CS Series

Features

Capacitance Type

- Metal cylinder/Resin cylinder/Square type
- Non-metal objects such as wood, paper, plastic and water can be detected.
- The operating distance is adjustable with a potentiometer.
- DC voltage / NPN output

Type

DC Voltage Output Type/3-wire DC System

Output Form		Operating Distance (mm)	Output Form	Model Number	Remarks
Resin Cylinder M22	Non-flush Mount Type	5	NPN NO	CS-31-5N*	
Metal Cylinder M30	Non-flush Mount Type	15	DC voltage	CS-85-15T	
			NPN NO	CS-85-15N	
Square type	Non-flush Mount Type	5	DC voltage	CS-16-5T	
			NPN NO	CS-16-5N	
		10	NPN NO	CS10-34CU-E	

* For installation, use the provided dedicated resin nut.

CS Series

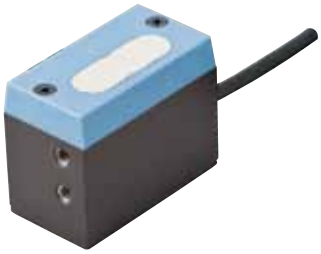
DC Voltage Output Type/3-wire DC System　Non-flush Mount Type

Effective Operating Distance			5 mm ±10%	15 mm ±10%
Photo				
Remarks			Resin Cylinder Type	Metal Cylinder Type
Output Form	DC Voltage	Model Number		CS-85-15T
		Price		Open
	NPN NO	Model Number	CS-31-5N*	CS-85-15N
		Price	Open	Open
Rated Working Voltage	DC Voltage Output Type		12 V DC (10 to 16 V DC) Allowable ripple rate: 10% p-p or less	
	DC Switching type (N Type)		24 V DC (20 to 30 V DC) Full wave rectification power supply can be used. (20 to 30 V DC mean value)	12/24 V DC (10 to 30 V DC) Full wave rectification power supply can be used. (10 to 30 V DC mean value)
No-load Current			T type: 27 mA or lower　N type: 20 mA or lower	
Standard Target Object (mm)			Iron　50 x 50 x 1 t (Grounding state)	
Reaction Material			Iron/Non ferrous metal/Non-metal (Operating distance changes depending on materials.)	
Effective Operating Distance			The operating distance can be changed from a multi-rotation volume.	
Hysteresis			Approx. 20%	
Operating Cycle Frequency			50 Hz	
Output	T Type		Output impedance: 1.8 kΩ (Output standard: 8P6N)	
	N Type Rated Working Current		100 mA (Load voltage: Not more than 50 V)	
Voltage Drop (N Type)			2.0 V or lower	
Off-state Current (N Type)			200 μA or less	
Indicator Lamp			Operation indication	
Use Ambient Temperature			-25 to +70˚C	
Temperature Characteristics			Within ±20% (At the operating distance at +20˚C)	
Withstand Voltage			500 V AC　50/60 Hz (1 minute)	
Insulation Resistance			5 MΩ or higher (500 V DC)	
Vibration Resistance			Double amplitude: 1.5 mm, 10 to 55 Hz (2 h each for X, Y and Z direction)	
Impact Resistance			600 m/s^2, within 11 ms (10 times each for X, Y and Z direction)	
Protection Level			IP65	
Case Material			Polycarbonate	Brass nickel plate (Detector surface: Polycarbonate)
Lead Wire			Oilproof vinyl chloride cable 1.5 m Outside diameter (Approx. ϕ4.5) 0.3 mm^2, 3 core	Oilproof vinyl chloride cable 2 m Outside diameter (Approx. ϕ6) 0.5 mm^2, 3 core
Tightening Torque			3 Nm or less	20 Nm or less
Weight (g)			Approx. 80	Approx. 250

* When installing the CS-31-5T and CS-31-5N, use the provided dedicated resin nuts.

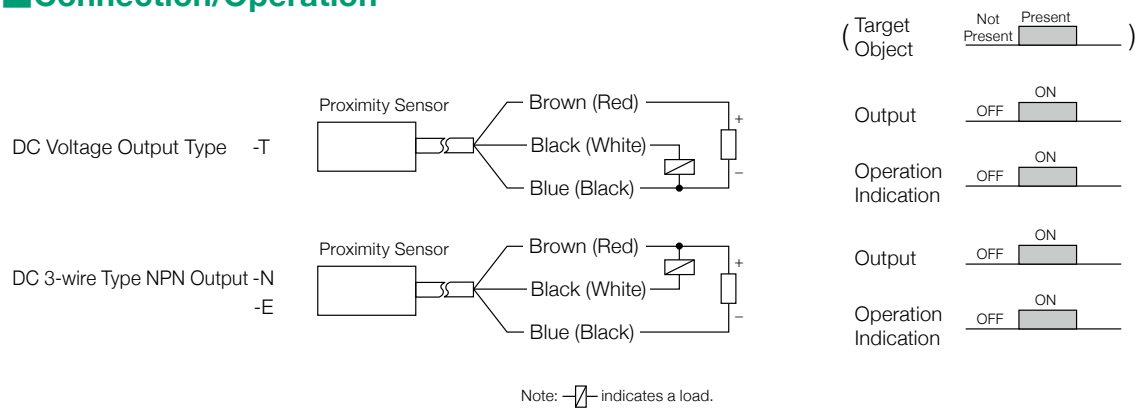
CS Series

DC Voltage Output Type/3-wire DC System　Non-flush Mount Type

Effective Operating Distance			10 mm ±10%	5 mm ±10%
Photo				
Remarks			Square type	Square type
Output Form	DC Voltage	Model Number		CS-16-5T
		Price		Open
	NPN NO	Model Number	CS10-34CU-E	CS-16-5N
		Price	Open	Open
Rated Working Voltage			12/24 V DC (10 to 30 V DC) Allowable ripple rate: 3% p-p or less	T type: 12 V DC (10 to 16 V DC) Allowable ripple rate: 10% p-p or less N type: 12/24 V DC (10 to 30 V DC) Full wave rectification power supply can be used. (10 to 30 V DC mean value)
No-load Current			20 mA or lower	T type: 27 mA or lower　N type: 20 mA or lower
Standard Target Object (mm)			Iron　50 x 50 x 1 t (Grounding state)	
Reaction Material			Iron/Non ferrous metal/Non-metal (Operating distance changes depending on materials.)	
Effective Operating Distance			10 mm ±10%	The operating distance can be changed from a multi-rotation volume.
Hysteresis			Approx. 20% or less	Approx. 20%
Operating Cycle Frequency			Up to 10 Hz	50 Hz
Output	T Type			Output impedance: 1.8 kΩ (Output standard: 8P6N)
	N/E Type Rated Working Current		E type: Up to 100 mA	N type: 100 mA (Load voltage: Not more than 50 V)
Voltage Drop			2.0 V or lower (Excluding CS-16-5T)	
Off-state Current			200 μA or less (Excluding CS-16-5T)	
Indicator Lamp			Operation indication	
Use Ambient Temperature			-10 to +55°C	
Temperature Characteristics			Within ±15% (At the operating distance at +23°C)	Within ±20% (At the operating distance at +20°C)
Withstand Voltage			500 V AC　50/60 Hz (1 minute)	
Insulation Resistance			50 MΩ or higher (500 V DC)	5 MΩ or higher (500 V DC)
Vibration Resistance			Double amplitude: 1.5 mm, 10 to 55 Hz (2 h each for X, Y and Z direction)	
Impact Resistance			490 m/s²	600 m/s²
			Within 11 ms (10 times each for X, Y and Z direction)	
Protection Level			IP66	IP50 (Dust-resistant)
Case Material			PBT	Aluminum (Detector surface: Polycarbonate)
Lead Wire			Oilproof vinyl chloride cable 2 m Outside diameter (Approx. φ3.8) 0.3 mm², 3 core	Oilproof vinyl chloride cable 1.5 m Outside diameter (Approx. φ4) 0.3 mm², 3 core
Tightening Torque			0.4 Nm or less	0.8 Nm or less
Weight (g)			Approx. 80	Approx. 100

CS Series
Connection and Operation

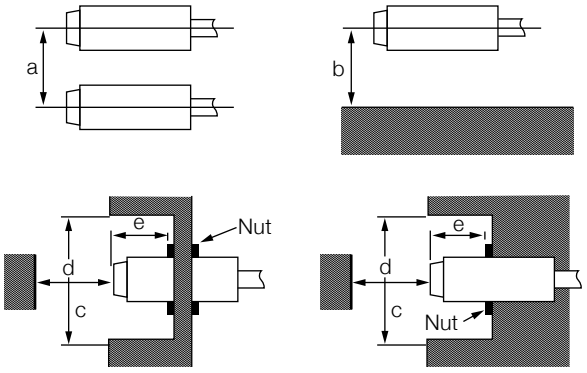
Connection/Operation



Note: —[/]— indicates a load.

Installation Method

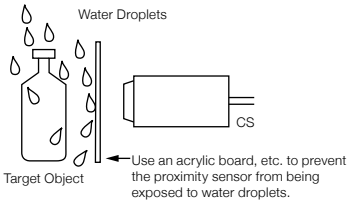
Since a capacitance proximity sensor detects the volumetric change in surrounding objects, it should be installed away from surrounding objects more than the dimensions shown in the table below.



	a	b	c	d	e
CS-31	44	33	66	44	22
CS-85	60	45	90	60	30
CS-16	92	69	138	92	46
CS10-34CU	40	30	60	30	10.4

Since a capacitance proximity sensor is highly sensitive to moisture, do not use it in a place that is highly humid or directly exposed to water.
Doing so may cause malfunction.

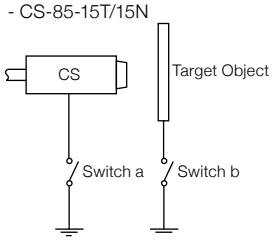
When using the sensor in a place exposed to water droplets, etc., the following measures should be taken.



Grounding

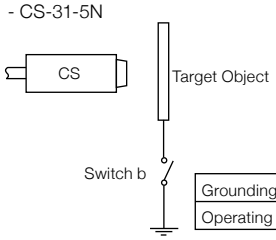
The operating distance changes according to the grounding state of the standard target object (50 x 50 x 1 t Iron) and capacitance proximity sensor. Use the information as reference for installing the proximity sensor and deciding the reaction material.

- CS-85-15T/15N



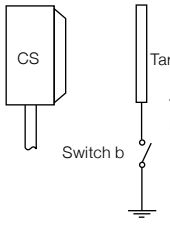
Grounding Conditions	Switch a	ON	OFF	ON	OFF
	Switch b	ON	ON	OFF	OFF
Operating Distance (mm)		15	18	6	6

- CS-31-5N



Grounding Conditions Switch b	ON	OFF
Operating Distance (mm)	5	2.6

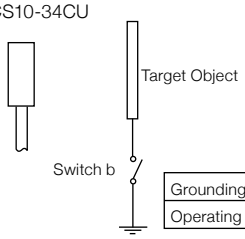
- CS-16-5T/5N



The case (aluminum) and circuit ground are common. Be careful when using them.

Grounding Conditions Switch b	ON	OFF
Operating Distance (mm)	5	2.6

- CS10-34CU



Grounding Conditions Switch b	ON	OFF
Operating Distance (mm)	10	3.0

CS Series

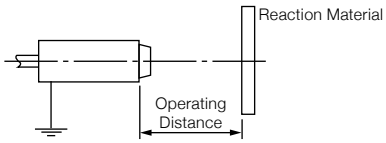
Connection and Operation

Potentiometer for Adjusting the Operating Distance

A multi-rotation potentiometer for adjusting the operating distance is equipped on the back of the main body of capacitance proximity sensors. After the capacitance proximity sensor is installed, use this multi-rotation potentiometer to adjust the operating distance to the standard distance for the grounded metal plate or larger standard target object (50 x 50 x 1 t mm) or below the standard distance, according to the usage. If the multi-rotation potentiometer is turned to the right, the operating distance becomes longer, and if it is turned to the left, the operating distance becomes shorter. Although the potentiometer can be adjusted 16±5 turns, even if it is turned too much, there will be no damage because the potentiometer turns idly without stopping at that point.
Note that, if the operating distance is set more than the rated operating distance, operation becomes unstable. (Except for the CS10-34CU-E)

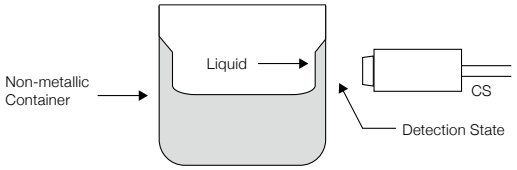
Material Characteristics

Even if the same material is detected, the operating distance differs by size and shape of the target object. The table below shows examples of how the operating distance differs by the type of material and shape when detected by a capacitance proximity sensor. (Detection distances differ according to the electrical conductivity, relative permittivity and the water absorption state and volume.)



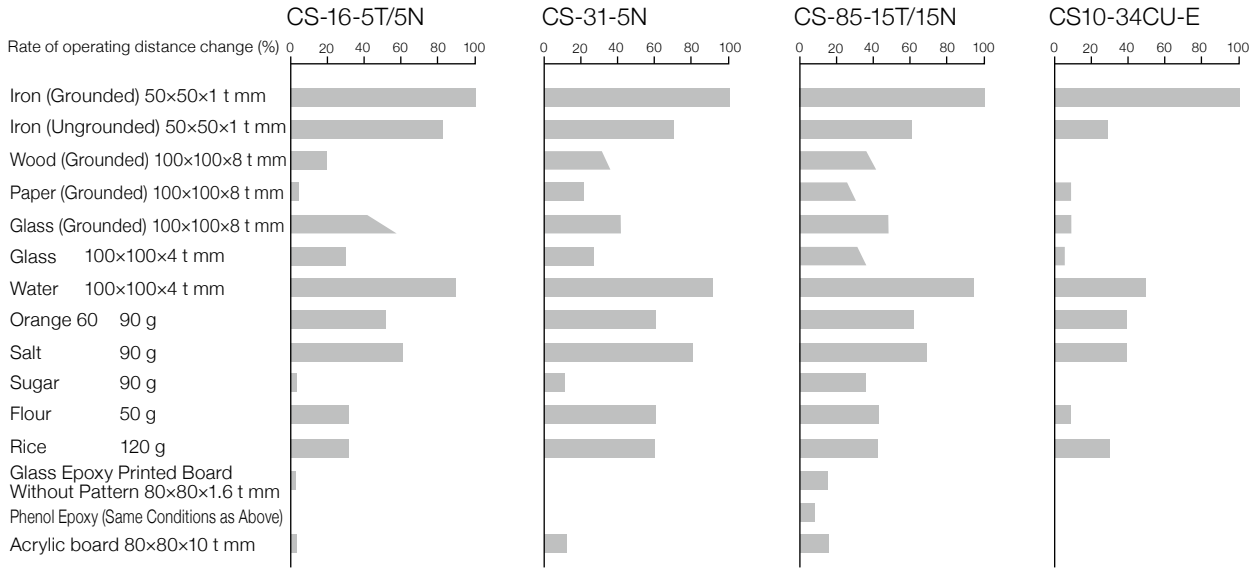
Precautions

① Pay careful attention to the possibility of condensation and freezing of the detector surface and the adhesion of water, oil, and dust to the detector surface because they may cause malfunction.
② Note that the adherence of fluid material and powder in a non-metal container may cause malfunction.



③ Three M4 screws are used for installing the CS-16-5T and CS-16-5N. Ensure that the screws do not penetrate the case more than 6 mm.
④ In the case of a 3-wire DC proximity sensor, a load with large making current (making current of 100 mA or more, such as a lamp, motor, and solenoid) may deteriorate or damage the switching element. In such case, use the sensor via a relay.

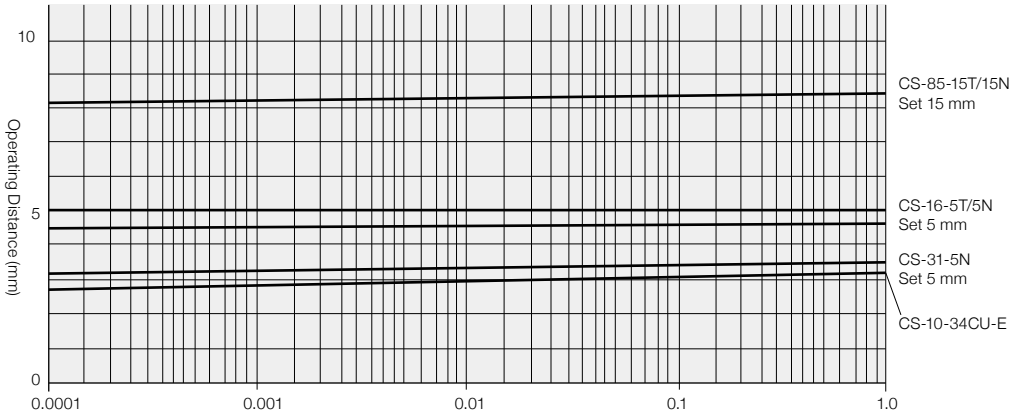
When the Operating Distance of Iron is 100%



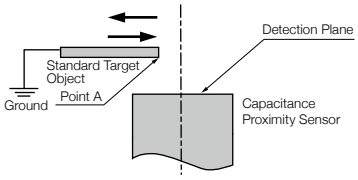
CS Series
Connection and Operation

Aluminum Thickness Characteristics

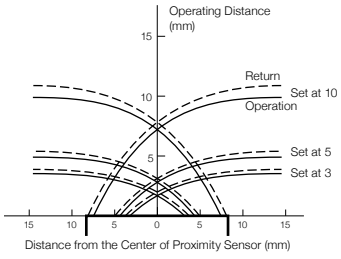
The operating distance differs according to the thickness of the target object. The figure shows the operating distance when a target object of the same size but a different thickness than the standard target object is used.



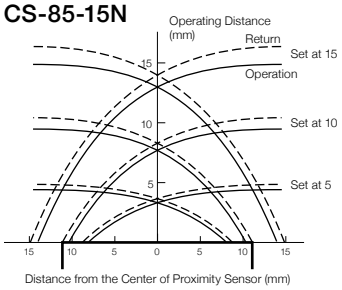
Detection Range Diagram (Representative Examples)



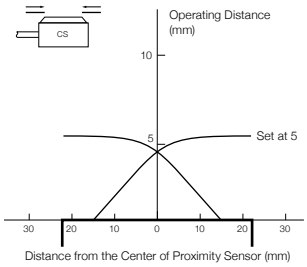
CS-31-5N

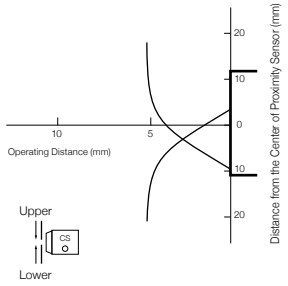


CS-85-15T
CS-85-15N

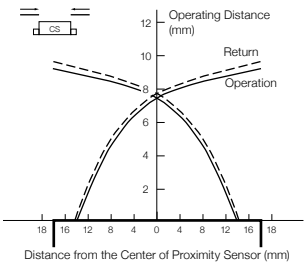


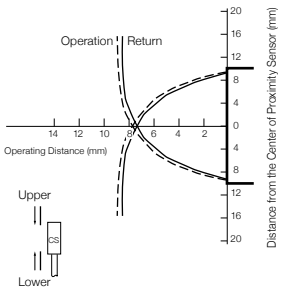
CS-16-5T
CS-16-5N





CS10-34CU-E



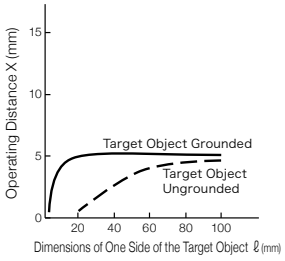


CS Series

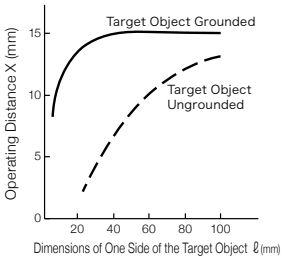
Connection and Operation

Shape Based Characteristics (Representative Examples)

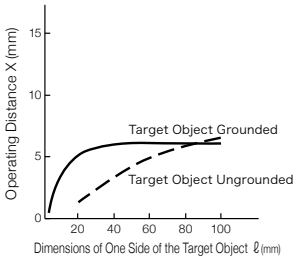
CS-31-5N



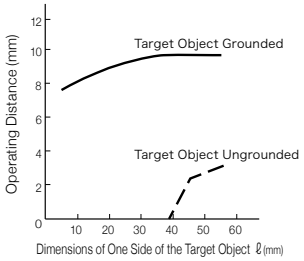
CS-85-15T
CS-85-15N



CS-16-5T
CS-16-5N



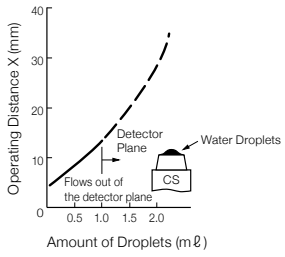
CS10-34CU-E



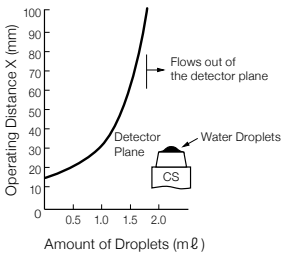
Effects of the Amount of Water on the Detector Surface

This graph shows the measured change in operating distance when water droplets have adhered to the detector surface of a capacitance proximity sensor.
When 0.2 ml of water (about 2 to 3 drops) adhere to the detector surface, the operating distance increases approx. 20% and when water flows out from the detector surface beyond the limit of surface tension, the operating distance increases 300% or more. (Except for the CS10-34CU-E)

CS-31-5N



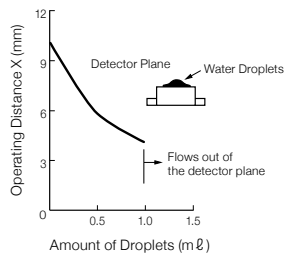
CS-85-15T
CS-85-15N



CS-16-5T
CS-16-5N

Because the detection board is exposed, when a water droplet touches the board, the detection state starts.

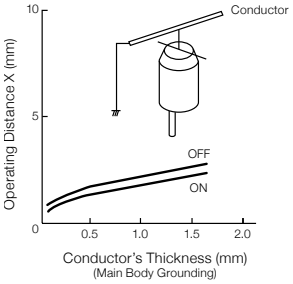
CS10-34CU-E



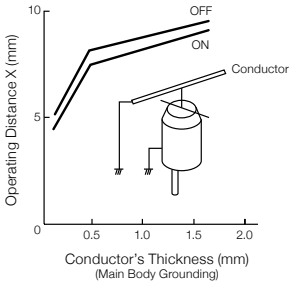
Conducting Wire Characteristics

Thin conducting wire (copper, steel, iron, aluminum, and other conducting wire) can be detected using a capacitance proximity sensor.
The figure shows the measured operating distance against the diameter of conducting wire.
The characteristics are obtained when the conducting wire is grounded (or has unlimited length).

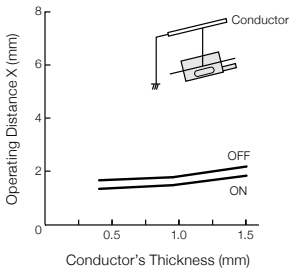
CS-31-5N

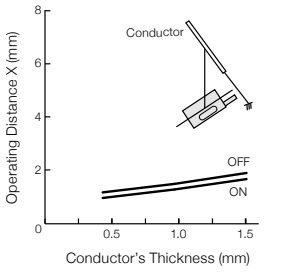


CS-85-15T
CS-85-15N

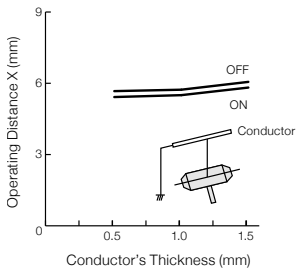


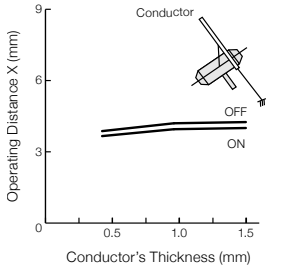
CS-16-5T
CS-16-5N





CS10-34CU-E

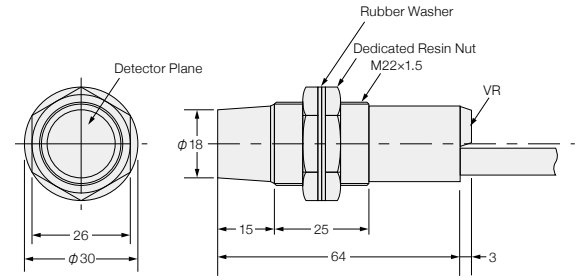




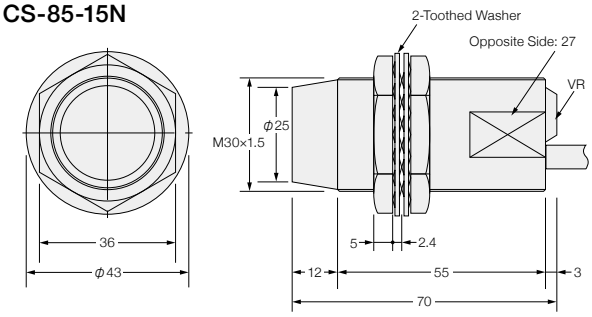
CS Series
Dimensions/Reference Material

Dimensions (Unit: mm)

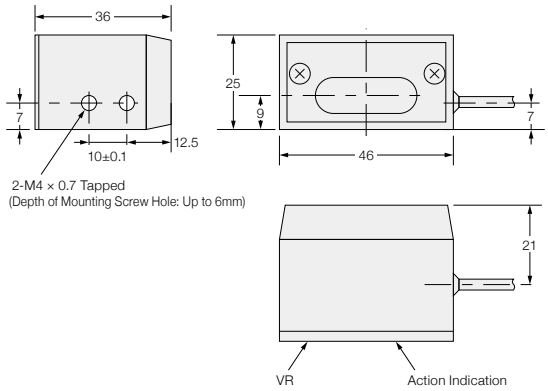
CS-31-5N



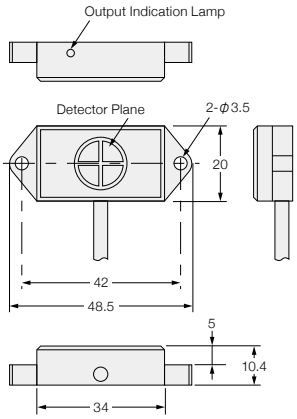
CS-85-15T
CS-85-15N



CS-16-5T
CS-16-5N



CS10-34CU-E

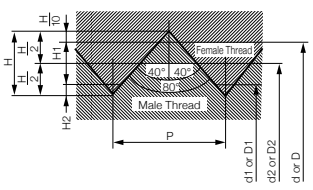


Reference Material

Screw Basic Profile and Basic Dimensions

The appendix table "Basic profile and basic dimensions of screws" shows screws that are made of JIS standard material and are of special size, as a reference material.
The thin steel conduit tube screw C15 is of a size suitable for the cable outlet of the APS-14 and APS-15 series.

Thin Steel Conduit Tube Screw (Abolished in April 1999)



The bold continuous line shows the basic profile.

$P = \frac{25.4}{n}$
$H = 0.59588P$
$H_1 = 0.43851P$
$H_2 = 0.09778P$
$d_2 = d\text{-}0.47670P$
$d_1 = d\text{-}0.87703P$
$D = d$
$D_2 = d_2$
$D_1 = d_1$

(Unit: mm)

Nominal Designation of Thread	Nominal Diameter of Applicable Tube	Number of Threads (Per 25.4 mm) n	Pitch P (Reference)	Thread Overlap H1	Male Thread		
					Outer Diameter d	Effective Diameter d2	Thread Minor Diameter d1
					Female Thread		
					Thread Minor Diameter D	Effective Diameter D2	Inner Diameter D1
C15	15	18	1.4111	0.619	15.900	15.227	14.663
C19	19	16	1.5875	0.696	19.100	18.343	17.708
C25	25	16	1.5875	0.696	25.400	24.643	24.008
C31	31	16	1.5875	0.696	31.800	31.043	30.408
C39	39	16	1.5875	0.696	38.100	37.343	36.708
C51	51	16	1.5875	0.696	50.800	50.043	49.408
C63	63	16	1.5875	0.696	63.500	62.743	62.108
C75	75	16	1.5875	0.696	76.200	75.443	74.808