



*Solving Problems for Problem Solvers<sup>®</sup>*

### FEATURES

- LabMaster<sup>®</sup> EP hardware for your computer.
- LabMaster Signal Unit with BNC connections.
- Windows based ElectroPhysiology Software Suite.
- Powerful, yet easy-to-use Graphical User Interface.
  - Graphically define your clamp Protocol.
  - Post acquisition analysis, curve-fitting, filtering.
  - Import / Export a variety of formats.
- Extremely configurable to work with virtually any ElectroPhysiology amplifier.

### OVERVIEW

The Scientific Solutions LabMaster EP is designed for working ElectroPhysiologists. It includes advanced computer data acquisition hardware and powerful windows graphical software.

The computer hardware is based upon the Scientific Solutions advanced LabMaster PRO. This product consists of a low-noise, high-speed data acquisition card that is installed in the computer and a convenient Signal Connection unit. With sample rates of ½ MegaSample / second, true 16-bit resolution, low-noise signal gain amplifiers, on-board memory, and PCI BusMaster technology; the LabMaster EP hardware is designed for continuous and reliable data acquisition in the multi-tasking windows environment.

The ElectroPhysiology Software Suite (The EP suite), developed for whole-cell recording and data analysis, provides the tools for designing and running voltage-clamp and current clamp experiments with the LabMaster EP hardware. Efficient data-collection; run-time clamp monitoring; and a host of analysis, filtering and data-editing tools round out this powerful, yet easy-to-use windows-based graphical software.

### WHAT YOU GET

**One:**

LabMaster PRO you install in a PCI slot of your computer. Includes a cable to connect to the LabMaster Signal Unit.



**Two:**

LabMaster Signal Unit featuring laboratory grade BNC connections with Analog Inputs to record membrane potentials, Analog Outputs to create low-noise accurate clamp signals and Digital signals to control and monitor your patch-clamp amplifier.



**Three:**

The graphical windows EP Software Suite



### WHAT YOU NEED

**One:**

Computer with Windows 2000, XP, Vista, 7.

**Two:**

Patch-Clamp amplifier such as from Axon, Dagan or other manufacturers.

**Three:**

Cables to connect from the LabMaster Signal Unit to your patch-clamp amplifier.

### WHAT YOU DO

**One:**

Install the EP software and LabMaster PRO in your computer and connect to the LabMaster Signal Unit.

**Two:**

Connect your Patch-Clamp amp to the Signal Unit.

**Three:**

Run the EP-Suite software, configure and calibrate your system and acquire your data!

**The LabMaster EP Software Suite**

Scientific Solutions offers the Henry ElectroPhysiology Software Suite (The EP Suite). Developed for whole-cell recording and data analysis using the LabMaster, the EP Suite is an easy-to-use powerful graphical-based collection of programs and utilities designed for working ElectroPhysiologists.

The EP Suite provides the tools for designing and running voltage-clamp (and current-clamp) experiments, interactive communication with the Scientific Solutions LabMaster data acquisition hardware, efficient data-collection, run-time clamp monitoring and many analysis and data-editing tools.

The EP Suite Includes the following applications:

<b>HENRY</b>	The primary, clamp-control and data acquisition/analysis application
<b>N-PRO</b>	Noise Profiling and Filter tools for improving the Signal-to-Noise ratios of collected data
<b>VICAR</b>	Virtual Chart Recorder
<b>Pandora!</b>	Collection of analysis tools and utilities, I:V modeling, Histograms and Time analysis.

The EP Suite is designed from the ground-up to be a true multi-tasking 32-bit windows graphical program and takes full advantage of user friendly “point-and-click” and “drag-and-drop” facilities for designing voltage and current clamp protocols and for selecting data for analysis. A printed manual is not included, as the software provides on line context-sensitive help and most would agree that the software is intuitive and easy to use.

Software Requirements for the LabMaster PRO EP Software Suite:

- ✓ Pentium II or better CPU with a PCI slot for installing the LabMaster PRO
- ✓ MicroSoft Windows 2000, XP, Vista or 7.

**Please note:**

The EP Software Suite is the result of many hours of work by highly talented researchers. This project is ongoing, and like any advanced software product it is in constant flux - with tasks to complete, changes to be made, new features to incorporate and constant updates. The applications and other modules comprising the EP Suite are designed to be intuitive and easy to use, subject to the constraints implied by the scientifically technical nature of the experimental conditions and electronic hardware in use.

The EP Suite is not currently sold as stand-alone commercial software, and at this point is provided at No Charge to our customers. This does not imply that it is a “light-weight” or “limited product.” On the contrary, it is a very complete and powerful set of tools and better than many high-priced commercial products currently in the market. At some point the software may be released as a commercial product for purchase. At this time we believe providing the software at no charge will allow users to be able to cost effectively upgrade their systems and encourage more wide-spread use of the software which will help to make a better product. We encourage comments, suggestions and general feedback. Your feedback will aid in the quick resolution of problems and help the ongoing development of the software suite.

**HENRY** - The primary, clamp control and data acquisition and analysis application

A Protocol defines the way in which a particular voltage or current - clamp experiment is performed. The Henry EP Protocol Editor allows you to design your voltage-clamp or current-clamp experiment using an intuitive, graphical user interface (GUI), whereby clamp values, times, sampling parameters and digital output signals can be defined and changed using the computer mouse in a 'point-and-press' and 'drag-and-drop' system.

Once you have designed a Protocol using the Protocol Editor, you can run the experiment using the RUN command. The Protocol is then compiled into a binary 'event-list' which is loaded into the LabMaster driver and the appropriate clamp is turned on and set to the initial value for the first cycle. Then depending upon the Trigger Mode you are using, the Protocol either runs immediately or waits for either Keyboard or the appropriate Digital In signal before starting the run.

Data sets collected during the Protocol run are stored directly on disk in a 16-bit data format that includes information about the Protocol that was run, software version information for compatibility with future enhancements, Amplifier settings in effect when the data was collected, and the cell geometry settings when the data was collected.

The Henry application provides a variety of tools for analyzing the collected data including:

I:V Analysis - Plotting of measured current versus voltage (I:V)

I<sub>ss</sub>-I<sub>i</sub> Analysis - I:V curves for the Steady State I<sub>ss</sub> and Instantaneous I<sub>i</sub> currents and their differences using dynamic, draggable cursors to select the exact data point.

Normalizing Data - View collected data from different cycles, which may have different 'Y' ranges, on the same, normalized scale, thus making it easier to spot kinetic (time scale) differences without the added complexity of magnitude differences.

Time-of-Y Analysis - Allows you to create and display a curve connecting the times at which elicited currents from different cycles of the same Protocol reach a give fraction of their final (steady-state) values.

Multi-File Analysis - This analysis consists of a series of similar files grouped together for common inspection, curve fitting and other analytical methods.

The Henry application includes tools for fitting a variety of curve types to raw data sets and some derived data. These are implemented, by default, using the well established, rapid and generally robust Levenberg-Marquadt function minimization algorithm, but you can choose to use the very much slower Direct Search method of Hooke and Jeeves, which may give better results in certain cases. Curve Fitting Includes:

Current versus Time - Exponential rise, Sum of Exponents, Polynomials

Current versus Voltage - Exponential rise, Sum of Exponents, Polynomials, Current (4-parameter), Conductance (3-parameter), GHK 'Open Channel'.

Data stored in Henry's Raw Data Files can be exported to a variety of file formats supported by common third-party data analysis/presentation programs.

Tab-Delimited Plain Text (ASCII) - common format readable by word processing applications, spreadsheet programs and plotting programs such as Excel and Sigmaplot.

Comma-Delimited format - similar to Tab, except data is separated by commas instead of the tab character. Again, very common open format.

Data values exported are converted from the raw binary integers to their corresponding 'real' voltages and currents according to the LabMaster A/D Amplifier and Rig gains and offsets stored in the file.

**N-PRO** - An application for improving signal-to-noise ratios in data sets collected within the suite and with a wide variety of third-party software.

Noise Profiling Tool - A popular tool that has proved very useful for patch-clamp (single channel) data that allows you to inspect and remove noise of a cyclical or pseudo-cyclical nature (particularly that caused by AC mains supply).

Smoothing Techniques - Gaussian (or binomial smoothing) and Savitsky-Golay (Least-Squares filter).

Digital Filtering - Notch Filters, Band Pass, High Pass and Low Pass digital filters

FFT Analysis - Frequency Analysis using the Fast Fourier Transform

Wavelet Filtering - A good alternative to Noise Profiling when the underlying noise takes the form of a complex waveform.

LULU Filtering - Another good alternative to Noise Profiling when the data set is particularly 'spiky'. This is implemented as a preliminary tool in the current release.

Block-Median Pyramidal Transform Filtering - Under development in the current version.

N-Pro can work with files produced by a variety of third-party software packages, in their native formats, including:

Axon Binary Files - Axon Instruments' pClamp and other applications use this ABF format

Bruyton Exchange Format - File format from Bruyton Corporation

Cambridge File System - File format from Cambridge Electronic Designs (CED).

HEKA Pulse and Pulse-Fit Files - Binary format from HEKA Elektronik.

Whole Cell Patch Files - Format generated by WCP program from Strathclyde Electrophysiological Software.

Henry's Raw Data Files - As expected, data files produced and/or edited with Henry are fully supported by all applications.

Plain Text (ASCII) Files

**VICAR** - Virtual Chart Recorder allows you to monitor the input from a number of DC channels over long periods of time, without having to use a standard, paper-based device.

The application allows control of the LabMaster Analog Output channels and clamp control while recording a chart.

You have the ability to insert up to four predefined comments, or text at either the current point or a preceding point

Allows recording to continue while the Henry application is running a Protocol.

**PANDORA!** - A collection of analysis tools and utilities for the analysis of single-channel (patch-clamp) data, as well as a variety of I:V modeling tools and conversion of 'third-party' data files into Henry's native format. Please note that "Pandora!" is a developmental version as the software is not yet complete; it is ongoing, and many of the features are not fully functional. However, it is included in its present form as it is still helpful in many instances.

Current-Amplitude Histograms - Provides information on the number of different types of channels, or sub-conductance states of a single type, located within the patch.

Restoration Analysis - Attempts to recreate the 'ideal' current trace (without, baseline drift and other artifacts) to the location and duration of channel openings can be determined.

Dwell Time Analysis - Compilation of the time intervals for each channel opening (or closing) 'event' into histograms, for subsequent statistical analysis.

I:V Modeling Tools - One of the features of the Pandora! application is a collection of tools allowing you to create 'model' I:V curves using a variety of established (and experimental) algorithms.

Amtmann-GHK I:V Models - This allows you to create steady-state I:V curves for three types of channels: inward rectifiers, outward rectifiers, and voltage independent - using the formula published by Anna Amtmann and Dale Sanders in 1999.

GHK 'Open Channel' Models - This allows the creation of I:V curves using the classic Goldman-Hodgkin-Katz equation for an open channel, specifying its conductance and reversal potential.

Pandora! can work with files produced by a variety of third-party software packages, in their native formats, including:

Axon Binary Files - Axon Instruments' pClamp and other applications use this ABF format

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Henry's Raw Data Files - As expected, data files produced and/or edited with Henry are fully supported by all applications.

Plain Text (ASCII) Files

## *The LabMaster PRO EP Hardware*

Scientific Solutions offers the LabMaster EP PRO for use with the Henry EP Software Suite. The LabMaster EP PRO includes a high-speed PCI data acquisition card that you install in your computer. This card is the brains of the operation and contains low-noise, high-resolution Analog-to-Digital, Digital-to-Analog, Counter/Timer and Digital I/O functions.

Features of the LabMaster PRO include:

### Analog Input

- 16 Input Channels
- True 16-bit resolution A/D converter
- ½ MegaSample / Second sampling rate
- Software controlled Amplifier from 1 to 100

### Analog Output

- 2 Output Channels
- True 16-bit resolution D/A converter
- ½ MegaSample / Second update rate

### Digital I/O

- 8 Input and 8 Output ports, 0-5v True-TTL/CMOS logic level compatible
- Telegraph characteristics and configuration to / from your EP amplifier

### Timer / Counter

- Five independent Timer / Counters, each running at 6.25Mhz
- 16-bit resolution cascadable to 80 bit
- Precise timing provides results in precise jitter-free measurements

### Advanced Features

- Dual PCI BusMaster & Sample Memory provides High-Speed data streaming with no data loss!
- Simultaneous clocking A/D, D/A and DIO functions which are essential for proper V/I-Clamp
- Embedded low-noise signal amplifier with on-the-fly gain adjustment for multi-channel acquisitions



Also provided is the LabMaster Signal unit. On the front of the unit are convenient laboratory grade BNC connections for all your signal needs. The Unit connects to the LabMaster EP PRO card using a single high-density 6ft. cable that is provided.

The EP Suite software was designed around the specifications of the LabMaster products to provide a matched set of hardware and software functions.

## Using the LabMaster PRO EP with your 'RIG'

In addition to the Scientific Solutions' LabMaster hardware and the EP Software, your electrophysiology setup will likely also have patch-clamp signal amplifiers, clamp-control devices and electrodes - collectively called "The Rig". Examples of amplifiers include Axon's AxoClamp-2B and GeneClamp 500; Dagan's PC-ONE or Model 8900, among others.

After installing the EP Software and the LabMaster hardware, you then need to connect The Rig to the LabMaster Signal Unit and configure the EP software to properly control The Rig. The connections from the LabMaster Signal Unit to The Rig vary depending upon the particular patch-clamp amplifier you are using and the types of experiments you are running.

Connecting the LabMaster to The Rig accomplishes two basic tasks:

- (1). Allows the LabMaster to record signals from the ElectroPhysiological amplifier  
Typical application is to use a couple of the LabMaster inputs to record Membrane Current ( $I_m$ ) and Membrane Voltage ( $V_m$ ). Also, some Rigs may have other "Telegraph" signals that provide information about how the amplifier is configured, i.e. mode settings, gain settings, etc.
- (2). Allows the LabMaster to control the operation of The Rig to perform the experiment.  
Typical application is to use LabMaster outputs to provide computer-generated voltage pulses to the patch-clamp command voltage input, which in-turn applies voltage stimulation to the cell, i.e. creating a complex experiment *Protocol*. Also some Rigs may use other signals to change the amplifier operating modes.

All ElectroPhysiological amplifiers are different and therefore can use different types of connections. Normally BNC connections are used for amplifier outputs Membrane Current ( $I_m$ ) and Membrane Voltage ( $V_m$ ). Telegraph signals can also use BNC type of connections. Sometimes D-style connectors, i.e. DA15 or DB25, are used instead of BNC.

This table lists example Rig Signals along with typical LabMaster signal connections.

LabMaster Signal Connections	Example Rig Signals	Description
Analog Input (ADCx)	Membrane Current ( $I_m$ )	Voltage proportional to $I_m$
Analog Input (ADCx)	Membrane Potential ( $V_m$ )	Voltage proportional to $V_m$
Analog Input (ADCx)	Gain Telegraph	Voltage level correspond to Amp gain
Analog Input (ADCx)	Mode Telegraph	Voltage level correspond to Amp mode
Analog Output (DACx)	Command Voltage Input (VC)	Voltage proportional to Clamp Signal
Digital Output (DOx)	Mode Control 1	0 or +5VDC level to set Amp mode
Digital Output (DOx)	Mode Control 2	0 or +5 VDC level to set Amp mode

The EP Software allows easy configuration of The Rig which includes selecting which LabMaster signals are used (ADC0, ADC1, etc), V-Clamp and I-Clamp gains and offsets, Clamp-command output process, Analog Input gains and offsets and Probe (Micro-Electrode/Amplifier) gains and offsets. The Rig configuration is probably the most complex part of the setup, and the versatility and many options in the software and hardware help a great deal in completing this process....and as always, Scientific Solutions Technical Support is available to guide you along the way!

## **How to Order**

The Scientific Solutions LabMaster PRO EP is available directly from Scientific Solutions.

Ordering Part Numbers:

<b>Part Number</b>	<b>Description</b>	<b>List Price</b>	<b>Introductory Price</b>
815315	LabMaster EP PRO with LabMaster BNC Signal Unit	\$7600.00	\$3,995.00

*The LabMaster PRO EP is a new product and the introductory price is for a limited time only, and includes the complete fully-functional version of the EP Suite, which is a fully active product and ready to use.*

*Compare our price against \$10,528.00 for pClamp10 (\$5000) and the DigiData 1440A (\$5528), as published at moleculardevices.com in October, 2010. We believe our EP Suite solution is every bit as good, if not better, than the competition....and at a competitive price.*

### **Product Includes:**

- 1). LabMaster PRO EP card for PCI computers  
Includes 6 ft. (1.8 m) cable connects between the LabMaster PCI card and the LabMaster Signal Unit
- 2). LabMaster BNC Signal unit  
DeskTop Unit measures 11" wide x 4" tall x 7" deep (280mm x 102mm x 178mm)
- 3). Henry EP Suite  
Henry, N-Pro, Vicar, Pandora! suite of software for ElectroPhysiology on a CDROM disk

**Scientific Solutions wants you to be completely satisfied with the product and performance and offer 30-day money back guarantee. Just contact us to arrange to return the product within 30 days of purchase and we will provide a complete refund of the product price!**

*Contact Scientific Solutions today for more information or to place an order!*



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