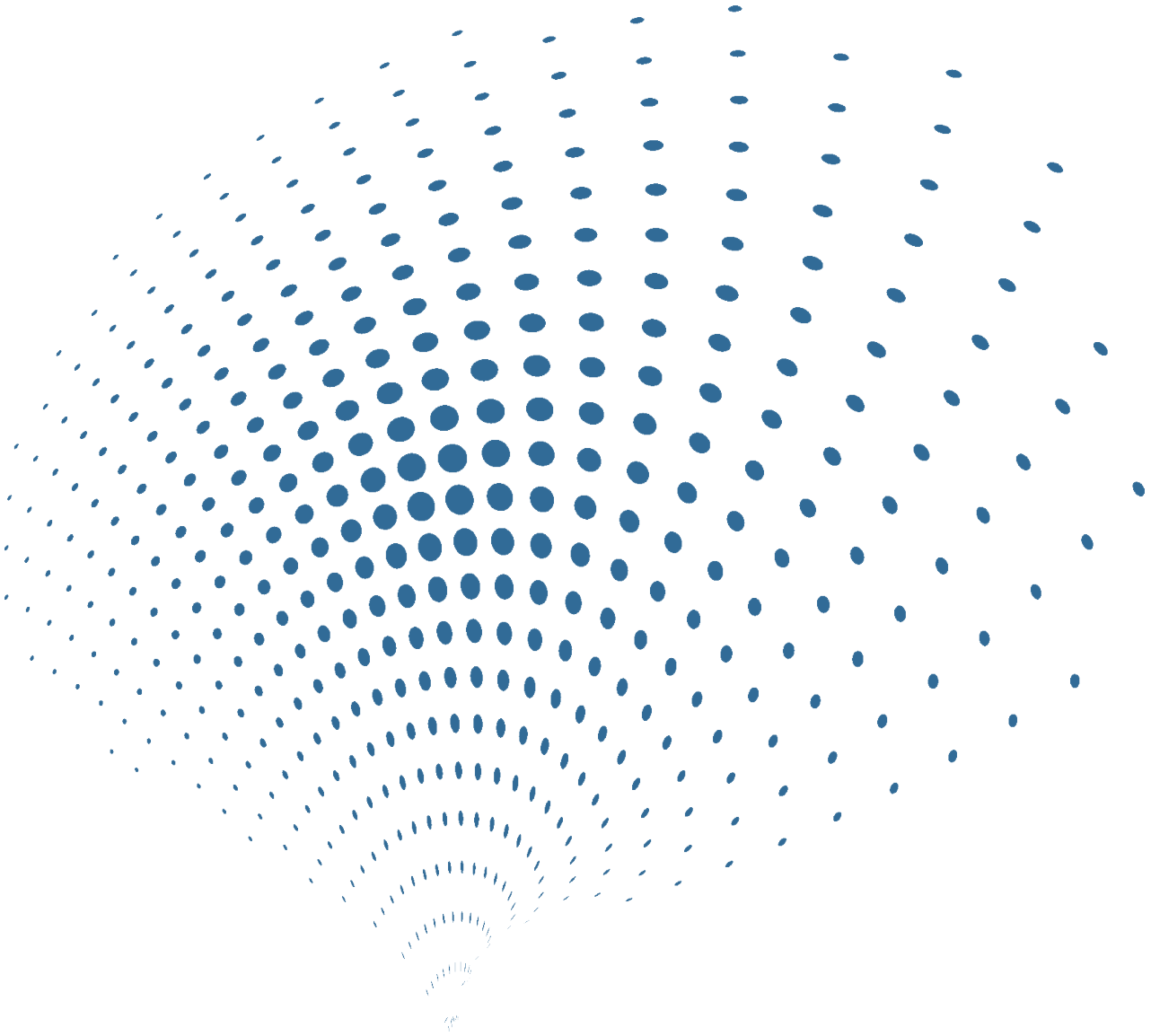
Vigor Technology



RS Inclinometer

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Features

- Standard industrial interface, support ModBus, HEX or ASCII
- Half-duplex, point-to-point, point-to-multipoint transmission models
- Insulated serial interface
- Transfer rate up to 500Kbps
- Long transfer distance up to 1200 meters
- Support network , max 256 nodes
- Provide powerful debugging & acquisition software
- ±15KV ESD protection, anti-electromagnetic interference strictly design

Descriptions

RS inclinometer is based on Vigor patent tilt measurement technology, according to high reliability & stability evaluation methodology of military/aerospace application. It focus to various industrial measuring and control system of PLC/DAQ application.Not only meet to critical null repeatability, also suite to static /dynamic leveling with different modules in platform leveling application.

RS inclinometer has strong measuring ability:

- √ ±0.02%FS linearity
- √ ±0.005°Offset
- √ Combine with gyro module, realize static/dynamic angle measuring for low/rapid platform leveling.
- √ Combine with vibration module, realize FFT computations in-time, output vibration frequency and amplitude data directly, eliminate the influence of vibration
- √ Combine with GPS module, realize data synchronization data acquisition and local position data in different installation places
- √ Further confirmed that offset, repeatability, hysteresis, turn on repeatability etc. parameters which are important influence factors to 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 directions not consistent to unit's sensitive axis
- √ Additional short-circuit, transient voltage, overheat protection and transposition protection to adapt to industry environment
- √ User an set unit's all kinds of parameters via interface, and query factory data

RS inclinometer supports MODBUS protocol, half/full-duplex, realize for single point or multipoint comm unication. Supports acknowledge/continuous sending/parameter setting modes. User can set zero point, baud rate, local gravitational acceleration value, zero calibration, vibration suppression filter factor, ID address, refresh rate etc..

Support 256 nodes in single network on one twisted-pair cable, the maximum distance 1200m and 500kps baud rate. By kinds of recommended options (see option table) can make longer transmission distance.

Applications

Factory automation, Instrumentation, Agriculture, Power industry, Medical equipment, Rail transportation, Solar tracking

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 stability(1 year)		≤0.02°					
Measurement axis		1 or 2 axis					
Temperature sensor		Range： -50~125℃, Accuracy:±1℃					
Output		RS485/RS422/RS232					
Output format		8bits Data,1bit Start,1bit Stop, No parity, Baud rate is1200~57600bps					
Protocol		Modbus /HEX/ASCII					
Cold start warming time		60s					
Response time		0.3s(@t_{90})					
Refresh rate		5Hz, 10Hz, 20Hz					
Power supply		9～36VDC					
Power consumption		Average working current≤50mA ; average power≤1.5W(25℃&24VDC)					
Operation temperature range		-40~85℃					
Storage temperature range		-60~100℃					
EMC		According to EN 61000 and GBT17626					
Insulation resistance		100MΩ					
MTBF		≥25000 h/times					
Shock		100g@11ms , three-axis, half-sine					
Vibration		8grms, 20~2000Hz					
Protection		IP65(Optional IP67)					
Connecting		Military class connector(GJB101A-199 , MIL-C-26482)					
Weight		420g (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

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

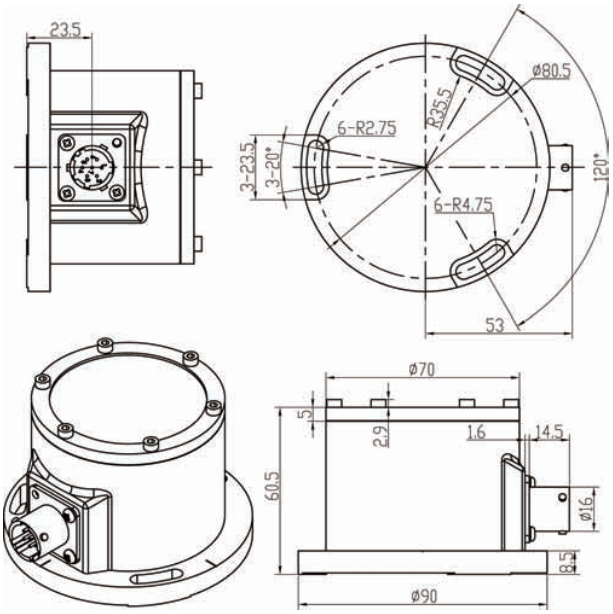
② The cross-axis sensitivity means the angle that the tilt sensor may be banked to the normal tilt direction of sensor. The cross-axis sensitivity (±0.1%FS) shows how much perpendicular acceleration or inclination is coupled to the inclinometer output signal. For example, for the single-axis inclinometer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

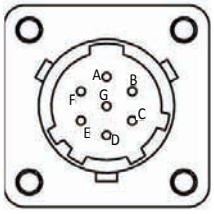
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

Dimensions (mm)



Picture 1 Housing with MIL class connector

Wiring



Picture2 MIL connector socket (View from outside)

Table 2 Pin definition

Pin	RS485	RS422	RS232
A	Power+	Power+	Power+
B	GND	GND	GND
C	Digital GND	Digital GND	Digital GND
D	NC	RS422-RXD+	
E	NC	RS422-RXD-	
F	RS485-A	RS422-TXD+	RS232-TXD
G	RS485-B	RS422-TXD-	RS232-RXD

Ordering

SST3 — Axis — Range — 00 — Function — 00 — Cable/Plug — Temp.drift

- Axis: Single axis — 01; Dual axis — 02
- Range: ±5° — 05; ±10° — 10; ±15° — 15; ±30° — 30; ±45° — 45; ±60° — 60
- 00: RS232 — 00; RS485 — G1; RS422 — G2
- Function: Only tilt — 00; Others: see table 3
- 00
- Cable/Plug: None — 00; Others: see table 3
- Temp.drift: 25℃ — 00; Others: see table 3

For example, if order a dual axis RS inclinometer, with range ±15°, room temperature accuracy ±0.02°, -20~60℃ total drift accuracy ±0.02°, output RS485, 100 meters cable with plug, vibration function module, the model should be chosen as: SST302-15-G1-F5 -00-C1-D3（100m）

Other options (see table 4):

Application software with PC——order number SST003-04-09

Accessories & Options

Table 3 Accessories

Item	Order Code	Accessories name	Function
Functional model (built-in)	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
	F3	Compass module	2-Axis Electronic compass technology Heading measurement range: 0~360°, Heading accuracy: <±1.0°RMS With hard magnetic compensation Optional higher precision or three-dimensional compass module
	F4	Gyro module	±100/250/400°/s, X/Y/Z axis dynamic angular rate In-run bias: ±0.02°/s, Non-linearity: 0.1%FS Bandwidth: 50Hz,Noise density : 0.02°/s/√Hz Higher accuracy gyro module available
	F5	Vibration module	Three-axis vibration detection, frequency response≤5 kHz Range: 0g~±1g/ ±5g/ ±10g/ ±20g, 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 0~60℃, 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°
	D9	Temperature drift	Temperature compensation range-40~85℃, accuracy ±0.05°@≤±30°
	D10	Temperature drift	Temperature compensation range-40~85℃, accuracy ±0.05°@>±30°

Table 4 Options

Item	P/N	Option name	Function
Software	SST003-04-09	PC application software	Setting function, Command function, Tool function Operating platform: Windows XP, Windows 7 More information please see datasheet of this options
Signal device	SST003-05-10	Signal Repeater	Automatically detect rate, determine and control Adaptive technology, no settings, switch freely Support RS485/RS422 relay and switch each other DC-DC isolation 3000V, no need serial port for power supply 3000V high-speed optical isolation and pre-emphasis technical Communication distance up to 3000 .meters (9600BPS) 1500W surge protection, 15KV ESD protection
	SST003-05-11	Lightning protection	Impact-resistant 5KV Metal housing, IP65, anti-corrosion function Adopt series connection to avoid high-voltage pulse on line To protect back-end equipment from lightning and surge Multi-level protection circuit, fast response, low output residual Response time <1ns Baud rate <1Mbps
	SST003-05-12	Wi-Fi converter	Sight distance up to 2000m, GFSK mode Carrier frequency: 433 MHz; ISM band, no need to apply 16 channel, can be expanded to 32 channels Transceiver, half duplex, transmitting-receiving automatically Multiple communication combination mode as single-point, multipoint, multipoint-to-point Transparent data transmission, can transmit larger frames standby modes: hardware wake ,serial wake, remote wake Automatically filter out false data, high reliability Optional ID protocol, IO scheduling function

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