EL Tiltmeter SC
56802199

This equipment should be installed, maintained, and operated by technically qualified personnel. Any errors or omissions in data, or the interpretation of data, are not the responsibility of Slope Indicator Company. The information herein is subject to change without notification.

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Contents

EL Tiltmeter SC

Introduction

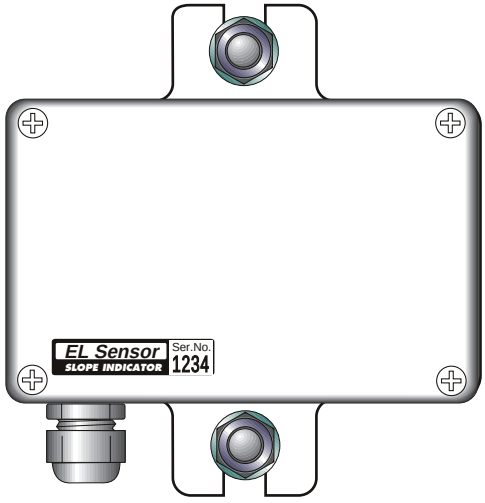
The EL Tiltmeter is used to monitor changes in the inclination of a structure. The resulting data can provide a record of movements and early warning of potential problems.

- Typical applications include monitoring the rotation of concrete dams, retaining walls, piers, and piles.
- Evaluating the performance of bridges and beams under load.

Compatible Readouts

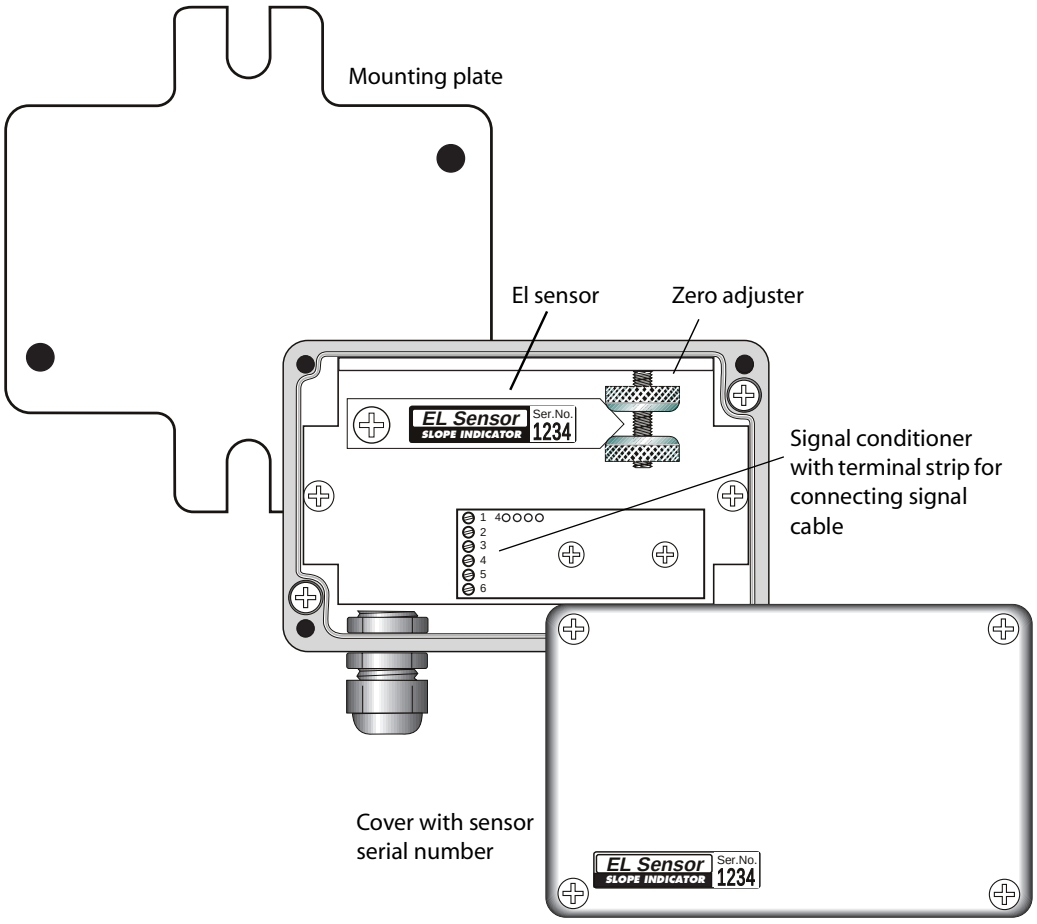
This tiltmeter is supplied with on-board signal conditioning which provides compatiblity with almost any data logger.

It requires a 5.5-15 Vdc power source and can be "zeroed" with a multimeter. It outputs readings in the ± 250 mV range.



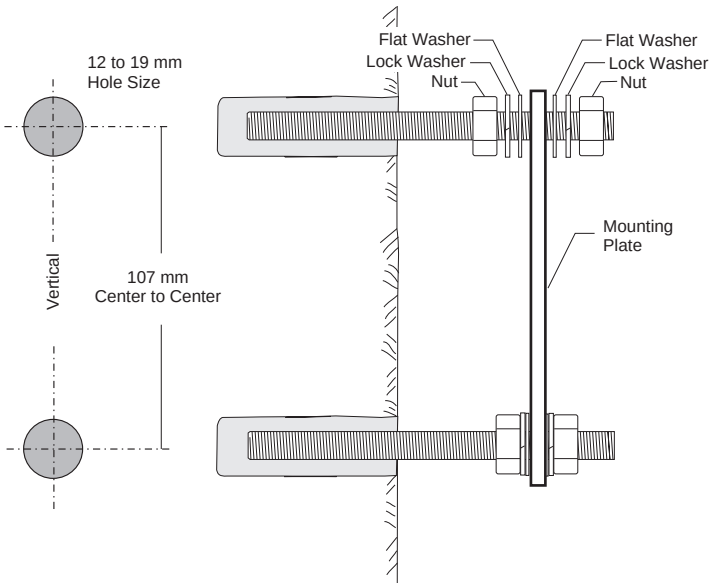
Components

Components of the EL Tiltmeter SC include a mounting plate, a NEMA enclosure, an EL sensor with zero-adjuster, and a signal conditioning board. Other components include an anchor kit and signal cable.

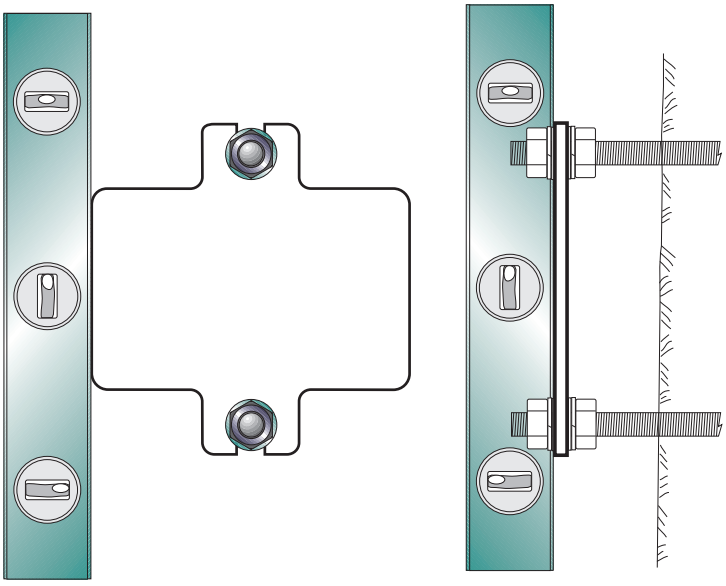


Installing Anchors

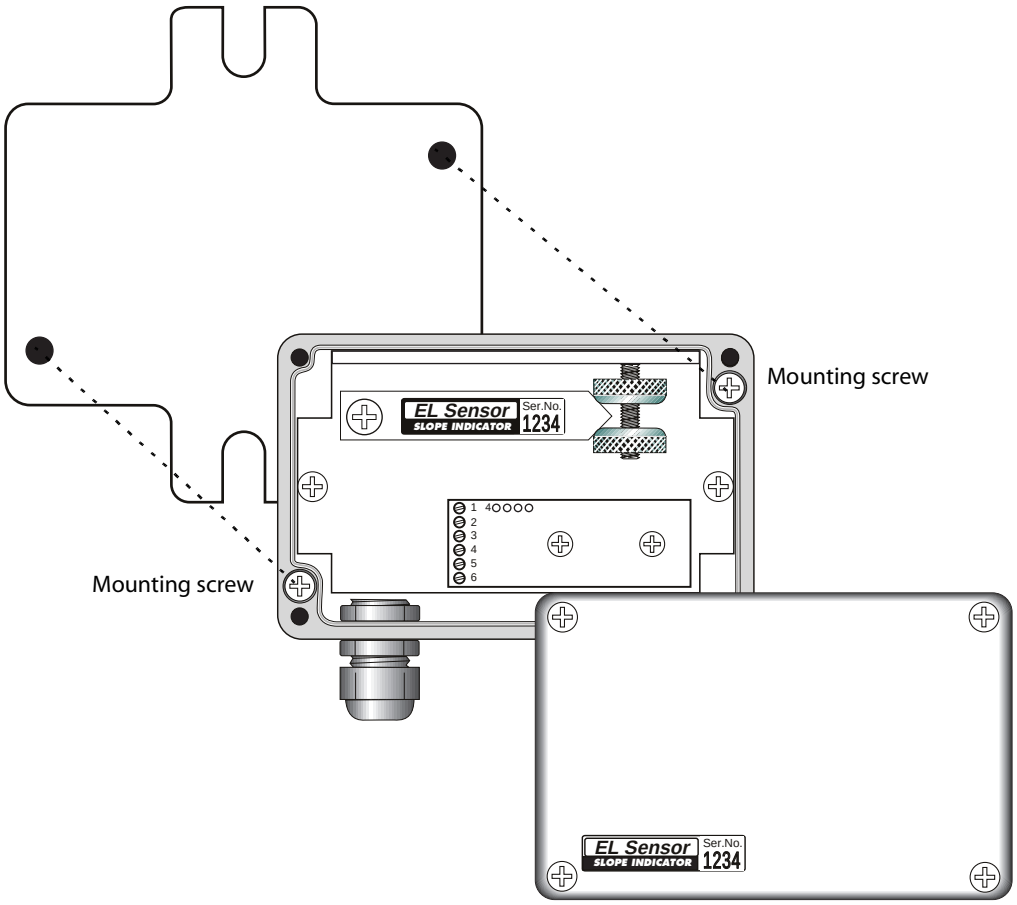
1. Mark locations for anchor holes as shown below.
2. Drill anchor holes in structure deep enough to embed about 50mm of anchor. Remove debris.
3. Attach mounting plate to anchors. This will keep the anchors parallel while grout hardens.
4. Mix epoxy grout as directed by manufacturer. Fill holes with grount, then insert anchors with mounting plate attached.



5. Use a level to check that the side and surface of the mounting plate are vertical, as shown below. Keep plate in correct position until grout hardens.



6. Screw tiltmeter to mounting plate.



Zeroing the Sensor

Overview

You must zero the tiltmeter to make full use of its narrow range. Be sure to finish mounting and wiring before you zero the sensor.

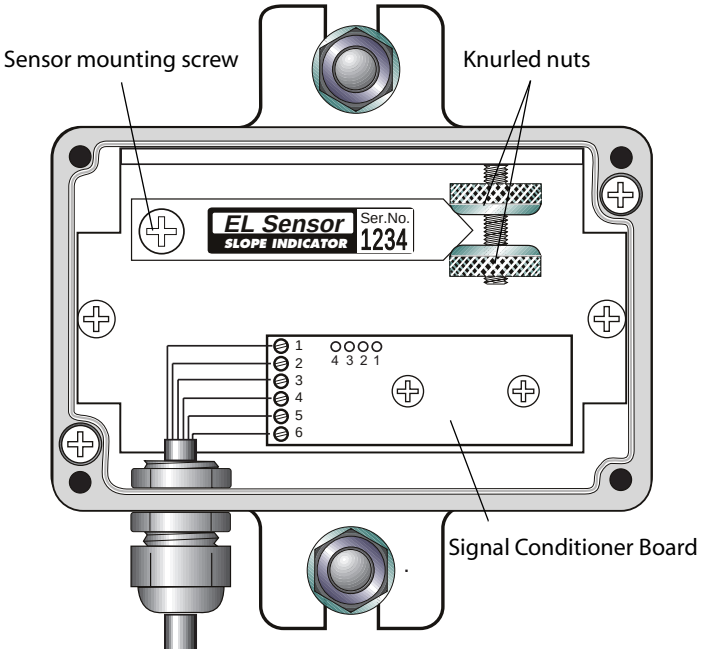
Equipment

Use either of the following devices for zeroing:

- DataMate MP.
- DC Voltmeter and Power Source. The voltmeter should display values in the low millivolt dc range. Examples include a Beckman Industrial DM15B voltmeter or a Radio Shack Digital Multimeter (22-802). The power source must supply between 5.5 and 15 Vdc. An alkaline 9-volt transistor radio battery is suitable.

Prepare Sensor

1. Loosen sensor mounting screw.
2. Using the knurled nuts, adjust the sensor until it is roughly horizontal.



Zeroing with the DataMate MP

1. Switch on.
2. Choose manual mode: EL SC RO.
3. Connect the signal cable to the bare-wire adapter (BWA) as follows. Wire color may vary:

Function	Sensor Terminal	Wire Color	BWA	Electrical
Power	1	Green	8	+Vdc power
	2	Black	6	Ground
Tilt Sensor	3	White	1	+Vdc output
	4	Red	2	- Vdc output
Thermistor	5		7	+Vdc

It is also possible to connect to the four pins on the signal conditioner board. You can obtain an appropriate connector at an electronics store and then wire as follows:

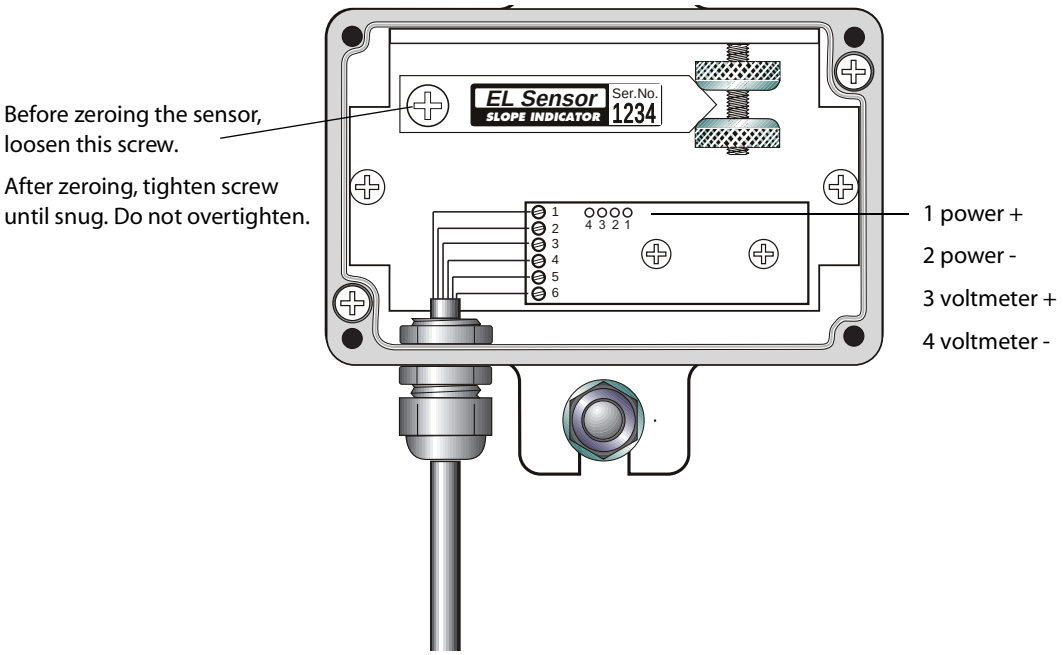
Function	Sensor Terminal	BWA	Electrical
Power	1	8	+Vdc power
	2	6	Ground
Tilt Sensor	3	1	+Vdc output
	4	2	- Vdc output

Adjust Zero

4. Move the knurled nuts up or down until the DataMate reads near zero.
5. Tighten the sensor mounting screw. It should be slightly more than finger tight.

Zeroing with a Voltmeter

1. Connect the power source to pins 1 (+) and 2 (-).
2. Connect the voltmeter to pins 3 (+ signal) and 4 (- signal).



Adjust Zero

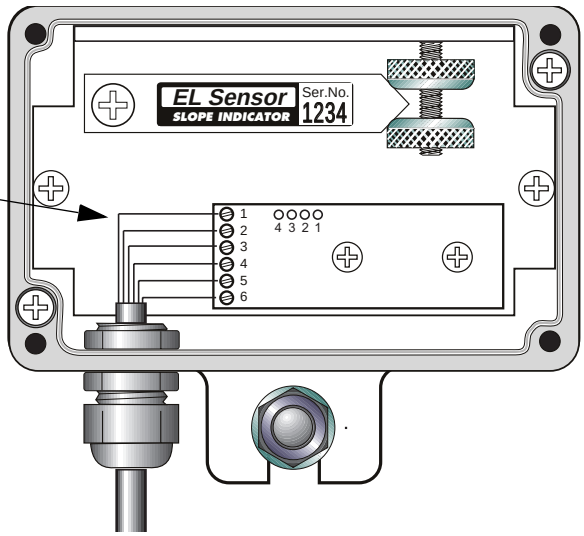
3. Move the knurled nuts up or down until the voltmeter reads near zero.
4. Tighten the sensor mounting screw. It should be slightly better than finger tight.

Taking Readings

Although readings are usually collected with a data logger, you can use the DataMate MP or a voltmeter to read the sensor too. DataMate MP connections are the same as used for zeroing the sensor.

If you want to read with a voltmeter, you must have a voltmeter capable of reading to hundredths of a millivolt. Connect a short length of wire to the tiltmeter so that you can read it without removing its cover. Use the wiring chart below.

Feed wire through cable gland and connect to terminals 1 through 6.



Wiring Chart

Function	Terminal	Electrical	Range
Power	1	+Vdc power	5.5 to 15 Vdc, requires 3mA max at 12 Vdc
	2	Ground	
Tilt Sensor	3	+Vdc output	±250 mV (differential)
	4	- Vdc output	
Thermistor	5 and 2	+Vdc	160 to 1820 mV
	6	Shield does not have to be connected for short cable.	

What do the readings mean?

Use the sensor calibration record to convert voltage readings to degrees of tilt. This is explained in the next section.

Data Reduction

Introduction

Data reduction is usually automated because it involves a large number of readings and a large number of calculations.

Here, we explain how to use the sensor calibration record and provide an example of converting a single reading from voltage to decimal degrees of tilt.

Calibration Record

A calibration record is provided with each sensor. Note that calibrations are unique for each sensor, so use sensor serial numbers to match sensors with their calibrations.

The table at right shows factors for sensor serial number 46294. Your sensors will have different factors

C0	-.00234415
C1	2.37404
C2	0.391697
C3	-25.9415
C4	-30.3059
C5	864.042

Applying Calibration Factors

Suppose you obtain a reading of 101.86 millivolts (0.10186V) from sensor 46294. How do you convert the voltage reading to degrees of tilt?

Converting sensor reading to mm per meter

Apply the C factors to the voltage reading as shown below. EL represents a reading in volts. C5 through C0 are factors that appear on the sensor calibration record. The result of the calculation is degrees of tilt.

degrees of tilt = $C5 \cdot EL^5 + C4 \cdot EL^4 + C3 \cdot EL^3 + C2 \cdot EL^2 + C1 \cdot EL + C0$

	C Factor	EL Reading	Value
C0	-.00234415		-.00234415
C1	2.37404	0.10186	.24182
C2	0.391697	0.10186^2	.004064
C3	-25.9415	0.10186^3	-0.02742
C4	-30.3059	0.10186^4	-0.00326
C5	864.042	0.10186^5	0.009474
degrees of tilt =			0.227

Converting the thermistor reading to degrees C.

The calibration record provides an equation for converting the thermistor reading to degrees C. You need the Toffset value from the calibration record and a thermistor reading. In the equation below, ET represents the thermistor reading in volts.

$$\mathbf{DegC = (58.6752 \cdot ET^5 - 278.839 \cdot ET^4 + 509.188 \cdot ET^3 - 449.099 \cdot ET^2 + 233.754 \cdot ET - 48.4917) - Toffset}$$