RTS6 Dual-Channel Redundant Tilt Sensor

Product manual

V1.0-20250815

Technical Characteristics

- ❖ Single-axis measurement range ±180°, Dual-axis ±60°;
- ❖ Accuracy : ±0.1°;
- ❖ Resolution 0.1°;
- ❖ DC 9~36V wide voltage input;
- ❖ High vibration resistance >2000g;
- ❖ Wide operating temperature range -40~+85℃.

Product Introduction

RTS series tilt sensor employs a dual-channel redundancy architecture and a single-axis measurement design , achieving a highly reliable system through hardware and software redundancy. The two independent working channels serve as backups for each other; if one channel fails , the other channel ensures continued stable system operation. This design not only enhances fault detection and diagnosis capabilities but also effectively suppresses noise interference through dual-channel data comparison. Significantly improves measurement accuracy This allows it to maintain excellent anti-interference performance and measurement reliability even under complex working conditions.

The product conforms to the CANOPEN communication protocol standard. The entire system, from hardware circuitry to software algorithms, employs redundant design. The precise structural design provides excellent electromagnetic compatibility and protection levels. Each device undergoes rigorous calibration and digital filtering before leaving the factory to ensure measurement accuracy meets technical specifications. The device's operating status is displayed in real-time via dual-color LED indicators and a status register. This greatly facilitates users' system debugging and equipment maintenance work.

Application Field

- ❖ construction machinery
- ❖ Rail transit
- ❖ Petroleum and Geological Exploration
- ❖ Naval Architecture and Ocean Engineering
- ❖ Tunnels and Underground Engineering

Specifications

RTS6	Condition	Parameter	
Measurement range	\	Single axis ±180°	Dual axis±60°
Measuring axis	\	X axis	XY axis
Resolution[1)]	\	0.1°	0.1°
Measurement accuracy [2)]	@25℃	±0.1°	±0.1°
Zero-point temp coefficient	-40 ~ 85℃	±0.02°/℃	±0.02°/℃
Power-on startup time	0.5s		
Cutoff frequency	0.9Hz		
Output signal	CAN OPEN		
Electromagnetic compatibility	According to EN61000 and GBT17626		
Insulation resistance	≥100MΩ		
Impact resistance	100g@11ms, triaxial (half-sine wave)		
Vibration resistance	10grms 10~1000Hz		
Waterproof rating	IP67		
weight	≤350g (excluding cable)		

Resolution: refers to the smallest change in the measured quantity that a sensor can detect and distinguish within its measurement range .
Measurement accuracy: refers to the combined error of the sensor's linearity, repeatability, hysteresis, zero-point deviation, and horizontal axis error under normal temperature conditions .

Order selection

Model	Measurement axis	Measurement range	Fixed selection
RTS6	X: X-axis	180: ±180°	RTS6X180: Single axisX-axis/ measurement range ±180°
	D: Dual axis	60: ±60°	RTS6D60: Dual axis XY axis/ measurement range ±60°

Electrical parameters

parameter	condition	Min	Typ		Max
Power supply voltage	standard	9V	12V	24V	36V
Operating current	No load		23mA (12V)		
Operating temperature		-40℃			+85℃
Storage temperature		-40℃			+85℃

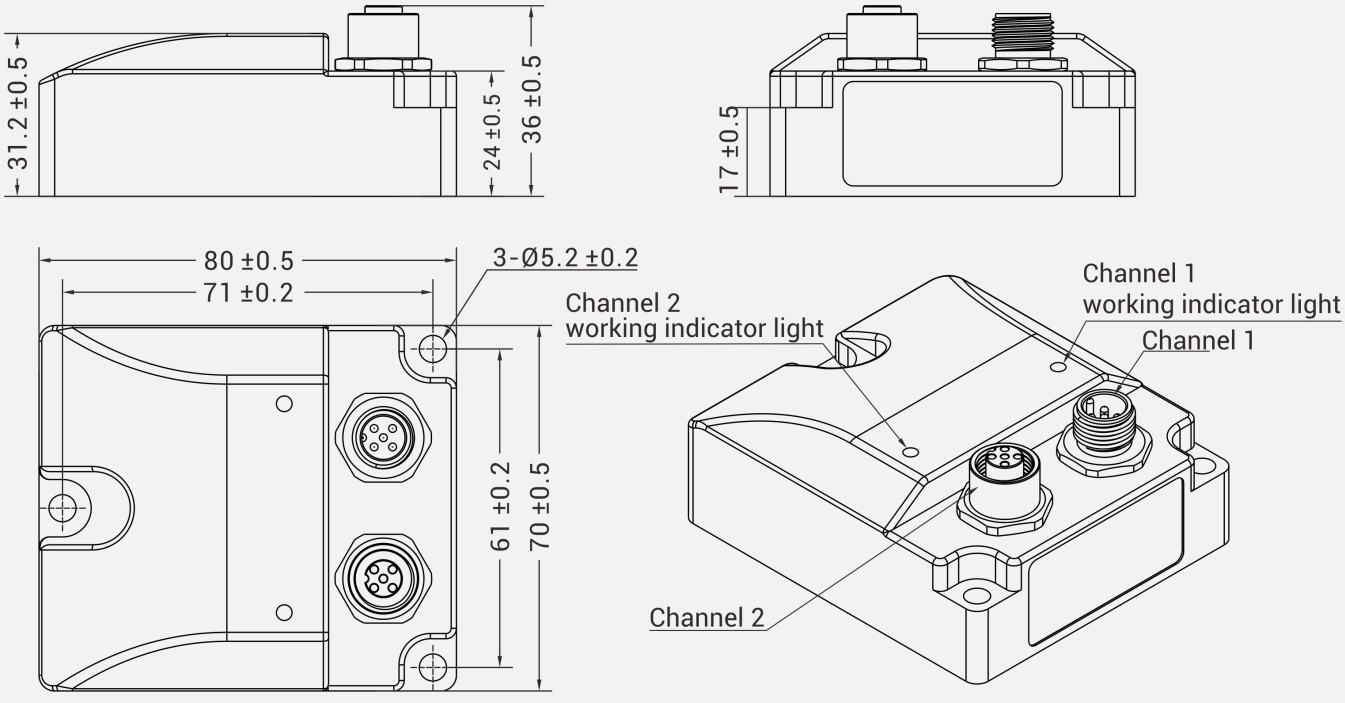
Interface Definition

AISLE 1		AISLE 2	
Pin	Definition	Pin	Definition
PIN 1	SCM shielded cable	PIN 1	SCM shielded cable
PIN 2	VCC	PIN 2	VCC
PIN 3	GND	PIN 3	GND
PIN 4	CAN_H	PIN 4	CAN_H
PIN 5	CAN_L	PIN 5	CAN_L

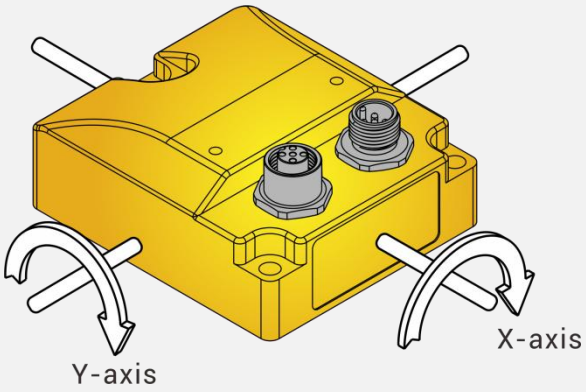
Working instructions for indicator lights

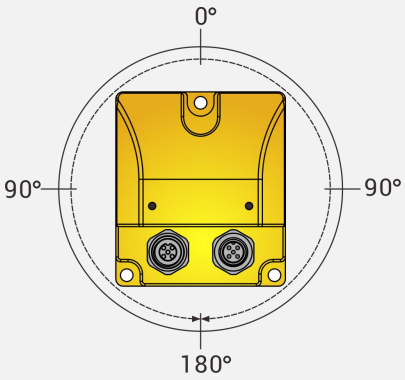
1) At the zero point position, the indicator light is constantly on green;
2) If the axial tilt exceeds 0.5 °, the green indicator light will flash;
3) When the lateral slope exceeds 45 degrees, the indicator light flashes alternately in red and green;
4) Sensor malfunction, corresponding channel indicator light is red and constantly on.

Shell Size

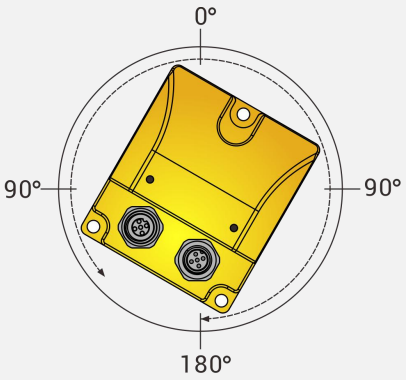


Installation direction

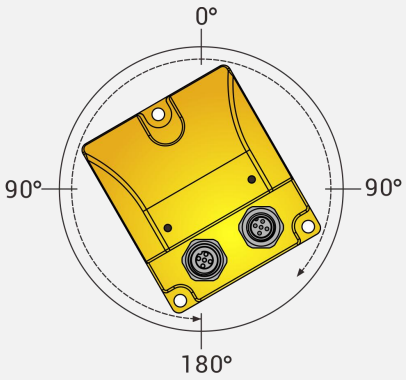




The sensor is at zero position

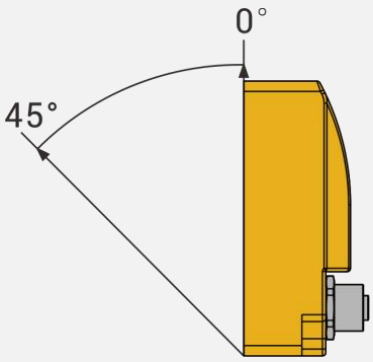


Clockwise rotation direction is from square 0 ° to+180 °



The counterclockwise rotation direction is from square 0 ° to -180 °

Measurement Instructions



Due to the lateral slope factor, there may be significant errors in measurement accuracy. Therefore, when the lateral slope exceeds 45 °, an over distance indicator is set to indicate that the measured value is invalid. At this time, the LED (flashing red and green) indicates and is indicated in index (2001h).

Communication Protocol

Default COB ID Definition

COB	Computational method	Default Value	
		Node ID 32	Node ID 33
NMT	0h	0h	0h
SYNC	80h	80h	80h
EMCY	80h + Node ID	0A0h	0A1h
TPDO1	180h + Node ID	1A0h	1A1h
Standard SDO (Client > Server)	580h + Node ID	5A0h	5A1h
Standard SDO (Server > Client)	600h + Node ID	620h	621h
Heartbeat	700h + Node ID	720h	721h

Index table:

Index	Sub-Index	Parameter	Access	Description
2000h	0h	Angle measurement value	Read Only	Angle measurement value
2001h	0h	Exceeding the measurement range	Read Only	Used to indicate measurement status 0: The angle value is valid 1: Invalid angle value
2010h	0h	Angle unit	R/W	Default values: 1, 0 radians, 1 angle, 2 percentage
2012h	0h	Angle reversal	R/W	Default values: 0, 0: Normal output, 1: Inverted output
2014h	0h	angle compensation	R/W	Default value: 0. Setting this value requires multiplying by the resolution,The sensor output value is the original value plus this value.
2016h	0h	Reference angle	White Only	Default value: 0. Setting this value requires multiplying by the resolution, The sensor directly outputs this value.
2018h	0h	resolution	R/W	Effective values: 1: 0.001, 10: 0.01, 100: 0.1, 1000: 1 Default value: 100
2020h	0h	Filter mode	R/W	Valid values: 0: on, 1: off, default value: 0
2025h	0h	Filter order	R/W	Valid values: 1~6, default value: 2nd order
3000h	1h	Channel 1 NodeId	R/W	Value range: 1... 127, default value: 32 This index setting has the same effect as channel 2
3000h	2h	Channel 2 NodeId	R/W	Value range: 1... 127, default value: 33 This index setting has the same effect as channel 1
3010h	1h	Channel 1 baud rate	R/W	Value range: 10k/20k/50k/125k/250k/500k/800k/1000k, default value: 125k; This index setting has the same effect as channel 2
3010h	2h	Channel 2 baud rate	R/W	Value range: 10k/20k/50k/125k/250k/500k/800k/1000k Default value: 125k; this index setting has the same effect as channel 1

1)Service Data Object SDO Instruction Description: SDO request and response messages consist of 8 bytes, with any insufficient data bytes followed by 0.

1.1): Set the node number, default channel one Node-ID is 0x20, channel two Node-ID is 0x21, Node ID range is 1-126.

Table 1-1 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+Node_ID	0x2F	0x00	0x30	0x01	New Node ID	0x00	0x00	0x00

Table 1-2 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	0x60	0x00	0x30	0x01	0x00	0x00	0x00	0x00

Note: This setting simultaneously configures the Node IDs of two channels. When changing the product Node ID, the second channel Node ID is set to+1, and the node ID change needs to be reset to take effect. If the controller sends CAN-ID=0x600+0x20 (default), send data: 2F 00 30 01 10 00 00 00

Sensor returns CAN-ID=0x580+0x20 (default), return data: 60 00 30 01 00 00 00

After powering on again, the frame ID of channel one is 0x590 (0x580+0x10), and the frame ID of channel two is 0x591, indicating that the Node ID has been successfully modified.

1.2) Set baud rate:10k / 20k / 50k / 125k / 250k / 500k / 800k / 1000k ;**Default value: 125K.**

Table 1-3 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+Node_ID	0x2B	0x10	0x30	0x01	XX	XX	0x00	0x00

Table 1-4 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	0x60	0x01	0x30	0x00	0x00	0x00	0x00	0x00

Note: This setting simultaneously configures the baud rate of two channels. The fifth byte is the low byte for setting the baud rate, and the sixth byte is the high byte for setting the baud rate. If the controller sends data: 2B 10 30 01 E8 03 00 00, return data: 60 10 30 01 00 00 00; The sensor needs to be powered on again to take effect at a baud rate of 1000K.

1.3) Set output unit, default value: 1 (angle), valid value is 0: radians; 1: Angle; 2: Percentage;

Table 1-5 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+Node_ID	0x2F	0x10	0x20	0x00	XX	0x00	0x00	0x00

Table 1-6 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+Node_ID	0x60	0x10	0x20	0x00	0x00	0x00	0x00	0x00

1.4) Set angle reversal, default value 0, effective value 0: normal output; 1: Reverse angle output;

Table 1-7 SDO Request Message

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+ Node_ID	0x2F	0x12	0x20	0x00	XX	0x00	0x00	0x00

Table 1-8 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x12	0x20	0x00	0x00	0x00	0x00	0x00

1.5) Set angle compensation with a default value of 0. The data format should be consistent with the angle output. After setting, the output value should be the original measurement value plus this setting value;

Table 1-9 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+Node_ID	0x2B	0x14	0x20	0x00	0xXX	0xXX	0x00	0x00

Table 1-10 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x14	0x20	0x00	0x00	0x00	0x00	0x00

1.6) Set the reference angle, with a default value of 0. The data format should be consistent with the angle output, and the output value should be the set value after setting;

Table 1-11 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+Node_ID	0x2B	0x16	0x20	0x00	0xXX	0x00	0x00	0x00

Table 1-12 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x14	0x20	0x00	0x00	0x00	0x00	0x00

1.7) Set angle resolution, default 100, valid values: 1(0.001°), 10(0.01°), 100(0.1°), 1000(1°),

Table 1-13 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+ Node_ID	0x2B	0x18	0x20	0x00	DL	DH	0x00	0x00

Table 1-14 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x18	0x20	0x00	0x00	0x00	0x00	0x00

1.8) Set filter mode, default 1, 0 off, 1 on

Table 1-15 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+ Node_ID	0x2F	0x20	0x20	0x00	XX	0x00	0x00	0x00

Table 1-16 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x20	0x20	0x00	0x00	0x00	0x00	0x00

1.9) Set the filter order to 2 by default, with a valid value range of 1-6.

Table 1-16 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+ Node_ID	0x2F	0x25	0x20	0x00	XX	0x00	0x00	0x00

Table 1-18 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x25	0x20	0x00	0x00	0x00	0x00	0x00

2.0) Set heartbeat cycle, default 0

Table 1-19 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+ Node_ID	0x2B	0x17	0x10	0x00	DL	DH	0x00	0x00

Table 1-20 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x17	0x10	0x00	0x00	0x00	0x00	0x00

2.1) Set PDO1 sending cycle, default 0, valid value range: greater than 10

Table 1-21 SDO Request Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x600+ Node_ID	0x2B	0x00	0x18	0x05	DL	DH	0x00	0x00

Table 1-22 SDO Response Message Format

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte
0x580+ Node_ID	0x60	0x00	0x18	0x05	0x00	0x00	0x00	0x00

3.0) PDO Data Analysis (Tilt Angle Analysis)

Index	Sub-Index	meaning	default value	
1800h	1h	COB-ID (X angle)	1A0h (416d)	1A1h (417d)
1800h	2h	PDO1 transmission method	254 (Asynchronous mode)	254 (Asynchronous mode)
1800h	3h	PDO1 Forbidden Time	100 (10ms)	100 (10ms)
1800h	5h	PDO1 Activity Duration	25 (25ms)	25 (25ms)

After the device is started, send the following message periodically

CAN-ID	1st byte	2nd byte	3rd byte	4th byte	5th byte	6th byte	7th byte	8th byte	CAN-ID
0x180+Node_ID	XL	XH	FLAG	-	-	-	-	-	-

PDO data length is 3, angle value is a 16 bit signed number, XL angle value is low byte, XL angle value is high byte, measurement value is valid when FLAG is 0, invalid when FLAG is 1, out of range.