

## TILT-SG360 (full 360 arcdeg)

### Features:

- ▲ *Single-axis tilt sensor with full 360 arcdeg range.*
- ▲ *Digital Temperature sensor.*
- ▲ *On-board digital signal processing.*
- ▲ *High Resolution(0.1 arcdeg) & absolute accuracy (+/- 0.5 arcdeg typ).*
- ▲ *Robust frequency signal 10 Hz = 1 arc deg.*
- ▲ *Micro-controller stores sensor ID & Calibration Coeffs. in Flash EEPROM.*
- ▲ *Suitable for moderate-high resolution applications.*
- ▲ *High survivability following blasts and vibration (accelerometer 1000g).*
- ▲ *Readout using Manual Interrogation Unit.*
- ▲ *Readout using SensorSYNC for PalmOS.*
- ▲ *Competitively priced for disposable application.*

YieldPoint's Tilt-SG360 model is packaged as a single-axis (1SG) tilt sensor designed for semi-permanent installation in either a borehole or surface application. The technology is based on an MEMS (MicroElectroMechanical Systems) accelerometer that measures the "static" acceleration due to gravity. Each instrument is individually calibrated with coefficients stored in the micro-controller EEPROM. The output signal is a robust frequency modulated signal with can be read using YieldPoint's standard Manual Interrogation Unit or a PalmOS handheld device via SensorSYNC™.

### Signal Processing

On board signal processing results in a high accuracy (0.25 arc deg) and resolution (0.01 arc deg). A digital temperature sensor(+/-2°C accuracy ) provides full temperature compensation over the specified thermal range of -25 - 85°C. Each instrument is individually calibrated (sheets available on request) and the coefficients are stored in EEPROM memory on the micro-controller. The output signal is a frequency modulated (CMOS and TTL compatible) digital signal that can be read by a low cost electronic meter or tachometer, can be routinely interfaced with digital channels on PLCs, or read from a handheld PalmOS device using SensorSYNC™. Frequency modulation is widely recognized as preferable for the harsh mining environment where amplitude signals (ie voltage) are prone to inaccuracies.

### Applications

Tilt-SG360 tilt sensors are designed for moderate-high resolution applications involving borehole or surface deployment.



Prospective applications are:

- ▲ Slope monitoring.
- ▲ Monitoring sag of backfill/ paste-fill
- ▲ Monitoring rotational failures
- ▲ Tailings dams
- ▲ Monitoring shear displacement of normal and reverse faults
- ▲ Monitoring shear failure of pillars
- ▲ Monitoring buckling of pillars
- ▲ Monitoring bulkheads
- ▲ Roadway deformation in coal-mines
- ▲ Monitoring fill mats
- ▲ Monitoring deformation in salt/potash
- ▲ Monitoring any failure involving toppling
- ▲ Monitoring shear displacement of faults

Creative practitioners can develop their own measurement structures that convert complex ground movement or crack opening into Tilt change.

### *Manual Readout*

Readout can be made using YieldPoint's low cost manual readout box, with a backlit LCD. An on-board micro-controller performs diagnostics on the lead-wires, recognizes the sensor type and ID and outputs the tilt and temperature data in arcdeg and °C. A manual reading can also be taken using a PalmOS handheld device (Palm or HandSpring) using the SensorSYNC module. Data is displayed and automatically save to a PalmOS database, so reducing the possibility of user-error.

### *Specification*

**Dimensions:** 20mm diameter, 75mm long. 5m of leadwire supplied.

**Borehole size:** 50mm+

#### *Core Technology*

MEMS accelerometers and digital temperature sensor.

**Output Signal** - High Speed CMOS + TTL compatible 0-5V square wave.

**Tilt. Range (F.S.)** +/- 360°.

**Tilt. Resolution** - 0.1 arcdeg,

**Tilt .Linearity** - typically 0.25% F.S

**Tilt. Accuracy** - better than +/- 1.0 arcdeg.

**Temp. Range** -20 - 85°C

**Temp Accuracy** +/-2°C Digitally trimmed at 0°C and 25°C

**Temp Resolution** 0.1°C

**Thermal Error** : <0.05%FS/°C ( 0-50°C for rates <5°C/hr)

### *Automated Data Retrieval*

Data from the Tilt-SG360 series can be collected for up to 3 months using the SLUG data-logger. Alternatively up to five Tilt-SG360 instruments can be logged using the DESTINY hub and then networked together using DESTINY (Digitally Enabled Sensor Transducer and Instrumentation Network from YieldPoint). This is a low cost, low maintenance RS-485 network (modbus protocol), that can save time and money by transmitting data directly to a central control room or an engineer's desktop. Alternatively the data can be interfaced with the mine's existing PLC network. A 2<sup>nd</sup> generation networking product, currently in development, will implement TCP-IP protocol for Internet connectivity.

