

MODEL 6191



Model 6191 Biaxial MEMS Tilt Box.

APPLICATIONS

The Model 6191 MEMS Tilt Box is designed for permanent long-term monitoring of changes in tilt of structures such as:

- Dams
- Embankments
- Foundation Walls
- Retaining walls
- Buildings

OPERATING PRINCIPLE

The unit is mounted to a structure and measures tilt in biaxial directions, in vertical (Model 6191) or horizontal (Model 6191-H) orientations. Angular changes of as little as two arc seconds can be detected.

The unit consists of a MEMS (Micro-Electro-Mechanical Systems) tilt sensor, installed inside an IP66-rated aluminum housing. An internal thermistor is installed to measure temperature. It 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.

Tilt boxes can be mounted interdependently. They can also be combined in a string via a four-wire bus digital cable during field installation. A cable from the independent tilt box, or the endmost tilt box when utilized as a string, connects the unit (s) to the chosen readout (PC, data logger, SCADA system, etc.). The tilt box is designed to be used with GEOKON

Model 02-313P9LTD cable, meant for digital applications. This cable can be ordered at a pre-determined length and prepped at the factory. Alternatively, cable can be bought in bulk spools and prepped in the field. The output consists of calibrated tilt readings and temperatures for each tilt box. For strings, this information 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

6191 tilt sensors can be used with automated data acquisition systems, which allows a series of sensors to be continuously monitored for profiling purposes.

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

DATA ACQUISITION

The Model 6191 Tilt Box 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 Data loggers, Campbell Scientific data loggers, or any other device capable of operating as a Modbus RTU client and having an RS-485 port.



GeoNet Addressable Data Logger



String of interconnected Model 6191 Tilt Boxes.

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	±0.001° across ±5° angular range (±0.016 mm/m) ±0.0016° across ±15° angular range (±0.026 mm/m) ±0.0026° across ±30° angular range (±0.042 mm/m)
Operating Temperature	-40 °C to 80 °C
Temperature Accuracy	±0.5 °C
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
Interface	RS-485
Protocol	MODBUS
Baud Rate	115,200 bps
Ingress Protection	IP66
Tilt Box Material	Aluminum with powder coat finish
Mounting Bracket Material	Aluminum
Dimensions	Refer to the product instruction manual
Weight	0.9 kg (1.98 lb.)

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 sensor in a string.

⁵ Per entire string.

ORDERING INFORMATION

6191: MEMS Digital Tilt Box, Biaxial, for vertical installation, includes mounting hardware.

6191H: MEMS Digital Tilt Box, Biaxial, for horizontal installation, includes mounting hardware.

02-313P9LTD: Violet Polyurethane Cable, 8 mm (0.313") Ø, twisted pairs.

TLS-208: Rawl Setting Tool, 1/4"

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



Model 6191-H Biaxial MEMS Tilt Box, for horizontal installations.