

# DeviceNet Inclinator



# DeviceNet Inclinometer

## Feature

- According to DeviceNet Slave protocol
- Support UCMM explicit message server, client
- Support all kinds of messages, offline connectivity
- Support 5K-1000Kbps total 15 kinds of CiA recommended
- Non-volatile memory storage network parameters, slave station configuration protocol file connectivity
- Built-in high-speed optical isolation
- ODVA certified communication cable



## Descriptions

DeviceNet inclinometer is based on Vigor patent tilt measurement technology and combined with DeviceNet interface. It shortens system building & debug, further reducing user's construction and maintenance costs. DeviceNet inclinometer except meets ODVA standard and implement industry-standard protocols, furthermore has strong measuring ability:

- ✓  $\pm 0.02\%$ FS linearity
- ✓  $\pm 0.005^\circ$  Offset
- ✓ Combine with gyro module, realize static/dynamic angle measuring for low/rapid leveling
- ✓ With vibration module, realize FFT computations in-time, output vibration frequency and amplitude data directly, eliminate the influence of environment 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 error. upgrades 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 real tilt unit's actual sensitive axis
- ✓ Short-circuit, transient voltage, transposition protections to adapt to industry environment
- ✓ User can set unit's all kinds of parameters via DeviceNet interface, and query factory data

DeviceNet Inclinometer supports DeviceNet standard protocol, can achieve point-to-point or point-to-multipoint communication, suit for all kinds of high interference, high real-time requirements and high-capacity data transmission application. Can directly connect and communicate with all kinds of PLC real time. A DeviceNet network can support up to 64 nodes and the distance of end-to-end is variable which based on network speed. At 125 Kbps baud, the maximum communication distance is up to 500m. At the highest 500 Kbps, the maximum distance is up to 100m. The bus topology is a trunkline-dropline linear bus. C16 cable option ( which Data and power functionality in one cable) Offers an Extensive Line-up of Inclinometer for DeviceNet Application.A

Zigbee	RS
Wi-Fi	CAN
GPRS	CANopen
CDMA	EtherCAT
SSI	DeviceNet
PWM	Profi-bus
Vibration-wire	HART
Switch	Ethernet
Analog	USB

# Performances

Table 1 Specifications

Measurement range	±5°	±10°	±15°	±30°	±45°	±60°	
Combined absolute accuracy <sup>①</sup> (@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 <sup>②</sup>	±0.1%FS					
	Offset <sup>③</sup>	±0.005°			±0.008°		
	Repeatability	±0.0025°					
	Hysteresis	±0.0025°					
Allowed installation misalignment <sup>④</sup>	±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 <sup>⑤</sup>	±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						
Output	DeviceNet protocol, Transmission rate: 125Kbps,250Kbps,500Kbps support 128 bytes I/O message, 250 bytes explicit message transmission Topology: point-to-point, multi-master or master / slave communication mode						
Maximum nodes	64						
Cold start warming time	60s						
Response time	0.3s(@t <sub>90</sub> )						
Update rate	5Hz, 10Hz, 20Hz						
Response frequency	3Hz @-3dB						
Power supply	9~36VDC						
Power consumption	Average working current≤250mA(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	Military class connector(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

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

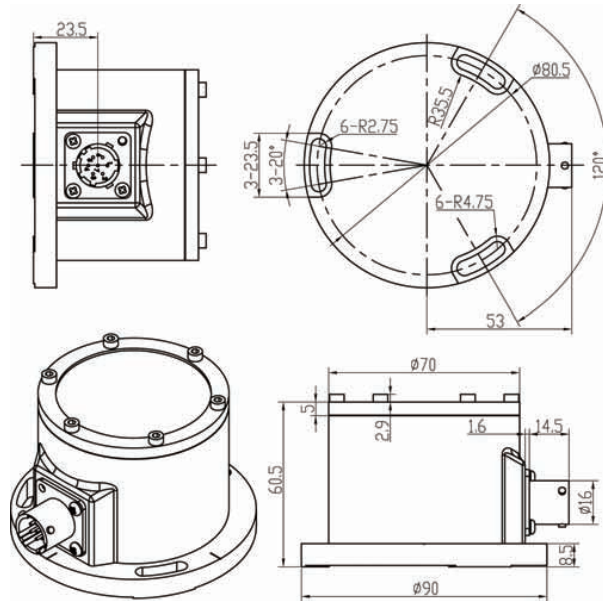
② The cross-axis sensitivity means the angle that the tilt sensor may be banked to the normal tilt direction of sensor. The cross-axis sensitivity (±0.1%FS) shows how much perpendicular acceleration or inclination is coupled to the inclinometer output signal. For example, for the single-axis inclinometer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

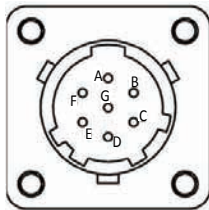
⑤ Offset turn on repeatability means the repeatability of the sensor in repeated by supply power on-off-on many times.

## Dimensions (mm)



Picture 1 Housing with MIL class connector

## Wiring

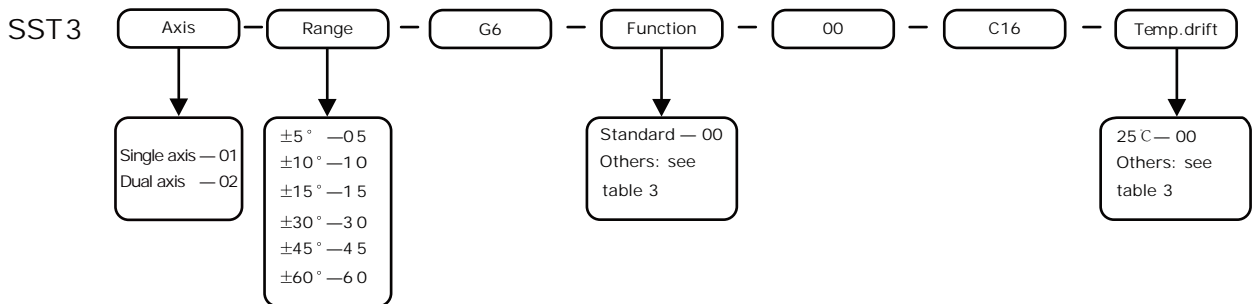


Picture2 MIL connector socket (View from outside)

Table 2 DeviceNet interface pin definition

Pin	Function
A	Power+
B	Power-
C	NC
D	CANH
E	CANL
F	NC
G	NC

## Ordering



For example, if order a dual axis DeviceNet inclinometer, with range  $\pm 15^\circ$ , room temperature accuracy  $\pm 0.02^\circ$ ,  $-20\sim 60^\circ\text{C}$  temperature drift  $\pm 0.02^\circ$ , output DeviceNet interface, 15m meters cable with plug, vibration function module, the model should be chosen as: SST302-15-G6-F5-00-C13-D3 (15m)

## Accessories

Table 3 Accessories

Item	Order Code	Accessories name	Function
Functional mode (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
	F4	Gyro module	$\pm 100/250/400^\circ/s$ , X/Y/Z axis dynamic angular rate In-run bias: $\pm 0.02^\circ/s$ , Non-linearity: 0.1%FS Bandwidth: 50Hz, Noise density : $0.02^\circ/s/\sqrt{Hz}$ Higher accuracy gyro module available
	F5	Vibration module	Three-axis vibration detection, frequency response $\leq 5$ kHz Range: $0g \sim \pm 1g/ \pm 5g/ \pm 10g/ \pm 20g$ , 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 $0 \sim 60^\circ C$ , accuracy $\pm 0.01^\circ @ \leq \pm 30^\circ$
	D2	Temperature drift	Temperature compensation range $0 \sim 60^\circ C$ , accuracy $\pm 0.01^\circ @ > \pm 30^\circ$
	D3	Temperature drift	Temperature compensation range $-20 \sim 60^\circ C$ , accuracy $\pm 0.02^\circ @ \leq \pm 30^\circ$
	D4	Temperature drift	Temperature compensation range $-20 \sim 60^\circ C$ , accuracy $\pm 0.02^\circ @ > \pm 30^\circ$
	D5	Temperature drift	Temperature compensation range $-30 \sim 60^\circ C$ , accuracy $\pm 0.03^\circ @ \leq \pm 30^\circ$
	D6	Temperature drift	Temperature compensation range $-30 \sim 60^\circ C$ , accuracy $\pm 0.03^\circ @ > \pm 30^\circ$
	D7	Temperature drift	Temperature compensation range $-40 \sim 65^\circ C$ , accuracy $\pm 0.05^\circ @ \leq \pm 30^\circ$
	D8	Temperature drift	Temperature compensation range $-40 \sim 65^\circ C$ , accuracy $\pm 0.05^\circ @ > \pm 30^\circ$
	D9	Temperature drift	Temperature compensation range $-40 \sim 85^\circ C$ , accuracy $\pm 0.05^\circ @ \leq \pm 30^\circ$
	D10	Temperature drift	Temperature compensation range $-40 \sim 85^\circ C$ , accuracy $\pm 0.05^\circ @ > \pm 30^\circ$