Wi-Fi Inclinometer

WiFi®

SST300 Inclinometer
Range ±30°
Output:RS232+Wi-Fi
Supply 9~36VDC
Protection IP67
P/N 302-30-G12-F1-00-C1-07

Vigor Technology

D10006C0030

Vigor Technology

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

Wi-Fi Inclinometer

Features

- Based on high performance SST300 inclinometer
- **According to IEEE802.11b/g, Wi-Fi compatib**le
- Support topology & AP etc. network types
- High speed transmission and security
- **2.4G ISM band**
- RF certificated by FCC, CE...
- Operation temperature: -40~80℃
- Radio range up to 200m
- Customized wireless sensor network (WSN), 256 nodes coverage

Descriptions

Wi-Fi inclinometer SST300 integrated with experienced wireless Sensor Network(WSN) technology & patented tilt measurement technology, suit for industrial remote tilt measurement system application where required precision tilt data, security & reliable data transmission, easy data collection & analysis. Based on this wireless inclinometer, easy to build one WSN system with lower-cost, shorter integrating period, stable & reliable long-term running, more compatibility ability with other type sensors .

Thanks to Wi-Fi technology, this industrial wireless inclinometer can perfectly match most commercial-class terminal mobile product, to enhance owned advantages itself.These advantages are as followed:

① High-accuracy robust SST300 utilizing advanced MEMS sensor technology to ensure maximum reliability even in the harshest environment.

② Adopt mature experienced Wi-Fi technology, to ensure accurate data remote transmission.

③ iAngle ^{TM} support to various software operation platforms, such as Windows system (Microsoft), iOS (Apple), An droid (Google), no matter the device is portable, moving or not.

④ **Easy to connect mobile &** fixed devices (with Wi-Fi interface) and build wireless network automatically, to realize data acquisition, storage, analysis and query.

⑤ With mobile terminal device (iPhone or iPad), surveyor & engineer can log & record data remotely while PLC system and control equipment running, especial to project monitoring, field equipment installing and debugging.

⑥ Easy to add & reduce amount of sensor or terminal equipment, can realize many sensor data queried by one de vice and one sensor datum queried by many devices simultaneously.

⑦ Lowest-cost to realize remote tilt measurement, data storage & analysis on your hand anytime & anywhere, may mostly replace to traditional spirit-levelmeter.

⑧ Through internet, data query in other cities comes true and it enables users to diagnose and set sensor remotely.

Picture 1 Data cabling & wireless transmission in original /traditional PLC control system.

Zigbee | RS

Wi-Fi | CAN

GPRS | CANopen

CDMA | EtherCAT

SSI | DeviceNet

PWM | Profi-bus

Vibration-wire | HART

Switch | Ethernet

Analog | USB

SST300 Wi-Fi inclinometer can set up network connection through IP address access and using Ad-Hoc or AP model.

With Ad-Hoc network, wireless device can connect each other directly. Refer to picture 2.
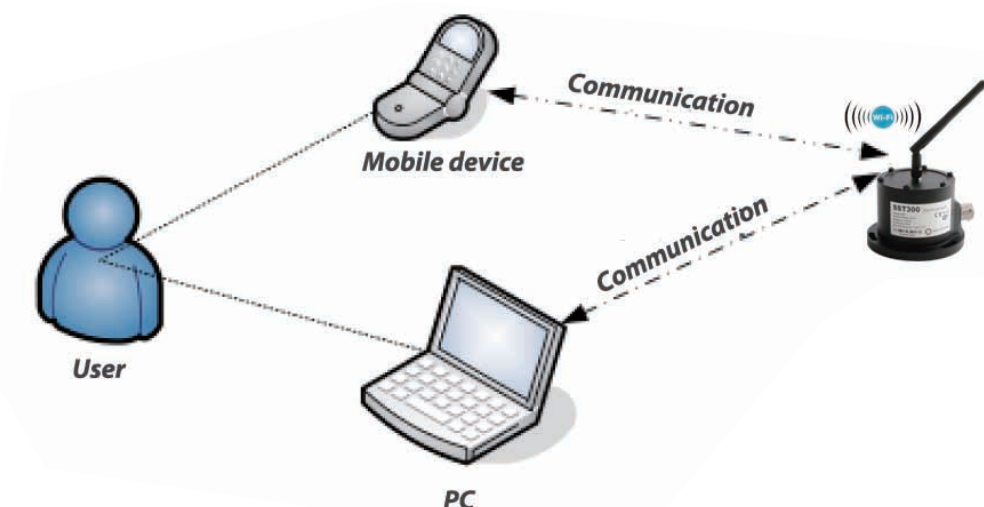
Picture 2 Ad-Hoc application

With AP network, data communication between sensors & PC/intelligent terminal equipment can be realized, also uploaded to other network with router, such as GPRS, 3G and ADSL. Refer to picture 3.
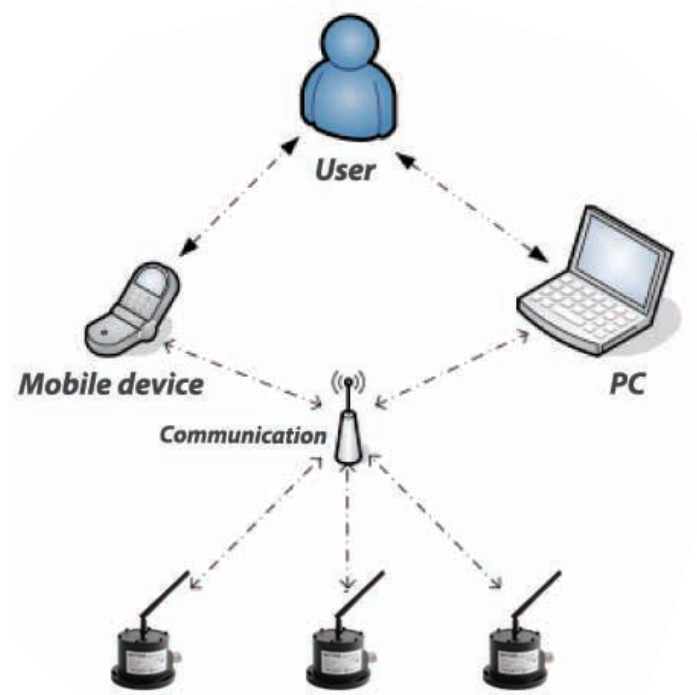
Picture 3 AP network application

Applications

Civil engineering: Engineering surveyor collect data from engineering filed remotely, Remote bridge health monitoring & testing system, Tunneling or trenchless filed data survey remotely, Remote structural components monitoring

Industry equipment: Remote equipment attitude detection & monitoring while installing, debugging, controlling or in dangerous

Measurement/test: Remote detecting & monitoring lab device, Remote monitoring/test under dangerous or limited space

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Performances

Table 1 Specifications

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					
	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 temp. drift coefficient		≤100ppm/℃	≤50ppm/℃				
Offset temperature drift coefficient		≤0.003°/ ℃					
Offset turn on repeatability⑤		±0.008°					
Resolution		0.0025°					
Long-term stability⑥		≤0.02°					
Measurement axis		1 or 2 axis					
Temperature sensor		Range : -50~125℃, Accuracy:±1℃					
Output		Wi-Fi(TCP/IP & UDP) Other output please refer to Table 5.2					
Cold start warming time		60s					
Response time⑦		0.3s (@t_{90})					
Refresh rate(digital output)		5Hz (Optional 10Hz,20Hz)					
Response frequency⑧		3Hz @-3dB					
Power supply		9~36VDC					
Power consumption		Average current ≤ 300mA (25 ℃& 24VDC)					
Operation temperature range		-40~80℃					
Storage temperature range		-60~100℃					
Insulation resistance		100MΩ					
MTBF		≥25000 hours / time					
Shock		100g@11ms, three-axis, half-sine					
Vibration		8grms, 20~2000Hz					
Protection		IP65 (Optional IP67)					
Connecting		Military class connector (MIL-C-26482)					
Weight		350g (without connector and cables)					

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 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.

Table 2 Wi-Fi communication specification

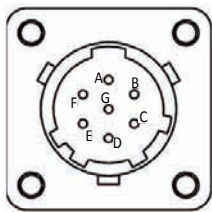|	
WLAN protocol	IEEE 802.11b/g, Wi-Fi compatible
Radio channel	802.11b: USA, Canada and Taiwan – 11 Most European Countries – 13 France – 4, Japan – 14 802.11g: USA and Canada – 11 Most European Countries – 13
Modulation system	DSSS, OFDM, DBPSK, DQPSK, CCK, 16-QAM, 64-QAM
Band	2.4G ISM
Transmission power	15dBm ±1.5dBm
Receiving sensitivity	802.11b : -91dBm 802.11g : -85dBm
Antenna interface	IPEX antenna connector
Wireless data transmission rate	802.11b: 1, 2, 5.5, 11Mbps 802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps
Wireless network co-existence	Cell phone(GSM/DCS/WCDMA/UMTS/3G) co-existence
WLAN setting up	Support AP & Ad-Hoc
Encryption	Support WEP40 and WEP104 encryption (64/128 bit). Support OSI & Shared key model WPA/WPA2 PSK, AES and TKIP
Wireless Medium Access Control(MAC) protocol	CSMA/CA, with ACK
Reset to Network Connection	≤3s (WEP) , 6s (WPA)
Other function	Wi-Fi automatically recovery after dis-connection max transmission speed 60kb/s(send & receive simultaneously), 90kb/s(send or receive) DNS service Support protocol TCP and UDP Support TCP Server and Client Support UDP broadcast or uni-cast TCP Automatically connection after disconnection As TCP server, permit 3 clients connection Flexible configuration: HTML or PC software

Dimensions (mm)
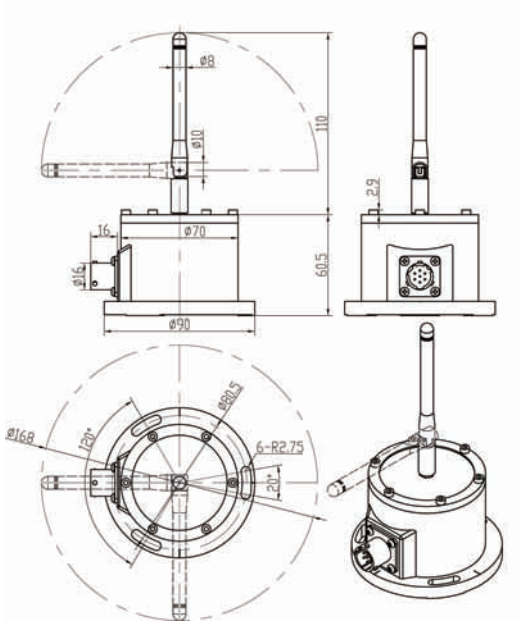
Picture 5 Dimensions(Wi-Fi Antenna adjusted to upright & rotary)
Note: For analog/digital output in parallel, the sensor height will chang, please ask Vigor for details.

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Wiring

Picture 4 Connector socket
(View from outside)
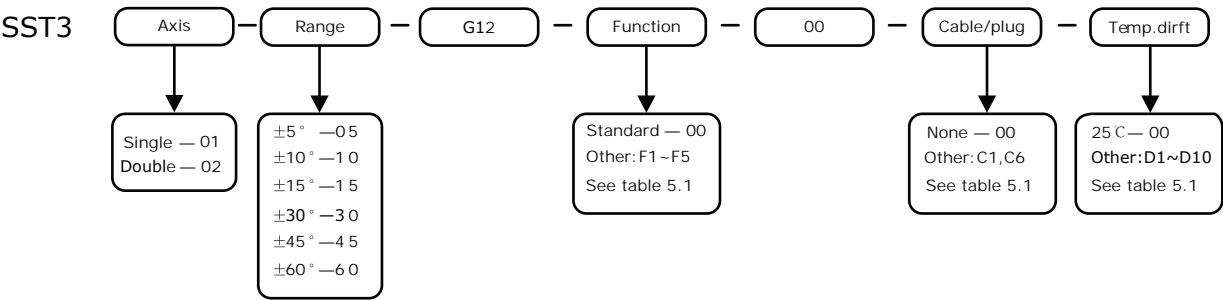
Table 3 Connector definition (only for Wi-Fi interface)

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

Table 4 Pin definitions for analog and digital interface(in parallel to Wi-Fi)

Pin	1 axis	2 axis	1 axis	2 axis	1 / 2 axis	1 / 2 axis	1 / 2 axis
	Current output(G19)		Voltage output(G20~G24)		RS232(00)	RS422(G2)	RS485(G1)
1	Power+	Power+	Power+	Power+	Power+	Power+	Power+
2	Power GND	Power GND	Power GND	Power GND	Power GND	Power GND	Power GND
3	Signal GND	Signal GND	Signal GND	Signal GND	Signal GND	Signal GND	Signal GND
4	Iout	Ioutx	Vout	Voutx	NC	RS422-RXD+	NC
5	NC	Iouty	NC	Vouty	NC	RS422-RXD-	NC
6	NC	NC	NC	NC	RS232—TXD	RS422-TXD+	RS485-A
7	NC	NC	NC	NC	RS232—RXD	RS422-TXD-	RS485-B

Note: For these outputs please refer to table 5.2 and order separately.

Ordering

SST3

| Axis | Range | G12 | Function | 00 | Cable/plug | Temp.dirft |

Single — 01
Double — 02

±5° —05
±10° —10
±15° —15
±30° —30
±45° —45
±60° —60

Standard — 00
Other:F1~F5
See table 5.1

None — 00
Other:C1,C6
See table 5.1

25℃— 00
Other:D1~D10
See table 5.1

If need other digital or analog output simultaneously, please order separately. The standard output is Wi-Fi only, for others please refer to table 5.2.

PC application software and test report please refers to Table 5.3

Accessories & Options

Table 5.1 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: <±1.0°RMS With hard magnetic compensation Optional higher precision or three-dimensional compass module
	F4	Gyro module	±100/250/400°/s, X/Y/Z axis dynamic angular rate In-run bias: ±0.02°/s, Non-linearity: 0.1%FS Bandwidth: 50Hz,Noise density : 0.02°/s/√Hz Higher accuracy gyro module available
Cable & plug	C1	Standard Cable with plug	Military class connector(meet MIL-C-26482),Standard 2M cable,IP67 protection, heavy duty up to 30kg
	C6	Standard plug	According 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 5.2 Other analog or digital output

Order Code	Name	Function
00	RS232 interface	Directly angle data output Data format: ASCII, 115200 Baud (adjustable), 8 data bits,1 start bit,1 stop bit , none parity Refresh rate: 5Hz, optional 10Hz, 20Hz
G1	RS485 interface	Isolated RS-485/422 transceiver, Compatible with half-duplex or full-duplex communication ±15kV ESD protection for RS-485/RS-422 physic pin Compatible with ANSI/TIA/EIA-485-A-98 and ISO8482:1987(E) Comply with UL1577---2500V rms for 1min
G2	RS422 interface	Transmission rate up to 500 kbps, support 256pcs max node High common mode transient suppression ability >25kV/us Support Modbus-RTU, sensor supply HEX or ASCII communication Built-in to SST300 inclinometer
G19	4~20mA output	Output current and Angle data in proportion precisely Linearity：0.02%FS max Output impedance 39Ω, allow load impedance 625Ω max Overheating and against access protection Built-in to SST300 inclinometer
G20	0~5VDC output	
G22	0~10VDC output	
G23	-10~+10VDC output	

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Item	P/N	Name	Function
Software	SST003-04-09	PC application software	Setting function, Command function, Tool function Operating platform: windows XP, Windows 7
	SST003-04-12-00 (Based on Windows) SST003-04-12-01 (Based on iOS) SST003-04-12-02 (Based on Andriod)	iss8 software	Collecting, preserving and monitoring data of 8pcs SST300 inclinometer max, can display each inclinometer data graph, parameters setting early warming and achieve multiple inclinometer networking Based on windows
	SST003-04-10-01 (Based on iphone) SST003-04-10-02 (Based on iPad)	iAngle mobile apps software	communication distance 200m max iPhone/iPad application tilt data inspect & settings: zero, range, sampling rate, filter coefficient, etc. Functions: alarm, graph, compass chart, bubble chart Sampling rate: 20time/sec
	SST003-04-11-00 (based on windows) SST003-04-11-01 (based on iOS) SST003-04-11-02 (based on Andriod)	iSS3 software	communication distance 200m max settings : zero, range and sampling rate attitude measurement three-dimensional data display Sampling rate: 20time/sec
	SST003-04-13-00 (based on windows) SST003-04-13-01 (Based on iOS) SST003-04-13-02 (Based on Andriod)	iSS2 software	flatness measurement communication distance 200m max Settings : zero, test range and sampling rate output plane simulation chart and report Sampling rate: 20time/sec.
	SST003-04-14-00 (Based on windows) SST003-04-14-01 (Based on iOS) SST003-04-14-02 (Based on Andriod)	iSS1 software	verticality measurement Suitable various platforms, fixed or mobile terminal devices communication distance 200m max Settings: zero, test range and sampling rate output vertical curve and report Sampling rate: 20time/sec.
Test report	SST003-11-01	Test report for cross-axis sensitvity	Accuracy test report under banking tilt, average 11 points of full range
	SST003-11-02	Test report for absolute linearity	Average 21 points of full range
	SST003-11-10	Test report for life simulation	Test report for zero position and full range under 7 days continuously power on