

Model 1150

High-Accuracy Directional Sensor



D a t a s h e e t

Features

- High accuracy $\pm 0.1^\circ$ for toolface (roll) and inclination, $\pm 0.3^\circ$ for azimuth
- Digital serial input/output
- Small size 1.360" OD by 29.2" long
- Temperature compensated to 150°C

Applications

- Tensor Digital Drop-in Replacement
- Orientation of borehole logging instruments
- Directional drilling

Description

The Model 1150 Directional Sensor is designed to enable high accuracy measurement of the toolface (roll), inclination and azimuth orientation angles in borehole logging and drilling applications. The unit is configured to be a direct replacement for Tensor directional sensors. The length of the sensor is 29.2", which is the same length as Tensor units.

The 1150 data interface is implemented with a Maxim Max186 analog to digital (A to D) converter; the user accesses this converter by means of the exposed SPI port. Calibration constants are stored in a Microchip 24AA16 flash memory chip accessed by means of an exposed IIC interface. Both the A to D and flash memory design are Tensor compatible. The Tensor 10-pin bus is also implemented as a means to carry signals through the sensor.

The Model 1150 sensor contains both a 3-axis fluxgate magnetometer and a 3-axis accelerometer. The combination of these two sensor systems enables the toolface, inclination and azimuth angles of the 1150 reference frame to be determined. The toolface and inclination angles are calculated from the accelerometer sensor outputs. The magnetometer sensor outputs are used to calculate the system azimuth angle.



The 1150 sensor employs very high performance magnetometer and accelerometer sensors. To maintain high accuracy over the temperature range of the system, the sensors are temperature compensated. This enables an accuracy of $\pm 0.1^\circ$ for toolface and inclination and an accuracy of $\pm 0.3^\circ$ for azimuth to be achieved over the full temperature range of the system.

In addition to the Tensor A to D and flash memory interfaces, the Model 1150 has a digital serial interface. This interface is capable of transmitting either the magnetometer and accelerometer outputs or the system orientation angles. The data transmitted over the digital interface is temperature calibrated and can be transmitted in either ASCII or binary format. The ASCII protocol is based upon sending ASCII characters to the 1150 to obtain data. The data returned by the 1150 is transmitted as an ASCII data stream complete with carriage returns and line feeds so that it can be easily displayed on a video terminal (provided a TTL to RS232 conversion is made by the user). The binary protocol is used for high speed computer to computer interchange. In this case, one byte is sent to request data. The 1150 can be configured to transmit digital data upon command or can be configured to autosend data upon power up.

The serial in and serial out lines of the digital interface operate at TTL/CMOS levels and are normally set to operate at 9600 baud with one stop bit and no parity. Other baud rates can be user programmed. The electrical interface to the 1150 sensor is shown on the next page.

Table 1. Model 1150 Specifications

Angular Accuracy	
Azimuth	±0.3°
Roll (Toolface)	±0.1°
Inclination	±0.1°
Temperature Range	
Operating	-20 to +150°C
Storage	-55 to +175°C
Power	
Input Voltage Range	+/- 15V @ 40 mA
Physical	
Weight	1.5 lbs.
Size	1.360" OD x 29.2" long cylinder
Environmental Performance	
Shock Vibration	1000G 1ms half sine wave 20G rms 5-1000Hz
Digital Interface	
Logic Level	TTL / CMOS
Baud Rate	User programmable to 9600 Baud
Protocol	User selectable, ASCII or Binary
Connectors	
Top	MDM21PH003F (ITT Cannon)
Bottom	MDM15SH003B (ITT Cannon)

Figure 1. Model 1150 Pin Connection Diagram

