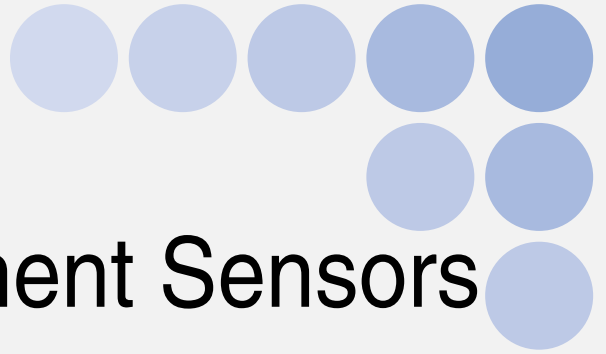


OMRON

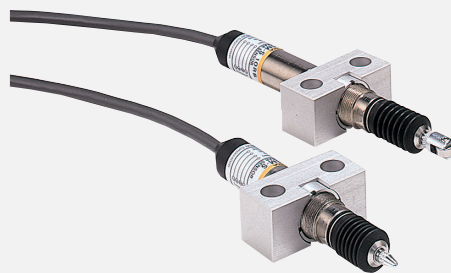


Contact Displacement Sensors



D5SN

D5M



D5V

Warranty and Application Considerations

Read and Understand this Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

■ Warranty and Limitations of Liability

Warranty and Limitations of Liability

WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

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In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

■ Application Considerations

Application Considerations

BASIC CONSIDERATIONS

At OMRON, we are constantly working to improve the quality and reliability of our products.

SELECTION OF PRODUCTS

The applications, illustrations, and charts shown in this catalog are intended solely for purposes of example. Because there are many variables and requirements associated with any particular application, the final design can only be made in view of the specific parameters of each application. OMRON does not assume responsibility or liability for actual use based upon the examples shown in this catalog. Please consult one of our sales offices if you have any doubts or questions concerning your application.

SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products.

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

■ Disclaimers

Disclaimers

PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON *Warranty and Limitations of Liability*.

CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

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Copyright and Copy Permission

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Safety Precautions

■ Meaning of Signal Words

The following signal words are used in this catalog.



CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury or in property damage.

■ Meaning of Alert Symbols

The following alert symbols are used in this catalog.



Indicates the possibility of fire under specific conditions.

■ Alert Statements in this Catalog

The following alert statements apply to the products in this catalog. Each alert statement also appears at the locations needed in this catalog to attract your attention.



CAUTION

Sensor malfunction or fire damage may occasionally occur. Do not apply excessive voltage or current to the Sensor input or output circuits.



Selection Guide

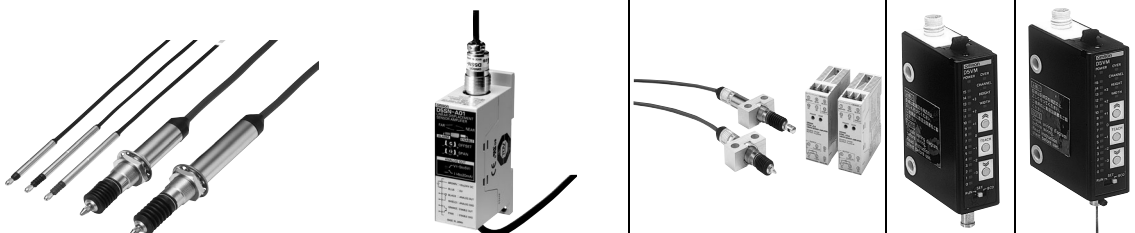
Appearance										
										
Features										
Compact dimensions, lightweight design, and high precision Compatibility between Sensors and Amplifier				Robust design and high precision Compatibility between Sensors and Amplifier		Robust design		Built-in amplifier Low OF Judgement and communications functions (D5VM)		
Model number	Sensor	D5SN-S01	D5SN-S04	D5SN-S04-L	D5SN-M05	D5SN-M10	Model number of set: D5M-5□	Model number of set: D5M-10□	D5VA	D5VM
	Amplifier	D5SN-A01								
Sensor diameter		6 mm			18 mm		18 mm		---	
Measurement range		1 mm	4 mm		5 mm	10 mm	5 mm	10 mm	5 mm	
Maximum actuator travel distance		Approx. 1.5 mm	Approx. 5 mm		Approx. 6 mm	Approx. 12 mm	Approx. 6 mm	Approx. 12 mm	Approx. 5.7 mm	
Resolution		0.1 μm	0.4 μm		0.5 μm	1 μm	2.5 μm	5 μm	10 μm	1 μm
Linearity		0.3% FS max.	0.5% FS max.		0.5% FS max.		0.5% FS max.		0.5% FS max.	
Repeat accuracy		0.5 μm max.	1.6 μm max.		10 μm max.	20 μm max.	10 μm max.	20 μm max.	10 μm max.	
Operating force		Approx. 0.7 N		Approx. 0.25 N	5 N max.		5.88 N max.		0.3 N max.	
Mechanical durability		10,000,000 operations min.				10,000,000 operations min.		10,000,000 operations min.		
Degree of protection		IP67		IP54	IP67		IP67		IP40	
Supply voltage		12 to 24 VDC (10.8 to 26.4 V)				24 VDC (21.6 to 26.4 V)		12 to 24 VDC (10.8 to 26.4 V)		
Output		Voltage (-5 to 5 V), current (4 to 20 mA)				Current (4 to 20 mA)		Current (4 to 20 mA)	B7A serial communications	
Reference page		8				18		23		

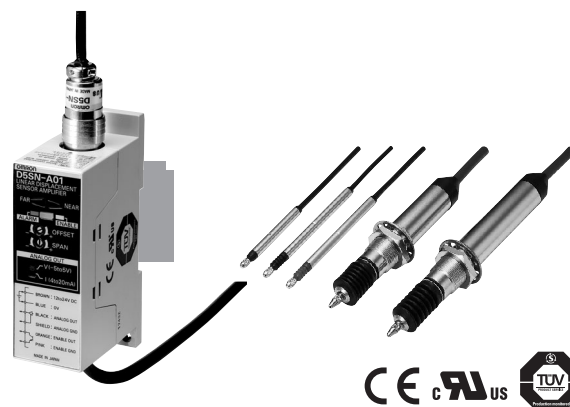
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Contact Displacement Sensor D5SN

Five Types of Sensor for Use in a Wide Range of Environments

- D5SN-S01/-S04/-S04-L Sensors have a compact and light-weight design with an ultra-small diameter of 6 mm.
- The D5SN-S01 offers a high resolution of 0.1 μm .
- D5SN-M05/-M10 Sensors have a robust construction and can withstand a horizontal load of 5 N.
- D5SN-S01/-S04/-M05/-M10 Sensors ensure IP67 degree of protection.
- All Sensors have an insulated design.



Ordering Information

■ List of Models

Sensor

Measurement range	Resolution	Operating force	Model
1 mm	0.1 μm	Approx. 0.7 N	D5SN-S01
4 mm	0.4 μm		D5SN-S04
		Approx. 0.25 N	D5SN-S04-L
5 mm	0.5 μm		D5SN-M05
10 mm	1 μm	5 N max.	D5SN-M10

Amplifier

Model
D5SN-A01

Note: This Amplifier can be used with each Sensor.

- The Amplifier is compatible with any one of five types of Sensor selected to suit the measurement environment.

Specifications

■ Sensor

Item	Model number (of set)	D5SN-S01	D5SN-S04	D5SN-S04-L	D5SN-M05	D5SN-M10
Measurement range		1 mm	4 mm		5 mm	10 mm
Max. actuator travel distance		Approx. 1.5 mm	Approx. 5 mm		Approx. 6 mm	Approx. 12 mm
Resolution (See note 2.)		0.1 μm	0.4 μm		0.5 μm	1 μm
Linearity (See note 3.)		0.3% FS max.	0.5% FS max.		0.5% FS max.	
Repeat accuracy		0.5 μm max.	1.6 μm max.		10 μm max.	20 μm max.
Response time (not including bounce time)		100 ms max.	200 ms max.		300 ms max.	
Operating force (See note 4.)		Approx. 0.7 N		Approx. 0.25 N	5 N max.	
Degree of protection (not including the connector)		IP67		IP54	IP67	
Mechanical durability		10,000,000 operations min.				
Insulation/non-insulation of mounting part		Insulated				

Item	Model number (of set)	D5SN-S01	D5SN-S04	D5SN-S04-L	D5SN-M05	D5SN-M10
Ambient operating temperature		-10 to 60 °C (with no icing or condensation)				
Ambient operating humidity		25% to 95% (with no condensation)				
Temperature influence (See note 5.)		0.025% FS/°C	0.010% FS/°C		0.03% FS/°C	
Weight		Approx. 70 g (including cable connector)			Approx. 230 g	Approx. 300 g
Connection cable length		3-conductor shielded cable, 2 m				

Note: 1. The above figures are for use with the standard actuator.

2. These figures are the smallest values that can be read when using OMRON's K3NX Process Meter.
3. "FS" refers to the corresponding measurement range.
4. These figures are representative values that apply for the measurement mid-point, and are for when the provided actuator is used, with the actuator moving downwards. If the actuator moves horizontally or vertically, the operating force will be reduced. Also, if an actuator other than the standard one is used, the operating force will vary with the weight of the actuator itself.
5. These figures are representative values that apply for the mid-point of the measurement range.

■ Amplifier

Item	Model	D5SN-A01
Supply voltage (allowable range)		12 to 24 VDC (10.8 to 26.4 VDC)
Current consumption		80 mA max.
Analog output (See note 1.)	Voltage	-5 to 5 V (load impedance: 10 kΩ min.)
	Current	4 to 20 mA (load impedance: 300 Ω max.)
Enable output	Output form	NPN open collector
	Output switching current	100 mA max.
	ON output residual voltage	1.5 V max.
	OFF collector dielectric strength	26.4 VDC
	OFF leakage current	0.1 mA max.
Degree of protection		IP30
Ambient operating temperature		-10 to 55 °C (with no icing or condensation)
Ambient operating humidity		25% to 85% (with no condensation)
Temperature influence (See note 2.)		0.010% FS/°C
Weight		Approx. 200 g (including the cable)
Connection cable length		2-m-long, 5-conductor shielded cable

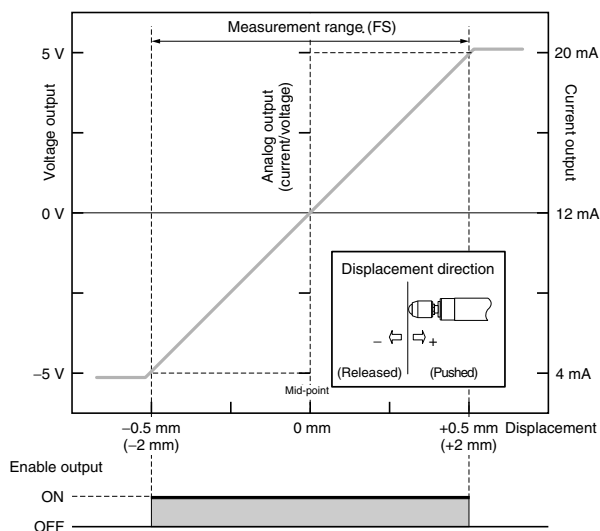
Note: 1. Depending on the offset adjustment and span adjustment, analog output may leave the specified range (-5 to 5 V or 4 to 20 mA) even for values within the specified measurement range.

2. These figures are representative values that apply for the mid-point of the measurement range.

Output Characteristics

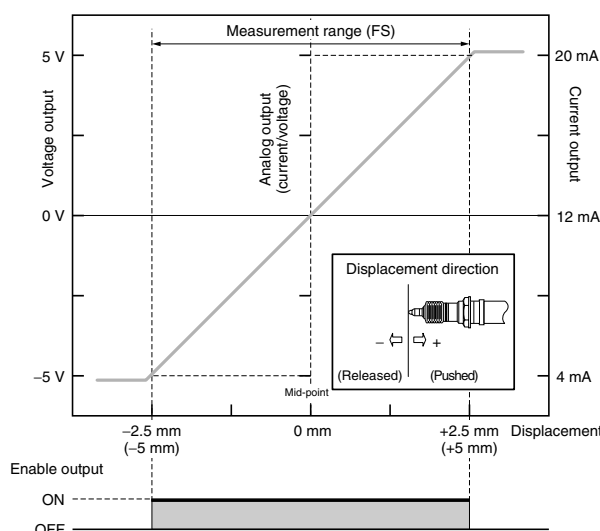
Voltage/Current Output

D5SN-S01/-S04/-S04-L



Note: Figures in parentheses are for the D5SN-S04/-S04-L.

D5SN-M05/M10



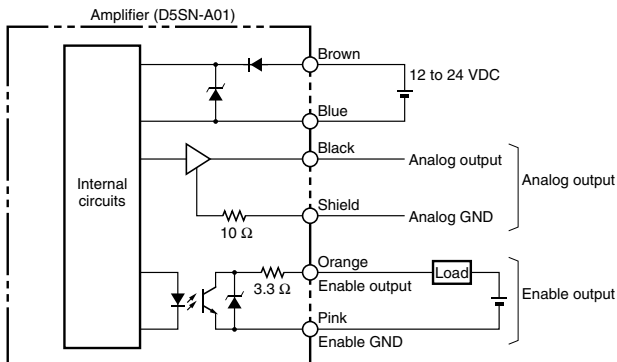
Note: Figures in parentheses are for the D5SN-M10.

LED Display and Enable Output

Travel position		LED display		Enable output	Details	
		FAR	NEAR			ALARM/ENABLE
Entire range (when an error occurs)					OFF	Indicates errors, such as faulty connector connection or Sensor cable disconnection.
Outside measurement range	Released direction				OFF	---
	Pressed direction				ON	---
Inside measurement range	Released direction				ON	---
	Near mid-point				ON	Indicates that the measurement value is near the mid-point (i.e., the origin set by adjustment) of the measurement range.
Outside measurement range	Released direction				ON	---
	Pressed direction				OFF	It is possible that the plunger is damaged.

Connections

I/O Circuit Diagram



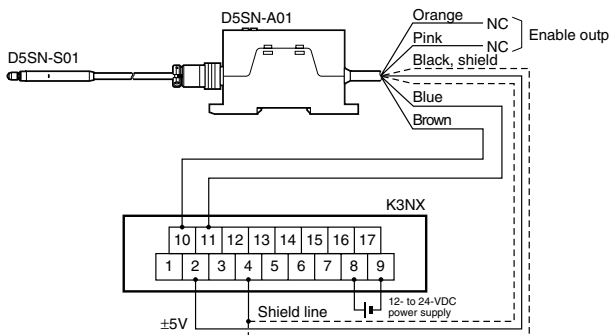
Points for Ensuring Stable Output

When connecting two or more Amplifiers to an AD board, use an AD board that supports differential input, or use an insulated power supply with for each Amplifier.

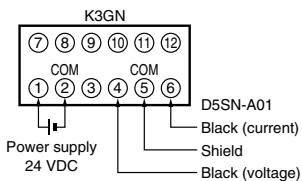
When connecting to any device other than an OMRON Digital Panel Meter (or Process Meter), do not wire the power supply ground and the analog ground to the same circuit.

Connection Diagrams

Connection to the K3NX Process Meter



Connection to the K3GN Digital Panel Meter



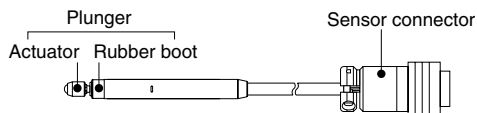
Note: The K3GN has no (24-VDC) power supply output.

- Note:** 1. When not using enable output (orange, pink), ensure that there is no contact with other lines using, for example, insulating tape.
2. Use a Digital Panel Meter that handles either DC voltage input or DC current input.

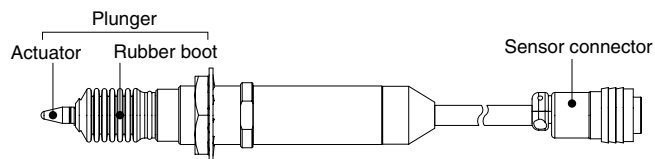
Nomenclature

Sensor

D5SN-S01

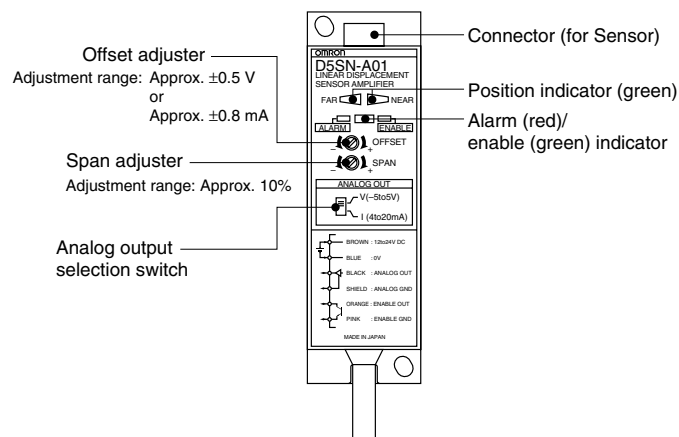


D5SN-M05



Amplifier

D5SN-A01



Note: The span is set to within $\pm 1\%$ of the ideal characteristics at the time of delivery.

Approved Standards

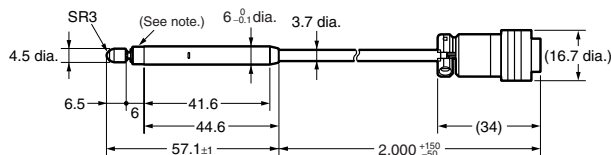
Agency	Standard	File No.
TÜV Product Service	EN61010-1	Z1030339656046
UL	UL50	E104818

Dimensions

Sensor

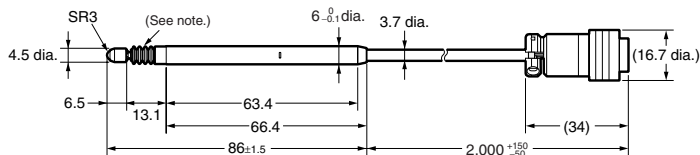
Note: The dimensions in the following diagrams are for when the plunger is in the released position.

D5SN-S01



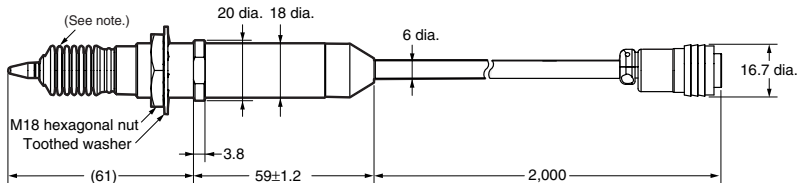
Note: Material of rubber boot: Fluorine rubber

D5SN-S04 D5SN-S04-L



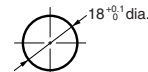
Note: Material of rubber boot
D5SN-S04: Fluorine rubber
D5SN-S04-L: Silicon rubber

D5SN-M05



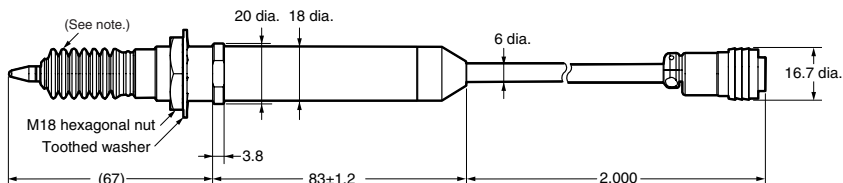
Note: Material of rubber boot: NBR

Panel Cutout Dimensions



Thickness, t = 5 to 12 mm

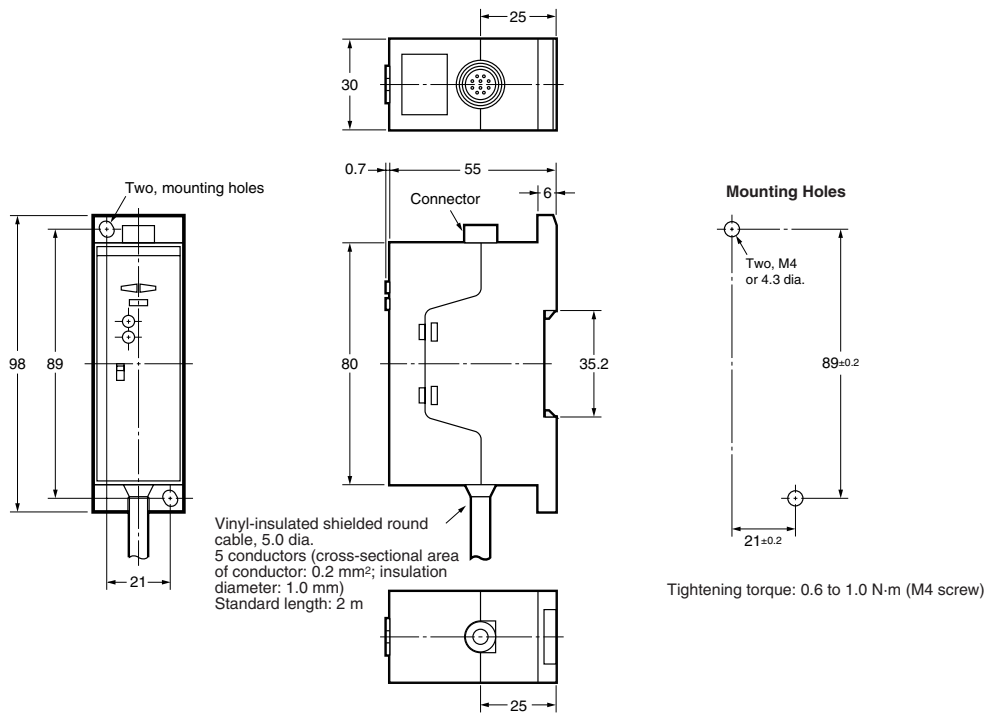
D5SN-M10



Note: Material of rubber boot: NBR

Amplifier

D5SN-A01



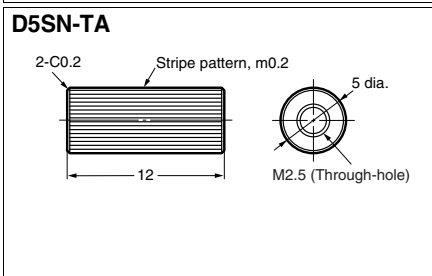
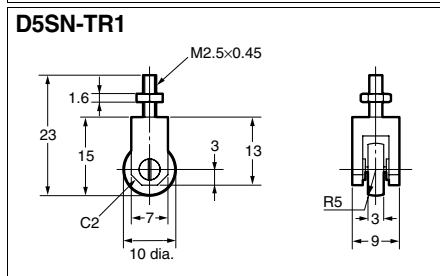
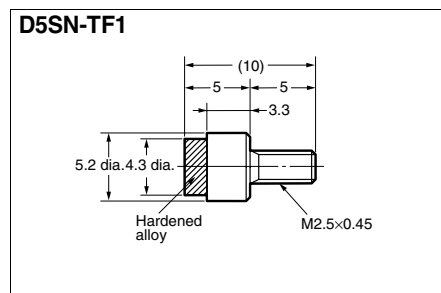
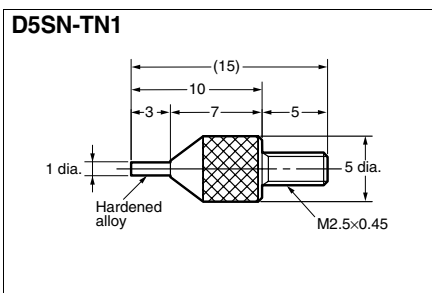
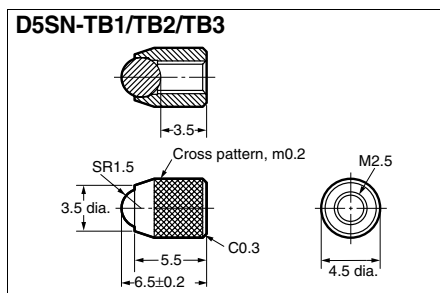
Options (Actuators)

Model	Type (material)	Screw hole	Appearance	Applications	Applicable Sensor		
					D5SN-S□	D5SN-M□	
D5SN-	TB1	Ball type (steel)	Female screw M2.5 × 0.45		General-purpose measurement on a flat surface (Provided with D5SN-S Sensors as a standard.)	○	×
	TB2	Ball type (carbide steel)	Female screw M2.5 × 0.45		Measurement applications requiring abrasion resistance Measurement object: Carbide steel (HR90) or softer materials	○	×
	TB3	Ball type (ruby)	Female screw M2.5 × 0.45		Measurement applications requiring abrasion resistance Measurement object: Carbide steel (HR90) or harder materials	○	×
	TN1	Pin type (carbide steel)	Male screw M2.5 × 0.45		Base measurement for grooves and holes	☆	×
	TF1	Flat type (carbide steel)	Male screw M2.5 × 0.45		Measurement of spherical surfaces	☆	○
	TR1	Roller type (quenched steel)	Male screw M2.5 × 0.45		Measurement while traveling or sliding horizontally Displacement of the roller must not exceed 10 μm.	×	○
	TA	Conversion Adapter (stainless steel)	Through-hole, female screw M2.5 × 0.45		Allows the D5SN-TN1/-TF1 or a commercial actuator to be mounted to a D5SN-S Sensor.	○	×

Note: The meanings of the symbols in the table are as follows:

○: Replacement possible; ☆: Replacement possible with Conversion Adapter; ×: Replacement not possible

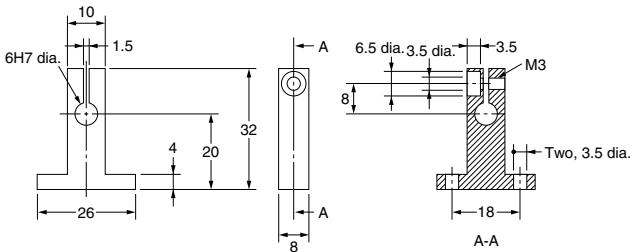
■ Dimensions



Accessories (Order Separately)

■ Mounting Jig

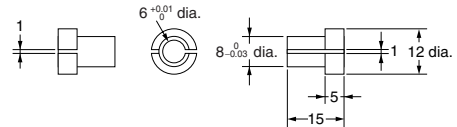
Recommended Mounting Jig



Tightening torque: 0.6 to 0.8 N·m (M3 screws)

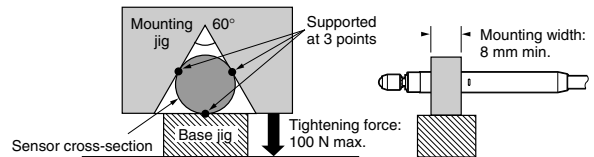
Material: Aluminum

Mounting Jig for 8-dia. Stand



Material: Brass

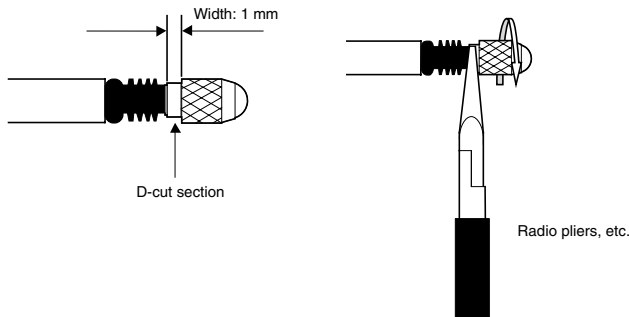
Mounting with 3 Support Points



Actuator Replacement Procedure

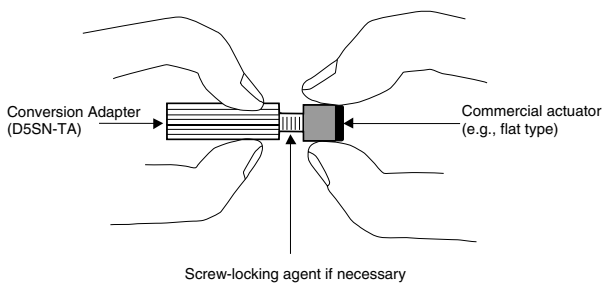
1. Remove the standard actuator.

- Hold the plunger's D-cut section with radio pliers or a similar tool while removing the actuator.
- If replacement must be performed by holding the Sensor itself, ensure that a torque exceeding 0.15 N·m is not applied. Applying excessive torque may have an adverse affect on plunger operation.



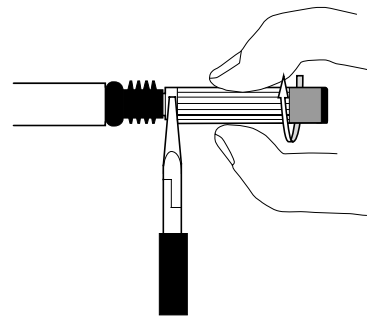
2. Mount the actuator to a Conversion Adapter.

- Tighten the actuator securely, and ensure that there is no looseness.
- If necessary, apply screw-locking agent. (Recommended type: Three Bond 1401B.)



3. Mount the Conversion Adapter to the plunger.

- Hold the plunger's D-cut section with radio pliers or a similar tool while mounting the Conversion Adapter.
- If replacement must be performed by holding the Sensor itself, ensure that a torque exceeding 0.15 N·m is not applied. Applying excessive torque may have an adverse affect on plunger operation.



Safety Precautions

Caution
 The tip of a pin-type actuator is sharp. Be careful when handling the actuator, otherwise an injury may occur.

Application Precautions

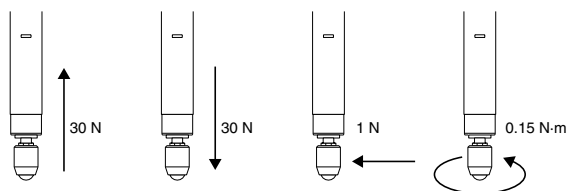
The following points must be observed to ensure safe operation.

- Do not use this product in environments where flammable or explosive gases are present.
- Do not attempt to disassemble, repair, or modify the product. In particular, do not attempt to cut or extend the Sensor's cable.

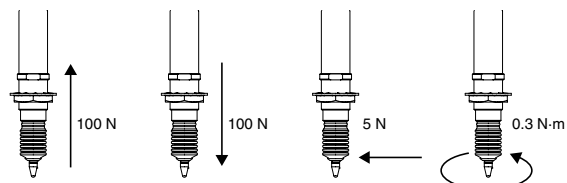
Correct Use

- This product is a high-precision measuring device. Do not drop the product, or subject it to any other kind of excessive shock.
- Do not subject the plunger to a force exceeding that shown in the corresponding diagram below. Doing so may damage the product.

D5SN-S Sensors



D5SN-M Sensors



- If the actuator is pushed in too far, the Sensor will be damaged. Perform measurement within a range where the overtravel warning indicator does not light.
- Do not remove the rubber boot (for preventing dust penetration). Doing so may allow the penetration of foreign matter, resulting in Sensor failure.
- Mount the Sensor and Amplifier at the specified place with the specified load. Applying excessive force when mounting may result in damage.

Operating Environment

1. Do not mount the product in the following places. Doing so may lead to product damage or failure.
 - Locations subject to direct sunlight
 - Locations with high humidity levels or where condensation may occur
 - Locations subject to corrosive gases
 - Locations subject to dust
 - Locations subject to splashes or water, oil, or chemicals
 - Locations where the Sensor may be directly subject to shock or vibration
 - Locations subject to static electricity or excessive noise

Also, do not mount the Sensor to ferromagnetic bodies or install it near devices that generate strong electromagnetic fields, such as motors.

2. Although the Sensor satisfies IP67 for degree of protection, it is not completely watertight. Do not use the Sensor submerged in water.

Wiring

- Do not perform wiring or connect/disconnect connectors with the power ON. Doing so may result in product failure or malfunctions.
- Keep wires far away from lines carrying high voltages or currents.
- Use the rated power supply voltage.
- Use the specified load.
- Be sure to perform wiring correctly with the correct terminal polarity.

Connection to Power Supply

The D5SN is used with a DC power supply and must meet the following conditions.

- Connect to either of the following circuits (1) or (2).
 - (1) Limited voltage/current circuit complying with UL508
 The circuit provides a power supply to the secondary winding of an isolating transformer that meets the following conditions.
 - Maximum voltage with no load: 30 Vrms (42.4 V peak)
 - Maximum current: (A) 8 A (including short-circuit)
 (B) When the current is limited by a circuit protector, such as a fuse, the ratings are as follows:

No load voltage (V peak)	Maximum current rating (A)
0 to 20	5.0
Over 20 and up to 30	100/peak voltage

- (2) A power supply circuit with a maximum voltage of 30 Vrms (42.4 V peak) that is supplied by a Class 2 power supply unit conforming to UL1310, or a Class 2 transformer conforming to UL1585
 - The DC line must not be connected to the DC distribution power supply.
 - The DC cable length must be 30 m max.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
 To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Contact Linear Sensor D5M

Contact Linear Sensor Conforming to IP67 Makes In-line Detection Possible Even in Harsh Environments

- Sensor satisfies IP67 (IEC standards) requirements.
- Ensures a current linear output of 4 to 20 mA.
- Easy offset adjustment with the Amplifier.
- Conforms to EMC Directives (certified by TÜV) and bears the CE marking.



Ordering Information

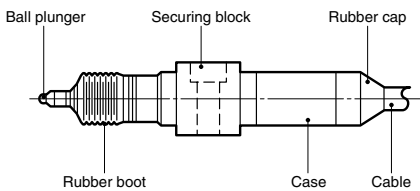
List of Models

Travel Distance	Actuator	Accessory	Model
5 mm	Ball type	---	D5M-5B
		Securing block	D5M-5BB
	Roller type	---	D5M-5R
		Securing block	D5M-5RB
10 mm	Ball type	---	D5M-10B
		Securing block	D5M-10BB
	Roller type	---	D5M-10R
		Securing block	D5M-10RB

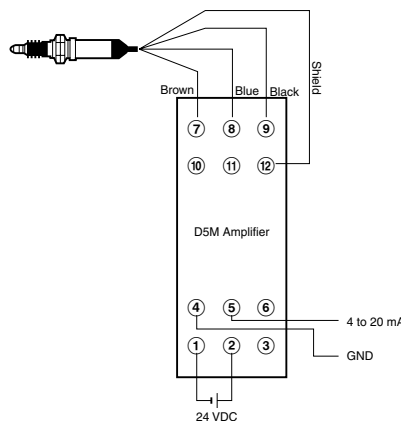
- Note:** 1. Specify the set when ordering.
2. A Sensor and Amplifier are adjusted together as a set. Purchase Sensors in combination with Amplifiers.

Connection Diagrams

Construction



Connection between Sensor and Amplifier



Terminal Arrangement

No.	Terminal
1	GND
2	24 VDC
3	N.C.
4	GND Output
5	4 to 20 mA
6	N.C.
7	Brown
8	Blue
9	Black
10	N.C.
11	N.C.
12	Shield

} Sensor head

Note: Nothing connects to terminals 3, 6, 10, and 11. Terminals 1, 4, and 12 are connected together internally.

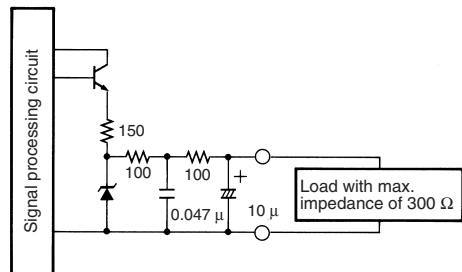
Specifications

Item	Model number (of set)	D5M-5□	D5M-10□
Degree of protection (Sensor)		IP67 (See note 1.)	
Mechanical durability		10,000,000 operations min.	
Supply voltage (operating voltage range)		24 VDC±10%	
Current consumption		80 mA max.	
Measurement range		5 mm	10 mm
Max. actuator travel distance		Approx. 6 mm	Approx. 12 mm
Resolution		2.5 μm	5 μm
Output characteristics	Repeat accuracy	10 μm	20 μm
	Linearity	0.5% FS max. (See note 2.)	
Output		4 to 20 mA (Allowable load resistance: 0 to 300 Ω)	
Operating force		5.88 N max.	
Indicator		Power (POWER) and overtravel (OVER) indicators	
Insulation resistance		100 MΩ min. between ground and the whole charged parts at 100 VDC	
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min between ground and the whole charged parts	
Rated insulation voltage (Ui)		1,000 VAC	
Degree of pollution (operating environment)		3 (IEC947-5-1)	
Electric shock protection class		Class II	
PTI (tracking characteristics)		175	
Switch category		3 (IEC335)	
Vibration resistance	Sensor	10 to 55 Hz, 2-mm double amplitude for 2 h each in X, Y, and Z directions	
	Amplifier	10 to 55 Hz, 0.75-mm double amplitude for 2 h each in X, Y, and Z directions	
Shock resistance	Sensor	500 m/s ² , 3 times each in X, Y, and Z directions	
	Amplifier	200 m/s ² , 3 times each in X, Y, and Z directions	
Ambient operating temperature	Sensor	-20°C to 60°C (with no icing or condensation)	
	Amplifier	-10°C to 55°C (with no icing or condensation)	
Ambient operating humidity	Sensor	95% max. (with no icing or condensation)	
	Amplifier	85% max. (with no icing or condensation)	
Temperature influence	Sensor	±0.03% FS/°C (See note 2.)	
	Amplifier	±0.03% FS/°C (See note 2.)	
Connection cable length (Sensor)		2-m long, 3-conductor shielded cable	
Weight	Sensor	Approx. 200 g	Approx. 300 g
	Amplifier	Approx. 100 g	
Material	Sensor	Stainless steel	
	Amplifier	ABS resin	

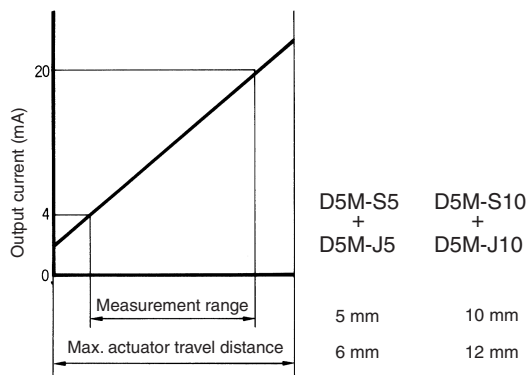
- Note:** 1. Although the product satisfies IP67 for degree of protection, the Sensor and Amplifier cannot be used in water or oil. The Amplifier is not of watertight or dust-tight construction.
 2. "FS" indicates the measurement range (e.g., it indicates 5 mm for the D5M-5□□).

Engineering Data

Amplifier Output Circuit Diagram



Output Characteristics



Approved Standards

Agency	Standard	File No.
TÜV Product Service	EN61010-1	950522868003
	EN55011 (EMI)	XA951122868008
	EN50082-1 (EMS)	

Approved Standard Ratings

TÜV (EN55011, EN50082-1)

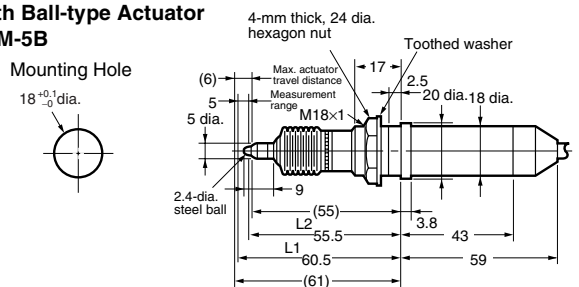
Rated current	0.1 A
Rated voltage	24 VDC

Dimensions

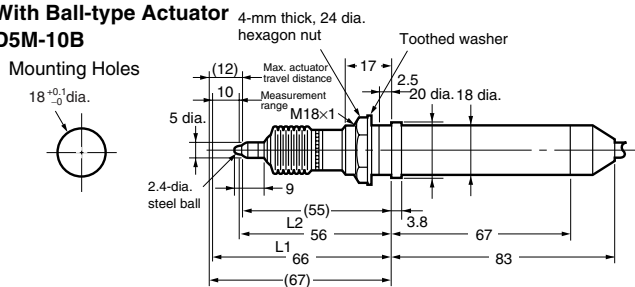
Sensor

Note: L1 is factory-set to the distance between the reference position and the lower limit (4 mA) of the effective output range and L2 is factory-set to the distance between the reference position and the upper limit (20 mA) for the effective output range.

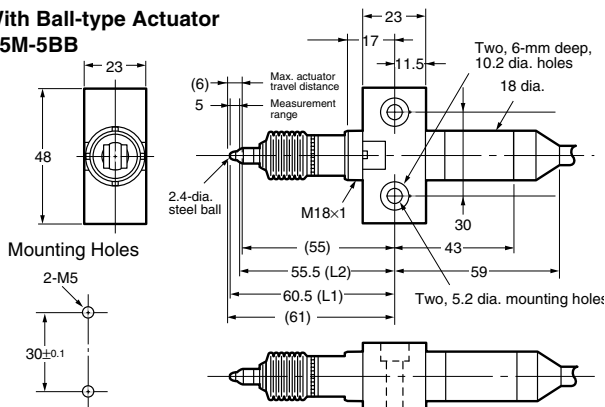
With Ball-type Actuator D5M-5B



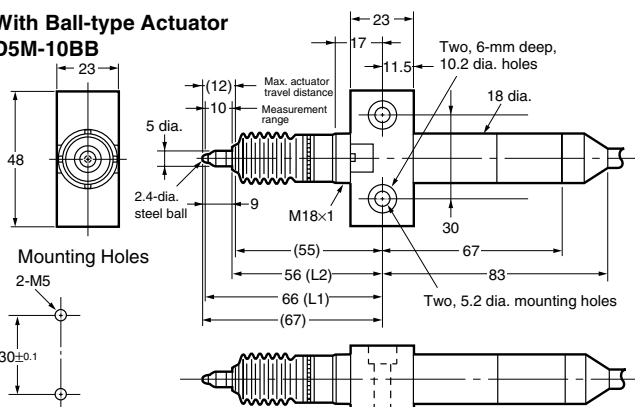
With Ball-type Actuator D5M-10B



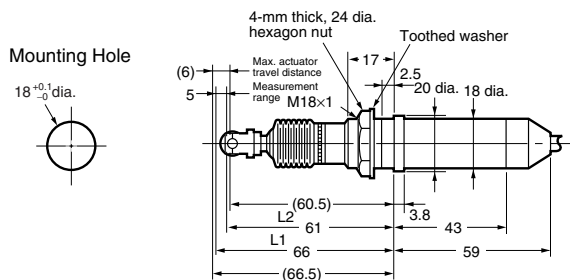
With Ball-type Actuator D5M-5BB



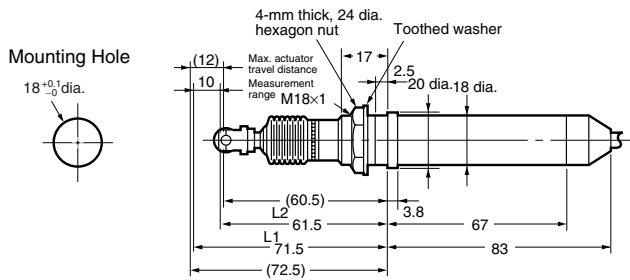
With Ball-type Actuator D5M-10BB



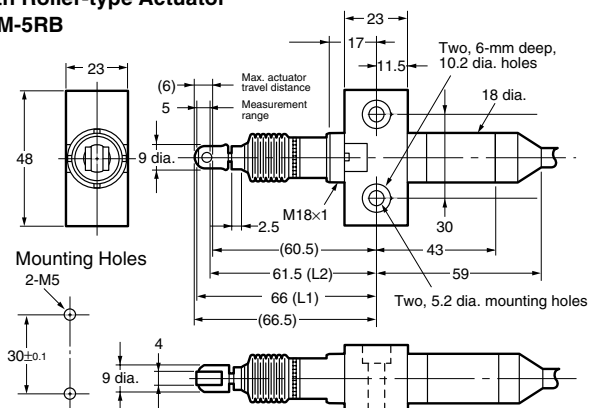
With Roller-type Actuator D5M-5R



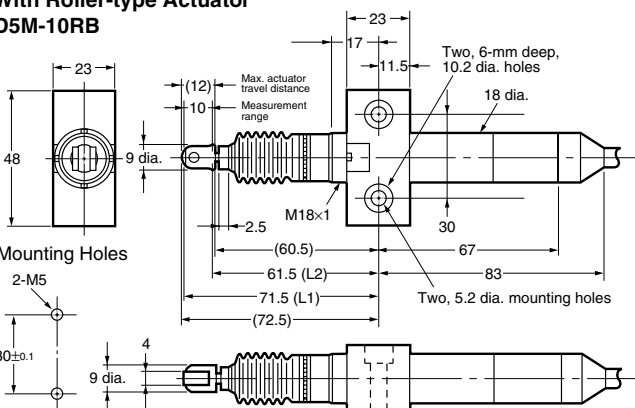
With Roller-type Actuator D5M-10R



With Roller-type Actuator D5M-5RB



With Roller-type Actuator D5M-10RB

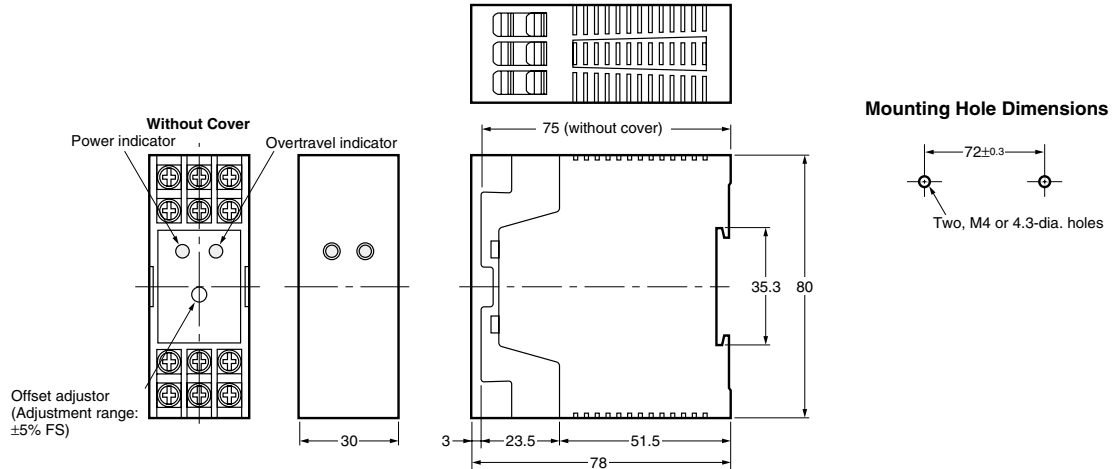


Note: Unless otherwise indicated, a tolerance of ± 0.4 mm applies to all dimensions in the above diagrams.

■ Amplifier

D5M-5□

D5M-10□



Note: Unless otherwise indicated, a tolerance of ± 0.4 mm applies to all dimensions in the above diagram.

Safety Precautions

1. The operating force is 5.88 N max. Depending on the material of the measurement object, the object surface may be dented or scratched. Check this before use.
2. Use a Sensor with a roller-type actuator (D5M-□R) for measurement of moving objects. Using a Sensor with a ball-type actuator may result in scratching.
3. Although the Sensor has a magnetic shield, using the Sensor near equipment that generates magnetic fields may result in large measurement errors and reduced linearity.
4. Do not perform measurement with the overtravel indicator lit. There may be large measurement errors in the range for which the overtravel indicator is lit, and excessive pushing may result in damage to the Sensor.

Consult your OMRON representative for more details.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Contact Displacement Sensor D5V

Contact Displacement Sensor with Built-in Amplifier That Enables In-line Measurement of a Wide Range of Objects with a Low Operating Force

- Works with a low operating force (0.29 N) to detect a wide variety of objects including glass, plastic, and rubber objects.
- Models with digital output for B7A Units and models with 4- to 20-mA linear output corresponding to the 0- to 5-mm measurement range are available.
- Models with ball-, flat-, or pin-type actuators are available for a wide variety of objects.
- The XS3 Sensor I/O Connector makes Sensor connections simple.



Ordering Information

■ List of Models

Measurement range	Output specifications	Actuator	Resolution	Model
5 mm	4 to 20 mA	Ball type	10 μm	D5VA-3B1
		Pin type		D5VA-3P1
		Flat type (See note 1.)		D5VA-3F1
	B7A serial communications output (See note 2.)	Ball type	1 μm	D5VM-3B1
		Pin type		D5VM-3P1
		Flat type (See note 1.)		D5VM-3F1

Note: 1. Flat-type actuators have a hole 5-mm deep for an M2.5 screw in the tip so that an actuator can be mounted externally.

2. Use the D5VM-3□1 in combination with the B7A Link Terminal Output Unit or a C200H or CQM1 B7A Interface Unit. Use 16- or 32-point Units with a standard transmission delay time (19.2 ms).

Specifications

Item	Model	D5VA-3□1	D5VM-3□1
Supply voltage		12 to 24 VDC±10% (See note 1.)	
Current consumption		80 mA max.	
Measurement range		5 mm	
Maximum actuator travel distance		Approx. 5.7 mm	
Offset adjustment range		±0.25 mm	
Resolution		10 μm	1 μm
Linearity		0.5% FS max.	
Repeat accuracy		10 μm max.	
Response time		6 ms max.	37 ms max. (including transmission delay time)
Operating force		0.3 N max.	
Output		Linear current output: 4 to 20 mA (Allowable load resistance: 0 to 300 Ω)	B7A serial communications output (See note 2.) (BCD and multipoint ON/OFF output modes) (See note 3.)
Mounting method		Two M4 screws	
Indicators		Power and overtravel indicators	Power, overtravel, setting, and output indicators
Mechanical durability		10,000,000 operations min.	
Temperature influence		±0.04% FS/°C max.	
Operating temperature		-10 to 55 °C (with no icing or condensation)	
Storage temperature		-25 to 65 °C (with no icing or condensation)	
Humidity range		35% to 85% (with no icing or condensation)	
Insulation resistance		100 MΩ min. (at 100 VDC)	
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min	
Noise resistance		1.5 kV with a pulse width of 100 ns to 1 μs	
Vibration resistance		10 to 55 Hz, 0.75-mm double amplitude	
Shock resistance		196 m/s ²	
Connection cable		2 m (XS3F-M421-402-R provided)	
Weight		Approx. 80 g (without cable)	
Material		ABS and PC polymer alloy	

Note: 1. If power is supplied to both the D5VM-3□1 and B7A Output Link Terminal from a single power supply, the supply voltage must be 24 VDC±10%.

2. Connectable models:

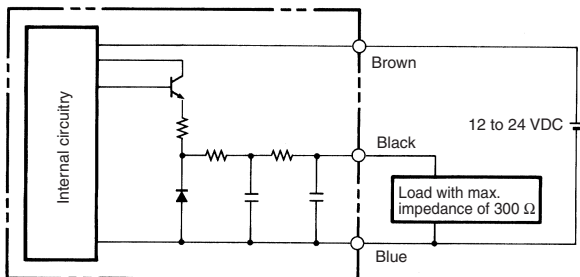
Model number	Description
B7A-R6□□1 B7AS-R6B□1	Screw-terminal models
B7A-R□A□3-□	PC-connector models
C200H-B7A21 C200H-B7A22 C200H-B7A11 C200H-B7A12	C200H B7A Interface Units
CQM1-B7A21 CQM1-B7A12 CQM1-B7A13	CQM1 B7A Interface Units
CJ1W-B7A22 CJ1W-B7A14 CJ1W-B7A04	CJW1 B7A Interface Units (for use in standard mode only)

3. BCD or multipoint output mode can be selected with the mode selector.

Engineering Data

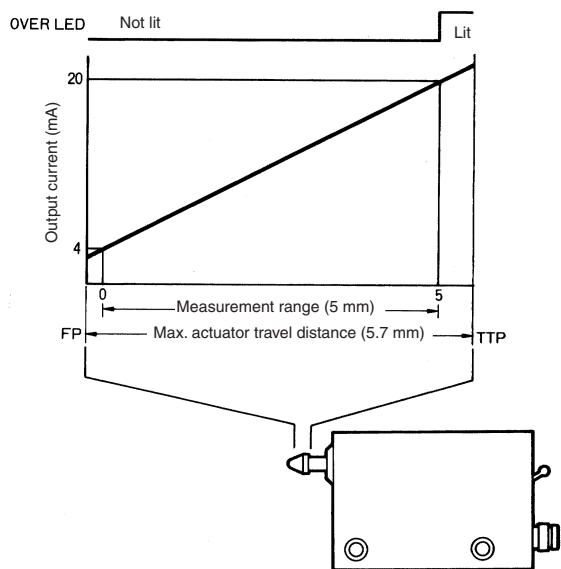
Output Characteristics

D5VA Output Circuit Diagram



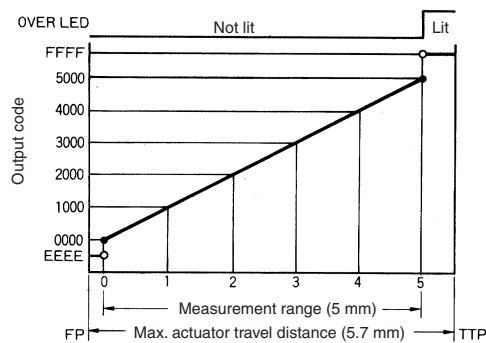
D5VA Output Characteristics

A current within a range between 4 and 20 mA is output according to the measurement range between 0 and 5 mm.

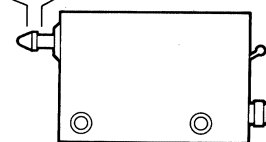


D5VM BCD Output Characteristics

A 16-bit BCD is output according to the measurement range between 0 and 5 mm.



The D5VM outputs codes within a range between 0000 and 5000 when the actuator is in the operating range, the code EEEE when the actuator is at the FP (free position), and the code FFFF when the actuator is pressed in excess of the measurement range.



Approved Standards

Approved Standard Ratings

Conformance to EN50081-1, pr50082-2

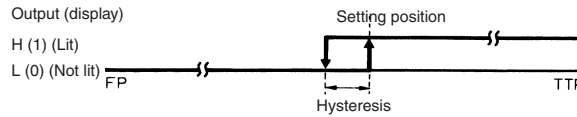
Rated current	100 mA
Rated voltage	24 VDC

D5VM Multipoint Output Characteristics

The following four types of signals are output according to the set value of the D5VM.

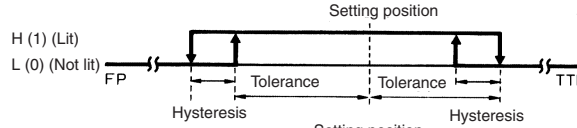
1. ON/OFF Output

Turns ON or OFF according to the set value as shown in the timing chart.



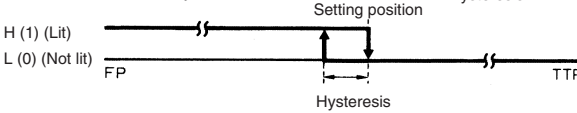
2. Tolerance Output

Turns ON or OFF according to the tolerance of the set value as shown in the timing chart.



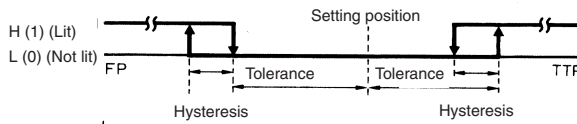
3. ON/OFF Reverse Output

Turns ON or OFF according to the set value. The signal timing is reverse to the signal 1 timing as shown in the timing chart.

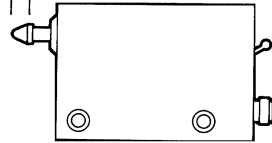


4. Tolerance Reverse Output

Turns ON or OFF according to the tolerance of the set value. The signal timing is reverse to the signal 2 timing as shown in the timing chart.



The hysteresis, which is 10 μm, is the difference between the position in the TTP direction where the actuator turns the output ON and the position in the FP direction where the actuator turns the output OFF.

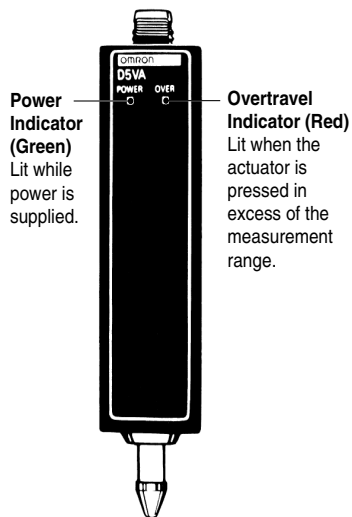


B7A Output Link Terminals Data

B7A OUT	BCD output	Multipoint output
#0	1's digit = 1	Point 0
#1	1's digit = 2	Point 1
#2	1's digit = 4	Point 2
#3	1's digit = 8	Point 3
#4	10's digit = 1	Point 4
#5	10's digit = 2	Point 5
#6	10's digit = 4	Point 6
#7	10's digit = 8	Point 7
#8	100's digit = 1	Point 8
#9	100's digit = 2	Point 9
#10	100's digit = 4	Point 10
#11	100's digit = 8	Point 11
#12	1000's digit = 1	Point 12
#13	1000's digit = 2	Point 13
#14	1000's digit = 4	Point 14
#15	1000's digit = 8	Point 15

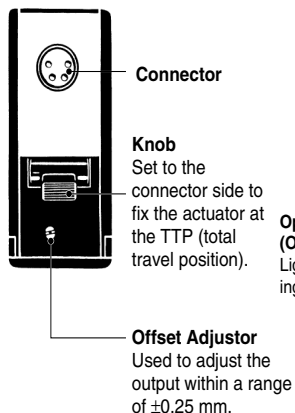
Nomenclature

D5VA-□□ (Linear Output)



Power Indicator (Green)
Lit while power is supplied.

Overtravel Indicator (Red)
Lit when the actuator is pressed in excess of the measurement range.

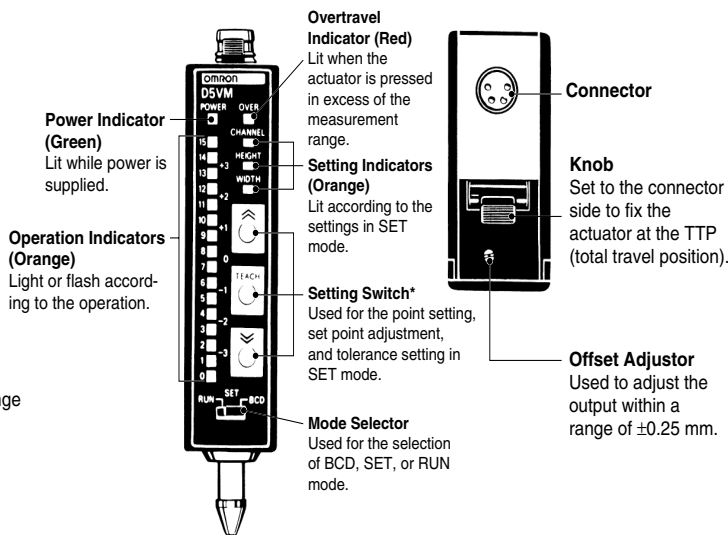


Connector

Knob
Set to the connector side to fix the actuator at the TTP (total travel position).

Offset Adjustor
Used to adjust the output within a range of ± 0.25 mm.

D5VM-□□ (B7A Serial Communications)



Power Indicator (Green)
Lit while power is supplied.

Operation Indicators (Orange)
Light or flash according to the operation.

Overtravel Indicator (Red)
Lit when the actuator is pressed in excess of the measurement range.

Setting Indicators (Orange)
Lit according to the settings in SET mode.

Setting Switch*
Used for the point setting, set point adjustment, and tolerance setting in SET mode.

Mode Selector
Used for the selection of BCD, SET, or RUN mode.

Connector

Knob
Set to the connector side to fix the actuator at the TTP (total travel position).

Offset Adjustor
Used to adjust the output within a range of ± 0.25 mm.

*Teaching Function (D5VM Series)

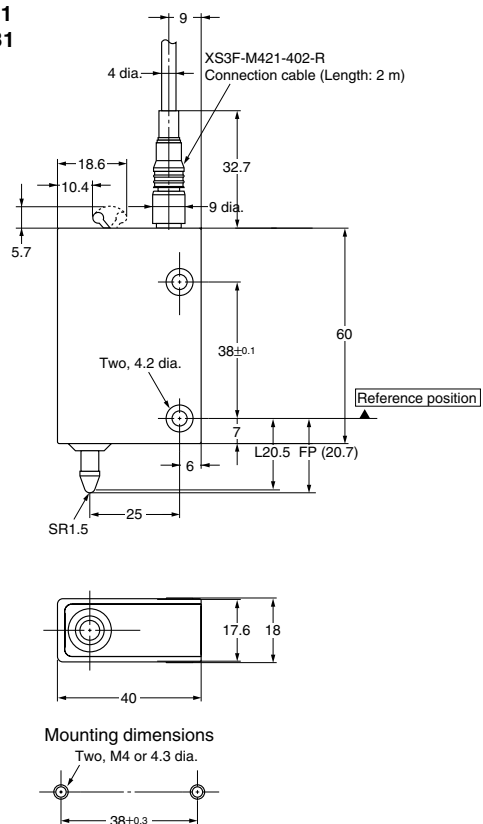
To use the teaching function, set the actuator in the position to be registered, and press the setting switch (TEACH). The corresponding set value will be recorded automatically. If the power is turned OFF, the set value will be saved and so it is not necessary to reset it each time measurement is performed.

Operation Indicators

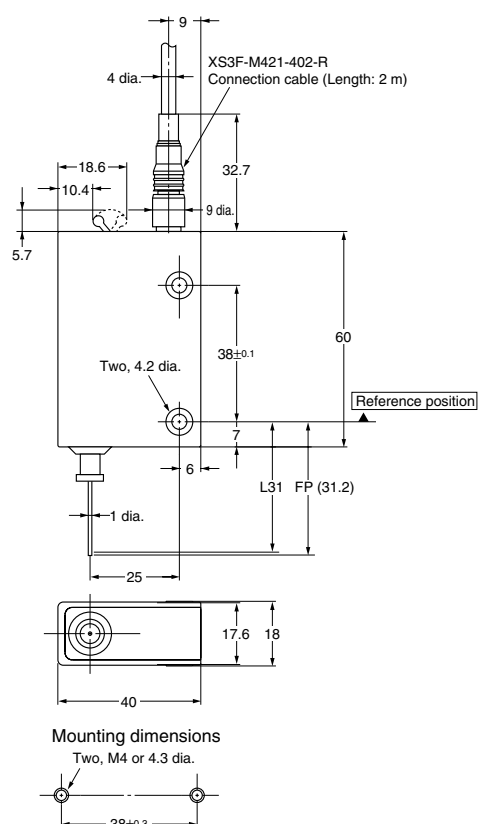
BCD	Lit according to the travel distance of the actuator (bar display).	
SET	CHANNEL	Lights for points that have been set. Flashes for points that are being set.
	HEIGHT	The adjustment value is displayed.
	WIDTH	The output status and tolerance are displayed.
RUN	The output statuses of points 0 to 15 are displayed.	

Dimensions

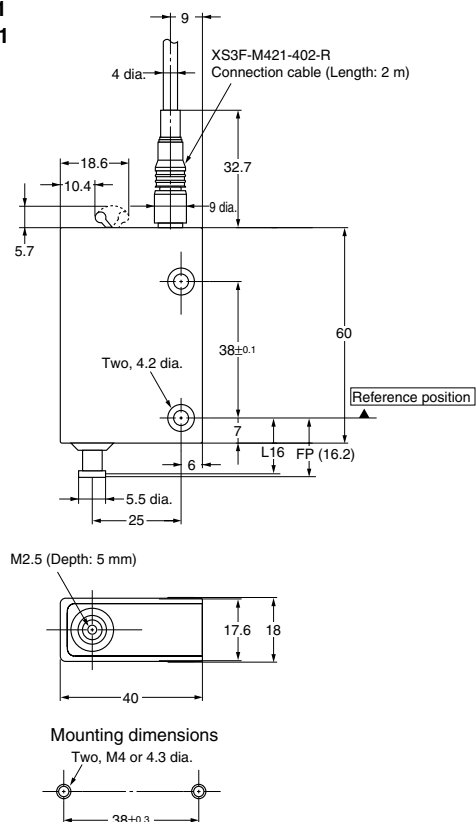
D5VA-3B1
D5VM-3B1



D5VA-3P1
D5VM-3P1




D5VA-3F1
D5VM-3F1



Operation


■ Connection to Digital Panel Meters

K3NX



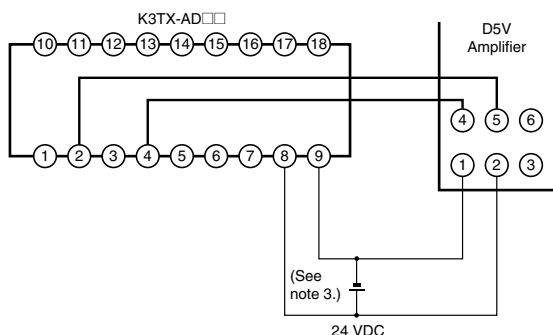
Product name	Process Meter
Model number	K3NX-AD□□-□
Features	Accuracy of $\pm 0.1\%$ rdg ± 1 digit max. Models with contact, transistor, BCD, communications, and linear output are available. Five-step comparison is available.

K3GN

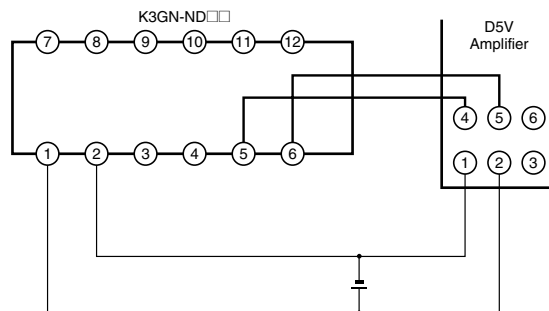


Product name	1/32 DIN Digital Panel Meter
Model number	K3GN-ND□□
Features	Compact dimensions of 48 (W) \times 24 (H) \times 83 (D). Display color can switch between red and green. Models with communications models also available.

Connection Examples



3. The wiring example shown above is for a K3NX model that runs on a DC power supply. When using a model that runs on an AC power supply, wire the AC power supply for the K3NX and the DC power supply for the D5M Amplifier separately.



- Note:**
1. The K3NX must be a DC input model.
 2. Various K3NX output models are available. Select the model most suited to the application.

Available Models

K3NX

Output form		Supply voltage
		12 to 24 VDC
Relay contact	HH, H, L, LL (SPST-NO), and PASS (SPDT)	K3NX-AD2A-C2
Transistor	HH, H, PASS, L, AND LL (NPN open collector)	K3NX-AD2A-T1

K3GN

Output form	Communications output form	Model specifications
Relay contact (2 outputs, SPST-NO)	None	K3GN-NDC: 24 VDC
Transistor output (3 outputs, NPN open collector)		K3GN-NDT1: 24 VDC

Note: For more details on the K3NX and K3NG, refer to the relevant datasheets (K3NX: N084; K3GN: N101).

Safety Precautions

Caution

The tip of a pin-type actuator is sharp. Be careful when handling the actuator, otherwise an injury may occur.

Correct Use

- Do not disassemble the D5V, otherwise an electric shock or injury may occur or the D5V may malfunction.
- The D5V will have detection errors if the operating speed of the actuator exceeds the response time.
- The operating force of the actuator is 0.3 N (30 gf). Before using the D5V to detect objects, make sure that the actuator will not damage the objects.
- The D5V will have large detection errors if it is used near generators, motors, or other machines generating strong magnetic fields.
- Make sure that the overtravel indicator of the D5V in operation is not lit. The Sensor will be damaged if the actuator is pressed in excess of the measurement range.
- Do not impose horizontal loads on the actuator, otherwise the actuator will deform and have difficulty in detecting objects correctly.
- The D5V is not of watertight or dust-tight construction. Do not use or store the D5V in an area with excessive humidity or dust or where water may be sprayed onto the D5V.
- An adapter may be attached to the flat-type actuator. The operating force may, however, change due to the weight of the adapter. Some types of adapters, such as roller-type adapters, may cause detection errors.
- The white lead wire of the cord is not used. Insulate the end of the white cord so that it will not come in contact with other lead wires.
- The D5V will not detect objects correctly if the knob is set to the connector side to fix the actuator at the TTP.

ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.

To convert millimeters into inches, multiply by 0.03937. To convert grams into ounces, multiply by 0.03527.

Displacement Sensor Terminology

Resolution

When analog output signals are converted to digital signals, the output is divided into steps, as shown in Fig. 1. The “resolution” is the size of the smallest unit that the output can be divided into (i.e., the size of one step). It is not the same as “accuracy.” With contact displacement sensors and other analog devices, however, this alone is not sufficient to define the resolution. The resolution of analog sensors is defined to be the size of the smallest displayable digit when connected to a display device equipped with an AD converter, such as a digital panel meter.

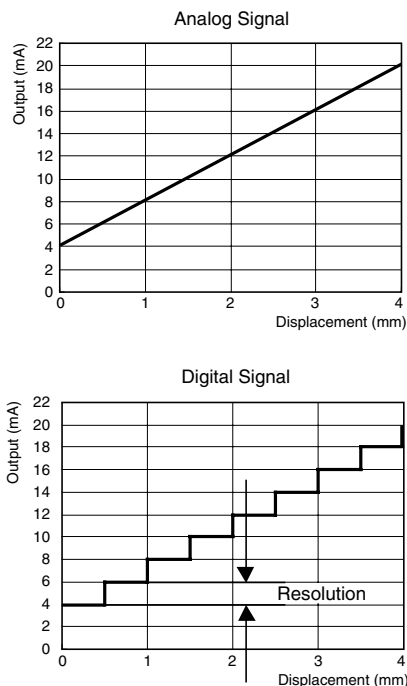


Fig.1 Analog and Digital Output Signals from a Sensor

Accuracy

“Accuracy” can be divided into the two categories shown below.

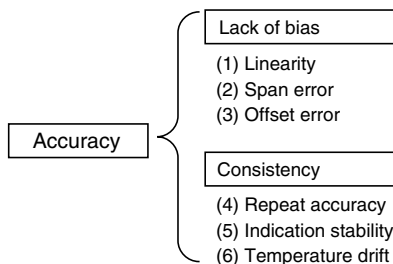


Fig. 2 Classification of Accuracy

1) Linearity

Fig. 3 shows the current output characteristics for contact displacement sensors. The D5SN-S04, for example, outputs current in the range 4 to 20 mA in accordance with values in a measurement range of 4 to 20 mA. Ideally, the characteristic curve for this would be a straight line. In practice, however, the actual curve deviates a little from a straight line. The “linearity” refers to the extent of this deviation.

Basically, the linearity is defined by the following formula and is expressed in the unit “% FS” (i.e., as a percentage of the measurement range).

$$\text{Linearity} = \frac{\text{Maximum deviation}}{\text{Full scale}} \times 100 \% \text{ FS}$$

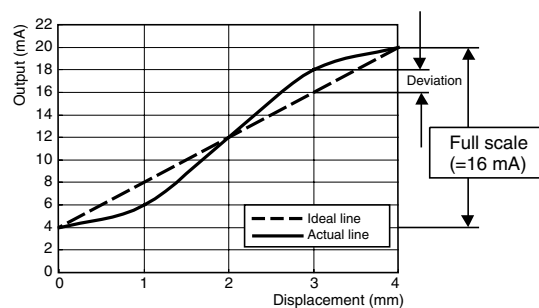


Fig. 3 Displacement Sensor Output Characteristics

2) Span Error

“Span error,” (as shown in Fig. 4) refers to the difference in inclination between the ideal and the actual output lines for the measuring device.

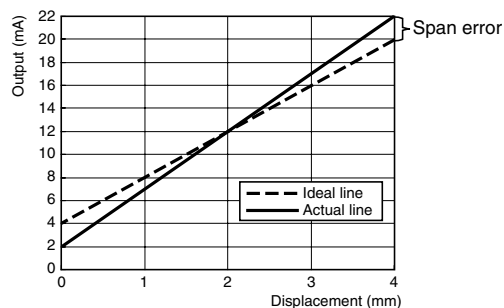


Fig. 4 Span Error

3) Offset Error

The “offset error,” (as shown in Fig. 5) refers to the difference between the ideal and actual output values (points on a regression line) for the measuring device corresponding to the mid-point of the measurement range (e.g., 2 mm with the D5SN-S04).

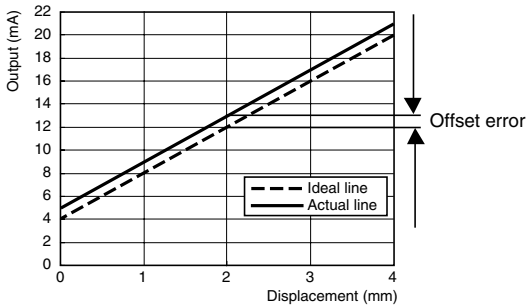


Fig. 5 Offset Error

4) Repeat Accuracy

The “repeat accuracy” refers to the degree of inconsistency in indicated values within a short period. Such inconsistencies are caused by mechanical chattering and hysteresis.

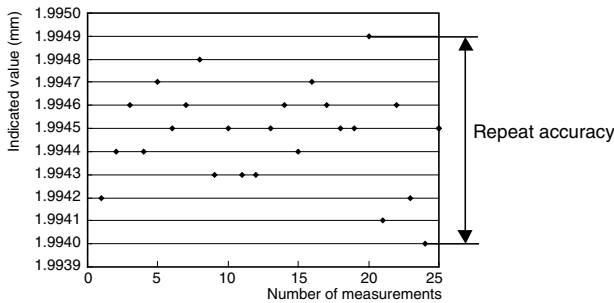


Fig. 6 Example of Repeat Accuracy

5) Indication Stability

The “indication stability” refers to the degree of fluctuation in indication values in environments with constant temperatures. It is mainly caused by temperature drift resulting from heat building up in circuits.

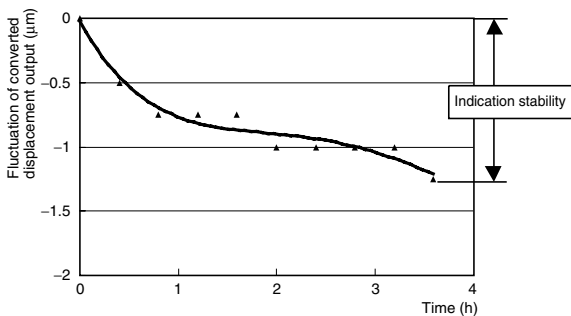


Fig. 7 Example of Indication Stability

6) Temperature Drift

“Temperature drift” refers to the range over which output values fluctuate due to changes in the ambient temperature.

The “temperature characteristics” (or “temperature influence”) are defined as the temperature drift corresponding to a change of 1°C at, in the case of contact displacement sensors, the electrical mid-point (e.g., the 0-V position for voltage output). It is usually expressed as a percentage of the measurement range (FS).

Example:

The following calculation is used to obtain the output fluctuation corresponding to a change in the ambient temperature of 1°C at the electrical mid-point when using the D5SN-S01.

(Temperature characteristics of Sensor and Amplifier: 0.035% FS/°C; full scale: 1 mm)

$$0.00035 \times 1 \times 1 = 0.00035 \text{ mm} = 0.35 \text{ } \mu\text{m}$$

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