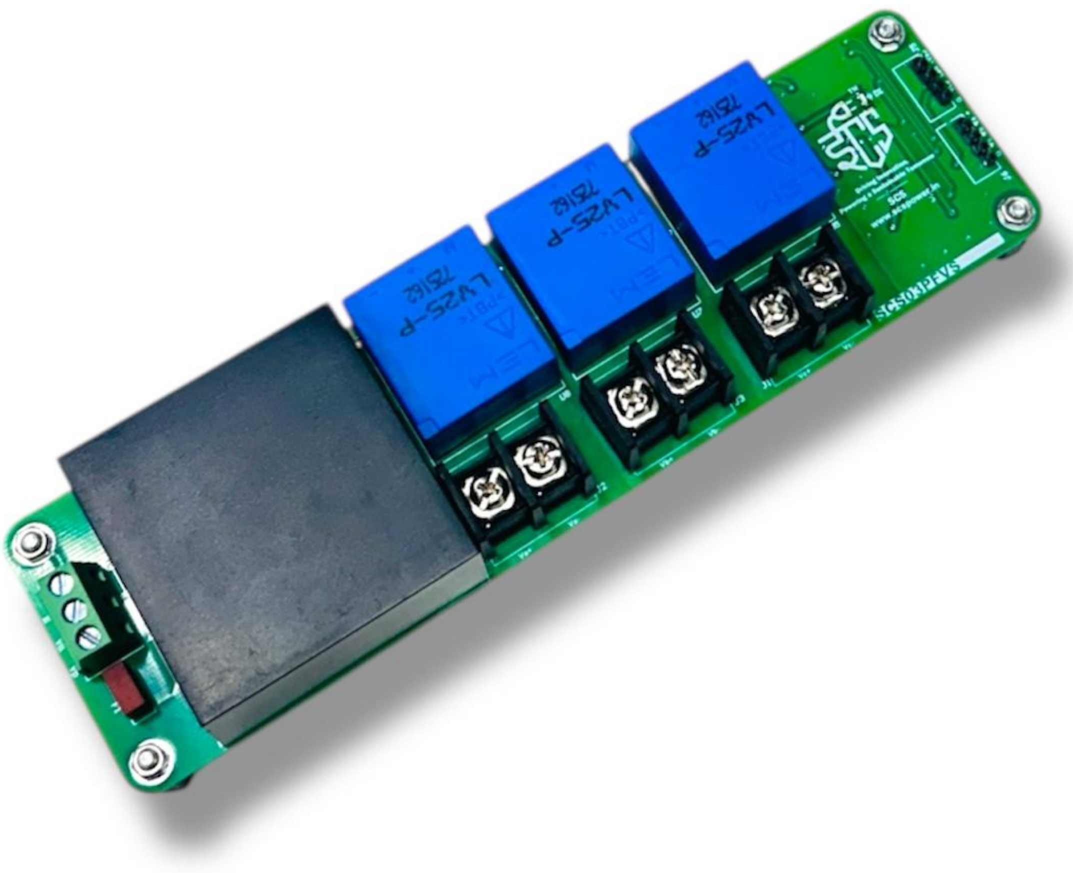
# User Manual

# SCS03PFVSXXXX

## (Power Frequency Voltage Sensors Board)




Prepared By: SCS

www.scspower.in info@scspower.in

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# 1. System Overview:

## 1.1 Features

- AC/DC universal voltage sensors board.
- On board Auxiliary power supplies.
- Excellent accuracy and linearity.
- Thermal and noise optimized PCB design.
- Up to three onboard voltage sensors (LEM make).
- Voltage sensing range maximum up to 1500V available.
- Bi-polar sensor output between -5 to 5 volts.
- Uni-polar sensor output between 0 to 3 volts with offset of 1.5 volts
- Board can be power up with single phase 85-300Vac power supply.
- LED indication for power on.

## 1.2 Board Protection:

- Over Current
- Over Voltage
- Short Circuit
- As per IEC 61000-4 Standard

## 1.3 Applications:

- Power Converters
- Electrical Drives
- General purpose industry applications
- Laboratory R&D purposes
- Testing purposes

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# 2. Sensor Gain Calculation

## 2.1 Conversion Formulas

$$\text{Gain} = \frac{I_{IN}}{V_{OUT}}$$

**For DC use mean value and for AC use rms values.**

Take three different readings and then average for better accuracy. For better calculation of gain use sensor near to its rated voltage values.

Use accurate voltmeter/multi-meter for calibrate sensors, use DC range for DC measurements and AC range for AC measurements.

**To obtain original wave shape in microcontroller/DSP/FPGA/DSPACE**:

The voltage outputs are available on pins $V_a, V_b, V_c$ without offset and $V_{ao}, V_{bo}, V_{co}$ with 1.5 volts offset, all referenced to GND. Each output pin has a fixed gain. In the microcontroller, simply multiply the ADC value by the gain in non-offset mode, and in offset mode, subtract 1.5 V from the ADC value first and then apply the gain.

**Table 1: Sample AC Voltage Gain Calculation At Vao**

| Input rms voltage(V) | Output rms voltage(V) | Gain |
|---|---|---|
| 51.1 | 0.107 | 477.57 |
| 101.2 | 0.213 | 475.11 |
| 150.3 | 0.315 | 477.14 |
| 201.1 | 0.422 | 476.54 |
| 250.9 | 0.528 | 475.16 |
| | **Average Gain** | 476.30 |

## 2.2 Gain Calculation Examples

**Example 1** – DC Channel (Gain Calculation)

Given:

- Input Voltage ($V_{in}$): 200 V
- Measured Output Voltage ($V_{out}$): 1.8 V

Gain:

$$\text{Gain} = \frac{V_{OUT}}{V_{IN}}$$

$$\text{Gain} = \frac{1.8}{200} = 0.009$$

**Example 2** – AC Channel

Given:

- Input Voltage ($V_{in}$): 200 V
- Measured Output Voltage ($V_{out}$): 2.2V

Gain:

$$V_{OUT} = 1.5 + (\text{Gain} \times V_{IN})$$
$$2.2 = 1.5 + (\text{Gain} \times 200)$$
$$\text{Gain} = \frac{2.2 - 1.5}{200}$$
$$\text{Gain} = 0.0035$$

# 3. Experimental Validation

## 3.1 Setup

The system was tested using a R load. Input power was supplied by a WANPTEK KPS15010D DC power supply with an output range of 0–150 V and 0–10 A. A SIGLENT SDS824 oscilloscope and FLUKE 15B+ Digital multimeter was used to monitor the output voltage and input current. The overall experimental setup is shown below.

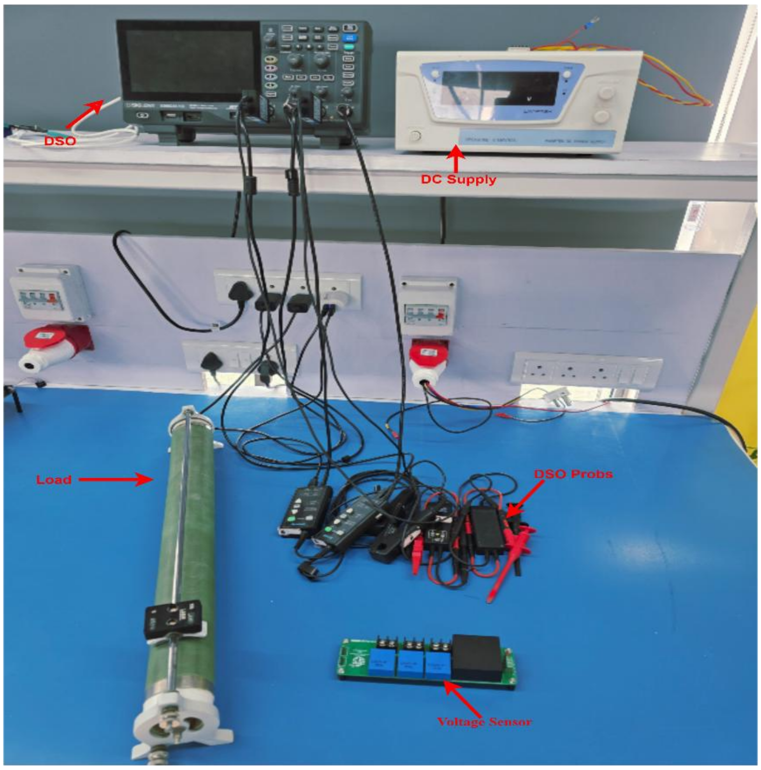


**Figure 1: Experimental setup**

## 3.2 Experimental results

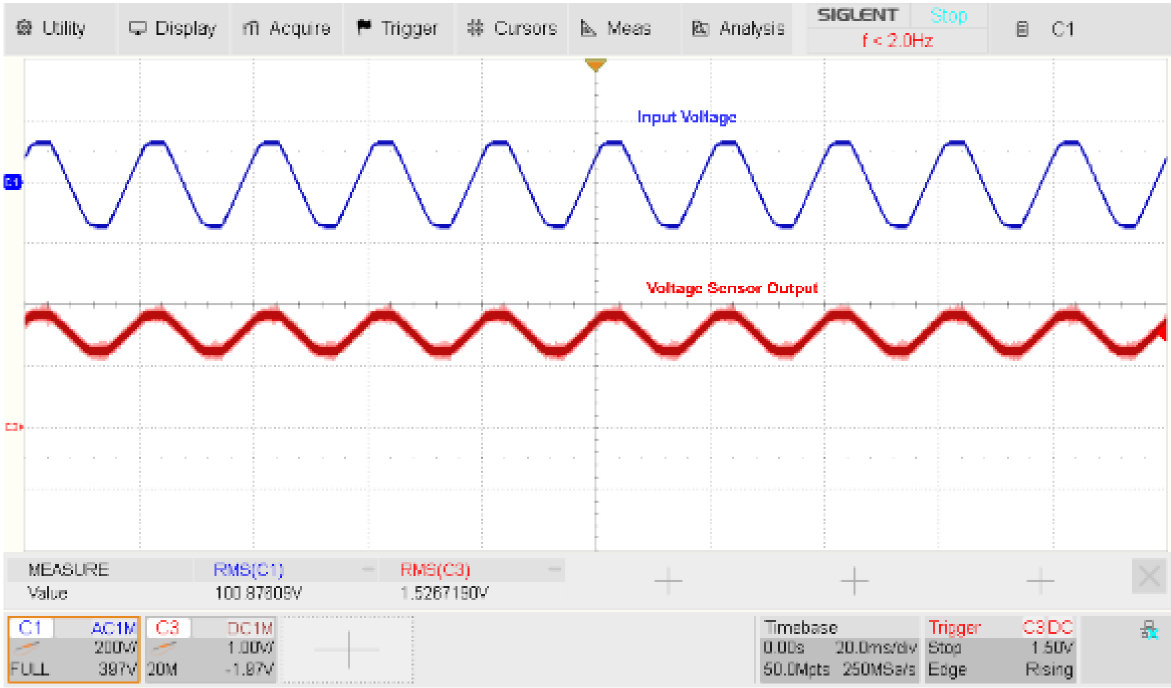


Figure 2 : Results with DC Voltage

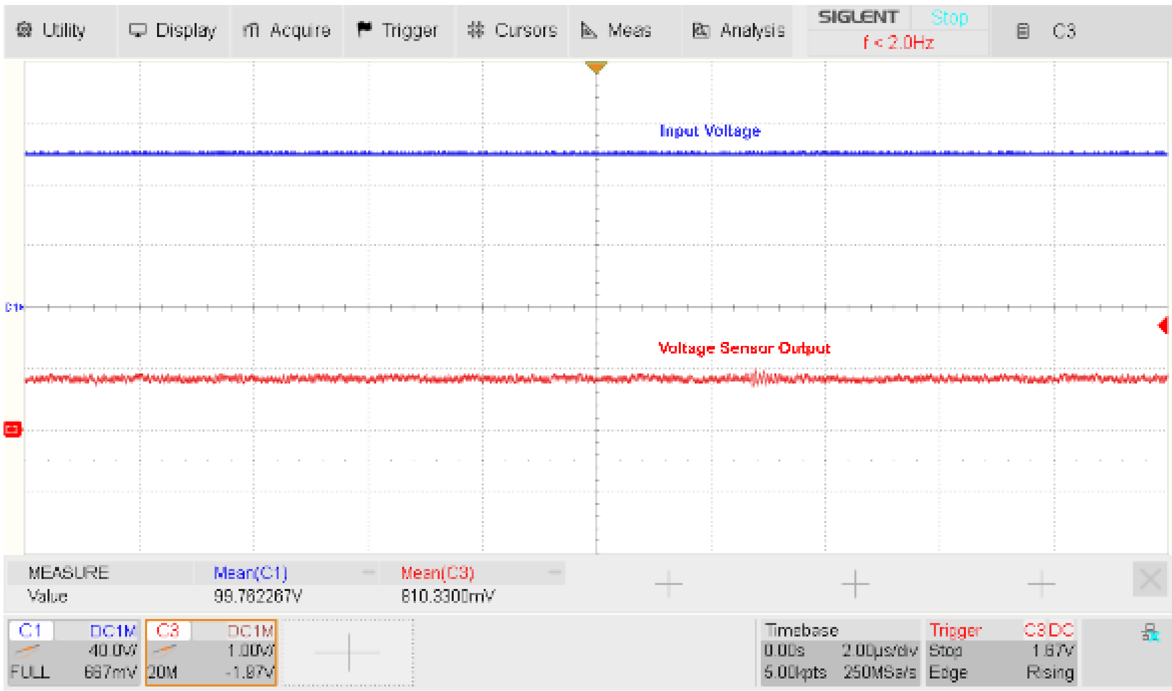


Figure 3 : Results with AC Voltage