

PT100 Temperature Sensor User Manual



**What's this manual about?**

This manual tells you about the PT100 Temperature Sensor and how to use it to measure temperature in concrete, rock and soil.

Who does this apply to?

Installers, field engineers and technicians using the PT100 Temperature Sensor

Welcome!

Thank you for choosing the PT100 Temperature Sensor.

This manual has been written to help you utilise all of the functions of the PT100 Temperature Sensor. Please read this manual thoroughly before use to help avoid any problems and keep it handy when using the PT100 Temperature Sensor.

PT100 Temperature Sensor

The PT100 Temperature Sensor is used to monitor temperature in concrete, rock and soil.

The sensor is ideal for monitoring temperature during concrete curing, for evaluating seasonal variations within ground and structures and to interpret temperature related stress and volume changes in dams.

The PT100 Temperature Sensor consists of a platinum element that changes resistance with temperature and the resulting resistance change is converted to temperature using a handheld readout or data acquisition system.

The element incorporates platinum as this is a superior, chemically inert material that has the most stable resistance over the largest temperature range. This allows for a more predictable change in resistance with a higher degree of accuracy and repeatability over a far wider temperature range.

PT100 Temperature Sensors provide high accuracy with low drift, making them more suitable than Vibrating Wire and Thermocouple sensors for precision applications.

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Part I – Overview

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Introduction: Important Information

The following symbols are used throughout the manual



IMPORTANT
INFORMATION



QUESTION



WARNING



TIP



! Important: Failure to adhere to the warnings in this manual may result in network disruption and possible data loss.

Failure to observe the warning may result in injury, product malfunction, unexpected readings or damage to the product that may invalidate its warranty.



Tips give additional information that may be helpful when using a PT100 Temperature Sensor

PRODUCT CHANGES

Soil Instruments has an on-going policy of design review and reserves the right to amend the design of their product and this instruction manual without notice.

WARRANTY

Refer to our terms and conditions of sale for warranty information. The batteries are a consumable item and are excluded from the warranty.

DISPOSAL



Products marked with the  symbol are subject to the following disposal rules in European countries:

- This product is designated for separate collection at an appropriate collection point
- Do not dispose of as household waste
- For more information, contact Soil Instruments or the local authority in charge of waste management.

System Description

Things You Need to Know About the PT100 Temperature Sensor

FEATURES

- High accuracy and repeatability
- Predictable change in resistance
- Long-term stability over a wide temperature range
- Suitable for manual or remote reading and datalogging
- Strong, screened and flexible cable

BENEFITS

- Precise, high quality data
- Reliable data that is easy to interpret
- Suitable for long-term monitoring due to stable, drift free readings
- Can be read with a handheld readout or automated using data acquisition software, such as 'Argus' monitoring software
- Can be used with long cable lengths (up to 600m)

System Components

THE PT100 TEMPERATURE SENSOR

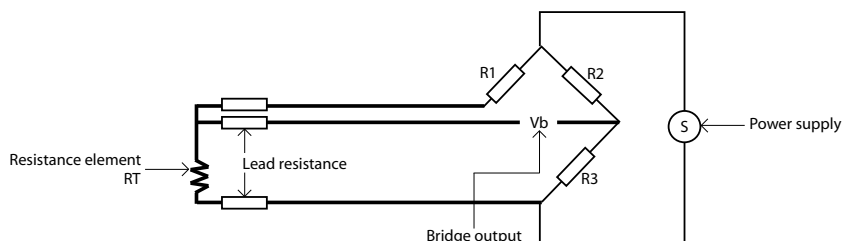
The Soil Instruments PT100 Temperature Sensor uses a three wire configuration to minimise the effects of lead resistance, therefore providing higher accuracy and repeatability.

The two leads to the sensor are attached to adjoining arms with a lead resistance in each arm of the bridge, which cancels out any resistance errors as the two lead resistances are precisely the same.

The PT100 temperature sensor consists of a 100Ω platinum sensing resistor (RTD) connected to a 4 core polyurethane cable encapsulated within a 10mm diameter Stainless Steel housing.

The sensing element has a theoretical sensing range of -200 to $+650^{\circ}\text{C}$ however its practical range is limited by the connecting cable and housing construction, therefore our recommended range is -20 to $+100^{\circ}\text{C}$.

Details of the PT100 Temperature Sensor



Quick Start Guide to Using the PT100 Temperature Sensor




Follow the precautions outlined in this manual at all times to properly maintain the PT100 Temperature Sensor.

- **Do not drop the sensor;** the temperature sensor may malfunction if subjected to strong shocks or vibrations
- **Do not immerse the handheld readout;** the readout has been designed to be water resistant to rain and jets of water but may malfunction if fully immersed under water
- **Keep the handheld readout away from strong magnetic fields;** do not use or store this device in the vicinity of equipment that generates strong electromagnetic radiation or magnetic fields
- **Do not expose the handheld readout to extremes of temperature;** do not expose to extreme hot or cold temperatures for long periods of time

BEFORE YOU GO TO SITE:

Unpack the PT100 Temperature Sensor and handheld readout and perform the following equipment test and setup procedure.

STEP	ACTION
1	Remove the rugged outer rubber case from the readout unit
2	Remove the two screws at either side of the battery compartment and remove the cover
3	Insert two AA batteries into the readout following the instructions on the battery housing, ensuring the batteries are placed with the correct polarity
4	Replace the battery compartment cover
5	Replace the two screws, making sure they are fully tightened
6	Replace the rubber case
7	Carefully line up the four pin plug with the socket on the top of the readout and push together; once inserted, tighten up the thumb screw on the plug until secure
8	Connect the pre-prepared wires from the temperature sensor to the corresponding crocodile clips
9	Turn on the readout
10	Select the desired temperature units by pressing the  key. The selected unit is confirmed by °C or °F on the display and once set, is retained when the instrument is switched off
11	Check the readout is displaying a stable reading for the temperature sensor




Ensure the screws holding the battery compartment are securely tightened when inserting or changing the batteries to maintain the waterproof rating.

**WHEN YOU ARE
IN THE FIELD:**

Soil Instruments recommend a **basic** skill level for using the PT100 Temperature Sensor.

STEP	ACTION
1	Place the PT100 Temperature Sensor into the medium to be monitored
2	Connect the pre-prepared wires from the temperature sensor to the corresponding crocodile clips
3	Turn on the readout
4	Check and record the reading displayed on the readout
5	Wire the sensor into a datalogger if using an automated system



The readout will automatically switch off after 12 minutes unless any key is activated or the instrument is in **MAX/MIN** mode. This function can be disabled by holding down the  key when the unit is switched on

Please refer to *Part IV – Appendix A – Datalogger Wiring Diagram* in this manual for more details.

Part II – Detailed PT100 Temperature Sensor User Guide

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Operating the Handheld Readout

INSTALLING THE BATTERIES INTO THE HANDHELD READOUT

The handheld readout is supplied with a rubber rugged case (IP65/67) with a belt clip attached to the underside.

To install the batteries you must first remove the rubber case from the readout. Once the case is removed, you will find instructions for correct battery polarity on the back of the readout.

Remove the two screws at either side of the battery compartment and remove the cover.


Insert the batteries ensuring they are fitted with the correct polarity before replacing the cover. Replace the screws and tighten securely to maintain waterproofing.

Replace the rubber case.



Ensure the screws holding the battery compartment are securely tightened when inserting or changing the batteries to maintain the waterproof rating.

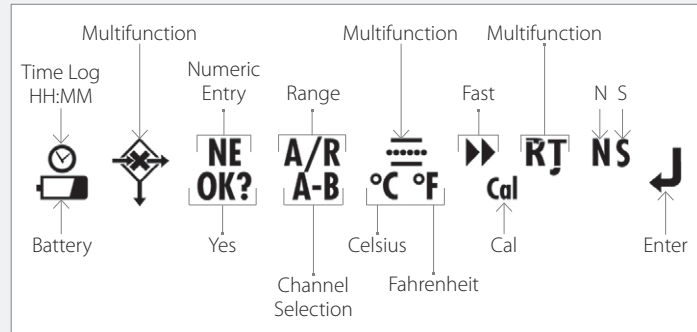


If the  symbol appears on the display, replace the batteries.

Menu Display

OVERVIEW

The display screen presents a variety of options via icons, depending on the function selected; a full icon overview is illustrated in the following diagram.



ON AND OFF FUNCTIONS

The handheld readout is switched on and off using the **ON** and **OFF** keys.

If you require the backlight, press and hold the **ON** key to activate this function.

The readout will automatically switch itself off after 12 minutes of inactivity, unless the device is in **MAX/MIN** mode, or any key is pressed during this time. This function can be disabled by holding down the \diamond key when the unit is switched on; the function will then be de-activated until the readout is manually switched off.



The readout will automatically switch off after 12 minutes unless any key is activated or the instrument is in **MAX/MIN** mode. This function can be disabled by holding down the \diamond key when the unit is switched on.



To turn on the backlight, press and hold the **ON** key.

MAX/MIN RECORDER

The **MAX/MIN** recorder stores the maximum and minimum temperature readings. To start **MAX/MIN** recorder, press the \diamond key. The readout will display alternating \wedge \vee symbols and the current reading. Press the \diamond key again to display the maximum temperature reading; the \wedge symbol will be displayed. Press the \diamond key again to display the minimum temperature reading; the \vee symbol will be displayed. To reset the **MAX/MIN** recorder function switch the readout off.



Some functions may be unavailable when information is stored in **MAX/MIN** mode to prevent the parameters mixing whilst recording.

OPEN CIRCUIT

If the sensor is not properly connected, the readout will display **O-C** for open circuit until the problem is resolved.



if the readout is in **MAX/MIN** mode, **O-C** will continue to be displayed, even after the open circuit has been cleared.

OUT OF RANGE

If the sensor is out of range, the readout will display **OUT**.

DISPLAY HOLD

The \diamond key will hold the display and prevent any changes. When activated, the \diamond symbol will appear on the display, press the \diamond again to return to the normal display.

SETTING THE TEMPERATURE UNIT

The readout has the option of displaying readings in $^{\circ}\text{C}$ (Centigrade) or $^{\circ}\text{F}$ (Fahrenheit). The desired unit is set by pressing the \odot key. When the required unit is selected, the display will show $^{\circ}\text{C}$ or $^{\circ}\text{F}$, respectively and the setting will be retained.

SPEEDREAD FUNCTION

The **SpeedRead** function can be used to measure poor thermal conductivity items as it enables an indicative reading within 14 seconds; however, using this function will reduce the accuracy to $\pm 2^{\circ}\text{C}$.

To correctly use the **SpeedRead** method, the sensor must be in good thermal contact with the medium to be measured, prior to activating the **SpeedRead** function. The difference between the initial sensor temperature and the medium under test is first required using a steep temperature gradient.

Once the sensor has been placed into the medium to be monitored, press the >> key. The ►► symbol will appear and **FAST** will flash on the display until the correct reading is shown and the ◇ symbol is displayed. The reading will then automatically hold until the ◇ key is pressed, after which normal mode will be resumed. If the temperature of the sensor and the medium to be monitored is too similar, a faster reading may not be possible, in which case the ►► symbol will be cancelled and the readout will automatically return to normal mode.



using the **SpeedRead** function will reduce the accuracy to $\pm 2^{\circ}\text{C}$.

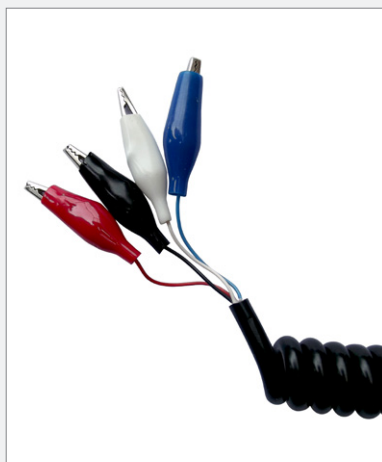
RANGE LOCK

All instruments have a 0.1° resolution from -199.9°C to $+199.9^{\circ}\text{C}$ (-199.9°F to $+392.8^{\circ}\text{F}$) and a 1° resolution outside this temperature range. The **Range Lock** will set the display to 1° resolution. To set **Range Lock**, press the **A/R** key, to cancel **Range Lock**, press the **A/R** key again; **A/R** will be shown on the display.

Connecting the Temperature Sensor

CONNECTING TO READOUT VIA LEAD

The readout is supplied with an expandable lead with a four pin male plug at one end and crocodile clips on the other.




Carefully line up the four pin plug with the socket on the top of the readout and push together; once inserted, tighten up the thumb screw on the plug until secure tightened.



Ensure the four pin plug and socket connection are properly aligned before pushing together to avoid damage to the connector pins.



If the  symbol appears on the display, replace the batteries.



To turn on the backlight, press and hold the **ON** key.

CONNECTING THE SENSOR TO A DATALOGGER

There are three ways to connect the sensor to a datalogger depending on the cable length and the precision required. You can find the three options and wiring for each in Appendix A.

Please refer to *Part IV – Appendix A – Datalogger Wiring Diagram* in this manual for more details.

Part III – Maintenance Guide

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Maintaining the PT100 Temperature Sensor




Follow the precautions outlined in this manual at all times to properly maintain the PT100 Temperature Sensor.

CABLE MAINTENANCE

The PT100 Temperature is a sensitive piece of equipment and must be handled with care; ensure that you adhere to the following precautions when handling the instrument to maintain full working order:

- **Do not drop the sensor;** the temperature sensor may malfunction if subjected to strong shocks or vibrations
- **Do not immerse the handheld readout;** the readout has been designed to be water resistant to rain and jets of water but may malfunction if fully immersed under water
- **Keep the handheld readout away from strong magnetic fields;** do not use or store this device in the vicinity of equipment that generates strong electromagnetic radiation or magnetic fields
- **Do not expose the handheld readout to extremes of temperature;** do not expose to extreme hot or cold temperatures for long periods of time

BATTERY REPLACEMENT

The  symbol on the readout display indicates that the battery levels are low and the batteries need replacing.

The readout requires two AA batteries.

STEP	ACTION
1	Remove the waterproof outer rubber case from the readout unit
2	Remove the two screws at either side of the battery compartment and remove the cover
3	Insert two AA batteries into the readout following the instructions on the battery housing, ensuring the batteries are placed with the correct polarity
4	Replace the battery compartment cover
5	Replace the two screws, making sure they are fully tightened
6	Replace the rubber case

Part IV – Appendices

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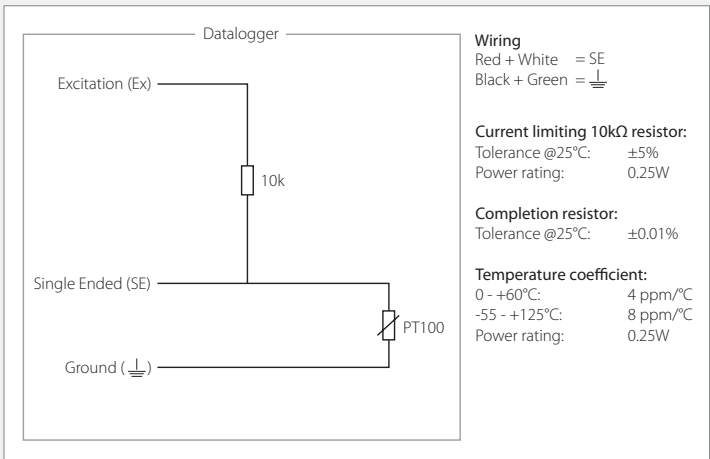
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Appendix A - Datalogger Wiring Diagram

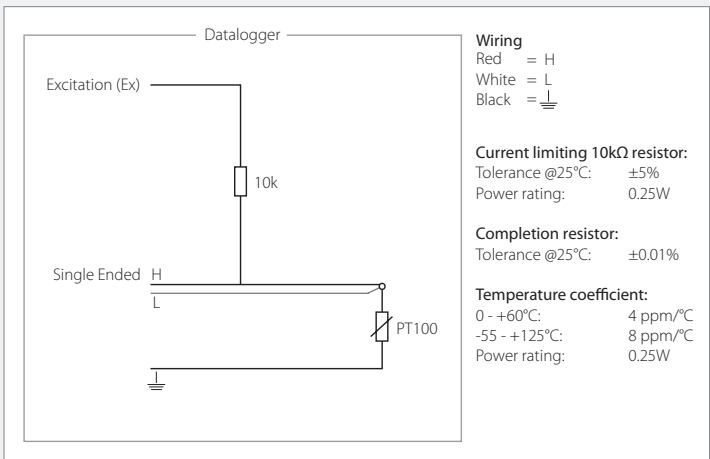
LOWER PRECISION

Lower Precision Measurements (or short cable length)

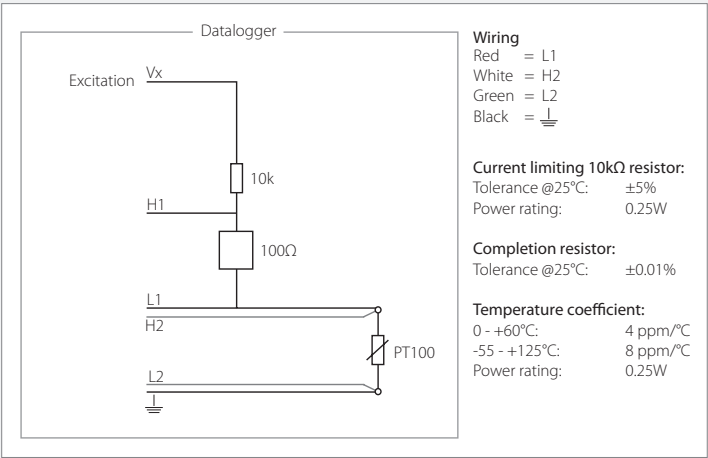


HIGH PRECISION

High Precision Measurements (or medium to long cable length)



Very High Precision Measurements (or very long cable length)



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