Ranged Inclinometer

Vigor Technology

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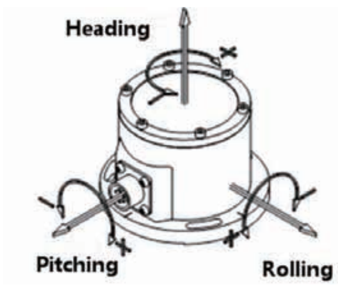
Features

- Measuring three-dimensional angle information: roll, pitch and heading
- Maximum measuring range for roll/pitch angle: ±60°
- Heading accuracy ±5°RMS@≤±30°, resolution 0.01°
- Tilt repeatability accuracy±0.0025°
- Refresh rate 5~20Hz
- Customized higher accuracy and dynamic nature products
- Patented tilt measurement technology to realize real high accuracy

Descriptions

Ranged inclinometer is developed to detect target motion objects' three-dimensional attitude, meanwhile output heading angle(relative to the arctic) and X/Y axis angle data(relative to the absolute horizontal plane). Mainly applicable to high precision tilt angle measurement and need heading data in indoor or outdoor industrial field.

Ranged inclinometer is a complement for GPS inclinometer, can realize X, Y, Z three direction attitude measuring without space restrictions, with stable and reliable heading data, calibration function for soft iron and hard iron, eliminate ambient magnetic which influence heading measurement accuracy. It suits for vehicle, onboard, ship and robot application.



√ ±0.02%FS linearity

√ ±0.005°Offset

√ Combine with gyro module, realize static/dynamic angle different measuring for low/rapid leveling

√ Combine with vibration module, realize FFT computations different in-time, output vibration frequency and amplitude different data directly, eliminate the influence of environment different vibration

√ Combine with GPS module, realize data synchronization data acquisition and local position data in different installation places

√ Further confirmed that offset, repeatability, hysteresis, turn on repeatability etc. parameters which are important influence factors to unit total performance evaluation

√ Internal enhanced advanced intelligent algorithms drastically reduce cross-axis sensitivity, upgrades real tilt angle measuring accuracy, abandoned the traditional incomplete understanding for tilt angle measurement precision concept

√ Greatly reduce measuring errors when the real tilt direction not consistent for unit's actual sensitive axis

√ Short-circuit, transient voltage and transposition protection to adapt to industry environment

√ User can set unit parameters and query factory data

Applications

Navigation, Communication radar, Microwave directional, Offshore platform control, Antenna engineering, Unmanned aircraft or vehicle, Robot, Motion orientation, Automatic control

Performances

Table 1 Specifications

Roll / pitch performances							
Measurement range		±5°	±10°	±15°	±30°	±45°	±60°
Combined absolute accuracy①(@25℃)		±0.01°	±0.015°	±0.02°	±0.04°	±0.06°	±0.08°
Accuracy subroutine parameter	Absolute linearity (LSF,%FS)	≤0.06	≤0.03	≤0.03	≤0.03	≤0.02	≤0.02
	Cross-axis sensitivity②	≤0.1%FS					
	Offset ③	≤0.005°				≤0.008°	
	Repeatability	≤0.0025°					
	Hysteresis	≤0.0025°					
Allowed installation misalignment④		±4.0°	±3.0°	±2.5°	±1.5°	±1.2°	±1.2°
Input-axis mislignment		≤±0.1°					
Sensitivity temperature drift Coefficient (max.)		≤100ppm/℃	≤50ppm/℃				
Offset temperature drift coefficient (max.)		≤0.003°/℃					
Offset turn on repeatability⑤		≤0.008°					
Resolution		0.0025°					
Long-term stability(1 year)⑥		<0.02°					
Measurement axis		2 axis					
Heading performances							
Accuracy⑦		<±5° RMS @ tilt range <±30°, ±0.5° RMS @level					
Repeatability		±0.3°					
Resolution		0.01°					
Total							
Temperature sensor		Range: -50~125℃ ,Accuracy:±1℃					
Output		RS232,RS422,RS485					
Function		Set zero point, baud rate, local gravitational acceleration value, zero calibration, vibration suppression filter coefficients, ID address, refresh rate, etc					
Cold start warming time		60s					
Refresh rate		5Hz, 10Hz, 20Hz					
Power supply		9~36VDC					
Power consumption		Average working current≤60mA, average power≤1.5W (25℃ &24VDC)					
Operation temperature range		-20~70℃					
Storage temperature range		-40~85℃					
EMC		According to EN 61000					
Insulation resistance		100MΩ					
MTBF		≥25000 h/times					
Shock		100g@11ms,three-axis, half- sine					
Vibration		8grms,20~2000Hz					
Protection		IP65(Optional IP67)					
Connecting		Military class connector (MIL-C-26482)					
Weight		500g(without connector and cable)					

① Combined absolute accuracy means the compositive value of sensor's absolute linearity, repeatability, hysteresis, offset and cross-axis sensitivity error. (in room temperature condition) as

$$\Delta=\pm\sqrt{\text{absolute linearity}^2+\text{repeatability}^2+\text{hysteresis}^2+\text{offset}^2+\text{cross-axis sensitivity error}^2}$$

② The cross-axis sensitivity means the angle that the tilt sensor may be banked to the normal tilt direction of sensor. The cross-axis sensitivity (±0.1%FS) shows how much perpendicular acceleration or inclination is coupled to the inclinometer output signal. For example, for the single-axis inclinometer with range ±30°(assuming the X-axis as measured tilt direction), when there is a 10° tilt angle perpendicular to the X-axis direction(the actual measuring angle is no change, example as +8.505°), the output signal will generate additional error for this 10° tilt angle, this error is called as cross-axis sensitivity error. SST300`s cross-axis sensitivity is 0.1%FS, the extra error is 0.1%×30°=0.03°(max), then real output angle should be +(8.505°±0.03°). In SST300 series, this error has been combined into the absolute accuracy

③ Offset means that when no angle input (such as the inclinometer is placed on an absolute level platform), output of sensor is not equal to zero,the actual output value is zero offset value.

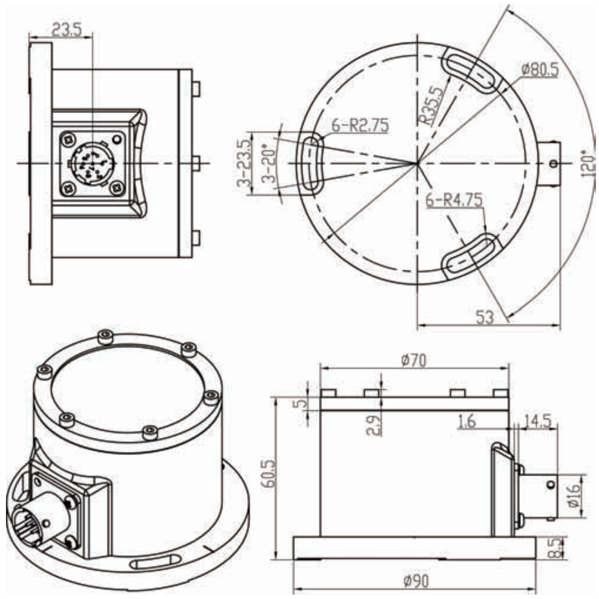
④ Allowed installation misalignment means during the installation, the allow able installation angle deviation between actual tilt direction and sensor's nature measurement direction. In general, when installed,SST300 sensor is required that the measured tilt direction keep parallel or coincident with sensor designated edge, this parameter can be allowed a certain deviation when sensor is installed and does not affect the measurement accuracy.

⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

⑥ Long-term stability means the deviation between the statistics of the maximum and the minimum output value after a year of continuous power supply when the sensor is at 20℃ .

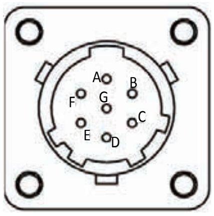
⑦ In actual use process, calibrate electronic compass in the main system, can get more accurate.

Dimensions (mm)



Picture 1 Housing with MIL class connector

Wiring



Picture 2 MIL connector socket (View from outside)

Table 2 MIL connector socket pin definition

Pin	RS232	RS485	RS422
A	Power+	Power+	Power+
B	Power GND	Power GND	Power GND
C	Signal GND	Signal GND	Signal GND
D	NC	NC	RXD+
E	NC	NC	RXD-
F	TXD	RS485-A	TXD+
G	RXD	RS485-B	TXD-

Ordering

SST3 Axis — Range — Output — F3 — 00 — Cable/plug — Temp.drift

- Axis: Single axis — 01; Dual axis — 02
- Range: ±5° —05; ±10° —60; ±15° —15; ±30° —30; ±45° —45; ±60° —60
- Output: RS232 — 00; Others: see table 3
- Cable/plug: None — 00; Others: see table 3
- Temp.drift: 25℃ — 00; Others: see table 3

For example, if order a Ranged inclinometer, with range ±15°, room temperature accuracy ±0.02°, -20~60℃ accuracy ±0.02°, two meters cable with plug, the model should be chosen as: SST302-15-00-F3 -00-C11-D3(2m).

Meanwhile some options (See table 4):

PC application software——order number SST003-04-09

Accessories & Options

Table 3 Accessories

Item	Order Code	Accessories name	Function
Output interface	00	RS232	Directly angle output Data format: Baud rate:115200(adjustable), 8 data bits, 1 start bit, 1 stop bit, none parity Refresh rate:5Hz, optional: 10Hz, 20Hz
	G1	RS485	Isolated, Compatible with half-duplex or full-duplex communication; ±15kV ESD protection Compatible with ANSI/TIA/EIA-485-A-98 & ISO8482:1987(E) Comply with UL1577---2500V rms for 1min ; Transmission rate up to 500 kbps, support max 256pcs node High common mode transient suppression ability>25kV/us ; Support Modbus-RTU, sensor supply HEX or ASCII communication
	G2	RS422	
Cable/Plug	C1	Standard plug with Cable	Meet MIL-C-26482,Standard 2m cable,IP67 protection, heavy duty up to 30kg
	C6	Standard plug	Meet to MIL-C-26482
Temperature drift	D1	Temperature drift	Temperature compensation range 0~60℃, accuracy ±0.01°@≤±30°
	D2	Temperature drift	Temperature compensation range 0~60℃, accuracy ±0.01°@>±30°
	D3	Temperature drift	Temperature compensation range -20~60℃, accuracy ±0.02°@≤±30°
	D4	Temperature drift	Temperature compensation range -20~60℃, accuracy ±0.02°@>±30°
	D5	Temperature drift	Temperature compensation range -30~60℃, accuracy ±0.03°@≤±30°
	D6	Temperature drift	Temperature compensation range -30~60℃, accuracy ±0.03°@>±30°
	D7	Temperature drift	Temperature compensation range -40~65℃, accuracy ±0.05°@≤±30°
	D8	Temperature drift	Temperature compensation range -40~65℃, accuracy ±0.05°@>±30°
	D9	Temperature drift	Temperature compensation range -40~85℃, accuracy ±0.05°@≤±30°
	D10	Temperature drift	Temperature compensation range -40~85℃, accuracy ±0.05°@>±30°

Table 4 Options

Item	P/N	Option name	Function
Installation tools	SST003-01-04	Adjustable base with micrometer screw	Three-points adjustment, resolution 0.001mm, stainless steel materials
Power	SST003-09-02	Portable battery packs	Output 24VDC,Continuous work 24 hours,IP65,rechargeable
Test report	SST003-11-01	Test report for cross-axis sensitivity	Test report under banking tilt, average 11 points of full range
	SST003-11-02	Absolute linearity	Average 21 points of full range
	SST003-11-03	Test report for Allowed Installation misalignment	Axis migration test report for vertical and horizontal axis of inclinometer,3 angles of point

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