Magnescale

SPEED X PRECISION

Magnescale Co., Ltd.

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The contents of this literature are as of Jul. 2013

This catalog is printed with soy ink.

MGS-LS-1307-EN-C

Magnescale

SPEED X PRECISION

Laserscale® General Catalog

Laserscale®

Magnescale Co., Ltd.

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.

ISO 9001 JACO QC10J0039

ISO 14001 BUREAU VERITAS Certification

UKAS MANAGEMENT SYSTEMS 008

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

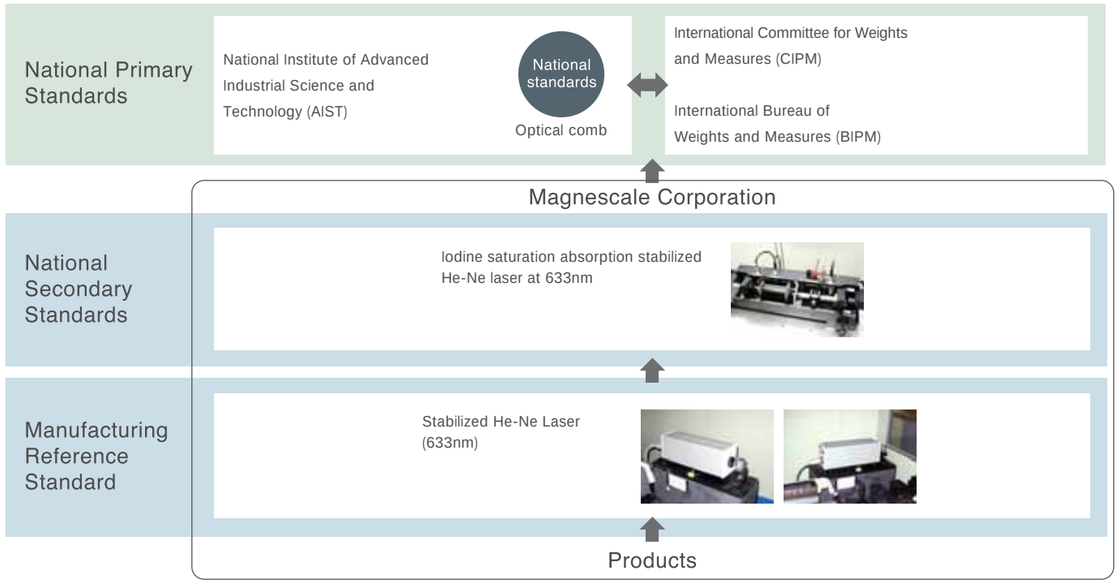
for Products with Laser:
• DHHS (21CFR1040.10) • IEC60825-1

* When using our devices with machines to which the European Machinery Drirective applies, please make sure that the devices when installed on the machines fulfil the applicable requirements of the Directive.

* Standards or regulations to be complied with may vary by product.

Traceability

Traceability Flow Chart (Length)

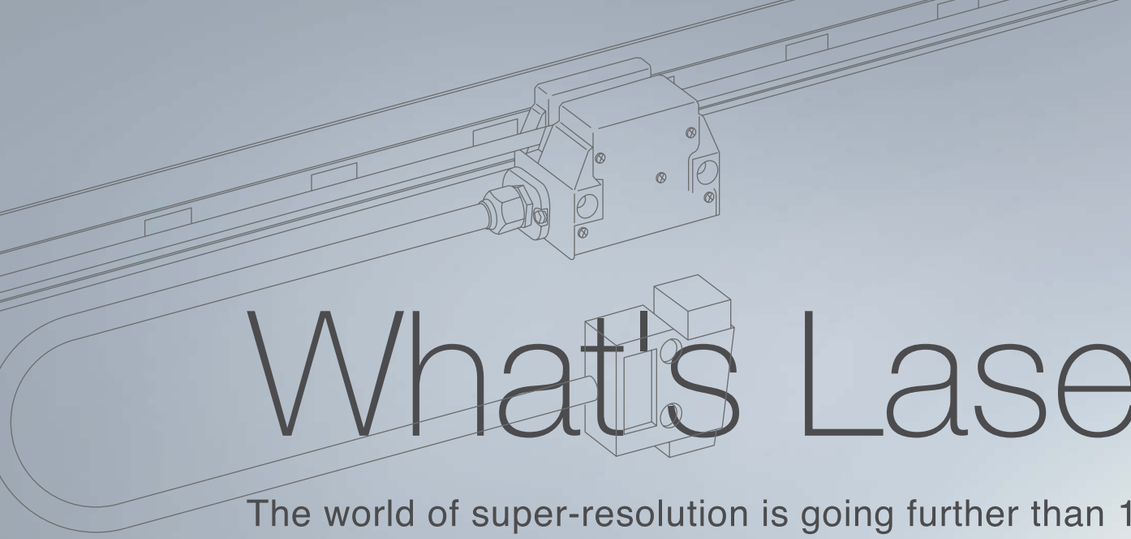


PD LD

Magnescale Corporation

Laserscale®

Contents



What's Lasers cale?

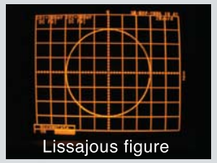
The world of super-resolution is going further than 1nm

Laserscale easily achieves measurement and control by ultra high resolution less than 1nm.
Sinusoidal wave of approx. 138nm signal period is generated by a hologram scale with high diffraction efficiency and a high resolution detecting head based on grating interference method,strong against disturbance by air pressure or current, plus easy to install (BS series). Signal distortion in principle remains minimal at high S/N ratio. The highest resolution reaches 17pm in combination with a interpolator featuring automatic compensation.

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

Ultra-high resolution

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



Highest resolution 17pm

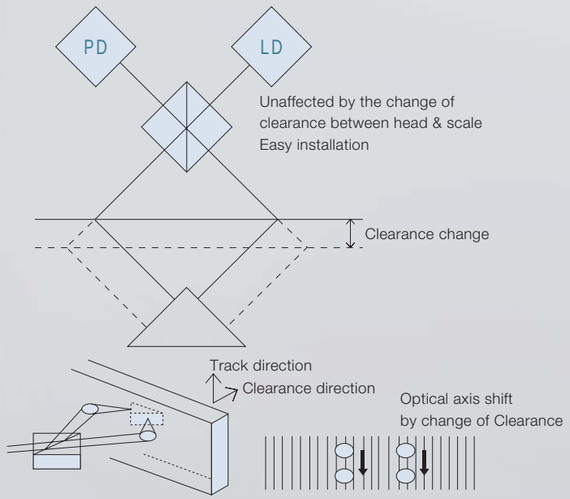
One count movement by holographic grating of 550nm wave length diffracts interfering signal to 4 periods, resulting 1/4 of original signal (approx. 0.14μm). And signals go through electrical Interpolator, it will be maxmum 17pm resolution.

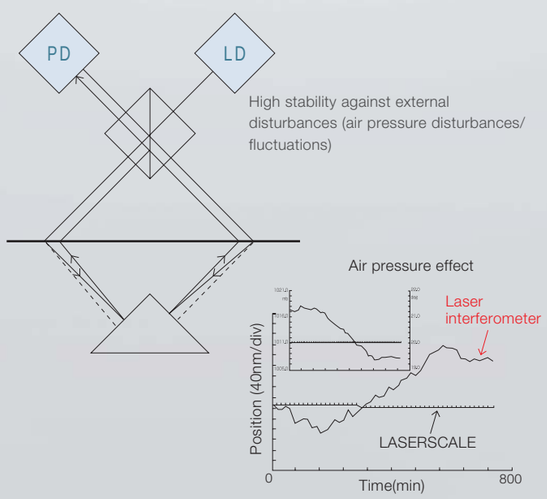
Ultra-high resolution and high speed response

Grating interference principle linear encoder generates signal of approx. 0.14μm period, that is 1/140 of conventional linear encoder with 20μm signal period. Also using our interpolator, 17pm resolution and high response as max. response speed 400mm/s are available.

Model	Output	Number of divisions	Resolutions		Maximum response speed
BS series Signal wavelength: 138nm	Binary	8000	17	pm	400mm/s
	AB quadrature	32	4.31	nm	60mm/s

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



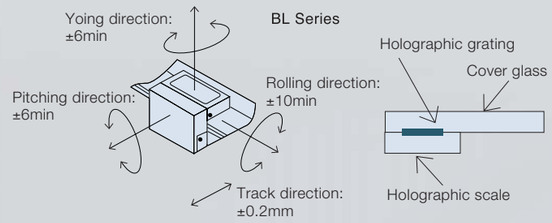


Easy installation & maintenance

[Easy to handle]
Large tolerance for installation
Easy installation, remarkable for ultra-high resolution, accuracy and non-contact detection

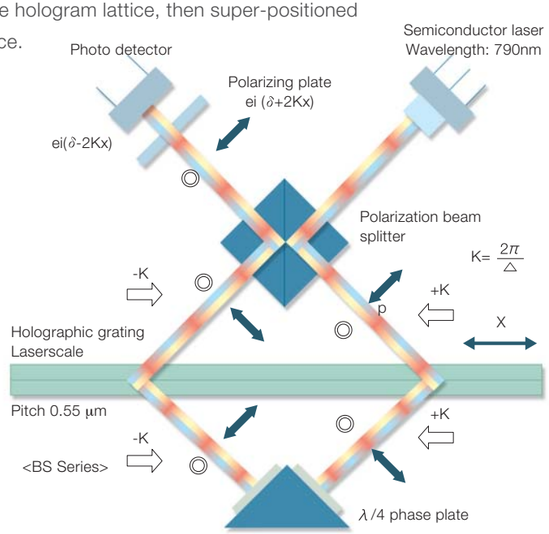
No electric adjustment after installation
Even with high tolerance for installation, no electric adjustment required after installation.

Protected holographic grating
Holographic grating is protected with cover glasses, which guards the grating against external pressure. The glass can be wiped out to clean dust and dirt.

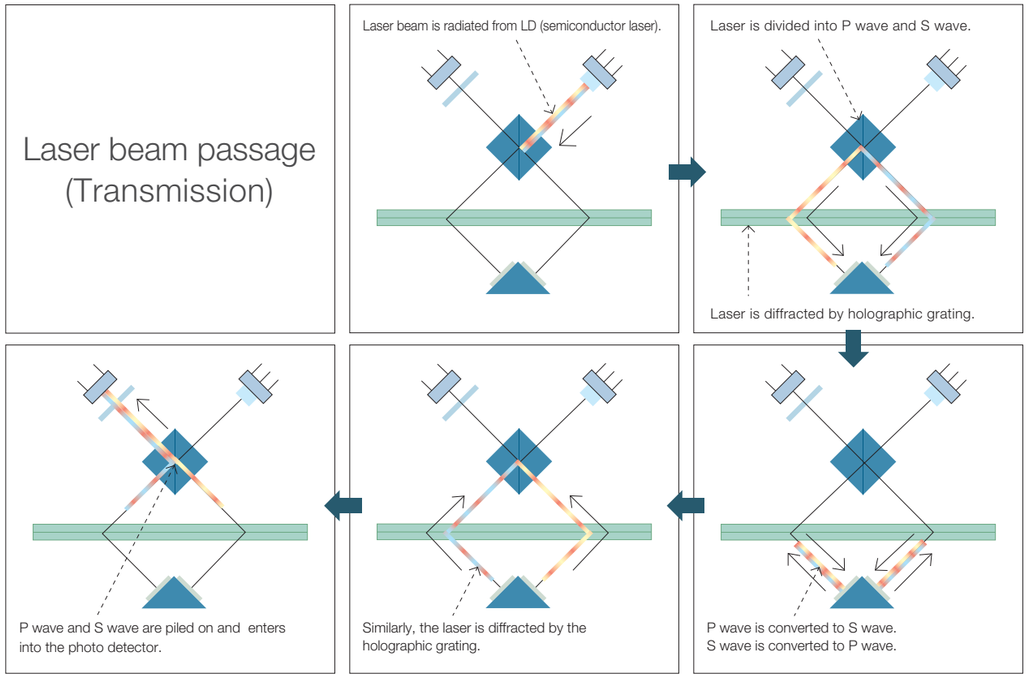


Principle

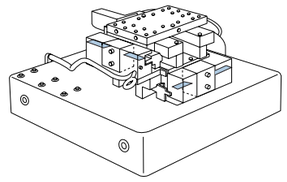
The semiconductor laser beam is split by a polarized light beam splitter into S and P polarized light beams, then diffracted through a volume hologram lattice with very high diffraction efficiency. The two diffracted beams pass through separate 1/4-wavelength plates to a mirror, which reflects the beams 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 hologram lattice, 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 +2 Kx and -2 Kx phases to each beam, the interference is subject to four light-dark inversion cycles for each lattice scale of movement. Thus a lattice pitch of 0.55 μm. produces a signal wavelength of 0.55/4 = 0.1379 μm. This detecting optics is free from fluctuations and change in air pressure, since the light path of both left and right changes identiacally even with the change in wavelength of the optical source. Repeatability and returning errors do not occur in principle.



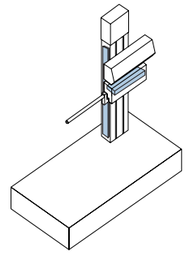
: Direction where light vibrates···Right and left ◎:Direction where light vibrates···Back and forth



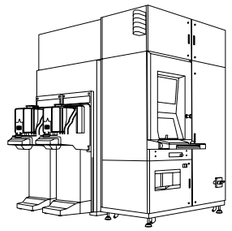
Application



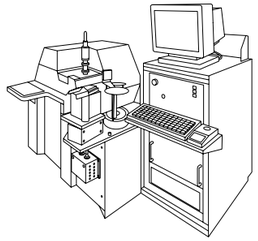
Ultra high precision air stages (vacuum resistant)



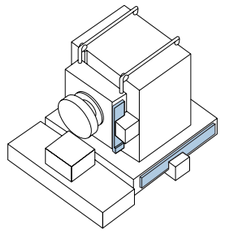
Surface roughness/ contour measuring machines



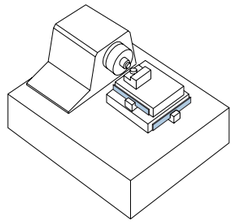
DUV-based automatic wafer defect classification systems



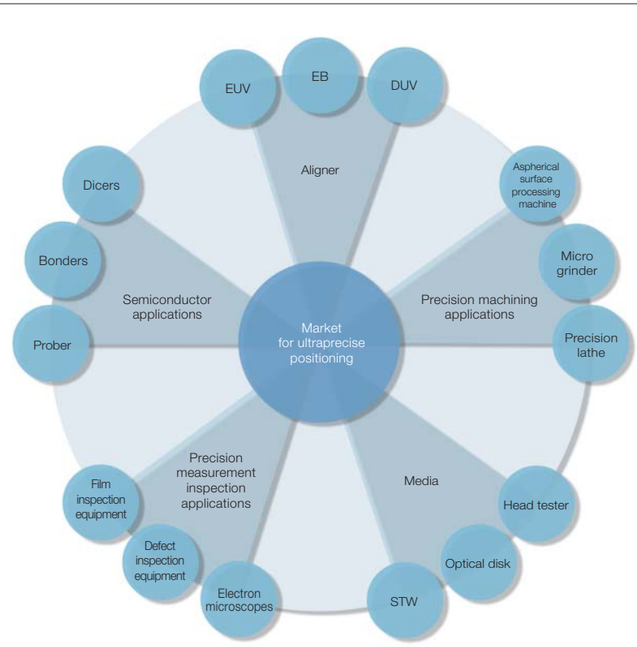
Non-contact measuring machines



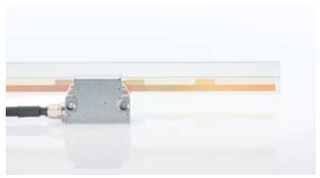
Micro grinders



Aspherical surface machining



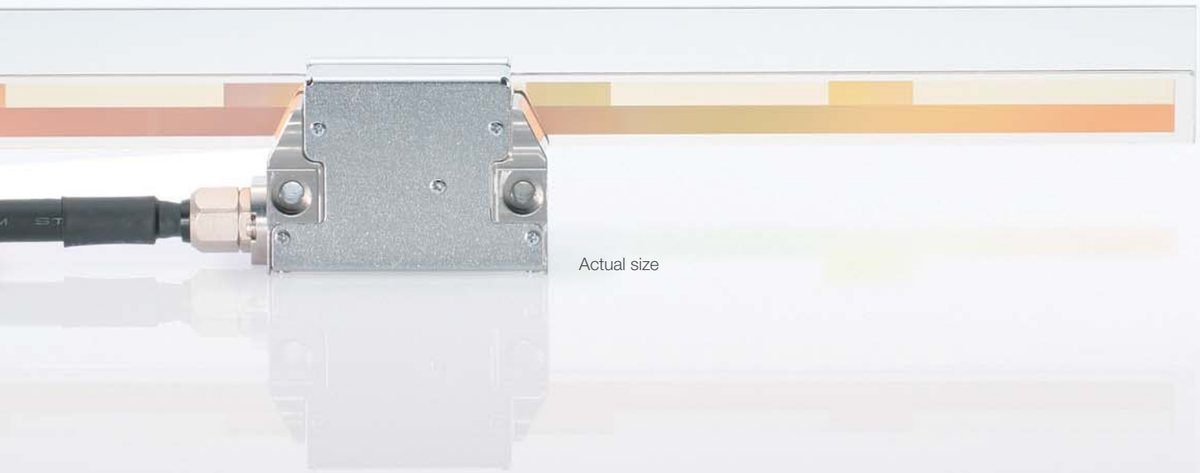
Lineup

		Series	Feature	Max.resolution	Accuracy	Measuring length	Interpolator	Output	Response speed	Page
BS λ=138nm Transmission		BS78	Low expansion glass	17pm	±0.04μm (Measuring length 40mm)	10mm~420mm	BD96 (BD95)	40bit Binary Serial	400mm/s	P. 10
		BS65-R	Long-length type Blue plate glass	17pm	L<460: (0.1+0.4L/100)μm L≥460:3μmp-p L:Measuring length(mm)	160mm~960mm	BD96 (BD95)	40bit Binary Serial	400mm/s	P. 12
BH λ=250nm Reflection		BH25-RE/NE	Low expansion glass Blue plate glass	0.03125nm	±0.5μm (30mm-170mm) ±1μm (220mm-420mm)	Low expansion glass: 30mm~420mm Blue plate glass: 30mm~420mm	BD96	40bit Binary Serial	700mm/s	P, 14
		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 36.1mm Radius 41.72mm	BD96	40bit Binary Serial	555min^{-1} (1,190min^{-1}, 529min^{-1} 396min^{-1}, 343min^{-1})	P, 16
		BH200-RE/NE	907,200 Pulse/rotation	6.93nrad	r36.1 Scale only	Radius 36.1mm	Nothing	Clock pulse (LVDS)	13,000min^{-1}	P, 18
BL λ=400nm Transmission		BL57-RE	Low expansion glass Blue plate glass	0.1/0.05/0.02/ 0.01μm	±0.5μm (30mm-170mm) ±1μm (220mm-370mm) ±1.5μm (420mm-1,060mm) Please ask for more than 1,060mm	Low expansion glass: 30mm~410mm Blue plate glass: 60mm~1,060mm	Built-in I/F Box	AB quadrature	1,500, 650, 300, 120mm/s	P, 20
				0.4μm (1Vp-p)			Nothing	Analog	3,000mm/s	
		BL57-NE	Low expansion glass Blue plate glass	0.1/0.05/0.02/ 0.01μm	±0.5μm (30-170mm) ±1μm (220-370mm) ±1.5μm (420-1,060mm) Please ask for more than 1,060mm	Low expansion glass: 30mm~420mm Blue plate glass: 60mm~1,060mm	Built-in I/F Box	AB quadrature	1,500, 650, 300, 120mm/s	P, 20
				0.4μm (1Vp-p)			Nothing	Analog	3,000mm/s	
		BL55-RU	Blue plate glass	0.1μm~0.01nm	±2.5μm (70mm-370mm) ±4.5μm (370mm or more)	Blue plate glass: 70mm~1,020mm	Built-in I/F Box	AB quadrature	1,500, 650, 300, 120 mm/s	P, 28
				400nm (1Vp-p)			Nothing	Analog	3,000mm/s	P, 28

BS

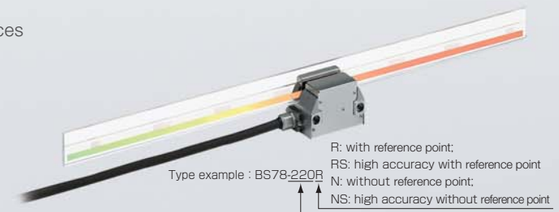
BS78
(with/without reference mark)

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



Actual size

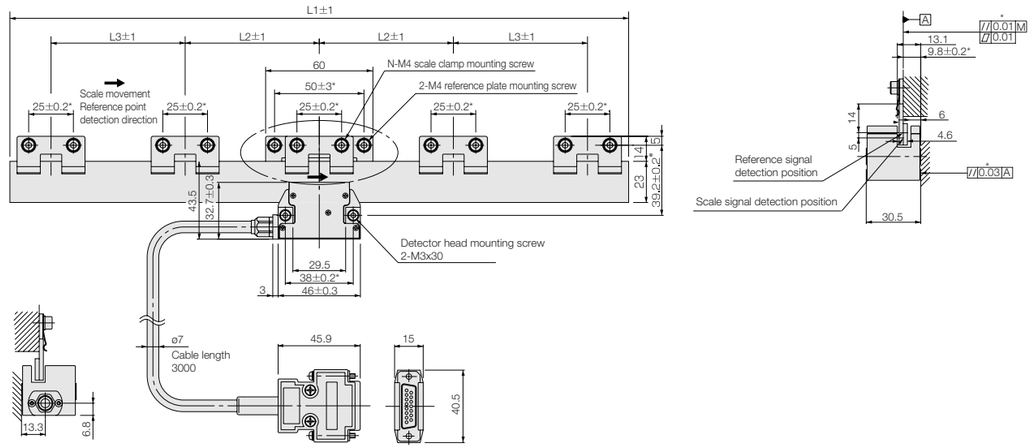
- High-resolution scale with signal wavelength of approx. 138nm, outperforming light wave interferometer systems
- High stability, unaffected by humidity, air pressure and air disturbances
- Reference point accuracy : ±0.1μm
- Scale accuracy : ±0.04μm or better (measuring length : 40 mm)
- Non-contact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

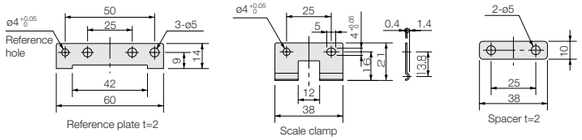


Type example : BS78-220R
R: with reference point;
RS: high accuracy with reference point
N: without reference point;
NS: high accuracy without reference point
Effective length

External Dimensions

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



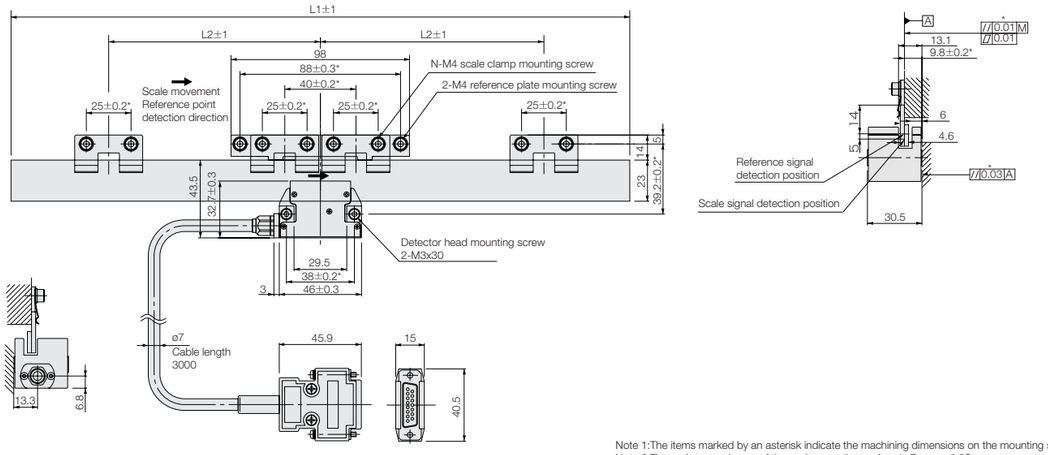


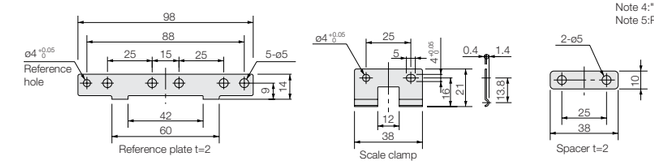
Note 1:The items marked by an asterisk indicate the machining dimensions on the mounting surface.
Note 2:The surface roughness of the scale mounting surface is Rmax = 6.3S.
Note 3:The surface roughness of the detector head mounting surface is Rmax = 12.5S.
Note 4:"M" refers to the machine guide.
Note 5: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-xxxN(NS)(measuring length:70／270／320)





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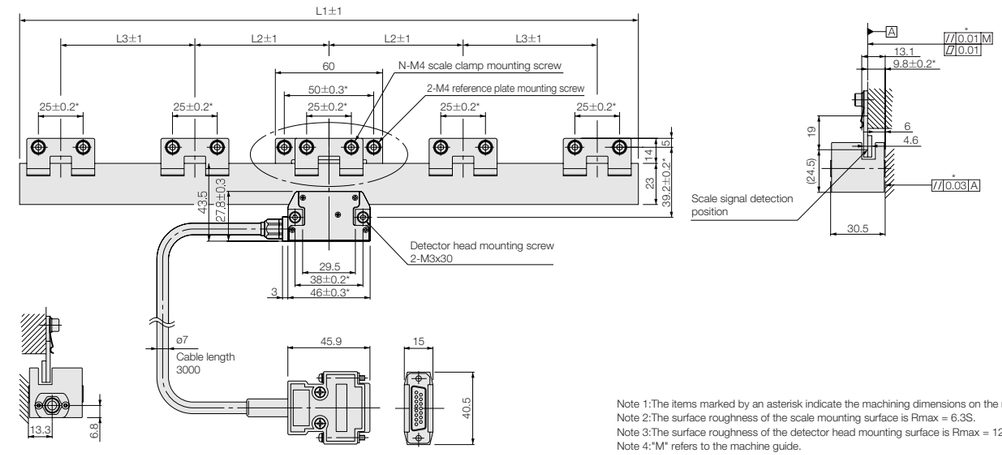
Note 3:The surface roughness of the detector head mounting surface is Rmax = 12.5S.
Note 4:"M" refers to the machine guide.
Note 5:Reference point detection direction : Standard (Scale movement direction→with the head stationary)

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-xxx(NS)(measuring length:40／120／170／220／370／420)



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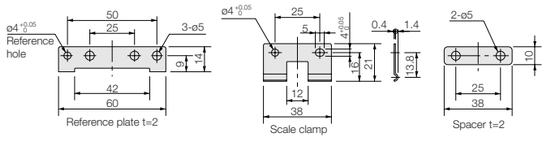
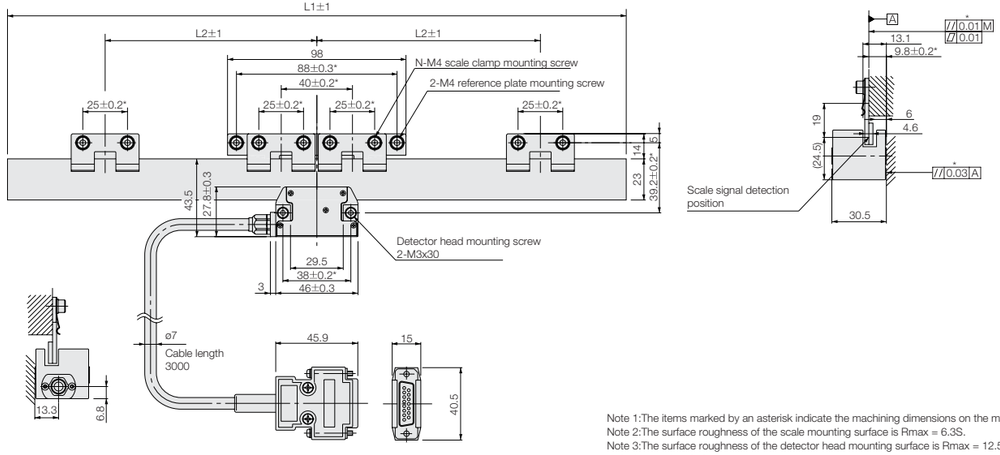


Model	L1	L2	L3	N
BS78-40N (NS)	66	—	—	2
BS78-120N (NS)	146	50	—	6
BS78-170N (NS)	196	75	—	6
BS78-220N (NS)	246	100	—	6
BS78-370N (NS)	396	75	75	10
BS78-420N (NS)	446	100	100	10

Unit: mm

● BS78-xxx(NS)(measuring length:70／270／320)



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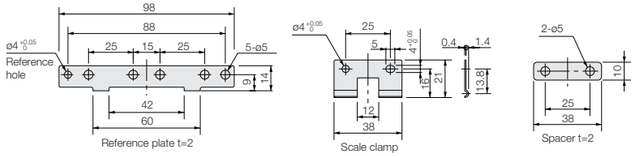


Model	L1	L2	N
BS78-70N (NS)	96	—	4
BS78-270N (NS)	296	120	8
BS78-320N (NS)	346	120	8

Unit: mm

Main specifications

Model	BS78	
Measuring length	10(only N/NS)/40/70/120/170/220/270/320/370/420	
Overall length	58mm (Measuring length 10mm) Measuring length + 26mm (Measuring length 40mm to 420mm)	
Max. travel length	Measuring length + 2mm (Measuring length 10mm) Measuring length +10mm (Measuring length 40mm to 420mm)	
Accuracy(at 20℃)	NS type, RS type : ± 0.03μm (NS type) ± 0.04μm ± 0.10μm ± 0.18μm ± 0.25μm ± 0.34μm ± 0.39μm ± 0.44μm	N type, R type : ± 0.06μm ± 0.08μm ± 0.20μm ± 0.35μm ± 0.50μm ± 0.65μm
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.	
Temperature coefficient	-0.7×10^{-6}/℃	
Light source	Semiconductor laser Wavelength, 780nm, Maximum output 10nW	
Radiation power	DHHS class 1	
Detection type	Diffraction grating scan type	
Operating temperature	10℃ to 30℃ (No condensation)	
Storage temperature	-10℃ to 50℃ (Humidity 60% or less)	
Weight	0.4/0.41/0.42/0.43/0.44/0.45/0.46/0.47/0.48kg (including head)	

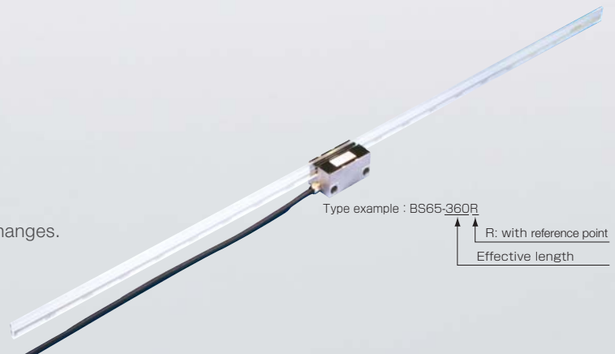
BS

BS65-R
(with reference mark)

High accuracy LASERSCALE™ with built-in optical zero point

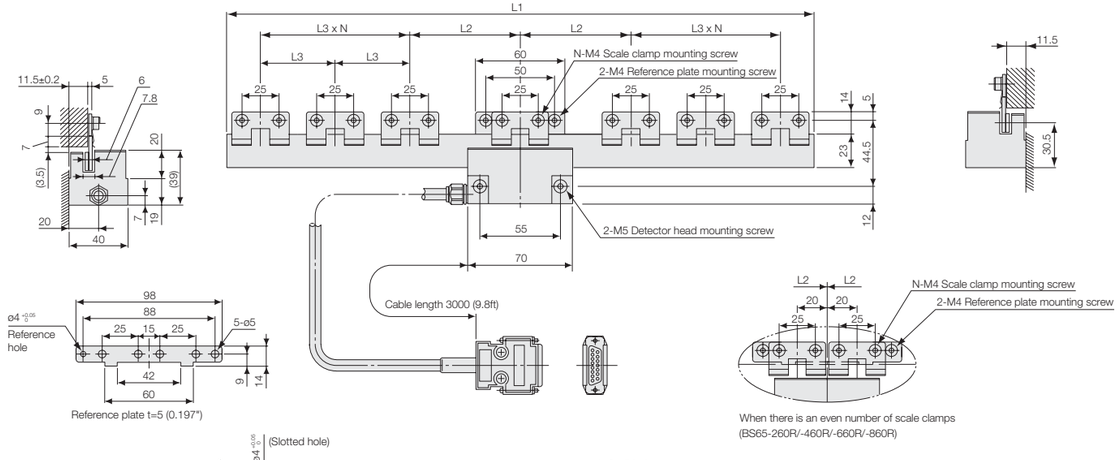
Actual size

- Signal wavelength of 138nm,
- High accuracy, high resolution laser scale :
  Accuracy : L < 460 : (0.1+0.4L / 100) μm p-p
  (L=measuring length in mm)
- Resolution : 0.07nm
- High accuracy optical reference point : ± 0.1 μm
- Measuring length : 160 mm to 960 mm / 6.29" to 37.79"
- Easy installation
- Minimal effect from disrupted air current and atmospheric changes.



External Dimensions

● **BS65-xxxN(NS)(measuring length:160／260／360／460／560／660／760／860／960)**



Unit: mm

Model	L1	L2	L3	N	A
BS65-160R	196	75	—	—	6
BS65-260R	296	120	—	—	8
BS65-360R	396	75	75	1	10
BS65-460R	496	120	75	1	12
BS65-560R	596	75	75	2	14
BS65-660R	696	120	75	2	16
BS65-760R	796	75	75	3	18
BS65-860R	896	120	75	3	20
BS65-960R	996	75	75	4	22

Main specifications

Model	BS65-R
Measuring length	160/260/360/460/560/660/760/860/960
Overall length	Measuring length + 36mm
Max. travel length	Measuring length + 10mm (5mm on each side)
Accuracy (at20℃)	L < 460 : (0.1 + 0.4L/100) μm p-p L≥ 460 : 3μm p-p L : Measuring length (mm)
Reference point accuracy	±0.1μm
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.
Temperature coefficient	8 x 10^{-6}/℃
Light source	Semiconductor laser Wavelength, 780nm, Maximum output 10nm
Radiation power	DHHS class 1
Detection type	Diffraction grating scan type
Operating temperature	10℃ to 30℃ (No condensation)
Storage temperature	-10℃ to 50℃ (Humidity less than 60%)
Weight (kg/lbs)	0.5kg to 1.0kg (including head)

BH

BH25-RE / BH25-NE

(with/without reference markreference mark)

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

Actual size

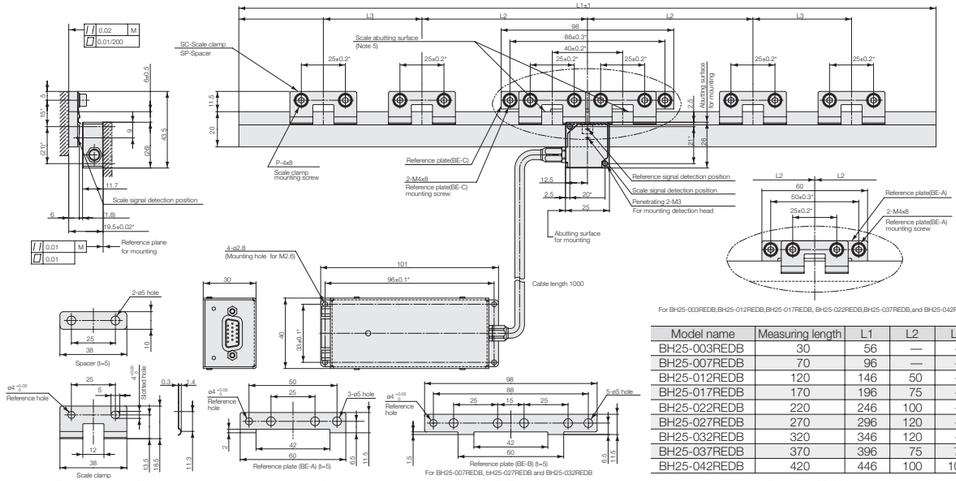
- Signal wavelength : 250nm
- High accuracy : ±1μm/420nm
- High response speed : 700mm/s
- Maximum resolution : 0.03125nm
- Available : with/without reference point
- Completely non-contact design Return error is theoretically eliminated.
- Scale : Blue plate glass/Low expansion glass
- Thin head with thickness of 12mm
- Supporting various resolutions and output modes (Depending on the interpolator connected.)
- Special non-magnetic and vacuum-compatible models available

Type example : BH25-170REDB

- B: Blue plate glass; C: Low-expansion glass
- BD96 connection
- E: Open type scale
- R: with reference point; N: without reference point
- Effective length

External Dimensions

● BH25-RED BH25-***REDB



For BH25-003REDB,BH25-012REDB,BH25-017REDB, BH25-022REDB,BH25-037REDB,and BH25-042REDB

Model name	Measuring length	L1	L2	L3	SC	SP	P
BH25-003REDB	30	56	—	—	1	—	2
BH25-007REDB	70	96	—	—	2	—	4
BH25-012REDB	120	146	50	—	3	2	6
BH25-017REDB	170	196	75	—	3	2	6
BH25-022REDB	220	246	100	—	3	2	6
BH25-027REDB	270	296	120	—	4	2	8
BH25-032REDB	320	346	120	—	4	2	8
BH25-037REDB	370	396	75	75	5	4	10
BH25-042REDB	420	446	100	100	5	4	10

Notes: 1. The items marked by an asterisk indicate the machining dimensions on the mounting surface. 2. The surface roughness of the scale mounting surface is Rmax = 6.3S(250μinch).
3. The surface roughness of the detector head mounting surface is Rmax = 6.3S(250μinch). 4. "M"refers to the machine guide.
5. Mount and sdjust the paired reference plates so that their reference surfaces have a parallelism of 0.01 or less with respect to the machine guide.

● BH25-RED BH25-***REDC

For BH25-003REDC, BH25-012REDC, BH25-017REDC, BH25-022REDC, BH25-037REDC, and BH25-042REDC

Model name	Measuring length	L1	L2	L3	SC	SP	P
BH25-003REDC	30	56	—	—	1	—	2
BH25-007REDC	70	96	—	—	2	—	4
BH25-012REDC	120	146	50	—	3	2	6
BH25-017REDC	170	196	75	—	3	2	6
BH25-022REDC	220	246	100	—	3	2	6
BH25-027REDC	270	296	120	—	4	2	8
BH25-032REDC	320	346	120	—	4	2	8
BH25-037REDC	370	396	75	75	5	4	10
BH25-042REDC	420	446	100	100	5	4	10

Notes: 1. The items marked by an asterisk indicate the machining dimensions on the mounting surface. 2. The surface roughness of the scale mounting surface is Rmax = 6.3S (250μinch).
3. The surface roughness of the detector head mounting surface is Rmax = 6.3S (250μinch). 4. "M"refers to the machine guide.
5. Mount and sdjust 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	BH25-RED	BH25-NED
Measuring length (mm)	30/70/120/170/220/270/320/370/420 (Low expansion glass/Blue plate glass)	
Overall scale length	Measuring length +26mm	
Maximum travel length	Measuring length +10mm	
Accuracy (at 20℃)	±0.5μm (30 to 170mm) ±1.0μm (220 to 420mm)	
Grating pitch	1.0μm	
Signal pitch	250nm	
Reference point	With reference point	None
Direction of starting point detection	For one	None
Output signal	AB phase and Intarporator BD96	
Output resolution	AB phase and BD96 connection(Depend on the number of partitions.)	
Temperature coefficient	-0.7 x 10^{-6}/℃ (Low expansion glass) 8 x 10^{-6}/℃ (Blue plate glass)	
Light source	Semiconductor laser Wavelength, 780nm, Maximum output 6mW	
Detection system	Diffraction grating scanning system	
Operating temperature range	+10℃ to +30℃ (No condensation)	
Storage temperature range	-10℃ to +50℃ (Humidity less than 60%)	
Maximum response speed	700mm/s (When connected with BD96)	

BH

BH20-RE / BH20-NE
(With / Without reference mark)

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.

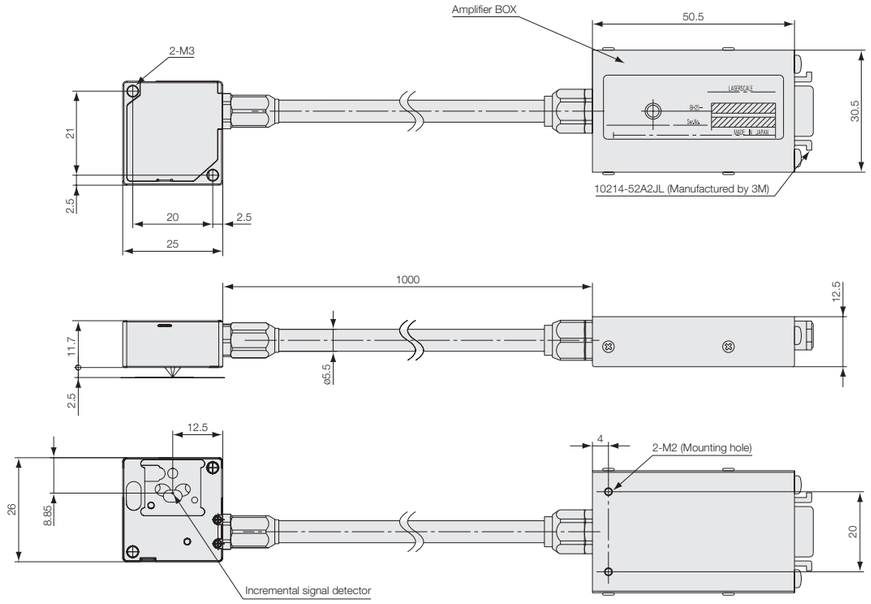
- Signal wavelength : 250nm
- High–speed response : 1,500mm/s (When using analog output),
  700mm/s(When using interpolator BD96)
  160 min^{-1} (when using r=41mm scale)
  555 min^{-1}(when using r=12mm scale)
- High resolution : 4,294,967,296 pulses/rotation
  (when using r=41mm scale, divisions=4096)
  3.017 x 10^{-4} sec (when using r=41mm scale)
  1.46nrad (when using r=41mm scale)
- Available with/without reference point
- Thin head with thickness of 12mm
- Interpolators with various resolutions and output modes available
- Special nonmagnetic and vacuum-compatible models available

Type example : BH20-RED
- D:BD Connected type
- E:Open type scale
- R:with reference point; N: without reference point

*Contact us directly for detail specifications

External Dimensions

● **BH20-NED**



Unit: mm

Main specifications

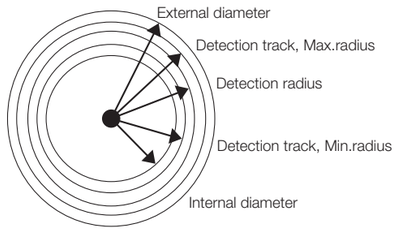
Detection head

Model	BH20-RED	BH20-NED
Detection system	Diffraction grating scanning system	
Light source	Semiconductor laser with power of 6mW or less and wavelength of 790nm	
Reference point	Single reference point; single -direction detection	None
Grating pitch	1.0μm	
Signal pitch	250μm	
Reference point	With reference point	None
Direction of starting point detection	For one	None
Scale	Linear scale : 7 to 18mm (scale : Ni-Co or Si) Rotary scale : Radius 6.016, 9.454, 12.032, 27.073, 36.097mm (rotary scale Ni-Co)	
Maximum response speed	1,500mm/s(When using analog output),700mm/s(When using interpolator BD96)	
Operating temperature range	+10℃ to +30℃ no condensation. Avoid operating under high humidity.	
Storage temperature range	±0℃ to +50℃ no condensation. Avoid operating under high humidity.	

Film scale (BE10)

Detection radius		12.032mm	27.073mm	36.097mm	41.723mm
Detection track	Max.radius	13.532mm	28.573mm	37.597mm	43.523mm
	Min.radius	10.532mm	25.573mm	34.597mm	40.597mm
External form	Internal diameter	7.7mm	19.77mm	29.00mm	34mm
	External diameter	13.45mm	28.57mm	37.60mm	43.523mm
Scale diameter		20ømm	59ømm	77ømm	87ømm
Number of output pulse of one rotation		302400	680400	907200	1048576
Maximum response speed *		1190 min^{-1}	529 min^{-1}	396 min^{-1}	343min^{-1}

* When using cable length 1m and Analog output. However, the Max.response speed is limited depending on the cable length.



BH

BH200-RE / BH200-NE
(with reference mark) / (without reference mark)

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

Actual size

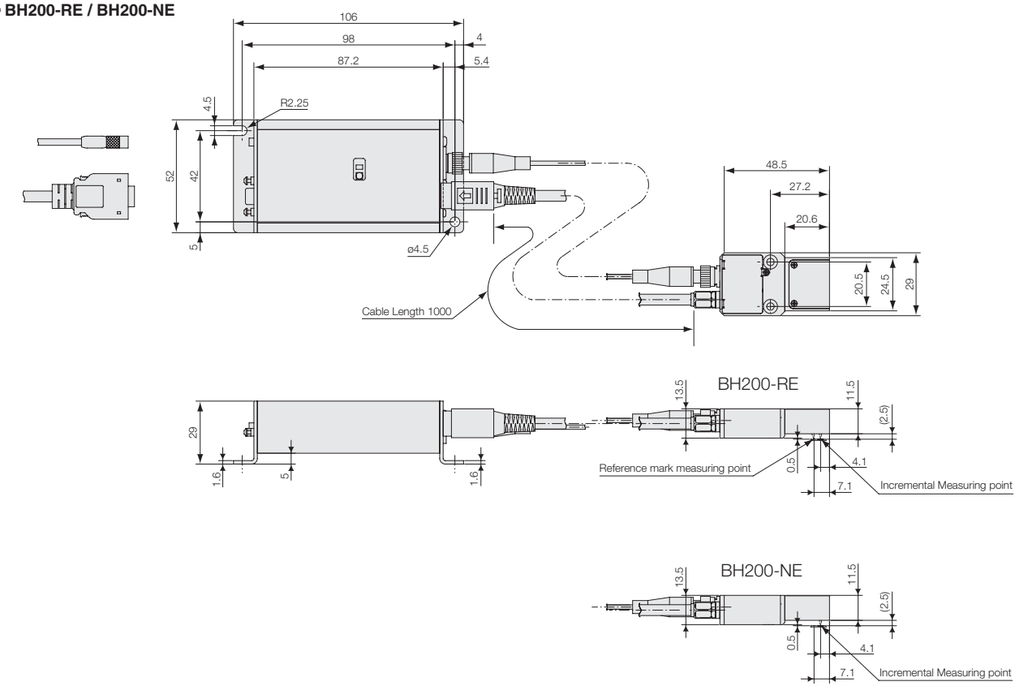
Type example : BH200-RE

- E:Open type scale
- R: with Reference point; N: without Reference point
- ✱Contact us directly for detail specifications

- High resolution and high response speed (signal wavelength : 250nm)
- Clock generator from 10 to 200 MHz
- 907,200 pulses/Rotation (r=36mm)
- Completely non-contact remote head
- Available with reference point (BH200-RE) and without reference point (BH200-NE)

External Dimensions

● **BH200-RE / BH200-NE**



Unit: mm

Main specifications

Model		BH200-RE	BH200-NE
Reference point[*1]		Asynchronous, unidirectional detection	None
Detection method		Grating interferometer	
Light source		Semiconductor laser Wavelength: 790nm Output: 6mW or less	
Pulse number/scale radius		907,200 pulses, scale detection radius: 36.1mm	
Response speed		10MHz to 200MHz(660rpm to 13,000min^{-1})	
Category temperature range		10 ℃~30 ℃ (head) 0 ℃~50 ℃ (detector part)	
Storage temperature range		Thing to avoid high humidity there is no 10℃~50℃ be dewy	
The maximum response speed		13,000min^{-1}	
Head angular tolerance	Roll	±10min(output ±40%)	
	Azimuth	±10min(output ±40%)	
	Roll	±10min(output ±40%)	
Head position tolerance	△X	±70μm(output ±40%)	
	△Y	±70μm(output ±40%)	
	△Z	±50μm(output ±40%)	
Output signal		CLK signal(LVDS), 1/2 or 1/4 CLK signal(LVDS)[*2]	
Input signal		Switch over 1/2 or 1/4(TTL)	
Power supply		DC ±5V(±5%)	
Maximum power consumption		DC +5V: 400mA, DC -5V: 200mA	
Operating temperature		+10 to +30 ℃ (head), 0 to +50 ℃ (detector)	
Storage temperature		-10 to +50 ℃ No condensation Avoid operating under high humidity	
Jitter (target)[*3]		0.5 nsec (@5000rpm)	
Optical fiber minimum bend radius		50mm	

*1 Zero point signal is asynchronous to CLK, 1/2CLK and 1/4CLK signals. Detection is unidirectional.
*2 1/2 or 1/4 signals to CLK signal frequency. No output with input frequency of 50MHz or less. 1/2 CLK and 1/4 CLK signals cannot be used simultaneously with CLK signal.
*3 Jitter of CLK signal: Pulse duration variation at 1000 pulses(3σp-p). Measured by inspection equipment at Magnescale Corporation.

BL

BL57-RE / BL57-NE

(with reference mark) / (without reference mark)

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.

Actual size

BL57-RE

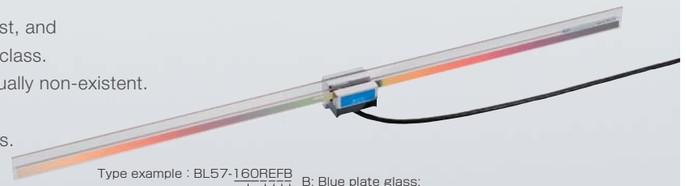
- Achieves a measuring length of up to 1,360mm upon request, and offers the highest-level response speed and accuracy in its class.
- With a head signal pitch of 400nm, interpolation error is virtually non-existent.
- Built-in Reference point.

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. Unparalled measuring stability achieved by use of low expansion glass
- With a head signal pitch of 400nm, interpolation error is virtually non-existent.

Applications: High-accuracy microscopes, stages, measurement equipment.

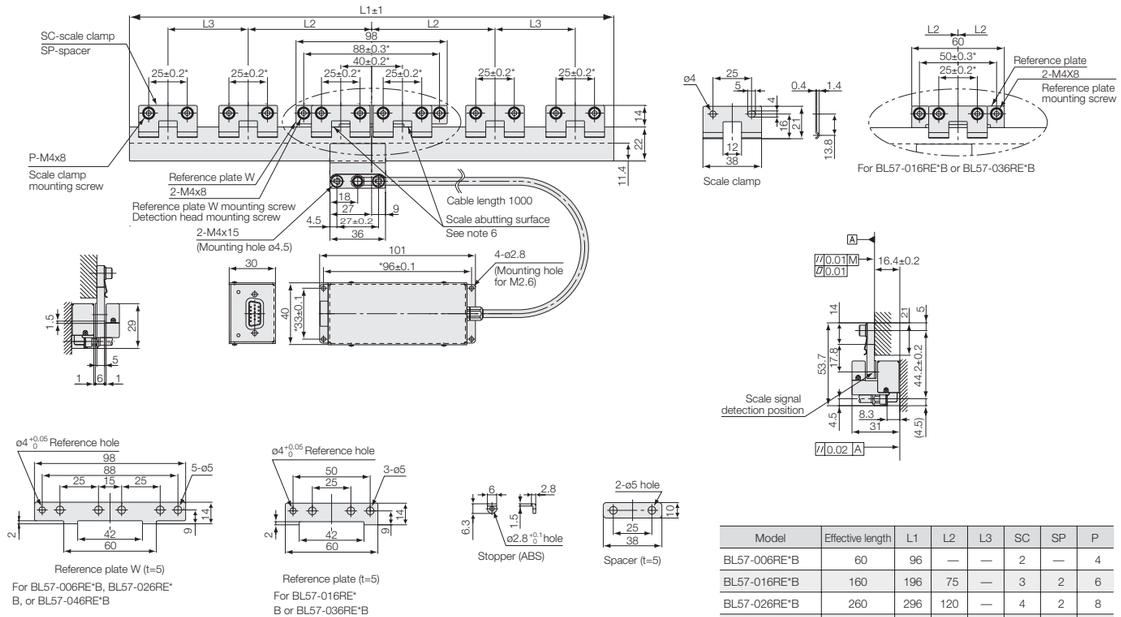


Type example : BL57-160REFB

- B: Blue plate glass; C: Low-expansion glass
- A: 4-split A/B phase output; A: 4-split 8-split A/B phase output; G: 20-split 40-split A/B phase output; H: Analog 1Vp-p output
- E: Open type scale
- R: with Reference point; N: without Reference point
- Effective length

External Dimensions

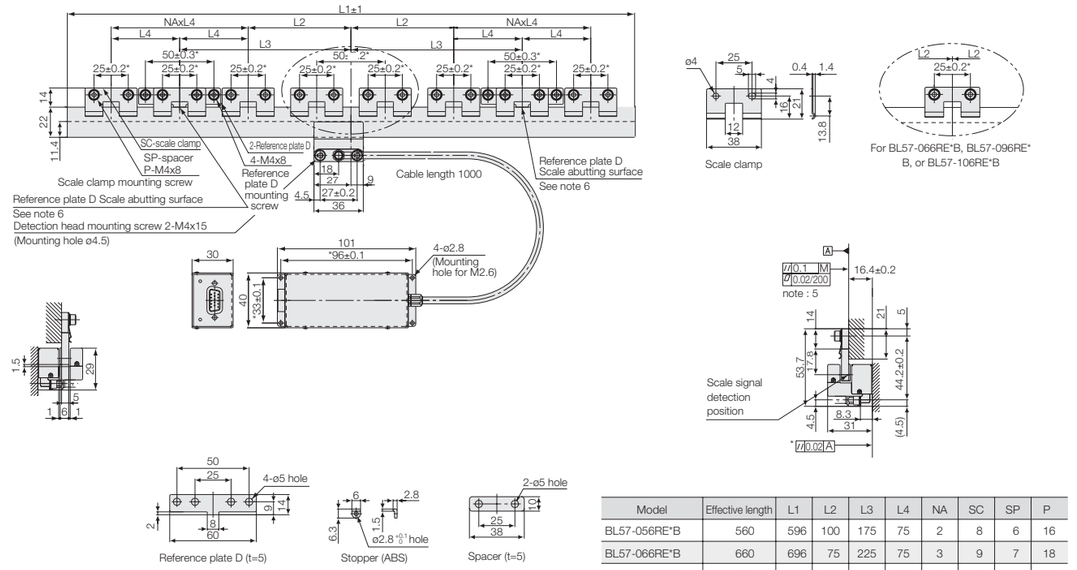
●BL57-xxxRE*B (Effective length: 006／016／026／036／046)



Model	Effective 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

Unit: mm

●BL57-xxxRE*B (Effective length: 056／066／076／086／096／106)

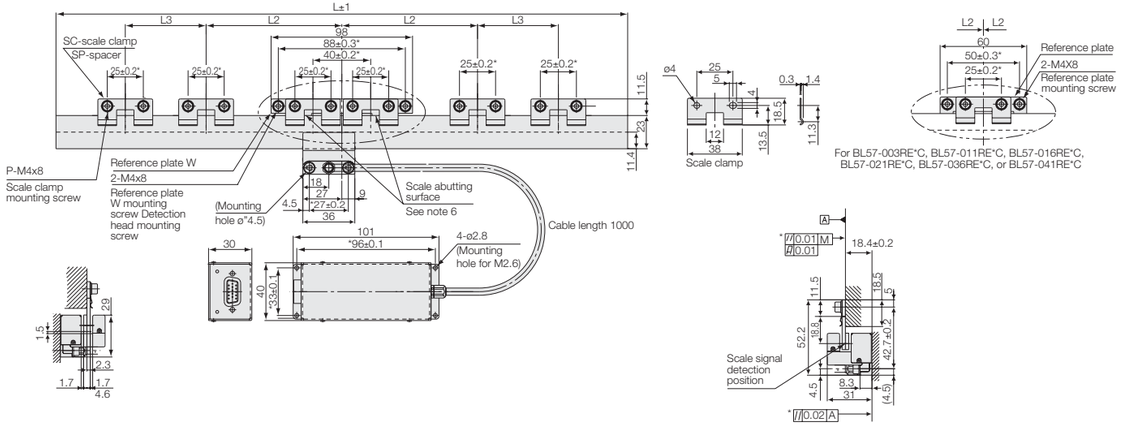


Model	Effective length	L1	L2	L3	L4	NA	SC	SP	P
BL57-056RE*B	560	596	100	175	75	2	8	6	16
BL57-066RE*B	660	696	75	225	75	3	9	7	18
BL57-076RE*B	760	796	100	250	75	3	10	8	20
BL57-086RE*B	860	896	100	250	75	4	12	10	24
BL57-096RE*B	960	996	75	300	75	5	13	11	26
BL57-106RE*B	1060	1096	75	300	75	6	15	13	30

Unit: mm

Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface roughness of the scale mounting surface is Rmax = 6.3 S (250μinch).
Note 3: The surface roughness of the detector head mounting surface is Rmax = 12.5 S (500μinch). 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.

●BL57-xxxRE*C（Effective length: 003／006／011／016／021／026／031／036／041）



Model	Effective length	L1	L2	L3	SC	SP	P
BL57-003RE*C	30	66	—	—	1	—	2
BL57-006RE*C	60	96	—	—	2	—	4
BL57-011RE*C	110	146	50	—	3	2	6
BL57-016RE*C	160	196	75	—	3	2	6
BL57-021RE*C	210	246	100	—	3	2	6
BL57-026RE*C	260	296	120	—	4	2	8
BL57-031RE*C	310	346	120	—	4	2	8
BL57-036RE*C	360	396	75	75	5	4	10
BL57-041RE*C	410	446	100	100	5	4	10

Unit: mm

Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface roughness of the scale mounting surface is Rmax = 6.3 S (250μinch).
Note 3: The surface roughness of the detector head mounting surface is Rmax = 12.5 S (500μinch). 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]

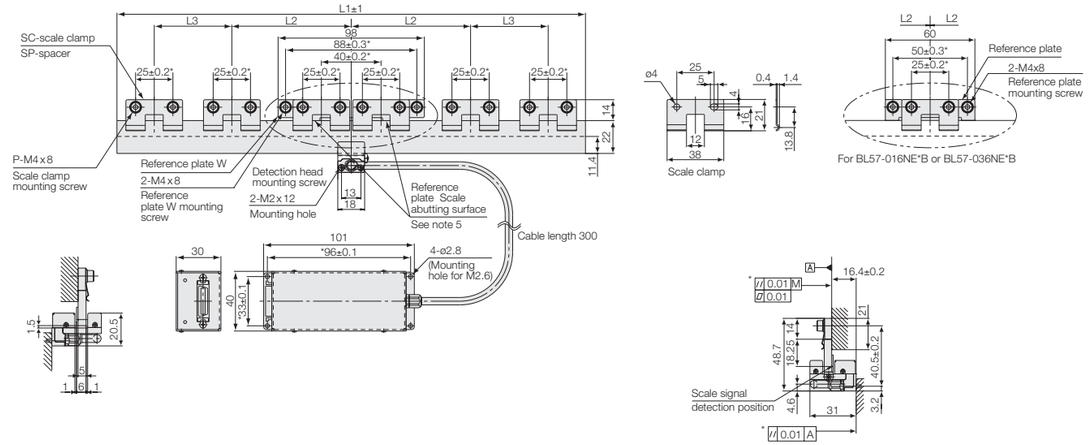
Model		F	G	H
Output signal form		A/B quadrature output		Analogue output
Detection system		Diffraction grating scanning system		
Scale length (Low expansion glass)	Measuring length(mm)	30. 60. 110. 160. 210. 260. 310. 360. 410		
	Maximum movable length	Measuring length + 10mm (5mm on each side)		
	Entire scale length	Measuring length + 36mm		
Scale length (Blue plate glass)	Measuring length(mm)	60. 160. 260. 360. 460. 560. 660. 760. 860. 960. 1060		
	Maximum movable length	Measuring length +10mm (5mm on each side)		
	Entire scale length	Measuring length + 36mm		
Grating pitch		1.6μm		
Signal pitch		0.4μm		
Output signal		Differential(compliant with EIA-422)		Differential (only zero point output models are compliant with EIA-422)
Resolution		0.1/0.05μm (switchable)	0.02/0.01μm (switchable)	0.4μm (1Vp-p)
Accuracy (at 20℃)		±0.5μm(30 to 170mm) / ±1.0μm(220 to 370mm) / ±1.5μm(420mm or more)		
Thermal expansion coefficient		Low expansion glass:-0.7x10^{-6}/℃・Blue plate glass:8x10^{-6}/℃		
Maximum response speed		1,500mm/s(0.1μm) 650mm/s(0.05μm)	300mm/s(0.02μm) 120mm/s(0.01μm)	3000mm/s
		Minimum phase difference:38ns	Minimum phase difference:38ns	Max 7.5MHz

Model		F	G	H
Alarm		High impedance, alarm by output signal when maximum response speed is exceeded or signal level error detected		None
Reference point position		User definable (within the range of effective length)		
Reference point accuracy (at 20℃)		±0.4μm (depending on machine movement accuracy)		
Reference point output signal		Unidirectional synchronous reference point (specify the position and detection direction)		
Head cable	Cable length	1m (Note 4)		
	Bending radius	When stationary : 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 120 ohm termination)		
Vibration resistance		100m/s^2 (50 to 2000Hz)		
Impact resistance		200m/s^2		
Operating temperature range		0 to +40℃(No condensation)		
Storage temperature range		-10 to + 50℃		
Light source		Semiconductor laser with power of 4mW and wavelength of 790nm		
Radiation power		JIS Class 1 equivalent, DHHS Class 1 equivalent		

Cable length (m)	Maximum response speed (mm/s)
3	3000
9	2330
15	1660

Note 1: There is a correlation between the maximum response speed and 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 maximum response speed is limited depending on the cable length.(In a 3m cable, the maximum response speed is two-thirds that of a 1m cable.)
Note 5: Special models can support a measuring length of 1,070mm to 1,360mm.

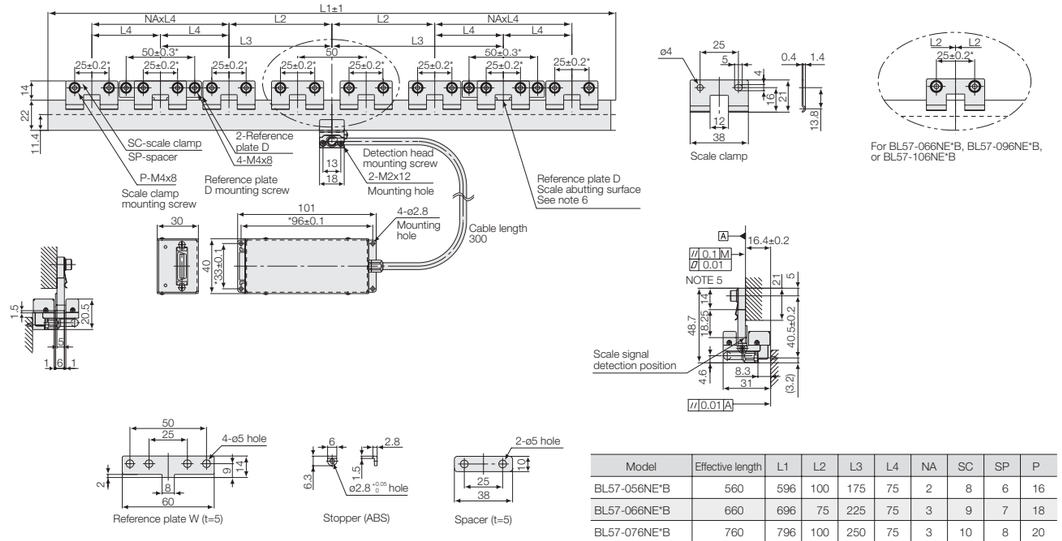
●BL57-xxxNE*B（Effective length: 006／016／026／036／046）



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

Unit: mm

●BL57-xxxNE*B（Effective length: 056／066／076／086／096／106）



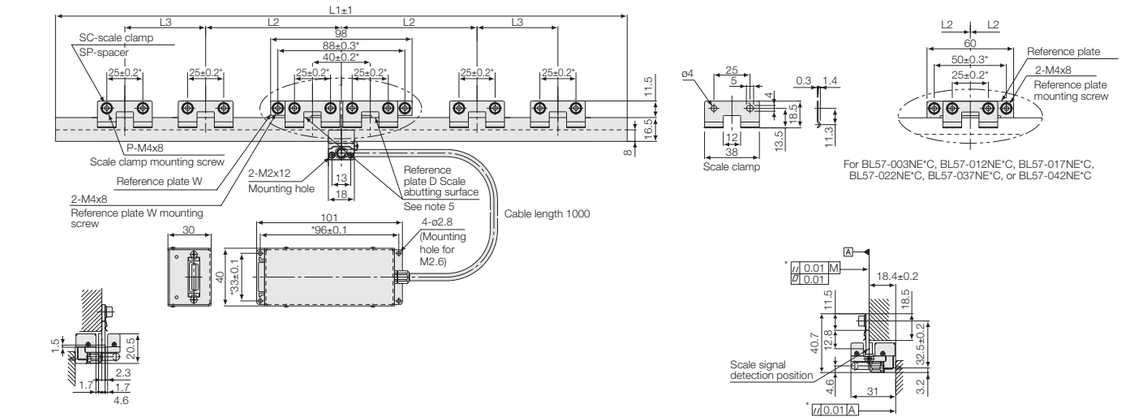
Model	Effective length	L1	L2	L3	L4	NA	SC	SP	P
BL57-056NE*B	560	596	100	175	75	2	8	6	16
BL57-066NE*B	660	696	75	225	75	3	9	7	18
BL57-076NE*B	760	796	100	250	75	3	10	8	20
BL57-086NE*B	860	896	100	250	75	4	12	10	24
BL57-096NE*B	960	996	75	300	75	5	13	11	26
BL57-106NE*B	1060	1096	75	300	75	6	15	13	30

Unit: mm

Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface roughness of the scale mounting surface is Rmax = 6.3 S (250μ inch).
Note 3: The surface roughness of the detector head mounting surface is Rmax = 12.5 S (500μ inch). 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*C（Effective length: 003／007／012／017／022／027／032／037／042）**



Model	Effective length	L1	L2	L3	SC	SP	P
BL57-003NE*C	30	56	—	—	1	—	2
BL57-007NE*C	70	96	—	—	2	—	4
BL57-012NE*C	120	146	50	—	3	2	6
BL57-017NE*C	170	196	75	—	3	2	6
BL57-022NE*C	220	246	100	—	3	2	6
BL57-027NE*C	270	296	120	—	4	2	8
BL57-032NE*C	320	346	120	—	4	2	8
BL57-037NE*C	370	396	75	75	5	4	10
BL57-042NE*C	420	446	100	100	5	4	10

Unit: mm

Note 1: The items marked by an asterisk indicate the machining dimensions on the mounting surface. Note 2: The surface roughness of the scale mounting surface is Rmax = 6.3 S (250μ inch).
Note 3: The surface roughness of the detector head mounting surface is Rmax = 12.5 S (500μ inch). 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]

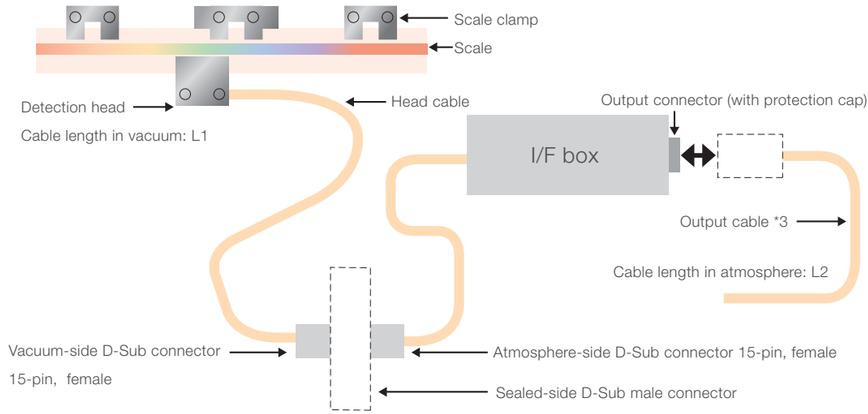
Model		A	F	G	H
Output signal form		A/B quadrature output			Analogue output
Detection system		Diffraction grating scanning system			
Scale length (Low expansion glass)	Measuring length(mm)	30. 70. 120. 170. 220. 270. 320. 370. 420			
	Maximum movable length	Measuring length +10mm (5mm on each side)			
	Entire scale length	Measuring length + 26mm			
Scale length (Blue plate glass)	Measuring length(mm)	60. 160. 260. 360. 460. 560. 660. 760. 860. 960. 1060			
	Maximum movable length	Measuring length +10mm (5mm on each side)			
	Entire scale length	Measuring length + 36mm			
Grating pitch		1.6μm			
Signal pitch		0.4μm			
Output signal		Differential (compliant with EIA-422)			Differential
Resolution		0.1μm	0.1/0.05μm (can be changed)	0.02/0.01μm (can be changed)	0.4μm (1Vp-p)
Accuracy (at 20℃)		±0.5μm (30 to 170mm)/ ±1.0μm (220 to 370mm)/ ±1.5μm (420mm or more)			
Temperature expansion coefficient		Low expansion glass: -0.7×10⁻⁶/℃・Blue plate glass:8×10⁻⁶/℃			
Maximum response speed		1000mm/s	1,500mm/s (0.1μm) 650mm/s(0.05μm)	300mm/s(0.02μm) 120mm/s(0.01μm)	3000mm/s (Note 1)
		Minimum phase difference:80ns	Minimum phase difference:38ns	Minimum phase difference:38ns	Max 7.5MHz

Model		A	F	G	H
Alarm		High-impedance A/B quadrature output signals when signal level error detected.	High-impedance output when maximum response speed exceeded or signal level error detected.		None
Head cable	Cable length	300min			
	Bending radius	When stationary: 10mm			
Output cable length		15mMax (Note 2) (to the electronic control section)			15mMax (Note 1) (Note 2)
Power source (Note 3)		+5V (+10%-5%)	+5V (±5%)		
Power consumption		200 mA (no load) 250 mA (9120 ohm termination)	290mA (no load) 350mA (120 ohm termination)		250 mA (no load,120 ohm termination)
Vibration resistance		100m/s²(50 to 2000Hz)			
Impact resistance		200m/s²			
Operating temperature range		0 to +40℃(no condensation)			
Storage temperature range		-10 to + 50℃			
Light source		Semiconductor laser with power of 4mW and wavelength of 790nm			
Radiation power		JIS Class 1 equivalent, DHHS Class 1 equivalent			

Cable length (m)	Maximum response speed (mm/s)
3	3000
9	2330
15	1660

Note 1: There is a correlation between the maximum response speed and 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.

BL57-RE supporting vacuum environment (Special models)

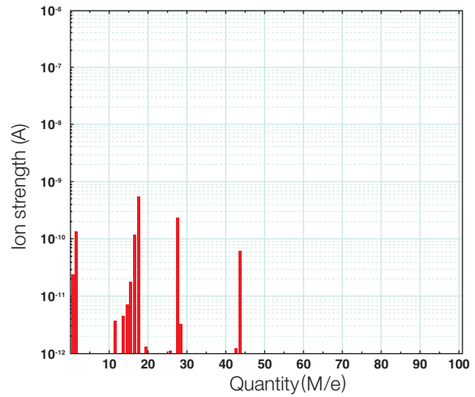


Vacuum-compatible, open type with reference point. Allowing ultra-precise positioning in a vacuum environment.

- Ultimate vacuum of 10^{-5} Pa class.
- Emitted gas flow rate of 10^{-6} Pa・m^3 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: These components are not included in the product.



BL

BL55-RU
(with reference mark)

Sealed type linear encoder with non-contact design offers minimal reversal error.
The enclosed design protection against contaminates (IP53)

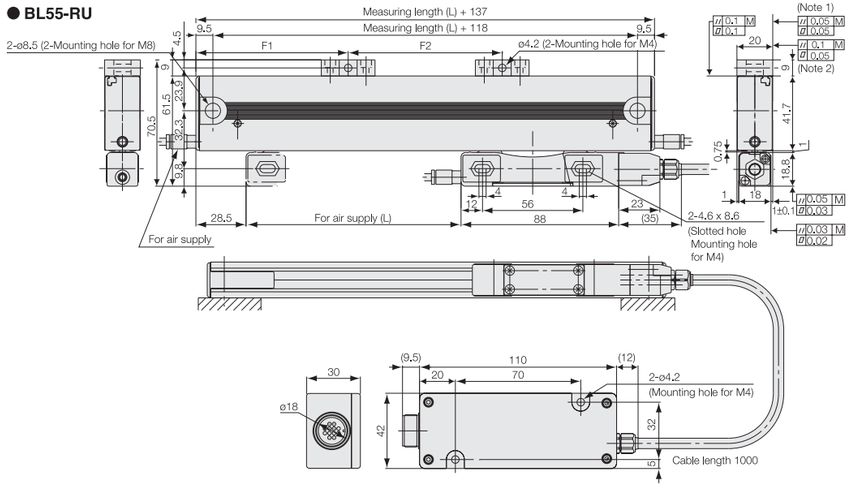
Actual size

- All the advanced features of Magnescale's Laserscale technology have been incorporated into the environmentally protective design.
- Highest response speed and accuracy in its class.
- Non-contact design of the detector head eliminates inherent mechanical error, and achieves a repeat accuracy of 0.1µm or less.
- Given the head signal pitch of 400nm, the interpolation error is practically non-existent.
- Built-in reference point.

Applications: Precision measuring equipment precision stages.

External Dimensions

● **BL55-RU**



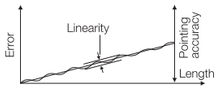
Measuring length (L)mm	F1 mm	F2 mm
70	—	—
120	—	—
170	—	—
220	—	—
270	—	—
320	—	—
370	—	—
420	—	—
470	—	—
520	329	—
570	354	—
620	379	—
720	429	—
770	454	—
820	479	—
870	504	—
920	529	—
1020	386	385

Unit: mm

Note 1: Parallelism is 0.05mm or less when Measuring length is 120mm or less. Note 2: Parallelism is 0.1mm or less when Measuring length is 170mm or more. Note 3: M indicates the machine guide (machine movement).

Main specifications

Model		F	G	H
Output signal form		A/B quadrature output		Analogue output
Detection system		Diffraction grating scanning system		
Scale length (Blue plate glass)	Measuring length (mm)	70・120・170・220・270・320・370・420・470・520・570・620・720・770・820・870・920・1020		
	Maximum movable length	Measuring length + 2mm		
	Overall scale length	Measuring length + 137mm		
Accuracy (20℃)		±2.5 (70 to 320mm) ±4.5µm (370mm or more)		
Linearity (Note 2)		±2.5µm (370mm or more)		
Grating pitch		1.6µm		
Signal pitch		400nm		
Output signal		Differential (compliant with EIA-422)		Differential (only reference point output models are compliant with EIA-422)
Resolution		0.1/0.05µm(switchable using a switch) (Note 1)	0.02/0.01µm(switchable using a switch)	0.4µm(1Vp-p)
Repeatability		0.1µm or less		
Return error		0.1µm or less		
Reference point accuracy (at 20℃)		±0.4µm (depending on machine movement accuracy)		
Reference point position		User definable		
Direction of reference point detection		For one		
Temperature expansion coefficient		$8x10^{-6}$/℃		
Light source		Two semiconductor lasers with power of 6mW and wavelength of 790nm		
Radiation power		JIS Class 1 equivalent, DHHS Class 1 equivalent		
Operating temperature range		0 to +40℃ (no condensation)		
Storage temperature range		-10 to + 50℃		
Maximum response speed		F: 1,500mm/s (0.1µm) 650mm/s (0.05µm) Minimum phase difference : 38ns G: 300mm/s (0.02µm) 120mm/s (0.01µm) Minimum phase difference : 38ns		3000mm/s (Note 3) Max 7.5MHz
Alarm		High impedance, alarm by output signal when maximum response speed is exceeded or signal level error detected		None
Head cable	Cable length	1000m (Note 4)		
	Bending radius	When stationary : 30mm When in motion : 100mm		
Output cable length		15m Max		15m Max (Note 3)
Power source		+5V (±5%)		
Power supply		450mA (no load) 600mA (maximum when cable is connected)		
Protective design		IP53 or equivalent (when air is supplied : IP64 or equivalent)		
Vibration resistance		100m/s² (50 to 2000Hz)		
Impact resistance		200m/s²		



Alarm

Note 1: Special modes can support AB quadrature output with 0.01µm resolution.
Note 2: The linearity is the range of scattering when scale accuracy slope is set to zero .
Note 3: Please inquire for details regarding the correlation between the maximum response speed and the output cable length.
Note 4: Special models can support up to 3m .

BD

BD96
Interpolator for Laserscale™

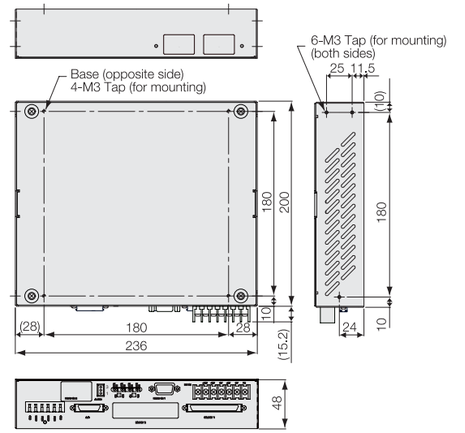
Maximum resolution of 17pm when combined with the BS series.
Supporting various serial and binary outputs.

- Maximum 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
- AB quadrature output
  (standard : 4 divisions) (binary output axis 1 or 2 type)
  BS series : 34.5nm, BH series : 62.5nm, BL series : 100nm
- Maximum no. of divisions : 8000 (When connected with BS and BH series)

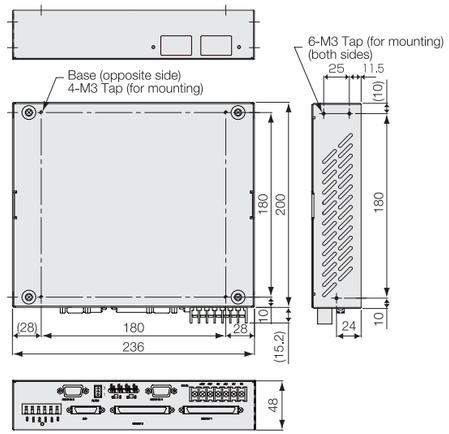
* Please inquire about various specifications, such as the number of divisions.

External Dimensions

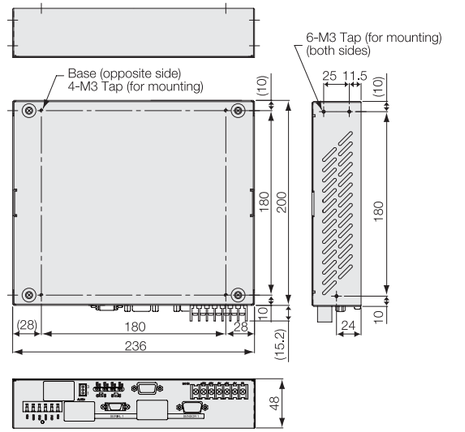
●BD96-B1



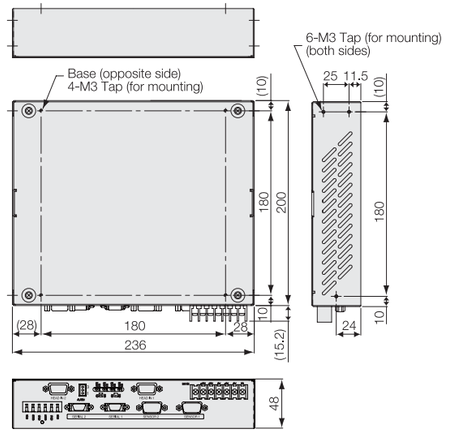
●BD96-B2



●BD96-Y1/M1



●BD96-Y2/M2



Unit: mm
*2 External dimensions of the 1- and 2-axis are identical.

Main specifications

Model	BD 96
MAX. resolution	0.4nm (When connected with BL series),0.03125nm (When connected with BH series),0.017nm (When connected with BS series)
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. division	025 : 256, 051 : 512, 040 : 400, 050 : 500, 100 : 1000, 200 : 2000, 400 : 4000, 800 : 8000
Alarm	When exceeding the maximum 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%
Current Consumption (When scale is connected)	DC +5V : 0.4A DC +12V : 0.7A DC -12V : 0.5A (2 axes type)
Operating temperature range	0 to +40℃
Storage temperature range	-10 to +50℃
Dimensions	236 (W) x 215.2 (D) x 48 (H)mm
Weight	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 800: 8000 divisions
- Axis type 1: 1 axis 2: 2 axes
- Output mode B: Binary (Axis type 1 or J : 40 bits, 2 : 20bits) Y: Yaskawa Electric serial M: Mitsubishi Electric serial F: FANUC*2 serial

*2 Special model

BD

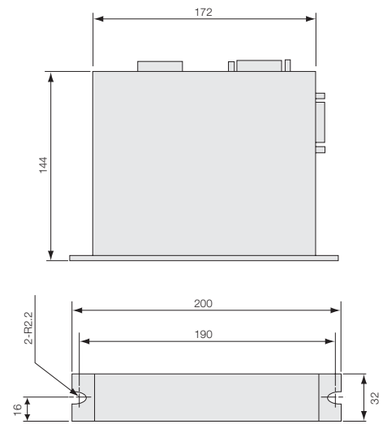
BD95
Interpolator for Laserscale™

Interpolator with A/B quadrature output that achieves resolution to 4.3nm.

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

External Dimensions

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

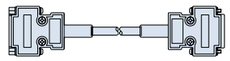
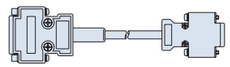
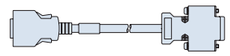


Unit: mm

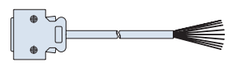
Main specifications

Model	BD95-T13	BD95-T14	BD95-T15	BD95-T16	BD95-T10	BD95-T17
Resolution (selectable)	34.5 nm (4divisions) or 17.2nm (8 divisions) 100 nm or 50 nm during pitchcompensation		17.2 nm (8divisions) or 8.6 nm(16 divisions) 100 nm, 50 50nm, or 10 nm during pitch compensation		8.6 nm (16divisions) or 4.3 nm(32 divisions) 100 nm, 50nm, 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) 120 mm/s (with 16 divisions)		120 mm/s (with 16 divisions) 60 mm/s (with 32 divisions)	
Output signal	AB quadrature 1 with / without pitch compensation (compliant with EIA-422) AB quadrature 2 without pitch compensation (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 only)					
Alarm	Max. response speed exceeded Low laser signal level(cable broken or disconnected) LEDs (Turn on independently for speed alarm and level alarm) Output signal: Output when either a speed or level alarm occurs. Switching between automatic reset and holding is possible					
Pitch compensation function	AB quadrature 1 only A round-off error of 1 resolution occurs.					
Input signal compensation (On/Off switching is possible)	DC offset, Amplitude level, Phase. Frequencies allowing compensation update: Input signals of 180 kHz or less					
Power supply	DC + 24V ± 1V					
Consumption current (when scale is connected)	400mA (maximum)					
Operating temperature	0℃ to 50℃ / 32˚ F to 122˚F					
Storage temperature	-10℃ to 60℃ / 14˚ F to 140˚F					
Dimensions	172 (W)x144(D)x32(H) mm/6.77"(W)x5.66"(D)x1.25"(H)					
Weight	Approx. 0.8 kg/Approx.1.76lbs					

Connection Cable

Scales		Extension Cable*2	Interpolator
Model	Head cable length*1		
BS78 BS65-R	3m (Standard)	Robot cable:CK-T61 (1.0m) CK-T24 (3.0m) CK-T54 (6.0m) 	BD95
		Robot cable:CK-T133 (0.1m) CK-T137 (3.0m) CK-T112 (5.0m) 	BD96
BH20-NE	1m (Standard)	Robot cable:CK-T148 (3.0m) 	
BH25-RED BH20-RED BL57-RED	1m (Standard)	Robot cable:CE20-03T10 (3.0m) CE20-06T01 (6.0m) CK-T144 (9.9.0m) 	

*1 Please ask for other length. *2 can lengthen to max. 9m. Please ask for more than 9m.

Scales		Extension Cable	Interpolator
Model	Head cable length*1		
BL55-RU	1m (Standard)	Robot cable:CE20-03 (3.0m) CE20-05 (5.0m) CE20-07 (7.0m) 	Built-in I/F Box
BL57-NE (A/B phase)	0.3m (Standard)	Robot cable:CE20-03T07 (3.0m) CE20-05T05 (5.0m) 	
BL57-RE (A/B phase)	1m (Standard)		
BL57-NE (Analog)	0.3m (Standard)	Robot cable:CE20-07T03 (7.0m) 	
BL57-RE (Analog)	1m (Standard)		

*1 Please ask for other length.

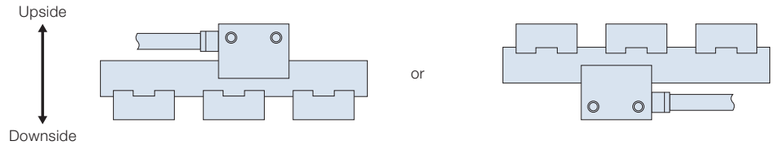
The robot cable minimum bend radius: R80mm is fixed repeatedly R10mm.

Technology

Before use

Mounting Direction BL55-RU

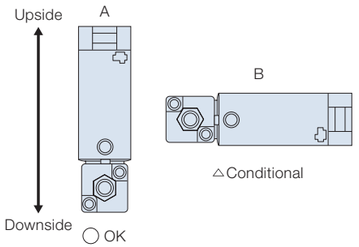
Please see the diagram blow about an installation method of Laserscale.



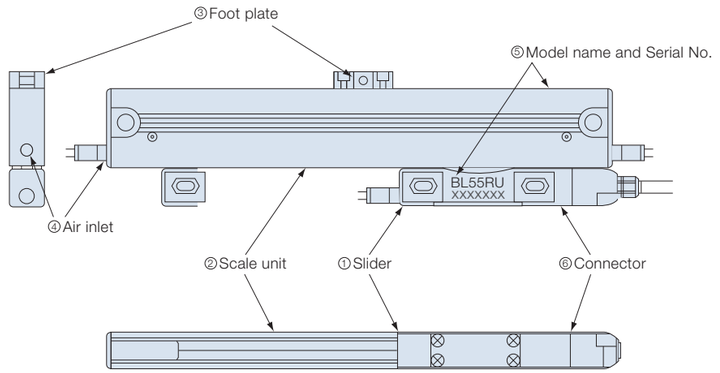
Checking the Installation Direction

Check that the scale is installed in the positional relationship shown in Fig. 3-1.
Except when installed on a vertical axis, only the orientation in Fig. 3-1 should be used.

[Note]
If installing on a machine tool or other equipment where powder and dust occur, install using the A orientation since this allows usage of cutting fluid and prevents the intrusion of cutting dust.
Install using the B orientation only in other situations when virtually no foreign objects can enter the scale.



Scale



①Slider

The slider has a built-in detector head. The slider is secured in place by the slider holders at shipping.

②Scale unit

The scale unit incorporates a high-accuracy LASERSCALE. It is protected by an aluminum cover.

③Foot plate

This is used to secure the scale in place.
The number of attached foot plates varies depending on the scale measuring length.
Measuring length of 470 mm or less ..... none
Measuring length of 520 mm to 920 mm 1
Measuring length of 1020 mm 2

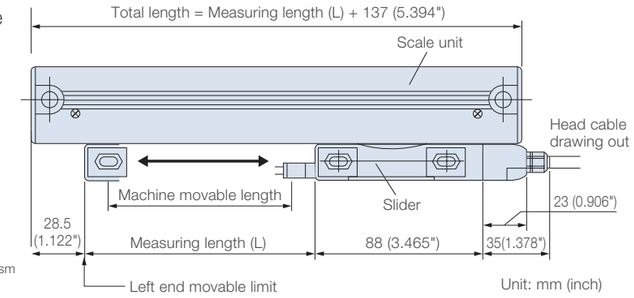
④Air inlet

This is used when air is injected. To inject air, remove the hex.socket-head set screws covering the inlets, and then attach the hex. sockethead half-union.

*Please refer to page 39 for an electric supply.

Range of Movement Settings BL55-RV

As shown in Fig. 3-3, when the head cable is drawn out to the right side,
the point where the distance from the slider left end and scale unit left end is 28.5 mm is considered the left end movable limit.
Although the slider or scale unit can move an amount equal to the measuring length from this left end movable limit,
there is almost no margin at both ends.
Be particularly careful that the machine movable length falls within the scale measuring length.



* The detector head will be damaged if the slider or scale unit is moved past the measuring length.A mechanical limiting mechanism (such as a stopper) is needed for machines that exceed the measuringlength (movable range) of the scale.
Be sure to install this type of device before installing the scale.

Compensation Value BS78, BS65

The hologram grating pitch of the scale is approximately 0.55 μm/22 μ inch, while the detector signal pitch is theoretically 1/4 of this, that is 138nm/5.5 μ inch. This value differs slightly from scale to scale. Therefore, it is necessary to additionally make the pitch compensation for each scale, in order to detect precise displacements.
The lowest four digits of the detector signal pitch for each scale PS = 0.1379 □□□□ μm at 20 ˚C/68 ˚F show the compensation value.
Before operation, be sure to always set the compensation value of the scale for the Intarporator when using a Intarporator that allows input of compensation values.
Linear compensation must be performed using the customer's machine if the compensation value cannot be set.

When you operate the unit in an environment where the temperature is not 20 ˚C/68 ˚F
To operate the unit in an environment where the temperature is not 20 ˚C/68 ˚F, adjust the compensation value as shown below to make a temperature adjustment. The following example shows the adjustment method for an operating temperature of 23 ˚C/73 ˚F.

Example : The compensation value shown on the compensation value label is 1234.

$$0.1379\boxed{1}\boxed{2}\boxed{3}\boxed{4} \times \{1 + (23-20) \times (-0.7 \times 10^{-6})\} = 0.1379\boxed{1}\boxed{2}\boxed{0}\boxed{5}$$

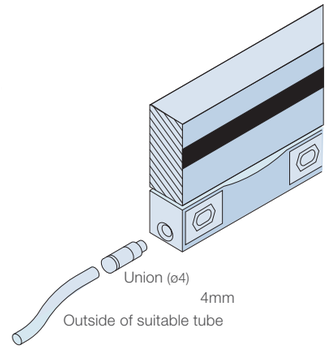
Temperature difference from 20 ˚C/68 ˚F
Coefficient of thermal expansion of the scale
The compensation value after temperature adjustment will be 1205. Set the detector to this value.

Air supply

Air Injection Procedure BL55-RU

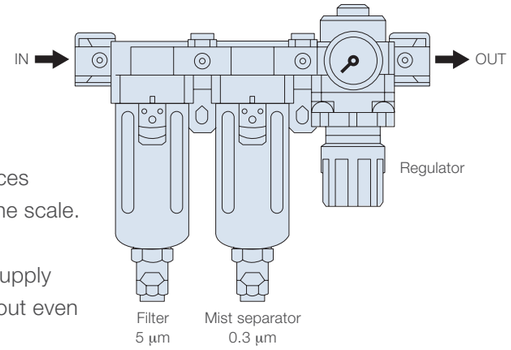
Chips, cutting oil, and other substances generated by cutting can frequently be scattered in the area around the scale unit, especially when it is installed on a machine tool.
Even when not using a machine tool, air should be injected to the scale when installed on machines generating dust or when dust is prevalent in the operating environment.

There are a total of three air inlets, one each on both sides of the scale unit and on the slider.
Supply air to all of the air inlets.



Air Pressure Source • Supply Amount BL55-RU

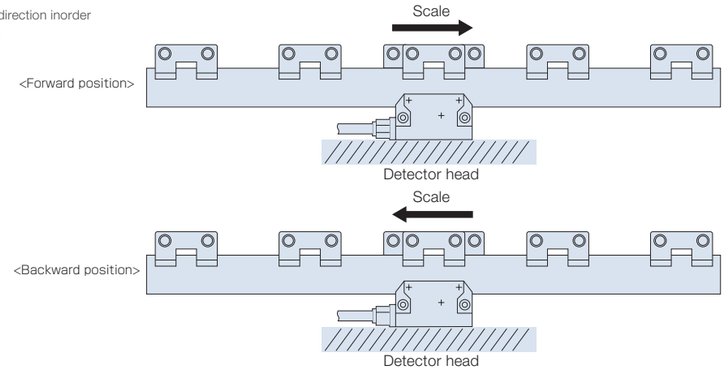
Whenever air is supplied to the scale from an air pressure source, the air should always pass through a filter (5 μm), mist separator (0.3 μm), and regulator to remove any dust, mist, and other foreign substances.
Sufficient care should be taken since foreign substances entering inside the scale can cause a breakdown of the scale.
Air should be supplied to the scale at a pressure of 19.6 kPa per scale. Note that the pressure of the supply section may be reduced due to the pipe length or layout even if the setting at the regulator is 19.6 kPa.



Reference point detection direction

The optical built-in reference point (reference mark) 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.

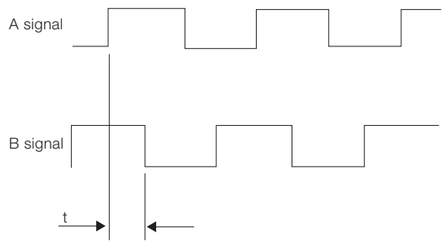
* Do not detect the reference point from the wrong direction inorder to keep the reliability of the reference point and to avoid deterioration.



Scale Signal Output

AB Signal and Alarm Output Specifications (For output formats F and G) BL55, BL57

- The output specifications are compliant with EIA-422.
- AB signal minimum phase difference t : 38 ns



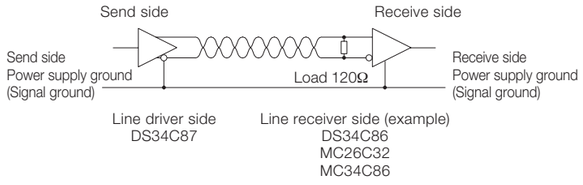
[Note]
- An error of about 38 ns is generated due to the synchronization of the AB signal by the 26.3 MHz internal clock.
- The minimum phase error can vary depending on the length of the output cable, cable capacity, receiver load, and other factors.

Connection Specifications

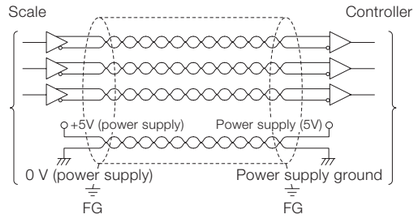
AB Signal Output Type

The line driver used by Magnescale Corporation 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 ± 12 V.
(Using the scale when the common mode voltage of ± 12 V is exceeded can damage the scale.)
To prevent problems between the control devices connected to this Magnescale product, it is recommended that you connect (shared connection) the signal ground (power supply ground) and set the load resistance to 120 Ω.
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>



<BL55, 57> Receiving power supplied from the controller



Analog Output Specifications (For output format H) BL55, BL57

SIN/COS output specifications

(Over the entire 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			Ω	

Note 1: When terminator Z0 = 120Ω supply voltage= 5V ± 5%
(voltage of load resistance at both ends)

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

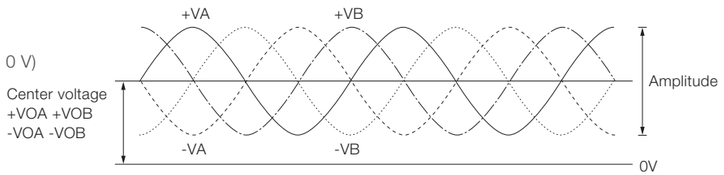
where

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

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.

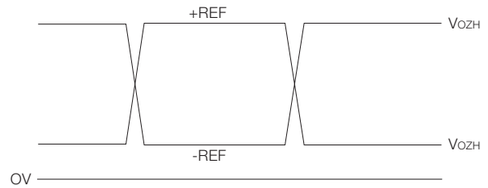


Reference point output specifications

The output specifications are compliant with EIA-422.

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

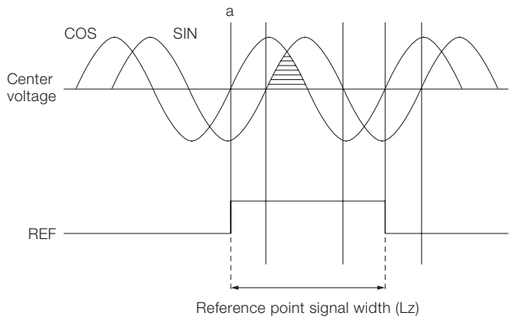
Item	Symbol	Specifications			Units
		Min.	Typ.	Max.	
"H" level output	VOZH	2.5	3.4	5	V
"L" level output	VOZL	0	0.3	0.5	V



Reference point signal and SIN and COS signal phases

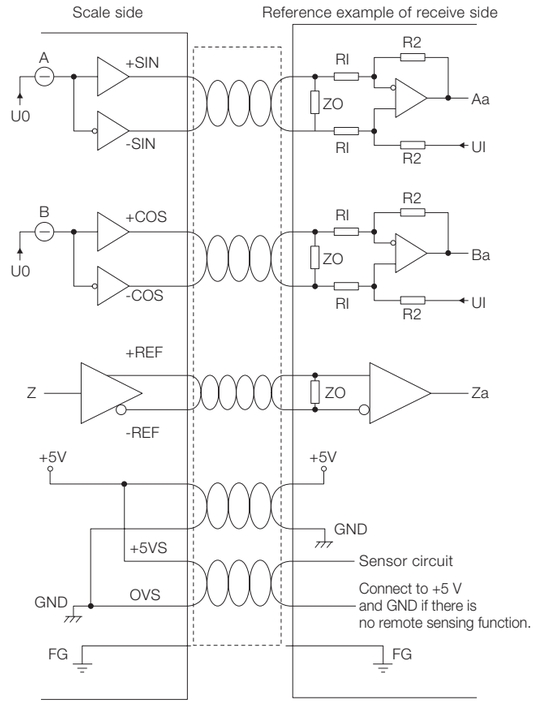
Item	Specifications		
	Min.	Typ.	Max.
Reference point signal width (Lz)	0.32 µm	0.4 µm	0.48 µm
Position of reference point signal edge a with respect to SIN signal	0°		90°

Reference point waveform diagram



Analog Output Type

Example of input circuit



U0=U1=2.5V ± 0.2V Z0=120Ω

Recommended elements
SIN and COS : Differential receiver LMH6654
R1 = R2 =10 kΩ
REF : DS34C86

Input/Output Connectors

Connectors BL55

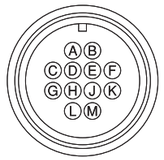
Interface unit side :

R04-R12M (manufactured by TAJIMI ELECTRONICS CO., LTD.)

Cable side :

R04-P12F (manufactured by TAJIMI ELECTRONICS CO., LTD.) ..... Waterproof type
R03-PB12F (manufactured by TAJIMI ELECTRONICS CO., LTD.) ..... Non-waterproof type

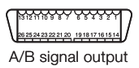
Pin arrangement	Input/output specifications	
	A/B signal output	Analog output
A	A	+COS
B	*A	-COS
C	B	+SIN
D	*B	-SIN
E	Z	+REF
F	*Z	-REF
G	+5 V (power supply)	
H	0 V (power supply)	
J	0 V (signal)	
K	0 V (signal)	
L	+5 VS	
M	0 VS	



[Note]
- 0 V is the circuit ground, and it is not connected to the frame ground.
- Make sure that the power supply voltage is 5 V DC ± 5 % at the input connector to the interface unit.
- +5 V S and 0 V S are for checking the voltage (remote sensing function) applied to the input connector of the interface unit.
  These voltages can be used to check and control for drops in the supply voltage due to the cables.
  When using a power supply that cannot control power supply fluctuations,
  a power supply input terminal can be used to reduce the supply voltage drops occurring due to the cable length.
  In this case, connect the cable to the respective +5 V or 0 V power supply.
- The appropriate cable thickness is AWG28 to AWG24.
- Connect all of the 0 V terminals to prevent mis-wiring.
- Use shielded cables for all cabling.
- Use twisted-pair cables for the output signals.
  Use cables so that the following signals are paired: A and *A, B and *B, Z and *Z, +SIN and -SiN, +COS and -COS, +REF and -REF.

Connectors (Open type) BL57-RE, BL57NE

Pin arrangement	Input/output specifications	
	A/B signal 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)	



A/B signal output


Analog output

Interface unit side:

A/B signal output : 10226-52A2JL
(manufactured by SUMITOMO 3M Limited)
Analog output : D02-M15SAG-26L9
(manufactured by Japan Aviation Electronics Industry, Limited)

Cable side:

A/B signal output : Plug 10126-3000VE
(manufactured by SUMITOMO 3M Limited)
: Shell 10326-52F0-00S
(manufactured by SUMITOMO 3M 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-F2-1
(manufactured by Japan Aviation Electronics Industry, Limited)

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