



V1.5

VOLTAGE TYPE SINGLE/DUAL AXIS INCLINOMETER

# **RION LCA310T&LCA320T**

**TECHNICAL MANUAL**

## **LCA310T/LCA320T VOLTAGE TYPE INCLINOMETER**



### **PRODUCTION STANDARD REFERENCE**

- Enterprise quality system standard: ISO9001: 2015 standard (Certification No.: 128101)
- The intellectual property management system conforms to the standard: GB / T 29490-2013 (certificate No.: 18117IP1529R0S)
- High-tech enterprise (certificate No.: GR201844204379)
- China National Intellectual Property Appearance Patent (Patent No .: ZL 201830752874.1)
- Production standard of inclination sensor: SJ 20873-2003 General specification for inclinometer and level
- Gyro acceleration test standard: QJ 2318-92 gyro accelerometer test method
- Software development reference standard: GJB 2786A-2009
- Product environmental testing standard: GJB150
- Electromagnetic immunity test standard: GB / T 17626
- Revision date: 2021-1-27

Note: Product functions, parameters, appearance, etc. will be adjusted as the technology upgrades, please contact our pre-sales business to confirm when purchasing.

## LCA310T/LCA320T VOLTAGE TYPE INCLINOMETER



### ► INTRODUCTION

LCA310T & LCA320T is a small-volume low-cost single-axis tilt sensor developed by RION technology. The output voltage is internally quadratic linearity corrected. It is a linearity voltage output tilt sensor. It is mainly aimed at applications where volume and cost are highly restrictive. Due to the built-in tilting unit of the latest technology micro-electromechanical production process, the volume is small, the power consumption is low, and the consistency and stability of the micro-electromechanical process are very high. The working temperature reaches industrial level  $-40 \sim +85^{\circ}\text{C}$ , which is a high cost performance Inclination module.

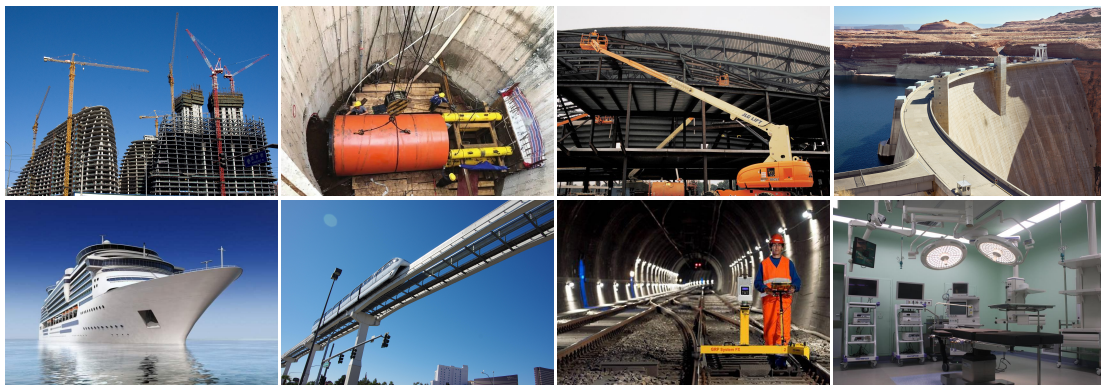
This product adopts the non-contact measurement principle, which can output the current inclination angle in real time. It is simple to use, small size, strong resistance to external electromagnetic interference, and strong ability to withstand shock and vibration; it is an ideal choice for industrial equipment and platform measurement attitude!

### ► MAIN FEATURES

- ★ Single and biaxial inclination measurement
- ★ Accuracy:  $0.1^{\circ}$
- ★ Output mode  $0 \sim 5\text{V}$
- ★ IP67 protection level
- ★ Resolution  $0.02^{\circ}$
- ★ Any range within  $360^{\circ}$  is optional
- ★ Wide voltage input  $9 \sim 36\text{V}$
- ★ Wide temperature operation  $-40 \sim +85^{\circ}\text{C}$
- ★ High anti-vibration performance  $> 3500\text{g}$
- ★ Small size  $55 \times 37 \times 24\text{mm}$  (customizable)

### ► APPLICATION RANGE

- ★ Electric blind chair leveling
- ★ Gimbal operation monitoring
- ★ Satellite antenna positioning
- ★ Medical bed level
- ★ Car chassis measurement
- ★ Four-wheel positioning system
- ★ Various engineering machinery angle control



## LCA310T/LCA320T VOLTAGE TYPE INCLINOMETER

### ► PERFORMANCE INDEX

LCA310T&LCA320T	CONDITION	PARAMETER				UNIT
Measure range		±30	±60	±90	0~360	°
Measure axis		X Y	X Y	X Y	X Y	Axis
Zero output	0° output	2.5	2.5	2.5	2.5	V
Resolution		0.02	0.03	0.05	0.08	°
Measure accuracy	@25℃	0.1	0.1	0.15	0.2	°
Long term. stability		<0.5	<0.5	<0.5	<0.5	°
Zero Temp.coefficient	-40 ~ 85℃	±0.02	±0.02	±0.02	±0.02	°/℃
Sensitivity temp-coeffi	-40 ~ 85℃	≤150	≤150	≤150	≤150	ppm/℃
Power-on start time		0.5	0.5	0.5	0.5	S
Response time		0.02	0.02	0.02	0.02	s
Response frequency		1 ~ 20	1 ~ 20	1 ~ 20	1 ~ 20	Hz
EMC	According to EN61000 and GBT17626					
MTBF	≥45000 hours/times					
Insulation Resistance	≥100 MΩ					
Impact resistance	100g@11ms, 3 Axial Direction (Half Sinusoid)					
Anti-vibration	10grms、10 ~ 1000Hz					
Protection grade	IP67					
Cables	standard configuration: 1 meter wearproof、grease proofing、wide temperature、Shielded cables 4*0.3mm <sup>2</sup>					
Weight	90g (exclude cable)					

\* This performance parameter only lists ± 30 °, ± 60 °, ± 90 °, ± 360 ° series as a reference, for other measurement ranges, please refer to the adjacent parameters.

### ► ELECTRONIC CHARACTERISTICS

PARAMETERS	CONDITION	MIN	TYPICAL	MAX	UNIT
Power supply voltage	Standard	9	12、24	36	V
Working current			12		mA
Output load	resistiveness	10			kΩ
	Capacitive			20	nF
Working temp.		-40		+85	℃
Store temp.		-40		+85	℃

### KEY WORDS

Resolution: It refers to the smallest change value that the sensor can detect and distinguish in the measurement range.

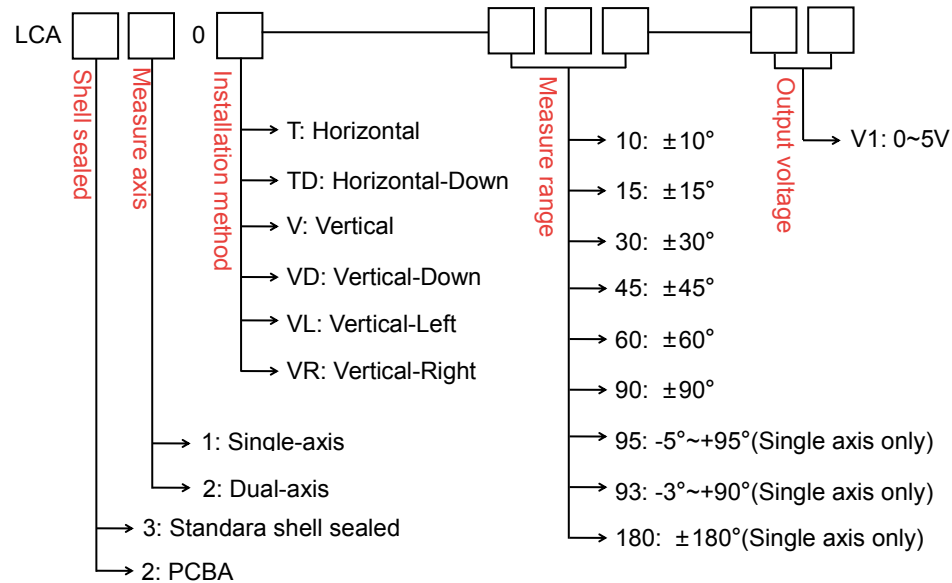
Measure accuracy: Refers to the combined error of linearity, repeatability, hysteresis, zero deviation, and horizontal axis error of the sensor under normal temperature conditions.

Long-term stability: refers to the deviation between the maximum value and the minimum value of the sensor under normal temperature conditions after a year of long-term work.

Response time: It refers to the time required for the sensor output to reach the standard value when the sensor changes angle once.

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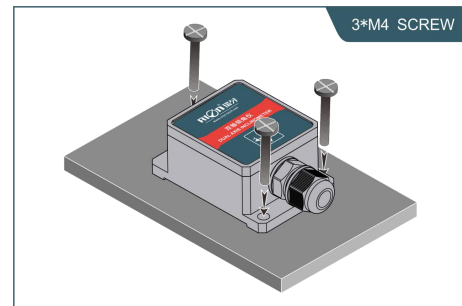
### ► ORDER INFORMATION



E.g : LCA310T-10-V1: Standara shell sealed / single axis / horizontal installation /  $\pm 10^\circ$  measure range / 0~5V output voltage.

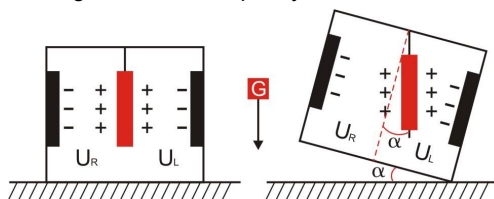
### ► MECHANICAL PARAMETERS

- Connector: 1m straight lead (customizable)
- Protection level: IP67
- Shell material: aluminum alloy frosted and oxidized
- Installation: Three M4 screws



### ► WORKING PRINCIPLE

Adopt imported core control unit and apply the principle of capacitive micro-pendulum. Using the principle of earth's gravity, when the tilting unit tilts, the earth's gravity will produce a gravitational component on the corresponding pendulum, and the corresponding electric capacity will change. By amplifying and filtering the electric capacity, the inclination angle is obtained after conversion.



$U_R, U_L$  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 CALCULATION FORMULA

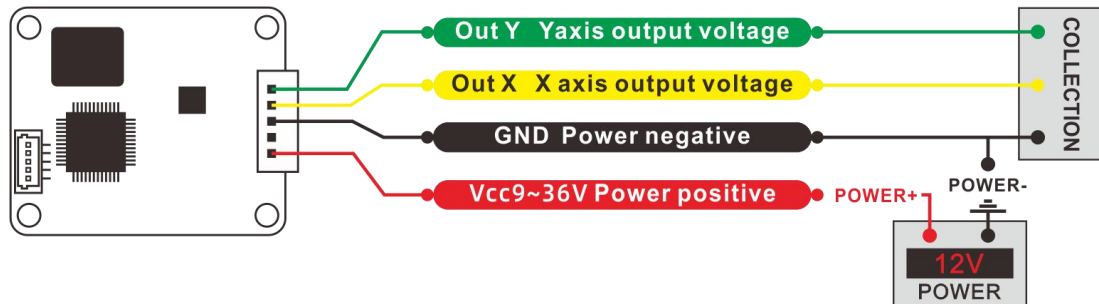
$$\begin{aligned} \text{Angle} &= (\text{output voltage} - \text{zero position voltage}) \div \text{angle sensitivity} \\ \text{Angle sensitivity} &= \text{output voltage range} \div \text{angle measurement range} \\ \text{Example: LCA310T-30-V1 } (\pm 30^\circ \text{ measuring range } 0 \sim 5\text{V output voltage range}) \\ \text{Angle sensitivity} &= 5 \div 60 = 0.083333 \text{ V} / ^\circ \end{aligned}$$

## **LCA310T/LCA320T VOLTAGE TYPE INCLINOMETER**

### ► ELECTRICAL CONNECTION

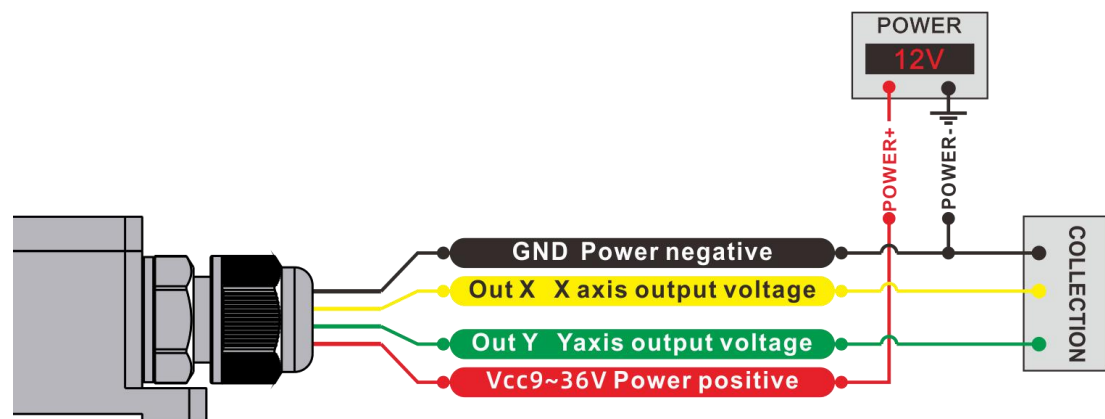
PCBA electrical connection

Color	GREEN	YELLOW	BLACK	RED
Function	Out Y-output voltage	Out X-output voltage	GND Power negative	Vcc3.6~7V Power positive



SHELL electrical connection

Color	BLACK	YELLOW	GREEN	RED
Function	GND Power negative	Out X-output voltage	Out Y-output voltage	Vcc3.6~7V Power positive

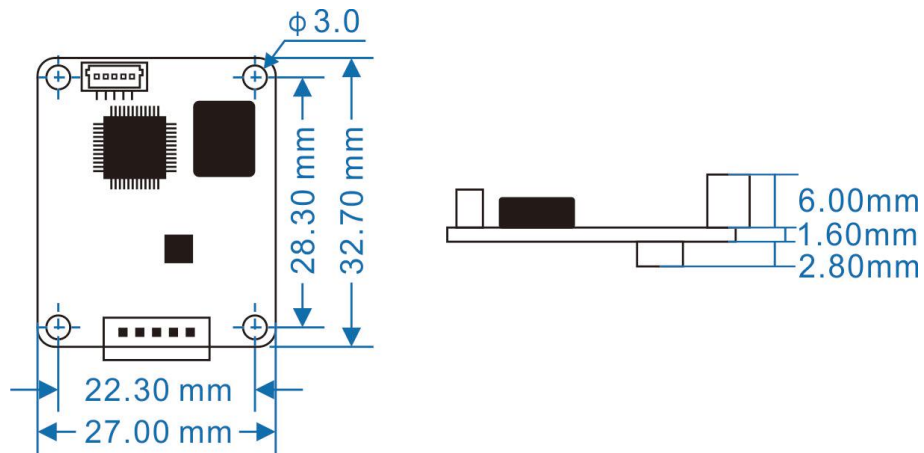




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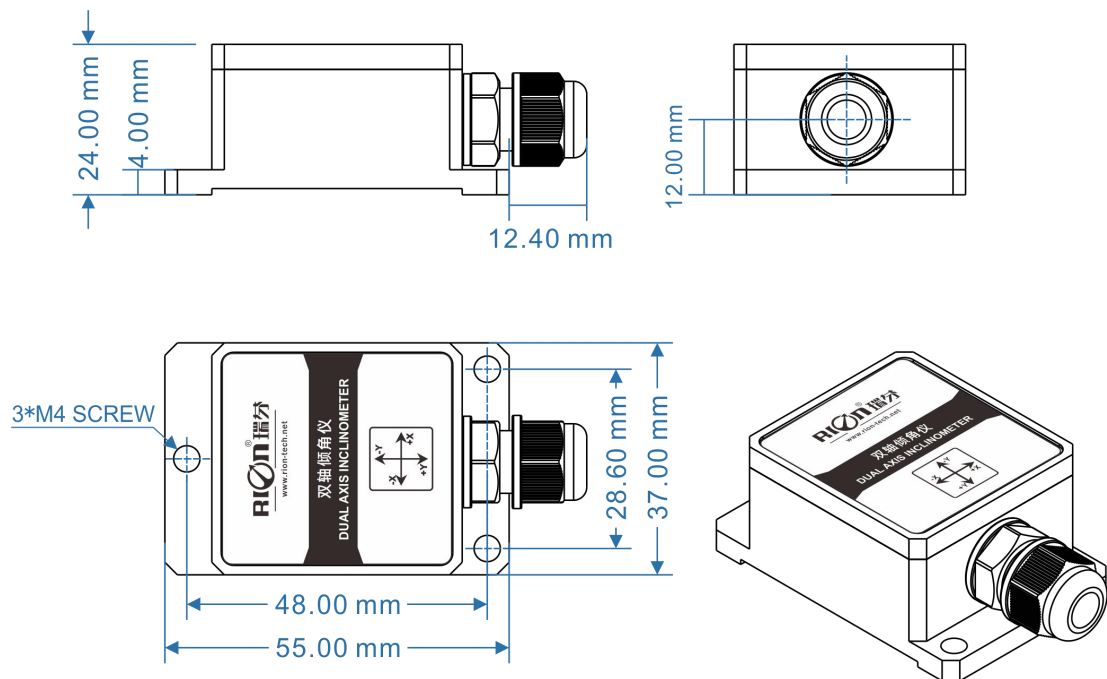
### ► SIZE

#### PCBA SIZE



SIZE : L27×W33×H10.5mm

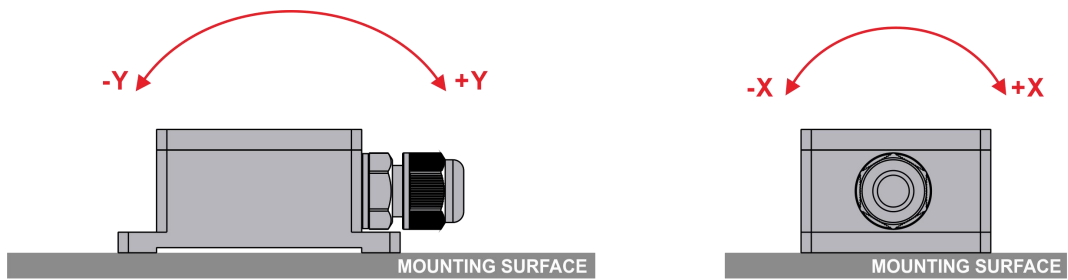
#### SHELL SIZE



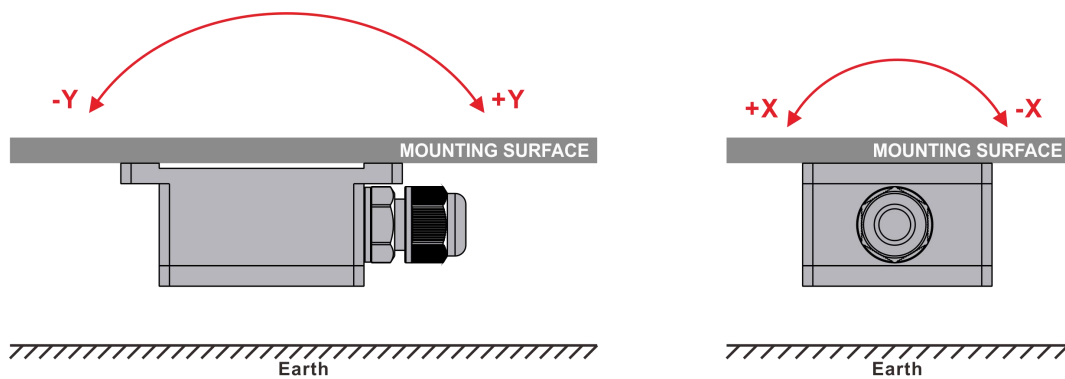
SIZE : L55mm×W37mm×H24mm

► **INSTALLATION DIRECTION**

During installation, keep the sensor mounting surface parallel to the target surface to be measured, and reduce the impact of dynamics and acceleration on the sensor. This product can be installed horizontally or vertically, please refer to the following diagram for the installation method:



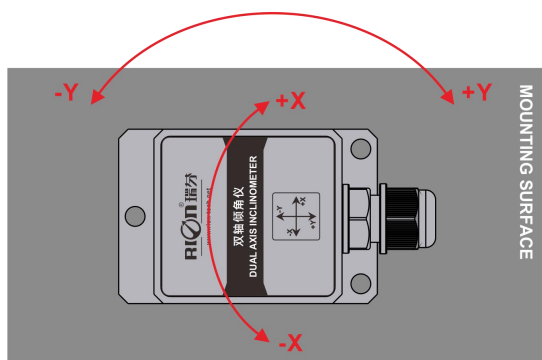
**Horizontal installation**



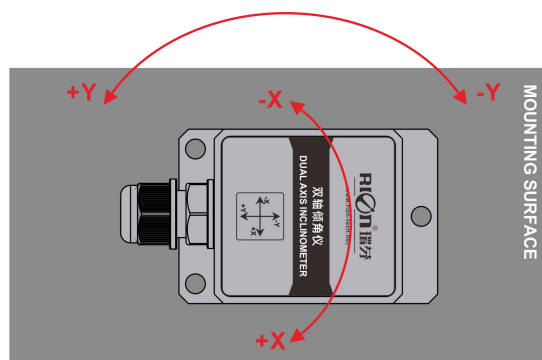
**Horizontal-down installation**



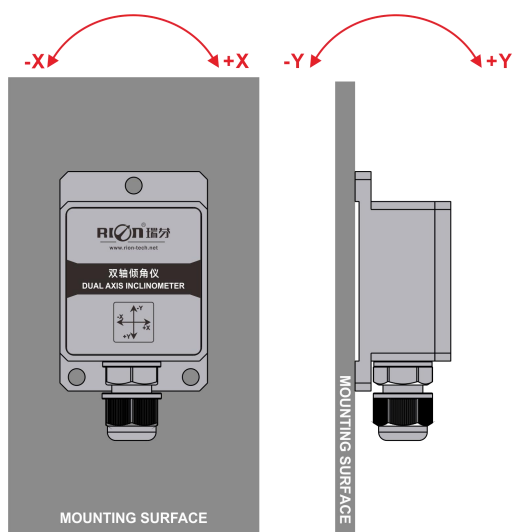
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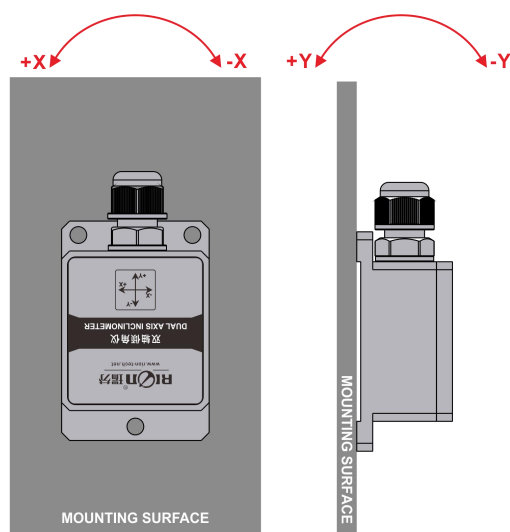
Vertical-left installation



Vertical-right installation



Vertical installation



Vertical-down installation

### ► INSTALLATION PRECAUTIONS

Please install the tilt sensor according to the correct method. Improper installation will cause measurement error. Pay attention to the first "surface" and the second "line": 1) The mounting surface of the sensor and the measured surface must be tight, flat and stable. The unevenness of the mounting surface is easy to cause the angle error of the sensor measurement.

2) The axis of the sensor and the axis to be measured must be parallel, and the angle between the two axes should be avoided as much as possible.

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