SST300 Inclinometer

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Range ±15°
Output TCP/IP
Supply 9~36VDC
Protection IP67

CE RoHS

C4504C615R

Vigor Technology

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Features

- Highest combined absolute accuracy ±0.01°@25℃
- Absolute accuracy combined with absolute linearity,
  cross axis sensitivity, offset, repeatability, hysteresis
- Cross-axis sensitivity ≤±0.1%FS
- Offset ≤±0.005°
- Precise installation & higher actual accuracy
- Adjustable vibration suppression while running
- Temperature drift accuracy(optional)：±0.05°@-40~+85℃
- Various output interfaces
- EMC certificated

Description

SST300 inclinometer is excellent tilt device which not only have outstanding performance, but also have simulation & process with advanced EDA&CAE technologies including reliability design, strict process control, structure design, components/materials collection & heat treatment, heat flow analysis, finite element analysis and so on, to achieve high reliability and stability.

Each inclinometer performed with Vigor's patented automatic testing technologies without manual operations and unpredictable random errors occupied. Not only general accuracy test, but also temperature drift compensation, nonlinear correction, cross-axis sensitivity error correction, and/or orthogonal error correction, input-axis misalignment compensation, vertical-axis misalignment compensation, as well as life test, made to reduce additional error caused by filed installation, then realize to installed-to-forgot and acquire accurate data.

Applications

Vessel, Precisioninstruments, Security detection, Civil engineering, Military project, Platform leveling, Drilling machines, Hydraulic leveling.

Referenced Standards

- GB/T 191 SJ 20873 General requirements for Inclinometer & levelmeter (China)
- GBT 18459 Methods for Calculating the Main static performance specifications for transducers(China)
- JJF 1059 Evaluation and Express of Uncertainty in Measurement(China)
- JJF 1094 Evaluation of the Characteristics of Measuring Instruments(China)
- JJF 1116 Calibration Specification for Linear Accelerometer used precision Centrifuger(China)
- QJ 2318 The test method of gyro & accelerometer(China)
- GJB 2786A General Requirements for Military Software Development(China)
- GJB 2884 General Specification for Three-Axis angular motion simulator(China)
- EN61000-4-11 Voltage dips &Voltage variations
- MIL-HDBD-338B
- ISO 5348 IDT
- MIL-STD-810F-501.4
- MIL-STD-810F-502.4
- MIL-STD-810F-503.4
- MIL-STD-810F-506.4

- MIL-STD-810F-510.4
- MIL-STD-810F-514.5
- MIL-STD-810F-516.5
- IEC60529 IP
- EN61000 -4-2 ESD
- EN61000-4-3 RS

- MIL-STD-810F-507.4
- EN61000-4-4 EFT
- EN61000-4-5 SURGE
- EN61000-4-6 CS
- EN61000-4-8 PFMF
- ISTA-2A

SST800 SST20
SST810 SST30
SST820 SST100
SST830 SST200
SSG100 SST300
SSG200 SST400
SST900 SST500

Performances

Table 1 Specifications

Measurement range		±5°	±10°	±15°	±30°	±45°	±60°
Combined absolute accuracy[①](@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 sensitivity[②]	±0.1%FS					
	Offset[③]	±0.005°				±0.008°	
	Repeatability	±0.0025°					
	Hysteresis	±0.0025°					
Allowed installation misalignment[④]		±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 repeatability[⑤]		±0.008°					
Resolution		0.0025°					
Long-term stability(1 year)		≤0.02°					
Measurement axis		1 or 2 axis					
Temperature sensor		Range: -50~125℃ ,Accuracy:±1℃					
Output		RS232 (optional 25 types, please refer to accessories)					
RS232 data format		115200 baud, 8 data bits, 1 start bit, 1 stop bit, none parity,ASCII					
Cold start warming time		60s					
Response time[⑦]		0.3s(@t$_{90}$)					
Refresh rate(digital output)		5Hz(optional 10Hz,20Hz)					
Response frequency[⑧] (analog output)		3Hz @-3dB					
Power supply		9~36VDC					
Power consumption		Average working current≤50mA, average power≤1.5W (25℃ &24VDC)					
Operation temperature range		-40~85℃					
Storage temperature range		-60~100℃					
EMC		According to EN 61000					
Insulation resistance		100MΩ					
MTBF		≥25000 h/times					
Shock		100g@11ms,three-axis, half- sine					
Vibration		8grms, 20~2000Hz					
Protection		IP67					
Connecting		Military class connector (MIL-C-26482)					
Weight		420g(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 allowable installation angle deviation between actual tilt direction and sensor's nature measure ment 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.
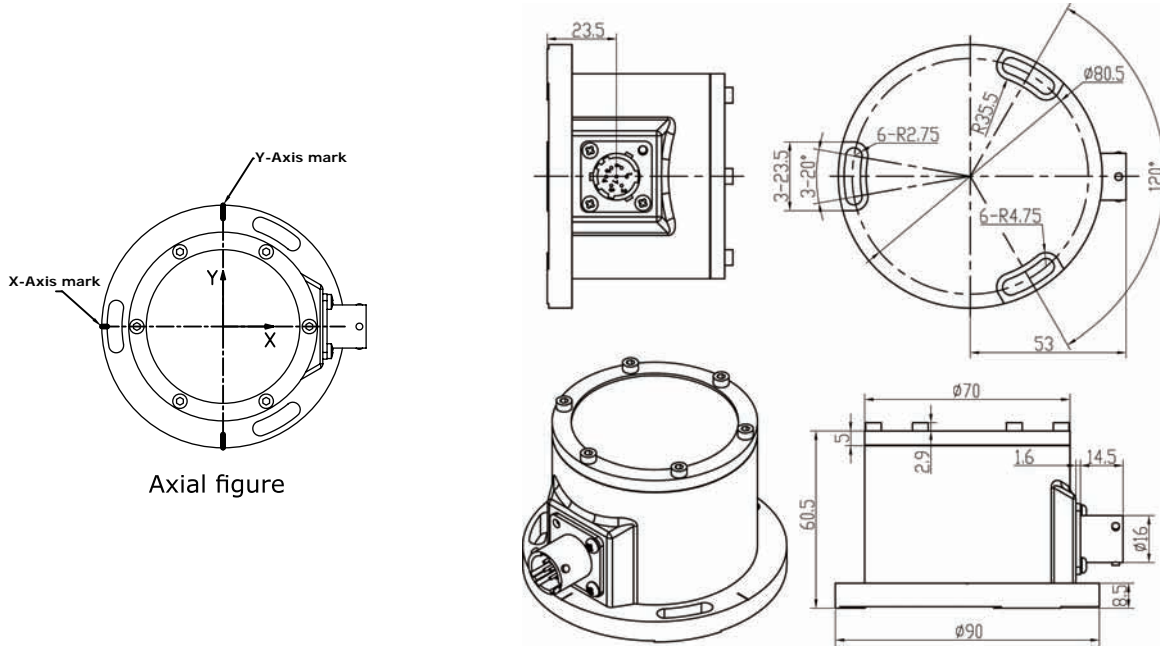
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

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 The response time refers to the angle sensor in a step change (such as the angle changes from -10 ° to +10 °within 5ms), the time required that output of the sensor achieved to the standard value of 90%. The index is different from the sensor set-up time
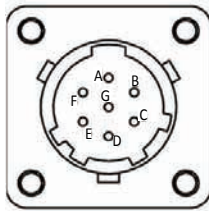
⑧ Response frequency is for the limitation of the dynamic measurement range, when the dynamic measurement exceeds 3 Hz, because of centripetal force, the output occupied additional random error,this error is difficult to define.

Dimensions（mm）

Axial figure

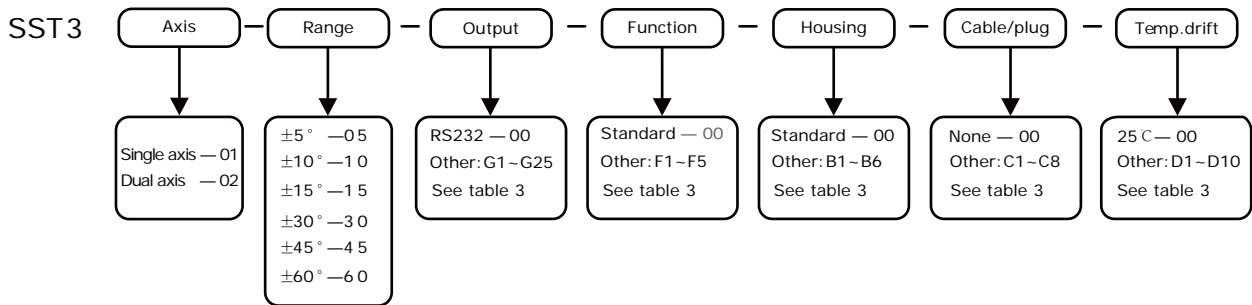Picture 1 Housing with MIL class connector

Wiring

Picture2 MIL connector
socket (View from outside)

Table 2 MIL connector socket pin definition

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

Ordering

| SST3 | Axis | Range | — | Output | — | Function | — | Housing | — | Cable/plug | — | Temp.drift |

Axis	Range	Output	Function	Housing	Cable/plug	Temp.drift
Single axis — 01 Dual axis — 02	±5°—05 ±10°—10 ±15°—15 ±30°—30 ±45°—45 ±60°—60	RS232—00 Other:G1~G25 See table 3	Standard—00 Other:F1~F5 See table 3	Standard—00 Other:B1~B6 See table 3	None—00 Other:C1~C8 See table 3	25℃—00 Other:D1~D10 See table 3

For example, if order a dual-axis inclinometer, with range ±15°, Output Zigbee Wi-Fi transmission, two meters cable with plug, vibration suppression function, anti-explosion housing, the model should be chosen as: SST302-15-G8-F5-B5-C1.

Meanwhile some options (See table 4):

4 channels hub — order number SST003-05-06

Fixed installation base — order number SST003-01-05

Zigbee LCD display with lithium battery — order number SST003-04-07

Complementary power combined with solar and wind energy— order number SST003-09-03

Field calibration equipment (accuracy ±30″) — order number SST003-10-02

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SST830　SST200

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Temperature drift	D1	Temperature drift	Temperature compensation range 0~60℃, and temperature drift accuracy ±0.01°@≤±30°
	D2	Temperature drift	Temperature compensation range 0~60℃, and temperature drift accuracy ±0.01°@>±30°
	D3	Temperature drift	Temperature compensation range -20~60℃, and temperature drift accuracy ±0.02°@≤±30°
	D4	Temperature drift	Temperature compensation range -20~60℃, and temperature drift accuracy ±0.02°@>±30°
	D5	Temperature drift	Temperature compensation range -30~60℃, and temperature drift accuracy ±0.03°@≤±30°
	D6	Temperature drift	Temperature compensation range -30~60℃, and temperature drift accuracy ±0.03°@>±30°
	D7	Temperature drift	Temperature compensation range -40~65℃, and temperature drift accuracy ±0.05°@≤±30°
	D8	Temperature drift	Temperature compensation range -40~65℃, and temperature drift accuracy ±0.05°@>±30°
	D9	Temperature drift	Temperature compensation range -40~85℃, and temperature drift accuracy ±0.05°@≤±30°
	D10	Temperature drift	Temperature compensation range -40~85℃, and temperature drift accuracy ±0.05°@>±30°

Table 4 Options

Item	P/N	Option name	Function
Display & Software	SST003-04-01	Remote single-axis inclination display instrument	LED display tilt angle data, range setup, sensor power supply, RS485 output, suitable for analog output single-axis inclinometer
	SST003-04-02	Remote dual-axis inclination display instrument	LED display tilt angle data, range setup, sensor power supply, RS485 output, suitable for analog output dual-axis inclinometer
	SST003-04-03	Remote single-axis inclination display & Control instrument	Alarm settings (2 points/axis), relay output, LED display, sensor power supply, RS485 output, suitable for analog output, single-axis inclinometer
	SST003-04-04	Remote dual-axis inclination display & Control instrument	alarm setting (2 points/axis), relay output, LED display, sensor power supply, RS485 output, suitable for analog output dual-axis tilt sensors
	SST003-04-05	LCD display	4½ LCD display, single/dual axis
	SST003-04-06	Zigbee LCD display	External power supply, with AC/DC regulator, single/dual axis, 200m distance
	SST003-04-07	Zigbee LCD display	Built-in lithium battery to 8 hours supply, single/dual axis,200m distance
	SST003-04-08	Zigbee LCD display/alarm	Built-in lithium battery to 8 hours supply, single/dual axis,sound/light alarm, emergency alarm can be set up, 200m distance
	SST003-04-09	Application software with PC	Functions: serial port setting, control, diagnose, record, adjustable sampling, zero setting and zero recovery, adjustable vibration suppression filter parameters
	SST003-04-10	Application software	The same function as SST003-04-09,can run in iPhone,iPad
	SST003-04-11	Three-dimensional angle display,measurement software	Can cooperate with inclinometer, which including compass, gyro, GPS, and also can run in iPhone, iPad, PC
	SST003-04-12	Display software with 8 channels	Can combined with SST003-04-09,each channel can achieve independence,can run in iPhone,iPad,PC
	SST003-04-13	Flatness measuring software	Measure and display the surface flatness of object, can run in iPhone,iPad,PC
	SST003-04-14	Verticality measuring software	Through multiple of sensors, to realize the whole object`s vertical degree measurement and display, can run in iPhone,iPad,PC

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SST200 SST830
SST300 SSG100
SST400 SSG200
SST500 SST900

Category	Code	Name	Description
Converter	SST003-05-01	RS232-USB converter	RS232 convert to USB2.0,external ,industrial-grade
	SST003-05-02	RS232-CAN converter	RS232 convert to CAN2.0B,external, industrial-grade
	SST003-05-03	RS232-GPRS converter	RS232 convert to GPRS Wi-Fi transmission, external ,industrial-grade
	SST003-05-04	4 in1 USB converter	4pcs USB access,1 USB output,external, industrial-grade
	SST003-05-05	4 in 1 RS232 converter	4pcs RS232 access,1 USB output,external, industrial-grade
	SST003-05-06	4 channels hub	Suitable for concentrated power supply and wiring distribution,IP65 protection,glass fiber materials,industrial field application
	SST003-05-07	8 channels hub	Suitable for concentrated power supply and wiring distribution,IP65 protection,glass fiber materials,industrial field application
	SST003-05-08	8 channels analog/digital signal data collection box	16 or 24 bits acquisition module, work independently, USB interface, can be connected with PC, etc
Installation tools	SST003-01-01	Magnetic base	50kg suction, permanent magnet, stainless steel materials
	SST003-01-02	Adjustable base	Three-points adjustment, range ±3°, stainless steel materials
	SST003-01-03	Adjustable base with bubble	Three-points adjustment, range ±3°, bubble accuracy is ±20″, stainless steel materials
	SST003-01-04	Adjustable base with micrometer screw	Three-points adjustment, resolution 0.001mm, stainless steel materials
	SST003-01-05	Fixed installation base	Three-points adjustment, stainless steel materials
	SST003-01-06	Alignment block	Positioning sensor's X\Y axis to align with actual tilt direction
Power	SST003-09-01	AC/DC power supply	Input 220VAC,output 24VDC,output current 2A
	SST003-09-02	The portable rechargeable lithium battery packs	Output 24VDC,Continuous work 24 hours, IP65, rechargeable
	SST003-09-03	Complementary power combined with solar and wind energy	solar and wind energy,output 24VDC@1A, Day & night working
Calibration equipment	SST003-10-01	Field calibration equipment	Mechanical, manual, accuracy ±20″, measurement range ±5°, single axis
	SST003-10-02	Field calibration equipment	Mechanical, manual, accuracy ±30″, measurement range ±30°, single axis
	SST003-10-03	High accuracy calibration equipment for lab	Manual, with LED display, accuracy ±5", resolution 0.5", measurement range±180°, single axis, weight 20 kg
	SST003-10-04	Cross-axis test equipment	Mechanical, manual, accuracy ±30 ", measurement range ±15 °
	SST003-10-05	Adjustable field level platform	Mechanical, manual, 3kgs payload ,level accuracy ±10", adjustable range(X/Y) ±1°
Test report	SST003-11-01	Test report for cross-axis error	Accuracy test report under banking tilt, average 11 points of full range
	SST003-11-02	Test report for Allowed installation	Average 21 points of full range
	SST003-11-03	Test report for Input-axis misalignment	Axis migration test report for vertical and horizontal axis of inclinometer, 3 angles of point
	SST003-11-04	Test report for response time and hysteresis	The report for time response curve/ data and hysteresis characteristics
	SST003-11-05	Test report for vibration	According to sensor`s standard vibration characteristic
	SST003-11-06	Test report for mechanical shock	According to sensor`s standard shock characteristic
	SST003-11-07	Test report for temperature shock	Test report of characteristics change under 10℃ /minute rate
	SST003-11-08	MTBF analysis report	MTBF Statistical analysis report
	SST003-11-09	FMEA analysis report	FMEA analysis report
	SST003-11-10	Test report for life simulation	Test report for zero position and full range under 7 days continuously power on
	SST003-11-11	Test report for high-low temperature storage	According to MIL standard (meet MIL-810F 501.4, 502.4)
	SST003-11-12	Test report by China National Shanghai Measurement institute	Average 5 points of full range
	SST003-11-13	Test report for salt spray	According to MIL standard(meet MIL-810F 509.4)
	SST003-11-14	Test report for IP protection	According to IEC standard
	SST003-11-15	EMC test report	According to EN6000

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