

## MODEL 6190



Model 6190 Triaxial MEMS Tilt Sensor (front), Model 6190S Standalone Tilt Sensor (rear).

### APPLICATIONS

The Model 6190 MEMS Tilt Sensors are designed to measure tilt on or in structures including:

- Buildings
- Dams
- Embankments
- Slopes
- Retaining walls
- Open pits
- Railroad tracks

### OPERATING PRINCIPLE

The basic principal of operation is the utilization of MEMS (Micro-Electro-Mechanical Systems) tilt sensors to make accurate measurements of inclination at discrete points where each Tilt Sensor is located.

The Model 6190 Tilt Sensor consists of a Triaxial MEMS Tilt Sensor, installed inside a stainless steel housing and includes an adjustable bracket for mounting. The bracket is bolted to the structure using the supplied hardware, which includes two 3/8" drop-in anchors.

Sensors can be ordered as standalone units or combined into strings.

Standalone sensors are shipped with a customer specified length of cable and bare leads. For sensor strings, each sensor is supplied with a pair of interconnecting cables, one with a male connector and the other with a female connector. When tilt string sensor spacing exceeds 1.5 m, extension cables (with requisite connectors) are required.

A four-wire bus cable connects the sensor/string to the chosen readout

(PC, datalogger, SCADA system, etc.) via stripped and tinned conductors.

Each sensor is individually serialized and calibrated. A calibration report showing the relationship between sensor output and inclination is provided with each sensor. Sensor output consists of temperature and calibrated tilt readings, which can be easily imported into MS Excel, or any data visualization software, without the need to convert raw data into engineering units.

### ADVANTAGES

MEMS tilt sensors are low-cost, robust, and virtually immune to shock loading. They operate over a wide angular range, with high sensitivity and

excellent long-term stability. Model 6190 tilt sensors can be used with automated data acquisition systems, which allows a series of

sensors to be continuously monitored for profiling purposes.

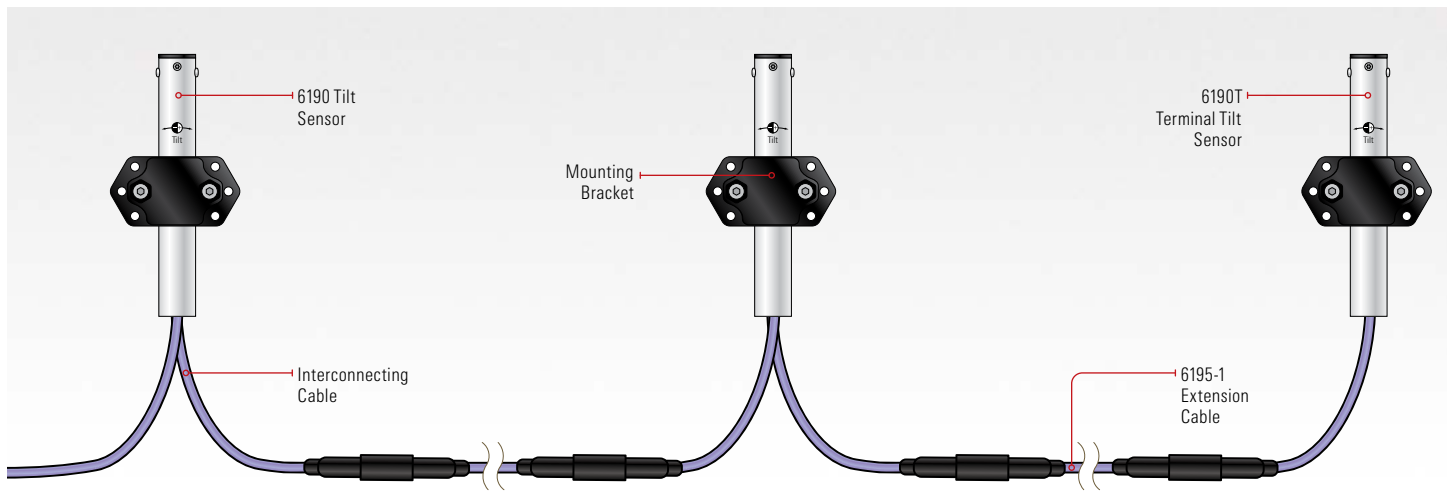
### DATA ACQUISITION

The Model 6190 Tilt Sensor uses industry standard Modbus® Remote Terminal Unit (RTU) protocol to communicate. It employs an RS-485 (half duplex) electrical interface, recognized for its prevalence,

simplicity, and success as a robust, industrial physical layer.

Monitoring can be accomplished using GeoNet Addressable Loggers, the Model 8020-38 Addressable

Bus Converter, Model 8600 Series Dataloggers, Campbell Scientific Dataloggers, or any other device capable of operating as a Modbus RTU client and having an RS-485 port.



String of interconnected Model 6190 Tilt Sensors.

## TECHNICAL SPECIFICATIONS

Range <sup>1</sup>	±90°
Resolution <sup>2</sup>	0.00025° (0.004 mm/m)
Precision <sup>3</sup>	±0.0075° (±0.13 mm/m)
Nonlinearity	±0.005° across ±30° range (±0.09 mm/m)
Temperature Dependent Uncertainty	±0.001° across ±5° range (±0.016 mm/m) ±0.0016° across ±15° range (±0.026 mm/m) ±0.0026° across ±30° range (±0.042 mm/m)
Operating Temperature	−40 °C to 65 °C (−40 °F to 149 °F)
Temperature Accuracy	±0.5 °C
Power Supply Voltage	12 VDC ±20%
Operating Current <sup>4</sup>	12 mA ±1 mA
Standby Current <sup>4</sup>	2 mA ±0.1 mA
Maximum Supply Current <sup>5</sup>	500 mA
Sensor Diameter	25.4 mm (1")
Sensor Length	180.3 mm (7.1")
Sensor Weight	0.29 kg (0.64 lb)
Sensor Materials	316 Stainless Steel, Engineered Polymer
Mounting Bracket Dimensions (L × W × D)	97 × 56 × 53 mm (3.8 × 2.2 × 2.1")
Mounting Bracket Weight	0.54 kg (1.18 lb)
Mounting Bracket Materials	Black Powder Coated Aluminum
Electrical Cable	Four Conductor, Foil shield, Polyurethane jacket, nominal OD = 7.9 mm
Interface	RS-485
Protocol	MODBUS
Baud Rate	115,200 bps
Ingress Protection	IP68 to 3MPa (300m head water)

<sup>1</sup> Calibrated Range: ±30°

<sup>2</sup> 99% confidence interval (i.e. 99 out of 100 individual readings fall within this tolerance).

<sup>3</sup> Includes random walk (changes between consecutive readings that have no discernible cause) and seismic noise during testing.

<sup>4</sup> Operating and standby current are for each individual sensor in a string.

<sup>5</sup> Per entire string.

## ORDERING INFORMATION

**6190S:** Standalone MEMS Digital Tilt Sensor, Triaxial  
**6190S-CR:** Standalone MEMS Digital Tilt Sensor, Triaxial, Corrosion Resistant  
**6190:** MEMS Digital Tilt Sensor, Triaxial  
**6190T:** MEMS Digital Tilt Sensor, Triaxial Terminal sensor  
**6190-1:** Mounting Hardware Kit  
**TLS-208:** Rawl Setting Tool, ¼"  
**6180-3-1:** Readout Cable, lengths <15 m (50 ft.), bare leads  
**6180-3-2:** as above, 16 to 30 m (50 to 100 ft.)  
**6180-3V:** as above, lengths >30 m (100 ft.)

**6195-1-10FT:** Extension Cable, 10 ft. length  
**6195-1-25FT:** Extension Cable, 25 ft. length  
**6195-1-50FT:** Extension Cable, 50 ft. length  
**6195-1-100FT:** Extension Cable, 100 ft. length  
**6195-1-150FT:** Extension Cable, 150 ft. length  
**6195-1-200FT:** Extension Cable, 200 ft. length  
**02-313P9LTD:** Violet Polyurethane Cable, 8 mm (0.313") Ø, twisted pairs

## LEGACY VERSIONS

Limited legacy versions are available allowing for the repair and/or expansion of retired, previously

available GEOKON In-Place Inclinator models. Please contact GEOKON for more information.

## COMPATIBLE READOUTS AND DATALOGGERS

**8600 Series:** Multi-Channel Dataloggers  
**8800 and 8900 Series:** GeoNet Wireless Data Acquisition System

**8920, 8930, 8950 Series:** GeoNet Cellular, Wi-Fi, and Satellite Network Loggers  
**8940:** GeoNet Dataloggers  
**8020-38:** Addressable Bus converter