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With the rapid growth of data acquisition electronics in today's society, there also comes a need for faster and compatible cross platform data transfer methods, whereby users will interface a computer with various types of electronic devices and be able to interact with them using the minimal amount of effort.

The measurements of temperature, pressure, Displacement, Speed, Vibration, and acoustics, Liquid level and relative humidity remotely by using the appropriate sensors are crucial for many industries for process control but also in daily life for buildings safety and security monitoring, traffic flow measuring, weather condition monitoring and etc.

To monitor such things, it is required to build an electronic device that will require various Temperature, tension, compression, Displacement, Speed, etc. measurement data to be uploaded to a PC, as well as tolerances to be set from the PC as well. The most popular and widely used method of data transfer these days utilizes the USB standard. It offers a combination of high performance and application simplicity that helps minimize the integration effort when data acquisition to an embedded design.

With the Universal Serial Bus standard allows users to connect almost any device without having to worry about installing a special card or worrying whether a serial or parallel adapter is need to interface with the computer. The USB standard essentially allows up to 127 devices to be connected to a PC, the cable that connects various devices to the PC is made up of 4 wires, a +5 V, GND, +D, and -D wire. The +D and -D wire are the wires that transmit the data back and forth. Keeping in mind this basic information, the purpose of this application note is to show anybody who wants to setup a USB device for data transfer how the hardware aspect, and the software aspect come together in accomplishing successful communication with a device and computer.
USB offers several advantages over other standard buses for connecting a data acquisition module. One is simplicity, USB requires only four wires while parallel buses typically 20 or more. This low wire count also provides flexibility in module placement. Devices on the USB can be located as far as 5m from the controller or hub to which its attached and can receive its power through the interface. The use of the cascaded hubs can increase the separation even further. This separation carries an additional advantage higher accuracy. Bus noise on the USB is minimum. Performance is another advantage of USB. Version 2.0 of the standard allows data rates as high as 480 Mbits/sec much faster than RS-232 and other common serial standards and comparable to most parallel buses.

Temperature is one of the most frequently measured environmental Variables. The USB controller is connected to a analog device called Temperature sensor (LM35). The LM35 has an output of 10 mV/°F with a typical nonlinearity of only ±0.35°F over a -50 to +300°F temperature range, and is accurate to within ±0.4°F typically at room temperature (77°F). The LM35’s low output impedance and linear output characteristic make interfacing with readout or control circuitry easy.

The analogue outputs of the sensors are connected to a microcontroller through an ADC for digital signal conversion and data logging. An LCD display is also connected to the microcontroller to display the measurements. For analysis and archiving purposes, the data can be transferred to a PC with a graphical user interface program through a USB link. The interface program allows sampling parameters such as the date and time of the data-logging operation to be configured. The device has many advantages as compared to other Temperature monitoring systems in terms of its smaller size, huge memory capacities, on-device display, lower cost and greater portability.