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V1.1

# HIGH PRECISION VOLTAGE TYPE INCLINOMETER **RION HCA510T/HCA520T-N**

## Technical Manual

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For pricing or any further information, please contact Omni Instruments Ltd.

## HCA510T/520T-N HIGH PRECISION VOLTAGE TYPE INCLINOMETER



### ► GENERAL DESCRIPTION

HCA510T/HCA520T-N is a high-precision analog voltage output single / dual axis inclination sensor. The highest precision in a small range can reach 0.003 °. It is one of the few high-precision inclinometers in China. Its function is mainly used to measure the inclination of the object based on horizontal plane.

Built-in micro solid pendulum ,by measuring the static gravity field changes then convert into inclination change,the changes in mode output voltage (0-5V).The internal use high-resolution differential digital-to-analog converter, by the internal MCU system secondary linearity and temperature correction, the customer no need to do a secondary linearity correction, meanwhile also reducing the error caused by environmental changes on the accuracy of the product.

This product uses non-contact measurement principle, can real-time output current posture inclination, Simple to use, and no need to retrieve the relative changed surface to install.Latest MEMS higher technology production, high-precision, small size, strong resistance to external electromagnetic interference ability, the ability to withstand shock and vibration. It is the ideal choice for industrial equipment, platform measuring attitude!

### ► FEATURES

- ★ Single / dual axis inclination measurement
- ★ Accuracy: Refer to technical data
- ★ Output mode 0 ~ 5V
- ★ IP67 protection
- ★ High resolution 0.001 °
- ★ Range  $\pm 1 \sim \pm 90^\circ$  optional
- ★ Wide voltage input 9 ~ 36V
- ★ Wide temperature operation  $-40^\circ\text{C} \sim + 85^\circ\text{C}$
- ★ High vibration resistance > 2000g
- ★ Small size L90 × W59 × H34mm

### ► APPLICATION

- ★ Equipment vehicle leveling
- ★ High-altitude platform safety protection
- ★ Attitude navigation of underground drilling rig
- ★ Direction measurement based on tilt angle
- ★ Mining machinery, oil drilling equipment
- ★ Alignment control , curve control
- ★ Pitch angle measurement of directional satellite communication antenna
- ★ Bridge and Dam monitoring
- ★ Angle control of medical equipment
- ★ Leveling of railway gauge and gauge
- ★ Tilt monitoring of geological equipment
- ★ Equipment level control



## HCA510T/520T-N HIGH PRECISION VOLTAGE TYPE INCLINOMETER

### ► TECHNICAL DATA

HCA510T/HCA520T-N	CONDITION	PARAMTERS				UNIT
Measure range		±10	±30	±60	±90	°
Measure axis		X / XY	X / XY	X / XY	X / XY	
Zero output	0° output	2.5	2.5	2.5	2.5	V
Resolution		0.001	0.001	0.001	0.001	°
Measure accuracy	@25°C	0.005	0.01	0.02	0.03	°
Zero Temp. coefficient	-40 ~ 85°C	0.0005	0.0008	0.0001	0.002	°/°C
Sensitivity temp. coefficient	-40 ~ 85°C	≤100	≤100	≤100	≤100	ppm/°C
Power on time		0.5	0.5	0.5	0.5	S
Response frequency	20Hz					
EMC	According to EN61000 and GBT17626					
MTBF	≥50000 hours/times					
Insulation Resistance	≥100MΩ					
Shockproof	100g@11ms、 3 Axial Direction (Half Sinusoid)					
Anti-vibration	10grms、 10 ~ 1000Hz					
Protection glass	IP67					
Cables	Standard configuration: 2m length, wear-resistant, wide temperature, shielded cable 7P * 6.8mm aviation connector, cable weight ≤110g					
Weight	≤250g(Excluding cable)					

\*This parameter only list ± 10 °, ± 30 °, ± 60 ° series for reference. For other measurement ranges, please refer to the nearest neighbor parameter.

### KEY WORDS:

Resolution : Refers to the sensor in measuring range to detect and identify the smallest changed value.

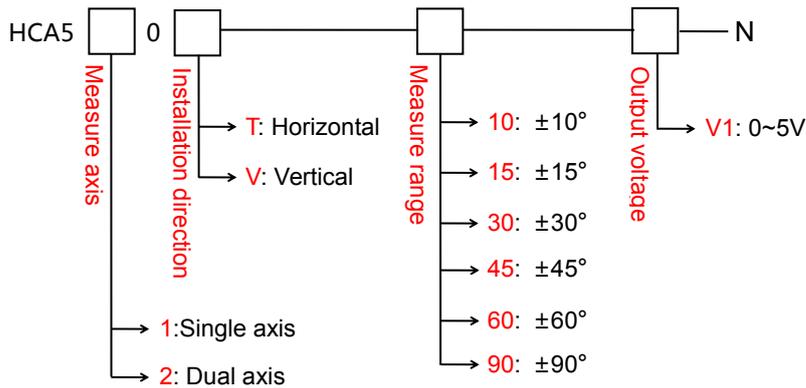
Measurement accuracy: refers to multiple measurements of angle (more than 16 times) under normal temperature conditions, and the root mean square difference between the measured value and the

### ► ELECTRONIC CHARACTERISTICS

PARAMETERS	CONDITION	MIN	STANDARD	MAX	UNIT
Power supply	Standard	9	12、 24	36	V
Working current			40		mA
Output load	Resistive	10			kΩ
	Capacitive			20	nF
Working temperature		-40		+85	°C
Store temperature		-40		+85	°C

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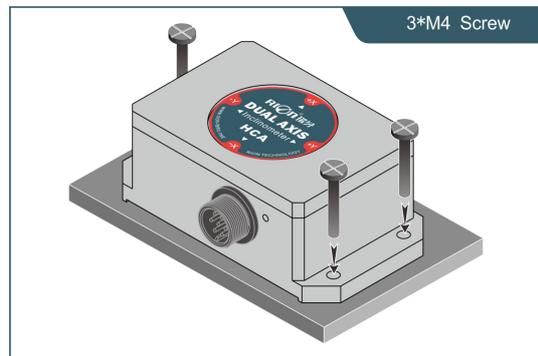
### ► ORDER INFORMATION



E.g :HCA510T-10-V1-N :Single axis/ standard horizontal measurement/±10°measure range /0~5V output.

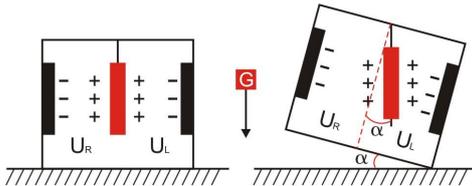
### ► MECHANICAL PARAMETERS

- Connector: aviation connector
- (1m Direct Leading Cable can Be Customized)
- Protection level: IP67
- Shell material: aluminum alloy shield oxidation
- Installation: Three M4 screws



### ► WORKING PRINCIPLE

Adopt the import of core control unit, using the capacitive micro pendulum principle and the earth gravity principle, when the the inclination unit is tilted, the Earth's gravity on the corresponding pendulum will produce a component of gravity, corresponding to the electric capacity will change,, by enlarge the amount of electric capacity , filtering and after conversion then get the inclination



$U_R, U_L$  Respectively is the pendulum left plate and the right plate corresponding to their respective voltage between the electrodes, when the tilt sensor is tilted,  $U_R, U_L$  Will change according to certain rules, so  $f(U_R, U_L, )$

On the inclination of  $\alpha$  function:

$$\alpha = f(U_R, U_L)$$

### ► ANGLE OUTPUT CALCULATION FORMULA

$$\text{Angle} = (\text{output voltage} - \text{Zero position voltage}) \div \text{Angle sensitivity}$$

$$\text{Angle sensitivity} = \text{output voltage range} \div \text{Angle measuring range}$$

E.G : HCA510T-30-V1-N ( $\pm 30^\circ$  measuring range 0 ~ 5V output voltage range )

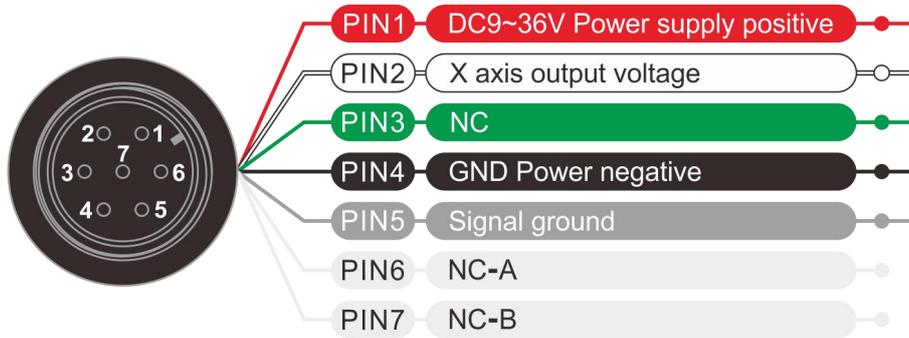
$$\text{Angle sensitivity} = 5 \div 60 = 0.83333 \text{ V}^\circ$$

## HCA510T/520T-N HIGH PRECISION VOLTAGE TYPE INCLINOMETER

### ► ELECTRICAL CONNECTION

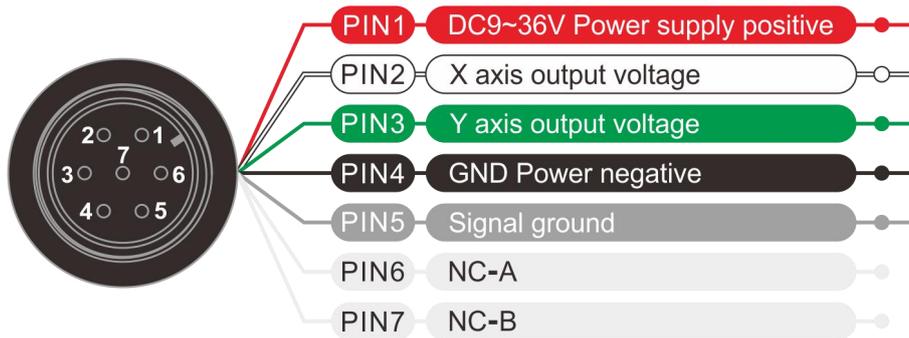
#### SINGLE AXIS CABLE WIRE CONNECTION

Wire Color	RED	WHITE	GREEN	BLACK	GRAY
function	DC9~36V Power supply positive	Out X X axis output voltage	NC	GND Power negative	Signal ground



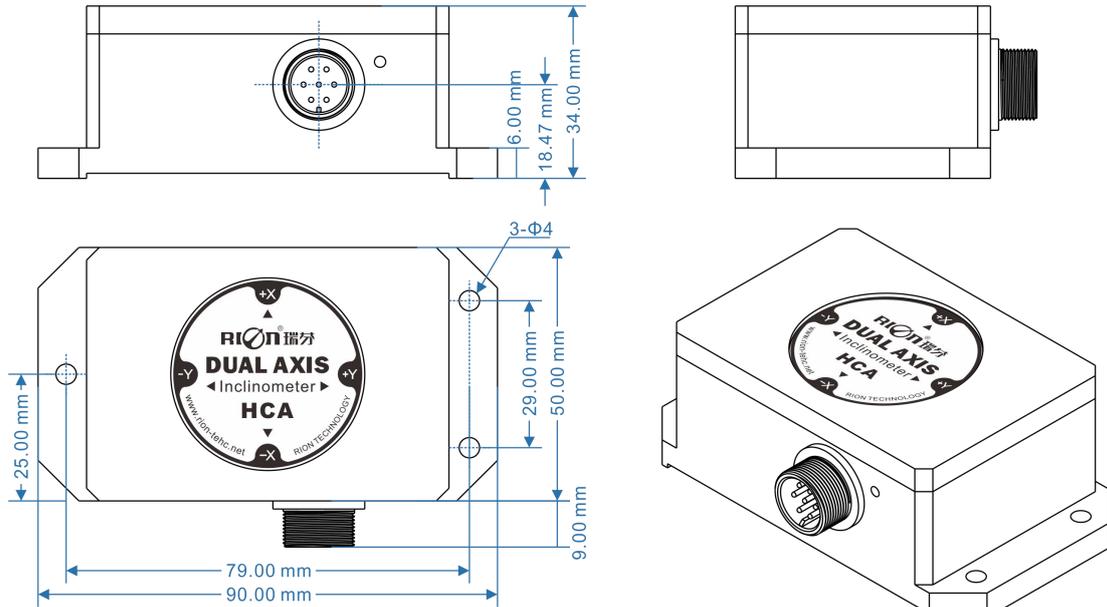
#### DUAL AXIS CABLE WIRE CONNECTION

Wire Color	RED	WHITE	GREEN	BLACK	GRAY
function	DC9~36V Power supply positive	Out X X axis output voltage	Out Y Y axis output voltage	GND Power negative	Signal ground



# HCA510T/520T-N HIGH PRECISION VOLTAGE TYPE INCLINOMETER

## ► DIMENSION



Shell size: L90×W59×H34mm

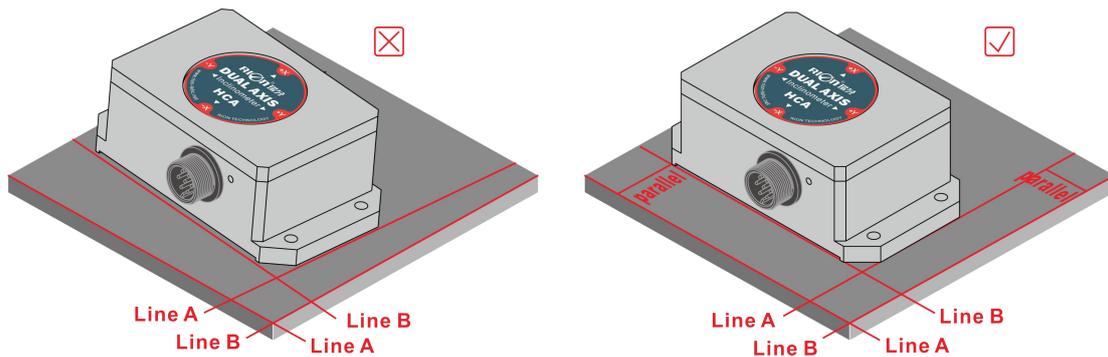
Installation size: L79×W29×H6mm

Mounting screws: 3M4 screws

## ► PRODUCTION INSTALLATION NOTES

Please follow the correct way to install tilt sensor, incorrect installation can cause measurement errors, with particular attention to the "surface", "line".

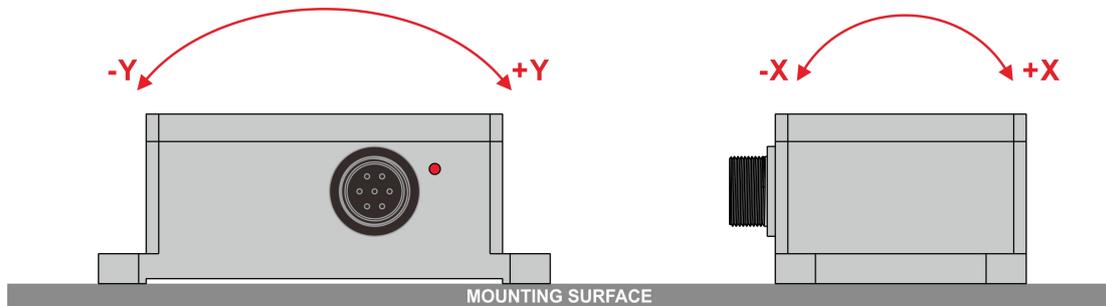
- 1) The Sensor mounting surface and the measured surface must be fixed closely, smoothly, stability, if mounting surface uneven likely to cause the sensor to measure the angle error.
- 2) The sensor axis and the measured axis must be parallel, the two axes do not produce the angle as much as possible.



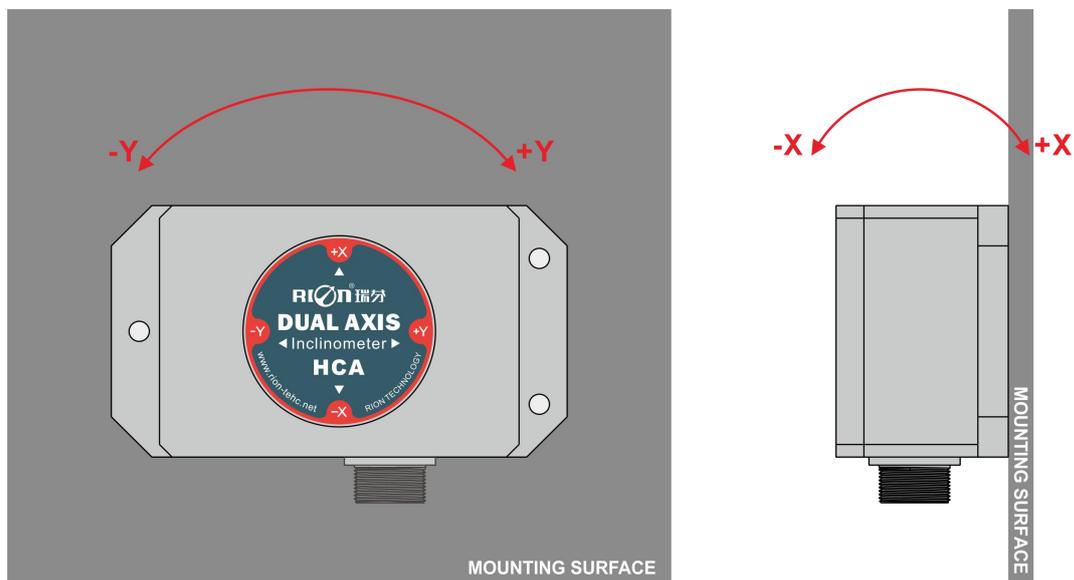
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### ► MEASURING DIRECTIONS

The installation must guarantee the product bottom is parallel to measured face, and reduce the influence of dynamic and acceleration to the sensor. This product can be installed horizontally or mounted vertically, for installation please refer to the following scheme.



Horizontal installation



Vertical installation