement standards>

# Traceability

Magnescale Co., Ltd. is an authorized calibration contractor. An accuracy chart is attached with every product. Measurement data is generated by equipment traceable to national standards. Magnescale can also issue a calibration certificate after a products ships.



National Secondary Standards

# All Magnescale Digital Gauges are traceable to national measurement standards

All Magnescale measuring and inspection equipment is calibrated to national measurement standards

▶ Inspection and calibration traceable to the national measurement standards

Magnescale Co., Ltd. performs regular accuracy inspections and calibrations to ensure compliance.

Accuracy measurement during manufacturing

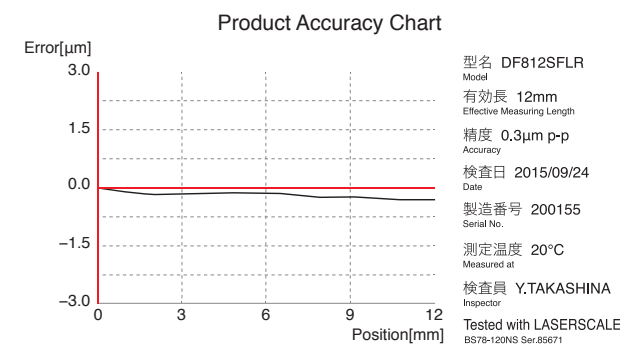
▶ Each product is shipped with an accuracy chart

All Digital Gauge products are shipped with an individual accuracy chart. If a customer loses a chart, we can re-issue it based on serial number information.

Product calibration certificates generated on-site

▶ Calibration certificates are also available after the product has shipped

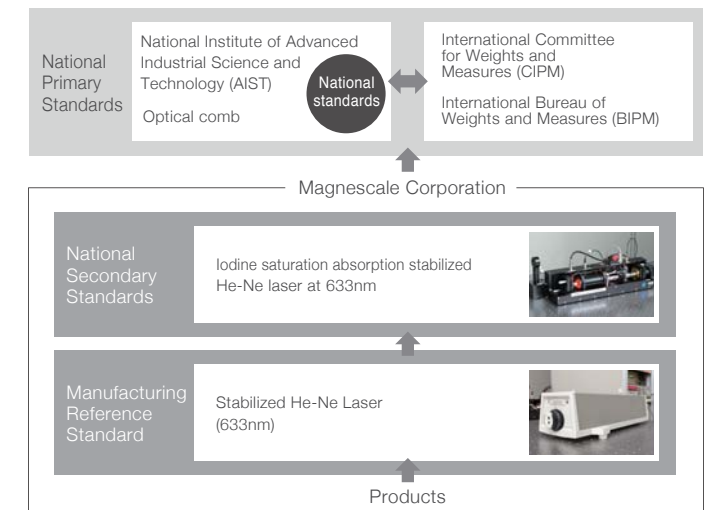
An accuracy chart is included with each shipment. Product calibration certificates required for ISO certifications are created on-site. Calibration certificates are also available after the product has shipped.



Certificate of Calibration



Length traceability system

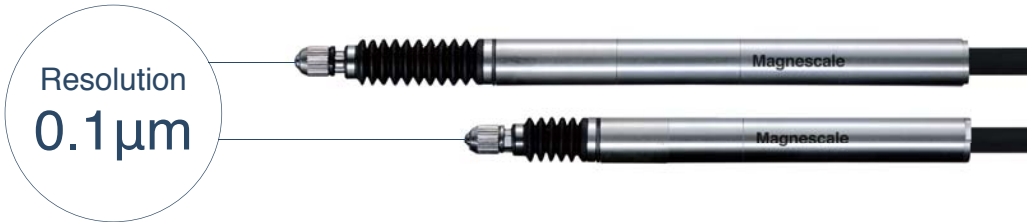


### A diverse lineup of gauges for a range of applications

## High Resolution

Using high-precision measurements, we improve the accuracy of post process assembly. Slim and compact, and offering 0.1 micron maximum resolution, these gauges also feature a highly durable mechanical structure capable of more than 210 million strokes.

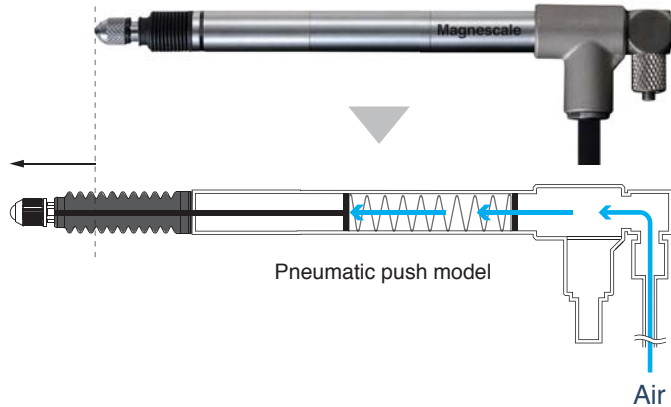
- ▶ DS800S series
- ▶ DF800S series
- ▶ DK800S series



## Air-driven

Using air allows for measurements to be tailored to the measurement piece and the application.

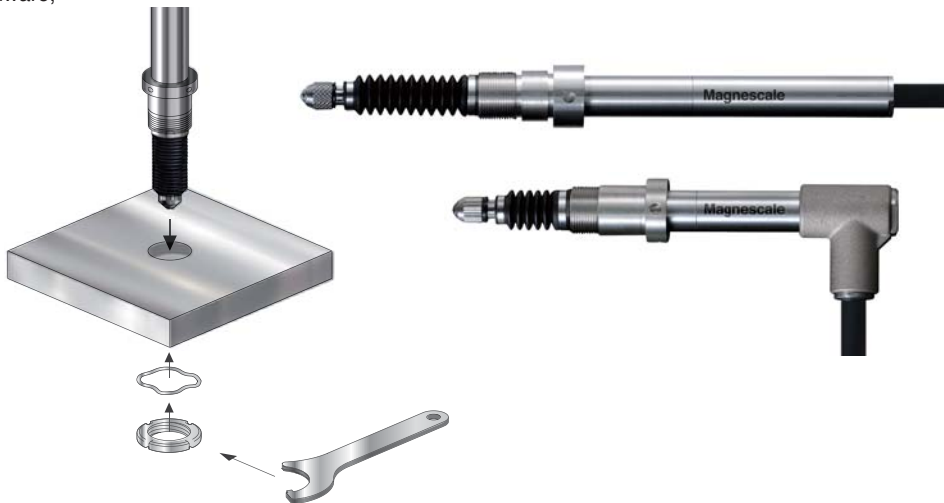
- ▶ DK800S series
- ▶ DS800S series
  - V model : Pneumatic push
  - L model : Vacuum suction
- ▶ DT series



## Flange Mount

Reduces the cost for custom mounting hardware, and lowers installation time.

- ▶ DS800S series
- ▶ DF800S series
- ▶ DK800S series
- F Type



### The ideal measurement solution for every application

## Robust, long measurement range

Long measurement ranges allow for objects of various sizes (205mm maximum). The robust structure creates superior environmental resistance and rigidity, and is able to be used in a wide range of applications.

- ▶ DK series



## General Purpose

The general purpose models can be used in simple applications, such as assembly checks and dimensional measurements. Lower cost, but still applicable to a wide range of applications.

- ▶ DT series



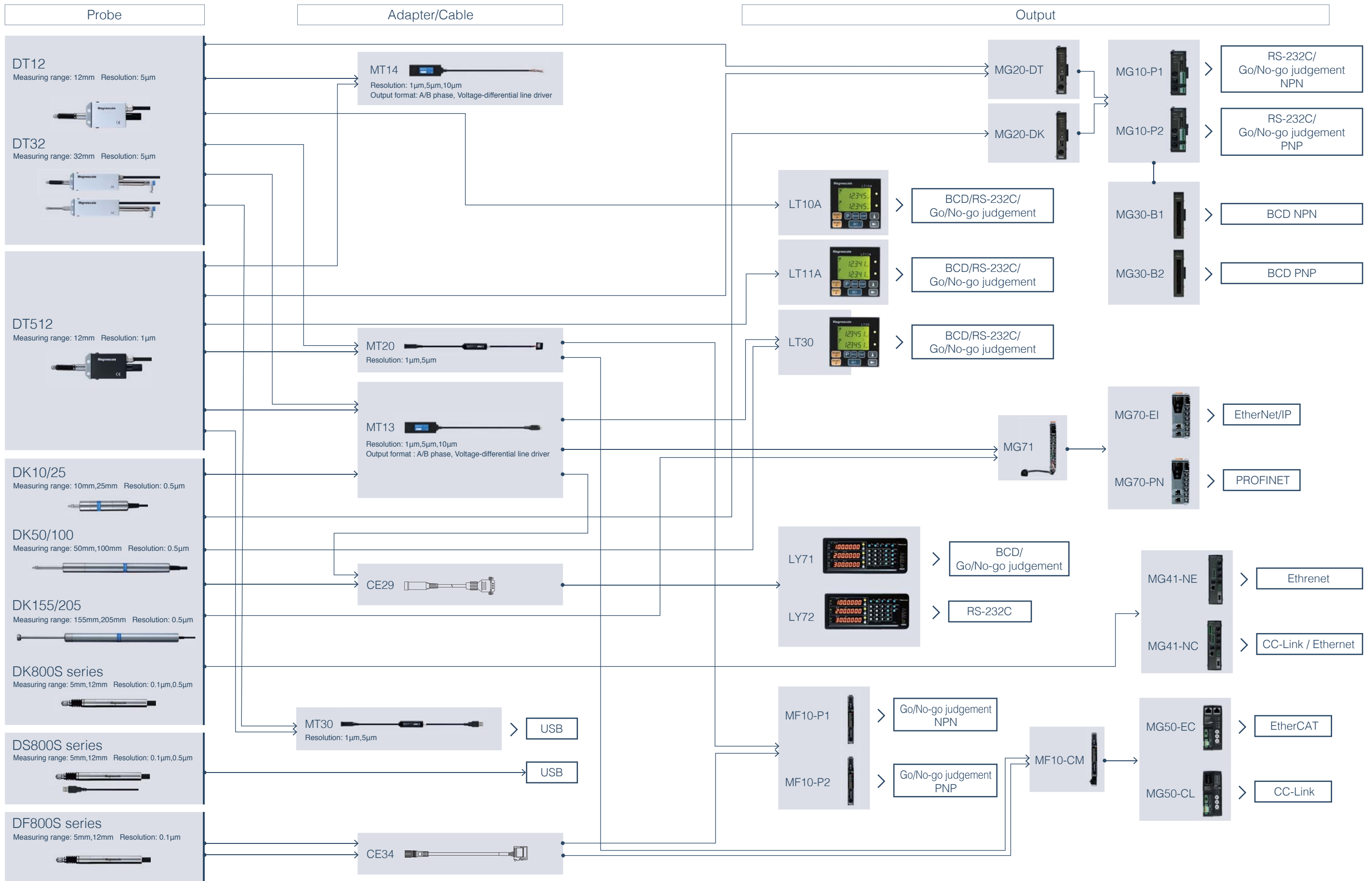
## USB Connection

Able to be directly connected to a computer via USB, enabling simple data acquisition. Perfect for post-process inspection.

- ▶ DS800S series



# Connection diagram



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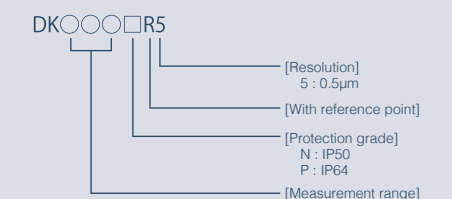
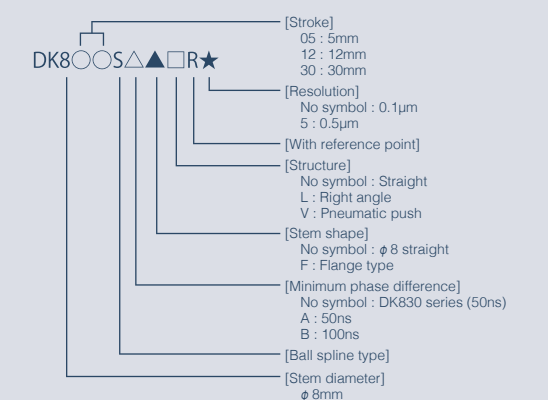
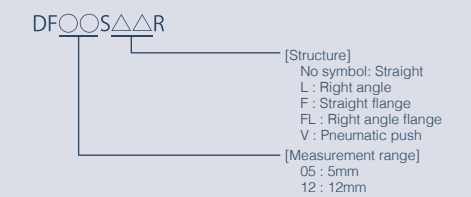
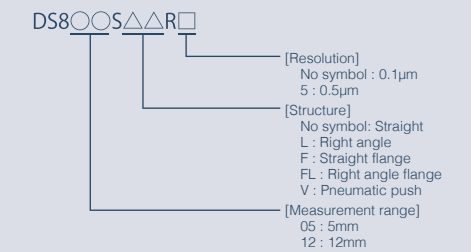
## Global Network

46

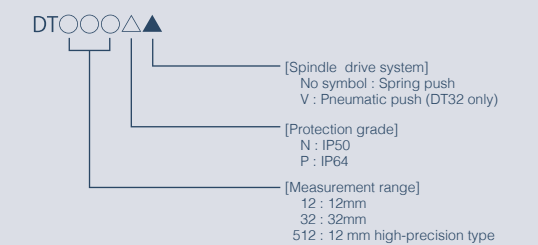
## Safety

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## Details of digital gauge models



\*Please refer to the Specifications Table for the DK110 series.





# DS800S series

Directly connect to a PC or hub via USB.  
Communications and measurement software is also available.

## DS805S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : S/SF//SL\*/SFL\* type IP64 : SL/SFL type
- High-durability (Ball spline structure)
- Output: USB

\* When using the supplied hose elbow and a φ4mm tube

5mm stroke



## DS812S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : S/SF/SV/SL\*/SFL\* type IP64 : SL/SFL type
- High-durability (Ball spline structure)
- Output: USB

\* When using the supplied hose elbow and a φ4mm tube

12mm stroke



# DF800S series

Connects to digital tolerance indicator MF10 and compatible with various field bus

## DF805S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : S/SF/SL\*/SFL\* type IP64 : SL/SFL type
- High-durability (Ball spline structure)
- Output: Dedicated serial communications protocol

\* When using the supplied hose elbow and a φ4mm tube

5mm stroke



## DF812S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : S/SF/SV/SL\*/SFL\* type IP64 : SL/SFL type
- High-durability (Ball spline structure)
- Output: Dedicated serial communications protocol

\* When using the supplied hose elbow and a φ4mm tube

12mm stroke



# DK800S series

Connects to LT30 series counters and MG20, MG40 and MG70 series interface units  
A/B quadrature signal connects to PLC counter cards.

## DK805S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : SA/SAF/SB/SBF/SAL\*/SAFL\*/SBL\*/SBFL\* type IP64 : SAL/SAFL/SBL/SBFL type
- High-durability (Ball spline structure)
- Output: A/B/ reference point

\* When using the supplied hose elbow and a φ4mm tube

5mm stroke



## DK812S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : SA/SAF/SB/SBF/SAV/SBV/SAF\*/SAFL\*/SBL\*/SBFL\* type IP64 : SAL/SAFL/SBL/SBFL type
- High-durability (Ball spline structure)
- Output: A/B/ reference point

\* When using the supplied hose elbow and a φ4mm tube

12mm stroke



## DK830S

- High resolution 0.1µm
- General purpose 0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section) IP67 : SL\*/SV\* type IP53 : S/SL/V type
- High-durability (Ball spline structure)
- Output: A/B/ reference point

\* When the bellows set (optional accessory) is mounted

30mm stroke



### High-speed sampling (Maximum speed: 1 ms\*1)



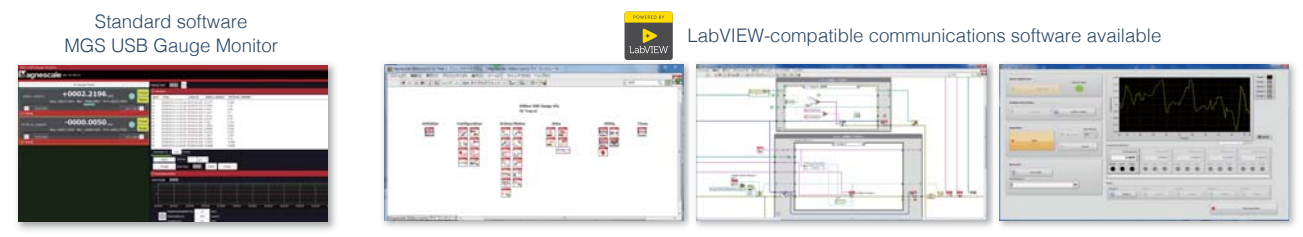
Able to perform multi-axis measurements using a powered hub\*2

### Recommended operating environment

- CPU: Intel Core i3 or higher
- RAM: 1 GB or higher
- OS: Windows 7 / Windows 10 (32 bit / 64 bit edition)
- For details of commands, please contact the Magnescale Sales Department.
- \*Windows and ActiveX are registered trademarks or trademarks of Microsoft Corporation in the United States and in other countries. Intel and Intel Core are registered trademarks or trademarks of Intel Corporation in the United States and in other countries.

- USB2.0SF-compatible digital gauges are capable of USB port-powered operation.
- A multi-axis configuration can be employed using a general-purpose USB hub. (Depending on the number of axes, the hub will require an external power supply).
- Operation verification software and sample programs are available free of charge from the Magnescale website.
- Functions can be executed via commands in the dedicated ActiveX Control provided by Magnescale.

### Standard software necessary for the display of measurement values is provided free of charge



An original Magnescale application provided with a wide range of display functions, including current value, maximum value, minimum value, P-P value, and judgment functions.

Importing data into Excel, VBA (OCX) and CSV makes it easy to create custom software solutions.

\*1 MGS sampling data when 1 axis is connected. Results may vary depending on specifications and environment.  
\*2 Please contact our sales about the maximum number of axes.

Long stroke / General-purpose resolution•Robust type

# DK series

Connects to LT30 series counters and MG20, MG40 and MG70 series interface units

## DK10/25

- High resolution  
0.1µm
- General purpose  
0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ20
- Protection grade (probe section)  
IP64 : N/NL type  
IP50 : P/PL type
- Output: A/B phases



## DK50/100

- High resolution  
0.1µm
- General purpose  
0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

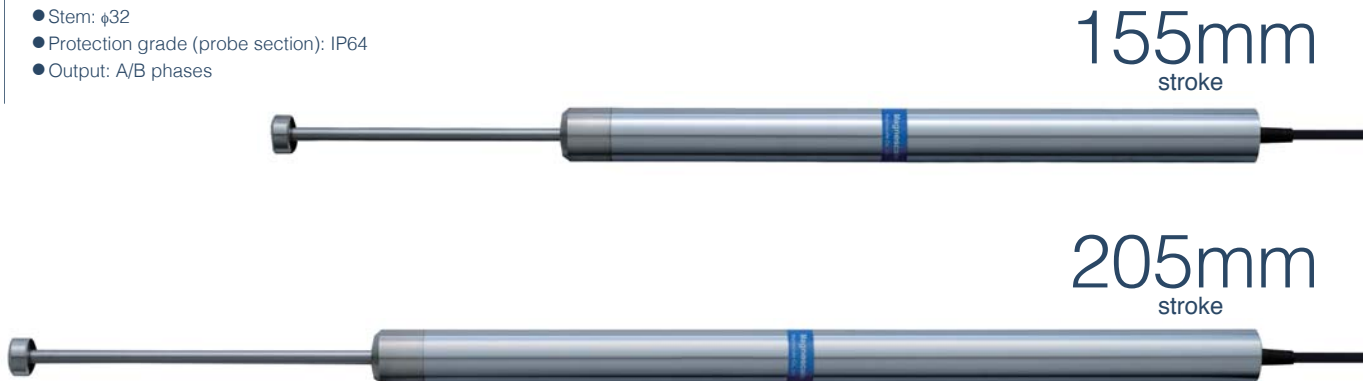
- Stem: φ20
- Protection grade (probe section)  
IP64 : N type  
IP50 : P type
- Output: A/B phases



## DK155/205

- High resolution  
0.1µm
- General purpose  
0.5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ32
- Protection grade (probe section): IP64
- Output: A/B phases



Small / General-purpose

# DT series

Connects to LT10A (DT12/DT32) / LT11A (DT512) counters and MG20 interface units

## DT512/12

- High resolution  
0.1µm
- General purpose  
1µm 5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section)  
IP64 : P type



## DT32

- High resolution  
0.1µm
- General purpose  
5µm
- Spring push
- Pneumatic push
- Flange mount
- Straight body
- Right angle body
- Reference point function

- Stem: φ8
- Protection grade (probe section)  
IP64 : P/PV type



DT gauge (DT12N/P, DT32N/NV/P/PV) compatible interpolators with A/B phase output

# Interpolator

When used in combination with DT gauges, able to convert measurement data to general-purpose A/B phase signal output. Able to be connected to PLC and other counter modules.

## MT13

- Resolution : 1 µm, 5 µm, 10 µm
- Output signal : A/B phase (The output becomes high impedance during an alarm)
- Output format : Voltage-differential line driver output (compliant with EIA-422)



## MT14

- Resolution : 1 µm, 5 µm, 10 µm
- Output signal : A/B phase, alarm (The output does not become high impedance during an alarm)
- Output format : Voltage-differential line driver output (compliant with EIA-422)



## MT20

- Resolution : 1 µm, 5 µm, 10 µm
- For MF10 only



## MT30

- Resolution : 1 µm, 5 µm, 10 µm
- USB2.0



# MG70/71

## Interface units for DK series digital gauges

Allow measurement data to be transferred to a PLC via EtherNet/IP or PROFINET fieldbuses.  
 Can also be connected to DT series general-purpose digital gauges using the MT30 interpolator.  
 Maximum number of length measurement unit connections: 85 axes  
 (Up to a maximum of 250 axes when a power supply module is employed)



MG70-EI MG71-CM

# MG40 series

## Interface units for DK series digital gauges

Interface units for DK series digital gauges  
 Allow measurement data to be transferred to a computer or PLC via Ethernet or CC-Link.  
 Maximum number of length measurement unit connections: 100 axes



MG41-NC MG41-NE MG42

# MG50

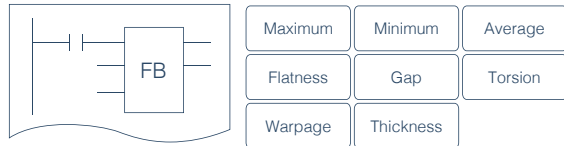
## Interface units for DF series digital gauges

Interface units for DF series digital gauges  
 Allow DF805S/DF812S series measurement data to be transferred to a PLC via EtherCAT or CC-Link fieldbuses.  
 Can also be connected to DT series general-purpose digital gauges using an MT20-01/05 interpolator.  
 Maximum number of length measurement unit connections:  
 MG50-EC: 30 axes  
 MG50-CL: 16 axes



MG50-CL MF10-CM MG50-EC MF10-CM

8 types of calculation functions are provided by the Function Block. Calculation functions can be executed easily by PLC programming.



\*Our function block is compatible with NJ series (OMRON), and Q and L series (Mitsubishi)  
 (Our function block does not support some versions.  
 For more details, please contact our sales staff.)

# MG10/20/30

## Interface units for DK and DT series digital gauges

Standard RS-232C output, allowing measurement data to be transferred to a computer or PLC.  
 Maximum number of length measurement unit connections: 16 axes (Up to a maximum of 64 axes using links)



MG30 MG10 MG20-DK MG20-DT

# MF10

## Compact display unit for DF series

Various mode displays  
(preset, tolerance setting, Go/NoGo display, output reversal function)  
Two types of tolerance settings and four setting methods can be selected  
Preset function allows arbitrary setting of origin point position

- Output Go/no-go Judgement
- MF10-P1 : NPN output type
- MF10-P2 : PNP output type
- MF10-CM : MG50 only



MF10-CM

# LY71

## High-function measurement display unit able to be connected to up to two axes

Fitted with general-purpose input/output terminals allowing selection of function  
Addition of expansion board enables BCD and comparator output

- Output BCD
- Output Go/no-go Judgement



# LT30 series (For DK and DK-S)

## Display unit for DK series

Equipped with functions necessary for measurement and judgment of tolerances, including preset, judgment output, external reset, latch, 2-axis addition, and P-P measurement

- Output BCD
- Output RS-232C
- Output Go/no-go Judgement



# LY72

## High-function display unit able to be connected to up to three axes

RS-232C fitted as standard, allowing operation by command

- Output RS-232C



# LT11A series (For DT512)

## Display unit for DT512

Equipped with functions necessary for measurement and judgment of tolerances, including preset, judgment output, external reset, latch, 2-axis addition, and P-P measurement

- Output BCD
- Output RS-232C
- Output Go/no-go Judgement



# LT10A series (For DT12/32)

## Display unit for DT12/DT32

Equipped with functions necessary for measurement and judgment of tolerances, including preset, judgment output, external reset, latch, 2-axis addition, and P-P measurement

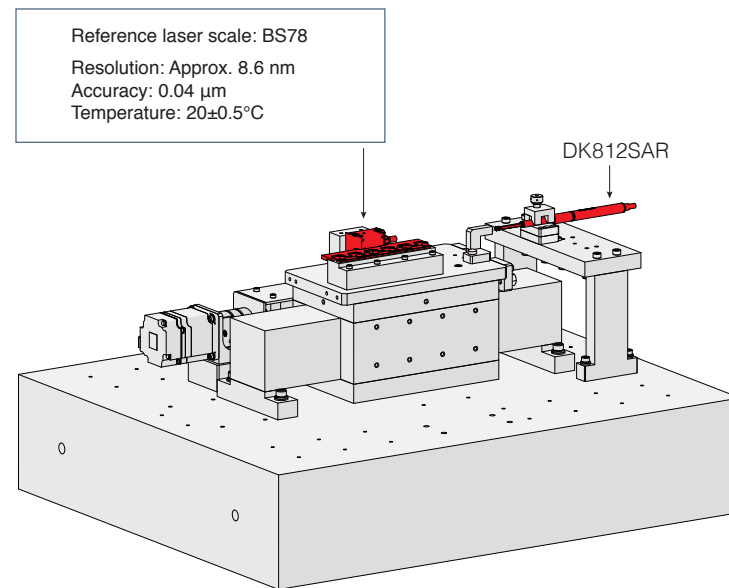
- Output BCD
- Output RS-232C
- Output Go/no-go Judgement



## DK812SAR repeatability

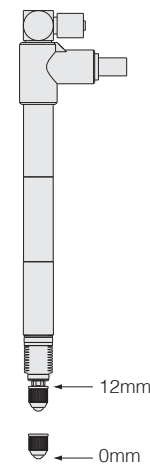
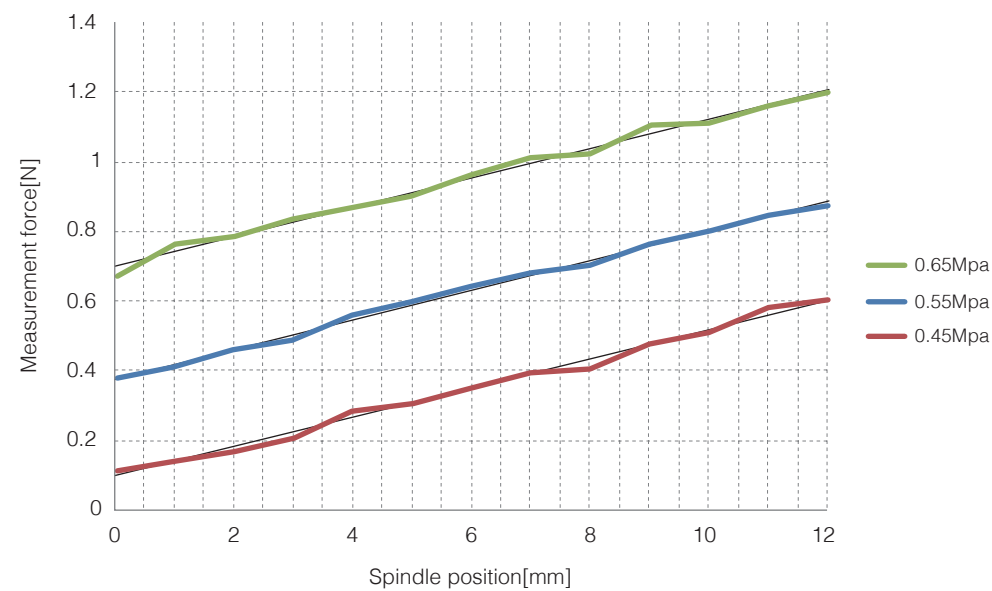
The result determined from measurements conducted five times each at various points between 1 mm and 12 mm from the reference position (DK812SAR spindle fully extended) using a Magnescale laser scale was  $2\sigma$ .

Measurement position	$2\sigma(\mu\text{m})$
1mm	0.068
2mm	0.066
3mm	0.056
4mm	0.039
5mm	0.038
6mm	0.048
7mm	0.052
8mm	0.029
9mm	0.038
10mm	0.018
11mm	0.031
12mm	0.027



## Relationship between DK812SAVR (pneumatic push type) air pressure and measurement pressure

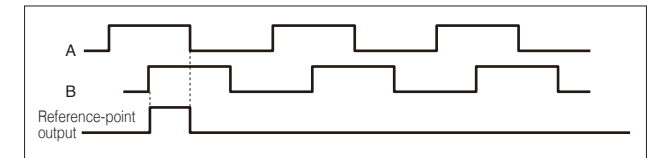
Product specifications: Upward direction:  $0.6\pm 0.5$  N (at 0.55 Mpa)  
 Side direction:  $0.7\pm 0.5$  N (at 0.55 Mpa)  
 Downward direction:  $0.8\pm 0.5$  N (at 0.55 Mpa)



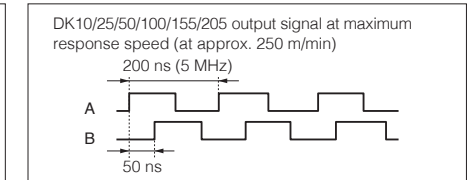
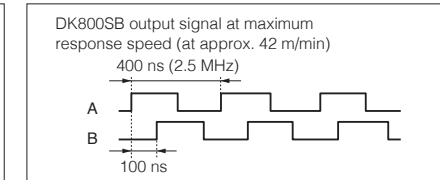
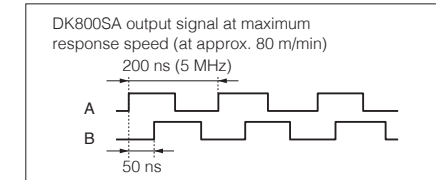
Measurement results and approximation lines for air pressure = 0.45 Mpa, 0.55 Mpa, and 0.65 Mpa and side direction N=1.

## DK Series measuring unit output signals

The signal output from these measuring units are A/B quadrature and reference point signals, voltage differential line driver output compliant with EIA-422.



The reference point is the synchronized reference point that is at Hi level when the signal A and signal B are at the Hi level.

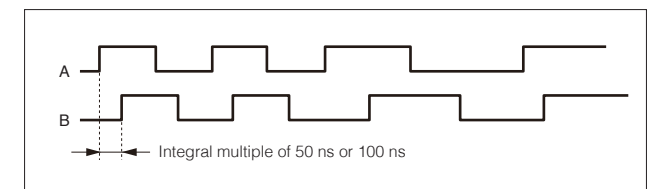


The A/B quadrature output signal by measuring unit is 5 MHz maximum with a minimum phase difference of 50 ns for DK800SA and is 2.5 MHz maximum with a minimum phase difference of 100 ns for DK800SB. The counter or control device capable of processing these signals should be used.

For DK the A/B quadrature output signal by measuring unit is 5 MHz maximum with a minimum phase difference of 50 ns. The counter or control device capable of processing these signals should be used.

### Output Signal Phase Difference

Moving length of the measuring unit is detected every 50 ns for the DK800SA/DK and every 100 ns for the DK800SB, and the phase difference proportional to the amount traveled is output. The amount of phase difference changes in integer multiples of 50 ns or 100 ns. Also, the minimum phase difference for the phase A and B is 50 ns for the DK800SA/DK and 100 ns for the DK800SB.

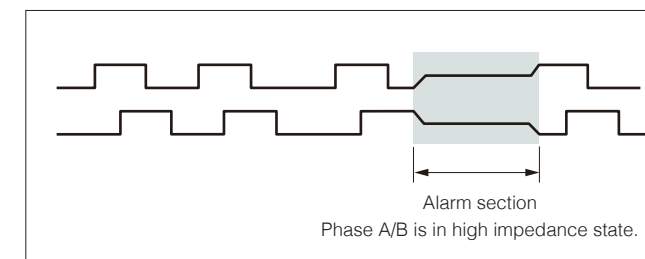


In the standard specifications, the minimum phase difference is fixed at 50 ns for the DK800SA and 100 ns for the DK800SB, however, the minimum phase differences in the following table below are available as special specifications.

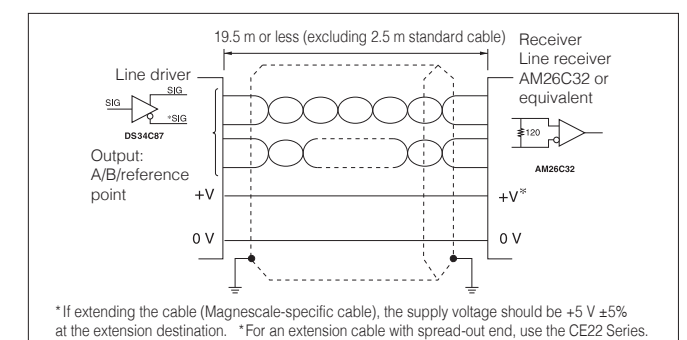
Phase A/B Minimum phase difference	Phase A single cycle	Counter's permissible frequency	Maximum response speed		Remarks
			Resolution 0.1 μm	Resolution 0.5 μm	
50ns	200ns	5MHz	80m/min	250m/min	DK800SA standard product
100ns	400ns	2.5MHz	42m/min	100m/min	DK800SB standard product
300ns	1.2μs	833kHz	14m/min	33m/min	Special specifications
500ns	2μs	500kHz	8.4m/min	20m/min	Special specifications

### Output Signal Alarm

If the response speed is exceeded, the phase A/B output from this measuring unit changes to high impedance state for about 400 ms as an alarm.

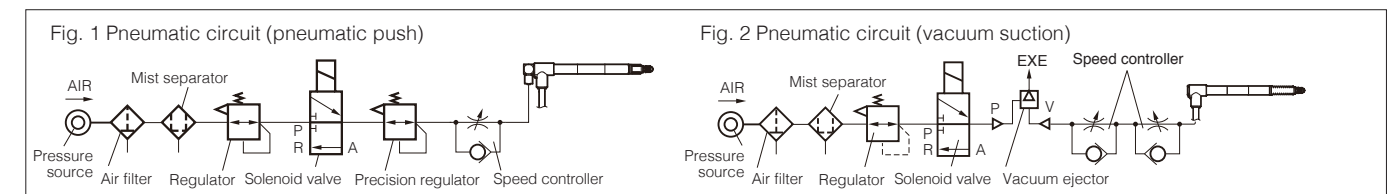


### Receiver



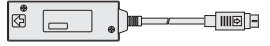
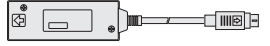
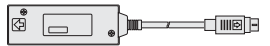


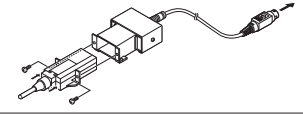


## DK Series operating cautions

- For the pneumatic push type, use of the pneumatic circuit shown in Fig. 1 enables the feeler to be air driven. Pressure regulation is required depending on the usage condition. A precision pressure regulator (e.g., SMC IR2010 or equivalent) should be used.
- For the vacuum suction type, use of the pneumatic circuit shown in Fig. 2 enables the feeler to be air driven.



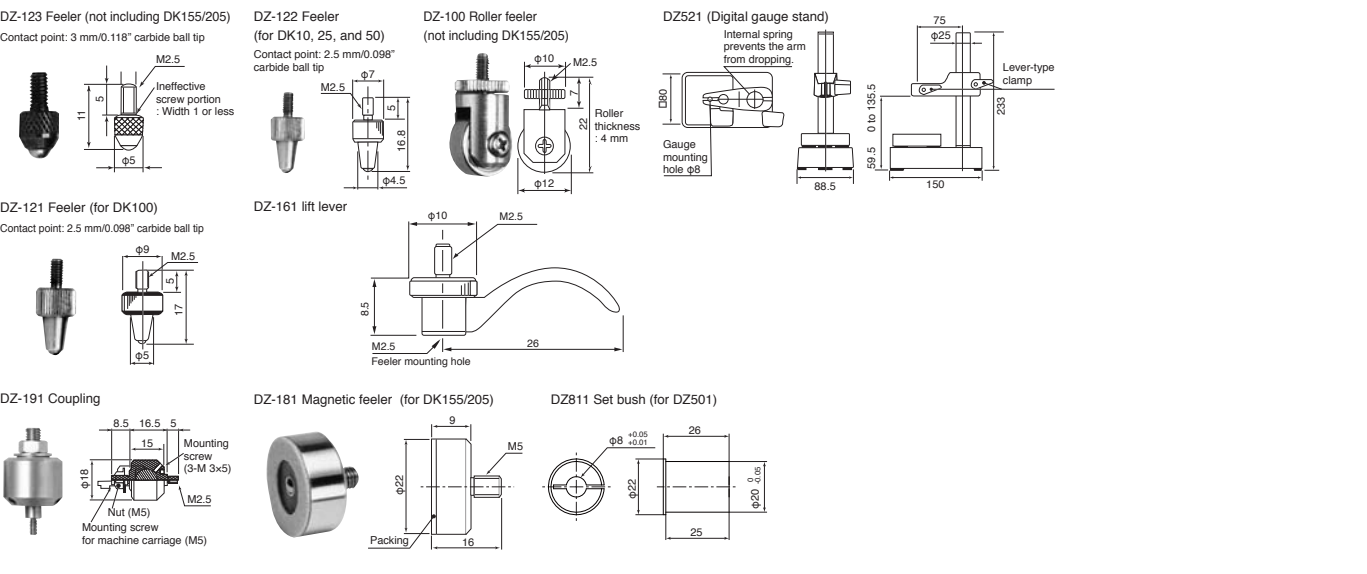
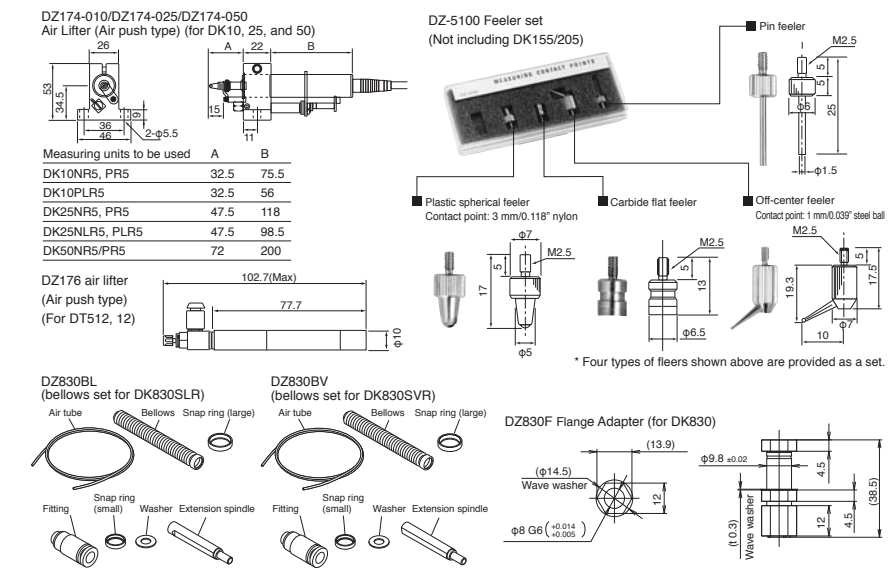
# Compatible

Digital gauge	Adapter/conversion cable Note 1: MT12/13 is interpolator.	Counters	Interface unit	Old counters	External device	Extension cables	
DK800A/B Series <b>Discontinued</b> DK800S Series DK10/25/50/100/110/155/205 Series	Unnecessary	LT30 Series	MG20-DK MG41-NE/NC MG42			CE08-1(1 m) -3(5 m) -5(5 m) -10(10 m) -15(15 m) * Total cable length is 20 m or less. CK-T12(1 m) -T13(3 m) -T14(5 m) -T15(10 m) -T16(15 m) * High-flex cable/total cable length is 20 m or less. CE27-01(1 m) -03(3 m) -05(5 m) -10(10 m) * High-flex cable/large-dia. cable/total cable length is 30 m or less.	
	CE29 Series Cable length: 0.3/1/3/5/10 m 	LH71A/72 LY71/72					
	(Cable with flying leads) 					○ : connectable A/B reference point (Differential line receiver input)	CE22-01(1 m) -03(3 m) -05(5 m) -10(10 m) * High-flex cable/flying leads/total cable length is 20 m or less. CE26-01(1 m) -03(3 m) -05(5 m) -10(10 m) * High-flex cable/flying leads/large-dia. cable/total cable length is 30 m or less. CE27-01(1 m) -03(3 m) -05(5 m) -10(10 m)(extension cable for CE26) * High-flex cable/large-dia. cable/total cable length is 30 m or less.
DG Series (with HA13) <b>Discontinued</b> * Model with no "B" assigned	SZ05-T01	LH71A/72 LY71/72					
	SZ05 + SZ51 - MS01			LY51/52 <b>Discontinued</b>		Without extension cable	
	Unnecessary			LY100/110 LH20, etc. <b>Discontinued</b>			
DT12/32 Series	Unnecessary	LT10A Series	MG20-DT	LT10 Series <b>Discontinued</b>			
	MT12-05/10 Note 1 	LT20A Series		LT20 Series <b>Discontinued</b>			
	MT13-05/10 Note 1 	LT30 Series				CE08-1(1 m) -3(5 m) -5(5 m) -10(10 m) -15(15 m) * Total cable length is 20 m or less. CK-T12(1 m) -T13(3 m) -T14(5 m) -T15(10 m) -T16(15 m) * High-flex cable/total cable length is 20 m or less.	
DT512 Series	Unnecessary	LT11A Series	MG20-DT	LT11 Series <b>Discontinued</b>			
	MT13-01 Note 1 	LT30 Series					
DK800 Series <b>Discontinued</b> * Models with no "A/B" assigned to model	Unnecessary	LT30 Series	MG20-DK			CE27-01(1 m) -03(3 m) -05(5 m) -10(10 m) * High-flex cable/large-dia. cable/total cable length is 10 m or less. * When CE08-1(1 m) -3(3 m) or CK-T12(1 m) -T13(3 m) is used, the total cable length is 5 m or less.	
	CE29 Series Cable length: 0.3/1/3/5/10 m 	LH71A/72 LY71/72					
	(Cable with flying leads) 					○ : connectable A/B reference point (Differential line receiver input)	CE22-01(1m) -03(3 m) * High-flex cable/flying leads/total cable length is 5 m or less. CE26-01(1 m) -03(3 m) * High-flex cable/flying leads/large-dia. cable/total cable length is 10 m or less. CE27-01(1 m) -03(3 m) -05(5 m)(extension cable for CE26) * High-flex cable/large-dia. cable/total cable length is 10 m or less.
DG-B Series <b>Discontinued</b>	DZ51 + SZ70-1	LH71A/72 LY71/72					
	Unnecessary	LT20A Series	MG20-DG	LT20 Series <b>Discontinued</b>		Without extension cable	
	DZ51			LY51/52 <b>Discontinued</b>			
DE12BR/DE30BR <b>Discontinued</b>	SZ70-2 	LT30 Series					
	SZ70-1	LH71A/72 LY71/72				Without extension cable	
	Unnecessary			LY51/52 <b>Discontinued</b>			
DL310B/DL330B/ <b>Discontinued</b> DL10BR/DL30BR/DL60BR	Unnecessary	LT20A Series	MG20-DG	LT20 Series <b>Discontinued</b>		Without extension cable (DL310B, 330B)	
	DZ51 + SZ70 - 1	LH71A/72 LY71/72				* Cable may be manufactured to specified length on a production by order basis. Total cable length: 10 m or less	
	DZ51			LY51/52 <b>Discontinued</b>			

	DS	DF	DK-S	DK20	DT	LY	LT	MG	MF
<b>PSC</b> (AC adapter) PSC-21A (for Japan only: 100 V) PSC-22A (for the US only: 120 V) PSC-23A (for Europe and other countries : 220 to 240 V) Please contact our sales for corresponding region.						●			
<b>CE</b> (Extension cable) CE08-1 (1m) CE08-3 (3m) CE08-5 (5m) CE08-10 (10m) CE08-15 (15m)			●	●	●		●	●	
(Conversion cable for LH70/LY70 Series) CE29-003 (0.3m) CE29-01 (1m) CE29-03 (3m) CE29-05 (5m) CE29-10 (10m)			●	●		●			
Extension cable, flying leads CE22-01 (1m) CE22-03 (3m) CE22-05 (5m) CE22-10 (10m)			●	●					
(Output cable) CE34-005 (0.5m) CE34-02 (2m) CE34-05 (5m) CE34-10 (10m) CE34-15 (15m) CE34-20 (20m)			●						●
(Extension cable) CE38-01 (1m) CE38-02 (2m) CE38-04 (4m)	●								

	DS	DF	DK-S	DK20	DT	LY	LT	MG	MF
<b>CK</b> (High-flex extension cable) CK-T12 (1m) CK-T13 (3m) CK-T14 (5m) CK-T15 (10m) CK-T16 (15m)			●	●	●		●	●	
<b>SZ</b> (Conversion cable) SZ70-1 (for LY71 and 72) SZ70-2 (for LT30)						●	●		
<b>MZ</b> (Link cable) MZ41-R5 (0.5m) MZ41-01 (1m) MZ41-02 (2m) MZ41-05 (5m) MZ41-10 (10m)									● MG41

- DZ252
- DZ253A
- DZ254
- DZ174-010
- DZ174-025
- DZ174-050
- DZ176
- DZ830BL
- DZ830BV
- DZ-5100
- DZ830F
- DZ-123
- DZ-121
- DZ-191
- DZ-122
- DZ-100
- DZ-161
- DZ-181
- DZ-521
- DZ811



# DS800S series

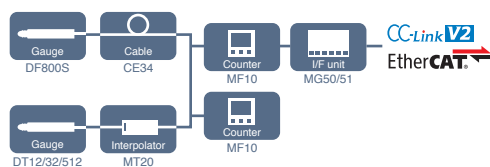


## DS805S/DS812S

Model	High-resolution models		General-purpose resolution models		High-resolution models		General-purpose resolution models	
	DS805SR, DS805SLR, DS805SFR, DS805SFLR		DS805SR5, DS805SLR5, DS805SFR5, DS805SFLR5		DS812SR, DS812SLR, DS812SFR, DS812SFLR		DS812SVR	
Measuring range	5mm				12mm			
Maximum resolution	0.1 μm		0.5 μm		0.1 μm		0.5 μm	
Accuracy(At 20°C)	1 μm p-p		1.5 μm p-p		1 μm p-p		1.5 μm p-p	
Repeatability	±0.1 μm or less							
Measuring force	Upward: 0.35±0.25N Horizontal: 0.4±0.25N Downward: 0.45±0.25N		Upward: 0.4±0.3N Horizontal: 0.5±0.3N Downward: 0.6±0.3N		Upward: 0.6±0.5N Horizontal: 0.7±0.5N Downward: 0.8±0.5N		Upward: 0.4±0.3N Horizontal: 0.5±0.3N Downward: 0.6±0.3N	
Maximum response speed	80m/min							
Reference point	Position at spindle movement of 1mm±0.5mm							
Reference point response speed	40m/min or less							
Output	USB2.0FS							
Spindle drive system	Spring push Vacuum suction: SL/SFL		Spring push Vacuum suction: SL/SFL		Air driving (Pneumatic push)		Spring push Vacuum suction: SL/SFL	
Protection grade <sup>2</sup>	IP67 (S/SF/SV), IP64 (SL/SFL), IP67 (SL/SFL) <sup>3</sup>							
Vibration resistance	100 m/s <sup>2</sup> (20~2000 Hz)							
Impact resistance	1000 m/s <sup>2</sup> (11 ms)							
Operating temperature and humidity range	0~+50 °C (No condensation)							
Storage temperature and humidity range	-20~+60 °C 90%RH or less							
Power supply	DC 5 V ±5 %							
Power consumption	120mA Max.							
Mass <sup>4</sup>	Approx. 30g							
Output cable length	Measuring unit ↔ Interpolation box : 2m Interpolation box ↔ USB : 0.5m							
Feeler	Carbide ball tip, Mounting screw M2.5		Steel ball tip, Mounting screw M2.5		Carbide ball tip, Mounting screw M2.5		Steel ball tip, Mounting screw M2.5	
Accessories	Spanner, Instruction Manual, Supplement Manual, +P M4x5 screw(2) SL/SFL only : Hose elbow, SF/SFL only : Tightening nut, Wave washer, Pin, Clamp spanner		Spanner, Instruction Manual, Supplement Manual, +P M4x5 screw(2) SL/SFL only : Tightening nut, Wave washer, Pin, Clamp spanner, DS812SF/SFL only : 2 mm collar for adjustment		Spanner, Instruction Manual, Supplement Manual, +P M4x5 screw(2) SL/SFL only : Hose elbow, SF/SFL only : Tightening nut, Wave washer, Pin, Clamp spanner, DS812SF/SFL only : 2 mm collar for adjustment		Spanner, Instruction Manual, Supplement Manual, +P M4x5 screw(2)	

\*1 Air pressure : 0.055MPa \*2 Not including interpolation box and connector \*3 When using the supplied hose elbow and a φ4mm tube \*4 Not including cable and interpolation box  
\*Magnescale reserves the right to change product specifications without prior notice.

# DF800S series

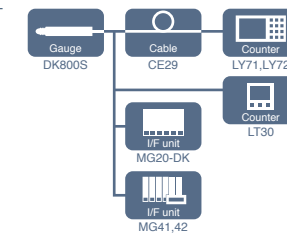


## DF805S/DF812S

Model	DF805SR, DF805SFR		DF805SLR, DF805SFLR		DF812SR, DF812SFR		DF812SLR, DF812SFLR		DF812SVR	
	Measuring range	5mm				12mm				
Maximum resolution	0.1 μm				0.1 μm					
Accuracy(At 20°C)	1 μm p-p				1 μm p-p					
Repeatability	±0.1 μm or less									
Measuring force	Upward: 0.35±0.25N Horizontal: 0.40±0.25N Downward: 0.45±0.25N		Upward: 0.35±0.25N Horizontal: 0.40±0.25N Downward: 0.45±0.25N		Upward: 0.35±0.25N Horizontal: 0.40±0.25N Downward: 0.45±0.25N		Upward: 0.6±0.5N <sup>1</sup> Horizontal: 0.7±0.5N <sup>1</sup> Downward: 0.8±0.5N <sup>1</sup>		Upward: 0.6±0.5N <sup>1</sup> Horizontal: 0.7±0.5N <sup>1</sup> Downward: 0.8±0.5N <sup>1</sup>	
Maximum response speed	80 m/min									
Reference point	Position at spindle movement of 1±0.5 mm									
Reference point response speed	80 m/min									
Output	Serial communication protocol									
Spindle drive system	Spring push								Air driving (Pneumatic push)	
Protection grade <sup>2</sup>	IP67(S/SF/SV), IP64(SL/SFL), IP67(SL/SFL) <sup>3</sup>									
Vibration resistance	100 m/s <sup>2</sup> (20 ~ 2000 Hz)									
Impact resistance	1000 m/s <sup>2</sup> (11 ms)									
Operating temperature and humidity range	0~+50°C (No condensation)									
Storage temperature and humidity range	-20~+60°C 90%RH or less									
Power supply	DC+10~+30 V									
Power consumption	1.2 W or less									
Mass <sup>4</sup>	Approx. 30 g (Not including cable and interpolation box)									
Output cable length	2 m									
Feeler	Carbide ball tip, Mounting screw M2.5									
Accessories	Instruction Manual, Spanner DF8**S*L* only : Hose elbow DF8**S*F** only : Tightening nut, Clamp spanner, Wave washer, Pin									

\*1 Air pressure: 0.055MPa \*2 Excluding the interpolation box \*3 When Hose elbow and φ4mm tube is connected \*4 Excluding cable section and interpolation box  
\*Magnescale reserves the right to change product specifications without prior notice.

# DK800S series



## DK805S/DK812S

Model	High-resolution models		General-purpose resolution models		High-resolution models		General-purpose resolution models	
	DK805SAR, DK805SALR, DK805SAFR, DK805SAFLR		DK805SBR, DK805SBLR, DK805SBR5, DK805SBFLR		DK812SAR, DK812SALR, DK812SAFR, DK812SAFLR, DK812SAVR		DK812SBR, DK812SBLR, DK812SBR5, DK812SBFLR, DK812SBVR	
Measuring range	5 mm				12 mm			
Maximum resolution	0.1 μm		0.5 μm		0.1 μm		0.5 μm	
Accuracy(At 20°C)	1 μm p-p		1.5 μm p-p		1 μm p-p		1.5 μm p-p	
Repeatability	±0.1 μm or less							
Measuring force	Upward: 0.35±0.25N Horizontal: 0.40±0.25N Downward: 0.45±0.25N				Upward: 0.4±0.3N Horizontal: 0.5±0.3N Downward: 0.6±0.3N			
Maximum response speed	80 m/min	42 m/min	250 m/min	100 m/min	80 m/min	42 m/min	250 m/min	100 m/min
Reference point	Position at spindle movement of 1mm±0.5mm							
Reference point response speed	Same as the noted maximum response speed							
Output	A/B/Reference point Voltage-differential line driver output (conforming to EIA-422)							
Spindle drive system	Spring push Vacuum suction (DK805SALR/SAFLR/SBLR/SBFLR/SALR5/SAFLR5/SBLR5/SBFLR5)				Spring push Air driving (Pneumatic push)(DK812SAVR/SBVR/SAVR5/SBVR5) Vacuum suction (DK812SALR/SAFLR/SBLR/SBFLR/SALR5/SAFLR5/SBLR5/SBFLR5)			
Protection grade <sup>1</sup>	IP67(SA/SAF/SAV/SB/SBF/SBV), IP64(SAL/SAFL/SBL/SBFL), IP67(SAL/SAFL/SBL/SBFL) <sup>2</sup>							
Vibration resistance	100 m/s <sup>2</sup> (20~2000 Hz)							
Impact resistance	1000 m/s <sup>2</sup> (11 ms)							
Operating temperature	0~+50 °C							
Storage temperature	-20~+60 °C							
Power supply	DC 5 V ±5 %							
Power consumption	1 W							
Mass <sup>3</sup>	Approx. 30g							
Output cable length	2.5 m							
Feeler	Carbide ball tip	Mounting screw M2.5	Steel ball tip	Mounting screw M2.5	Carbide ball tip	Mounting screw M2.5	Steel ball tip	Mounting screw M2.5
Accessories	Instruction Manual +P M4 x 5 screw(2pc) tightening nut, Clamp spanner, wave washer, mounting pin 1 each(DK8**S*F** only) Hose elbow 1 pc(DK8**S*L** only) one spanner							

\*1 Excluding the interpolation box and connector \*2 When φ4mm tube is connected for right-angle model \*3 Excluding cable and interpolation box  
\*Magnescale reserves the right to change product specifications without prior notice.

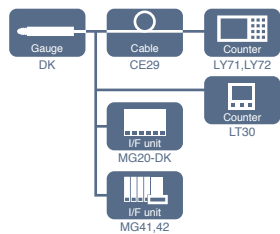
## DK830S

Model	Straight type		Right-angle type		Pneumatic push type	
	DK830SR		DK830SLR		DK830SVR	
Measuring range	30 mm					
Maximum resolution	0.1 μm(0.5 μm resolution can also be selected as special specifications.)					
Accuracy(At 20°C)	1.3 μm p-p			1.7 μm p-p		
Repeatability	±0.1 μm or less					
Measuring force	Upward: 0.5±0.35N Horizontal: 0.6±0.35N Downward: 0.7±0.35N			Air pressure 0.07 Mpa: 1.9N or less in all directions Air pressure 0.09 Mpa: 2.6N or less in all directions		
Maximum response speed	80 m/min					
Reference point	Position at spindle movement of 1mm±0.5mm					
Reference point response speed	Same as the noted maximum response speed					
Output	A/B/Reference point Voltage-differential line driver output (conforming to EIA-422)					
Spindle drive system	Spring push				Air driving (Pneumatic push)	
Protection grade <sup>1</sup>	IP53		IP53/IP67 <sup>2</sup>			
Vibration resistance	100 m/s <sup>2</sup> (20~2000 Hz)					
Impact resistance	1000 m/s <sup>2</sup> (11 ms)					
Operating temperature	0 °C~+50 °C					
Storage temperature	-20 °C~+60 °C					
Power supply	DC +5 V ±5 %					
Power consumption	1 W					
Mass <sup>3</sup>	Approx. 70g			Approx. 80g		
Output cable length	2.5 m					
Feeler	Carbide ball tip, Mounting screw M2.5					
Accessories	Spanner Instruction Manual Supplement +P M4 x 5 screw(2pc)					

\*1 Excluding the interpolation box and connector \*2 When the bellows set(optional accessory) is mounted \*3 Excluding cable section and interpolation box  
\*Magnescale reserves the right to change product specifications without prior notice.



# DK series



## DK10/25/50/100

Model	Standard model		Protected type model		Standard model		Protected type model		Standard model		Protected type model	
	DK10NR5	DK10PR5	DK10PLR5	DK25NR5	DK25PR5	DK25NLR5	DK25PLR5	DK50NR5	DK50PR5	DK100NR5	DK100PR5	
Measuring range	10 mm				25 mm				50 mm		100 mm	
Maximum resolution	0.5 μm											
Accuracy(At 20°C)	2 μm p-p				4 μm							
Measuring force	Upward: 0.3±0.25N Horizontal: 0.6±0.3N Downward: 0.8±0.35N	4.9 N or less		Upward: 0.4±0.3N Horizontal: 0.7±0.35N Downward: 1±0.4N	4.9 N or less		Upward: 0.4±0.3N Horizontal: 0.7±0.35N Downward: 1±0.4N	4.9 N or less		Upward: - Horizontal: 1.8±0.65N Downward: 2.7±0.55N	9.3 N or less	
Maximum response speed	250 m/min											
Reference point	Position at the spindle movement of 1mm											
Reference point response speed	Same as the noted maximum response speed											
Output	A/B/Reference point Voltage-differential line driver output(conforming to EIA-422)											
Spindle drive system	Spring push											
Protection grade <sup>1</sup>	IP50	IP64	IP50	IP64	IP50	IP64	IP50	IP64	IP50	IP64	IP50	IP64
Vibration resistance	150 m/s <sup>2</sup> (10~2000 Hz)											
Impact resistance	1500 m/s <sup>2</sup> (11 ms )											
Operating temperature	0~+50 °C											
Storage temperature	-20~+60 °C											
Power Supply	DC 5 V±5 %											
Power consumption	1 W											
Mass <sup>2</sup>	Approx. 230g			Approx. 300g			Approx. 360g			Approx. 630g		
Output cable length	2.5 m											
Feeler	Carbide ball tip, Mounting screw M2.5											
Accessories	Instruction manual +P M4x5 screw(2pc)											

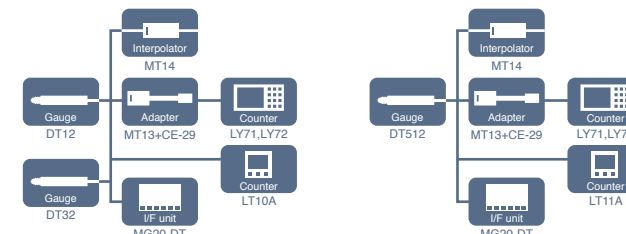
\*1 Excluding interpolation box and connector \*2 Excluding cable section and interpolation box \*Magnescale reserves the right to change product specifications without prior notice.

## DK155/205

Model	DK155PR5		DK205PR5	
	Measuring range	155 mm		205 mm
Maximum resolution	0.5 μm			
Accuracy(At 20°C)	5 μm p-p		6 μm p-p	
Maximum response speed	250 m/min			
Reference point	Position at the spindle movement of 5mm			
Reference point response speed	Same as noted maximum response speed			
Output	A/B/Reference point Voltage-differential line driver output(conforming to EIA-422)			
Spindle drive system	None			
Protection grade <sup>1</sup>	IP64			
Vibration resistance	150 m/s <sup>2</sup> (10~2000 Hz)			
Impact resistance	1500 m/s <sup>2</sup> (11 ms )			
Operating temperature	0~+50 °C			
Storage temperature	-20~+60 °C			
Power Supply	DC 5 V±5 %			
Power consumption	1 W			
Mass <sup>2</sup>	Approx. 1100g		Approx. 1300g	
Output cable length	2.5 m			
Feeler	DZ-181			
Surface to be measured	Soft magnetic material			
Magnetically attachable feeler	Magnetic attraction: 10N, Resistance against horizontal slip: 2.7N			
Spindle <sup>3</sup>	φ8 mm, radial swing: 0.04mm max			
Accessories	Instruction manual +P M4 x 5 screw(2pc)			

\*1 Excluding the interpolation box and connector \*2 Excluding cable section and interpolation box \*3 The spindle weighs about 400g. \*Magnescale reserves the right to change product specifications without prior notice.

# DT series



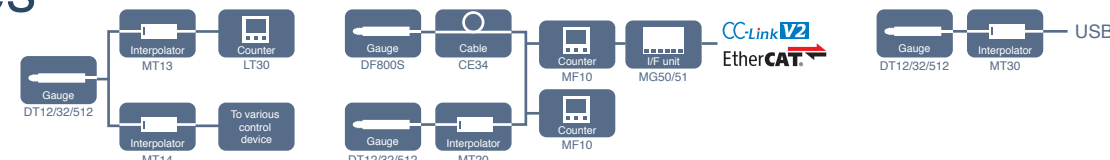
## DT12/32/512

Model	Standard model		Protected type model		Standard model		Protected type model		Standard model		Protected type model	
	DT512N	DT512P	DT12N	DT12P	DT32N	DT32NV	DT32P	DT32PV				
Measuring range	12 mm				32 mm							
Maximum resolution	1 μm				5 μm							
Accuracy(At 20°C)	6 μm p-p				10 μm p-p							
Measuring force	Upward: 0.7±0.5N Horizontal: 0.8±0.5N Downward: 0.9±0.5N	1.7N or less in all direction		Upward: 0.7±0.5N Horizontal: 0.8±0.5N Downward: 0.9±0.5N	1.7N or less in all direction		*1 Upward: 1.1±0.8N Horizontal: 1.3±0.8N Downward: 1.5±0.8N		2.9N or less in all direction		9N or less in all direction <sup>2</sup>	
Maximum response speed	Depending on unit to be connected											
Reference point	None											
Spindle drive system	Spring push				Air driving (Pneumatic push)				Spring push		Air driving (Pneumatic push)	
Protection grade	—		IP64 or equivalent <sup>1</sup>		—		IP64 or equivalent <sup>1</sup>		—		IP64 or equivalent <sup>3</sup>	
Operating temperature	0~+50 °C											
Storage temperature	-10~+60 °C											
Mass	Approx. 75g <sup>2</sup>	Approx. 80g <sup>2</sup>	Approx. 75g <sup>2</sup>	Approx. 80g <sup>2</sup>	Approx. 120g <sup>4</sup>	Approx. 140g <sup>4</sup>	Approx. 120g <sup>4</sup>	Approx. 140g <sup>4</sup>				
Output cable length	2 m											
Feeler	Steel ball tip, Mounting screw M2.5											
Accessories	Instruction manual											

\*1 At input air pressure of 1.96 x 10<sup>5</sup> Pa with speed controller open(DT32NV) \*2 At input air pressure of 2.35 x 10<sup>5</sup> Pa with speed controller open \*3 Excluding the connector \*4 Excluding cable section

\*Magnescale reserves the right to change product specifications without prior notice.

# MT series



## MT13/14

Model	MT13-01		MT13-05		MT13-10		MT14-01		MT14-05		MT14-10	
	Compatible measuring units	DT512/DT12/DT32										
Maximum response speed	100 m/min											
Resolution	1 μm		5 μm		10 μm		1 μm		5 μm		10 μm	
Power voltage	DC5 V ±4 %											
Power consumption	1.2 W (When output load of 120Ω is connected)											
Output format	A/B Voltage-differential line driver											
Operating temperature and humidity range	0~+50 °C (No condensation)											
Storage temperature and humidity range	-10~+60 °C (20 to 90 %RH)											
Mass	Approx. 90g											

\*Magnescale reserves the right to change product specifications without prior notice.

## MT20

Model	MT20-01		MT20-05	
	Compatible measuring units	DT512 series		DT12/DT32 series
Maximum response speed	150 m/min			
Resolution	1 μm		5 μm	
Power voltage	DC+10~+30V			
Power consumption	1.2 W or less			
Operating temperature and humidity range	0~+50 °C (No condensation)			
Storage temperature and humidity range	-10~+60 °C (90%RH or less)			
Mass	Approx. 50 g			

\*Magnescale reserves the right to change product specifications without prior notice.

## MT30

Model	MT30-01		MT30-05	
	Compatible measuring units	DT512 series		DT12/DT32 series
Maximum response speed	150 m/min			
Resolution	1 μm		5 μm	
Power voltage	DC5V ±5 %			
Power consumption	120mA Max			
Operating temperature and humidity range	0~+50 °C (No condensation)			
Storage temperature and humidity range	-10~+60 °C (90%RH or less)			
Mass	Approx. 50 g			

\*Magnescale reserves the right to change product specifications without prior notice.

# Interface unit

## MG70 Interface

- ▲ MG70-EI : EtherNet/IP
- ▲ MG70-PN : PROFINET RT

### Compatible with DK series

Model	Main module		Counter module
	MG70-EI	MG70-PN	MG71-CM
Communication	EtherNet/IP	PROFINET RT	Data transferred to main module by dedicated protocol
Data transfer speed	10 / 100 Mbps	100 Mbps	-
Node address setting method	Set with hexadecimal rotary switch	Set with hexadecimal rotary switch	-
Node address range	DxDD~DxFF		-
Maximum connectable measuring unit	Counter module	85 units <sup>*1</sup>	-
	Measuring unit	-	1 units
Cable length (Communication distance)	Segment length: Max. 100m between two station		
Mounting method	35mm DIN rail mounting		
Power supply voltage	DC24 V (DC20.4~28.8 V)		
Power consumption	2W or less	2.5W or less	1.01W or less
Operating temperature and humidity range	Horizontal use: -25~+60°C Vertical use: -25~+50°C		
Storage temperature and humidity range	-40~+85°C		
Mass	Approx. 150g		Approx. 80g

\*1 This is the maximum number of connections when supplying power by one power supply module. Maximum of 250 units of MG71-CM can be connected by adding power supply modules.

\*Magnescale reserves the right to change product specifications without prior notice.

## MG50 Interface

- ▲ MG50-EC : EtherCAT
- ▲ MG50-CL : CC-Link (Compatible with iQSS)

### Compatible with DF/DT series

Model	Main module		Distribution module
	MG50-EC	MG50-CL	MG51
Communication	EtherCAT	CC-Link (Compatible with iQSS)	Data transferred to main module by dedicated protocol
Data transfer speed	100 Mbps	Maximu downlink speed of 10Mbps	-
Node address setting method	Set with decimal rotary switches or software	Set with decimal rotary switches	-
Node address range	000~192	Max. 64	-
Maximum connectable measuring unit	Counter module	30 units	10 units
	Distribution module	8 units	-
Cable length	Maximum cable length between main module and distribution module: 30m		
Mounting method	35mm DIN rail mounting		
Power supply voltage	DC24 V (DC20.4 ~26.4 V)		
Power consumption / Consumption current	2.4 W or less 100 mA or less (DC24V)		2W or less 80 mA or less (DC24V)
Operating temperature and humidity range	1-2 units are installed side by side: 0~+55°C 11-16 units are installed side by side: 0~+45°C	3-10 units are installed side by side: 0~+50°C 17-30 units are installed side by side: 0~+40°C 25~85%RH (No condensation or icing)	1-2 units are installed side by side: 0~+55°C 3-10 units are installed side by side: 0~+50°C 11-16 units are installed side by side: 0~+45°C 25~85%RH (No condensation or icing)
Storage temperature and humidity range	-30~+70°C 25~85%RH (No condensation or icing)		
Mass	Approx. 95g		Approx. 40 g

\*Magnescale reserves the right to change product specifications without prior notice.

## MG40 Interface

- ▲ MG41-NC : CC-Link/Ethernet
- ▲ MG41-NE : Ethernet

### Compatible with DK series

Model	Main unit		Hub unit
	MG41-NC	MG41-NE	MG42-4
Communication	CC-Link / Ethernet		Ethernet
Maximum connectable measuring unit	Measuring unit (Entire system)	100 unit(Connection of 101th unit and later disabled)	
	Measuring unit (Each unit)	4 units	
	Hub unit	24 units	
Cable length	Total cable length between main unit and hub unit: 0.5 / 1 / 2 / 5 / 10 m (Connection cable MZ41(Optional)) Total cable length between the hub units: 0.5 / 1 / 2 / 5 / 10 m (Connection cable MZ41(Optional)) Total cable length from Main units: Max. 30m (Max. current: 4A or less)		
Output resolution <sup>*1</sup>	Input resolution <sup>*2</sup> at resolution of 0.1µm	0.1 / 0.5 / 1 / 5 / 10 µm	
	Input resolution <sup>*2</sup> at resolution of 0.5µm	0.5 / 1 / 5 / 10 µm	
Measuring unit data capture ability (Communication 10Mbps)	Maximum 10000 data/sec (When 100 axes are connected) <sup>*3</sup>		
Output data	Single axis	Recalculation of peak value is started by start function	
	At addition and subtraction	Current, maximum, minimum, and peak-to peak values for each axis	
Function	Comparator, Reset, Preset, Datum points setting function <sup>*4</sup> , Reference point <sup>*4</sup> , Master calibration <sup>*5</sup> , Measuring unit product information, Command setting		
Mounting method	35mm DIN rail mounting		
Power supply voltage (Terminal board)	DC12~24 V (DC11~26.4 V) <sup>*6</sup>		
Power consumption	System total (Max. current 4A) <sup>*7</sup>		
Operating temperature and humidity range	0~+50°C (No condensation)		
Storage temperature and humidity range	-10~+60°C (20~90 %RH)		
Mass	300 g		250 g

\*1 Settable output data resolution and display resolution. \*2 Measuring units resolution. \*3 The data for one axis is counted as one data. \*4 When master calibration function is not used

\*5 Addition / subtraction axis is not possible \*6 Use a power supply with a current that is 4 A or higher for every six MG42 hub units

\*7 When the maximum current is exceeded, the connection can be enabled by providing a power supply to the MG42 hub units that come later in the connection.

\*Magnescale reserves the right to change product specifications without prior notice.

## MG10/20/30 Interface

- ▲ MG10-P1 : RS-232C(Conforming to EIA-232C)
- ▲ MG10-P2 : RS-232C(Conforming to EIA-232C)

### Compatible with DK/DT Series

### Main module specifications

Model	MG10-P1	MG10-P2
Power source	Power supply	DC12~24 V (11~26.4 V) Start up time: 100ms or less
	Power consumption	2.0W + total power consumption for connected modules <sup>*1</sup>
	Inrush current(10 ms)	10A or less (When the maximum number of modules are connected)
Communication	Power supply protection	Fuses (5-A fuses is built in)
	Communication I/F	RS-232C (EIA-232C or equivalent)
	Baud rate setting	2400/9600/19200/38400 bps (set with DIP switch)
	Data length	7/8 bit (set with DIP switch)
	Stop bit	1/2 bit (set with DIP switch)
	Parity	NONE/ODD/EVEN (set with DIP switch)
	Delimiter	CR/CR+LF (set with DIP switch)
Linkage function	Maximum number of linkages	16 (Total of counter modules: 64)
	Maximum number of linking cable	10m
I/O	Input format	Source input(+COM) Sink input(-COM)
	Output format	Open collector output sink type(-COM) Source input(+COM)
	Input signal	Reset, Pause, Start, Latching, and Data out trigger to whole channel
	Output signal	Intergrated alarm
	Connectable modules	Counter modules MG20-DK, MG20-DG, MG20-DT (Available for mixed use, up to 16 modules) <sup>*1</sup>
	Interface modules	MG30- B1, MG30-B2 <sup>*1</sup>

\*1 Total power of modules connected to MG10 should not be over 54W(at 12 VDC input) or 108W(at 24 VDC input)

\*Magnescale reserves the right to change product specifications without prior notice.

### Counter module specifications

Model	MG20-DK	MG20-DT
Power consumption	1W + power consumption for connected measuring unit	0.8 W
Measuring unit input	Corresponding mesuring unit	DK Series (Voltage differential A/B quadrature input)
	Allowable resolution setting <sup>*2</sup>	DT Series
	Maximum response speed	10/5/1/0.5/0.1 µm set with DIP switch
	Maximum response accleration	5 µm (DT12/32) 1 µm (DT512)
	Reference point	Subject to the specification of connected measuring unit
Others	Alarm	Subject to the specification of connected measuring unit
		REF-LED(reference point loaded) shows on the display after the reference point is detected Set "0" or preset value on the counter when the reference point is detected
		S-ALM LED activates by excess speed/acceleration of measuring unit C-ALM LED activates by excess speed of the internal circuit of counter
		The alarm display is cancelled by reset command from MG10 or with the reset button of main unit

\*2 Set the resolution value of the connected mesuring unit

\*Magnescale reserves the right to change product specifications without prior notice.

### Interface module specifications

Model	MG30-B1	MG30-B2
Power consumption	1W	
I/O	Input format	Source input(+COM) Counterpart output circuit : Current sink input(-COM) Current sink input(-COM) Counterpart output circuit: Source type(+COM)
	Output format	Open collector output sink type(-COM) Source type(+COM) Source type(+COM) Counterpart output circuit(+COM): Source type(-COM)
	Input signal	Photocoupler insulation, external power: 5-24V DC
	Output signal	Photocoupler insulation, external power: 5-24V DC
Output setting	DRQ, channel address, Measuring mode shifting, Comparator shifting, Reset, Start, Pause, Reference-point loaded	
	BCD data(6 digits) READY GO/No-go output Alarm referene point	
	Timer(1 to 128ms) OUT/OR Polarity (Set with internal DIP switch)	

All models	Operation temperature and humidity range	0~+50 °C (No condensation)
	Storage temperature and humidity range	-10~+60 °C (20~90%RH)

\*Magnescale reserves the right to change product specifications without prior notice.

# MF10

Digital tolerance indicator / Counter module

Model	Digital tolerance indicator		Counter module
	MF10-P1	MF10-P2	MF10-CM
Function	NPN output (current sink)	PNP output (current source)	Counter module for MG50
I/O	Number of Go/No Go judgement output 2, Number of external inputs 1		-
Minimum display unit	0.1µm		-
Cable length	input/output, power cable 2m		-
Power supply	+10~30V DC including ripple (p-p) 10%		
Power supply voltage / Power consumption	2.1W or less / 85A or less (DC24V)		
Operating temperature and humidity range	When lining up 1 or 2 digital tolerance indicators: 0°C to +55°C 35% to 85% RH (with no condensation)		1 to 2 amplifiers connected : 0~55°C 3 to 10 amplifiers connected : 0~50°C 11 to 16 amplifiers connected : 0~45°C 17 to 30 amplifiers connected : 0~40°C 35~85%RH(No condensation)
Storage temperature and humidity range	-10°C ~ +60°C (with no icing or condensation)		
Mass	Approx. 75g		

\*Magnescale reserves the right to change product specifications without prior notice.

# LT30

For DK, DK-S

Model	LT30-1G	LT30-1GB	LT30-1GC	LT30-2G	LT30-2GB	LT30-2GC
Number of input axes	1 axis			2 axes		
Input resolution	0.1 / 0.5 / 1 / 5 / 10 µm (parameter setting for each axis)					
Number of display axes	1 axis			2 axes		
Display data	Current, max., min., peak-to-peak values (=max. value - min. value)			current, max., min., peak-to-peak values (=max. value - min. value), additional/subtraction value		
Direction	Switchable					
Alarm display	Alarm display, Addition and subtraction function (Except LT30-1**), Peak hold function, Restart, Hold (latch and pause), Comparator, Reset, Preset, Master calibration, Reference point, Key lock					
Input/output	I/O connector	○	○	○	○	○
	BCD output	-	○	-	-	○
	RS-232C	-	-	○	-	○
	RS-TRG	-	-	○	-	○
	Comparator judgement	○	○	○	○	○
Power supply	DC10.8~26.4 V					
Power consumption	5 W	5.5 W	5 W	8.5 W	9 W	8.5 W
Operating temperature and humidity range	0~+40°C					
Storage temperature and humidity range	-10~+50°C					
Mass	Approx. 200 g	Approx. 230 g	Approx. 220 g	Approx. 210 g	Approx. 270 g	Approx. 230 g

\*Magnescale reserves the right to change product specifications without prior notice.

# LT11A/LT10A

For DK, DK-S

Model	LT10A-105/LT11A-101	LT10A-105B/LT11A-101B	LT10A-105C/LT11A-101C	LT10A-205/LT11A-201	LT10A-205B/LT11A-201B	LT10A-205C/LT11A-201C
Number of input axes	1 axis			2 axes		
Input resolution	1 / 5 / 10 µm (parameter setting for each axis) (1µm resolution is available only for 11A)					
Number of display axes	1 axis			2 axes		
Display data	Current, max., min., peak-to-peak values (=max. value - min. value)			Current, max., min., peak-to-peak values (=max. value - min. value), additional/subtraction value		
Direction	Switchable					
Function	Alarm display, Addition and subtraction function (Except LT10A-105* and LT11A-101), peak hold function, restart, hold(latch and pause), comparator, reset, preset, master calibration, reference point, key lock					
Input/output	I/O connector	○	○	○	○	○
	BCD	-	○	-	-	○
	RS-232C	-	-	○	-	○
	RS-TRG	-	-	○	-	○
	Comparator judgement	○	○	○	○	○
Power supply	DC9~26.4 V					
Power consumption	1.8 W	2.9 W	2.0 W	2.3 W	4.0 W	2.5 W
Operating temperature and humidity range	0~+40°C					
Storage temperature and humidity range	-10~+50°C					
Mass	Approx. 200 g	Approx. 230 g	Approx. 220 g	Approx. 210 g	Approx. 270 g	Approx. 230 g

\*Magnescale reserves the right to change product specifications without prior notice.

# LY71/LY72

Compatible with DK series

\*Compatible with GB-ER series(Magnescale), PL20 series(Digiruler)

Model	LY71	LY72 <sup>1)</sup>	
		When axis label A, B, and C are selected	When axis label X, Y, and Z are selected
Number of input axis	1 axis or 2 axes(by parameter setting)	1 axis, 2 axes, or 3 axes(by parameter setting)	
Input resolution	Linear standard : 0.1 / 0.5 / 1 / 5 / 10 µm (Expanded linear: 0.05/2/20/25/50/100 µm) Angle : 1 s / 10 s / 1 min / 10 min (Expanded angle : 1 degree)		
Number of display axes	3 axes(Axes A, B and C) <sup>1)</sup>	3 axes(Axes A, B and C)	3 axes (Axes X, Y and Z)
Display data	Current, max., min., and peak-to-peak values (=max. value - min. value) of each axis or current, max., min., and peak-to-peak values(=max. value - min. value) of 2 axis addition and subtraction <sup>2)</sup>	Current, max., min., and peak-to-peak values (=max. value - min. value) of each axis	Current value of each axis
Direction	Switchable		
Function	Alarm display, addition and subtraction <sup>3)</sup> , peak hold, restart, hold(latch and pause), comparator <sup>5)</sup> , positioning, reset, preset, master calibration, Datum point/reference point, keylock, data storage, scaling, linear compensation	Alarm display, peak hold(When using axes A, B and C), restart(When using axes A, B and C), hold(latch and pause), reset, preset, master calibration(When using axes A, B and C), Datum point/reference point, keylock, data storage, scaling, linear compensation	Alarm display, hold(latch and pause), reset, preset datum point/reference point, keylock, data storage, scaling linear compensation
Input/Output	BCD output <sup>4)</sup>	○	-
	RS-232C	-	○
	Comparator judgement function <sup>5)</sup>	○	-
Power supply	Optional PSC-21/22/23 adapter is used		
Power consumption	32 VA max.(When optional AC adapter is used)		
Operating temperature and humidity range	0~+40°C(No condensation)		
Storage temperature and humidity range	-20~+60°C(No condensation)		
Mass	Approx. 1.5 kg		

<sup>1)</sup> LY72 can select whether to use ABC or XYZ in the axis label lamp on the left side of counter display.

ABC is mainly used when using measurement unit. XYZ is mainly used when using scale measurement unit.

<sup>2)</sup> Available only 1 axis (A axis display) when LZ71-KR is used. Only comparator display when showing B-axis and C-axis.

<sup>3)</sup> Addition / subtraction display is not available when using two LZ71-B.

<sup>4)</sup> Available only when LZ71-B is used

<sup>5)</sup> Available only when LZ71-KR is used

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## LZ71-B

Model	LZ71-B
BCD output	7-digit parallel data (4 bits x7 digits) Sign (1bit) READY signal (1bit)
Output logic	Positive and negative logic can be selected individually for data and sign READY signal: Negative logic
Electrical specifications	Photocoupler output V <sub>CE</sub> : Recommended DC+12-24V I <sub>c</sub> : Maximum 15mA /terminal;TOTAL:300mA Output connector: 36 pin micro-ribbon connector
Output data at power ON and during alarm	Data output and alarm status (all OFF) can be selected (Via initial settings)
Output data	Current (1st-axis, 2nd-axis, addition axis), max., min., and peak-to-peak values
Latch	Selectable from BCD-only latch and BCD and display latch
Input signal	DRQ1-3 (Photocoupler:12-24V)
Output selection	3 DRQ input signals: DRQ 1-3; output data is assigned via settings. Ex.) DRQ1: Current value; DRQ2: Maximum value; DRQ3: Minimum value
Output modes	Constant output: Output irrespective of DRQ; prohibited when refreshing data Latch: BCD data-only latch LATCH: BCD data and display latch Request output: Output with DRQ input only. Otherwise, OFF can be selected
Operating temperature and humidity range	0~+40 °C (with no condensation)
Storage temperature and humidity range	-20~+60 °C (with no condensation)

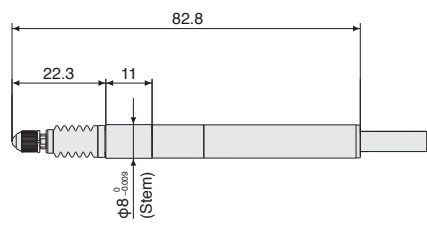
\*Magnescale reserves the right to change product specifications without prior notice.

## LZ71-KR

Model	LZ71-KR
Comparator function	Setting of comparator values 1 = 4 and judgment of magnitude of data
Comparable data	Current, max., min., and peak-to-peak values (Depends on setting)(For 1st-axis or Addition axis)
Combination of upper and lower values	With comparator values 1-4 as one group, data for 16 groups are selectable Selection method: Key operation or external contact input
Output data	5-terminal signal output Photocoupler (Withstand voltage: 24V) I <sub>c</sub> =15mA 5-terminal contact output DC24V AC120V 0.3A
External contacts	Photocoupler: 12-24V
Positioning function (One terminal)	Setting of positioning data, output signal ON for 0.5 sec when set value matches current value
Data to which position can be assigned	Current values only (In relation to 1st axis and additional axes)
Types of position value	Positioning values: With one terminal as one group, data for 16 groups are selectable Selection method: Same as comparator function
Operating temperature and humidity range	0~+40 °C (with no condensation)
Storage temperature and humidity range	-20~+60 °C (with no condensation)

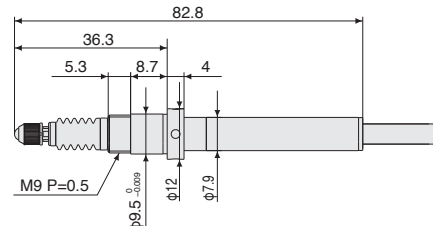
\*Magnescale reserves the right to change product specifications without prior notice.

DK805SAR/DK805SAR5/DK805SBR/DK805SBR5  
DS805SR/DS805SR5  
DF805SR

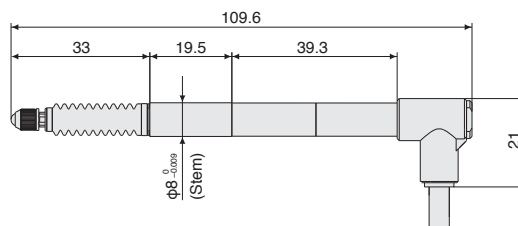


\*Upon installation, clamp the stem

DK805SAFR/DK805SAFR5/DK805SBFR/DK805SBFR5  
DS805SFR/DS805SFR5  
DF805SFR

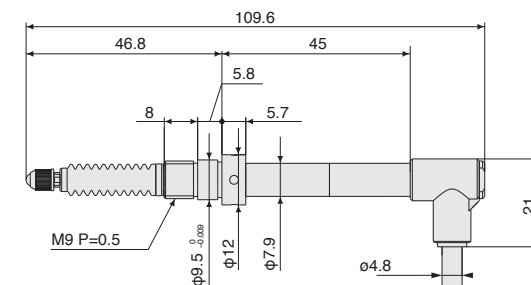


DK812SALR/DK812SALR5/DK812SBLR/DK812SBLR5  
DS812SLR/DS812SLR5  
DF812SLR

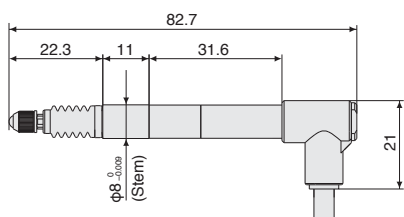


\*Upon installation, clamp the stem

DK812SAFLR/DK812SAFLR5/DK812SBFLR/DK812SBFLR5  
DS812SFLR/DS812SFLR5  
DF812SFLR

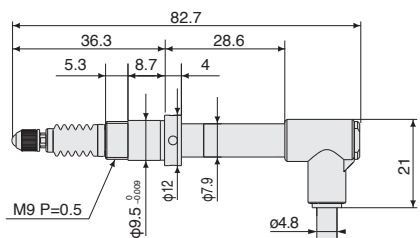


DK805SALR/DK805SALR5/DK805SBLR/DK805SBLR5  
DS805SLR/DS805SLR5  
DF805SLR

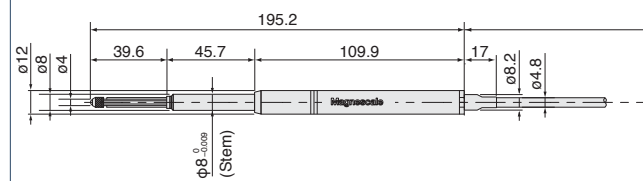


\*Upon installation, clamp the stem

DK805SAFLR/DK805SAFLR5/DK805SBFLR/DK805SBFLR5  
DS805SFLR/DS805SFLR5  
DF805SFLR

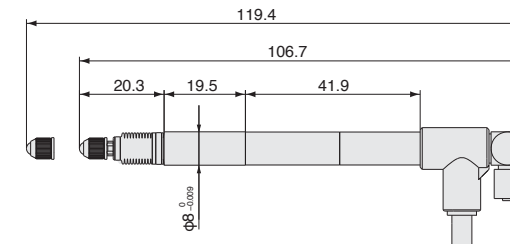


DK830SR



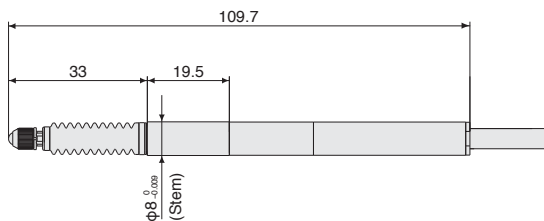
\*Upon installation, clamp the stem

DK812SAVR/DK812SAV5/DK812SBVR/DK812SBV5  
DF812SVR  
(Pneumatic push type)



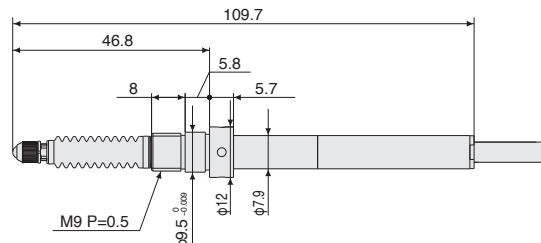
\*Upon installation, clamp the stem

DK812SAR/DK812SAR5/DK812SBR/DK812SBR5  
DS812SR/DS812SR5  
DF812SR

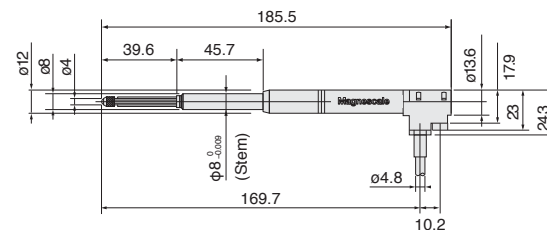


\*Upon installation, clamp the stem

DK812SAFR/DK812SAFR5/DK812SBFR/DK812SBFR5  
DS812SFR/DS812SFR5  
DF812SFR

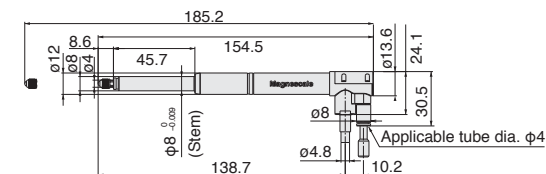


DK830SLR

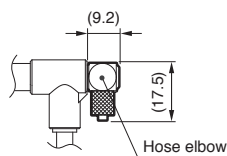


\*Upon installation, clamp the stem

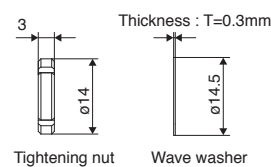
DK830SVR



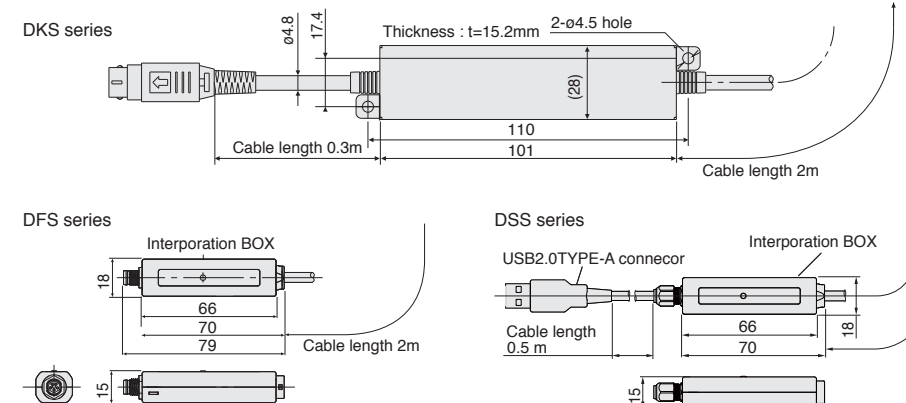
DK/DF/DS 8\*\*S\*L\*\* only

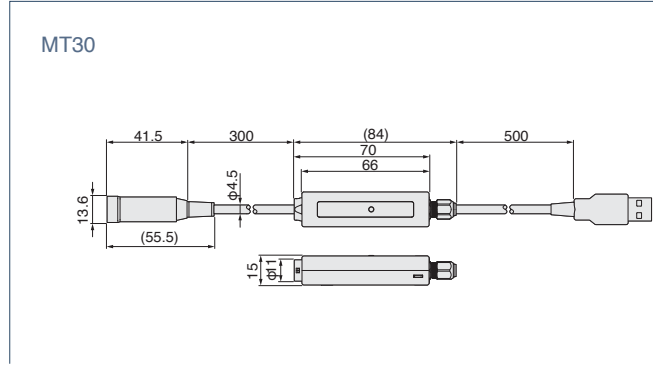
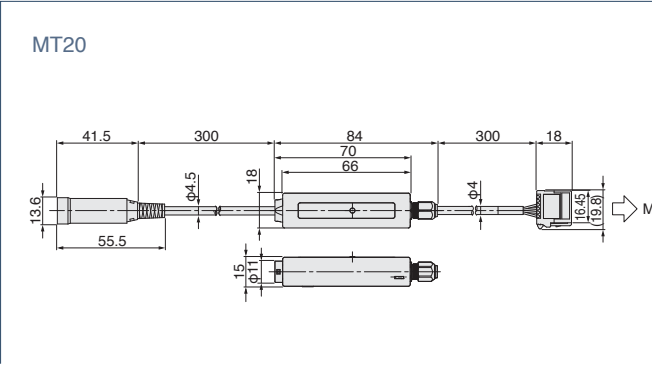
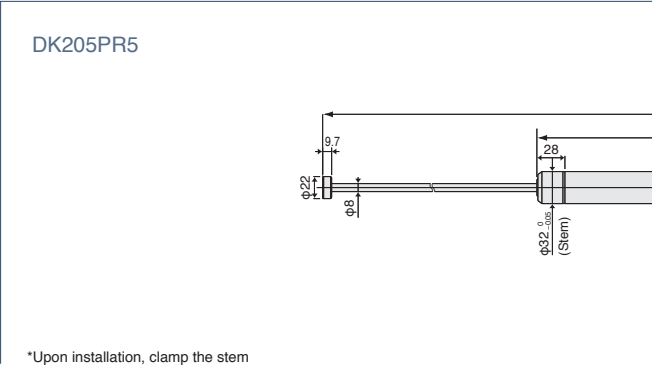
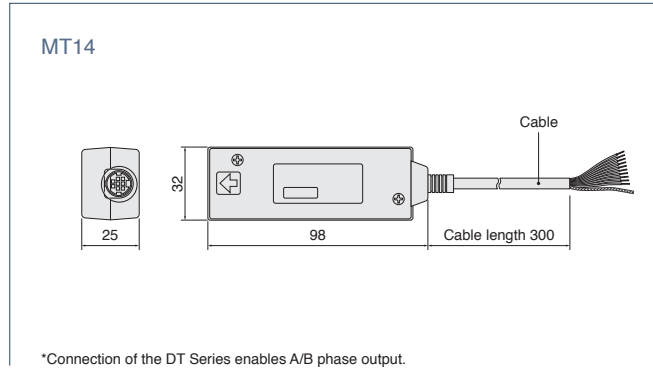
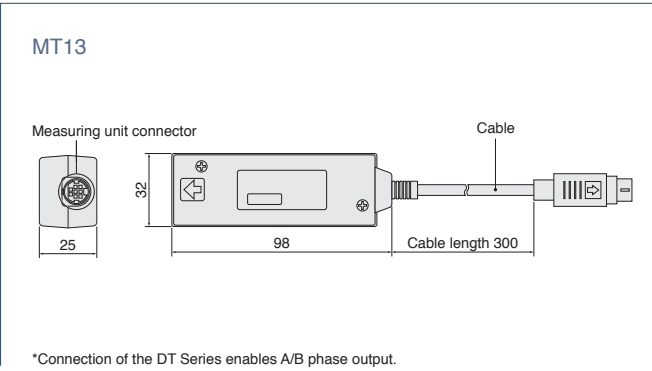
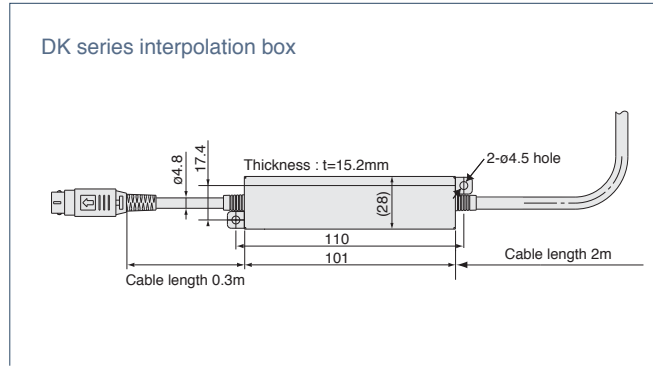
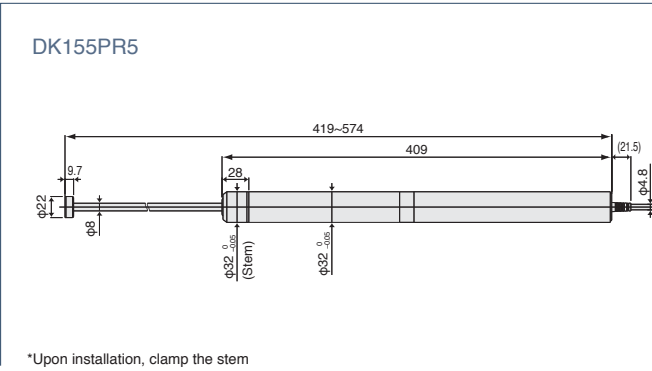
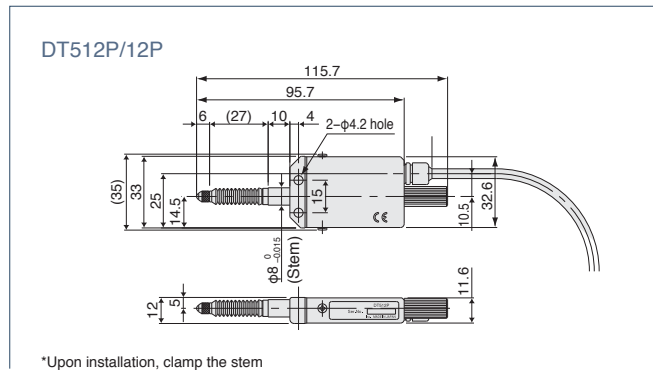
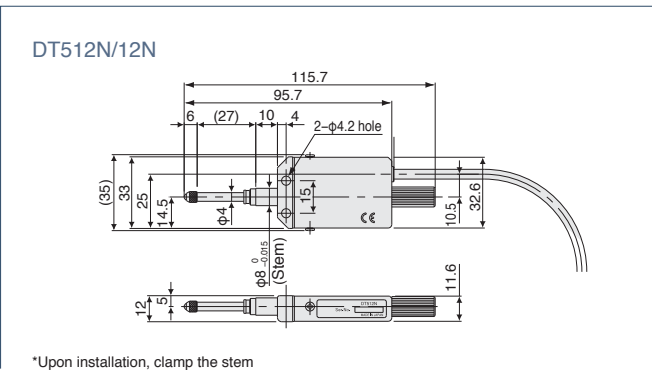
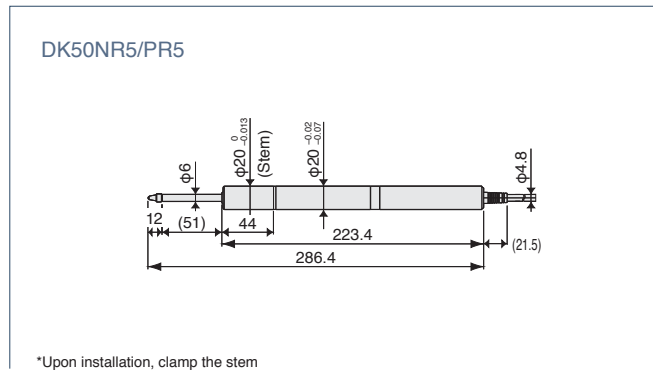
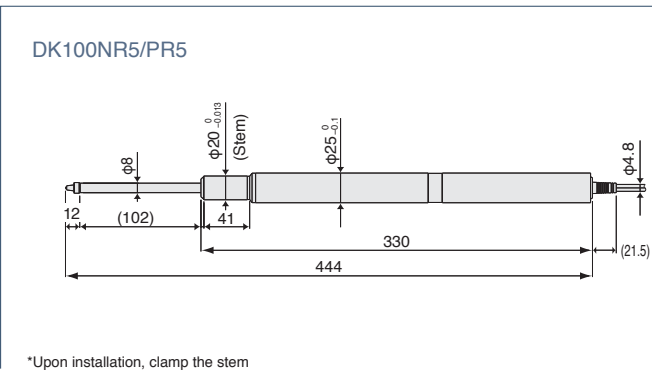
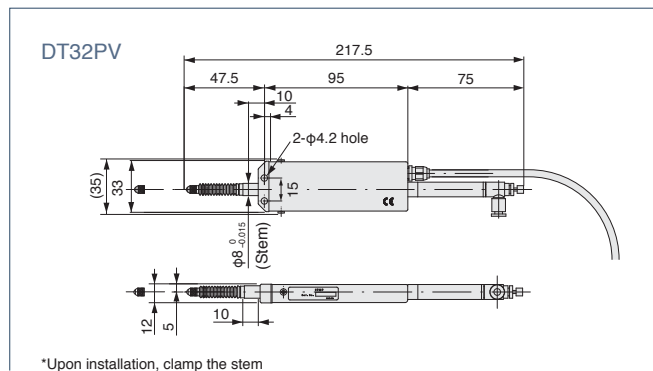
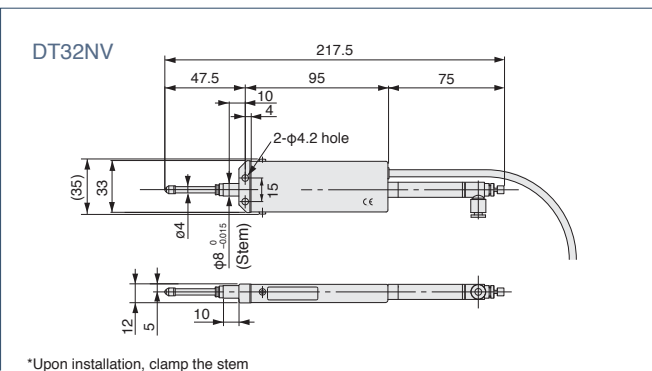
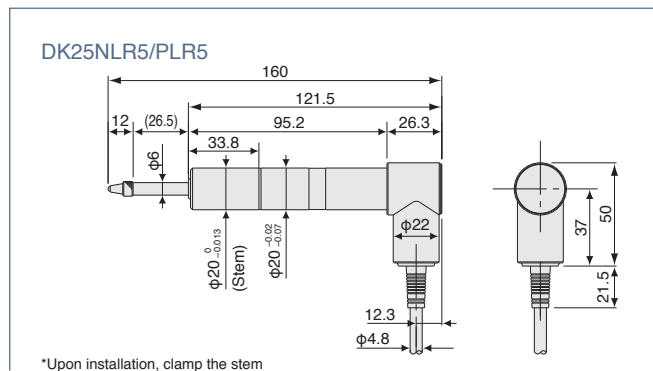
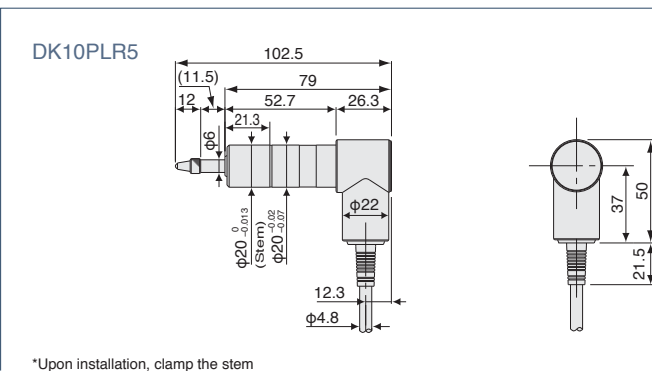
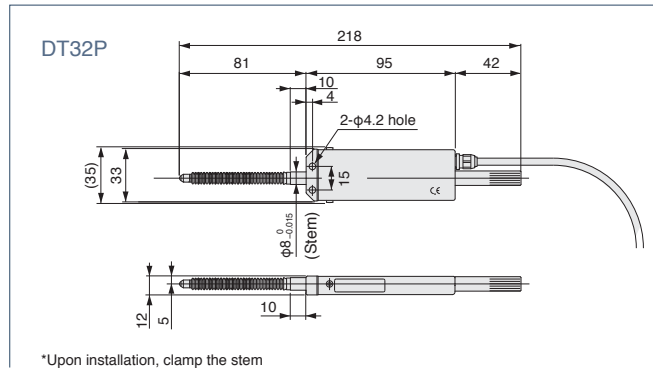
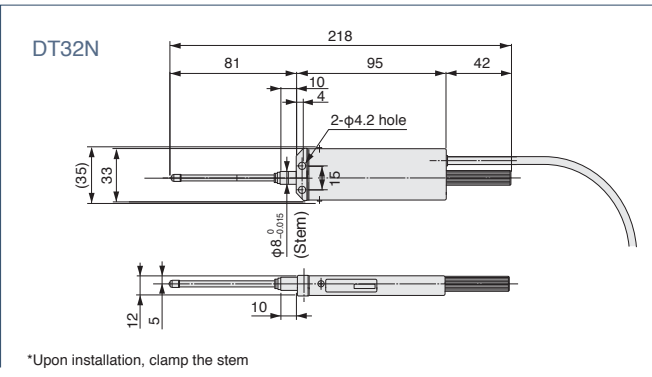
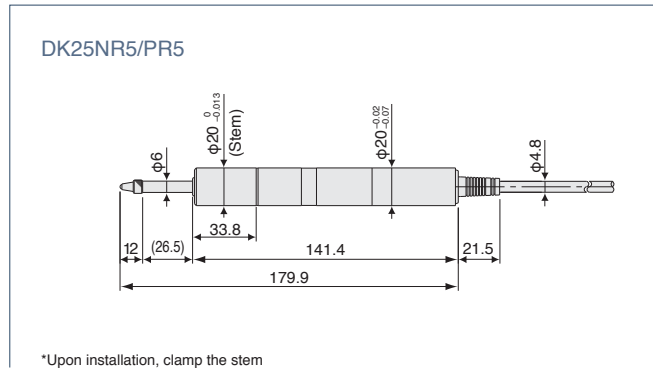
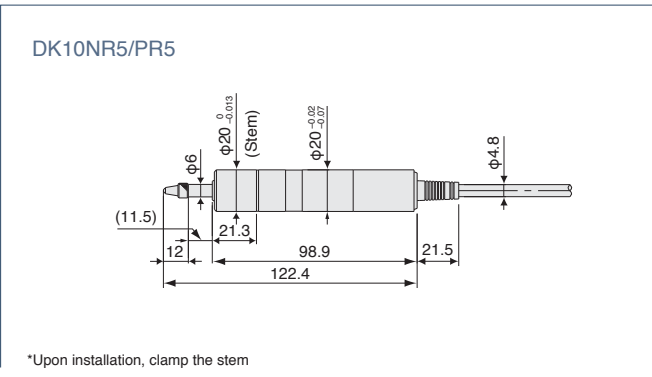


DK/DF/DS 8\*\*S\*F\* only



Interporation box

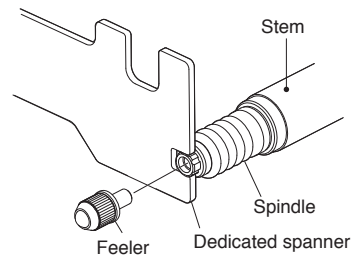




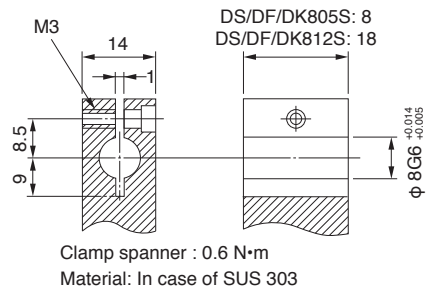
# Installation

## DS805S/812S, DF805S/812S, DK805S/812S installation cautions

### Feeler installation/removal method



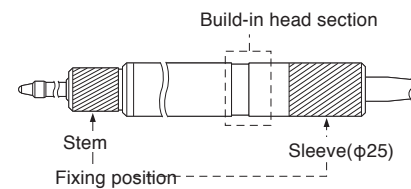
### Mounting holder dimensions and tolerance



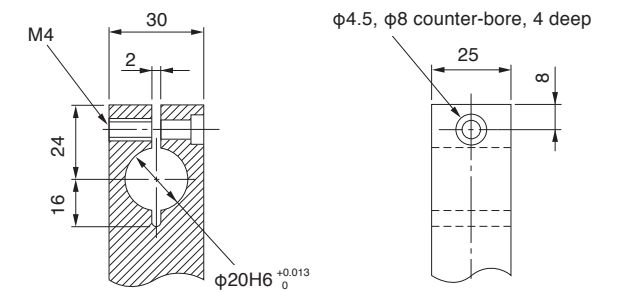
Unit: mm

## DK50/100 installation cautions

### Mounting/fixing position



### Mounting holder dimensions and tolerance

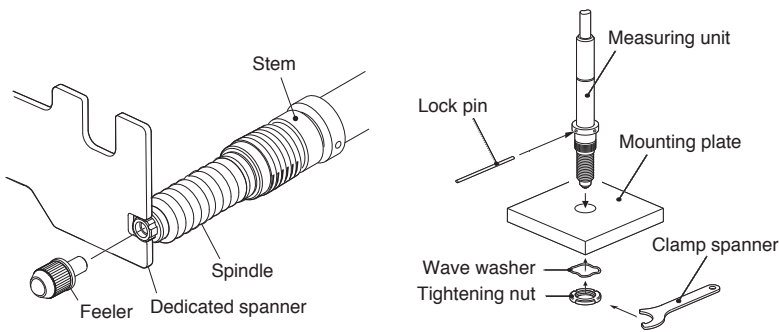


Tightening Torque: 4 N·m  
Hex. Socket head bolt M4 is used

Unit: mm

## DS805SF/812SF, DF805SF/812SF, DK805SF/812SF installation cautions

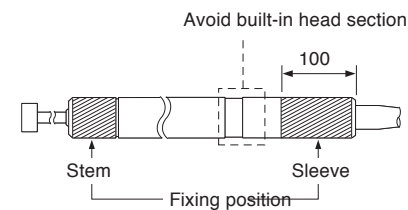
### Feeler installation/removal method



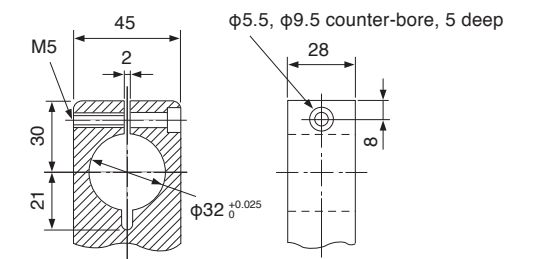
The recommended value of measuring unit mounting hole is  $\phi 9.7 \pm 0.15$ mm  
The mounting thickness is as follows:  
DS/DF/DK805SF : 7~11 mm  
DS/DF/DK812SF : 9~11 mm  
Mounting parallelism affects measurement accuracy  
Adjust the squareness to the surface to be measured or parallelism with respect to traveling to 0.02mm/14mm or less

## DK155/DK205 installation cautions

### Mounting/fixing position



### Mounting holder dimensions and tolerance

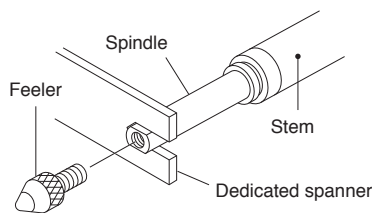


Tightening Torque: 6 N·m  
Hex. Socket head bolt M5 is used

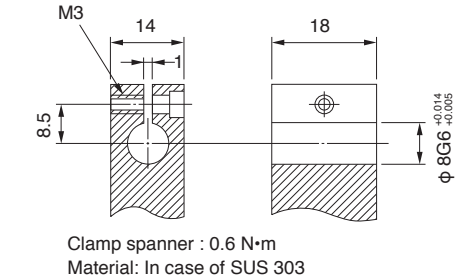
Unit: mm

## DK830 installation cautions

### Feeler installation/removal method



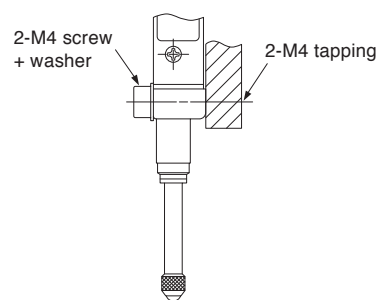
### Mounting holder dimensions and tolerance



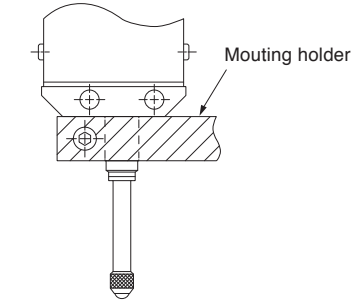
Unit: mm

## DT12/512/32 installation cautions

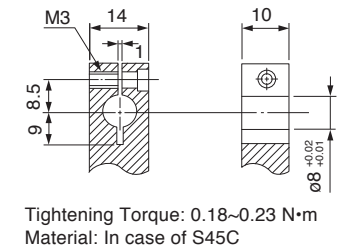
### Mounting method using mounting hole



### Mounting method using holder



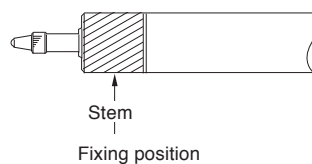
### Mounting holder dimension



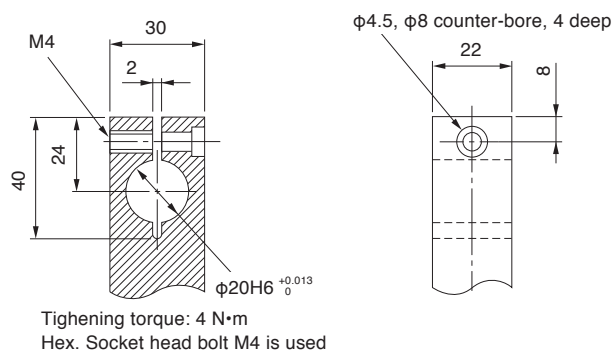
Unit: mm

## DK10/25 installation cautions

### Mounting /fixing position



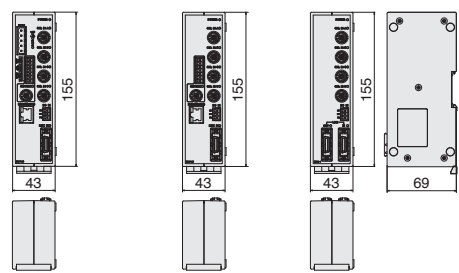
### Mounting holder dimensions and tolerance



Unit: mm

**MG40 Series**

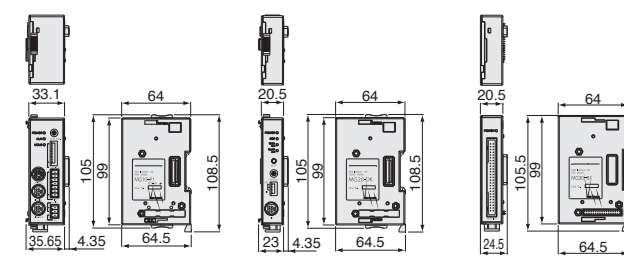
Main unit MG41-NC (CC-Link, Ethernet)    Main unit MG41-NE (Ethernet)    Hub unit MG42 "common to MG41-NC and MG41-NE"



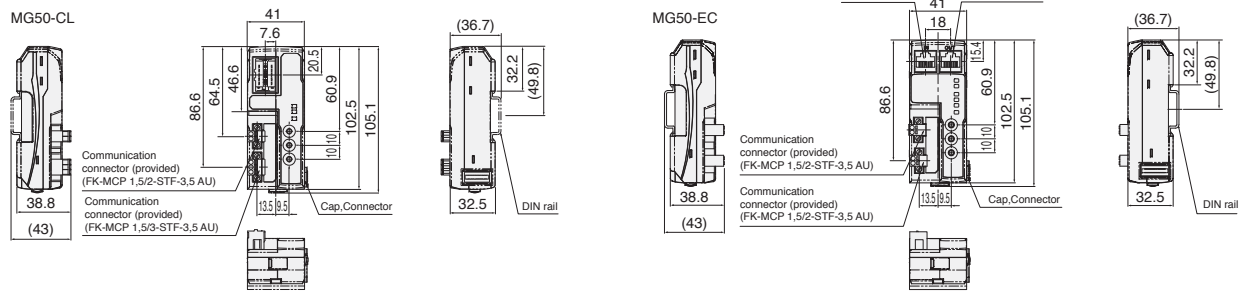
Link cable MZ41-R5(0.5 m), MZ41-01(1 m), MZ41-02(2 m), MZ41-05(5 m), MZ41-10(10 m)

**MG10/20/30**

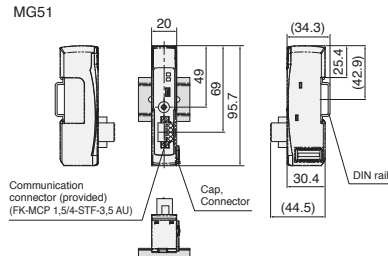
MG10-P1/P2    MG20-DK/DT    MG30-B1/B2



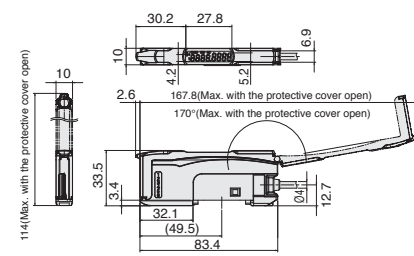
**MG50 Series**



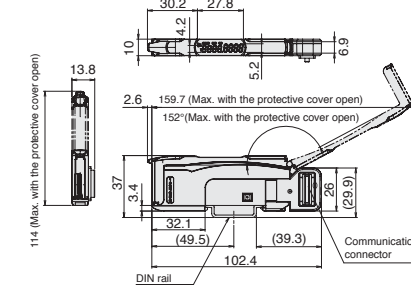
**MG51 series**



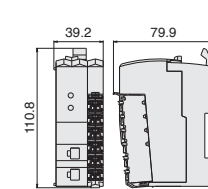
**MF10-P1/P2**



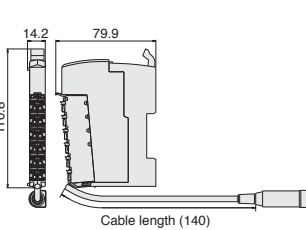
**MF10-CM**



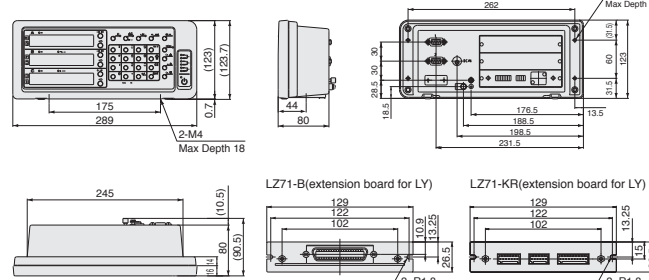
**Main module MG70-EI/MG70-PN**



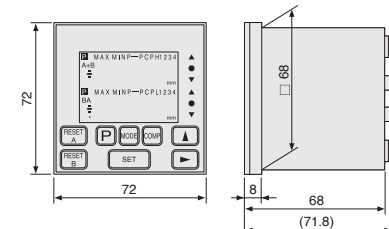
**Counter module MG71-CM**



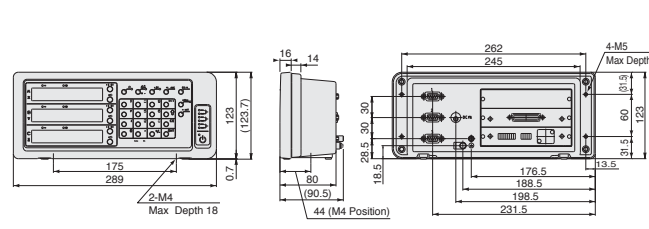
**LY71 series**



**LT30/LT11A/LT10A series**



**LY72 series**

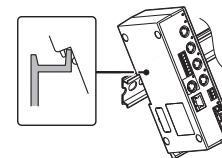


Unit: mm

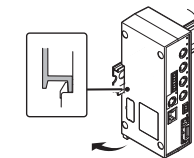
**Mounting of MG10/20/30/41/42 main unit**

The MG series main unit can be mounted to a DIN rail in an electrical panel. Please note that the DIN rail lock is in the "locked" position from the factory. DIN rail specifications: 35mm

1. Match the upper side of groove on the back of the MG41 main unit with the upper side of DIN rail

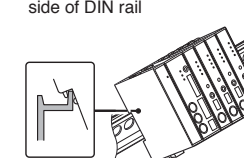


2. Push and install the MG41 main unit until a click is heard so that the lower side of groove on the back of the MG41 main unit is fit into the DIN rail.

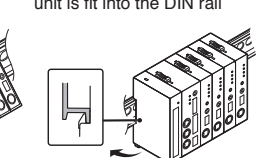


Note: Check that the entire unit is mounted to the DIN rail.

Mounting to DIN rail 1. Match the upper side of groove on the back of the unit with the upper side of DIN rail



2. Push and install the unit until a click is heard so that the lower side of groove on the back of the unit is fit into the DIN rail



**MG50 installation cautions**

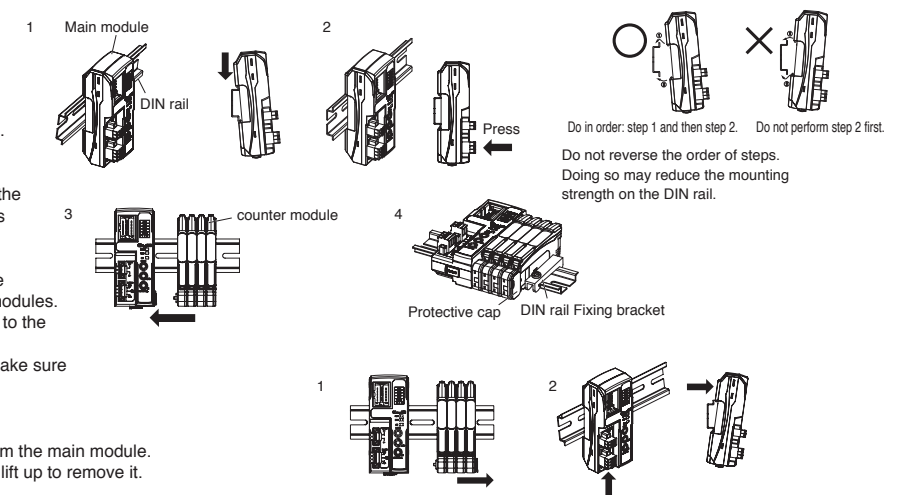
**Installation**

1. Place the top part of the module onto the DIN rail.

2. Press the bottom part of the module onto the DIN rail.

3. Remove the protective cap from the right side of the Main module. Then, slide on the counter module, align the connector with the Main module, and press the modules together until you hear them lock into place.

4. Secure the enclosed DIN rail Fixing brackets onto the ends so that there is no space between them and the modules. Finally, attach the protective cap you removed in step 3 to the Counter module on the far right end. After you have completed above procedure, check to make sure that the MG50-\*\* is mounted securely into place.



**Removal Procedure**

1. Slide the counter modules apart to separate them from the main module.  
2. Press in on the Main module toward the DIN rail and lift up to remove it.

**MG10 installation cautions**

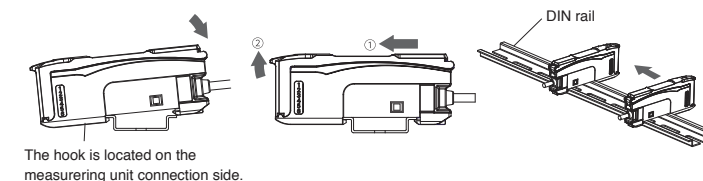
**Mounting on Din rail**

1. Let the hook on the underside of the indicator catch the DIN rail track.  
2. Push the module until the hook clicks into place.

**Removal from DIN rail**

1. Push the module in the direction of arrow 1.  
2. Lift the module in the direction of arrow 2 while performing step (1).

\*Up to 30 digital tolerance indicators can be installed in a row.

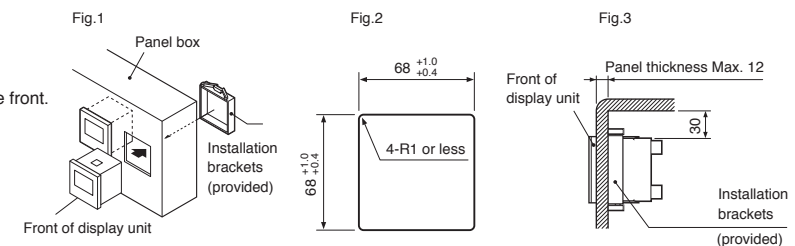


**LT10A/11A/30 installation cautions**

**When mounting in a panel**

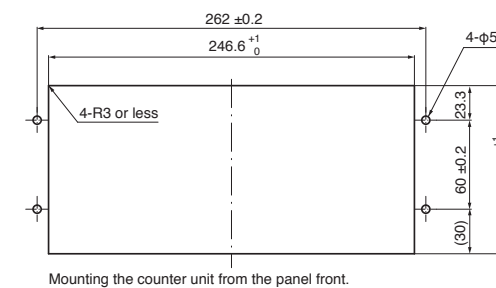
1. Cut out an opening to match the dimensions shown (Fig. 2).  
2. Insert the counter unit into the cut-out opening in the panel from the front.  
3. Attach the supplied counter stopper from the rear.  
4. Press in the counter stopper until it touches the panel.

Note: When attaching the counter stopper to the counter unit, leave enough space (min. 30 mm/1,18") between the top and bottom. (Fig. 3)



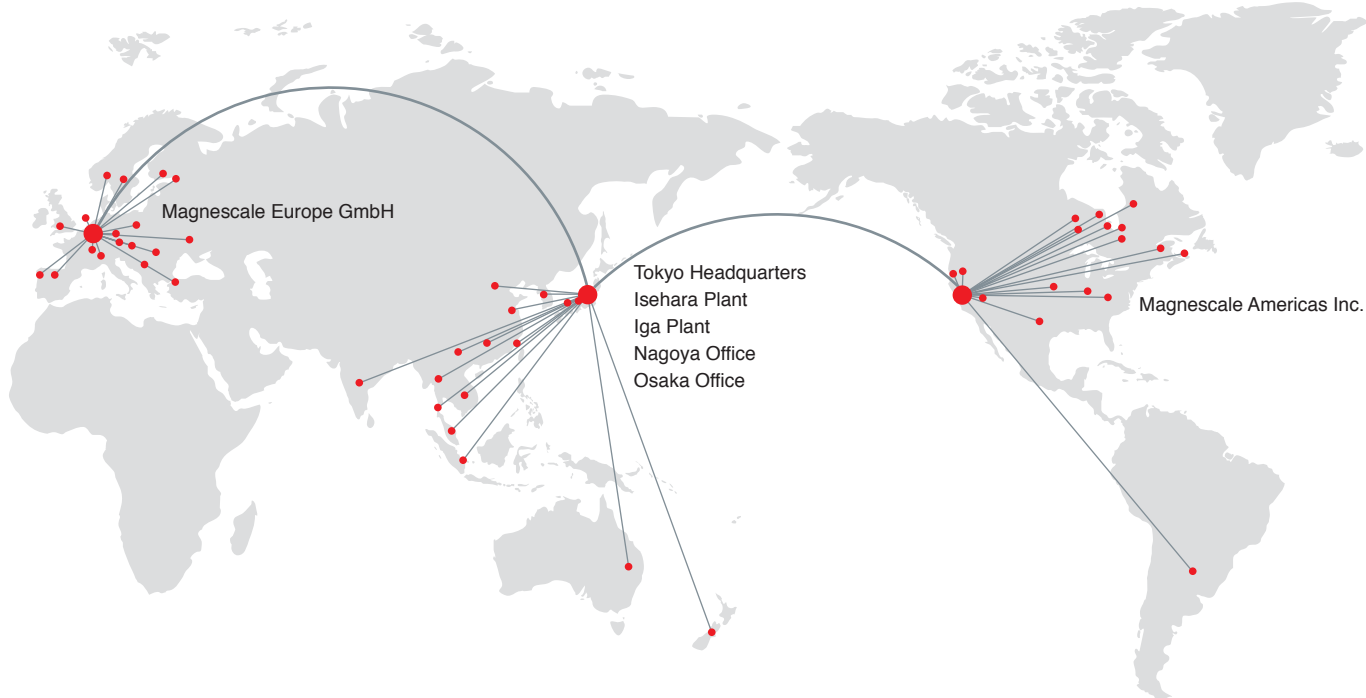
**LY71/72 installation cautions**

**Panel cut-out diagram**



Mounting the counter unit from the panel front.

Unit: mm



Offices

Tokyo Headquarters	3-1-4 Edagawa, Koto-ku, Tokyo 135-0051, Japan TEL:03-6632-7920 FAX:03-6632-7921	Tokyo Office	3-1-4 Edagawa, Koto-ku, Tokyo 135-0051, Japan TEL:03-6632-7922 FAX:03-6632-7928
Isehara Plant	45 Suzukawa, Isehara-shi, Kanagawa 259-1146, Japan TEL:0463-92-1011 FAX:0463-92-1012	Nagoya Office	2-35-16, Meieki, Nakamura-ku, Nagoya-shi, Aichi 450-0002, Japan TEL:052-587-1823 FAX:052-587-1848
Iga Plant	201 Midai, Iga-shi, Mie 519-1414, Japan TEL:0595-45-2663 FAX:0595-45-2683	Osaka Office	2-14-6, Nishi-Nakajima, Yodogawa-ku, Osaka-shi, Osaka 532-0011, Japan TEL:06-6305-3101 FAX:06-6304-6586

Magnescale Americas Inc.	1 Technology Drive, Suite F217 Irvine, CA 92618 USA TEL: +1 (949) 727-4017 FAX: +1 (949) 727-4047	Magnescale Europe GmbH	Antoniusstrasse 14, 73249 Wernau, Germany TEL:+49(0)7153 934 291 FAX:+49(0)7153 934 299
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Agency 34 countries in the world 82 agencies

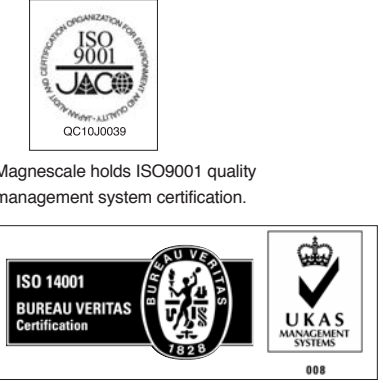
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|--|---|--|---|--|--|
| <p><b>Europe</b></p> <ul style="list-style-type: none"> <li>• Germany</li> <li>• Czech Republic</li> <li>• Finland</li> <li>• Spain</li> <li>• Italy</li> <li>• Norway</li> <li>• Ukraine</li> </ul> | <ul style="list-style-type: none"> <li>• Portugal</li> <li>• Romania</li> <li>• United Kingdom</li> <li>• Sweden</li> <li>• Bulgaria</li> <li>• Denmark</li> <li>• France, 2 companies</li> </ul> | <ul style="list-style-type: none"> <li>• Hungary</li> <li>• Nederland</li> <li>• Poland</li> <li>• Turkey, 2 companies</li> <li>• Switzerland</li> <li>• Austria, 2 companies</li> </ul> | <p><b>Asia · Oceania</b></p> <ul style="list-style-type: none"> <li>• China, 3 companies</li> <li>• Hong Kong</li> <li>• Taiwan</li> <li>• Korea</li> <li>• Vietnam, 2 companies</li> <li>• Indonesia, 2 companies</li> </ul> | <ul style="list-style-type: none"> <li>• Singapore</li> <li>• Australia</li> <li>• Thailand, 2 companies</li> <li>• Malaysia</li> <li>• India, 2 companies</li> <li>• Philippine</li> <li>• New Zealand</li> </ul> | <p><b>America</b></p> <ul style="list-style-type: none"> <li>• America, 33 companies</li> <li>• Mexico, 3 companies</li> <li>• Canada, 3 companies</li> <li>• Argentina</li> </ul> |
|--|---|--|---|--|--|

Magnescale has established a comprehensive support system enabling us to provide superior products. We offer a wide range of sales and servicing support for Magnescale products and technologies throughout Japan.

Deploying a global-standard production system, from quality control to environmental protection, Magnescale is thoroughly committed to delivering high-precision products.



We have established a total quality control system that oversees our processes from design to manufacture, ensuring that we are able to supply products with an unwaveringly high level of safety, quality, and reliability, offering our customers 100% satisfaction. As one example, we obtained certification for length calibration that is compliant with the system of traceability stipulated by Japan's Measurement Act. In addition to this, we have obtained ISO9001 certification, enabling us to create a quality management system that satisfies our customers' needs. We are also responding to the problem of noise, which is a subject of regulation throughout the world, by introducing electromagnetic environment compatibility (EMC) testing equipment of the highest standard, focusing all of our energies on quality management.



Always aware that our products are incorporated in a wide range of devices and used throughout the world, we have obtained certification in CE Marking, UL, and other international standards.

We comply with the following standards:

- CE Marking (EMC Directive) EMI : EN61000-6-4 EMS : EN61000-6-2
- FCC standard FCC Part 15 Subpart B Class A

In the case of products with built-in AC power supplies, we also comply with the following standards:  
● UL61010-1 ● EN61010-1

In the case of products that use lasers, we comply with the following standards:  
● DHHS(21CFR1040.10) ● IEC60825-1

\*When using a device to which IEC Directive EN60204-1 (Safety of machinery) applies, please use the device only after taking steps to comply with the standard.  
\*Depending on the product, applicable standards may differ, or the product may not be certified. Please inquire before purchase if considering export, etc.



# Magnescale

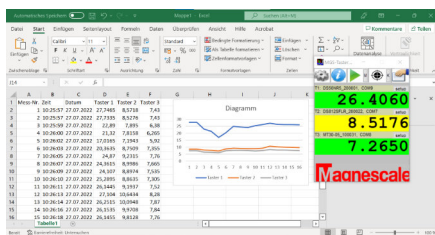
SPEED X PRECISION

## USB DIGITAL GAUGE

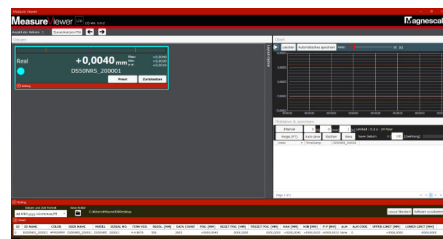
DS800S series  
DS10/25/50/100 series  
DT series + MT30



MGSE USB SOFTWARE



MEASURE VIEWER LIGHT



Magnescale Co., Ltd.

Model name	DS805S□□R / DS812S□□R	DS805S□□R5 / DS812S□□R5	DS830SLR
Measuring range	DS805S: 5mm	DS812S: 12mm	30mm
Maximum resolution	0.1μm	0.5μm	0.1μm
Accuracy (at 20°)	1μm	1.5μm	1.5μm
Measuring force (at 20°C)	Upward	DS805S: 0.35 ± 0.25N DS812S: 0.40 ± 0.30N*1 DS812VR/DS812SVR5: 0.60 ± 0.50N*2	0.50 ± 0.35N
	Horizontal	DS805S: 0.40 ± 0.25N DS812S: 0.50 ± 0.30N*1 DS812VR/DS812SVR5: 0.70 ± 0.50N*2	0.60 ± 0.35N
	Downward	DS805S: 0.45 ± 0.25N DS812S: 0.60 ± 0.30N*1 DS812VR/DS812SVR5: 0.80 ± 0.50N*2	0.70 ± 0.35N
Reference point	Position at spindle movement of 1mm		
Protection grade (cable and interpolator box not included)	IP67		IP53/IP67*3
Vibration resistance	100m/s <sup>2</sup> (20Hz to 2kHz)		
Impact resistance	1,000m <sup>2</sup> (11ms)		
Operating temperature	0 to 50°C (No condensation)		
Storage temperature	-20 to 60°C (90% RH or less)		
Power supply	5V DC ± 5%		
Power consumption	120mA max.		
Mass (Probe)	Approximately 30g	Approximately 70g	
Cable length	Gauge ⇒ Interpolator: 2m Interpolator ⇒ USB: 0.5m		
Feeler	Carbide ball tip with M2.5 thread	Steel ball tip with M2.5 thread	Carbide ball tip with M2.5 thread
Accessory	Instruction manual, tightening nut, clamp spanner, wave washer, hose elbow, spanner		Instruction manual, spanner
Communication Interface	USB2.0FS		
Recommended system specifications	CPU: Intel Core i3 or higher RAM: 1GB or more OS: Windows 7, Windows 10 (32bit/64bit)		

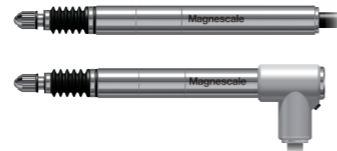
Model name: DS 8 0 5 S □ □ R □  
DS 8 1 2 S □ □ R □

【Resolution / Accuracy】  
No symbol: Resolution 0.1μm  
Accuracy 1μm  
5: Resolution 0.5μm  
Accuracy 1.5μm

【Structure】  
No symbol: Straight  
L: Right angle  
F: Flange  
FL: Flange right angle  
V: Pneumatic push (DS812S model only)

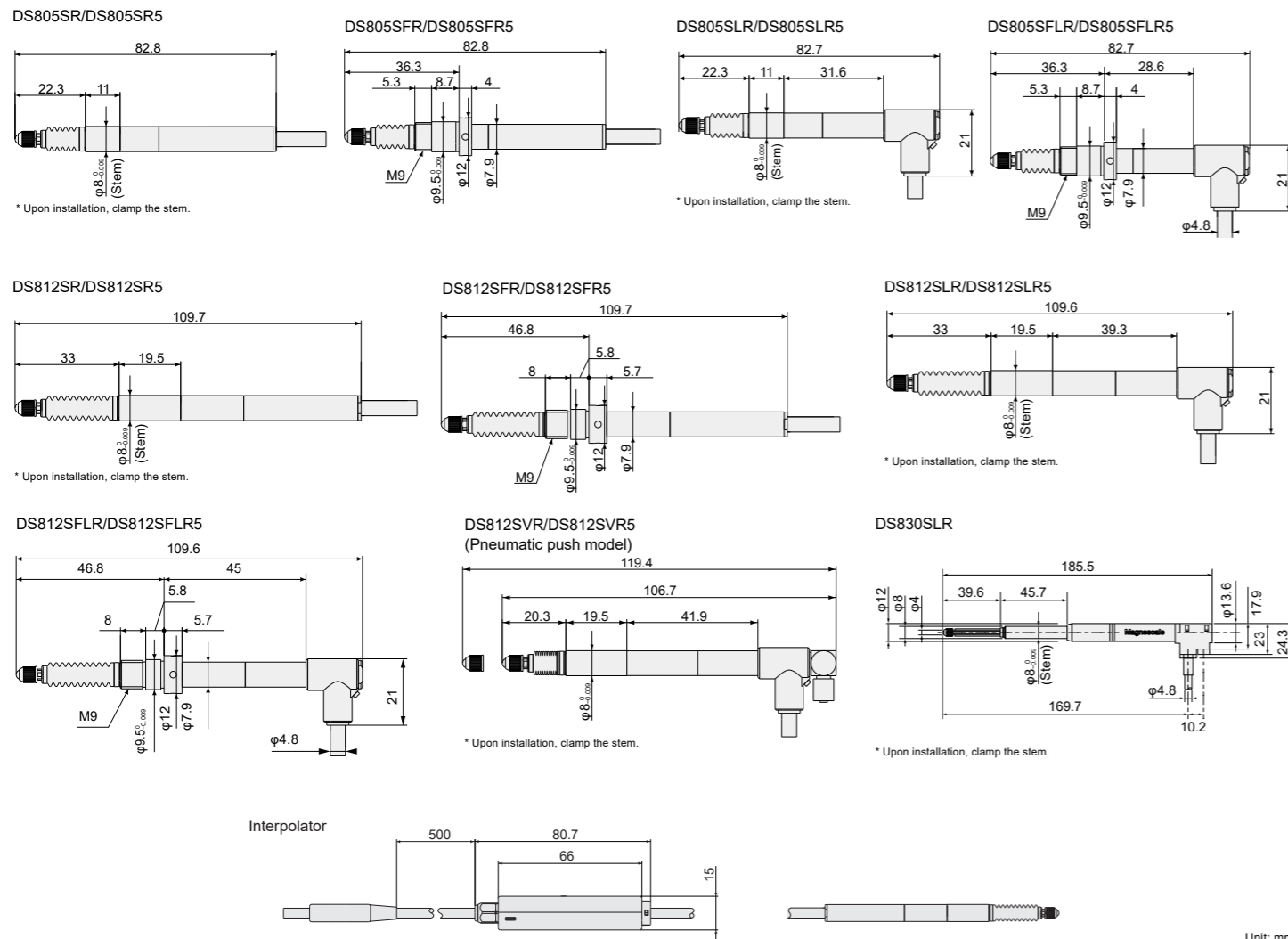
【Ball spline model】

【Measuring range】  
05 : 5mm  
12 : 12mm



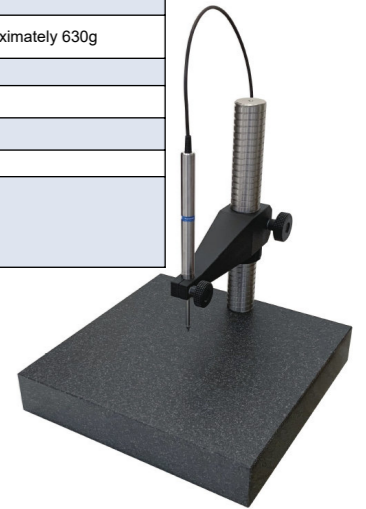
\*1 Except SVR/SVR5 \*2 When air pressure in 0.055Mpa  
\*3 When bellow set (optional accessory) is mounted

Dimensions

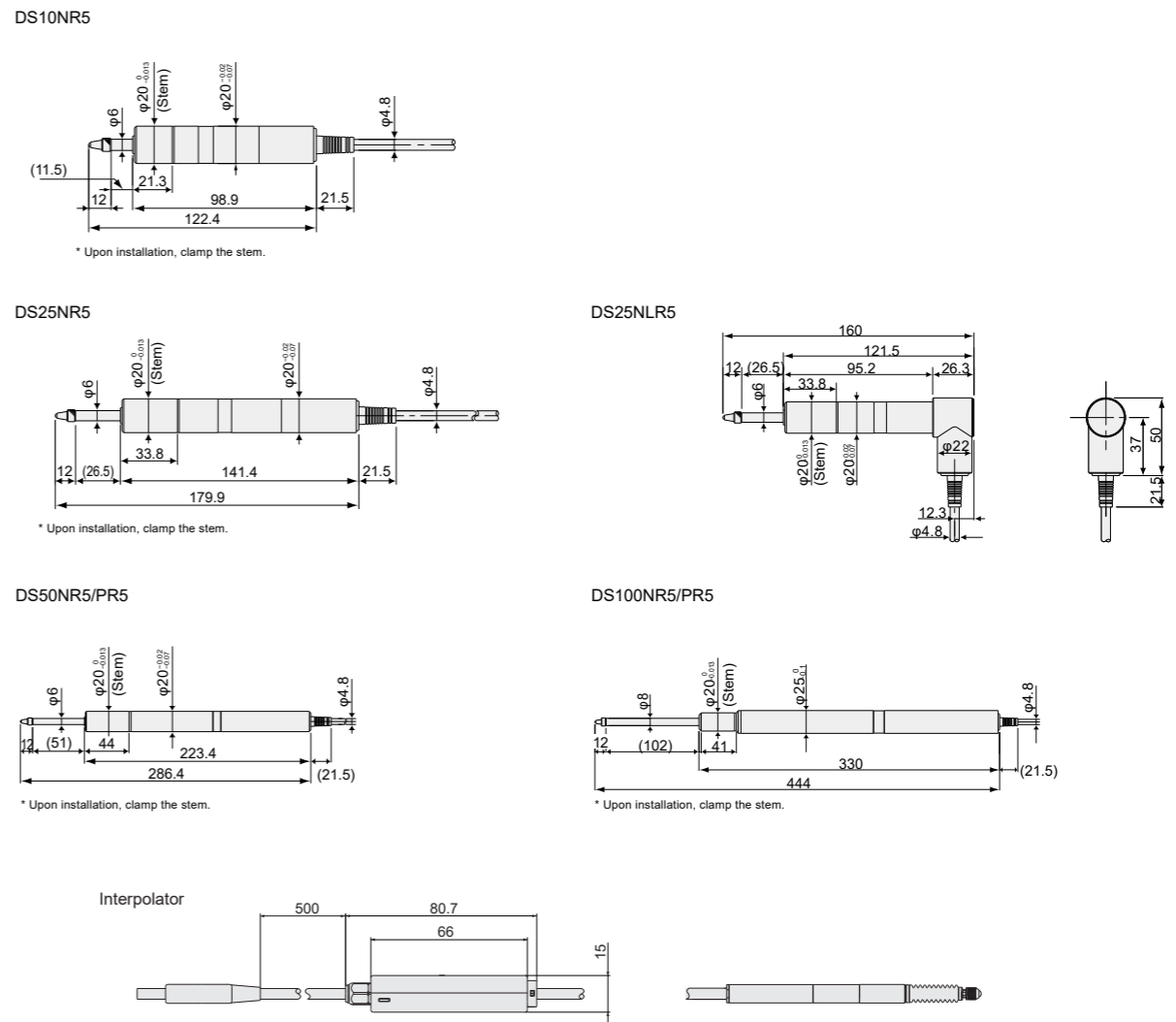


Unit: mm

Model name	DS10NR5	DS25NR5	DS25NLR5	DS50NR5	DS50PR5	DS100NR5	DS100PR5
Measuring range	10mm	25mm		50mm		100mm	
Maximum resolution	0.5μm						
Accuracy (at 20°)	3μm		4μm		5μm		
Measuring force (at 20°C)	Upward	0.30 ± 0.25N	0.40 ± 0.30N	-	6.20N or less	-	9.30N or less
	Horizontal	0.60 ± 0.30N	0.70 ± 0.35N	0.90 ± 0.40N		1.80 ± 0.65N	
	Downward	0.80 ± 0.35N	1.00 ± 0.40N	1.30 ± 0.50N		2.70 ± 0.55N	
Reference point	Position at spindle movement of 1mm						
Protection grade (cable and interpolator box not included)	IP50				IP64	IP50	IP64
Vibration resistance	150m/s <sup>2</sup> (10Hz to 2kHz)						
Impact resistance	1,500m <sup>2</sup> (11ms)						
Operating temperature	0 to 50°C (No condensation)						
Storage temperature	-20 to 60°C (90% RH or less)						
Power supply	5V DC ± 5%						
Power consumption	120mA max.						
Mass (Probe)	Approximately 230g	Approximately 300g	Approximately 360g	Approximately 630g			
Cable length	Gauge ⇒ Interpolator: 2m Interpolator ⇒ USB: 0.5m						
Feeler	Carbide ball tip with M2.5 thread						
Accessory	Instruction manual						
Communication Interface	USB2.0FS						
Recommended system specifications	CPU: Intel Core i3 or higher RAM: 1GB or more OS: Windows 7, Windows 10 (32bit/64bit)						



Dimensions



Unit: mm

Model name	DT512N	DT512P	DT12N	DT12P	DT32N	DT32NV	DT32P	DT32PV	
Measuring range	12mm				32mm				
Maximum resolution	1µm				5µm				
Accuracy (at 20°)	6µm				10µm				
Measuring force (at 20°C)	Upward	0.70 ± 0.50N	1.70N or less	0.70 ± 0.50N	1.70N or less	1.10 ± 0.80N		2.90N or less	9.00N or less
	Horizontal	0.80 ± 0.50N		0.80 ± 0.50N		1.30 ± 0.80N			
	Downward	0.90 ± 0.50N		0.90 ± 0.50N		1.50 ± 0.80N			
Maximum response speed	Depending on unit to be connected								
Reference point	None								
Spindle drive system	Spring push-out				Pneumatic push		Spring push-out		Pneumatic push
Protection grade (connector not included)	-	IP64 or equivalent	-	IP64 or equivalent	-	IP64 or equivalent			
Operating temperature	0 to 50°C								
Storage temperature	-10 to 60°C								
Power supply	5V DC ± 5%*1								
Power consumption	120mA max.*1								
Mass (Probe)	Approximately 75g	Approximately 80g	Approximately 75g	Approximately 80g	Approximately 120g	Approximately 140g	Approximately 120g	Approximately 140g	
Cable length	2m								
Feeler	Steel ball tip with M2.5 thread								
Accessory	Instruction manual								

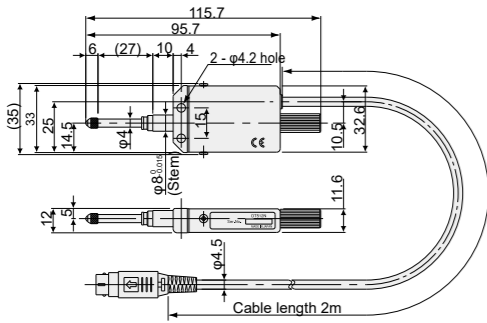
\*1 When connected to USB with MT30

The DT series can be directly connected to USB with MT30 adapter



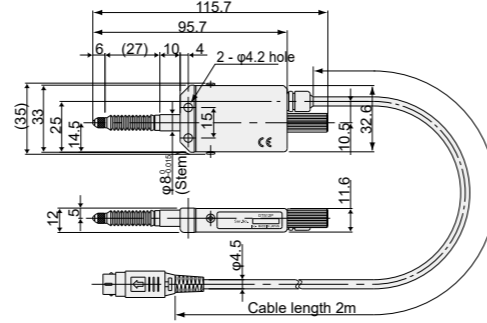
Dimensions

DT512N/12N



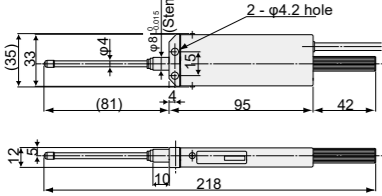
\* Upon installation, clamp the stem.

DT512P/12P



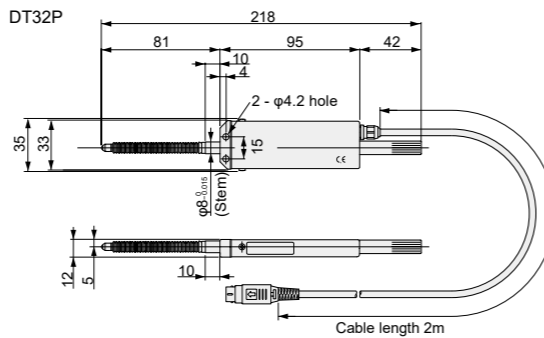
\* Upon installation, clamp the stem.

DT32N

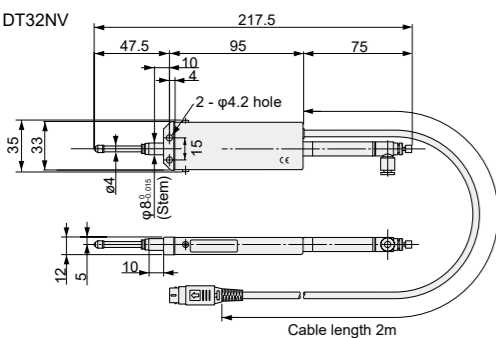


\* Upon installation, clamp the stem.

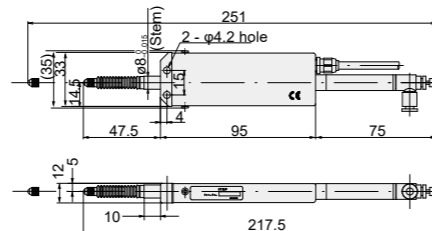
DT32P



DT32NV



DT32PV



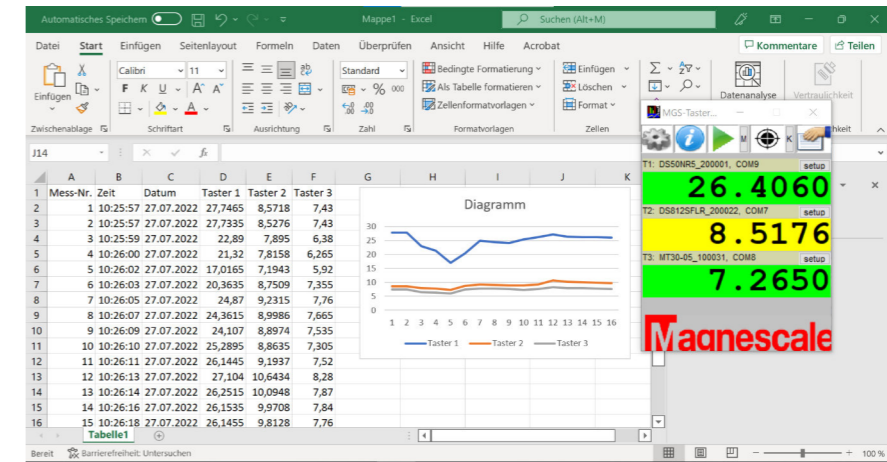
\* Upon installation, clamp the stem.

Unit: mm

Easy to use MGSE USB software

- Up to 8 gauges can be connected
- Actual measurement values
- Calibration function
- Preset
- Scaling function
- Threshold and warning threshold displayed in different colours (green, yellow, red)
- Trigger of measurement possible with external switch (e.g. foot switch, CNC)
- Measurement values can be saved in Excel or CSV format
- Compatible with Windows XP, 7, 8 and 10

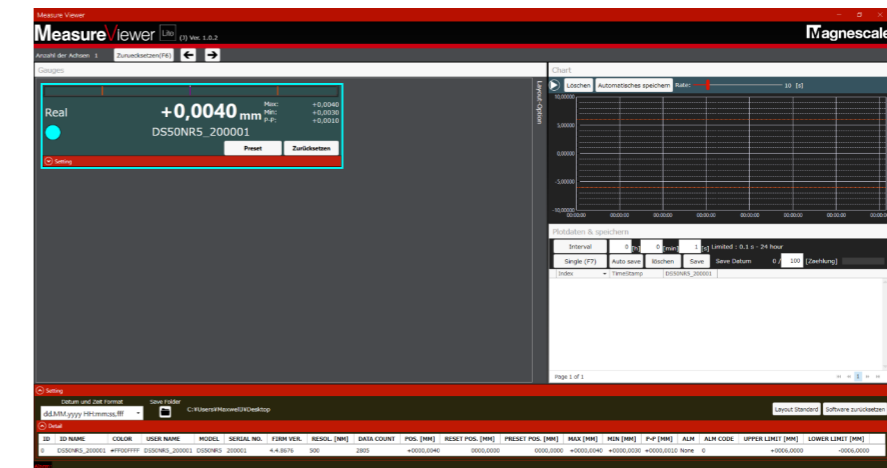
Free of cost



MeasureViewer Light

- Up to 16 gauges can be connected
- Actual measurement values
- Counting direction can be changed
- Reset, preset
- 2 steps of threshold and warning threshold displayed in different colours (blue, red)
- Measurement values can be saved in CSV format
- Japanese, English and German are available
- Recommended operating environment of Windows 7 and 10


Free of cost



Several software driver compatible: Labview, C++, C#, Visual Basic

# Magnescale

SPEED X PRECISION

 Safety Precautions: To use this product safely, please read the instruction manual carefully prior to usage. • Magnescale reserves the right to change product specifications without prior notice.

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The contents of this literature are as of October 2022

# Magnescale

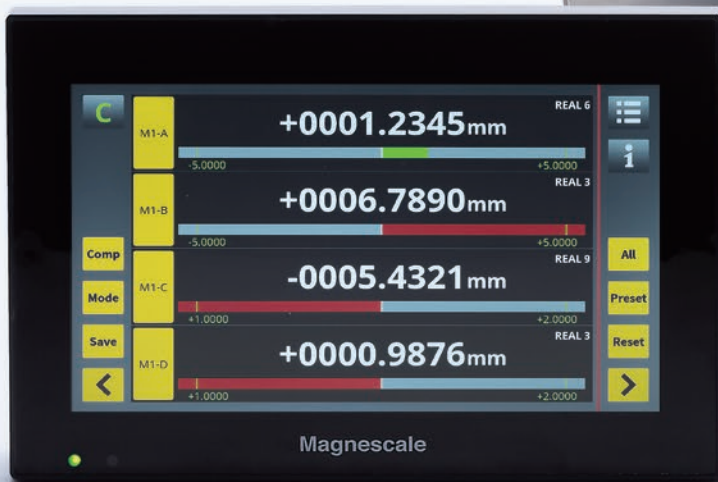
SPEED X PRECISION

## Next generation high speed data acquisition system

> **LT80** | Intelligent multi measurement station

> **MG80**

> **LZ80** series



### Clear and easy to use HMI functions

- 7-inch touch screen LCD display (1024x600)
- Displays I/O status, add/sub results and measurement modes (Current value, Min, Max, P-P)
- Multilingual support (Japanese/English/German/Italian/Spanish/French)
- Key-lock feature to prevent accidental operation

### Expandable multi-axis measurement module system

- Connect up to 32 Magnescale DK- or DT-series gauges (via MT adaptor)
- Wide variety of measurement applications with multiple I/O functions
- Allows for defective part identification, trend management, part sorting and tolerance judgement by 2 or 4 stage comparator function
- Add/subtract operations and scaling functions allow real-time calculation of measured values

### 3 different interfaces allow for data transfer and parameter setting

- Data is transferred to PC via Ethernet
- Data storing and Parameter writing in SD card/USB flash drive
- Data can be automatically saved to USB or SD card via custom LT80 settings or by PLC I/O commands.

### Flexible installation

- LT80 available with panel mount or VESA-compatible display stand
- DIN rail mount for easy installation (MG80 and LZ80)
- 20m maximum between MG80 modules and LT80 display via Ethernet cable

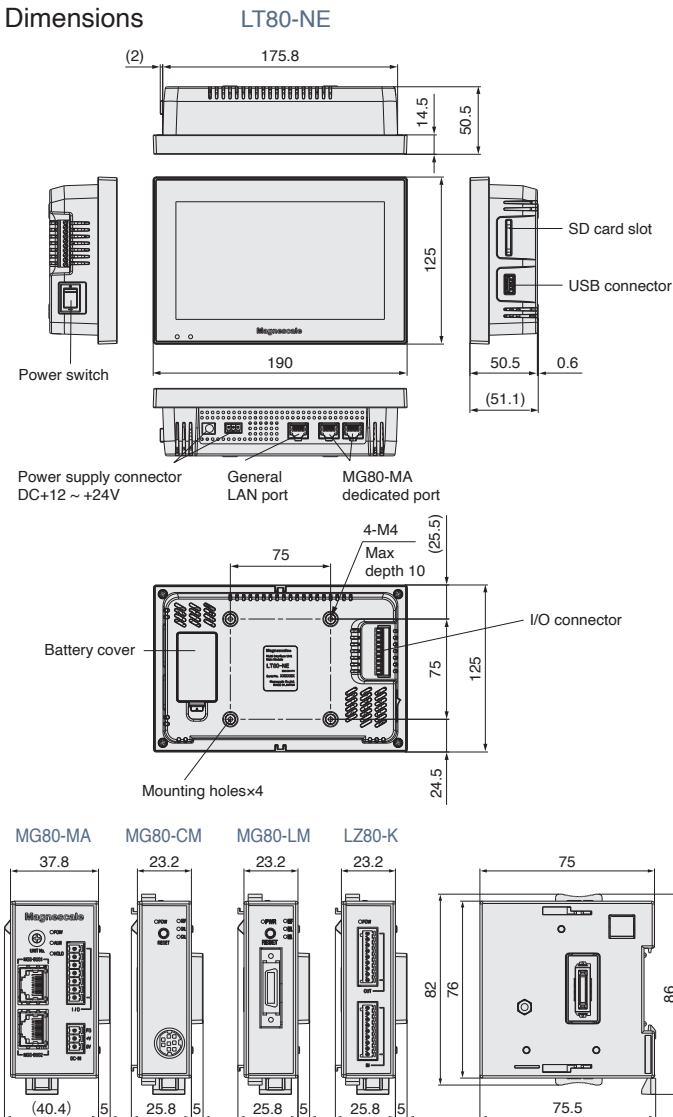
Magnescale Co., Ltd.

# Main specifications

Display unit	LT80-NE	
Power consumption	14W or less	
Maximum connectable units	4 units of MG80-MA <sup>*1</sup>	
Measurement screen	Measurement display	Display measurement values of 2, 4, 8 or 16 axis, Alarm display, Comparator group, Measurement mode, Measurement bar graph, Reset, Preset
	I/O information	I/O condition monitoring (All I/O of device and module)
Setting menu	Measuring unit setting	Resolution, direction, with or without reference point connected to MG80-CM
	Display setting	Resolution display, number of axes to display (2, 4, 8, or 16 axes)
	Measurement mode	Measurement mode setting of each axis (current, MAX, MIN, P-P)
	Comparator value setting	8 groups with 2 stages, or 8 groups with 4 stages per axis Default setting of each axis
	I/O setting	I/O function assignments of LT80-NE, I/O function assignments of connected LZ80-K, Reference point detection, Reset, Preset, Comparator output, Alarm, Reference point passed, Each channel address, Change measurement mode, Saving measurement data
	Calculation	Maximum of 16 combinations of add/subtract calculations per MG80-MA module, Scaling function
Maintenance display	Main body information, Service usage (Software update for LT80 and MG80)	
System port command (using LAN port)	LT80 operation from PC (setting, measurement operation, data acquisition)	

<sup>\*1</sup> When using LINK function of MG80-MA dedicated port and MG80-MA

## Dimensions



Main module	MG80-MA1/MG80-MA2
Power consumption	2.4W or less
Maximum connectable units	(16) MG80-CM, (2) LZ80-K <sup>*1</sup>
I/O	7-pole connector Photo coupler insulated 4 input, 1 output MG80-MA1: Current Sink MG80-MA2: Current Source
Interface connector	For data: RJ45 x 2 (shielding compatible)
Communication protocol	100BASE-TX
Transmission speed	100 Mbit/s
Maximum cable length	20m (CAT5e shielding type recommended <sup>*2</sup> )
Setting menu	Rotary switch for setting unit number

<sup>\*1</sup> Per each MG80-MA1/MA2. Total system maximum: (4) MG80-MA1/MA2, (32) MG80-CM, (8) LZ80-K  
<sup>\*2</sup> Communication cables not included

Counter module	MG80-CM
Power consumption	2.0W or less (Measuring unit excluded)
Compatible measuring units	DK series, DT series (via MT)
Alarm	Frequency response exceeded, Measuring unit not connected, Broken connection

I/O module	LZ80-K1/LZ80-K2
Power consumption	2.0W or less
I/O	9-pole connector x 2 Photo coupler insulated 8 input, 8 output LZ80-K1: Current Sink LZ80-K2: Current Source

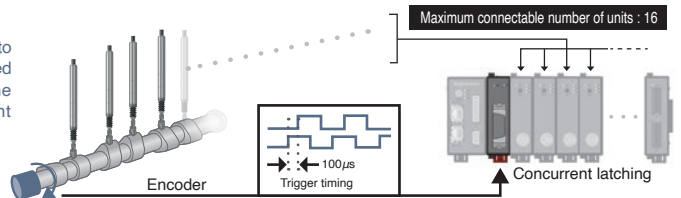
Latch module	MG80-LM
Power consumption	2.0W or less (Not including encoder)
Data latch interval	100 μs (Measurement data acquisition only) 400 μs (All functions can be used, including reference operation, arithmetic function, comparator function, MAX, MIN, P-P, etc.)
Encoder signal input	A/B/Reference point Voltage differential type line receiver (EIA-422 compliant)
A/B signal input minimum phase difference	50 ns
Power supply for connected encoder	DC5V 500mA (Max)
Alarm	Input response frequency exceeded, encoder not connected, cable disconnection.

LT80/MG80/LZ80	
Supply voltage	DC10.8 ~ 26.4V
Operating temperature/humidity range	0 ~ +50°C (No condensation)
Storage temperature/humidity range	-20 ~ +60°C (20 ~ 90%RH)

## Latch module MG80-LM

By connecting the A/B/Z signals of a rotary or linear encoder<sup>\*1</sup> to the latch module, the LT80 measurement values can be acquired by the timing of the encoder signal (trigger), and stored in the LT80 for up to 16 axes. This enables dynamic measurement based on the rotation angle or travel distance.

<sup>\*1</sup> We have confirmed the operation with Magnescale encoders. For connection to other manufacturers' encoders, please contact our sales department.



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LT80-EA02C  
C.2105.CB.500

# Magnescale

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RS-232C and Ethernet  
interface modules

# MG80-SC

PLC link function allows communication with  
multiple PLC brands with no programming



Bi-directional data  
transfer via RS-232C

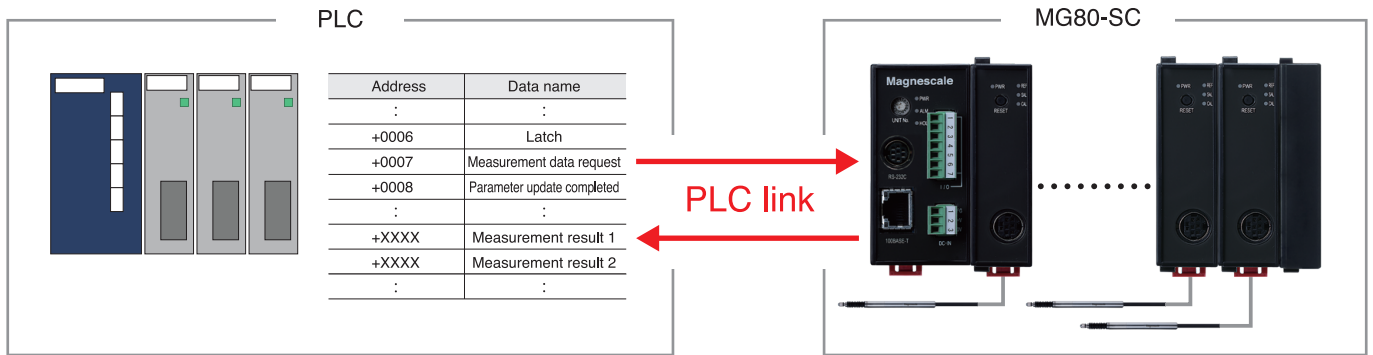
Connect up to 16 Magnescale  
DK- or DT-series gauges



Magnescale Co., Ltd.

## ■ PLC link

By connecting the PLC to the MG80-SC via RS-232C or Ethernet, data can be transferred without PLC programming. Compatible with PLCs manufactured by Mitsubishi Electric, OMRON and Keyence.



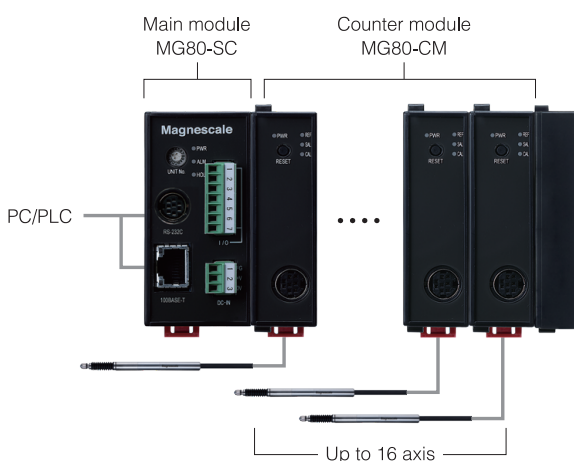
## ■ Main specifications

Main module	MG80-SC1/MG80-SC2
Communication protocol	RS-232C (2,400bit/s to 230,400bit/s) Ethernet(100BASE-TX : 100Mbit/s)
Function	Resolution selection (0.1 to 10 μm) reference point setting / reset / preset / master preset / current value maximum value, minimum value, P-P value output of each axis / comparator function (Up to 2 or 4 steps can be set) / PLC link*1
Maximum connectable counter modules	Up to 16 MG80-CM can be connected (MG80-SC+MG80-CM x16)
Mounting method	35 mm DIN rail mounting
Power supply voltage	DC 10.8 to 26.4 V
Power consumption	2.4 W or less
Maximum communication cable length	RS-232C : 15m*2 Ethernet : 20m(shielded CAT5e LAN cable recommended*3)

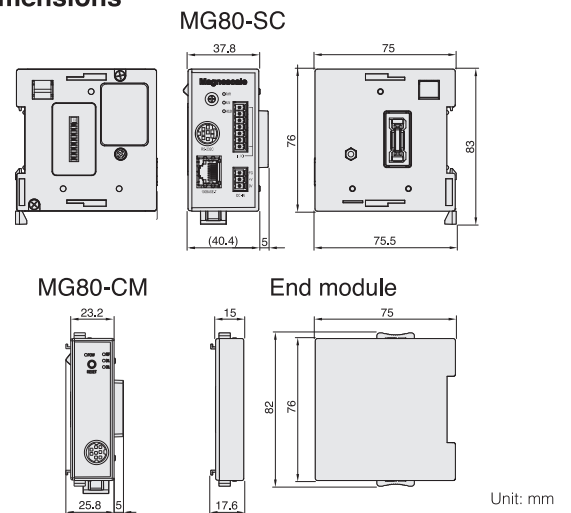
\*1 Refer to the connection manual for compatible PLCs. \*2 Please use DZ252 (sold separately) for RS-232C communication cable. \*3 Ethernet communication cables not included.

Counter module	MG80-CM
Power consumption	2.0 W or less (Measuring unit excluded)
Compatible measuring units	DK series, DT series (via MT)
Alarm	Frequency response exceeded, Measuring unit not connected, Cable breakage

## ■ System overview



## ■ Dimensions



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MG80-SC-EA01C  
C.2105.CB.500



Ethernet-based network interface

# MG80-NE/EI/PN/EC

High-speed processing (400 $\mu$ s) of all axis values and calculations. Perfect for quick cycle times and dynamic measurement.



## Main specifications

Main module	MG80-NE	MG80-EI	MG80-PN	MG80-EC
Communication protocol	Ethernet (TCP/IP) 100BASE-TX	EtherNet/IP	PROFINET	EtherCAT
Function	Resolution selection (0.1 to 10 $\mu$ m), reference point setting, reset, preset, master preset, current value / maximum value / minimum value / P-P value output of each axis, calculation function (2-axis addition and subtraction), comparator function (Up to 8 sets of 2 or 4 steps can be set)			
Transmission speed	100 Mbit/s			
Maximum connectable counter modules	Up to 16 MG80-CM can be connected to each MG80-NE. This enables an overall configuration of up to 64 modules by linked connection.	Up to 16 MG80-CM can be connected to each MG80-EI or MG80-PN. Link up to 255 units via fieldbus IP address configuration.	Up to 16 MG80-CM can be connected to each MG80-EC. Link up to 65,535 units via fieldbus IP address configuration.	
Mounting method	35 mm DIN rail mounting			
Power supply voltage	DC 10.8 to 26.4 V			
Power consumption	2.4 W or less			
Maximum cable length*	20 m (shielded CAT5e LAN cable recommended)			

\*The customer must provide the communication cables.

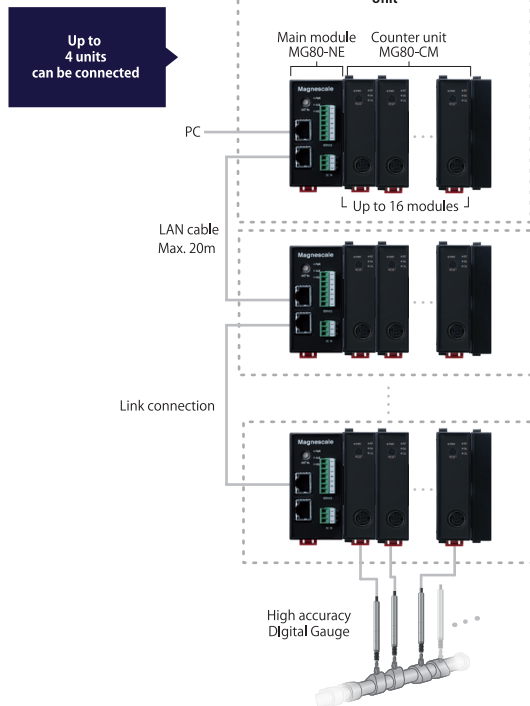
Counter module	MG80-CM
Power consumption	2.0 W or less (Measuring unit excluded)
Compatible measuring units	DK series, DT series (via MT)
Alarm	Frequency response exceeded, Measuring unit not connected, Cable breakage

I/O module (Option)*	LZ80-K1/LZ80-K2
Power consumption	2.0 W or less
I/O	9-pole connector $\times$ 2 Photo coupler insulated 8 input, 8 output LZ80-K1: Current Sink LZ80-K2: Current Source

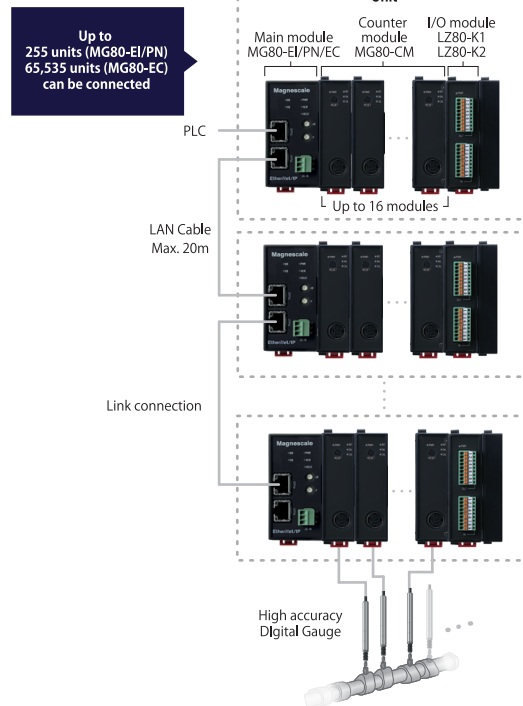
\* Cannot connect to MG80-NE

## System overview

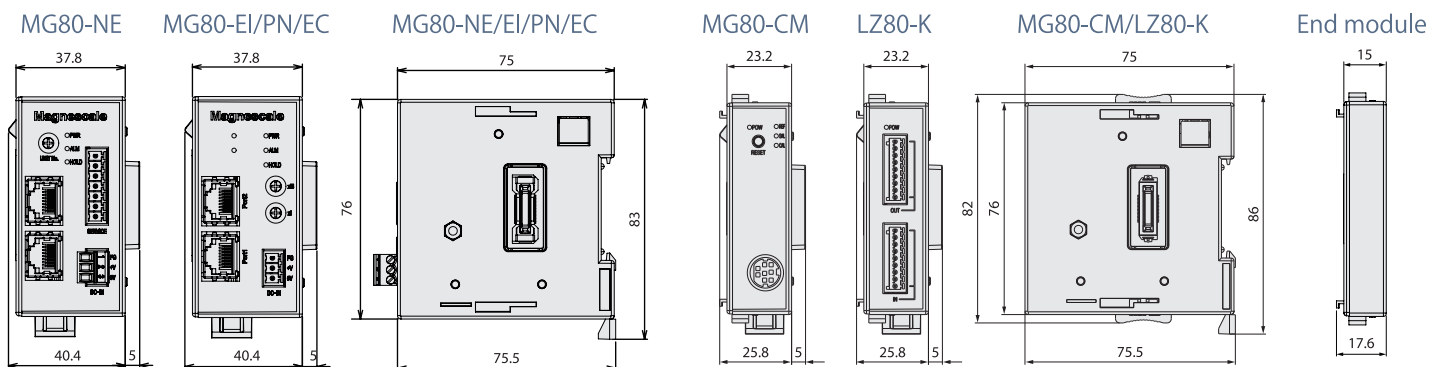
### MG80-NE



### MG80-EI/PN/EC



## Dimensions



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MG80-NE/EI/PN/EC-EA02M M.2107

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SPEED X PRECISION



## Feedback Scale

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MGS-FB-1812-EN-C

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# Blessing of the Earth



**Absolute Magnescale**

A compass using geomagnetism will guide you across the sea even during conditions of zero visibility in dense fog or in a storm with giant waves. Similarly, Magnescale uses magnetic technology to provide precise positioning even in severely harsh environments such as oil, coolant, and condensation in machine tools. Magnescale is jam-packed with state-of-the-art technologies, from precise magnetic recording and detection technology to advanced arithmetic processing technology and beyond. And, it's these cutting-edge technologies that are supporting the next generation of global manufacturing.

Beyond to **N**ext **S**tage

Advanced technology supports the evolution of high precision and resistance to harsh environments. Magnescale continues its endless evolution to develop scales with the high precision and durability demanded by machine tool applications.

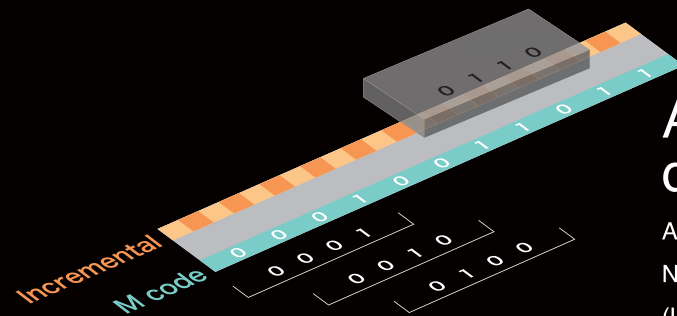
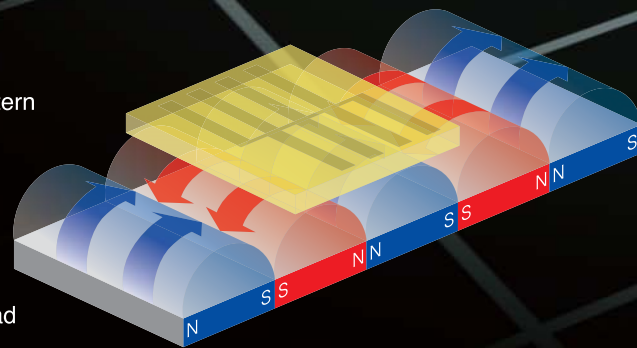
Born from advanced magnetic technology, Magnescale scales utilize a magnetic based operating principle which makes them resistant to oil and condensation inherent to machine tools, thus enabling consistently stable and precise position detection.

## Principle

### Detection principle

A thin-film MR element with a high-precision, low-distortion pattern arrangement is used as the detecting element.

The resistance value of the MR element changes when the magnetic field acting on the element changes due to an alteration in the relative positions between the element and the magnetic media. This change in resistance value is read electronically to detect the amount of positional change.

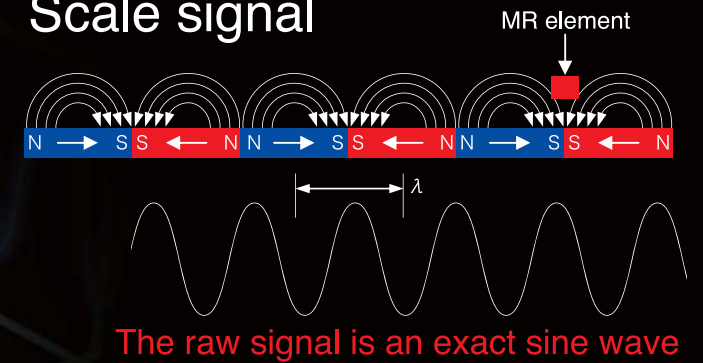


### Absolute position detection system

Adopts the 2-track M-code system.  
Number of M-code bits: Up to 18 bits  
(Left figure: Example of 4-bit codes)

## Stability

### Scale signal



### MR element

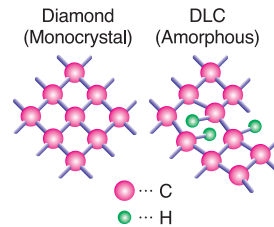
The MR element uses a special pattern to enable stable signal detection with high precision.

The patented detecting head pattern incorporates various technologies that help to achieve a high-precision signal, such as the following:

- 1) Harmonic distortion components are removed from the detected signal.
- 2) Stable signal output can be obtained over the entire effective length.
- 3) Stable signal output can be obtained with respect to temperature variation.



# Resistance to Harsh Environments

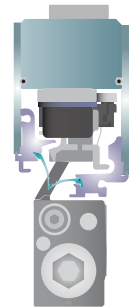


## Protective structure

A diamond-like carbon (DLC) film is formed on the surface of the detecting head (the surface facing the magnetic scale) as a protective film. The detecting head is securely protected against both mechanical and environmental factors by multiple layers of protective film, which includes the DLC film (the world's first patent pending protective DLC film to be used on a MR element surface).

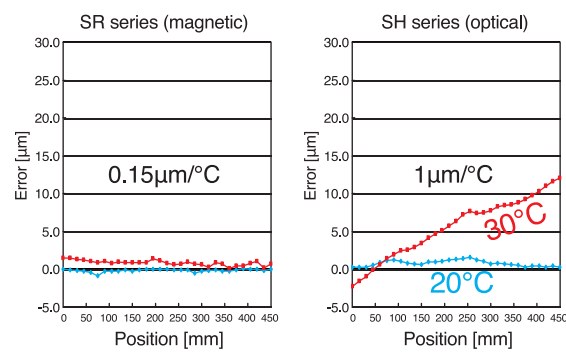
**Impact resistance of 450 m/s<sup>2</sup>,  
vibration resistance of 250 m/s<sup>2</sup>**

Magnescale primarily uses ferrous materials to protect the detector, thereby realizing high vibration and impact resistance characteristics. Furthermore, the SR67A series employs multi-point connection construction and a highly rigid case to achieve top class vibration and impact resistance.



## Thermal expansion

Magnescales' have the same linear expansion coefficient as that of cast iron used for the structure of general machine tools. Therefore, the scales exhibit the same thermal behavior as the equipment in which they are installed. This is evident in maintaining extremely stable positioning even in environments where the temperature is constantly changing. Due to the design structure of the SR series scales, they can be installed in close contact with the equipment while still achieving high positioning accuracy despite large temperature fluctuations.



## Resistance to condensation and oil

Magnescale employs a magnetic detection principle that is resistant to the effects of condensation and oil inherent to machine tools. This principle allows for the achievement of high positioning accuracy even in severe environments.

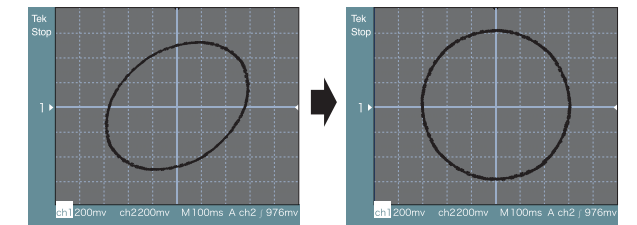


# High Precision

## Advanced arithmetic processing technology

Use of an arithmetic processing circuit, based on original technology, achieves a higher interpolation accuracy.

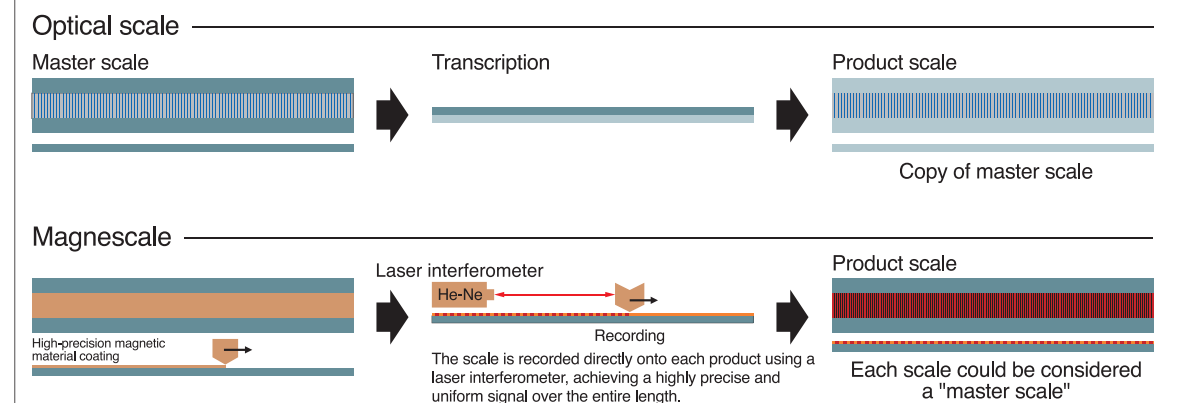
Example of multi-arithmetic processing circuit.



# High resolution

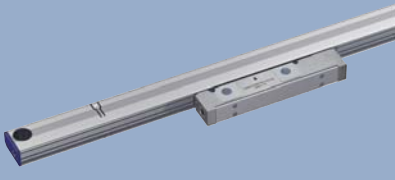
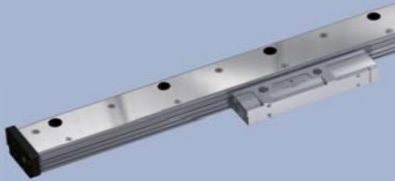


High performance processing allows for resolutions down to 5nm and 1nm.\*

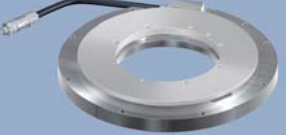
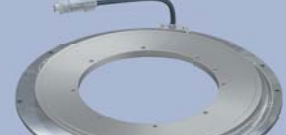


## Scale recording method



\*For resolution of 1nm(0.001μm), please contact our sales department.

# Lineup

	Communication system	Type/model name		Output signal	Compatible controllers	Effective length	Maximum resolution	Accuracy	Maximum response speed	Protective design grade	Page	
Linear encoder	ABS (Absolute)	Slim type <b>SR27A</b>		Absolute serial bidirectional signal Compliant with EIA-485 / DRIVE-CLiQ	FANUC Mitsubishi Electric SIEMENS	70 to 2,040 mm	0.005μm (0.001μm is available*)	(3+3L/1,000) μmp-p or (5+5L/1,000) μmp-p L:Effective length(mm)	200m/min	IP54 (Air purge not included) IP65 (Air purge included)	P10•11	
		Robust type <b>SR67A</b>		Absolute serial bidirectional signal Compliant with EIA-485 / DRIVE-CLiQ	FANUC Mitsubishi Electric SIEMENS	140 to 3,640 mm	0.005μm (0.001μm is available*)	(3+3L/1,000) μmp-p or (5+5L/1,000) μmp-p L:Effective length(mm)	200m/min	IP54 (Air purge not included) IP65 (Air purge included)	P12•13	
	INC (Incremental)	Slim type <b>SR74</b>		A/B/Reference point Line driver signal Compliant with EIA-422	-	-	70 to 2,040 mm	0.05μm	(3+3L/1,000) μmp-p or (5+5L/1,000) μmp-p L:Effective length(mm)	50m/min (Resolution: 0.1 μm, Minimum phase difference: at 50 ns)	IP54 (Air purge not included) IP65 (Air purge included)	P14•15
		Robust type <b>SR84</b>		A/B/Reference point Line driver signal Compliant with EIA-422	-	-	140 to 3,040 mm	0.05μm	(3+3L/1,000) μmp-p or (5+5L/1,000) μmp-p L:Effective length(mm)	50m/min (Resolution: 0.1 μm, Minimum phase difference: at 50 ns)	IP54 (Air purge not included) IP65 (Air purge included)	P16•17

	Communication system	Type/model name		Output signal	Compatible controllers	Through hole diameter	Maximum resolution	Accuracy	Maximum response speed	Protective design grade	Page
Angle encoder	ABS (Absolute)	Exposed type <b>RS97-1024E</b>		Absolute serial bidirectional signal Compliant with EIA-485 / DRIVE-CLiQ	FANUC Mitsubishi Electric SIEMENS	φ96mm	23 bit (8,388,608 pulse/revolution)	±2.5"	5,000min <sup>-1</sup>	IP65	P18•19
		Exposed type <b>RS97-1024N</b>		Absolute serial bidirectional signal Compliant with EIA-485 / DRIVE-CLiQ	FANUC Mitsubishi Electric SIEMENS	φ180mm	23 bit (8,388,608 pulse/revolution)	±2.5"	5,000min <sup>-1</sup>	IP65	P20•21
		Enclosed type <b>RU97-2048</b>		Compliant with DRIVE-CLiQ	SIEMENS	A: φ20mm B: φ22mm	25 bit (33,554,432 pulse/revolution)	±2.5"	2,000min <sup>-1</sup> (Maximum mechanical revolutions: 3,000min <sup>-1</sup> )	IP65	P22•23
		Enclosed type <b>RU77-4096</b>		Absolute serial bidirectional signal Compliant with EIA-485	FANUC Mitsubishi Electric Yaskawa Electric	φ20mm	25 bit (33,554,432 pulse/revolution)	±2.5"	2,000min <sup>-1</sup> (Maximum mechanical revolutions: 3,000min <sup>-1</sup> )	IP65	P24•25

\*For resolution of 1nm(0.001μm), please contact our sales department. \*Magnescale reserves the right to change product specifications without prior notice.

Absolute linear encoder

Slim type

# SR27A

- Slim type allows installation in narrow spaces
- Magnetic system enables use even in environments with condensation, oil, and other adverse conditions
- Supports the communication protocol of each supporting manufacturer
- Same thermal expansion as iron

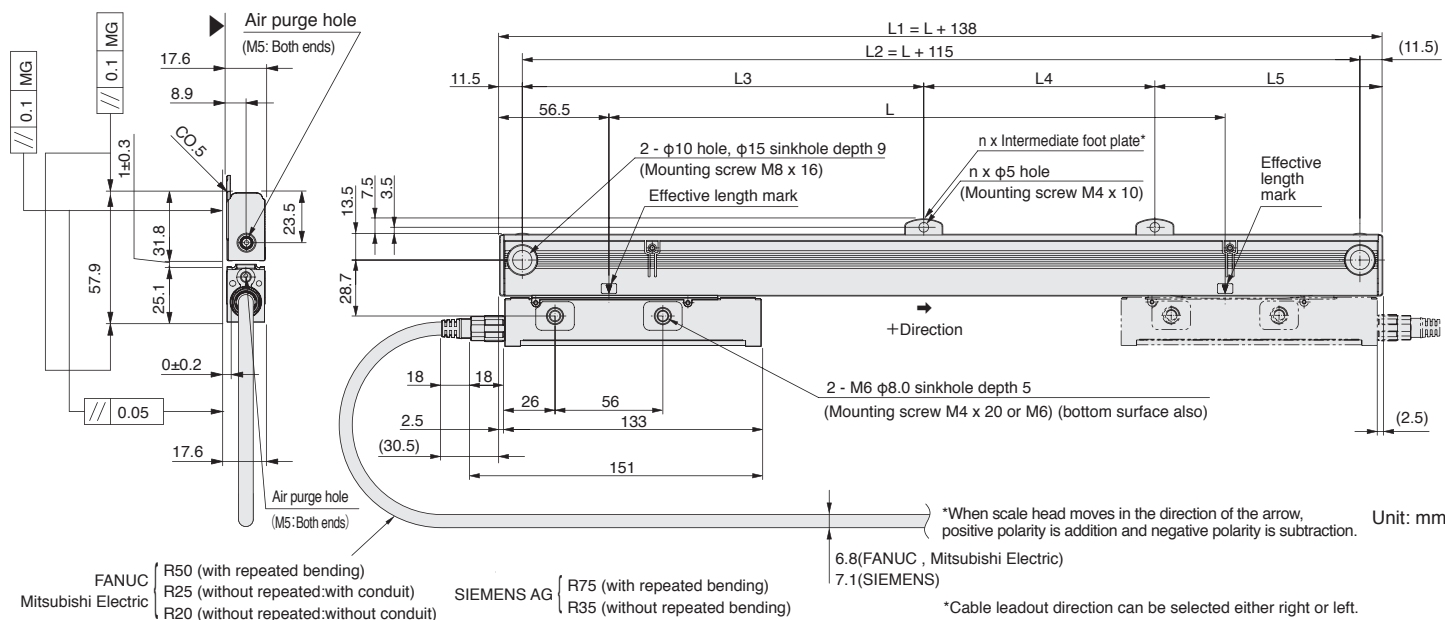


FANUC

Mitsubishi Electric

SIEMENS

## Dimensions



Effective length	Total length	Mounting pitch					Number of intermediate foot plates
		L1	L2	L3	L4	L5	
L	L1	L2	L3	L4	L5	n	
70	208	185	-	-	-	0	
120	258	235	-	-	-	0	
170	308	285	-	-	-	0	
220	358	335	-	-	-	0	
270	408	385	-	-	-	0	
320	458	435	-	-	-	0	
370	508	485	-	-	-	0	
420	558	535	-	-	-	0	
470	608	585	-	-	-	0	
520	658	635	-	-	-	0	
570	708	685	-	-	-	0	
620	758	735	-	-	-	0	
670	808	785	392.5	-	392.5	1	
720	858	835	417.5	-	417.5	1	

Effective length	Total length	Mounting pitch					Number of intermediate foot plates
		L1	L2	L3	L4	L5	
L	L1	L2	L3	L4	L5	n	
770	908	885	442.5	-	442.5	1	
820	958	935	467.5	-	467.5	1	
920	1,058	1,035	517.5	-	517.5	1	
1,020	1,158	1,135	567.5	-	567.5	1	
1,140	1,278	1,255	627.5	-	627.5	1	
1,240	1,378	1,355	677.5	-	677.5	1	
1,340	1,478	1,455	727.5	-	727.5	1	
1,440	1,578	1,555	777.5	-	777.5	1	
1,540	1,678	1,655	827.5	-	827.5	1	
1,640	1,778	1,755	877.5	-	877.5	1	
1,740	1,878	1,855	927.5	-	927.5	1	
1,840	1,978	1,955	977.5	-	977.5	1	
2,040	2,178	2,155	1,027.5	-	1,027.5	1	

MG: Machine guide \* Intermediate foot plate: One location when L ≥ 670 mm, two locations when L ≥ 1440 mm

- Notes**
- The surface indicated by the ▲ marks is the installation surface.
  - Screws indicated in the diagram are supplied as standard accessories.
  - Movement outside the effective length (L) will damage the scale head. It is recommended that the mechanical movable length (stroke) be set to 10 mm or more to the inside of both ends of the effective length (L).

## Specifications

Model name	SR27A - xxx□□AX	SR27A - xxx□□BX SR27A - xxx□□DX	SR27A - xxx□□ZY
Effective length (L: mm)	70 - 2,040		
Thermal expansion coefficient	12±1 × 10 <sup>-6</sup> /°C		
Accuracy(at 20°C)	(3+3L/1,000) μm-p or (5+5L/1,000) μm-p, L: Effective length (mm)		
Reference point	Center, or user-selected position (Set at factory shipping)	Fixed to center	Fixed to 10 mm from left end of effective length
Output signal	Absolute serial bidirectional signal, compliant with EIA-485		Compliant with DRIVE-CLiQ
Compatible controllers	FANUC α/ai interface compatible	Mitsubishi Electric	SIEMENS AG
Resolution	Selectable from 0.001*, 0.005, 0.01, 0.05, 0.1, 0.5 and 1 μm (Factory set)	Selectable from 0.001*, 0.005, 0.01, 0.05 and 0.1 μm (Factory set)	Selectable from 0.001*, 0.005 and 0.01 μm (Factory set)
Maximum response speed	200 m/min		
Functional safety	Please consult with each controller manufacturer regarding support for functional safety.		EN ISO13849-1:2008 Cat.3 EN 62061:2005 / IEC 61508:2010 EN61800-5-2:2007
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2		
Operating temperature range	0 to +50°C		
Storage temperature range	-20 to +55°C		
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 3,000 Hz)		
Impact resistance	350 m/s <sup>2</sup> (11 ms)		
Protective design grade	IP54 (Air purge not included), IP65 (Air purge included)		
Power supply voltage range	DC+4.75 to +5.25 V		DC+17 to +30.8 V
Maximum power consumption	1.3W or less (4.75V or 5.25V)		1.75W or less (17V) 1.9W or less (30.8V)
Consumption current	250mA (5V) (when the controller is connected)		75mA (24V) (when the controller is connected)
Mass	Approx. 0.39kg + 1.53kg/m or less		
Compatible cables (types without relay connectors) Maximum cable length	CH23-***NVF 13 m	CH23-***NVM 13 m	CH22-***NSMY 30 m
Compatible cables (types with relay connectors) Maximum cable length	CH23-***NVK + CH23-***NPFA 30 m	CH23-***NVK + CH23-***NPMA 30 m	CH22-***NSMF + CH22-***NSFY 30 m

\*For resolution of 1nm(0.001μm), please contact our sales department. \*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

Scale

SR27A - xxx□□△#

[xxx]Effective length (cm)

[□]Accuracy grade

Type	Accuracy grade
A	(5+5L/1,000) μm-p
S	(3+3L/1,000) μm-p

L: Effective length(mm)

[□]Resolution and direction (μm)

Type	Direction	Resolution	Type	Direction	Resolution
S		0.005	T		0.005
A		0.01	F		0.01
B	+	0.05	G	-	0.05
C		0.1	H		0.1
D		0.5	J		0.5
E		1	K		1

SIEMENS AG: S, A  
Mitsubishi Electric: S, A, B, C  
FANUC: S, A, B, C, D, E, T, F, G, H, I, J, K

[△]Communication protocol

Type	NC manufacturer	Remarks
A	FANUC	α/ai interface
B	Mitsubishi Electric	2-wire
D	Mitsubishi Electric	4-wire
Z	SIEMENS AG	DRIVE-CLiQ

SIEMENS AG: Y only  
Mitsubishi Electric, FANUC: X only  
\* Please consult our representative separately for arbitrary positions.

[#]Reference point position

Type	Reference point position
X	Center
Y	Fixed to 10mm from left end of effective length

Cables

CH22 - □□□□▽※#

[▽]Cable sheath (covering)

Type	Cable specification
S	PU (Polyurethane, Siemens Motion connect 800+)

[※]Scale side connector

Type	Specification	Remarks
M	Scale head connector	Standard
F	M12 connector (Female) made by Phoenix Contact	Relay/Waterproofing
E	M12 connector (Female) with panel mount relay made by Phoenix Contact	Relay/Waterproofing/Attached connector

[#]Controller side connector

Type	Specification	Remarks
None	Open-end	Standard
Y	RJ45 connector made by YAMAICHI ELECTRONICS	Adopts NC machine tool
Z	RJ45 connector (water proof) made by YAMAICHI ELECTRONICS	Relay
F	M12 connector (Male) made by Phoenix Contact	Relay/Waterproofing

CH23 - □□□□▽※#

[□□□]Cable length

Type	Cable length
010	1.5m
005	0.5m
065	6.5m
100	10m

[□]Conduit specification

Type	Conduit specification
C	With conduit (standard)
N	Without conduit

[▽]Cable sheath

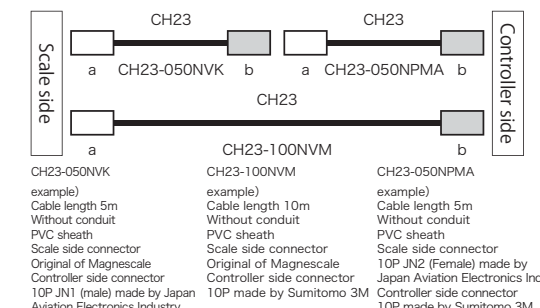
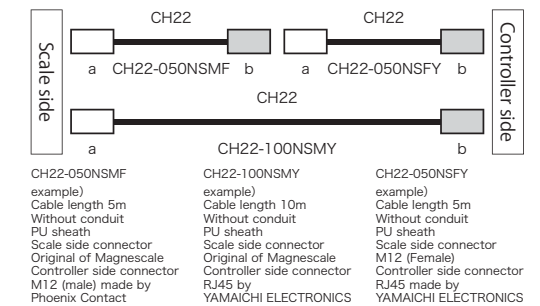
Type	Cable specification
V	PVC(Φ6.8)[Scale side]
P	PVC(Φ8)[Controller side]
E	PU(Φ8)[Controller side]

[※]Controller side connector

Type	Specification	Remarks
Without	Earth wire	
Z	Open-end	Scale side connector should be 10P JN2 (Female) made by Japan Aviation Electronics Industry or 2P made by TAJIMI ELECTRONICS
None		Standard
M	10P made by Sumitomo 3M	Mitsubishi NC, J3 (INC serial, ABS)
F	20P straight case made by Honda Tsushin Kogyo	FANUC (INC serial, ABS)
J	Horizontal drawing case made by HIROSE Electric	FANUC (INC serial, ABS)
K	10P JN1 (Male) made by Japan Aviation Electronics Industry	Relay
N	12P R04 (Male) made by TAJIMI ELECTRONICS	Relay (fixed)

[#]Scale side connector

Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P R04-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)



SR27A  
SR67A  
SR7A  
SR8A  
RS97-02A/E  
RS97-02A/N  
RU97-20A8  
RU77-4098



Absolute linear encoder  
Robust type

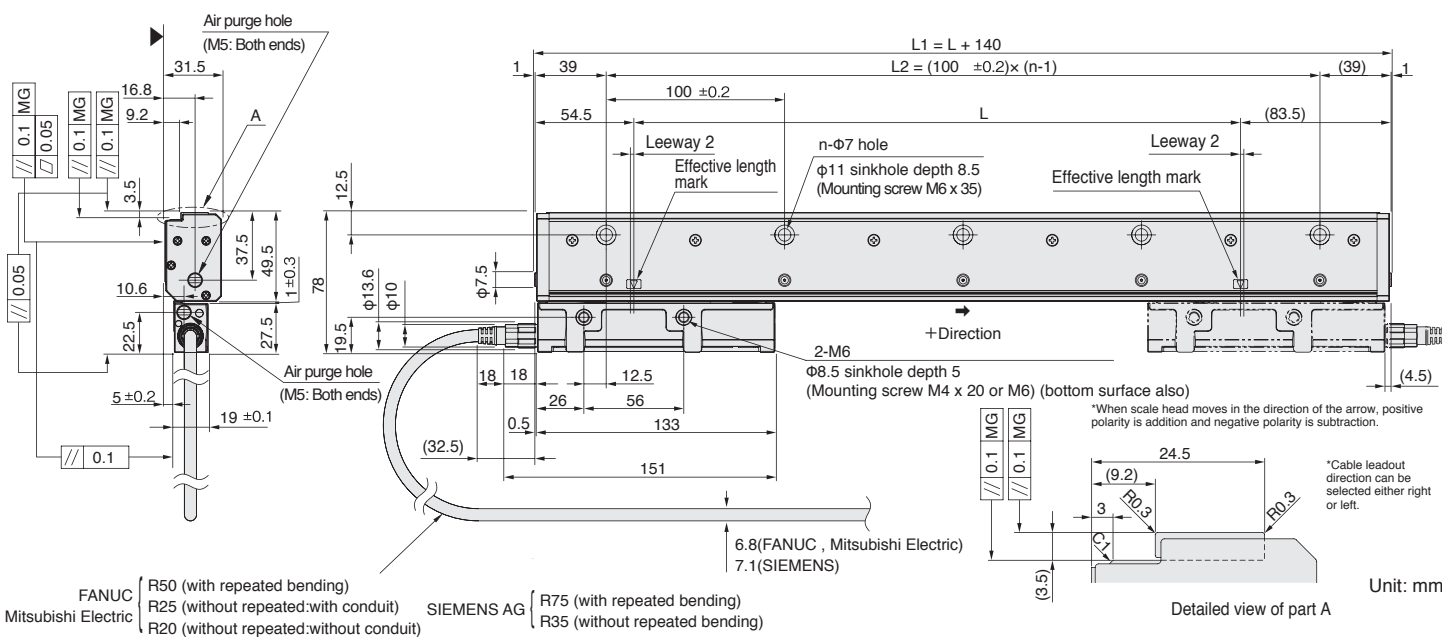
# SR67A

- High rigidity provides resistance to shock and vibration
- Magnetic system allows use even in environments with condensation, oil, and other adverse conditions
- Enables direct communication using the protocol of each supporting manufacturer without the requirement of an amplifier
- Same thermal expansion as iron



FANUC Mitsubishi Electric SIEMENS

## Dimensions



Effective length	Total length	L2	n
L	L1		
140	280	200	3
240	380	300	4
340	480	400	5
440	580	500	6
540	680	600	7
640	780	700	8
740	880	800	9
840	980	900	10
940	1,080	1,000	11
1,040	1,180	1,100	12
1,140	1,280	1,200	13
1,240	1,380	1,300	14
1,340	1,480	1,400	15
1,440	1,580	1,500	16

Effective length	Total length	L2	n
L	L1		
1,540	1,680	1,600	17
1,640	1,780	1,700	18
1,740	1,880	1,800	19
1,840	1,980	1,900	20
2,040	2,180	2,100	22
2,240	2,380	2,300	24
2,440	2,580	2,500	26
2,640	2,780	2,700	28
2,840	2,980	2,900	30
3,040	3,180	3,100	32
3,240	3,380	3,300	34
3,440	3,580	3,500	36
3,640	3,780	3,700	38

MG: Machine guide

**Notes**

- The surface indicated by the ▲ marks is the installation surface.
- Movement outside the effective length (L) will damage the scale head. It is recommended that the mechanical movable length (stroke) be set to 10 mm or more to the inside of both ends of the effective length (L).

## Specifications

Model name	SR67A - xxx□□AX	SR67A - xxx□□BX SR67A - xxx□□DX	SR67A - xxx□□AZY
Effective length (L: mm)	140 - 3,640		
Thermal expansion coefficient	12±1 × 10 <sup>-6</sup> /°C		
Accuracy (at 20°C)	(3+3L/1,000) μm-p (effective length 140 to 3,040 mm) or (5+5L/1,000) μm-p (effective length 140 to 3,640 mm), L: Effective length (mm)		
Reference point	Center, or user-selected position (Set at factory shipping)	Fixed to center	Fixed to 10 mm from left end of effective length
Output signal	Absolute serial bidirectional signal, compliant with EIA-485		Compliant with DRIVE-CLiQ
Compatible controllers	FANUC α/ai interface compatible	Mitsubishi Electric	SIEMENS AG
Resolution	Selectable from 0.001*, 0.005, 0.01, 0.05, 0.1, 0.5 and 1 μm (Factory set)	Selectable from 0.001*, 0.005, 0.01, 0.05 and 0.1 μm (Factory set)	Selectable from 0.001*, 0.005 and 0.01 μm (Factory set)
Maximum response speed	200 m/min		
Functional safety	Please consult with each controller manufacturer regarding support for functional safety.		EN ISO13849-1:2008 Cat.3 EN 62061:2005 / IEC 61508:2010 EN61800-5-2:2007
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2		
Operating temperature range	0 to +50°C		
Storage temperature range	-20 to +55°C		
Vibration resistance	250 m/s <sup>2</sup> (50 Hz to 3,000 Hz)		
Impact resistance	450 m/s <sup>2</sup> (11 ms)		
Protective design grade	IP54 (Air purge not included), IP65 (Air purge included)		
Power supply voltage range	DC+4.75 to +5.25 V		DC+17 to +30.8 V
Maximum consumption current	1.3W or less (4.75V or 5.25V)		1.75W or less (17V) 1.9W or less (30.8V)
Consumption current	250mA (5V) (when the controller is connected)		75mA (24V) (when the controller is connected)
Mass	Approx. 0.9kg+ 5.2kg/m or less		
Compatible cables (types without relay connectors) Maximum cable length	CH23-***NVF 13 m	CH23-***NVM 13 m	CH22-***NSMY 30 m
Compatible cables (types with relay connectors) Maximum cable length	CH23-***NVK + CH23-***NPFA 30 m	CH23-***NVK + CH23-***NPMA 30 m	CH22-***NSMF + CH22-***NSFY 30 m

\*For resolution of 1nm(0.001μm), please contact our sales department. \*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

**Scale**  
SR67A - xxx□□△#

[xxx]Effective length (cm)  
 [□□]Resolution and direction (μm)  
 [△]Communication protocol  
 [#]Reference point position

**Accuracy grade**

Type	Accuracy grade
A	(5+5L/1,000)μm-p
S	(3+3L/1,000)μm-p

L: Effective length (mm)

**Resolution and direction**

Type	Direction	Resolution	Type	Direction	Resolution
S		0.005	T		0.005
A		0.01	F		0.01
B	+	0.05	G	-	0.05
C		0.1	H		0.1
D		0.5	J		0.5
E		1	K		1

SIEMENS AG: S, A  
Mitsubishi Electric: S, A, B, C  
FANUC: S, A, B, C, D, E, T, F, G, H, I, J, K

**Communication protocol**

Type	NC manufacture	Remarks
A	FANUC	α/ai interface
B	Mitsubishi Electric	2-wire
D	Mitsubishi Electric	4-wire
Z	SIEMENS AG	DRIVE-CLiQ

SIEMENS AG: Y only  
Mitsubishi Electric, FANUC: X only  
\*Please consult our representative separately for arbitrary positions.

**Reference point position**

Type	Reference point position
X	Center
Y	Fixed to 10mm from left end of effective length

## Cables

CH22 - □□□□▽※#

**Cable length**

Written by flush right, indication in "m" units, up to 30 m, 0.5 m pitch (Example)

Type	Cable length
015	1.5m
070	7m
260	26m

**Conduit specification**

Type	Conduit specification
C	With conduit
N	Without conduit (standard)

**Cable sheath (covering)**

Type	Cable specification
S	PU (Polyurethane, Siemens Motion connect 800+)

**Scale side connector**

Type	Specification	Remarks
M	Scale head connector	Standard
F	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing
E	M12 connector (Female) with panel mount relay made by Phoenix Contact	Relay/ Waterproofing/ Attached connector

**Controller side connector**

Type	Specification	Remarks
None	Open-end	
Y	RJ45 connector made by YAMAICHI ELECTRONICS	Adopts NC machine tool
Z	RJ45 connector (water proof) made by YAMAICHI ELECTRONICS	Relay
F	M12 connector (Male) made by Phoenix Contact	Relay/ Waterproofing

## CH23 - □□□□▽※#

**Cable length**

(Example)

Type	Cable length
010	1m
005	0.5m
065	6.5m
100	10m

**Conduit specification**

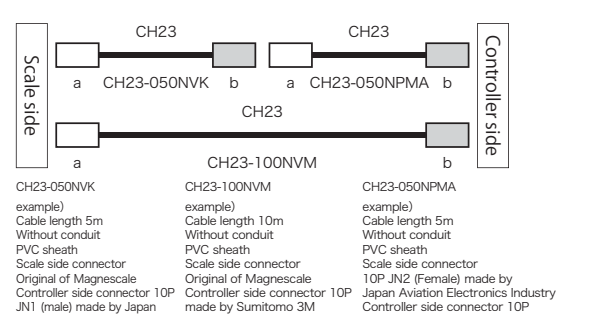
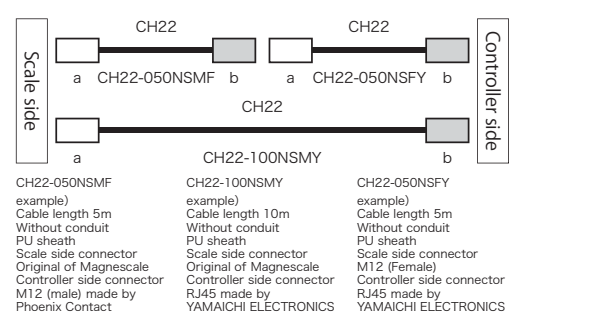
Type	Conduit specification
C	With conduit (standard)
N	Without conduit

**Controller side connector**

Type	Specification	Remarks
Z	-	Scale side connector should be 10P JN2 (Female) made by Japan Aviation Electronics Industry or 2P made by TAJIMI ELECTRONICS
None	-	Standard
M	-	10P made by Sumitomo 3M Mitsubishi NC, J3 (INC serial, ABS)
F	-	20P straight case made by Honda Tsushin Kogyo FANUC (INC serial, ABS)
J	-	Horizontal drawing case made by HIROSE Electric FANUC (INC serial, ABS)
K	-	10P JN1 (Male) made by Japan Aviation Electronics Industry Relay
N	-	12P R04 (Male) made by TAJIMI ELECTRONICS Relay (fixed)

**Scale side connector**

Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P R04-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)



SR67A  
SR67A  
SR7A  
SR8A  
SR97-02A1E  
SR97-02A1N  
RU97-20A8  
RU77-4096

Incremental linear encoder

Slim type

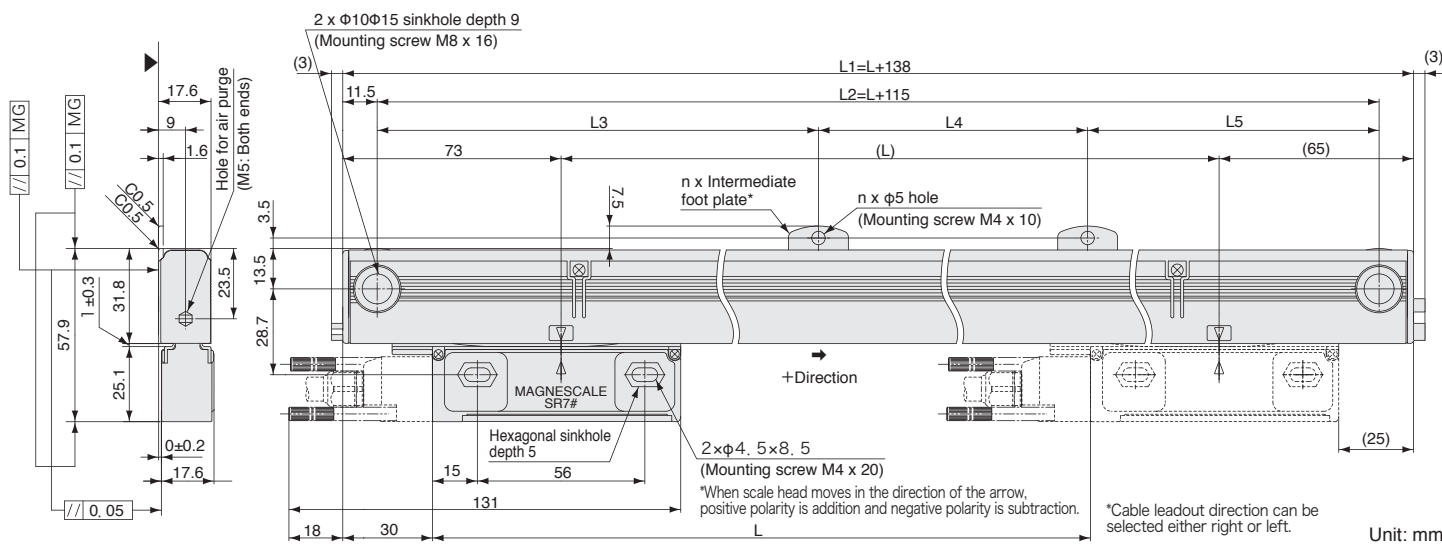
# SR74

- Slim type allows installation in narrow spaces
- Magnetic system allows use even in environments with condensation, oil, and other adverse conditions
- Same thermal expansion coefficient as iron



A/B/Reference point

## Dimensions (cable left-lead out direction)



Effective length	Total length	Mounting pitch					Number of intermediate foot plates
		L	L1	L2	L3	L4	
70	208	185	-	-	-	0	
120	258	235	-	-	-	0	
170	308	285	-	-	-	0	
220	358	335	-	-	-	0	
270	408	385	-	-	-	0	
320	458	435	-	-	-	0	
370	508	485	-	-	-	0	
420	558	535	-	-	-	0	
470	608	585	-	-	-	0	
520	658	635	-	-	-	0	
570	708	685	-	-	-	0	
620	758	735	-	-	-	0	
720	858	835	417.5	-	417.5	1	

Effective length	Total length	Mounting pitch					Number of intermediate foot plates
		L	L1	L2	L3	L4	
770	908	885	442.5	-	442.5	1	
820	958	935	467.5	-	467.5	1	
920	1,058	1,035	517.5	-	517.5	1	
1,020	1,158	1,135	567.5	-	567.5	1	
1,140	1,278	1,255	627.5	-	627.5	1	
1,240	1,378	1,355	677.5	-	677.5	1	
1,340	1,478	1,455	727.5	-	727.5	1	
1,440	1,578	1,555	777.5	520	515	2	
1,540	1,678	1,655	827.5	550	555	2	
1,640	1,778	1,755	877.5	585	585	2	
1,740	1,878	1,855	927.5	620	615	2	
1,840	1,978	1,955	977.5	650	655	2	
2,040	2,178	2,155	1,027.5	720	715	2	

MG: Machine guide \* Intermediate foot plate: One location when L ≥ 720 mm, two locations when L ≥ 1440 mm

Unit: mm

- Notes
- The surface indicated by the ▲ marks is the installation surface.
  - Screws indicated in the diagram are supplied as standard accessories.
  - Movement outside the effective length (L) will damage the scale head. It is recommended that the mechanical movable length (stroke) be set to 10 mm or more to the inside of both ends of the effective length (L).

## Specifications

Model name	SR74
Effective length (L: mm)	70-2,040
Thermal expansion coefficient	12±1 × 10 <sup>-6</sup> /°C
Accuracy(at 20°C)	(3+3L/1,000) μmp-p or (5+5L/1,000) μmp-p L: Effective length (mm)
Reference point	Center point, Multi point (40 mm pitch), Signed-type (standard pitch 20 mm), User-selected point (1 mm pitch)
Output signal	A/B/Reference point line driver signal, compliant with EIA-422
Resolution	Selectable from 0.05, 0.1, 0.5, and 1 μm (Set at factory shipping)
Maximum response speed	50m/ min (Resolution: 0.1 μm, Minimum phase difference: at 50 ns)
Functional safety	-
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2(60 V DC or less)
Operating temperature range	0 to +50°C
Storage temperature range	-20 to +55°C
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 3,000Hz)
Impact resistance	350 m/s <sup>2</sup> (11 ms)
Protective design grade	IP54 (Air purge not included), IP65 (Air purge included)
Power supply voltage range	DC+4.75 to +5.25 V
Maximum consumption current	1.0W or less (4.75V or 5.25V)
Consumption current	200mA (5V) (when the controller is connected)
Mass	Approx. 0.27kg+ 1.36kg/m or less
Standard compatible cable	CH33-***CP/CE
Maximum cable length	15 m

\*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

Scale

SR74 - xxx★□◆# # #

[xxx]Effective length (L): cm units

[□]Resolution and direction (μm)

[# # #]Reference point position

[★]Cable lead-out direction

Type	Lead-out direction
R	Right
L	Left

Type	Direction	Resolution	Type	Direction	Resolution
B		0.05	G		0.05
C	+	0.1	H	-	0.1
D		0.5	J		0.5
E		1.0	K		1

(Distance from left end of effective length: Unit mm)

Reference point position	Indication method
Less than 1,000	Number (850 mm → 850)
1,000-1,099 mm	A + lower 2 digits(1,050 mm → A50)
1,100-1,199 mm	B + lower 2 digits
1,200-1,299 mm	C + lower 2 digits
1,300-1,399 mm	D + lower 2 digits
1,400-1,499 mm	E + lower 2 digits
1,500-1,599 mm	F + lower 2 digits
1,600-1,699 mm	G + lower 2 digits
1,700-1,799 mm	H + lower 2 digits
1,800-1,899 mm	J + lower 2 digits
1,900-1,999 mm	K + lower 2 digits
2,000-2,040 mm	L + lower 2 digits
Center	X
Multi	Y
Signed-type	Z

[□]Accuracy grade

Type	Accuracy grade
A	(5+5L/1,000) μmp-p
S	(3+3L/1,000) μmp-p

L: Effective length(mm)

[◆]Minimum phase difference

Type	Phase difference (ns)	Type	Phase difference (ns)	Type	Phase difference (ns)
A	50	F	300	L	1,250
B	100	G	400	M	2,500
C	150	H	500	N	3,000
D	200	J	650		
E	250	K	1,000		

Cable

CH33 - □□□▽※ #

[□□]Cable length

Written by flush right, indication in "m" units, up to 30 m, 1 m pitch (Example)

Type	Cable length
07	7m
26	26m

[□]Conduit

Type	Conduit
C	With conduit (standard)
N	Without conduit

[▽]Cable sheath (covering)

Type	Specification
P	PVC (Polyvinyl chloride)
E	PU (Polyurethane)

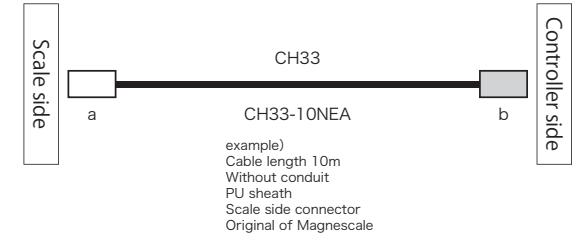
[※]Controller side connector

Type	Specification	Remarks
Without	Earth wire	
None	Open-end	Standard
A	D-sub 15P	
D	D-sub 9P	
L	10P made by Sumitomo 3M	Mitsubishi NC, J3 (A/B/Reference)
E	20P straight case made by Honda Tsushin Kogyo	FANUC (A/B/Reference)
G	6P made by molex*	YASKAWA Electric, Panasonic (INC serial, ABS)
H	R Horizontal drawing case made by HIROSE Electric	FANUC (A/B/Reference)

[#]Scale side connector

Type	Specification	Remarks
None	Original of Magnescale	Standard

\*Relay type cannot be used for A/B/Reference type of SR74 and SR84



Incremental linear encoder

Robust type

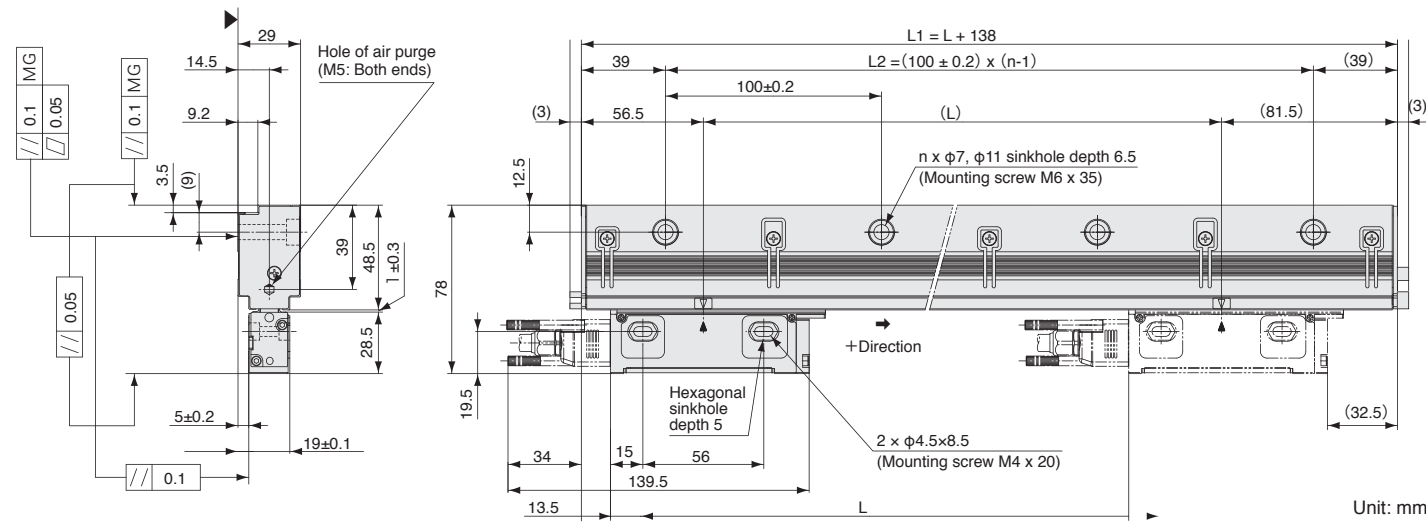
# SR84

- High rigidity provides resistance to shock and vibration
- Magnetic system allows use even in environments with condensation, oil, and other adverse conditions
- Same thermal expansion as iron



A/B/Reference point

Dimensions (cable left-lead out direction)



\*When scale head moves in the direction of the arrow, positive polarity is addition and negative polarity is subtraction. \*Cable leadout direction can be selected either right or left.

Effective length	Total length	L2	n
L	L1		
140	278	200	3
240	378	300	4
340	478	400	5
440	578	500	6
540	678	600	7
640	778	700	8
740	878	800	9
840	978	900	10
940	1,078	1,000	11
1,040	1,178	1,100	12
1,140	1,278	1,200	13
1,240	1,378	1,300	14

MG: Machine guide

- Notes**
- The surface indicated by the ▲ marks is the installation surface.
  - Screws indicated in the diagram are supplied as standard accessories.
  - Movement outside the effective length (L) will damage the scale head. It is recommended that the mechanical movable length (stroke) be set to 10 mm or more to the inside of both ends of the effective length (L).

Effective length	Total length	L2	n
L	L1		
1,340	1,478	1,400	15
1,440	1,578	1,500	16
1,540	1,678	1,600	17
1,640	1,778	1,700	18
1,740	1,878	1,800	19
1,840	1,978	1,900	20
2,040	2,178	2,100	22
2,240	2,378	2,300	24
2,440	2,578	2,500	26
2,640	2,778	2,700	28
2,840	2,978	2,900	30
3,040	3,178	3,100	32

Unit: mm

## Specifications

Model name	SR84
Effective length (L: mm)	140-3,040
Thermal expansion coefficient	12±1 × 10 <sup>-6</sup> /°C
Accuracy(at 20°C)	(3+3L/1,000) μmp-p or (5+5L/1,000) μmp-p L: Effective length (mm)
Reference point	None, Center point, Multi point, Signed-type, User-selected point (1 mm pitch)
Output signal	A/B/Reference point line driver signal, compliant with EIA-422
Resolution	Selectable from 0.05, 0.1, 0.5, and 1 μm (Set at factory shipping)
Maximum response speed	50m/ min (Resolution: 0.1 μm, Minimum phase difference: at 50 ns)
Functional safety	—
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2 Safety standards not applicable (60 V DC or less)
Operating temperature range	0 to +50°C
Storage temperature range	-20 to +55°C
Vibration resistance	250 m/s <sup>2</sup> (50 Hz to 2,000Hz)
Impact resistance	450 m/s <sup>2</sup> (11 ms)
Protective design grade	IP54 (Air purge not included), IP65 (Air purge included)
Power supply voltage range	DC+4.75 to +5.25 V
Maximum consumption current	1.0W or less (4.75V or 5.25V)
Consumption current	200mA (5V) (when the controller is connected)
Mass	Approx. 1.24kg+ 4kg/m or less
Standard compatible cable	CH33-***CP/CE
Maximum cable length	15 m

\*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

Scale

SR84 - xxx★□◇# ##

[xxx]Effective length (L): cm units

[□]Resolution and direction (μm)

[★]Cable lead-out direction

Type	Lead-out direction
R	Right
L	Left

Type	Direction	Resolution	Type	Direction	Resolution
B		0.05	G		0.05
C	+	0.1	H	-	0.1
D		0.5	J		0.5
E		1.0	K		1

[◇]Accuracy grade

Type	Accuracy grade
A	(5+5L/1,000) μmp-p
S	(3+3L/1,000) μmp-p

L: Effective length(mm)

[#]Minimum phase difference

Type	Phase difference (ns)	Type	Phase difference (ns)	Type	Phase difference (ns)
A	50	F	300	L	1,250
B	100	G	400	M	2,500
C	150	H	500	N	3,000
D	200	J	650		
E	250	K	1,000		

[##]Reference point position (Distance from left end of effective length:Unit mm)

Reference point position	Indication method
Less than 1,000	Number (850 mm → 850)
1,000–1,099 mm	A + lower 2 digits (1,050 mm→A50)
1,100–1,199 mm	B + lower 2 digits
1,200–1,299 mm	C + lower 2 digits
1,300–1,399 mm	D + lower 2 digits
1,400–1,499 mm	E + lower 2 digits
1,500–1,599 mm	F + lower 2 digits
1,600–1,699 mm	G + lower 2 digits
1,700–1,799 mm	H + lower 2 digits
1,800–1,899 mm	J + lower 2 digits
1,900–1,999 mm	K + lower 2 digits
2,000–2,099 mm	L + lower 2 digits
2,100–2,199 mm	M + lower 2 digits
2,200–2,299 mm	N + lower 2 digits
2,300–2,399 mm	P + lower 2 digits
2,400–2,499 mm	Q + lower 2 digits
2,500–2,599 mm	R + lower 2 digits
2,600–2,699 mm	S + lower 2 digits
2,700–2,799 mm	T + lower 2 digits
2,800–2,899 mm	U + lower 2 digits
2,900–2,999 mm	V + lower 2 digits
3,000–3,040 mm	W + lower 2 digits
Center	X
Multi	Y
Signed-type	Z

Cable

CH33 - □□□▽※ #

[□□]Cable length  
Written by flush right,  
indication in "m" units,  
up to 30 m, 1 m pitch  
(Example)

Type	Cable length
07	7m
26	26m

[○]Conduit

Type	Conduit
C	With conduit (standard)
N	Without conduit

[▽]Cable sheath (covering)

Type	Specification
P	PVC (Polyvinyl chloride)
E	PU (Polyurethane)

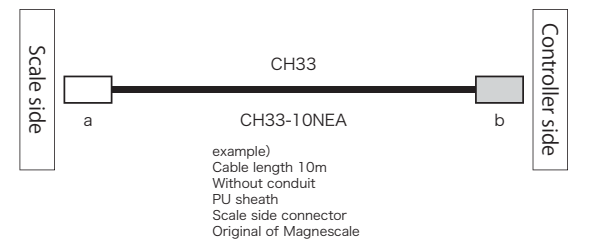
[※]Controller side connector

Type	Specification	Remarks
Without	Earth wire	
None	Open-end	Standard
A	D-sub 15P	
D	D-sub 9P	
L	10P made by Sumitomo 3M	Mitsubishi NC, J3 (A/B/Reference)
E	20P straight case made by Honda Tsushin Kogyo	FANUC (A/B/Reference)
G	6P made by molex*	YASKAWA Electric, Panasonic (INC serial, ABS)
H	R Horizontal drawing case made by HIROSE Electric	FANUC (A/B/Reference)

[#]Scale side connector

Type	Specification	Remarks
None	Original of Magnescale	Standard

\*Relay type cannot be used for A/B/Reference type of SR74 and SR84



SR27

SR67A

SR74

SR84

RS97-02A/E

RS97-02A/N

RU97-20A8

RU77-4096

Absolute angle encoder  
Exposed type

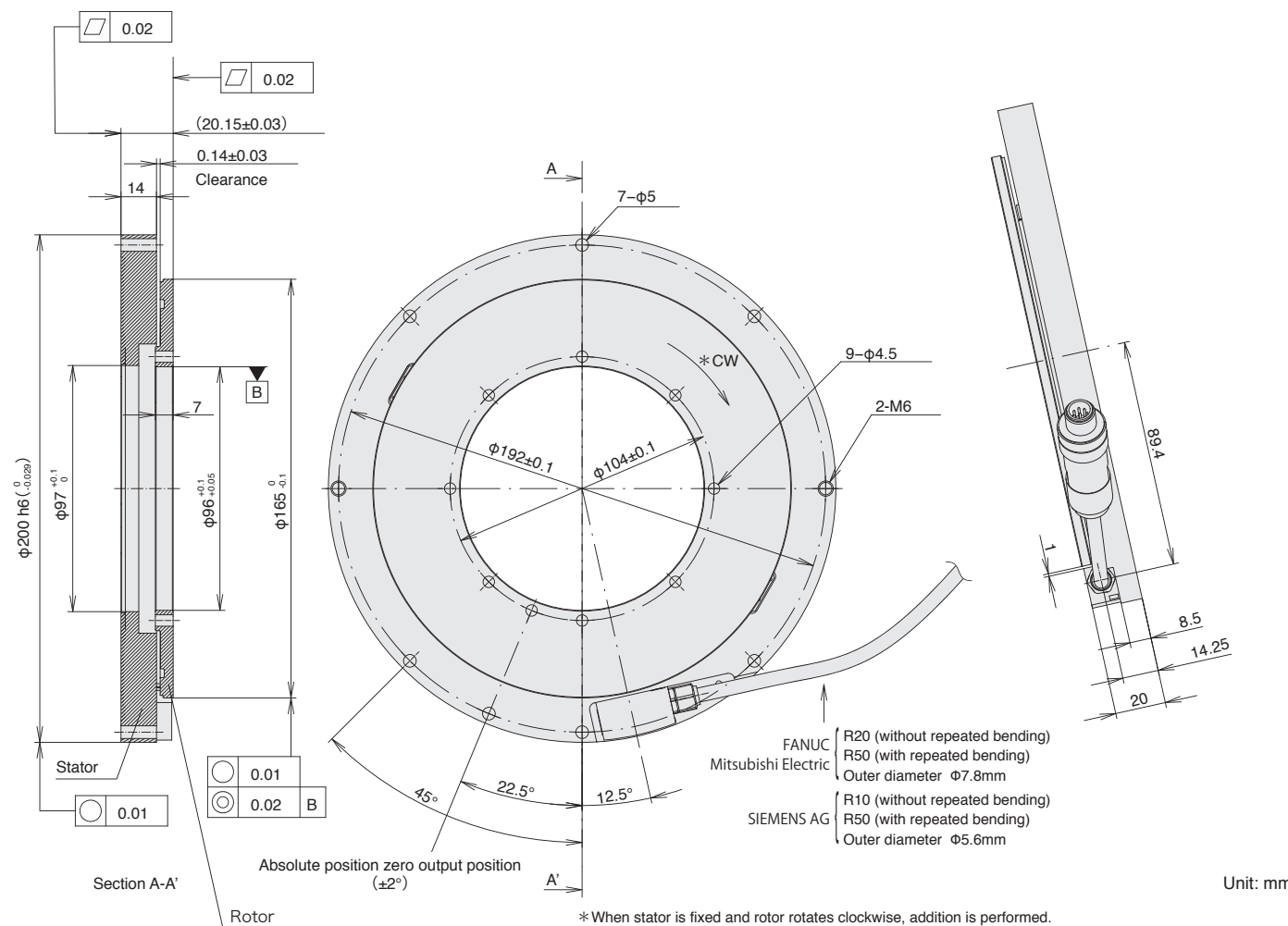
# RS97-1024E



- Enables direct communication using the protocol of each supporting manufacturer without the requirement of an amplifier
- Magnetic system allows use even in environments with condensation, oil, and other adverse conditions
- 96mm diameter through-hole allows for design and mounting flexibility
- Dual head configuration reduces the effect of axial runout



## Dimensions



Specifications			
Model name	RS97-1024EGA	RS97-1024EGD	RS97-1024EGZ
Output wave number	1,024 waves/revolution		
Through hole diameter	φ96 mm		
Accuracy(at 20°C)	±2.5"		
Output signal	Absolute serial bidirectional signal, compliant with EIA-485		Compliant with DRIVE-CLiQ
Compatible controllers	FANUC	Mitsubishi Electric	SIEMENS AG
Resolution	23 bits (8,388,608 pulses/revolution)		
Maximum response revolutions	5,000 min <sup>-1</sup>		
Functional safety	Please consult with each controller manufacturer regarding support for functional safety.		EN ISO13849-1:2008 Cat.3 EN 62061:2005 / IEC 61508:2010 EN61800-5-2:2007
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2		
Operating temperature range	0 to +60°C		
Storage temperature range	-10 to +60°C		
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 2,000 Hz)		
Impact resistance	1,000 m/s <sup>2</sup> (11 ms)		
Protective design grade	IP65		
Power supply voltage range	DC+4.75 to +5.25 V		DC+17 to +30.8 V
Maximum consumption current	1.25W or less (4.75V) 1.2W or less (5.25V)		2.3W or less (17V) 3.1W or less (30.8V)
Consumption current	240mA (5V) (when the controller is connected)		120mA (24V) (when the controller is connected)
Output connector	JN1HS10PL4S made by Japan Aviation Electronics Industry		SACC-M12MS-8QH made by Phoenix Contact
Moment of inertia	9x10 <sup>-4</sup> kgm <sup>2</sup> or less		
Mass	Approx. 2kg (rotor: 0.2kg/ stator: 1.7kg) or less		
Compatible cables (types without relay connectors) Maximum cable length	CH23-***NPFA 30 m	CH23-***NPMA 30 m	CH22-***NSFY 30 m
Compatible cables (types with relay connectors) Maximum cable length	CH23-***NPKA + CH23-***NPFA 30 m	CH23-***NPKA + CH23-***NPMA 30 m	CH22-***NSFF + CH22-***NSFY 30 m

\*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

### Scale

RS97-1024EG△■

[E] Rotor inner diameter 96 mm  
[G] Resolution 23 bit

Type	NC manufacturer	Remarks
A	FANUC	α interface
D	Mitsubishi Electric	4-wire
Z	SIEMENS AG	DRIVE-CLiQ

Type	Head cable length
01	1 m
02	2 m

### Cables

CH22 - □□□○▽※#

Type	Cable length
015	1.5m
070	7m
260	26m

Type	Cable specification
V	PVC(φ6.8)[Scale side]
P	PVC(φ8)[Controller side]
E	PU(φ8)[Controller side]

Type	Specification	Remarks
None	Open-end	Standard
M	10P made by Sumitomo 3M	Mitsubishi NC, J3 (INC serial, ABS)
F	20P straight case made by Honda Tsushin Kogyo	FANUC (INC serial, ABS)
J	Horizontal drawing case made by HROSE Electric	FANUC (INC serial, ABS)
K	10P JN1 (Male) made by Japan Aviation Electronics Industry	Relay
N	12P RD4 (Male) made by TAJIMI ELECTRONICS	Relay (fixed)

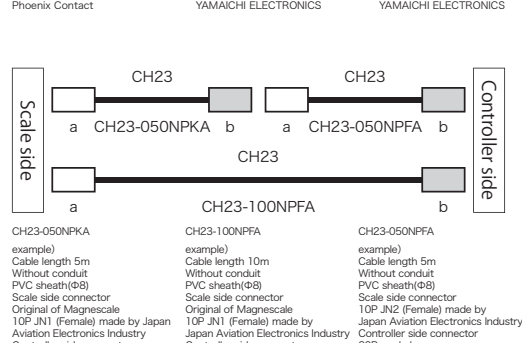
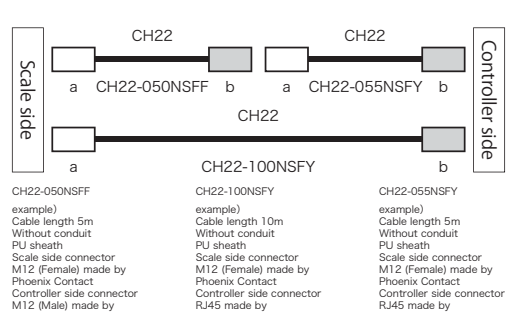
Type	Cable specification	Remarks
S	PU (Polyurethane, Siemens Motion connect 800+)	

Type	Specification	Remarks
M	Scale head connector	Standard
F	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing
E	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing/ Attached connector

Type	Specification	Remarks
None	Open-end	Standard
Y	RJ45 connector made by YAMAICHI ELECTRONICS	Adopts NC machine tool
Z	RJ46 connector (water proof) made by YAMAICHI ELECTRONICS	Relay
F	M12 connector (Male) made by Phoenix Contact	Relay/ Waterproofing

Type	Specification	Remarks
Z	Scale side connector should be 10P JN2 (Female) made by Japan Aviation Electronics Industry or 2P made by TAJIMI ELECTRONICS	
None	Open-end	Standard
M	10P made by Sumitomo 3M	Mitsubishi NC, J3 (INC serial, ABS)
F	20P straight case made by Honda Tsushin Kogyo	FANUC (INC serial, ABS)
J	Horizontal drawing case made by HROSE Electric	FANUC (INC serial, ABS)
K	10P JN1 (Male) made by Japan Aviation Electronics Industry	Relay
N	12P RD4 (Male) made by TAJIMI ELECTRONICS	Relay (fixed)

Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P RD4-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)



SR27  
SR67A  
SR7A  
SR84  
RS97-1024E  
RS97-1024N  
RU97-2048  
RU77-4096

Absolute angle encoder  
Exposed type

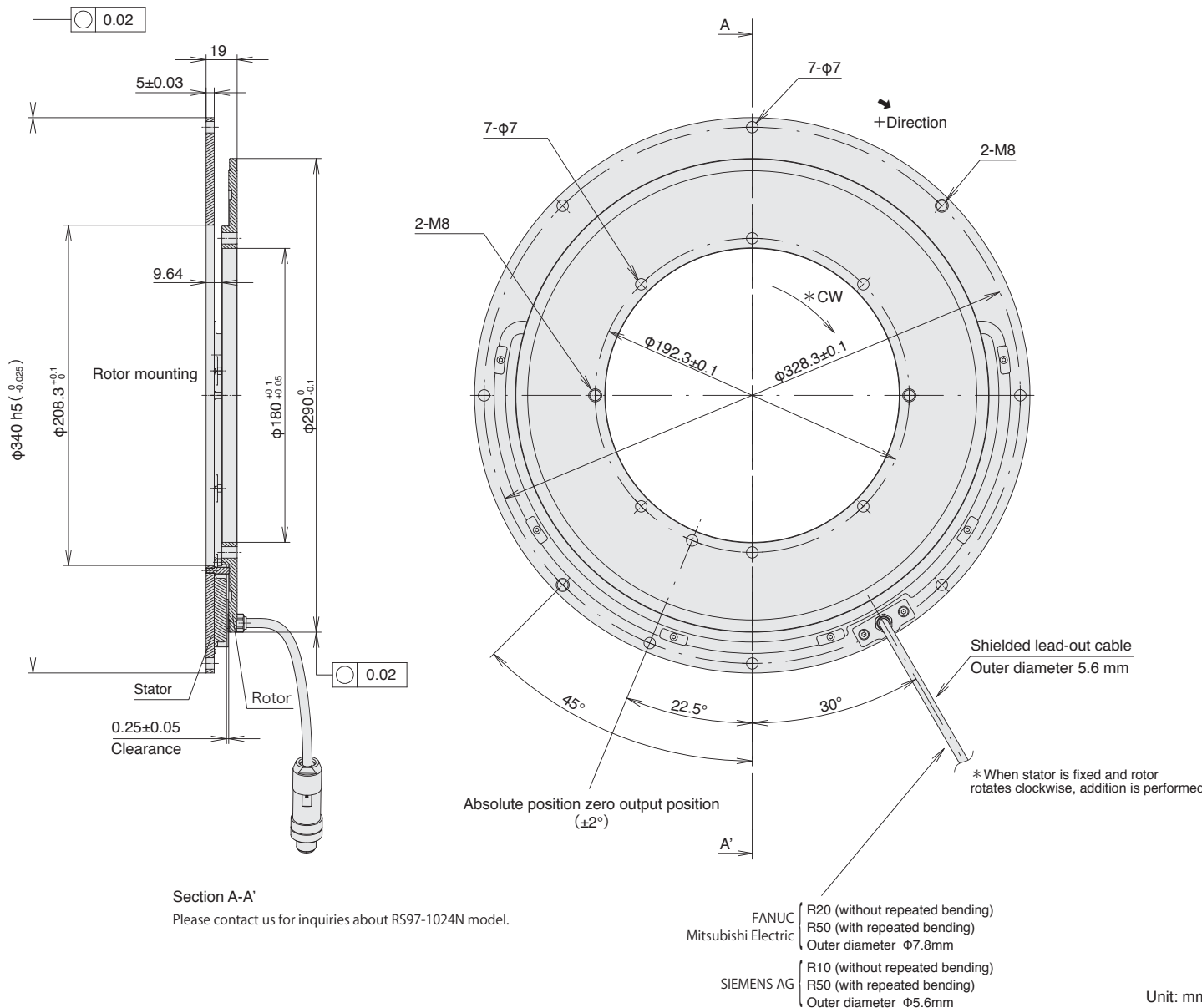
# RS97-1024N



- Enables direct communication using the protocol of each supporting manufacturer without the requirement of an amplifier
- Magnetic system enables use even in environments with condensation, oil, and other adverse conditions
- 180mm diameter through-hole allows for design and mounting flexibility
- Dual head configuration reduces the effect of axial runout



## Dimensions



Specifications			
Model name	RS97-1024NGA	RS97-1024NGD	RS97-1024NGZ
Output wave number	1,024 waves/revolution		
Through hole diameter	$\Phi 180$ mm		
Accuracy(at 20°C)	$\pm 2.5''$		
Output signal	Absolute serial bidirectional signal, compliant with EIA-485		Compliant with DRIVE-CLiQ
Compatible controllers	FANUC	Mitsubishi Electric	SIEMENS AG
Resolution	23 bits (8,388,608 pulses/revolution)		
Maximum response revolutions	5,000 min <sup>-1</sup>		
Functional Safety	Please consult with each controller manufacturer regarding support for functional safety.		EN ISO13849-1:2008 Cat.3 EN 62061:2005 / IEC 61508:2010 EN61800-5-2:2007
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2		
Operating temperature range	0 to +60°C		
Storage temperature range	-10 to +60°C		
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 2,000 Hz)		
Impact resistance	1,000 m/s <sup>2</sup> (11 ms)		
Protective design grade	IP65		
Power supply voltage range	DC+4.75 to +5.25 V		DC+17 to +30.8 V
Maximum consumption current	1.35W or less (4.75V) 1.3W or less (5.25V)		2.5W or less (17V) 3.2W or less (30.8V)
Consumption current	260mA (5V) (when the controller is connected)		120mA (24V) (when the controller is connected)
Output connector	JN1HS10PL2 made by Japan Aviation Electronics Industry		SACC-M12MS-8Q H made by Phoenix Contact
Moment of inertia	8.8× 10 <sup>-3</sup> kgm <sup>2</sup> or less		
Mass	Approx. 3.4kg (rotor: 0.6kg/ stator: 2.8kg) or less		
Compatible cables (types without relay connectors) Maximum cable length	CH23-***NPFA 30 m	CH23-***NPMA 30 m	CH22-***NSFY 30 m
Compatible cables (types with relay connectors) Maximum cable length	CH23-***NPKA + CH23-***NPFA 30 m	CH23-***NPKA + CH23-***NPMA 30 m	CH22-***NSFF + CH22-***NSFY 30 m

\*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

**Scale**  
RS97-1024NG△■

[N] Rotor inner diameter 180 mm  
[△] Communication protocol  
[■] Head cable length

Type	NC manufacturer	Remarks
A	FANUC	α interface
D	Mitsubishi Electric	4-wire
Z	SIEMENS AG	DRIVE-CLiQ

[G] Resolution 23 bit

Type	Head cable length
01	1 m
02	2 m
03	3 m

**Cables**  
CH22 - □□□○▽※#

[□□□] Cable length  
Written in flush right, indication in "m" units, up to 30 m, 0.5 m pitch (Example)

Type	Cable length
015	1.5m
070	7m
260	26m

[○] Conduit specification

Type	Conduit specification
C	With conduit
N	Without conduit (standard)

[▽] Cable sheath (covering)

Type	Cable specification
S	PU (Polyurethane, Siemens Motion connect 800+)

[\*] Scale side connector

Type	Specification	Remarks
M	Scale head connector	Standard
F	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing
E	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing/ Attached connector

[#] Controller side connector

Type	Specification	Remarks
None	Open-end	Standard
Z	RJ45 connector made by YAMAICHI ELECTRONICS	Adopts NC machine tool
Y	RJ45 connector (water proof) made by YAMAICHI ELECTRONICS	Relay
F	M12 connector (Male) made by Phoenix Contact	Relay/ Waterproofing

[#] Controller side connector

Type	Specification	Remarks
Without	Earth wire	Standard
Z	Open-end	Scale side connector should be 10P JN2 (Female) made by Japan Aviation Electronics Industry or 2P made by TAJIMI ELECTRONICS
None	-	Standard
M	10P made by Sumitomo 3M	Mitsubishi NC, J3 (INC serial, ABS)
F	20P straight case made by Honda Tsushin Kogyo	FANUC (INC serial, ABS)
J	Horizontal drawing case made by HROSE Electric	FANUC (INC serial, ABS)
K	10P JN1 (Male) made by Japan Aviation Electronics Industry	Relay
N	12P RD4 (Male) made by TAJIMI ELECTRONICS	Relay (fixed)

[#] Scale side connector

Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P RD4-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)

**CH23 - □□□○▽※#**

[□□□] Cable length (Example)

Type	Cable length
010	1m
005	0.5m
065	6.5m
100	10m

[○] Conduit specification

Type	Conduit specification
C	With conduit (standard)
N	Without conduit

[▽] Cable sheath

Type	Cable specification
V	PVC(Φ6.8) [Scale side]
P	PVC(Φ8) [Controller side]
E	PU(Φ8) [Controller side]

**Scale side** and **Controller side** connector diagrams are shown for CH22 and CH23, including examples for various cable types and lengths.

Absolute angle encoder  
Enclosed type

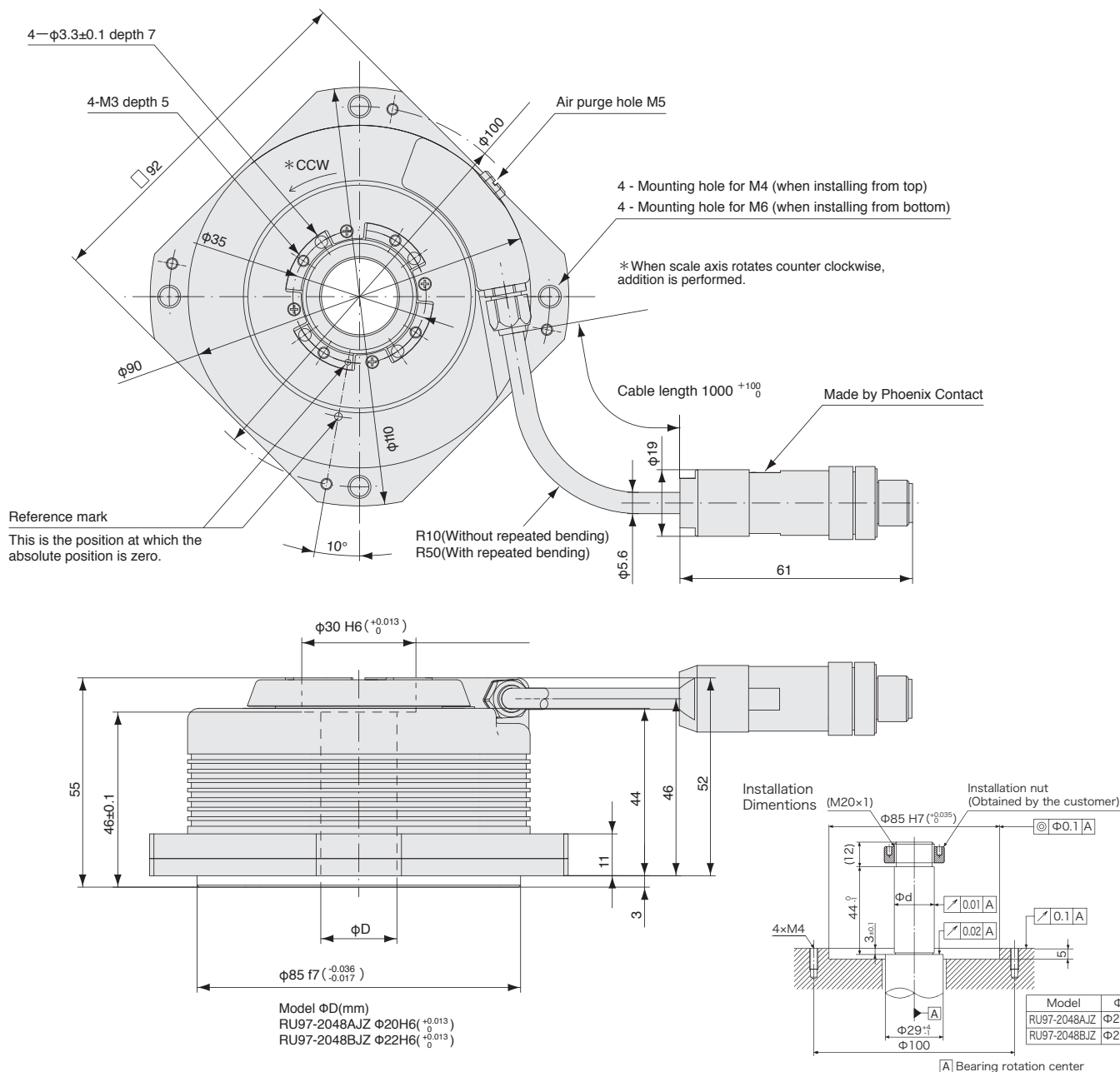
# RU97-2048

- Enables direct communication using the SIEMENS DRIVE-CLiQ protocol without the requirement of an amplifier
- Magnetic system enables use even in environments with condensation, oil, and other adverse conditions
- Internal coupling allows for design and mounting flexibility



SIEMENS

## Dimensions



## Specifications

Model name	RU97-2048AJZ RU97-2048BJZ
Output wave number	2,048 waves/revolution
Through hole diameter	A: φ20 mm, B: φ22 mm
Accuracy(at 20°C)	±2.5"
Output signal	Compliant with DRIVE-CLiQ, single turn absolute type
Compatible controllers	SIEMENS AG
Resolution	25 bit (33,554,432 pulses/revolution)
Maximum response revolutions	2,000 min <sup>-1</sup>
Maximum mechanical revolutions	3,000 min <sup>-1</sup>
Functional safety	EN ISO13849-1:2008 Cat.3 EN 62061:2005 / IEC 61508:2010 / EN61800-5-2:2007
Legal compliance	FCC Part15 Subpart B Class A ICES-003 Class A Digital Device EN55011 Gp1 Class A, EN61000-6-2
Operating temperature range	0 to +60°C
Storage temperature range	-10 to +60°C
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 2,000 Hz)
Impact resistance	1,000 m/s <sup>2</sup> (11 ms)
Protective design grade	IP65
Power supply voltage range	DC+17 to +30.8 V
Maximum consumption current	1.6 W or less (17 V or 30.8 V)
Consumption current	65 mA (24 V) (when the controller is connected)
Moment of inertia	9.4×10 <sup>-5</sup> kgm <sup>2</sup> or less
Starting torque (at 20°C)	0.08 Nm or less
Mass	Approx. 1.2kg or less
Compatible cables (types without relay connectors) Maximum cable length	CH22-***NSFY 30 m
Compatible cables (types with relay connectors) Maximum cable length	CH22-***NSFF + CH22-***NSFY 30 m

\*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

### Scale

RU97-2048 ☆ JZ ■ ■

☆] Drum inner diameter	Type	Drum inner diameter
	A	φ20 mm
	B	φ22 mm

[J] Resolution 25 bit

[Z] SIEMENS AG DRIVE-CLiQ

■] Head cable length

Type	Head cable length
01	1 m
02	2 m
03	3 m

### Cables

CH22 - □ □ □ □ □ ▽ ※ #

□ □ □ □	Cable length
015	1.5m
070	7m
260	26m

□	Conduit specification
C	With conduit
N	Without conduit (standard)

▽] Cable sheath (covering)

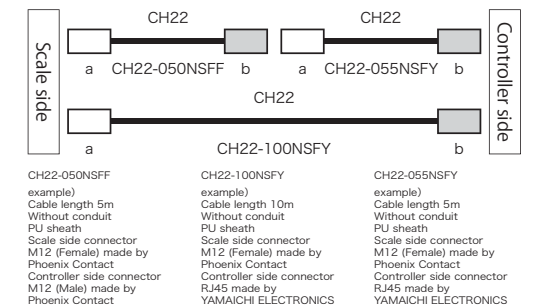
Type	Cable specification
S	PU (Polyurethane, Siemens Motion connect 800+)

※] Scale side connector

Type	Specification	Remarks
M	Scale head connector	Standard
F	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing
E	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing/ Attached connector

#] Controller side connector

Type	Specification	Remarks
None	Open-end	
Y	RJ45 connector made by YAMAICHI ELECTRONICS	Adopts NC machine tool
Z	RJ45 connector (water proof) made by YAMAICHI ELECTRONICS	Relay
F	M12 connector (Male) made by Phoenix Contact	Relay/ Waterproofing



Absolute angle encoder  
Enclosed type

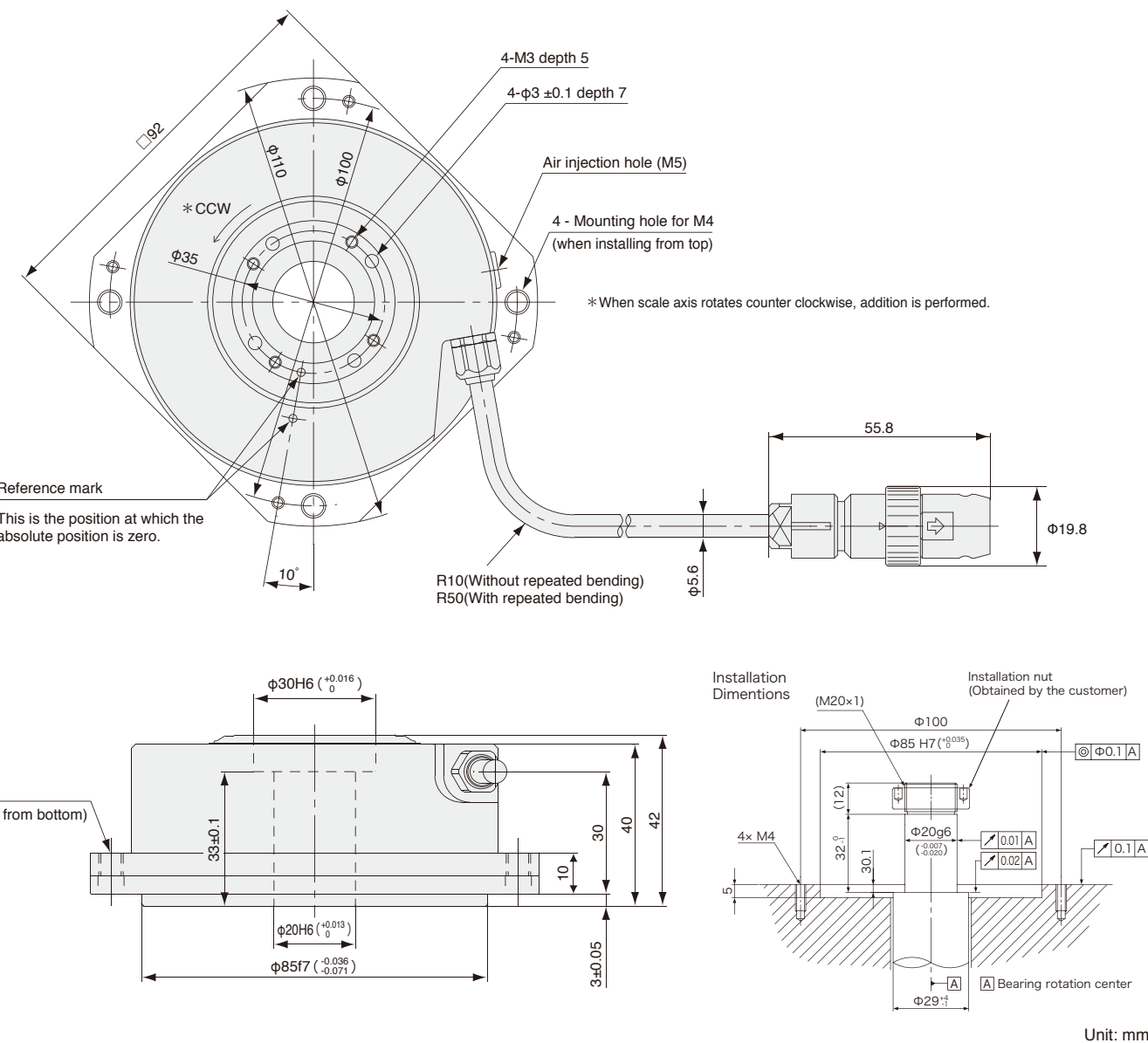
# RU77-4096

- Magnetic system enables use even in environments with condensation, oil, and other adverse conditions
- Enables direct communication using the protocol of each supporting manufacturer without the requirement of an amplifier
- Internal coupling allows for design and mounting flexibility



FANUC Mitsubishi Electric Yaskawa Electric

## Dimensions



## Specifications

Model name	RU77 - 4096A□A	RU77 - 4096A□B RU77 - 4096A□D	RU77 - 4096A□F
Output wave number	4,096 waves/revolution		
Through hole diameter	φ20 mm		
Accuracy(at 20°C)	±2.5"		
Output signal	Absolute serial bidirectional signal, compliant with EIA-485		
Compatible controllers	FANUC	Mitsubishi Electric	Yaskawa Electric
Maximum resolution	25bit (33,554,432 pulse/revolution)		21bit (2,097,152 pulse/revolution)
Maximum response revolutions	2,000 min <sup>-1</sup>		
Maximum mechanical revolutions	3,000 min <sup>-1</sup>		
Functional safety	-		
Legal compliance	FCC Part15 Subpart B Class A and ICES-003 Class A Digital Device and EN55011 Gp 1 Class A, EN 61000-6-2 Safety standards not applicable (60 V DC or less)		
Operating temperature range	0 to +60°C		
Storage temperature range	-10 to +60°C		
Vibration resistance	150 m/s <sup>2</sup> (50 Hz to 2000 Hz)		
Impact resistance	1,000 m/s <sup>2</sup> (11 ms)		
Protective design grade	IP65		
Power supply voltage range	DC4.75-5.25 V (with connecting terminal)		
Consumption current	200mA (at 120Ω termination)		
Moment of inertia	9.4×10 <sup>-5</sup> kgm <sup>2</sup> or less		
Starting torque (at 20°C)	0.1 Nm or less		
Mass	Approx. 1.2kg or less		
Standard compatible cable	CH33-***, CE28-***		
Maximum cable length	CH33-*** : 30 m, CE28-*** : 15 m		

\*Magnescale reserves the right to change product specifications without prior notice.

## Details of model designation

### Scale

RU77 - 4096A□△★○○

#### Resolution

Type	Resolution	Number of pulses/revolution	Number of partitions
A	Approx. 2.5°/1,000	131,072	1/32
B	Approx. 1°/1,000	262,144	1/64
C	Approx. 7°/10,000	524,288	1/128
D	Approx. 3.5°/10,000	1,048,576	1/256
E	Approx. 2°/10,000	2,097,152	1/512
F	Approx. 1°/10,000	4,194,304	1/1,024
G	Approx. 4.5°/100,000	8,388,608	1/2,048
H	Approx. 2°/100,000	16,777,216	1/4,096
J	Approx. 1°/100,000	33,554,432	1/8,192

#### Communication protocol

Type	Number of wires	NC manufacturer
A	4-wire	FANUC α interface
B	2-wire	Mitsubishi Electric
D	4-wire	Mitsubishi Electric
F	2-wire	Yaskawa Electric

#### Cable length

Type	Cable length
10	1 m

\*Yaskawa Electric: D,F

#### Connector

Connector	Description	Remarks
Plastic water proofing(Male)	J	main cable length Max.1m, extension cable : CH33 ※Max cable length(main+extension) : 30m
Metal water proofing(Male)	G	main cable length Max.9m, extension cable : CE28 ※Max cable length(main+extension) : 15m

### CH33 - □□□□▽※#

□□ Cable length  
Written by flush right,  
indication in "m" units,  
up to 30 m, 1 m pitch

(Example)

Type	Cable length	Type	Conduit
07	7m	C	With conduit (standard)
26	26m	N	Without conduit

#### Cable sheath (covering)

Type	Specification
P	PVC (Polyvinyl chloride)
E	PU (Polyurethane)

#### Controller side connector

Type	Specification	Remarks
Without/With	Earth wire	
None	-	Open-end
M	-	10P made by Sumitomo 3M
-	Q	20P straight case made by Honda Tsushin Kogyo
G	-	6P made by molex*
-	S	Horizontal drawing case made by Hirose Electric
K	-	10P JN1 (Male) made by Japan Aviation Electronics Industry

### Cable

CE28 - □□□□○※

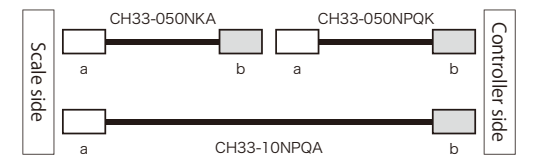
□□□□ Cable length  
Written by flush right,  
indication in "10cm" units,  
up to 14m, 1m pitch

(Example)

Type	Cable length	Type	Conduit
070	7m	C	With conduit (standard)
090	9m	N	Without conduit
130	13m		

#### Controller side connector

Type	Specification	Remarks
Without/With	Earth wire	
Without	-	Open-end
M	-	10P made by Sumitomo 3M
F	Q	20P made by Honda Tsushin Kogyo
G	-	6P made by molex*
J	-	10P JN2 (Female) made by Japan Aviation Electronics Industry
K	-	10P JN1 made by Japan Aviation Electronics Industry



Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P R04-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)

#### Scale side connector

Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P R04-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)

# Other Models

## Absolute linear encoder slim type SR77

- FANUC
- Mitsubishi Electric
- Panasonic
- Yaskawa Electric



- Effective length: 70,120,170,220,270,320,370,420,470,520,570,620,720,770,820,920,1020,1140,1240,1340,1440,1540,1640,1740,1840,2040 mm
- Maximum resolution: 0.01 μm
- Accuracy: (3+3L/1,000) μmp-p L:mm (5+5L/1,000) μmp-p L:mm
- Maximum response speed: 200m/min
- Protective design grade: IP65

Cable: CH33  
※ Please refer to page 29 for cable specifications.

SR77-xxx★○△◇□□□

Reference point position	Indication method	Reference point position	Indication method	Reference point position	Indication method
Less than 1,000	Number (850 mm→850)	1,700-1,799 mm	H + lower 2 digits	Center	X
1,000-1,099 mm	A + lower 2 digits (1,050 mm→450)	1,800-1,899 mm	J + lower 2 digits		
1,100-1,199 mm	B + lower 2 digits	1,900-1,999 mm	K + lower 2 digits		
1,200-1,299 mm	C + lower 2 digits	2,000-2,040 mm	L + lower 2 digits		
1,300-1,399 mm	D + lower 2 digits				
1,400-1,499 mm	E + lower 2 digits				
1,500-1,599 mm	F + lower 2 digits				
1,600-1,699 mm	G + lower 2 digits				

Type	NC manufacturer	Number of wires
A	FANUC α interface	4-wire
B	Mitsubishi Electric	2-wire
D	Mitsubishi Electric	4-wire
H	Panasonic	2-wire
F	Yaskawa Electric	2-wire

Type	Direction	Resolution	Type	Direction	Resolution
A		0.01	F		0.01
B		0.05	G		0.05
C	(plus)	0.1	H	(minus)	0.1
D		0.5	J		0.5
E		1	K		1

Type	Direction	Number of partitions
L	(plus)	1/8,192
M		1/1,024

Type	Accuracy grade
A	(5+5L/1,000) μm
S	(3+3L/1,000) μm

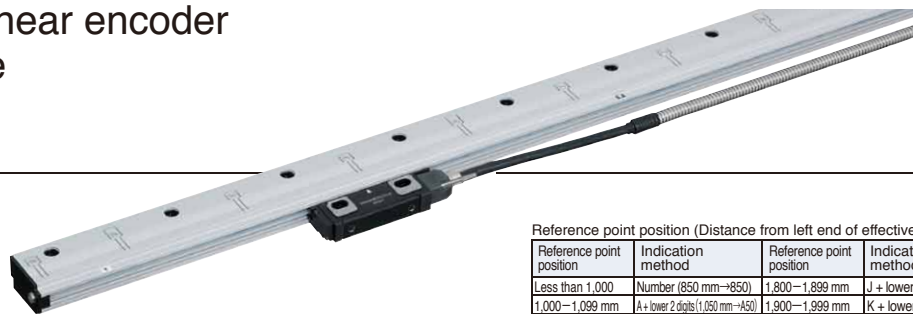
Type	Lead-out direction
R	Right
L	Left

Effective length (L): cm units

L: Effective length(mm)

## Absolute linear encoder robust type SR87

- FANUC
- Mitsubishi Electric
- Panasonic
- Yaskawa Electric



- Effective length: 140,240,340,440,540,640,740,840,940,1040,1140,1240,1340,1440,1540,1640,1740,1840,2040,2240,2440,2640,2840,3040 mm
- Maximum resolution: 0.01 μm
- Accuracy: (3+3L/1,000) μmp-p L:mm (5+5L/1,000) μmp-p L:mm
- Maximum response speed: 200m/min
- Protective design grade: IP65

Cable: CH33  
※ Please refer to page 29 for cable specifications.

SR87-xxx★○△◇□□□

Reference point position	Indication method	Reference point position	Indication method	Reference point position	Indication method
Less than 1,000	Number (850 mm→850)	1,800-1,899 mm	J + lower 2 digits	2,700-2,799 mm	T + lower 2 digits
1,000-1,099 mm	A + lower 2 digits (1,050 mm→450)	1,900-1,999 mm	K + lower 2 digits	2,800-2,899 mm	U + lower 2 digits
1,100-1,199 mm	B + lower 2 digits	2,000-2,040 mm	L + lower 2 digits	2,900-2,999 mm	V + lower 2 digits
1,200-1,299 mm	C + lower 2 digits	2,100-2,199 mm	M + lower 2 digits	3,000-3,040 mm	W + lower 2 digits
1,300-1,399 mm	D + lower 2 digits	2,200-2,299 mm	N + lower 2 digits	Center	X
1,400-1,499 mm	E + lower 2 digits	2,300-2,399 mm	P + lower 2 digits		
1,500-1,599 mm	F + lower 2 digits	2,400-2,499 mm	Q + lower 2 digits		
1,600-1,699 mm	G + lower 2 digits	2,500-2,599 mm	R + lower 2 digits		
1,700-1,799 mm	H + lower 2 digits	2,600-2,699 mm	S + lower 2 digits		

Type	NC manufacturer	Number of wires
A	FANUC α interface	4-wire
B	Mitsubishi Electric	2-wire
D	Mitsubishi Electric	4-wire
H	Panasonic	2-wire
F	Yaskawa Electric	2-wire

Type	Direction	Resolution	Type	Direction	Resolution
A		0.01	F		0.01
B		0.05	G		0.05
C	(plus)	0.1	H	(minus)	0.1
D		0.5	J		0.5
E		1	K		1

Type	Direction	Number of partitions
L	(plus)	1/8,192
M		1/1,024

Type	Accuracy grade
A	(5+5L/1,000) μm
S	(3+3L/1,000) μm

Type	Lead-out direction
R	Right
L	Left

Effective length (L): cm units

L: Effective length(mm)

## Incremental linear encoder slim type SR75

- Mitsubishi Electric
- Panasonic
- Yaskawa Electric



- Effective length: 70,120,170,220,270,320,370,420,470,520,570,620,720,770,820,920,1020,1140,1240,1340,1440,1540,1640,1740,1840,2040 mm
- Maximum resolution: 0.01 μm
- Accuracy: (3+3L/1,000) μmp-p L:mm (5+5L/1,000) μmp-p L:mm
- Maximum response speed: 200m/min
- Protective design grade: IP65

Cable: CH33  
※ Please refer to page 29 for cable specifications.

SR75-xxx★○△◇□□□

Reference point position	Indication method	Reference point position	Indication method	Reference point position	Indication method
Less than 1,000	Number (850 mm→850)	1,700-1,799 mm	H + lower 2 digits	Center	X
1,000-1,099 mm	A + lower 2 digits (1,050 mm→450)	1,800-1,899 mm	J + lower 2 digits		
1,100-1,199 mm	B + lower 2 digits	1,900-1,999 mm	K + lower 2 digits		
1,200-1,299 mm	C + lower 2 digits	2,000-2,040 mm	L + lower 2 digits		
1,300-1,399 mm	D + lower 2 digits				
1,400-1,499 mm	E + lower 2 digits				
1,500-1,599 mm	F + lower 2 digits				
1,600-1,699 mm	G + lower 2 digits				

Type	NC manufacturer	Number of wires
B	Mitsubishi Electric	2-wire
D	Mitsubishi Electric	4-wire
H	Panasonic	2-wire
F	Yaskawa Electric	2-wire

Type	Direction	Resolution
A		0.01
B		0.05
C	(plus)	0.1
D		0.5
E		1

Type	Direction	Number of partitions
L	(plus)	1/8,192
M		1/1,024

Type	Accuracy grade
A	5+5L/1,000 μm
S	3+3L/1,000 μm

Type	Lead-out direction
R	Right
L	Left

Effective length (L): cm units

L: Effective length(mm)

## Incremental angle encoder enclosed type RU74

A/B/Reference point



- Hollow diameter: φ20
- Resolution: Approx. 1/1,000°, Approx. 1/10,000°
- Accuracy: ±2.5"
- Maximum response revolution: As the table on the right
- Protective design grade: IP65

Cable  
CE28-\*\*\*○#

Scale side connector  
Conduit  
Type/Conduit  
C With conduit (standard)  
N Without conduit

Cable length  
Written by flush right, indication in "10 cm" units, up to 14 m, 1 m pitch  
Note: 15 m or less including RU74 main unit head cable length

RU74-4096A□■

Type	Minimum phase difference	Response revolutions (min.)	Type	Minimum phase difference	Response revolutions (min.)
A	50	2,000	E	250	533
B	100	1,332	F	300	444
C	150	888	G	400	333
D	200	666	H	500	266
			J	650	205
			K	1,000	133

Type	Resolution	Rotation direction and polarity	Number of pulses/revolution
A	Approx. 1°/1,000	CCW/+	360,448
B	Approx. 1°/1,000	CCW/+	360,448
C	Approx. 1°/10,000	CW/+	3,600,384
D	Approx. 1°/10,000	CCW/+	3,600,384



# List of Adapter Cables

Scale	Connected equipment	Controller side Connector	List of Adapter Cables	Scale side Connector	Maximum cable length	Cable bending radius	
SR27A SR67A	General-purpose cable	Open end	CH23-***□	Scale side Original of Magnescale	13 m	20 mm(Fixed, without conduit) 25 mm(Fixed, with conduit) 50 mm(Elbow-shaped bend)	
	FANUC	Controller side Honda Tsushin Kogyo PCR-S20FS+	CH23-***□F	Scale side Original of Magnescale	13 m	20 mm(Fixed, without conduit) 25 mm(Fixed, with conduit) 50 mm(Elbow-shaped bend)	
			CH23-***□FA/QA    CH23-***□K				
	Relay connector JAE JN1HS10PL2	CH23-***□KA	Relay connector JAE JN2DS10SL-R	Combined total 30 m			
	Mitsubishi Electric	Controller side Sumitomo 3M 36210-0100PL	CH23-***□M	Scale side Original of Magnescale	13 m		
			CH23-***□MA    CH23-***□K				Combined total 30 m
	Relay connector JAE JN1HS10PL2	CH23-***□KA	Relay connector JAE JN2DS10SL-R	Combined total 30 m			
	SIEMENS	Controller side YAMAICHI ELECTRONICS CN078P-061-0001	CH22-***□SMY	Scale side Original of Magnescale	30 m		
			CH22-***□SFY    CH22-***□SMF				Combined total 30 m
			Relay connector Phoenix Contact SACC-M12MS-8Q SH				CH22-***□SFF
SR74 SR84	General-purpose cable	Open end	CH33-***□▽	Scale side Original of Magnescale	30 m		20 mm(Fixed, without conduit) 25 mm(Fixed, with conduit) 50 mm(Elbow-shaped bend)
	FANUC	Controller side Honda Tsushin Kogyo PCR-S20FS+	CH33-***□▽E/P	Scale side Original of Magnescale	30 m	20 mm(Fixed, without conduit) 25 mm(Fixed, with conduit) 50 mm(Elbow-shaped bend) Relay type cannot be used for A/B/Reference of SR74 and SR84.	
			CH33-***□▽L				
Mitsubishi Electric	Controller side Sumitomo 3M 36210-0100PL	CH33-***□▽L	Scale side Original of Magnescale	30 m			

Scale	Connected equipment	Controller side Connector	List of Adapter Cables	Scale side Connector	Maximum cable length	Cable bending radius
RU97	SIEMENS	Controller side YAMAICHI ELECTRONICS CN078P-061-0001	CH22-***□SFY	Relay connector Phoenix Contact SACC-M12MS-8Q SH	30 m	35 mm(Fixed) 75 mm(Elbow-shaped bend)
		Relay connector Phoenix Contact SACC-M12MS-8Q SH	CH22-***□SFF	Relay connector Phoenix Contact SACC-M12MS-8Q SH	Combined total 30 m	
RU77	FANUC	Controller side Honda Tsushin Kogyo PCR-S20FS+	CE28-***□F	Scale side JAE JB1HB10SL2	14 m	10 mm(Fixed, without conduit) 25 mm(Fixed, with conduit) 50 mm(Elbow-shaped bend)
		Relay connector JAE JB1D10PL2	CE28-***□J	Relay connector JAE JB1HB10SL2		
	Mitsubishi Electric	Controller side Sumitomo 3M 36210-0100PL	CE28-***□M	Scale side JAE JB1HB10SL2		
		Relay connector JAE JB1D10PL2	CE28-***□J	Relay connector JAE JB1HB10SL2		
	Yaskawa Electric	Controller side Molex 6P 55100-0670	CE28-***□G	Scale side JAE JB1HB10SL2		
		Relay connector JAE JB1D10PL2	CE28-***□J	Relay connector JAE JB1HB10SL2		
RS97	FANUC	Controller side Honda Tsushin Kogyo PCR-S20FS+	CH23-***□FA/QA	Scale side JAE JN2DS10SL-R	30 m	20 mm(Fixed, without conduit) 25 mm(Fixed, with conduit) 50 mm(Elbow-shaped bend)
		Relay connector JAE JN1HS10PL2	CH23-***□KA	Relay connector JAE JN2DS10SL-R	Combined total 30 m	
	Mitsubishi Electric	Controller side Sumitomo 3M 36210-0100PL	CH23-***□MA	Scale side JAE JN2DS10SL-R	30 m	
		Relay connector JAE JN1HS10PL2	CH23-***□KA	Relay connector JAE JN2DS10SL-R	Combined total 30 m	
	SIEMENS	Controller side YAMAICHI ELECTRONICS CN078P-061-0001	CH22-***□SFY	Scale side Phoenix Contact SACC-M12FS-8Q SH	30 m	
		Relay connector Phoenix Contact SACC-M12MS-8Q SH	CH22-***□SFF	Relay connector Phoenix Contact SACC-M12MS-8Q SH	Combined total 30 m	

## Cables

### CH22 - □□□□▽※ #

□□□□ Cable length  
Written by flush right,  
indication in "m" units,  
up to 30 m, 0.5 m pitch

Type	Cable length	Type	Conduit specification
015	1.5m	C	With conduit
070	7m	N	Without conduit (standard)
260	26m		

### 【▽】Cable sheath (covering)

Type	Specification
S	PU (Polyurethane, Siemens Motion connect 800+)

### 【#】Scale side connector

Type	Specification	Remarks
M	Scale head connector	Standard
F	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing
E	M12 connector (Female) made by Phoenix Contact	Relay/ Waterproofing/ Attached connector

### 【#】Controller side connector

Type	Specification	Remarks
None	Open-end	Standard
Y	RJ45 connector made by YAMAICHI ELECTRONICS	Adopts NC machine tool
Z	RJ45 connector (water proof) made by YAMAICHI ELECTRONICS	Relay
F	M12 connector (Male) made by Phoenix Contact	Relay/ Waterproofing

### CH23 - □□□□▽※ #

□□□□ Cable length

Type	Cable length	Type	Conduit specification
010	1m	C	With conduit (standard)
005	0.5m	N	Without conduit
065	6.5m		
100	10m		

### 【▽】Cable sheath (covering)

Type	Specification
V	PVC (Φ6.8) [Scale side]
P	PVC (Φ8) [Controller side]
E	PU (Φ8) [Controller side]

### 【#】Controller side connector

Type	Specification	Remarks
Without	Earth wire	
Z	Open-end	Scale side connector should be 10P JN2 (Female) made by Japan Aviation Electronics Industry or 2P made by TAJIMI ELECTRONICS
None	Standard	
M	10P made by Sumitomo 3M	Mitsubishi NC, J3 (INC serial, ABS)
F	20P straight case made by Honda Tsushin Kogyo	FANUC (INC serial, ABS)
J	S Horizontal drawing case made by HROSE Electric	FANUC (INC serial, ABS)
K	10P JN1 (Male) made by Japan Aviation Electronics Industry	Relay
N	12P R04 (Male) made by TAJIMI ELECTRONICS	Relay (fixed)

### 【#】Scale side connector

Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P R04-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)

### CE28 - □□□□※

□□□□ Cable length  
Written by flush right,  
indication in "10 cm" units,  
up to 14m, 1m pitch

Type	Cable length
070	7m
090	9m
130	13m

### 【○】Conduit

Type	Conduit
C	With conduit (standard)
N	Without conduit

### 【#】Controller side connector

Type	Specification	Remarks
Without	Earth wire	
Without	Open-end	Standard
L	10P made by Sumitomo 3M	Mitsubishi NC, J3 (A/B/Reference)
M	10P made by Sumitomo 3M	Mitsubishi NC, J3 (INC serial, ABS)
F	20P made by Honda Tsushin Kogyo	FANUC (A/B/Reference)
P	20P made by HROSE Electric	FANUC (INC serial, ABS)
Q	6P made by molex*	YASKAWA Electric (INC serial, ABS)
G	6P made by molex*	YASKAWA Electric (INC serial, ABS)
J	10P JN1 made by Japan Aviation Electronics Industry	RU77 cable extension (standard)
K	10P JN1 made by Japan Aviation Electronics Industry	RU77 cable extension (standard)

### CH33 - □□□□▽※ #

□□□□ Cable length  
Written by flush right,  
indication in "m" units,  
up to 30 m, 1 m pitch

Type	Cable length	Type	Conduit
07	7m	C	With conduit (standard)
26	26m	N	Without conduit

### 【▽】Cable sheath (covering)

Type	Specification
P	PVC (Polyvinyl chloride)
E	PU (Polyurethane)

### 【#】Controller side connector

Type	Specification	Remarks
Without	Earth wire	
None	Open-end	Standard
A	D-sub 15P	
D	D-sub 9P	
L	10P made by Sumitomo 3M	Mitsubishi NC, J3, J4 (A/B Phase)
M	10P made by Sumitomo 3M	Mitsubishi NC, J3, J4 (INC serial, ABS)
-	20P straight case made by Honda Tsushin Kogyo	FANUC (A/B Phase)
-	20P straight case made by HROSE Electric	FANUC (INC serial, ABS)
G	6P made by molex*	YASKAWA Electric, Panasonic (INC serial, ABS)
-	6P made by molex*	FANUC (A/B Phase)
-	Horizontal drawing case made by HROSE Electric	FANUC (A/B Phase)
-	Horizontal drawing case made by HROSE Electric	FANUC (INC serial, ABS)
K	10P JN1 (Male) made by Japan Aviation Electronics Industry	Relay
N	12P R04 (Male) made by TAJIMI ELECTRONICS	Relay (fixed)

### 【#】Scale side connector

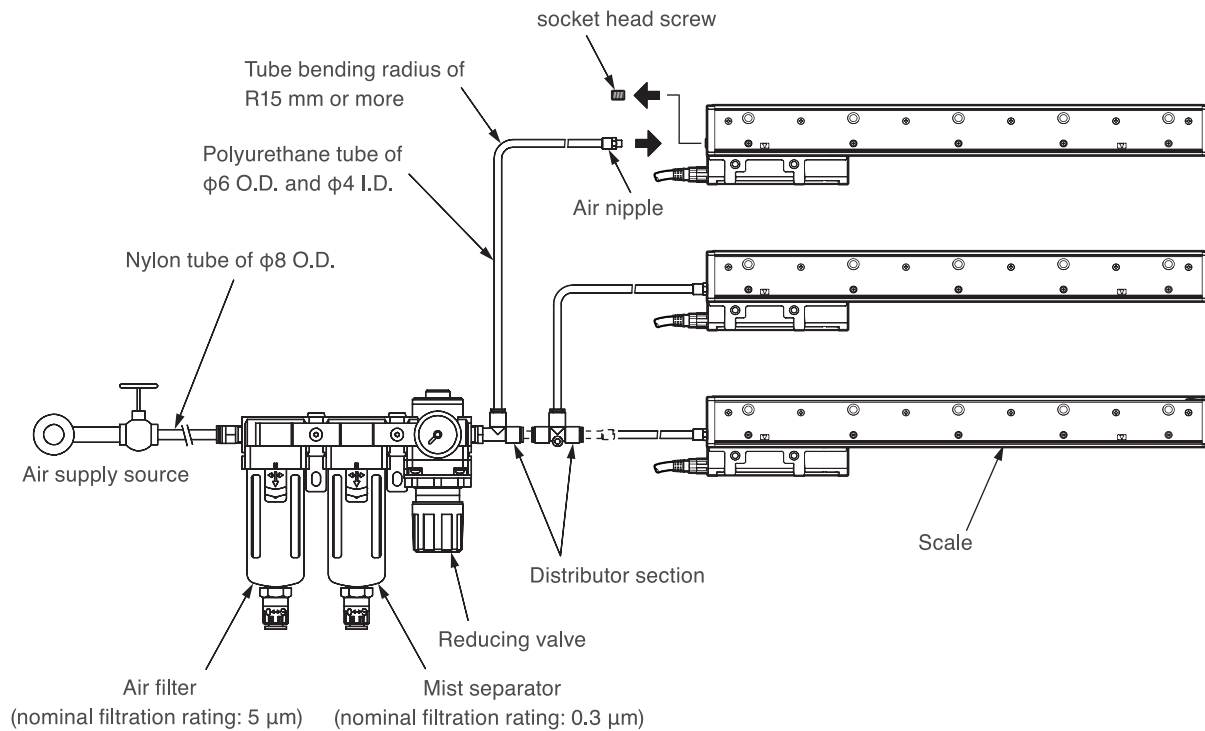
Type	Specification	Remarks
None	Original of Magnescale	Standard
A	10P JN2 (Female) made by Japan Aviation Electronics Industry	Relay
C	12P R04-9125JF8.5 made by TAJIMI ELECTRONICS	Relay (fixed)

\*Relay type cannot be used for A/B/Reference type of SR74 and SR84

# Technology

## Air purging

If scale is used in a dusty or misty environment, it is recommended that air is introduced into the scale to alleviate any unwanted effects. Attach air nipples to M5 holes for air introduction that are provided at both ends of the scale to supply air into the scale. When introducing air into the scale, supply air via an air filter (nominal filtration rating: 5  $\mu\text{m}$ ), mist separator (nominal filtration rating: 0.3  $\mu\text{m}$ ), and a regulator to remove dust, dirt, and mist. As a guide, the amount of air supplied to the scale is 10-20  $\text{l}/\text{min}$ .



# Safety

## No compromise for high-accuracy products



The total quality control system that operates throughout the entire design and production process ensures products with enhanced safety, high quality, and high reliability that match our customers' requirements. The company is certified for length calibration in compliance with the traceability system required by the "Weights and Measures Act," and has been granted ISO 9001 certification, which is the international standard for quality assurance.



Magnescale Co., Ltd.  
is registered to ISO 9001 (Quality)



Our products comply with CE Marking requirements, have acquired UL certifications and meet other regulations, ensuring safe use the world over.

We have met:

- EMC Directives(CE) EMI: EN 55011 Group 1 Class A / 91 EMS: EN 61000-6-2
- FCC regulation FCC Part 15 Subpart B Class A

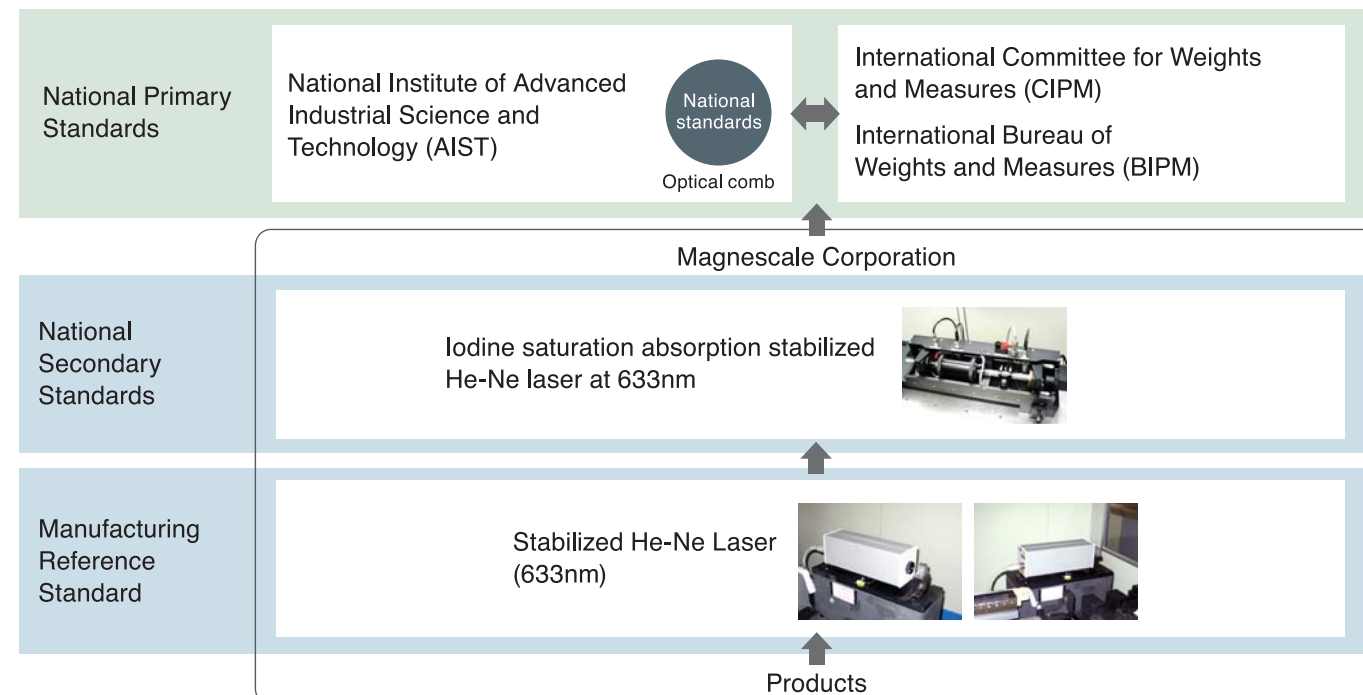
for Products with built-in AC power supply:  
• UL61010-1 • EN61010-1

for Products with Laser:  
• DHHS (21CFR1040.10) • IEC60825-1

\* When using our devices with machines to which the European Machinery Directive applies, please make sure that the devices when installed on the machines fulfill the applicable requirements of the Directive.  
\* Standards or regulations to be complied with may vary by product.

# Traceability

## Traceability Flow Chart (Length)



# Functional Safety

Recently, great importance has been placed on human safety around industrial machines and machine tools. In 2010, the European Machinery Directive mandated compliance with functional safety for electrical equipment used in the safety systems of machines subject to the Machinery Directory. These safety demands are anticipated to spread across many additional regions and industries in the future. Magnescale leads the competition with its lineup of feedback scale that have acquired third-party functional safety certification in order to meet global demands for safety.

Certification standards  
IEC61508:2010 / EN62061:2005 SIL 2  
EN ISO13849-1 Cat. 3 / PL d  
EN61800-5-2



Models that have acquired certification

- Angle encoders  
RS97-1024EGZ series  
RS97-1024NGZ series  
RU97-2048 Z series

- Linear encoders  
SR27A-AZ series  
SR67A-AZ series



\* Consult our sales representative for details.

Specifications

Model name	SQ47	SQ57
Effective length	90 to 6,240mm	70 to 6,270mm
Accuracy	$\pm(1.5+1.5L/1000)\mu\text{m}$	
Resolution	Selectable from 0.005/0.01/0.05/0.1/0.5/1 $\mu\text{m}$	
Maximum response speed	200m/min	
Vibration resistance	250m/s <sup>2</sup>	
Impact resistance	980m/s <sup>2</sup>	
Protective design grade	IP67	
Maximum consumption current	1.3W	
Power supply voltage	DC5V $\pm$ 5%	
Operating temperature	0 to 50°C	
Output signal	Compatible with each serial interface	
Option	Connection cable: CH23 series	

Model name : SQ◆◆-xxx★S△▽□□□

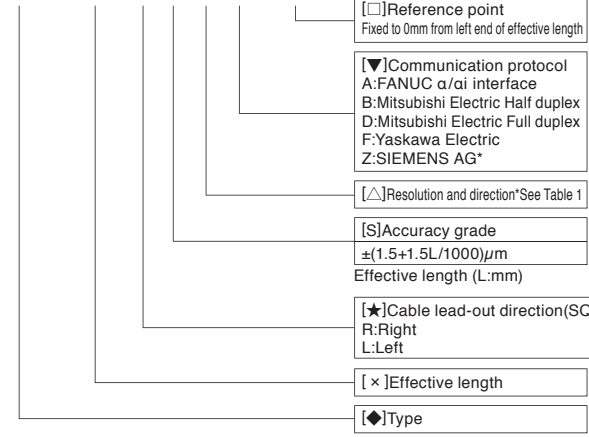


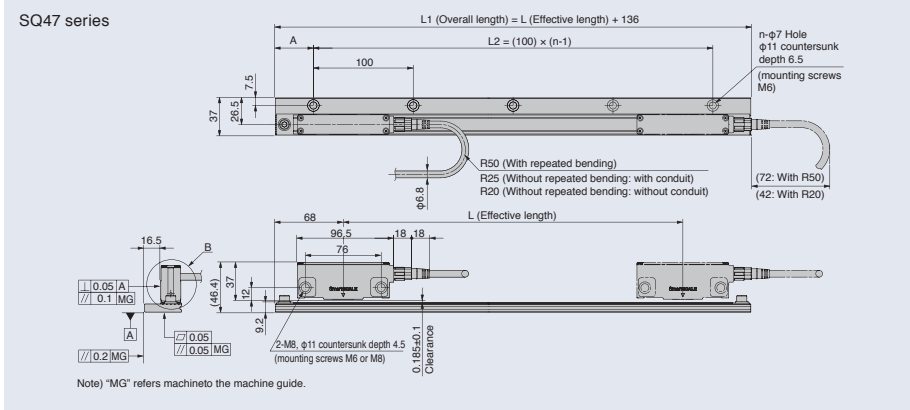
Table 1

Model name	Direction	Resolution	Model name	Direction	Resolution
S		0.005 $\mu\text{m}$	T		0.005 $\mu\text{m}$
A		0.01 $\mu\text{m}$	F		0.01 $\mu\text{m}$
B		0.05 $\mu\text{m}$	G		0.05 $\mu\text{m}$
C	+	0.1 $\mu\text{m}$	H	-	0.1 $\mu\text{m}$
D		0.5 $\mu\text{m}$	J		0.5 $\mu\text{m}$
E		1 $\mu\text{m}$	K		1 $\mu\text{m}$

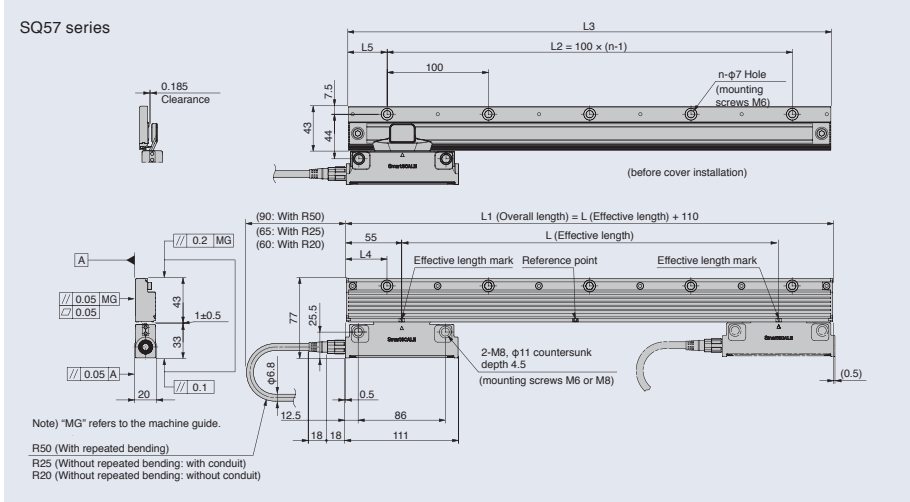
- Reference point  
Fixed to 0mm from left end of effective length
- ▼ Communication protocol  
A: FANUC  $\alpha$ /ai interface  
B: Mitsubishi Electric Half duplex  
D: Mitsubishi Electric Full duplex  
F: Yaskawa Electric  
Z: SIEMENS AG\*
- △ Resolution and direction\* See Table 1
- S Accuracy grade  
 $\pm(1.5+1.5L/1000)\mu\text{m}$   
Effective length (L: mm)
- ★ Cable lead-out direction (SQ47 only)  
R: Right  
L: Left
- × Effective length
- ◆ Type

\*Please contact us for more details.

Dimensions



Lineup



Please contact us for more details.



# Magnescape

SPEED X PRECISION

Absolute type  
**SmartSCALE**

Stronger resistance to harsh environments

⚠ To use this product safely, please read the instruction manual carefully and thoroughly prior to usage. \*Magnescape reserves the right to change products and specifications without prior notice.

Magnescape Co., Ltd.

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 Magnescape Europe GmbH : Antoniusstrasse 14, 73249 Wernau, Germany TEL.+49(0)7153-934-291 FAX.+49(0)7153-934-299  
 Service & Parts : 45 Suzukawa, Isehara-shi, Kanagawa 259-1146, Japan TEL.+81(0)463-92-2132 FAX.+81(0)463-92-3090

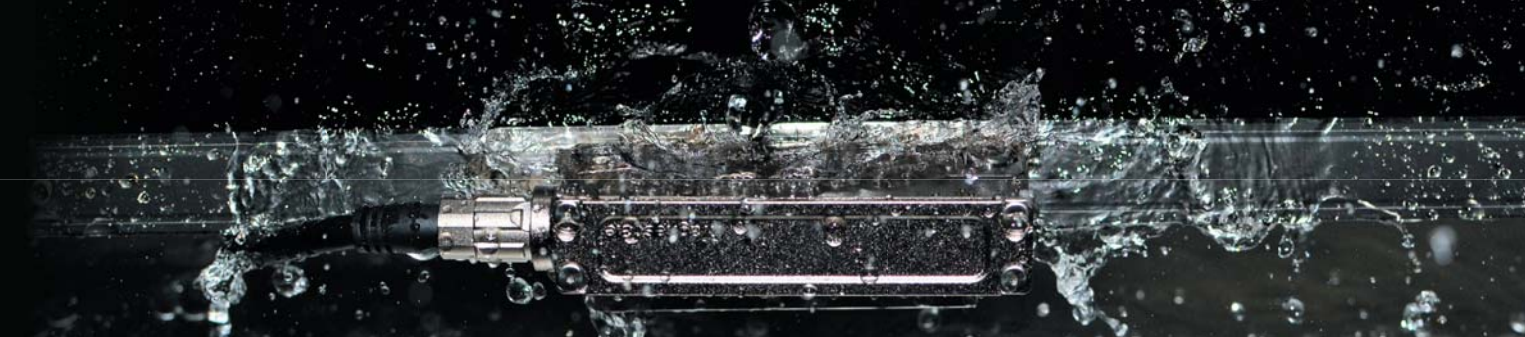
<http://www.magnescape.com>

The contents of this literature are as of June, 2018

Magnescape Co., Ltd.

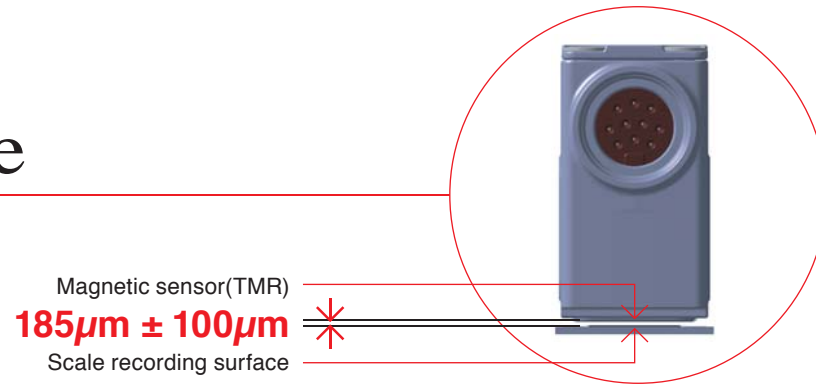
# Stronger resistance to harsh environments

Air purging not necessary



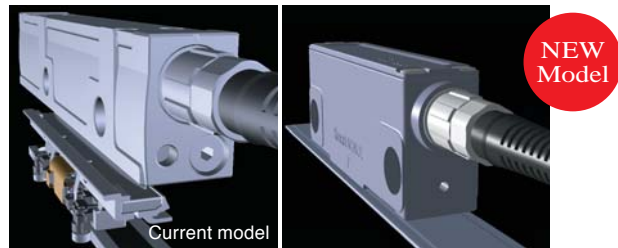
## Wide gap and clearance tolerance

Gap between scale and head : 2 times greater than current model.  
Clearance tolerance between scale and head : 5 times greater than current model.



## Separate type simple architecture

Space saving design by bearingless and miniaturization enables encoders to install near works and multiple encoders in one axis.



## 5nm high-resolution

Achieves best in class 5nm resolution by utilizing the latest interpolation technology with a newly developed algorithm.

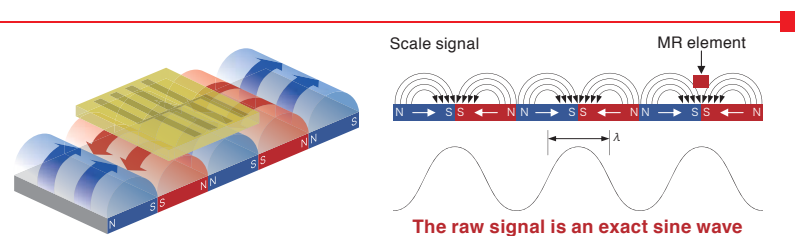
## Sealed structure with IP67 grade

The magnetic encoder and detection device are fully protected by a 50µm thin metal cover.  
High resistance to coolant/water splashing and to sludge/metal chips provides stable operation under harsh environments.



## Principle

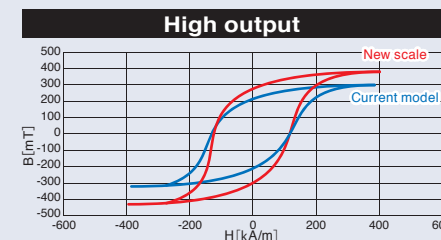
**Detection Principle**  
A thin-film MR element with a high-precision, low-distortion pattern arrangement is used as the detecting element. The resistance value of the MR element changes when the magnetic field acting on the element changes due to an alteration in the relative position between the element and the magnetic media. This change in resistance value is read electronically to detect the amount of positional change.



## New technology

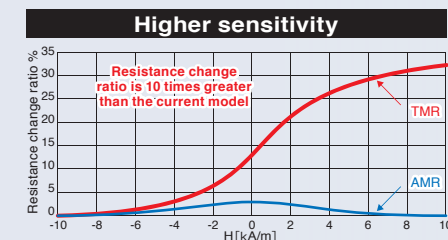
### Development of a new magnetic medium

The output detection signal has improved 30% by changing the composition and consistency of the magnetic medium of the scale, and by improving the production method.



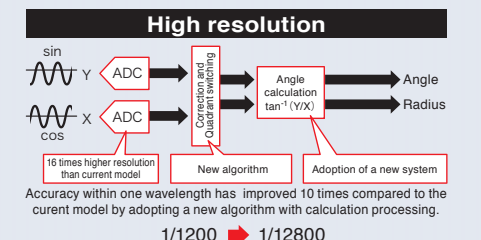
### The development of a high sensitivity sensor using a new TMR device

Utilizes a low strain sensor enabling 10 times higher sensitivity compared to the current model by the development of a TMR element based on the Spin-Valve method.

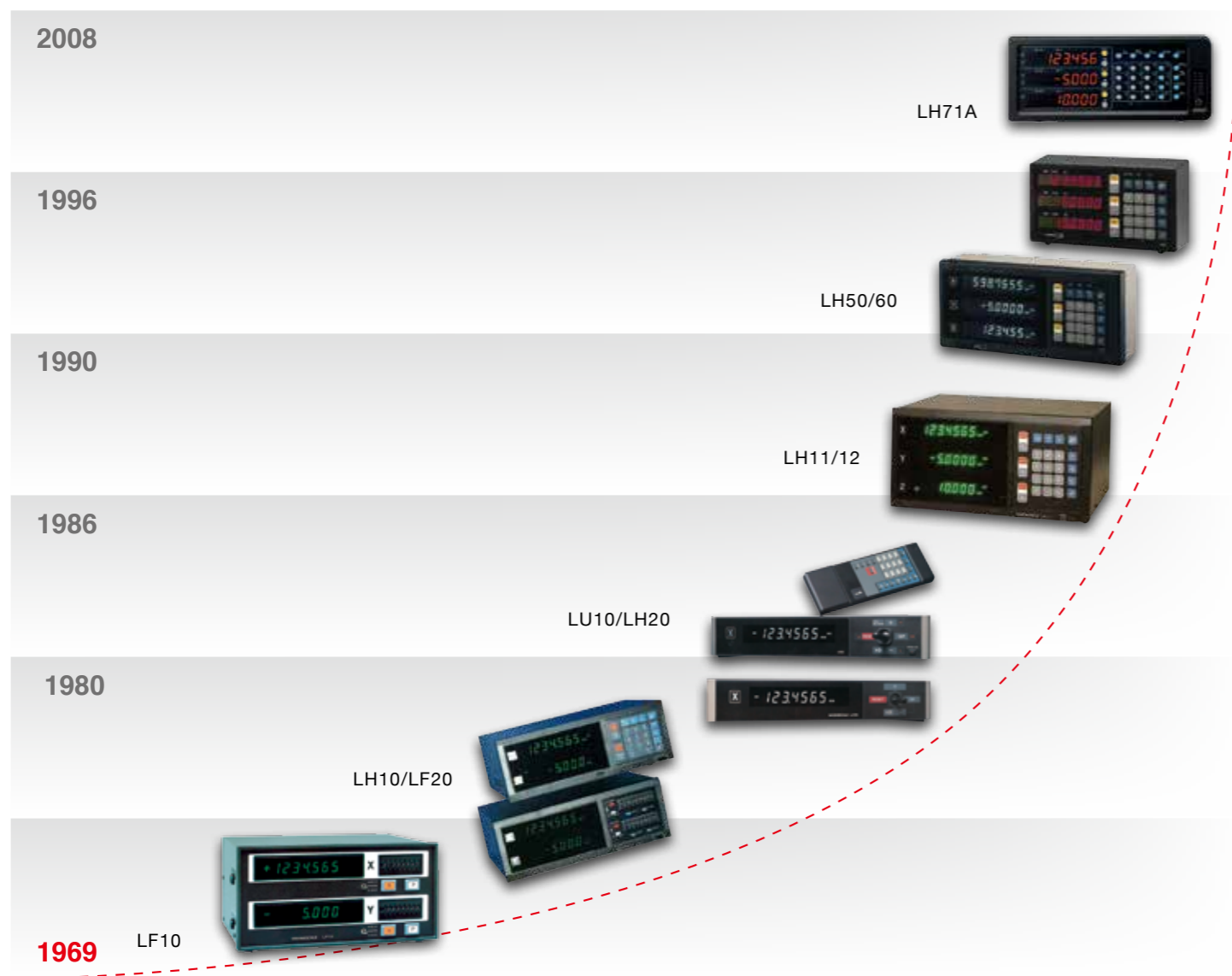


### New interpolation calculation method

Achieves 5nm resolution and improves interpolation accuracy by utilizing a new interpolation calculation method.



## Over Forty Years of Legendary Reliability Magnescale counter history



Some old models may require adapter or other accessories. If you have any question, please contact us.

### Magnescale Co., Ltd.

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Magnescale Europe GmbH	Antoniusstrasse 14, 73249 Wernau, Germany	TEL.+49(0)7153-934-291	FAX.+49(0)7153-934-299	E-mail : info-eu@magnescale.com
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<http://www.magnescale.com>

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# Magnescale

SPEED X PRECISION

Digital Readout General Catalog



## Digital Readout

Magnescale Co., Ltd.

**For over 40 years,  
Magnescale has been providing  
superior accuracy and  
legendary reliability to  
customers around the world.**

Magnescale magnetic scale technology can maintain high accuracy even under the harsh environments without being affected by condensation, oil or coolant.

With a wide range of capability and installation options, Magnescale magnetic scale technology is suitable for all types of machines.

**The Advantages of Magnetic Scales:**

- Resistant to oil, dust, vibration and shock
- Easy installation

**Suitable for a wide range of applications:**

- Grinding machines
- Milling machines
- Measuring machines
- Lathes
- Drilling machines
- Measuring fixtures

## Digital Readouts



### Multifunctional counters LG20, LH70, LH71, LH71A, LH72

The LH70 Series are position counters developed for general-purpose machine tools. LH71A-3 can be used for milling machines and lathes applications by switching initial settings. LH72 is designed for lathes.

Multifunction units LG20 / LH70/71/72 series				
	LG20	LH70	LH71 / LH71A	LH72
Display axes	1, 2, 3			3
Display	7 digits, orange LEDs, floating minus sign			
Display resolution	0.1/0.5/1/5/10 μm	0.1/0.5/1/5/10 μm 1 s /10 s/ 1 min/10 min		
Input signal	A/B quadrature/Z signal (EIA422)			
Compatible measuring systems	GB-ER, SJ700A and PL20C with SL110 / 130			
Power supply	12 VDC using separate power supply unit PSC2* with 100-240 VAC			
Weight	1.5 kg			

### Functions at a glance

Model	LG20	LH70	LH71	LH71A	LH72
Reset	■	■	■	■	■
Preset	■	■	■	■	■
Absolute/Incremental		■	■	■	■
Diameter display	■	■	■	■	■
Angle display		■	■	■	■
Alarm display	■	■	■	■	■
Zero point detection		■	■	■	■
Datum points		10	150	150	
Tool memory*		12	99	99	99
Midpoint calculation		■	■	■	■
Scaling			■	■	■
Addition function*		■	■	■	■
Programming function			■	■	■
Bolt hole circle		■	■	■	
Line hole			■	■	
Simple R cutting		■	■	■	
Linear error compensation	■	■	■	■	■
Segment error compensation			■	■	■
Data storage	■	■	■	■	■
Energy saving function	■	■	■	■	■
Navigation function		■	■	■	■
External reset				■	■
Touch sensor function				■	

\* only 3 axis display

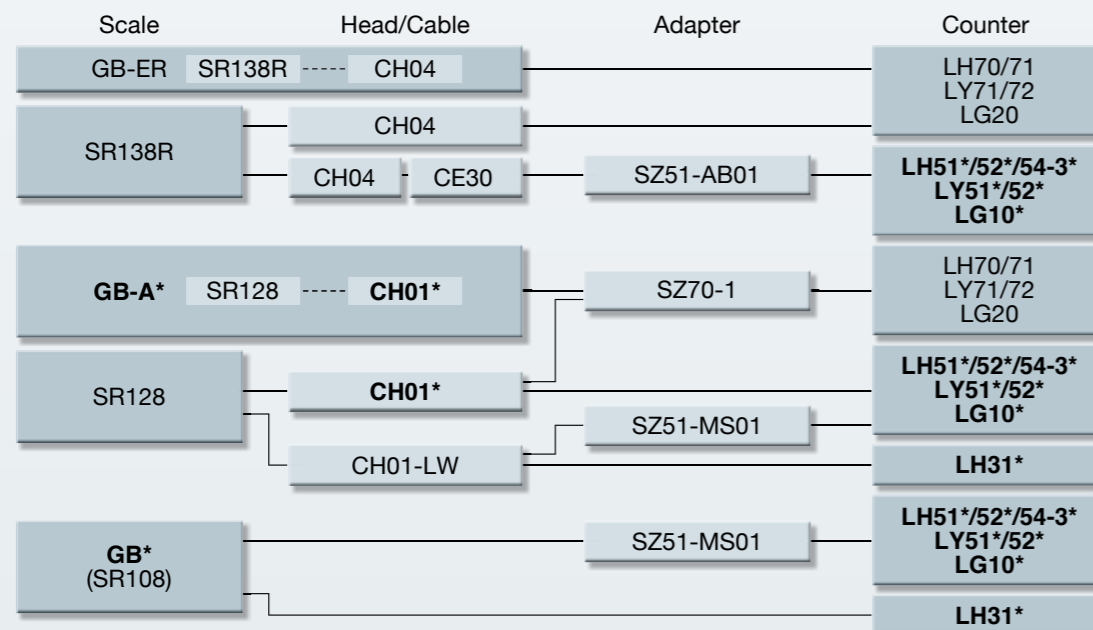
# GB-ER

Renowned for its legendary accuracy and reliability, the GB-ER is suitable for precise, high-resolution applications.

- Excellent durability against workshop conditions - resistant to oil, dirt, shock and vibration
- Compact design for easy installation
- Resolution: 0.5  $\mu\text{m}$
- Accuracy: (5+5L/1000)  $\mu\text{m}$



## GB Series Connection Chart



Products marked \* are discontinued

# SJ700A

Reliable magnetic scale general purpose applications

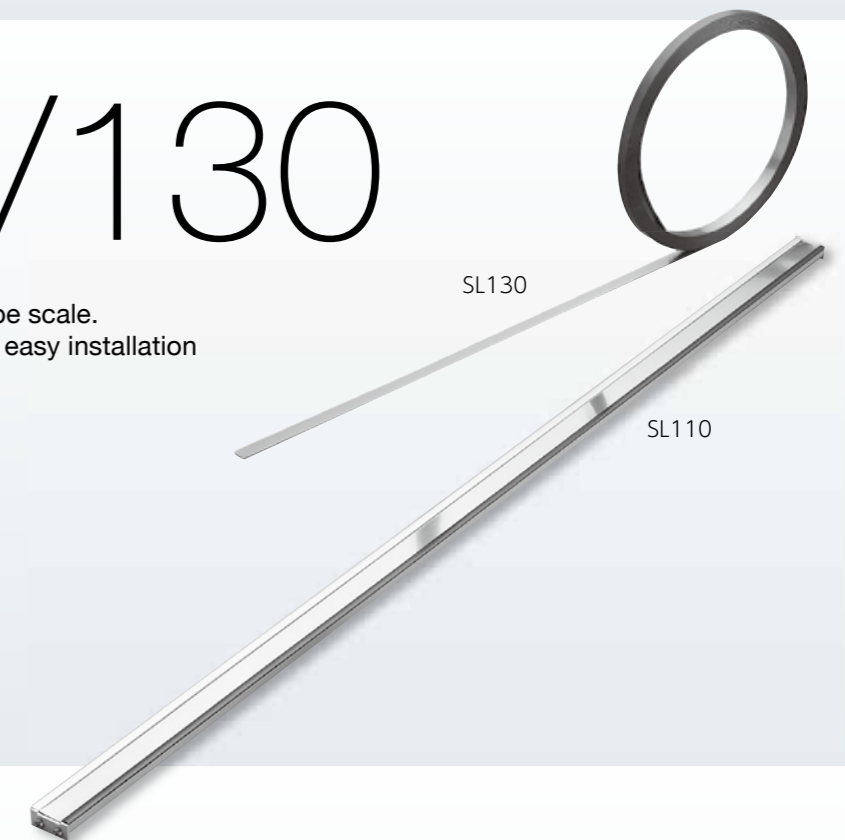
- Same coefficient of expansion as machine tools
- Measuring length: 150 mm to 1600 mm / 5.9" to 62.9"
- Resolution: 5  $\mu\text{m}$
- Accuracy:  $\pm 10 \mu\text{m}$ ,  $\pm 15 \mu\text{m}$
- Output signal: A/B Quadrature



# SL110/130

Digiruler is a non-contact, flexible magnetic tape scale. This design creates unparalleled durability and easy installation for all types of measurement applications.

- Available in lengths up to 30 m (SL130)
- Cost efficient for applications from woodworking to metal cutting
- Resolution: 10  $\mu\text{m}$  (with PL20C)
- Max. response speed: 300 m/min (with PL20C)



# PL20C

Reader Head and Cable (for SL110/SL130)

- Excellent resistance to workshop conditions (IP65)
- Resistant to oil, dirt, vibration, and shock
- Resolution: 10  $\mu\text{m}$  (with PL20C)
- Max. response speed: 300 m/min (varies with the read head and settings)
- Output signal: A/B quadrature (with PL20C)



## GB-ER

Specifications		GB-ER
Model	GB-ER	
Measurement Length (ML) L: mm(inch)	50 (1.9"), 100 (3.9"), 150 (5.9"), 200 (7.8"), 250 (9.8"), 300 (11.8"), 350 (13.7"), 400 (15.7"), 450 (17.7"), 500 (19.6"), 550 (21.6"), 600 (23.6"), 650 (25.5"), 750 (29.5"), 850 (33.4"), 950 (37.4"), 1050 (41.3"), 1250 (49.2"), 1400 (55.1"), 1600 (62.9"), 1850 (72.8"), 2050 (80.7"), 2200 (88.6")	
Overall length	Measuring length + 104 (4.1(50 to 200 mm)*) Measuring length + 120 (4.7(250 to 2200 mm)*)	
Max. travel	L + 14 mm (50 to 200 mm) Overall length (250 to 2200 mm) L + 30 mm (250 to 2200 mm) Overall length (50 to 200 mm)	
With or without Centerfootplate	Included with ML: 1050 mm to 2200 mm Excluded ML: 50 mm to 950 mm	
Accuracy at 20 °C/68 °F	(5 + 5L / 1000) μm	
Resolution	0.5 μm	
Max. response speed (scale signal, reference signal)	60 m/min	
Reference point	Standard:Center of scale, User-defined position also available	
Mounting parallelism	± 0.1 mm	
Thermal expansion coefficient	(11±1) × 10 <sup>-6</sup> /°C	
Operating temperature	0 °C to 40 °C/ 32 °F to 104 °F	
Storage temperature	-20 °C to 50 °C/ 4 °F to 122 °F	
Head cable length	0.3 m	
Cable length	3 m	
Protective design grade	Scale: IP65 (Interpolation Unit: IP30)	
Input/Output signal	Output signal	AB/ quadrature signal, Z signal
	Power supply	+5 VDC ±5 %
Power consumption	Connector	D-sub 9 pin
		Max. 200 mA

## SJ700A

Specifications		SJ700A
Model	SJ700A	
Measurement Length (ML) L: mm(inch)	150 (5.9"), 250 (9.8"), 350 (13.7"), 400 (15.7"), 500 (19.6"), 650 (25.5"), 800 (31.5"), 950 (37.4"), 1050 (41.3"), 1250 (49.2"), 1400 (55.1"), 1600 (62.9")	
Overall length	Measuring length + 120 (4.73")	
Max. travel	Measuring length + 20 (0.78") (10 (0.39") each at right and left)	
With or without Centerfootplate	Included with ML: 1250 mm to 1600 mm Excluded ML: 150 mm to 1050 mm	
Accuracy at 20 °C/68 °F	±10 μm (Measuring length 1250 (49.21") or less) ±15 μm (Measuring length 1400 (55.12") or more)	
Resolution	5 μm	
Thermal expansion coefficient	(12 ±1) × 10 <sup>-6</sup> /°C	
Operating temperature	0 °C to 40 °C/ 32 °F to 104 °F	
Storage temperature	-20 °C to 60 °C/ 4 °F to 140 °F	
Protective design grade	IP54	
Input/Output signal	Output signal	AB/ quadrature signal, Z signal
	Power supply	+5 VDC ±5 %
Power consumption	Connector	D-sub 9 pin
		Max. 200 mA

## SL110/SL130

Model	SL110		SL130	
	-20 to -200		-20 to -700	
Measurement length L mm (inch)	200/300/400/500/600/700/800/1000/1200/ 1500/1600/1700/1800/1900/2000 (7.8/11.8/15.7/19.6/23.6/27.5/31.4/39.3/47.2/ 59.0/62.9/66.9/70.8/78.7)		200/300/400/500/600/700/800/1000/1200/ 1500/1600/1700/1800/2000/2500/3000/ 4000/5000/6000/7000 (7.8/11.8/15.7/19.6/23.6/27.5/31.4/39.3/ 47.2/59.0/62.9/66.9/70.8/78.7/98.4/118.1/ 157.4/196.8/236.2/275.5)	
Overall length	L+103 mm/ 4.1"		L+100 mm/ 3.9"	
Accuracy at 20 °C/68 °F	± (25 + 5L/ 1000) μm		± (25 + 5L/ 1000 + 10N) μm N=1 when L=8000 /9000/10000, N=2 when L=20000, N=3 when L=30000	
Resolution	10 μm		300 m/min	
Max. response speed	(11.1 ± 1) × 10 <sup>-6</sup> /°C		(10.4 ± 1) × 10 <sup>-6</sup> /°C	
Thermal expansion coefficient	-5 °C to 45 °C / 23 °F to 113 °F		-10 °C to 50 °C / 14 °F to 122 °F	
Operating temperature	-10 °C to 50 °C / 14 °F to 122 °F		PL20C	
Storage temperature				
Compatible read head				

\*Accuracy shows the value when used with PL20C read head.

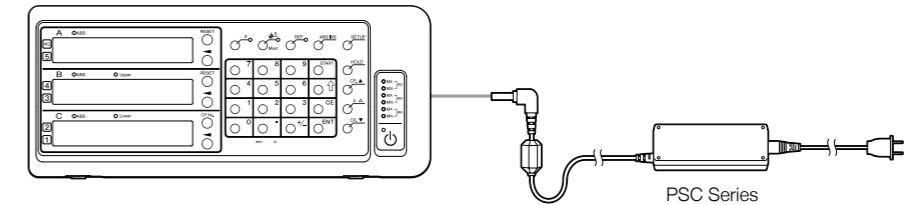
## PL20C

Specifications						
Model	PL20C-3/-3C	PL20C-5/-5C	PL20C-10/-10C	PL20C-15/-15C	PL20C-20/-20C	PL20C-30
Cable length	3 m	5 m	10 m	15 m	20 m	30 m
Output signal	AB quadrature signal					
Resolution	10 μm					
Max. response speed	300 m/min					
Head mtg. screw tightening torque	0.7-1.1 N·m					
Operating temperature	0 °C to 45 °C/32 °F to 113 °F					
Storage temperature	-10 °C to 50 °C/-14 °F to 122 °F					

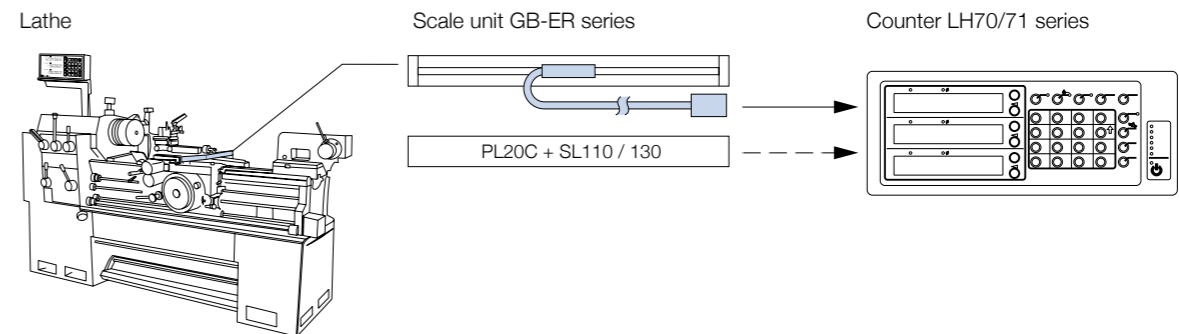
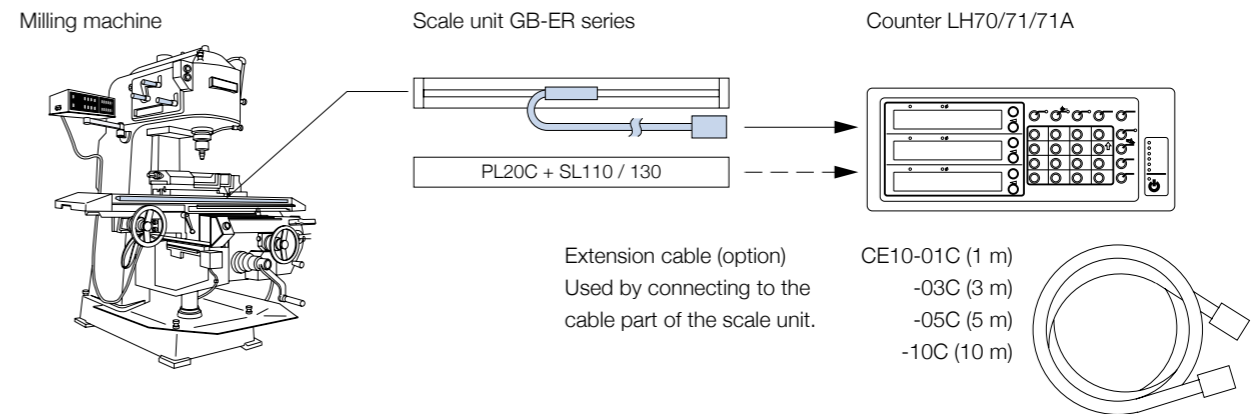
# Accessories

### Power supply adapter

- PSC-21 (For Japan only) 100 V
- PSC-22 (For U.S. only) 120 V
- PSC-23 (For Europe and other country.) 220 to 240 V



### System configuration



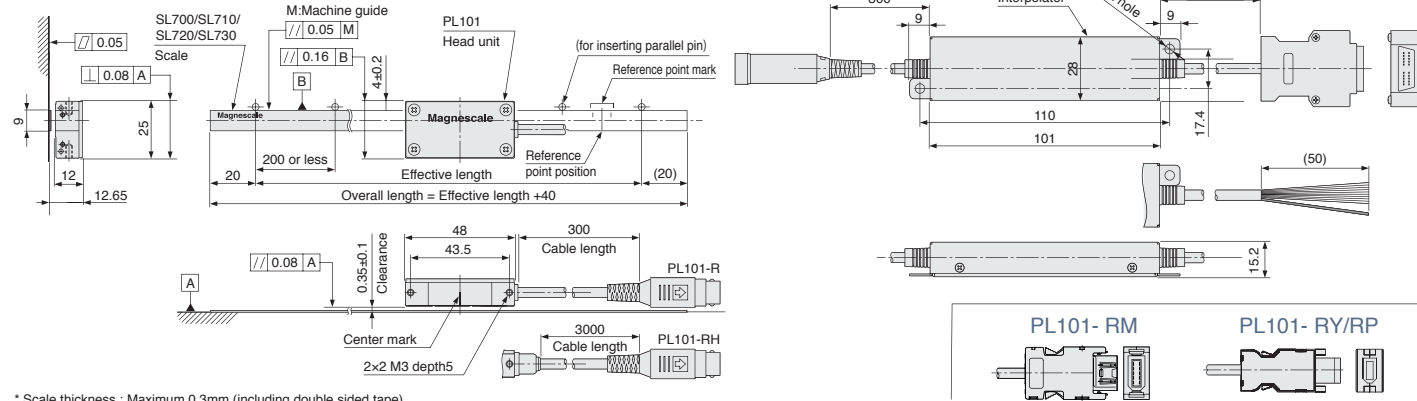
### How to order

LG20 - □	PSC-21	GB - □□□ ER	SJ700A - □□□
LH70 - □	-22	Series L of scales in cm	Series L in cm
LH71 - □	-23		
LH71A - □	Separate power supply		
Series			
	Number of axes (1, 2 or 3)		
SL110 - □□□ + PL20C - □ C			
Series	L in cm	Series	Length of connecting cable (m)
			With armour



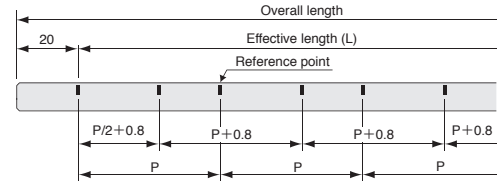
Dimensions

PL101- RA / SL700 series



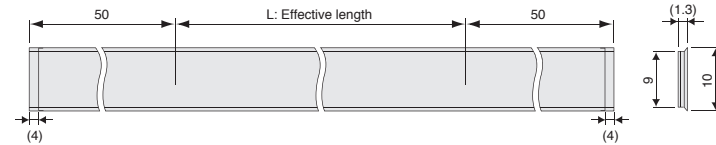
\* Scale thickness : Maximum 0.3mm (including double sided tape)  
 \* Install on non-magnetic materials. If installing on magnetic materials, please ensure a non-magnetic layer of at least 3mm between the scale and the mounting surface.

SL730  
Distance coded reference marks signal explanation

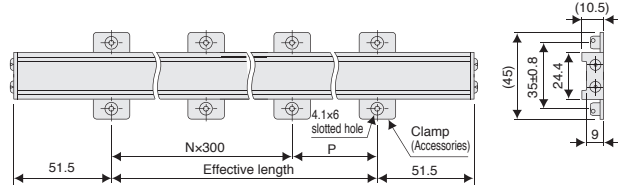


Reference pitch (P)	Effective length : mm
80 mm	200 <math>< L \leq 2,000</math>
160 mm	2,000 <math>< L \leq 12,000</math>
320 mm	12,000 <math>< L \leq 56,000</math>
480 mm	56,000 <math>< L \leq 100,000</math>

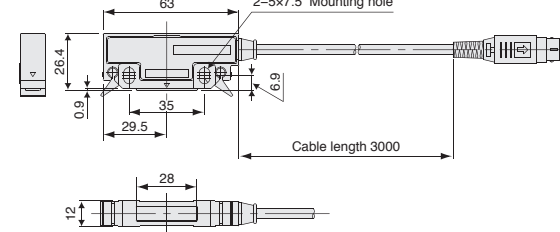
SL331/130



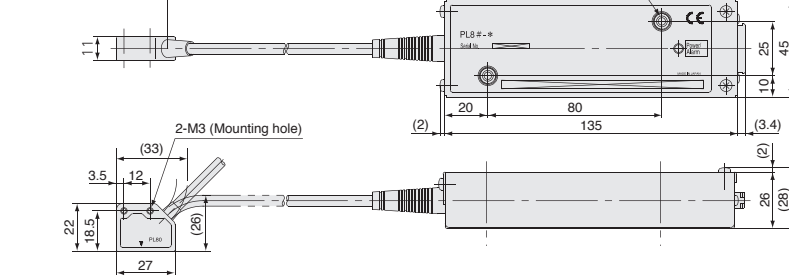
SL110



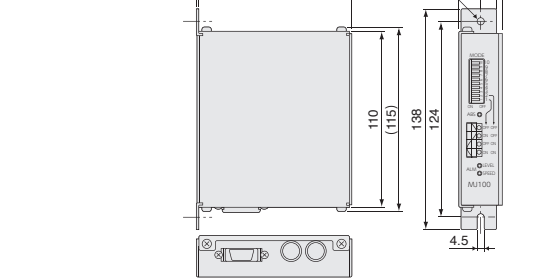
PL60/25



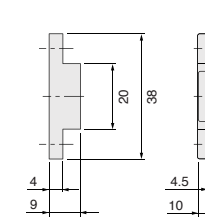
PL81/PL82



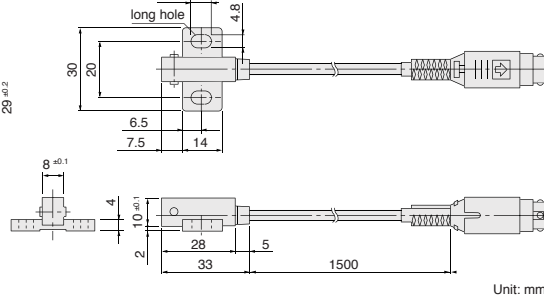
MJ100/110



SET-P16  
Magnet PG-104



Sensor PK16



Unit: mm

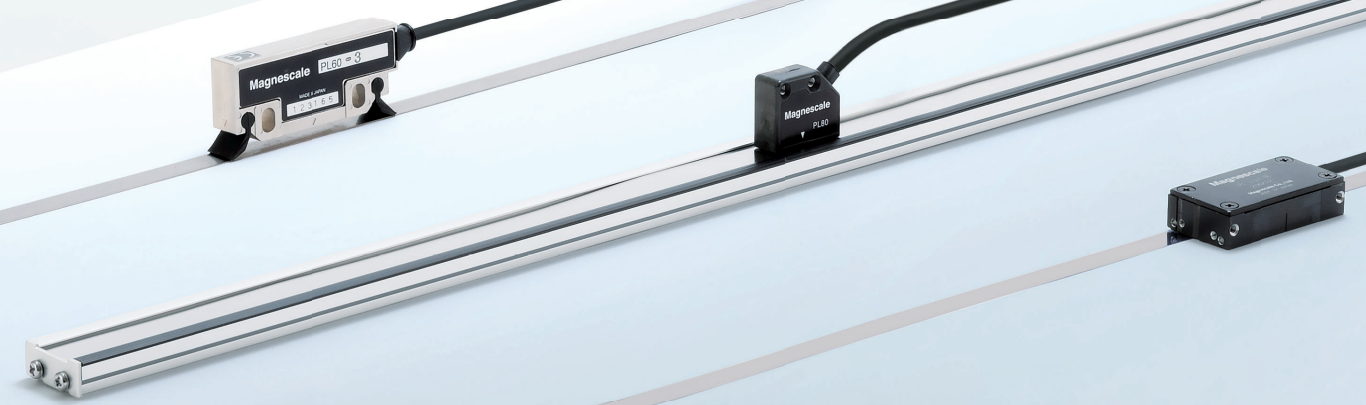
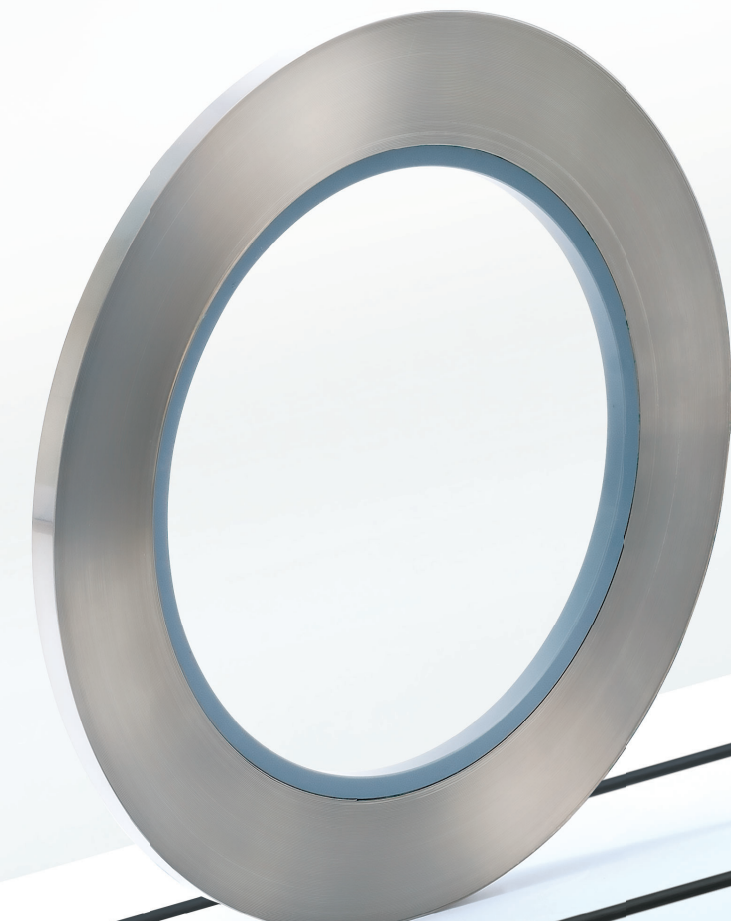
# Magnescale

SPEED X PRECISION

Magnetic Ribbon Scale

## DIGIRULER

High environmental resistance,  
 High response speed (10m/s) and high resolution (0.1μm).  
 Magnetic digital scale technology produces real-time measurement data



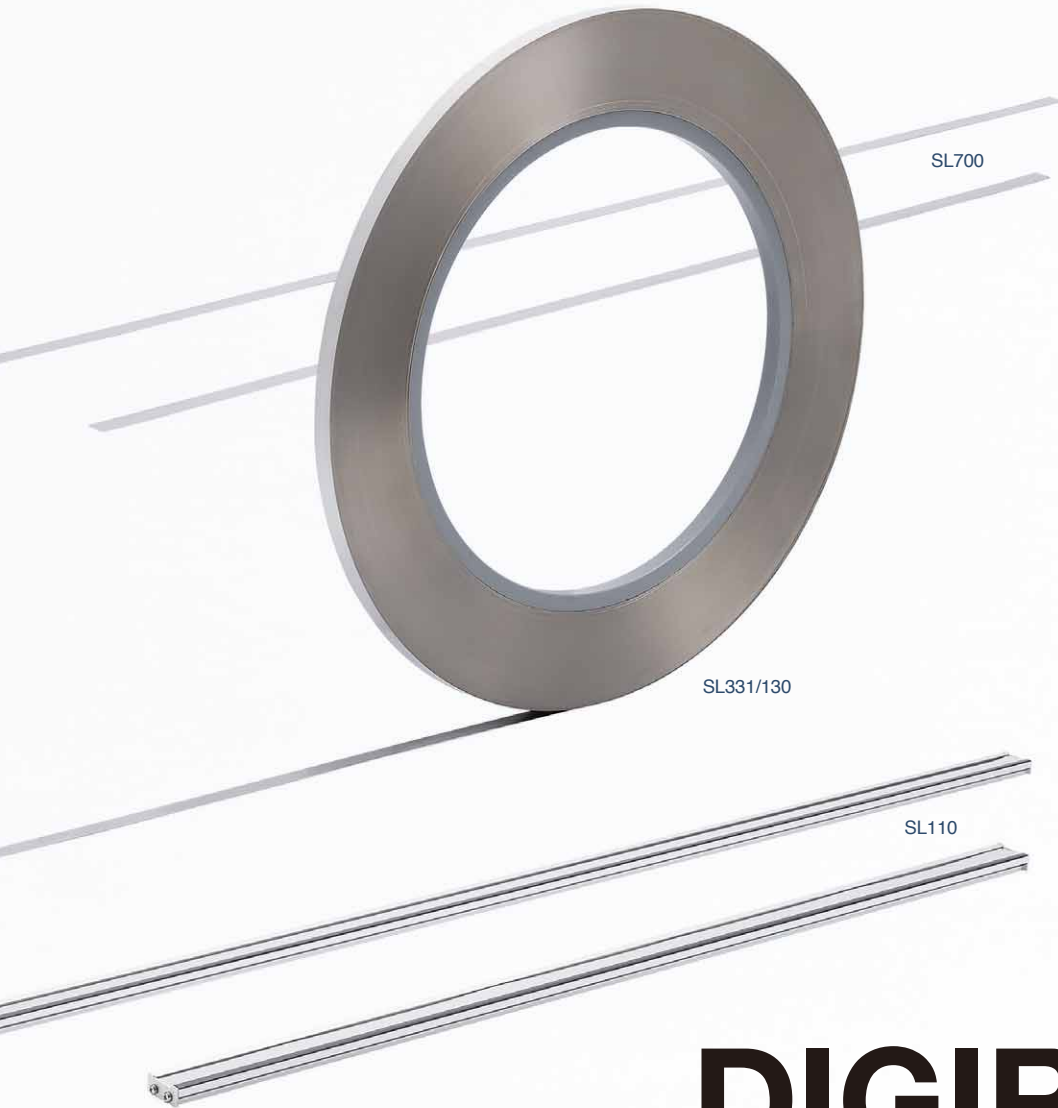
Magnescale Co., Ltd.

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Magnescale Europe GmbH	Antoniusstrasse 14, 73249 Wernau, Germany	TEL.+49(0)7153-934-291	FAX.+49(0)7153-934-299	E-mail : info-eu@magnescale.com
Service & Parts	45 Suzukawa, Isehara-shi, Kanagawa 259-1146, Japan	TEL.+81(0)463-92-2132	FAX.+81(0)463-92-3090	E-mail : info-css@magnescale.com

<http://www.magnescale.com>

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 This catalog is printed with soy ink.  
 DIGIRULER-EA01C  
 C.1907.CB.1000

Magnescale Co., Ltd.



**SCALE** → **HEAD** → **INTERPOLATOR** → **OUTPUT**

**SL700** Reference point: None  
Effective Length: 50 - 100,000mm

**SL710** Reference point: One  
Effective Length: 50 - 100,000mm

**SL720** Reference point : Multi-point  
Effective Length: 100 - 100,000mm

**SL730** Reference point: Distance coded  
reference marks  
Effective Length: 200 - 100,000mm

**SL331** Reference point: None  
Effective Length: 200 - 8,000mm

**SL110** Reference point: None  
Effective Length: 200 - 2,000mm

**SL130** Reference point: None  
Effective Length: 200 - 30,000mm

**PL101-R/RH**

**PL101-RA/RHA**  
**PL101-R/RH** ----- **MJ632**

**PL101-RM/RHM**  
**PL101-R/RH** ----- **MJ832**

**PL101-RP/RHP**  
**PL101-R/RH** ----- **MJ852**

**PL101-RY/RHY**  
**PL101-R/RH** ----- **MJ842**

**PL60**

**PL25**

Magneswitch  
<External reference point>  
**SET-P16-1**

Head cable with interpolator  
**PL81** Open collector  
**PL82** Line driver

**MJ100** Line driver

**MJ110** Open collector

➤➤ Analog 1 Vp-p

➤➤ A/B quadrature  
Reference point signal

➤➤ Mitsubishi Electric Corporation serial  
communication signal

➤➤ Panasonic Corporation serial  
communication signal

➤➤ Yaskawa Electric Corporation serial  
communication signal

➤➤ A/B quadrature  
Reference point signal

➤➤ A/B quadrature

# DIGIRULER

Magnetic detection system with excellent resistance to dust, oil, and water  
(Maintenance free, IP67 grade model available)  
Wide variety of measurement lengths available from 50mm to 100,000mm

	SL700	SL710	SL720	SL730	SL331	SL110	SL130
Effective Length(L)	50 to 100,000 mm		100 to 100,000 mm	200 to 100,000 mm	200 to 8,000 mm	200 to 2,000 mm	200 to 30,000 mm
Reference point	None	One	Multi point	Distance coded reference marks	None	None	None
Accuracy (at 20°C) *1	±10ML μm (ML ≤ 3 m. ML=Effective length in 1m increments) *2			(30+10L/1,000) μm p-p	(50+10L/1,000) μm p-p	(50+10L/1,000) μm p-p	(50+10L/1,000) μm p-p
Reproduced wavelength	800 μm		2 mm	5 mm			
Compatible reader head	PL101		PL60	PL25 / PL81 / PL82			
Operating temperature range	0 to +45°C		0 to +45°C	-5 to +45°C			

\*1 With compatible reader head \*2 Please contact our sales department for measurement lengths over 3,000mm \*3 Please contact our sales department for measurement lengths over 8,000mm

	PL101									
	Head		PL101-RA		PL101-RHA		PL101-RM		PL101-RHM	
Head	PL101-R	PL101-RH	PL101-R	PL101-RH	PL101-R	PL101-RH	PL101-R	PL101-RH	PL101-R	PL101-RH
Interpolator	-	-	MJ632		MJ832		MJ852		MJ842	
Output Signal	Analog output 1 Vp-p		A/B quadrature, (Line driver, compliant with EIA-422), reference point, alarm signal		Mitsubishi Electric Corporation serial communication signal (compliant with EIA-485)		Panasonic Corporation serial communication signal (compliant with EIA-485)		Yaskawa Electric Corporation serial communication signal (compliant with EIA-485)	
Compatible scale	SL700 / SL710 / SL720 / SL730		SL700 / SL710 / SL720 / SL730		SL700 / SL710		SL700 / SL710 / SL720 *1		SL700 / SL710 / SL720 / SL730	
Resolution (number of divisions)	1 μm recommended		0.2 to 10 μm		0.1 μm		0.1 μm		(1/8, 1/2)	
Reference mark detection	Available									
Maximum response speed	Varies according to the connected control		Varies according to the combination of resolution and minimum phase difference *2				10 m/s			
Installation tolerance	Clearance between head and scale : 0.35 ± 0.1 mm Pitch : ±0.1° Yaw : ±0.2° Roll : ±0.2°									
Head cable length	PL101-R : 300 mm PL101-RH : 3 m									
Protection grade	IP50 or equivalent *3	IP67 or equivalent *3	IP50 or equivalent *4	IP67 or equivalent *4	IP50 or equivalent *4	IP67 or equivalent *4	IP50 or equivalent *4	IP67 or equivalent *4	IP50 or equivalent *4	IP67 or equivalent *4
Power supply voltage	DC 5 V ±5 %									
Operating temperature range	0 to +45°C (No condensation)									

\*1 To connect a PL101 reader head with a SL720 scale requires a special model with modified specifications. Please contact our sales department. \*2 Please contact our sales department \*3 Except the connector \*4 Except the connector and interpolator Please contact our sales department for extension cables

	PL60	PL25	PL81	PL82
Compatible interpolator	MJ100/MJ110			
Output signal	Signal for MJ100/MJ110 connection		A/B quadrature, alarm signal (Open collector)	A/B quadrature, alarm signal (Line driver, compliant with EIA-422)
Compatible scale	SL331	SL110 / SL130	SL110 / SL130	
Resolution	Variable depending on MJ100/MJ110 setting (5μm recommended)		Variable depending on MJ100/MJ110 setting (10μm recommended)	
Reference point detection	Requires SET-P16-1			
Maximum response speed	-			
Installation tolerance	Clearance between the scale: 0.5mm (Maximum 0.8mm) Pitch : ±0.3° Yaw : ±1° Roll : ±1°		Clearance between the scale: 0.8mm (Maximum 1.5mm) Pitch : ±0.5° Yaw : ±3° Roll : ±3°	
Head cable length	3m			
Protection grade	IP65 or equivalent *1		IP67 or equivalent *2	
Power supply voltage	Power supplied by MJ100/MJ110		DC 10 V to 30 V	DC 5 V ± 5%
Operating temperature range	0 to +45°C (No condensation)			
Optional accessories	SZ11 (Wiper : For removing dirt and dust from the scale), SZ12 (Bracket for tapped mounting holes. Vertical reader head installation), SZ13 (Bracket for tapped mounting holes. Horizontal reader head installation), SZ14 (Bracket for PL20 (standard model) without wiper), SZ15 (Bracket for PL20 (standard model) with wiper)			

\*1 Except the connector \*2 Except the connector and interpolator Please contact our sales department for extension cables

	MJ100	MJ110
Output interface	Line driver (compliant with EIA-422)	Open collector (IOL=50mA max.)
Output signal	A/B quadrature, reference point, UVW phase, alarm signal	
Division number	1,000 / 960 / 800 / 512 / 500 / 480 / 400 / 256 / 240 / 200 / 128 / 120 / 100 / 80 / 64 / 40 and 1/2 of each of these (Please contact our sales department)	
Maximum response frequency	1000 divisions	6kHz when connected to PL25 1800/min when connected to PL60 720/min
	500 divisions	15kHz when connected to PL25 4500/min when connected to PL60 1800/min
	200 divisions	42kHz when connected to PL25 12600/min when connected to PL60 5000/min
	120 divisions	70kHz when connected to PL25 21000/min when connected to PL60 8400/min
Minimum phase difference	100 ns	1 μs
Alarm signal	Speed alarm (minimum phase difference time or maximum response frequency) / Level alarm	
Compatible reader head	PL25 / PL60	
Power supply voltage	DC 5 V (4.5 V to 6 V)	DC 12 V to 30 V (11 V to 31 V)
Operating temperature range	0 to +45°C	
Optional accessories	SET-P16-1 (for external reference point), Head extension cable, External reference point extension cable	

	SET-P16-1
Sensor	PK16-1
Magnet	PG-104
Detection direction	1 direction
Repeatability	±3 μm (*Under the following condition)
Working range	7.5 ± 2 mm (When clearance equals to 1mm)
Maximum response frequency	10 kHz
Output format	NPN transistor, open collector
Protection grade	IP67 or equivalent
Operating temperature range	-10 to +60°C

\*Clearance 1mm, temperature fluctuation 1.2°C or less, voltage fluctuation ±1% or less, 5 min after energizing

# Magnescale

SPEED X PRECISION

Feedback scale System for Rolling mills

Head  
**HA705LK Series**  
Scale  
**MSS-976R Series**  
Interpolator  
**MD50-2N/4N Series**



- Major Rolling mill manufacturers around the world adopt this system.
- Proven and reliable digital measuring system for use in metal processing environments.
- Feedback control system can be incorporated into custom built equipment racks.
- 2 and 4 axis interpolator available.
- Magnescale® Technology

# Head Scale

## HA-705LK MSS-976R

-Excellent vibration resistance and waterproof head, guaranteed high reliability.

### Head : HA-705LK

■ Waterproof performance equivalent to IP67.

■ Structure of excellent vibration resistance and shock resistance.

-Resist bad environment of rolling mill by water proof head developed only for it and excellent against harsh environment Magnescale.

-At tests done by our company, it has shock resistance which is 30 to 50G at acceleration and 110G or more at drop test (under our test condition).

■ Capable of extend with the cable only for it.

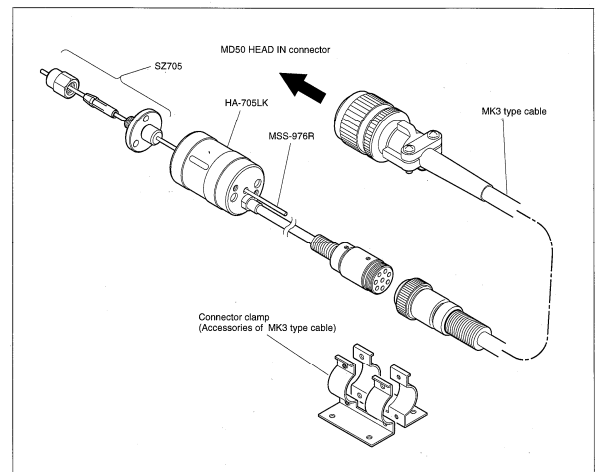
-Compliable with cable length up to max.150m

-Use material excellent for waterproof and oilproof

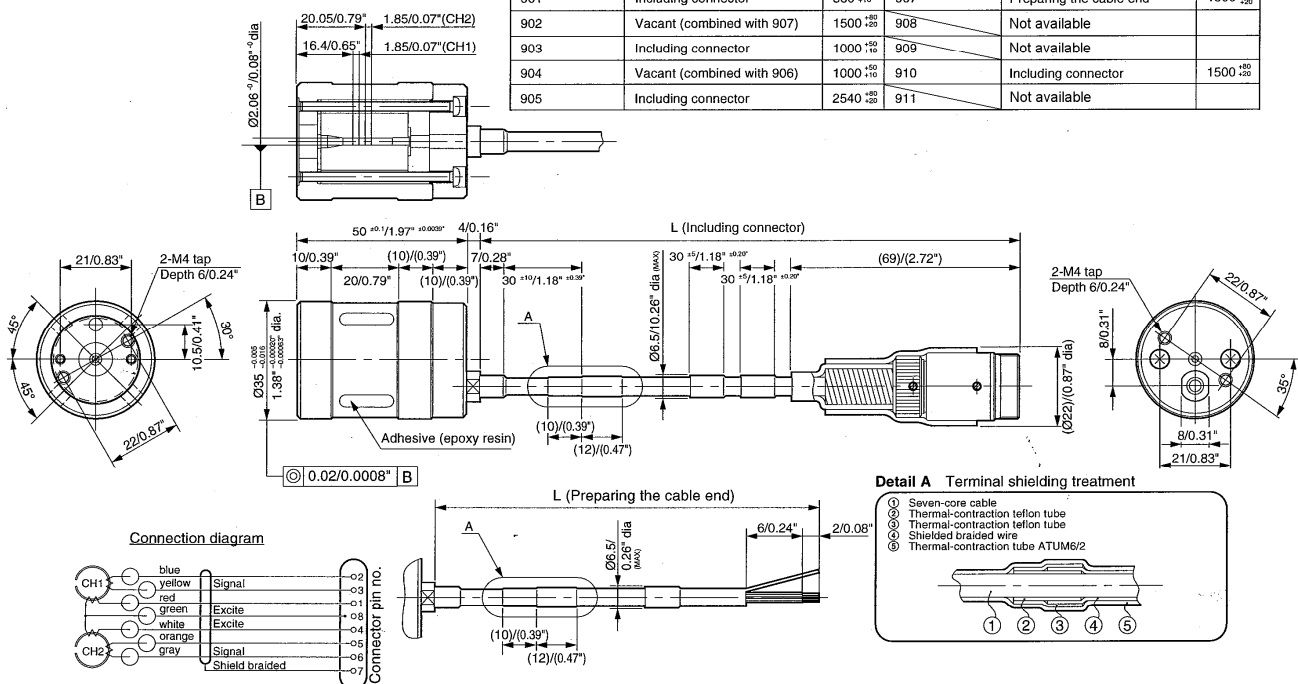
### Scale rod : MSS-976R

■ Accuracy :  $\pm 3\mu\text{m}$

■ Measuring length : 200mm up to 600mm  
(Overall length ; 30+ML+30 mm)



Special connection model	Cable terminal processing, description	L measurement	Special connection model	Cable terminal processing, description	L measurement
Standard	Preparing the cable end	500 <sup>+50</sup> / <sub>-10</sub>	906	Preparing the cable end	1000 <sup>+50</sup> / <sub>-10</sub>
901	Including connector	560 <sup>+50</sup> / <sub>-10</sub>	907	Preparing the cable end	1500 <sup>+50</sup> / <sub>-20</sub>
902	Vacant (combined with 907)	1500 <sup>+50</sup> / <sub>-20</sub>	908	Not available	
903	Including connector	1000 <sup>+50</sup> / <sub>-20</sub>	909	Not available	
904	Vacant (combined with 906)	1000 <sup>+50</sup> / <sub>-10</sub>	910	Including connector	1500 <sup>+50</sup> / <sub>-30</sub>
905	Including connector	2540 <sup>+50</sup> / <sub>-30</sub>	911	Not available	



#### Insulation resistance and insulation yield strength

There should be DC 250 V over at least 50 m and a one-minute leakage current of 5 mA or less at AC250 V between the coils, coil and head unit, head unit and housing, and shield and head unit.

#### Note

The connection section of the thermal-contraction tube ATUM6/2 for the cable does not have a designated location. (This is because the length varies depending on the contraction state.)

# Interpolator

## MD50-2N/4N

-High reliability and many functions, it can comply with a variety of equipments.

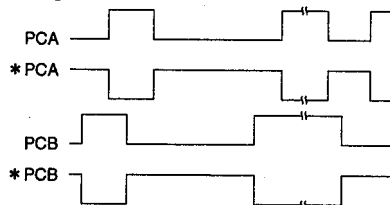


- With max. response speed 100m/min, comply with shocks of rolled material.
- Comply with world-wide power source : AC100 to 240V
- Selectable from 5 kinds of output pulse resolution and 9 kinds of output pulse width
  - Select resolution from 0.5 to 10 $\mu$ m, output pulse width from 0.1 to 4.0 $\mu$ s.
- Can be selected A/B signal or Up/Down signal.

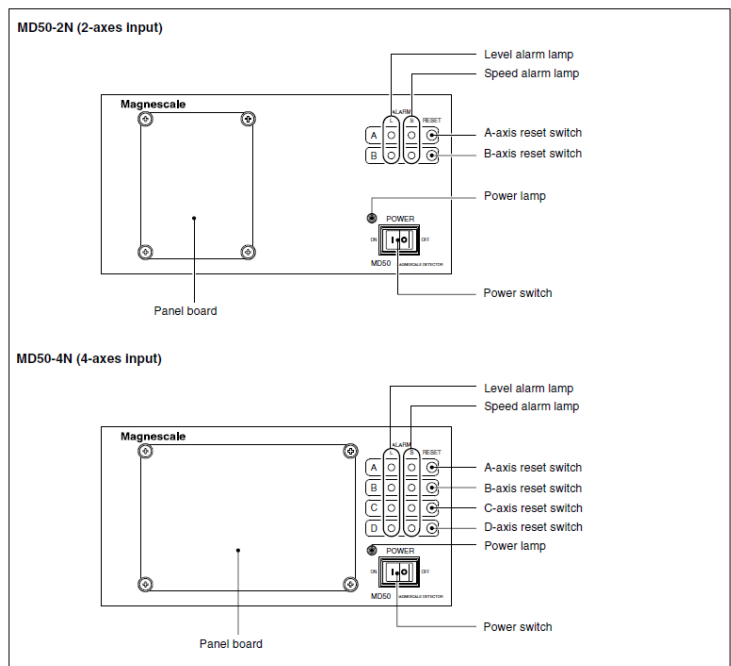
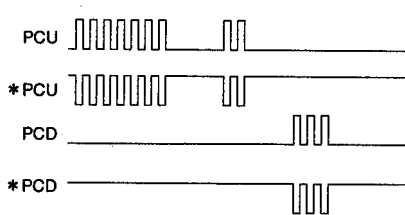
- Selectable of setting 2 kinds and 6ways of alarm output adjusting to user's usages
  - Alarm output can be detected with signal output to controller and with lump of main unit lighting. This makes it monitor deteriorating with age, and it becomes effective means of maintenance.
- Standard equipping A/B signal for monitor or Up/Down signal output.
  - Possible to make A/B signal output as a monitor for maintenance, except signal output to control device.
- Body configuration of capable of inputting up to max.4 axes.

-Capable of easy maintenance because of adopting card type detector board. And, even if only 1 axis is out of order, it can do with the change of only the board, because each axis is independent.

### AB Signal

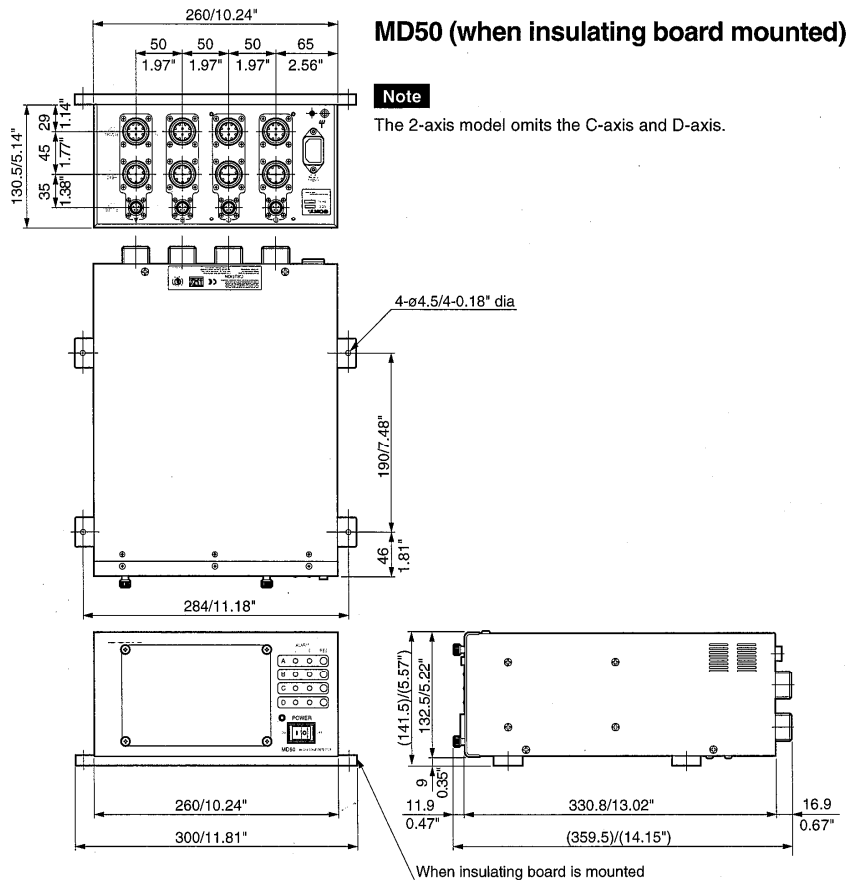


### Up / Down Signal



## ■ Main specifications

Model name	MD50-2N	MD50-4N
Input axes	2 axes	4 axes
Scales to be connected	HA-705LK	
Resolutions	0.5, 1, 2, 5, 10 $\mu$ m (Selectable)	
Output pulse width	0.1, 0.2, 0.4, 0.8, 1.0, 1.6, 2.0, 3.2, 4.0 $\mu$ s (Selectable)	
Max. response speed	100m/min (Depending on the resolution and output pulse width)	
Main output signal	A/B signal or Up/Down signal (Selectable), Line driver output (Equivalent to SN75183)	
Sub output signal	A/B signal or Up/Down signal (Selectable), Line driver output (Equivalent to SN75183)	
Synchronous signal	Output for the stable reception of A/B or Up/Down signals.	
Alarm functions	Level alarm : Hi-level signal is output when the scale signal drops be 1.4Vp-p (or 0.6Vp-p) or less. Speed alarm : Hi-level signal is output when the maximum response speed of scale is exceeded.	
Alarm reset functions	Manual reset operation : Push the RESET switch on the front panel. Reset operation by external signal : Apply a DC voltage between 2 input terminal.	
Cable length	Max. 150m (Option : Extension cable : MK3 -30, -50, -100, -120, -135, -150)	
Operating temperature	0 to 40°C	
Storage temperature	-20 to 60°C	
Power consumption	Max. 70 VA	
Input power voltage	100 to 230V $\pm$ 10% 50/60Hz	
Dimensions	260(W) x 359.5(D) x 141.5(H) mm	
Mass	Approx. 5.8Kg	Approx. 7.0Kg
Applicable standards	UL3101-1 , FCC Part 15, Subpart B, Class A EMC Directive EN55011 Group 1, Class A EN50082-2 , Low Voltage Directive EN61010-1	



Magnescale Europe GmbH.

\*Designs and appearances are subject to change without prior notice.

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[www.mgscale.com](http://www.mgscale.com) E-mail : info-eu@mgscale.com  
 Description in this brochure on the specifications as of Dec. 2011.

## Offener Maßstab

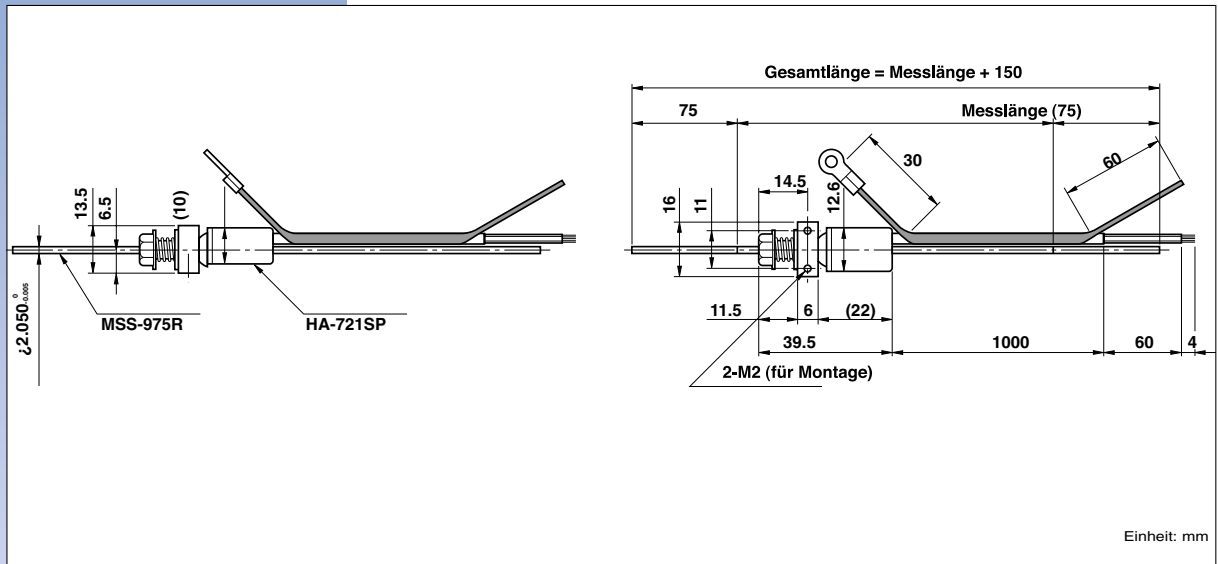
- Magnettechnologie
- Auflösung: 0,5 µm, 1 µm, 2 µm, 5 µm und 10 µm
- Extrem kleine Bauweise
- Einfache Montage

## Spezifikationen

Modell	SR721-SP
Messlänge L in mm	150 / 200 / 250 / 300 / 350 / 400 mm
Gesamtlängel	L + 150 mm
Maßstabsdurchmesser	2 mm
Genauigkeit (bei 20°C)	± 5 µm
Auflösung	0,5 µm, 1 µm, 2 µm, 5 µm und 10 µm
zulässige Einbautoleranz	—// 0,01mm/ 50 mm
Wärmeausdehnungskoeffizient	(11 ± 1) x 10 <sup>-6</sup> / °C
Kompatible Interpolationseinheit	MD10, MD20A, MD21, MW10
Betriebstemperatur	-5 °C bis 40 °C
Lagertemperatur	-10 °C bis 50 °C
Lesekopfkabellänge	1 m
Kabellänge (Verbindung zur Anzeige)	3 m, 5 m, 10 m, 15 m

\* beim SR721-SP muß das Anschlusskabel separat bestellt werden. Bei Anschluss an eine Positionsanzeige ist zusätzlich der Anschlussadapter SZ51-MS01 erforderlich. Siehe Anschlussstabelle

## Abmessungen

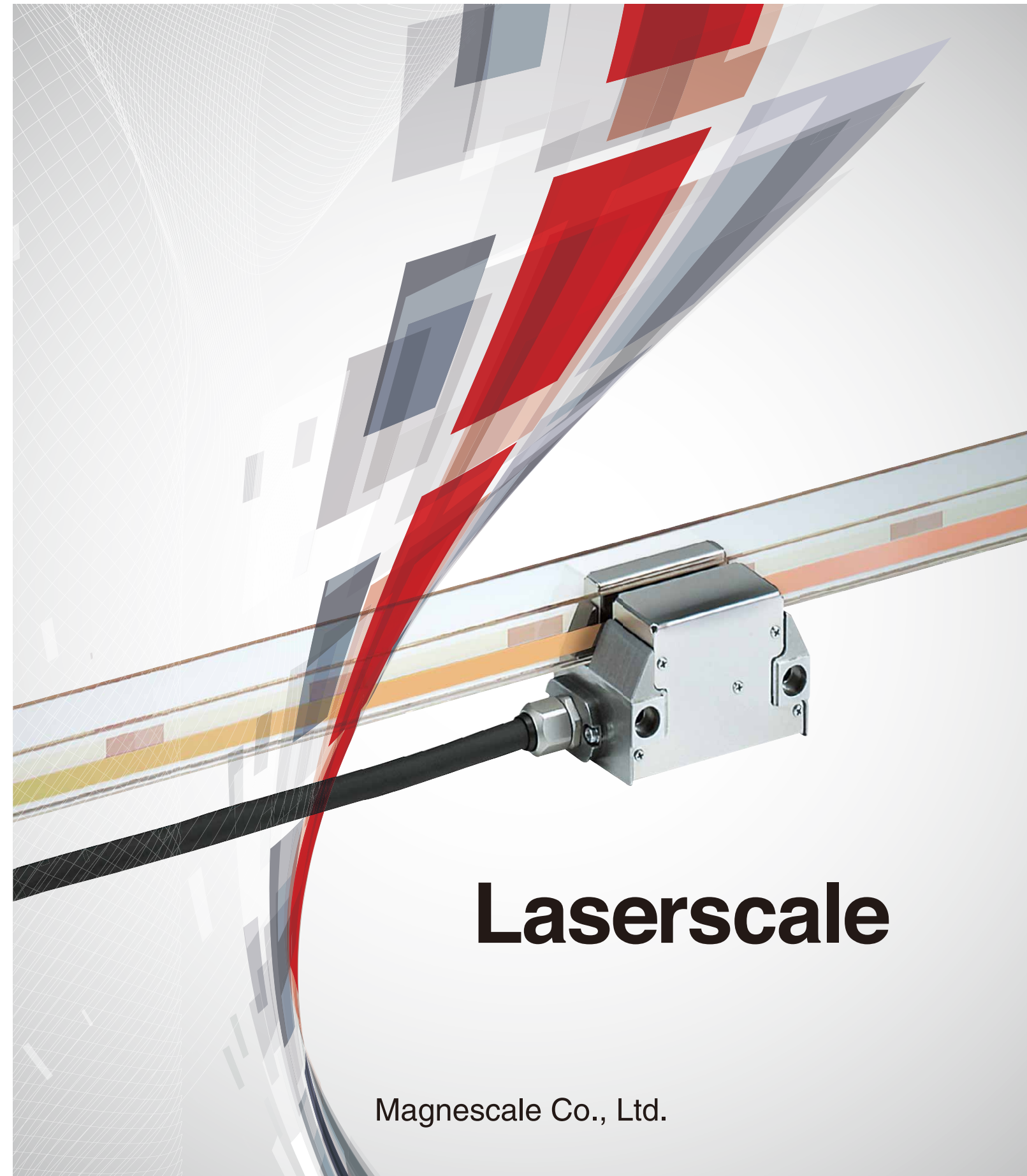


# Magnescale

SPEED X PRECISION

# Magnescale

SPEED X PRECISION



# Laserscale

Magnescale Co., Ltd.

## Magnescale Co., Ltd.

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Magnescale Europe GmbH	Antoniusstrasse 14, 73249 Wernau, Germany	TEL.+49(0)7153-934-291	FAX.+49(0)7153-934-299	E-mail : info-eu@magnescale.com
Service & Parts	45 Suzukawa, Isehara-shi, Kanagawa 259-1146, Japan	TEL.+81(0)463-92-2132	FAX.+81(0)463-92-3090	E-mail : info-css@magnescale.com

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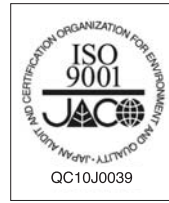


# Safety

No compromise for high-accuracy products



The total quality control system that operates throughout the entire design and production process ensures products with enhanced safety, high quality, and high reliability that match our customers' requirements. The company is certified for length calibration in compliance with the traceability system required by the "Weights and Measures Act," and has been granted ISO 9001 certification, which is the international standard for quality assurance.



Magnescale Co., Ltd. is registered to ISO 9001 (Quality)

**Our products comply with CE Marking requirements, have acquired UL certifications and meet other regulations, ensuring safe use the world over.**

We have met:

•EMC Directives(CE)

EMI: EN 55011 Group 1 Class A

EMS: EN 61000-6-2

•FCC regulation

FCC Part 15 Subpart B Class A

for Products with built-in AC power supply:

• UL61010-1 • EN61010-1

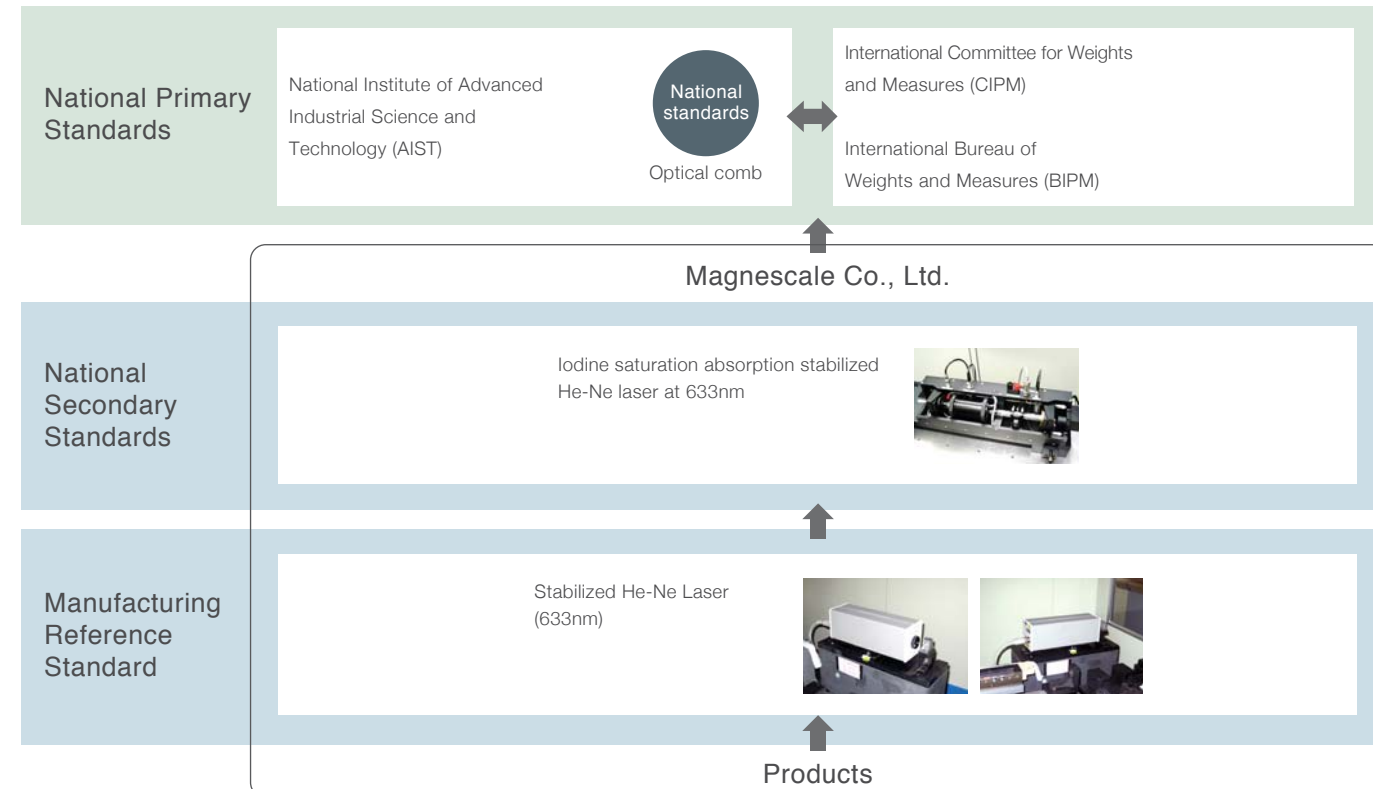
for Products with Laser:

• DHHS (21CFR1040.10) • IEC60825-1

\* When using our devices with machines to which the European Machinery Directive applies, please make sure that the devices when installed on the machines fulfill the applicable requirements of the Directive.  
\* Standards or regulations to be complied with may vary by product.

# Traceability

Traceability Flow Chart (Length)



PD

LD

# Laserscale

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\* The product name "Laserscale" is trademark of Magnescale Co., Ltd.

# What's Laserscale?

## The world of super-resolution is going further than 1nm

Laserscale easily achieves measurement and control with ultra high resolution of better than 1nm.

A sinusoidal wave (approximately 138nm signal pitch) is generated using the grating interference method by utilizing a holographic scale with high diffraction efficiency and a high resolution head.

The BS series offers strong resistance to disturbance by air pressure or current, and is easy to install. Signal distortion, in principle, remains minimal at a high S/N ratio.

Resolution of 17pm can be achieved using our automatic compensation interpolator.



138nm

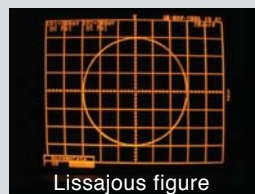
High-resolution scale with signal pitch of approx. 138nm outperforms light wave interferometer systems

### Ultra-high resolution

Volume holography technology of Laserscale achieves high diffraction efficiency to generate a high S/N signal and a strong output signal.

### Best in class 17pm resolution

One count movement of the 0.55µm holographic grating pitch diffracts the signal to 4 periods. The 1/4 of the original signal results in a signal of approximately 0.138µm. Using our interpolator, this signal can achieve 17pm resolution.

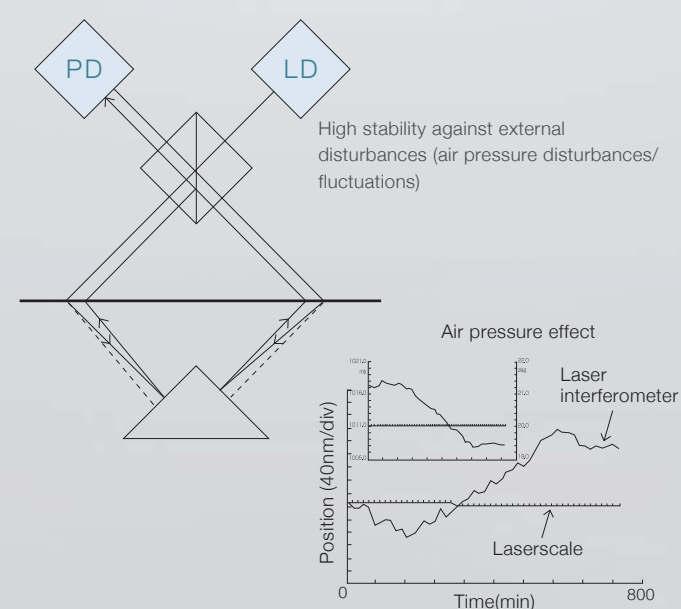
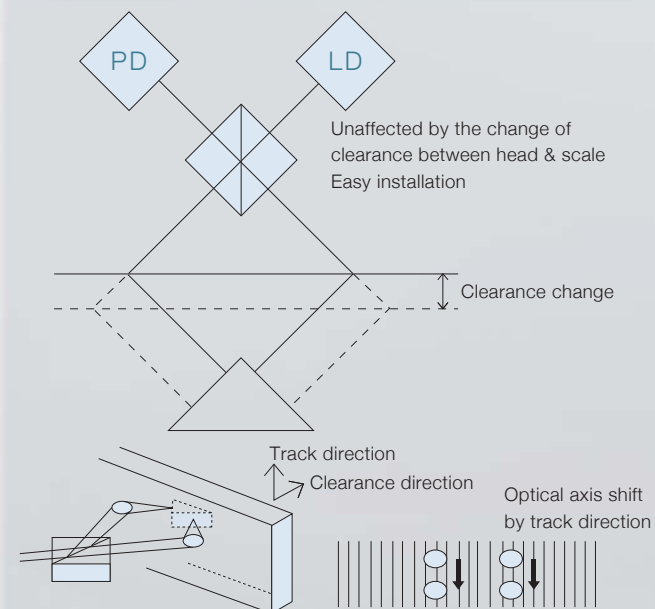


### Ultra-high resolution and high response speed

Our grating interference principle linear encoders offer a signal pitch of approximately 0.14µm. That is 1/140th of a conventional linear encoder with a 20µm signal pitch. Using our interpolator, 17pm resolution and a response speed of up to 400mm/s is achievable.

Model	Output	Max. divisions	Resolutions	Max. response speed
BS series Signal pitch: 138nm	Binary	8000	17 pm	400mm/s
	A/B quadrature	32	4.31 nm	60mm/s

High stability : Free from temperature, air pressure, or air disturbances



Easy installation & maintenance

### [Easy installation & maintenance]

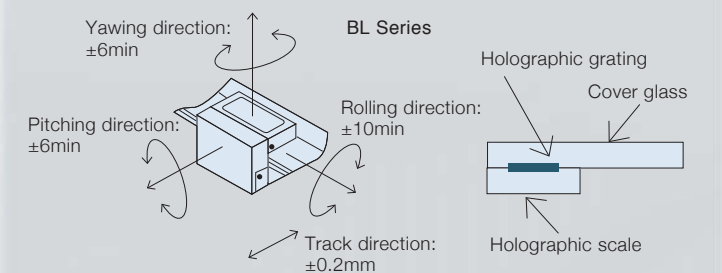
Large installation tolerances  
Easy installation and non-contact detection

### No electrical adjustment after installation

Despite the high installation tolerances, no electrical adjustment is required after installation.

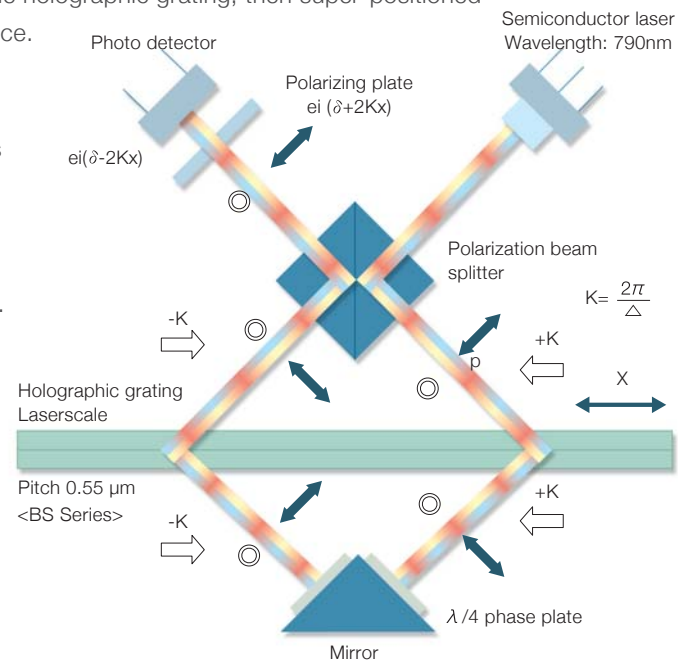
### Protected holographic grating

The holographic grating is protected by glass covers which guard the grating against external pressure. The glass can be wiped to clean dust and dirt.



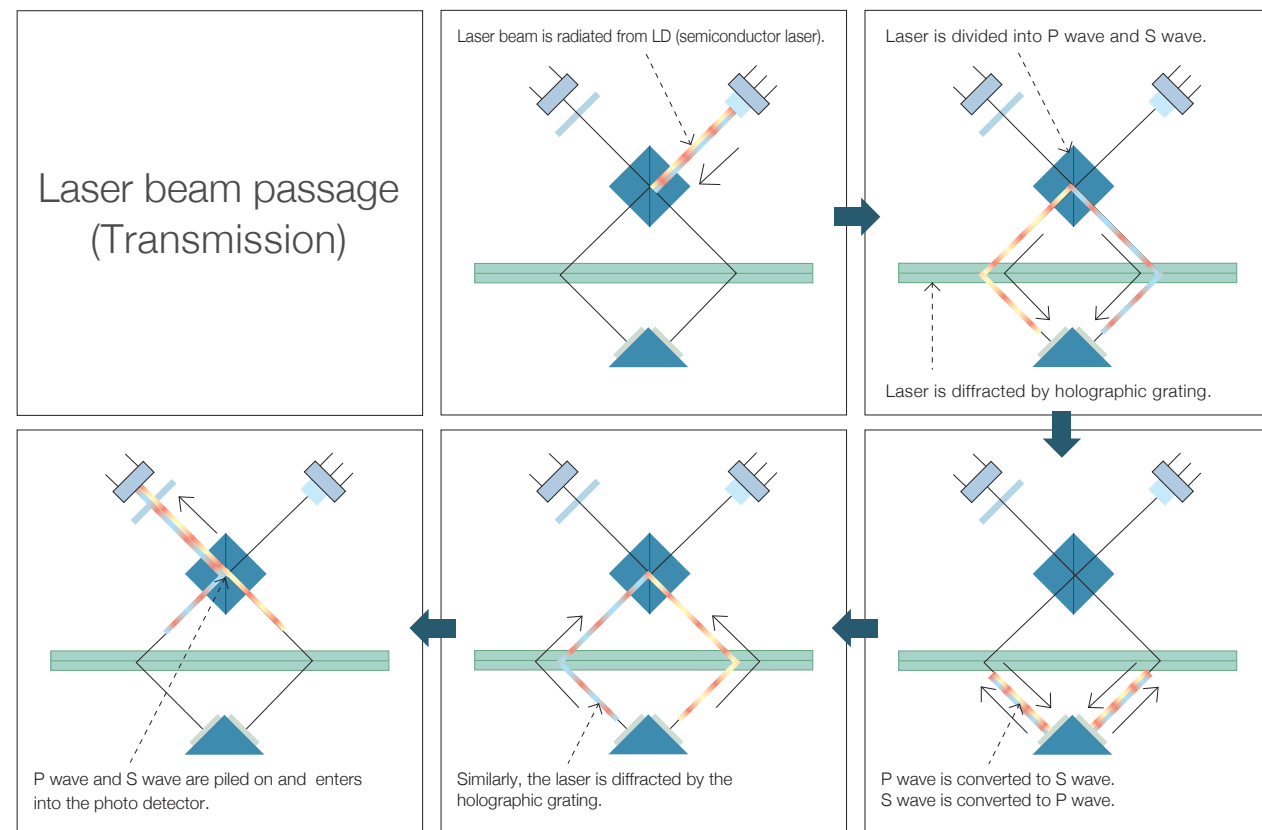
# Principle

The semiconductor laser beam is split by a polarized light beam splitter into S and P polarized light beams, then diffracted through a volume holographic grating with very high diffraction efficiency. The two diffracted beams pass through separate 1/4-wavelength plates to a mirror, which reflects the beams back through the plates. This process converts the S polarized beam to P polarized light and the P polarized beam to S polarized light. The two beams are diffracted again through the volume holographic grating, then super-positioned by the polarized light beam splitter to create interference. All interference travels to the photo-detector side due to conversion of the polarization direction. Since double diffraction adds  $+2Kx$  and  $-2Kx$  phases to each beam, the interference is subject to four light-dark inversion cycles for each grating scale of movement. Thus a grating pitch of  $0.55\ \mu\text{m}$  produces a signal pitch of  $0.55/4 = \text{approx. } 0.138\ \mu\text{m}$ . This detecting optics is free from fluctuations and change in air pressure, since the light path of both left and right changes identically even with the change in wavelength of the optical source. Repeatability and returning errors do not occur in principle.

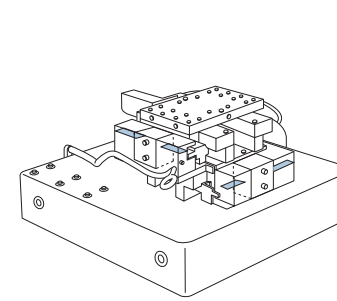


↔: Direction where light vibrates...Right and left    ⊙: Direction where light vibrates...Back and forth

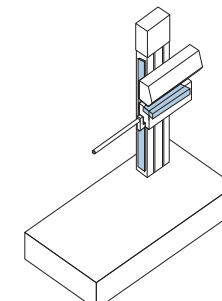
## Laser beam passage (Transmission)



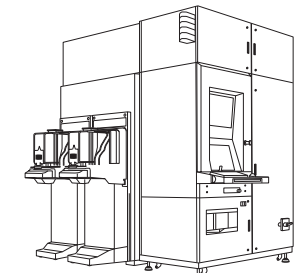
# Application



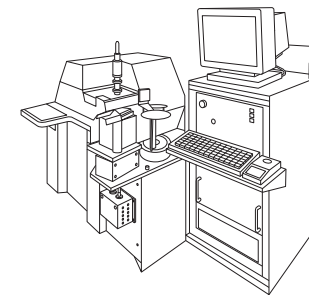
Ultra high precision air stages (vacuum resistant)



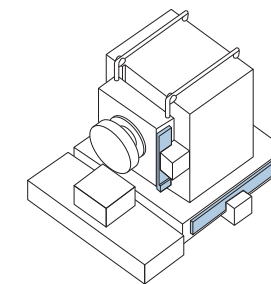
Surface roughness/contour measuring machines



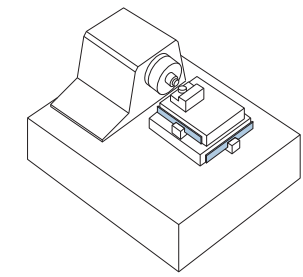
DUV-based automatic wafer defect classification systems



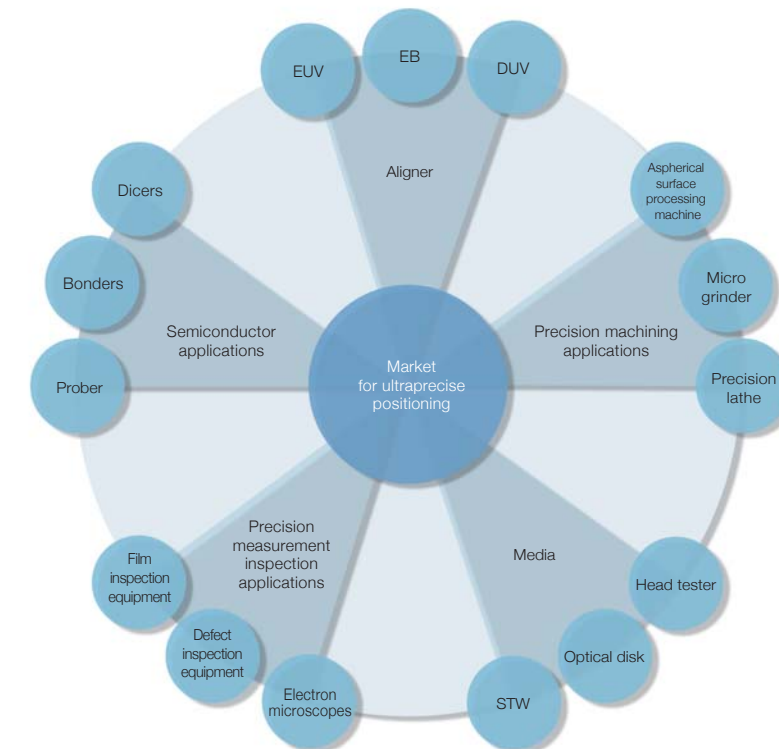
Non-contact measuring machines



Micro grinders



Aspherical surface machining



# Lineup

	Series	Feature	Minimum resolution	Scale accuracy	Measuring length	Interpolator	Output	Max. response speed	Page
<p><b>BS</b></p> <p><math>\lambda</math>=approx. 138nm Transmission</p> 	BS78	Low expansion glass	17pm	$\pm 0.04\mu\text{m}$ (Measuring length 40mm)	10mm~420mm	BD96 (BD95)	40bit Binary	400mm/s	P.10
							Serial		
	BS65-R	Long length type Soda-lime glass	17pm	L<460: (0.1+0.4L/100) $\mu\text{m}$ p-p L $\geq$ 460:3 $\mu\text{m}$ p-p L:Measuring length(mm)	160mm~960mm	BD96 (BD95)	40bit Binary	400mm/s	P.14
							Serial		
<p><b>BH</b></p> <p><math>\lambda</math>=250nm Reflection</p> 	BH25-RE/NE	Low expansion glass Soda-lime glass	31.25pm	$\pm 0.5\mu\text{m}$ (30mm-170mm) $\pm 1\mu\text{m}$ (220mm-420mm)	Low expansion glass: 30mm~420mm Soda-lime glass: 30mm~420mm	BD96	40bit Binary	700mm/s	P.16
							Serial		
	BH20-RE/NE	302,400Pulse/rotation 680,400Pulse/rotation 907,200Pulse/rotation 1,048,576Pulse/rotation	1.5nrad	—	Radius 12.03mm Radius 27.07mm Radius 36.10mm Radius 41.72mm	BD96	40bit Binary	$555\text{min}^{-1}$ $(1,428\text{min}^{-1}, 634\text{min}^{-1})$ $(476\text{min}^{-1}, 411\text{min}^{-1})$	P.18
							Serial		
<p><b>BL</b></p> <p><math>\lambda</math>=400nm Transmission</p> 	BL57-RE	Low expansion glass Soda-lime glass	0.1/0.05/0.02/ 0.01 $\mu\text{m}$	$\pm 0.5\mu\text{m}$ (30mm-160mm) $\pm 1\mu\text{m}$ (210mm-360mm) $\pm 1.5\mu\text{m}$ (410mm-1,060mm)	Low expansion glass: 30mm~410mm Soda-lime glass: 60mm~1,060mm <small>Please ask for more than 1,060mm</small>	Built-in I/F Box	A/B quadrature	1,500, 650, 300, 120mm/s	P.20
			0.4 $\mu\text{m}$ (1Vp-p)			NONE	Analog		
	BL57-NE	Low expansion glass Soda-lime glass	0.1/0.05/0.02/ 0.01 $\mu\text{m}$	$\pm 0.5\mu\text{m}$ (30-170mm) $\pm 1\mu\text{m}$ (220-370mm) $\pm 1.5\mu\text{m}$ (420-1,060mm)	Low expansion glass: 30mm~420mm Soda-lime glass: 60mm~1,060mm <small>Please ask for more than 1,060mm</small>	Built-in I/F Box	A/B quadrature	1,500, 650, 300, 120mm/s	
			0.4 $\mu\text{m}$ (1Vp-p)			NONE	Analog	3,000mm/s	

# B S

## BS78 (with/without reference point)

High-speed and high-resolution, while maintaining stable, ultraprecision measuring. Ideal for precision stages, semiconductor inspection/manufacturing systems, and ultraprecision processing machines.



Actual size

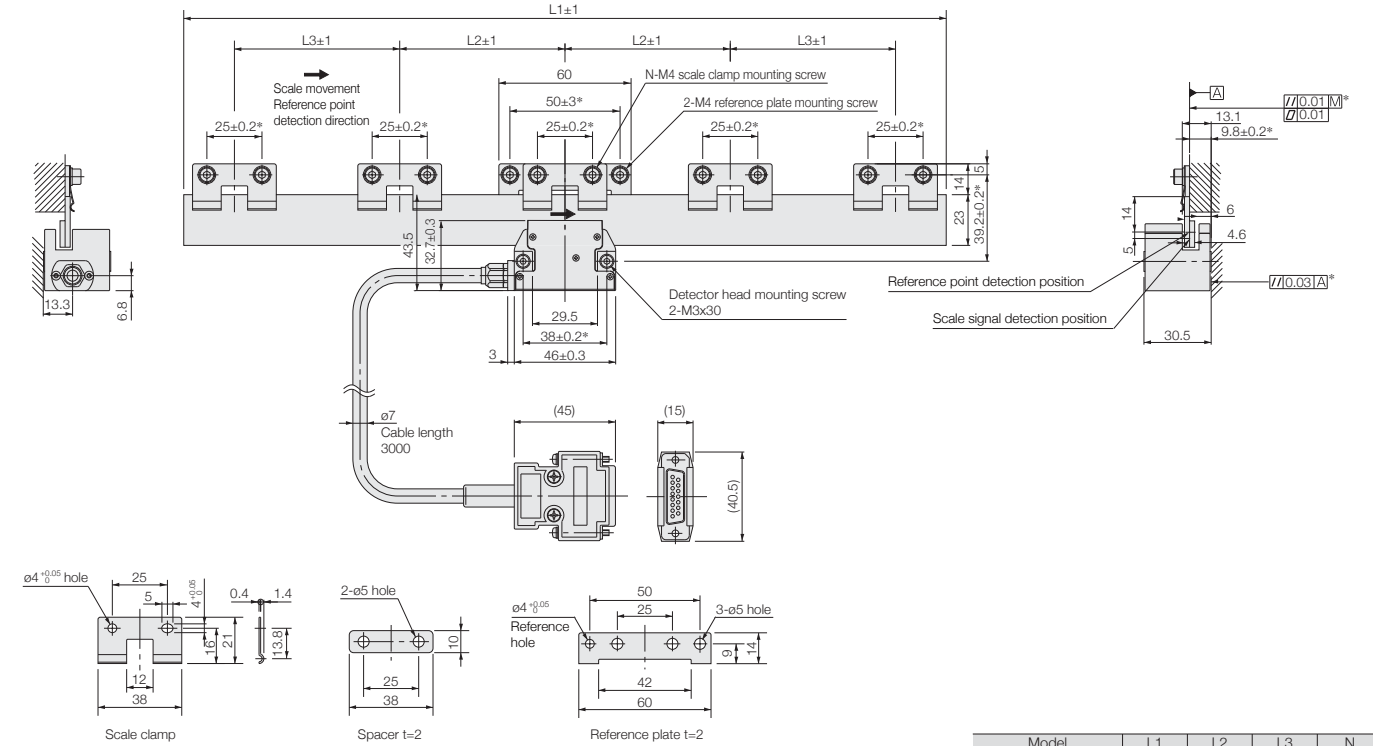
- High-resolution scale with signal pitch of approx. 138nm, outperforming light wave interferometer systems
- High stability, unaffected by humidity, air pressure and air disturbances
- Reference point accuracy :  $\pm 0.1\mu\text{m}$
- Scale accuracy :  $\pm 0.04\mu\text{m}$  (measuring length : 40 mm)
- Non-contact design eliminates return error.
- Special non-magnetic and vacuum-compatible models available
- Using low expansion glass :  $-0.7 \times 10^{-6}/^\circ\text{C}$  (measuring length : 10 to 420 mm)



R: with reference point;  
RS: high accuracy with reference point  
N: without reference point;  
NS: high accuracy without reference point  
Type example : BS78-220R  
Measuring length

### External Dimensions

#### ● BS78-xxxR(RS) (Measuring length : 40/120/170/220/370/420 mm)

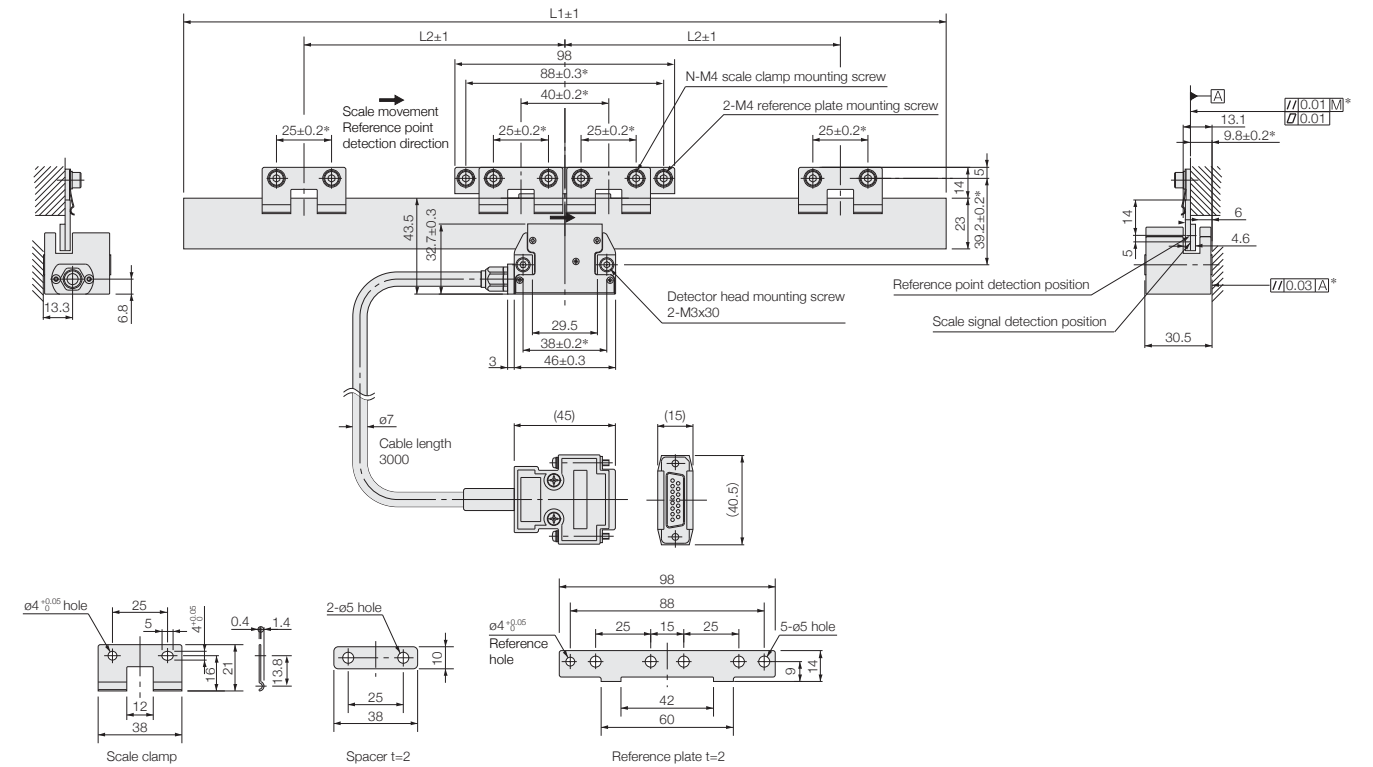


Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
Note 2: The surface properties of the scale mounting surface is  $R_{\text{max}} = 6.3\text{S}$ .  
Note 3: The surface properties of the detector head mounting surface is  $R_{\text{max}} = 12.5\text{S}$ .  
Note 4: "M" refers to the machine guide.  
Note 5: Mount and adjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.  
Note 6: Reference point detection direction : Standard (Scale movement direction→ with the head stationary)

Model	L1	L2	L3	N
BS78-40R (RS)	66	—	—	2
BS78-120R (RS)	146	50	—	6
BS78-170R (RS)	196	75	—	6
BS78-220R (RS)	246	100	—	6
BS78-370R (RS)	396	75	75	10
BS78-420R (RS)	446	100	100	10

Unit: mm

#### ● BS78-xxxR(RS) (Measuring length : 70/270/320 mm)



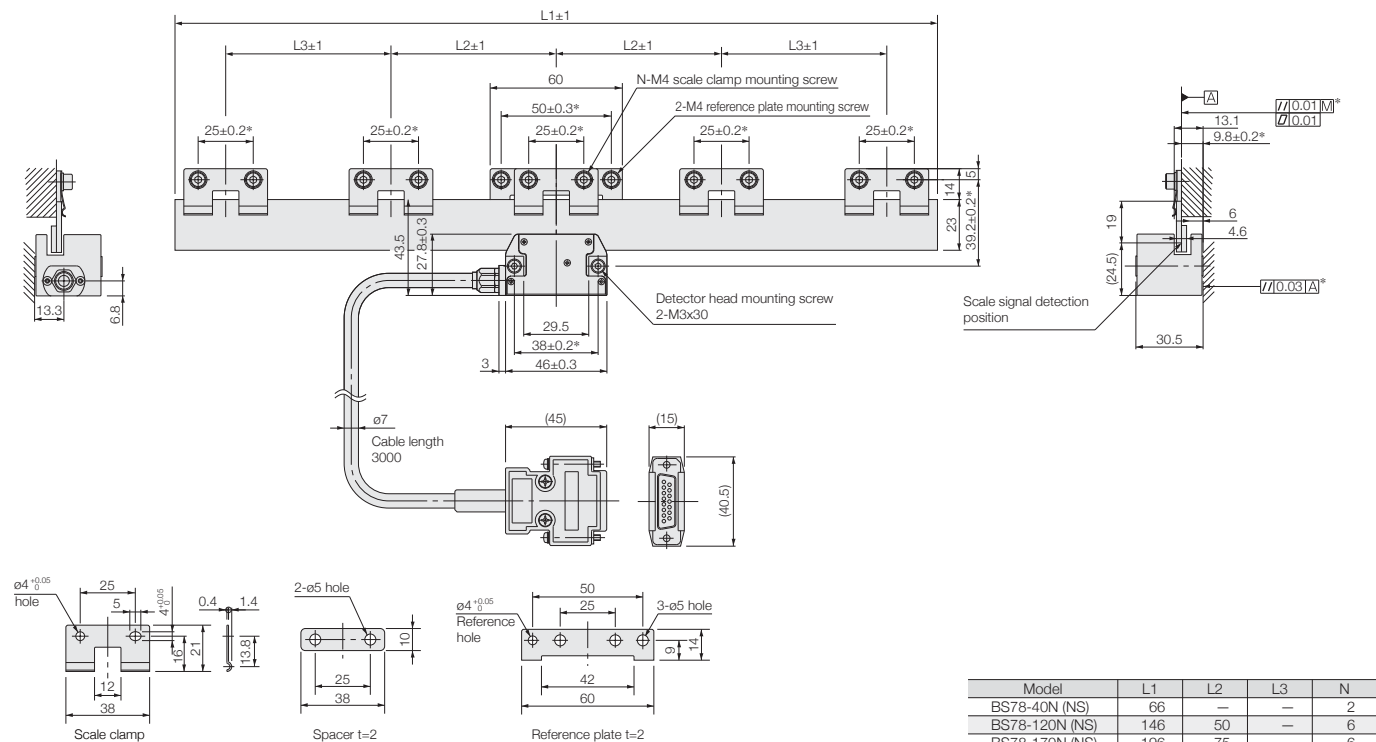
Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
Note 2: The surface properties of the scale mounting surface is  $R_{\text{max}} = 6.3\text{S}$ .  
Note 3: The surface properties of the detector head mounting surface is  $R_{\text{max}} = 12.5\text{S}$ .  
Note 4: "M" refers to the machine guide.  
Note 5: Mount and adjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.  
Note 6: Reference point detection direction : Standard (Scale movement direction→ with the head stationary)

Model	L1	L2	N
BS78-70R (RS)	96	—	4
BS78-270R (RS)	296	120	8
BS78-320R (RS)	346	120	8

Unit: mm

External Dimensions

● BS78-xxxN(NS) (Measuring length : 40/120/170/220/370/420 mm)

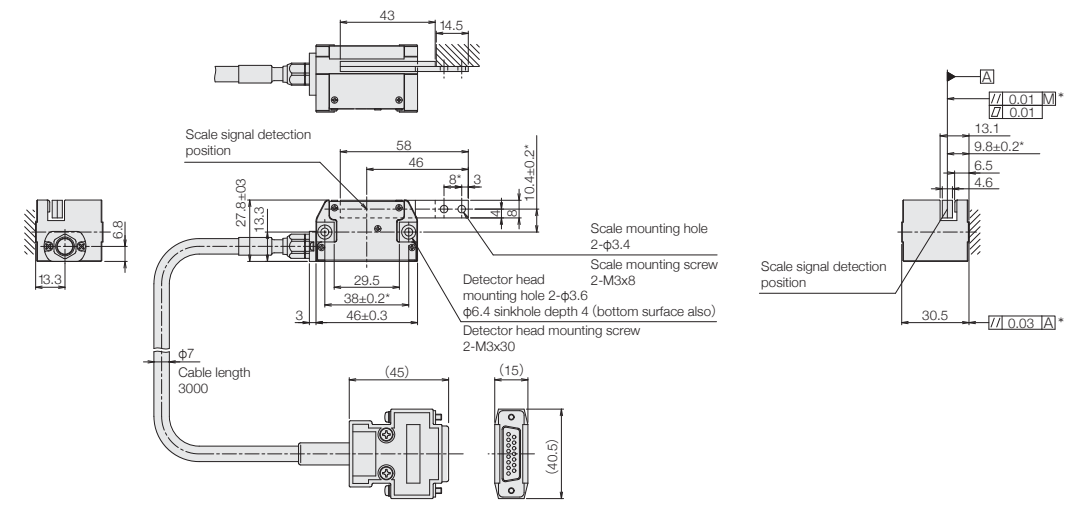


Model	L1	L2	L3	N
BS78-40N (NS)	66	—	—	2
BS78-120N (NS)	146	50	—	6
BS78-170N (NS)	196	75	—	6
BS78-220N (NS)	246	100	—	6
BS78-370N (NS)	396	75	75	10
BS78-420N (NS)	446	100	100	10

Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
 Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S.  
 Note 4: "M" refers to the machine guide.  
 Note 5: Mount and adjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.  
 Unit: mm

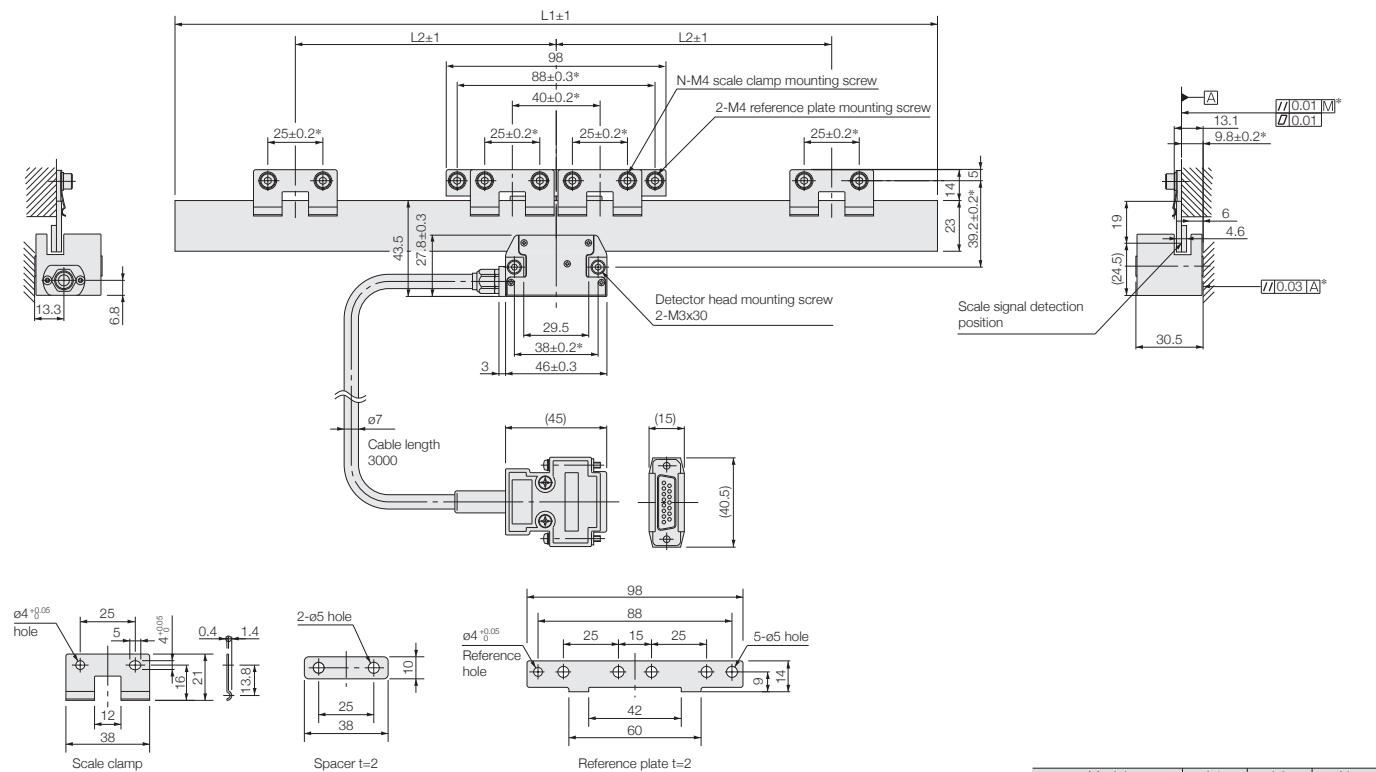
External Dimensions

● BS78-10N/NS (Measuring length : 10 mm)



Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
 Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S.  
 Note 4: "M" refers to the machine guide.  
 Note 5: Mount and adjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.  
 Unit: mm

● BS78-xxxN(NS) (Measuring length : 70/270/320 mm)



Model	L1	L2	N
BS78-70N (NS)	96	—	4
BS78-270N (NS)	296	120	8
BS78-320N (NS)	346	120	8

Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
 Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S.  
 Note 4: "M" refers to the machine guide.  
 Note 5: Mount and adjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.  
 Unit: mm

Main Specifications

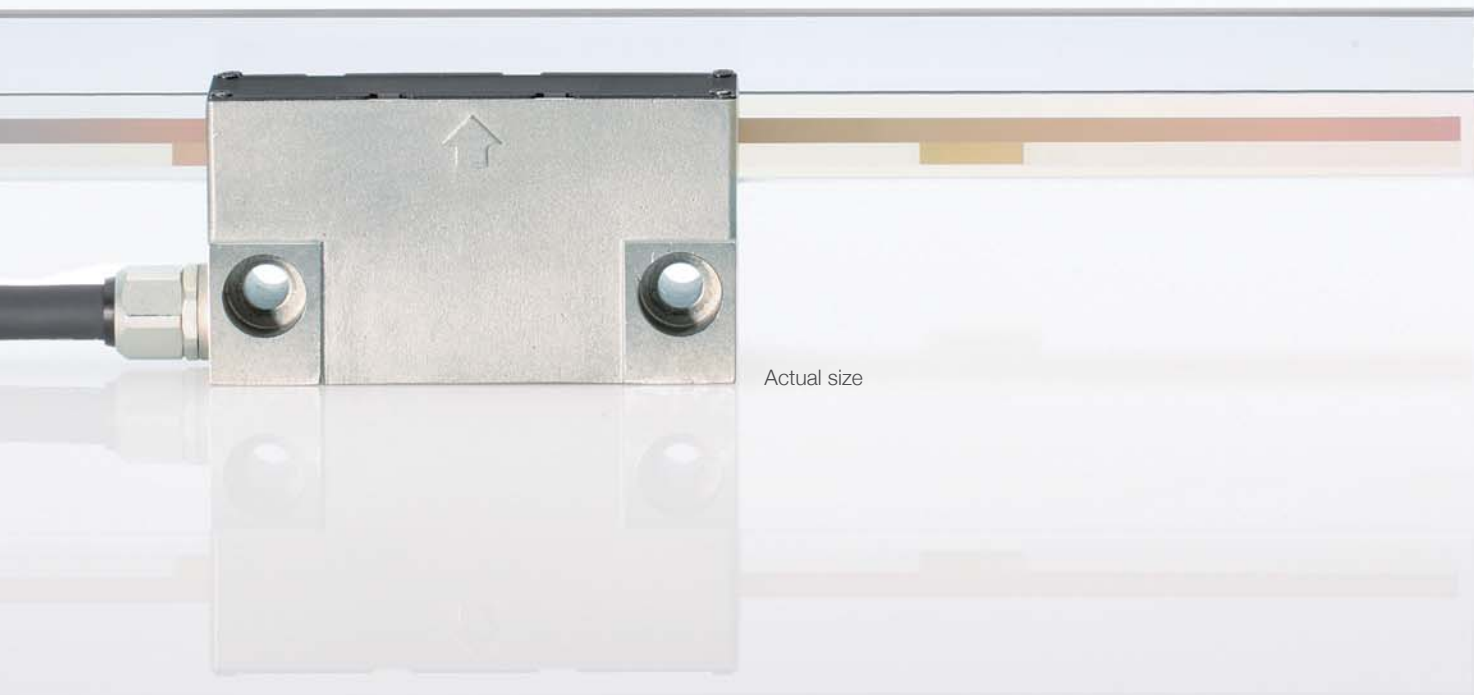
Model		BS78	
Measuring length	10(only N/NS)/40/70/120/170/220/270/320/370/420 mm		
Overall length	58mm (L=10mm:open type scale), L + 26mm (L= 40mm to 420mm) L: Measuring length		
Max. travel	L + 2mm (L=10mm:open type scale), L + 10mm (L= 40mm to 420mm) L: Measuring length		
Scale accuracy(at20°C)	NS type, RS type : ±0.03µm (L=10mm : NS type) ±0.04µm (L=40mm) ±0.10µm (L=70/120mm) ±0.18µm (L=170/220mm) L: Measuring length	±0.25µm (L=270mm) ±0.34µm (L=320mm) ±0.39µm (L=370mm) ±0.44µm (L=420mm)	N type, R type : ±0.06µm (L=10mm : N type) ±0.08µm (L=40mm) ±0.20µm (L=70/120mm) ±0.65µm (L=420mm) L: Measuring length
Grating pitch	Approx. 0.55µm		
Signal pitch	Approx. 0.138µm (Approx. 138nm)		
Reference point accuracy	0.1µm (Only R/RS type)		
Reference point position	At the center, and every 50mm from the center to the left and to the right (BS78 models with measuring lengths of 320, 370, 420mm: 20mm offset from the center at 50mm intervals)		
Reference point detection direction	Single direction		
Return error	This is virtually eliminated. It should be considered to be less than two resolution limits of the detector that is used.		
Repeatability	This is virtually eliminated. It should be considered to be less than one resolution limit of the detector that is used.		
Thermal expansion coefficient	-0.7 x 10 <sup>-6</sup> /°C		
Light source	Semiconductor laser : Wavelength 790nm, Output 6mW		
Radiation power	DHHS class 1		
Detection principle	Diffraction grating scanning system		
Operating temperature	10 to 30°C (No condensation)		
Storage temperature	-10 to 50°C (Humidity 60% or less)		
Max. response speed	400mm/s (When connected with BD96)		

Magnescape reserves the right to change product specifications without prior notice.

# BS

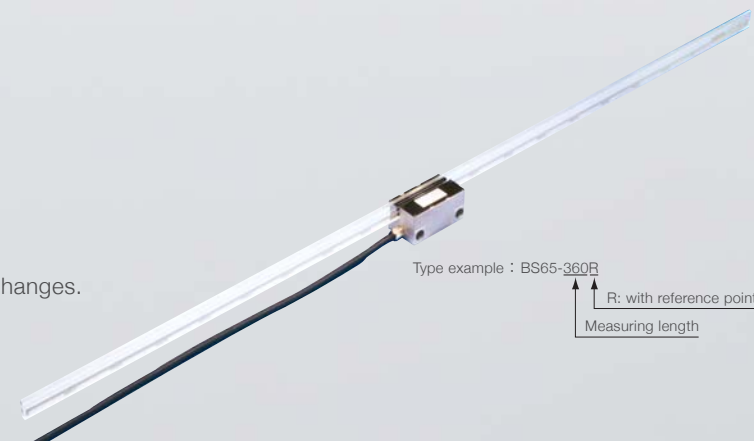
## BS65-R (with reference point)

High accuracy Laserscale with built-in optical reference point



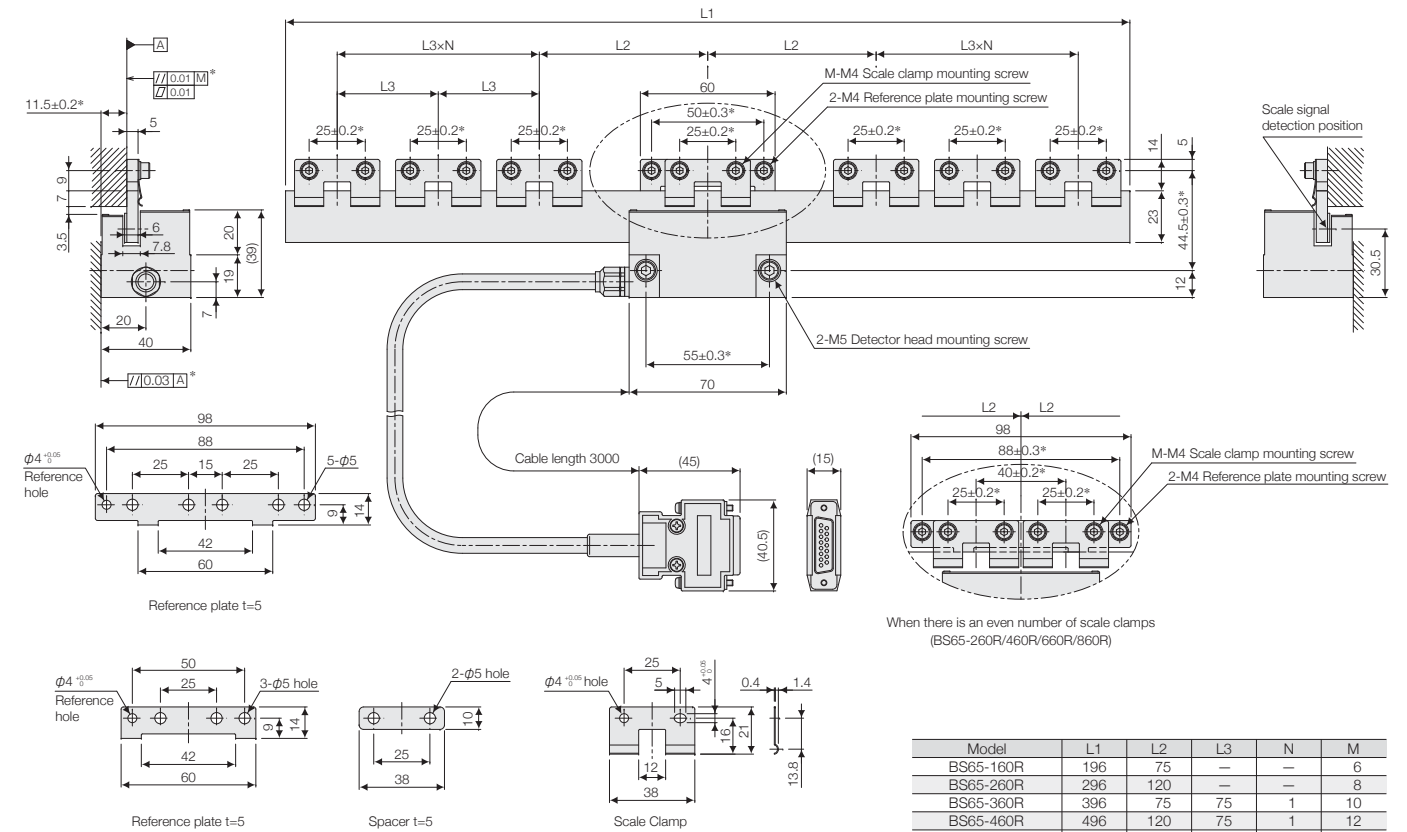
Actual size

- Signal pitch of 138nm
- High accuracy, high resolution  
Scale accuracy :  $L < 460 : (0.1+0.4L / 100) \mu\text{m p-p}$   
(L=measuring length in mm)
- High accuracy optical reference point :  $\pm 0.1 \mu\text{m}$
- Measuring length : 160 mm to 960 mm
- Easy installation
- Minimal effect from disrupted air current and atmospheric changes.



### External Dimensions

#### ● BS65-xxxR (Measuring length : 160/260/360/460/560/660/760/860/960 mm)



- Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
 Note 2: The surface properties of the scale mounting surface is  $R_{\text{max}} = 6.3S$ .  
 Note 3: The surface properties of the detector head mounting surface is  $R_{\text{max}} = 12.5S$ .  
 Note 4: "M" refers to the machine guide.  
 Note 5: Mount and adjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.

Unit: mm

### Main Specifications

Model		BS65-R
Measuring length		160/260/360/460/560/660/760/860/960 mm
Overall length		Measuring length + 36mm
Max. travel		Measuring length + 10mm (5mm on each side)
Scale accuracy (at 20°C)		$L < 460 : (0.1 + 0.4L/100) \mu\text{m p-p}$ , $L \geq 460 : 3 \mu\text{m p-p}$ L : Measuring length (mm)
Grating pitch		Approx. $0.55 \mu\text{m}$
Signal pitch		Approx. $0.138 \mu\text{m}$ (Approx. 138nm)
Reference point accuracy		$\pm 0.1 \mu\text{m}$
Reference point position		At the center, and every 50mm from the center to the left and to the right
Reference point detection direction		Single direction
Return error		This is virtually eliminated. It should be considered to be less than two resolution limits of the detector that is used.
Repeatability		This is virtually eliminated. It should be considered to be less than one resolution limit of the detector that is used.
Thermal expansion coefficient		$8 \times 10^{-6} / ^\circ\text{C}$
Light source		Semiconductor laser : Wavelength 790nm, Output 6mW
Radiation power		DHHS class 1
Detection principle		Diffraction grating scanning system
Operating temperature		10 to 30°C (No condensation)
Storage temperature		-10 to 50°C (Humidity less than 60%)
Max. response speed		400mm/s (When connected with BD96)

Magnescape reserves the right to change product specifications without prior notice.

# BH

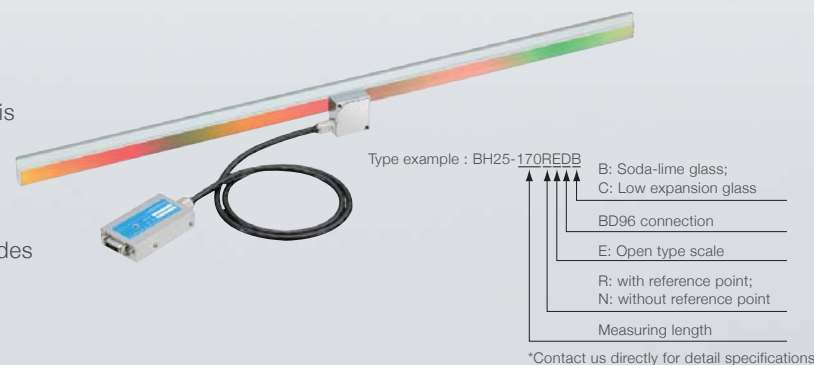
BH25-RE / BH25-NE  
(with/without reference point)

High-accuracy, reflective Laserscale with signal pitch of 250nm  
Ideal for low-profile stages, semiconductor back-end processing equipment  
and precision microscopes



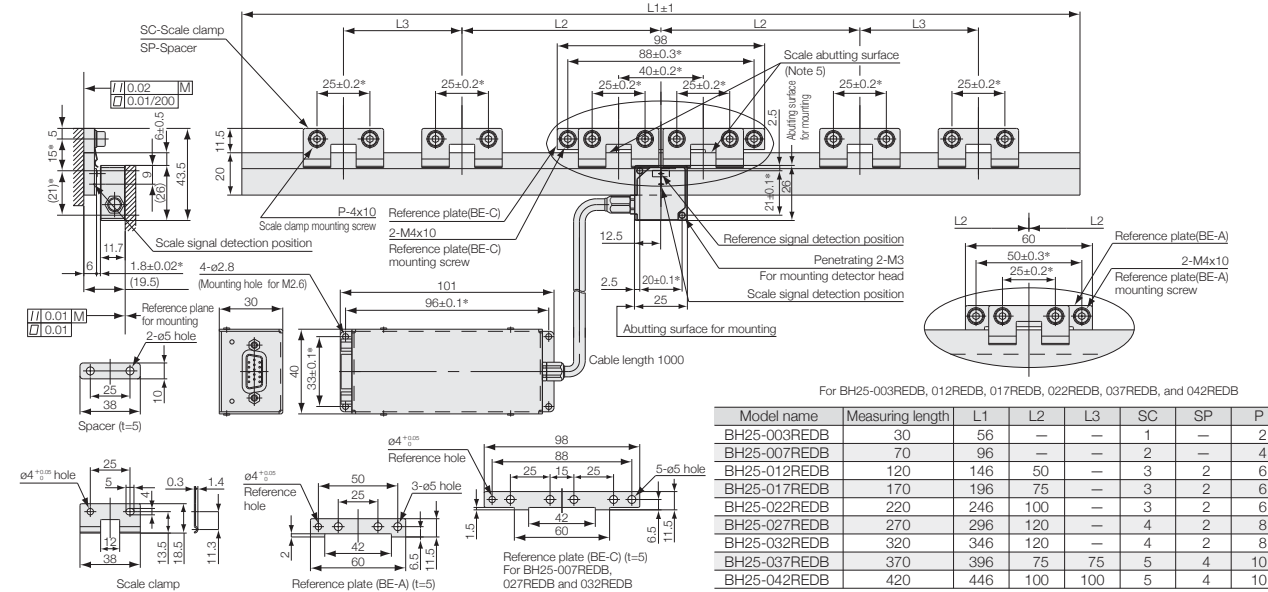
Actual size

- Signal pitch : 250nm
- High accuracy :  $\pm 1\mu\text{m}/420\text{mm}$
- High response speed : 700mm/s
- Minimum resolution : 0.03125mm
- Available : with/without reference point
- Completely non-contact design : Return error is theoretically eliminated.
- Scale : Soda-lime glass/Low expansion glass
- Thin head with thickness of 12mm
- Supporting various resolutions and output modes (Depending on the interpolator connected.)
- Special vacuum-compatible models available



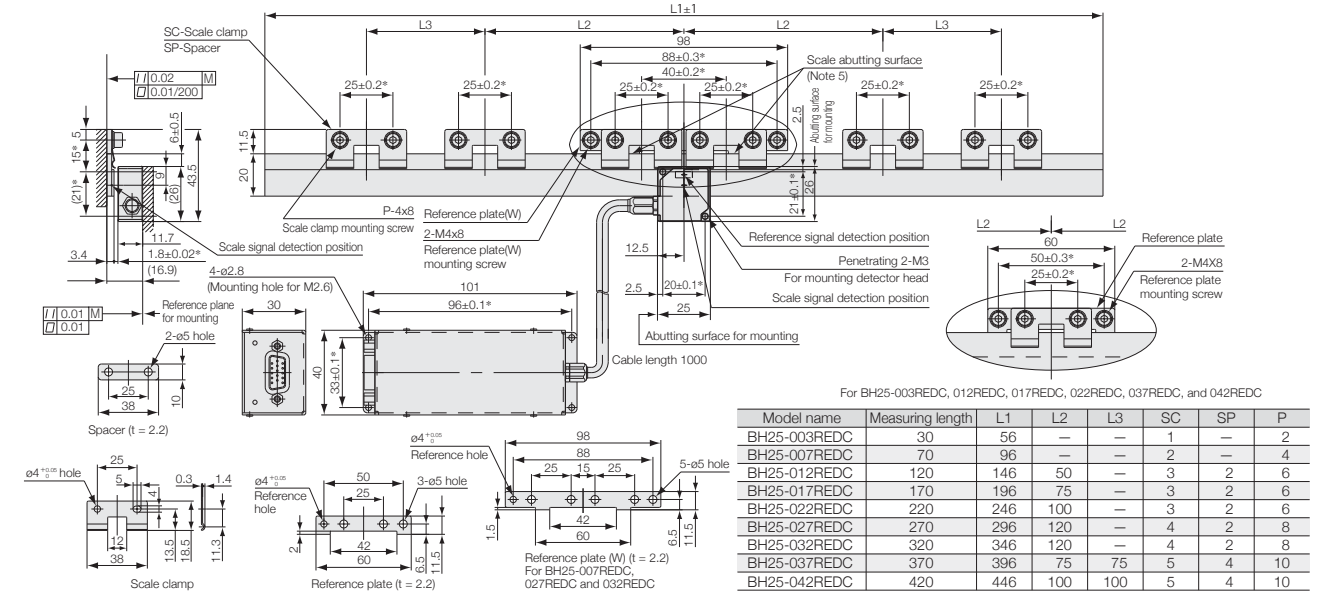
## External Dimensions

### ● BH25-xxxREDB (Measuring length : 30/70/120/170/220/270/320/370/420 mm)



Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface properties of the scale mounting surface is  $R_{\text{max}} = 6.3S$ .  
Note 3: The surface properties of the detector head mounting surface is  $R_{\text{max}} = 6.3S$ . Note 4: \*M refers to the machine guide.  
Note 5: Mount and adjust the reference plate so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.

### ● BH25-xxxREDC (Measuring length : 30/70/120/170/220/270/320/370/420 mm)



Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface properties of the scale mounting surface is  $R_{\text{max}} = 6.3S$ .  
Note 3: The surface properties of the detector head mounting surface is  $R_{\text{max}} = 6.3S$ . Note 4: \*M refers to the machine guide.  
Note 5: Mount and adjust the reference plate so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.

## Main Specifications

Model	BH25-RED	BH25-NED
Measuring length	30/70/120/170/220/270/320/370/420 mm (Low expansion glass/Soda-lime glass)	
Overall length	Measuring length +26mm	
Max. travel	Measuring length +10mm	
Scale accuracy (at 20°C)	$\pm 0.5\mu\text{m}$ (30 to 170mm) $\pm 1.0\mu\text{m}$ (220 to 420mm)	
Grating pitch	1.0 $\mu\text{m}$	
Signal pitch	0.25 $\mu\text{m}$ (250nm)	
Reference point	With reference point	None
Reference point detection direction	Single direction	None
Output signal	Interpolator BD96	
Resolution	BD96 connection(Depend on the number of divisions )	
Thermal expansion coefficient	$-0.7 \times 10^{-6}/^\circ\text{C}$ (Low expansion glass) $8 \times 10^{-6}/^\circ\text{C}$ (Soda-lime glass)	
Light source	Semiconductor laser : Wavelength 790nm, Output 6mW	
Detection principle	Diffraction grating scanning system	
Operating temperature	10 to 30°C (No condensation)	
Storage temperature	-10 to 50°C (Humidity less than 60%)	
Max. response speed	700mm/s (When connected with BD96)	

Magnescale reserves the right to change product specifications without prior notice.



# BH

BH20-RE / BH20-NE  
(with/without reference point)

Compact, reflective rotary Laserscale featuring high accuracy, high resolution and high response speed.  
Ideal for high-resolution angle measuring in HDD manufacturing equipment, precision measuring instruments, and aspheric surface processing machines.



- Signal pitch : 250nm
- High response speed : 1,800mm/s (When using analog output), 700mm/s(When connected with BD96)  
160 min<sup>-1</sup> (when using r=41mm scale)  
555 min<sup>-1</sup>(when using r=12mm scale)
- High resolution : 4,194,304,000 pulses/rotation (when using r=41mm scale, divisions=4000)  
3.09 x 10<sup>-4</sup> s  
=1.5nrad
- Available with/without reference point
- Thin head with thickness of 12mm
- Interpolators with various resolutions and output modes available (BD96)
- Special vacuum-compatible models available



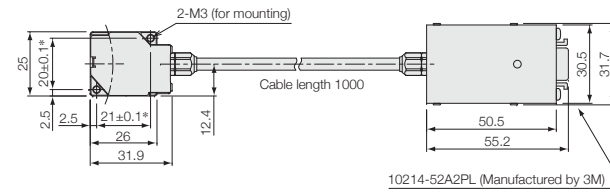
Type example: BH20-RED

D: BD96 Connected type  
E: Open type scale  
R: with reference point; N: without reference point  
\*Contact us directly for detail specifications

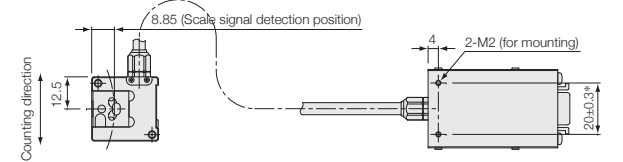
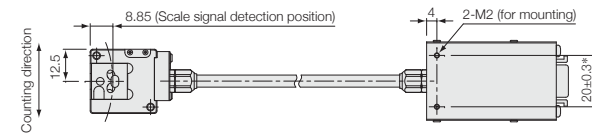
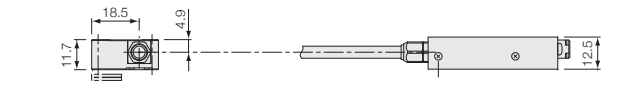
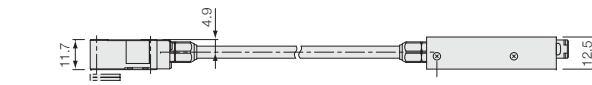
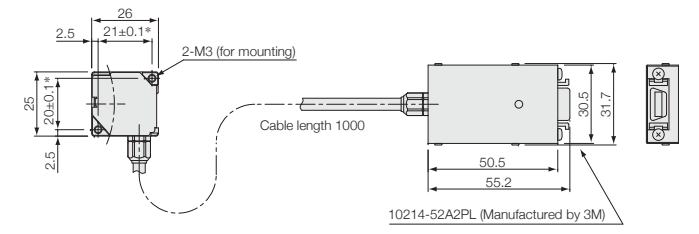
## External Dimensions

### ● BH20-NED

Straight cable exit



Lateral cable exit



Note: The items marked by an asterisk indicate the machining dimensions on the mounting surface.

Unit: mm

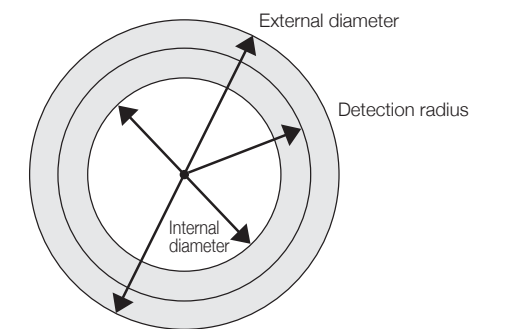
## Main Specifications

Detector head		BH20-RED	BH20-NED
Model		BH20-RED	BH20-NED
Detection principle		Diffraction grating scanning system	
Light source		Semiconductor laser : Wavelength 790nm, Output 6mW	
Signal pitch		250nm	
Reference point		With reference point	None
Reference point detection direction		Single direction	None
Max. response speed		700mm/s(When connected with BD96)	
Operating temperature		10 to 30°C (No condensation)	
Storage temperature		0 to 50°C (No condensation)	

## Signal scale (BE10)

External form	Signal scale (BE10)				
	Detection radius	12.032mm	27.073mm	36.097mm	41.723mm
External form	Internal diameter	8.5mm	37mm	57mm	68mm
	External diameter	27mm	60mm	78mm	89mm
Grating pitch		1.0μm			
Number of output pulse of one rotation		302,400	680,400	907,200	1,048,576
Max. response speed*(Note1)		1,428 min <sup>-1</sup>	634 min <sup>-1</sup>	476 min <sup>-1</sup>	411 min <sup>-1</sup>

Note 1: When using cable length 1m and Analog output. However, the Max.response speed is limited depending on the cable length.  
Note 2: When the scale and the detector head are purchased separately, signal adjustment is required.  
Magnescale reserves the right to change product specifications without prior notice.



# BL

## BL57-RE / BL57-NE (with/without reference point)

Supports a wide range of applications and offers the highest performance in its class.  
Ideal for precision stages, semiconductor inspection systems,  
precision processing machines, and liquid crystal manufacturing equipment.



### BL57-RE

- Achieves a measuring length of up to 1,060mm upon request, and offers the highest-level response speed and accuracy in its class.
- Signal pitch : 400nm
- Built-in reference point.  
(Applications) Precision measuring equipment, precision stages.

### BL57-NE

- Compact size makes machine integration much easier
- Theoretically unaffected by changes in temperature, humidity, air pressure and air movement. Unparalleled measuring stability achieved by use of low expansion glass
- Signal pitch : 400nm  
(Applications) High-accuracy microscopes, measurement equipment.



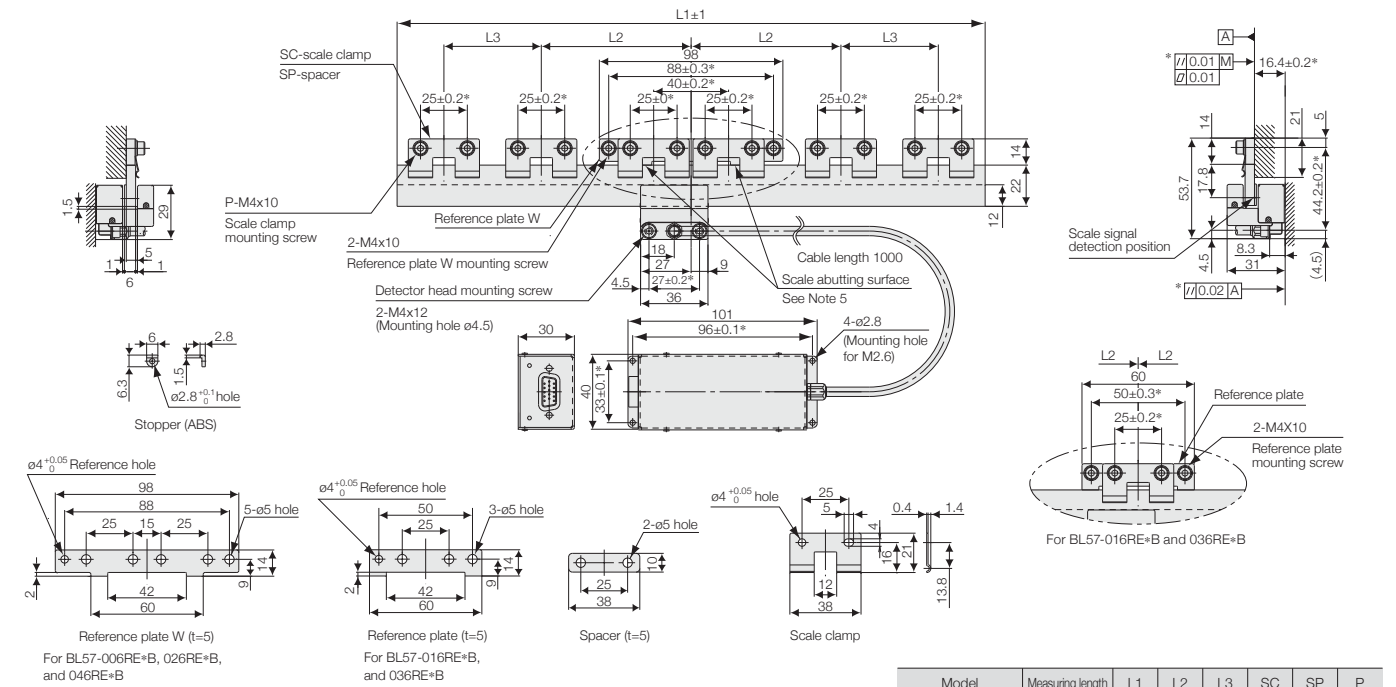
Type example : BL57-106REFB

- ↑ B: Soda-lime glass;
- ↑ C: Low expansion glass
- ↑ A: 4-split A/B quadrature output
- ↑ F: 4-split 8-split A/B quadrature output
- ↑ G: 20-split 40-split A/B quadrature output
- ↑ H: Analog 1Vp-p output
- ↑ E: Open type scale
- ↑ R: with reference point; N: without reference point
- ↑ Measuring length

\*Contact us directly for connection with BD96

### External Dimensions

#### ● BL57-xxxRE\*B (Measuring length : 60/160/260/360/460 mm)

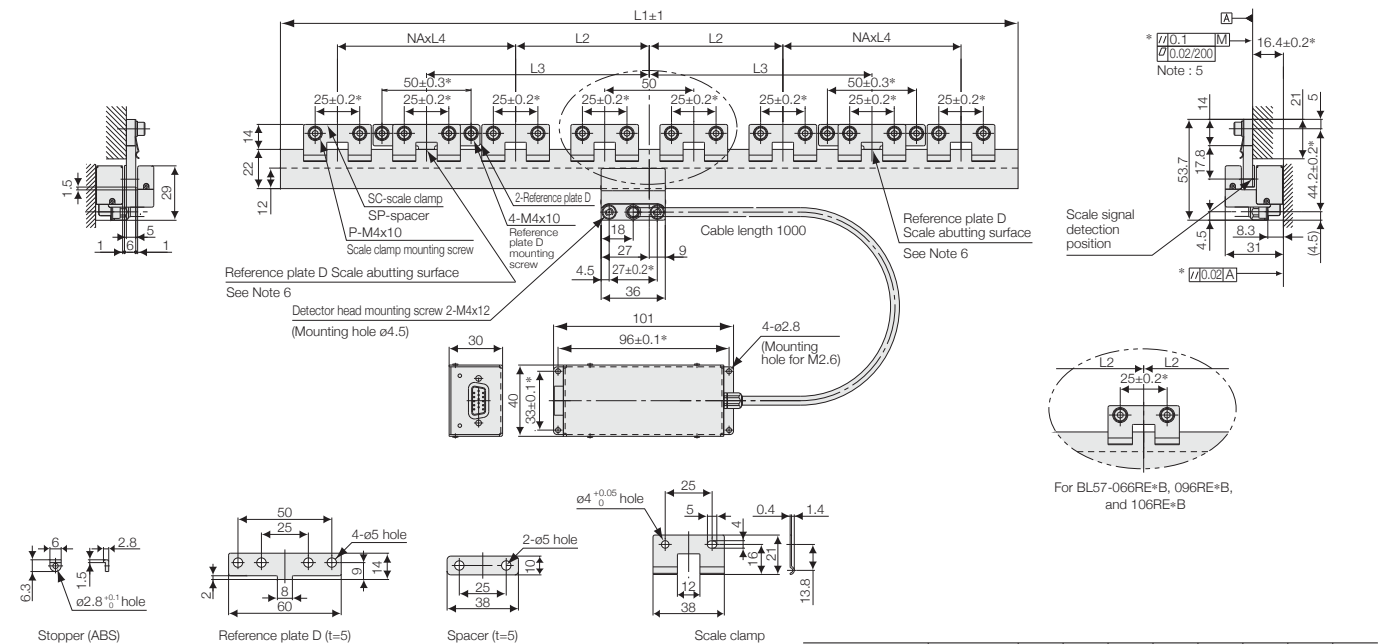


Model	Measuring length	L1	L2	L3	SC	SP	P
BL57-006RE*B	60	96	—	—	2	—	4
BL57-016RE*B	160	196	75	—	3	2	6
BL57-026RE*B	260	296	120	—	4	2	8
BL57-036RE*B	360	396	75	75	5	4	10
BL57-046RE*B	460	496	120	75	6	4	12

- Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
 Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S.  
 Note 4: \*M\* refers to the machine guide.  
 Note 5: When mounting the reference plate (reference plate W), adjust the plate so that the parallelism between the corresponding scale abutting surface and the machine guide is 0.01mm or less.

Unit: mm

#### ● BL57-xxxRE\*B (Measuring length : 560/660/760/860/960/1060 mm)



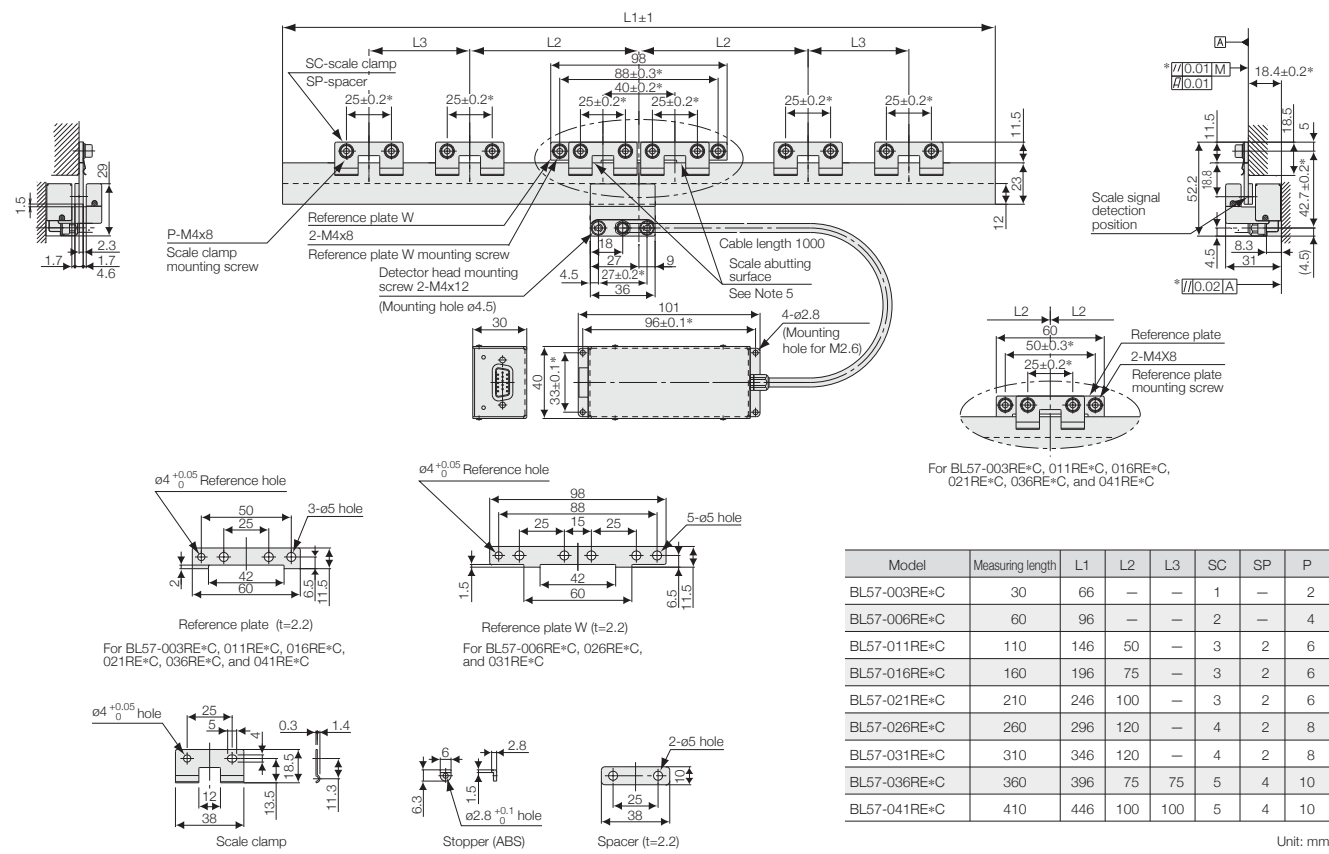
Model	Measuring length	L1	L2	L3	L4	NA	SC	SP	P
BL57-056RE*B	560	596	100	175	75	2	8	6	16
BL57-066RE*B	660	696	75	225	75	3	9	7	18
BL57-076RE*B	760	796	100	250	75	3	10	8	20
BL57-086RE*B	860	896	100	250	75	4	12	10	24
BL57-096RE*B	960	996	75	300	75	5	13	11	26
BL57-106RE*B	1060	1096	75	300	75	6	15	13	30

- Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface.  
 Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S.  
 Note 4: \*M\* refers to the machine guide.  
 Note 5: The flatness of the scale mounting surface must be within 0.02 over the range of 7 (width) x 200 (length) mm.  
 Note 6: Mount and adjust the paired reference plates (D) so that their reference surfaces have a parallelism of 0.1 or less with respect to the machine guide.

Unit: mm

External Dimensions

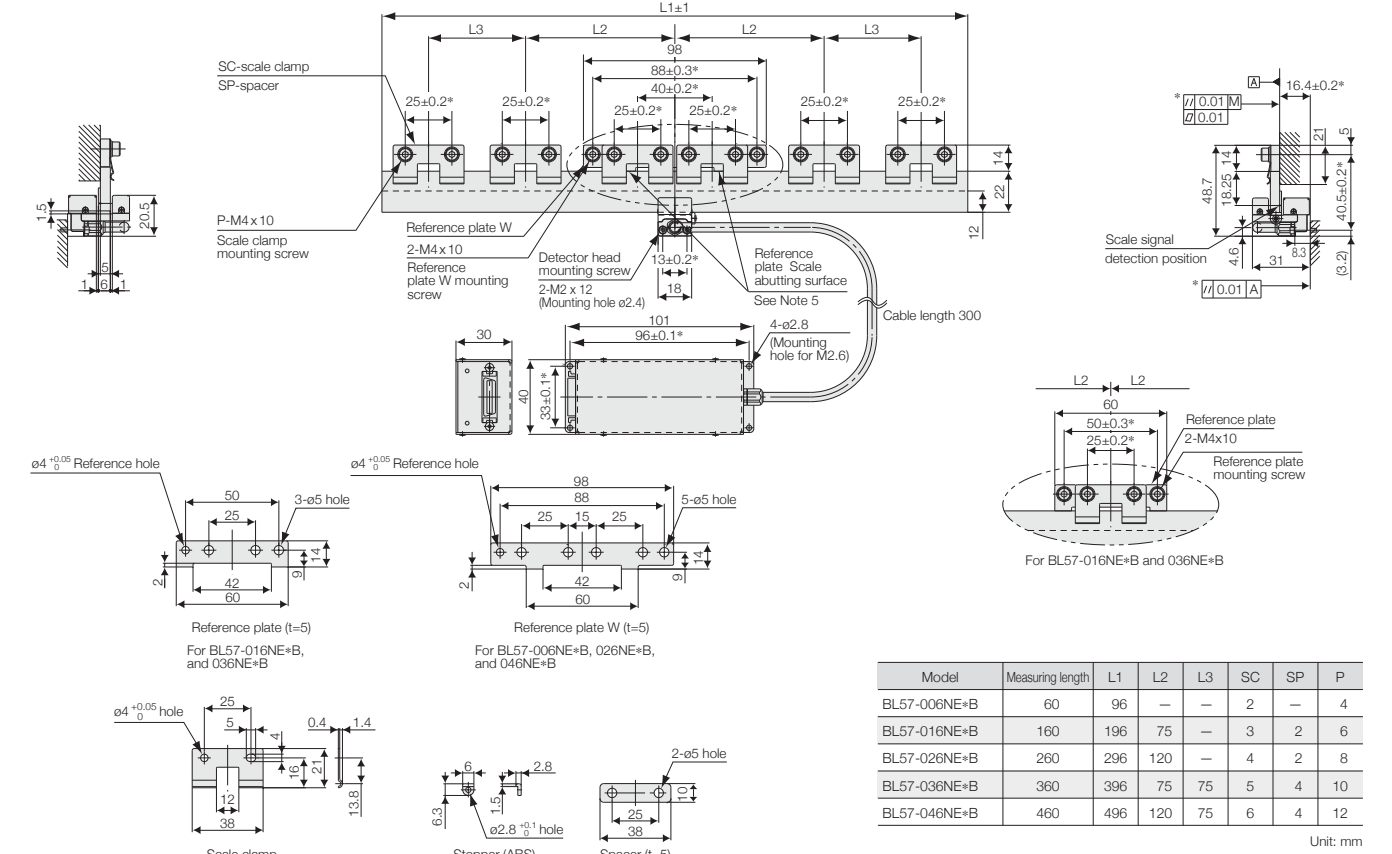
● BL57-xxxRE=C (Measuring length : 30/60/110/160/210/260/310/360/410 mm)



Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S. Note 4: "M" refers to the machine guide.  
 Note 5: When mounting the reference plate (reference plate W), adjust the plate so that the parallelism between the corresponding scale abutting surface and the machine guide is 0.01mm or less.

External Dimensions

● BL57-xxxNE=B (Measuring length : 60/160/260/360/460 mm)



Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S. Note 4: "M" refers to the machine guide.  
 Note 5: When mounting the reference plate (reference plate W), adjust the plate so that the parallelism between the corresponding scale abutting surface and the machine guide is 0.01mm or less.

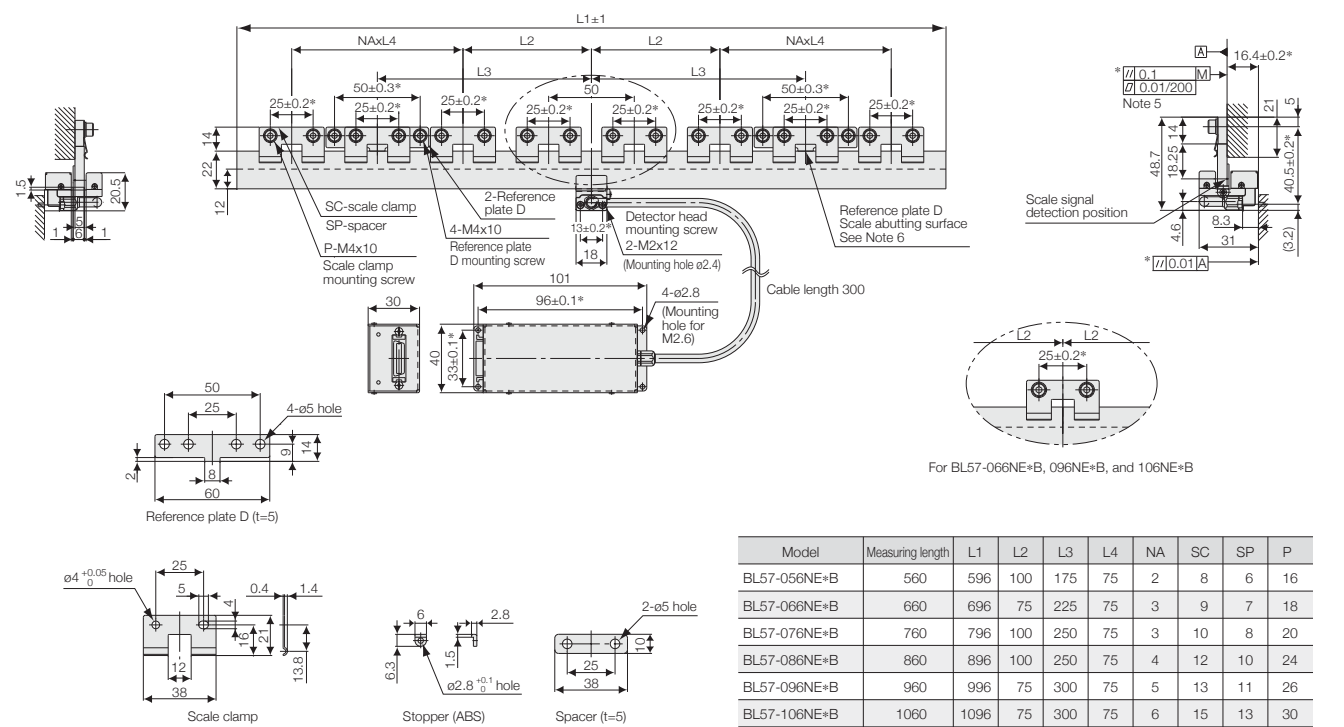
Main Specifications [BL57-RE]

Model	F	G	H
Output signal form	A/B quadrature output		Analog output
Detection principle	Diffraction grating scanning system		
Scale length (Low expansion glass)	Measuring length	30, 60, 110, 160, 210, 260, 310, 360, 410 mm	
	Max. travel	Measuring length + 10mm (5mm on each side)	
	Overall length	Measuring length + 36mm	
Scale length (Soda-lime glass)	Measuring length	60, 160, 260, 360, 460, 560, 660, 760, 860, 960, 1060 mm	
	Max. travel	Measuring length + 10mm (5mm on each side)	
	Overall length	Measuring length + 36mm	
Grating pitch	1.6μm		
Signal pitch	0.4μm (400nm)		
Output signal	Differential (compliant with EIA-422)		Differential (only reference point output are compliant with EIA-422)
Resolution	0.1/0.05μm (selectable)	0.02/0.01μm (selectable)	0.4μm (1Vp-p)
Scale accuracy (at 20°C)	±0.5μm(30 to 160mm) / 1.0μm(210 to 360mm) / ±1.5m(410mm or more)		
Thermal expansion coefficient	Low expansion glass:-0.7x10 <sup>-6</sup> /°C · Soda-lime glass:8x10 <sup>-6</sup> /°C		
Max. response speed	1,500mm/s(0.1μm)	300mm/s(0.02μm)	3,000mm/s
	650mm/s(0.05μm)	120mm/s(0.01μm)	(Note1)
Minimum phase difference:38ns	Minimum phase difference:38ns		Max 7.5MHz

Note 1: Max. response speed become limited by output cable length (the part beyond the interface box).  
 Note 2: A power supply line longer than 10m is incompatible with EN61000-6-2. Take surge protection measures upon use.  
 Note 3: Satisfy the required specifications at the connector input section.  
 Note 4: Special models can support up to 3m. However, the max. response speed is limited depending on the cable length.(In a 3m cable, the max. response speed is two-thirds that of a 1m cable.)  
 Note 5: Special models can support a measuring length of 420mm by low expansion glass and 1,070mm to 1,260mm by soda-lime glass.  
 Magnescale reserves the right to change product specifications without prior notice.

Model	F	G	H
Alarm	High impedance, output when max. response speed is exceeded or signal level error detected		None
Reference point position	User definable (within the range of measuring length)		
Reference point accuracy (at 20°C)	±0.4μm (depending on machine movement accuracy)		
Reference point detection direction	Single direction synchronous reference point		
Head cable	Cable length	1m (Note 4)	
	Bending radius	Static : 10mm	
Output cable length	15m Max (Note 2)(to the electronic control section)		15m Max(Note1) (Note 2)
Power supply (Note 3)	+5V (±5%)		
Power consumption	450mA (no load), 600mA (with 120Ω termination)		
Vibration resistance	100m/s <sup>2</sup> (50 to 2000Hz)		
Impact resistance	200m/s <sup>2</sup>		
Operating temperature	0 to +40°C(No condensation)		
Storage temperature	-10 to +50°C		
Light source	Semiconductor laser : Wavelength 790nm, Output 6mW		
Radiation power	JIS Class 1 equivalent, DHHS Class 1 equivalent		
(Note1)			
Cable length (m)	Max. response speed (mm/s)		
3	3,000		
9	2,330		
15	1,660		

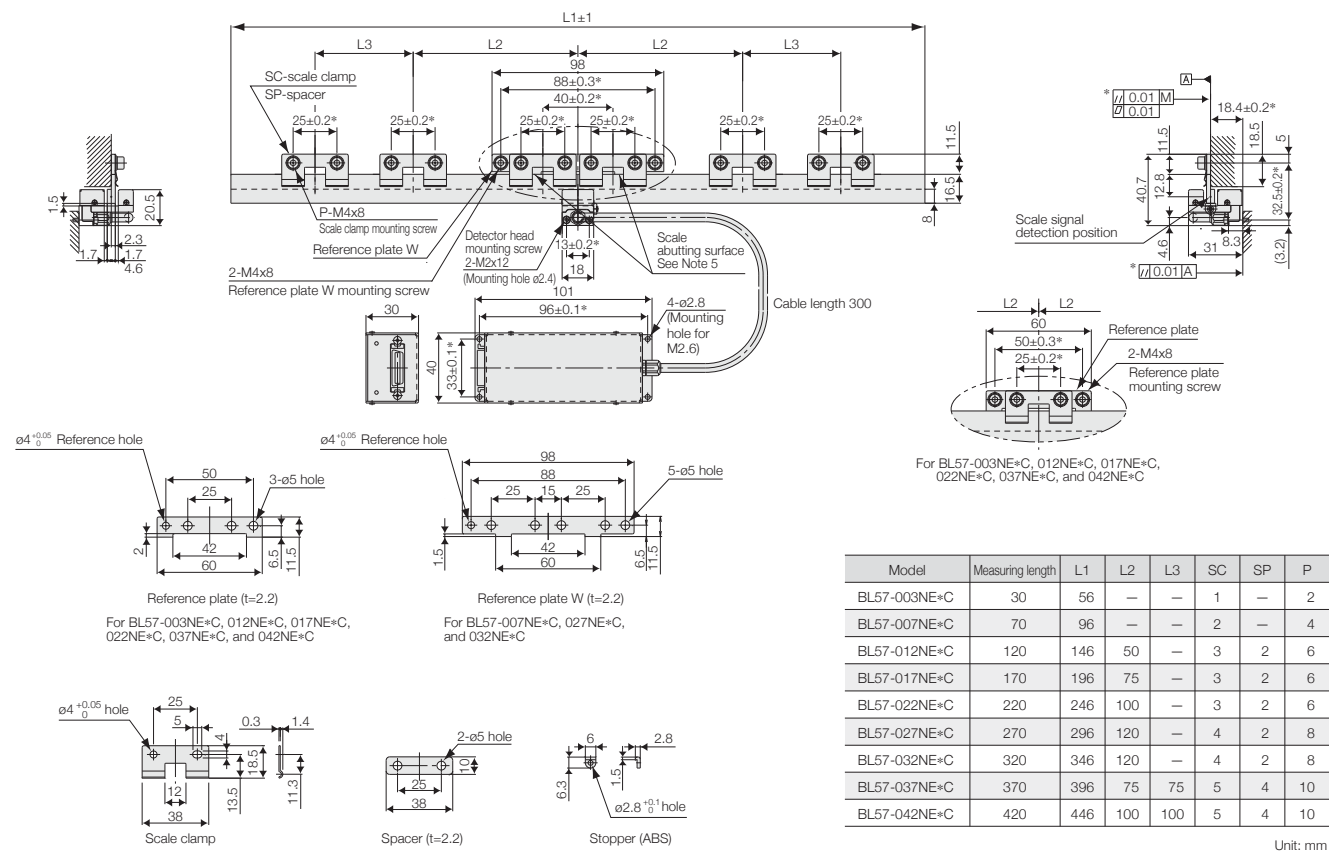
● BL57-xxxNE=B (Measuring length : 560/660/760/860/960/1060 mm)



Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S.  
 Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S. Note 4: "M" refers to the machine guide.  
 Note 5: The flatness of the scale mounting surface must be within 0.02 over the range of 7 (width)×200 (length)mm.  
 Note 6: Mount and adjust the paired reference plates (D) so that their reference surfaces have a parallelism of 0.1 or less with respect to the machine guide.

External Dimensions

● BL57-xxxNE=C (Measuring length : 30/70/120/170/220/270/320/370/420 mm)

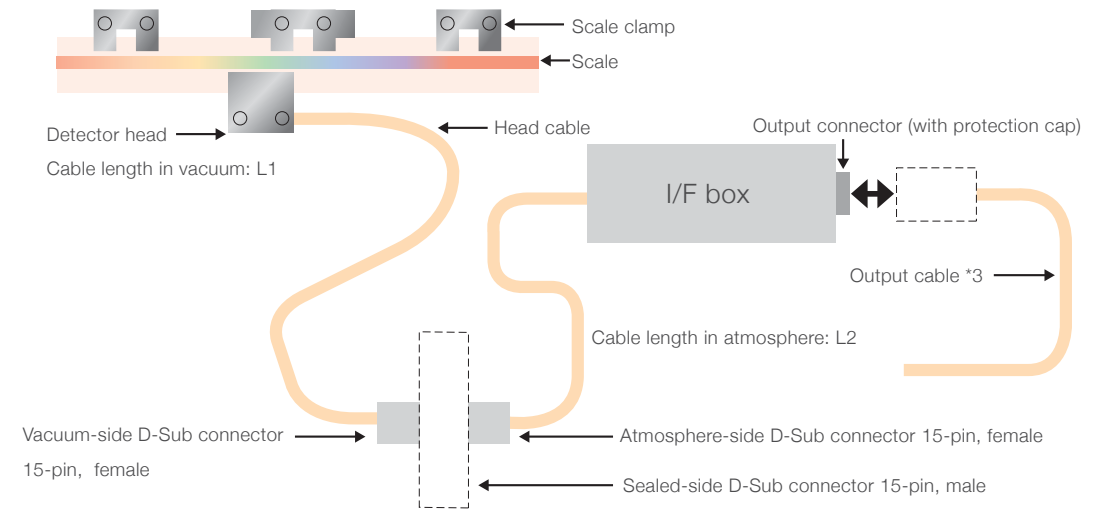


Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface properties of the scale mounting surface is Rmax = 6.3S. Note 3: The surface properties of the detector head mounting surface is Rmax = 12.5S. Note 4: "M" refers to the machine guide. Note 5: When mounting the reference plate (reference plate W), adjust the plate so that the parallelism between the corresponding scale abutting surface and the machine guide is 0.01mm or less.

Main Specifications[BL57-NE]				
Model	A	F	G	H
Output signal form	A/B quadrature output			Analog output
Detection principle	Diffraction grating scanning system			
Scale length (Low expansion glass)	Measuring length	30, 70, 120, 170, 220, 270, 320, 370, 420 mm		
	Max. travel	Measuring length + 10mm (5mm on each side)		
	Overall length	Measuring length + 26mm		
Scale length (Soda-lime glass)	Measuring length	60, 160, 260, 360, 460, 560, 660, 760, 860, 960, 1060 mm		
	Max. travel	Measuring length + 10mm (5mm on each side)		
	Overall length	Measuring length + 36mm		
Grating pitch	1.6µm			
Signal pitch	0.4µm (400nm)			
Output signal	Differential (compliant with EIA-422)			Differential
Resolution	0.1µm	0.1/0.05µm (selectable)	0.02/0.01µm (selectable)	0.4µm (1Vp-p)
Scale accuracy (at 20°C)	±0.5µm (30 to 170mm)/ ±1.0µm (220 to 370mm)/ ±1.5µm (420mm or more)			
Thermal expansion coefficient	Low expansion glass: -0.7 x 10 <sup>-6</sup> /°C · Soda-lime glass: 8 x 10 <sup>-6</sup> /°C			
Max. response speed	1,000mm/s	1,500mm/s (0.1µm) 650mm/s (0.05µm)	300mm/s (0.02µm) 120mm/s (0.01µm)	3,000mm/s (Note 1)
	Minimum phase difference: 80ns	Minimum phase difference: 38ns	Minimum phase difference: 38ns	Max 7.5MHz

Note 1: Max. response speed become limited by output cable length (the part beyond the interface box). Note 2: A power supply line longer than 10m is incompatible with EN61000-6-2. Take surge protection measures upon use. Note 3: Satisfy the required specifications at the connector input section. Magnescale reserves the right to change product specifications without prior notice.

BL57-RE supporting vacuum environment (Special models)



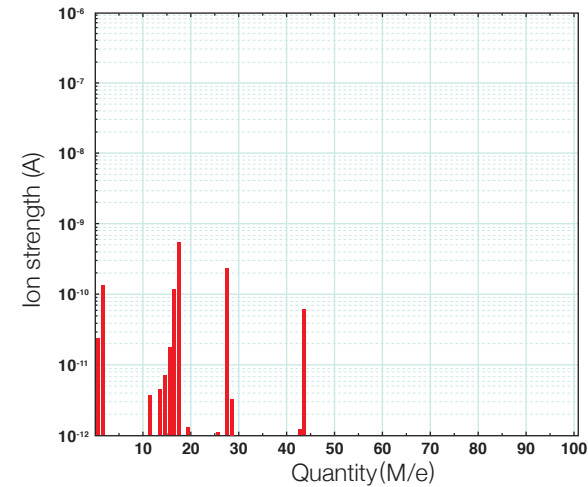
Vacuum-compatible, open type with reference point. Allowing ultra-precise positioning in a vacuum environment.

- Ultimate vacuum of 10<sup>-5</sup> Pa class.
- Emitted gas flow rate of 10<sup>-6</sup> Pa·m<sup>3</sup> class.
- Signal pitch 0.4µm
- Built-in reference point.

Applications: Semiconductor inspection systems, length measuring SEM.

\*1: For dimensions of head, scale, and I/F box, see the page on BL57-RE. \*2: Cable length in vacuum and in atmosphere (L1 + L2) is up to 3m. \*3: Output cable is not included in the product.

Outgas analysis chart



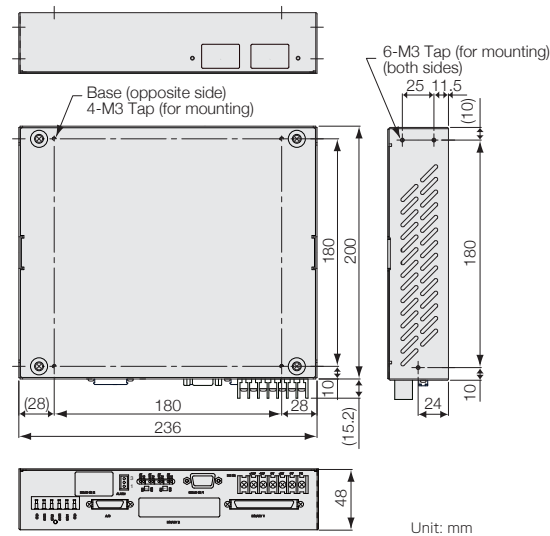
# BD

## BD96 Interpolator for Laserscale

Minimum resolution of 17pm when combined with the BS series.  
Supporting various serial and binary outputs.

### External Dimensions

#### ● BD96-B1,B2,Y1,Y2, M1, M2 commonness



- Minimum resolution :  
0.4nm (When connected with BL series)  
31pm (When connected with BH series)  
17pm (When connected with BS series)
- High response speed :  
1,100mm/s (When connected with BL series)  
700mm/s (When connected with BH series)  
400mm/s (When connected with BS series)
- Various serial or binary outputs
- Includes automatic signal compensation
- A/B quadrature output (standard : 4 divisions) (binary output axis 1 or 2 type)  
BS series : 34.5nm, BH series : 62.5nm, BL series : 100nm
- Max. divisions : 8000 (When connected with BS and BH series) (special model)

\* Please inquire about various specifications, such as the number of divisions.

Main Specifications	
Model	BD96
Resolution	17pm (When connected with BS series), 31.25pm (When connected with BH series), 0.4nm (When connected with BL series)
Max. response speed	400mm/s (When connected with BS series), 700mm/s (When connected with BH series), 1,100mm/s (When connected with BL series)
Max. divisions	025 : 256, 051 : 512, 040 : 400, 050 : 500, 100 : 1000, 200 : 2000, 400 : 4000 (special model 800 : 8000 divisions)
Alarm	When exceeding the max. response speed or when the laser signal level is too low (disconnection); LED lights up
Input signal compensation	DC offset, amplitude, phase
Power supply	DC +5V±5% DC +12V±5% DC -12V±5%
Power consumption (When connected with scale)	DC +5V : 0.4A DC +12V : 0.4A DC -12V : 0.2A ( 1 axes type ) DC +5V : 0.4A DC +12V : 0.7A DC -12V : 0.5A ( 2 axes type )
Operating temperature	0 to +40°C
Storage temperature	-10 to +50°C
Dimensions	236 (W) x 215.2 (D) x 48 (H)mm
Mass	Approx. 1.6kg

BD96-☆△\*\*□C  
 ↑ Shape C: Case type  
 ↑ Scale type S: BS series H: BH series L: BL series  
 ↑ Division 025: 256 divisions 051: 512 divisions 040: 400 divisions 050: 500 divisions 100: 1000 divisions 200: 2000 divisions 400: 4000 divisions  
 ↑ Axis type 1: 1 axis 2: 2 axes  
 ↑ Output mode B: Binary (Axis type 1 : 40 bits, 2 : 20bits) Y: Yaskawa Electric serial \*1 M: Mitsubishi Electric serial F: FANUC serial \*2

\*1 Only supported with 256 and 512 division \*2 Special model  
Magnescale reserves the right to change product specifications without prior notice.



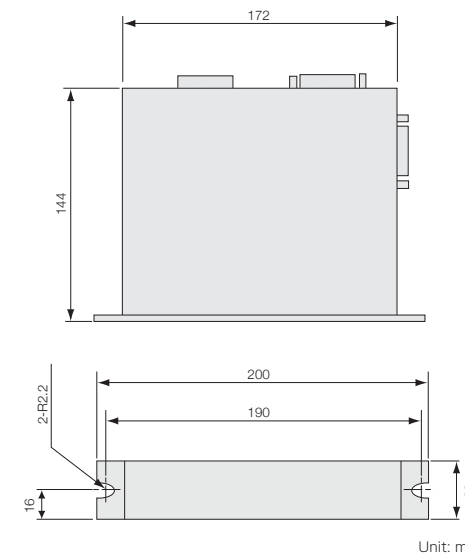
# BD

## BD95 Interpolator for BS series Laserscale

Interpolator with A/B quadrature output that achieves resolution from 4.3nm~34.5nm.

### External Dimensions

#### ● BD95-T10,T13,T14,T15,T16,T17commonness



- High resolution: 4.3 to 34.5nm (depends on the number of divisions)
- High response speed: 400mm/s
- DC offset, gain, phase automatic conditioning
- 32 bit binary output by data request input (T14, T16, T17)

Main Specifications						
Model	BD95-T13	BD95-T14	BD95-T15	BD95-T16	BD95-T10	BD95-T17
Resolution	34.5 nm (4 divisions) or 17.2nm (8 divisions) 100 nm or 50 nm during pitch compensation	17.2 nm (8 divisions) or 8.6 nm(16 divisions) 100 nm, 50 nm, or 10 nm during pitch compensation	17.2 nm (8 divisions) or 8.6 nm(16 divisions) 100 nm, 50 nm, or 10 nm during pitch compensation	100 nm, 50 nm, 10 nm or 5 nm during pitch compensation	8.6 nm (16 divisions) or 4.3 nm(32 divisions) 100 nm, 50nm, 10 nm or 5 nm during pitch compensation	8.6 nm (16 divisions) or 4.3 nm(32 divisions) 100 nm, 50nm, 10 nm or 5 nm during pitch compensation
Max. response speed	400 mm/s (with 4 divisions) 275 mm/s (with 8 divisions)	275 mm/s (with 8 divisions)	275 mm/s (with 8 divisions)	120 mm/s (with 16 divisions)	120 mm/s (with 16 divisions)	60 mm/s (with 32 divisions)
Output signal	A/B quadrature 1 with / without pitch compensation (compliant with EIA-422) A/B quadrature 2 without pitch compensation (compliant with EIA-422) Reference point (compliant with EIA-422) Alarm (compliant with EIA-422) (Switching between automatic reset and holding is possible) Laserscale signal (SIN/COS) 32-bit binary data (-T14, -T16, -T17 only)					
Alarm	When exceeding the max. response speed or when the laser signal level is too low (disconnection); LED lights up					
Pitch compensation function	A/B quadrature 1 only A round-off error of 1 resolution occurs.					
Power supply	DC + 24V±1V					
Power consumption (when connected with scale)	400mA (maximum)					
Operating temperature	0 to 50°C					
Storage temperature	-10 to 60°C					
Dimensions	172 (W)x144(D)x32(H) mm					
Mass	Approx. 0.8 kg					

Magnescale reserves the right to change product specifications without prior notice.

# Connection Cable

Scales		Extension Cable*2	Interpolator
Model	Head cable length*1		
BS78 BS65-R	3m (Standard)	Robot cable:CK-T133 (0.1m) CK-T137 (3.0m) CK-T167 (4.0m) CK-T112 (5.0m) CK-T132 (8.0m) CK-T159 (9.0m)	
BH25-NE BH20-NE	1m (Standard)	Robot cable:CK-T148 (3.0m)	BD96
BH25-RED BH20-RED BL57-RED	1m (Standard)	Robot cable:CE20-01T01 (1.0m) CE20-02T02 (2.0m) CE20-03T10 (3.0m) CE20-04T01 (4.0m) CE20-05T08 (5.0m) CE20-06T01 (6.0m) CK-T144 (9.0m)	

\*1 Please contact sales for additional lengths. \*2 Available up to 9 meters (BS series). For cables longer than 9 meters, please contact sales.

Scales		Extension Cable	Interpolator
Model	Head cable length*1		
BS78 BS65-R	3m (Standard)	Robot cable:CK-T41 (0.3m) CK-T67 (1.0m) CK-T199 (2.0m) CK-T24 (3.0m) CK-T168 (4.0m) CK-T54 (6.0m) CK-T106 (8.0m)	BD95

Scales		Extension Cable	Interpolator
Model	Head cable length*1		
BL57-NE (A/B quadrature)	0.3m (Standard)	Robot cable:CE20-03T07 (3.0m) CE20-05T05 (5.0m) CE20-10T02 (10.0m)	Built-in I/F Box
BL57-RE (A/B quadrature)	1m (Standard)		
BL57-NE (Analog)	0.3m (Standard)	Robot cable:CE20-03T12 (3.0m) CE20-07T03 (7.0m)	None
BL57-RE (Analog)	1m (Standard)	CE20-12T01 (12.0m)	

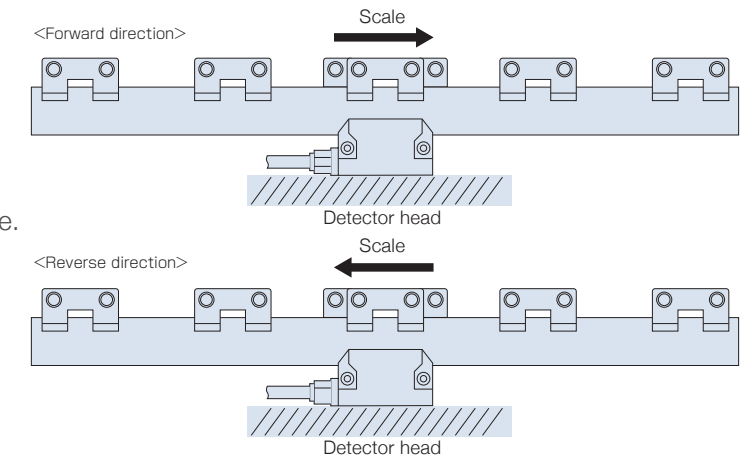
\*1 Please ask for other length.

The robot cable minimum bending radius: R80mm is fixed repeatedly R10mm.

# Technology

## Reference point detection direction

The optical built-in reference point of the laserscale can be detected by single direction.  
Forward detection is set as standard, but it can detect signal from reverse direction depending on the equipment in use.  
The direction should be specified before order.  
Please contact us for further information.



\* Do not detect the reference point from the wrong direction in order to keep the reliability of the reference point and to avoid deterioration.

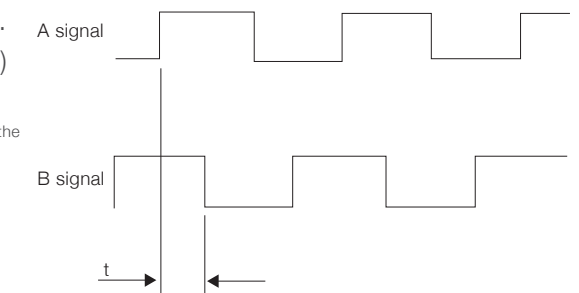
## Scale Signal Output

### A/B quadrature and Alarm Output Specifications (For output formats F and G) BL57

- The output specifications are compliant with EIA-422.
- A/B quadrature minimum phase difference  $t$  : 38 ns (BL57)

[Note]

- An error of about 38 ns is generated due to the synchronization of the A/B quadrature by the 26.3 MHz internal clock.
- The minimum phase difference can vary depending on the length of the output cable, cable capacity, receiver load, and other factors.



## Connection Specifications

### A/B quadrature Output Type

The line driver used by Magnescale Co., Ltd. is compliant with EIA-422.

Also, based on the EIA-422 standards, the common mode voltage between the line driver and line receiver is stipulated as  $\pm 12$  V.

(Using the scale when the common mode voltage of  $\pm 12$  V is exceeded can damage the scale.)

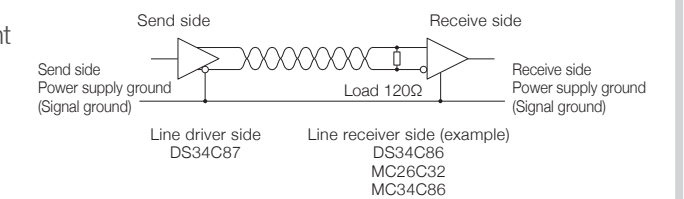
To prevent problems between the control devices connected to this Magnescale Co., Ltd. product, it is recommended that you connect (shared connection) the signal ground (power supply ground) and set the load resistance to 120  $\Omega$ .

Twisted pair cables (1 turn/1 inch min.) with a

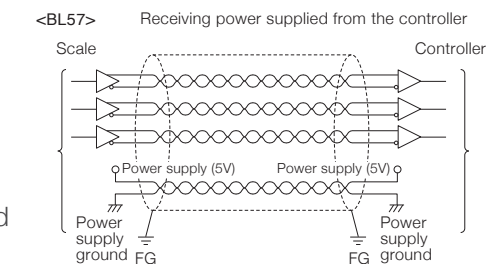
core thickness of at least AWG28 are recommended for the differential signal cables.

(It is even better if the characteristic differential impedance is the same as the load resistance value.)

### <Commonness>



### <BL57>



## Analog Output Specifications BL57

### SIN/COS output specifications (For output format H)

(Over the overall length and the entire operating temperature range)

Item	Symbol	Specifications			Units	Remarks
		Min.	Typ.	Max.		
Output signal amplitude	$(+VA) - (-VA), (+VB) - (-VB)$	0.6	1	1.2	Vp-p	Note 1
Output signal phase difference		80	90	100	deg	
Center voltage	$+VOA, +VOB, -VOA, -VOB$	2.3	2.5	2.7	V	
Offset voltage	$(+VOA) - (-VOA), (+VOB) - (-VOB)$	-50	0	50	mV	
Gain unbalance		-6	0	6	%	System 1
Load resistance			120		$\Omega$	

Note 1: When terminator  $Z0 = 120\Omega$  supply voltage =  $5V \pm 5\%$   
(voltage of load resistance at both ends)

System 1:  $\frac{A \text{ signal output voltage p-p value} - A/B \text{ quadrature output average}}{A/B \text{ quadrature output average}} \times 100$

where

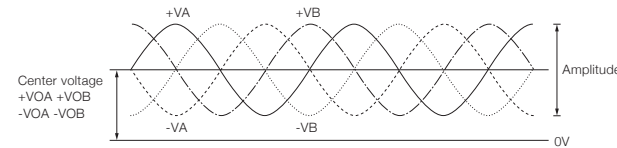
A/B quadrature output average

$$= \frac{A \text{ signal output voltage p-p value} + B \text{ signal output voltage p-p value}}{2}$$

### Output waveform diagram

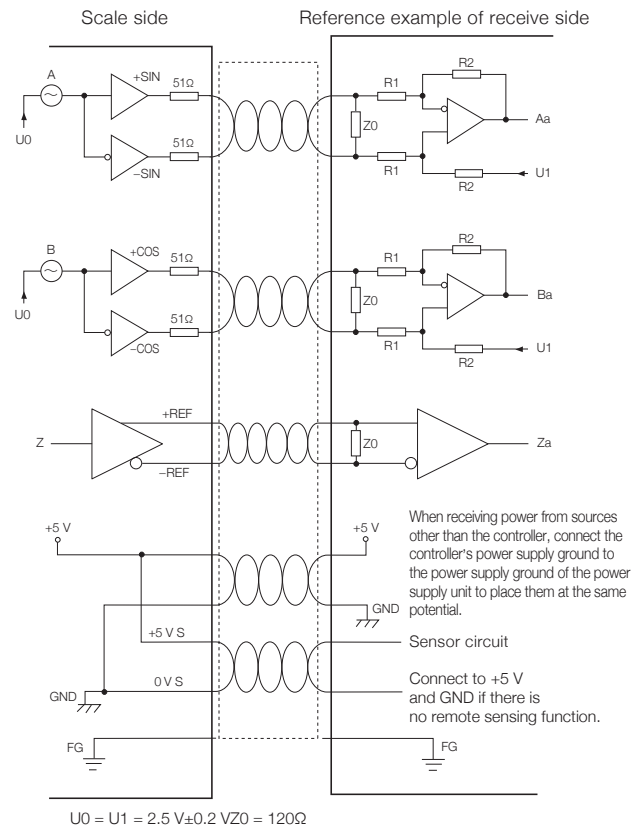
(When each output is viewed based on 0 V)

The A signal corresponds to SIN,  
and the B signal corresponds to COS.



### Connection Specification

Example of input circuit



Recommended elements  
SIN and COS : Differential receiver LMH6654  
 $R1 = R2 = 10 \text{ k}\Omega$   
REF : DS34C86

Reference point signal and SIN and COS signal phases

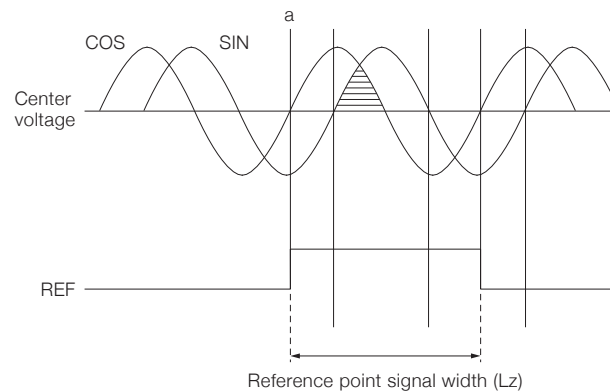
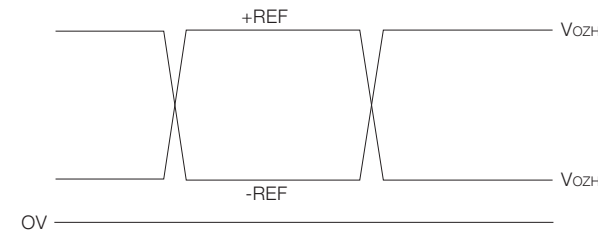
Item	Specifications		
	Min.	Typ.	Max.
Reference point signal width (Lz)	0.32 $\mu\text{m}$	0.4 $\mu\text{m}$	0.48 $\mu\text{m}$
Position of reference point signal edge a with respect to SIN signal	0°		90°

### Reference point output specifications

The output specifications are compliant with EIA-422.

(Over the overall length and the entire operating temperature range)

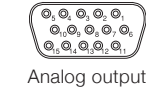
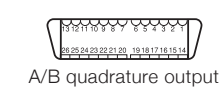
Item	Symbol	Specifications			Units
		Min.	Typ.	Max.	
"H" level output	$VoZH$	2.5	3.4	5	V
"L" level output	$VoZL$	0	0.3	0.5	V



## Input/Output Connectors

### Connectors (Open type) BL57

Pin arrangement	Input/output specifications	
	A/B quadrature output (Output format F, G)	Analog output (Output format H)
1	A	+COS
2	*A	-COS
3	B	+SIN
4	*B	-SIN
5	REF	(Not connectable)
6	*REF	0 V (power supply)
7	+5 V (power supply)	0VS
8	ALM	(Not connectable)
9	+5 V (power supply)	+5 V (power supply)
10	*ALM	+5VS
11	+5VS	+REF
12	(Not connectable)	-REF
13	+5 V (power supply)	(Not connectable)
14	SIN (M)	(Not connectable)
15	0 V (power supply)	(Not connectable)
16	COS (M)	
17	0 V (power supply)	
18	(Not connectable)	
19	0VS	
20	(Not connectable)	
21	0V (M)	
22	(Not connectable)	
23	0 V (power supply)	
24	(Not connectable)	
25	0 V (signal)	
26	(Not connectable)	



### Interface unit side:

A/B quadrature output : 10226-52A2PL

(manufactured by 3M Japan Limited)

Analog output : D02-M15SAG-26L9E

(manufactured by Japan Aviation Electronics Industry, Limited)

### Cable side:

A/B quadrature output : Plug 10126-3000PE

(manufactured by 3M Japan Limited)

: Shell 10326-52F0-00S

(manufactured by 3M Japan Limited)

Analog output : Plug D02-M15PG-N-F0

(manufactured by Japan Aviation Electronics Industry, Limited)

: Contact When AWG24 wire is used

D02-22-22P-PKG100

(manufactured by Japan Aviation Electronics Industry, Limited)

: Contact When AWG26-28 wire is used

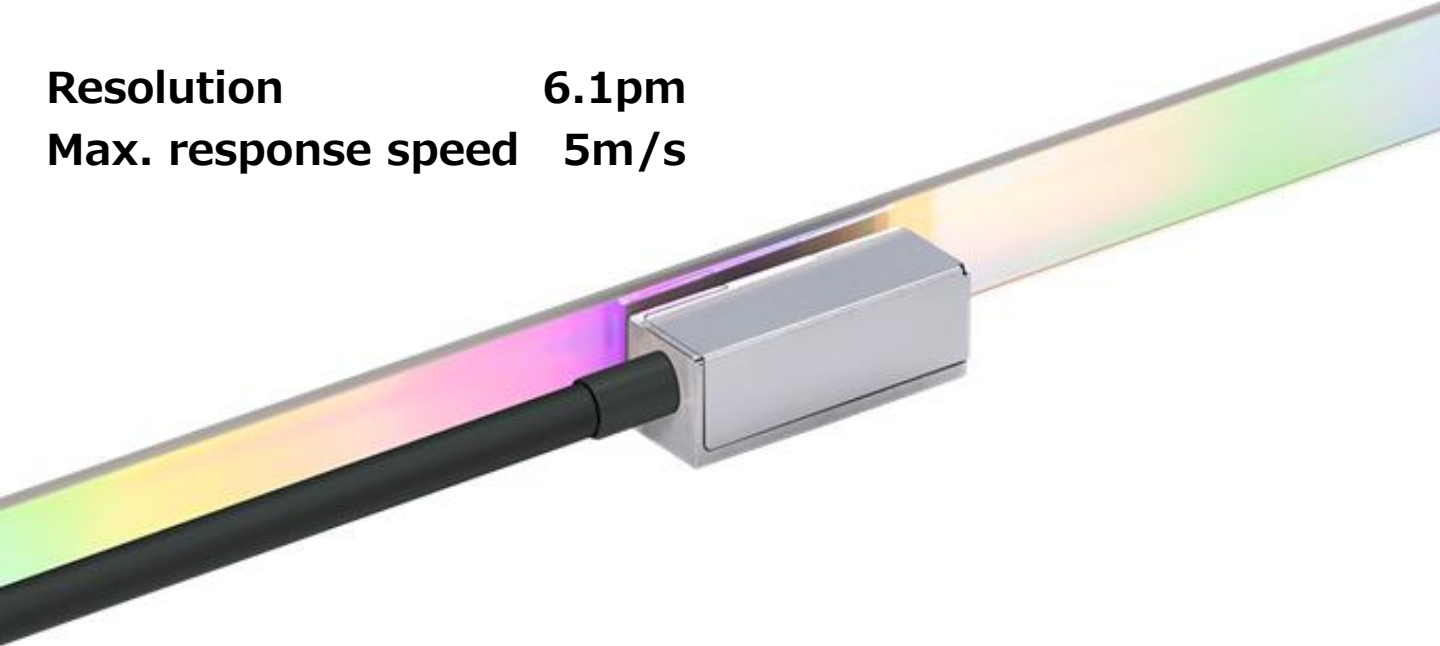
D02-22-26P-PKG100

(manufactured by Japan Aviation Electronics Industry, Limited)

: Shell DE-C8-J9-F2-1R

(manufactured by Japan Aviation Electronics Industry, Limited)

**Resolution**                                      **6.1pm**  
**Max. response speed**    **5m/s**



Laserscale for motion control  
to achieve both high resolution and high speed

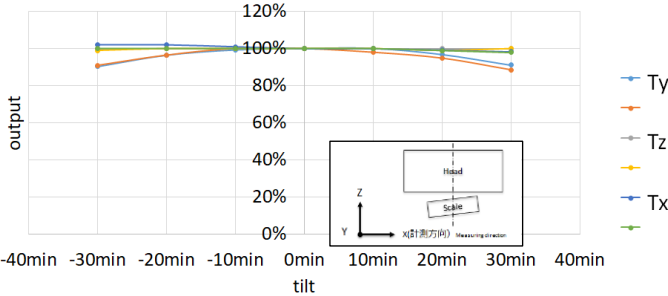
## High resolution & speed

BL50H uses 1.6μm grating pitch. Grating interferometer type scanning head outputs fine signal pitch of 400nm. Dedicated interpolator divides this signal up to 6.1pm resolution. Also, maximum response speed is 5m/s.

## Wide tolerance for angle

Optimized detection optics in BL50H enable wide angular tolerance of ±30min by constant output characteristics to all rotational directions.

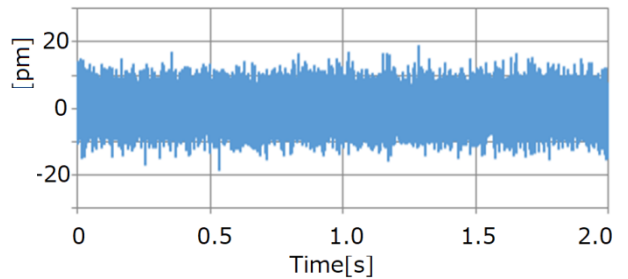
tilt vs output (relative)



# BL50H series

## Low noise

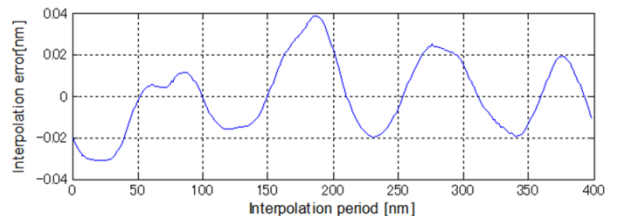
BL50H series provide S/N ratio of 13pm under condition of LPF6kHz.



## Excellent interpolation accuracy

BL50H realizes excellent interpolation accuracy with combination to BD700 interpolator.

± 50pm/400nm



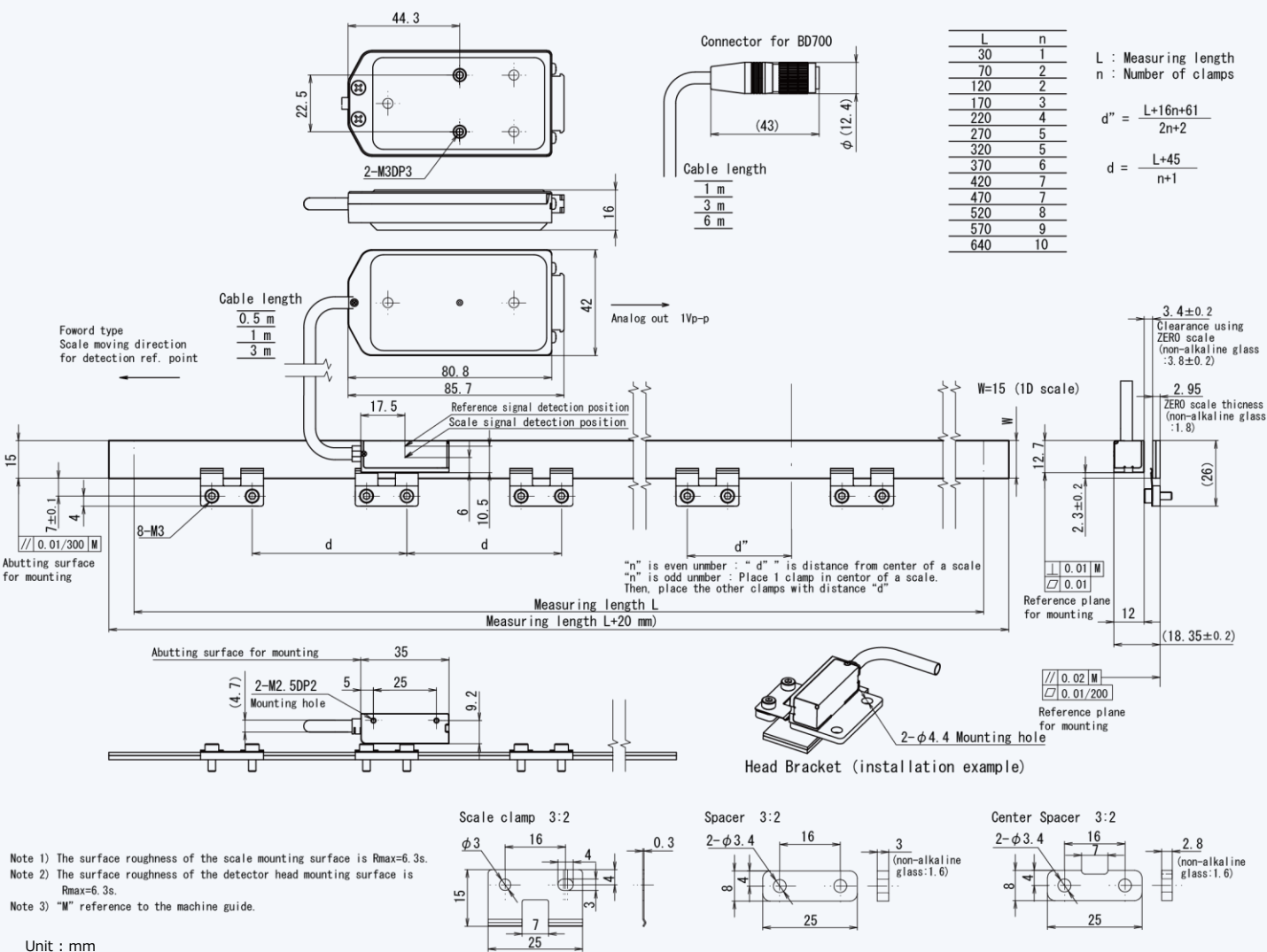
## Long-life laser diode

Long-life laser diode (the life is longer by 5 times of the conventional product) is used on BL50H, one piece of the laser diode is equipped in one scanning head unit.

There is also special type available which is operative in temperature 40 deg. C or more. For detail, please contact our sales office.



# Dimensions



# Specifications

## Scale unit

Model name	BL50H-SZ * * * * *	BL50H-SA * * * * *
Scale material	ZERO glass $0.1 \times 10^{-6} / ^\circ C$	Alkali-free glass $3.7 \times 10^{-6} / ^\circ C$
Measuring length	30 to 640mm	
Grating pitch	1.6 $\mu$ m	
Reference mark	Without or with a reference point in the center	
Accuracy (at 20°C)	$\pm 0.1 \mu m / 500mm$ (with BD700 compensation), $\pm 0.5 \mu m / 30mm$ to 120mm, $\pm 1 \mu m / 170mm$ to 270mm, $\pm 1.5 \mu m / 320mm$ to 370mm, $\pm 3 \mu m / 420mm$ to 640mm ( $\pm 1.5 \mu m$ with special specification)	
Interpolation accuracy	$\pm 50pm$ (with interpolator BD700)	

## Head unit

Model name	BL50H-FS * * * D	BL50H-FS * * * H
Output signal	Interpolator BD700 connection (*)	Analog 1Vp-p
Signal pitch	400nm	
Maximum resolution	6.1pm	-
Maximum response speed	3m/s (5m/s with special handling)	5m/s
Clearance	ZERO glass : $3.4 \pm 0.2mm$ Alkali-free glass : $3.8 \pm 0.2mm$	
Angle tolerance	Yaw : $\pm 8.7mrad$ Pitch : $\pm 8.7mrad$ Rolling : $\pm 8.7mrad$	
Head cable length	1m, 3m, 6m	0.5m, 1m, 3m
Operating temperature	+10 to +40°C (No condensation)	

(\*) : Converted to A/B phase, serial interface of various companies, and analog output by BD700 interpolator

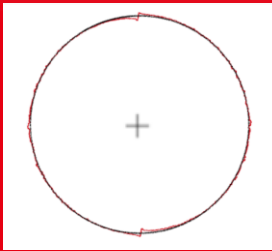
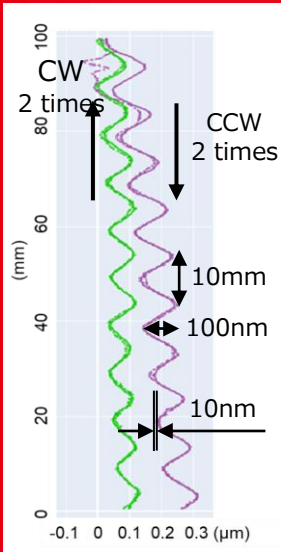
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## The 2D enables to show what you couldn't see



Example of Roundness Measurement



New Standard of Precision Stage Accuracy Validation

# SET-SC2020

High Resolution, High Frequency

**Resolution 10pm**

Sampling Frequency 10kHz

Enables high accuracy measurement equivalent to an interferometer, with no atmospheric effect.

**Cumulative Accuracy ±0.5μm**

( Measurement Scale Length 200×200mm )

Provides ZERO glass which is less affected by ambient temperature

**Thermal Expansion Coefficient  $0.1 \times 10^{-6}$**

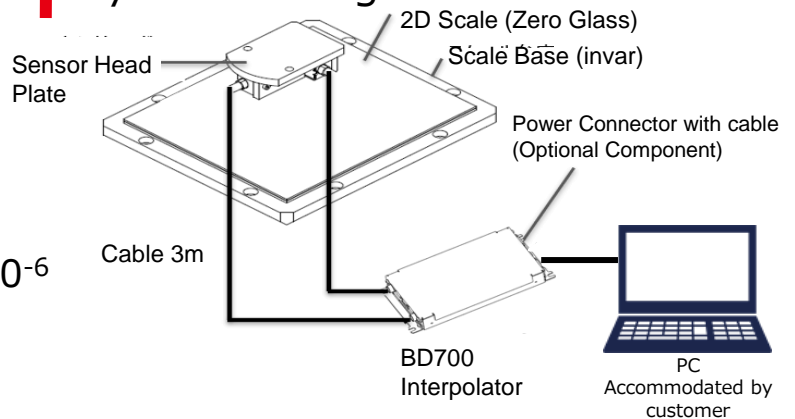
Easy installation with wide sensor head working distance tolerance. Also enables vertical installation

Distance between the sensor head and the scale

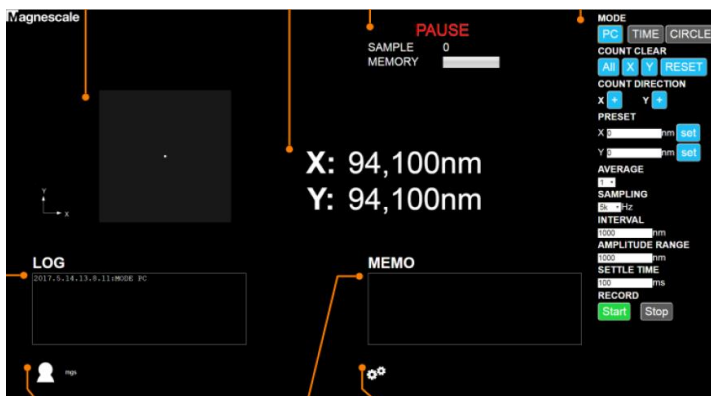
**$2.9\text{mm} \pm 0.2\text{mm}$**



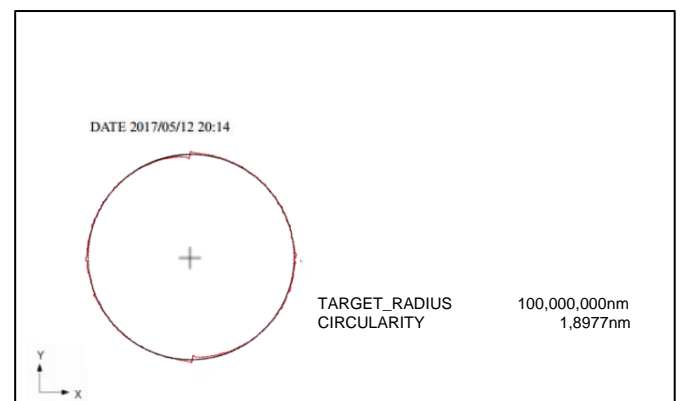
## System Configuration



## Measurement Software



Measurement Software

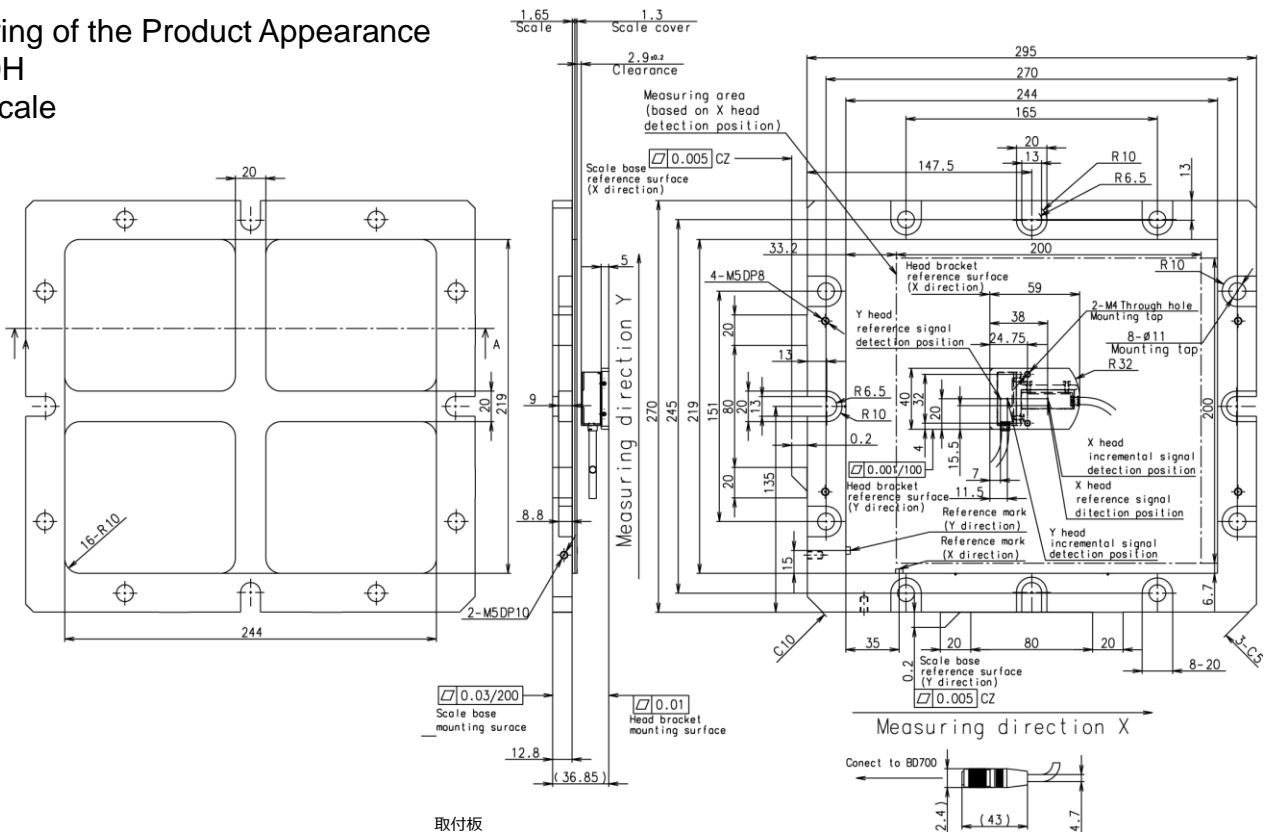


Circular Motion Report Software

# Drawing of the Product Appearance

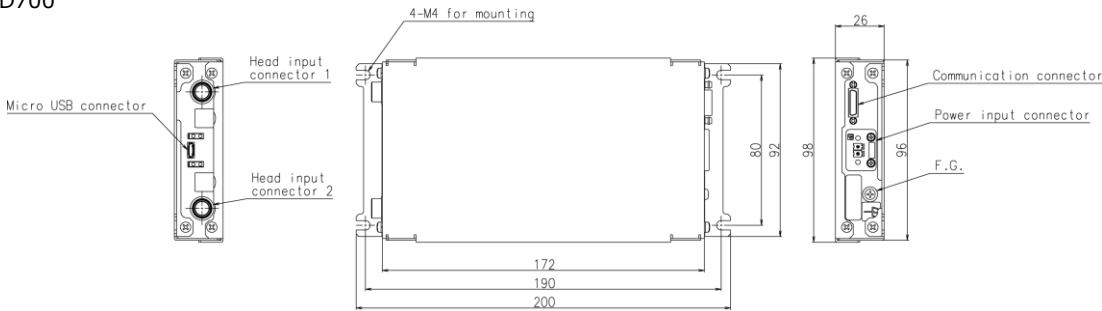
## BL50H

### 2D Scale



取付板

Interpolator  
BD700



Unit : mm

## Main Specifications

Measuring Length	200 × 200 mm
Signal Cycle	400 nm
Maximum Resolution	10 μm
Cumulative Accuracy	±0.5 μm (After adjustment, scale measuring length 200 × 200mm)
Working Distance	2.9±0.2 mm
XY Orthogonality	±0.3 sec. (After adjustment)
Scale Material and the Thermal Expansion Coefficient	ZERO Glass、0.1×10 <sup>-6</sup>
Scale Base Material and the Thermal Expansion Coefficient	Invar、±2×10 <sup>-6</sup>
Measuring Speed	0.3 m/s
Sensor Head Weight	0.2 kg ( without cable)
Cable Length	3 m
Output Signal	BissC Output、USB Output
Packaging	With Carry Case
Software for Test Measurement	Measurement Software (CSV output), Roundness Software, Lissajous monitoring software

\*For your safety : Please read "Instruction Manual "carefully before using the product.

\*This product (and technology) falls under item 16 of the Export Ordinance Appendix 1 (Item 16 of the Foreign Exchange Ordinance Appendix).

Please check with the exporter regarding the necessity of permission from the Ministry of Economy, Trade and Industry under the catch-all control.

•Magnescale reserves the right to change product specifications without prior notice.

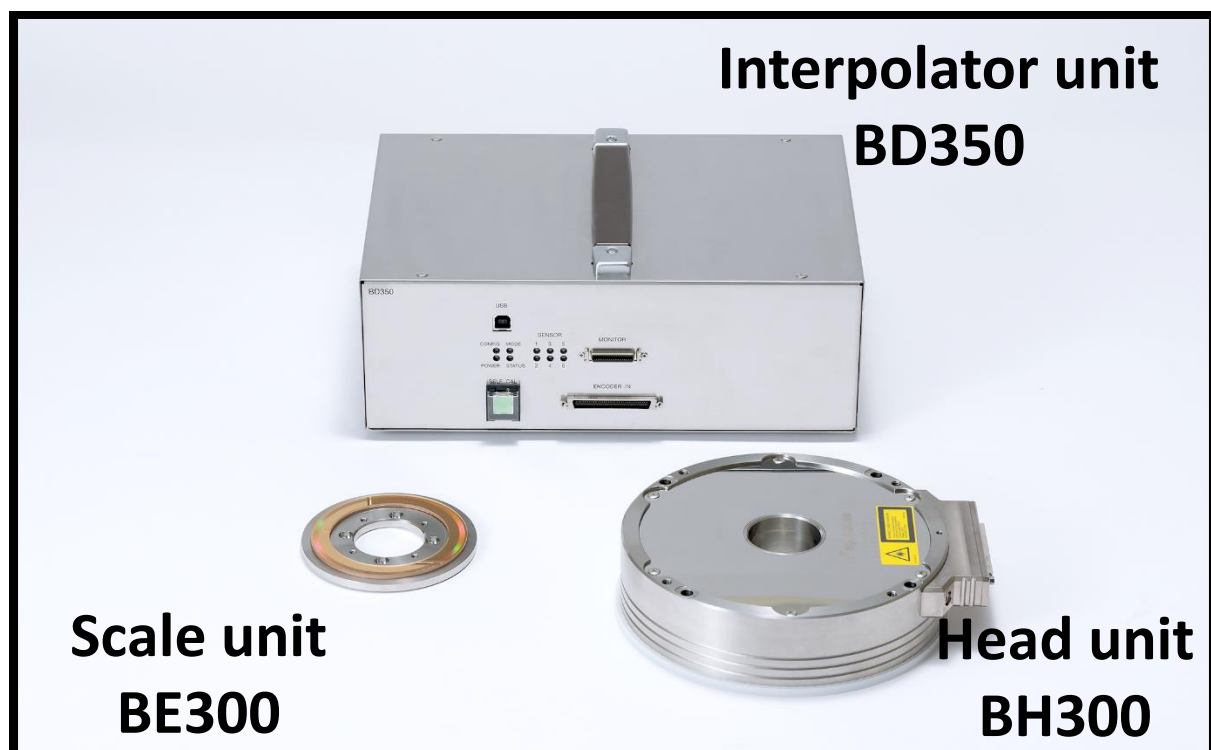
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 FAX.+49(0)7153-934-299  
 FAX.+81(0)463-92-3090

## Angle calibration system Newly Released by Magnescale

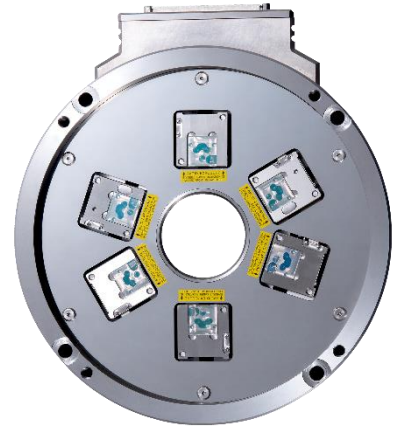
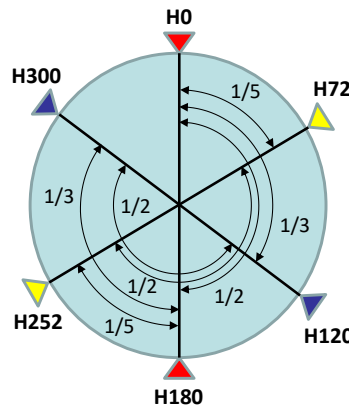


## Self-calibrating Rotary Encoder System **SET-HD100**

<b>High angular accuracy</b>	$\pm 0.1$ arcsec achieved by unique Self-calibration function (Resolution: 0.0012 arcsec)
<b>Traceability of accuracy</b>	Qualified to the national primary standard by AIST (National Inst. of Advanced Industrial Science & Technology)
<b>High repeatability</b>	High repeatability in repeated measurements and for rotational direction
<b>Easy installation</b>	15 minutes only from installation to measurement
<b>Handy measuring kit</b>	Compact and easy to carry

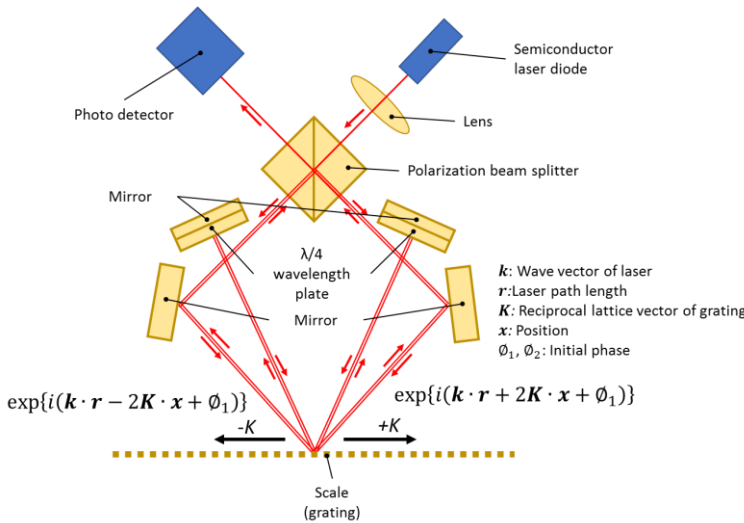
# Self-compensating algorithm for angle accuracy

Intelligent encoder can compensate its own errors. Magnescale original self-calibration algorithm "VEDA-method" \*1 enables higher order correction with less heads, achieving up to 30<sup>th</sup> order compensation with only 6 heads at world-class high accuracy.



\*1 Patent application No.6386368

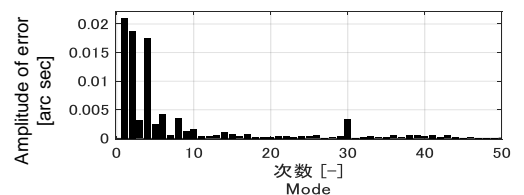
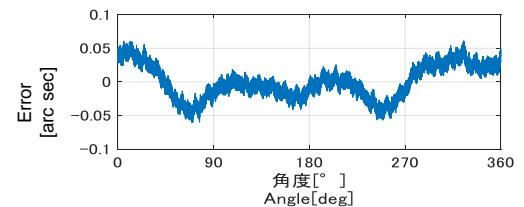
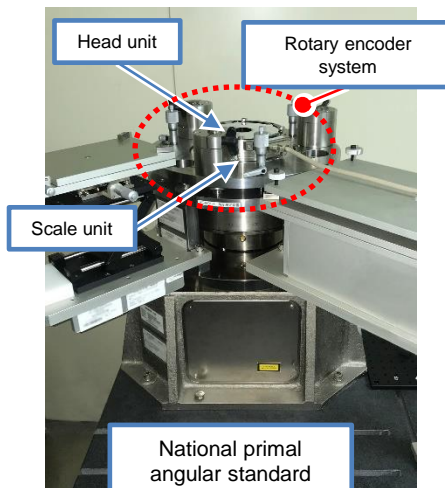
# High resolution and stability by Laserscale



Laserscale allows high stability against environmental change such as pressure and temperature with the combination of high resolution, diffraction grating and a sensor head with symmetric optical path. Signal wavelength 1.24 arcsec = 6.0  $\mu\text{rad}$  (250 nm on the circle of  $\varnothing 42$  scale) is electrically interpolated to the resolution of 0.0012 arcsec = 5.9 nrad (0.25 nm on  $\varnothing 42$ ) at the low noise level.

# High accuracy and traceability

Accuracy is qualified against the primal national standard at AIST. at Calibration :  $\pm 0.1$  arcsec  
 Magnescale is certified by the National Institute of Technology and Evaluation (NITE) as an accredited calibration service provider. Magnescale will carry out JCSS calibration and issue a calibration certificate.

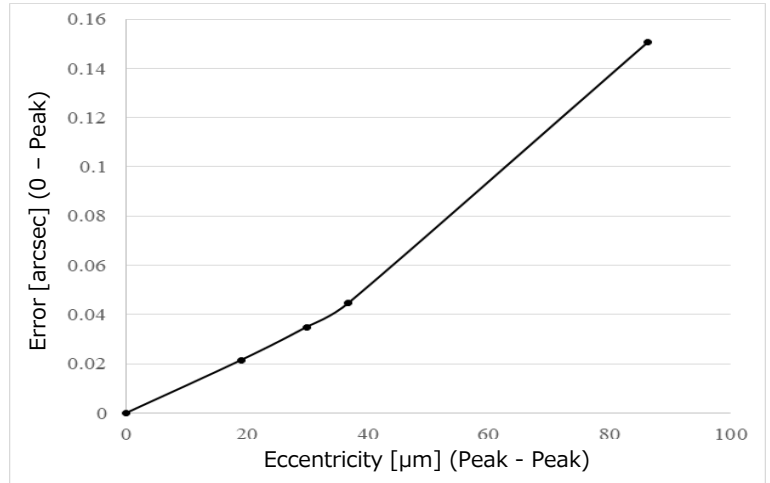


Example of accuracy measurement against national primal standard :  $\pm 0.061$  arcsec

# High repeatability on the measurement machine

Fine mechanical adjustment in the head unit keeps angle error from eccentricity at installation of a scale significantly low.  
 High accuracy in repeating measurement and in CW/CCW direction enables high repeatability  
 Non-contact design eliminates the effect from the encoder onto rotating axis of the measured target.

e.g. Eccentric response

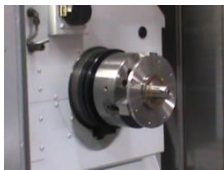


## Easy installation

15 minutes from installation to measurement

Remark: act. time depends on mounting conditions at customer site

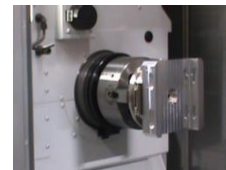
Example of installation onto a horizontal machine



**① Mount scale unit**  
 Match the eccentricity of a scale and rotation axis  
 Insert positioning shaft



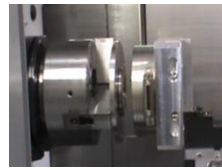
**② Mount head unit**  
 Adjust and mount the head to mechanical reference of inner diameter of a scale



**③ Mount attachment & fix to outer part**  
 Install an attachment to fix the head unit onto the outer part



**④ Remove positioning shaft**  
 Slide the head unit then remove a positioning shaft



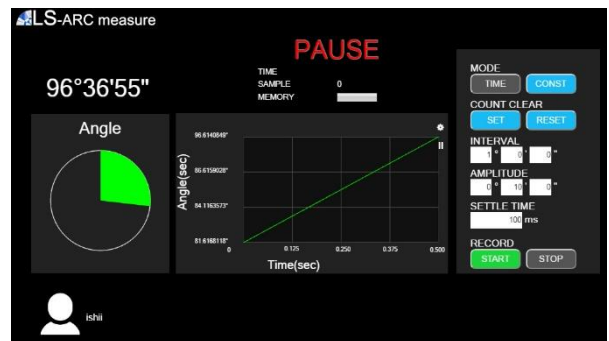
**⑤ Adjust clearance**  
 Adjust a clearance by moving a head unit toward the scale

## Easy operation

No complex process needed for self-compensation.  
 Interpolator applies compensated value automatically and output accurate angular position by pressing a single switch.  
 Dedicated software generates angular data on a display and saves measured data.

Functions available by Magnescale software

- Real time data display
- Storage of measured data (TIME mode)
  - Measurement at constant sampling of 20 kHz
  - Suitable for servo vibration analysis and speed jitter evaluation
- Storage of measured data(CONSTANT mode)
  - Data acquired at constant angle for accuracy measurement and saving compensation data



e.g. display by dedicated software during measurement

# Portable measurement kit

Carry-on case is included to a standard package, which makes transportation easy and secures performance as an angular calibration system.



# Recognition on outstanding technology



Magnescale won “2018 JSPE technology award” by Japan Society for Precision Engineering for introduction of the rotary system with original, self-compensation algorithm. Several research papers to explain the principle and development of the algorithm were also published in journals of JSPE as well as Advanced Mechanical Design, Systems and Manufacturing.

- (1) N. Ishii, K. Taniguchi, K. Yamazaki and H. Aoyama: Development of super-accurate angular encoder system with multi-detecting heads using VEDA method, Journal of Advanced Mechanical Design, Systems, and Manufacturing, **12** (2018).
- (2) N. Ishii, K. Taniguchi, K. Yamazaki and H. Aoyama: Super-Accurate Angular Encoder System with Multi-Detecting Heads Using VEDA Method, Journal of the Japan Society for Precision Engineering, **84** (2018). 717-723.

# Specifications

Item	Specification	Item	Specification
Detecting radius	41.723 mm	Number of sensor	6 sensors / unit
Maximum rotary response speed	10 min <sup>-1</sup>	Light source	Semiconductor laser × 6
Number of source signals	2 <sup>20</sup> (1,048,576) / revolution		Wave length 790 nm, 5 mW or less / sensor
Source signal resolution	1.236 arcsec	Radiation power	EN60825: class 3B, JIS: class 3B, DHHS: class IIIb
Accuracy	at Calibration : ±0.1 arcsec Mounting tolerance : ±0.2 arcsec	Operating temperature range	+10 to +30 °C (no condensation)
Reference point position	1 point	Storage temperature range	0 to +50 °C (no condensation)
Output format	USB 2.0	Power supply	DC 20 to 24 V / 5 A (Max. 8 A)
Number of interpolations	2 <sup>10</sup> (1,024) / revolution		Scale unit: Φ100×H8.5 mm / 300 g or less
Number of output divisions	2 <sup>30</sup> (1,073,741,824) / revolution	Dimension/Mass	Head unit: Φ180×H46 mm / 3.8 kg or less
Output resolution	0.0012 arcsec		Interpolator unit: 298×210×110 mm / 5 kg or less

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