TOC Tilt Switch

SST300 Inclinometer

Range ±15°
Output RS232
Supply 9~36VDC
Protection IP67

CE RoHS

C4504C615R

Vigor Technology

Vigor Technology

Zigbee | RS

Wi-Fi | CAN

GPRS | CANopen

CDMA | EtherCAT

SSI | DeviceNet

PWM | Profi-bus

Vibration-wire | HART

Switch | Ethernet

Analog | USB

TOC Tilt Switch

Features

- Hysteresis up to 0.01°
- Trip repeatability up to 0.005°
- Dual trip point each axis
- Adjustable filtering when vibrating
- Electrical damp - Eliminates inadvertent outputs due to
  momentary movement
- Delay time adjustable
- Efficient EMC protection
- IP67 Protection
- Both tilt data+switch signal output
- Omini-direction alarm optional

Descriptions

TOC tilt switch is used in high accuracy and strictly security requirements with hysteresis up to 0.01° .
Through the real higher combined absolute accuracy, greatly improve the real alarm accuracy than others
with about 3% cross-axis senitirity.
This tilt switch employee transistor open collector output, with rapid response and high drive ability.
Via RS232 interface, user can adjust alarm point, damp ratio, alarm delay time etc.

-6.53° -6.52°   6.52°   6.53°

Control accuracy0.01° max   Control accuracy0.01° max
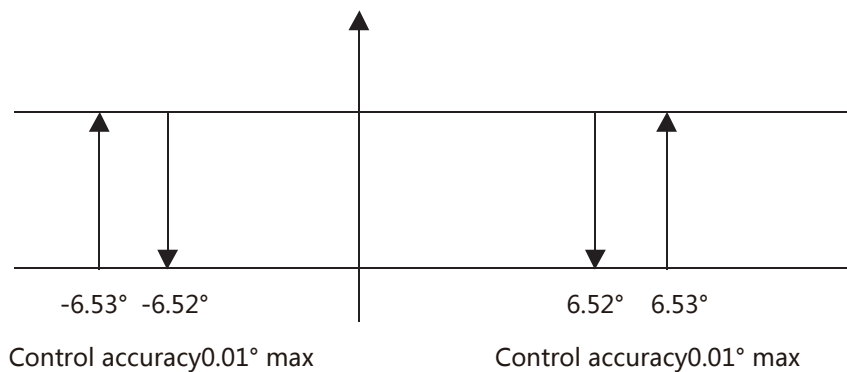
Picture 1 Hysteresis characteristic diagram

Applications

Construction equipment, Building controls, Cranes, Forklifts

RS | Zigbee
CAN | Wi-Fi
CANopen | GPRS
EtherCAT | CDMA
DeviceNet | SSI
Profi-bus | PWM
HART | Vibration-wire
Ethernet | Switch
USB | Analog

Performances

Table 1 Specifications

Measurement range		±5°	±10°	±15°	±30°	±45°	±60°
Inclination parameter							
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					
	Offset③	±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)		≤0.02°					
Measurement axis		1 or 2 axis					
RS232 update rate		5Hz, 10Hz, 20Hz					
RS232 data format		8 data bits, 1 start bit, 1 stop bit, none parity, 115200 baud , ASCII					
Response frequency		3Hz @-3dB					
Switching parameter							
Alarm output		Open-collector(2 alarms/axis) NO or NC optional					
Trip angle		full range with min.0.005°interval					
Hysteresis		0.01°~0.08°					
Accuracy		Trip point repeatable within ±0.005°					
Vibration filtering		0.1~0.9					
Delay time		0.5~5 seconds					
Response time		10ms					
Protection		Reverse Polarity, Over-Voltage, Open/Shorted Signal Leads, shorten transient Voltage Supply					
Load capacity		1A@80VDC					
Load voltage		3~80VDC					
Load type		Resistance, inductive					
Other parameter							
Functions(via RS232)		X/Y tilt data output, trip point setup, trip delay time setup, vibration filtering setup, NO/NC setup, Zeroing, Zero calibration					
Power supply		9~36VDC					
Power consumption		Average working current≤200mA(25℃&24VDC)					
Operation temperature range		-40~85℃					
Storage temperature range		-60~100℃					
Insulation resistance		100MΩ					
MTBF		≥25000 h /s					
Shock		100g@11ms, three-axis, half-sine					
Vibration		8grms, 20~2000Hz					
Protection		IP67					
Connecting		Military class connector(GJB101A-1997, MIL-C-26482)					
Weight		450g(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
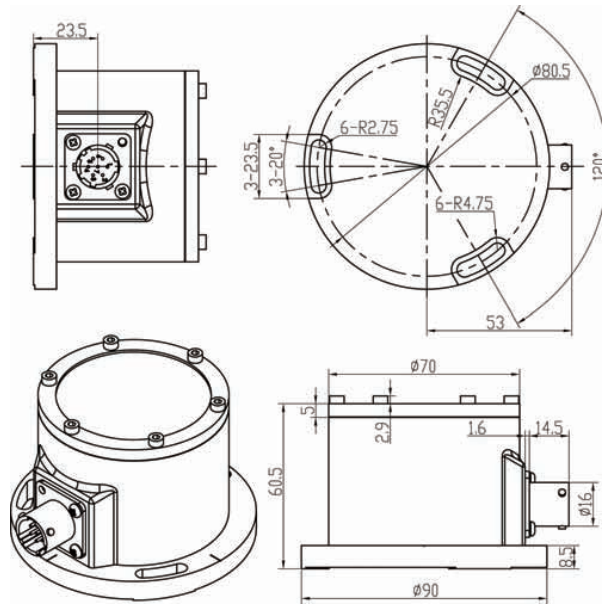
$$\Delta = \pm \sqrt{\text{absolute linearity}^2 + \text{repeatability}^2 + \text{hysteresis}^2 + \text{offset}^2 + \text{cross-axis sensitivity error}^2}$$

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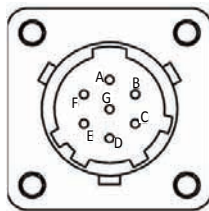
④ Allowed installation misalignment means during the installation, the allowable installation angle deviation between actual tilt direction and sensor's nature measurement direction. In general, when installed,SST300 sensor is required that the measured tilt direction keep parallel or coincident with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

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Dimensions（mm）

Picture 2 Housing with MIL class connector

Wiring

Picture 3 MIL connector socket
(View from outside)

Table 2 Pin definition

Pin	Function
A	Power＋(9~36VDC)
B	Power GND & signal G N D
C	Control power input(3~80VDC)
D	X-axis alarm1
E	Y-axis alarm1
F	X-axis alarm2/RS232-TXD
G	Y-axis alarm2/RS232-RXD

Ordering

SST3 — Axis — Range — G25 — 00 — 00 — Cable/plug — Temp.drift

Axis:
Single axis — 01
Dual axis   — 02

Range:
±5° —0 5
±10° —1 0
±15° —1 5
±30° —3 0
±45° —4 5
±60° —6 0

Cable/plug:
None — 00
Other: see
table 3

Temp.drift:
25℃— 00
Others: see
table 3
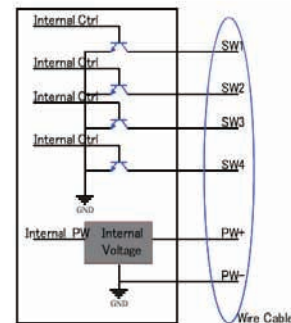
For example, if order a dual axis tilt switch, with range ±15°, room temperature accuracy ±0.02°, -20~60℃ accuracy±0.02°, switch output, 8 meters cable with plug, the model should be chosen as: SST302-15-G25-00-00-C1-D3（8m）

Other options (see table 4):

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

Magnetic base——order number SST003-01-01

RS Zigbee
CAN Wi-Fi
CANopen GPRS
EtherCAT CDMA
DeviceNet SSI
Profi-bus PWM
HART Vibration-wire
Ethernet Switch
USB Analog

Accessories & Options

Table 3 Accessories

Item	Order Code	Accessories name	Function
Cable/Plug	C1	Standard Cable with plug	Military class connector(meet MIL-C-26482),Standard 2M cable,IP67 protection, heavy duty up to 30kg
	C4	Armoured cables	Increase cable mechanical strength, anti-erosion and anti-jamming capability
	C6	Standard plug	According to MIL-C-26482, IP67 protection
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	SST003-01-01	Magnetic base	50kg suction, permanent magnet, stainless steel materials
	SST003-01-06	Alignment block	Positioning sensor's X\Y axis to align with actual tilt direction
Softaware	SST003-04-09	PC application software	Setting function: serial port, data save, display, alarm Command function: zero, filter coefficient, refresh rate, acceleration of gravity, ID address, output model Tool function: zero calibration, software update, playback mode, real-time display mode, cursor load display, raw data display Viewgraph function: status bar, toolbar, data area, chart area Operating platform: windows XP, Windows 7 More information please see datasheet of this options
Test report	SST003-11-01	Test report for cross-axis error	Accuracy test report under banking tilt, average 11 points of full range
	SST003-11-03	Test report for Allowed Installation misalignment	Axis migration test report for vertical and horizontal axis of inclinometer,3 angles of point
	SST003-11-04	Response time and hysteresis	The report for time response curve/ data and hysteresis characteristics
	SST003-11-05	Test report for vibration	According to inclinometer's standard vibration characteristic
	SST003-11-06	Test report for mechanical shock	According to inclinometer's standard shock characteristic
	SST003-11-08	MTBF analysis report	MTBF Statistical analysis report