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Voltage ±30 V (TRMS) Sensor

Product Number: ENVLT102

Overview

The Voltage sensor measures voltage between -30 to 30 V using the highly accurate True Root Mean Square (TRMS) method. This differential sensor is capable of measuring both direct and alternating voltage and it is ideal for use in a wide range of Physics and Chemistry experiments.

The Voltage sensor has floating inputs, meaning you can connect any number of voltage sensors to a circuit without shorting them.

The sensor has two durable banana plugs for easy connection.

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Typical experiments

Electricity and Magnetic Field

- EMF and internal resistance
- V-I characteristics of a wire, a light bulb and a diode
- Resistance of a wire – Ohm's Law
- Series and parallel circuits
- Charging and discharging a capacitor
- Investigating the transformer
- Specific heat

How it works

When a differential voltage is applied to the sensor it is converted to a voltage between 0-3 V then passed through an Analog-to-Digital convertor which produces the voltage count. When measuring alternating voltage, the sensor measures this voltage, squares the values and then uses the square root of the results to determine the true measurement. This True Root Mean Square (TRMS) reading is considered the most accurate way of measuring voltage. The Voltage sensor is protected from input voltages of up to 220 V.

Sensor specification

Instantaneous range	±30 V
Effective (TRMS) range (DC)	0 to 30 V Effective (TRMS)
range (Sine wave):	0 to 21 V Input Voltage AC or DC
Accuracy – Instantaneous	±1.5 % over entire range
Accuracy - Effective (TRMS)	±3 % over entire range
Resolution Instantaneous	14.6 mV
Resolution Effective (TRMS)	7.3 mV
Minimum Sample Rate	1,000 samples per second (TRMS mode)
Input Resistance	5 MΩ
Bandwidth - Instantaneous	0 to 10 KHz
Bandwidth – Effective (TRMS)	20 Hz to 10 KHz
Protection	Up to 220 V
Common mode signal	Max ±40 V

Note: sensor cables sold separately

Technical Notes

- In order to get more accurate results, when measuring TRMS, it is best to set the Sampling Rate to 10 times the sample signal's frequency.

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- **Warning** – extreme caution should be taken when experimenting with electricity. These experiments should only be conducted in the presence of a teacher or supervisor
- **Warning** – Keep all liquids away from any electricity experiments
- **Warning** - This sensor is designed for up to 30 volts, never use for higher voltages
- **Warning** - This sensor is not designed to measure line voltage. Never connect this sensor to a wall socket
- For more accurate measurements connect the sensor's negative input (black) to the power source negative input (ground)
- The Voltage sensor is equipped with built-in protection from voltages of up to 220 V
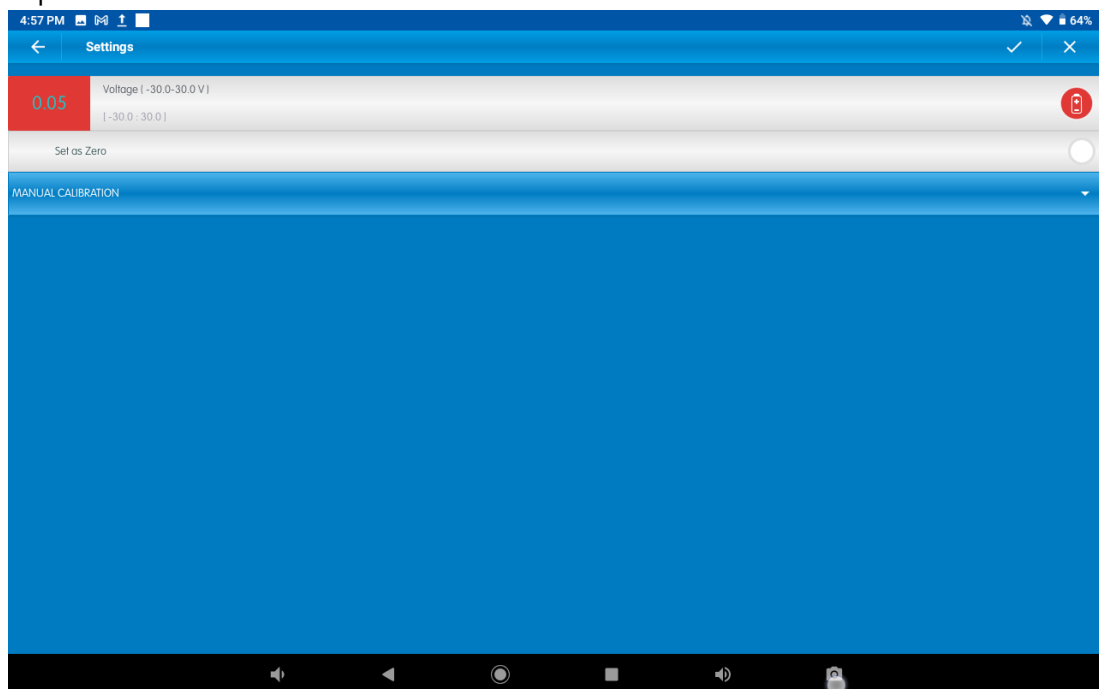
Calibration

The Voltage sensor requires no calibration.

For better accuracy the sensor can also be calibrated in one of two ways – Set Zero and Two Point Calibration.
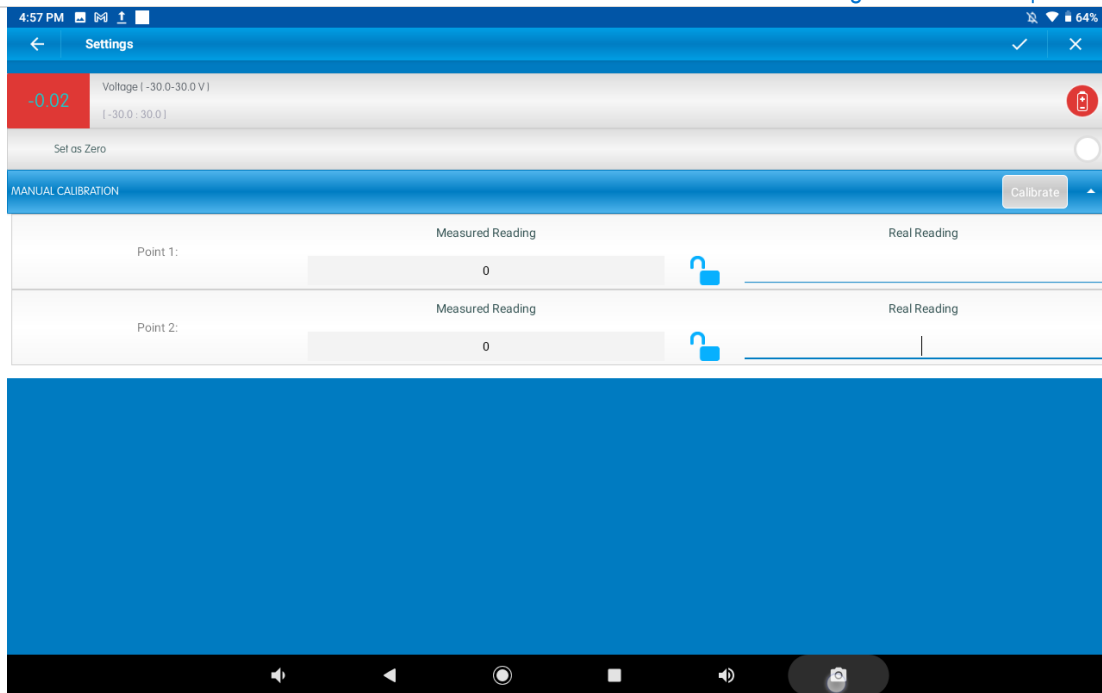
Android

1. Tap Sensors
2. Tap on the arrow icon

Set Zero Calibration

1. Flip the Set as Zero switch to set the current value as the zero or base value.

Two Point Calibration

1. Tap Manual Calibration

2. Prepare something of a known voltage. Enter this known value in the Point 1, Real Reading field

3. Measure the voltage and wait for the readings to stabilize.

4. Tap the lock icon

5. Prepare something of a known voltage. Enter this known voltage in the Point 2, Real Reading field

6. Measure the voltage and wait for the readings to stabilize.

7. Tap the lock icon

8. Tap Calibrate.

Note: For the most accurate results try to calibrate the sensor with one Real Reading under the expected results and one Real Reading over the expected results.

Desktop
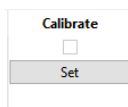
Go to full setup window

Set Zero Calibration

In the Current Reading column, click Set to set the current value as the zero or base value.
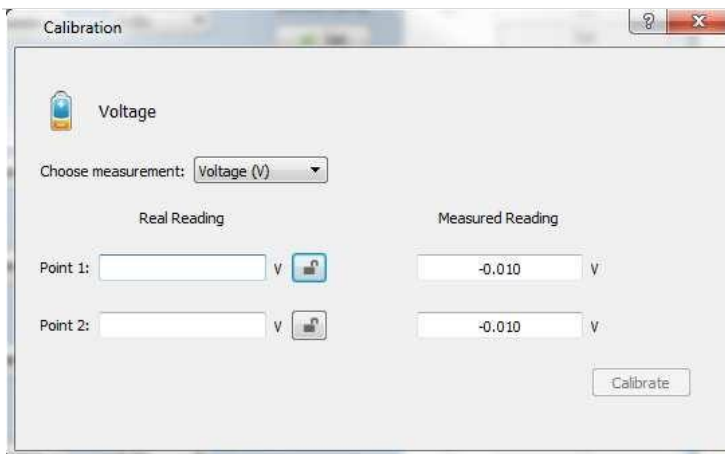
Clicking on Reset cancels this action

Two Point Calibration

1. click Set in the Calibration column


2. The Calibration window will appear

9. Prepare something of a known voltage. Enter this known value in the Point 1, Real Reading field

10. Measure the voltage and wait for the readings to stabilize.

11. Tap the lock icon

12. Prepare something of a known voltage. Enter this known voltage in the Point 2, Real Reading field

13. Measure the voltage and wait for the readings to stabilize.

14. Tap the lock icon

15. Tap **Calibrate**.

Note: For the most accurate results try to calibrate the sensor with one Real Reading under the expected results and one Real Reading over the expected results.

Data logging and analysis

Android

1. Take your einstein™ Tablet OR pair your einstein™ LabMate with your Android or iOS tablet via Bluetooth
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLAEx and then tap on IAB Start an Experiment
4. MiLABEX will automatically detect the sensor
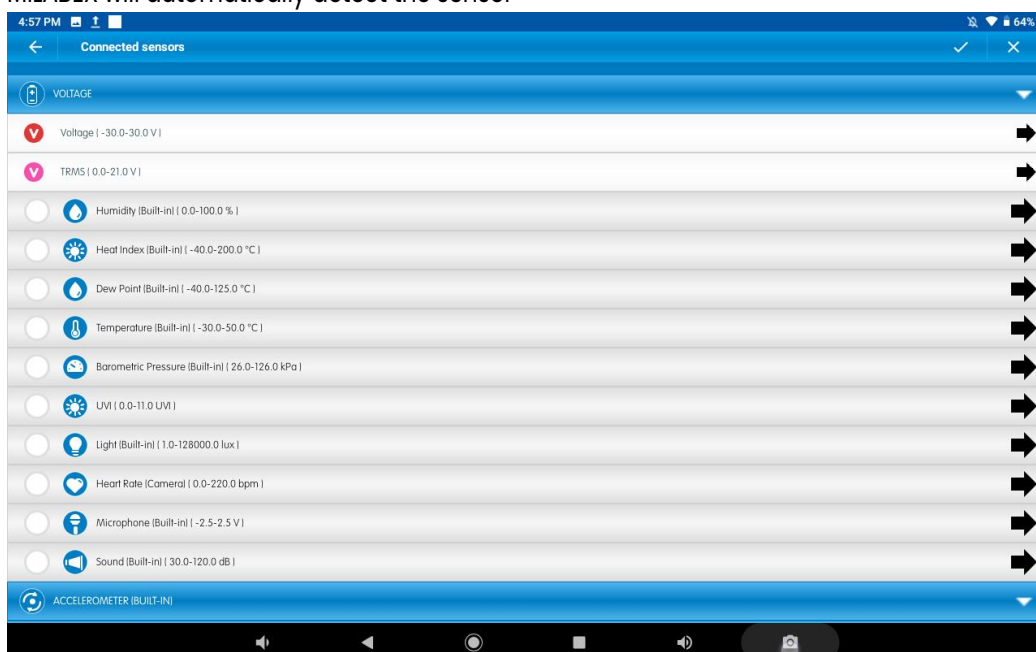
5. To ensure the sensors is selected go to Sensors and Check that the icon next to the sensor is checked.

Desktop

1. Pair your einstein™ LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable (found in the einstein™ LabMate box).
2. Insert the sensor cable into one of the sensor ports
3. Launch MiLAEX and then Click on IAB Start an Experiment
4. MILABEx will automatically detect the sensor and show it in the Current Setup Summary window

5. Click Full Setup, located at the bottom of the Current Setup Summary window to program the data logger's sample rate, number of samples, units of measurement, and other options
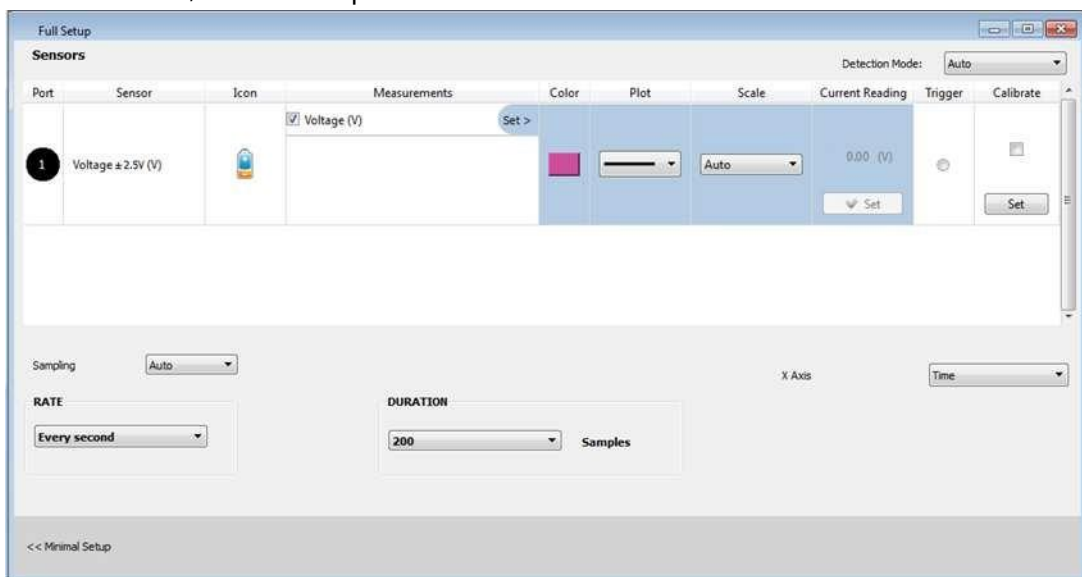
6. Click the Run button on the main toolbar of the Launcher View to start logging

Example of using the Voltage Sensor

### Comparing a Voltage Reading to a TRMS Reading

In this experiment we will compare the readings between a regular Voltage sensor and one using true root mean square (TRMS) to calculate the results. For this experiment you will need:

- A function generator
- An einstein™ device
- A Voltage sensor

Experiment Procedure

1. Attach the Voltage sensor to the function generator

2. Attach the Voltage sensor to the einstein™ device

3. Set the function generator to a sinus wave to 100Hz

4. Open MiLAB™

5. Go to either Settings or Full Setup

6. Make sure that both Voltage and TRMS are selected

7. Set the Sample Rate to 1000 samples per second

8. Set the Duration to 1 second or Number of Samples to 1000

9. Select Run

10. Compare the two readings

Sample graph of this experiment:

Typical graph of this experiment in MiLAB™ for Desktop. Red represents the Voltage reading, blue the TRMS reading.
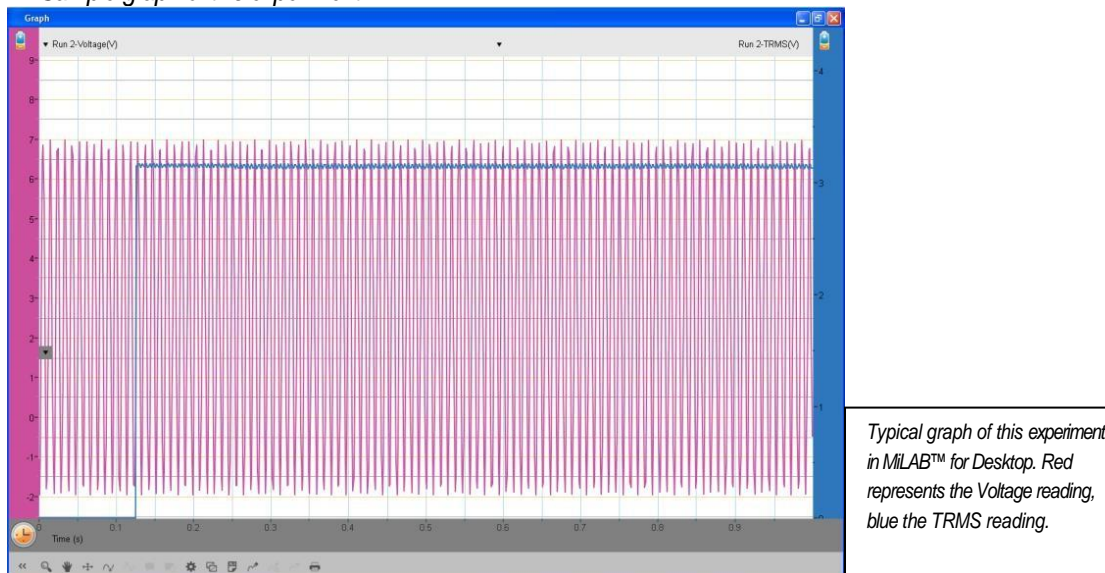
Troubleshooting

If the Voltage sensor isn't automatically recognized by MiLAB, please contact Fourier Education's technical support.

Technical support

For technical support, you can contact the Fourier Education's technical support team at: Web: www.einsteinworld.com/support
Email: support@fourieredu.com

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.

This warranty does not cover breakage of the product caused by misuse or abuse.

This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.

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