# Adjustable Range Reflective Photoelectric Sensor Amplifier Built-in Multi-voltage ERIES

FIBER SENSORS

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UV CURING SYSTEMS



General terms and conditions...... F-7

Glossary of terms / General precautions......P.1455~ / P.1458~





Sensor selection guide...... P.271~

China's CCC mark ..... P.1505







# Long range sensing capability to 2.5 m 8.202 ft Stable sensing unaffected by color or material

# Long sensing range

An adjustable range to 2.5 m 8.202 ft allows plenty of space for installation.

1 m 3.281 ft sensing range type also available. Adjust the volume easily to suit your needs when using at close range.

# Hardly affected by background objects

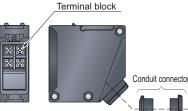
Because the sensor doesn't detect objects outside the preset sensing field by using the 2-segment photodiode adjustable range system, it will not malfunction even if someone walks behind the sensing object or machines or conveyors are in the background.

Note: Please note that malfunction may occur when there are specular objects or objects with a mirror-like surface in the background. Refer to p.368 "Mounting" of "PRECAUTIONS FOR PROPER USE" section.

# MOUNTING

# **Convenient terminal block type**

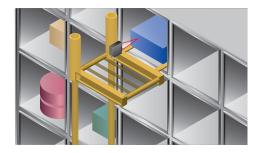
Cabling enabled by way of a terminal block that eliminates waste.



# Impervious to variations color or angle

The optical system has been optimized. Since the sensor is hardly influenced at all by angles or the gloss of objects compared to the previous model, it is possible to detect both white objects and black objects at almost a constant distance.

The difference in sensing range between white non-glossy paper and gray non-glossy paper (lightness: 5) is approx 5% when set at a distance of 2 m 6.562 ft.



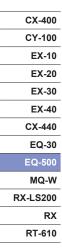
# OPERABILITY

# An easy to set adjuster with indicator

Equipped with a 2-turn adjuster with indicator, making it easy to set for short or long distances.





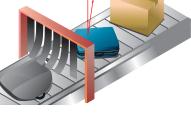


### APPLICATIONS

**Level check within the hopper** The distance to the object can be set to enable residual amount sensing in the hopper regardless of color.



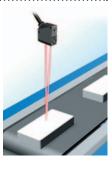
Confirmation of the passage of packages on a conveyor belt Can accurately detect packages even if they vary in size and color.



# VARIETIES

# Equipped with both NPN and PNP outputs EQ-51

We've added a DC-voltage type with NPN and PNP transistor outputs all in one sensor. Its BGS / FGS function controls any background effects for more stable sensing.



### Multi-voltage

### EQ-50□

EQ-510

Because it can function with 24 to 240 V AC and 12 to 240 V DC, almost any power supply anywhere in the world will do.

# Convenient timer function models

Types with an ON-delay / OFF-delay timer available. OFF-delay, e.g. useful when the response of the connected device is slow, ON-delay, e.g. useful to detect objects that take a long time to move.

Operation: ON-delay, OFF-delay
Timer period: 0.1 to 5 sec. (individual setting possible)

## **FUNCTIONS**

# BGS / FGS functions make even the most challenging settings possible!

### The BGS function is best suited for background not present



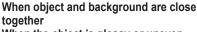
#### When object and background are separated BGS (Background suppression) function The sensor judges that an object is present when light is received at position

A of the light-receiving element (2-segment element). This is useful if the object and background

are far apart.

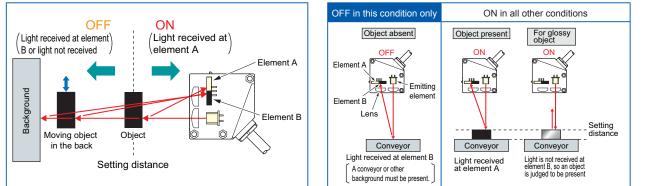
Not affected if the background color changes or someone passes behind the conveyor.

### The FGS function is best suited for background present



When the object is glossy or uneven FGS (Foreground suppression) function The sensor judges that no object is present

The sensor judges that no object is present when light is received at position B of the light receiving element (2-segment element) (The conveyor is detected). This function is useful if the object and the background are close together or if the object is glossy or uneven. However, sensing is impossible if there is no background (conveyor, etc.).



Note: Refer to "BGS / FGS function (p.369)" of "PRECAUTIONS FOR PROPER USE" for operation of BGS / FGS function.

#### FIBER SENSORS

LASER SENSORS

MICRO PHOTOELECTRIC SENSORS

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FA COMPONENTS

MACHINE VISION SYSTEMS

UV CURING SYSTEMS

#### Selection Guide Amplifier Built-in Power Supply Built-in Amplifierseparated

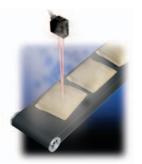
OV 400

CX-400	
CY-100	
EX-10	_
EX-20	
EX-30	
EX-40	
CX-440	
EQ-30	
EQ-500	
MQ-W	
RX-LS200	
RX	
RT-610	

# ENVIRONMENTAL RESISTANCE

# Little affected by contamination on lens

Even if the lens surface gets somewhat dirty from dust particles, there is very little change in the operation field, by usage adjustable range system.



### Waterproof

IP67 protection permits use in environments where water may splash.

Note: Sensor may detect a water drop itself, if it is exposed to water splashes during operation.



# ORDER GUIDE

Туре	Appearance	Sensing range	Model No.	Supply voltage	Output	Timer function
		0.1 to 2.5 m	EQ-501		Relay contact 1a	
oltage With timer		0.328 to 8.202 ft	EQ-501T	24 to 240 V AC ±10 %		ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)
Multi-voltage With tir		0.1 to 1.0 m	EQ-502	or 12 to 240 V DC ±10 %		
With timer		0.328 to 3.281 ft	EQ-502T	-		ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)
	e e	0.1 to 2.5 m	EQ-511		NPN	
Vith timer		0.328 to 8.202 ft	EQ-511T	12 to 24 V DC	open-collector transistor	ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)
DC-voltage With ti		0 1 to 1 0 m	EQ-512		open-collector transistor ( Equipped with )	
With timer		0.328 to 3.281 ft	EQ-512T		2 outputs	ON-delay / OFF-delay timer (Timer period: 0.1 to 5 sec.)

# OPTION

RT-610

Selection Guide Amplifier Built-in

# Designation Model No. Description Sensor mounting bracket MS-EQ5-01 Foot / back angled mounting bracket

### Sensor mounting bracket

• MS-EQ5-01



Two M5 (length 30 mm 1.181 in) screws with washers and two nuts are attached.

# SPECIFICATIONS

		Tuna	Multi-voltage				DC-voltage			
	$\langle \rangle$	Туре		With timer		With timer		With timer		With timer
tem		Model No.	EQ-501	EQ-501T	EQ-502	EQ-502T	EQ-511	EQ-511T	EQ-512	EQ-512T
dju	stable range	(Note 2,3)	0.2 to 2.5 m 0	.656 to 8.202 ft	0.2 to 1.0 m 0	.656 to 3.281 ft	0.2 to 2.5 m 0	656 to 8.202 ft	0.2 to 1.0 m 0	.656 to 3.281 ft
ensin	g range (at max. sett	ting distance) (Note 3)	0.1 to 2.5 m 0.328 to 8.202 ft 0.1 to 1.0 m 0.328 to 3.281 ft 0.1 to 2.5 m 0.328 to 8.202 ft 0.1 to 1.0 m 0.328 to 3.2			.328 to 3.281 ft				
yst	eresis (Note	3)				10 % or less of o	peration distanc	e		
hdr	oly voltage		24 to 240 V AC ±10 % or 12 to 240 V DC ±10 % Ripple P-P 10 % or less			% 12 to 24 V DC ±10 % Ripple P-P 10 % or less			6 or less	
ow	er / Current c	consumption	AC: 4 VA or less       AC: 5 VA or less       AC: 4 VA or less       AC: 5 VA or less         DC: 3 W or less       DC: 4 W or less       DC: 4 W or less       AC: 5 VA or less							
Dutput		Relay contact 1a • Switching capacity: 250 V AC 3 A (resistive load) 30 V DC 3 A (resistive load) • Electrical life: 100,000 or more switching operations (switching frequency 1,200 operations/hour)			NPN open-collector transistor • Maximum sink current: 100 mA • Applied voltage: 30 V DC or less (between output and 0 • Residual voltage: 1 V or less (at 100 mA sink current) 0.4 V or less (at 16 mA sink current) PNP open-collector transistor		c current)			
		Mechanical life: 50 million o			g operations	<ul> <li>Maximum source current: 100 mA</li> <li>Applied voltage: 30 V DC or less (betwee</li> <li>Residual voltage: 1 V or less (at 100 m/ 0.4 V or less (at 16 m)</li> </ul>			less (between output and +V)	
	Output oper	ation			Switchal	ble either Detect	on-ON or Detec	tion-OFF		
	Short-circuit	t protection						Incorp	orated	
esp	oonse time		20 ms or less (	For <b>EQ-50</b> □ <b>T</b> dep	ends on the sett	nds on the setting timer period) 2 ms or less (For EQ-51 T depends on the setting timer period)				
pe	ration indicate	or			Orang	Orange LED (lights up when the output is ON)				
ab	ility indicator		Green LED (lights up under stable operating condition)							
ista	ance adjuster	•	2-turn mechanical a			I adjuster with indicator				
ens	sing mode					Switchable either BGS or FGS function				
me	er function			Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer		Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer		Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay timer		Incorporated with variable (0.1 to 5 sec.) ON-delay / OFF-delay time
utom	atic interference p	prevention function				Incorporate	ed (Note 4)			
	Protection		IP67			(IEC)				
	Ambient ten	nperature	–20 t	to +55 °C -4 to +	131 °F (No dew	condensation or	icing allowed),	Storage: -30 to ·	+70 °C –22 to +	158 °F
2	Ambient hur	midity	35 to 85 % RH, Sto				age: 35 to 85 %	RH		
סופופ	Ambient illu	minance			Incandesc	cent light: 3,000 &	x at the light-rec	eiving face		
Environmental resistance	Voltage with	nstandability	metal parts an	r one min. amon nd relay contact c een relay contac	output terminals,		,	C for one min. be together and er		y terminals
Environ	Insulation re	esistance	100 MΩ, or more, with 500 V DC megger among supply terminals, non-supply metal parts and relay contact output terminals as well as between relay contacts       20 MΩ, or more, with 250 V DC megger between all supply terminals connected together and enclosure			een all supply				
	Vibration rea	sistance		10 to 55 Hz fre	equency, 1.5 mn	n 0.059 in amplit	ude in X, Y and	Z directions for t	wo hours each	
	Shock resist	tance		500 m/s	<sup>2</sup> acceleration (5	60 G approx.) in λ	K, Y and Z direct	ions for three tin	nes each	
nit	ting element			Infr	ared LED (Peak	emission wavele	ength: 855 nm 0	.034 mil, modula	ted)	
ece	eiving elemer	nt				2-segment	photodiode			
ate	erial			Enclo	osure: ABS, Fro	nt cover: Polycar	bonate, Display	cover: Polycarb	onate	
oni	nection methe	od				Screw-on term	inal connection			
abl	e				Suitable for r	ound cable ø9 to	ø ø11 mm ø0.35	4 to ø0.433 in		
Cabl	e length			Total leng	th up to 100 m	328.084 ft is pos	sible with 0.3 mr	n <sup>2</sup> , or more, cab	yre cable.	
Veig	jht	ht Net weight: 100 g approx. Net weight: 85 g approx.								
cce	essory					Adjusting scre	ewdriver: 1 pc.			

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +23 °C +73.4 °F.

2) The adjustable range stands for the maximum sensing range which can be set with the distance adjuster. The sensor can also detect an object 0.1 m 0.328 ft, or more, away.

3) The adjustable range, sensing range and hysteresis are specified for white non-glossy paper (200 × 200 mm 7.874 × 7.874 in) as the object.

4) Note that the detection may be unstable depending on the mounting conditions or the sensing object. In the state that this product is mounted, be sure to check the operation with the actual sensing object. Refer to "Automatic interference function (p.368)" of "PRECAUTIONS FOR PROPER USE" for details.

FIBER SENSORS

EQ-500

MQ-W

SENSOR OPTIONS

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ENERGY CONSUMPTION VISUALIZATION COMPONENTS

FA COMPONENTS

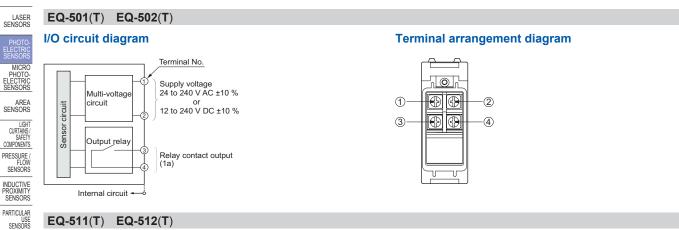
MACHINE VISION SYSTEMS

CURING

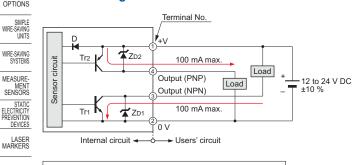
CY-100 EX-10

ΠV

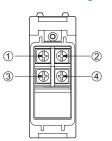
# I/O CIRCUIT AND WIRING DIAGRAMS



# I/O circuit diagram



### **Terminal arrangement diagram**



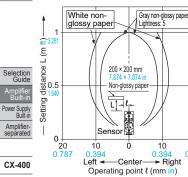
#### Symbols ... D: Reverse supply polarity protection diode ZD1, ZD2: Surge absorption zener diode Tr1: NPN output transistor Tr2: PNP output transistor

# **SENSING CHARACTERISTICS (TYPICAL)**

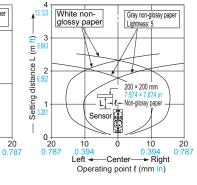
# EQ-501(T) EQ-511(T)

### Sensing fields

Setting distance: 1 m 3.281 ft

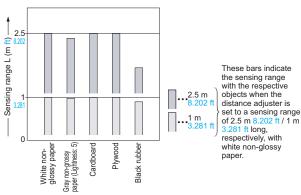


# Setting distance: 2.5 m 8.202 ft

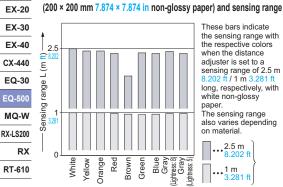


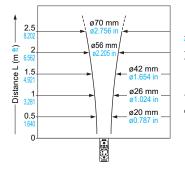
# **Correlation between material**

(200 × 200 mm 7.874 × 7.874 in) and sensing range



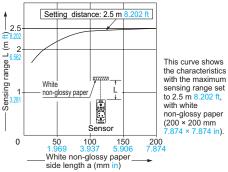
Correlation between color





**Emitted beam** 

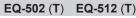
Correlation between sensing object size and sensing range



FIBER SENSORS

LASER SENSORS

# SENSING CHARACTERISTICS (TYPICAL)



Sensing object

Sensing object

operation with the actual sensing object.

· When detecting a specular object (aluminum or copper foil,

etc.) or an object having a glossy surface or coating, please

note that there are cases when the object may not be detected

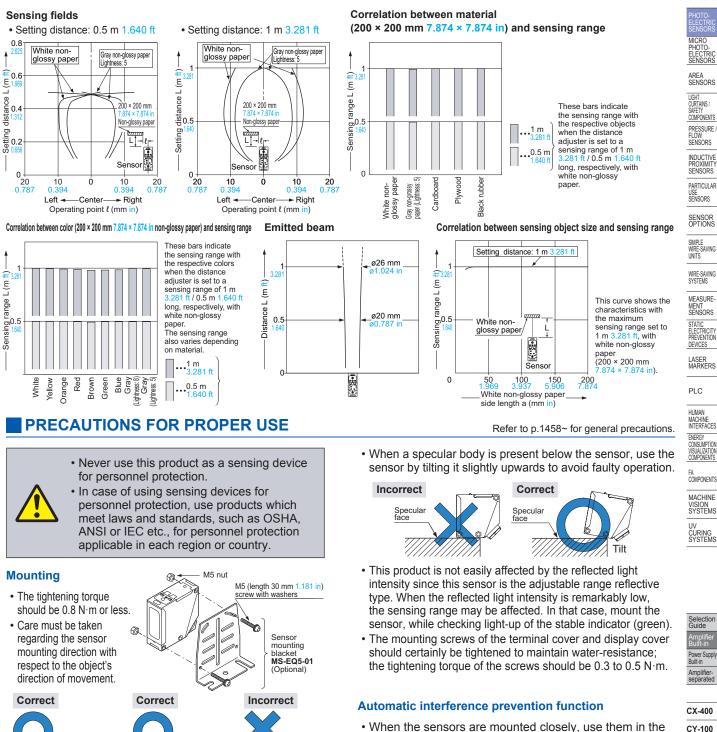
due to a change in angle, wrinkles on the object surface, etc.

· If a specular body is present in the background, faulty operation may

body. In that case, install the sensor at an inclination and confirm the

be caused due to a small change in the angle of the background

Sensing object



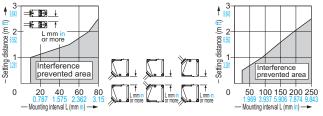
Do not make the sense

detect an object in this

direction because it may

cause unstable operation

• When the sensors are mounted closely, use them in the interference prevented area, as shown below.



• Note that the detection may be unstable depending on the mounting conditions or the sensing object to be used. In the state that this product is mounted, be sure to check the operation with the actual sensing object to be used.

RX-LS200

EX-10

EX-20

EX-30

EX-40

CX-440

EQ-30

EQ-500

MQ-W

FIBER SENSORS

LASER SENSORS

# PRECAUTIONS FOR PROPER USE

### Wiring

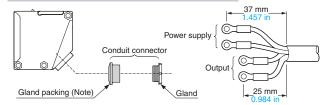
- Check all wiring before applying power since incorrect wiring may damage the internal circuit. Also, carefully tighten the terminal screws so that the wires of adjacent terminals do not touch.
- The mounting hole for the terminal cover fixing screws inclines 70 degrees to the terminal cover, as shown in the figure below.

To avoid damaging this product or screw, take care when tightening or loosening a screw.

Screw for terminal cover fixing

- To maintain water-resistance, the cable should have an outer diameter between ø9 to ø11 mm ø0.354 to ø0.433 in with a smooth covering material that allows the attached conduit connector to be securely tightened; the tightening torque of the screw should be of 1.5 to 2.0 N·m.
- If an external surge voltage exceeding 4 kV is impressed (DC-voltage type: 1 kV), the internal circuit will be damaged, and a surge suppressing element should be used.
- Prepare the cable end as shown below.

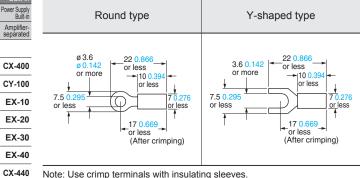
### Conduit connector construction and cabling



- Note: When assembling the conduit connector, pay attention to the direction of the gland packing.
  - Furthermore, in order to maintain water-resistance, fit the gland packing such that the seating surface of the gland packing contacts the packing holder part of the terminal cover evenly.
- The size of conduit is M20  $\times$  1.5 mm 0.787 in.
- If pressure terminals are to be used, affix the connected pressure terminals to a terminal (M3.5 screw).

(Unit: mm in)

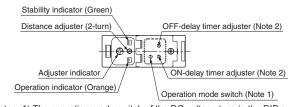
### Dimensions of the suitable crimp terminals



Note: Use crimp terminals with insulating sleeves. Recommended crimp terminal: Nominal size 1.25 × 3.5 0.049 × 0.138.

• The tightening torque for the terminal screws should be 0.3 to 0.5 N·m.

### Part description



 Notes: 1) The operation mode switch of the DC-voltage type is the DIP switch. Refer to 'DC-voltage type' of 'Operation mode switch' for details.
 2) Incorporated on EQ-5□T only.

### **Operation mode switch**

#### Multi-voltage type (L-ON / D-ON mode only)

Operation mode switch	Description
	Detection-ON mode is obtained when the switch is turned fully clockwise (L side).
	Detection-OFF mode is obtained when the switch is turned fully counterclockwise (D side).

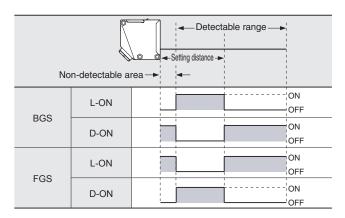
Note: Turn the operation mode switch gradually and lightly with the attached screwdriver. Turning with excessive strength will cause damage to the adjuster.

### DC-voltage type

L-ON / D-ON mode	D
	D
BGS / FGS mode	FGS
Timer mode OFF	Timer ON
Not used N.C.	N.C.

### BGS / FGS function (DC-voltage type only)

- DC-voltage type sensor incorporates BGS / FGS function. Select either the BGS or FGS function depending on the positions of the background and sensing object.
- BGS / FGS function is set with the operation mode switch.
- FGS function is used when the sensing object contacts the background (conveyor, etc).
- Depends on a selection of either BGS or FGS function, the output operation changes as follows.



RX RT-610

EQ-30

EQ-500

MQ-W RX-LS200

Selection Guide

Amplifie Built-i

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# PRECAUTIONS FOR PROPER USE

### Timer function (EQ-5 T only)

- EQ-5 T incorporates an OFF-delay timer, which is useful when the response of the connected device is slow, etc., and an ON-delay timer, which is useful for detecting objects that move slowly, for example.
- The OFF-delay and ON-delay timers can be used simultaneously.
- For DC-voltage type, set the DIP switch for the timer mode to 'Timer ON' side.

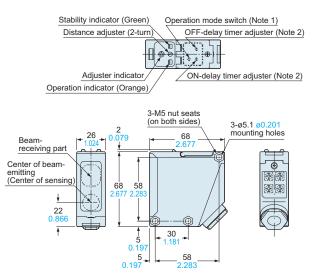
### Time chart

Sensing condition Operation	Detection Non- detection
Detection normal operation	
Detection ON-delay	OFF
Detection OFF-delay	
Detection ON / OFF-delay	T T ON OFF
Non-detection normal operation	ON OFF
Non-detection ON-delay	T T ON OFF
Non-detection OFF-delay	ON OFF
Non-detection ON / OFF-delay	ON OFF
	Timer period: $T = 0.1$ to 5 sec. (variable)

Timer period: T = 0.1 to 5 sec. (variable)

# DIMENSIONS (Unit: mm in)

# EQ-501(T) EQ-502(T) EQ-511(T) EQ-512(T)



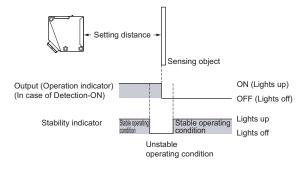
Notes: 1) The operation mode switch of the DC-voltage type is the DIP switch.
2) For EQ-5□T only.

Refer to p.1458~ for general precautions.

### **Stability indicator**

• Since the **EQ-500** series uses a 2-segment photodiode as its receiving element, and sensing is done based on the difference in the incident beam angle of the reflected beam from the sensing object, the output and the operation indicator (orange) operate according to the object distance.

Furthermore, the stability indicator (green) shows the margin of the setting distance.



### Others

- Do not use during the initial transient time (50 ms) after the power supply is switched on.
- Its distance adjuster is mechanically operated. Do not drop; avoid other shocks.

The CAD data in the dimensions can be downloaded from our website.

#### MACHINE VISION SYSTEMS UV CURING SYSTEMS

FA COMPONENTS

Selection Guide
Amplifier Built-in
Power Supply Built-in
Amplifier- separated

CX-400
CY-100
EX-10
EX-20
EX-30
EX-40
CX-440
EQ-30
EQ-500
MQ-W
RX-LS200

RX-LS200 RX RT-610

# Assembly dimensions with sensor mounting bracket MS-EQ5-01 (Optional) (Foot angled mounting)

$\begin{array}{c} 6.5 \\ 2.29 \\ 1.142 \\ 1.142 \\ 1.142 \\ 1.142 \\ 1.114$
2-M5 (length 30 1.181) screws
ter of beam- ting ner of sensing) 37 1.457 + 26 + 29 + 1.024 + 1.142 + 0.197 - 258 + 2.283 888 2.283 888 2.283 888 2.283 886 2.283 886 2.283 189 + 228 1000 1000 - 1000 - 10000 - 10000 - 10000 - 10000 - 10000 - 10000 - 10000 - 100000 - 100000 - 1000000 - 1000000000000000000000000000000000000

Material: Cold rolled carbon steel (SPCC)

Cent emit (Cer

Two M5 (length 30 mm 1.181 in) screws with washers and two nuts are attached.

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