

# Development of a Portable Measuring Device by connecting Anemometer Probes, Prandtl-Tubes and a SCT-Probe to a laptop

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<http://www.hs-regensburg.de/fk/m/labore/562.php>

## 1. A/D Conversion

An A/D converter is used to interface the analog environment (the real world) and the digital environment. Continuous, analog signals, such as voltage or current, are hereby converted to discrete, digital numbers. This conversion is vital for many processes in the field of modern measurement engineering, as measured variables usually are analog signals. After the conversion, those signals can be processed by digital instruments.

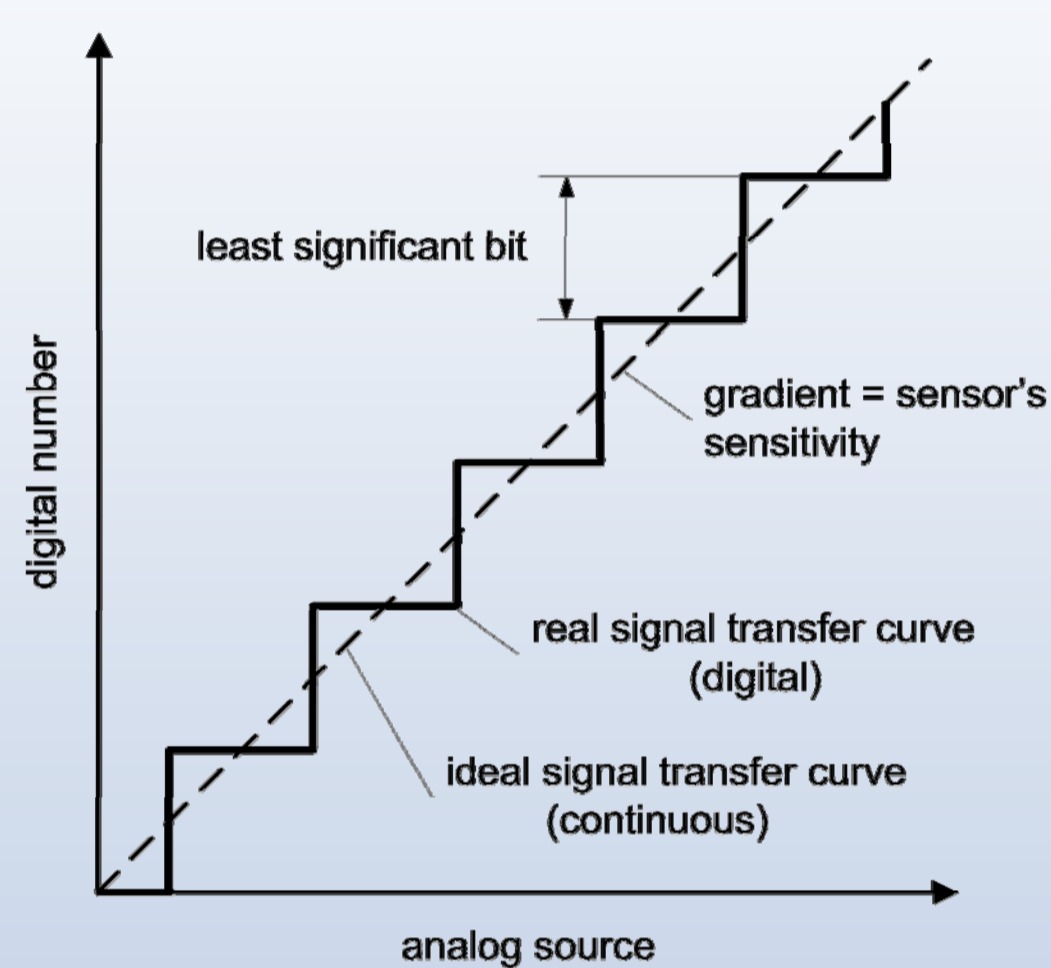


Fig. 1: Resolution of an A/D converter

The basic principle of an A/D converter is shown in Fig. 1. The resolution indicates the number of discrete values it can produce over the range of analog values and is usually expressed in bits. A 12 bit A/D converter, for example, has  $2^{12} = 4096$  levels. The least significant bit characterizes the smallest change of an analog signal that can be displayed by the A/D converter [LS09].

## 2. Components of the Portable Measuring Device

All Components of the Portable Measuring Device can be seen in Fig. 2. As far as possible, all of the sensor's electrical parts are integrated in an aluminum case, called "Sensorbox". With the exception of the SCT-Probe, all sensors can be operated with only the laptop's battery. Fig. 2 also shows the sensor's information flows.

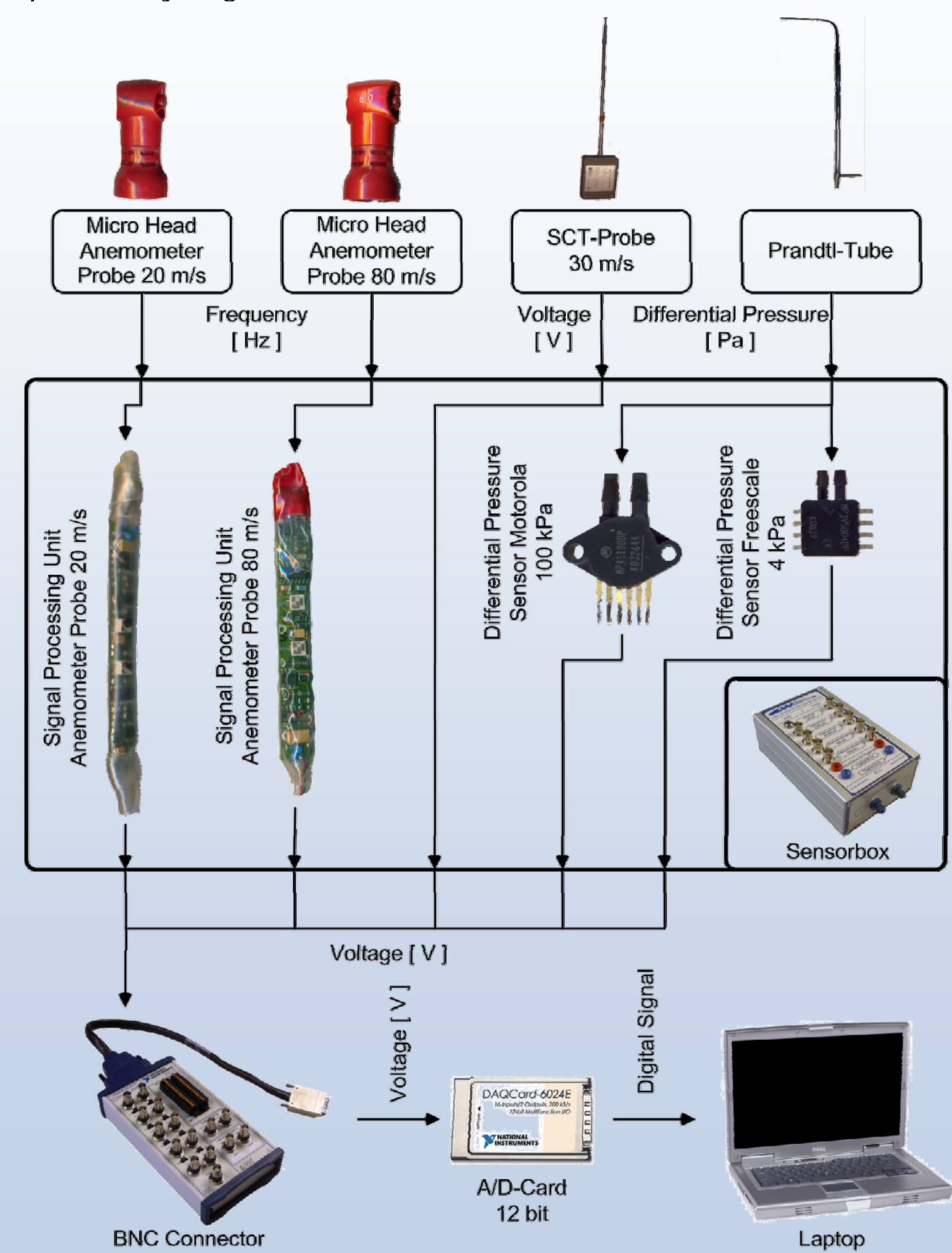


Fig. 2: Components of the Portable Measuring Device including information flow

## 3. LabVIEW Program

Fig. 3 shows the frontpanel of the main LabVIEW Program "tme\_v1.vi". The panel is divided by three tabs: Two are used for measurements and one can be used for the sensor's calibration.

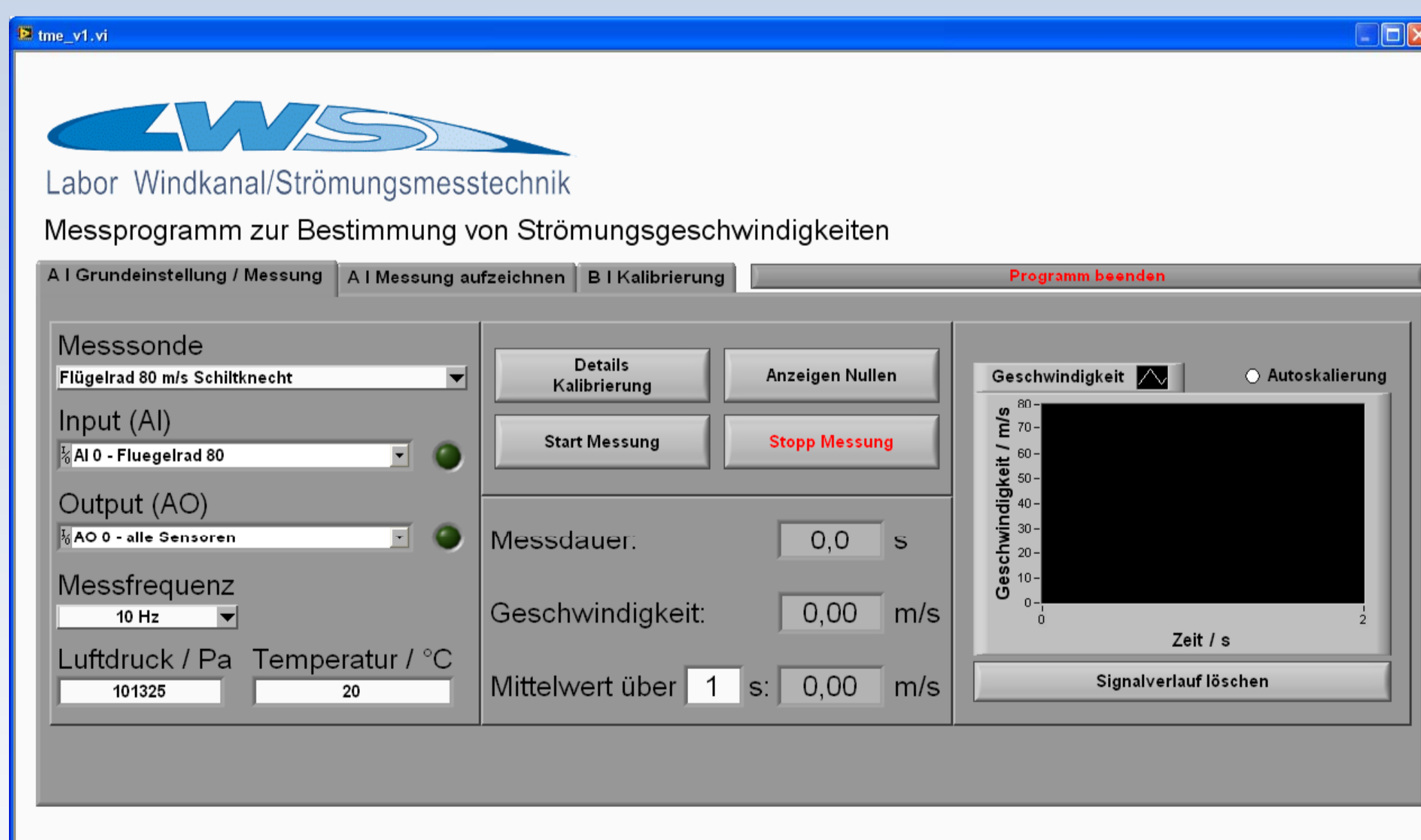


Fig. 3: Frontpanel of the main LabVIEW Program "tme\_v1.vi"

After selecting the sensor in the main program, its inputs and outputs (from the Sensorbox) are connected with the BNC Connector Block according to their name, shown in the program. For each sensor, a "Task" is defined in the National Instruments Measurement and Automation Explorer (a specially designed software which comes with the National Instruments A/D-Card). Thus, the input voltage range can be selected individually for each sensor. This has a beneficial effect on the A/D-Card's resolution.

## 4. Calibration

Only the SCT-Probe comes with a calibration certificate, all other sensors are calibrated in the wind tunnel "Kalibrierwindkanal GUNT HM 225" at the Laboratory Wind Tunnel/Flow Measurements. Fig. 4 shows the characteristic of the Freescale Differential Pressure Sensor. After calibration, the characteristic's parameters can be fed in the main LabVIEW program.

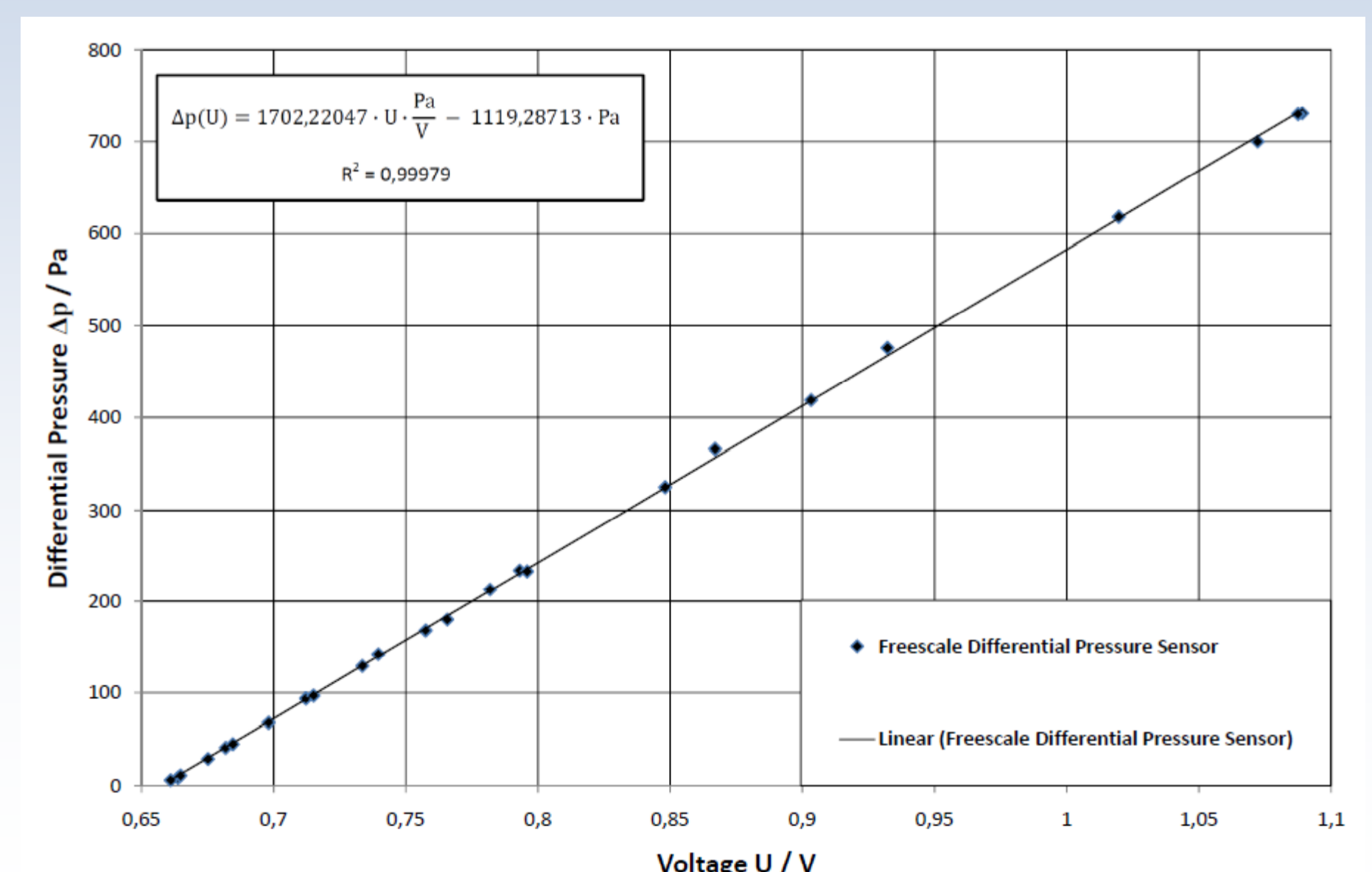


Fig. 4: Characteristic, Freescale Semiconductor Inc. Differential Pressure Sensor