BS/GS series
DG series

Digital Linear Gauge

ONO SOKKI

CONTENTS

Instrument that solves what you want to know and what you don't know in the field.

Ono Sokki's Digital Linear Gauge

Our linear gauge sensors use optical technology to measure the dimensions and displacement of objects. In addition to measuring the dimensions of finished products, it also meets various on-site requirements such as inspecting for defects on the production line, rigidity testing, and positioning stages, etc.

Variety of product lineup

We offer a wide range of linear gauge sensors to suit your needs. You can choose a product according to the size of the measured object and the desired resolution: measurement range from 10 mm (BS series) to 100 mm (GS-5000A series) and resolutions range from 0.1 µm (GS-3800B series) to 10 µm. In addition to the general-purpose type, there are linear gauge sensors that meet the performance required by customers, such as shock resistant, oil-proof, long life (tough gauge) and compact types.
(For the linear gauge sensor lineup, see pages 6 and 7.)

High resolution type that is resistant to noise

The high resolution of 0.1 µm type (GS-3800B series) uses a 90° phase difference differential method (line driver output method). By adopting a method that is more resistant to noise than usual, it is possible to achieve more accurate measurements with fewer errors even in high-resolution measurements.
(For high-resolution linear gauge sensors, see page 9.)

Please refer to pages 4 and 5 for application examples.

For more details of the linear gauge sensor, please refer to page 26 onwards.

Digital Gauge Counter

The signal from the linear gauge sensor is input to precisely measure and display dimensions and displacement. The calculation function, condition memory function, and abundant external outputs allow connection to a PLC, PC*1, recorder*1, etc., making it easy to record and manage measurement data.
(*1. Compatible with DG-5100 and DG-2310 only, option cards are required separately.)

Compact and general
DG-4320/DG-4340

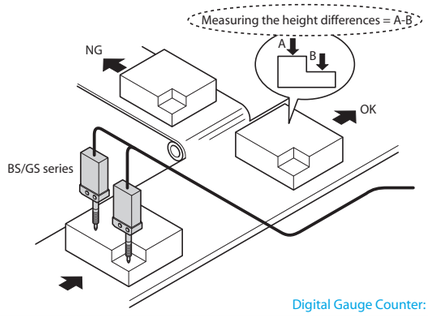
High resolution type
DG-5100

2ch sum-difference calculation function
DG-2310

Application examples

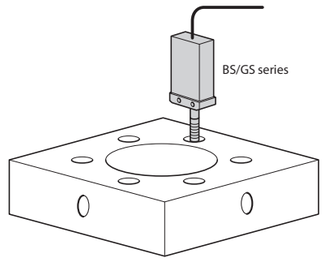
Ono Sokki's Digital Linear Gauges meet a variety of needs

Measuring and screening for height of small parts



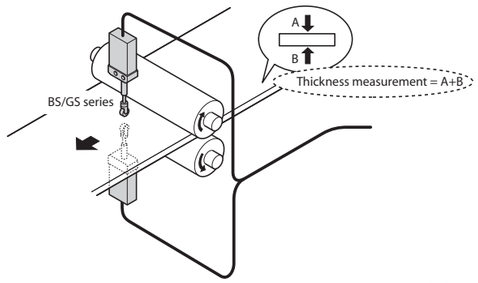
Digital Gauge Counter: DG-2310

Hole depth measurement for molded products



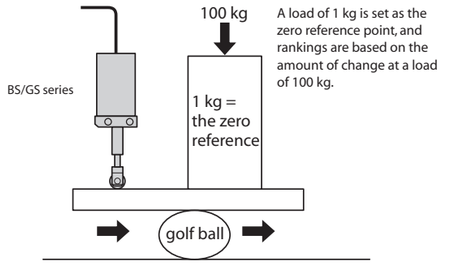
Digital Gauge Counter: DG-4320/4340/5100

Measuring material thickness



Digital Gauge Counter: DG-2310

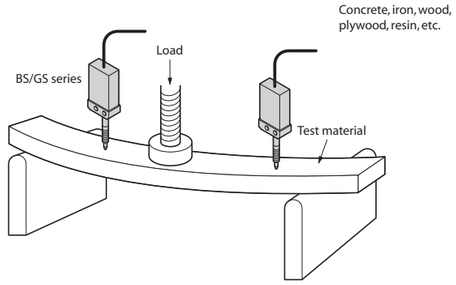
Ranking golf balls



A load of 1 kg is set as the zero reference point, and rankings are based on the amount of change at a load of 100 kg.

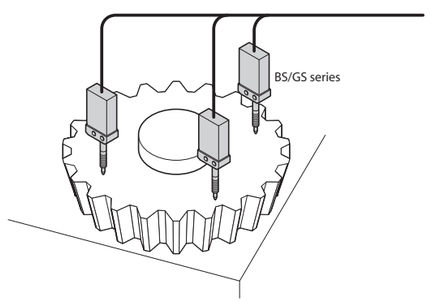
Digital Gauge Counter: DG-4320/4340/5100

Strength testing of construction and civil engineering materials



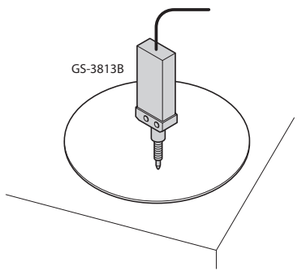
Digital Gauge Counter: DG-4320/4340/5100

Measuring the flatness of transmission gears



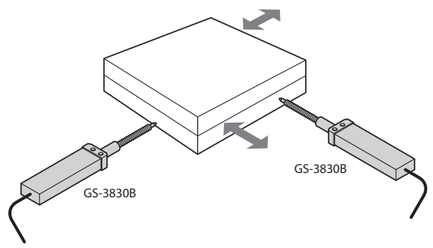
Digital Gauge Counter: DG-4320/4340/5100

Measuring silicon wafer thickness



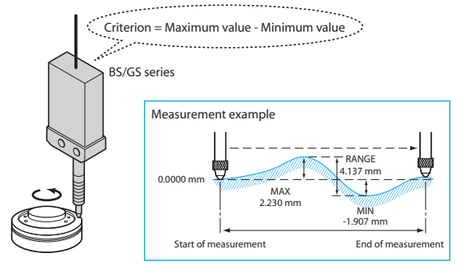
Dedicated digital gauge counter: DG-5100

Positioning measurement of XY stages, etc.



Dedicated digital gauge counter: DG-5100

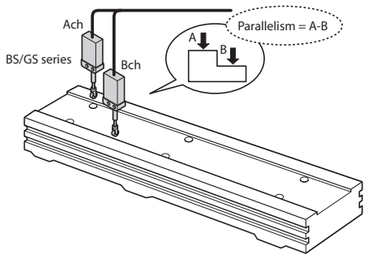
Measuring the deflection of rotating shaft



Digital Gauge Counter: DG-4320/4340/5100

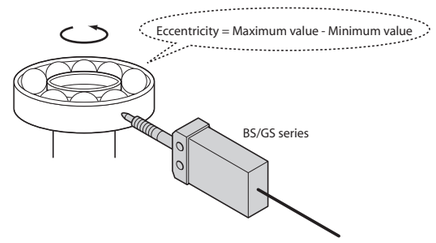
Measuring parallelism of building components with steps

Attach a linear gauge sensor (2ch) to a part with a step. Slide and measure parallelism by the difference between the two channels (A-B).



Digital Gauge Counter: DG-2310

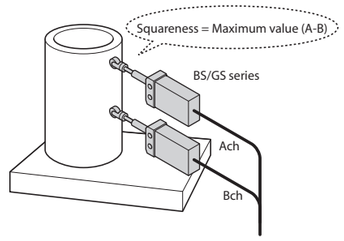
Measuring bearing eccentricity



Digital Gauge Counter: DG-4320/4340/5100

Measuring the squareness of cylindrical component

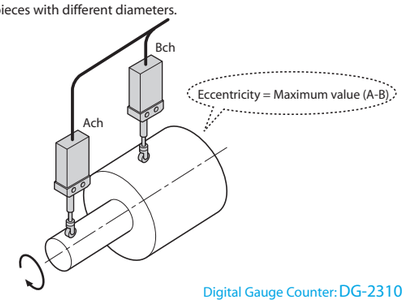
Attach a linear gauge sensor (2ch) perpendicular to the side of a cylindrical part, and measure squareness using the maximum value of the difference between the 2ch (A-B).



Digital Gauge Counter: DG-2310

Measuring eccentricity

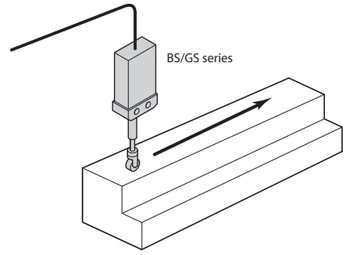
Measure the maximum eccentricity of B relative to A by DG-2310 while rotating the largest workpieces with different diameters.



Digital Gauge Counter: DG-2310

Measuring parallelism

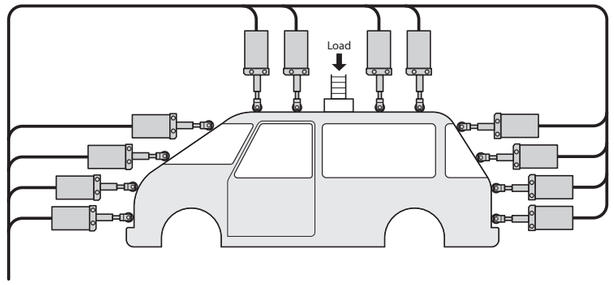
Slide the linear gauge sensor to measure the parallelism (MAX value) of the workpiece and judge pass/fail.



Digital Gauge Counter: DG-4320/4340/5100

Measuring the strength of large molded parts

A certain load is gradually applied to the body or door of a car, and the displacement of the measurement points at that time is measured using multiple channels.
The strength of the body can be determined from the load-displacement relationship.



Signal conversion box: DG-0010/0020

Gauges & Counters connection table

Liner Gauge Sensos

Type	Resolution	Measurement range 10 mm	13 mm	30 mm	50 mm	100 mm
General Protection class IP64	10 µm		GS-1713A P.10	GS-1730A P.10		
	1 µm		GS-1813A P.10	GS-1830A P.10		
Vibration resistant[*1] Protection class IP64	10 µm		GS-6713A P.11	GS-6730A P.11		
	1 µm		GS-6813A P.11	GS-6830A P.11		
Tough Gauge **Vibration resistant, oil-proof Long life**[*2] Protection class IP66G	10 µm		GS-4713A P.12	GS-4730A P.12		
	1 µm		GS-4813A P.12	GS-4830A P.12		
Small Protection class IP66	10 µm	BS-1210 P.8				
	1 µm	BS-1310 P.8				
Long stroke Protection class IP5X	10 µm				GS-5050A P.130	GS-5100A P.13
	1 µm				GS-5051A P.13	GS-5101A P.13
High resolution Protection class IP66G	0.1 µm		GS-3813B P.9	GS-3830B P.9		

*1: Vibration resistant type means that the sensor is not damaged even if prescribed shock vibration is added. It does not guarantee the normal measurement under vibration or shock.
*2: The number of sliding times has tripled compared with the existing model.

Extension signal cable

Model	Points of extension (in between)
AA-8801 to 8804 P.25	①
AA-8811 to 8814 (Bending resistant type) P.25	①
AA-8901 to 8904 P.25	②

Digital Gauge Counter

Model name \ Features	Display LCD	LED	Fluorescent	DIN size	Function 2ch add & sub cal	Offset	MAX hold	MIN hold	Range (MAX-MIN)	Multi plier setting	Output RS-232C	Analog	BCD	Comparator
DG-4320 P.16	○	—	—	72 X 72	—	○	○	○	○	○	—	—	○	—
DG-4340 P.16	○	—	—	72 X 72	—	○	○	○	○	○	—	—	○	○
DG-2310 P.18	—	○	—	144 X 72	○	○	○	○	○	—	○	○	○	○
*7 DG-5100 P.14	—	—	○	96 X 48	—	○	○	○	○	○	△[*3]	△[*4]	△[*5]	△[*6]

*3: RS-232C card option TM-0350 is required.
*4: BCD option DG-0522 is required
*5: Analog output option DG-0530 is required.
*6: Comparator output option TM-0340 is required.
*7: Connection conversion cable AA-8910 is required

Signal conversion box

Model name \ Features	Output type	Output connector
DG-0010 P.20	Open collector	R03-R6M
DG-0020 P.20	Line driver	R03-R6M

CPU — Customer prepared
Recorder — Customer prepared
PLC — Customer prepared

Option

Mechanical release/Finger lift/Air lifter P.21

These are auxiliary accessories that move the spindle of the linear gauge sensor up and down.

Extension spindle P.21

It is effective for measuring places that cannot be reached with a standard spindle alone, such as measuring the depth of a pin hole.

Gauge head P.22

You may choose the desired gauge head depending on the measurement application. We also offer flat gauge heads and roller gauge heads that can be used on production lines.

Dust proof rubber P.23

Mounting fixture P.23

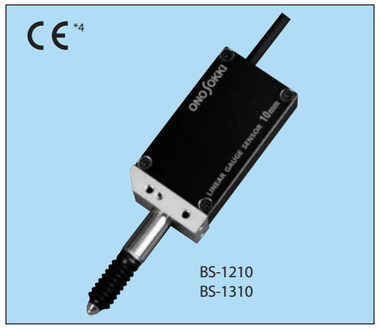
For mounting a linear gauge sensor.

Gauge stand P.24

There are three types of gauge stands to secure the linear gauge sensor. Please choose based on the stem diameter of linear gauge sensor. For those using linear gauge sensors with different stem diameters, stand bushes for changing the stem diameter are also available.

Linear Gauge sensor

BS series (Baby Gauge sensor)



BS-1210/1310

- Detects various dimensions, displacements, and amounts of movement.
- Conforms to the protection class IP66.
- Achieves excellent durability and vibration and shock resistance despite a compact body.

Specifications

Item \ Model name	BS-1210	BS-1310
Measurement range	10 mm	
Resolution	10 µm	1 µm
Accuracy (at +20)	3 µm	
Maximum response speed*1	1 (4) m/s	0.3 (1.2) m/s
Measurement force (downward)*2	1.47 or less	
Number of strokes	30 million times	
Protection class	IP 66 (excluding connector)	
Stem diameter	ø8 $mm^{+0}_{-0.03}$ mm	
Power supply	DC 4.5 to 5.5 V	
Power consumption (DC 5 V)	30 mA or less	50 mA or less
Output signal (DC 5 V)	Two-phase square wave, phase difference: 90°± 20° Output voltage Hi: +4.5 V or more (no load) Lo: +0.4 V or less	
Output impedance	Approx. 33 Ω (PTC thermistor at 25 °C)	
Vibration resistance (when the power is off)*3	98 m/s^2 in each of the three axial directions (150 minutes per each) 20 cycles of 10 Hz to 150 Hz sweeping	
Shock resistance (when the power is off)*3	980 m/s^2 three times each in the x, y, and z directions, and in the positive and negative directions of each axis, half sine wave, application time: 6 ms	
Operating temperature range	0 to +50 °C	
Storage temperature range	-10 to +65 °C	
Cable length	Approx. 1.9 m	
Weight (including cable)	Approx. 110 g	
Accessory	Instruction manual	

*1. When used with Ono Sokki's Gauge Counter. The values within parentheses ( ) is the maximum response speed with the DG-4320/4340/5100.
*2. There may be rare cases where the spindle's range of motion is abnormal. If an abnormality occurs, manually move the spindle to its full stroke.
*3. Vibration/shock resistance values described in above are not guaranteed during measurement operation.
*4. Disconnected or modified signal cable is not applicable to CE marking.

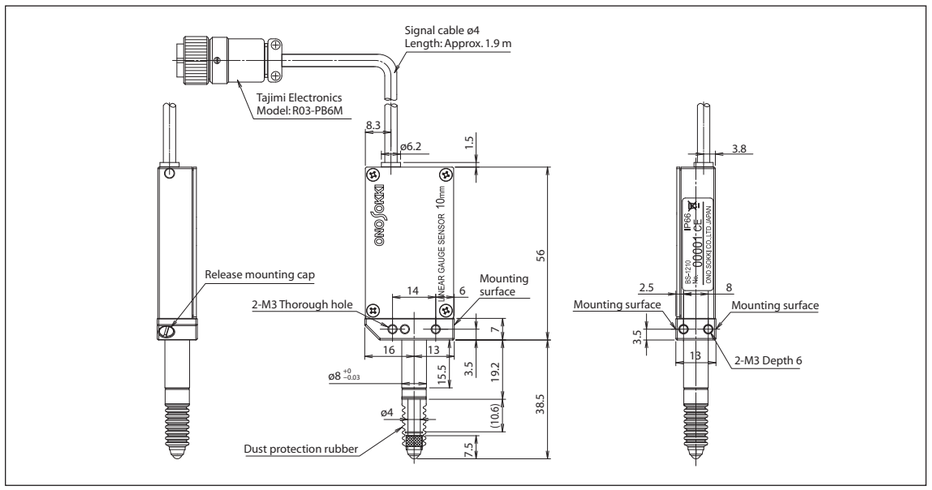
Options

Mechanical release*5	AA-813
Gauge stand	ST-022
Dust protection rubber for replacement	AA-973
Gauge head*6	Various
Extension spindle	AA-844 (30 mm), AA-845 (50 mm)
Extension signal cables	Various

*5. IP66 is not guaranteed when a release is used.
*6. IP66 is not guaranteed when a gauge head is used as a dust protection rubber is removed.

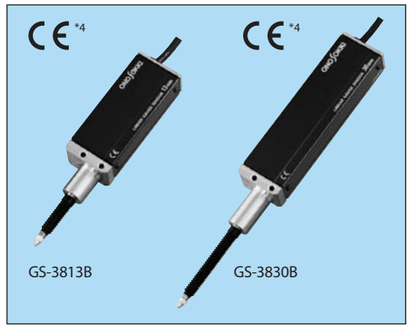
Outer dimensions

(Unit: mm)



Linear Gauge sensor

GS-3800B series (High resolution type)



GS-3813B/3830B

- 0.1 µm high resolution
- Protection class: IP66G
  Dust-proof, water-proof and oil-proof
- Greatly improved bearing life and environmental resistance

Specifications

Item \ Model name	GS-3813B	GS-3830B
Measurement range	13 mm	30 mm
Applicable Digital Gauge Counter	DG-5100	
Resolution	0.1 µm	
Accuracy (at 20°C)	1 µm	
Maximum response speed*1	0.3 m/s (1.2 m/s)	
Measurement force (downward)*2	2.3 N or less	2.7 N or less
The number of sliding times (proven in our endurance test)	15 million times	
Protection class (not including connector part)	IP66G	
Stem diameter	ø15 $^{+0}_{-0.009}$ mm	
Power requirement	4.5 to 5.5 VDC	
Power consumption (when 5VDC)	150 mA or less	
Signal output (when 5VDC)	90°phase-differential, square wave, applicable to RS422A, line driver output (equivalent to 26C31)	
Vibration resistance (When the power is off.)*3	196 m/s^2 in each of the three axial directions (75 minutes per each), 10 cycles of 10 Hz to 150 Hz sweeping	
Shock resistance (When the power is off.)*3	1960 m/s^2 three times each in the x, y, and z directions, and in the positive and negative directions of each axis, half sine wave, application time: 6 ms	
Operating temperature range	0 to +40 °C	
Storage temperature range	-10 to +55 °C	
Cable length	Approx. 4.9 m	
Weight (including cable, connector)	Approx.350 g	Approx.420 g
Accessories	Instruction manual, spanner	

*1. When used with Ono Sokki's Gauge Counter. The values within parentheses ( ) are the maximum response speed used with the DG-5100.
*2. When used in an upward position, the spindle may not return completely.
*3. Vibration/shock resistance values described in above are not guaranteed during measurement operation.
*4. Disconnected or modified signal cable is not applicable to CE marking.

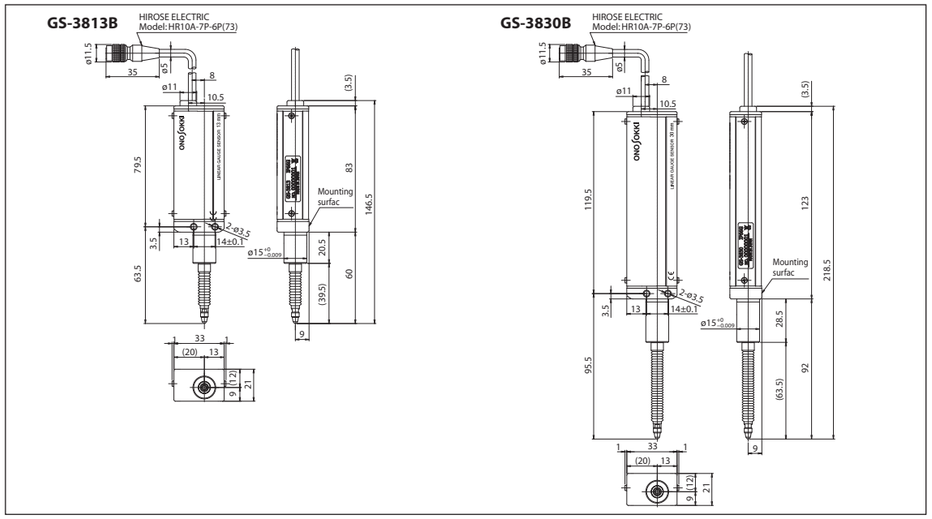
Options

Finger lift	AA-969
Gauge stand	ST-0230
Dust-protective rubber (spare)	AA-4104 (13 mm), AA-4105 (30 mm)*5
Extension spindle	AA-844 (30 mm), AA-845 (50 mm)
Gauge head	Various
Mounting fixture	AA-3310
Extension cable	AA-8901 (5 m), AA-8902 (10 m), AA-8903 (20 m), AA-8904 (30 m)

*5. Dust-protective rubber is subject to replacement charge.

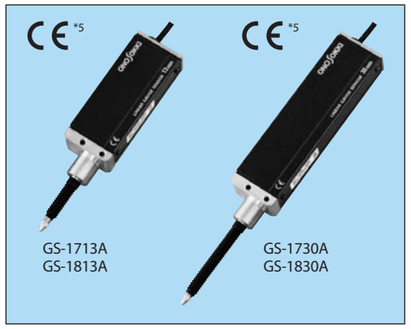
Outer dimensions

(Unit: mm)



Linear Gauge sensor

GS-1700A/1800A series (Basic type)



GS-1713A/1730A
GS-1813A/1830A

- Ono Sokki Linear Gauge Sensor standard
- Protection class: IP64
- Ball bearings ensure stable spindle movement for a long time.

Specifications

Item \ Model name	GS-1713A	GS-1730A	GS-1813A	GS-1830A
Measurement range	13 mm	30 mm	13 mm	30 mm
Resolution	10 µm		1 µm	
Accuracy (at +20 °C)	3 µm		2 µm	3 µm
Maximum response speed*1	1 (4) m/s		0.3 (1.2) m/s	
Measurement force (downward)*2	1.3 N or less	1.9 N or less	1.3 N or less	1.9 N or less
Measurement force change range (option)*3	0.6 to 1.3 N	0.7 to 1.9 N	0.6 to 1.3 N	0.7 to 1.9 N
Number of sliding times (proven in our endurance test)	6.5 million times			
Protection class (excluding connector part)	IP64			
Stem diameter	ø15$^{+0}_{-0.009}$ mm			
Power supply	4.5 to 5.5 VDC			
Power consumption (when 5 VDC)	120 mA or less			
Signal output (when 5 VDC)	Two-phase square wave, phase difference: 90° ± 20° Output voltage Hi: 4.5 V or more Lo: 0.4 V or less			
Output impedance	Approx. 22 Ω			
Vibration resistance (when the power is off)*4	98 m/s² in each of the three axial directions (75 minutes per each), 10 cycles of 10 Hz to 150 Hz sweeping			
Shock resistance (when the power is off)*4	1960 m/s² three times each in the x, y, and z directions, and in the positive and negative directions of each axis, half sine wave, application time: 6 ms			
Operating temperature range	0 to +40 °C			
Storage temperature range	-10 to +55 °C			
Cable length	Approx. 1.9 m			
Weight (including cable, connector)	Approx. 250 g	Approx. 310 g	Approx. 250 g	Approx. 310 g
Accessories	Instruction manual, spanner			

*1. When used with Ono Sokki's Gauge Counter. The values within parentheses ( ) are the maximum response speed used with the DG-4320/4340/5100.
*2. When used in an upward position, the spindle may not return completely.
*3. The value when facing downwards. A spindle may not return completely if it is facing upwards.
*4. Vibration/shock resistance values described in above are not guaranteed during measurement operation.
*5. Disconnected or modified signal cable is not applicable to CE marking.

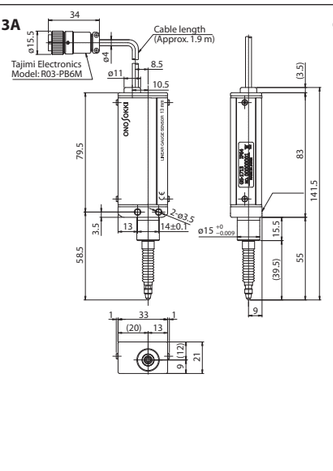
Options

Finger lift	AA-969
Gauge stand	ST-0230
Spare dust proof rubber	AA-4102 (13mm), AA-4103 (30mm)
Extension spindle	AA-844 (30mm), AA-845 (50mm)
Measurement tip	Various types
Mounting fixture	AA-3310
Extension cable	AA-8801 (5 m) AA-8802 (10 m) AA-8803 (20 m) AA-8804 (30 m)

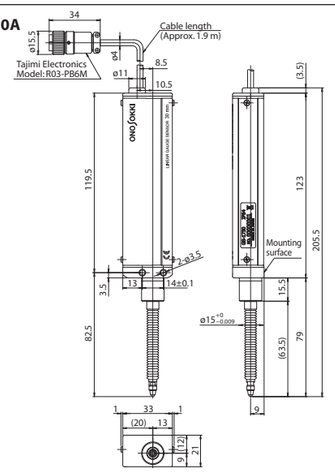
Outer dimensions

(Unit: mm)

GS-1713A/1813A

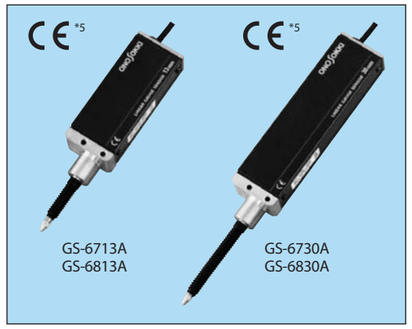


GS-1730A/1830A



Linear Gauge sensor

GS-6700A/6800A series (Vibration resistant type)



GS-6713A/6730A
GS-6813A/6830A

- 1.5 times stronger vibration and shock resistance than Ono Sokki's standard gauges
- Protection class: IP64
- Ideal for use with automated machines

Specifications

Item \ Model name	GS-6713A	GS-6730A	GS-6813A	GS-6830A
Measurement range	13 mm	30 mm	13 mm	30 mm
Resolution	10 µm		1 µm	
Accuracy (at +20°C)	3 µm		2 µm	3 µm
Maximum response speed*1	1 (4) m/s		0.3 (1.2) m/s	
Measurement force (downward)*2	1.3 N or less	1.9 N or less	1.3 N or less	1.9 N or less
Measurement force change range (option)*3	0.6 to 1.3 N	0.7 to 1.9 N	0.6 to 1.3 N	0.7 to 1.9 N
Number of sliding times (proven in our endurance test)	6.5 million times			
Protection class (excluding connector section)	IP64			
Stem diameter	ø15$^{+0}_{-0.009}$ mm			
Power requirement	4.5 to 5.5 VDC			
Power consumption (when 5 VDC)	120 mA or less			
Signal output (when 5 VDC)	Two-phase square wave, Phase difference: 90°± 20°, Output voltage Hi: 4.5 V or more Lo: 0.4 V or less			
Output impedance	Approx. 22 Ω			
Vibration resistance (when the power is off)*4	147 m/s² in each of three axial directions (for 75 minutes each) 10 cycles of 10 to 150 Hz sweep			
Shock resistance (when the power is off)*4	1470 m/s² three times each in the x, y, and z directions, and in the positive and negative directions of each axis, half sine wave, application time: 6 ms			
Operating temperature range	0 to +40 ºC			
Storage temperature range	-10 to +55 ºC			
Cable length	Approx. 1.9 m			
Weight (including cable and connector)	Approx. 250 g	Approx. 310 g	Approx. 250 g	Approx. 310 g
Accessories	Instruction manual, spanner			

*1. When used with Ono Sokki's Gauge Counter. The values within parentheses ( ) is the maximum response speed with the DG-4320/4340/5100.
*2. When used in an upward position, the spindle may not return completely.
*3. The value when facing downwards. A spindle may not return completely if it is facing upwards.
*4. Vibration/shock resistance values described in above are not guaranteed during measurement operation.
*5. Disconnected or modified signal cable is not applicable to CE marking.

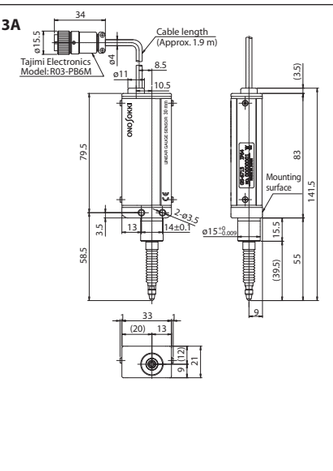
Options

Finger lift	AA-969
Gauge stand	ST-0230
Dust-protective rubber (spare)	AA-4102 (13 mm), AA-4103 (30 mm)
Extension spindle	AA-844 (30 mm), AA-845 (50 mm)
Gauge head	Various
Mounting fixture	AA-3310
Extension cable	AA-8901 (5 m), AA-8902 (10 m), AA-8903 (20 m), AA-8904 (30 m)

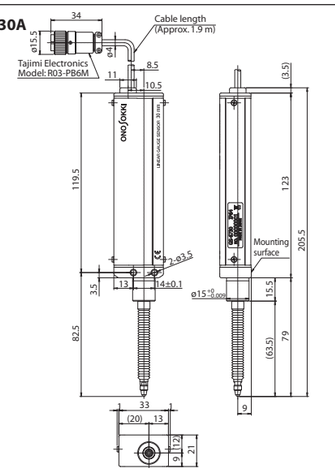
Outer dimensions

(Unit: mm)

GS-6713A/6813A

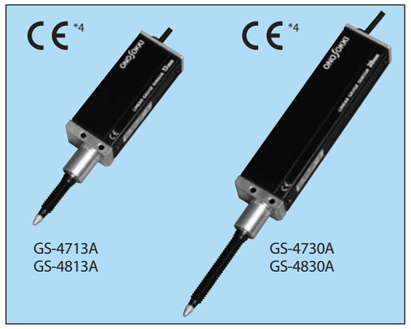


GS-6730A/6830A



Linear Gauge sensor

GS-4700A/4800A series (Long life type)



GS-4713A/4730A
GS-4813A/4830A

- Bearing life is more than twice as long as the GS-1700A/1800A.
- Protection class: IP66G
- Tough gauge with long life and high environmental resistance

Specifications

Item \ Model name	GS-4713A	GS-4730A	GS-4813A	GS-4830A
Measurement range	13 mm	30 mm	13 mm	30 mm
Resolution	10 µm		1 µm	
Accuracy (at +20°C)	3 µm		2 µm	3 µm
Maximum response speed *1	1 (4) m/s		0.3 (1.2) m/s	
Measurement force (downward)*2	1.8 N or less	2.4 N or less	1.8 N or less	2.4 N or less
Number of sliding times (proven in our endurance test)	15 million times			
Protection class (excluding connector section)	IP66G			
Stem diameter	ø15$^{+0}_{-0.009}$ mm			
Power requirement	4.5 to 5.5 VDC			
Power consumption (when 5 VDC)	120 mA or less			
Signal output (when 5 VDC)	Two-phase square wave, Phase difference: 90°± 20°, Output voltage Hi: 4.5 V or more Lo: 0.4 V or less			
Output impedance	Approx. 22 Ω			
Vibration resistance (when the power is off)*3	196 m/s^2 in each of three axial directions (for 75 minutes each) 10 cycles of 10 to 150 Hz sweep			
Shock resistance (when the power is off)*3	1960 m/s^2 three times each in the x, y, and z directions, and in the positive and negative directions of each axis, half sine wave, application time: 6 ms			
Operating temperature range	0 to +40 °C			
Storage temperature range	-10 to +55 °C			
Cable length	Approx. 4.9 m			
Weight (including cable and connector)	Approx. 325 g	Approx. 385 g	Approx. 325 g	Approx. 385 g
Accessories	Instruction manual, spanner			

*1. When used with Ono Sokki's Gauge Counter. The values within parentheses ( ) are the maximum response speed used with the DG-4320/4340/5100.
*2. When used in an upward position, the spindle may not return completely.
*3. Vibration/shock resistance values described in above are not guaranteed during measurement operation.
*4. Disconnected or modified signal cable is not applicable to CE marking.

Options

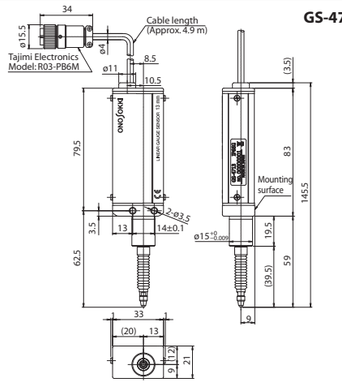
Finger lift	AA-969
Gauge stand	ST-0230
Dust-protective rubber (spare)	AA-4104 (13 mm), AA-4105 (30 mm)
Extension spindle	AA-844 (30 mm), AA-845 (50 mm)
Gauge head	Various
Mounting fixture	AA-3310
Extension cable	AA-8801 (5 m), AA-8802 (10 m), AA-8803 (20 m), AA-8804 (30 m)

*5. Silicone rubber attached type (E) is also available. Its protection class is IP64.
Dust-protective rubber is subject to replacement charge. (excluding silicone rubber attached type)

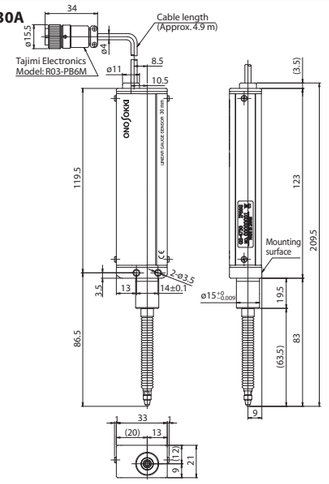
Outer dimensions

(Unit: mm)

GS-4713A/4813A

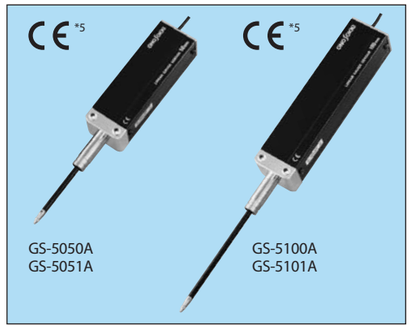


GS-4730A/4830A



Linear Gauge sensor

GS-5050A/5100A series (Long stroke type)



GS-5050A/5100A
GS-5051A/5101A

- Measurement range: 50 mm, 100 mm
- Protection class: IP5X
- Capable of highly accurate displacement measurement of large objects such as building materials and large molded products.

Specifications

Item \ Model name	GS-5050A	GS-5100A	GS-5051A	GS-5101A
Measurement range	50 mm	100 mm	50 mm	100 mm
Resolution	10 µm		1 µm	
Accuracy (at +20°C)	10 µm	12 µm	4 µm	5 µm
Maximum response speed *1	1 (4) m/s		0.3 (1.2) m/s	
Measurement force (downward)*2	2.9 N or less	5.2 N or less	2.9 N or less	5.2 N or less
Measurement force change range (option)*3	approx. 1.8 to 2.9 N	approx. 3.4 to 5.2 N	approx. 1.8 to 2.9 N	approx. 3.4 to 5.2 N
Number of sliding times (proven in our endurance test)	15 million times			
Protection class (excluding connector section)	IP5X			
Stem diameter	ø15$^{+0}_{-0.009}$ mm			
Power requirement	4.5 to 5.5 VDC			
Power consumption (when 5 VDC)	120 mA or less			
Signal output (when 5 VDC)	Two-phase square wave, Phase difference: 90°± 20°, Output voltage Hi: 4.5 V or more Lo: 0.4 V or less			
Output impedance	Approx. 22 Ω			
Vibration resistance (when the power is off)*4	147 m/s^2 in each of three axial directions (for 75 minutes each) 10 cycles of 10 to 150 Hz sweep			
Shock resistance (when the power is off)*4	1470 m/s^2 three times each in the x, y, and z directions, and in the positive and negative directions of each axis, half sine wave, application time: 6 ms			
Operating temperature range	0 to +40 °C			
Storage temperature range	-10 to +55 °C			
Cable length	Approx. 4.9 m			
Weight (including cable and connector)	Approx. 570 g	Approx. 655 g	Approx. 570 g	Approx. 655 g
Accessories	Instruction manual			

*1. When used with Ono Sokki's Gauge Counter. The values within parentheses ( ) is the maximum response speed with the DG-4320/4340/5100.
*2. When used in an upward position, the spindle may not return completely.
*3. The value when facing downwards. A spindle may not return completely if it is facing upwards.
*4. Vibration/shock resistance values described in above are not guaranteed during measurement operation.
*5. Disconnected or modified signal cable is not applicable to CE marking.

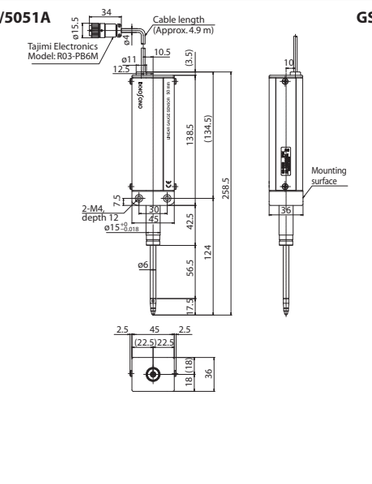
Options

Finger lift	AA-969
Gauge stand	ST-0230/044B
Extension spindle	AA-844 (30 mm), AA-845 (50 mm)
Gauge head	Various
Mounting fixture	AA-8560
Extension cable	AA-8801 (5 m), AA-8802 (10 m), AA-8803 (20 m), AA-8804 (30 m)

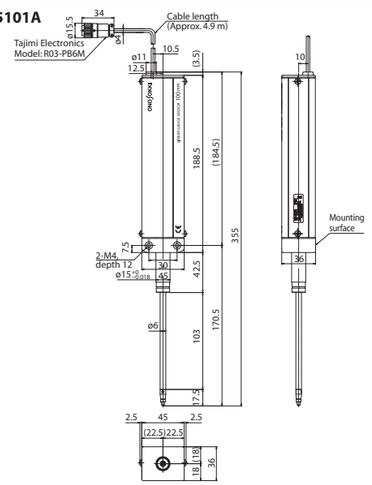
Outer dimensions

(Unit: mm)

GS-5050A/5051A



GS-5100A/5101A



Digital Gauge Counter

DG-5100 (0.1 µm resolution)

DG-5100

- For Linear gauge sensor with 0.1 µm resolution
- Achieves the spindle speed equivalent to the linear gauge sensor with 1 µm resolution.
- The necessary functions such as BCD output, analog output and comparator output can be flexibly selsected and installed.

Specifications

Item \ Model name		DG-5100
Applicable sensors*1		GS, BS series
Display		Fluorescent display tube, 7 digits
Measurement range*2		0.0000 to ±99.9999 / 0.000 to ±999.999 / 0.00 to ±9999.99 mm
Calculation functions		MAX value, MIN value, MAX value – MIN value(Range) hold, coefficient correction function, offset value setting, panel condition memory
Input signal		Square wave, phase difference: 90°, Line driver output or voltage output
External control input signal		Hold, reset
Power requirement		100 to 240 VAC (50/60 Hz), 30 VA or less
Operating temperature range		0 to +50 °C
Storage temperature range		-10 to +60 °C
Outer dimensions		96(W)×48(H)×148(D) mm
Weight		Approx. 370 g
Accessories		Instruction manuals, MC1.5/3-ST3.5 connector, mounting fixtures*3
Options	DG-0522 BCD output	Output of BCD data with open collector (update time: 10 ms)
	DG-0530 Analog output	Output method : Selectable from voltage or current Conversion method : 12 bit D/A Output voltage : -10 to +10 V/FS (FS is variable setting.) Output current : 0 to 16 mA or 4 to 20 mA/FS (FS is variable setting.) Load resistance : 100 kΩ or more at voltage output, 500 Ω or less at current output Linearity error : ±0.3 % FS
	TM-0301 DC power supply	DC 12 to 24 V
	TM-0340 Comparator output	Output format: 1-make contact output (semiconductor relays) 3 outputs of COMP1, COMP2, COMP3 Maximum contact capacity: 30 VDC/1A 250 VAC/1A
	TM-0350 RS-232C	RS-232C function Communication method: Serial communications (asynchronous) Transmission rate (baud rate): Selectable from 9600 bps or 19200 bps Reading out of measurement data, setting or reading out of parameters Connector: MC1, 5/10-ST3.5
	AX-2050N	Power supply cable with crimp-type terminals (3 m)

*1. When using a linear gauge sensor other than GS-3813B/3830B, you will need the connection conversion cable AA-8910.
*2. Counts up to ±400,000.
*3. Power supply cable is not provided as accessory.

BCD Input/Output

Output form:
7-digit parallel output, polarity output

Output type:
Open collector

Sink current:
max 32mA

Output withstand voltage:
max 24V

Data refreshing interval:
About 10 ms

Receptacle:
HDR-EC50LFDT1-SLE+

Plug:
HDR-E50MAG1+

Plug case:
HDR-E50LPA5-LS

Pin No		Signal	
1	BCD output	1×10^0	BCD output
2		2×10^0	
3		4×10^0	
4		8×10^0	
5	BCD output	1×10^1	
6		2×10^1	
7		4×10^1	
8		8×10^1	
9	BCD output	1×10^2	
10		2×10^2	
11		4×10^2	
12		8×10^2	
13	BCD output	1×10^3	
14		2×10^3	
15		4×10^3	
16		8×10^3	
17	BCD output	1×10^4	
18		2×10^4	
19		4×10^4	
20		8×10^4	
21	BCD output	1×10^5	
22		2×10^5	
23		4×10^5	
24		8×10^5	
25	BCD output	1×10^6	
26		2×10^6	
27		4×10^6	
28		8×10^6	

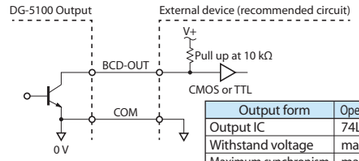
Pin No		Signal	
29	Start calculation		Starting various calculations by signal input
30	Stop calculation		Stopping various calculations by signal input
31		NC	
32	COMP output 1		ON when comparator is operating
33	COMP output 2		ON when comparator is operating
34	COMP output 3		ON when comparator is operating
35		NC	
36	Polarity output +		Set the gauge spindle push direction to the + direction (positive logic)
37	Polarity output –		Set the gauge spindle pull direction to the + direction (positive logic)
38		NC	
39	DP1	1	Number of decimal places
40	DP2	2	
41	DP3	3	
42	DP4	4	
43		NC	
44		NC	
45	Hold input		
46	Reset input		
47	Print command		ON when print command is output
48	Error output		ON at error
49		NC	
50	COM		

DP	1	2	3	4	
	OFF	OFF	OFF	OFF	XXXXXXX
	OFF	OFF	OFF	ON	XXXXXX.X
	OFF	OFF	ON	OFF	XXXXX.XX
	OFF	OFF	ON	ON	XXXX.XXX
	OFF	ON	OFF	OFF	XXX.XXXX
	OFF	ON	OFF	ON	XX.XXXXX
	OFF	ON	ON	OFF	X.XXXXXX

External signal input/output

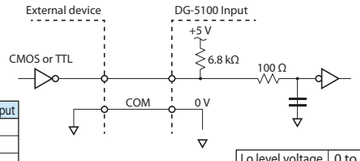
Recommended interface

(1) Interface circuit for output signals (error output, print command output)



Output form	Open collector output
Output IC	74LS06
Withstand voltage	max24 V
Maximum synchronism current	max32 mA
Residual voltage	max0.5 V

(2) Interface circuit for input signals (start/stop, hold, reset)

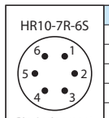


Lo level voltage	0 to 1.4 V
Hi Level voltage	3 to 5.25 V
Impedance	1 kΩ or more

Input/Output signal

Linear gauge sensor input signal

90-degree phase difference square wave
Line driver, RS422A or equivalent
(By using the conversion cable AA-8910, it also supports voltage signals.)



Pin No	Signal
1	Sig1
2	$\overline{Sig1}$
3	Sig2
4	$\overline{Sig2}$
5	+5 V
6	COM

RS-232C communication

RS-232C communication
Communication method: Serial communication (start-stop transmission)
Baud rate: 9600bps/19200bps
Gate output
Control function: Start / Stop / Reset

Analog Output

Output signal	Voltage/current selectable
Output mode	12 bits D/A conversion method (The resolution changes depending on the setting value)
Output	Voltage range: -10 to 10V
	Current range: 4 to 20 mA, 0 to 16 mA
Load resistance	Voltage output: 100 kΩ or higher
	Current output: 500 Ω or lower
	Linearity: ± 0.3% FS
Zero drift	± 0.05% FS/ºC
Span drift	± 0.05% FS/ºC
Output refresh time	About 10 ms
Connecting screw for terminal block	M3

Comparator function

Three outputs: COMP1, COMP2, and COMP3. The relay can be switched ON/OFF.

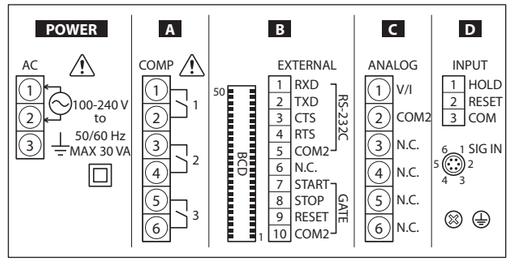
Mode 1 : UPPER and LOWER outputs can be set for each comparator.
UPPER setting: 7-digit setting, Turns on relay when UPPER ≦ count value display value)
LOWER setting: 7-digit setting, Turns on relay when LOWER ≧ count value display value

Mode 2 (WINDOW) : Upper and lower limits can be set for each comparator. It turns on when the displayed value is between the upper and lower limits. setting: Turns on relay when LOWER ≦ count value display value) ≦ UPPER

Automatic recover : After the contact turns ON, if the displayed value falls below the judgment level again, the contact turns OFF (restores).

Connecting screw for terminal block: M3

Rear panel



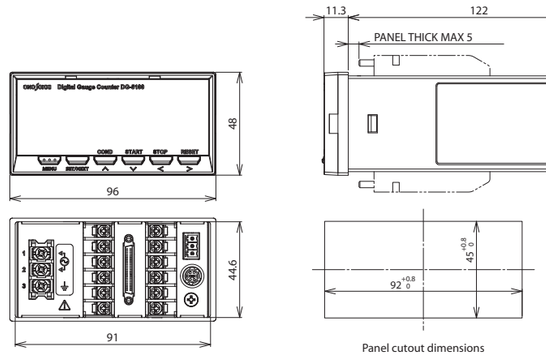
Slot functions

Slot name	Function		Model name
POWER	AC power supply: 100 to 240 VAC (50/60 Hz)	standard	–
	DC power supply: DC12 to 24 V±5 %	option	TM-0301
A slot	Comparator output: 3 outputs	option	TM-0340
B slot*3	BCD output: Output of BCD data with open collector (update time: 10 ms) 7 digits parallel output	option	DG-0522
	RS-232C	option	TM-0350
C slot	Analog output: Voltage/current selection	option	DG-0530
D slot	Usage for line driver, voltage signal (required conversion connector), power supply for sensor 5 V	standard	–

*3 Either one of the two is available

Outer dimensions

(Unit: mm)



Digital Gauge Counter

DG-4320/4340 (Compact, general type)

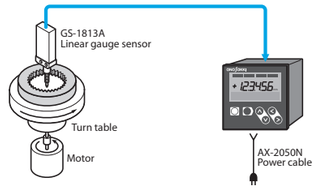
DG-4320

DG-4340

DG-4320/4340

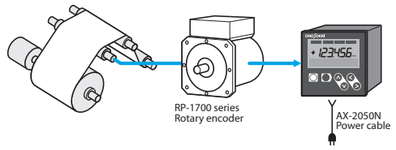
- Compatible with all linear gauge sensors made by Ono Sokki (excluding GS-3800B series).
- Multiplication switching function, Panel condition memory, Calculation functions such as MAX, MIN and RANGE.

<Application example 1> Pass/Fail judgment of flatness using RANGE function



Turn around the measurement object using the linear gauge sensor. Flatness can be measured easily to see MAX value and MIN value. By using the comparator function of the DG-4340, the pass/fail judgment of the flatness can be made.

<Application example 2> Length measurement using pulse counter function



By selecting an encoder as the connecting sensor, it can be used as a pulse counter.
It is also possible to double a single-phase pulse signal.

- Compatible with 12 V power supply sensor (optional)
  It enables to count 1-phase pulse signals from rotation detectors or signals from encoders.
- 3-ch comparator function can make Pass/Fail judgment (DG-4340)
  Backlight turns red when the comparator is operating.

Specifications

Item \ Model name	DG-4320	DG-4340
Display	LCD display, segment and dot matrix display, 2-color backlight 6-digit, 0 to ±199999 (0 or 5 is displayed on the first digit when the resolution of 0.5 µm is selected.)	
Applicable sensor	Linear gauge sensors by Ono Sokki (excluding the GS-3800 series)*1 2-phase and 1-phase square wave voltage output type sensors by Ono Sokki (encoder etc.)	
Power supply for sensor	DC5 V 200 mA, DC12 V 150mA option: when DG-0430 attached	
Input signal	2-phase with 90 degree phase difference square wave or 1-phase square wave (Can be changed by setup menu)	
Resolution selection	Can be selected from 0.5 µm, 1 µm or 10 µm	
Display values	Instantaneous value, Max value, Min value, RANGE value (Max value-Min value)	
Calculation function	Offset setting, Factor setting, Multiplication switching, Number of decimal place setting	
Digital output	BCD output, update cycle: 10 ms, open collector output (Positive or negative logic can be selectable)	
Comparator	–	3-ch semiconductor relay The setup can be changed by upper comparator, lower comparator or OK/NG comparator. Backlight turns red when the comparator is "ON".
Panel condition memory function	Setup parameters can be stored to a counter (4 conditions)	
Outer dimensions	72(W) × 72(H) × 114(D) mm	
Weight	approx.320 g	
Power supply	AC 100 to 240 V (50/60 Hz), 6 VA or less (at AC 100 V)	
Operating temperature range	0 to +40 °C	
Storage temperature range	-10 to +55 °C	
Accessories	Instruction manual, panel mounting fixtures, terminal block cover*2	
Option	DG-0430 (DC12 V), AA-8107 (BCD cable:3 m), AX-2050N (Power cable:3 m)	

*1. Please contact your nearest distributor or Ono Sokki sales office nearby when you use DG-4300 series in combination with BS-102 series (discontinued).
*2. Power cable is not provided as an accessory.

DG-0430 Power supply alteration for sensor (option)

Input connector : R03R6F
Pin assignment : A—SIG1
B—SIG2
C—12 V
D—N.C.
E—COM
F—N.C.

The DG-0430 is required when connecting to an encoder or rotation detector that requires a 12 V power supply. *1*2

*1. If DG-0430 is added, please note that it cannot be connected to a linear gauge sensor.
*2. We can also provide cables to connect to our encoders (use D5UL cable for the connection cable).

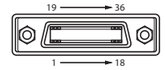
BCD Input/Output

BCD output Pin assignment

Pin No	Signal description	Pin No	Signal description
1	1×10^0 BCD output	19	4×10^4
2	2×10^0	20	8×10^4
3	4×10^0	21	Start calculation
4	8×10^0	22	Stop calculation
5	1×10^1 BCD output	23	Display selection input 1
6	2×10^1	24	Display selection input 2
7	4×10^1	25	Polarity output +
8	8×10^1	26	Polarity output –
9	1×10^2 BCD output	27	Decimal point 1
10	2×10^2	28	Decimal point 2
11	4×10^2	29	1×10^5 BCD output
12	8×10^2	30	Error output
13	1×10^3 BCD output	31	Hold input
14	2×10^3	32	Reset input
15	4×10^3	33	Busy input
16	8×10^3	34	Comparator gate input
17	1×10^4 BCD output	35	Print command output
18	2×10^4	36	Common

Receptacle:
DX10A-36S (Hirose electric)
Plug:
DX40-36P (Hirose electric)
Plug case:
DX36-CV1 (Hirose electric)

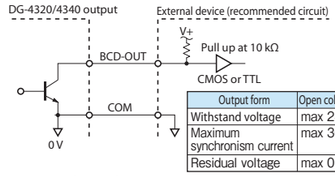
Main unit connector figure



BCD cable (3 m) one side open
AA-8107

Interface for output signals

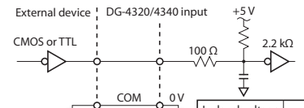
The BCD data output, polarity output, decimal point output, error output, and print command output are all open collector outputs.
Please pay attention to the rated voltage etc. when using.



Output form	Open collector output
Withstand voltage	max 24 V
Maximum synchronism current	max 30 mA
Residual voltage	max 0.5 V

Interface for input signals

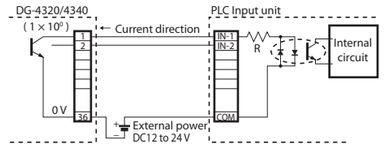
START/STOP input, display switching input, hold input, reset input, busy input, and comparator gate input execute commands via external contact input.



Lo level voltage	0 to 1.4 V
Hi Level voltage	3 to 5.25 V
Impedance	1 kΩ or more

Connection between the PLC and the BCD out

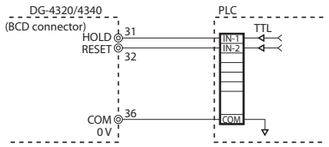
The BCD output is an open collector output, thus please use the PLC input unit (DC 12 to 24 V, maximum current 32 mA).



*If the polarity of the external power is connected reversely, the BCD output circuit will be broken. Please be careful not to connect it reversely.

Connection to control signals*

When connecting the hold/reset signal, input a TTL signal (Lo level) to each pin of the BCD connector.



*When a hold signal is input, the BCD output, comparator output, display value (including polarity), and pass/fail judgment (LCD backlight) are held.
• Please be careful when connecting the HOLD/RESET signal as it is a voltage signal input.

Comparator function

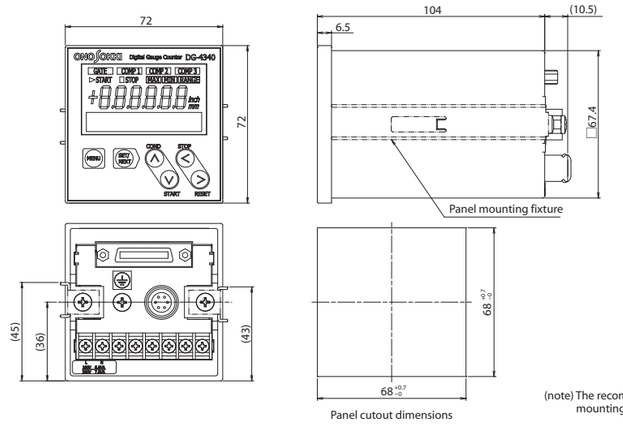
(DG-4340)

Evaluated data	Instantaneous values, main display values (calculated values)	
Output format	Semiconductor relays (one make contact each)	
	Three outputs (COMP1, COMP2, COMP3)	
Output conditions	Upper	ON when UPPER setting ≦ count value
	Lower	ON when LOWER setting ≧ count value
	OK/NG	ON when LOWER setting < count value < UPPER setting
	OFF	Disables the comparator setting
Maximum contact capacity	30 VDC, 100 mA max.	
Output format	Terminal blocks: 6 terminals (M3)	
Output update cycle	10 ms approx.	
Backlight display	Green: OK, Red: Error	

The DG-4340's comparator has three channels. You can select one of three modes for each channel: Lower, Upper, and OK/NG.
In the OK/NG mode, you can set a Lower value and an Upper value for one channel, allowing you to set OK/NG comparators for three channels. Further, in the OK/NG mode, ON/OFF can be reversed by entering a Lower>Upper value.

Outer dimensions

(Unit: mm)



(note) The recommended thickness of the mounting panel is 1 to 3.2 mm.

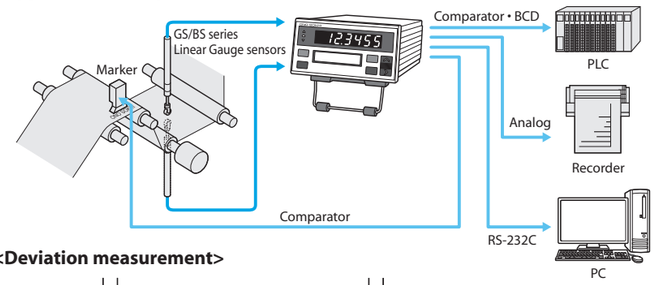
Digital Gauge Counter

DG-2310 (2ch sum-difference calculation function)

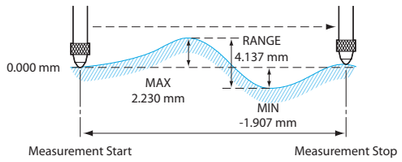
DG-2310

- It can connect up to 2 units of Linear Gauge sensors.
- Equipped with a sum-difference calculation function for step measurement and thickness measurement.

<Application examples> Material thickness measurement and control



<Deviation measurement>



Specifications

Item \ Model name		DG-2310
Applicable sensors		GS/BS series Linear gauge sensor (excluding GS3800B)
Display		Main display: LED - Polarity (-) & numerical values (6 digits), Sub display: LCD - 16 characters x 2 lines, Comparator display: LED - Upper & Lower/Red, Good/Green
Number of input sensors		2 ch
Input signal		Square wave signal with 90-degree phase difference, DC to 100 kHz
External input signal		Input signal type Voltage signals, Non-voltage contact signals
		Reset, peak-hold, hold, and key protection inputs
BCD signal		Output: BCD, Polarity, judgment, error: open collector (Max. 30 V) Input: Reset/Hold, Hi: +4 to +5.25 V, Lo: 0 to 1V
Analog output		0 to ±10 V (Full Scale), 12-bit D/A, Refresh rate: less than 10 ms
RS-232C		Baud rate: 2400/4800/9600 bps Read measurement data and set/read parameters
Comparator output		Setting range at 0 to ±999999, output: LOWER/GOOD/UPPER Semiconductor relay, 30 VAC/0.1A, Refresh rate: less than 10 ms
Mode function	Calculation	A+B, A-B, B
	Peak hold	MAX, MIN, MAX-MIN (RANGE)
	Offset	Setting range at 0 to ±999999
	Resolution selection	0.5 µm, 1 µm, 10 µm
Power supply		AC 100 to 240 V(50/60 Hz)
Operating temperature range		0 to +40 ºC
Storage temperature range		-10 to +55 ºC
Outer dimension		144 (W)×72 (H)×180 (D) mm
Weight		Approx. 1.3 kg
Accessories		Instruction manual, power cable, panel mount fixture, stand foot, terminal socket (10 pin x 1, 5 pin x 1), unit seal, rubber foot
Options		AX-5022B: RS-232C cable (2 m), AA-8107: BCD cable (3 m, one side open)

BCD Input/Output
(BCD signal Pin assignment)

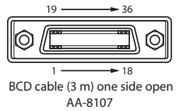
Pin No	Signal type	IN/OUT	Signal descriptions	Pin No	Signal type	IN/OUT	Signal descriptions
1	Data	OUT	1×10^0	19	Data	OUT	4×10^4
2			2×10^0	20			8×10^4
3			4×10^0	21			1×10^5
4			8×10^0	22			2×10^5
5			1×10^1	23			4×10^5
6			2×10^1	24			8×10^5
7			4×10^1	25			Polarity output (+)
8			8×10^1	26			Polarity output (–)
9			1×10^2	27	Judgmen output	OUT	LOWER output
10			2×10^2	28			GOOD output
11			4×10^2	29			UPPER output
12			8×10^2	30	Control output	OUT	Error output
13			1×10^3	31	Control input	IN	Hold input
14			2×10^3	32			Reset input
15			4×10^3	33			Peak-hold input
16			8×10^3	34			
17			1×10^4	35	Control output	OUT	Print command output
18			2×10^4	36	COM	—	COM

Receptacle:
DX10A-36S (Hirose electric)

Plug:
DX40-36P (Hirose electric)

Plug case:
DX36-CV1 (Hirose electric)

Main unit connector figure

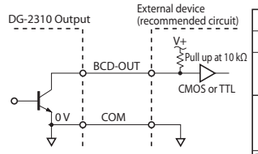


BCD cable (3 m) one side open
AA-8107

External signal input/output
(BCD)

- Recommended interface

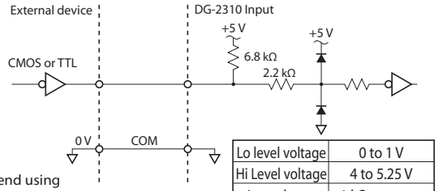
(1) Interface circuit for output signals
(error output, print command output)



Output form	Open collector output
Output IC	74LS07
Withstand voltage*1	max 30 V
Maximum synchronism current	max 32 mA
Residual voltage	max 0.5 V

*1. To improve reliability, recommend using a power supply of +24 V or less.

(2) Interface circuit for input signals
(start/stop, hold, reset)

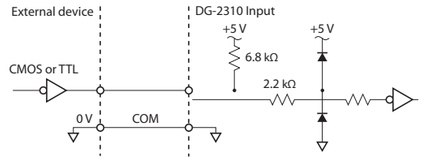


Lo level voltage	0 to 1 V
Hi Level voltage	4 to 5.25 V
Impedance	1 kΩ or more

External signal input
(terminal board)

- Recommended interface

Interface circuit for input signals
(hold, reset, peak-hold, key protect input)



Voltage signal

Lo level voltage	0 to 1 V
Hi Level voltage	4 to 5.25 V

Non-voltage contact signal (open collector)

Open voltage	DC5 ±0.25 (MAX)
Short-circuit current	1 mA (MAX)
Contact resistance	50 Ω or less

RS-232C

Communication mode	Asynchronous full-duplex
Transmission rate (baud rate)	2400/4800/9600
Character length	8 bits
Parity check	None
Stop bit length	1 bit
X parameter control	Disabled
Terminator	CR+LF
Character code	ASCII

Connector: Mini-DIN 8-pin (Hirose Electric)

Pin No.	Signal name	Function	I/O
1	FG (AA)	Signal ground	—
2	RxD (BB)	Receive data	Input
3	TxD (BB)	Send data	Output
4	CTS (CB)	Clear to send	Input
5	RTS (CA)	Request to send	Output
6	DSR (CC)	Not connected	*2
7	COM (AB)	Signal ground	
8	DTR (CD)	Data terminal ready	*2

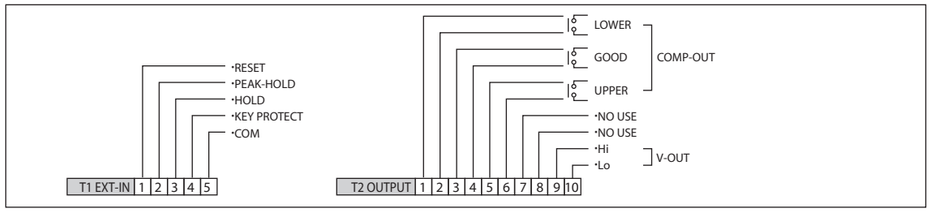
*2. DSR and DTR are connected (short-circuited) internally.

Comparator function
(Setting and judgment)

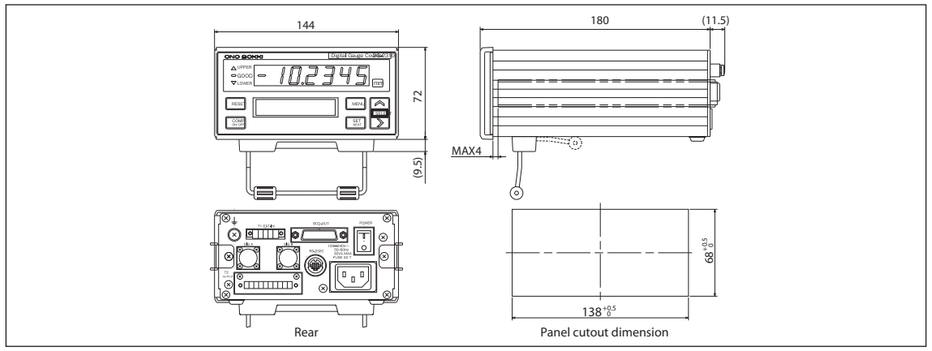
Judgment made as follows:

Judgment criteria	Judgment	Display and output of judgment results	
LOWER setup value ≧ Count value	LOWER	• "LOWER" of status display lights up RED.	• IN/OUT connector: LOWER output (Pin 27)
LOWER setup value < Count value < UPPER setup value	GOOD	• "GOOD" of status display lights up Green.	• IN/OUT connector: GOOD output (Pin 28)
UPPER setup value ≦ Count value	UPPER	• "UPPER" of status display lights up RED.	• IN/OUT connector: UPPER output (Pin 29)

Terminal board



Outer dimensions
(Unit: mm)



DG-0010/0020 (Signal conversion box)

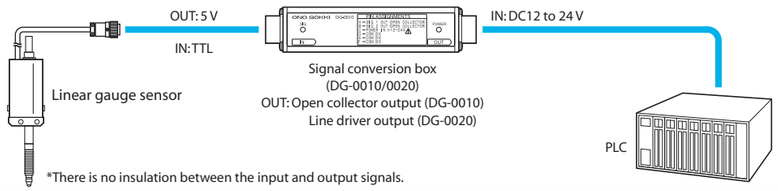
DG-0010/0020

- This is a unit to convert 2-phase signals (TTL) from the linear gauge sensor into open collector (DG-0010) or line driver (DG-0020) signals.
- The DC12 to 24 V power supply, which is common in PLCs, can be converted to DC5 V, which is used for our linear gauge sensors.
- Compact design
- It can be mounted on a control panel using DIN rail. (Dedicated mounting legs are required.)

Specifications

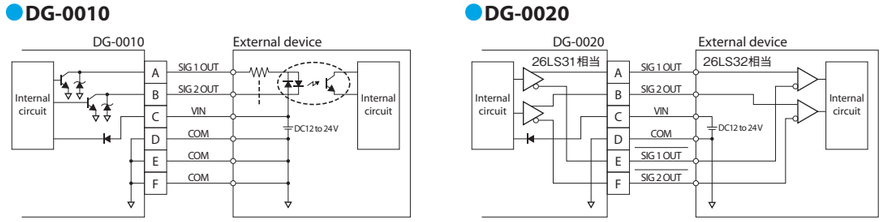
Item \ Model name	**DG-0010** (Open collector output)	**DG-0020** (Line driver output)
Applicable Gauge Sensors	GS/BS series linear gauge sensor (excluding GS-3800 series)	
Input Section		
Signal waveform	90-degree phase difference signals in square wave	
Input level Hi level	3 to 5.25 V	
Input level Lo level	0 to 1.4 V	
Frequency range	DC to 300 kHz (when the sensor made by Ono Sokki is used.)	
Connector (receptacle)	R03-R6F	
Applicable connector (plug)	R03-PB6M	
Output Section		
Output format	Open collector output	Line driver output (equivalent to RS-422A)
Withstand voltage	Max 30 V	–
Synchronism current	Max100 mA	–
Residual voltage	1 V or less	–
Connector (receptacle)	R03-R6M	
Applicable connector (plug)	R03-PB6F or R04-PB6M (waterproof type)	
General Specification		
Power voltage	DC 12 to 24 V	
Current consumption	80 mA (DC 12 V)	120 mA (DC 12 V)
Operating temperature range	0 to 40 ºC	
Storage temperature range	-10 to 55 ºC	
Outer dimensions	23 W ×29 H ×90 D mm (protrusions not included)	
Weight	Approx. 100 g	
Accessory	Instruction manual	
Options	MX-7100 series (Open collector output signal cable), made to order (Line driver signal cable)	

Connection example



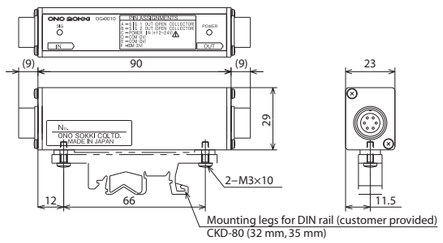
*There is no insulation between the input and output signals.

Output circuit diagram



Outer dimensions

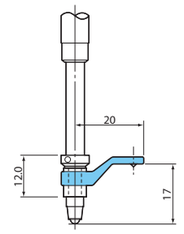
(Unit: mm)



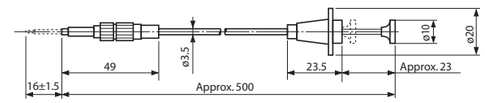
Release /Finger lift

Product name	Model name	Applicable sensors
Finger lift	AA-969	GS-1500A/1600A/1700A/1800A series, GS-4500/4600/4700A/4800A series, GS-6500/6600/6700A/6800A series, GS-3800B series, GS-503, GS-5011, GS-1000, GS-5050A/5100A series, GS-102, GS-251/251W, DG-525H/825/925
Mechanical release	AA-813	DG-525H/825/925 (in combination with Release lifter AA-972), GS-102, BS-102/112, BS-1210/1310, HS-3425

Finger lift **AA-969**



Mechanical release **AA-813**

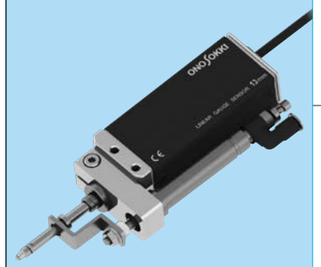


Air lifter (The spindle of the linear gauge sensor rises and falls when air is exhausted and supplied.)

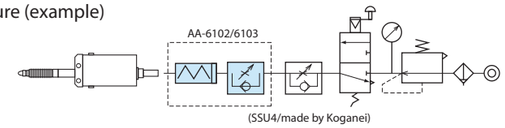
Model name	Applicable gauge sensors	Measurement range (mm)	Air pressure (Mpa)	Weight (g)
AA-6102*1*2	GS-1713A/1813A/3813B/4713A/4813A/6713A/6813A	0 to13	0.25 to 0.7	75
AA-6103*1*2	GS-1730A/1830A/3830B/4730A/4830A/6730A/6830A	0 to 30		85

*1. The Air Lifter AA-6102/6103 (with extension spindle) requires the extension spindle, so the overall length of the linear gauge sensor will be increased by 22 mm/37 mm respectively.
*2. It is required for air piping and electromagnetic valve for ON/OFF operation. The distance between sensor mounting surface and spindle sensor (9 mm) is not changed.

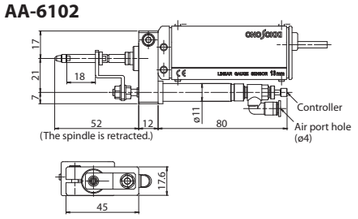
Air lifter



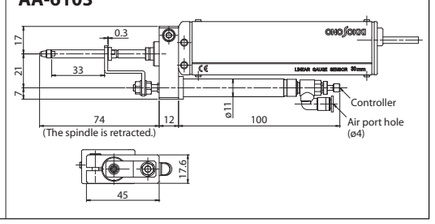
Air piping figure (example)



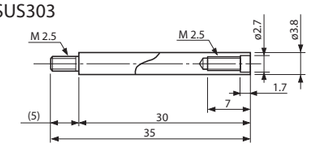
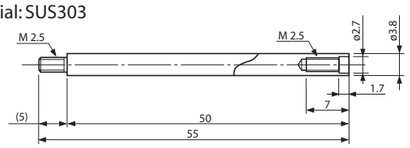
AA-6102



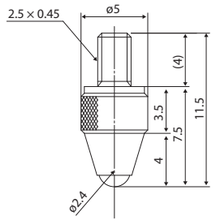
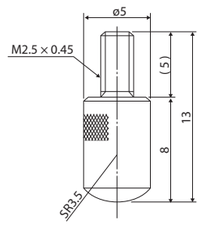
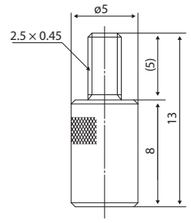
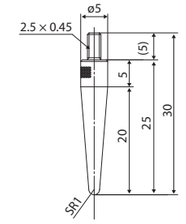
AA-6103

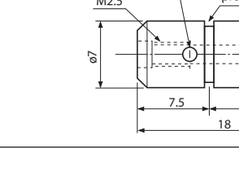
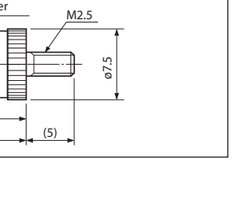


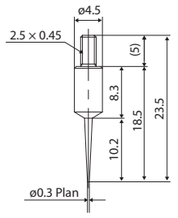
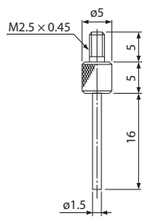
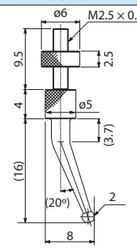
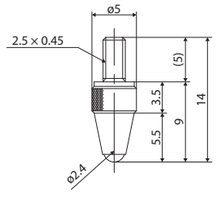
Extension spindle (depth measurement for pin hole)

Model name	**AA-844**	**AA-845**
Outer dimensions	Material: SUS303 	Material: SUS303 

Gauge head

Model name	AA-0200 (Standard)*1	AA-0210	AA-0220*2	AA-0230
Outer dimensions				
	Material at a tip: steel ball	Material: SKS3	Material: SKS3	Material: SKS3

Model name	AA-0240*2	AA-0250*2	AA-827*3	AA-828*3
Outer dimensions				
	Material: SKS3	Material: SKS3	Roller width: 4 mm Material: SUJ2	Roller width: 7 mm Material: SUJ2

Model name	AA-0320	AA-921	AA-0330*4	AA-0400
Outer dimensions				
	Material: SKS3	Material: SKS3	Material at a tip: carbide	Material at a tip: ruby

*1. The BS series uses gauge heads other than the standard gauge head (AA-0200).

*2. When mounting a flat gauge head such as AA-0220/0240/0250 to a gauge sensor with resolution of 1 µm or 10 µm, adjustment of the degree of parallelization to match the surface of the measurement stand is required. In this case, the gauge head and gauge stand should be purchased as a pair.
*Accuracy after parallelization adjustment by us is approx. 10 µm or less.

*3. When mounting a roller gauge head such as AA-827/828 to a gauge sensor with resolution of 1/1000mm (1 µm), the described accuracy in the specification is not obtained. The AA-827/828 uses a bearing, but as the gap cannot be eliminated, an error of approximately 10µm may appear.

*4. Made to order

Gauge head adapter

(for replacing gauge head)

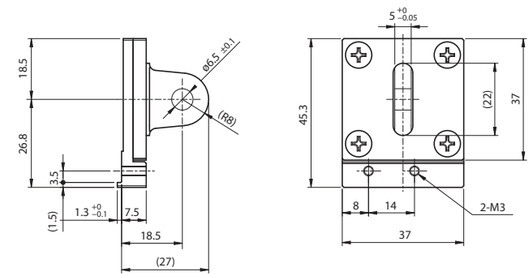
For GS-102/251/503/1000 DG525H/825/925

Model name	AA-829*4
Outer dimensions	Material: C3602

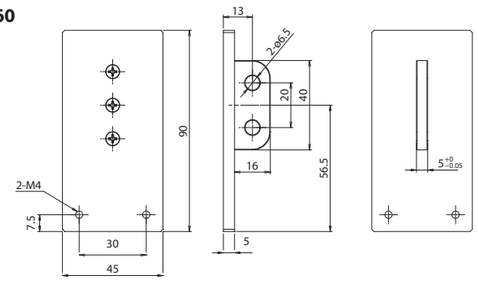
Mounting fixture

Model name	Description	
AA-3310	Mounting fixture	GS-1513A/1530A/1613A/1630A/4513/4530/4613/4630/6513/6530/6613/6630/1713A/1730A /1813A/1830A/3813B/3830B/4713A/4730A/4813A/4830A/6713A/6730A/6813A/6830A
AA-8560	Mounting fixture	GS-5050A/5051A/5100A/5101A

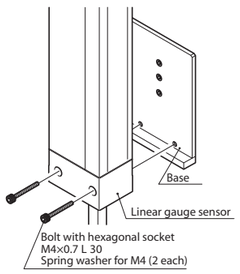
AA-3310



AA-8560



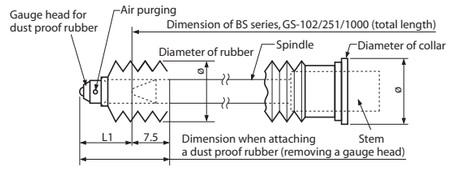
How to mount



Dust proof rubber (not for DG-525H)

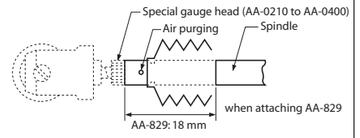
Model name	Applicable gauge sensors	L1 (mm)	Diameter of collar (ømm)	Diameter of rubber (ømm)	Stem diameter (ømm)	Material *3
AA-841*1	GS-1000	40.5	22	24	15	CR
AA-973*1	BS-102/102W/112 /112W/1210/1310			8	8	EPM
AA-975*2	GS-5011	8.5		16	20	NBR
Made to order	GS-4513/4530 /4613/4630	—	—	10	10	FKM
AA-4102	GS-1713A/1813A /6713A/6813A	—	—	8	15	Si
AA-4103	GS-1730A/1830A /6730A/6830A	—	—	8	15	Si
AA-4104*5	GS-3813B/4713A /4813A	—	—	8	15	HNBR
AA-4105*6	GS-3830B/4730A /4830A	—	—	8	15	HNBR

***1 AA-841/973**



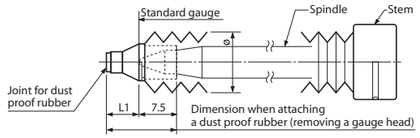
AA-829

The AA-829 (for GS-102/251 /503/1000) gauge head adapter is required when the special gauge head and dust-proof rubber are used with. (Please refer to the outer dimensions on P22.)



***2 AA-975** (For GS-5011)

Please attach the AA-975 (joint for dust proof rubber) directly when the special gauge head is used with. The joint for the special gauge head is no required.



*1. Gauge head for dust proof rubber
*2. Joint for dust proof rubber
*3. CR: Chloroprene rubber, NBR: Nitrile rubber, EPM: Ethylene propylene rubber, Si: Silicon rubber, HNBR: Hydrogenated nitrile rubber, FKM: Fluorine rubber
*4. Shipping costs will be charged separately.
*5. The GS-4713A/4813A is also available with silicone rubber (E).
*6. The GS-4730A/4830A is also available with silicone rubber (E).
*7. Installation fee is required separately.

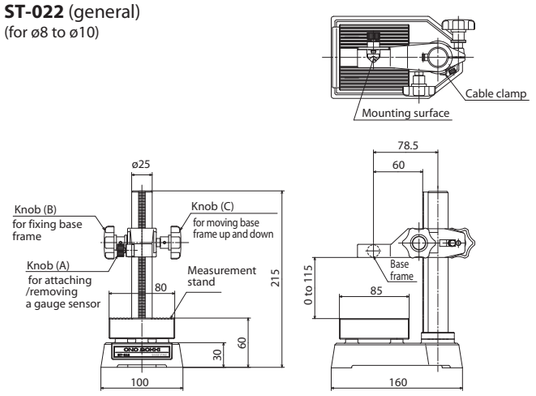
Gauge stand

Model name	ST-022	ST-0230	ST-044B
Table dimension	80 × 85 mm	80 × 85 mm	105 × 105 mm
Diameter of mounting hole	ø8 to ø10 mm	ø15 mm	ø15 to ø20 mm
Table material	Ceramic (with groove)		
Flatness of measuring surface	1 µm		
Roughness of measuring surface	0.4 s lapping finish		
Base stand (Width×Depth)	100 ×160 mm		130 × 200 mm
Measurable depth	approx. 59 mm	approx. 60 mm	approx. 73.5 mm
Measurable height	approx. 115 mm		approx. 210 mm
Weight	4.1 kg	4.2 kg	7.5 kg
Applicable gauge	BS-1210/1310	GS-1700A/1800A/3800B /4700A/4800A/5050A/5100A /6700A/6800A series	GS-5050A/5100A series

Sand bush

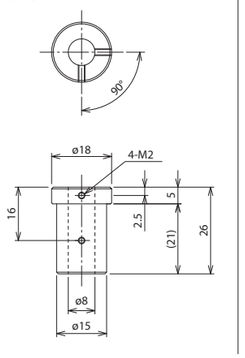
Model name	AA-891	AA-892
Stem diameter	ø8 mm	ø10 mm
Purpose	In combination with ST-0230/ST-044B	
Applicable gauge sensors	DG-825/925/GS-102/251 GS-1500/1600/6500/6600 series	DG-525H/KG-850/GS-251W/503 GS-4500/4600/7000 series

ST-022 (general)
(for ø8 to ø10)

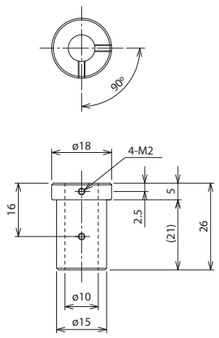


Stand bush

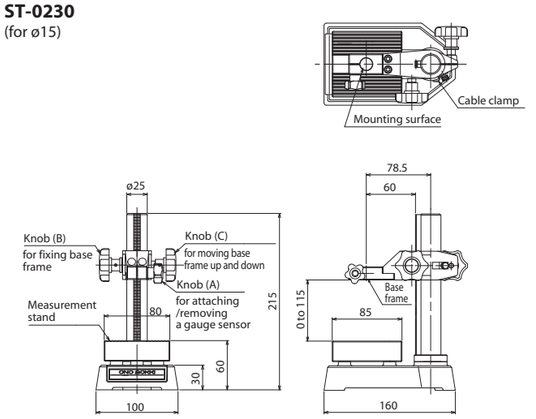
AA-891



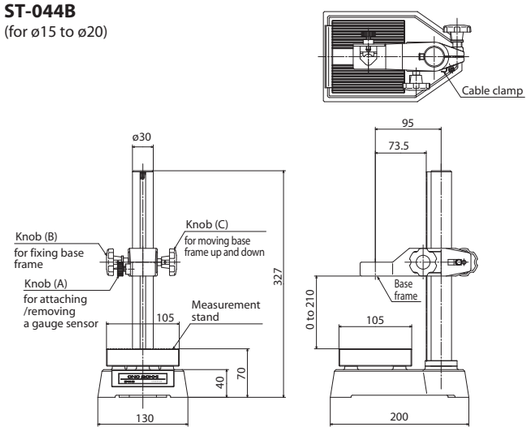
AA-892



ST-0230
(for ø15)



ST-044B
(for ø15 to ø20)



Cables

Model name	Product name	Length	Sensor side	Connector	Appearance	Connector	Counter side	Remarks
AA-8801 AA-8802 AA-8803 AA-8804	Signal extension cable	5 m 10 m 20 m 30 m	BS/GS series Linear gauge sensor	R03-JB6F (made by Tajimi)		R03-PB6M (made by Tajimi)	DG series Digital gauge counter	The maximum extension cable length from the linear gauge sensor is 30 m.
AA-8811 AA-8812 AA-8813 AA-8814	Bending resistant signal extension cable	5 m 10 m 20 m 30 m	BS/GS series Linear gauge sensor	R03-JB6F (made by Tajimi)	*1	R03-PB6M (made by Tajimi)	DG series Digital gauge counter	The maximum extension cable length from the linear gauge sensor is 30 m.
AA-8901 AA-8902 AA-8903 AA-8904	Signal extension cable	5 m 10 m 20 m 30 m	GS-3813B/3830B Linear gauge sensor	HR10A-7J-6S		HR10A-7P-6P	DG-5100 Digital gauge counter	
AA-8910	Conversion cable	0.2 m	BS/GS series Linear gauge sensor (excluding GS-3800B series)	R03-JB6F (made by Tajimi)		HR10A-7P-6P	DG-5100 Digital gauge counter	
AA-8101	BCD cable	3 m	DG-4320/4340 Gauge counter	DX30A-36P*2 (made by Hirose Electric)		DX30A-36P*2 (made by Hirose Electric)	DA-4130 D/A converter	
AA-8107	BCD cable	3 m	DG-2310/4320/4340 Gauge counter	DX30A-36P*2 (made by Hirose Electric)		One side open		
AX-2050N	Power supply cable	3 m	DG-4320/4340, DG-5100 Gauge counter	M3		AC plug 3P	AC100 V power	Conforming to Electrical Appliance and Material Safety Act
AX-5022B	RS-232C cable	2 m	DG-2310 Gauge counter	HR212-10P8PC (71) (made by Hirose Electric)		HDEB-9S (made by Hirose Electric)	PC	
MX-7105 MX-7110 MX-7115 MX-7120	Signal cable	5 m 10 m 15 m 20 m	DG-0010 Output signal conversion box	R04-PB6F	Cable: D5-UL (Composite 5-core vinyl sheath)	One side crimped terminal		20 m to 30 m (made to order)
Made to order	Signal cable	30 m to 1200 m	DG-0020 Output signal conversion box	R03-PB6F		One side open		30 m (made to order)

*1. Do not use/store cables under the environment at 0 °C or less. It is different from the storage temperature of linear gauge sensor.
*2. DX30A-36P is a crimping type connector. A tool for crimping type is required for wiring.
Soldered type connector (DX40-36P, DX36CV1) is recommenced when you buy a connector.

Plug cover/Connector/Panel mounting fixture

Model name	Product name	Purpose	Remarks
R03-PB6M	Connector for gauge sensor signal	–	
DX40-36P	36-core connector for cable	For DG-4120/4140/4240/4280, DA-4130	For BCD signal, for soldered (DX36CV1 is required)
DX36CV1	Plug cover	For DX40-36P	
—	Panel mounting fixtures	Accessories for DG-4320/4340	2 piece/pair
—	Signal connector	5 pin for DG-2310	For input/output
—	Signal connector	10 pin for DG-2310	For input/output
—	Signal connector	For DG-5100	For external control

Consumables for printer

Model name	Product name	Purpose	Remarks
AA-5100	Thermal recording paper (10-roll / pack)	For RQ-1410	10-roll/pack
AA-5102	Thermal recording paper (10-roll / pack)	For RQ-2110	10-roll/pack

Operating principles

Linear gauge consists of a linear gauge sensor (detector) and a digital gauge counter (displaying device). A moving scale which moves together with a spindle is placed opposite to two scales fixed at certain positions in a linear gauge sensor. Each scale has a light/dark scale printed at regular intervals. The fixed scale B is placed out of the fixed scale A by 1/4P (pitch). These moving and fixed scales are sandwiched between light sources (LED) and receiving light elements. (Fig.1)

When the moving scale moves with respect to the fixed scales, the extent of the light passing through the window in the fixed scale constantly repeats light-dark change. At this time, two synchronized sine-wave signals having a relative 90-degree phase difference are output. A linear gauge sensor judges the direction by this phase lead or delay, and then a digital gauge counter measures an amount of displacement by addition/subtraction operation. (Fig.2)

As linear gauge sensor outputs as 1P (pitch) = 4 µm* (1 µm resolution type) or 1P (pitch) = 40 µm (10 µm resolution type), multiplying output signal by 4 with digital gauge counter provides output signal as 1/4 of 1P (pitch) of resolution (1 µm or 10 µm).

*For the GS-3800B series, 1P (pitch) = 0.4 µm.

Fig.1

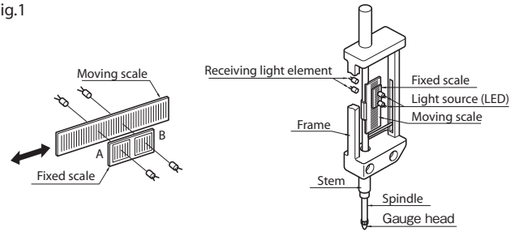
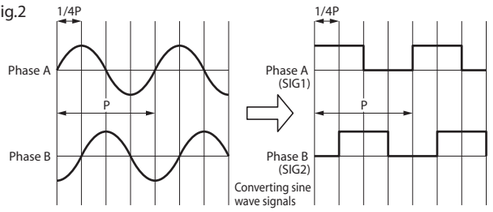


Fig.2

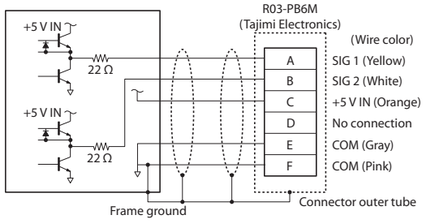


Output circuit

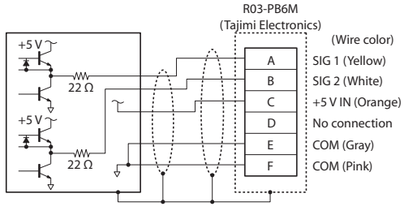
Linear Gauge Sensors - Differences by Model

- GS-1713/1730/1813/1830/3813/3830/4713/4730/4813/4830/6713/6730/6813/6830/5050/5100/5051/5101
  The metal case is electrically connected to the circuit 0 V (except for the BS series).
  If the linear gauge sensor is not attached to a solid earth ground, failure may occur.
  Please make sure that the contact points of the linear gauge sensor and the gauge head are firmly grounded before use.
- GS-1713A/1730A/1813A/1830A/3813B/3830B/4713A/4730A/4813A/4830A/6713A/6730A/6813A/6830A/5050A/5100A/5051A/5101A
  The metal case and the 0 V circuit are isolated.

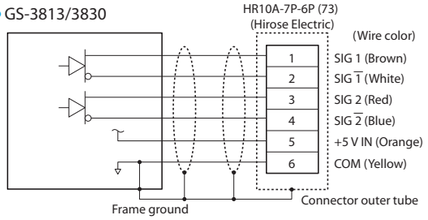
- GS-1713/1730/1813/1830/4713/4730/4813/4830/6713/6730/6813/6830/5050/5100/5051/5101



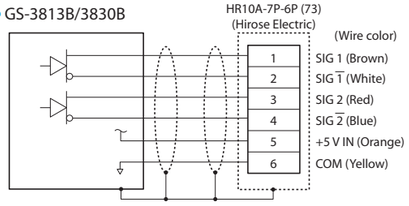
- GS-1713A/1730A/1813A/1830A/4713A/4730A/4813A/4830A/6713A/6730A/6813A/6830A/5050A/5100A/5051A/5101A



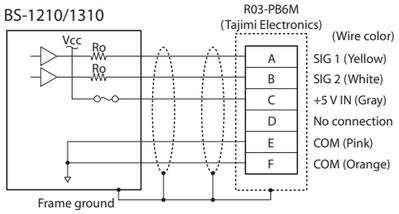
- GS-3813/3830



- GS-3813B/3830B



- BS-1210/1310

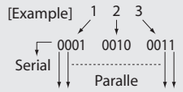


* We recommend using a linear gauge sensor in combination with a digital gauge counter.
If you are using the linear gauge sensor alone, please check the specifications in the instruction manual before use.

Measurement terminology

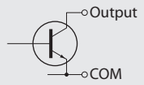
BCD

It is an abbreviation for Binary Coded Decimal code, and is a method of expressing decimal numbers from 0 to 9 by converting them into 4 bits of binary numbers (1, 2, 4, 8).



Open collector (BCD)

It is an output circuit that uses a transistor, with the collector serving as the output terminal. It is mainly connected to the photocoupler input of a PLC.

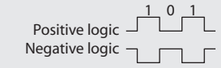


TTL

An abbreviation for Transistor Transistor Logic (IC), which indicates the voltage level of the pulse. Generally, +2.4 V or higher is considered "high" (Hi level) and +0.4 V or lower is considered "low" (Lo level); this voltage is called the TTL level.

Positive logic /negative logic

In digital signals, 1 being the Hi level and 0 being the Lo level is called positive logic.
Conversely, negative logic means that 1 is the Lo level and 0 is the Hi level.



RS-232C

This is a standard used as a serial interface in many PCs. It is possible to exchange data between the computer and measuring instruments and to control the measuring instruments.

Comparator

It is a function that sets a certain threshold value, judges whether the measured value is larger or smaller than that value, and outputs signals. The output is available in two types: contact output and non-voltage contact output (open collector output).

Sum-difference calculation

An operation that adds (sum) or subtracts (subtracts) two numbers. In digital gauge counters, thickness and step measurements can be made by performing sum and difference calculations using two linear gauge sensors.

Protection class IP64G

IP stands for International Protection, and the numbers following it indicate the level of dust-proof and waterproof protection. In the case of IP64, "6" means that dust cannot enter, "4" means no harmful effects from splashes from any direction.

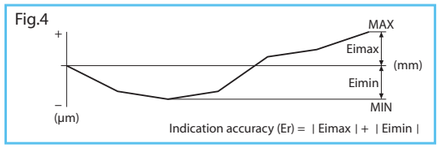
Indication accuracy and resolution

The accuracy of our linear gauge sensors are based on JIS-B7450.

The reading value Yi of the linear gauge sensor to be measured minus the corresponding scale value Mi of the reference instrument.
Indication error (Ei) = Yi - Mi
We use a length measurement instrument with a resolution of 0.01 µm as a reference for checking accuracy. (See Fig.3)

Fig.3

Fig.4



●Indication accuracy

The indication error Ei is measured for each measurement point over the entire measurement range, and the value is calculated using the maximum indication error Eimax and minimum indication error Eimin using the following formula (see Fig.4).
Indication accuracy (Er) = | Eimax | + | Eimin |

To reduce quantization errors, the scale value of the reference instrument is read at the moment when the displayed value of the digital gauge counter reaches the measurement point.
Therefore, the indication accuracy is smaller than the resolution of the linear gauge sensor.

●Resolution

Resolution refers to a minimum read value of the linear gauge sensor.
For instance, the minimum read value of linear gauge sensor GS-1730A is 10 µm.

●Influence of temperature

The accuracy of our linear gauge sensors is specified for use at 20 degree. The glass scale used in the sensor's detection section changes with temperature, thus when using the sensor at temperatures other than 20 degree, the accuracy must take into account errors caused by changes in the glass scale. (*Only if the temperature is stable and stable will the digital gauge counter value be reset.)
Our detection glass scale has a linear expansion coefficient of 9×10^{-6}/K.
The error at a certain temperature (A °C) can be calculated using the following formula.
9×10^{-6} x stroke amount (mm) x (A-20) mm
By adding the error calculated by this formula to the accuracy at 20 degree, you can find the accuracy at a certain temperature.
When the spindle is pushed to the maximum in a 100 mm stroke linear gauge sensor, 9×10^{-6} x 100 (mm) x (A - 20) mm will be added; when the stroke is 50 mm, it will be 1/2 of the above, and when the stroke is 30 mm, it will be 3/10. This is an error that is independent of the resolution and depends on the stroke amount.
The amount of change in the 0 point due to temperature change cannot be expressed quantitatively since the change in the glass (which varies depending on the position of the detection part in relation to the overall length of the glass), the change in the spindle, and the change in the jig part that holds the linear gauge sensor all affect each other.

Measuring force

The pressure with which the gauge head presses against the workpiece is taken as the measuring force. A spring that pushes out the spindle is built into the linear gauge sensor, thus the pressure applied to the workpiece when the spindle is pushed in to the maximum is expressed as the measuring force. The unit is N (Newton). The measuring force applied to a unit area of the surface pressing the workpiece is called the measurement pressure. The unit is N/mm^2.

The measuring force can be changed by replacing the spring. Please specify this when ordering (modification fee is required). However, depending on the modification, the spring may not return fully if it is installed facing upwards or sideways.

Regarding constant pressure modifications*, please contact us.

*Constant pressure modification means making the measuring force, which normally varies depending on the spindle position, constant over the entire stroke (variation of ±0.1 N, without dustproof rubber).

When reading measurements using digital signals

(1) Using BCD output

The BCD output interface function for digital gauge counter enables high-speed transfer.

(2) Using output signal of linear gauge sensor (90 degree two-phase difference)

The output signal of linear gauge sensor directly input to PLC counter. The output signal of the linear gauge sensor is a pulse output with four times the resolution for both phase A (SIG1) and phase B (SIG2), thus the counter on the PLC side must have the 4-times multiplying function.

(3) Using open collector output and line driver output signal

Use the output conversion box DG-0010 (open collector output) or DG-0020 (line driver output).

(4) Using RS-232C communication

The DG-2310/5100 uses the RS-232C communication function to read measurement values and change conditions. (For DG-5100, the optional function TM-0350 is required.)

Connection type / Items	Digital gauge counter				Linear gauge sensor
	BCD output	Analog output	Open collector output	Line driver output	90 degree two-phase difference signal
PLC interface	Parallel port	12 bit D/A conversion	90 degree two-phase difference signal	90 degree two-phase difference signal	90 degree two-phase difference signal
Response time*1/ Communication speed	approx. 10 mms	approx. 10 mms	approx. 1 µs or less*2	approx. 1 µs or less*2	–
Cable length	–	–	30 m	200 m or more	30 m
Counting error detection	Available	N.A.	N.A.	N.A.	N.A.
Applicable models	DG-2310/4320 /4340/5100	DG-2310/5100	DG-0010	DG-0020	BS/GS series

*1. The response time from when a pulse is input to the digital gauge counter until the BCD output bit changes.
*2 Transfer time varies depending on the PLC circuit conditions (voltage/current).

When reading measurements using analog signals

Use the analog output of the digital gauge counter DG-2310/5100.

When controlling with comparator output signals

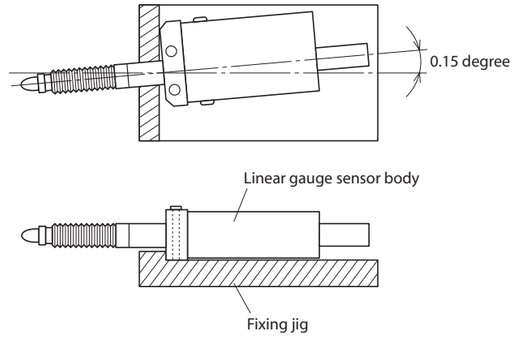
Use the results of comparing the measured value with the value set on the digital gauge counter.

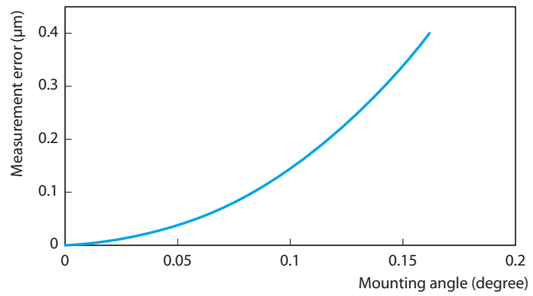
Response time	Approx. 10 ms
Contact Capacity	DC30 V/100 mA (DG-2310/4340/5100)
Purpose	Driving device

How to install the sensor

●Installation tolerance when fixing the main unit

The fixture should have a rigid structure and the linear gauge sensor body should be attached at a right angle.
The recommended mounting angle is 0.15 degrees (squareness 260 µm/100 mm) or less.
If the linear gauge sensor body is installed slantingly, not only will errors occur, but lateral force will be applied to the spindle, causing it to malfunction.
In addition, the shape of the fixing jig should be L-shaped. This makes it easier to install the linear gauge sensor body at a right angle.





Measurement error for a stroke of 100 mm

(When the mounting angle is 0.15 degrees, the measurement error for a stroke of 100 mm is 0.4 µm.)

●Tightening torque when fixing the main unit

The recommended screw tightening torque values at fixing the linear gauge sensor are shown in the table on the right. After tightening, be sure to check the movement of the spindle. If it doesn't move smoothly, it may be too tight so loosen it. However, if it is loosened too much, the fixation of the main body will become unstable and you cannot do the measurement properly. Please be careful of the movement of the spindle after fixing. If necessary, use a thread locking agent.

Screw (a male screw)	Setting jig (a female screw)	The recommended tightening torque value for the M3 screw	The recommended tightening torque value for the M4 screw
Iron	Iron	0.7 N·m	1.4 N·m
Iron	Aluminum	0.52 N·m	0.84 N·m

●Tightening torque value for the stem fixing part

After tightening, be sure to check the movement of the spindle. If it doesn't move smoothly, it may be too tight so loosen it. However, if it is loosened too much, the fixation of the main body will become unstable and you cannot do the measurement properly. Please be careful of the movement of the spindle after fixing.

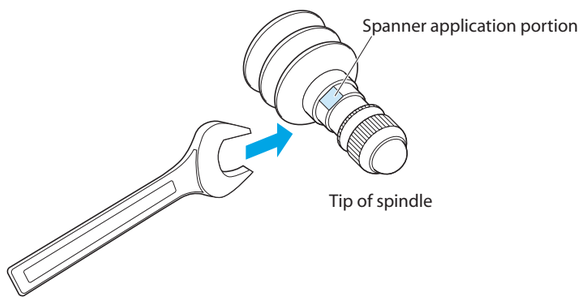
Recommended value

Model	Tightening torque
GS-1700A/1800A/3800B/4700A/4800A/5050A/5100A/6700A/6800A series	0.5 N·m
BS series	0.7 N·m

●Replacing the gauge head

When replacing the gauge head, if a locking spanner is provided, first hook it at the spanner application portion so that torsional force is not applied to the spindle. Then, use pliers or similar to clamp the gauge head and remove or attach it. When using pliers, use felt or similar to protect the gauge head from damage.
Please note that if rotational force is applied to the spindle, it may cause the internal mechanism to malfunction and damage the linear gauge sensor.

If a locking spanner is not provided, follow the instructions in the instruction manual.



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