TILT BEAM (TRIAXIAL MEMS)

GEOKON®

MODEL 6195



Model 6195 Triaxial MEMS Tilt Beams.

APPLICATIONS

The remote, continuous, and automatic monitoring in:

- Buildings and retaining walls
- Concrete dams
- Structures adjacent to or above tunnels and underground openings
- Monitoring deflections in structures subject to compensation grouting
- Measuring differential settlements along embankments, railroad tracks, and pipelines



GeoNet Addressable Data Logger

OPERATING PRINCIPLE

The basic principle of operation is the utilization of MEMS (Micro-Electro-Mechanical Systems) tilt sensors to make accurate measurements of inclination over a distance dictated by the Tilt Beam.

The Model 6195 Tilt Beam consists of a Triaxial MEMS Tilt Sensor, installed in a section of stainless steel tubing, manufactured to a customer-selected length. Precision machined mounting brackets at each end of the beam, along with supplied hardware, are used to bolt the beam to the structure/surface of interest.

Beams can be combined in a string and electrically connected by means of waterproof connectors on a four-wire bus cable. The cable from the endmost beam connects the string to the chosen readout (PC, data logger, SCADA system, etc.).

The output from each string consists of calibrated tilt readings and temperatures for each beam, 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 operate over a wide angular range, with high sensitivity, and excellent long-term stability. In addition, their low profile and low mass makes them very resistant to shock loads.

Digital sensor systems offer greater noise immunity than analog types and are capable of signal transmission over cable lengths up to 1200 m, depending on the number of beams in the string.

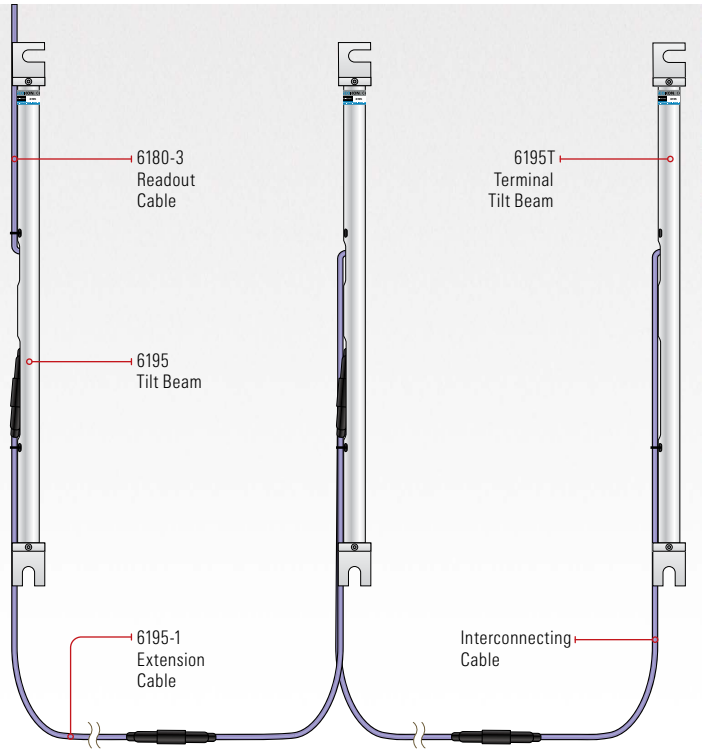
Other advantages of automated Tilt Beam readings include the ability for increased frequency of readings, which can be critical for online (real-time) monitoring applications.

Tilt beams can be customized to meet your needs. Our staff will work with you throughout the process. Common customizations include tilt range, temperature range, corrosion resistant housings, specialty cables, etc.

DATA ACQUISITION

The Model 6195 Tilt Beam 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 Data 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 6195 Tilt Beams.

TECHNICAL SPECIFICATIONS

Range[1]	±90°
Resolution[2]	0.00025° (0.004 mm/m)
Precision[3]	±0.0075° (±0.13 mm/m)
Nonlinearity	±0.005° across ±30° range (±0.09 mm/m)
Temperature Dependent Uncertainty	± 0.0010 across ± 5° angular range (±0.016 mm/m/°C) ± 0.0016 across ± 15° angular range (±0.026 mm/m/°C) ± 0.0026 across ± 30° angular range (±0.042 mm/m/°C)
Operating Temperature	–40 °C to 65 °C (–40 °F to 149 °F)
Power Supply Voltage	12 VDC ±20%
Operating Current[4]	12 mA ±1 mA
Standby Current[4]	2 mA ±0.1 mA
Maximum Supply Current[5]	500 mA
Beam Diameter	25.4 mm (1")
Standard Beam Length[6]	0.5 m, 1 m, 2 m, 3 m, 2 ft., 5 ft., 10 ft.
Beam Weight	0.5M: 0.80 kg (1.77 lb.) 1M: 1.20 kg (2.65 lb.) 2M: 2.01 kg (4.42 lb.) 3M: 2.81 kg (6.19 lb.) 2FT 0.89 kg (1.96 lb.) 5FT: 1.62 kg (3.58 lb.) 10FT: 2.85 kg (6.28 lb.)
Materials	316 Stainless Steel, Engineered Polymer
Electrical Cable	Four Conductor, Foil shield, Polyurethane jacket, nominal OD = 7.9 mm
Interface	RS-485
Protocol	MODBUS
Baud Rate	115,200 bps
Temperature Accuracy	±0.5 °C
Ingress Protection	IP68 to 3 MPa (300 m head water)

[1] Calibrated Range: ±30°
[2] 99% confidence interval (i.e. 99 out of 100 individual readings fall within this tolerance).
[3] Includes random walk (changes between consecutive readings that have no discernible cause) and seismic noise during testing.
[4] Operating and standby current are for each individual beam drop in a string.
[5] Per entire string.
[6] Custom lengths available upon request.

ORDERING INFORMATION

6195-0.5M: MEMS Digital Tilt Beam, Triaxial sensor, for 0.5 m spacing
6195-1M: as above, 1 m spacing
6195-2M: as above, 2 m spacing
6195-3M: as above, 3 m spacing
6195-2FT: as above, 2 ft. spacing
6195-5FT: as above, 5 ft. spacing
6195-10FT: as above, 10 ft. spacing
6195T-0.5M: MEMS Digital Tilt Beam, Triaxial terminal sensor, for 0.5 m spacing
6195T-1M: as above, 1 m spacing
6195T-2M: as above, 2 m spacing
6195T-3M: as above, 3 m spacing
6195T-2FT: as above, 2 ft. spacing
6195T-5FT: as above, 5 ft. spacing
6195T-10FT: as above, 10 ft. spacing
6195-2: Mounting Hardware Kit
TLS-209: Rawl Setting Tool, ⅜"
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

COMPATIBLE READOUTS AND DATA LOGGERS

8800 and 8900 Series: GeoNet Wireless Mesh Data Acquisition System
8910 Series: GeoNet Wireless LoRa® Data Acquisition System
8920 and 8921 Series: GeoNet Cellular Data Loggers
8930 Series: GeoNet Wi-Fi Data Loggers
8940 Series: GeoNet Local Data Loggers
8600 Series: Data Loggers

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