



## SPECIFICATIONS

Item No.: SCA126T

Description: Digital Type Dual-Axis Inclinerometer

Version: Ver.08

### **Production implementation standard reference**

- Enterprise quality system standards: ISO9001: 2008 standard (certification number: 128101)
- Tilt sensor production standards: GB / T 191 SJ 20873-2003 inclinometer general specification of Level
- The Academy of metrology and quality inspection Calibrated in accordance to : JJF1119-2004  
Electronic Level calibration Specification
- Gyro accelerometer test standard: QJ 2318-92 Gyro accelerometer test methods
- Software development reference standard: GJB 2786A-2009 military software development General requirements
- Product environmental testing standards: GJB150
- Electromagnetic anti-interference test standards: GB / T 17626

# SCA126T--Digital Type Dual-Axis Inclinometer



## General Description

SCA126T is a serial output dual-axis inclinometer launched by RION company to the field of industrial control, built-in high-precision 16bit A / D differential converter, through 5 filtering algorithm, which can measure the angle of sensor output relative to the horizontal tilt and pitch tilt. The output interface RS485, RS232, RS422, TTL, CAN、MODBUS are optional.

Because of Built in ADI company's high precision digital temperature sensor that can correct the sensor temperature drift in accordance with the changes of the built-in temperature sensor, to ensure high repeatability of the product in the low-temperature and high-temperature environment. The output frequency response standards up to 18Hz, for higher response frequency Division we can customize according to the user requests. The products are truly industrial-grade products, reliable performance, scalability, and a variety of output options. Suitable for a variety of harsh industrial control environment.

## Features:

- Dual-Axis Inclinometer
- Accuracy: refer to the technical data
- Wide temperature working: -40~+85℃
- IP67 protection class
- Direct lead cable interface
- Output mode RS232/RS485/RS422/PWM/CAN (optional)
- Measuring Range :±1~±90° optional
- Wide voltage input: 9~36V
- Resolution: 0.01°
- Highly anti-vibration performance >2000g
- Small size :90×40×26mm (customized)

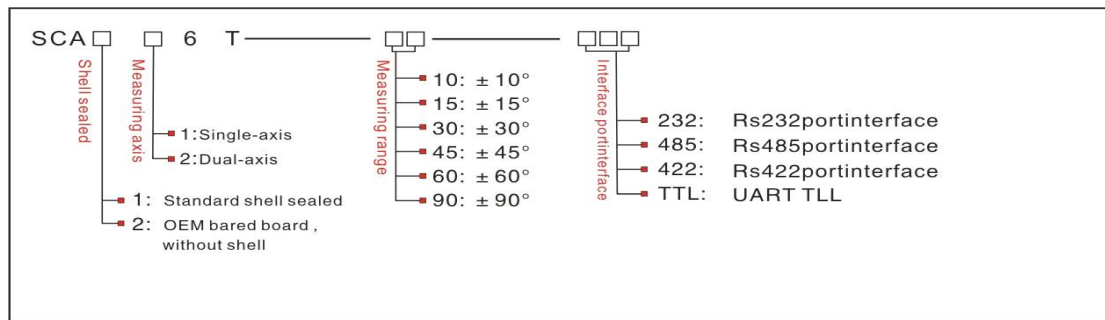
## Application:

- Satellite positioning Search
- engineering mechanical measurement of dip angle
- Radar detection of vehicle platform
- Gun Barrel angle measurement in early shooting
- Satellite communications vehicle posture detection
- Ship's navigation posture measurement
- Rail-mobile monitoring
- oil-well drilling equipment
- Underground drill posture navigation
- Based on the angle direction measurement
- Shield pipe jacking application
- Geological equipment inclined monitoring



# SCA126T--Digital Type Dual-Axis Inclinometer

## Ordering information:



E.g: SCA126T-10-232: Single axis /Standard /±10°Measuring range /RS232 output

## Technical Data

Parameters	Conditions	SCA126T-10	SCA126T-30	SCA126T-60	SCA126T-90	Unit
Measuring range		±10	±30	±60	±90	°
Measuring axis		X,Y	X,Y	X,Y	X,Y	
Resolution		0.01	0.01	0.01	0.01	°
Absolute accuracy		0.02	0.05	0.08	0.1	°
Long term stability		0.05	0.05	0.05	0.05	
Zero temperature coefficient	-40~85°	±0.006	±0.006	±0.006	±0.006	°/°C
Sensitivity temperature coefficient	-40~85°	≤100	≤100	≤100	≤100	ppm/°C
Power on time		0.5	0.5	0.5	0.5	S
Response time		0.05	0.05	0.05	0.05	s
Output rate	5Hz、15Hz、35Hz、50Hz can be setting					
Output signal	RS232/RS485/RS422/TTL/PWM/CAN/MODBUS					
EMC	According to EN61000 and GBT17626					
MTBF	≥50000hours/times					
Insulation Resistance	≥100M					
Shockproof	100g@11ms、3Times/Axis(half sinusoid))					
Anti-vibration	10grms、10~1000Hz					
Protection glass	IP67					
Cables	Standard 1M length、wearproof、grease proofing、wide temperature、Shielded cables 4*0.4mm2					
Weight	120g(without cable)					

\*This Technical data only list ± 10 °, ± 30 °, ± 60 °, + 90 ° series for reference, other measuring range please refer to the adjacent parameters



## Electronic Characteristics

Parameters	Conditions	Min	Standard	Max	Unit
Power supply	Standard	9	12、24	36	V
	customized		5		V
Working current	non-loaded		30		mA
Working temperature		-40		+85	°C
Store temperature		-55		+125	°C

## Key words :

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

**Absolute accuracy:** Refers to in the normal temperature circumstances, the sensor absolute linearity, repeatability, hysteresis, zero deviation, and transverse error comprehensive error.

**Long term stability :** Refers to the sensors in normal temperature conditions, the deviation between the maximum and minimum values after a year's long time work.

**Response time:** Refers to the sensor in an angle change, the sensor output value reached the standard time required.

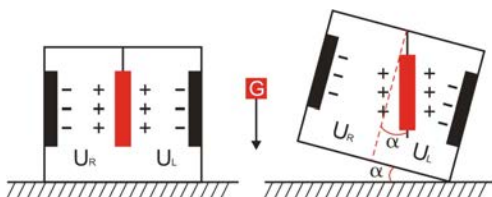
## Mechanical Parameters

- Connectors: 1m lead cable (customized)
- Protection glass: IP67
- Enclosure material : Aluminum Oxide
- Installation : 4\*M6 screws



## Working Principle

Adopt the European 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.



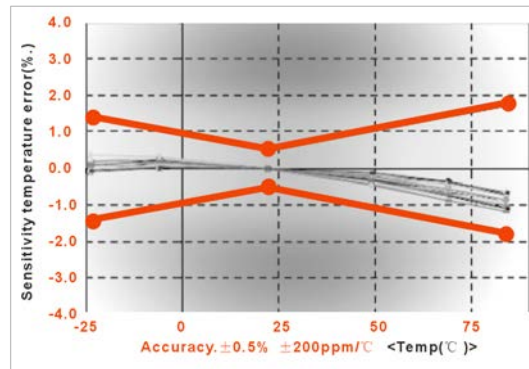
$U_R, U_L$  Respectively is the pendulum left plate and the right plate corresponding to their respective voltage between the electrodes, when the tilt sensor is tilted,  $U_R, U_L$  Will change according to certain rules, so  $f(U_R, U_L, )$  On the inclination of  $\alpha$  function:

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

# SCA126T--Digital Type Dual-Axis Inclinometer

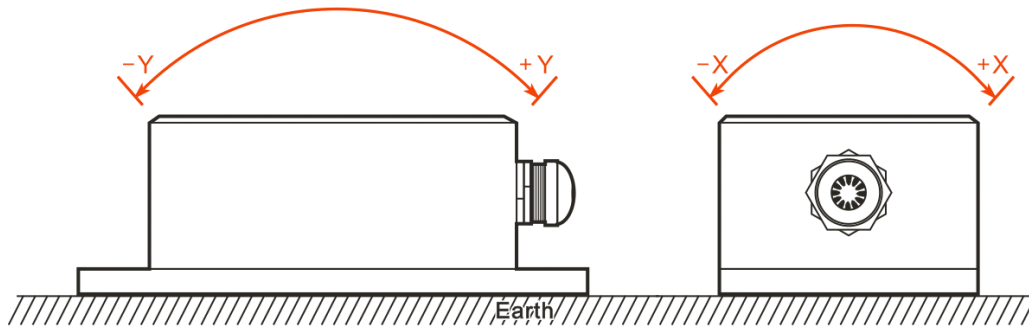
## Typical performance diagram

Temperature characteristic chart:

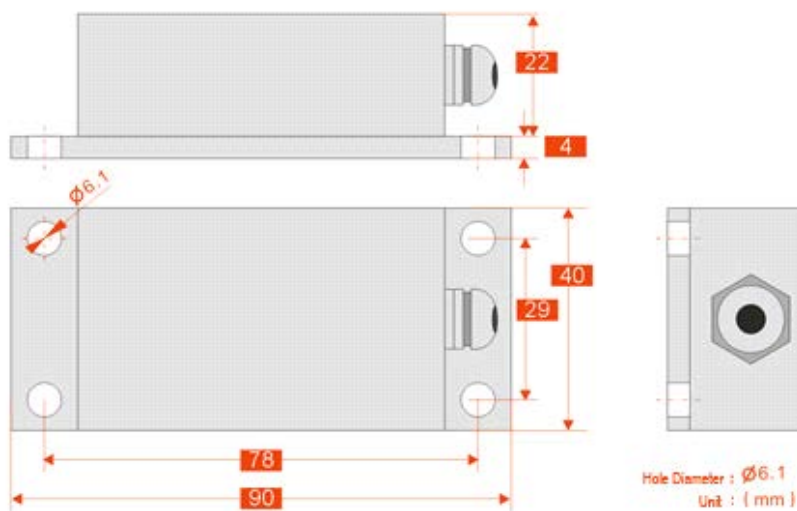


## Measuring Directions&Fix

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 (mounted vertically selection is only applicable to the single axis), for installation please refer to the following scheme.



## Dimension



Size: L90×W40×H26mm

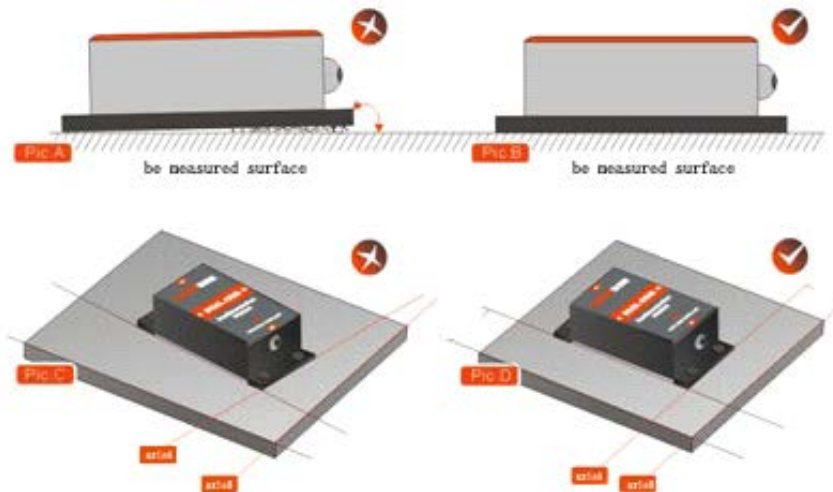


# SCA126T--Digital Type Dual-Axis Inclinometer

## Production installation notes:

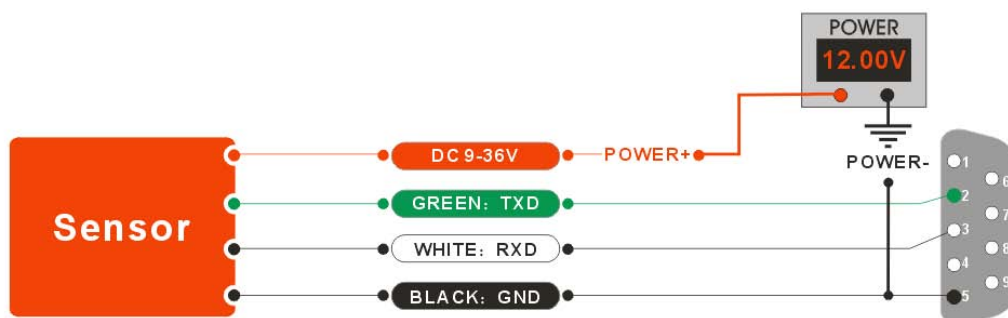
Please follow the correct way to install tilt sensor, incorrect installation can cause measurement errors, with particular attention to the "surface", "line"::

- 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. See Figure Pic.AB
- 2) The sensor axis and the measured axis must be parallel, the two axes do not produce the angle as much as possible. See Figure Pic.CD



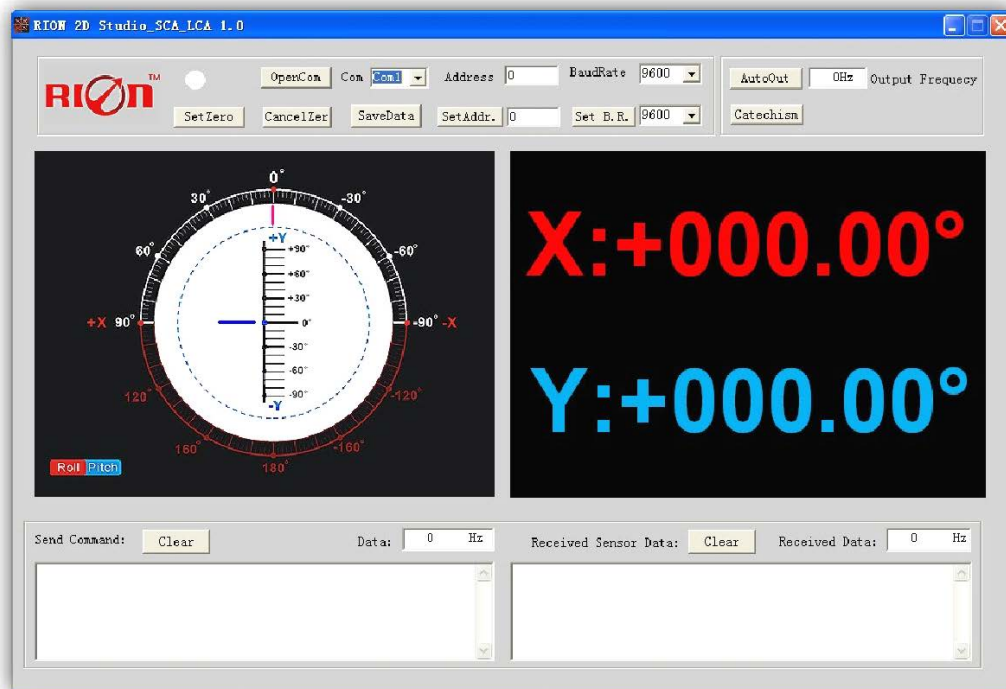
## Electrical Connection

Line color	BLACK	WHITE	BLUE	BROWN
function	GND Power Negative	RS232(RXD) RS485(D+)	RS232(TXD) RS485(D-)	Vcc 9~36V Power positive



## RION serial port tester software

You can download the RION angle debugging software from RION's official website for the preliminary angle debugging, also you Can download public version of the serial port assistant software on line for using .



Open/Close: Open and close COM port;

Com: Select the the device corresponding to the COM port

Address: Fill in the sensor current address code, the factory default is 00

Set Address: Set the sensor address code input box on the right to enter the desired address code, click Set Addr button

Save Data: Save the data, click here data can be synchronized Save angle data, the file is stored by default in the C: ---- COMDATA file

Set Zero: Set relative zero, the sensor current angle is 00.00 degrees

Cancel Zero: Unset the relative zero, to restore the sensor to the factory absolute zero;

Baud Rate: Select the sense baud rate , the factory default is 9600;

Set Baud Rate: Set the sensor baud rate, on the right of the selection box to select corresponding baud rate then click SetB.R. button;

Auto Output: Switch the sensor to automatically output mode, in the automatic output mode can be filled with different output frequency in Hz;

Catechism: The sensor switch to answer pattern, such as choosing the answer type, must input "send command "( command, please refer to the specification ) on the left of "Send Command" input box, but also can fill in the transmit frequency in the Send Data, the unit Hz;

Note: after install the RION's debugging software, if can not open, please operate by the following steps ( please appear to the administrator status to operate ):

- 1) Copy these three files mscomm.srg、mscomm32.ocx、mscomm32.dep from the folder to C:/Windows/system32 path below.

# SCA126T--Digital Type Dual-Axis Inclinometer

2) Click "Start" --"run" --regsvr32 mscomm32.ocx, You are prompted to install successful dialog.

## Product Protocol

### 1、DATA FRAME FORMAT: (8 bits date, 1 bit stop, No check, Default baud rate 9600)

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain	Check sum (1byte)
68					

Date format: hexadecimal

Identifier: Fixed68

Data length: From data length to check sum (including check sum) length

Address code: Accumulating module address, Default :00

Date domain will be changed according to the content and length of command word

Check sum: Data length、Address code、Command word and data domain sum, No carry.

### 2、COMMAND word analysis

Desc.	Meaning/Example	Description
<b>0X01</b>	<b>Read X axis angle command</b> E.g: <b>68 04 00 01 05</b>	Data domain(0byte) No Data domain command
<b>0X81</b>	Sensor answer reply E.g: <b>68 07 00 81 10 26 80 3E</b>	Data domain: (3byte) <b>SA AA BB</b> Data domain is 3 byte return angle value , compress to BCD code, S is sign bit (0 positive ,1 negative) AAA is three position integer value ,BB is decimal Value, eg. 102680 indicate -26.80deg.
<b>0X02</b>	<b>Read Y axis angle command</b> E.g: <b>68 04 00 02 06</b>	Data domain (0byte) No Data domain command
<b>0X82</b>	<b>Answer reply command read Y axis angle</b> The sensor answer reply E.g: <b>68 07 00 82 00 66 25 11</b>	Data domain: (3byte) <b>SA AA BB</b> Data domain is 3 byte return angle value , compress to BCD code, S is sign bit (0 positive ,1 negative) AAA is three position integer value ,BB is decimal Value, eg. 006625 indicate 066.25deg .
<b>0X04</b>	<b>Meanwhile read X.Y angle command</b> E.g: <b>68 04 00 04 08</b>	Data domain (0byte) No Data domain command
<b>0X84</b>	<b>The sensor answer reply</b> E.g: <b>68 0D 00 84 00 20 10 10 05 25 00 00 00 FB</b>	Data domain (9byte) AA AB BB CC CD DD EE EE EE AA AB BB: three character means X axis CC CD DD: three character means Y axis EE EE EE : : three character retention data ,regular is 000000 Angle format with same analytic method as X axis or Y axis The angle on the left example is X axis 020.10deg, Y axis -05.25deg
<b>0X05</b>	<b>Setting relative/absolute ZERO :</b> Can set the current angle to Zero degree, relative measurement, can also be set to absolute ex-factory zero, power off save E.g: <b>68 05 00 05 00 0A</b>	Data domain (1byte) 00: absolute ZERO 01: relative ZERO





## SCA126T--Digital Type Dual-Axis Inclinometer

<b>0X85</b>	Sensor answer reply command E.g: <b>68 05 00 85 00 8A</b>	Data domain (1byte) Data domain in the number means the sensor response results 00 Setting successfully FF Setting failure
<b>0X0B</b>	<b>Setting communication rate</b> <b>E.g: 68 05 00 0B 03 13</b> The command setting is effective after power off then restart ( power off with save function)	Data domain (1byte) Baud rate: 00 means 2400 01 means 4800 02 means 9600 03 means 19200, default value is :9600.
<b>0X8B</b>	Sensor answer reply command E.G: <b>68 05 00 8B 90</b>	Data domain (1byte) Data domain in the number means the sensor response results 00 Success FF Failure
<b>0X0C</b>	<b>Setting sensor output mode</b> Response rule; Need upper computer send reading angle command , the sensor answer the corresponding angle Automatic output rule: The sensor with power on can Automatically output X angle , output frequency is 20HZ (Power off with save function) E.g: <b>68 05 00 0C 00 11</b>	Data domain (1byte) 00 Answer reply mode 01 Automatical output mode
<b>0X8C</b>	The sensor answer reply command E.g: <b>68 05 00 8C 00 91</b>	Data domain (1byte) Data domain in the number means the sensor response results 00 Success FF Failure
<b>0X0F</b>	<b>Setting module address command</b> The sensor default address is 00, 1, such as a plurality of sensor to be connected with a bus cable, e.g RS485.requires each sensor is set to a different address, in order to achieve control and response angle . 2, If successfully changed the new address, follow all of the commands and responding Packet address code has to switch to the new address code which already changed then to be effective, otherwise the	Data domain (1byte) XX Module address Address from 00 to EF range Note: All products have a common address :FF, If forget the address what has been set during operation , can use FF address to operate the product can still normally respond



## SCA126T--Digital Type Dual-Axis Inclinometer

	<p>sensor will not respond to commands.(power off with save function)</p> <p>E.g: <b>68 05 00 0F 01 15</b></p> <p>Setting the address to 01</p> <p><b>68 05 FF 0F 00 13</b></p> <p>Use the common address to reset address to 00</p>	
<b>0X8F</b>	<p>The sensor answer reply command</p> <p>E.g: 68 05 00 8F 94</p>	<p>Data domain (1byte) ,</p> <p>Data domain in the number means the sensor response results</p> <p>00 Success FF Failure</p>
<b>0X0D</b>	<p><b>Query relative/absolute ZERO</b></p> <p>Used to query the sensor current</p> <p>ZERO mode is relative ZERO or absolute ZERO</p> <p>E.g</p> <p>: <b>68 04 00 0D 11</b></p>	<p>Data domain (0byte)</p> <p>No data domain commands</p>
<b>0X8D</b>	<p>The sensor answer reply command</p> <p>E.g:<b>68 05 00 8D 00 92</b></p>	<p>Data domain (1byte) ,</p> <p>Data domain in the number means the sensor response results</p> <p>00 Absolute ZERO</p> <p>01 Relative ZERO</p>

