

SSL300 Explosion-Proof

Inclinometer

Features

- Real high accuracy & long-term stability, analog signal output
- Armored cable, Anti-pull, wear & corrosion resistance and so on
- EXdIICT6 explosion-proof
- IP66 protection
- Aluminum alloy shell, Low cost



Descriptions

Explosion-proof inclinometer is developed on the basis of LT's patented tilt technology and special EX protections, featuring real high accuracy and high safety & durability with robust casting aluminum, adopting professional connector/cable/protection/grounding etc.

Explosion-proof inclinometer has strong tilt measuring ability:

- ✓ $\pm 0.02\%$ FS linearity
- ✓ $\pm 0.005^\circ$ Offset
- ✓ 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 accuracy concept
- ✓ Greatly reduce measuring errors when the real tilt direction not consistent for unit's sensitive axis
- ✓ Short-circuit, transient voltage, overheat protection and transposition protection to adapt to industry environment

Applications

Level measurement in harsh environment (petroleum, chemical industry, natural gas, flammable and explosive), precision angle measurement, and industry & lab equipment leveling.

Attitude monitoring, angle measurement and alarming of the building and structures in gas explosion-proof zone 1 & 2 and dust explosion-proof zone 21 & 22.

Attitude monitoring in harsh environment, such as offshore drilling platform, large-inflammable and explosive storage, complex geology, dangerous vehicles and vessels. Also applied for monitoring the detection equipment in the dangerous area.

Performances

Table 1 Specifications

Measurement range		±5°	±10°	±15°	±30°	±45°	±60°
Combined absolute accuracy ^① (@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 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/℃	≤50ppm/ °℃				
Offset temperature drift coefficient(max.)		≤0.003°/ °℃					
Offset turn on repeatability ^⑤		±0.008°					
Resolution		0.0025°					
Long-term stability ^⑥		≤0.02°					
Measurement axes		Single & Dual axis					
Output		4~20mA, 0~5VDC, -5~+5VDC					
Cold start warming time		60s					
Response time ^⑦		0.3s@t90					
Refresh rate		5Hz, optional 10Hz, 20Hz					
Response frequency ^⑧		3Hz @-3dB					
Power supply		9~36VDC					
Power consumption		Average working current≤ 50mA, average power≤ 1.5W(25℃&24VDC)					
Operation temperature range		-40~55℃					
Storage temperature range		-60~100℃					
EMC		EN 61000					
Explosion-proof		EXdIICT6					
Insulation resistance		100MΩ					
MTBF		≥25000 hour/time					
Shock		100g@11ms, three-axis,half-sine					
Vibration		8grms, 20~2000Hz					
Protection		IP66					
Connecting		Explosion proof connector					
Cable		Armored cable, standard length 2m, Customized					
Weight		0.9Kg(without cable or connector)					

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.

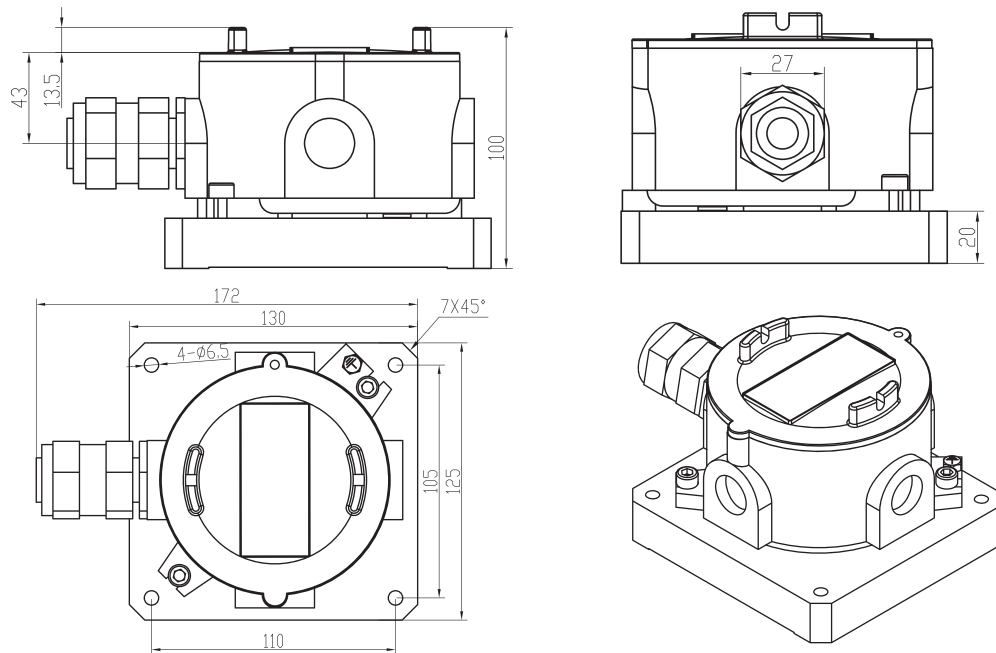
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

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.

Dimensions (mm)

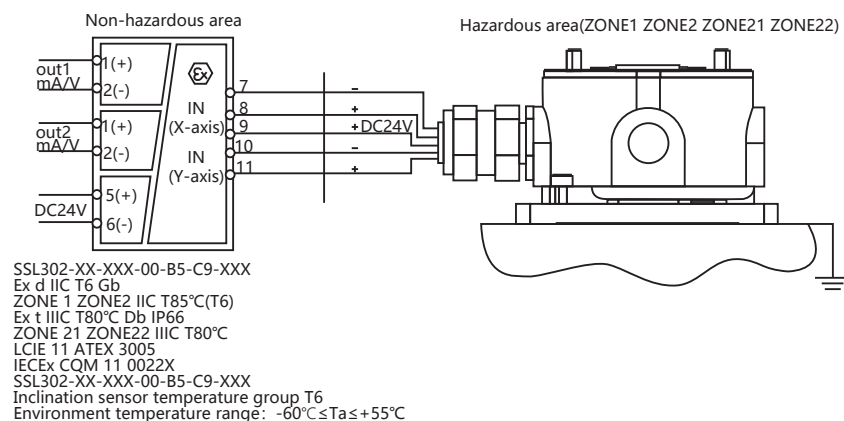


Picture 1 Dimensions & Outline

Wiring

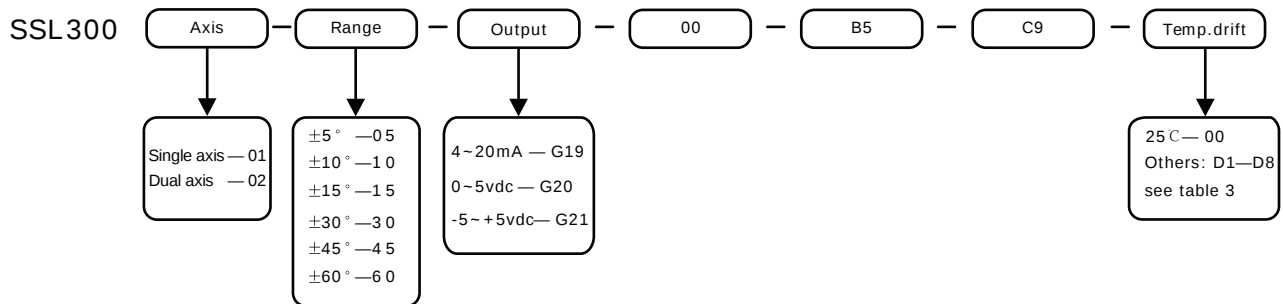
Table2 Pin definition

Wire Color	Single axis	Dual axis	Single axis	Dual axis
	Current output (G19)		Voltage output (G20, G21)	
Red	Power+	Power+	Power+	Power+
Black	Power-	Power-	Power-	Power-
Green	Signal GND	Signal GND	Signal GND	Signal GND
Yellow	Iout	Ioutx	Vout	Voutx
White	NC	Iouty	NC	Vouty
Blue	NC	NC	NC	NC
Brown	NC	NC	NC	NC



Picture 2 Safety barrier & wiring diagram

Ordering



For example: If ordering an explosion-proof inclinometer, measurement range is $\pm 5^\circ$, the accuracy is $\pm 0.02^\circ$ from $-20\sim 60^\circ\text{C}$, 4~20mA output, 10m length cable, the model should be chosen as SSL302-05-G19-00-B5-C9-D3 (10m)

Options (see table 4):

Safety barrier -----Order No. is SSL003-12-02, quantity: 1 pc.

Accessories & Options

Table 3 Accessories

Item	Order code	Accessories Name	Function
Output	G19	4~20mA	Output voltage proportional to tilt angle data Linearity: 0.02% FS Output impedance 39Ω , maximum load 625Ω
	G20	0~5VDC	Output voltage proportional to tilt angle data Linearity: 0.02% FS
	G21	-5~+5VDC	Output impedance: 100Ω , maximum output current: 10mA
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 $\pm 0.05^\circ@ > \pm 30^\circ$

Table 4 Options

Item	P/N	Option name	Function
Security products	SSL003-12-02	Safety barrier(current input)	Ex-mark[Exia]IIC Certificate no.: CNEx11.0456 (China) 35mm rail power supply: $24\text{V}\pm 10\%$ DC, Input signal: 4~20mA, 0~20mA, input impedance $\leq 250\Omega$, Output: voltage/current, RS-485, Switch output, Accuracy: $0.2\%\text{FS}\pm 1$ bit Power supply (for inclinometer): 24VDC Insulating strength : 2500V, A.C: 1min Operating temperature: $-40^\circ\text{C}\sim 85^\circ\text{C}$
Test report	SSL003-11-01	Test report for cross-axis sensitivity	Test report under cross-axis tilt, average 11 points of full range
	SSL003-11-02	Test report for absolute linearity	Average 21 points of full range
	SSL003-11-03	Test report for Allowed Installation misalignment	Axis migration test report for vertical and horizontal axis of inclinometer, 3 angles
	SSL003-11-10	Test report for life simulation	Test report for zero position and full range under 7 days continuously power on
	SSL003-11-13	Test report for salt spray	According to MIL standard (meet MIL810F 509.4)