

SSL300 Profi-bus Inclinometer

Features

- In accordance with EN50170 V2 and IEC61158 standard
- Support PROFIBUS-DP slave protocol
- Max 12Mbps transmission, baud rate adaptive
- Isolated Profi-bus interface, enhanced ESD protection
- User can setup Profi-bus-DP parameter, improve bus efficiency
- Patent tilt measuring technical, real high accuracy



Descriptions

Profi-bus inclinometer is based on LT patent tilt measurement technology with Profibus-DP interface, can directly connect with various PLC on the market.

Profi-bus inclinometer except meet EN50170 V2 and IEC61158 standard, furthermore has strong measuring ability:

- ✓ $\pm 0.02\%$ FS linearity
- ✓ 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. upgrades 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
- ✓ Performs with short-circuit, transient voltage, overheat protection and transposition protection to adapt to industry environment
- ✓ User can set unit's all kinds of parameters via Profibus interface, and query factory data

Profi-bus inclinometer supports Profi-bus standard protocol with slave service. Adapted to strong various interference, high real-time requirements, large volume data transfer application. Supports acknowledge model, continuous sending mode and parameter setting mode, can directly realize real-time connection and communication with various PLC.

Profi-bus interface supports 127 nodes and 32 workstations in single network with one twisted-pair cable. The maximum communication distance is 4800m without repeater, 1200m with repeater. The Max transmitting rate is 12Mbps.

C15 cable option is a 150Ω twisted-pair cable according to Profi-bus specifications. match with impedance, twisted pair structure, and allowing to carry amount the maximum data. It includes proprietary 100% aluminum foil shield and 65% tinned copper braid shield, with maximum shielding effect. It is capable of carrying PLTC listed signal of UL NEC Type.

Meanwhile, in order to meet request of real on-site adjustment and display, LT provides specialized Profi-bus interface LED indicator. Via this indicator, user can setup with unit's parameters, alarm point etc..

Applications

Factory automation, Instrument, Agriculture, Engineering machinery, Industrial network, Medical equipment, Building control, Railway

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 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 axis or 2 axis					
Temperature sensor		Range: -50~125°C, Accuracy: ±1°C					
Interface		Supported protocols: PROFIBUS-DP protocol, with EN50170 V2 and IEC61158 standard, DP-V1 value Transfer rate: baud rate adaptive, Max. 12 Mb. Transfer capacity: Max.244Byte input, 244Byte output; Parameter optimization: realize parametric functions for PROFIBUS-DP users, improve bus efficiency Hardware interfaces: RS485					
Cold start warming time		60s					
Response time		0.3s(@t ₉₀)					
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		MIL-C-26482					
Weight		1.0Kg(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

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

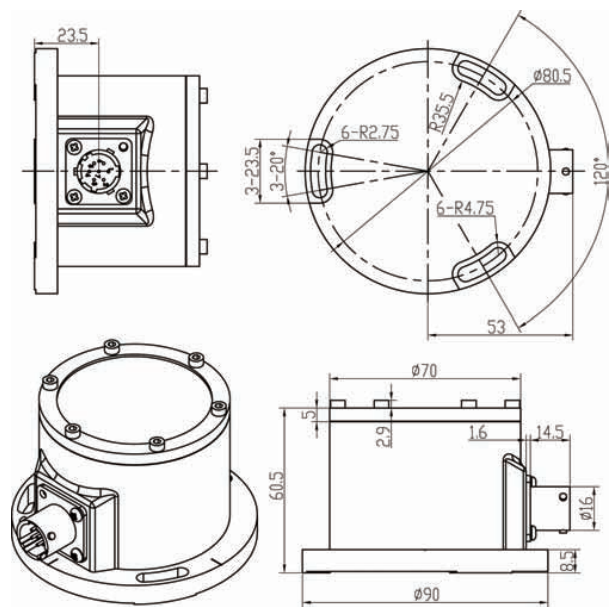
② The cross-axis sensitivity means the angle that the tilt sensor may be banked to the normal tilt direction of sensor. The cross-axis sensitivity (±0.1%FS) shows how much perpendicular acceleration or inclination is coupled to the inclinometer output signal. For example, for the single-axis inclinometer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

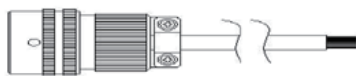
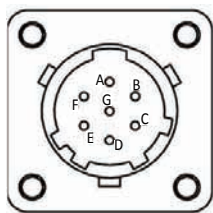
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

Dimensions (mm)



Picture 1 Housing with MIL class connector

Wiring



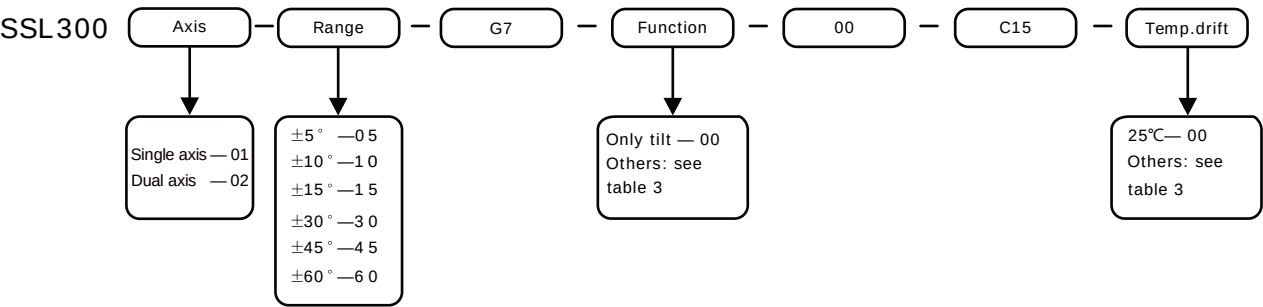
Picture 3 Cable/plug option(C15)

Picture2 MIL connector socket (View from outside)

Table 2 Pin definition

Pin	Color	Function
A	Red	Power +
B	Black	GND
C	Green	Signal GND
D	Yellow	NC
E	White	NC
F	Blue	RS485-A
G	Brown	RS485-B

Ordering



For example, if order a dual axis ProfiBus inclinometer, with range ±15°, room temperature accuracy ±0.02°, -20~60 C accuracy ±0.02°, output RS485, 25 meters cable with plug, vibration suppression function, the model should be chosen as: SSL302-15-G7-F5-00-C15-D3 (25m)

Other options (see table 4):
Profibus indicator——order number SSL003-04-20

Accessories & Options

Table 3 Accessories

Item	Order Code	Accessories name	Function
Function Module	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
	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 $0 \sim 60^\circ\text{C}$, accuracy $\pm 0.01^\circ @ \leq \pm 30^\circ$
	D2	Temperature drift	Temperature compensation range $0 \sim 60^\circ\text{C}$, accuracy $\pm 0.01^\circ @ > \pm 30^\circ$
	D3	Temperature drift	Temperature compensation range $-20 \sim 60^\circ\text{C}$, accuracy $\pm 0.02^\circ @ \leq \pm 30^\circ$
	D4	Temperature drift	Temperature compensation range $-20 \sim 60^\circ\text{C}$, accuracy $\pm 0.02^\circ @ > \pm 30^\circ$
	D5	Temperature drift	Temperature compensation range $-30 \sim 60^\circ\text{C}$, accuracy $\pm 0.03^\circ @ \leq \pm 30^\circ$
	D6	Temperature drift	Temperature compensation range $-30 \sim 60^\circ\text{C}$, accuracy $\pm 0.03^\circ @ > \pm 30^\circ$
	D7	Temperature drift	Temperature compensation range $-40 \sim 65^\circ\text{C}$, accuracy $\pm 0.05^\circ @ \leq \pm 30^\circ$
	D8	Temperature drift	Temperature compensation range $-40 \sim 65^\circ\text{C}$, accuracy $\pm 0.05^\circ @ > \pm 30^\circ$
	D9	Temperature drift	Temperature compensation range $-40 \sim 85^\circ\text{C}$, accuracy $\pm 0.05^\circ @ \leq \pm 30^\circ$
	D10	Temperature drift	Temperature compensation range $-40 \sim 85^\circ\text{C}$, accuracy $\pm 0.05^\circ @ > \pm 30^\circ$

Table 4 Options

Item	P/N	Option name	Function
Indicator	SSL003-04-20	Profibus Indicator	Power supply: $0 \sim 30\text{VDC}$, 100 mA @ 24VDC Communications protocol : Profibus-DP Slave, EN 50 170 Baud rate : 9.6kb/s $\sim 12 \text{ Mb/s}$ LED display range- 99999~999999 Working temperature: $0 \sim +45^\circ\text{C}$ Size: 96x72x149mm