

# MELD Data Acquisition System

For PalmOS Handheld Computers

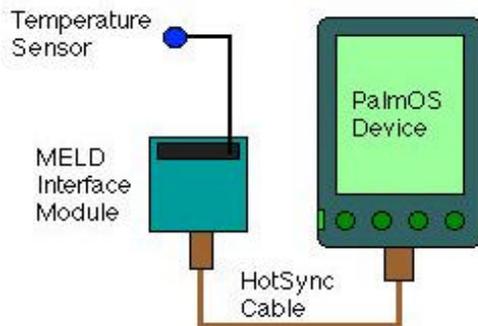
Version 2.02, Feb. 26, 2001

## Overview

Turn your Palm Pilot into an electronic measurement instrument! MELD is an analog data acquisition system for PalmOS handheld computers. The MELD system is intended for routine data logging and development of new applications. It consists of an analog interface module and PalmOS-based support software. It is compact, rugged, portable, has exceptional battery lifetime, and is easy to configure.

## Brief Tutorial

**Data acquisition** is the use of a computer to perform physical measurements. Here, the MELD system is shown hooked up to an electronic temperature sensor. The MELD Interface Module measures the output of the temperature sensor and transmits the resulting data to the PalmOS device. That's the essence of data acquisition!



An **analog** signal is one in which a physical quantity is represented by an electrical signal such as a voltage or current. For instance, the sensor shown in the diagram produces a voltage proportional to temperature. Analog sensors are available for a wide variety of measurements, such as temperature, pressure, pH, humidity, light intensity, and so forth. Many of these are designed specifically for use with data acquisition systems.

A typical computer cannot measure an analog signal by itself, so an **analog-to-digital converter (ADC)** is required. The ADC converts an analog signal into a digital number that can be used by the computer. The MELD Interface Module is essentially an ADC that connects to the HotSync cable of a PalmOS device. It has four inputs for voltage measurement, and an additional frequency measurement input.

A data acquisition system requires **software** to make it useful. A common application is **data logging**, in which periodic measurements are made over long time periods, for subsequent graphing or analysis. A data acquisition system can also support numerous **virtual instruments**, which are software programs that mimic the functionality of conventional test instruments such as voltmeters and oscilloscopes.

When comparing data acquisition systems, some important factors to consider are:

**Range and resolution:** These depend on the output characteristics of the sensors you are interested in using. Sometimes a sensor output must be adapted to the fixed input range of an ADC with a small amount of circuitry. Examples will be added to the documentation soon.

**Input channels:** How many signals can be measured simultaneously? The MELD system has 4 inputs for voltage signals, and one input for digital frequency measurement.

**Absolute or ratiometric operation:** A **ratiometric** sensor operates in such a way that the ratio between two voltages is proportional to the quantity being measured. Examples are thermistors and photoconductive sensors. Other sensors produce a single **absolute** output. The MELD system handles both kinds of sensors.

**Overload protection:** A data acquisition system that can be damaged by exceeding the specified input range must be used with extreme care. Especially in application development, signals can go astray. The MELD system is specified, designed, and tested for generous overload protection on all inputs and outputs.

**Power consumption:** Can the system run on batteries? For how long? Even if a power source is available, battery operation adds convenience and portability, as well as elimination of "ground loops" that affect sensitive measurements. The MELD system is designed to conserve power in the interface module, sensors, and in the PalmOS device itself, for data logging tasks that can last for days or even months. It automatically turns itself off when not in use.

**Other features:** Some applications require frequency measurement. Examples include tachometers, anemometers, and a light-to-frequency converter chip. The MELD system has an input that measures frequencies up to 500 kHz.

**Programmability:** Does the product come with enough information to support users who want to write their own software or even extend the hardware design? The MELD system is a completely open system. Complete design information is supplied.

Computerized data acquisition offers many advantages over conventional measurement instruments. The computer is objective and tireless, and the resulting data are in computer-readable form without tedious manual data entry. A data acquisition system can perform tasks that a human operator cannot, for instance making repetitive measurements at a high rate of speed, measuring many different things at once, collecting enormous amounts of data for statistical analysis, or in some cases, working in unpleasant environments.

The MELD product is supplied as a complete system with a pre-wired temperature sensor, ready to use with your Palm III or V series device. In fact, temperature monitoring is the most common data acquisition application, and many systems are designed exclusively for this purpose. For other kinds of measurements, you must supply

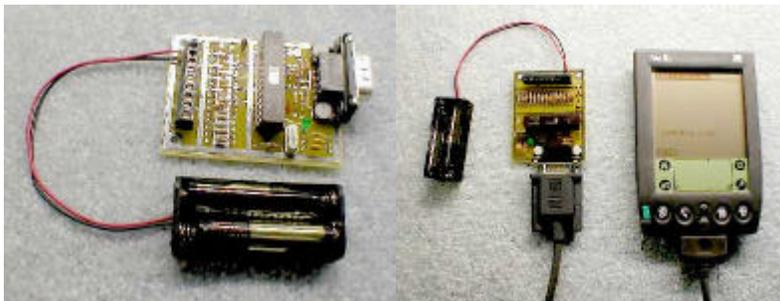
your own sensors. A very common application is simply to replace the old-fashioned paper chart recorder.

Handheld computers are beginning to gain acceptance in data acquisition applications. In many cases, a conventional system based on a desktop or notebook computer is too expensive and cumbersome. Often, the decision to forego data acquisition is made, rather than having to move a bulky computer and find power for it. A handheld system is worth considering for decentralized laboratory and industrial settings, remote locations, and perhaps even in critical environments such as clean rooms and controlled atmosphere chambers.

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## Features

- Analog-to-digital converter with 4 inputs and 12-bit resolution
- Digital frequency input with 500 kHz range
- Generous overload protection on all inputs and outputs
- Interface module runs for months on 2 type AAA batteries
- MeldVI virtual instrument software automates common data acquisition tasks
- Open hardware and software designs including Pocket C and HotPaw Basic drivers and examples
- Supplied with pre-wired temperature sensor -- ready to use!
- Compatible with standard RS-232 serial port



*Click on a picture for a magnificent view!*

The MELD interface module connects to a PalmOS device via the HotSync cradle or an inexpensive cable. It is controlled by the MeldVI software package. MeldVI provides "virtual instruments" to automate common measurement tasks. At present, it includes a multichannel digital voltmeter and a data logger. A companion program for Windows systems converts logged data files to a spreadsheet-compatible text format.

No programming is required to get started with the MELD system. However, many users are interested in writing custom data acquisition software for specialized applications. For this reason, MELD is supplied as an "open" system. Complete design information, including circuit diagrams, firmware, and software, are available for free with source

code. Subsequent use of this code is unrestricted and royalty-free. At present, the following programming languages are supported:

- HotPaw Basic ([www.nicholson.com/rhn/hotpaw](http://www.nicholson.com/rhn/hotpaw))
- Pocket C ([www.orbworks.com](http://www.orbworks.com))

Support for other programming languages will be added based on demand, or from code shared by users.

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## Specifications

Analog-to-digital Converter	Voltage input channels: 4 Input range: 0 to +2.048 V in absolute mode Input range: 0 to +Vs in ratiometric mode Resolution: 12 bits Overload protection: $\pm 20$ V
Frequency Counter	CMOS-compatible logic input Range: 500 kHz Overload protection: $\pm 10$ V
Sensor power output	Output: + Vs through 25 Ohms Short circuit protected Switched off during "sleep" mode
Power supply	+Vs = 2.5 to 5.5 Volts Holder provided for 2 type AAA batteries
Battery life	Greatly exceeds PalmOS device battery life
Sleep mode	Low-power shutdown between readings
Compatibility	Palm III/V series <i>(Incompatible with Handspring Visor)</i>
Physical	50 x 70 x 17 mm 4 mounting holes Male DB9 connector to HotSync cable Mini screw terminal block for signals
Software	MeldVI virtual instrument package MeldPDB database translator for Windows Drivers for Pocket C and HotPaw Basic
Specifications and design subject to change without notice	

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## Requirements

The "reference" platform for testing the MELD system is a Palm IIIx. Users have reported success with Palm V. The hardware requirements are:

- Palm III and V series, or compatible device
- PalmOS version 2 or later to run the MeldVI program

At present, the system is known to be *incompatible with Handspring Visor devices*. This was determined after extensive testing.

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## Downloads

- [MeldVI.zip](#) (61 kBytes)
    - MeldVI virtual instrument software
    - MeldPDB database translator
  - [MeldDoc.zip](#) (162 kBytes)
    - HTML documentation
  - [MeldSrc.zip](#) (9 kBytes)
    - Source code listings for MeldVI and MeldPDB
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## Ordering

**USA:** Payment should be check or money order, payable in US Dollars. Orders should be sent to:

*Francis Deck*  
*5026 Sherwood Road*  
*Madison, WI 53711*  
*USA*

**International:** The "default" shipping cost is based on a worst-case estimate for United States Global Priority Mail plus handling costs for export shipment. Payment should be via Postal Money Order, in US Dollars. US export restrictions may prohibit shipping MELD to some countries.

MELD System Price List				
Destination:	Wisconsin	Rest of USA	Canada Mexico	Rest of World
MELD system package:				
<ul style="list-style-type: none"><li>• MELD interface module</li><li>• Temperature sensor</li><li>• Software disc</li></ul>	\$60.00	\$60.00	\$60.00	\$60.00

• Batteries not included				
Wisconsin 5.5% sales tax	\$3.30	--	--	--
Shipping	\$6.00	\$6.00	\$12.00	\$25.00
Total	\$69.30	\$66.00	U.S. \$72.00	U.S. \$85.00

Note a small increase in the shipping cost. This is simply due to having a better estimate of the total costs after shipping out the first few units.

**Confidentiality:** You have a right to full confidentiality. A record of each order will be saved for accounting purposes only. Your personal information will not be sold or shared. I will not bug you about updates -- they will be posted to this site.

**Corporate orders:** At present, the only available terms are pay-in-advance. But most companies now prefer pay-in-advance for small orders, due to the higher cost of processing a purchase order separately from a payment request.

### Warranty Disclaimer

Commercial product warranties are typically based on the expectation of a finite product lifetime and known failure modes. Instead, the MELD module is conservatively designed and uses components whose manufacturers have established extremely high reliability standards. The design is published for inspection. *There are no known failure modes for the hardware module* when it is operated under normal conditions. I have not seen a hardware failure. But the MELD module is sold for experimentation, and its primary failure mode is damage due to operation under extreme conditions. For this reason, the MELD module is sold without warranty.

The manufacturer of the MELD Data Acquisition System disclaims all warranties, express or implied, including, without limitation, the warranties of merchantability and of fitness for a particular purpose. This disclaimer applies to hardware, firmware, and software. The manufacturer assumes no liability for damages direct or consequential, which may result from use of the System, including interrupted operation, loss of data, erroneous measurement, hardware damage, fire, or any other reason. In no event shall the manufacturer's liability for any damages ever exceed the price paid for the System, regardless of the form of the claim. The person using the System bears all risk as to the quality, performance, and safety of the System.

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## Contacts

The MELD system is designed and manufactured by [Francis Deck](#). Feel free to contact me with questions and bug reports. Also, if you have developed interesting hardware or software applications based on the MELD design, please consider sharing them with others. I will be happy to provide links to your Web page.