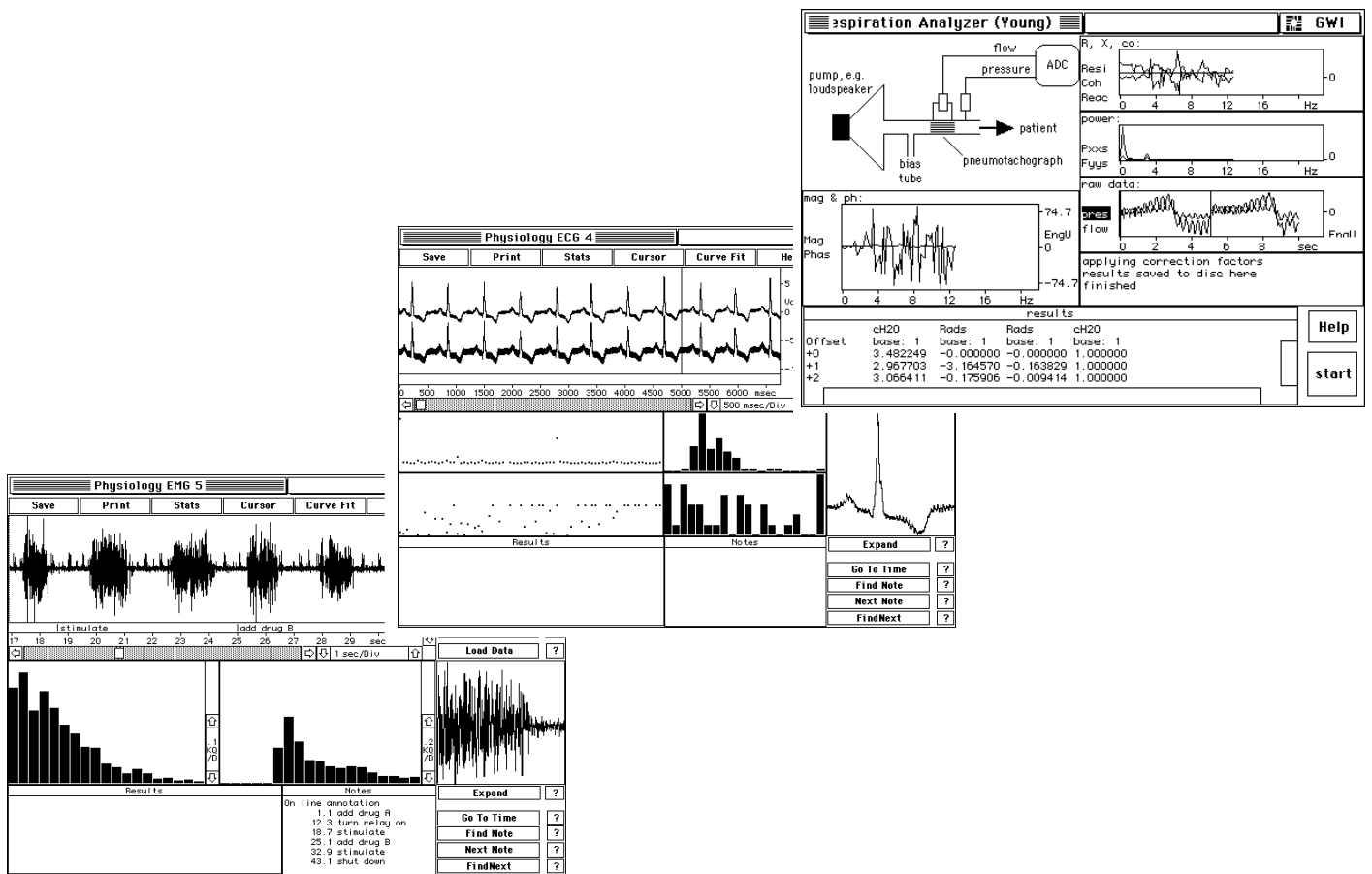


SUPERSCOPE II

USER'S MANUAL

The World's Most Advanced Recording Tool



GW Instruments, Inc.

SuperScope II User's Manual

**October 1, 1999
Manual Version 3**

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Chapter 1

Installation

Welcome to the wonderful world of SuperScope II. We are extremely excited about this product and hope you can share in our enthusiasm. SuperScope II is more than just 1 product, it is a core technology on which the following products are based:

SuperScope II	<i>Base Package, usb key</i>	#GWI-SS2-usb
SuperScope II	<i>Base Package, adb key</i>	#GWI-SS2-adb

SuperScope II supports all instruNet hardware for a variety of data acquisition, analysis, control and presentation tasks. GWI is committed to the SuperScope II platform and will continue to develop it throughout this decade and into the 21st Century.

TO GET STARTED WITH SUPERSCOPE II QUICKLY:

- 1) First install your instruNet hardware system per Chapter 1 of the instruNet User's Manual. Do the steps listed in the *Hardware Installation*, *Software Installation*, and *Verify That Your System is Working Properly* sections of this chapter. Use instruNet World software to verify that your hardware is operating properly before using SuperScope II
- 2) Do Chapter 2, instruNet Tutorial, of the instruNet User's Manual. SuperScope II accesses the windows and dialogs reviewed in this chapter; and therefore all information in instruNet World is relevant to SuperScope II.
- 3) Install SuperScope II PPC 3.x software onto your computer via the following steps:
 - * Copy the "SS2-SOS 3.x CD" folder from the CD onto your hard disk drive via the Finder.
 - * Copy the following files from the "Extensions - Important" folder in the "SS2-SOS 3.x CD" folder to the "Extensions" folder within your "System" folder: "E3ITF", "RainbowUSBShim", "SSProtect INIT", and "USBSentinel".
 - * Attach the SuperScope II hardware security key (small plastic box) to your USB or ADB keyboard/mouse connector.

Please Note:

- * SuperScope II 3.x is not compatible with 68K computers and requires System ≥ 7.5 . It is compatible with the newer Macintosh computers including the iBook, iMac, G3 and G4 models. SuperScope II 3.x is based on a CD and is not available on floppy. SuperScope II 3.x is compatible with instruNet data acquisition hardware; and will work with in most cases with the older MacADIOS hardware, yet this is not guaranteed.
 - * Free technical support is available only via email at support@gwinst.com.
 - * CD Rom software upgrades are available, part #gwi-SS2-upg-xxx. No upgrades/updates are available via the internet.
- 4) Please do Chapter 2 Tutorial of the SuperScope II User's Manual.
 - 5) Optionally, do Chapter 3 Building Instruments & 4 Advanced Techniques of the SuperScope II User's Manual.

- 6) Review Chapter 9 of the SoundScope & SuperScope II Reference Manual (formally the 16pg "SuperScope II Design Guide") -- it summarizes instrument design, and is EXTREMELY HELPFUL.
- 7) To learn how to design your own instruments or modify existing instruments, read Chapter 5 Instrument Design of the SuperScope II User's Manual. For detailed information on task instructions and mathematical functions, refer to the SoundScope & SuperScope II Reference Manual. Descriptions are listed in alphabetical order in Chapters 6 & 7.

CONVERTING OLD MACADIOS INSTRUMENTS TO INSTRUNET

To convert an old MacADIOS instrument to instruNet, make sure the instruNet driver is installed in the Extensions folder, load the old MacADIOS instrument into SuperScope II, choose Edit Menubar Full under Edit, select the instruNet Menu, and then choose Show. This will cause the MacADIOS "Hardware" menu to disappear, and for the MacADIOS channels to be converted to SuperScope II waves. To re-attach these "now" waves to instruNet channels, please refer to the below instructions. To convert an instrument from instruNet to MacADIOS, select the "Hardware" menu in the Menubar Editor dialog. Things are much simpler with instruNet -- all options in the MacADIOS hardware menu are gone. There are no such things as "digitizing" modes. Instead, instruNet digitizes in what was "segment seamless" and has an options in it's Digitize Segment task instruction that selects between Oscilloscope and Strip Chart (i.e. continuous or non-continuous "scans"). Oh, by the way, a "trace" is now a "scan".

ASSOCIATING INSTRUNET CHANNELS WITH SUPERSCOPE II WAVES

To associate an instruNet channel with a SuperScope II wave (which enables it for digitizing when a Digitizer Task is run), enter the Wave Options dialog, select "Link to instruNet Channel", and then select the desired instruNet channel. All linked waves are automatically filled with digitized data when a Digitizer Task runs. The sample rate, number of scans per task, and whether or not the scans are continuous (i.e. Oscilloscope or Strip Chart) are all selected within a Digitizer Task's Digitize Segment instruction. It is within this instruction that little segments of waveform are digitized, in a loop, between the Segment Loop Begin and Segment Loop End instructions.

THE INSTRUNET MENU

The instruNet menu is used to view and set the instruNet channel options, and to record waveforms directly into the instruNet World Record window for purposes of verifying that the channels are set up properly. For information on how to use the instruNet World Record, Network and Test pages (all accessible from the SuperScope II instruNet menu), please refer to the instruNet User's Manual. All settings in the Network page are used when digitizing (e.g. analog and digital filter settings, integration times for each channel, sensor type, etc) and are saved with SuperScope II instruments. The Digitizer Task automatically digitizes into SuperScope II waves that have been linked to instruNet channels via the "Link to instruNet Channel" option within the Wave Options dialog box. These links can be turned on/off at run time via the Set Wave Internals instruction.

INCLUDED INSTRUNET INSTRUMENTS

It is recommended that one begin with the included instruments inside the "instruNet Instruments:Best Instruments" folder, relying on their HELP windows (opened with a Help button) for information on how they work. These instruments are both powerful and fairly simple, with only a handful of tasks each, where each task typically includes less than 5 instructions. To learn good SuperScope II programming techniques, it is recommended that one study these tasks. Recommended instruments are:

- Oscilloscope with Database.iNet
- Strip Chart To Disk.iNet
- Strip Chart w Database.iNet
- Transient Database.iNet
- XY Recorder.iNet
- Spectrum Analyzer.iNet

COMPUTER REQUIREMENTS

SuperScope II must be run on a machine with the following minimum requirements:

Computer

SuperScope II is compatible with PowerPC computers (not 68K) including iBook, iMac, G3 and G4 models.

Operating System

Apple System 7.5 or newer is required.

Monitor

SuperScope II supports all monitors including: two page displays, 24bit color, and grayscale.

Hard Disk

SuperScope II requires a hard disk with at least 50 MB free.

Random Access Memory (RAM)

At least 5 MB of RAM should be allocated for SuperScope II, although it will run with as little as 3.5 MB of RAM. System 7.x itself can consume 4 MB or more of RAM. Adding extensions ("INITs") to your System Folder requires additional RAM as well. In summary, 16MB of total computer RAM is recommended. If you incur a memory error upon application launch or when running an instrument, try increasing the Memory Allocation field in the SuperScope II Get Info dialog (i.e. select the SuperScope II application icon from the Finder, and choose Get Info in the File menu).

SYSTEM COMPONENTS

The SuperScope II product family includes the following systems:

SuperScope II

BASIC PACKAGE

#GWI-SS2-xxx

- ◇ SuperScope II Software on CD
- ◇ SuperScope II User's Manual
- ◇ SuperScope II & SoundScope Reference Manual
- ◇ Eve™ security key

SUPERSCOPE II FIVE-PACK

Multiple Systems

#GWI-SS2-5pak-xxx

- ◇ Five additional security keys for a multi-station installation. At least one base system (Parts #GWI-SS2) must be purchased in order to qualify for the Five-Pack purchase. Five-Packs cannot be broken (e.g. you cannot buy 3 for 60% of the Five-Pack price).

OUR MISSION FOR THE 90'S (AND BEYOND)

The world of computing is currently evolving at lightning speed with computers the size of notebooks doing what mainframes did only 10 years ago. And we believe this spectacular growth will continue at a 5%/month increase in price-to-performance-ratio well into the 21st Century (it's exciting). This, coupled with the fact that the manufacturing cost of software is negligible, has led us to believe that companies who invest heavily in developing ultra advanced software will be the winners at the turn of the century.

In 1989, we undertook the challenge of developing a highly advanced software product family. This involved over 30 developers and three years of painstaking effort before it produced it's first fruit. SuperScope II is more than one computer instrument -- it is an environment in which the end user can design their own instruments. We believe that the next revolution in computing will involve the end user taking on the role of the developer; designing, prototyping, learning, and implementing new and unique methods in the field. Subsequently the SuperScope II product family allows the end user to "program" with an easy to use mouse/dialog box user interface.

Our Company Mission is to change the way scientists, engineers and medical researchers work in the laboratory by developing computer based instrumentation which is faster, stronger, more accurate, more capable, more flexible, less expensive and easier to use than the traditional benchtop counterparts. We hope this product made a dent in this quest and wish to hear from you if you have ideas concerning future releases.

IDEAS FOR NEW FEATURES

If you have any suggestions for improvements, please phone or write us *Attention: New Products*. We develop products for you, the user, and want your feedback.

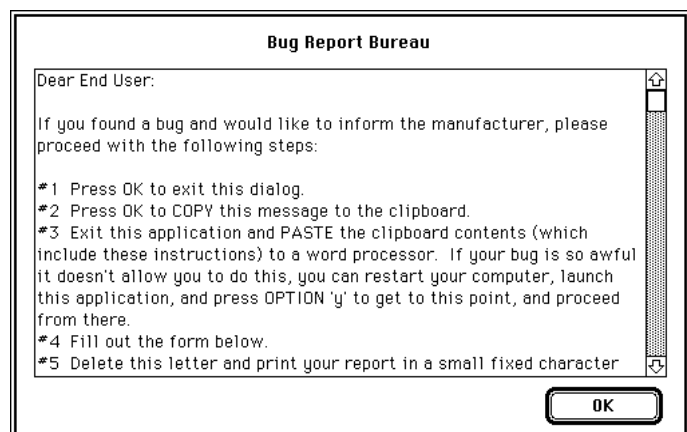
APPLICATION NOTES

GW Instruments collects 2 page summaries of common instruments. If you would like to write about your instrument, or would like to read about someone else's, please call or write GW Instruments, attention *Application Note Program Coordinator*.

REPORTING BUGS

To learn about dead bugs, known bugs and areas under development please open file "!Development Status.note" in the "Programmer's Notes" folder inside the "Goodies" folder. This file can be opened using any text editor (e.g. Microsoft Word, Word Perfect). This file expects tabs every 4 characters (i.e. choose Options under Journal and then set the Tabs to "4" characters).
To report a bug, please:

- #1 If the bug causes an Error Alert to appear (i.e. one with a Bug Report button), press the magic button to open the Bug Report dialog, pictured to the right. Alternatively, if the bug does not cause an Error Alert to appear, press *Option 'y'*, at any time, to invoke the Bug Report dialog.
- #2 Read the displayed instructions.
- #3 Press OK to exit the dialog.
- #4 Press OK to copy the bug report information to the clipboard.



- #5 Paste the clipboard text into a new word processor window.
- #6 Describe the sequence of steps required to reproduce the bug (this is crucial). If we cannot see the problem at GW Instruments, we probably cannot fix it.
- #7 Delete the Dear End User letter at the top of the file, to save trees.
- #8 Print in a small font (e.g. Courier 8) and send to GW Instruments via fax, mail, or electronic mail. If you phone us, please do so while in front of your computer, if possible.
- #9 If your bug is real mean, please refer to Tip #413 in Appendix E of the SoundScope & SuperScope II Reference Manual.

SOFTWARE UPGRADES

To receive the latest version of the SuperScope II software, please contact GW Instruments.

SuperScope II Software Upgrade.....*Part #GWI-SS2-Upg-xxx*

TECHNICAL SUPPORT

Please contact your SuperScope II Supplier for Technical Support.

PLEASE RETURN THE
OWNER REGISTRATION FORM
TO RECEIVE NEWS AND UPDATES.

Chapter 2

Tutorial: Quickstart

This chapter describes how to quickly build an oscilloscope or strip chart recorder instrument using SuperScope II in conjunction with instruNet hardware. Front panel layout, acquiring data, creating tasks, saving data to disk and on-line analysis will be covered in easy to follow steps.

In the instructions for designing the instrument, each step is preceded by a bullet symbol (•). It is important to not miss a step, since many steps depend on previous steps. SuperScope II makes extensive use of hierarchical menus (i.e. submenus) to provide direct access to waves, displays, journals and other objects. This manual uses the ▶ character to indicate a submenu. For example, "Select Load Data ▶ A from the Wave menu" is shorthand for "Pull down the Wave menu, drag down to the Load Data submenu, drag across to 'A', and then release the mouse button to select it."

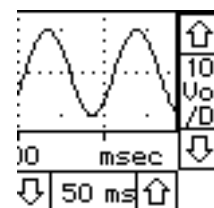
SUPERSCOPE II OBJECTS

SuperScope II is designed to acquire, analyze, present, archive and control real-time-based waveform data. It is used by two different audiences, instrument users and instrument designers. Instrument users can begin work right away, using software instruments that were created by GW Instruments or by colleagues. Instrument designers construct instruments by creating and customizing objects, and gluing them together. There are several kinds of objects, and the instrument designer creates as many as needed to build the application of his/her dreams. Objects are set up with mouse-driven pull down menus and dialog boxes -- no previous programming experience is necessary. The different types of objects are summarized below.

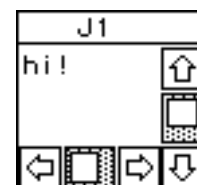
Waves are used to represent real world continuous data as a list of numbers that show a waveform when plotted. Waves are digitized, synthesized, analyzed, edited, viewed, used to hold the results of analysis, loaded from disk, and imported/exported to/from other application programs.



Displays reside on the front panel and are used to view and edit waveforms. They are extremely versatile with many customizable attributes such as horizontal and vertical controls, labels, markers and much more. Displays can be positioned on the front panel in any pattern and in any number, space permitting. Each display can contain up to 8 waves and supports mouse-driven Cut, Copy, Paste, and drawing of waveform segments.



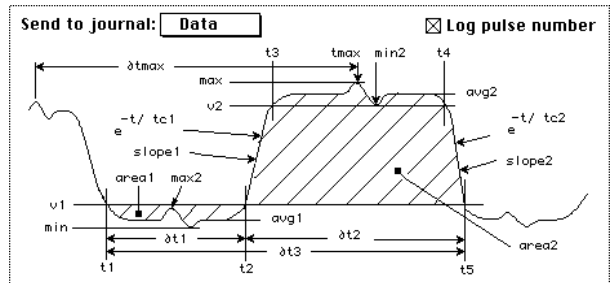
Journals are text regions that are used to enter, view and edit text in a manner similar to that done with a word processor. The contents of Journals can easily be saved to disk and then loaded by a word processor or spreadsheet program. Journal windows can be resized and positioned on the front panel in any pattern and in any quantity, space permitting.



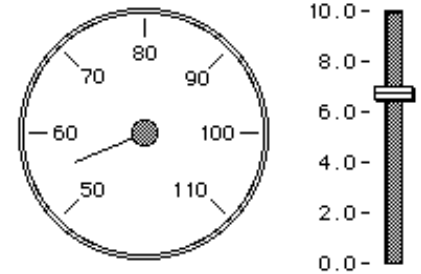
Tasks are sequences of instructions that perform a series of operations. For example, one could write a task to record data, analyze, update the screen, and then print the results. Tasks are easily created, viewed, edited, and debugged; and can be set up to run when a marker moves, when a wave changes, when a specific menu item is chosen or when the user chooses Run Task. One "programs" tasks using a powerful mouse/dialog user interface. The neat thing about programming SuperScope II is you do not need to know a syntax — the mouse-driven dialog boxes take care of you!

Calculate Wave
Pulse Analysis
Sound Statistics
Statistics

Instructions are the building blocks used to create tasks. There are over 30 kinds of instructions, each dedicated to a specific function (e.g. save a wave to disk, move a marker). A task contains a list of instructions that are executed in the order that they appear in the task; and each instruction can be viewed in it's own dialog box, edited, cut, copied, and pasted.



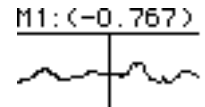
Controls and Indicators are used to control and indicate the state of Boolean true/false values, scalars, and text. Controls (e.g. buttons, checkboxes, edit fields, knobs, sliders) reside on the front panel and are controlled with the mouse and/or keyboard. From the task's perspective, a control is a variable that is read. Also, controls can trigger a task when moved. Indicators (e.g. dial, static text, bar graph) are front panel objects that display a value or string. From the task's perspective, an indicator is a variable that is written to.



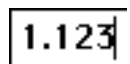
Menubars are a powerful tool for modifying the current menubar, or creating your own. Each menubar consist of a set of menus and a set of items under each menu.



Markers are typically used to mark a time in a wave or display. The user can create as many markers as he/she desires and can place any marker in any display. In displays, they appear as vertical lines that can be moved left and right with the mouse.



Strings & Variables are used to hold text and numerical values. Many task instructions transfer data to and from strings & variables.

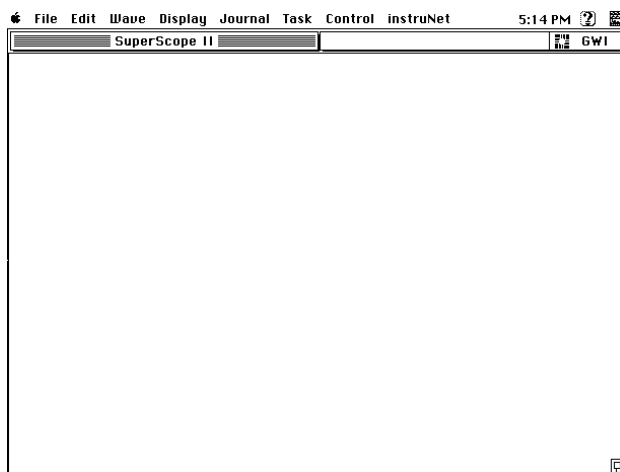


BUILDING YOUR FIRST SUPERSCOPE II INSTRUMENT

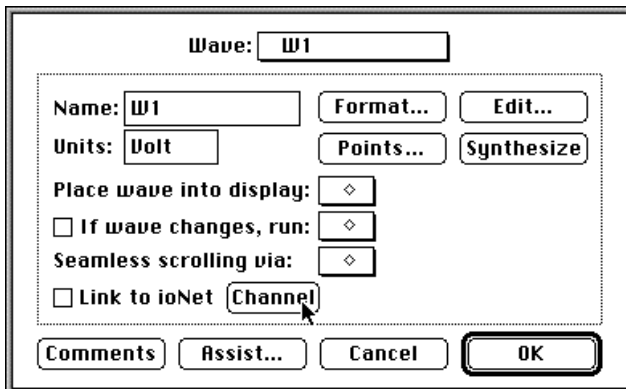
- 🍏 This tutorial assumes you have done *Chapter 1 Installation & Chapter 2 instruNet Tutorial* of the instruNet User's Manual. If you have not done so, please do this now.
- 🍏 Please make sure your computer equipment is powered on, and that you have installed the SuperScope II software and instruNet, as described in *Chapter 1, Installation of this manual*.
- 🍏 Open the SuperScope II application by double-clicking on its icon.

You will get an error message if there is not enough memory (RAM) to launch SuperScope II. SuperScope II prefers 5 MB (5000 K) or more, but will run with as little as 3500K allocated for small instruments. To determine if your machine has enough memory, select About this Macintosh (or About the Finder) from the Finder's Apple (🍏) menu. You can also quit other applications to increase the memory available. Please see *Chapter 1, Installation* for a detailed discussion of memory issues.

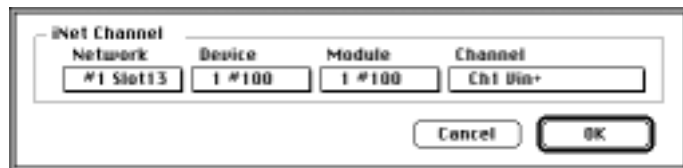
After a few seconds, SuperScope II's menubar will appear at the top of the screen, and a blank front panel will appear, as shown to the right. SuperScope II instruments are built by first laying out a front panel, and then by creating tasks which add functionality to the instrument. The front panel of an instrument is built by adding displays, controls and indicators, journals, and waves to the blank panel. Tasks are a lists of instructions to be executed that can include instructions for acquisition of data, output of waveforms, analysis and displaying of data, and saving data to disk. The instrument you will build in this chapter will be a 1 channel oscilloscope that calculates the absolute value of the acquired waveform. This first instrument will include 2 displays, 2 waveforms, 1 button, 1 task and 1 journal. For your reference a finished version of this instrument named "instruNet First Contact" is in the "Chapter 2" folder inside of the "Tutorial Instruments" folder; inside of the "instruNet Instruments" folder.



- 🍏 Select New under the Wave menu. The wave dialog will open as shown in the figure to the right. A wave can be linked to an instruNet input channel in which case it will store data acquired from that channel in RAM, linked to an instruNet output channel in which case it will hold a list of values in RAM to be output on an analog output channel, or as an array used to store the results of calculations.



- 🍏 Click the Link to instruNet Channel button at the bottom of the dialog to open the instruNet Channel Selection dialog, as shown to the right. Every channel in an instruNet network is defined by its Network number, Device number, Module number and Channel number. Any wave can be linked to any instruNet channel by selecting the desired channel using the 4 popups in the instruNet Channel Selector dialog.



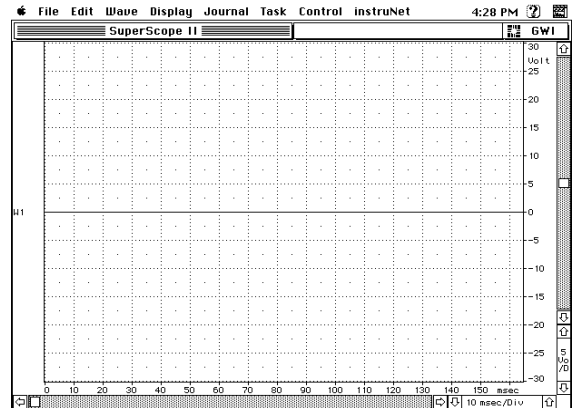
Click the Channel popup to view the list of available channels. The list shown to the right is what would appear if a Model 100 or Model 100B was attached as the first network device to your instruNet network. Note that all of the input and output channels for the device are listed. If a second device was attached to your controller you would access its channels by first selecting that device in the Device popup in the Channel Selection dialog, and then select the desired channel in the Channel popup.

- Ch1 Vin+
- Ch2 Vin-
- Ch3 Vout
- Ch4 Vin+
- Ch5 Vin-
- Ch6 Vout
- Ch7 Vin+
- Ch8 Vin-
- Ch9 Vout

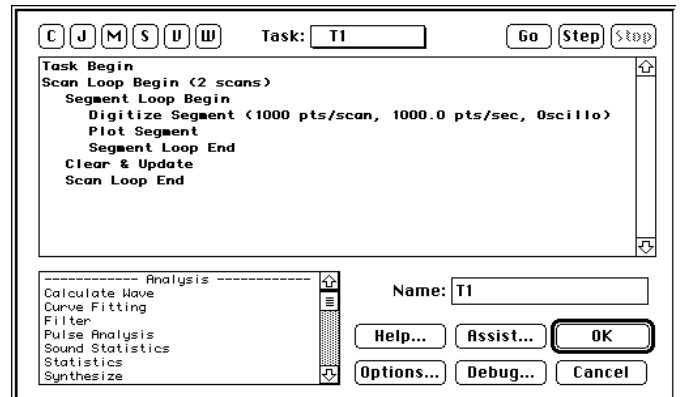
Select Ch1 Vin+ in the popup. This links Ch1 Vin+ to wave W1. Now, when data is digitized from the Ch1 Vin+ screw terminal, it will automatically be stored in wave W1 in RAM.

Click OK to exit the Channel Selection dialog.

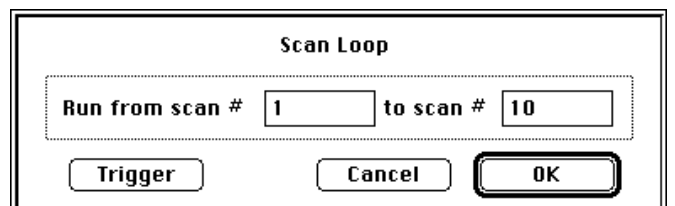
Click the Assist button in the bottom of the Wave dialog to open the Wave Assist dialog. Click the OK button, which causes a new display to be created, places the wave W1 (i.e. Ch1 Vin+) into that display and centers the display on the front panel. A number of the object dialogs (e.g. Wave, Display, Task, Journal) have Assist buttons. These buttons allow you to save time in creating instruments by automating common steps. Your SuperScope II front panel should now look as shown below.



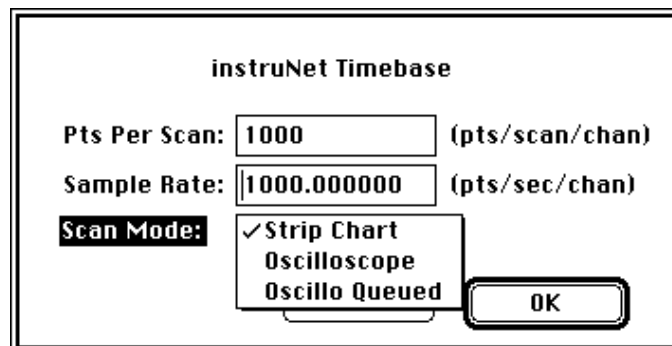
Select New Digitize... under the Task menu to create a new task and to open the Task Editor as shown to the right. Functionality is added to a SuperScope II instrument by creating tasks. SuperScope II allows for the creation of two types of tasks - digitizing and non-digitizing. A digitizing task is typically created for the purposes of acquiring data, saving data to disk, real time displaying of acquired data, and on-line analysis. A non-digitizing task is created for off-line analysis. The Task Editor contains two scroll boxes. The larger scroll box at the top of the dialog contains a list of the instructions to be executed when the task is run. The smaller scroll box at the lower left contains a list of instructions that can be added to the task to add more functionality. When a new digitizing task is created a set of template instructions are automatically added to the task to implement the actual acquisition and display of data. These are the bolded instructions shown in the dialog above. These bolded instructions cannot be moved nor deleted. When a non-digitizing task is created no template instructions are added.



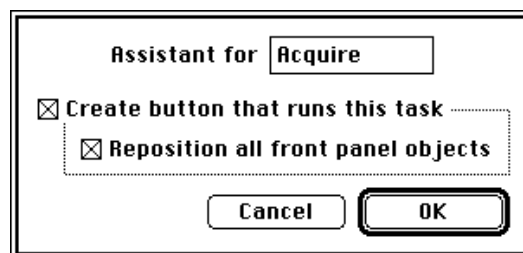
Double click on the Scan Loop Begin (2 Scans) instruction to open the dialog as shown to the right. This dialog is used to set the number of scans of data to be collected. Set the number of scans to run from 1 to 10. Click OK to exit the dialog.



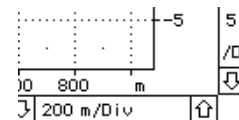
- Double click on the Digitize Segment instruction to open the Timebase dialog as shown to the right. The timebase dialog is used to set the sample rate, the number of data points to be acquired per channel for each scan (Pts Per Scan) and the data acquisition mode (Strip Chart, Oscilloscope, or Oscillo Queued). Set the Scan Mode popup for Strip Chart and click OK to exit the dialog. For a detailed explanation of the various modes please refer to *The Record Page* section of *Chapter 5 instruNet World Application Program* in the *instruNet User's Manual*.



- Change the name of the task to Acquire by deleting the name T1 and typing the name Acquire in the Name field in the lower right section of the task editor. Next click the Assist button to open the Task Assistant dialog as shown to the right. Click OK in this dialog and then OK again in the subsequent dialog that appears. The Task Assistant automatically creates a button with the same name as the task and puts the button at the top of the front panel. Clicking this button will run the task.

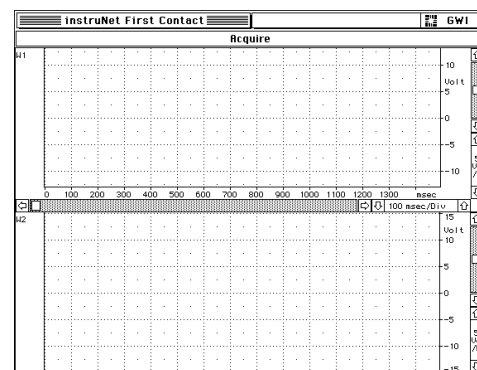



- Click the Acquire button to run the instrument. This button actually runs the Acquire task which was set up to acquire 10 scans of data at a sample rate of 1000 samples/sec and 1000 pts/scan in Strip Chart mode. If you have a signal (e.g. a function generator) attached to Ch1 Vin+ you would see it plotting in the display; otherwise if nothing is connected you will see a straight line at 0V. To view the entire waveform in the display, click the horizontal up arrow in the lower right corner of the display, as shown to the right, until a setting of 100 or 200 ms/div is achieved.

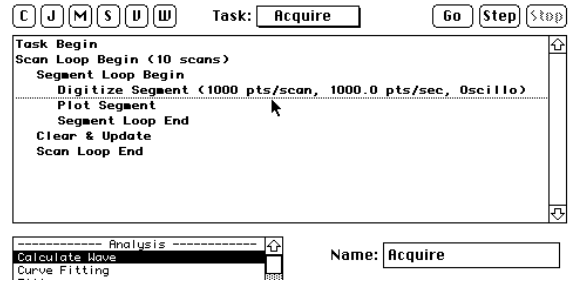


- Select Save As... under the File menu, enter a name for your new instrument and then click the Save button.

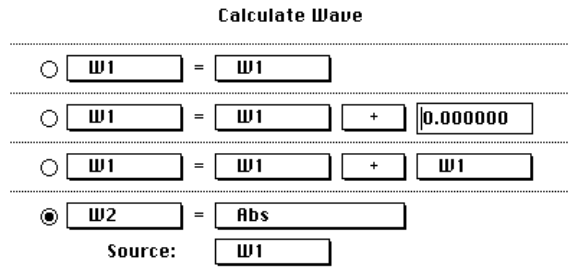
- Select New under the Wave menu to create another wave. Do not link this wave to an instruNet channel. Click the Assist button at the bottom of the wave dialog and then click OK in the next two dialog boxes that appear. This will automatically create a second display, put the second wave (W2) in the new display and place the new display under the first display. No horizontal scale adjustment or scroll bar will appear in the second display since these two items are linked to the first display. When you horizontally scroll the top display the bottom display will scroll with it and when you change the scale adjustment on the top display, the scale adjustment on the bottom display will automatically change to the same setting. The two displays are linked in time. Your front panel should look like the panel shown to the right. Select Save under the File menu to save your instrument to disk.



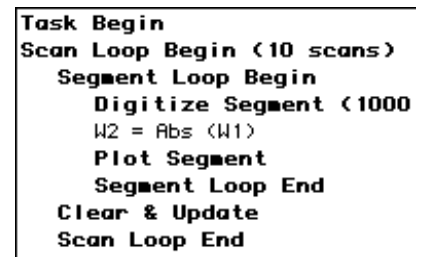
-  Select Edit ▶ Acquire under the Task menu to open the Task Editor. The small box at the lower left is called the Instruction Dictionary and contains instructions that can be added to a task. Click and hold down on the Calculate Wave instruction (the first instruction in the list), drag it up to a position between the Digitize Segment and the Plot Segment instructions, as shown in the figure to the right, and let the mouse button go. The Calculate Wave dialog will open as shown to the






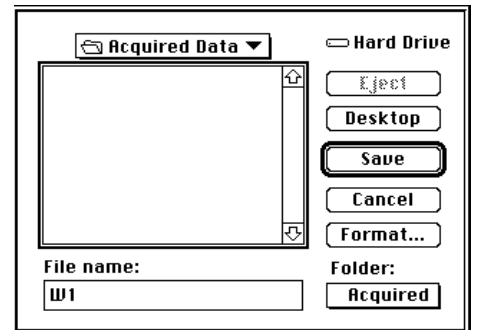
right. This is the dialog used to define general wave math instructions (e.g. add, subtract, integral, FFT). Click the lower of the 4 radio buttons on the left of the dialog. Select W2 in the wave popup to the right of the radio button. Select Abs (i.e. absolute value) in the popup to the right of the = sign. Select W1 in the Source popup. This defines the equation: $W2 = \text{Abs}(W1)$, or in effect $W2 = \text{Abs}(\text{Ch1 Vin+})$. When done your dialog should look exactly like the dialog pictured to the above right. Click the OK button to exit the dialog.



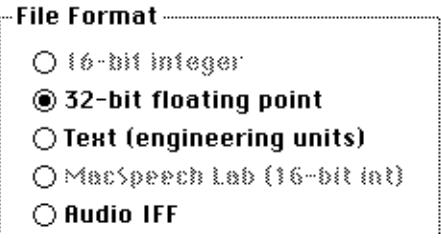
Your Acquire task should appear as shown to the right. If you accidentally put the instruction in the wrong place, click on it once to highlight it, select Cut under the Edit menu, click once on the Segment Loop End instruction to highlight it, and select Paste (or Command-V) under the Edit menu. If you entered the wrong math instruction double click on the instruction to re-open its dialog and then change the parameters to the correct settings. Click OK to exit the Task Editor.



-  Click on the Acquire button to run the instrument. At the end of each scan an absolute value of the data acquired on channel Ch1 Vin+ will be calculated, the results will be stored in wave W2, and displayed in the lower display.
-  Select New... under the Journal menu to open the Journal Dialog. Enter the name Notes into the Name field and click the Assist button and click OK in the dialog that appears. Note that the journal "Notes" is placed beneath the bottom display. The journal works like a built in text editor where the user can type comments, or collect numerical data.
-  Select Save As ▶ W1 under the Wave menu to open the file dialog as shown to the right. For this instrument we will save data to disk manually. Saving data to disk and loading data from disk can also be automated within a task. Automatic saving and retrieval of data is covered in the tutorial instruments described in Chapters 3 and 4 of this manual.



- Click the Format button to open the wave format dialog shown to the right. SuperScope II waves can be saved as 32-bit floating point, Text, or Audio IFF (AIFF). Click the Text (engineering units) button and click OK to exit the dialog. Enter the file name Test Wave and click the Save button. Since the wave was saved in a Text (i.e. ASCII) format it can be opened from text editors or spreadsheets as well as from SuperScope II. If the wave was saved in a 32-bit floating point it could be opened using SuperScope II or programming languages (e.g. C, Basic) but could not be opened using text editors or spreadsheets.



- Select Open under the File menu and select Test Wave. This will load the wave back into SuperScope II for analysis and display.

This is the end of the design of the first tutorial instrument. Chapters 3 and 4 of this manual cover advanced topics in instrument design.

Chapter 3

Tutorial: Building Instruments

This chapter describes the main features of SuperScope II, in tutorial fashion. From here, you can take advantage of the familiar Macintosh interface to explore additional capabilities. This chapter assumes you are working with Version 2.0 or later of the software.

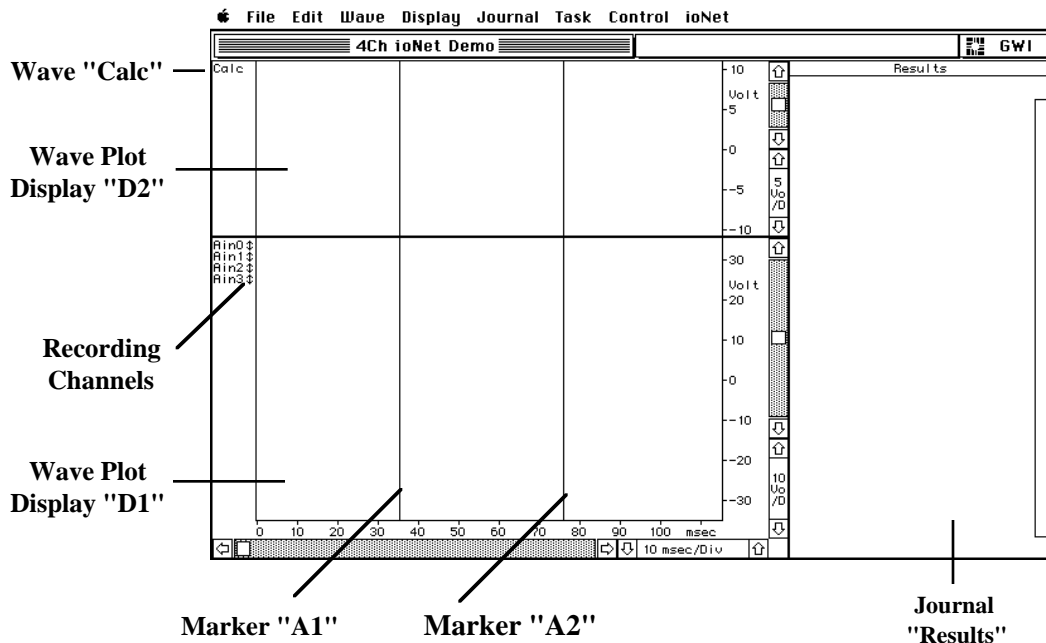
SuperScope II is designed to acquire, analyze, present, archive and control real-time-based waveform data. It's features are summarized below:

- Extensive analysis, mathematics, presentation, data management and file I/O capabilities.
- Simultaneously digitize, plot and save to disk continuous streams of data indefinitely! File size is only limited by hard disk capacity.
- Compatible with instruNet hardware.
- Includes RS-232 support.
- Powerful dialog-box based macro language and menu editor enables the end user to redefine the menubar and link new menu commands to macros. This, in essence, enables the end user to design his/her own menu-driven application program.
- Employs an object-oriented approach that supports the following kinds of objects: waves, segments, markers, displays, instructions, tasks, journals, menubars, strings, and variables. Objects are created in any quantity, memory permitting.
- Includes powerful debugging tools.

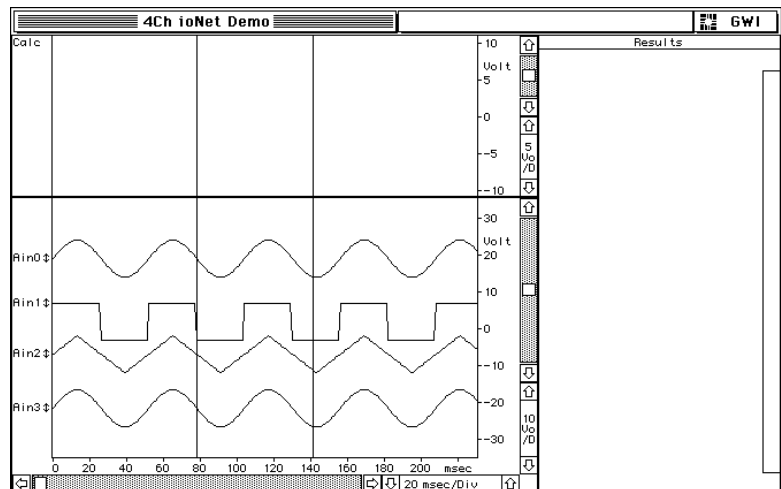
PART 1: GETTING STARTED

- Inside the "SuperScope II" folder on your hard disk, locate the instrument file called "4Ch iNet Demo Demo" (inside the "Tutorial" sub-folder of the "instruNet Instruments" folder). Double-click on the SuperScope II application to start it. Select Open... from the SuperScope II File menu and open the "4Ch iNet Demo Demo" instrument.

After a few seconds, SuperScope II's menubar will appear at the top of the screen, and the instrument will load, as illustrated below:

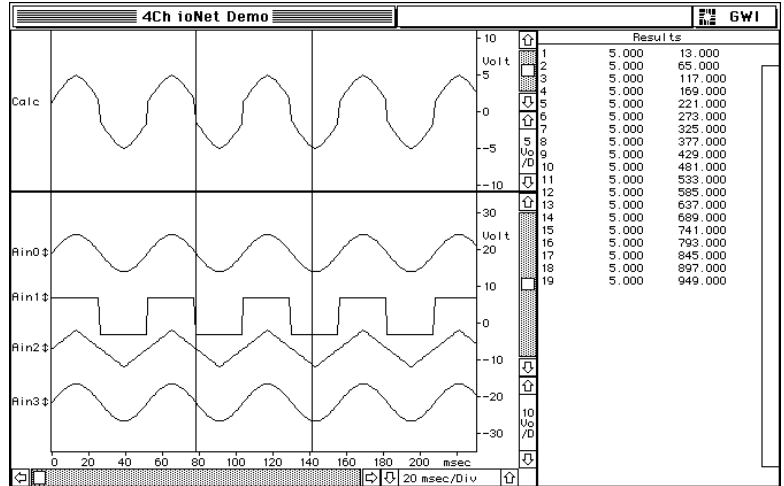


- Select Run ▶ Record under the Task menu. SuperScope II will respond by clearing its lower-most display and plotting the 4 analog voltage inputs vs. time. If you are running in demo mode 4 analog input channels will be simulated. If you are connected to instruNet hardware actual data recorded from the first 4 channels will be displayed. The screen will show a 4 channel strip chart recorder that acquires 10000 points per channel at 1000 samples/sec per channel, as shown to the right.



- Select Run ▶ Average from the Task menu to run the task and view its results.

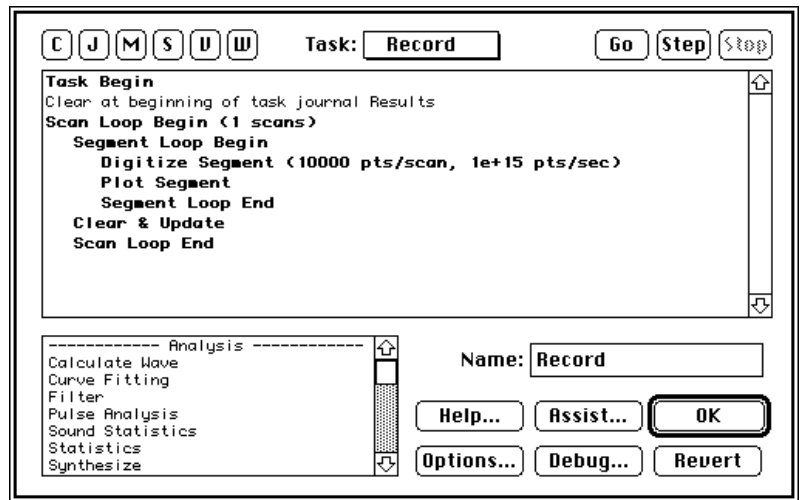
Each instruction executes in the order that it appears in the task. First, the journal "Results" is cleared, then the point-wise average of the 4 input channels are calculated, and then the W1 pulses times and maximums are logged to the journal. At the end, the display updates, as shown to the right.



THE TASK MENU

Tasks are programs that consist of a list of instructions, which are executed in a top-to-bottom sequence. Each instruction is not typed, however, as done in traditional textual programming environments; instead, each instruction has an associated dialog box from which the user specifies, in detail, the instruction's functionality -- with easy to use pop-up menus, check boxes, radio buttons and edit fields. It's as easy as forming a sentence!

- 🍏 Select **Edit** ▶ **Record** in the Task menu to open the Task Editor, shown to the right. The task shown is the default digitizer-based-task with one additional instruction: "Clear at beginning of task Journal Results". The minimal instructions needed to run the digitizing task are bolded while the added instruction is not. None of the minimal instructions can be removed from the task, while added instructions can be modified, moved around or deleted. Digitizer-based-tasks are used to control the basic I/O functions of instruNet hardware.



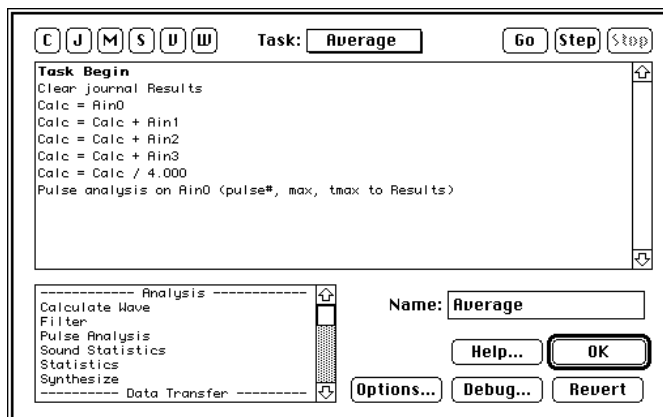
The user adds an instruction to a task by dragging one from the Instruction Dictionary, in the Task Editor lower-left, to the desired position within the task. Alternatively, the user can double-click on an instruction in the dictionary to position it at the end of a task. All bold-faced instructions are present when a task is created. They form the skeleton functionality and cannot be moved. The non-bolded, user-added instructions are easily moved with the standard select, Cut, Copy and Paste commands. To create a task without the bold-faced Digitize Scan, etc. instructions, one would choose New under Task, instead of New Digitizer under Task.

- 🍏 Scroll the Instruction Dictionary until the item "Displays" under the header "Management" is visible. Double-click on Displays to open it's dialog. This is an example of a user-added instruction. After viewing it, press Cancel. If you had pressed OK, it would have been added to the task.
- 🍏 Double-click on each instruction in the Dictionary to view the many wonderful tools that are available to you. Press Cancel to exit each dialog.

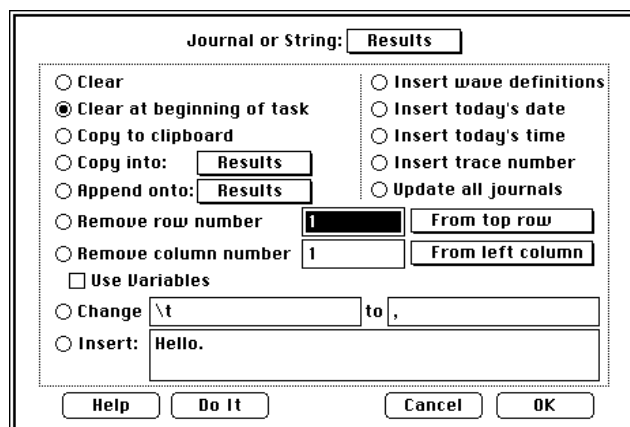
The beauty of programming with dialog boxes is they coach you into doing the right thing.

Click on the Cancel button to exit the Task Editor. If you clicked OK your modifications would have been saved.

Select Edit ► Average from the Task menu to view a task named "Average", shown to the right. This task first clears the display "Results", and then sums the four analog inputs, point-by-point, to produce the point-wise sum of the four. It then divides this sum by 4 to yield the average. This all occurs point-wise, which means that the *N*th point of the result is the average of the *N*th point in the 4 inputs, for all points. The last instruction searches wave W1, for pulses and when a pulse is found, it transfers the time and maximum value of the pulse to the front panel journal named "Results". In this case, a pulse is defined in the Pulse Detection dialog as falling below 2V, crossing 3V in the positive direction, and then falling below 2V again.

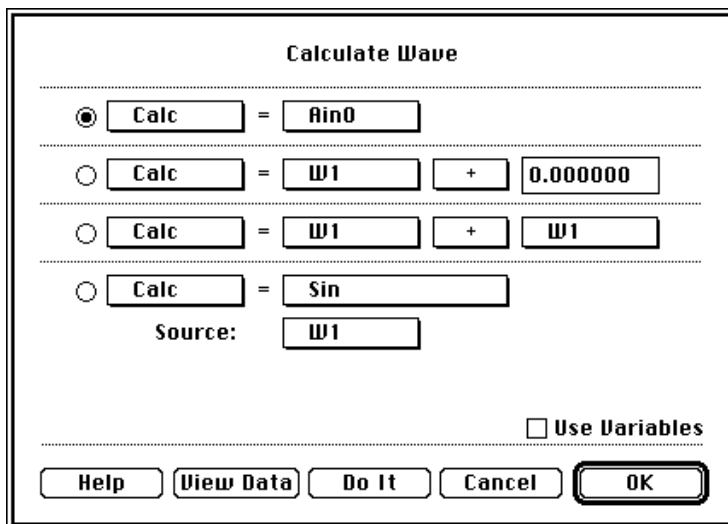


Double-click on the line "Clear at beginning of task Journal Results" to open the Journals & Strings dialog, shown to the right. This instruction can clear, insert text, append, copy, and search-replace text within a journal or string. Strings are SuperScope II objects that are used to hold text. Journals are similar, yet their text is shown in a text region that supports typing, Cut, Copy and Paste.



Many analysis instructions send results, in a tabular format, to journals. This text can then be saved to disk, or transferred to another application program (e.g. word processor, spreadsheet, database, etc) via the standard Copy and Paste. Click OK to close of the Journals & Strings dialog.

Double-click on the "Calc = W1" instruction to open the Calculate Wave dialog, shown to the right. This instructions supports over 80 waveform mathematics functions, including signal averaging, convolution, integration, derivative, Fourier analysis and much more. This instruction is currently setup to copy data in wave W1 into wave Calc.

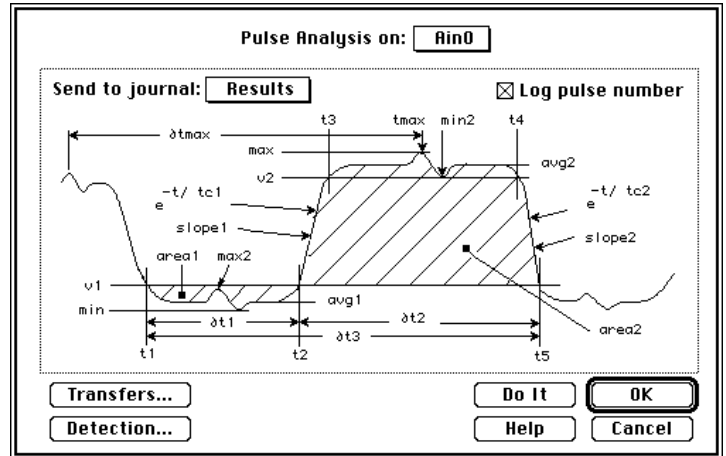


Calculate Wave contains pop-up menus that are used to build a sentence, such as "Calc = Calc + W1". When the Calculate Wave dialog is closed, the sentence is placed into the task, and when the instruction is executed, the actual mathematics are calculated. To calculate immediately, one would press the Do It button.

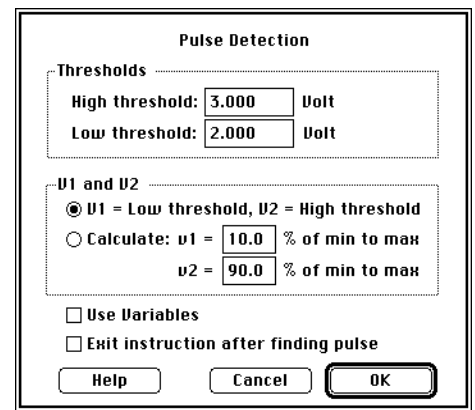
- Press on some of the pop-ups to gain a sense of how this works. Press **Cancel** when done with your review.

Programming SuperScope II is as easy as forming a sentence; therefore, it's learning curve is surprisingly short, and previous programming experience is not necessary.

- Double click on the "Pulse analysis ..." instruction. The Pulse Analysis dialog will open, as pictured to the right. This instruction is used to determine pulse characteristics (e.g. time, width, area, maximum value, etc) and sends the results to journals, waves, markers, variables, strings and/or front panel indicators. For example, this instruction could be used to measure the peak voltage on every pulse in a waveform, and to send the results to another wave. Hence, one could view a plot of the maximums by placing the result wave into a display. In our current example, Pulse Analysis sends the maximum value, and the time of occurrence, of each W1 pulse, to the journal "Results". To enable a calculation to a journal, one simply clicks on the desired parameter. To disable, one clicks again. Selected parameters are marked with an enclosing box (e.g. **max**, **tmax**).

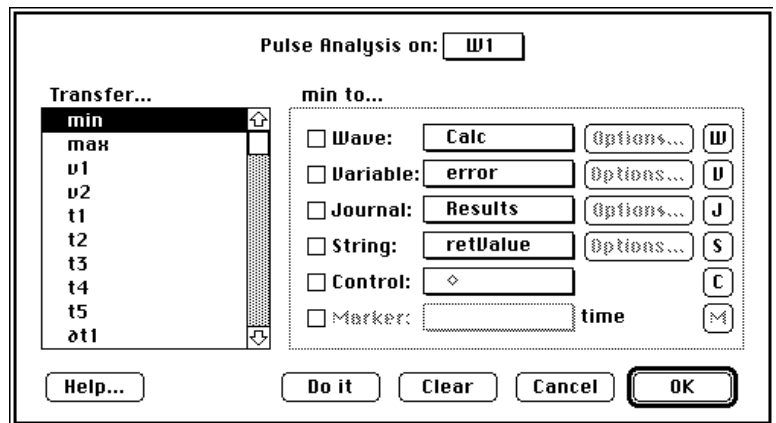


- Click on the Detection button at the lower left to open dialog pictured to the right. A pulse is currently defined as a fall below 2V, a rise above 3V and then a fall below 2V. Having two thresholds instead of one reduces false triggers caused by noise. Notice that 0V is irrelevant. Click Cancel to close the Pulse Detection dialog.



- Click on the Transfers button to open the dialog shown to the right. This is used to send any of the 24 pulse characteristics to waves, variables, strings, controls, and markers; in any combination! A marker's value is derived from it's position; a control's value is derived from it's setting; a string or journal's

value is derived from it's text (zero is assumed if the text does not contain a number); and a wave's scalar value is derived from one point, as specified in the Wave Transfer Options dialog, discussed later. This method of transferring values, to and from objects, of different type, is used by a variety of Instructions.



- Please press Cancel twice to return to the Task Editor, and then press OK to return to the front panel.

SuperScope II supports the transfer of data between objects of different type. This is called polymorphism, and is a powerful attribute of SuperScope II's object oriented design.

SCROLLING THROUGH A DISPLAY

- Press on the horizontal and vertical time-per-division arrows at the lower right to see the correspondence between these controls and display contents. Also, play with the horizontal and vertical scroll bars to see how the entire display contents can be shifted left, right, up or down. These controls enable the end user to zoom in, and pan, on interesting sections of a waveform.
- Select Mouse ▶ Vertical Adjust in the Display menu and then click once on the W1 wave label at the left edge of the display. Notice that the wave label highlights after being selected. This means that you have selected this wave for mouse activity. Since the display contains more than one wave, you need to specify which one is to be operated on.

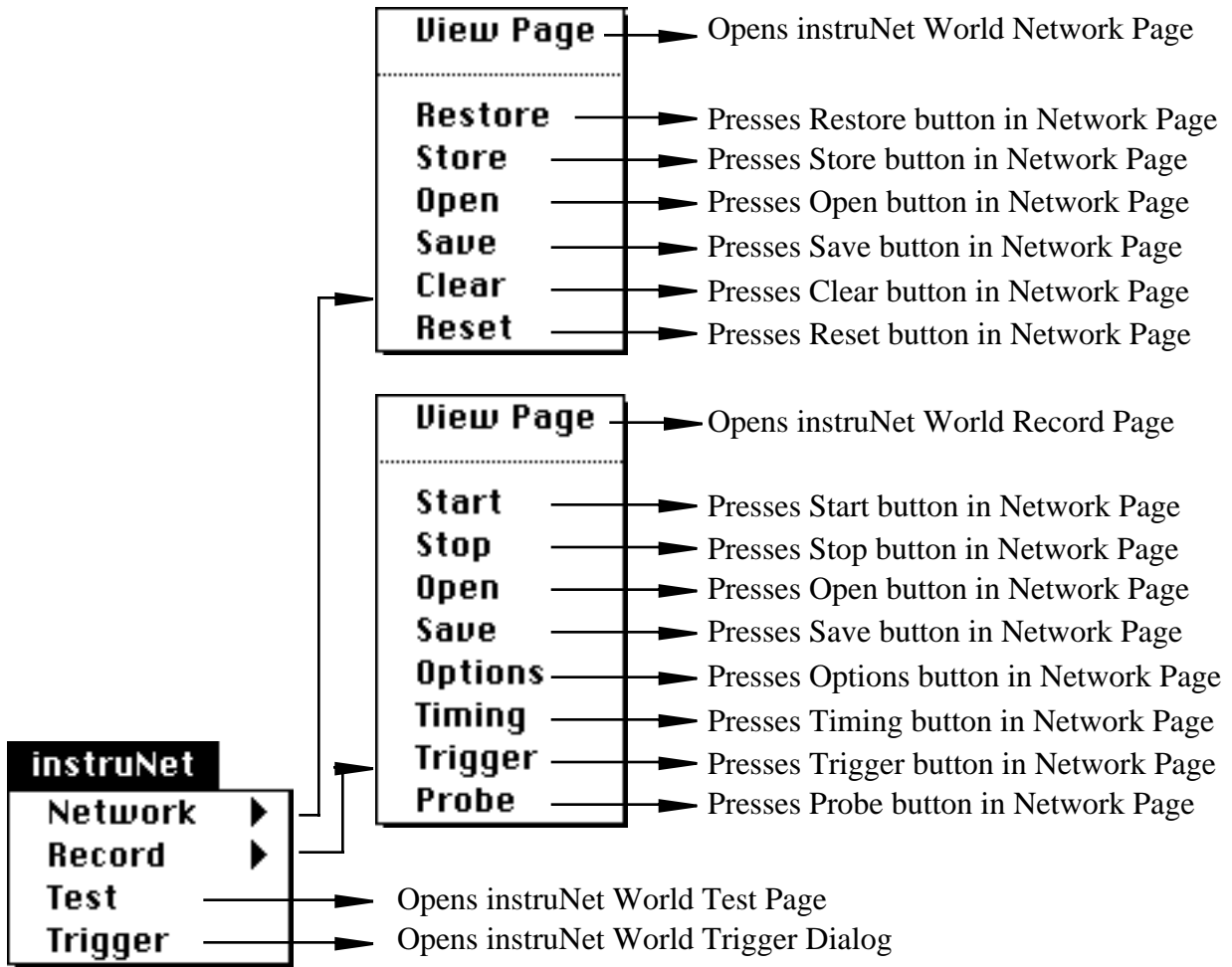
There are a number of things the mouse can do to a wave, one of which is always specified in the Mouse ▶ submenu under Display. Vertical Adjust is used to adjust a wave vertically, and to therefore de-couple it from the vertical scale at the right of the display. A double-arrow (↕) appears next to the wave labels of de-coupled waves. Pressing on this double-arrow causes the wave to snap back into position. Vertically adjusting is useful if several waves are plotted on top of each other, and need to be separated.

- Grab the W1 wave with the mouse and drag it up and down to get a feel for Vertical Adjust. Notice the ↕ symbol that appears next to the label when the wave is first moved.
- Click on the ↕ symbol to snap W1 back into position.

Other mouse modes include *Edit*, which is used to select, Cut, Copy, and Paste waveform segments; *Draw*, which is used to redraw the waveform; *Log Coords*, which is used to log an X & Y waveform coordinate position to a journal; and *Move Marker*, which is used to move markers. Markers are vertical lines that mark a position within a wave.

THE INSTRUNET MENU

The instruNet menu is used to set up the instruNet hardware. It maps directly to instruNet World pages and buttons, as illustrated below. For example, choosing the View submenu under Record opens the instruNet World Record page, and choosing the other Record submenus are like pressing the corresponding buttons in the instruNet World Record page. For information on these features please refer to the instruNet User's Manual.



- Select Network ► View Page to open the Network Page, as shown to the right. It is here that one selects the channel parameters and options such as filters, sensor settings and ranges. Please refer to *Chapter 5* of the instruNet User's Manual for a detailed description of the Network Page. Changes made here are stored in the SuperScope II instrument file. Click the upper left corner close box to close the instruNet window.

ioNet World				
Restore	Store	Open	Save	Cl
Channel	net	dev	mod	Value Input
Ch1 Vin+	1	1	1	1.0693
Ch4 Vin+	1	1	1	1.0631
Ch7 Vin+	1	1	1	0.10348
Ch10 Vin+	1	1	1	1.0643
Ch13 Vin+	1	1	1	1.0912
Ch16 Vin+	1	1	1	1.0704
Ch19 Vin+	1	1	1	1.0539
Ch22 Vin+	1	1	1	-0.38365
Ch2 Vin-	1	1	1	-0.072194

- Select Options ► W1 under the Wave menu to open the wave dialog, and then click the Channel button to open the instruNet Channel Selection dialog, as shown to the right. This dialog provides 4 popups that select an instruNet channel via its channel address, as described in the instruNet User's Manual. Using this dialog, any SuperScope II wave can be linked to any input or output channel via its address (i.e. Network, Device, Module and Channel). In this example instrument, wave W1 is linked to the first analog input channel on the instruNet network. When a digitizer based task runs, data digitized from Channel Ch1 Vin+ is stored in wave W1. The other instruNet analog input channels are linked to waves W2, W3 and W4, in this instrument.

Network Address

Network	Device	Module	Channel
#1 Slot14	1 #100	1 #100	Ch1 Vin+

SAVING THE INSTRUMENT SETUP

To preserve changes in the setup, save the instrument to disk.

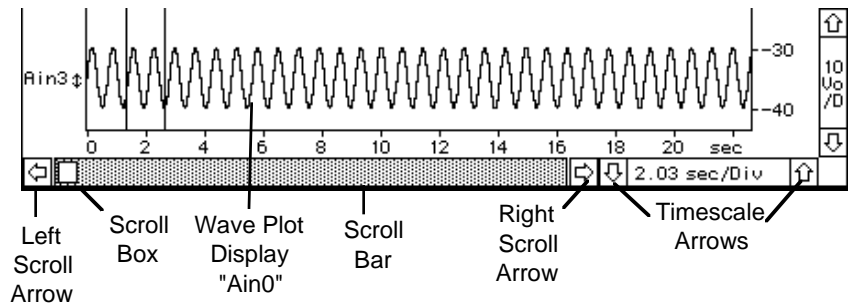
- 🍏 Select Save As... from the File menu.
- 🍏 Type "4Ch iNet Demo Demo#2" into the standard file dialog, and click on the Save button.

PART 2: EXPLORING THE FRONT PANEL

This part of the tutorial continues to use the demo instrument "4Ch iNet Demo Demo".

- 🍏 Select Run ▶ Record from the Task menu. The lower display will update as pictured below (or something similar).

The **Wave Plot** display, named D1, shows a plot of the 4 recorded channels (in volts) as a function of time (in seconds). The recorded data varies in amplitude from -10 Volts to +10 Volts. Depending on the size of your screen, and the software instrument that you select, the Wave Plot display may not show the entire range.



SCROLLING AND CHANGING SCALE

If only a portion of the time wave is visible in the display, use the scroll bar to move around:


- 🍏 Click or press on the right and left horizontal position arrows (◀ ▶) for precise movement, drag the scroll box (▢) to move to a specific location, or click on either side of the scroll box to move by about 75% of a screenful.

To change the amount of time that is displayed, change the horizontal scale (seconds-per-division):

- 🍏 Click the down time scale arrow (⏴) several times to zoom in on the time wave. Notice that the msec/Div number decreases each time the ⏴ is clicked. Then click the up time scale arrow (⏵) until you can see the entire waveform.
- 🍏 As a shortcut, click on the H button (⏶) in the upper right corner of the D1 display. SuperScope II will automatically set the horizontal scale so that the entire waveform fits exactly in the display.

MOVING MARKERS

Specific time values in a wave are specified with vertical **markers** that are moved with the mouse. Two markers, M1 and M2, are currently visible in the two displays. Each marker can be moved independently of the other, and each maintains its position until moved again.

- 🍏 Click once inside D1 (at the bottom of the screen) to make it active.
- 🍏 Move the mouse pointer to the left-most marker, M1. When the mouse pointer lies directly on the marker, hold down the *Option* key (which changes the cursor to ) , press the mouse button and drag the marker about half an inch in either direction. Release the *Option* key and the mouse button. If you have trouble moving the marker, make sure you are placing the cursor exactly on top of the marker, and then press the mouse button, and hold it down as you move the mouse left or right.

THE MARKER LABEL AREA

The row of text and numbers at the top of display D2 is called the marker-label-area, and it shows information pertaining to marker positions. In this instrument, the marker names, time positions, (in

seconds) and W1 values (e.g. Volts) are shown directly above each marker. The time difference could also be shown, on the far left side of the marker-label-area.

- 🍏 In D1, move markers M1 and M2 and notice how the numbers in the marker-label-area reflect the positions of the markers.

The SuperScope II front panel is completely customizable, allowing multiple displays, linked in time, with the same markers shown in each display.

JOURNALS

SuperScope II journals are simple text editors for storing data and notes.

- 🍏 Select Mouse ▶ Log Coords from the Display menu. Select Log Coordinates ▶ Results from the Display menu.
- 🍏 Click once on the W1 label, at the far left of display D1, to select W1 for mouse activity. When selected, it will become highlighted with a dark rectangle (**W1**). You might need to click two times, once to select the display, and once to select the wave.
- 🍏 Click at several points along W1 and notice the wave coordinates that are logged to journal Results.
- 🍏 Select Save As ▶ Results from the Journal menu and then press Save when the File dialog appears. This saves a text file to disk that can later be opened by a word processor, spreadsheet, or database.

Results	
Ain0	
X:sec	Y:Volt
1.976624	4.155
3.769376	-1.914
4.252040	-3.174

This concludes Part 2 of the tour. The next section will cover waves, and introduce two different software instruments.

PART 3: WORKING WITH WAVES

Both acquired waves and the results of calculations are stored in SuperScope II objects known as "waves". This section will demonstrate how to edit and analyze these objects. We will continue the tutorial with the same instrument.

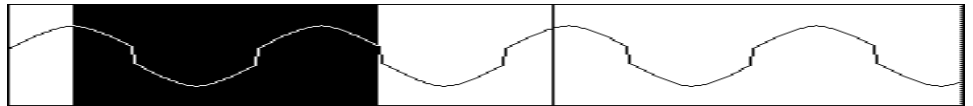
SELECTING A PORTION OF A WAVE

It is often useful to work with a small portion of a waveform. The standard technique for selecting a range of data is to drag the mouse. You are accustomed to doing this with text, and in SuperScope II, you can do this with waves.

🍏 Click once inside display D2 (at the top of the screen) to make it active.

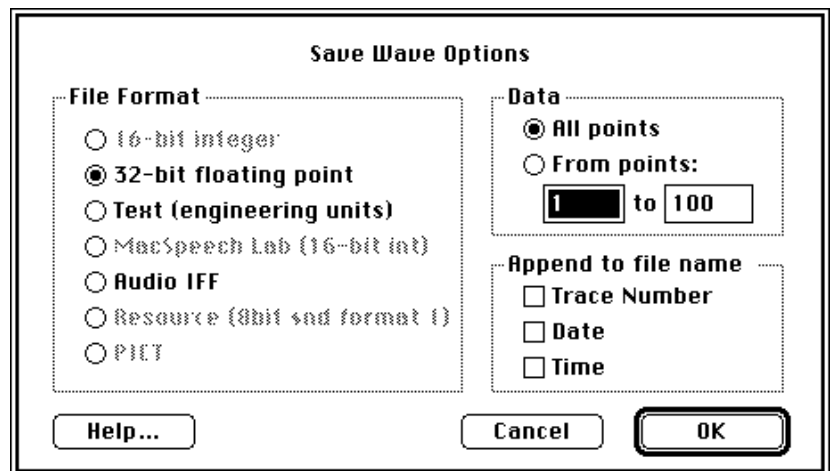
🍏 Select Mouse ▸ Edit from the Display menu.

🍏 Drag over a portion of the wave with the mouse. The selected portion will become highlighted.



This portion is called the "Selected" wave, and can be analyzed like any other wave. Like segments, the "Selected" wave shares the data with the host wave.

🍏 To save the data in the highlighted region, select Save As ▸ Selected from the wave menu. When the File Save dialog appears, press the Format button to open the Save Wave Options box, pictured to the right. It is here that the user specifies one of the many file data formats. *32-bit floating point* and *16-bit integer* are the most common and are supported by both GW Instruments products and Igor. Text is compatible with word processors and spreadsheets, yet is slow and creates large files.

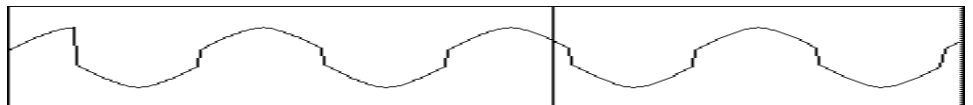



🍏 Click Cancel to exit the Save Wave Options dialog, and then click Save to save the "Selected" wave to disk.

WAVEFORM EDITING


The standard Macintosh Cut, Copy & Paste commands make editing a breeze.

🍏 Select Cut from the Edit menu. The Selected region will disappear, and will be copied to the clipboard.



-  Select the journal with one mouse click, and then choose Paste under Edit. The wave on the clipboard, which is just a list of numbers, will be copied into the journal, as shown to the right. In this way, one can copy wave data to and from many application programs. The Copy Wave Text command under Edit is similar to Copy, except it transfers an entire wave, segment or Selected to the clipboard.


Results
4.65820312
4.49707031
4.31396484
4.10888672
3.88671875
3.64257812


-  Click the mouse at any point on the waveform and select Paste from the Edit menu. The previously Cut data will be inserted into the wave.

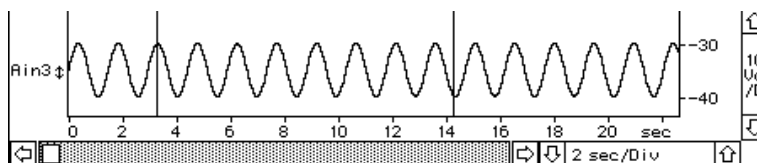
In summary, waves are edited with Cut, Copy, and Paste; just like text.


WAVEFORM SEGMENTS

SuperScope II offers a second technique for defining a portion of a wave: any two markers and a source wave can define a "segment".

-  Click once inside D1 (on the bottom) to make it active.

-  Change the scale to about 2 sec per division (depending on your screen size). Since the horizontal axes of both displays are linked, the top display will adjust to keep up with the lower display. The vertical axes are not linked however; therefore their scales can be adjusted independently.



-  Select Markers ▶ D1 in the display menu and then click New in the Segment area of the dialog. This will create a new segment, called "Seg1", and defined it as the section of wave W1 between markers M1 and M2, as shown to the right. Click OK to exit the dialog.


Segment:


Name:

Wave:

Bound:

Bound:

-  Double-click on the region above the label or choose Options D1 under Display to open the Display Options dialog.

-  Notice the two lists in the Contents area of the dialog. The Waves list, on the left, shows all available waves, I/O channels and segments; the Display list on the right shows which waves, I/O channels and segments are to be plotted in this display. Drag channel Seg from the Waves list to any slot in the Display list as pictured above. Press OK to exit the Display Options dialog.


Display:

Name:

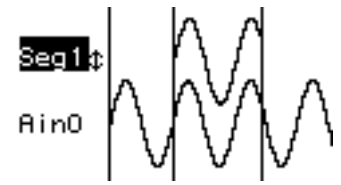
Type:

Contents

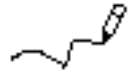
Waves	Display
Ain0	Ain0
Ain1	Ain1
Ain2	Ain2
Ain3	Ain3
Calc	
Selected	
Seg1	Seg1

-  Select Mouse ▶ Vertical Adjust in the Display menu and then click once on the Seg1 wave label at the left edge of the display. Notice that the wave label highlights after being selected.

- Vertically adjust segment Seg1 (i.e. drag the mouse) to offset it from its host wave, as pictured to the right.
- While holding down the *Option* key (which will change the cursor), move the left marker one-half an inch to the left, and then move the right marker one-half an inch to the right. Notice the segment updates accordingly.



- Select Mouse ▸ Draw in the Display menu. The mouse will change to a pencil. Now draw on the Seg1 wave (i.e. drag the mouse) to update it's data. Notice that W1's data changes as well. This is because both segment and host share the same data. If you select Grid Snap on in the same menu the mouse will be restricted to drawing straight lines.



From a task's perspective, a marker is like a variable that contains a value. This value corresponds to the position of the marker. For example, a marker at 0.123 sec contains the value 0.123. This value can then be read or updated by a task instruction, just like a variable. When a marker is moved by the user, it's value updates accordingly.

EDITING WAVEFORM VALUES

On the computer, waves are represented as a series of numbers. These numbers are often referred to as "points", "values" or "samples". Each sample represents the digitized voltage (typically in the range of ±10 V) at a particular time. It is sometimes useful to examine and edit the actual list of numbers.

- Choose Edit Values ▸ W1 from the Wave menu. The Wave Editor shows the index in the left-most column, and the wave values in columns #2 through #6. The individual data points are read left to right, top to bottom, with five samples on each row. For example, in the picture to the right, point#1 is 0.000, point #5 is 1.914, point#6 and is 2.358. Point#6 is at 0.115 seconds, relative to point#1, which is at 0.000 seconds.

Edit Values: <input type="text" value="Ain0"/>						
sec						
0.000	0.000	0.488	0.977	1.450	1.914	↑
0.115	2.358	2.778	3.174	3.535	3.867	□
0.230	4.155	4.409	4.619	4.785	4.902	□
0.345	4.976	5.000	4.976	4.902	4.785	□
0.460	4.619	4.409	4.155	3.867	3.535	□
0.575	3.174	2.778	2.358	1.914	1.450	□
0.690	0.977	0.488	0.000	-0.488	-0.977	□
0.804	-1.450	-1.914	-2.358	-2.778	-3.174	□
0.919	-3.535	-3.867	-4.155	-4.409	-4.619	□
1.034	-4.785	-4.902	-4.976	-5.000	-4.976	↓

Options

Index	Format	Units	Typing
<input checked="" type="radio"/> Time	<input checked="" type="radio"/> Dec	<input checked="" type="radio"/> Volt	<input checked="" type="radio"/> Overwrite
<input type="radio"/> Point	<input type="radio"/> Hex	<input type="radio"/> Internal	<input type="radio"/> Insert

In the Wave Editor, the value of any sample may be changed by typing a new number into its cell. If the Typing option is set to Overwrite, the value in the selected cell is overwritten; otherwise, the entire wave is shifted forward each time the user clicks in a cell. And hence, one can "insert" a point into a wave. Ranges of cells can be selected, Cut, Copied and Pasted within the Wave Editor, and to and from SuperScope II journals and displays. Additionally, this text can be transferred to and from third-party spreadsheets, word processors and application software. When waves are represented as text, each point is separated with a carriage return. Subsequently, they appear as a column of numbers in a spreadsheet or word processor window.

- Click OK to exit the Wave Editor.

WAVE STATISTICS

The user can easily calculate Statistics on a wave, I/O channel, segment or selection.

🍏 Select Run ▶ Average from the Task menu. The point-wise average of the four channels will be placed into the upper-most display.

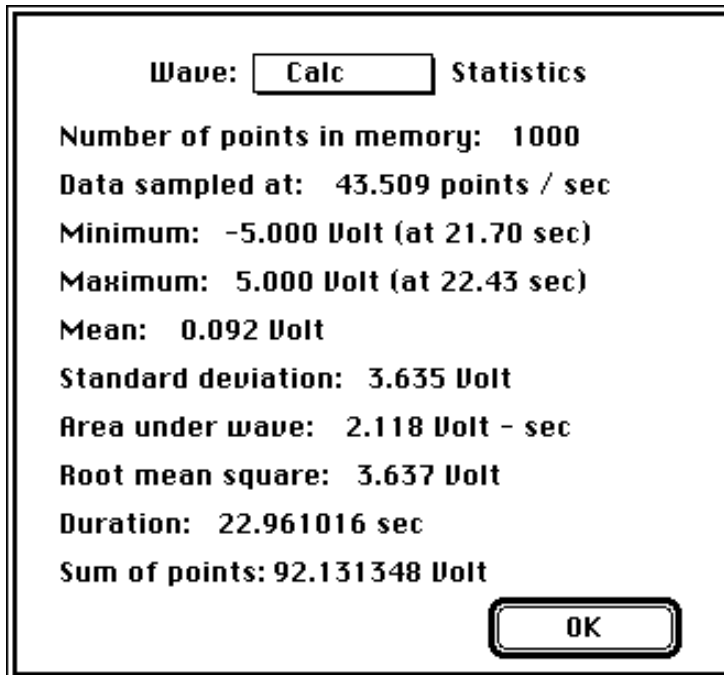
🍏 Choose Wave Statistics ▶ Calc from the Wave menu to view wave statistics. Select another wave in the upper-most pop-up menu to view statistics on another wave.

This is an example of doing analysis manually with a menu command. Alternatively, one could set up a task to do this automatically and send results to a journal, wave, marker, control, indicator, variable, or string,

🍏 Choose Filter ▶ Ain2 from the Wave menu, and then change the Frequency Cutoff for the filter to 5% of the sample rate. Stay with the Low Pass HAM (Hamming Window) filter. Click OK to apply the low pass filter.

The display will show that the high-frequency components in the square wave have been attenuated. Many of the higher order harmonics were filtered out to leave something

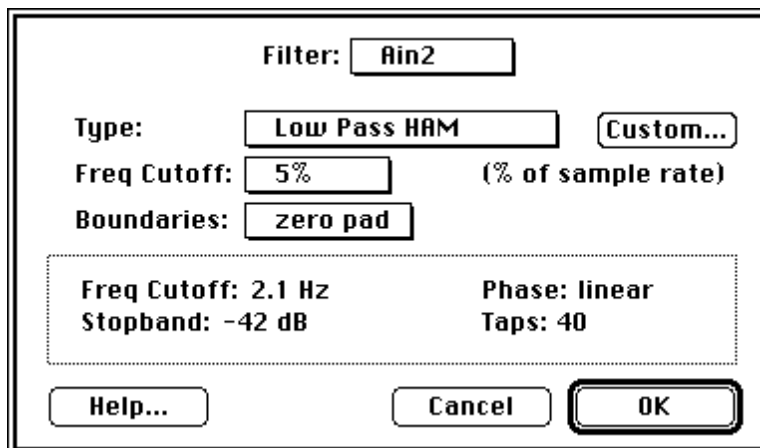
🍏 Click OK when done with your review.



FILTERING

similar to a sine (i.e. the wave got smoother).

The Filter dialog contains several resident filters, yet in many cases, they will not suit your specific needs. In these cases, you need to design a custom filter with another application program, and store this filter in a SuperScope II instrument. For a wonderful little \$99 product to do this, please contact Zola Technologies, order #Z-WLFDAP, TEL# 404/843-2972, FAX# 404/843-0116.



EXPLORING SUPERSCOPE II

Using the techniques that you have learned, please explore SuperScope II on your own. Try loading other instruments and waves. Test out any menu item or front panel control. If you get stuck and need some help, please feel free to give us a call.

QUITTING SUPERSCOPE II

The next section covers the instrument design features in SuperScope II. If you do not want to tackle that quite yet, you can quit and explore more at another time.

🍏 If you do not wish to continue, select Quit from the File menu.

PART 4: DESIGNING INSTRUMENTS

Waves, markers, displays, journals, controls, variables and tasks can be combined like building blocks to create software **instruments**. A few pre-defined instruments have been included with SuperScope II. This section describes how to customize SuperScope II by modifying an existing software instrument, or creating a new one from scratch.

The following pages demonstrate how to change the front panel layout and add a new display. Before starting, reload the instrument used in Part 1.

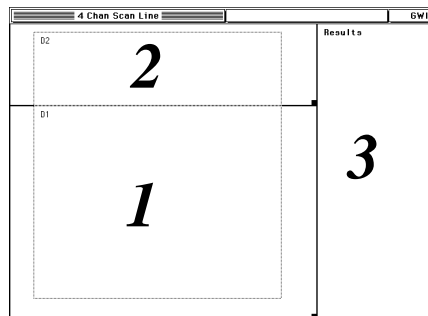
🍏 Select Open from the File menu, and choose "4 Channel instruNet.demo".

THE FRONT PANEL

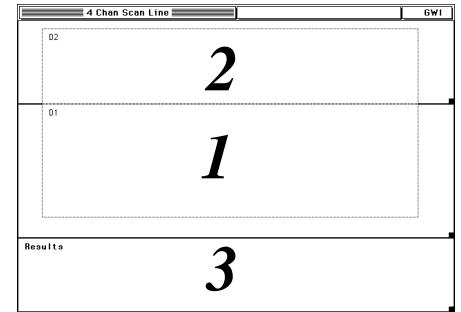
The main SuperScope II window is referred to as the **front panel**. It contains displays, front panel journals, controls, indicators and pictures. You can change the size and position of each front panel object with Panel Edit Mode. For example, you may want a wider journal to enter more substantial comments, as illustrated to the right.

In Panel Edit Mode, all displays, journals, controls, indicators and pictures can be moved, resized, and deleted. When Panel Edit is turned on, a rectangular outline of each front panel object appears, with the object name in the upper left corner, as shown to the right.

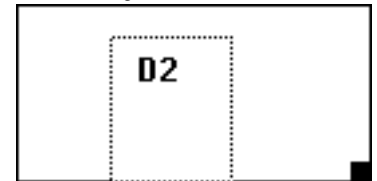
If an object is selected, its name appears bold. To resize, one simply drags the resize box (i.e. little black square at lower right). To reposition, the user drags the actual object. To reposition an object one pixel at a time, the user selects with the mouse, and then taps on the ← ↓ ↑ → keys. To resize one pixel at a time, one selects with the mouse, holds down the *Option* key, and then taps on the ← ↓ ↑ → keys. This is very similar to working with rectangles in MacDraw.



Before



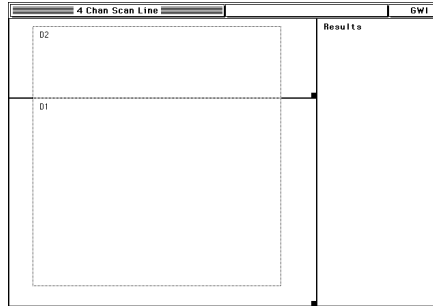
After



SuperScope II prohibits shrinking displays below a practical minimum size to ensure readable content. Individual items within objects cannot be resized, independent of the object. Should displays or journals overlap, a warning is issued (i.e. "Invalid Panel" in status bar) and the user is prohibited from leaving Panel Edit Mode until the overlapping is eliminated.

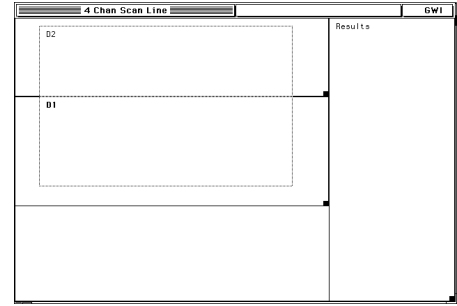
🍏 Select Panel Edit On from the Display menu.

- Resize the D1 display by pressing on the small black box in the lower right corner and dragging to a new position.



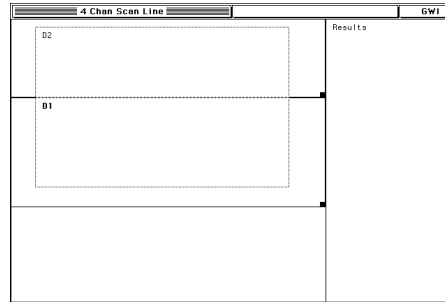
Before

- Resize the Results journal by the same method.

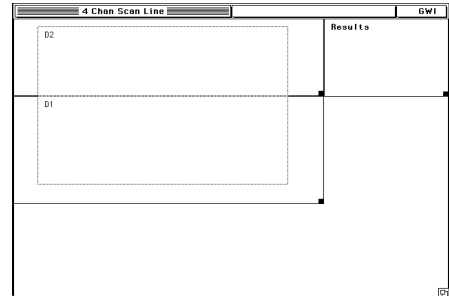


After

- Move the Results journal so it is directly under display D1. Make sure it is touching D1, yet not overlapping.

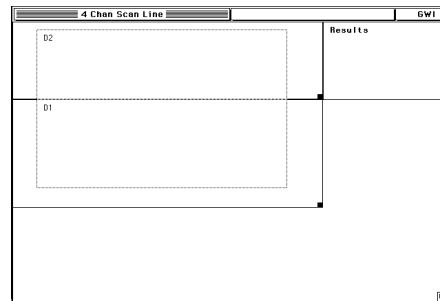


Before

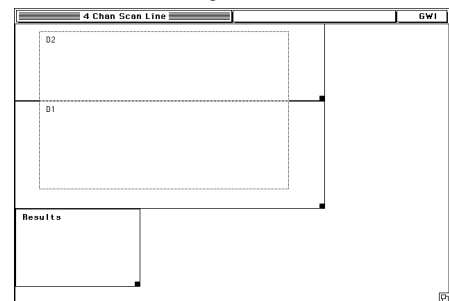


After

- Resize the displays and journal as shown in the figure to the right. (Tip: hold down the *Option* key and use the right and left arrow keys to resize one pixel at a time).

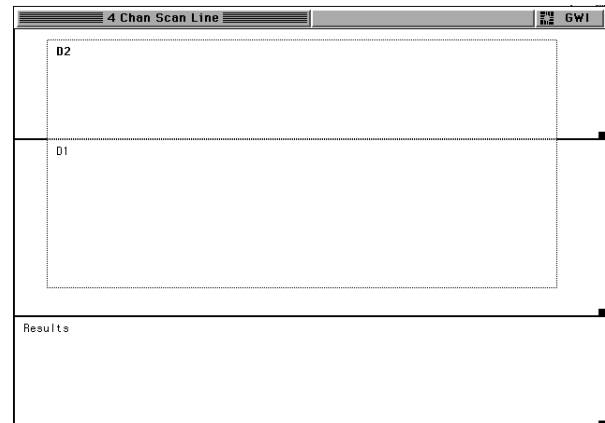


Before

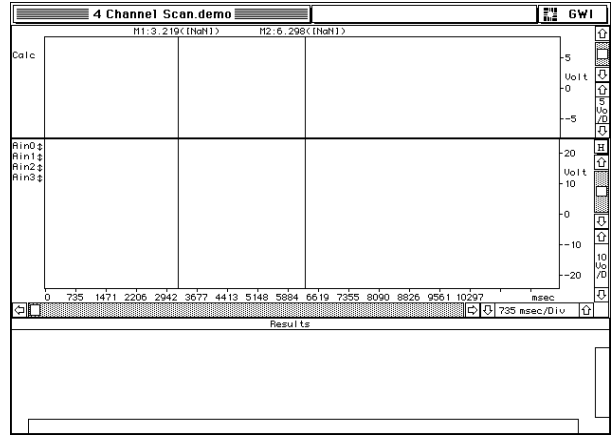


After

- Select Panel Edit Off from the Display menu. You can now use the new layout. Congratulations! You have created your first SuperScope II front panel.



- To save this instrument for future use, select Save As from the File menu, type "4Ch iNet Demo Demo 3" into the file name field, and then click the Save button. You have now added a new instrument to your portfolio.



CREATING DISPLAYS AND WAVES

In addition to rearranging a front panel layout, you may want to add objects to the front panel. We will show you how this is done by adding a wave and a display to the 4Ch iNet Demo Demo instrument. Objects in SuperScope II can appear in any quantity, memory permitting.

- Select Open from the File menu, select the original "4Ch iNet Demo Demo" instrument, and press OK.

- To create a new wave, select New from the Wave menu. The Wave Options dialog will appear, as shown to the right. It is from here that one can view and modify a wave's internal data and length.

- Type in the name "Sine" and click on the Synthesize button to open the Wave Synthesizer.

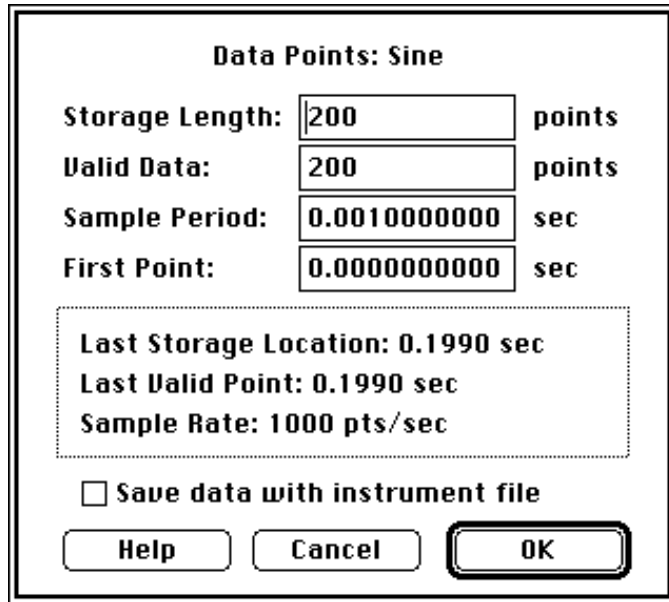
The Synthesizer is used to load a wave with a sine-wave, square-wave, triangle-wave, ramp, constant value, gaussian noise, or uniform noise. Sine, Triangle and Square waves are specified with the Points-per-cycle and Peak-to-Peak Amplitude fields, the Ramp is specified with the levels at the two end-points, the Gaussian noise (histogram is a gaussian curve centered about 0) is specified with an RMS (Root Mean Square) value, and the Uniform noise (histogram is flat) is specified with a \pm range value.

- Click the OK button to load "Sine" with a 200 point, 52 point-per-cycle, 10V peak-to-peak sine-wave.

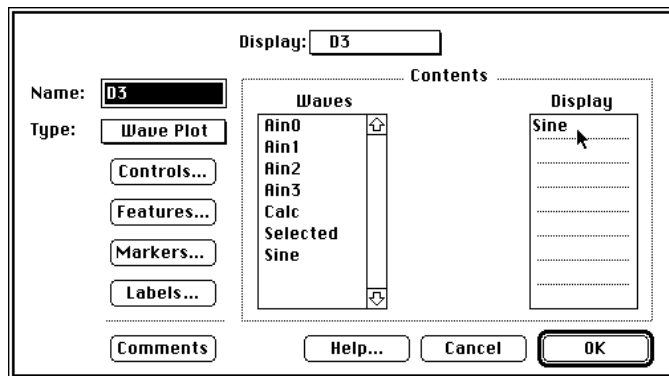
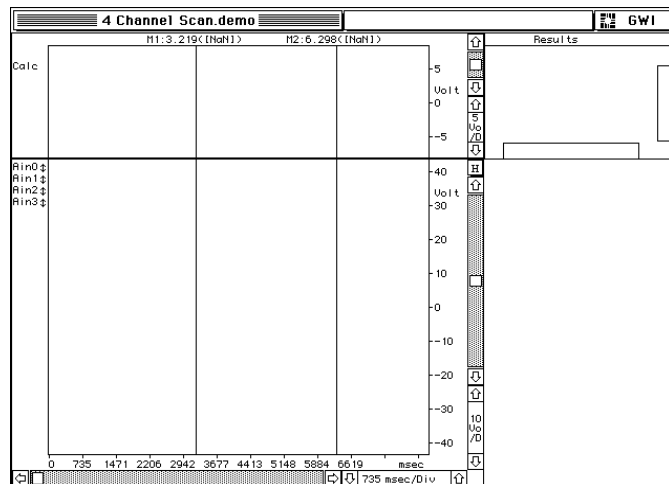
- Click the Edit button to view your data. Click OK when done.

- Click the Points button to view several internal parameters.

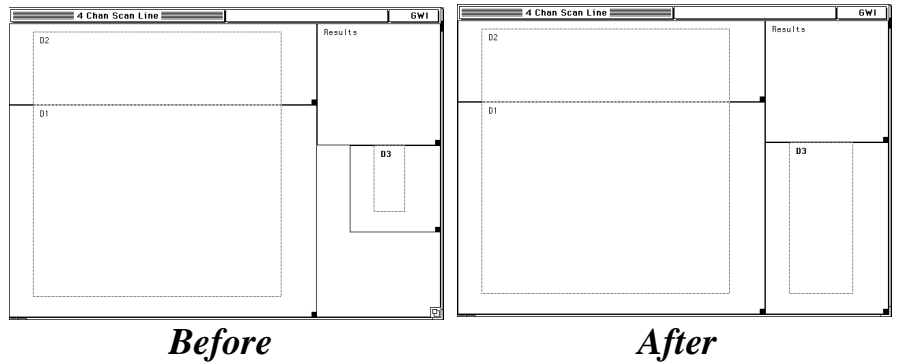
This dialog is used to view and edit the amount of data storage (in points) assigned to the wave, the number of valid data points, the sample period (time between points) and the first point time. The storage length is the amount of memory allocated to the wave in terms of # of points, and the number of valid data points is the # of valid data currently in that storage buffer. The # of valid points will range from 0 to the storage length, and the storage length will range from 0 to that permitted by available memory. 16bit integers consume 2bytes per point and 32bit float consume 4 bytes per point; therefore a 250K point float wave would consume 1MB, for example. If Save Data With Instrument File is checked, SuperScope II will save the wave's data in the instrument file. If it is not checked, the wave is saved with 0 points of data. Including wave data in an instrument file increases the size of that file by the space required to hold that data.



- Click OK twice to return to the front panel.
- Select Panel Edit On from the Display menu.
- Resize the Results journal to make room for a new display, as shown to the right
- Select New from the Display menu to create a new display and to open it's Options dialog, pictured to the right. Use the default display name D3, and make sure Wave Plot is chosen in the Type pop-up menu. Drag the Sine wave from the Waves list into the top slot of the Display Contents list, as shown in the illustration to the right.
- Click OK to accept the changes and exit this dialog.



- 🍏 Move and resize D3 until it fills the lower right corner of the panel, as shown to the right.
- 🍏 Select Panel Edit Off from the Display menu. You can now use the new layout.
- 🍏 To save this instrument for future use, select Save As from the File menu, type "4Ch iNet Demo Demo 4" into the dialog, and click on the Save button.

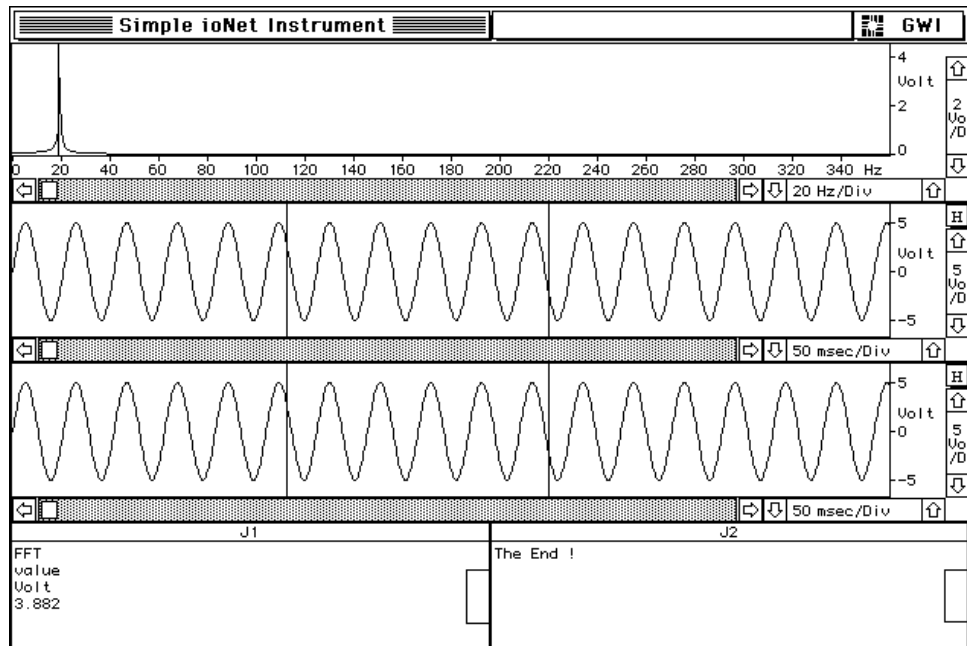


This new instrument is very similar to the "4Ch iNet Demo Demo", although it has an additional display. Display D3 is used to hold the "Sine" wave, yet it could also be used to display the results of a calculation or to show an additional I/O channel.

PART 5: CREATING A NEW INSTRUMENT

This section shows how to create a simple instrument from scratch. This instrument, pictured to the right, contains two wave plot displays, a journal, several waves, several markers and a segment. It also contains one digitizer-based-task and one regular-task, named *Acquire* and *Analyze* respectively. *Acquire* does the following 10 times (i.e. 10 scans):

- Digitize 4100 points at a 50µs per-point rate from one analog input channel.
- Calculate the point-wise average of W1 (i.e. $\text{SigAvg} = \text{SignalAvg}[W1]$).
- Update the screen.



The *Analyze* task moves marker A3 to the peak of the FFT wave, and then transfers the maximum FFT value (the intersection of the marker and the FFT wave value) to the journal.

If you are running a demo version of SuperScope II 2.0 it will simulate an instruNet hardware system consisting of 1 controller and 1 Model 100 network device. This tutorial is applicable to both the demo version of SS II 2.0 and the real version. If you are using the real version of SuperScope II in conjunction with an instruNet controller and network device you might want to connect a signal (i.e. a signal generator) to channel Ch1 Vin+ following the directions in *Chapter 3* of the instruNet User's Manual. You can do the tutorial with the real version of SuperScope II and without connecting a signal but the incoming signal will be a flat line (0 Volts) and the analysis will not provide meaningful results.

- Select New Instrument from the File menu and click OK in the confirmation dialog. This command deletes all objects, allowing you to proceed with a “clean slate.” Creating a new instrument does not erase the old instrument from disk, it merely deletes it from temporary RAM memory.

THE INSTRUNET NETWORK & INPUT CHANNELS

- Select Network View from the instruNet menu. This will open the instruNet World

Network Page described in the instruNet User's Manual and is the starting point for setting channel parameters (e.g. sensor options, filter options). Horizontally scroll through the

Channel	net	dev	mod	Filter
Ch1 Vin+	1	1	1	Off

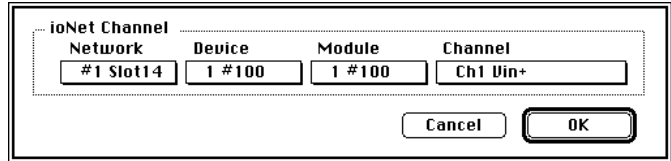
Network Page to the left until the column labeled Filter appears. Click the Filter cell for the Ch1 Vin+ (i.e. the first row in the Network Page if you have a model 100 network device installed) to open the Probe Dialog set up to display the Low Pass Filter settings. Select Elliptic in the Filter popup and then click the enter button at the bottom right of the dialog to turn the filter on. If you have a signal connected to the Ch1 Vin+ channel you should see the immediate affect of implementing the filter in the snapshot display at the bottom of the dialog assuming your input frequency is larger than the low pass cut off frequency. Try several different filter settings and then click OK to exit the dialog. For a

complete description of the Low Pass filter dialog please refer to *Chapter 2* in the *instruNet User's Manual*.

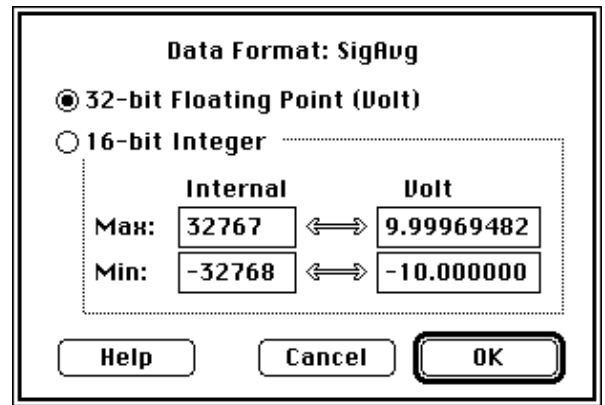
WAVES

We will now create three waves, one to store the data acquired on channel Ch1 Vin+ and the other two to hold the results of analysis performed on the acquired data.

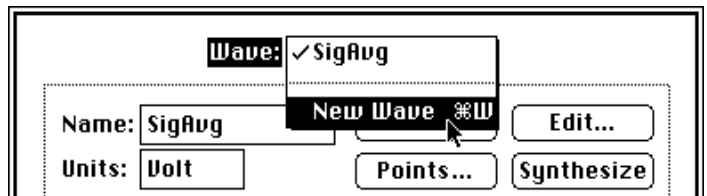
- Select New from the Wave menu to create a new wave and open the wave dialog. Leave the default name of W1 and click on the Link to instruNet checkbox. This will open the instruNet Channel dialog which is used to specify which instruNet channel is linked to this particular SuperScope II wave. Press OK after selecting a channel.



- Create a second wave by clicking in the Wave popup at the top of the Wave dialog and select New Wave. Type "SigAvg" into the Name field. Click the Format button and note the default setting is 32-bit floating point. Data can either be stored in 16-bit integer or 32-bit floating point format. Recorded instruNet data is always stored in 32-bit floating point format and waveforms used for calculations are frequently set to 32-bit floating point for accuracy and speed. Click Cancel when done with your review.



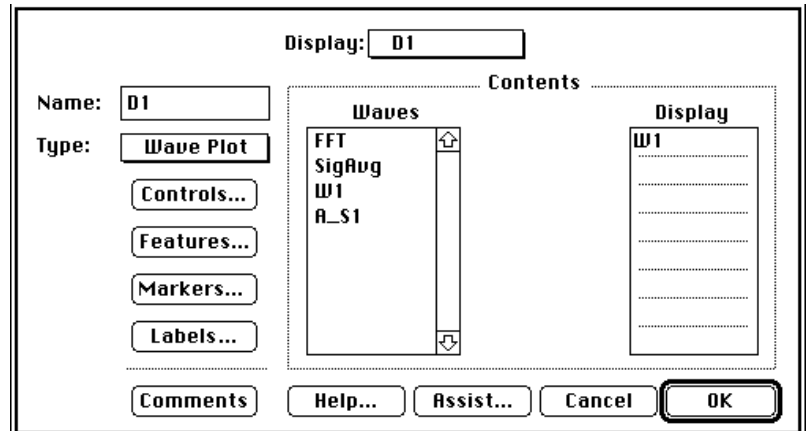
- Create one more wave, name it "FFT", and then press the OK button to exit the Wave dialog. FFT will also be a 32bit floating point wave.



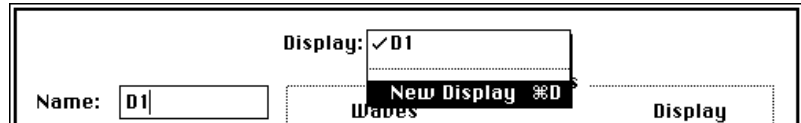
DISPLAYS

We will now create three displays.

- Select New from the Display menu.
- Drag wave W1 from the Waves list to any slot in the Display list, as illustrated to the right. This will cause wave W1, which will contain the data acquired from channel Ch1 Vin+ on the instruNet network to be shown in display D1.



- From the upper-most pop-up, select New Display and then type "AvgDisp" in the Name field. Notice that the display type is currently set to Wave Plot. If we wanted to plot one wave against another, we would set the display type to XY Plot.

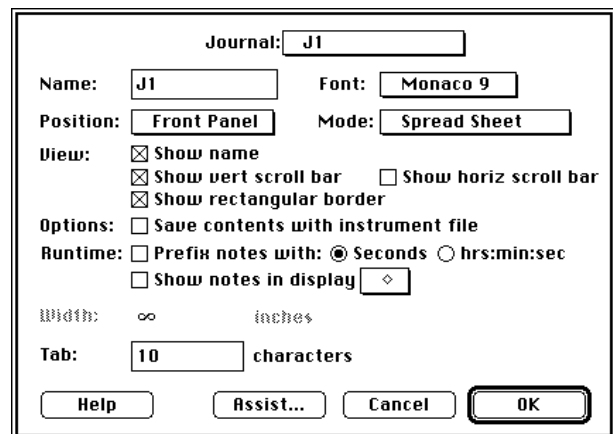


- Drag wave SigAvg from the Waves list into the Display Contents list.
- Click the Assist button at the bottom of the Display dialog and click OK in each of the dialogs that appears. The Assist button automatically places objects on the front panel in an orderly fashion. Clicking OK in the Assist dialog links the horizontal scale in the second display to that of the first display. This time-locks the displays such that changing the horizontal scale in the first display, or scrolling through the first display will have the same affect on the second display.
- Create one more new display and name it "FFTDisp", and then drag the "FFT" wave into it's Display Contents area. Click the Features button in the Display dialog and set the Horizontal Unit field to Hz. Click Okay to exit the dialog. Click the Assist button again but when the first dialog appears turn off the "Link horizontal axis to Previous display" option. Since the FFT wave has a horizontal unit of Hertz, and not seconds, it would not make sense to link these two displays.
- Click OK to accept the changes and exit the Display dialog.

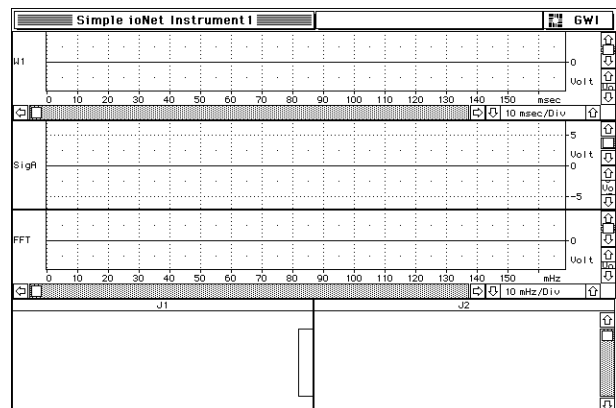
JOURNALS

We will now create two journals.

- Select New from the Journal menu. We'll use the default journal name, "J1", for now.
- Select New Journal in the upper pop-up menu to create another journal, and then press Assist. Click OK in the dialog that appears. Note the journals are placed immediately below the displays.



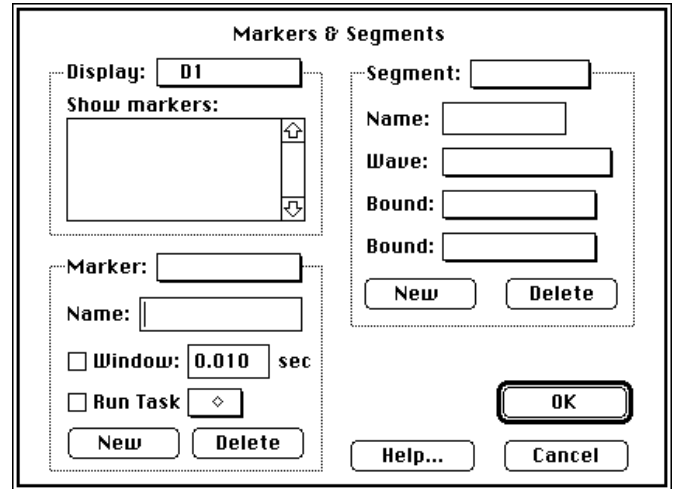
At this point your front panel should look like the one displayed to the right. The three displays are automatically placed on the top of the display and the two journals are placed on the bottom. Using the Assist button helps you to quickly design a front panel. If you don't like the Assisted layout, turn panel Edit On (under the Display menu), and adjust the front panel as needed.



MARKERS & SEGMENTS

We will now create three markers and one segment.

🍏 Select Markers ▶ D1 from the Display menu to open the Markers & Segment dialog, pictured to the right. Take a moment to survey this powerful dialog. It is divided into three areas. The *Display* area determines which markers are shown in each display. The *Segment* area is used to create, modify and delete segments; and the *Marker* area is used to create, modify, and delete markers. We will use all three areas of this dialog.



🍏 In the Marker area, press the New button once. You've just created your first marker!

🍏 In the same way, create a second marker.

🍏 Both marker names will appear in the Show Markers list, in the Display area. Click M1 and then click M2 to specify that both are to be displayed in the D1 display.

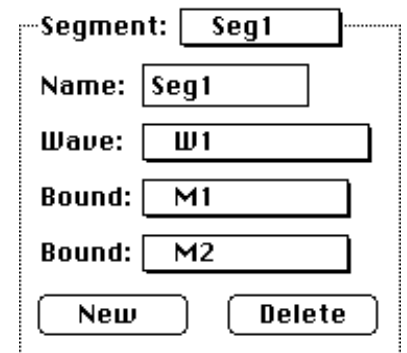
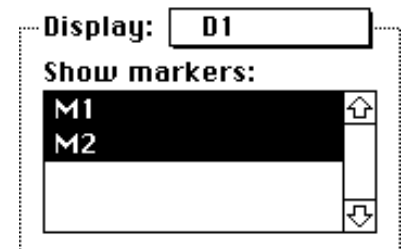
🍏 In the Display pop-up menu, select AvgDisp and then click M1 and M2 again to place these markers in the AvgDisp display.

🍏 In the Segment area, press the New button once. W1, M1 and M2 are automatically selected in the lower three pop-up menus. You have just created the segment Seg1, which is defined as the section of wave W1 between the markers M1 and M2.

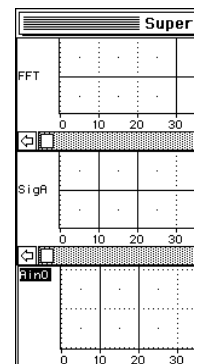
🍏 In the Marker area, press the New button once to create a third marker.

🍏 In the Display pop-up menu, select FFTDisp, and then click once on the "M3" marker.

🍏 Click OK to exit the Markers & Segments dialog.




At this time, markers M1 and M2 should be visible in the D1 and AvgDisp displays, and marker M3 should be visible in the FFTDisp, as pictured to the right.

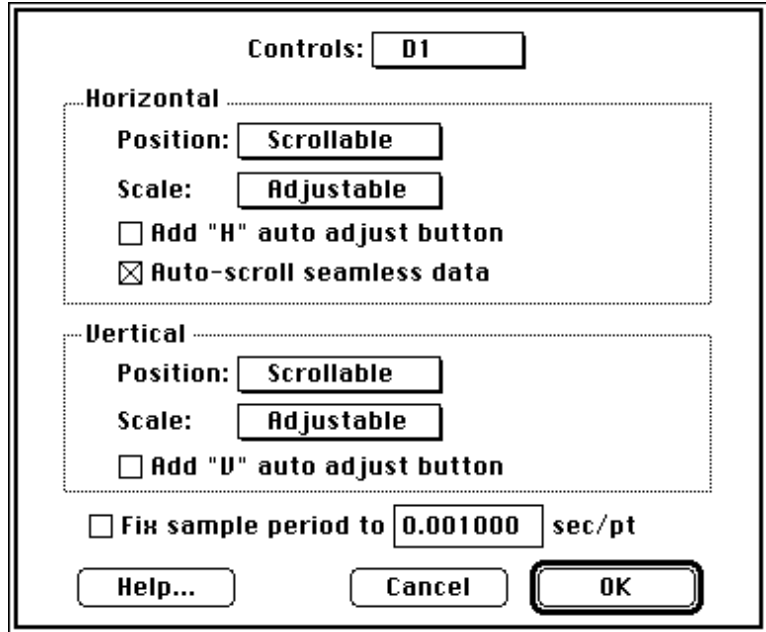



CUSTOMIZING THE DISPLAYS


The next step is to modify the appearance of the three displays.

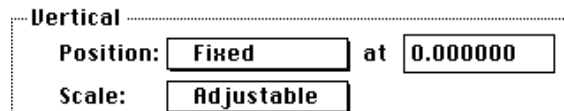
-  Select Controls ▶ D1 from the Display menu to open the dialog pictured to the right.





This dialog is divided into two areas. The upper area determines the horizontal scale (e.g. Time/Div) and position controls; and the lower area determines the vertical scale (e.g. Volts/Div) and position controls. Notice that the Horizontal Position is set to Scrollable and the Horizontal Scale to is set to Adjustable. This means that a scroll bar controls the horizontal position (i.e. the left edge of the display) and up/down scale buttons control the number of horizontal units-per-division (i.e. seconds-per-division).



-  Click on the "Add H auto adjust button" checkbox to add a magical little button (**H**) to the display. When this button is pressed, the horizontal scale and position will automatically adjust to accommodate the wave. The left edge of the display is set to the first point of the left-most wave; and the right edge of the display is set to the last point of the right-most wave.

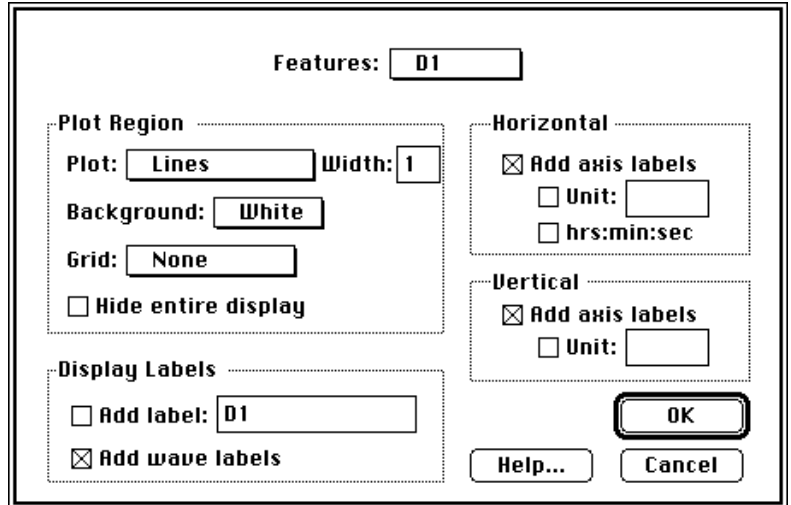
-  In the Vertical area, select Fixed in the Position pop-up. This removes the vertical scrollbar and fixes the center of the display to 0 (e.g. Volts). We will leave the Vertical Scale to Adjustable. This will enable the end user to update the Volts-per-division, as desired, with the front panel controls.



-  Click in the Controls popup at the top of the dialog and select display SigAvg. Select Fixed in the Vertical Position pop-up menu or the SigAvg display and leave the Vertical Scale pop-up menu set to Adjustable. This will allow for vertical scaling with the center of the display fixed at 0 Volts.
-  Select FFTDisp from the upper-most Controls pop-up menu.
-  Set the Horizontal Scale, Horizontal Position, and Vertical Position pop-up menus to Automatic; and leave the Vertical Scale set to Adjustable. Automatic causes the display to automatically adjust to fit the wave (the left edge of the display aligns with the first point of the left-most wave, etc.).
-  Click OK to exit the Controls dialog.

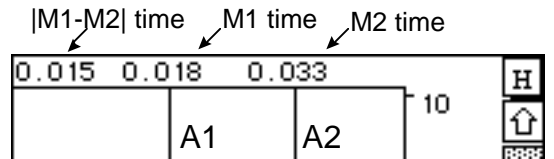
We will now modify a few attributes in the AvgDisp and D1 displays.

- Select Features ▶ D1 from the Display menu. The Display Features dialog will appear, as pictured to the right.
- Select None from the Grid pop-up menu to eliminate the dotted lines that in the plot region.
- De-select the Add Wave Labels checkbox to remove left-edge wave label region. Wave labels are useful when more than one wave is shown in a display, and you need select one (i.e. click on a wave label) for Mouse Edit, Draw, Vertical Adjust, or Log Coordinates.



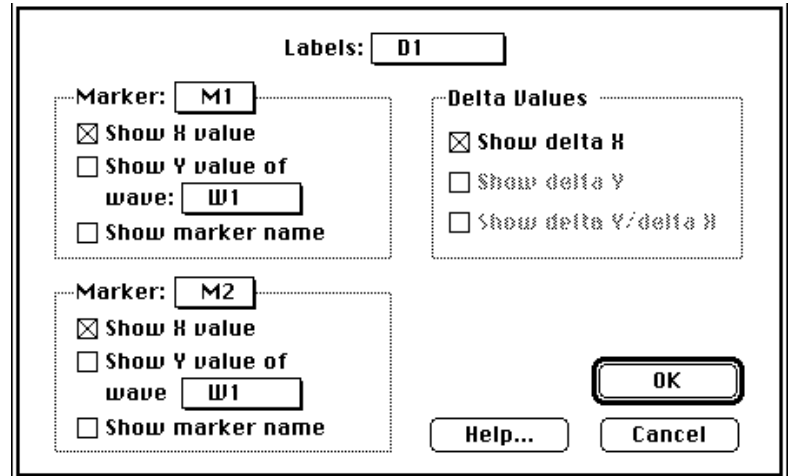
- Use the upper-most pop-up to make the same modifications (i.e. turn off grid and disable wave labels) to the other two displays and then click OK to exit the Features dialog.

We will now add a marker label line, pictured to the right, to show the positions of markers M1 and M2.



- Select Labels ▶ D1 from the Display menu to open the Display Labels dialog, shown to the right.

- M1 is selected in the upper-most pop-up menu. Select the "Show X value" option under this pop-up to enable the M1 position label.
- M2 is selected in the other Marker pop-up menu. Click the "Show X value" checkbox, below this pop-up, to enable the M2 position label.
- In the Delta Values area, click the "Show delta X" checkbox to show the time difference between markers M1 and M2.



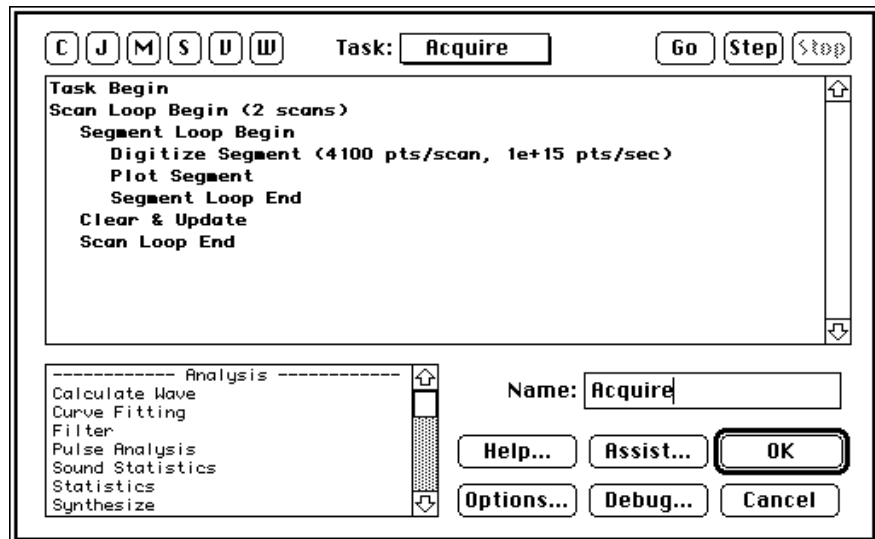
- Click OK to exit the Display Labels dialog.

DIGITIZING TASKS

We will now create a digitizer-based-task to collect and signal average data from a single analog input channel.

- 🍏 Select Task ▶ New Digitizer from the Task menu, and when the Task Editor opens, rename this task "Acquire", as pictured to the right.

Take a moment to survey the Task Editor. It is divided into two main areas, the *Task Region* and the *Instruction Dictionary*.

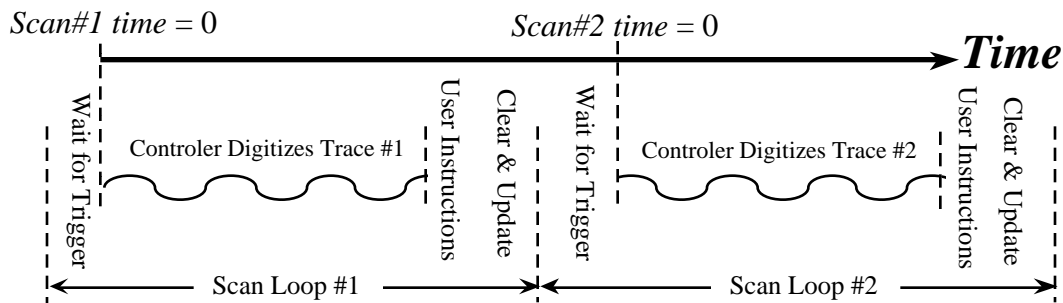


The Task Region, at the top, shows the actual contents of the task.

When a task is Run, instructions in this area are executed, one line at a time. The user can easily add, delete, view, Cut, Copy, and Paste instructions. The five bolded instructions form the skeleton of a digitizer-based-task.

The Instruction Dictionary, at the bottom of the Task Editor, contains a list of all available Instructions. These are the building blocks that are used to create tasks. The instructions are divided into several categories (e.g. Analysis, Data Transfer) and are explained in detail in *Chapter 6* of the SoundScope & SuperScope II Reference Manual.

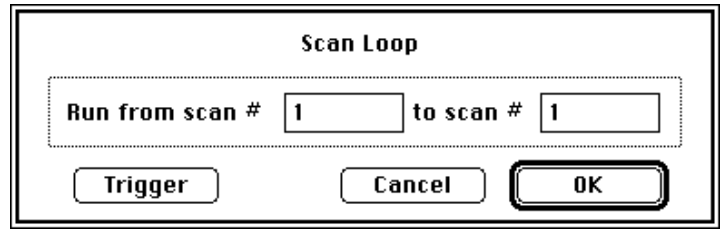
The indentation after the Scan Loop Begin instruction tells us that the indented instructions will to be executed repeatedly. The Scan Loop Begin instruction determines how many times they are executed. This loop count, which is currently set to 2, is easily modified by double-clicking on the Scan Loop Begin instruction. Currently, this task is setup to execute instructions in the following sequence: Task Begin, Scan Loop Begin, Digitize Scan, Scan Loop Begin, Scan Loop Begin, Digitize Segment, and Scan Loop End. This is illustrated in the following figure:



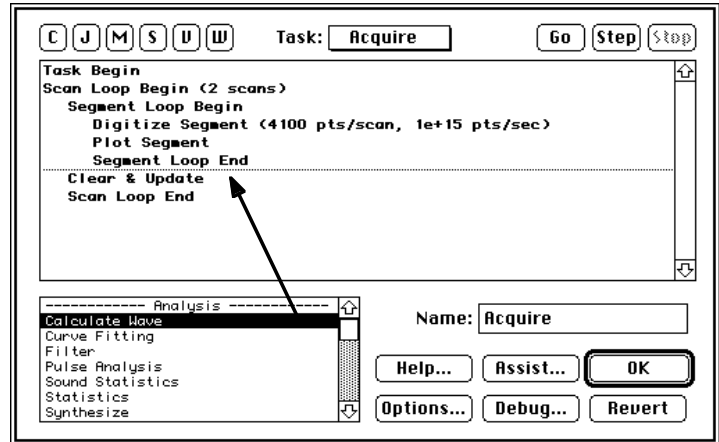
The Task Begin instruction is always the first instruction and is used to initialize several internal variables -- you can ignore it. The Digitize Segment instruction digitizes per its settings (pts/scan, sample rate, strip chart/oscilloscope) and the Scan Loop End instruction tells the task to jump back to the Scan Loop Begin instruction. Digitize Segment grabs a small (e.g. .1sec) chunk of digitized data from the instruNet channels that have been linked to SuperScope II waves. Instructions after Digitize Segment can be used to process this data.

We will now modify this task to digitize 10 scans instead to 2 and to calculate the point-wise average scan.

- Double-click on the Scan Loop Begin instruction, and when the dialog opens, as shown to the right, set the upper scan bound to 10. Press OK to return to the Task Editor.

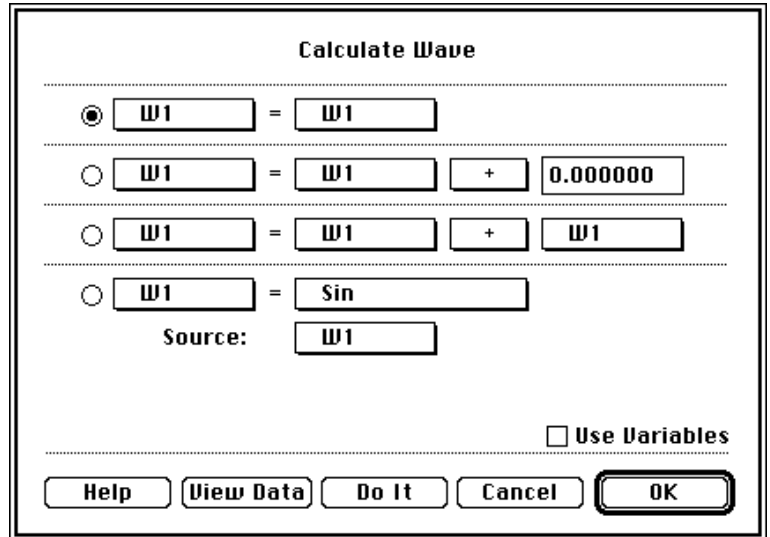


- Drag the Calculate Wave instruction from the Instruction Dictionary to the space directly under the Segment Loop End instruction. The instruction will appear as a dotted line while being dragged. Release the mouse button when the instruction is in position, as illustrated to the right.

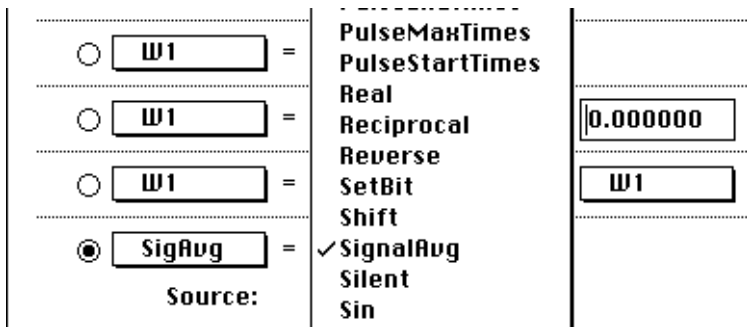


When the mouse button is released, the Calculate Wave dialog will appear, as shown to the right. This dialog is used to access over 85 waveform and operators including integration, Fourier analysis, derivatives, and much more.

The Calculate Wave dialog contains several rows. The first is used to copy the contents of one wave into another. The second is used to $+/-*/\div$ a constant with each point in a waveform. The third is used to $+/-*/\div$ two waveforms (e.g. $W1 = W2 + W3$) in point-wise fashion. The fourth is used to apply a mathematical function to each waveform point (e.g. $W1 = \text{deriv}(W2)$), and the fifth is used for functions such as Fourier analysis and waveform smoothing.



- Click on the various pop-ups to familiarize yourself with how it works. In summary, one uses pop-up menus to form a sentence, which is implemented when the instruction is executed.



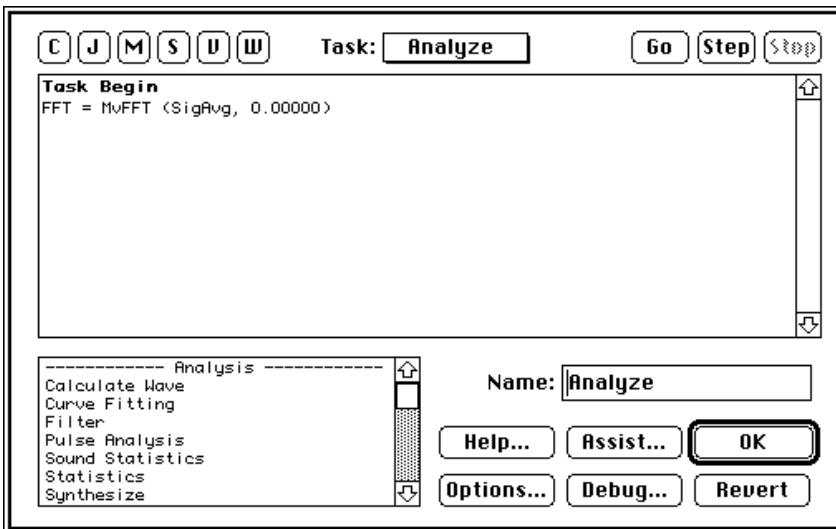
Use the pop-ups to set up the sentence "SigAvg = SignalAvg (W1)", as illustrated to the right. This will cause the SigAvg wave to be loaded, when the task is run, with the point-wise average of all analog input scans acquired since the task started execution.

- Click OK to close the Calculate Wave dialog and to install this new instruction into the task.
- Click the Assist button in the Task dialog and then click OK in the Assistant dialog and the next dialog that appears. The Assistant will automatically create a button with the same name as the Task, and place it on the front panel. When the newly created Acquire button is pressed it will run the Acquire task.

NON-DIGITIZER-BASED TASKS

We will now create a task that calculates the frequency spectrum of the averaged wave (SigAvg), displays the results, and logs the spectrum's peak value to a journal.

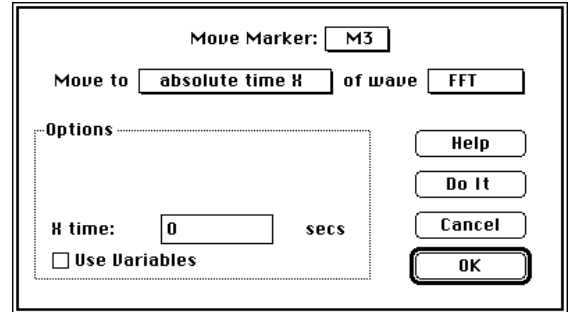
Select Task ▶ New from the Task menu to create a new non-digitizer-based task, and to open the Task Editor. Non-digitizer-based tasks are similar to digitizer-based-tasks, except they do not contain the bolded template instructions that form the skeleton digitization procedure.



Rename this task "Analyze", and then drag the Calculate Wave instruction to the position directly under Task Begin, and then let go, as illustrated to the right.

When the Calculate wave dialog appears, set up the sentence "FFT = MvFFT (SigAvg)" and then press OK to install the instruction. The second parameter in this function is used to specify the number of points for the FFT; 0 specifies as many points as available.

- Scroll the Instruction Dictionary to find the Move Marker instruction (under the Management heading). Drag this instruction to the position directly under the MvFFT instruction and let go. The Move Marker dialog will appear, as shown to the right.
- Click on the various pop-ups to learn how this instruction works. Again, one uses pop-up menus to form a sentence.



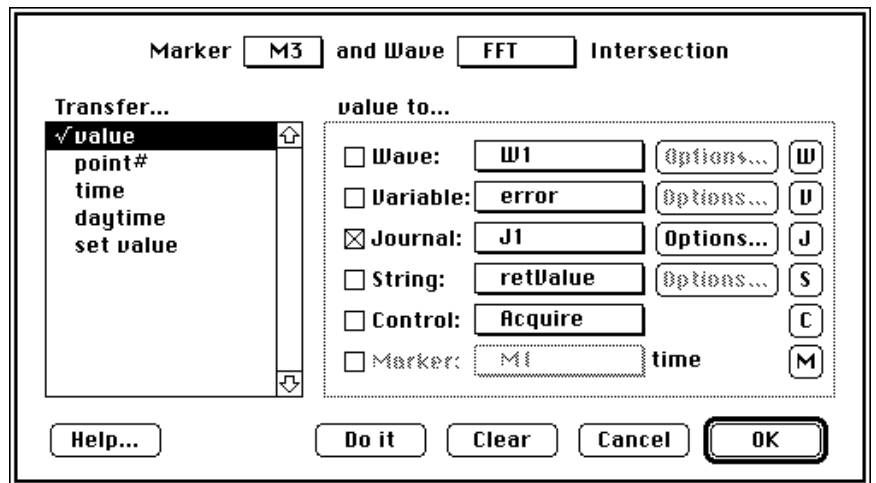
We will now set up this instruction to move marker M3 to the 0.000 position (i.e. the left edge) of the FFTDisp display.

- Select M3 in the upper-most pop-up, select Absolute Time X in the left-most pop-up, select FFT in the right-most pop-up, and then enter 0.0 in the X time field that appears in the Options area. Click OK to exit this dialog and install the instruction.
- Add another Move Marker instruction directly below the one we just created, and set it up to move marker M3 to the Next Maximum of wave FFT. Click OK to exit and install.

We will now set up an instruction to transfer the value of the FFT wave, at the marker M3 position, to journal J1.

- Scroll the Instruction Dictionary to the Data Transfer section, and then drag the Log Marker Values instruction to the position below the last Move Marker instruction.

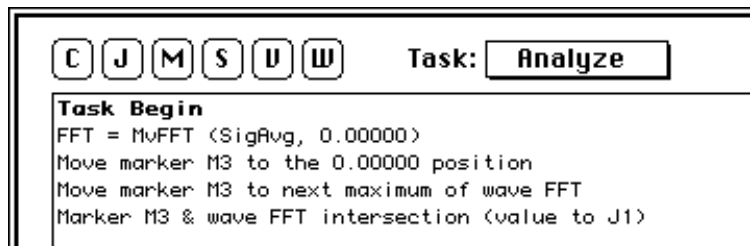
When you release the mouse button, the Log Marker Values dialog will appear, as shown to the right.



- Select M3 in the Marker pop-up and then select FFT in the wave pop-up menu.
- Click on the Value line in the Transfer list, and then select the Journal checkbox. This will cause the FFT value, at the M3 position, to be transferred to the journal J1.

The Transfer Area is very powerful since it can transfer the values of multiple parameters to any combination of objects, in any combination. For example you could transfer the Point# parameter to wave W1 and to marker M1; and then transfer the Value parameter to journal J2. This general purpose transfer environment exists in a number of instructions.

- Click OK to exit and install the Log Marker Values instruction and to return to the Task Editor.
- If your task does not appear as pictured to the right, please correct it. Recall that instructions can be Cut, Copied, Pasted;

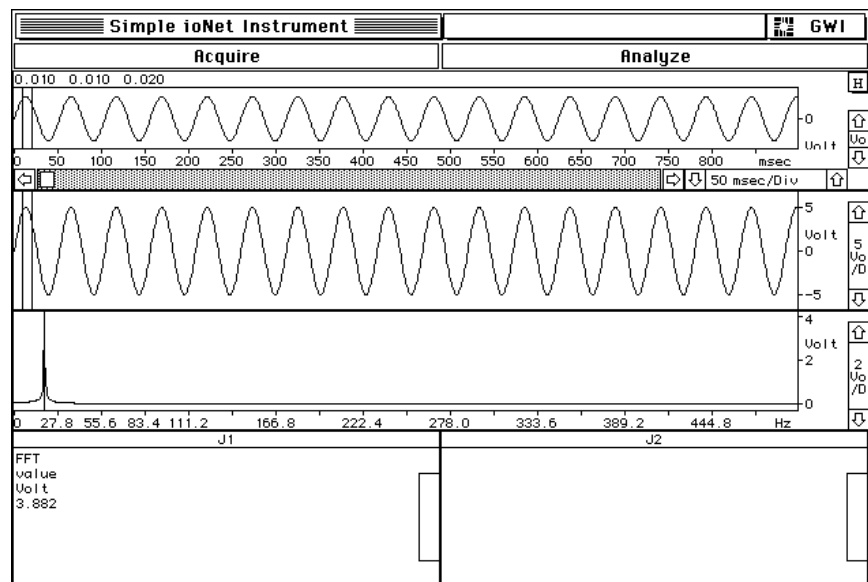


and their dialog's can be opened by double-clicking.

- Click the Assist button. Click OK in both dialogs that appear. This will automatically create a button named Analyze that will run the Analyze task when clicked. Your front panel should look like the figure below, although at this time the displays and journals will be empty.

RUNNING THE INSTRUMENT

- Select Run ► Acquire from the Task menu and watch the instrument simulate a single channel oscilloscope, with a signal averager.
- Select Run ► Analyze from the Task menu to calculate the frequency spectrum and send the peak spectral energy to journal J1.
- Click once in the J2 journal, to select it, and then type "The End". Your screen should appear as shown above.



SAVING THE INSTRUMENT

Save your new instrument to disk for later use.

- Select Save As from the File menu, type "my instrument" into the file dialog, and then click the Save button. For your reference there exists a completed version of this instrument, named Simple iNet Instrument, in the "instruNet Instruments" folder.

You may want to practice working with this instrument -- feel free to make additional changes. Also, feel free to copy and modify the instruments included with SuperScope II, or swap instruments with friends and colleagues. If you create a special-purpose instrument, please consider sending it to us so we can share it with others.

Congratulations! You have completed the tour and are well on your way to becoming a SuperScope II expert.

WHERE TO GO FOR MORE INFORMATION

Chapter 4 provides a tour of the more advanced topics, Chapter 5 covers the building blocks used in instrument design, and Chapter 6 describes two of the instruments that are included with SuperScope II.

Chapter 4





Tutorial: Advanced Techniques

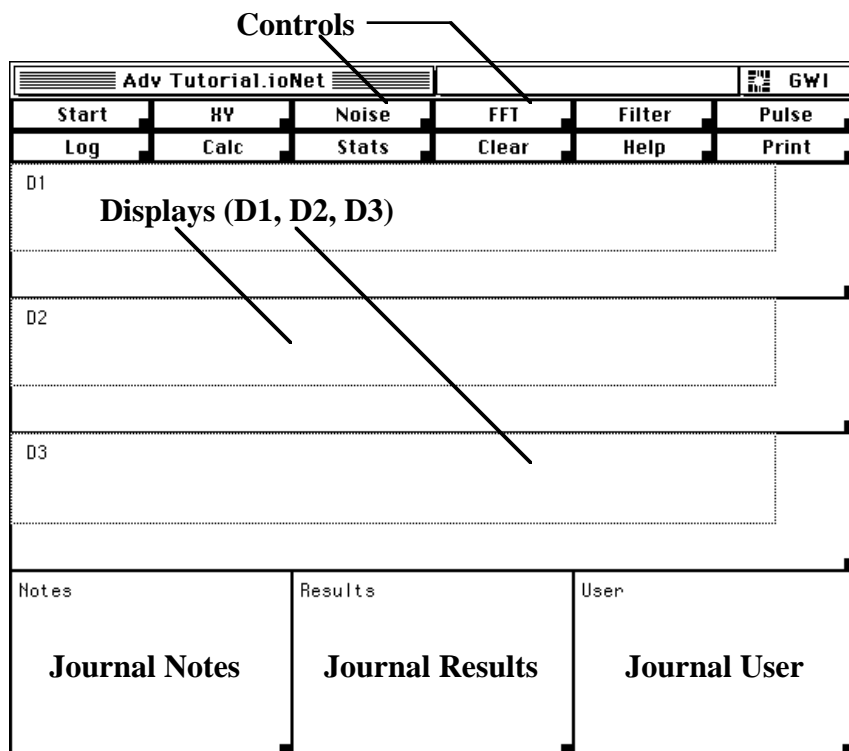
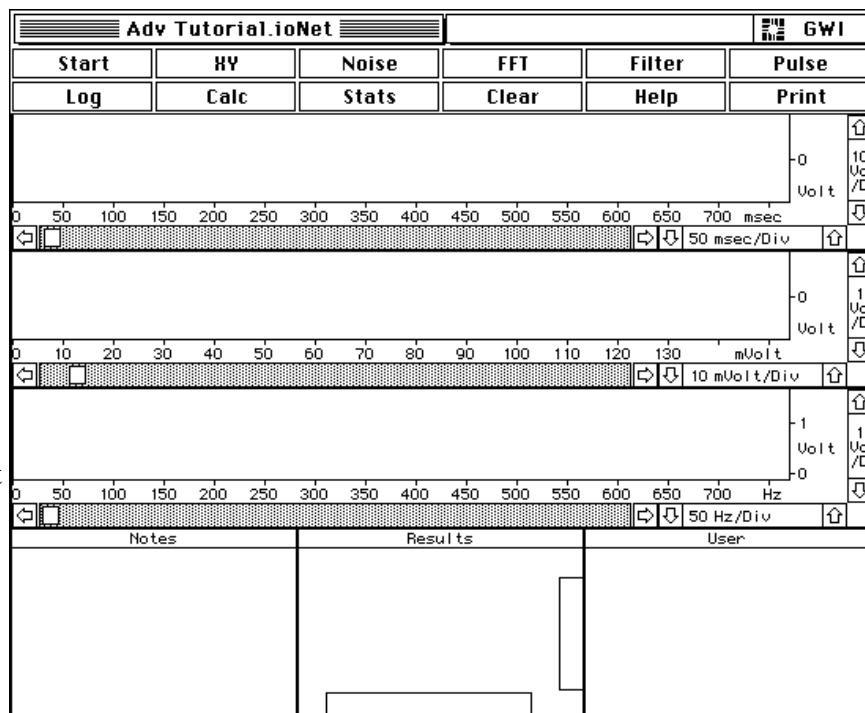
One dilemma encountered in designing software involves the tradeoff between the number-of-features and the ease-of-use. Products with few features tend to be easy to learn and use, and those packed with features tend to be more challenging. In some cases, simple applications will not satisfy a user's requirements, forcing them toward complex applications that require steep, time consuming, learning curves. We have worked very hard to make SuperScope II both featureful, and easy-to-use. Simple instruments can be set up in a minimal amount of time, and complex instruments can be designed without knowledge of a conventional programming language.

SuperScope II allows customers to tailor their instruments to their own needs. It's powerful design environment includes a menubar editor (for designing custom menu bars), a dialog-driven command language, and a powerful set of database export tools. The Menubar Editor enables an instrument designer to create a menubar, and assign tasks to each menu item. The menubar may contain any number of menus and commands; subsequently making it possible to create a very simple instrument, with only a few menu commands.

This chapter provides a tour of an instrument, named Adv Tutorial.iNet, that digitizes two signals, analyzes the acquired data, and sends the results to a FileMaker database. Adv Tutorial.iNet covers the main features of SuperScope II including menu editing, acquisition, decision making, data export, analysis, continuous recording, and debugging.

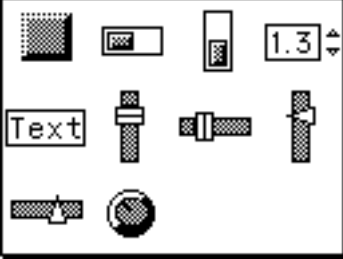
- 🍏 If SuperScope II is already open, please choose Quit under File.
- 🍏 Find the Adv Tutorial.iNet instrument, select it, and choose duplicate under the File menu. This will cause the file to be duplicated and renamed to "Adv Tutorial.iNet copy". It is good to work with a copy of an instrument when doing design; so you can return to the starting point, if desired. *Also, as you are designing, it is always good to save your instrument every now and then with a different file name (e.g. fred1, fred2, fred3, etc), to keep a running log of you work.*

-  Double-click on Adv Tutorial.ioNet copy; or launch SuperScope II, and then choose Open under File to load the instrument. The Adv Tutorial.ioNet instrument will appear, as shown to the right. This instrument contains a suite of buttons, three journals, three displays and a custom menubar.
-  Select Choose Menubar ▶ Full under Edit to turn off the custom menubar, named "MyMenu", and enable the default Full menubar (it may already be selected).
-  Select Panel Edit On from the Display menu to view the front panel objects, as shown to the right.
-  Select Panel Edit Off from the Display menu when done with your review.






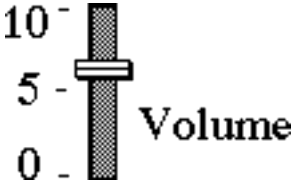
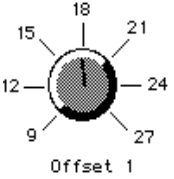
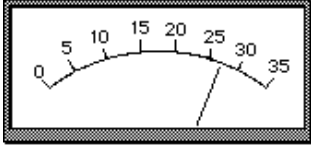

SUPERSCOPE II OBJECTS

SuperScope II instruments are comprised of objects that are created by the user, and assembled like building blocks, to form an instrument. Waves, segments, variables, strings, journals, datapipes, and markers are used to hold data. Displays and journals are used to display data; and tasks are used to acquire, analyze, present and move data. For details on objects, please refer to *Chapter 5* of this Manual. The Adv Tutorial contains many objects, illustrated below:

<p><i>Displays</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>D1 D2 D3</p> </div>	<p><i>Markers</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>✓M1 M2 M3</p> </div>	<p><i>Channels</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Ain0 Ain1</p> </div>
<p><i>Journals</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>EXPORT Notes Results SinVal TEMP User</p> </div>	<p><i>String</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>retValue message PeakFFT Area comma SinU</p> </div>	<p><i>Waves</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>W1 W2 FFT Noise Selected Seg1</p> </div>
<p><i>Variables</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>✓error ST UDP DS SR area Avg StdDev RMS min</p> </div>	<p><i>Controls</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">  </div>	<p><i>Tasks</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Start FFT Filter HY Calc Clear Pulse Log Stats HCMDr Noise</p> </div>
<p><i>Menubars</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>✓Full Short MyMenu</p> </div>	<p><i>Segments</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Seg1</p> </div>	<p><i>Datapipes</i></p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;"> <p>Data</p> </div>

FRONT PANEL CONTROLS

SuperScope II offers a complete line of controls and indicators; including lights, buttons, switches, sliders, dials, meters, numeric fields, static text, and lists. Adv Tutorial uses buttons to start tasks.

 <p>Dout0</p> <p>Lights indicate the state of a Boolean true/false value.</p>	 <p>Buttons often initiate the execution of a task.</p>	<p>Power</p>  <p>Switches specify a true/false Boolean condition.</p>
 <p>Sliders control a scalar quantity.</p>	 <p>Dials control a continuous or quantized scalar quantity.</p>	 <p>Meters indicate a scalar quantity.</p>
 <p>Numeric Fields control a scalar quantity or a text string.</p>	<p>Duration = 12.52</p> <p>Static Text shows a scalar quantity or a text string.</p>	

- Select **Options** ▶ **Clear** under **Controls** to open the Control Options dialog, pictured to the right.

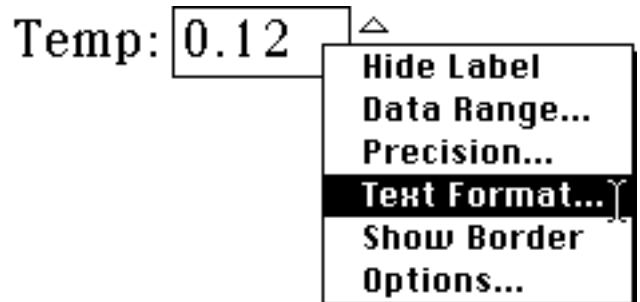
This dialog is used to specify the style, attributes and behavior of controls and indicators. The Type and Style pop-ups determine if the object is a switch, button, dial, knob, etc. The Name field determines the object's name, and is used by tasks to reference the object's value. For example, a task could be setup to beep if switch "Fred" was set to the On position. In the Boolean world, False is represented by 0.000; and True is represented by all other values, with 1.000 being the most common True value. Therefore, a task could read the value of Fred, and beep if Fred's value was not zero. Other items in the Control Options dialog specify the range for a dial or slider, the label shown next to the object, and the task that is executed when the control is moved with the mouse.

The screenshot shows the 'Control Options' dialog box for a control named 'Clear'. At the top, the control name is 'Clear'. Below this, the 'Object' section contains:

- Name:** Clear
- Type:** Control
- Style:** A square with a grid pattern.
- Value:** 0.000000
- On:** mouse up
- run:** Start
- T:** A small box containing the letter 'T'.

 The 'Options' section contains four dropdown menus: **Main:**, **Label:**, **Readout:**, and **Ruler:**. Below these is a warning: 'This area is still in development (be careful)'. At the bottom are three buttons: **Help**, **Revert**, and **OK**.

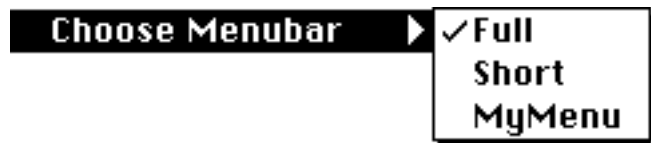
Controls are positioned and resized in Panel Edit Mode just like displays and journals. Attributes of elements within objects are adjusted by *Option* clicking on the element (hold down both the *Option* keys and then mouse down). This causes a floating menu to appear, illustrated to the right, that lists the various adjustable attributes; such as Data Range, Precision, and Text Format. For example, one could set a label's font by *Option* clicking on that label, and then choosing Text Format from the floating menu.



- Press **OK** to exit the Control Options dialog.

THE MENUBAR EDITOR

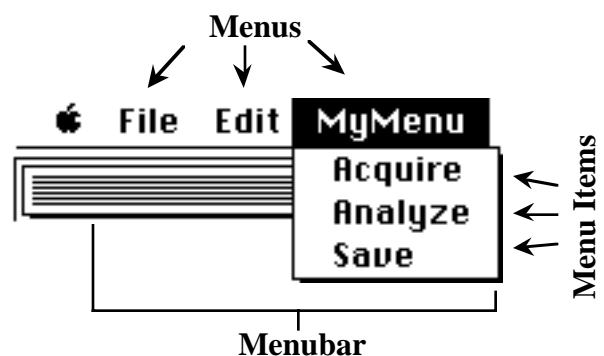
SuperScope II contains a powerful menubar editing environment for creating custom menubars. The user can create as many menubars as he/she desires, and can quickly move from one to the other with the Choose Menubar command under Edit, illustrated above. With the Menubar Editor, one can edit an existing menubar, create new menubars, and attach tasks to menu items.



Attaching tasks to menu items is a powerful feature, since it enables the End User to add functionality to menu commands, which ultimately enables one to design their own menu driven application program!

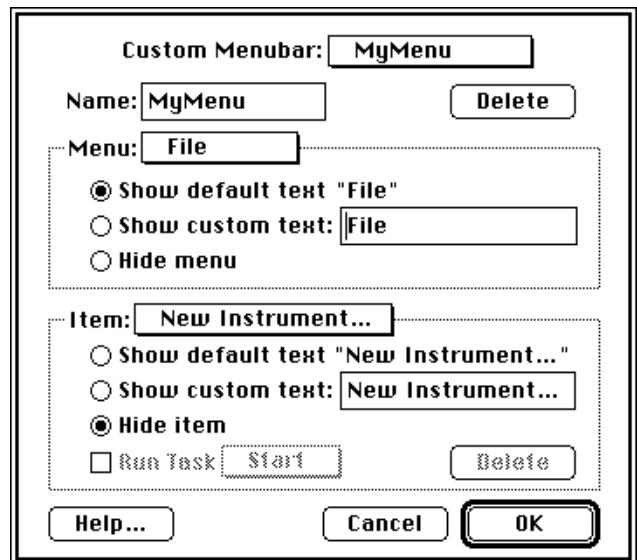
Editing a menubar entails hiding entire menus (e.g. File, Edit, Wave), hiding menu items (e.g. Cut, Save, New), adding menus, and adding items to menus. For example, one could create a very simple menubar with several commands to acquire, analyze and save data; as illustrated to the right.

- 🍏 Select Edit Menubar ▶ MyMenu under Edit to open the Menubar Editor, pictured to the right.



The Menubar Editor contains two editing areas. The top area is used to add, hide, and rename menus; whereas the bottom area is used to add, hide, rename and link-to-task menu items. Each SuperScope II instrument contains several menubars, one of which is specified in the upper-most pop-up menu of the Menubar Editor. Each menubar can be renamed or deleted via the upper-most Delete button (except the default Full and Short menubars). To create a new menubar, one chooses New Menubar in the upper-most pop-up. Menu and menu items are easily renamed by selecting "Show custom text:" and then typing a new name in the adjacent field.

- 🍏 Notice that the "New Instrument" item, in the lower area, under File, has been hidden with the Hide Item radio. Click on the Item pop-up menu and select Save. The Save item has not been hidden. Look at the other items in the Item pop-up and note that most are hidden.



- 🍏 Click on the Menu pop-up and select Edit. Notice that the Edit menu is not hidden, yet most of its items are. All of the other menus have been hidden except for the Task menu.

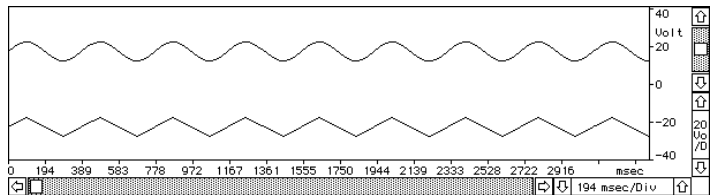
- 🍏 Select Task from the Menu pop-up. Notice that this menu has been renamed to "MyMenu". Menus and menu items are easily renamed by selecting "Show custom text:" and then typing a new name in the adjacent field.

- 🍏 Play with the Item pop-up menu. Notice that the standard Task items have been hidden, and that two "User Items" have been added.
- 🍏 Select User Item 1. This menu item has been renamed "Acquire" and has been set up to run task "Start" when chosen.
- 🍏 Click on the Run Task pop-up to see the list of available tasks. Any User Item can be set up to run any task.
- 🍏 Select User Item 2 in the Item pop-up. This menu item has been renamed "Analyze" and has been set up to run task "Calc" when chosen.
- 🍏 Click OK to exit the Menubar Editor.
- 🍏 Observe the custom menubar, and when done, Choose Menubar ▶ Full under Edit to enable the Full menubar.

STRIP CHART RECORDER

The Adv Tutorial.iNet digitizes and analyzes several signals simultaneously. It can be run with either the demo version of SuperScope II in which case it will simulate 2 input channels or with the real version of SuperScope II connected to instruNet hardware in which case it will record directly from the first 2 analog input channels.

- 🍏 Click once on the Start button in the upper-left corner of the instrument. This will cause the "Start" task to run, which in turn executes several instructions that implement a two channel real time strip chart recorder (simulated if you are using the Demo digitizer).



- 🍏 Select Edit ▶ Start under Task to view the task. It is similar to the digitizer-based-task reviewed in *Chapter 2*, yet contains six additional instructions; three are used to clear displays and three are used to set markers to the 0.000 position.

The Adv Tutorial has three displays and three markers. The bottom display, named D1, contains two markers (M1 & M2) and the top-right display, named D2, contains one marker (M3).

- 🍏 Click OK to exit the Task Editor.

```

Task Begin
Move marker M1 to the 0.00000 position
Move marker M2 to the 0.00000 position
Move marker M3 to the 0.00000 position
Clear Display D1
Clear Display D2
Clear Display D3
Scan Loop Begin (2 scans)
  Segment Loop Begin
    Digitize Segment (10000 pts/scan,
    Plot Segment
    Segment Loop End

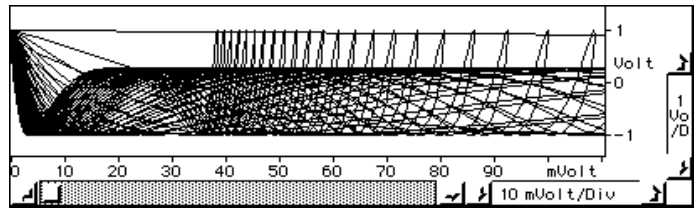
```

XY ANALYSIS

- Click on the XY button to plot the cosine of W1 against the average-to-date of W2. This button causes the XY task to run, which calculates:

$$W3 = \text{Cos}(W1)$$

$$W4 = \text{AvgToDate}(W2)$$



Display D2 plots the points in wave W3 against those in W4, in XY fashion; and is updated automatically when the task is finished executing.

- To view the XY task, select Edit ▶ XY from the Task menu. This task uses two Calculate Wave instructions to do the wave mathematics. Press OK when done with your review.

```
Task Begin
W3 = Cos (W1)
W4 = AvgToDate (W2)
```

SPECTRUM ANALYSIS

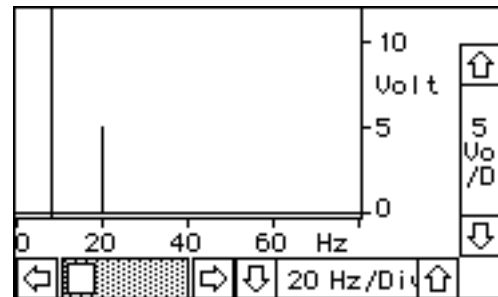
- Click on the FFT button to calculate the frequency spectrum of W1. This button causes the FFT task to run, which calculates:

$$\text{FFT} = \text{MvFFT}(W1, 1024)$$

Display D3 plots the points in wave FFT; and is updated automatically when the FFT task is finished executing.

Frequency in Hertz is represented along the horizontal axis, while frequency magnitude is shown on the vertical axis. Notice that

W1 is a 5V amplitude (10V peak-to-peak) sine wave with a frequency of approximately 20Hz (this may vary, depending on your setup), and the spectrum analysis shows one point at {20Hz, 5V}. To show dB along the vertical axis, one would substitute Spectrum() for MvFFT(). For details, please see the Spectrum Analyzer example at the beginning of *Chapter 7* in the SoundScope & SuperScope II Reference Manual.



- To view the FFT task, select Edit ▶ FFT from the Task menu. This task uses one Calculate Wave instruction to calculate the frequency spectrum.

```
Task Begin
FFT = MvFFT (W1, 1024.00)
```

- Double-click on the FFT = MvFFT(W1, 1024) instruction to view the Calculate Wave sentence. When the result wave "FFT" is plotted, we see the frequency amplitude between 0Hz and half the sample rate (166Hz sample rate ÷ 2 = 83Hz = Nyquist frequency). The frequency resolution (i.e. # of Hz between each frequency point) is the Nyquist frequency divided by half the number of FFT points (83Hz ÷ (1024 ÷ 2) = .16Hz).



- Press Cancel to exit the Calculate Wave instruction, and then press OK to exit the Task Editor.

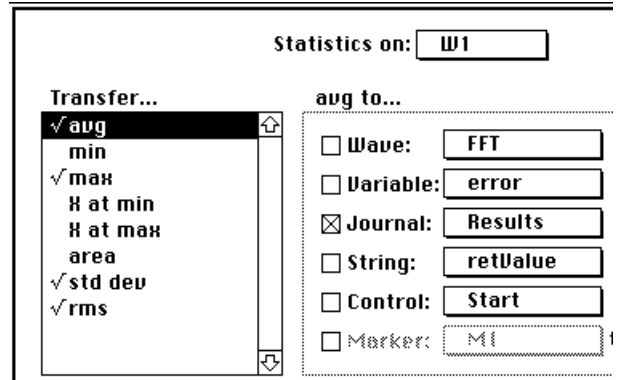
WAVEFORM STATISTICS

- Click on the Stats button to automatically calculate the average value, maximum value, standard deviation, and rms of W1. When the file dialog appears, press Save to save the results to disk.

- 🍏 To view the Stats task, select Edit ▶ Stats from the Task menu.

Task Begin
 Statistics on W1 (avg to Results; max
 Choose Save As... Results Under Journ...

- 🍏 Double-click on the Statistics instruction to view it's dialog. This instruction calculates statistics on a wave, channel, segment, or selected region. Several statistical parameters are supported, each of which can be sent to a wave, variable, journal, string, control or marker; in any combination. Recall that a marker's value is derived from it's position; a control's value is derived from it's setting; a string or journal's value is derived from it's text (zero is assumed if the text does not contain a number); and a wave's scalar value is derived from one point, as specified in the Wave Transfer Options dialog, discussed later.

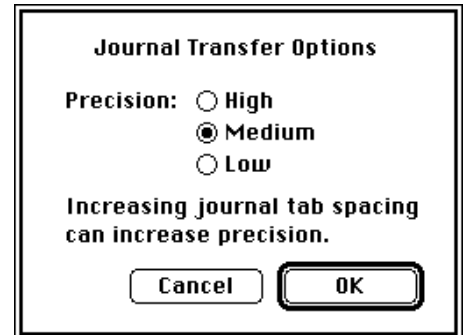


In this case, four parameters are calculated and their results are sent to journal Results, in tabular fashion, as pictured to the right.

Results		
W1	W1	W1
avg	max	std dev
Volt	Volt	Volt
0.060	5.000	5.000

- 🍏 Click on the Journal Options button to open the Journal Transfer Options dialog box. This dialog determines the precision of the transferred data, as described below.

Precision	Digits after ". "	Example
Low	1	1.1
Medium	3	1.093
High	7	1.0927861



- 🍏 Click OK to exit the Journal Transfer Options dialog.
- 🍏 Click on the various Transfer parameters (e.g. avg, min, max, X at min, X at max) and view the various transfers that have been enabled (e.g. avg to journal Results, max to journal Results).

- Click on the Wave checkbox to enable the transfer of a statistic to a wave, and then click on the Wave Options button to open the Wave Transfer Options dialog, pictured to the right.

The dialog box is titled "Wave Transfer Options". It contains the following fields and options:

- 1st Transfer:** Point # Append to last point of wave
- Next Transfer:** Next location Same location
- If hit wave end:** Transfer to point #1 Stop transfers yet don't stop task Stop task and show alert Try to enlarge wave
- Upon new trace:** Continue Transfer to point #1
- Wave size:** points minimum

Buttons: Cancel, OK

Transferring a scalar (i.e. one number) to a wave is a little tricky since one must specify the waveform point that is to receive the scalar. This is accomplished with the Wave Transfer Options dialog. The first value transferred in a task is either sent to a specific point number (where point #1 is the first point), or to the end of the wave. Each subsequent transfer (in a running task) is either done to the Next Point Location, or to the Same Location. If the wave's last storage location is exceeded: the value is transferred to point #1, the transfer does not occur, the task is stopped, or the wave is enlarged and the value is transferred normally. When a new scan is acquired in a digitizer-based-task, transfers occur normally, or they can reset to point #1. At the beginning of a task, all waves are resized, as requested by the Wave Size field. Wave enlarging occasionally fails due to memory limitations; in which case, an alert is shown.

- Click Cancel twice to return to the Task Editor.

- Double-click on the Choose Save As instruction to open the Choose Menu dialog.

The dialog box is titled "Choose Menu". It contains the following fields and options:

- Menu:**
- Key press:**
- % Key:**
- Open instruction number** **in task**

Automatically press encountered OK buttons

Buttons: Help..., Do It, Cancel, OK

Choose Menu is used to simulate the selection of a menubar command, or a key press (e.g. choose Print under File, press Option 'e', etc). In this example, Save As ► Results under Journal is chosen, automatically, when this instruction is executed. Subsequently, the standard Save As dialog appears and the journal is saved to disk, as a text file, when the user presses the Save button. This is very powerful since it brings all menubar and keyboard commands within the scope of task instructions.

- Click Cancel to exit the Choose Menu dialog and then click OK to exit the Task Editor.
- Choose Clear ► Results under Journal to delete the data.

SCALARS, STRINGS, SEGMENTS & PROGRAMMING

- Click on the Calc button to analyze several waves and send the results to the Results journal. If an alert appears, press OK.

Results
Max FFT value = 4.9999590
Area = 0.7839148

- To view the Calc task, select Edit
 - Calc from the Task menu.

This task is listed on the following page with comments and line numbers. A textual description of a task can be copied to the clipboard by choosing Copy Task under the Edit menu. Alternatively, one can copy a complete textual description of the instrument by pressing *Shift Option 'A'*. To view or print the description, one can paste the text into a word processor or into a journal. For a

quick view, one can choose Show ▸ Clipboard under Edit, and then resize the clipboard window as needed. If a journal by the name of "read" exists, its text is included in the description. A journal by this name is the standard repository for user documentation of an instrument. If the user presses *Option 'a'* (i.e. lower case 'a'), a more brief textual description is sent to the clipboard. The brief version does not include the ReadMe or the Menubar description. These documents look best when printed with a small fixed character width font such as Courier 9. Task text is not a functional description of a task, since many settings are not included; it is only used as a reference.

```

Task Begin
Move M3 to absolute time X of FFT
Move M3 to next maximum of FFT
Marker M3 & wave FFT intersection (
Insert "Max FFT value = " into jour
If (String PeakFFT > 4.500) then ..
    Append text onto the end of Resu
    Jump to "out"
    If end
Insert "Low" into journal Results
Beep
Beep

```

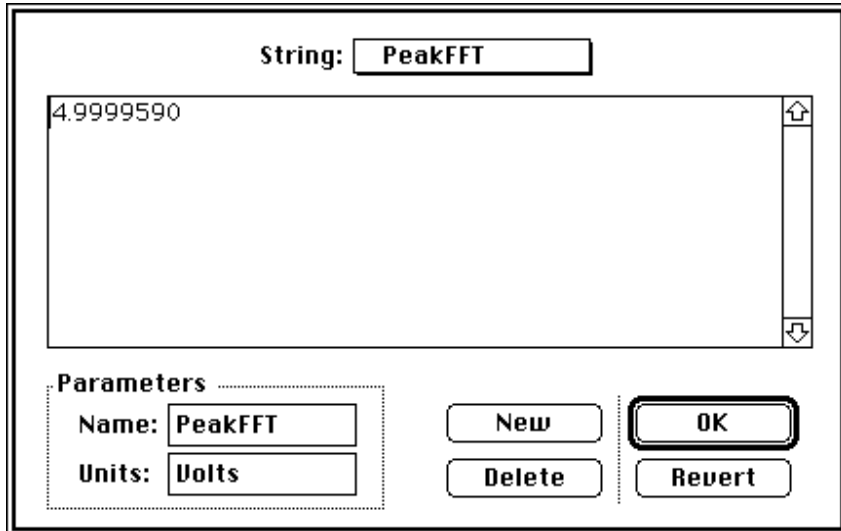
01	Task Begin	
02	Move M3 to absolute time X of FFT	<i>move marker M3 to 0Hz</i>
03	Move M3 to next maximum of FFT	<i>move marker M3 to the frequency peak</i>
04	Marker M3 & wave FFT (value to PeakFFT)	<i>copy peak amplitude into string PeakFFT</i>
05	Insert "Max FFT value = " into jrn Results	<i>insert text into journal Results</i>
06	If (String PeakFFT > 4.500) then ...	<i>if amplitude value is greater than 4.5 then ...</i>
07	Append text onto the end of Results with data from string PeakFFT	
08	Jump to "out"	<i>jump to the "out" label (6 lines below)</i>
09	If end	<i>end of the if (>4.5) case</i>
10	Insert "Low" into journal Results	<i>insert text into journal Results</i>
11	Beep	<i>make a beep sound</i>
12	Beep	<i>make a beep sound</i>
13	Show Alert: "Max FFT Low!"	<i>show alert to say that frequency peak is $\leq 4.5V$</i>
14	out:	<i>target for a Jump instruction</i>
15	Insert "\r" into journal Results	<i>insert a carriage return into journal Results</i>
16	Move M1 to absolute time X of W1	<i>move marker M1 to 0 seconds</i>
17	Move M2 to absolute time X of W1	<i>move marker M2 to 0 seconds</i>
18	Move M2 to next peak of W1	<i>move marker M2 to the 1st peak in W1</i>
19	Move M2 to next peak of W1	<i>move marker M2 to the 2nd peak in W1</i>
20	Move M2 to next value of W1	<i>move M2 to the next place where W1 crosses -1</i>
21	Move M1 to next valley of W1	<i>move marker M1 to the 1st valley in W1</i>
22	Move M1 to next value of W1	<i>move M1 to the next place where W1 crosses -1</i>
23	Pulse analysis Seg1 (area2 to area, Area)	<i>send area of segment Seg1 to variable & string Area</i>
24	Insert "Area = " into journal Results	<i>insert text into journal Results</i>
25	If (String Area > 0.1000) then ...	<i>if area value is greater than .1 then ...</i>
26	Append text onto the end of Results with data from string Area	
27	Jump to "out2"	<i>jump to the "out2" label (6 lines below)</i>
28	If end	<i>end of the if (>0.1) case</i>
29	Insert "Low" into journal Results	<i>insert text into journal Results</i>
30	Beep	<i>make a beep sound</i>
31	Beep	<i>make a beep sound</i>
32	Show Alert: "Area Low !"	<i>show alert to say that area value is ≤ 0.1</i>

33 out2:	<i>target for a Jump instruction</i>
34 Insert "\r" into journal Results	<i>insert a carriage return into journal Results</i>

The first 4 instructions locate the maximum frequency amplitude value and transfer it to string "PeakFFT".

- Press the **S** button (Task Editor upper-left) and then choose PeakFFT in the upper pop-up menu.

Strings are used to hold a series of characters of any length, memory permitting (e.g. "hi", "1.2"). They are easily created, renamed, and deleted; and their text is easily viewed and edited in the String dialog. Many task instructions transfer text to and from strings.



The PeakFFT string currently contains "4.999", as shown in the text editor. This area is very powerful since it supports the standard Cut, Copy, Paste, and user typing -- just like a journal or text editor window!

- Press OK to exit the String dialog.

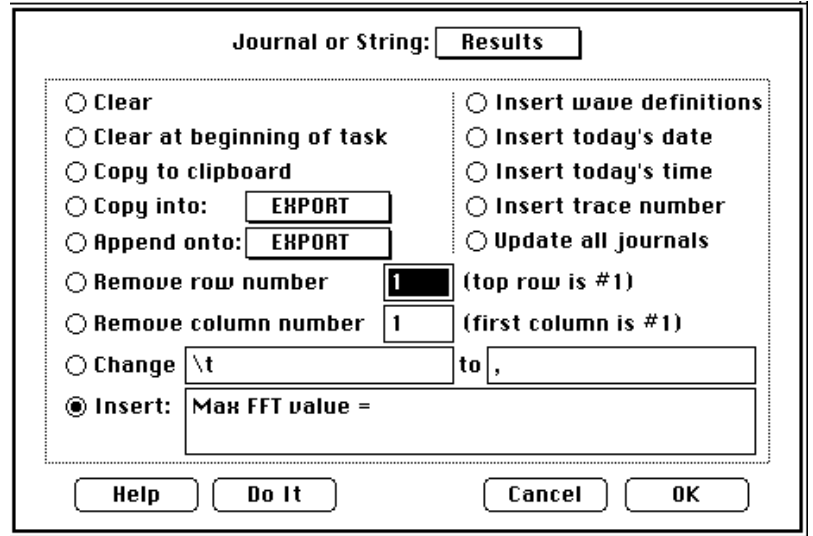
The C, J, M, S, V and W buttons are used to view and modify controls, journals, markers, strings, variables, and waves; during, before, or after running a task. This is helpful when a "problem" is encountered. These buttons create a new object if one does not already exist; otherwise, they open the dialog for the first item in the corresponding object list. Several instructions, such as Statistics, contain these buttons, for your convenience.



- Press the W button, at the upper-left, to open the Wave Options dialog. From here, one can view a wave's values with the Edit button, or the number of points with the Points button, for example. To view another wave, simply select it in the upper pop-up menu. Press OK to exit the Wave Options dialog.

- Double-click on instruction #5, "Insert Max ...", to open the Journals & Strings dialog.

This instruction is used to clear, insert text, append, copy, and search-replace text within a journal or string. It is very powerful and often used to prepare text before being transferred (i.e. "inserted") into a journal. In this case, we are inserting the text "Max FFT value =" into journal Results. The insertion occurs at the location of the insertion point, which is typically at the end of the journal or string.



Scalars are either sent to journals in a tabular or a scrolling text fashion, illustrated below. Tables are constructed by transferring scalars directly to journals (e.g. the Statistics instruction's transfer-to-journal area). Scrolling text is produced by first transferring a scalar to a string, and then inserting it via the Journals & Strings instruction. This typically requires three instructions: insert label into journal, insert value into journal, and insert carriage return ($\backslash r$) into journal. The Calc task uses the latter technique with both the maximum frequency amplitude value, and the area value, as illustrated below.

Results		
W1	W1	W1
avg	max	std dev
Volt	Volt	Volt
0.060	5.000	5.000

Tabular Format

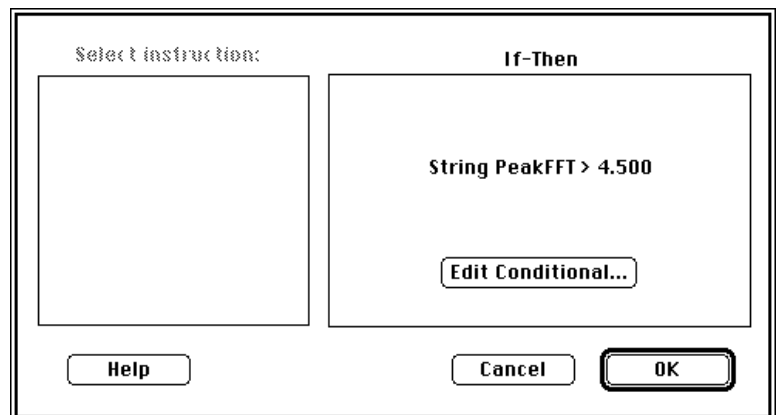
```
Max FFT value = 4.9999590
Area = 0.7839148
```

Scrolling Text

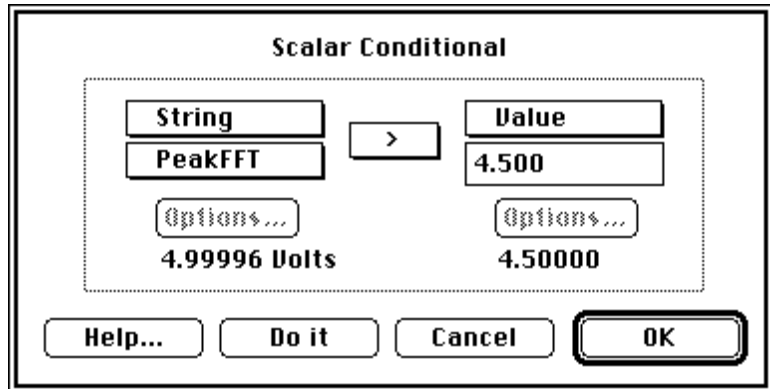
- Press the Cancel button to exit the Journals & Strings dialog.

- Double-click on instruction #6, "If (string peak..)", to open the If...Then dialog box, pictured to the right.

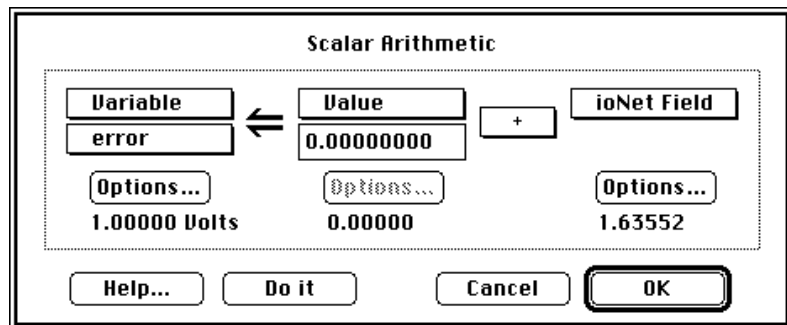
If...Then in SuperScope II is similar to If...Then in any conventional programming language such as 'C' or BASIC. A conditional statement is evaluated, and if True, the body of the If...Then is executed; otherwise it is not. In our case, instructions #7 and #8 are executed if the PeakFFT string contains a number in excess of 4.5.



- Press the Edit Conditional button to open the conditional dialog, shown to the right.
- Play with the pop-up menus to see how this dialog compares the value in two objects. Recall that a marker's value is derived from it's position; a control's value is derived from it's setting; a string or journal's value is derived from it's text (zero is assumed if the text does not contain a number); and a wave's scalar value is derived from one point, as specified by the Wave Transfers Options dialog, discussed earlier. For your convenience, the current value of each object is shown at the base of the dialog. Again, this is as easy as forming a sentence!

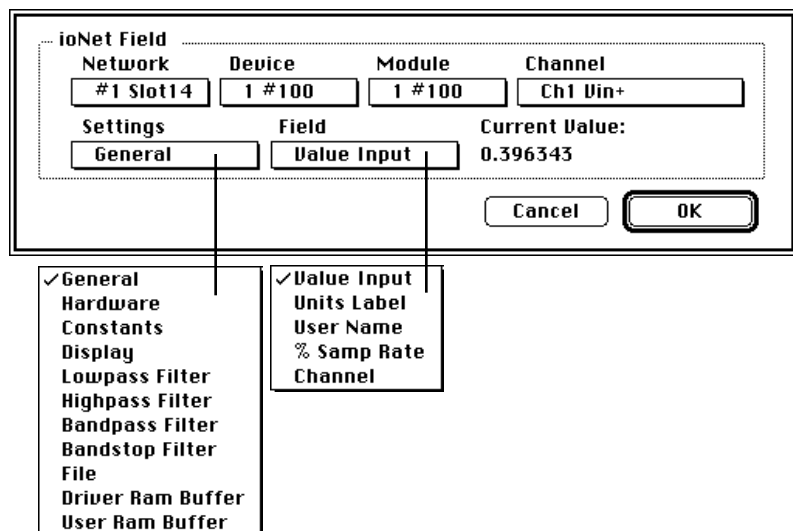


- When done with your review, press Cancel to exit the Scalar Conditional dialog, and then press Cancel again to exit the If...Then dialog.
- Scroll to the bottom of the Instruction Dictionary and then double-click on the Arithmetic instruction, illustrated to the right.

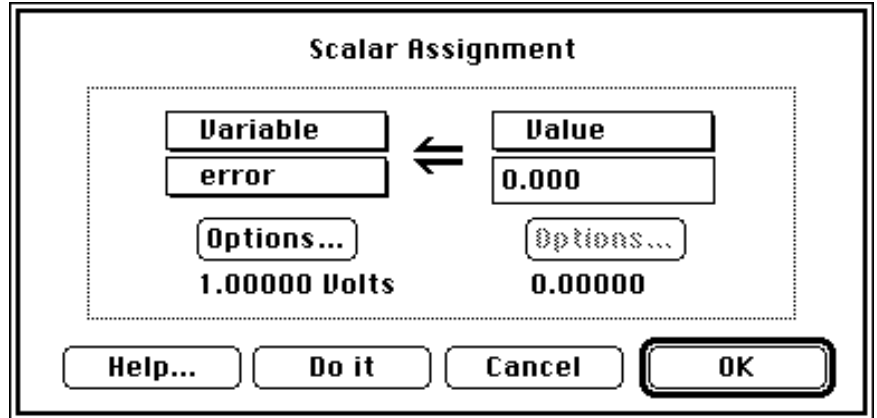


- Play with the pop-up menus to see how this dialog arithmetically combines the scalar value in two objects, and then transfers it to a third. Again, the current value of each object is shown at the base of the dialog, and it's as easy as forming a sentence. The conditionals (e.g. <, >, <= less then or equal to, >= greater then or equal to, == equal to, != not equal to) return 1.000 if the expression is True, and 0.000 if the expression is False. "AND" & "OR" are bitwise operators.

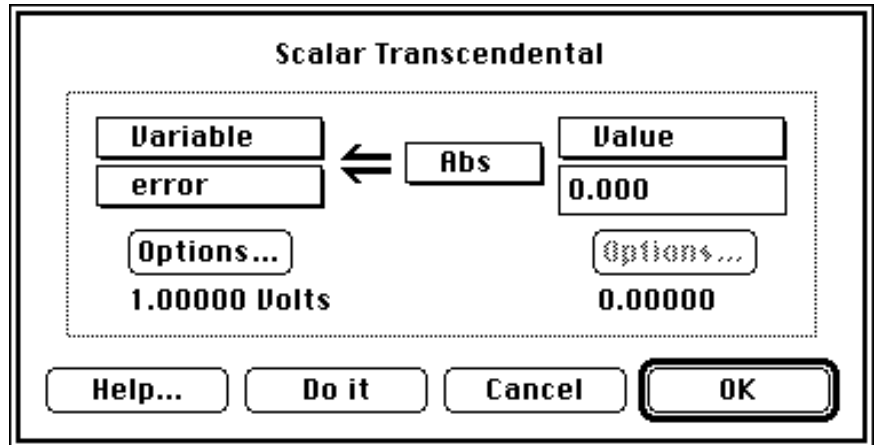
- Select instruNet in the upper right popup and then press the lower Options button to open the instruNet Field dialog. This dialog is used to select an instruNet field for reading or writing. In fact, it allows one to access all fields in the instruNet Network page, where each cell of the network spreadsheet corresponds to one instruNet field. Press cancel to exit the instruNet Field dialog and cancel again to exit the Scalar Arithmetic dialog.



Double-click on the Assignment instruction, illustrated to the right. Play with the pop-up menus to see how this dialog transfers a scalar value from one object into another object. Press Cancel when done with your review.



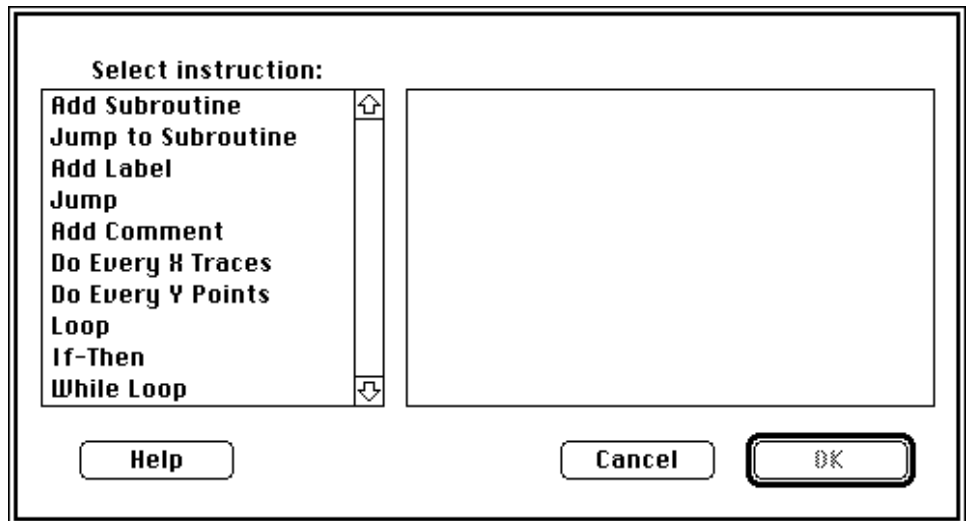
Double-click on the Transcendental instruction, illustrated to the right. Play with the pop-up menus to see how this dialog calculates a transcendental function (e.g. sin, cos, abs, ln) on one object, and then transfers the scalar result into another object. Press Cancel when done with your review.



Double-click on the Programming instruction in the Instruction Dictionary.

Programming supports common programming features such as: If...Then, Goto, While Loop, Loop N Times, Define Subroutine, Jump to Subroutine, Execute another task, Insert Comment, and Insert Label (used as a target for Goto).

Add Subroutine creates a subroutine, which is an independent program sequences that is executed with a Jump To Subroutine command, described below. Upon completion of a subroutine, program flow returns back to where the subroutine was originally called.



Jump To Subroutine is used to jump to the designated subroutine.

 Subroutine "mySub" begins here:
 Subroutine return

Jump to subroutine "mySub"

Add Label is used to insert a program label, for purposes of documentation, and to provide a target for the Jump instruction. Labels are suffixed with a colon (e.g. "Jump Here:").

```
myLabel:
```

Jump is used to divert program flow to a program label (which is set up with Add Label).

```
Jump to "myLabel"
```

Add Comment inserts a comment, for documentation purposes.

```
• Hi, my name is spoonman.
```

Loop is used to implement an unconditional loop. The body (i.e. one or more instructions between *Loop N times* and *Loop end*, that are added by the user) is executed several times, as specified in the Programming Instruction dialog. Body instructions are indented 4 characters.

```
Task Begin
Loop 5 times
  W1 = W2 + W3
Loop end
```

If-Then conditionally executes several instructions. The body (i.e. one or more instructions between *If...then* and *If end*, that are added by the user) is executed if the conditional, which is defined in the Programming Instruction dialog, is True. Body instructions are indented 4 characters.

```
Task Begin
If (Wave W1 > Wave W2) then ...
  W1 = W2 + W3
If end
```

While is used to implement a conditional loop. The body (i.e. one or more instructions between *While...do* and *While end*, that are added by the user) is executed repeatedly, while the conditional (which is defined in the Programming Instruction dialog) is True. Body instructions are indented 4 characters .

```
Task Begin
While (Wave W1 > Wave W2) do ...
  W1 = W2 + W3
While end
```

- Press on the various instructions to see how this dialog creates common programming constructs. Press Cancel when done with your review.

The Programming instruction is used widely in the Calc task.

05	Insert "Max FFT value =" into jrnL Results	<i>insert text into journal Results</i>
06	If (String PeakFFT > 4.500) then ...	<i>if amplitude value is greater than 4.5 then ...</i>
07	Append text onto the end of Results with data from string PeakFFT	
08	Jump to "out"	<i>jump to the "out" label (6 lines down)</i>
09	If end	<i>end of the if (>4.5) case</i>
10	Insert "Low" into journal Results	<i>insert text into journal Results</i>
11	Beep	<i>make a beep sound</i>
12	Beep	<i>make a beep sound</i>
13	Show Alert: "Max FFT Low!"	<i>show alert to say that frequency peak is ≤4.5V</i>
14	out:	<i>this label is a target for a Jump instruction</i>

Instructions #7 and #8 are executed if the frequency amplitude is greater than 4.5; otherwise, #10, #11, #12, and #13 are executed. The former causes the maximum frequency amplitude to be transferred to the journal; whereas the latter results in "Max FFT value = Low" being transferred to the journal and an alert.

- Double-click on instruction #13, "Show Alert...", to open the Alert, Beep & Delay instruction, pictured to the right.

This dialog is used to sound a beep, show a message in an alert, stop the task, wait until the mouse button is pressed, wait until the mouse button is released, wait for a specific key press, freeze for a specified duration, or synchronize to a specified duration. In this case, the instruction shows an alert with the "Max FFT Low!" message.

- Press Cancel when done with your review.

- Double-click on the User Prompt instruction in the Instruction Dictionary.

This instruction shows a custom alert with an optional response field and an optional Cancel button. The alert message, default response text, Left button text and Right button text are all specified in this dialog.

- Press the Do It button to invoke the custom alert. Press Yep to exit the alert.

- Enable the Response field and Left button checkboxes, and then press Do It again. An alert will appear, as pictured to the right.

- Press Nope to exit the alert, and then press Cancel to exit the User Prompt dialog.

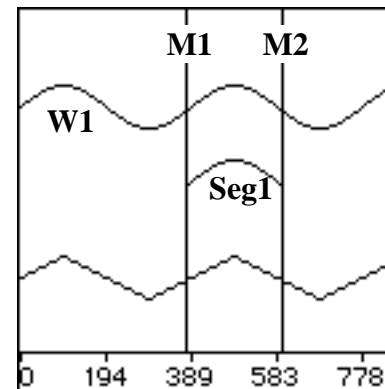
- Press the **S** button and then choose retValue in the upper pop-up menu. The string should be loaded with the response, "No, I cook electric.". Upon exiting the custom alert, string "retValue" is loaded with the response text. Also, variable "error" is loaded with 1 if the Right button was pressed, and 2 if the Left button was pressed. Variable "error", and string "retValue" are system objects, and are loaded with information after each instruction is executed. Please refer to Appendix D of the

SoundScope & SuperScope II Reference Manual for details on who returns what. Instruction feedback is often used to break out of a loop. For example, one could continuously call the "Move marker to next peak" instruction, in a loop, until it returned an "error" code of 3 (marker hit end of the wave).

- 🍏 Press OK to return to the Task Editor.
- 🍏 Click on several functions in the scroll area to familiarize yourself with this environment, and then press Cancel when done with your review.

16	Move M1 to absolute time X of W1	<i>move marker M1 to 0 seconds</i>
17	Move M2 to absolute time X of W1	<i>move marker M2 to 0 seconds</i>
18	Move M2 to next peak of W1	<i>move marker M2 to the 1st peak in W1</i>
19	Move M2 to next peak of W1	<i>move marker M2 to the 2nd peak in W1</i>
20	Move M2 to next value of W1	<i>move M2 to the next place where W1 crosses -1</i>
21	Move M1 to next valley of W1	<i>move marker M1 to the 1st valley in W1</i>
22	Move M1 to next value of W1	<i>move M1 to the next place where W1 crosses -1</i>
23	Pulse analysis Seg1 (area2 to area, Area)	<i>send area of segment Seg1 to variable & string Area</i>
24	Insert "Area = " into journal Results	<i>insert text into journal Results</i>
25	If (String Area > 0.1000) then ...	<i>if area value is greater than .1 then ...</i>
26	Append text onto the end of Results with data from string Area	
27	Jump to "out2"	<i>jump to the "out2" label (6 lines down)</i>
28	If end	<i>end of the if (>0.1) case</i>
29	Insert "Low" into journal Results	<i>insert text into journal Results</i>
30	Beep	<i>make a beep sound</i>
31	Beep	<i>make a beep sound</i>
32	Show Alert: "Area Low !"	<i>show alert to say that area value is ≤0.1</i>
33	out2:	<i>this label is a target for a Jump instruction</i>
34	Insert "\r" into journal Results	<i>insert a carriage return into journal Results</i>

Segment "Seg1" is defined as the section of wave W1 between markers M1 and M2. Instructions #16 through #22 move markers M1 and M2 about the second pulse in wave W1, causing Seg1 to become this pulse, as illustrated to the right.

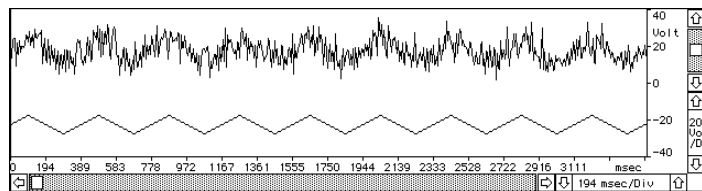


- 🍏 Instruction #23 calculates the area under Seg1 (in units of "volts * seconds"), and transfers the result to variable "area" and string "Area". Instructions #24 through #34 inserts the area value into journal Results, if it is greater than 0.1; otherwise an alert indicates the area is too low.

- 🍏 Press OK to exit the Task Editor, and then press the front panel "Noise" button to add Gaussian noise to wave W1. W1 will fuzz-up,

as pictured to the right (your screen may look a little different, depending on your setup).

- 🍏 To view the Noise task, select Edit ▶ Noise from the Task menu. The task will appear, as illustrated below.



01	Fill wave 'Noise' with 5.000 Volt RMS gaussian noise, 2200 points
02	Read W1 internals (start time to ST; sample time to SR; etc)
03	Set wave Noise internals (ST to start time; SR to sample time; etc)

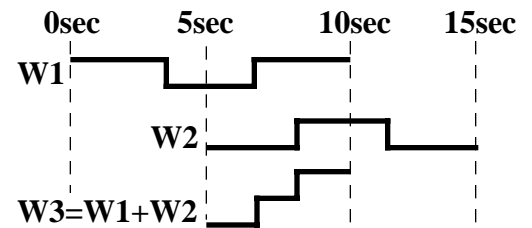
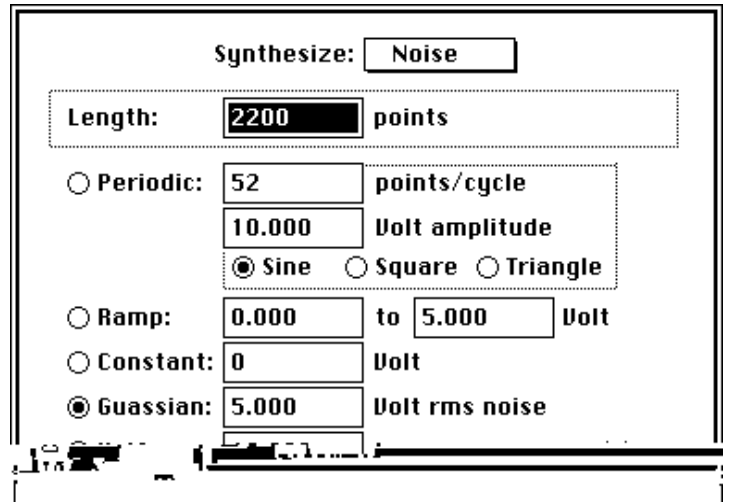
04 W1 = W1 + Noise

Double-click on instruction #1, "File wave ...", to open the Synthesize dialog. This instruction is currently set up to load wave "Noise" with 2300 points of 5V_{rms} Gaussian noise. Instruction #4 will later add each point in wave Noise, to each corresponding point in wave W1, and place the results into wave W1.

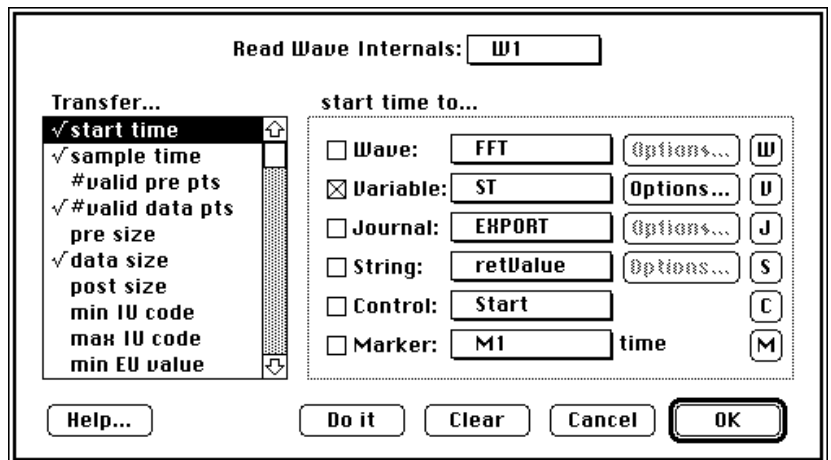
Press Cancel to exit the Synthesize dialog.

Since waves cannot "add" unless their sample periods are identical, we first set wave Noise's sample period to that of wave W1. Also, adding two waves results in their time-wise intersection if one is time shifted with respect to the other, or if one is longer than the other. For example, adding a 0-10sec wave to a 5-15sec wave results in a 5-10sec wave, as illustrated to the right.

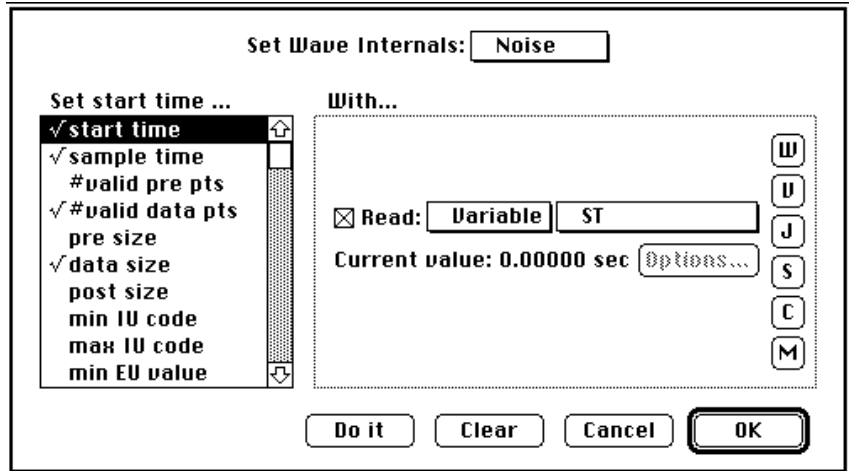
Subsequently, instruction #2 is used to transfer the W1 sample period, start time, # of valid points, and data storage size to variables SR, ST, VDP and DS, respectively; and instruction #3 is used to set wave Noise's internal's parameters to these values.



Double-click on instruction #2, "Read W1 ...", to open the Read Wave Internals dialog, pictured to the right. This transfer area is similar to that in Statistics and Pulse Analysis. Play with the transfer parameters and pop-ups to get a better feel for this environment; it's used by a many instructions. Press Cancel when done with your review.

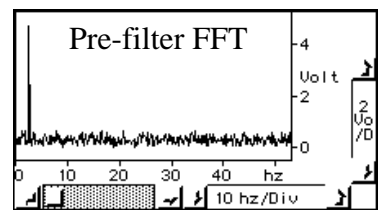


- Double-click on instruction #3, "Set wave ...", to open the Set Wave Internals dialog, pictured to the right. This is very similar to Read Wave Internals, yet sends data in the opposite direction: from waves, variables, journals, strings, controls, and markers to internal wave parameters. The With... area is similar to that in the Assignment, Arithmetic and Transcendental instructions. The checkbox enables the transfer, the first pop-up selects the type of object, and the second pop-up, or edit field, selects the specific object or value. The value below the Type pop-up shows the current value of the object, and the Options button opens a Wave, Journal or Variable Transfer Options dialog, described earlier. Play with the "Set ..." parameters and pop-ups to learn how this works, and then press Cancel when done with your review.

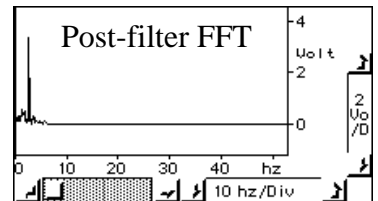


- Press OK to exit the Task Editor, and then click on the front panel FFT button to recalculate the frequency spectrum of wave W1. Notice the broad-band energy that has been added to wave W1.

- Now click on the front panel Filter button to low pass filter W1. This causes the high frequencies (mostly noise) to be attenuated, and the low frequency sine component to continue on it's merry way. The Filter button runs the Filter task, which executes the Filter instruction, which is similar to the Filter command under the Wave menu, discussed earlier. For details on this, please consult the Filter discussion in *Chapter 6* of the SoundScope & SuperScope II Reference Manual.

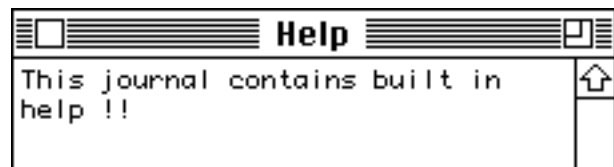


- Click again on the FFT button to recalculate the W1 frequency spectrum. Notice that the higher frequency energy has disappeared, as illustrated above.



BUILT IN HELP AND PRINTING

- Click on the Help button to open the built in help journal.
- To view the Help task, select Edit ► Help from the Task menu.



This task is listed to the above right. A textual description of a task can be copied to the clipboard by choosing Copy Task. The task consists of one instruction only - the Choose Menu instruction. This is a powerful instruction that allows any menu item to be executed from any SuperScope task. In this instance the Choose Menu instruction is being used to show the window journal Help.

Task Begin
Choose Show Help Under Edit

- If you have a printer connected you can click on the Print button to print the front screen. The Print task uses the same instruction that the Help task uses - the Choose Menu instruction. To view the

Print task select Edit ▶ Print from the task menu. Double-click on Choose Print... Under File and view the options available. Any menu item in any menu can be selected.

DATABASE ACCESS

After data is acquired, it is often saved. Waves are often stored in binary files on disk, and text is often saved in a database or spreadsheet. Formatting text for export is relatively easy, as shown in the following pages.

- 🍏 Click the front panel Clear button to clear all journals.
- 🍏 Type your name in the User journal and then type a comment in the Notes journal, as illustrated to the right.
- 🍏 Select Show ▶ TEMP under Edit to brings TEMP into view.
- 🍏 Select Run ▶ Log under Task to gather data for export, and to save it on disk as a text file. Press Save when the File Save dialog appears and remember where you put the data.
- 🍏 Select Edit ▶ Log under Task to view Log, illustrated below.

User:
Bart Simpson
Notes:
Hey Man!

```

01 Clear at beginning of task journal TEMP
02 Statistics on W1 (avg to TEMP; min to TEMP; area to TEMP; std dev to etc)
03 Statistics on FFT (max to TEMP; X at max to TEMP)
04 Insert today's time into journal TEMP
05 Insert today's date into journal TEMP
06 Append text onto the end of TEMP with data from journal User
07 Insert "," into journal TEMP
08 Append text onto the end of TEMP with data from journal Notes
09 Change "\t" to "," in journal TEMP
10 Remove row #1 from journal TEMP
11 Remove row #1 from journal TEMP
12 Remove row #1 from journal TEMP
13 Change "\r" to "" in journal TEMP
14 Choose Save As... TEMP Under Journal
    
```

Instructions #2 through #8 fill journal TEMP with various statistics, parameters, and journals, as pictured below.

TEMP								
W1	W1	W1	W1	W1	FFT	FFT	Time	Date
avg	min	area	std dev	rms	max	X at max		
Volt	Volt	Volt-sec	Volt	Volt	Volt	Hz		
3.16e-3	-5.000	0.016	3.534	3.534	4.242	19.531	23:53:00	3/26/96

Instructions #9 through #13 then format this data into 11 neat data fields, each separated with a comma, as shown below.

TEMP										
0.013,-5.322,0.167,2.677,2.677,3.488,2.572,19:29:16,1/2/93,Bart Simpson,Hey man!										

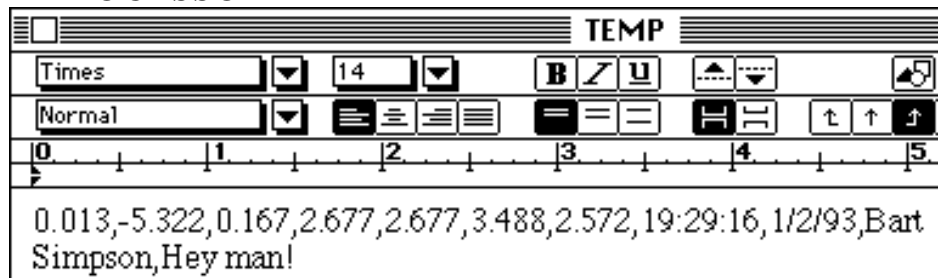
SEND DATA TO A SPREADSHEET

If you have a spreadsheet application, such as Microsoft Excel, you could open the recently saved text file into a spreadsheet window, as shown below. When importing text into a spreadsheet, commas can separate columns and carriage returns can separate rows. In the case of Excel, commas need to be specified explicitly in the Text Options dialog, which is accessed by pressing the Text button in the Excel File Open dialog.

	A	B	C	D	E	F	G	H	I	J	K
1	0.013	-5.322	0.167	2.677	2.677	3.488	2.572	19:29:16	1/2/93	Bart Simpson	Hey man!
2											

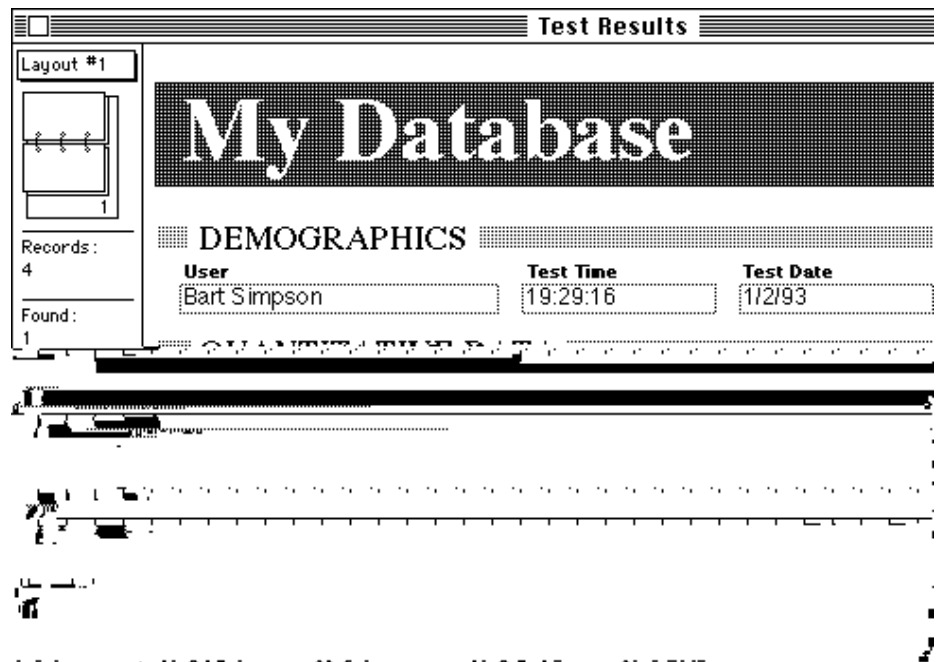
SEND DATA TO A WORD PROCESSOR

If you have a word processor, such as Microsoft Word, you could open the data directly into a word processing window, as shown to the right.



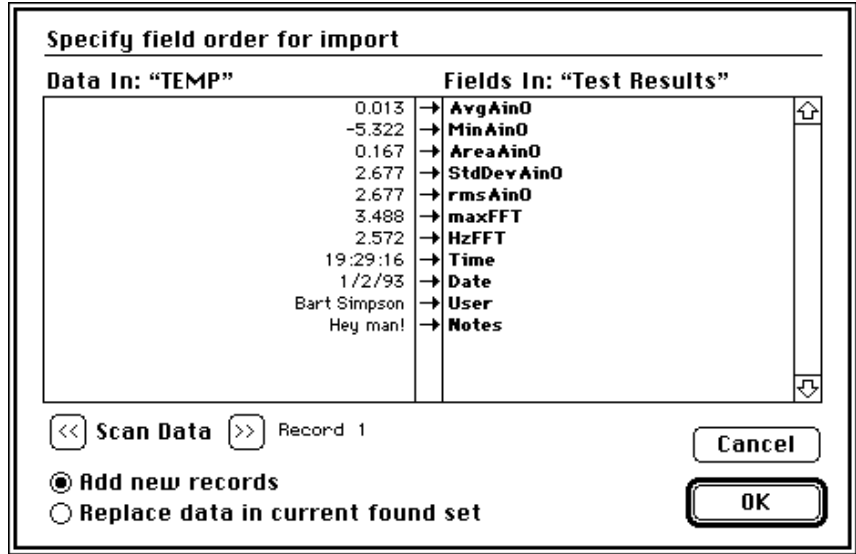
SEND DATA TO A DATABASE

If you have a database application, such as Claris's FileMaker Pro, you could import the data into a database, as pictured to the right. The database shown here is included on the SuperScope II disk, in file "Adv Tutorial Database". FileMaker Pro is not included with SuperScope II.



To import data into FileMaker Pro, one must choose Import under File in FileMaker. This causes a new record to be created, and it's fields to be loaded with data from a text file. The latter step involves aligned incoming data to database fields, as shown to the right.

- Press OK to exit the Task Editor.
- Hide the TEMP window by pressing it's close box.



DEBUGGING

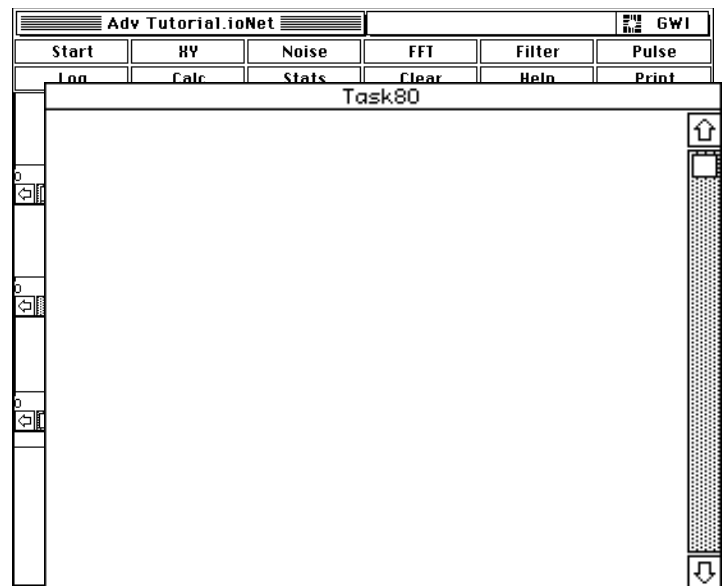
When debugging SuperScope II instruments we recommend that you first debug and verify the instruNet hardware, your cables, your sensors and your signals with instruNet World software -- without running SuperScope II. Please refer to the instruNet User's Manual for details on how to do this. When you are satisfied with your configuration, click the Store button on the Network Page to save the instruNet World field settings.

Then launch SuperScope II, select Network ▶ Open under the instruNet menu and press the Restore button to load the instruNet World field settings you previously stored. Also when you save a SuperScope II instrument file the current instruNet field settings are automatically saved in the SuperScope II instrument file, such that loading the SuperScope II instrument causes the instruNet field settings to be restored to their previous state.

THE TASK80 JOURNAL

One of the most powerful SuperScope II debugging features is the Task80 journal. If a journal exists of the name "Task80", status text is written to this journal, in real time, after each instruction is executed.

- Choose New under Journal to create another journal. When it's Options dialog appears, choose Window in the Position pop-up (to specify that this journal is to have it's own window), rename it "Task80", and then press OK. When the window appears, reposition and resize as pictured to the right.



- Now choose Run ▶ Calc under Task. As each task instruction is executed, it's status line is printed in the Task80 journal, as illustrated below.

The status line contains the first 30 characters of each instruction, the value of the "error" variable after the instruction is executed, and the action taken. For example, the "If (string PeakFFT > 4.5) then" line resulted a "(5 > 4.5)" test, which produced True, causing the body of the

If...Then statement to be executed.

The "error" variable is loaded with a SuperScope II Error Code after each instruction is executed. A value of 1.000 means things went OK. For a list of SuperScope II Error codes, please see Appendix D in the SoundScope & SuperScope II Reference Manual.

- Try running several tasks with the Run ▶ menu command to get a better feel for this powerful feature. If the Task80 window

TASK Calc	error	Action
Task Begin	1.000000	
Move marker M3 to the 0.00000	1.000000	we moved the marker
Move marker M3 to next maximu	1.000000	we moved the marker
Marker M3 & wave FFT intersec	1.000000	value=4.242
Insert "Max FFT value = " int	1.000000	
If (String PeakFFT > 4.500) t	1.000000	(4.242 > 4.500) = fals
Insert "Low" into journal Res	1.000000	
Beep	1.000000	
Beep	1.000000	
Show Alert: "Max FFT Low!"	1.000000	
out:	1.000000	
Insert "\r" into journal Resu	1.000000	
Move marker M1 to the 0.00000	1.000000	we moved the marker
Move marker M2 to the 0.00000	1.000000	we moved the marker
Move M2 to next peak of W1 <t	1.000000	we moved the marker

ever becomes hidden, choose Show ▶ Task80 under Edit to bring it to the front. If the journal becomes too cluttered, you can always clear it by choosing Clear ▶ Task80 under Journal.

THE BENCH JOURNAL

Since data acquisition involves time, it is often important to know how much time is consumed by each instruction. If a journal exists by the name "Bench", benchmark information is written to this journal, in real time, after each instruction is executed. The benchmark indicates, in seconds, the amount of time required to execute the instruction. The time required to write to the Bench journal is not included. Also, the amount of time required to do house-keeping chores in-between each instruction is not included. This "in-between" time can vary from 20µsec to 200msec in a worst case scenario (100µs is typical). An example bad-case would be the sending of update events to an application running on a remote hard disk via System 7.0 file sharing. The user can easily specify which in-between chores are executed with settings in the Task Options dialog, detailed in *Chapter 3* of the SoundScope & SuperScope II Reference Manual.

Benchmark times are accurate to $\pm 0.25\mu\text{s}$ if an instruNet controller is installed in your computer; otherwise, the durations are accurate to $\pm 16\text{ms}$.

- 🍏 Choose Options ▶ Task80 under Journal, rename the journal "Bench", and then press OK.
- 🍏 Now choose Run ▶ Calc under Task. The Bench journal will fill with instruction execution times, in units of seconds, as shown to the right. This example was done with a Quadra 650 and Model 200 controller.

It turns out that most time is spent updating front panel displays and journals. Therefore, reducing their size and number tends to expedite tasks the most. Waveform calculations are coded in highly optimized C; and therefore execute very quickly with long waveforms (e.g. 3.64µs per point when adding two 32bit floating point waveforms with a Macintosh IIfx).

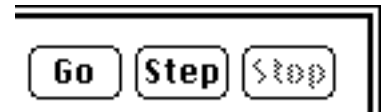
```
-----  
Task:Calc      Date:3/27/96      Time:00:11:28  AI  
-----  
0.045241      Task Begin  
0.001981      Move marker M3 to the 0.00000  
0.002676      Move marker M3 to next maximu  
0.001389      Marker M3 & wave FFT intersec  
0.007026      Insert "Max FFT value = " int  
0.000919      If (String PeakFFT > 4.500) t  
0.005944      Insert "Low" into journal Res  
0.173509      Beep  
0.165564      Beep  
1.019424      Show Alert: "Max FFT Low!"  
0.000000      out:  
0.005086      Insert "\r" into journal Resu  
0.002165      Move marker M1 to the 0.00000  
0.002206      Move marker M2 to the 0.00000  
0.002574      Move M2 to next peak of W1 (t  
0.002839      Move M2 to next peak of W1 (t  
0.002615      Move M2 to next position wher
```

ONE THING AT A TIME

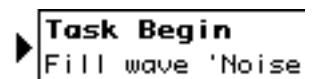
Many tasks are best debugged by executing each instruction, one at a time, and viewing source data before each execution, and result data after each execution. This is easily facilitated with the Task Debugger buttons.

- 🍏 Choose Options ▶ Bench under Journal, rename the journal "Bench_", press OK to disable the bench marking feature, and then click on the Bench_ window's close box.
- 🍏 Now choose Edit ▶ Noise under Task to open the task Editor.

The Go, Step and Stop buttons at the Task Editor upper right are used to run and debug tasks. Go executes a task while the Task Editor is open. A triangular instruction pointer (▶), at the left edge, follows the execution and indicates to the user which instruction is being executed. While the task is running, the user can either press Step, to freeze execution; or Stop to halt execution and move the instruction pointer to the top. When execution is frozen via Step, the instruction pointer stays where it is and the user is free to either view and alter data (e.g. with the C, J, M, S, V, and W buttons), press Go to continue running, press Step to execute another instruction and then freeze, or press Stop to halt execution and move the pointer to the top.



- 🍏 Press the Step button, once, to execute the first line. The pointer will advance, as shown to the right.



- 🍏 Press the W button to open the Wave Options dialog. Then press the button to open the Wave Editor. Notice how you can switch from one wave to another, by clicking in the upper pop-up menu. When done with your review, return to the Task Editor.
- 🍏 Press the Step button again to execute the next instruction, and then press the V button to inspect the ST, SR, DS and VDP variables. Return to the Task Editor when done.
- 🍏 Play with the debugging features to better acquaint yourself with these tools. In some cases, viewing data on the front panel is adequate, yet in others, the C, J, M, S, V, and W buttons are necessary. Exit the Task Editor when done.

Stepping is an extremely powerful debugging tool, since it helps you verify that each instruction does as expected; and if there is a discrepancy, it places you at the heart of the problem.

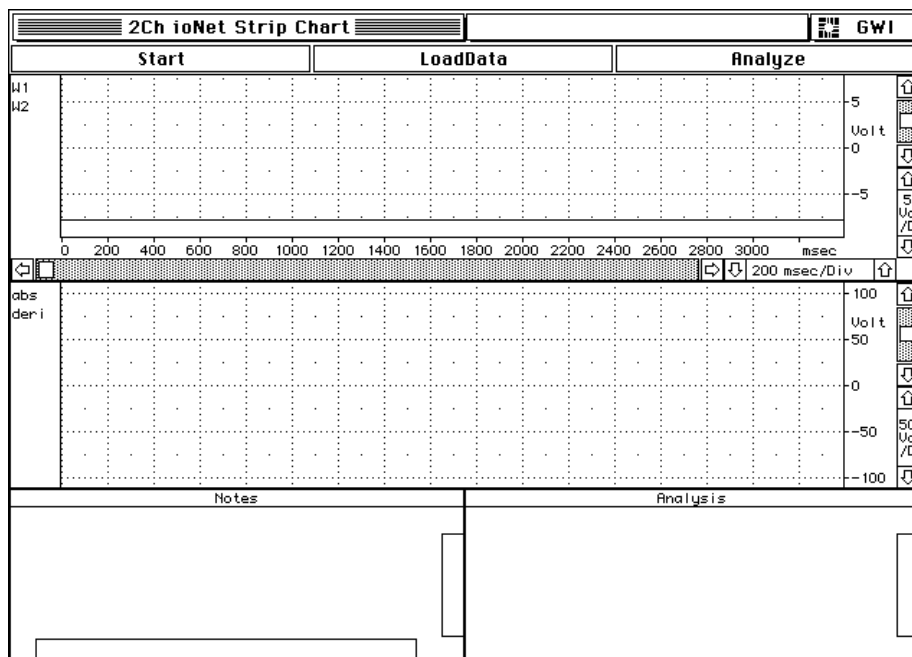
THE ULTIMATE STRIP CHART RECORDER

SuperScope II's fundamental architecture is based on the concept of the ultimate strip chart recorder, which simultaneously acquires, analyzes, plots, and saves to disk continuous streams of acquired data and waves containing the results of analysis performed on the acquired data.

This part of the tutorial uses an instrument that is designed specifically for an instruNet system consisting of 1 controller and 1 Model 100 network device. If an instruNet system is not installed on your computer, this instrument will simulate a system consisting of 1 controller and 1 Model 100 network device.

- 🍏 Find the "2Ch iNet Strip Chart" instrument which is located in the "Tutorial" subfolder inside of the "instruNet instruments" folder, and duplicate it.

- Double-click on "2Ch iNet Strip Chart copy" (i.e. the duplicate instrument); or launch SuperScope II, and then choose Open under File to load the instrument. The 2Ch iNet Strip Chart will appear, as shown to the right.



This instrument does three things. Pressing the Start button runs a task that digitizes two analog input channels ("W1" and "W2"), calculates the absolute value of W1 (i.e. $abs = Abs[W1]$), takes the derivative of the absolute value (i.e. $temp = Deriv[abs]$), scales the derivative (i.e. $deriv = temp * 30$), sends the pulses times of W1 to the journal Notes, and saves the waves W1, W2, calc & deriv, and the journals Notes and Analysis, to disk.

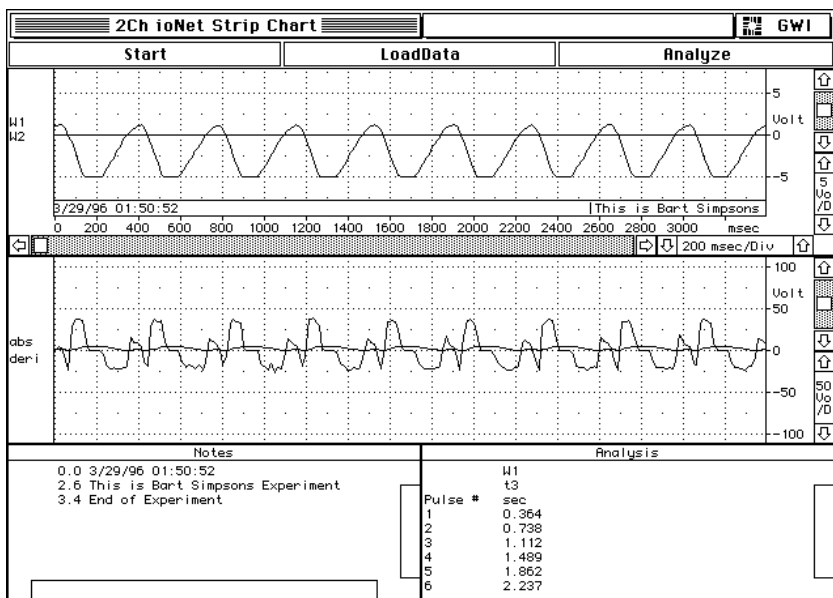
Pressing the LoadData button runs a task that allows you to open and scan through a previously acquired data set.

Pressing the Analyze button runs a task allows you to select a previously recorded wave and then runs the Pulse Analysis instruction on it.

The ability to simultaneously acquire, analyze, and present continuous streams of data makes SuperScope II an extremely powerful waveform recording tool.

- Press the Start button. When the Save File dialog appears, enter a name for the folder in which the waves and journals will be saved and press OK.

The screen will plot five 50sample/sec waveforms, in pseudo real-time, for a total of 25 seconds. While running the screen will appear as shown to the right. What is pseudo real-time? Well, you may have noticed a pause in the plotting at the scan breaks (every 5sec). During this pause, the computer was saving scans to disk. This does not effect the data however, since digitizing is being done by the instruNet controller in the background.



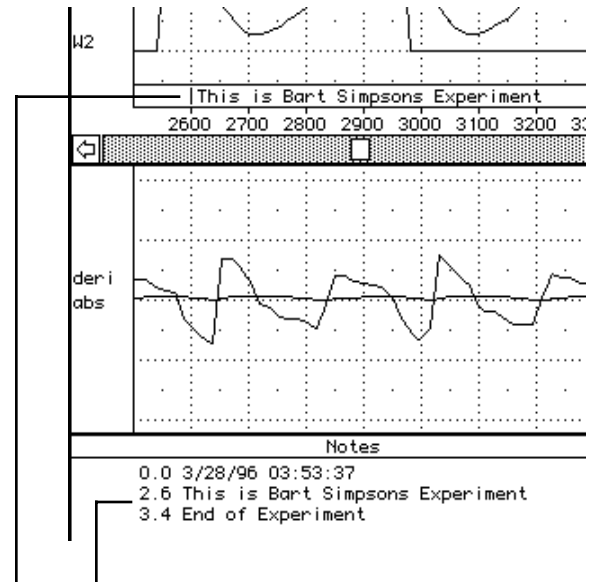
- While data is being acquired click

once in the journal Notes and then type in a comment (i.e. "This is Bart Simpsons Experiment"). Press *carriage return* on the keyboard and type in another comment.

Comments entered into the journal "Notes" will be automatically prefixed with a time annotation, and also automatically placed into the display "D1", which is linked to the journal "Notes". If a comment is entered into the journal "Notes" at 2.2 sec it will appear at the bottom of display "D1" at 2.2 sec, as indicated in the figure to the right.

The time annotation that is automatically entered for each comment entered in the journal "Notes" is the time between the beginning of the trigger condition that initiated data acquisition in the "Start" task, and the time the first keystroke was entered for the comment.

Entering a carriage-return ends a note, and the first key stroke entered after the carriage return starts the beginning of a new note. If no trigger condition was specified (i.e. Trigger None in the Trigger Dialog) then the time annotated in the journal is the time since the execution of the **Scan Loop Begin** instruction (for the first scan) in the Start task. Instruments can be designed with multiple runtime journals, each linked to separate displays.



Comments entered into the journal "Notes" are automatically time annotated & placed into the display "D1", which is linked to the journal "Notes"

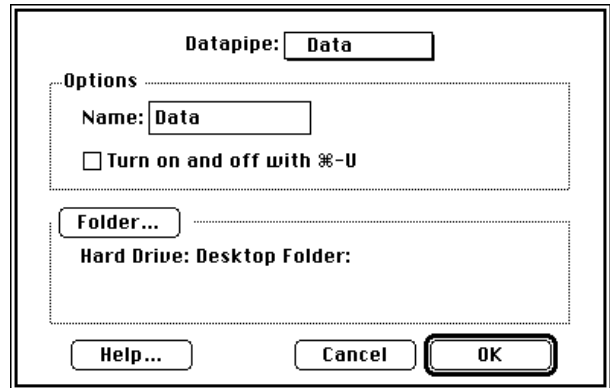
Pressing the Start button on this instrument runs the "Start" task which acquires 5 scans of data and saves all of the waves (i.e. "W1", "W2", "abs" & "deriv") after each scan, and the journals (i.e. "Notes" & "Analysis") once at the end of the task. The two sets of acquired waves "W1" and "W2", along with the waves "calc" and "deriv" which contain the results of calculations performed on the acquired waves, are saved to disk under their wave names prefixed by the scan number (e.g. "00000001 W1", "00000002 W1", etc.). A total of 22 files, 5 for each channel and 1 for each journal, are saved to disk. Each of the acquired waves "W1" and "W2" are contiguous across scans as are the analysis waves "abs" and "deriv". Neither the acquired data nor the results of analysis are affected by scan breaks.

- After the instrument is done acquiring data, choose Options ▸ Notes under Journals to view the **Runtime** options for the "Notes" journal as shown to the right below. The "Show notes in display" popup links a Runtime journal to a display. Each display can have it's own Runtime journal and more than one Runtime journal can be linked to a display. If experiments are long (e.g. hours or days) it may be more optimal to enable the "hrs:min:sec" Radio button. Click Cancel to exit the journal dialog.

Runtime: Prefix notes with: Seconds hrs:min:sec
 Show notes in display D1

- Choose Datapipe ▸ Data under File to open the Datapipe dialog, shown to the

right. Click the Folder... button to view the available hard-disks and folders to which the Datapipe "Data" can point. If you want to change where the Datapipe is pointing do so now in the File dialog. Click Cancel (or OK if you have changed where the datapipe points) to exit the file dialog and then click OK again to exit the Datapipe dialog.



After creating a datapipe and specifying where the datapipe points, any Disk I/O instruction that is added to the instrument that saves waves, journals or strings and that specifies that datapipe as being the location where the data is to be saved, will automatically send data to whatever hard-disk or folder that the datapipe points to.

The power of datapipes is that they limit the bookkeeping required in storing and keeping track of waveforms associated with particular experiments.

🍏 Choose Edit ▶ TakeData under Task to view the acquisition task, shown below.

```

01 Clear at beginning of task journal Notes
02 Clear at beginning of task journal Analysis
03 Create new folder for Datapipe "Data" and prompt for name
04 Scan Loop Begin (5 scans)
05   Segment Loop Begin
06     Digitize Segment (250 pts/scan, 50.000 pts/sec)
07     abs = Abs (W1)
08     temp = Deriv (abs)
09     deriv = temp * 30.000
10     Plot Segment
11     Segment Loop End
12   Pulse analysis on W1 (pulse#, t3 to Notes)
13   Save wave W1 to disk
14   Save wave W2 to disk
15   Save wave abs to disk
16   Save wave deriv to disk
17 Scan Loop End
18   Save journal Notes to disk
19   Save journal Analysis to disk
    
```

The segment loop works as described below each time it is executed:

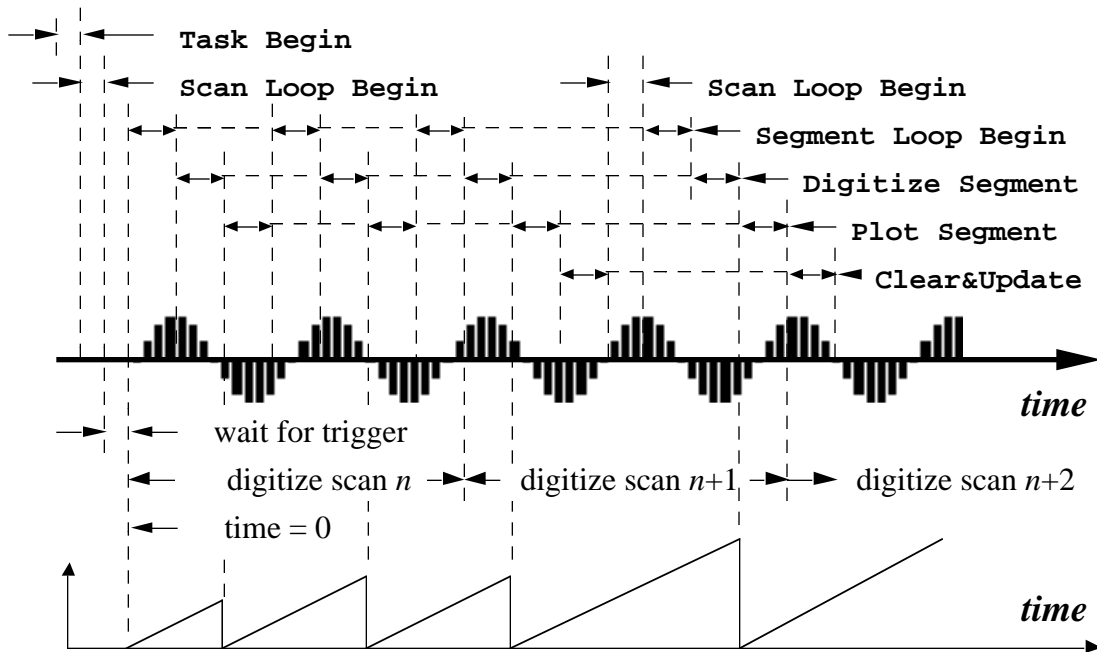
- #1 Small chunks (e.g. .1s) of digitized data from W1 and W2 are loaded into SuperScope II.
- #2 The absolute value of the recently acquired W1 data is calculated, and placed into wave abs.
- #3 The derivative of W1 is calculated and placed into temp.
- #4 The most recent temp chunk is scaled, and copied to wave deriv.

```

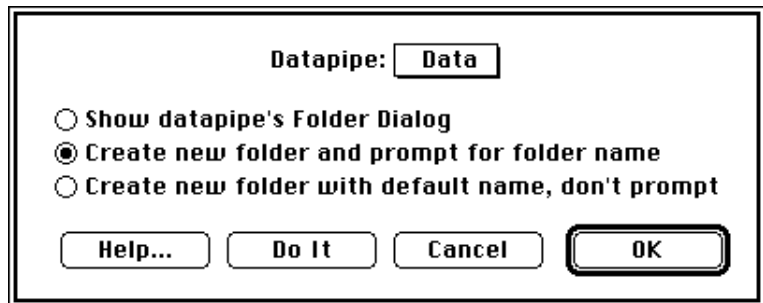
Scan Loop Begin (5 scans)
  Segment Loop Begin
    Digitize Segment (250 pts/scan,
    abs = Abs (W1)
    temp = Deriv (abs)
    deriv = temp * 30.0000
    Plot Segment
  Segment Loop End
    
```

The Scan Loop instructions (#4, #12, #13, #14, #15, #16, #17 & #18) execute once for each scan and operate on whole scans. In other words, the segment Loop instructions continuously fill buffers (250

points long, in our case), and after the buffers are filled, the Scan Loop instructions crunch on the 250 point blocks of data. After this, the segment Loop instructions fill up the buffers again, and over-write the old data. And the cycle repeats itself, five times in our case. Notice this means the instruction after Segment Loop End, #12, waits until a complete scan is acquired (i.e. continuous stream points #250, #500, #750, #1000, and #1250), before it executes. While it waits, data is acquired by the instruNet Controller. This process is referred to as the Segment Seamless Collection Mode, and is illustrated below.

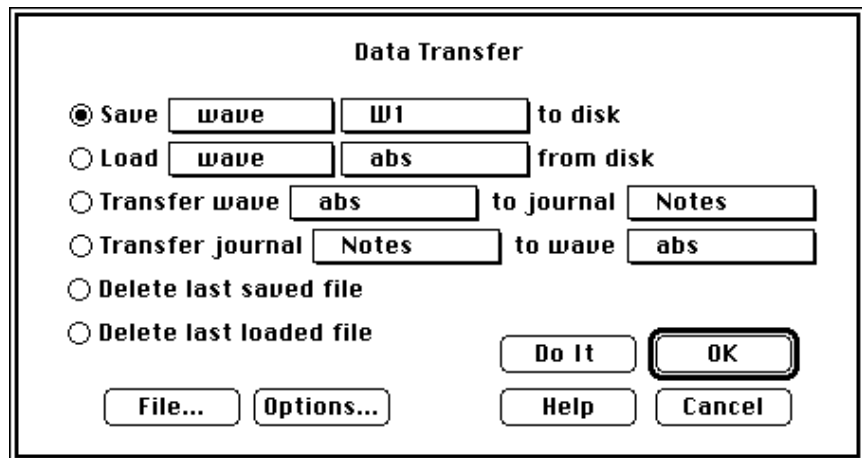


- Double-click on instruction #3, "Create new folder for datapipe "Data" and prompt for name" to bring up the Datapipe dialog, as shown to the right. The Datapipe dialog offers three options, one of which (the one enabled for this instrument) is "Create new folder and prompt for folder name".



When this instruction is executed a dialog will appear prompting the user for the name of a new folder that will automatically be created. Entering a name into the dialog and clicking OK will create a folder with the name entered, and put it on the computer at the same level as the datapipe "Data". For instance, when this instruction is executed, if the Datapipe named "Data" currently points to a hard disk named "HardDisk", and you enter the name "Flow Data Set 1" into the dialog that appears, then a folder named "Flow Data Set 1" will be created and put on the hard disk "HardDisk". After this instruction is executed, any Disk I/O instructions that are run in the task that save waves, journals or strings to disk, and that direct that their data be saved to the Datapipe "Data", will save their files in the folder "Flow Data Set 1". Datapipes can save a lot of work in record keeping. As an example, in this instrument, each time the start button is pressed, the user is prompted for the name for a new folder, and all data (i.e. waves & journals) are stored in that folder. After a number of experiments are run each data set (i.e. Waves and Journals) is stored in an individual folder inside of a designated folder (i.e. the Datapipe) on the computer.

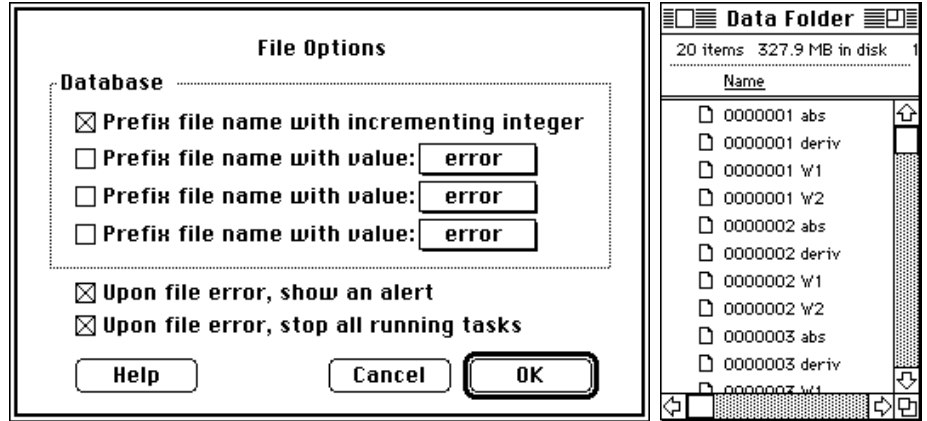
- Press Cancel to exit the Datapipe instruction and then Double-click on instruction #13, "Save wave..", to open the Data Transfer dialog, shown to the right. This instruction saves and loads waves and journals to and from disk, transfers data between waves, journals and strings, and deletes files. The currently selected option is to save the wave "W1" to disk.



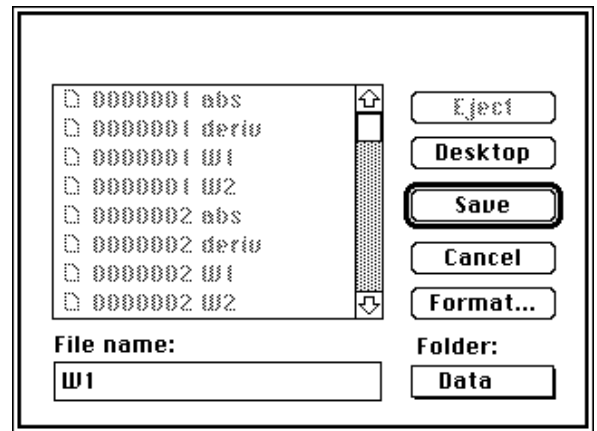
- Press on the Options... button to open the File Options dialog, pictured to the right below. The "Prefix file name with incrementing integer" is selected which causes files to be saved with an index attached to their file name, as illustrated to the right of the File Options dialog. This option must always be enabled

when designing Strip Chart instruments that stream continuous waveforms to disk. Click Cancel to exit the File Options dialog.

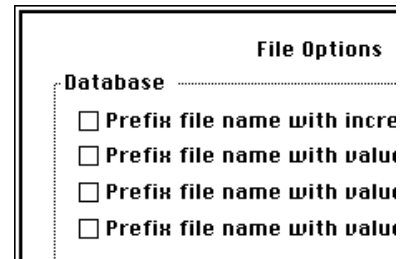
- Press the File... button to open the File Save dialog, shown to the right. This dialog is used to specify the file name, and the path to where the file is saved. The datapipe "Data" is selected in the Folder: popup. This means the file "W1" will be saved to the folder specified by the datapipe. Press Cancel twice to exit to the Data Transfer instruction..



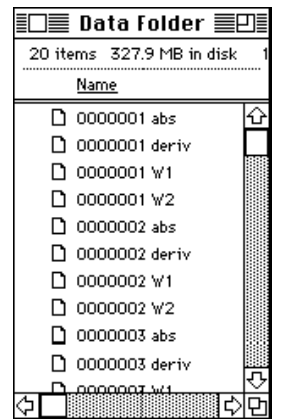
- Double click on the instruction "Save journal "Notes" to disk" (#17). The Disk I/O instruction that is used to save wave data to disk is also used to save journal data to disk, but with one modification. Click on the Options... button to view the file saving options for saving the journal "Notes" to disk. The "Prefix file name with incrementing integer" option is not enabled for saving the journal "Notes" to disk. This is because the journal "Notes" is only saved once at the end of the experiment and not at the end of each scan as is the case with the waves. Click Cancel to exit the Options dialog. Click the File... button to open the File dialog. The datapipe "Data" is selected in the Folder: popup which directs the Disk I/O instruction to always save the journal "Notes" wherever the datapipe "Data" points when this instruction is executed.



- Open the folder on your computer that contains the data that was just acquired with this instrument (i.e. the folder you named in the File I/O dialog right after you pressed the Start button) and view it's contents. It should look like the folder shown to the right.



Each of the four waveforms (i.e. "W1", "W2", "abs" & "deriv") will appear 5 times; each time having the same name but prefixed with an incrementing integer. The journals Notes and Analysis will only appear once and will not be prefixed with an integer.



The Start task is designed to loop 5 times, and since a Disk I/O instruction is installed for each of the 4 waves inside of the Scan loop, each wave will be saved to disk at the end of each scan; each time having the same name but being prefixed with an incrementing integer. If the "Prefix file with Incrementing Integer" option was not enabled then only 1 copy of each waveform would appear on disk -- in fact "W1" and "W2" would contain the data acquired in the last scan and "abs" and "deriv" would contain the results of the waveform analysis of the

last scan. In summary if the "Prefix file name with Incrementing Integer" option was not selected, running the Disk I/O instruction at the end of each Scan would overwrite the data from the previous scan.

Since the Scan Mode popup in the Timing dialog is set to Strip Chart each file of wave data saved is continuous across scans. The last point of the wave "0000001 W1" is continuous with the first point of the wave "0000002 W1". This is also true of the waves "abs" and "deriv" used to hold the results of waveform analysis - the last point of the wave "0000001 abs" is continuous with the first point of the wave "0000002 abs". Waves saved to disk in a similar fashion (i.e. inside of a Scan Loop) in instruments designed with the Scan Mode popup set to "Oscilloscope" or "Oscillo Queued" are not continuous across scans.

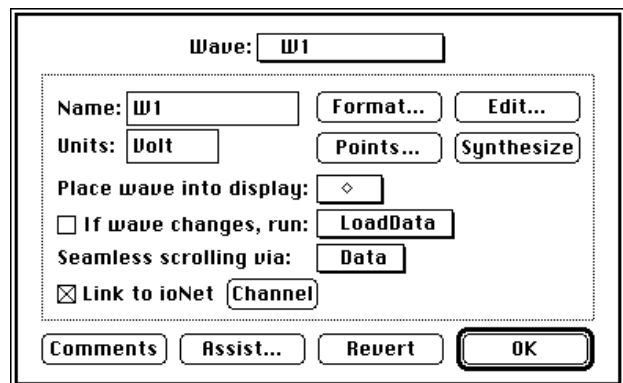
The journals "Notes" and "Analysis" only appear once in the folder since the Disk I/O instruction that is used to save them to disk only appears once at the end of the Start task.

- Press the button LoadData which will run the Task "LoadData" illustrated below. This task will load in the four waves ("W1", "W2", "abs" & "deriv") and the two journals ("Notes" & "Analysis") that we previously saved to disk. The first instruction executed (#1) "Show Datapipe "Data" Folder Dialog Box" will open the File Open dialog. When the File Open dialog appears, find and open the folder in which the waves and journals were saved when you ran the instrument (i.e. the folder you named in the dialog that appeared immediately after you pressed the Start button), and click OK. The first item in the folder will automatically be highlighted. The next 6 instructions (#2, #3, #4, #5, #6, #7) will each in turn load either a wave or journal that was saved to disk.

01	Show Datapipe "Data" Folder Dialog Box
02	Load wave W1 from disk
03	Load wave W2 from disk
04	Load wave abs from disk
05	Load wave deriv from disk
06	Load journal Notes from disk
07	Load journal Analysis from disk

- Scroll through the loaded data set using the horizontal scroll bar on the top display. The journal "Notes" is loaded with the original comments that were entered into it for this data set, and the comments appear in the bottom of display "D1" as well. Using this task you can load in any previously acquired data set and scroll through it.

- Choose Options... ▶ W1 under the SuperScope II Wave menu to open the Wave Options dialog. The datapipe "Data" is selected in the Seamless Scrolling via: popup, as shown in the figure to the right. This determines which datapipe the wave "W1" will pull wave scans from when scanning through previously acquired data.



In this example instrument SuperScope II saved the waves "W1", "W2", "abs" and "deriv" to disk at the end of each scan prefixing each scan into the datapipe "Data", with an incrementing integer. SuperScope II allows you to scan through the individual scans of acquired data as if it were one continuous wave, keeping track of which scan follows another on a given wave by the integer number prefixed to its name.

Each time the button LoadData is pressed and you select a folder in which wave data is stored SuperScope will allow you to scan through the individual scans of acquired data as if they were one continuous scan. Click OK to exit the Wave dialog.

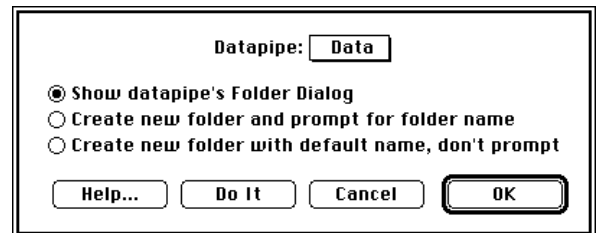
In SuperScope II, folders are used to hold the results of each experiment. Each folder may contain many wave and journal files, and these may or may not be indexed with an incrementing integer. Folders are typically accessed via a datapipe.

- Press the button Analyze which will run the Task "Analyze" illustrated below. When the File I/O dialog appears select and open the folder containing the waves and journals acquired when you ran the Start task. If this is done correctly the first item in the folder will be highlighted. This task then will load each of the 5 scans of wave "W1" and run the Pulse Analysis instruction on them, treating them as if they were one continuous wave. The results of the analysis will appear in the journal Results.

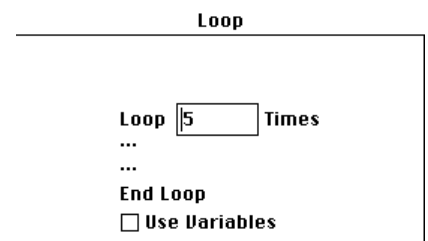
```
01 Clear at beginning of task journal Analysis
02 Show Datapipe "Data" Folder Dialog Box
03 Loop 5 times
04 Load wave W1 from disk
05 Pulse analysis on W1 (pulse#, area2, ...
06 Loop end
```

- Double-click on the instruction "Show Datapipe "Data" Folder Dialog Box" to open the Datapipe instruction, as shown to the right.

This is the same datapipe instruction that was used in the Start task to prompt the user for the name of a new folder to be created, but in this case the option "Show datapipe's Folder Dialog" is enabled, and the datapipe "Data" is selected in the Datapipe: popup at the top of the dialog. When executed, this instruction directs the user to select a folder that contains wave and journal data that was previously acquired when the Start task was run. When you select a data set to be loaded you must make sure to open the folder containing the previously recorded data. Click Cancel to exit the Datapipe dialog.



- Double-click on the "Loop 5 times" instruction to bring up the Loop dialog as shown to the right. The Loop instruction is a subset of the Programming Instruction. The Loop instruction allows you to set the number of loops in the edit field, or by using a variable. If you want to set the number of loops using a variable enable the Use Variable option which will turn the edit field into a popup listing all SuperScope variables, and select a variable in the popup.



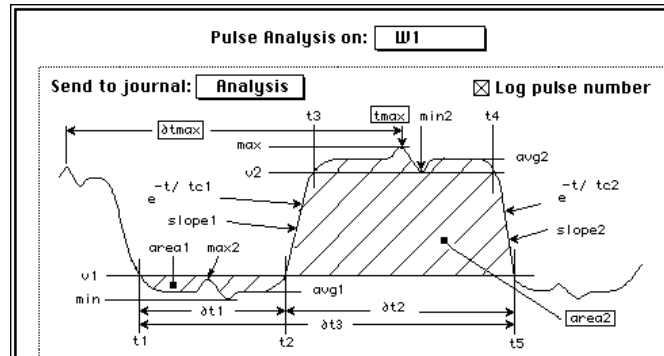
Whenever you add a Loop instruction to a task it will automatically add both the "Loop 'x' times" (#3) and the "Loop End" (#6) items to define the beginning and end of the loop. When the task executes a Loop instruction it runs all of the instructions in the loop, in the order in which they are listed, and does this for the number of times specified by the loop. In this example, in the first loop the first scan of wave "W1" (i.e. 0000001W1) will be loaded and then the Pulse Analysis instruction will be run on it. In the second loop the second scan of wave "W1" (i.e. 0000002W1) will be loaded and processed. Click Cancel to exit the Loop dialog.

- Double-click on the instruction "Load wave W1 from disk" to bring up the Data Transfer dialog. Click the Options... button to bring up the Options dialog. The "Save file name with incrementing integer" option is selected, which is the same option used when saving the wave "W1" to disk. Because this option is enabled the Loop instruction will automatically load the waves from disk in the order in which they were saved -- that is the first time through the loop it will load wave "000001W1"

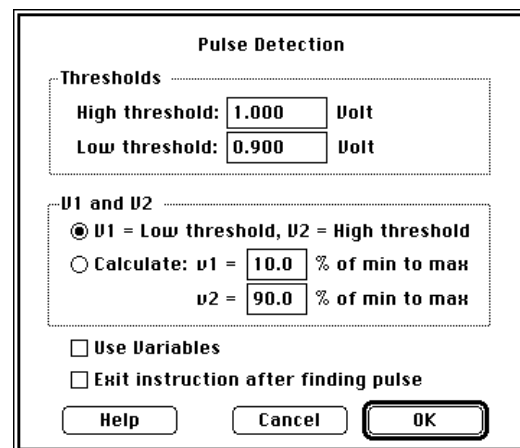
and the second time through the loop it will load wave "000002W1". Whenever you are building a task to load previously stored objects (i.e. waves, journals or strings) always set your options identically to the way the object was saved. Click cancel to exit the Options dialog.

Click the File... button to open the File dialog. Since the Folder: popup points to the datapipe "Data", this instruction will always load data from the folder as selected in the instruction "Show Datapipe "Data" Folder Dialog Box". This is the power of datapipes, they keep track of what folder you are currently working out of, for all instructions that access that datapipe. Click Cancel to exit the File dialog, and click Cancel again to exit the Data Transfer dialog.

- Double-click on the instruction "Pulse analysis on W1(pulse#, ..." to bring up the Pulse Analysis dialog, as shown to the right. The three measurements "tmax", "Δtmax" and "area2" are all selected. To select a measurement to be performed click on it. To send the measurements to a journal select a journal in the Send to Journal popup.



- Click on the Detection... button to open the Pulse Detection dialog shown to the right. The "High Threshold" is set to 1 Volt and the "Low Threshold" is set to .9 Volt. Any pulses that cross the specified threshold conditions will be detected and the selected measurements will be performed on the pulse. If there are pulses in your waveform but they do not cross the threshold conditions they will not be detected. Click Cancel to exit the Pulse Detection dialog and click Cancel again to exit the Pulse Analysis dialog. Click OK to exit the Task editor.



In this task the Pulse Analysis instruction will treat the wave "W1" as one continuous wave, that is it will analyze contiguously across the individual wave scans stored to disk. If the start of a pulse is at the end of wave "000001 W1" and the end of the same pulse is at the beginning of the wave "000002 W1" the pulse analysis instruction will detect this as one pulse and analyze it correctly.

This concludes the tour. We hope you enjoyed it, and hope you share in our enthusiasm for, what we believe, is the worlds most advanced recording tool.

COMMON QUESTIONS

Why break continuous streams into scans?

- There may not be enough physical memory to contain the entire data stream, and the waves used for analysis on the data. Each data point in each waveform takes up 4 bytes of RAM.
- The user may want to do analysis or data management on whole blocks of data, periodically, during the acquisition of a long stream.

Many analysis instructions support seamless scans in a loop. For example, in the TakeData task, Pulse Analysis is performed on wave W1, and the results, placed into journal Notes, are not effected by the scan-breaks at 5sec, 10sec, 15sec, etc. Notice that it found the W1 pulses correctly at 7, 15 and 22

seconds. In the task, Pulse Analysis is executed five times and analyzes 250 points in memory each time, yet never sees the entire 1250 points at one time.

Does this mean that the Pulse Analysis instruction can evaluate a continuous stream of data indefinitely? Yes, it can, provided you don't save the stream to disk like we do in TakeData. Pulse Analysis is independent of disk I/O.

Do all Task instructions support the evaluation of long streams of data via seamless scans in the Scan Loop? And do all task instructions support the evaluation of segments in the segment Loop? Some do, and some don't. To see who does what, please refer to Appendix C in the SoundScope & SuperScope II Reference Manual.

What is my maximum sample rate when operating the Segment Seamless Data Collection Mode? It depends on the speed of your computer, what you place in the Segment Loop, what you place in the Scan Loop, your scan size, the # of channels digitized, settings in the Scan Options dialog, and the objects on the front panel. For example, a Power Macintosh 7100 can digitize and plot one channel at a 90 ksample/second rate. The user determines the maximum rate empirically by telling SuperScope II to run fast (e.g. 100Ksamples/sec), and then letting it hit a limitation, stop the task and recommend a slower rate. It may do this several times, since there are a number of mechanisms that limit the maximum rate.

Data acquisition parameters are set by the user as described in the following table.

Parameter	Where Parameter is Specified
# of digitized channels	Specified by linking a SuperScope II wave to an instruNet channel via the Wave Options dialog.
# of sets of scans to acquire	Specified in the Scan Loop Begin dialog, which is opened by double-clicking on the Scan Loop Begin instruction in a digitizer-based-task.
# of points-per-scan	Specified in the Digitize Segment dialog, which is accessed by opening the Digitize Segment instruction in the Task Editor
sample period	Specified in the Digitize Segment dialog, which is accessed by opening the Digitize Segment instruction in the Task Editor
Trigger source & method	Specified in the Trigger dialog, which is opened by choosing Trigger under instruNet. Choices are Off, Auto, or Norm.
Scan Mode (determines if scans are seamless w.r.t. each other.)	Specified in the Digitize Segment dialog, which is accessed by opening the Digitize Segment instruction in the Task Editor. Choices are Strip Chart, Oscilloscope, Oscillo Queued. For details, please see <i>Chapters 2</i> in the instruNet User's Manual.


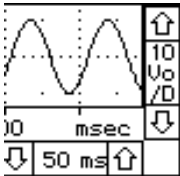
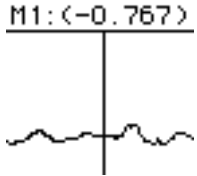

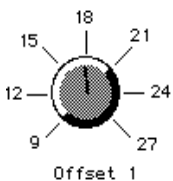

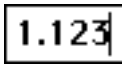
Chapter 5

Principles Of Instrument Design

It is said that, in the future, programmers will not program (in the traditional sense) due to the development of sophisticated software that facilitates programming by the end user, "programming" being defined as the act of building an application program. SuperScope II is another milestone in this evolution since it provides an environment where the end user can design their own menu driven application program. We refer to these applications as SuperScope II "instruments", and have included several with the product.

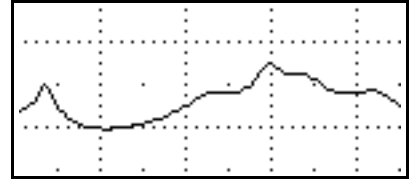
SUPERSCOPE II OBJECTS

The SuperScope II user creates and customizes objects with mouse driven pull down menus and dialog boxes -- no previous programming experience is necessary. There are several types of objects, as shown below. One can create as many of each type as needed to build the application of their dreams. Each type has it's own dialog where one can view and edit attributes, such as the object's name. This chapter summarizes these powerful building blocks.

 <p>Waves</p>	 <p>Displays</p>	 <p>Markers</p>
 <p>Journals</p>	 <p>Controls</p>	 <p>Menubars</p>
<p>abcdef</p> <p>Strings</p>	 <p>Variables</p>	<p>Calculate Wave Pulse Analysis Sound Statistics Statistics</p> <p>Tasks</p>

WAVES

Waves are used to represent real world continuous data as a list of values, which when plotted, produce a waveform. Waves can be digitized, synthesized, analyzed, edited, viewed, used to hold the results of analysis, loaded from disk, saved to disk, sent to the clipboard as a column of numbers in text format, and sent to the clipboard as a graphical image.



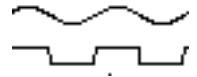
Typical instruments have 3 to 10 (or more) waves and wherever you see a squiggle in SuperScope II, you are looking at a Wave object. Waves are stored in memory as a list of 16-bit integer ($\pm 32,768$) or 32-bit floating point values and their maximum lengths are limited by memory (each point consumes two or four bytes depending on the storage format).

Waves are created by choosing New under Wave. The wave dialog appears and it is from here that one can view and edit the number of points (via the Points button), view and edit the internal storage format (via the Format button), view and edit the individual wave values (via the Edit button), or synthesize.

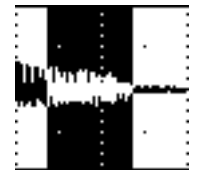
The **Value Editor** is a spreadsheet-like environment that shows the individual points with 5 points displayed in each row. Cells can be selected, cut, copied and pasted with the mouse. Additionally, selected cells can be edited numerically with the keyboard. Wave segments on the clipboard are stored as a column of numbers in a text format and can easily be transferred to a graphics, spreadsheet or word processing program.

35.705	35.415
33.065	31.595
26.020	24.080

The **Wave Synthesizer** loads a wave with a constant value, ramp, sine wave, triangle wave, square wave, uniform noise (flat histogram), or gaussian noise (gaussian distribution).

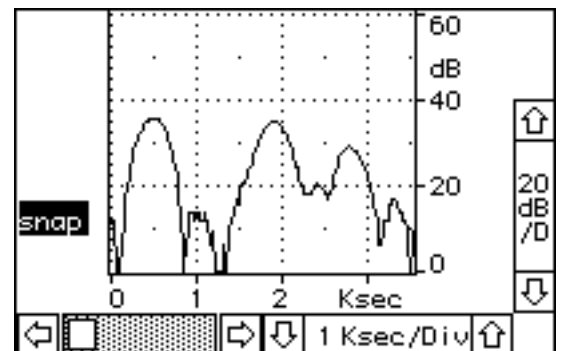


One can easily **edit a wave** by moving wave segments to and from the clipboard via the standard Macintosh Cut, Copy and Paste commands. The user identifies a segment by dragging the mouse over the region of interest. The insertion point is positioned by clicking the mouse once. Cut, Copy and Paste commands correspond to the selected wave (a wave is selected by clicking on its wave label; or, if there is only one wave in the display, clicking in the display).



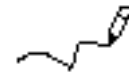
DISPLAYS

Displays reside on the front panel and are used to view waveforms and perform calculations. They are extremely versatile with many customizable attributes such as horizontal/vertical scroll/position controls, labels, waves, markers and much more. Displays can be positioned on the front panel in any pattern and in any number, space permitting. Each display can contain up to 8 waves and supports mouse-driven cut/copy/paste of waveform segments, drawing of waves, and logging wave values to a journal.

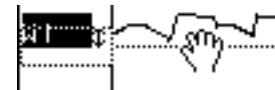


To create a display, one must choose New under Display. Subsequently, the display dialog appears and it is here that one specifies which waves are to be displayed (this is done by dragging wave names from the waves list box to the display contents box). There are four display types: **Wave Plot**, **XY Plot**, **Analysis** and **Snapshot**. Wave Plot is used to plot 1 to 8 waves across the screen, XY plots 1 to 8 wave pairs, Snapshot analyzes (e.g. frequency spectrum) a time wave at a marker position, and Analysis analyzes a segment of a time wave. Customizable labels, controls, axes, grids, plot graphics and markers are easily adjusted with dialogs accessed by choosing Features, Labels, Controls, and Markers under Display.

The user can easily **redraw** a waveform segment by placing SuperScope II in Draw mode (choose Mouse ▶ Draw under Display) and then drawing in a Display with the mouse.

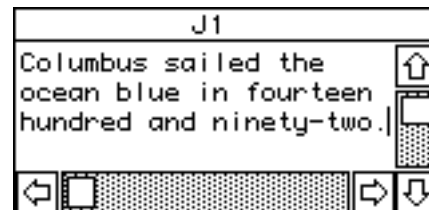


The user can **vertically re-position** a waveform by placing SuperScope II in Vertical Adjust mode (choose Mouse ▶ Vertical Adjust under Display) and then dragging the selected wave up or down in a display. A double headed arrow is appended to the wave name of a vertically adjusted wave to indicate that it no longer corresponds to the vertical scale at the right of the display region. Clicking this double arrow once will cause the vertically adjusted wave to snap back into its original position.



JOURNALS

Journals are text regions that are used to enter, view and edit text in a manner similar to that done with a word processor. With commands in the menubar, the user can Clear, Save, View, Save to Clipboard, Print, Delete and Create Journals. The contents of Journals can easily be saved to disk and then loaded by a word processor, graphics, or spreadsheet program. Journal windows can be resized and positioned on the front panel in any pattern and in any number, space permitting. Many task instructions transfer text to and from journals.



To create a Journal, one chooses New from the Journal menu. Subsequently, the Journal dialog opens, and it is from here that one specifies several Journal options such as journal name, the number of characters between each tab, and whether or not the journal's contents are stored with the instrument file.



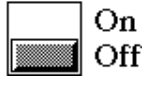

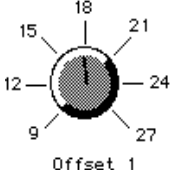
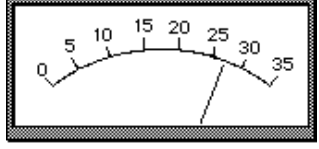

Each journal can operate in one of two modes: *Word Processor* or *Spreadsheet*. The Word Processor mode works with a fixed page width (e.g. 7 inches) and supports automatic wrap-around. This mode is useful when one wants to send the journal contents to a word processor or print the journal with a limited width format. The spreadsheet mode is more like a traditional spreadsheet with an unlimited width, no wrap-around, and horizontal scrolling that will go as far right as necessary. This is useful when it is necessary to send the journal's contents to a spreadsheet. Tabular numeric data in SuperScope II journals transfer nicely to spreadsheets, with each value being placed in its own spreadsheet cell. This is made possible with a TAB delimiter between each column and a CARRIAGE RETURN character between each row. This is a wonderful standard for text files since it insures compatibility between journals, word processors and spreadsheet application programs!

The user can **log points to a journal** by placing SuperScope II in Log Coordinates Mouse mode (choose Mouse ▶ Log Coords under Display) and then clicking the mouse on a selected wave (recall that you select a wave by clicking on its label; or, if there is only one wave in the display, clicking in the display).

X: Hz	Y: dB
2278.63	18.060
2339.68	18.060

CONTROLS & INDICATORS

Front panel Controls and Indicators, shown below, allow the adjustment of, Boolean true/false values, scalars, lists, and text. These objects appear in a variety of styles, sizes, fonts, and colors; and their states are easily read and updated with tasks.

 <p>Dout0</p> <p>Lights indicate the state of a Boolean true/false value.</p>	 <p>Buttons often initiate the execution of a task.</p>	<p>Power</p>  <p>Switches specify a true/false Boolean condition.</p>
 <p>Sliders control a scalar quantity.</p>	 <p>Dials control a continuous or quantitized scalar quantity.</p>	 <p>Meters indicate a scalar quantity.</p>
 <p>Channel 0</p> <p>Numeric Fields control a scalar quantity or a text string.</p>	<p>Duration = 12.52</p> <p>Static Text shows a scalar quantity or a text string.</p>	

MARKERS

Markers are typically used to mark a time in a wave or display. The user can create as many markers as he/she desires and can place any marker in any display (via Markers under Display). In displays, they appear as vertical lines that can be moved left and right with the mouse. Additionally, the display can be set up to show marker labels at the top of the display (choose Label under Display). A neat trick is to use two markers and one wave to describe another wave, called a "segment", which is defined as the section of the original wave between any two markers (via Markers under Display). The segment and the source wave share the same data.

The **cursor window** is used to numerically view specific points along a waveform. The contents of the cursor window corresponds to the location of the mouse. This is opened by choosing Show ▶ Cursor under Edit.

Cursor		
Wave	Horizontal	Vertical
mouse	3162.500 dB	22.34375 dB
snap	3162.500 dB	9.540 dB

MENUBARS

Menubars are a powerful tool for modifying the current menubar, or creating your own. In some cases, it is desirable to have a very simple menubar to limit a user's options. Menubars are easily created, renamed, and deleted. Each menubar consist of a set of menus and a set of items for each menu. Each menu and item can be renamed (e.g. change "Open..." to "Open Sesame"), hidden, or set up to run a Task when chosen.

Custom Menubar:

Name:

Menu:

Show default text "File"
 Show custom text:
 Hide menu

Item:

Show default text "User Item 1"
 Show custom text:
 Hide item
 Run Task

TASKS

Tasks are little program sequences that perform a series of operations when run. For example, one could write a task to record data, analyze, update the screen, and then print the results. Tasks are easily created, viewed, edited, and debugged; and can be set up to run when a marker moves, when a wave changes, when a specific menu item is chosen or when the user chooses Run Task. One "programs" tasks using a powerful mouse/dialog user interface. The neat thing about programming SuperScope II is you do not need to know any syntax -- the mouse-driven dialog boxes take care of you.

Task Begin

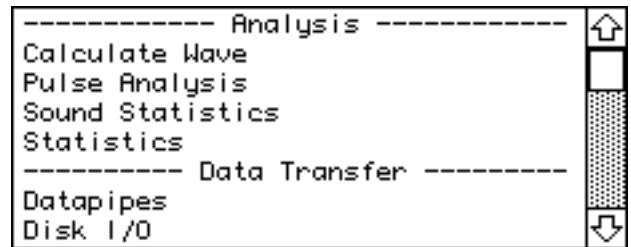
```

Clear at beginning of task journal Data
Clear, Calculate and Redraw Display Analysis
Voiced = Voiced (time)
Move M1 to absolute time X of time
Move M2 to absolute time X of time
Loop 3 times
    Pulse analysis on Voiced (pulse# to Data; t3
    Sound Statistics on Segment (shimmer (APQ) to
    Loop end
Move M1 to first peak of Voiced
Move M1 to relative time X of Voiced

```

INSTRUCTIONS

Instructions are the building blocks used to create tasks. There are over 30 kinds of instructions, each of which is used to perform a specific function (e.g. save a wave to disk, move a marker, choose a menu item, calculate the derivative of a wave, etc.). Each task contains a list of instructions that are executed in the order they appear in the list; and each instruction can be viewed, edited, cut, copied, and pasted.

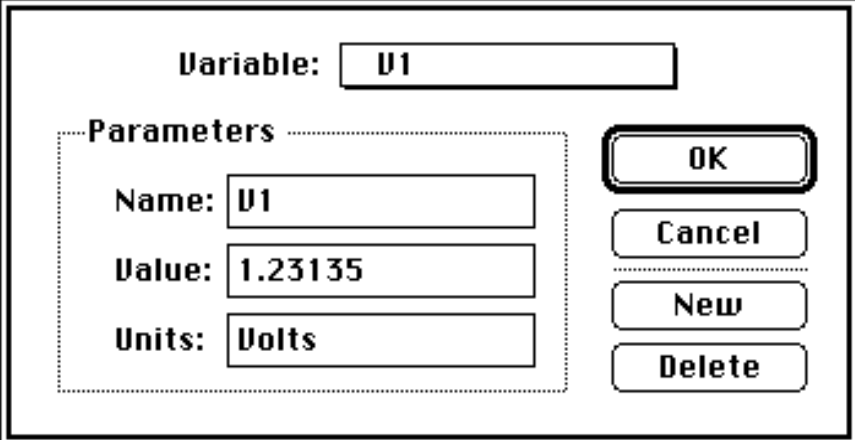


DATAPIPES

A datapipe is a reference to a folder on a hard disk or floppy disk. Technically, a datapipe is a pathname to a folder. Think of it as a pipe, through which you squirt data between SuperScope II and a folder on disk. Datapipes are often used to access folders from within tasks, where the name of the folder may change with each experiment. The Datapipe instruction can be used to create a new data folder, and to attach a datapipe to that folder. The Disk I/O instruction could then be used to push data into the datapipe, and ultimately into the new folder. Datapipes, like other SuperScope II objects, are created, deleted, and named. To view or modify a datapipe's folder, choose Datapipe Folder ▶ under File.

VARIABLES

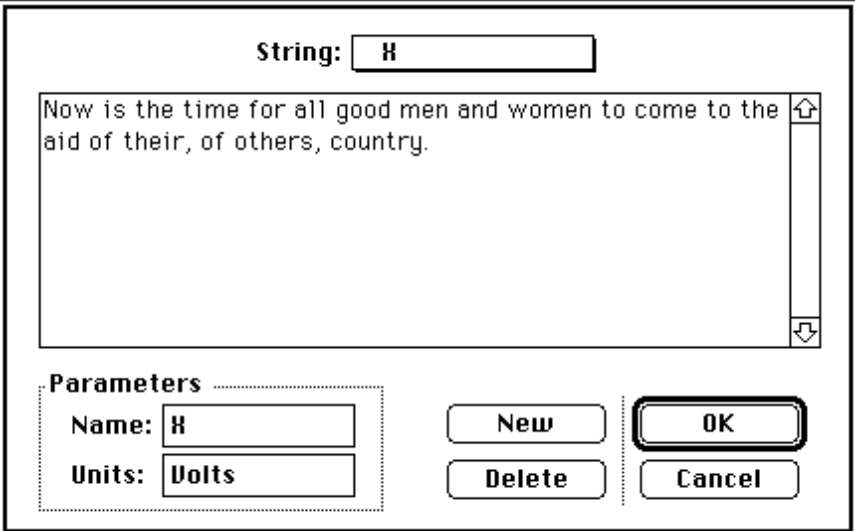
Variables are used to hold one 32-bit floating point value (e.g. 16, 2.3, 1.34e6). They are easily created, renamed, and deleted; and their values are easily viewed and edited. Many task instructions transfer values to and from variables.



A dialog box for editing a variable. At the top, the label "Variable:" is followed by a text box containing "U1". Below this is a dashed-line box labeled "Parameters" containing three text boxes: "Name:" with "U1", "Value:" with "1.23135", and "Units:" with "Volts". To the right of the "Parameters" box are four buttons: "OK", "Cancel", "New", and "Delete".

STRINGS

Strings are used to hold a series of characters of any length, memory permitting (e.g. "hi", "1.2"). They are easily created, renamed, and deleted; and their text is easily viewed and edited. Many task instructions transfer text to and from strings.



A dialog box for editing a string. At the top, the label "String:" is followed by a text box containing "H". Below this is a large text area containing the text "Now is the time for all good men and women to come to the aid of their, of others, country." with a vertical scrollbar on the right. Below the text area is a dashed-line box labeled "Parameters" containing two text boxes: "Name:" with "H" and "Units:" with "Volts". To the right of the "Parameters" box are four buttons: "New", "Delete", "OK", and "Cancel".

TASKS AND INSTRUCTIONS

SuperScope II provides an easy to use environment by which one explicitly defines acquisition, analysis, archival and presentation features. From this environment, one defines little programs called Tasks, each of which can be created, edited, viewed and run. These little programs consist of a list of instructions which are executed in a top to bottom sequence. Each instruction is not typed however, as done in traditional textual programming environments; instead, each instruction has an associated dialog box from which the user specifies, in detail, the instruction's functionality -- with easy to use pop-up menus, check boxes, radio buttons and edit fields. These dialogs appear when one initially adds an instruction to a task, and when one edits an instruction by double clicking on it's text. Instructions are added to a task by dragging one from the Instruction Dictionary; deleted from a task by being selected and then removed with the Delete key; moved from one position in a task to another via the standard Cut, Copy & Paste clipboard features; and modified by double-clicking with the mouse. An example instruction is the Calculate Wave instruction which enables the user to place mathematical expressions into a task (e.g. $W1 = \text{AutoCorrelation}(W2)$). The instructions are summarized below:

ALERT, BEEP, OR DELAY is used to sound a beep, show a message in an alert, stop the task, wait until the mouse button is pressed, wait until the mouse button is released, wait until the mouse button is released, wait for a specific key press, freeze for a specified duration, or synchronize to a specified duration.

The dialog box titled "Alert, Beep & Delay" contains several radio button options: Beep, Stop task, Break out of Trace Loop, Wait for mouse down, Wait for mouse up, Wait for key [r] press, Delay for 2.000 seconds, and Synchronize to 1.000 second intervals. The "Show Alert" option is selected, with a text field containing "Max FFT Low!". At the bottom are buttons for Help, Do It, Cancel, and OK.

ARITHMETIC is used to arithmetically combine two objects (e.g. +, -, ÷, *) and transfer the result to a third. Objects include variables, strings, waves, markers, journals and controls.

The dialog box titled "Scalar Arithmetic" shows a mathematical expression: Journal view ← Marker M1 + Wave W1. Below each object is an "Options..." button and a numerical value: Journal view (0.00000), Marker M1 (0.01000), and Wave W1 (0.00000 Volt). Buttons for Help..., Do it, Cancel, and OK are at the bottom.

ASSIGNMENT is used to copy the scalar value of one object into another object. A marker's value is derived from it's position; a control's value is derived from it's setting; a string or journal's value is derived from it's text; and a wave's scalar value is derived from one

The dialog box titled "Scalar Assignment" shows a variable assignment: Variable error ← Value 0.000. Below each is an "Options..." button and a numerical value: Variable error (1.00000 Volts) and Value (0.00000). Buttons for Help..., Do it, Cancel, and OK are at the bottom.

CALCULATE WAVE is used to perform waveform calculations; such as FFT, cos, +, or *. Over 80 functions and operators are supported.

CHOOSE MENU is used to select a menubar command or press a key (e.g. choose Print under File, press *Option 'e'*, etc). This is very powerful since it brings all menubar and keyboard commands within the scope of task instructions.

CURVE FITTING fits a wave to a lorentzian, sin, gaussian, polynomial, exponential or linear expression.

DATAPIPES is used to show a datapipe folder dialog, create a new folder for data, or create a new folder and prompt for a folder name.

DISK I/O is used to transfer a wave or journal to or from disk, delete a file, transfer wave data to a journal, or transfer journal data to a wave.

The **Data Transfer** dialog box contains the following options and controls:

- Save to disk
- Load from disk
- Transfer wave to journal
- Transfer journal to wave
- Delete last saved file
- Delete last loaded file

Buttons: **File...**, **Options...**, **Do It**, **OK**, **Help**, **Cancel**

DISPLAYS is used to clear, calculate, or redraw a display. This is important since updating a display takes processor time, and therefore should not be done redundantly or too seldom.

The **Display:** dialog box contains the following options:

- Clear display
- Clear, Calculate and Redraw display
- Calculate and Redraw display; don't Clear
- Clear, Calculate and Redraw all displays which are not current with the latest data

Buttons: **Help...**, **Do It**, **Cancel**, **OK**

FILTER is used to run a low-pass, or high-pass FIR filter on a waveform. Alternatively, you can provide your own FIR filter coefficients to implement a custom filter.

The **Filter:** dialog box contains the following settings:

- Type:** **Custom...**
- FreqCutoff:** (% of sample rate)
- Boundries:**

Summary: **Freq Cutoff: 125.0 Hz**, **Phase: linear**, **Stopband: -98 dB**, **Taps: 99**

Buttons: **Help...**, **Cancel**, **OK**

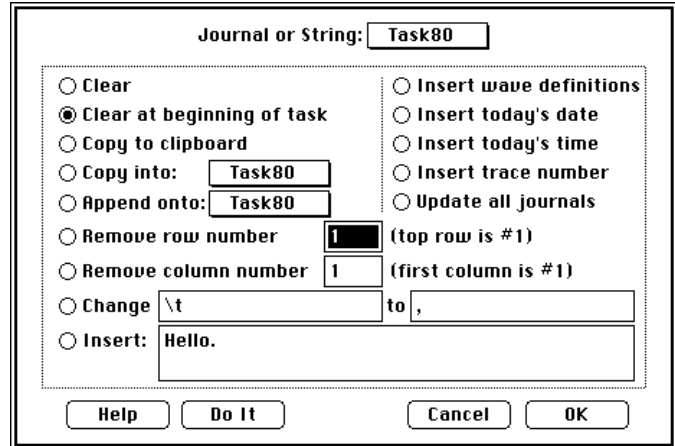
GET TIME obtains immediate time information for purposes of absolute time, and duration measurements. For example, one could use this instruction to read the time since the beginning of the task, twice, accurate to $\pm.25 \mu\text{s}$, and then subtract the two values to produce a duration measurement accurate to $\pm.25 \mu\text{s}$.

The **Get Time** dialog box features a list of transfer options and a set of checkboxes for data transfer:

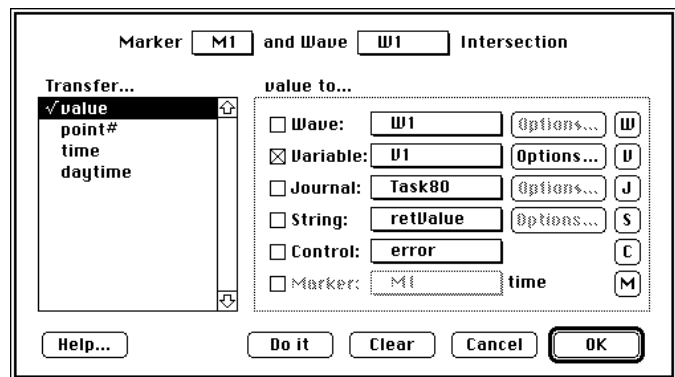
- Transfer...** list: month (checked), day, year, hour, minutes, seconds, power on secs, apl launch secs, begin task secs, trigger secs
- month to...** section:
 - Wave: **Options...** **W**
 - Variable: **Options...** **V**
 - Journal: **Options...** **J**
 - String: **Options...** **S**
 - Control: **C**
 - Marker: time **M**

Buttons: **Do it**, **Clear**, **Cancel**, **OK**

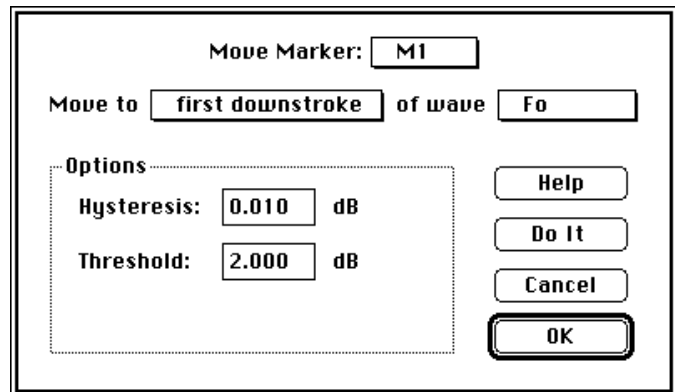
JOURNALS & STRINGS is used to clear, insert text, append, copy, and search-replace text within a journal or string.



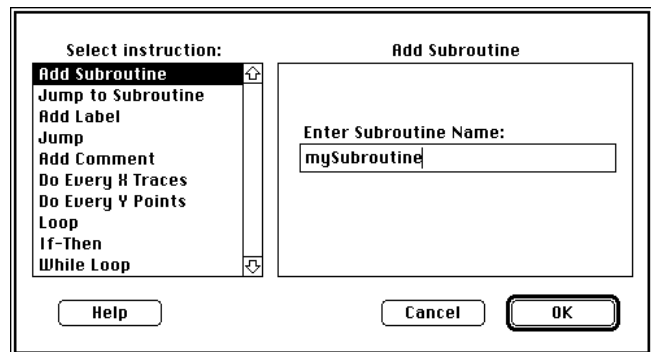
LOG MARKER is used to send the marker position, or wave value at a marker position, to journals, waves, controls, strings, variables, and markers.



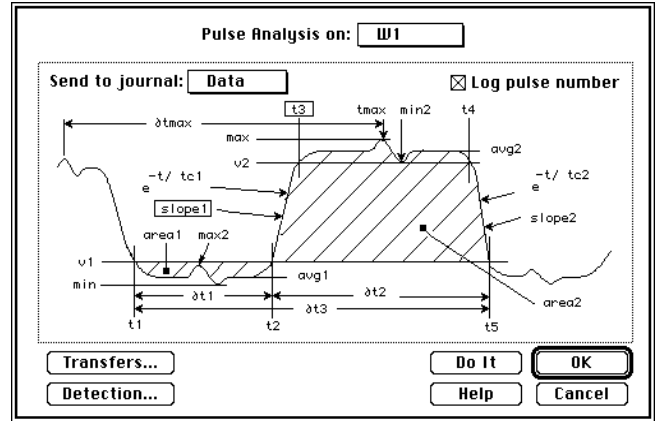
MOVE MARKER is used to move markers to waveform minimums, maximums, local minimums ("valleys"), local maximums ("peaks"), upstrokes, downstrokes, specified points, and specified wave values. This instruction supports seamless traces; subsequently, trace breaks have no effect (e.g. ten seamless traces would be viewed as one long trace).



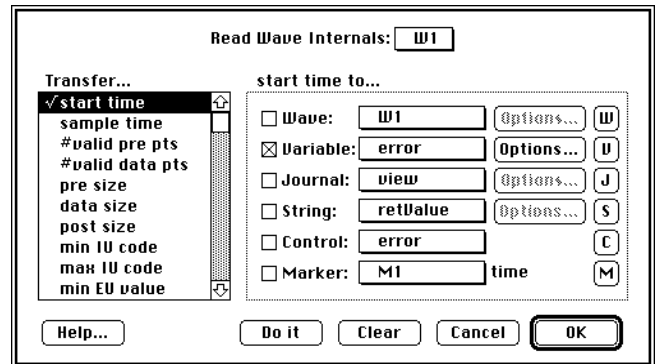
PROGRAMMING supports common programming features such as If...Then, Goto, While Loop, Loop N Times, Define Subroutine, Jump To Subroutine, Insert Comment, and Insert Label.



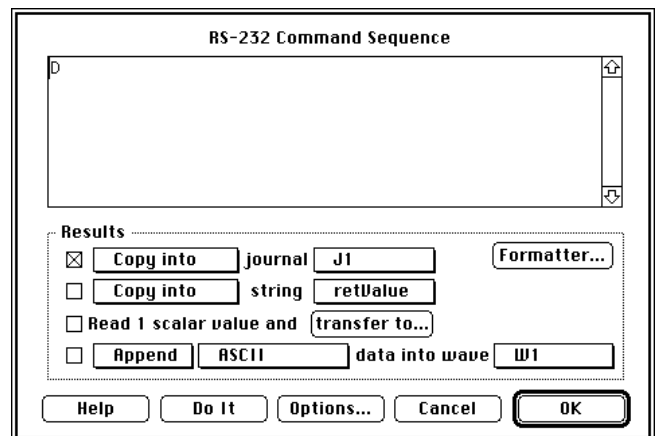
PULSE ANALYSIS is used to analyze pulses and send up to 24 characteristics (e.g. min, max, rise time, fall time, etc.) of each pulse to journals, waves, controls, strings, variables, and markers.



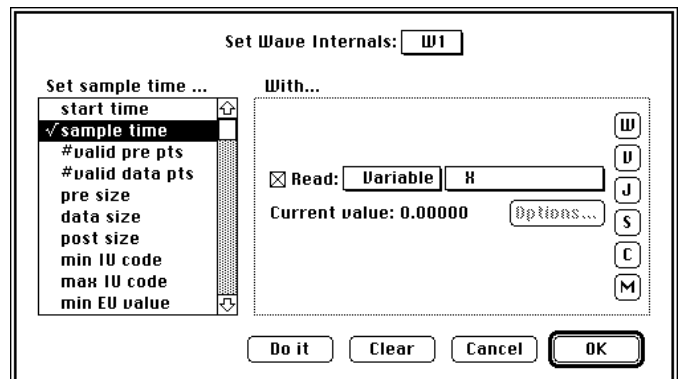
READ WAVE INTERNALS is used to extract wave characteristics, such as sample rate and # of points, and transfer them to journals, waves, controls, strings, variables, and markers.



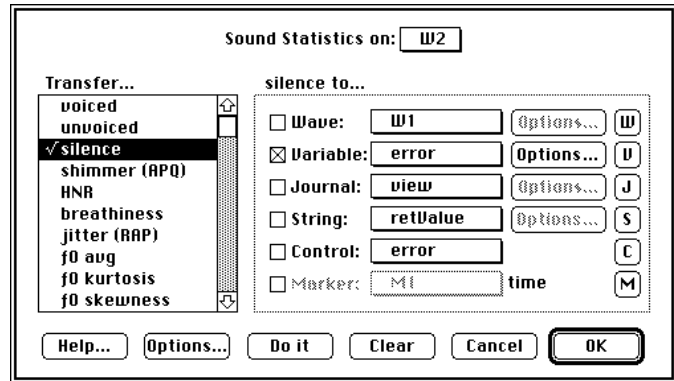
RS-232 is used to communicate with RS-232 hardware devices via the computer's MODEM and PRINTER ports. These ports support serial communication at rates up to 57.6K BAUD via the Macintosh Serial Port Driver. This instruction can be used to send text, receive text, copy a received string into a journal, and interpret a received string.



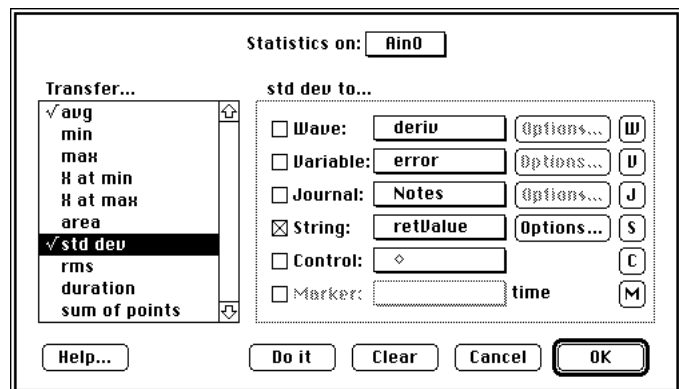
SET WAVE INTERNALS is used to set wave characteristics, such as sample rate and # of points. This is done with values from journals, waves, controls, strings, variables, and markers.



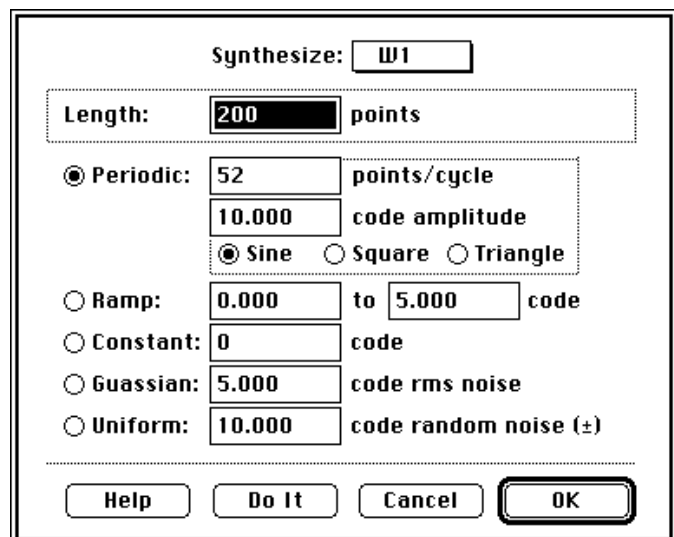
SOUND STATISTICS is used to calculate the following statistics on a speech wave: % voiced, % unvoiced, % silent, shimmer, jitter, HNR, breathiness, Fo average, Fo kurtosis, Fo skewness, Fo range and Fo std dev.



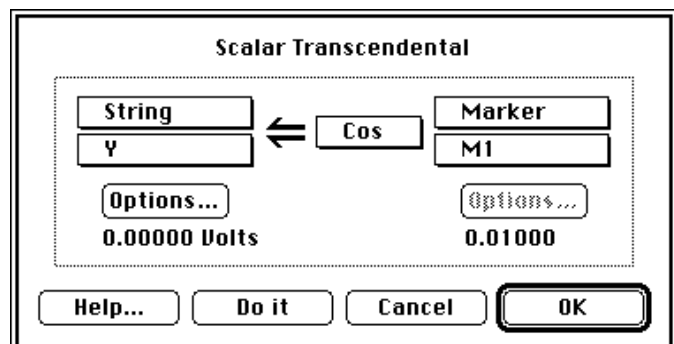
STATISTICS is used to calculate the following statistics on a wave: avg, min, max, time of min, time of max, std dev, rms and area. Results are easily sent to Journals, Waves, Variables, Strings, Controls and Markers.



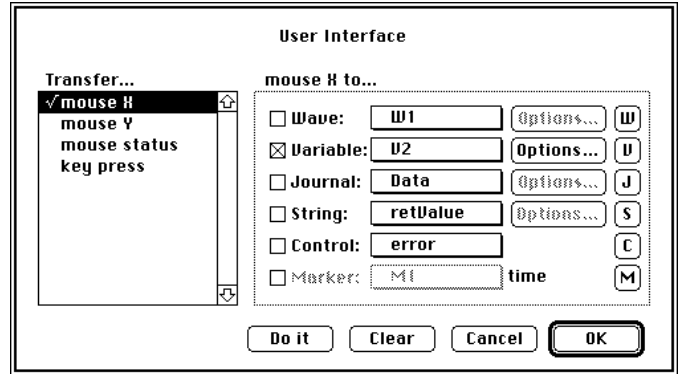
SYNTHESIZE is used to load a wave with a constant value, ramp, sine wave, triangle wave, square wave, gaussian noise (gaussian distribution), or uniform noise (flat histogram).



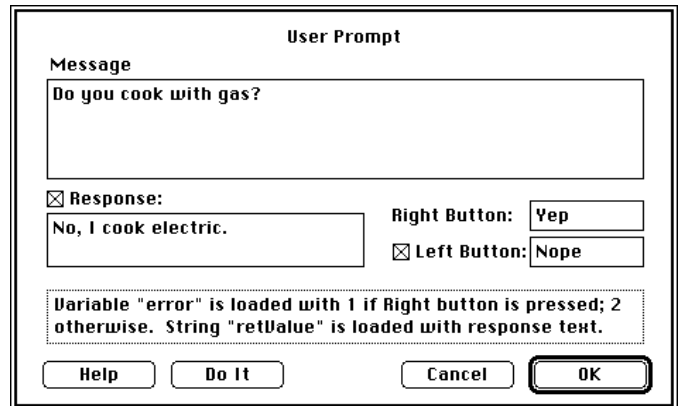
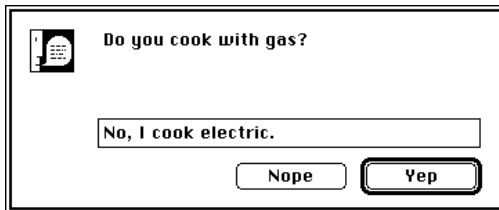
TRANSCENDENTAL is used to calculate a transcendental function on one object, and transfers the result into another object. A marker's value is derived from it's position; a control's value is derived from it's setting; a string or journal's value is derived from it's text; and a wave's scalar value is derived from one point.



USER INTERFACE is used to monitor the X-Y position of the mouse, the status of the mouse button (up or down) and the status of the keyboard (i.e. the last keypress). Results are sent to journals, waves, variables, strings, markers, and controls.



USER PROMPT is used to show a custom alert, with an optional response field and an optional Cancel button. For example, the instruction to the right results in the alert pictured below.



FUNCTIONS

The Calculate Wave instruction allows one to define waves in terms of other waves (e.g. "W1 = deriv(W2)"). From within the Calculate Wave dialog, one can use any of 12 operators and any of over 65 functions (e.g. FFT, cos, signal average), as summarized in the table below.

Waves of type 16-bit integer and 32-bit floating point can be intermixed within a function (e.g. "int16Wave = Abs(flt32Wave)"). Integer waves are always analyzed with respect to their engineering units. For example; if wave *Result* and *Source* are both 16-bit integer waves with ± 10 Volts mapped to $\pm 32,768$ (e.g. 5V corresponds to 16384 internally, etc.), *Source* is loaded with 1.0V (3,277 internally) and one does "*Result* = cos(*Source*)", then *Result* would be loaded with 0.54 (1770 internally). The neat thing about integer waves is that the user, the displays and the tasks only see Engineering Units (e.g. Volts); subsequently, one does not need to keep track of the internal values. Digitized data (e.g. from an analog-to-digital or digital-to-analog converter) is always contained in 16-bit integer waves, since this is the native format for I/O hardware. To see internal data, choose Edit Values under Wave and then select Internal.

Function	Description	Example
+	add	$W1 = W2 + W3$
-	subtract	$W1 = W2 - W3$
*	multiply	$W1 = W2 * W3$
/	divide	$W1 = W2 / W3$
AND	bitwise AND	$W1 = W2 \& W3$
OR	bitwise OR	$W1 = W2 W3$
<	1 if less then; 0 otherwise	$W1 = W2 < W3$
>	1 if greater then; 0 otherwise	$W1 = W2 > W3$
≤	1 if < or equal; 0 otherwise	$W1 = W2 \leq W3$
≥	1 if > or equal; 0 otherwise	$W1 = W2 \geq W3$
==	1 if equal; 0 otherwise	$W1 = W2 == W3$
!=	1 if not equal; 0 otherwise	$W1 = W2 \neq W3$
Abs	absolute value	$W1 = \text{Abs}(W2)$,
Alarm	beep if value is out of bounds	$W1 = \text{Alarm}(W2, 5, 0)$
Append	append one wave to another	$W1 = \text{Append}(W2, W3)$
Arccos	inverse cosine	$W1 = \text{Arccos}(W2)$
Arcsin	inverse sine	$W1 = \text{Arcsin}(W2)$
Arctan	inverse tangent	$W1 = \text{Arctan}(W2)$
AutoCorrelation	autocorrelation	$W1 = \text{AutoC}(W2)$
AvgToDate	average value to date	$W1 = \text{AvgToD}(W2)$
Blackman	generate a Blackman window	$W1 = \text{Blackman}(256)$
Compress	decrease sample rate	$W1 = \text{Compress}(W2, 2)$
Convolve	convolution	$W1 = \text{Convolve}(W2, W3)$
CopyTiming	copy sample period & start time	$W1 = \text{CopyTiming}(W2)$
Cos	cosine	$W1 = \text{Cos}(W2)$
CrossCorrelation	cross correlation	$W1 = \text{CrossC}(W2, W3)$
CrossPower	cross power	$W1 = \text{CrossP}(W2, W3)$
DeConvolution	de-convolution	$W1 = \text{DeConv}(W2, W3)$
Delete	delete a waveform segment	$W1 = \text{Delete}(W2, 50, 100)$
Deriv	derivative	$W1 = \text{Deriv}(W2)$
DerivFivePt	5 pt. Lagrange derivative	$W1 = \text{DerivFivePt}(W2)$
Exp	exponential	$W1 = \text{Exp}(W2)$
Expand	increase sample rate	$W1 = \text{Expand}(W2, 2)$
FFT	fast Fourier transform, reals	$W1 = \text{FFT}(W2, 256)$
Hamm	generate a Hamming window	$W1 = \text{Hamm}(256)$
Hann	generate a Hanning window	$W1 = \text{Hann}(256)$
Histo	histogram	$W1 = \text{Histo}(W2, 0, 50, 10)$
Imag	convert complex imaginary	$W1 = \text{Imag}(W2)$
IndexSort	sort given indices	$W1 = \text{IndexSort}(W2, W3)$
Insert	insert a segment into a wave	$W1 = \text{Insert}(W2, W3, 50)$
Int	convert to closest integer	$W1 = \text{Int}(W2)$
Integ	integrate	$W1 = \text{Integ}(W2)$
IntegAV	integrate, reset when area = A	$W1 = \text{IntegAV}(W2, 10)$
IntegPT	integrate, reset when time = T	$W1 = \text{IntegPT}(W2, 0.1)$
IntegTL	integrate, reset at list of times	$W1 = \text{IntegTL}(W2, W3)$

Function	Description	Example
IntegTV	integrate, reset when wave > V	W1 = IntegTV(W2, 5)
InvFFT	inverse fast Fourier transform	W1 = InvFFT(W2, 256)
Kaiser	generate a Kaiser window	W1 = Kaiser(W2, 256)
Last	return data from last trace	W1 = Last(W2)
Limit	apply high & low bounds	W1 = Limit(W2, 5, 0)
Ln	natural logarithm	W1 = Ln(W2)
Log10	logarithm with base 10	W1 = Log10(W2)
Mag	convert complex to magnitudes	W1 = Mag(W2)
MakeComplex	return complex given real	W1 = MakeC(W2)
MakeIndex	return indices for a sort	W1 = MakeI(W2)
MaxToDate	maximum value to date	W1 = MaxToDate(W2)
Minimum	minimum value	W1 = Minimum(W2)
MinToDate	minimum value to date	W1 = MinToDate(W2)
Mod	modulo	W1 = Mod(W2)
MvFFT	return magnitude FFT	W1 = MvFFT(W2, 256)
OnOff	on/off feedback control loop	W1 = OnOff(W2, 5, 0)
Peak	find peaks	W1 = Peak(W2, 2, 5)
PID	PID feedback loop	W1 = PID(W2, W3, 1...
PulseEndTimes	return list of pulse end times	W1 = PulseEndTimes(W..
PulseMaxTimes	return list of pulse max times	W1 = PulseMaxTimes(W..
PulseStartTimes	return list of pulse start times	W1 = PulseStartTimes(W..
Phase	return phase given complex	W1 = Phase(W2)
Real	return real given complex	W1 = Real(W2)
Reverse	reverse the order of elements	W1 = Reverse(W2)
Reciprocal	return reciprocal of source	W1 = Reciprocal(W2)
Shift	shift wave horizontally	W1 = Shift(W2, 50)
SignalAvg	determine waveform average	W1 = SignalAvg(W2)
Silent	determine silent region	W1 = Silent(W2)
Sin	sine	W1 = Sin(W2)
Smooth	smooth waveform by n points	W1 = Smooth(W2, 12)
Sort	sort wave elements	W1 = Sort(W2)
Spectrum	calculate frequency spectrum	W1 = Spectrum(W2, 256)
Sqrt	square root	W1 = Sqrt(W2)
Tan	tangent	W1 = Tan(W2)
TC	find °C given thermocouple V	W1 = TC(W2, 1)
TimeHisto	time histogram	W1 = TimeH(W2, 2, 100)
TimeValues	returns values given times	W1 = TimeV(W2, W3)
UnVoiced	determine unvoiced region	W1 = UnVoiced(W2)
Voiced	determine voiced region	W1 = Voiced(W2, W3)

Chapter 6

Example Instruments

This chapter describes two software instruments that are included with SuperScope II. A SuperScope II instrument consists of waves, markers, displays, journals, controls, indicators, datapipes and tasks that have been assembled like building blocks to create a software environment that is appropriate for specific work. You can use these instruments as is, customize them to your specific needs, or build new instruments from scratch. *More instruments may have been added to the disk since this chapter was printed. Most object names are consistent across instruments, so the extra ones should be easy to understand.*

USING AN INSTRUMENT

To begin using an instrument, it is recommended that you first duplicate the instrument file and work with a copy. Please these new files outside the SuperScope II application folder (e.g. the "SS2 Instruments & Data" folder is ok) to reduce the chance of losing it during a software update. To open the file, either double-click on its icon from the Finder, or launch SuperScope II and then choose Open in the File menu. After opening, you should verify the hardware setup, and save the instrument to disk.

The best instruNet instrument are in the "SuperScope II:instruNet Instruments:BEST INSTRUMENTS" folder.

OBJECT NAMING CONVENTIONS

Nearly all SuperScope II instruments from GW Instruments follow a single naming convention. This consistency makes it easy to use the instrument most appropriate to a specific task, without having to relearn the basics for each. It also allows tasks to be created on one instrument and used in any instrument that contains similar objects. These names strike a balance between simplicity and flexibility. You may alter any object name, or use any names when creating your own instrument. However, doing so will make it more difficult to exchange tasks and instruments with colleagues.

Waves are prefixed with the letter "W". The first wave you create will be named W1 and the second W2. The user is free to change the name of any wave at any time - even after an instrument is saved and tasks are set up that access the waves data. SuperScope II will take care of all internal dependencies on the waves name. *Segment* names are all automatically prefixed with "Seg". The first segment you create will be called Seg1 and the second Seg2. As with all other SuperScope II objects segment names can be change at any time. *Displays* are prefixed with "D". The first display created will be D1, the next D2. *Markers* are prefixed with "M". The first marker will be M1 and the next M2. *Journals* are prefixed with "J".

The first journal will be J1 and the next J2. Specific names are reserved for journals for debugging purposes. If a journal is named Bench it will bench mark each instruction in a task while it is running. If a task is named Task80 it will list each instruction in a task as it is run. A journal named Task10 will produce an abbreviated form of each instruction run. *Tasks* are prefixed with "T". The first task will be T1 and the next T2. One feature SuperScope II offers is the ability to run tasks directly as menu selections. The instrument Menu Editor is an example that runs tasks as menu selections. *Controls* are prefixed with "C". The first task will be C1 and the next C2. As with all other SuperScope II objects users are free to give controls the name of their choosing. *Variables* are prefixed with "V".

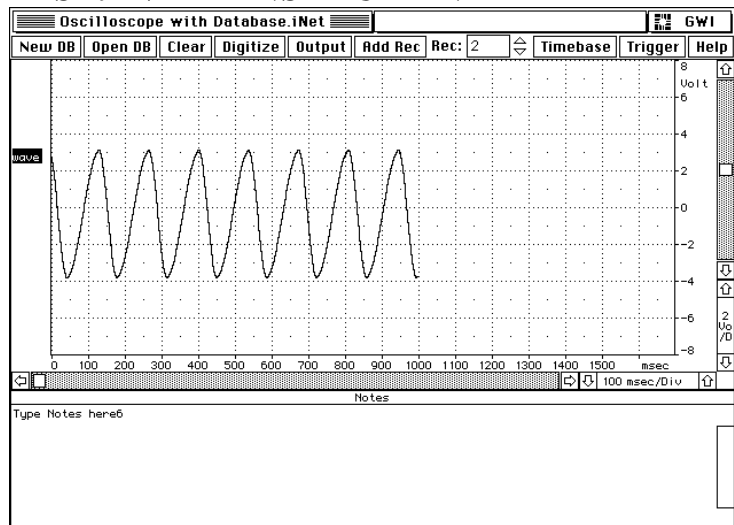
The first variable will be V1 and the next V2. All SuperScope II instruments include a variable called "error" that is used to show the return value of certain functions. *Strings* are prefixed with "S". The first string will be S1 and the next S2. Two strings, retValue and message, are built into every SuperScope II instrument. Message and retValue are global and are used a variety of message passing schemes. retValue will contain the input string return from the dialog task. *Datapipes* are prefixed with "DP". The first datapipe will be DP1 and the next DP2. As with all other SuperScope II objects users are free to give datapipes the name of their choosing.

TWO EXAMPLE SUPERSCOPE II INSTRUMENTS

Two instrument are documented in the following pages. The instruments described here are included in the SuperScope II folder. Some will include a read me file that can be opened with any text editor, or TeachText.

THE "OSCILLOSCOPE WITH DATABASE.INET" INSTRUMENT

This instrument uses instruNet to implement an Oscilloscope, where the maximum wave length is limited by available RAM memory (4 bytes for each point). The digitized wave and notes journal is easily saved in one record of a SuperScope II disk-based database. The database contains two files for each record: wave W1 and journal Notes. These waves and journals are kept in their own files, in the RECORDNUMBER OBJECTNAME format (e.g. file "000005 Notes" contains the Notes text for record #5). In SuperScope II, databases are simply a collection of files in this format, stored in one folder which is referenced by a datapipe. The NEW DB button prompts the user for a new database (i.e. folder) name, OPEN DB prompts the user to specify a



database (i.e. folder) on disk, ADD RECORD adds a record to the database, DIGITIZE digitizes a trace, OUTPUT outputs the current trace via D/A #0, and CLEAR zeros out the current trace. The sample rate and the number of points per trace are viewed and modified by pressing the TIMEBASE button; and the Trigger is viewed and modified by pressing the TRIGGER button. The database records can be scanned manually by pressing the increment/decrement arrows in the Record # field, or automatically in a task. Subsequently, one could place all data acquired during a year, for example, on disk in a format that is easily accessed by SuperScope II, automatically or manually. This instrument could easily be adapted to work with virtually any instruNet digitizer.

This instrument contains several buttons, each of which cause a task to run when pressed. These tasks are typically several instructions long, and can be viewed by choosing Edit under Task. The front panel buttons are used as follows:

NEW DB - The NEW DATABASE button causes an alert to appear prompting the user for a new database name. A folder is then created with this name, the DB datapipe is attached to the new folder (so that all file I/O will be directed to that folder), and the Record edit field (which displays the current database record number) is reset to 0.

OPEN DB - This is used to present the standard File Open dialog. The user then navigates via this dialog to the inside of a database folder (i.e. this redirects the DB datapipe). The last record in this database is then loaded.

CLEAR - This clears (i.e. sets all points to 0) the W1 wave.

DIGITIZE - This button starts the digitization of 1 signal. The 2 waveforms are acquired at 1Kpts/sec, 1000 pts/trace, for 1 second (only 1 scan is digitized). To adjust the number of points per scan (i.e. the total # of points digitized for each channel), or the number of points digitized per second, press the Timebase button. To adjust the # of channels, choose New or Delete under Hardware.

OUTPUT - This causes the W1 wave to be output via the D/A converter #0.

RECORD EDIT FIELD - This edit field shows the record number that you are currently viewing {1... total # of Records}. You can press the adjacent UP or DOWN arrows to increment or decrement to the next record number. This causes new W1 and Notes data to be loaded in from disk.

ADD RECORD - This adds 1 record to the database. Each record contains W1 wave data and Notes journal text. The waves and journals are stored in separate files with their names prefixed by record #'s (e.g. file "0000003 W1" contains the data for wave W1 in the 3rd record).

TIMEBASE - This opens the Timebase dialog, which is used to set the sample period (i.e. # of microseconds between each digitized point) and the # of points that are stored in memory (and in each disk file) each scan.

TRIGGER - This opens the Trigger dialog, which is used to set the trigger to one of the following: Auto (analog positive or negative with fall-through), Norm (same as Auto, yet without fall-through), or None.

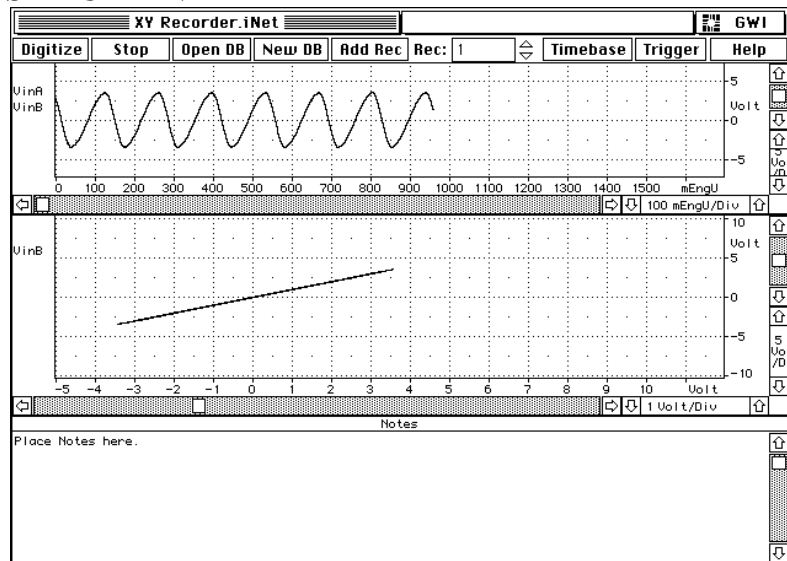
HELP - This causes the Help journal to appear (which is the one you are now viewing). To close this window, click the box at the upper left.

THE "XY RECORDER.INET" INSTRUMENT

This instrument uses instruNet to implement an Oscilloscope/XY Recorder, where the maximum wave length is limited by available RAM memory (4 bytes for each point). The digitized wave and notes journal is easily saved in one record of a SuperScope II disk-based database.

The database contains three files for each record: wave VinA, VinB and journal Notes. These waves and journals are kept in their own files, in the RECORDNUMBER OBJECTNAME format (e.g. file "000005 Notes" contains the Notes text for record #5). In SuperScope II, databases are simply a collection of files in this format, stored in one folder which is referenced by a datapipe.

The NEW DB button prompts the user for a new database (i.e. folder) name, OPEN DB prompts the user to specify a database (i.e. folder) on disk, ADD RECORD adds a record to the database, DIGITIZE digitizes scans continuously until STOP is pressed. The sample rate and the number of points per scan are viewed and modified by pressing the TIMEBASE button; and the Trigger is viewed and modified by pressing the TRIGGER button. The database records can be scanned manually by pressing the increment/decrement arrows in the Record # field, or automatically in a task. Subsequently, one could place all data acquired during a year, for example, on disk in a format that is easily accessed by SuperScope II, automatically or manually. This instrument could easily be adapted to work with virtually any instruNet digitizer.



This instrument contains several buttons, each of which cause a task to run when pressed. These tasks are typically several instructions long, and can be viewed by choosing Edit under Task. The front panel buttons are used as follows:

NEW DB - The NEW DATABASE button causes an alert to appear prompting the user for a new database name. A folder is then created with this name, the DB datapipe is attached to the new folder (so that all file I/O will be directed to that folder), and the Record edit field (which displays the current database record number) is reset to 0.

OPEN DB - This is used to present the standard File Open dialog. The user then navigates via this dialog to the inside of a database folder (i.e. this redirects the DB datapipe). The last record in this database is then loaded.

DIGITIZE - This button starts the digitization of 1 signal and displays both its time wave and VinA vs. VinB in XY form. The waveforms are acquired at 1Kpts/sec, 1000 pts/scan, for 1 second. To adjust the number of points per scan (i.e. the total # of points digitized for each channel), or the number of points digitized per second, press the Timebase button. To adjust the # of channels, create new waves and then attach them to instruNet channels in the Wave Options dialog.

STOP - This causes the digitizing to stop.

RECORD EDIT FIELD This edit field shows the record number that you are currently viewing {1... total # of Records}. You can press the adjacent UP or DOWN arrows to increment or decrement to the next record number. This causes new wave, fft and Notes data to be loaded in from disk.

ADD RECORD - This adds 1 record to the database. Each record contains time wave data and Notes journal text. The waves and journals are stored in separate files with their names prefixed by record #'s (e.g. file "0000003 VinA" contains the data for wave "VinA" in the 3rd record).

TIMEBASE - This opens the Timebase dialog, which is used to set the sample rate and the # of points that are stored in memory (and in each disk file) each scan.

TRIGGER - This opens the Trigger dialog, which is used to set the trigger to one of the following: Auto (analog positive or negative with fall-through), Norm (same as Auto, yet without fall-through), or None.

