

GPRS Inclinator

GPRS



GPRS Inclinometer

Features

- Industry GPRS interface
- Quad-Band 850/ 900/ 1800/ 1900 MHz Transmission worldwide
- Support PBCCH, CSD up to 14.4 kbps
- Support single/multi-center modes
- Support domain and IP address access center
- Embedded standard TCP/IP protocol stack
- Patented tilt measurement technology

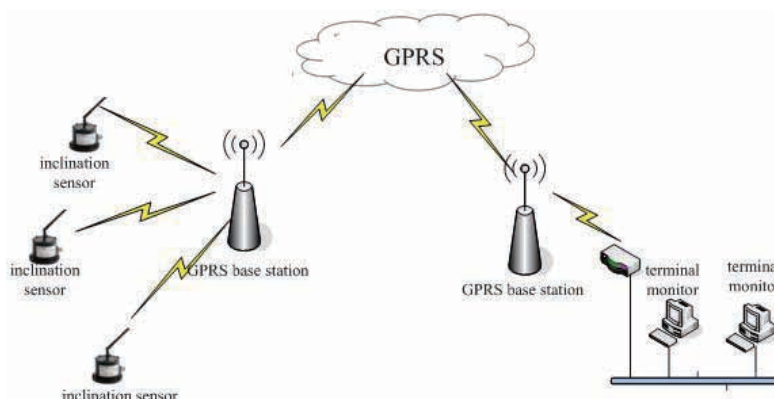


Descriptions

GPRS inclinometer is developed based on Vigor patent tilt measurement technology and combined with GPRS wireless module, to meet with remote object monitoring and system maintenance requirements.

GPRS inclinometer has strong tilt measuring ability:

- ✓ $\pm 0.02\%$ FS linearity
- ✓ $\pm 0.005^\circ$ Offset
- ✓ Combine with gyro module; realize static/dynamic angle measuring for low/rapid leveling
- ✓ Combine with vibration module, realize FFT computations in-time, output vibration frequency and amplitude data directly, eliminate the influence of environment 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 error, upgrade real tilt angle measuring accuracy, abandoned the traditional incomplete understanding for tilt angle measurement precision concept
- ✓ Patent error calculation and test calibration method, greatly upgrades real tilt angle measuring accuracy and reliability
- ✓ Greatly reduce measuring errors when the real tilt direction not consistent for unit's sensitive axis
- ✓ Short-circuit, transient voltage, transposition protection to adapt to industry environment
- ✓ User can set zero point, baud rate, local gravitational acceleration value, zero calibration, vibration suppression filter coefficients, ID address, refresh rate, etc.



Performances

Table 1 Specifications

Measurement range	±5°	±10°	±15°	±30°	±45°	±60°
Combined absolute accuracy ^① (@25°C)	±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
	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/°C	≤50ppm/°C				
Offset temperature drift coefficient(max.)	≤0.003°/°C					
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°C , Accuracy: ±1°C					
Output	GPRS class 10: max. 85.6 kbps(downlink) support PBCCH and Coding schemes CS 1, 2, 3, 4 CSD up to 14.4 kbps, support USSD, PPP-stack					
GPRS operating characteristics	Quad-band 850/ 900/ 1800/ 1900 MHz GPRS multi-slot class 10/8					
Cold start warming time	60s					
Response time	0.3s(@t ₉₀)					
Refresh rate	5Hz, 10Hz, 20Hz					
Response frequency (analog output)	3Hz @-3dB					
Power supply	9~36VDC					
Power consumption	Average working current≤200mA(25°C&24VDC)					
Operation temperature range	-40~85°C					
Storage temperature range	-60~100°C					
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	420kg(without connector and cable)					

① Combined absolute accuracy means the composite value of sensor's absolute linearity, repeatability, hysteresis, offset and cross-axis sensitivity error. (in room temperature condition) as
 $\Delta = \pm \sqrt{\text{absolute linearity}^2 + \text{repeatability}^2 + \text{hysteresis}^2 + \text{offset}^2 + \text{cross-axis sensitivity error}^2}$

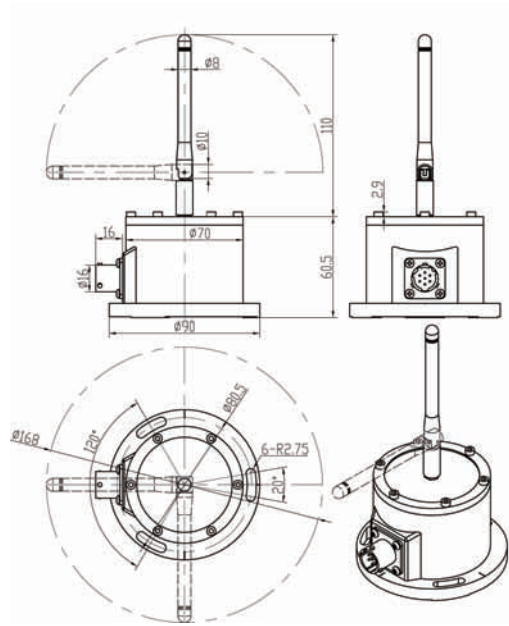
② The cross-axis sensitivity means the angle that the tilt sensor may be banked to the normal tilt direction of sensor. The cross-axis sensitivity (±0.1%FS) shows how much perpendicular acceleration or inclination is coupled to the inclinometer output signal. For example, for the single-axis inclinometer 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.

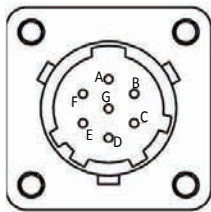
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

Dimensions (mm)



Picture 1 Housing with MIL class connector

Wiring

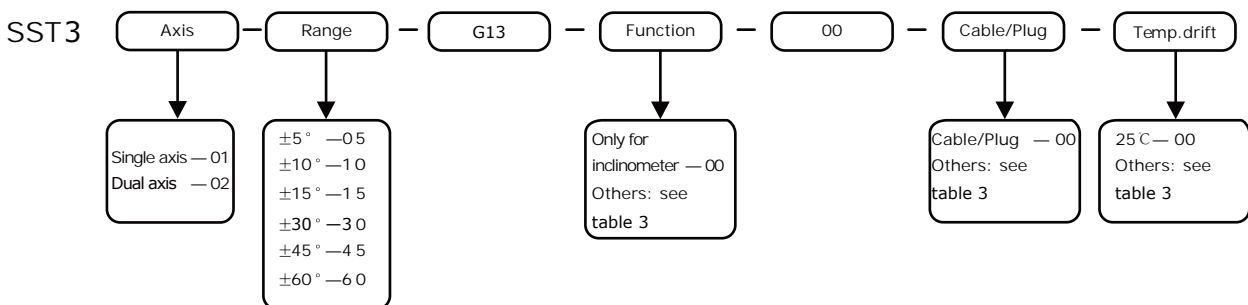


Picture2 MIL connector socket (View from outside)

Table2 Pin definition

Pin	Function
A	Power +
B	Power -
C	NC
D	NC
E	NC
F	RS232-TXD
G	RS232-RXD

Ordering



For example, if order a dual axis GPRS inclinometer, with range $\pm 15^\circ$, room temperature accuracy $\pm 0.02^\circ$, $-20\sim 60^\circ\text{C}$ accuracy $\pm 0.02^\circ$, Output GPRS wireless transmission, 2 meters cable with plug, Vibration function module, the model should be chosen as: SST302-15-G13-F5-00-C1-D3 (2m)

Other options (see table 4):

PC application software—order number SST003-04-09

Magnetic base—order number SST003-01-01

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

Accuracy $\pm 30''$ field calibration equipment—SST003-10-02

Accessories & Options

Table 3 Accessories

Item	Order Code	Accessories name	Function
Functional module (built-in)	F1	GPS module	Positioning accuracy 2.5m CEP; 2.0m @ SBAS Local gravity acceleration automatic revision Time pulse accuracy: 30ns RMS Original data refresh rate: 4Hz Speed accuracy: 0.1m/s Receiver type: GPS L1 band, C/A code; Higher positioning accuracy GPS available
	F3	Compass module	2-Axis Electronic compass technology Heading measurement range: 0~360° Heading accuracy: $\pm 1.0^\circ\text{RMS}$ With hard magnetic compensation Optional higher precision or three-dimensional compass module
	F4	Gyro module	$\pm 100/250/400^\circ/\text{s}$, X/Y/Z axis dynamic angular rate In-run bias: $\pm 0.02^\circ/\text{s}$, Non-linearity: 0.1%FS Bandwidth: 50Hz, Noise density : $0.02^\circ/\text{s}/\sqrt{\text{Hz}}$ Higher accuracy gyro module available
	F5	Vibration module	Three-axis vibration detection, frequency response $\leq 5\text{ kHz}$ Range: $0\text{g} \sim \pm 1\text{g} / \pm 5\text{g} / \pm 10\text{g} / \pm 20\text{g}$, adjustable Sampling(real-time): 20.48 kSPS Filter programmable, 11pcs set points FFT, 512-point, real valued, all three-axis(x, y, z) Storage: 14 FFT records on all three-axis(x, y, z) Alarm programmable, 6 spectrums
Temperature drift	D1	Temperature drift	Temperature compensation range 0~60°C, accuracy $\pm 0.01^\circ @ \leq \pm 30^\circ$
	D2	Temperature drift	Temperature compensation range 0~60°C, accuracy $\pm 0.01^\circ @ > \pm 30^\circ$
	D3	Temperature drift	Temperature compensation range -20~60°C, accuracy $\pm 0.02^\circ @ \leq \pm 30^\circ$
	D4	Temperature drift	Temperature compensation range -20~60°C, accuracy $\pm 0.02^\circ @ > \pm 30^\circ$
	D5	Temperature drift	Temperature compensation range -30~60°C, accuracy $\pm 0.03^\circ @ \leq \pm 30^\circ$
	D6	Temperature drift	Temperature compensation range -30~60°C, accuracy $\pm 0.03^\circ @ > \pm 30^\circ$
	D7	Temperature drift	Temperature compensation range -40~65°C, accuracy $\pm 0.05^\circ @ \leq \pm 30^\circ$
	D8	Temperature drift	Temperature compensation range -40~65°C, accuracy $\pm 0.05^\circ @ > \pm 30^\circ$
	D9	Temperature drift	Temperature compensation range -40~85°C, accuracy $\pm 0.05^\circ @ \leq \pm 30^\circ$
	D10	Temperature drift	Temperature compensation range -40~85°C, accuracy $\pm 0.05^\circ @ > \pm 30^\circ$

Table 4 Options

Item	P/N	Option name	Function
Installation tools	SST003-01-01	Magnetic base	50kg suction, permanent magnet, stainless steel materials
	SST003-01-04	Adjustable base with micrometer screw	Three-points adjustment, resolution 0.001mm, stainless steel materials
Software	SST003-04-09	PC application software	Setting function, Command function, Tool function Operating platform: windows XP, Windows 7 More information please see datasheet of this options
	SST003-04-12-00	iss8 software	Collecting, preserving and monitoring data of 8pcs SST300 inclinometer max, can display each inclinometer data graph, parameters setting early warning and achieve multiple inclinometer networking Based on windows
Power	SST003-09-02	The portable rechargeable lithium battery packs	Input 220VAC, output 24VDC, output current 2A
	SST003-09-03	Complementary power combined with solar and wind energy	Solar and wind energy, Day & night working Fan input power 0.6KW; solar input power 0.3KW Battery rated voltage 24V; AC output power 1KW, 220VAC DC output: 24VDC@1A
Test report	SST003-11-03	Test report for Allowed Installation misalignment	Axis migration test report for vertical and horizontal axis of inclinometer, 3 angles of point