

SPI Signal Conditioner for Electrolytic Tilt Sensors

Part Number: 1-6200-005

Operating Specifications

Interface	SPI
Analog Input Resolution	16 bits (10 bits oversampled)
Operating Range	0% to 100% of sensor range
Supply Voltage	3.3 V DC to 5 V DC
Supply Current	6 mA @ 5 V DC, 4 mA @ 3.3 V DC
Operating Temperature	-40 °C to 85 °C
Storage Temperature	-40 °C to 125 °C
Sensors Controlled	1 or 2
Axes of Measurement	1 or 2
Temperature Sensor Range	-40 °C to 125 °C

Physical Characteristics

Housing	None
Electrical Connections	7 Pin, 2.54 mm (0.1") spacing
Weight	4 g
Length	32 mm (1.25")
Width	32 mm (1.25")
Hole Center	27 mm (1.05")

Ordering Information

Part Number	Description
1-6200-005	Signal Conditioner, 1 or 2 Axis, SPI

Compatible With

Part Number	Description
0717-4313-99	Tilt Sensor, ±50°, 2 Axis
0717-4315-99	Tilt Sensor, ±60°, 2 Axis
0717-4318-99	Tilt Sensor, ±60°, 2 Axis
0717-4319-99	Tilt Sensor, ±50°, 2 Axis
0717-4321-99	Tilt Sensor, ±40°, 2 Axis
0717-4322-99	Tilt Sensor, ±45°, 2 Axis
0717-4323-99	Tilt Sensor, ±50°, 2 Axis
0703-1602-99	Tilt Sensor, ±25°, 1 Axis
0703-0711-99	Tilt Sensor, ±3°, 1 Axis

Related Products

Part Number	Description
1-6200-006	Signal Conditioner, 1 or 2 Axis, RS-232
1-6200-007	Signal Conditioner, 1 or 2 Axis, Analog/PWM
1-6200-008	Signal Conditioner, 1 or 2 Axis, RS-485
1-6200-012	Signal Conditioner, 1 or 2 Axis, Analog/RS-232

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Description

The 1-6200-005 SPI signal conditioner can be used with any Fredericks electrolytic tilt sensor. This signal conditioner can be connected to a dual-axis tilt sensor or 1 or 2 single axis tilt sensors to provide single or dual-axis position measurement over the sensor's range.

Fredericks [0717 series wide range tilt sensors](#) can be mounted directly to the PCB for a complete inclinometer solution. Single-axis sensors must be mounted externally to the PCB and connected with wires.

Key Features and Benefits

- Very low power consumption
- Simple integration into a new or existing design
- Excellent resolution and repeatability of measurements
- -40 °C to 85 °C operating temperature for industrial applications
- Live text and video chat technical support

Applications

- [Recreational vehicle \(RV\) leveling systems](#)
- [Geotechnical and structural monitoring](#)
- [Construction tools, laser leveling](#)
- [Construction machinery and equipment](#)

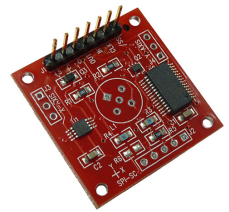
View the full list at www.frederickscompany.com/markets.

SPI Slave Information

Clock	From master, idle high, 500 kHz to 1 MHz
Data Transfer Edge	Clock high to low
Data Bits	8, MSB first
SPI Mode	2 (CPOL = 1, CPHA = 0)
Slave Select Polarity	Idle high, low when transferring data

SPI Commands, ASCII and Hexadecimal Values

'1', 0x31	X axis high byte of 16 bit output
'2', 0x32	X axis low byte of 16 bit output
'3', 0x33	Y axis high byte of 16 bit output
'4', 0x34	Y axis low byte of 16 bit output
'5', 0x35	Board temperature high byte of 10 bit output
'6', 0x36	Board temperature low byte of 10 bit output
'9', 0x39	Update all data (software version 2.0.0 and higher)



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Electrical Connections

J1 Pin 1 (+5)	Supply (+)
J1 Pin 2 (C)	Supply (-)
J1 Pin 3 (C)	Ground
J1 Pin 4 (OUT)	SDO, SPI slave data output
J1 Pin 5 (IN)	SDI, SPI slave data input
J1 Pin 6 (CLK)	SCK, SPI slave clock input
J1 Pin 7 (/SS)	SPI slave select
L1	Dual axis sensor connection
J3	Single axis sensor x axis connection
J4	Single axis sensor y axis connection

Converting Temperature Values

The board temperature output is a 10-bit value (0 to 1023). To convert that value to a temperature in °C, use the following equation:

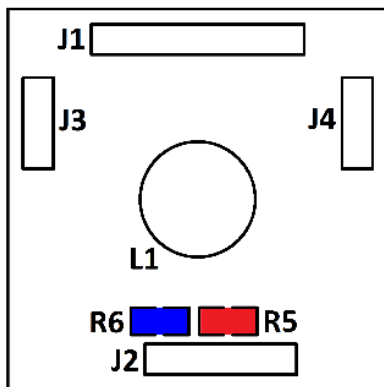
$$\text{Temperature in } ^\circ\text{C} = (((\text{output}/1023) * \text{supply voltage}) - 0.5) / 0.01$$

Board Configuration

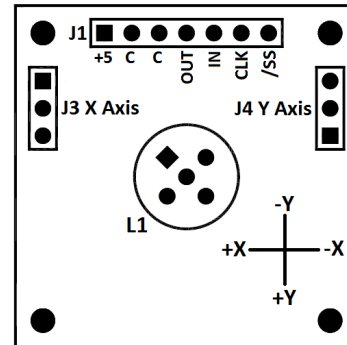
The 1-6200-005 signal conditioner can be configured to operate one dual-axis sensor or two single-axis sensors. Dual-axis sensors can be mounted directly to the board, whereas single-axis sensors must be mounted off the board and connected with wires.

The board must be configured for either dual-axis sensors or single-axis sensors. This configuration is determined by the resistor values of R5 and R6.

- For a dual-axis sensor: R5 (red) is 10 kΩ, R6 (blue) is not installed (open circuit). The sensor is connected to L1.
- For single-axis sensors: R5 (red) is not installed (open circuit), R6 (blue) is 1 kΩ. Sensors are connected to J3 and J4.

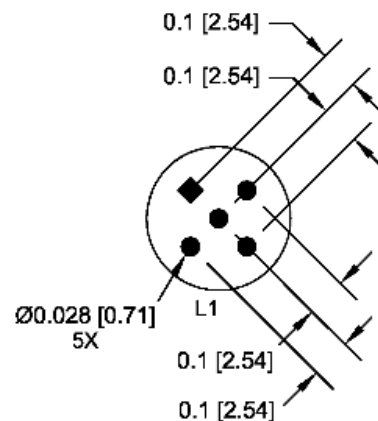
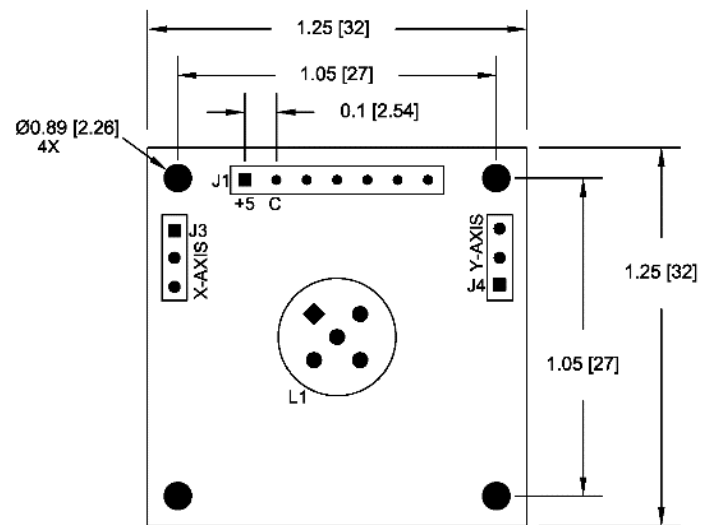


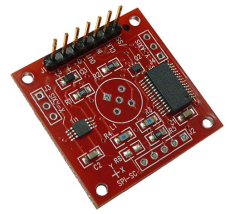
Pin Diagram and Direction of Measurement



Note that the direction of measurement only applies when a dual axis sensor is mounted on the PCB.

Dimensional Drawings





SPI Signal Conditioner for Electrolytic Tilt Sensors

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Example SPI Command Sequence

Update data and retrieve X and Y axis tilt values which both return 32768 (0° tilt), transmit and receive values are listed in hexadecimal:

```
[Master TX] 0x39 //update all values
[Master RX] Ignore. //no valid data in buffer yet
Delay 1 ms.
[Master TX] 0x31 //request x axis high byte
[Master RX] 0x2A //'*' response to 0x39 command, data updated
Delay 1 ms.
[Master TX] 0x32 //request x axis low byte
[Master RX] 0x80 //x axis high byte, response to 0x31 command
Delay 1 ms.
[Master TX] 0x33 //request y axis high byte
[Master RX] 0x00 //x axis low byte, response to 0x32 command
Delay 1 ms.
[Master TX] 0x34 //request y axis low byte
[Master RX] 0x80 //y axis high byte, response to 0x31 command
Delay 1 ms.
[Master TX] 0x39 //update all values
[Master RX] 0x00 //y axis low byte, response to 0x32 command
```

X axis value = 0x8000 = 32768 = 0° tilt

Y axis value = 0x8000 = 32768 = 0° tilt

Additional Documentation

AN1000	Electrolytic Tilt Sensor Excitation
AN1001	Temperature Compensation of Electrolytic Tilt Sensors
AN1003	Configuring Tera Term to Use with TFC Tilt Products
AN1005	Converting Tilt Angle to Degrees
AN1006	Obtaining Measurements from TFC Signal Conditioners

Certifications and Ratings

- RoHS Compliant

Company Information

Specialty Manufacturing Services That Promise Precision - Since 1935, The Fredericks Company has been a global provider and U.S. designer and manufacturer of the highest performance tilt and vacuum measurement products on the market, with manufacturing processes that ensure the reliability of our products.

Tilt Measurement Products and Sensors That Set Standards -

Fredericks' comprehensive tilt measurement product portfolio offers [electrolytic tilt sensors](#), [inclinometers](#), and [tilt switches](#). Engineered to outperform competing technology, our tilt sensors are accurate and repeatable with excellent resolution. Our tilt measurement products have no planned obsolescence and serve industries ranging from [construction](#) and [RV leveling](#) to aerospace applications and everything in between.

A Partnership That Prioritizes Uptime, Lead Time, and Service -

Fredericks guarantees customer satisfaction and our "not too big, not too small" operation is what enables us to offer a true partnership experience. Our dedicated representatives and engineers offer exceptionally responsive service and the fastest lead times in the industry, knowing that uptime is the key to your success. With anytime access to our leadership team and solutions that enhance your products, you will feel the Fredericks difference.

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