



Patent No. : ZL 201830752890.0

V1.7

HIGH PRECISION CURRENTY TYPE INCLINOMETER

HCA518T/HCA528T-N

Technical Manual



► GENERAL DESCRIPTION

HCA518T/HCA528T-N is a high accuracy single /dual axis inclinometer, output adopt the standard industry electronic interface 4 ~ 20mA, can be long-distance transmission of up to 2000 meters. The product uses the latest MEMS high technology for production, made precise compensation and correction to temperature error and nonlinearity error, small measuring range and the highest accurate up to 0.003 ° (bigger measuring range index, please refer to product technical data),

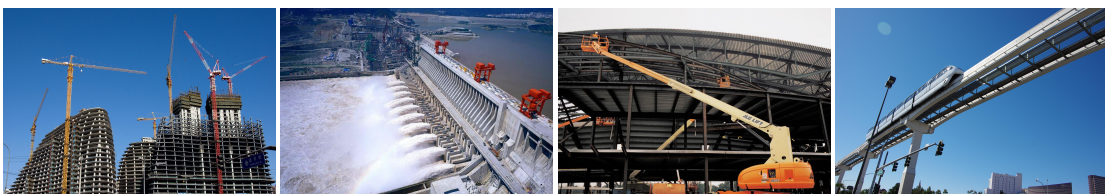
HCA518T&HCA528T inclinometer use the dynamic zero test compensation technology to ensure product Quick Launch, high resolution ,stable data, good capacity to bear shock & vibration, built-in anti-RF, adopts anti-electromagnetic interference circuit to ensure that the output signal to a higher anti-interference ,in addition to this product is better than the similar market product on software technical data, on the reliability and stability the product is also using the high-end application-level MCU,three-proofing PCB board, imported cable, wide temperature shielded metal enclosure and other measures to improve product industrial level,to ensure the product can be long-term & safety extraordinary operation in harsh environments.

► FEATURES

- ★ Single / dual axis inclination measurement
- ★ Accuracy: Refer to technical data
- ★ Output mode 4~20mA
- ★ IP67 protection
- ★ High resolution 0.001 °
- ★ Range $\pm 1 \sim \pm 60$ ° optional
- ★ Wide voltage input 11.5 ~ 36V
- ★ Wide temperature operation -40 ~ + 85 °C
- ★ High vibration resistance > 2000g
- ★ Small size L90mm × W59mm × H34mm (customizable)

► 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



► SPECIFICATIONS

HCA518T/HCA528T-N		CONDITION	PARAMETERS				UNIT
Measure range			±10	±30	±60	±90	°
Measure axis			X/XY	X/XY	X/XY	X/XY	axis
Zero output		0° output	12	12	12	12	mA
Resolution			0.001	0.001	0.001	0.001	°
Measure accuracy	MAXE	Room temp.	0.005	0.01	0.02	0.03	°
	RMSE	Room temp.	0.003	0.003	0.005	0.008	°
Zero Temp. coefficient		-40 ~ 85°C	0.0005	0.0005	0.0005	0.0005	°/°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
Sensitivity temp. coefficient			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.

MAXE: refers to the biggest error of the product within the range and at multiple angle points.

RMSE: refers to the root mean square difference between the measured value and the actual angle of the product within the range and for multiple times (more than 16 times).

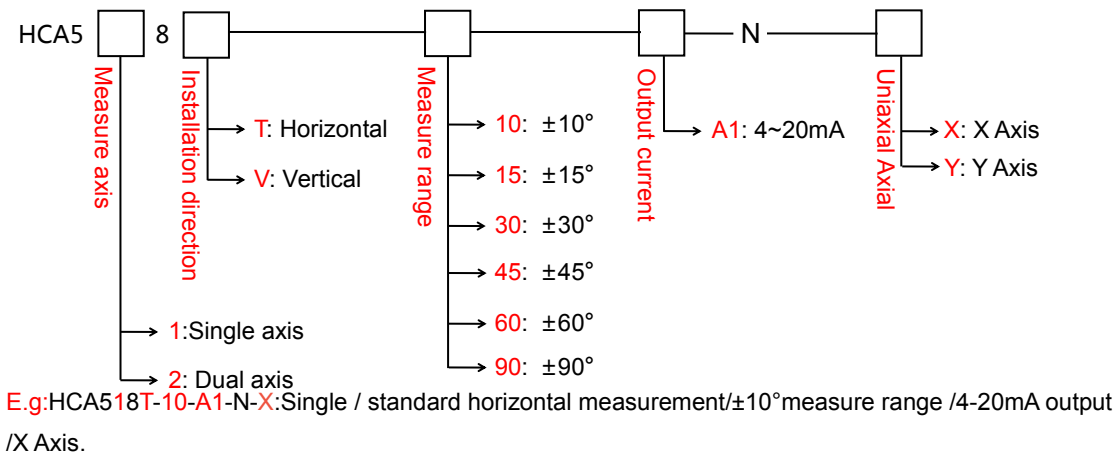
Zero Temperature Drift Coefficient: the change rate of the indication value relative to normal temperature within the rated operating temperature range of the sensor at the zero degree.

Sensitivity Temperature Drift Coefficient: The percentage change rate with temperature of the full-scale indication relative to the full-scale indication at room temperature of the sensor in its rated operating temperature range.

► ELECTRONIC CHARACTERISTICS

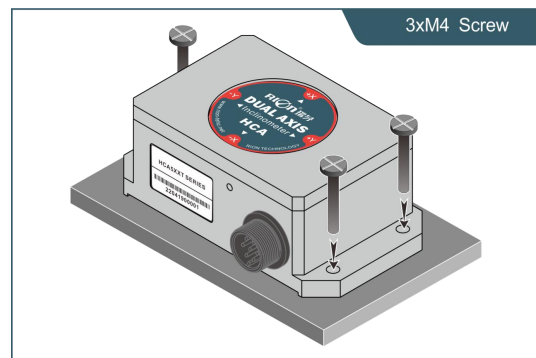
PARAMETERS	CONDITIONS	MIN	STANDARD	MAX	UNIT
Power supply	Standard	11.5	12 24	36	V
Working current	No load		40		mA
Output load	Resistive		400	1000	kΩ
Working temperature		-40		+85	°C
Store temperature		-40		+85	°C

► ORDER INFORMATION



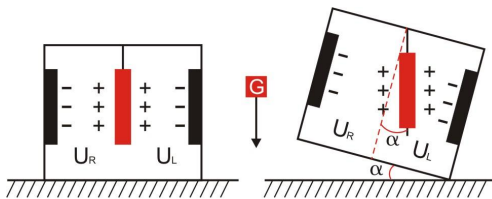
► MECHANICAL PARAMETERS

- 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 α function:

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

► ANGLE OUTPUT CALCULATION FORMULA

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

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

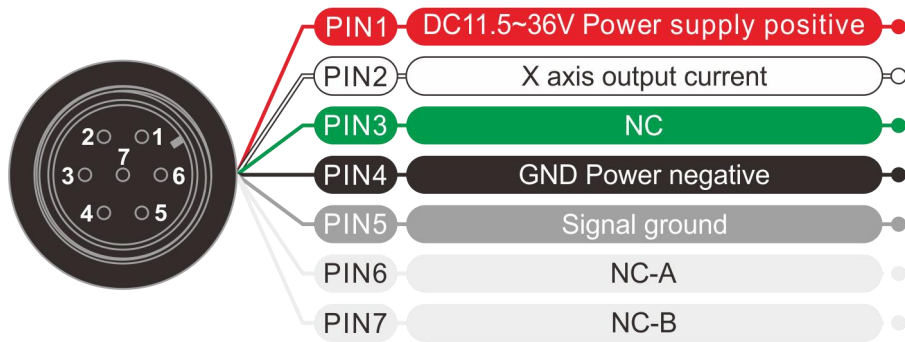
E.g : HCA518T-30-A1-N (±30° measure range 16mA output voltage range)

$$\text{Angle sensitivity} = 16 \div 60 = 0.266666 \text{ mA/}^\circ$$

► ELECTRICAL CONNECTION

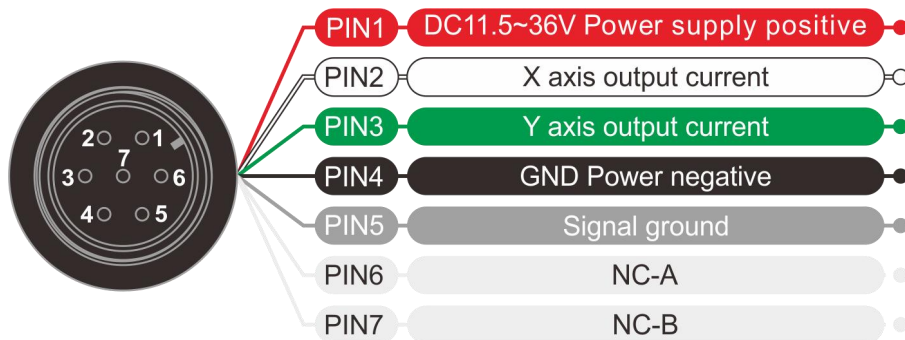
Single axis cable wire connection :

Wire Color	RED	WHITE	GREEN	BLACK	GRAY
function	DC11.5~36V Power supply positive	Out X X axis output current	NC	GND Power negative	Signal ground

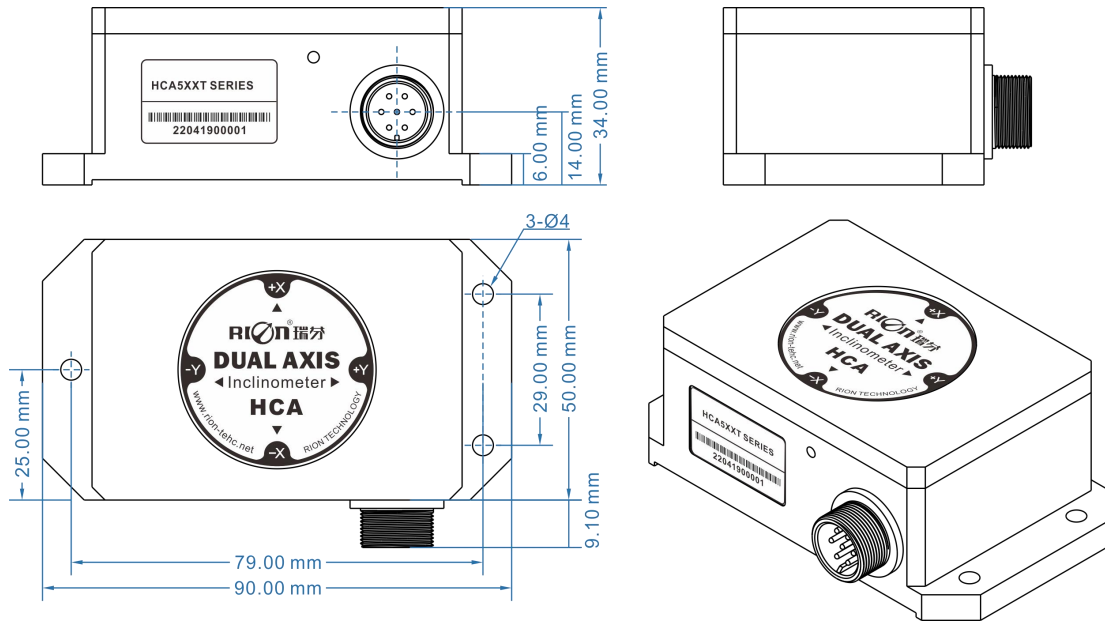


Dual axis cable wire connection :

Wire Color	RED	WHITE	GREEN	BLACK	GRAY
function	DC11.5~36V Power supply positive	Out X X axis output current	Out Y Y axis output current	GND Power negative	Signal ground



► DIMENSION

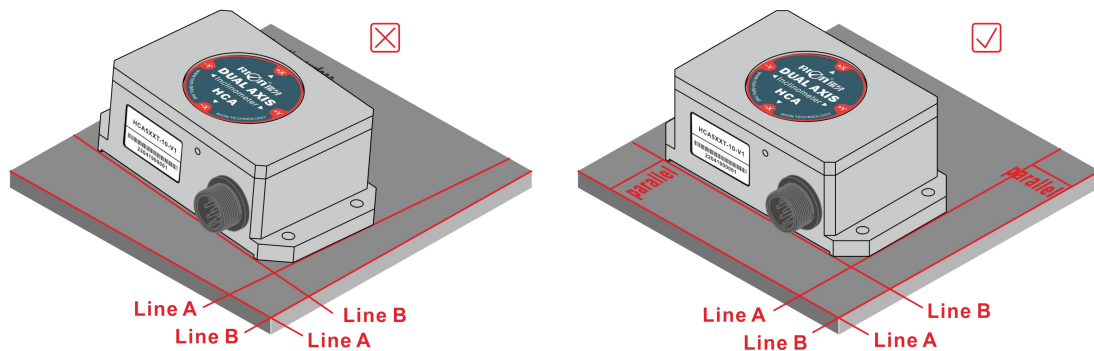


Shell size: L90×W59×H34mm
 Installation size: L79×W29×H6mm
 Mounting screws: 3M4 screws

► PRODUCTION INSTALLATION NOTES

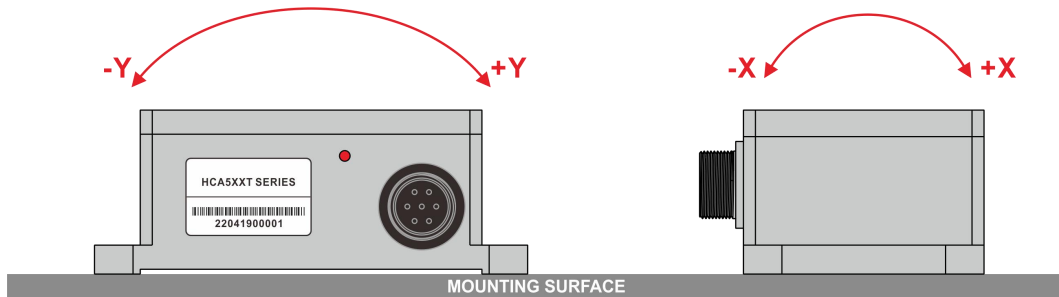
Please follow the correct way to install tilt sensor, incorrect installation can cause measurement errors, with particular attention to the "surface", "line".

- 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.

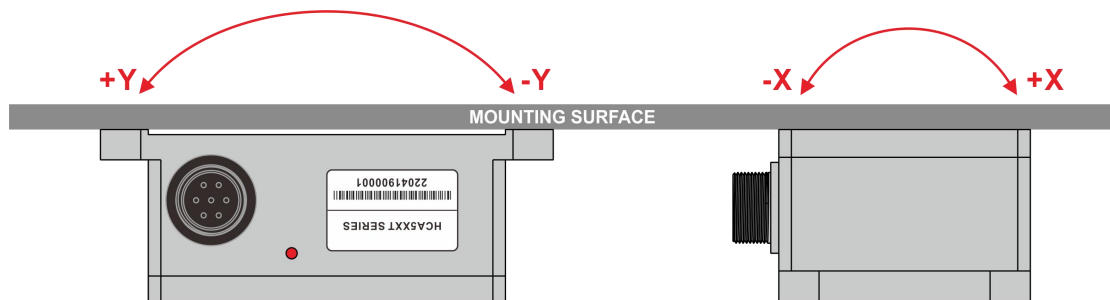


► MEASURING DIRECTIONS

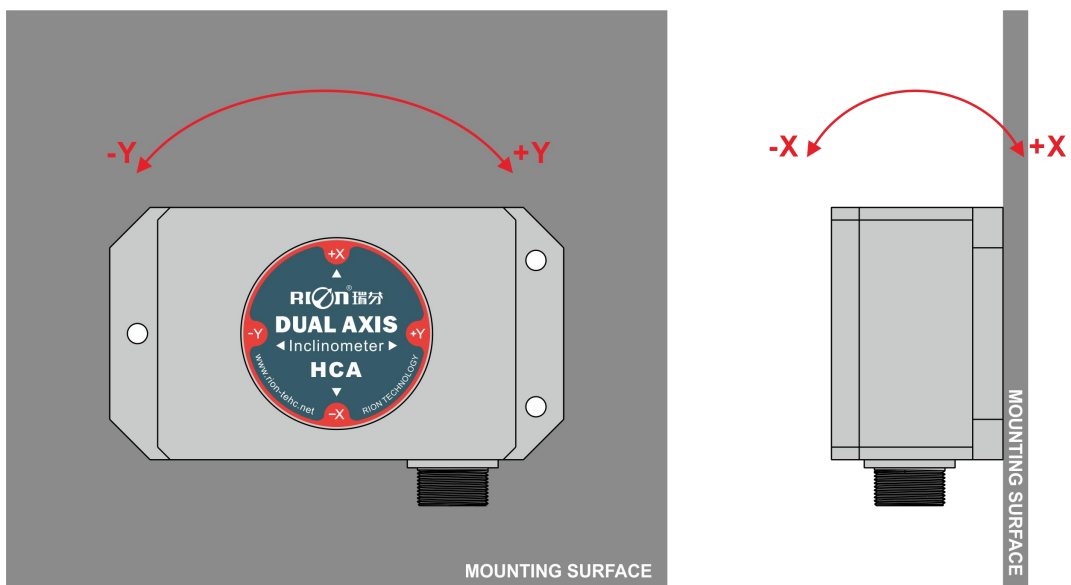
The installation must guarantee the product bottom is parallel to measured face, and reduce the influence of dynamic and acceleration to the sensor. This product can be installed horizontally or mounted vertically, for installation please refer to the following scheme.



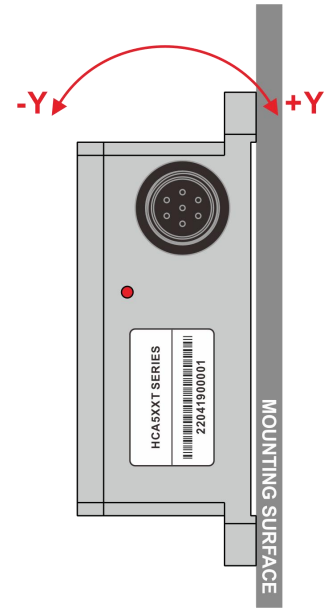
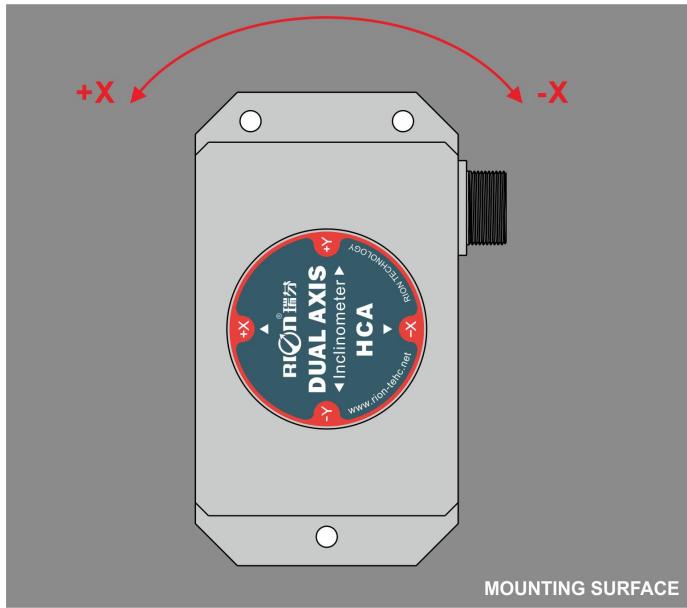
Horizontal installation



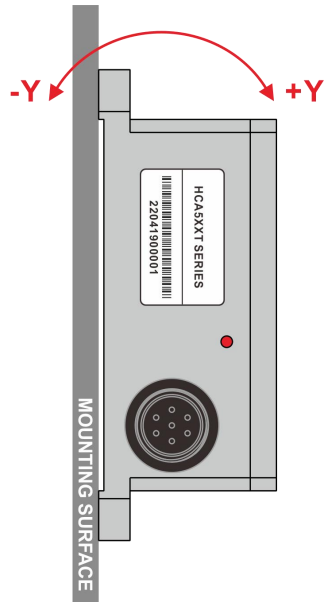
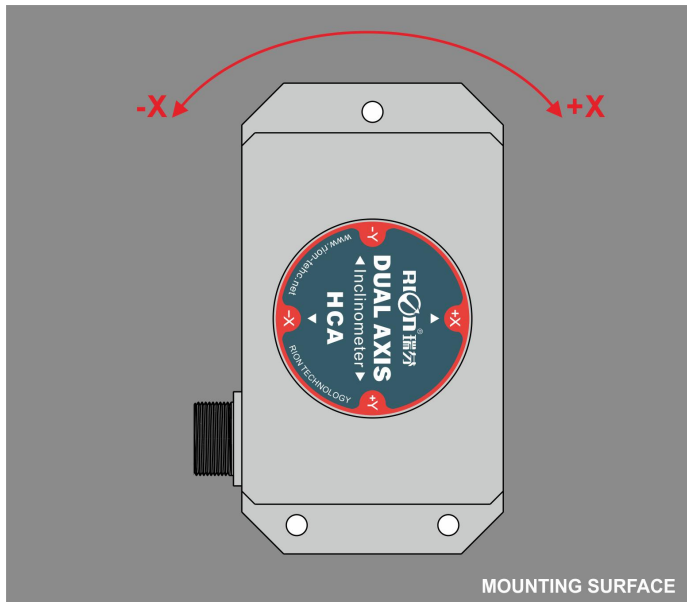
Horizontal-down installation



Vertical installation



Vertical-left installation



Vertical-right installation