

Gyro Inclinometer





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Features

- Gyro range: ±100/±250/±400°/s

- Gyro In - run bias: ±0.02°/s

- Gyro nonlinearity: 0.1%FS

- Gyro bandwidth: 50Hz

- Three axis angular rate & relative angle increment measurement

- Tilt range(X&Y axis): ±5° ~ ±60°

- Up to ±0.01° combined absolute accuracy



Descriptions

Gyro - inclinometer not only provide roll, pitch attitude angle in static, but also output relative roll, pitch &heading increment angle or angular rate in high dynamic test.

General inclinometer which based on accelerometer or electrolyte principle, will be affected much by additional axial acceleration and centripetal acceleration from rapid movement, and take measurement accuracy down. But gyroscope has good dynamic characteristics, not affected by acceleration, and output angular rate and relative angle increment under dynamic moving. In the low - frequency quasi - static conditions, the inclinometer will have accurate measurement, while gyroscope drift timely.

Based on good quasi - static characteristics of inclinometer and good dynamic characteristics of gyroscope, gyro - inclinometer combined gyroscope and inclinometer perfectly, to adapt to both dynamic and quas - static angle measurement.

Gryo - inclinometer have more choices as:

Single inclinometer +Z axes gyroscope with analog/digital output

Dual inclinometer +Z axes gyroscope with analog/digital output

Dual inclinometer +Y axes gyroscope with analog/digital output

Dual inclinometer +X/Y axes gyroscope with analog/digital output

Dual inclinometer +X/Y/Z axes gyroscope with analog/digital output

Also, Vigor may provide customized gyro's performance as demand Gyro inclinemeter has strong measuring ability:

- Gyro inclinometer has strong measuring ability:

 √ ±0.02%FS linearity and±0.005°Offset, higher zero accuracy with large measurement range
 - $\sqrt{\ }$ Gyro bias stability $\pm 0.02^{\circ}$ /s & 50Hz bandwidth, has quick & accurate relative angle & angular rate measuring ability
 - √ Relative angle & angle rate not affected by additional acceleration
 - √ With static/dynamic angle measuring ability, suite to low/rapid platform leveling
 - √ Combine with vibration module, realize FFT computations in-time, output vibration frequency and amplitude data directly, eliminate the influence of environment vibration
 - $\sqrt{\ }$ Inclination axial and gyro axial have precisely aligned & calibrated, to ensure all measurement data simultaneous sampling in the same coordinate system
 - √ 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 sensitivity, upgrades real tilt angle measuring accuracy, abandoned the traditional incomplete understanding for tilt angle measurement precision concept
 - √ Greatly reduce measuring errors when the real tilt direction not consistent for unit's actual sensitive axis
 - √ Short-circuit, transient voltage and transposition protection to adapt to industry environment
 - $\sqrt{}$ User can set unit's all kinds of parameters and query factory data via digital interface.

Applications

Factory automation, Agricultural machinery, Construction machinery, Rail transportation, Road traffic, Robots, Vehicle system, Weapons platform, Satellite communication, Photoelectric platform, etc





Performances

Table 1 Specifications

			ble 1 Spec					
			nometer sp		T	1	Т	
	rement range	±5°	±10°	±15°	±30°	±45°	±60°	
Combined absolute accuracy [⊕] (@25°C))		±0.01°	±0.015°	±0.02°	±0.04°	±0.06°	±0.08°	
	Absolute linearity (LSF,%FS)	±0.06	±0.03	±0.03	±0.03	±0.02	±0.02	
Accuracy ubroutine	Cross - axis sensitivity ²	±0.1%FS						
parameter	Offset [®]	±0.005° ±0.008°						
	Repeatability	±0.005 ±0.005°						
	Hysteresis	±0.0025°						
Allowe	d installation							
misa	alignment [®]	±4.0°	±3.0°	±2.5°	±1.5°	±1.2°	±1.2°	
	xis mislignment			≤±0	1°		I	
Sensitivity	temperature drift cient (max.)	≤±0.1 ≤100ppm/°C ≤50ppm/°C						
Offset te	mperature drift	≤0.003°/°C						
	cient (max.) on repeatability [©]			. 0 0	000			
	esolution	±0.008°						
	stability(1 year)	0.0025°						
	urement axis	≤0.02° 1 or 2 axis						
	ponse time	0.3s(@t ₉₀)						
	fresh rate	0.35(ಆنور) 5Hz(optional 10Hz or 20Hz)						
Response frequency		3Hz @-3dB						
·		Angu	lar rate/dif	ferent angle				
Measurement axis		1 axis(Z), 2 axis(X,Y), 3 axis(X,Y and Z)						
Measurement range		±100°/s,±250°/s,±400°/s						
In-Run bias stability		±0.02°/s						
bias		±0.03°/s						
Offset temperature drift		±0.004°/s/°C						
-	temperature drift	±0.004°/s /°C						
	pefficient nlinearity							
INO	ПППеагіту	±0.1% 0.02°/√Hz @±100°/s range						
	se density	0.03°/√Hz @±250°/s or ±400°/s range						
Ba	andwidth				OHZ			
			Total spec			. 1)		
Misalignment		±0.1° (Inclinometer axial & gyro axial) 9~36VDC						
	ver supply	9~36VDC RS232, RS422,CAN,0~5VDC						
Output		Single/dual axis tilt angle data						
		Single/dual/tri axis different angle data						
Outpu	ıt parameter	Single/dual/ tri axis different angular rate data						
ļ		inner temperature data(only for digital output)						
Functions		set zero point, baud rate, local gravitational acceleration value, zero calibration,						
(only for digital output)		vibration suppression filter coefficients, ID address, refresh rate, etc						
Ref	fresh rate	5Hz, 10Hz, 20Hz, 50Hz,100Hz(only for digital output)						
		Average working current≤150mA(25°C&24VDC, double axis tilt, tri-axis gyroscopes)						
	emperature range							
Storage temperature range		-40~85°C						
Insulation resistance		100ΜΩ						
MTBF		≥25000 h/times						
Shock		100g@11ms,three - axis, half - sine						
	'ibration	8grms, 20~2000Hz						
Protection		IP65(optional IP67)						
Connecting		Military class connector						
	Weight		450g(without connector and cable) compositive value of sensor's absolute linearity, repeatability, hysteresis, offset and cross-axis sensitivity en					

⁽in room temperature condition) as

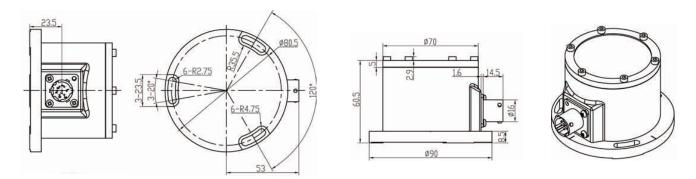
 $[\]Delta = \pm \sqrt{absolute linearity} + repeatability^2 + hysteresis^2 + offset^2 + cross-axis sensitivity error^2$ ②The cross-axis sensitivity means the angle that the tilt sensor may be banked to the normal tilt direction of sensor. The cross-axis sensitivity ($\pm 0.1\%FS$) shows how much perpendicular 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 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

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.

[§] 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

Table 2 Pin definitions for analog and digital interface



Picture 2 MIL connector socket (View from outside)

					<u> </u>			
	Any combination of gyro - inclinometer			Single tilt	Dual tilt	Dual tilt	Dual tilt	Dual tilt
Socket pin	Digital output		+Z gyro	+Z gyros	+Y gyro	+X/Y gyro	+X/Y/Z gyro	
RS232 CAN RS422		0~5VDC						
А	Power+	Power+	Power+	Power+	Power+	Power+	Power+	Power+
В	Power GND	Power GND	Power GND	Power GND	Power GND	Power GND	Power GND	Power GND
С	Signal GND	NC	Signal GND	Signal GND	Signal GND	Signal GND	Signal GND	Signal GND
D	NC	CAN-H	RS422-RXD+	Voutx-T	Voutx-T	Voutx-T	Voutx-T	Voutx-T
E	NC	CAN-L	RS422-RXD-	NC	Vouty-T	Vouty-T	Vouty-T	Vouty-T
F	RS232-TXD	NC	RS422-TXD+	Voutz-R	Voutz-R	NC	Voutx-R	Voutx-R
G	RS232-RXD	NC	RS422-TXD-	NC	NC	Vouty-R	Vouty-R	Vouty-R
Н								Voutz-R
ı								NC

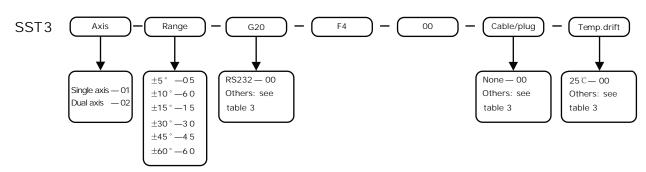
Note:

1. Voutx - T means X axes voltage output of tilt;

Voutz - R means Z axes voltage output of angular rate;

- 2. Only <Dual tilt +X/Y/Z axis gyro> adopt 9-pin connector, others adopt 7-pin connector
- 3. For digital output, housing, see Picture 2 as standard; but for 0~5VDC output, please ask Vigor when order.

Ordering



For example, if order one Gyro-inclinometer, with tilt range $\pm 60^{\circ}$, dual axis, absolute tilt accuracy $\pm 0.08^{\circ}$, $-20{\sim}60^{\circ}$ tilt temperature compensated accuracy $\pm 0.02^{\circ}$, X & Y axis gyroscope(X axis range $\pm 100^{\circ}$ /s, Y axis range $\pm 250^{\circ}$ /s), 2m cable with plug, 0-5VDC output, the final model should be chosen as: SST302 - 60 - G20 - F4 - 00 - C1 - D3(gyroscopes with X axis range $\pm 100^{\circ}$ /s, Y axis range $\pm 250^{\circ}$ /s)

Other options (see Table 4):

Magnetic base—order number SST003-01 - 01

Accessories & Options

Table 3 Accessories

Item	Order Code	Accessories name	Function			
		RS232	Directly angle output			
	00		Data format: Baud rate: 115200(adjustable), 8 data bits, 1 start			
	00		bit, 1 stop bit, none parity			
			Refresh rate: 5Hz, optional: 10Hz, 20Hz			
		RS422	Isolated, Compatible with half-duplex or full-duplex communication;			
			±15kV ESD protection			
			Compatible with ANSI/TIA/EIA-485-A-98 & ISO8482:1987(E)			
	G2		Comply with UL15772500V rms for 1min;			
Output			Transmission rate up to 500 kbps, support max 256pcs node			
interface			High common mode transient suppression ability>25kV/us;			
			Support Modbus-RTU, sensor supply HEX or ASCII communication			
		CAN	Compliance with ISO/DIS 11898, twisted-pair output			
			Support CAN2.0A, CAN2.0B protocol			
	G3		Build-in high-speed photo isolators			
			Support 15 baud rates from 5k to 1000Kbps			
			Transmission distance: 10km Max			
	G20	0~5VDC	Linearity: 0.02%FS max			
			Output impedance 100 Ω , output current ± 10 mA max			
	C1	Standard Cable	Military class connector(meet MIL-C-26482)			
		with plug	Standard 2M cable, IP67 protection, heavy duty up to 30kg			
Cable/Plug	C4	Armoured cables	Increase cable mechanical strength, anti-erosion and			
			anti-jamming capability			
	C6	Standard plug	According to MIL-C-26482, IP67 protection			
	D1	Temperature drift	Temperature compensation range 0~60°C, accuracy ±0.01°@≤±30°			
	D2	Temperature drift	Temperature compensation range 0~60°C, accuracy ±0.01°@>±30°			
	D3	Temperature drift	Temperature compensation range -20~60°C, accuracy ±0.02°@≤±30°			
Temperature drift	D4	Temperature drift	Temperature compensation range -20~60°C, accuracy ±0.02°@>±30°			
	D5	Temperature drift	Temperature compensation range -30~60°C, accuracy ±0.03°@≤±30°			
	D6	Temperature drift	Temperature compensation range -30~60°C, accuracy ±0.03°@>±30°			
	D7	Temperature drift	Temperature compensation range -40~65°C, accuracy ±0.05°@≤±30°			
	D8	Temperature drift	Temperature compensation range -40~65°C, accuracy ±0.05°@>±30°			
	D9	Temperature drift	Temperature compensation range -40~85°C, accuracy ±0.05°@≤±30°			
	D10	Temperature drift	Temperature compensation range -40~85°C, accuracy ±0.05°@>±30°			

Table 4 Options

Item	P/N	Option name	Function		
Installation tools	SST003-01-01	Magnetic base	50kg suction, permanent magnet, stainless steel materials		
	SST003-01-04	Adjustable base with micrometer screw	Three-points adjustment, resolution 0.001mm, stainless steel materials		
Power	SST003-09-02	The portable rechargeable lithium battery packs	Output 24VDC, Continuous work 24 hours, IP65, rechargeable		
	SST003-11-02	Absolute linearity	Average 21 points of full range		
Test report	SST003-11-03 Test report for Allowed Installation misalignment		Axis migration test report for vertical and horizontal axis of inclinometer,3 angles		
	SST003-11-04	Test report for response time and hysteresis	The report for time response curve/ data and hysteresis characteristics		
	SST003-11-05	Test report for vibration	According to inclinometer's standard vibration characteristic		



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