

SSL300 Wi-Fi Inclinometer

Features

- Based on high performance SSL300 inclinometer
- According to IEEE802.11b/g, Wi-Fi compatible
- High speed transmission and security
- 2.4G ISM band
- RF certificated by FCC, CE
- Operation temperature: -40~80°C
- Radio range up to 200m
- Customized wireless sensor network (WSN), 256 nodes max



Descriptions

SSL300 Wi-Fi inclinometer integrated with experienced wireless Sensor Network(WSN) technology & patented tilt measurement technology, suitable for industrial remote tilt measurement system application, is a new economical and convenient sensor network product.

SSL300 Wi-Fi inclinometer, perfectly combines industrial-grade products with commercial-grade terminal products, giving full play to their respective advantages. It has the following remarkable characteristics:

- ① High-accuracy SSL300 inclinometer with 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 Support a variety of software operating platforms, whether fixed or mobile terminal devices.
- 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 device 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.
- ⑧ Through internet, data query in other cities comes true and it enables users to diagnose and set sensor remotely.

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

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	±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 temp. drift coefficient		≤100ppm/°C	≤50ppm/°C				
Offset temperature drift coefficient		≤0.003°/ °C					
Offset turn on repeatability ^⑤		±0.008°					
Resolution		0.0025°					
Long-term stability ^⑥		≤0.02°					
Measurement axis		1 or 2 axis					
Temperature sensor		Range : -50~125°C, Accuracy:±1°C					
Output		Wi-Fi(TCP/IP & UDP) Other output please refer to Table 4					
Cold start warming time		60s					
Response time ^⑦		0.3s (@t ₉₀)					
Refresh rate(digital output)		5Hz (Optional 10Hz,20Hz)					
Response frequency ^⑧		3Hz @-3dB					
Power supply		9 ~ 36VDC					
Power consumption		Average current ≤ 300mA (25 °C&24VDC)					
Operation temperature range		-40 ~ 80°C					
Storage temperature range		-60~100°C					
Insulation resistance		100MΩ					
MTBF		≥25000 hours / time					
Shock		100g@11ms, three-axis, half-sine					
Vibration		8grms, 20 ~ 2000Hz					
Protection		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

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

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. SSL300'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 SSL300 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,SSL300 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°C .

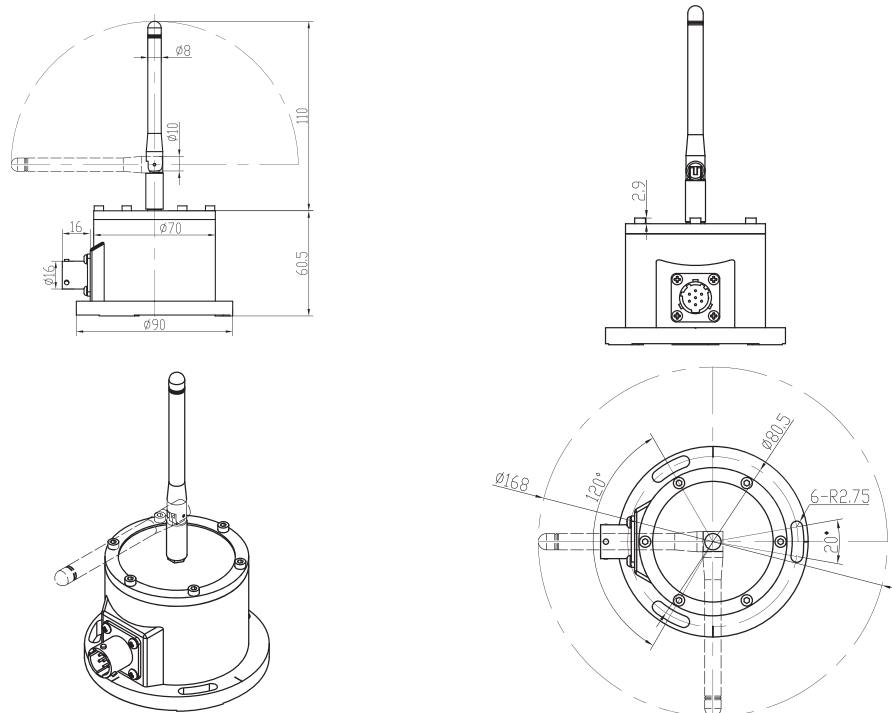
⑦ The response time refers to the angle sensor in a step change (such as the angle changes from -10 ° to +10 °within 5ms), the time required that output of the sensor achieved to the standard value of 90%. The index is different from the sensor set-up time

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 specafication

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 $\pm$ 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	$\leq 3s$ (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

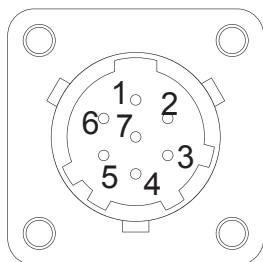
Dimensions (mm)



Picture 1 Dimensions(Wi-Fi Antenna adjusted to upright & rotary)

Note: For analog/digital output in parallel, the sensor height will change, please ask LT for details.

Wiring



Picture 2 Connector socket
(View from outside)

Table 3 Connector definition

Pin	Function
1	Power+
2	Power-
3	Signal GND
4	NC
5	NC
6	RS232-TXD
7	RS232-RXD

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

Pin	1 axis	2 axis	1 axis	2 axis	1 or 2 axis	1 or 2 axis	1 or 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: The various output listed in this table need to be explained separately when ordering.
The output of standard products is only Wi-Fi output.

Ordering



For example, if order a dual-axis Wi-Fi inclinometer, with range ±15°, ±0.02° accuracy@-20~60°C , the model should be chosen as:
SSL302-15-G12-00-00-C1-D3 (2m) .

Accessories & Options

Table 5 Accessories

Cable/Plug	C1	Standard Cable with plug	Military class connector(meet MIL-C-26482),Standard 2M cable,IP67 protection, heavy duty up to 30kg
	C2	Tensile reinforced shield cable	Heavy duty up to 50kg
	C3	High temperature cable	Up to 250°C
	C4	Armor cover cable	Increasing mechanical strength, erosion and anti-interference ability.
	C5	Watertight cable with plug	3000m underwater with special plug
	C6	Standard plug	According to MIL-C-26482,IP67 protection
	C7	Compatible with Amphenol plug	Compatible with the standard of SSL300 outlet, manufactured by Amphenol
	C8	Corners plug	90° corner,according to MIL-C-26482,IP67 protection
	C9	Explosion proof connectors and cables	For SSL30X-XX-XXX-00-B5-C9-XX only
	C10	Pigtail connector	Only for beam tilt sensor SSL301-XX-XXX-XX - B4-C10-XX
	C11	USB cable	For SSL30X-XX-G10-00-00-C11-XX only, one end is MIL connector, the other end is USB port.
	C12	Ethernet cable	For SSL30X-XX-G9-00-B5-C12-XX only, one end is MIL connector, the other end is RJ45
	C13	CAN/CANopen cable	Military class connector, standard 2M long, DB-9 interface at the other end, IP67 protection, anti 30KG pull
Temperature drift	D1	Temperature drift	Temperature compensation range is 0~60°C , and temperature drift accuracy $\pm 0.01^{\circ} @ \leq \pm 30^{\circ}$
	D2	Temperature drift	Temperature compensation range is 0~60°C , and temperature drift accuracy $\pm 0.01^{\circ} @ > \pm 30^{\circ}$
	D3	Temperature drift	Temperature compensation range is -20~60°C , and temperature drift accuracy $\pm 0.02^{\circ} @ \leq \pm 30^{\circ}$
	D4	Temperature drift	Temperature compensation range is -20~60°C , and temperature drift accuracy $\pm 0.02^{\circ} @ > \pm 30^{\circ}$
	D5	Temperature drift	Temperature compensation range is -30~60°C , and temperature drift accuracy $\pm 0.03^{\circ} @ \leq \pm 30^{\circ}$
	D6	Temperature drift	Temperature compensation range is -30~60°C , and temperature drift accuracy $\pm 0.03^{\circ} @ > \pm 30^{\circ}$
	D7	Temperature drift	Temperature compensation range is -40~65°C , and temperature drift accuracy $\pm 0.05^{\circ} @ \leq \pm 30^{\circ}$
	D8	Temperature drift	Temperature compensation range is -40~65°C , and temperature drift accuracy $\pm 0.05^{\circ} @ > \pm 30^{\circ}$
	D9	Temperature drift	Temperature compensation range is -40~85°C , and temperature drift accuracy $\pm 0.05^{\circ} @ \leq \pm 30^{\circ}$
	D10	Temperature drift	Temperature compensation range is -40~85°C , and temperature drift accuracy $\pm 0.05^{\circ} @ > \pm 30^{\circ}$