# VW
# Total Pressure Cell

## 52608299



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.



**SLOPE INDICATOR**
12123 Harbour Reach Drive
Mukilteo, Washington, USA, 98275
Tel: 425-493-6200  Fax: 425-493-6250
E-mail: solutions@slope.com
Website: www.slopeindicator.com

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# Introduction

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The total pressure cell measures the combined pressure of effective stress and pore-water pressure. Typical applications include:

- Monitoring total pressure exerted on a structure to verify design assumptions.
- Determining the magnitude, distribution, and orientation of stresses.

## Operation

Total pressure is the intergranular pressure in the soil (effective stress) combined with the pressure of water in the voids between soil grains (pore water pressure).

The pressure cell is formed from two circular plates of stainless steel whose edges are welded together to form a sealed cavity. The cavity is filled with a non-compressible fluid.

The cell is installed with its sensitive surface in direct contact with the soil. The total pressure applied to that surface is transmitted to the fluid inside the cell and measured with a vibrating wire pressure transducer.

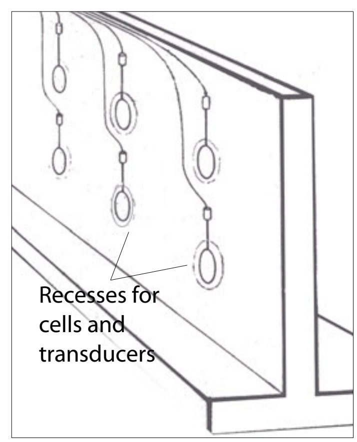
# Installation

## Overview

VW Pressure Cells are installed at the interface between a concrete structure and soil or rock around the structure. Pressure cells may also be embedded in soils such as clays.

- When mounted on a pre-cast structures, the cell is placed into a recess so that its sensitive side is flush with the surface of the structure.
- If cast into the structure, the cell is attached to the formwork before concreting.
- If cast into a diaphragm wall, where the soil itself becomes the formwork, the cell may be jacked out from the reinforcing cage to make contact with the soil before concreting begins.
- When embedded in fill, the cell is placed in a carefully excavated pocket and covered in several layers of hand-compacted fill before normal fill and compaction operations can resume. In embedded installations, cells are often installed in arrays, with each cell is placed in a different orientation.

## Attaching to Precast Structures

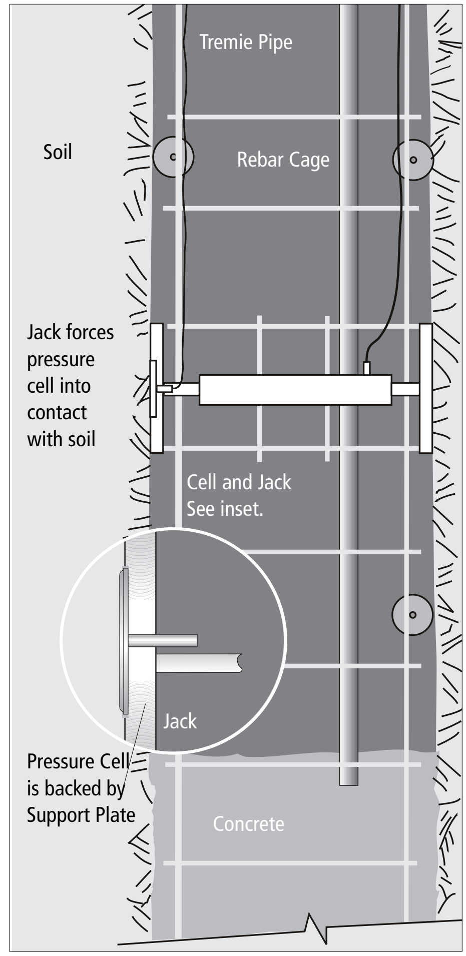



1. Prepare a recess in the formwork to hold the cell and the transducer.
2. Mount the cell with its sensitive surface flush with the structure. The cell must remain in place during backfilling. Sometimes a pad of cement mortar is placed within the recess and then the cell is pressed into the pad until a layer of mortar about two to five thick remains between the cell and the structure.

## Attaching to Formwork

1. Fix the cell to the formwork so that its sensitive surface will be flush with the concrete. Sometimes a layer of soft sealing material is wapped around the rim of the cell.
2. Protect the sensor and its signal cable so that it will not be damaged during concreting.

## Casting into a Diaphragm Wall



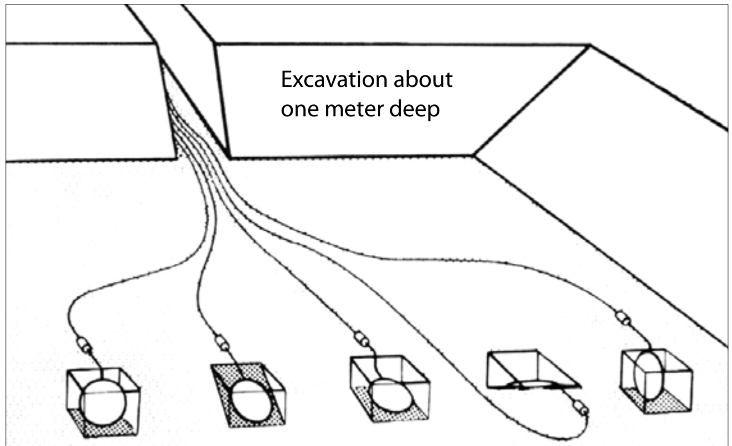

A specially configured "jackout cell" is available for installation in cast-in-place structures, such as diaphragm walls. Its name is derived from the use of a hydraulic jack that is activated to keep the cell in contact with the soil during concreting.

The jack-out cell is installed in the reinforcing cage, as shown in the drawing. The signal cable and hydraulic hose are secured, and the cage is lowered into the slurry trench.

When the cage is in position, the jack is activated and locked, forcing the cell into contact with the soil. The jack acts on the support plate, rather than directly on the cell, to prevent distortion of the cell. An equal force is applied to the reaction plate.

The trench is then concreted. In the illustration above, the jack has been activated, and the cell is in contact with the soil. Concrete is being delivered through a tremie pipe and will eventually displace the slurry.

## Installation in Soils




Pockets for cells spaced about one meter apart.

1. Make a one-meter deep excavation in the fill. The excavation should be large enough to accommodate all of the pressure cells, spaced at least one meter apart. The floor of the excavation should be levelled and compacted. Also excavate a trench for cables.

2. Carefully excavate individual pockets for each cell. Most specifications say that the pockets should be about twice the size of the cells. One surface of the pocket should be flat so it can hold the cell in the proper orientation.

3. Remove any rocks from the pockets. Place the cell in the pocket and check that a reading can be obtained. Then backfill the pocket, using the excavated soil when possible (without stones and at the same moisture content).

4. The main excavation should then be backfilled with the same material at unchanged water content. Three lifts of 100 to 200 mm (4 to 8) should be placed and compacted by hand operated equipment before completing the backfill with light mechnical equipment. At least 1 meter of fill should be placed this way before heavy vibratory rollers are used.

# Taking Readings

## Introduction

These instructions tell how to read the VW presssure transducer with Slope Indicator's portable readouts.

Instructions for reading VW sensors with a Campbell Scientific CR10 can be found at www.slopeindicator.com. Go to Support - Tech Notes and click on the link titled "CR10-VW Sensors."

## Reading with the VW Data Recorder

1. Connect signal cable to the data recorder:

| Binding Posts | Wire Colors | |
|---|---|---|
| VW | Orange | Red |
| VW | White & Orange | Black |
| TEMP | Blue | White |
| TEMP | White & Blue | Green |
| SHIELD | Shield | Shield |

2. Choose Hz + RTD or Hz + Thermistor.
3. Select the 1400-3500 Hz range.
4. The recorder displays a pressure reading in Hz and a temperature reading in degrees C.

## Reading with the VWP Indicator

1. Connect signal cable to the jumper from the VWP indicator, as shown in the tables below.
2. Read the settlement cell: Select the 1.4-3.5 kHz range with the Sweep key. Select Hz with the Data key.
3. Read the temperature sensor: Select °C with the Data key. Note that the VWP Indicator reads RTDs only and cannot read thermistors.

### Standard Jumper 52611950

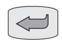
Connect alligator clips as shown below:

| Clips | Wire Colors | | Function |
|---|---|---|---|
| Red | Orange | Red | VW |
| Red | White & Orange | Black | VW |
| Black | Blue | White | TEMP |
| Black | White & Blue | Green | TEMP |

## Reading with the DataMate MP

The DataMate MP allows you to choose engineering units for your readings. However, for ease of data reduction, we recommend that you record readings in Hz. See the DataMate MP manual for directions on programming.

### Manual Mode

1. Connect the DataMate to the sensor (see connection table below).
2. Switch on. Press  (Manual Mode).
3. Scroll through the list to find "Vibrating Wire Hz."
4. Press  to excite the sensor and display a pressure reading in Hz and a temperature reading in degrees C. Note that this provides readings only for RTDs, not thermistors
5. Obtain barometer reading separately.

### Connections

The DataMate jumper cable has a universal connector that connects directly to a universal terminal box or to signal cables that are terminated with a universal connector. A bare-wire adapter (BWA) is also supplied with the DataMate. It allows connection to wires of the signal cable as shown below:

| Terminals on BWA or Terminal Box | Wire Colors | | Function |
|---|---|---|---|
| 5 | Blue | White | RTD |
| 6 | White & Orange | Black | VW |
| 7 | White & Blue | Green | RTD |
| 8 | Orange | Red | VW |
| 10 | Shield | Shield | Shield |

# Data Reduction

## Overview

Readings from the VW pressure transducer are typically in Hz, rather than in units of pressure. To convert the Hz reading to units of pressure, you must apply factors listed on the sensor calibration record.

## Sensor Calibration Record

Each VW transducer has a unique calibration. Use the sensor serial number to match the sensor with its calibration record.

### Conversion Factors

**ABC Factors:** Your calibration record may list these as "manual" ABC factors. They are used to convert Hz readings to various engineering units. They can be used in programmable readouts, such as the DataMate MP, or they can be used in spreadsheets. Keep in mind that it is always a good idea to record unprocessed readings (Hz and °C). Processing on your PC is almost always preferable to processing in the readout or data logger.

**IDA ABC Factors:** These factors are used to program "retired" readouts, such as the VS DataMate and the IDA system. These readouts can be programmed to provide readings in Hz and °C.

### Temperature Correction Factors

These two factors can be used to correct the pressure reading for temperature effects. These factors are applied to the temperature reading that you obtain from the sensor's built-in thermistor or RTD. Older calibration records list a temperature coefficient.

### Temperature Offset

The temperature offset shows the difference between a reading taken with the transducer's built-in thermistor or RTD and a reading taken with an NIST-traceable temperature sensor.

If you are interested in more accurate temperature values, add the offset to your temperature readings. However, do not add the offset when you are calculating temperature corrections.

## Converting Hz Readings to Units of Pressure

1. Choose a unit of pressure from the ABC factors listed on the sensor calibration record.
2. Apply the factors as follows.Apply the factors as follows:

   Pressure Reading = $Ax^2 + Bx + C$

   Where x is the Hz reading and A, B, and C are factors listed on the sensor calibration record

## Finding Changes in Pressure

Subtract the initial reading from the current reading. A positive value indicates increased pressure. A negative reading indicates decreased pressure.

$\Delta Pressure = Pressure_{current} - Pressure_{initial}$