Explosion-Proof Inclinometer

Vigor Technology

Explosion-Proof Inclinometer

Features

- Real high accuracy & long-term stability
- Armored cable, Anti-pull, wear & corrosion resistance and so on
- Compliance with standards of CENELEC, IEC and NEC
- EXdIICT6 explosion-proof , IP66 protection
- Aluminum alloy housing, Low cost

Descriptions

Explosion-proof inclinometer based on Vigor's patented tilt technology and special EX protections, performs real high accuracy tilt data and high safety & durability, including robust casting aluminum, also employed professional connector/cable/protection/grounding etc. which according to ATEX/IECEX.

Explosion-proof inclinometer has strong tilt measuring ability:

- √ ±0.02%FS linearity
- √ ±0.005°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 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 temperature drift coefficient(max.)		≤100ppm/℃			≤50ppm/ ℃		
Offset temperature drift coefficient(max.)		≤0.003°/ ℃					
Offset turn on repeatability⑤		±0.008°					
Resolution		0.0025°					
Long-term stability⑥		≤0.02°					
Measurement axes		Single & Dual axis					
Output		4~20mA, 0~5VDC, -5~+5VDC					
Cold start warming time		60s					
Response time⑦		0.3s@t90					
Refresh rate		5Hz, 10Hz, 20Hz					
Response frequency⑧		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		LCIE 11 ATEX 3005 IECEx CQM 11.0022X EXdIICT6					
Insulation resistance		100MΩ					
MTBF		≥25000 hour/time					
Shock		100g@11ms, three-axis,half-sine					
Vibration		8grms, 20~2000Hz					
Protection		IP65(Optional IP66)					
Connecting		Explosion proof connector(meet ATEX)					
Cable		Armored cable(meet ATEX), 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

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

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.

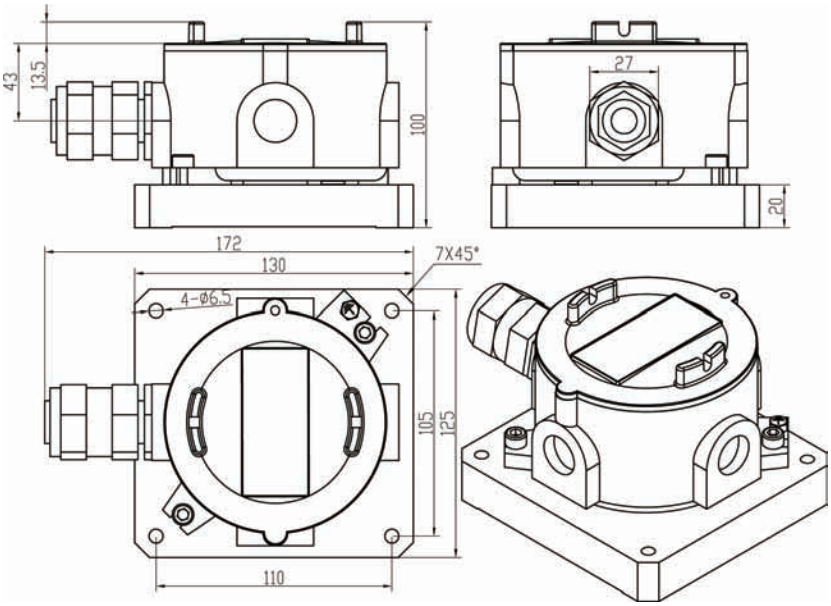
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

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.

Dimensions (mm)

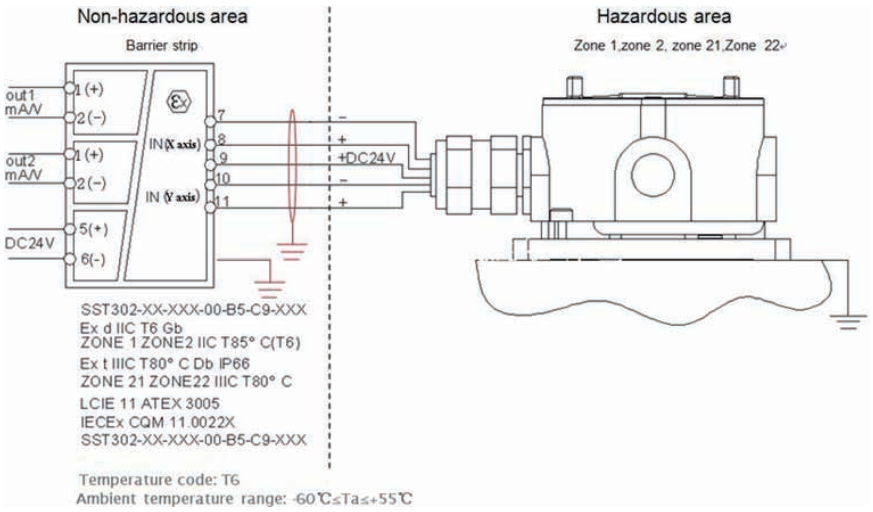


Picture 1 Dimensions & Outline

Wiring

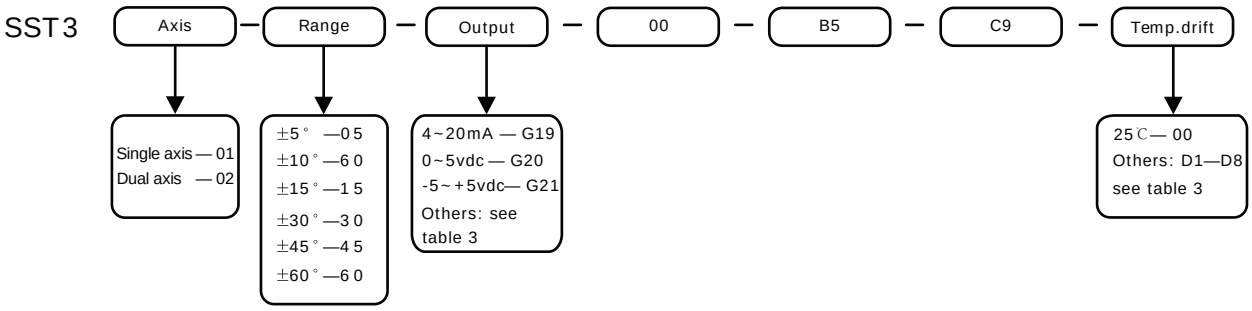
Table2 Cable definition

Color	Single axis	Dual axis	Single axis	Dual axis
	Current output (G19)		Voltage output (G20, G21)	
Red	Power+	Power+	Power+	Power+
Black	GND	GND	GND	GND
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 Barrier & wiring diagram

Ordering



For example: If ordering need an explosion proof inclinometer, measurement range is ±5°, the accuracy is ±0.02°（normal temp）, ±0.02° at temp from -20~60℃, 4~20mA output, 10m length cable, so the model should be SST302-05-G19-00-B5-C9-D3（10m）
Options (see table 4):
Barriers -----Order No. is SST003-12-01, 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 Output impedance: 100Ω, maximum output current: 10mA
	G21	-5~+5VDC	
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°

Table 4 Options

Item	P/N	Option name	Function
Security products	SST003-12-01	 Barrier(voltage input)	Ex-mark[Exia]IIC Analog output: GYB081023 (China) RS485 output: GYB081133(China) Switch output: GYB081555(China) 35mm rail Power supply:24V±10% DC Input signal:0~5VDC, -5~+5VDC, input impedance≥510KΩ Output: voltage/current, RS-485, switch output Accuracy: 0.2%FS±1 bit, Operating temperature: -40℃~85℃
	SST003-12-02	 Barrier(current input)	Ex-mark[Exia]IIC Certificate no.: CNEx11.0456 (China) 35mm rail power supply: 24V±10% DC, Input signal: 4~20mA, 0~20mA, input impedance≤250Ω, Output: voltage/current , RS-485, Switch output, Accuracy: 0.2%FS±1 bit Power supply (for inclinometer): 24VDC Insulating strength : 2500V, A.C: 1min Operating temperature: -40℃~85℃
	Optional other barrier product with Europe, Canada & US certificate, Please ask Shanghai Vigor.		
Test report	SST003-11-01	Test report for cross-axis sensitivity	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
	SST003-11-03	Test report for Alloewd Installation misalignment	Axis migration test report for vertical and horizontal axis of inclinometer,3 angles
	SST003-11-10	Test report for life simulation	Test report for zero position and full range under 7 days continuously power on
	SST003-11-13	Test report for salt spray	According to MIL standard (meet MIL810F 509.4)