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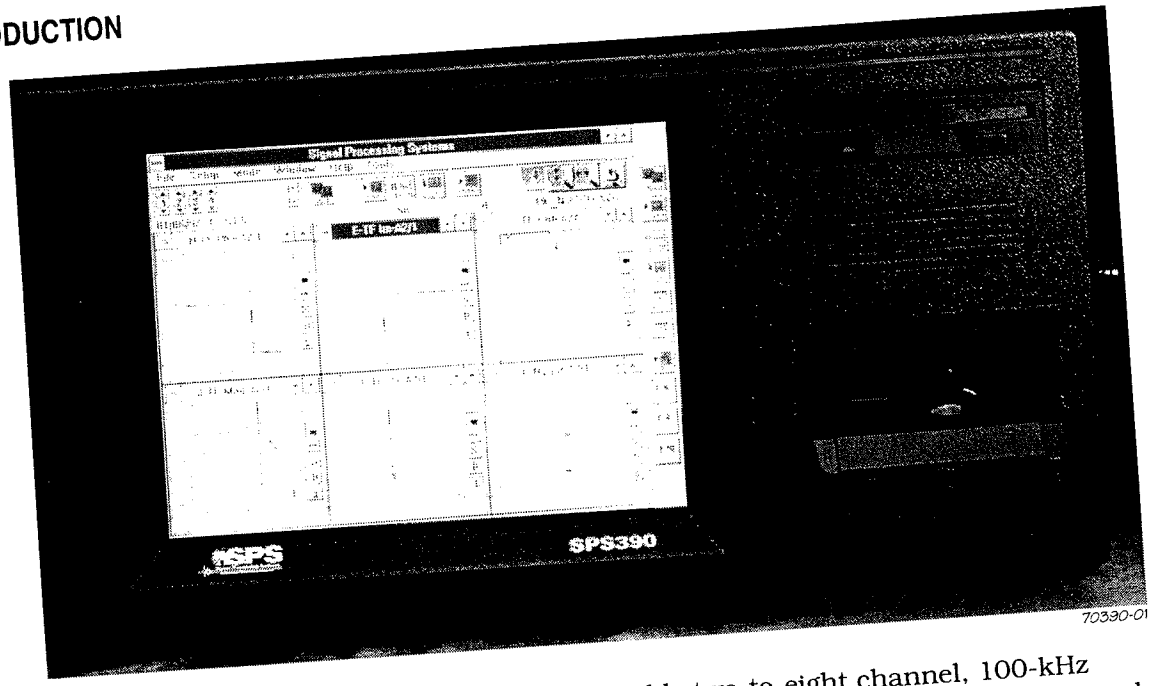
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1–1 INTRODUCTION



The SPS390 is a versatile and easily configurable two-to-eight channel, 100-kHz analyzer that allows Live acquisition, analysis, and display of waveform signals, and post-processing (playback) of acquired data. The SPS390 is a completely self-contained system capable of various types of analyses for applications in mechanical vibration, acoustics, structural (modal), rotating machinery, and general test and measurement. You can choose from many options and operating modes to suit your particular requirements.

In addition to the standard features included with your instrument, additional options are available and may be installed in your particular configuration. These features are:

- Signature Ratio Analysis (SRA)
- Signal Source Generation (SSG)
- SMS Modal Analysis Interface
- Multiple Input Multiple Output (MIMO) Analysis

If these features are not installed, they will appear as *inactive* selections on the menus or with the dialogs.

All features of the SPS390 are accessed from pull down Menus. Parameters are selected via dialog boxes, and functions are selected by software control buttons.

All choices and parameter entries can be made solely with the trackball and trackball selector button, or you can use an optional mouse and keyboard. Where alphanumeric entry is required within the SPS390 application, a Virtual Keyboard is available that only uses the Trackball and Selector button.

Integral with the SPS390 are the Microsoft® Windows™ and DOS operating systems. The SPS390 takes full advantage of the Windows feature of running multiple

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1–3 GENERAL CONVENTIONS

The following types of formatting in the text identify special information:



This icon points out a crucial piece of information that should be noted before using the feature described.



This icon identifies additional useful information regarding the feature discussed.



SPS390 HINT: *This type of box appears throughout the text; it contains helpful tips and hints for effective software usage.*

Menu and dialog box callouts are listed in **bold** throughout the manual as they appear on panels or on the screen.

1–4 SAFETY SUMMARY

1–4.1 General

The following are general safety precautions that are not related to any specific procedures and therefore do not appear elsewhere in this manual. It is the user's responsibility to understand and apply these safety precautions during all phases of operation, service, and repair of this system. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of this system.

1–4.2 Grounding The System

To minimize shock hazard, system chassis and equipment cabinet must be connected to an electrical protective earth ground. The SPS390 is equipped with a three-conductor AC power cable. This power cable must be installed in accordance with installation procedures provided.

1–4.3 Safety Precautions

The SPS390 presents no hazard to operating personnel if operated in accordance with the instructions contained in this manual.

The protection provided by this equipment may be impaired if the equipment is not used in the manner specified by the manufacturer.

There are no user serviceable items inside the SPS390. Return the unit to the factory for servicing is necessary.

Do not set containers with liquids on top of the unit. Accidental spills can enter unit through cooling vents, cracks or media access slots.

When connecting unit to external electrical peripherals, ensure the SPS390 is switched off and the connector ratings specified in this manual are not exceeded.

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1–5 SPS390 SPECIFICATIONS

General

Number of Channels	Standard: two channels Optional: four, six or eight channels
Frequency Ranges	dc to 100 kHz full scale in 1, 2, 4, 5 sequence less 50 kHz range, two channels active
	dc to 40 kHz full scale 1, 2, 4, 5 sequence, four to eight channels active
Anti-Aliasing Filter	Standard on each channel with 120 dB/Octave rolloff
A/D Conversion	Ranges up to 40 kHz: 16 Bit Resolution - All channels parallel sampled
	100 kHz range: 12 Bit Resolution - Two channels parallel sampled
Sampling Rate	2.56 x upper frequency range
Maximum Composite Sampling Rate	819, 200 samples per second
DSP Operation	32 Bit 40 MHz Floating Point Primary Processor (20 Million Floating Point Operations per Second)
	16 Bit Secondary Processor for each channel pair (20 Million Operations per Second)
Dynamic Range (analog board type 1)	0.05 Vrms F.S. to 20.0 Vrms F.S. 0–40 kHz, >90 dB below F.S. with 8 avg.
	40 kHz–100 kHz, >80 dB below F.S. with 8 average
Noise Floor (analog board type 1)	0.05 Vrms F.S. to 20.0 Vrms F.S. 0–40 kHz >90 dB below F.S. with 8 average
	40 kHz–100 kHz, >80 dB below F.S. with 8 averages
Real Time Performance	>20 kHz real time rate on dual spectrum calculation
Full Scale Voltage Range	0.001 Vrms to 20 Vrms in 1, 2, 5 sequence with autoranging, independently selectable on each channel
Channel to Channel Match (analog board Type 1)	
Amplitude:	± 0.25 dB, 0–40 kHz, I mVrms F.S. to 1.0 Vrms F.S.
	± 0.5 dB, 0–40 kHz, 2 Vrms F.S. to 20 Vrms F.S.
	±0.5 dB, 40 kHz–100 kHz, 1 mVrms F.S. to 20 Vrms F.S.

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Hard Disk Drive	
Standard:	850 MB minimum
Optional:	1 GB, 2GB, 4 GB
Workstation CPU	
Memory	32-Bit and Integral Coprocessor (Intel® 486 or Pentium) with 8MB RAM minimum
Real Time Clock	On-screen display of date and time to 1 second resolution
	Annotation of time and stored records to 0.01 second resolution in waterfall memory
X-Axis Readouts	Hz, rpm, Seconds, and Orders (optional)
Y-Axis Readouts	Volts, EU, dB, dBV, dBR, with modifiers of magnitude, magnitude squared, and magnitude squared/Hz. User defined labels for EU up to 5 characters. dBref calculated and displayed for each channel
Y Units Select	English or Metric
Phase Offset	±180 degrees or 0° to 360° for all channels
Cursors/Markers	Locked cursors for like displays selectable.
	X-axis minimum and maximum boundaries, overall level, harmonics, peaks above threshold, maximum peak track, total harmonic distortion, interpolated amplitude and frequency, and user defined computed and displayed with selectable on-trace marker annotation.
View Window	User defined full scale minimum and maximum for both x- and y-axes in the selected units readout
	Y-axis default or autoscale selectable for each display
Text Entry	User defined text entry header and comment lines on any hardcopy available.
Transducer Sensitivities	
mV/EU	0.001 to 10,000 mV/EU
dB Ref	0 to 200 dB
Vref	1e-9 to 20 Vrms
EUlabel	User Defined (Up to 5 Characters)

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Third Party Software Compatibility	Direct data exchange with SMS StarModal ®, StarStruct® and StarAcoustics® software programs, for complete modal, acoustic, and structural analysis calculations and display. (Requires Analyzer/SMS Star Driver Option 42) ASCII data export of trace data Universal File Format (UFF) data export
Dynamic Data Exchange	Server for following values: Cursor X-value Cursor Y-value Overall level Record number RPM Fundamental frequency Magnitude Phase 2xRPM value Non-synchronous noise level Values are available for respective selected display
Hard Copy	Compatible with a wide variety of printers/plotters supported by Microsoft® Windows™ through the parallel printer port or serial port. Capture entire screen to clipboard and paste to report, print one or all displays on screen with information list and header. Print to output device or save graphic file to disk.
Operating System	Windows 3.11 or Windows® 95 can be the operating system for the SPS PRO Series analyzers. (Windows NT is not supported.) The entire operating sytem and PRO Series analyzer software packages supplied are year 2000 (Y2K) compliant. Analyzer opeation can be 100 % controlled with built-in trackball, pointer or external mouse. (Intelli-mouse operation is not supported.) External mouse must be connected at power-up to be recognized. If an external mouse becomes disconnected after power-up, the internal trackball will become active and lockout any reconnection of the external mouse. An external keyboard may be connected or disconnected at anytime before, during or after power-up.
Standard Ports	Mouse Port Parallel Printer Port External Keyboard Port VGA® Monitor Port RS-232 Serial Port

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Waterfall Display Window Size	Selectable from 2 records to greater than 200 per window, window can scroll through entire file
Waterfall Display Types	Cascade Single Record Peak Hold Envelope Profile (any frequency or SRA Order) Profile Overall Level
Z-axis Units	Record number rpm Time (sec)
X and Y-axis Units	Same as for analyzer display mode in linear or logarithmic format
Baseline Suppression	Programmable in 1% amplitude increments
Waterfall Display	
Skew	±45, ±30, ±15, and 0 degrees
Direction	Up or down
Display Setups	Independently selectable for each channel

Signal Source Generator (-15 Option)

Analog Output Signals	Pseudo Random: to 100 kHz bandwidth White Noise: over 100 kHz bandwidth with a selectable RMS output from 10 mV to 2.5 V RMS in 5 mV steps Pink Noise: over 100 kHz bandwidth with a selectable RMS output from 10 mV to 2.5 V RMS in 5 mV steps Burst Random: white noise output with a burst duration equal to 50% of the selected memory period Swept Sine: programmable amplitude from 10 mVpeak to 10 Vpeak in 5 mV increments from 0.5 Hz to 50 kHz (linear or logarithmic sweep) Sine Dwell: programmable fixed frequency and amplitude level
DAC Output	16 Bit Resolution
Sync Pulse Output on a BNC	A TTL pulse corresponding to the start of each frame.

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Peak hold envelope spectrum of entire array
Selected single spectrum; amplitude *vs* order
Profile overall level *vs* rpm
Profile selected order *vs* rpm
(Start and stop rpm independently selectable for each display)

Octave Analysis (-41 Option)

Conforms to ANSI S1.11-1986, Order 3, Type 1D, extended and additional frequency ranges for:

1/1 Octave (at center frequency)

Center Frequency (Hz)	Band Number
1 – 1000	0 – 30
2 – 2000	3 – 33
4 – 4000	6 – 36
8 – 8000	9 – 39
16 – 16000	2 – 42

1/3 Octave (at center frequency)

Center Frequency (Hz)	Band Number
0.75 – 1250	-1 – 31
1.6 – 2500	2 – 34
3.15 – 5000	5 – 37
6.3 – 10000	8 – 40
12.5 – 20000	11 – 43

Dynamic Range	70 dB down from Full Scale Typical (1/3 Octave)
Display Ranges	1/1 Octave, 11 Bands 1/3 Octave, 33 Bands
Update Rate	25 per second (1/3 Octave mode for one or two Channels 20 kHz, typical)
Acoustic Weighting	Flat, A, B, C, or D on all channels
Averaging Mode	Selectable in Seconds Linear or exponential method
Marker Readout	X-axis: Hz and Band Number Y-axis: V, EU, dB, dBV, dBR, and Overall Level (OA) Allows any two active channels to be utilized as references in cross property measurements (Channels 1 and 2 are default)

Remote Control (-58 Option)

Terminal Control Functions	Start averager Stop averager Resume Hold Update

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Fuse — 120 V~ Operation

Number required	1
Rating	T4A/250V

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2– INSTALLATION

2–1 INTRODUCTION

This section contains instructions for performing an initial inspection of the Model SPS390, general safety precautions, instructions on preparation for use, return shipment procedures including repacking instructions for return shipment, and procedures for claiming warranty repairs.

2–2 INITIAL INSPECTION

Although the instrument is thoroughly inspected mechanically and electrically before packing for shipment, it must be inspected upon receipt for possible damage in transit.

2–2.1 SHOCKWATCH Monitors

If the shipping containers are equipped with SHOCKWATCH monitors, check the condition of the monitors before opening the containers. If the monitor indicates rough handling, follow the instructions on the SHOCKWATCH label.

2–2.2 Unpacking

Use care when removing the instrument from its shipping container to prevent damage to the front and rear-panel controls. Save the shipping container and all packing materials until the instrument has been thoroughly inspected for damage and checked for proper operation.

2–2.3 Equipment Furnished

Make sure that each item on the packing list is included with the shipment. Accessory kits may be shipped in separate containers.

2–2.4 Inspection for Physical Damage

Inspect all panels for dents, signs of chipped paint, or scratches. Check for broken or bent connectors, switches, and knobs. Photographs of damage may be helpful in substantiating subsequent claims.

2–3 RESHIPMENT PROCEDURE

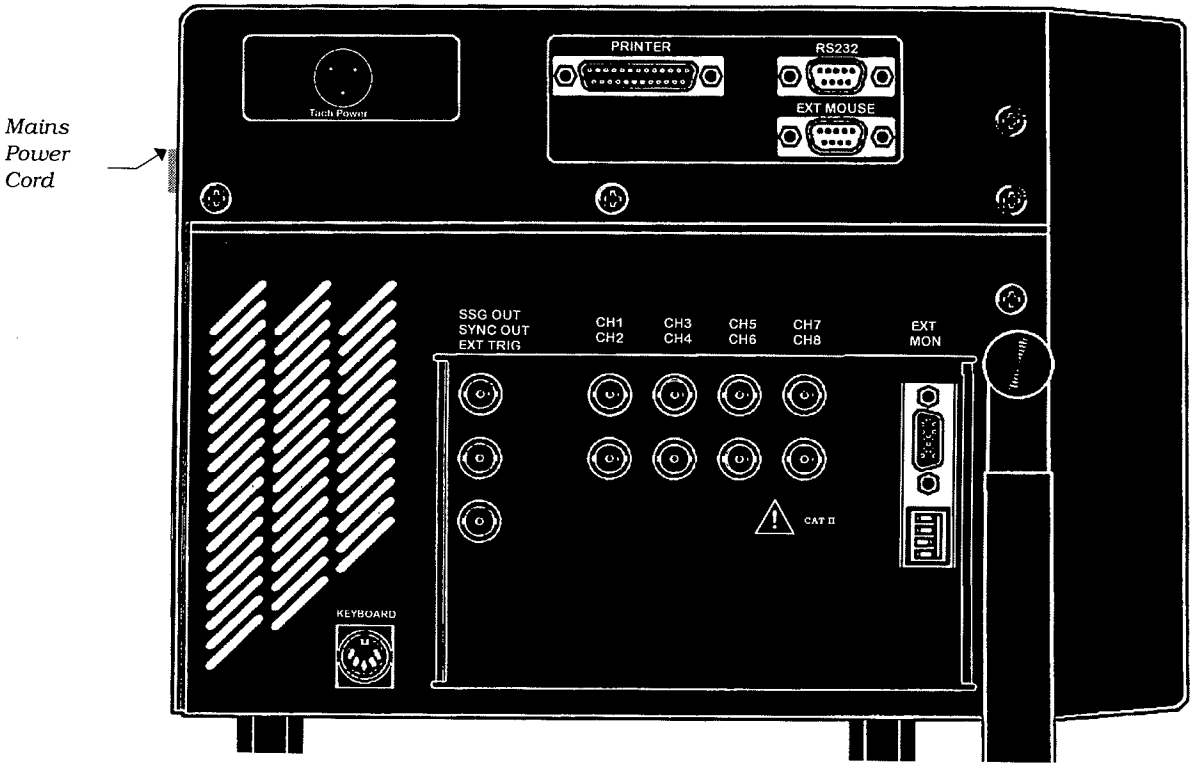
If the instrument is to be reshipped after receipt, use of the original shipping container and packing materials is recommended. If original packing materials are not available, the following materials should be used:

CAUTION

The use of flowable styrofoam packing materials (i.e., popcorn, peanuts, shells, and spaghetti), is a leading cause of equipment damage during shipping. Any shipping damage resulting from the use of flowable packing material by the customer will be charged to the customer.

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Figure 1. SPS390 Side Panel Connectors



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2–5.5.1 Description of the Side-Panel Connectors

Figure 2. Description and Characteristics of the SPS390 Input/Output Connectors

⚠ Connector	Voltage Range	Frequency Range	Description
SSG OUT	±10 Vpk	0 - 100 kHz	With the SSG Option installed, the SSG OUT BNC connector provides one of five types of signal outputs. The output signal type and amplitude are controlled by the Noise Generator and Sine Generator Setup menus.
SYNC OUT	±10 Vpk	0 - 10 kHz	A TTL trigger output coincident with the start of each random sequence is provided at the SYNC OUT BNC connector. Each sequence length matches the memory period of the analyzer. This output can be used as the SYNC TIME trigger input for the SYNC TIME averaging functions.
EXT TRIG	±20 Vpk	0 - 5 kHz	The EXT TRIG Connector is for applying an external trigger or tachometer signal. This connector can accept either an ac coupled or dc coupled signal.

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Figure 4. Keyboard Connector Pin Assignment

Pin #	Assignment
1	+ Keyboard Clock
2	+ Keyboard Data
3	– Keyboard Reset
4	Ground
5	+ 5 Volts

Figure 5. Printer Connector Pin Assignments

Pin #	I/O	Assignment
1	<>	- Strobe
2	>	+ Data Bit 0
3	>	+ Data Bit 1
4	>	+ Data Bit 2
5	>	+ Data Bit 3
6	>	+ Data Bit 4
7	>	+ Data Bit 5
8	>	+ Data Bit 6
9	>	+ Data Bit 7
10	<	- Acknowledge
11	<	+ Busy
12	<	+ Paper End
13	<	+ Select
14	<	- Auto Feed
15	<>	- Error
16	<>	- Init. Printer
17	<	- Select Input
18-25		Ground

Figure 6. RS232 Connector Pin Assignments

Pin #	Assignment	
1	DCD	(Data Carrier Detect)
2	RX	(Receive Data)
3	TX	(Transmit Data)
4	DTR	(Data Terminal Ready)
5	GND	(Signal Ground)
6	DSR	(Data Set Ready)
7	RTS	(Request To Send)
8	CTS	(Clear To Send)
9	RI	(Ring Indicator)

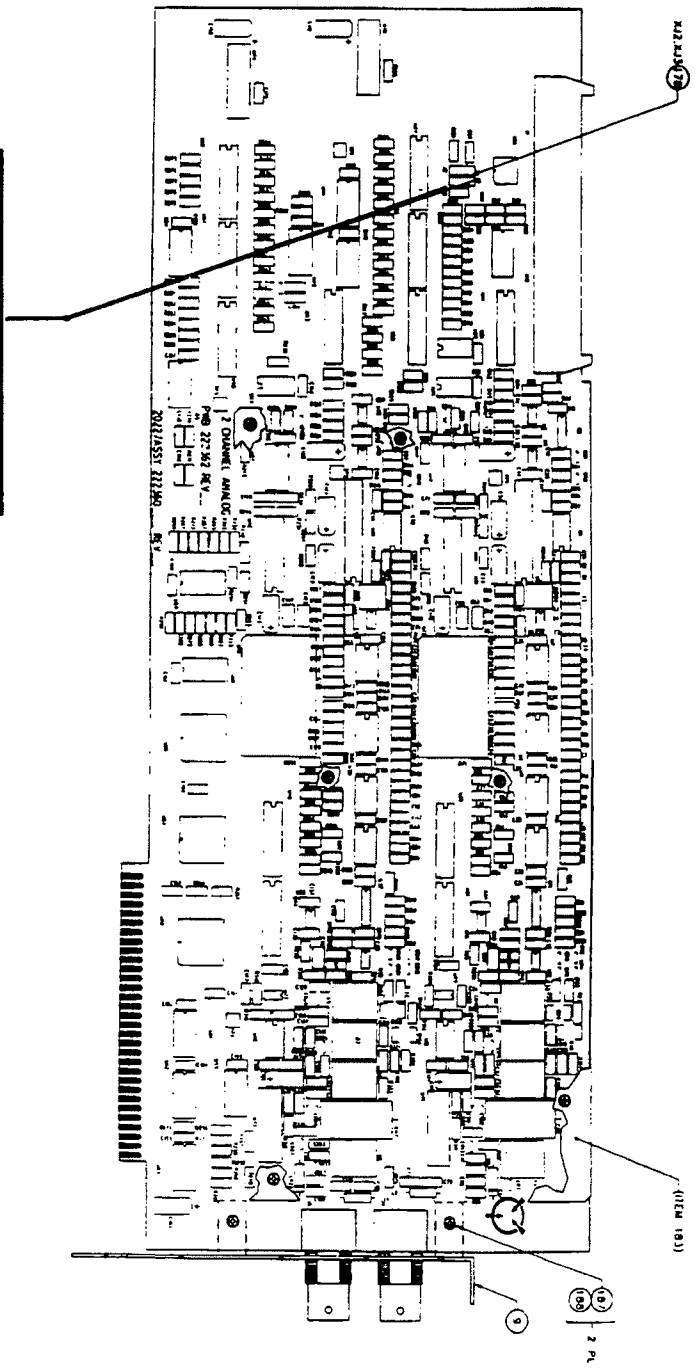
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	double-click the Add/Remove Program option.
4.	**During the** Setup **procedure, you will be prompted to obtain and insert any option software programs that you may have purchased.**
5.	**When the Setup program is complete, the system software is fully installed.**

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Figure 2-2. SPS390 Analog Card — 2 Channel Surface Mount Type 1

JUMPER POSITIONS	
Ch. Pair	**J2 & J3**
1 & 2	Close/ Close
3 & 4	Open/ Close
5 & 6	Close/ Open
7 & 8	Open/ Open



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3–OPERATION

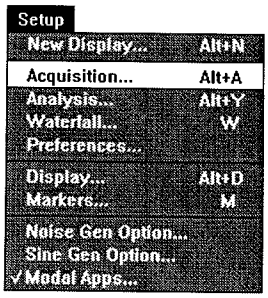
3–1 QUICK START

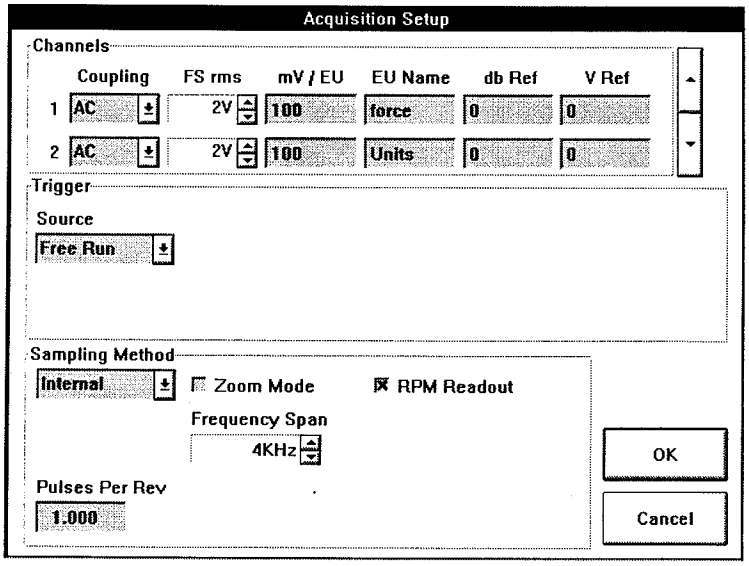
The SPS390 is an extremely flexible system that offers many configuration, acquisition, analysis, and display options. This Quick Start provides a concise approach to a *typical* data acquisition, analysis, and display task, showing the menus and dialogs to be accessed and the order in which to access them. However, this procedure can differ, depending on the application. As you work with the SPS390, the setup procedures for your particular applications will quickly become second nature.

➲ *SPS390 HINT:* ***Before tackling a particular acquisition/analysis task, ask yourself the following questions, in the order shown. They provide a useful guide in deciding how best to proceed.***

What Signal Am I Going to Acquire?

The **Acquisition Setup** menu is typically a good starting point:



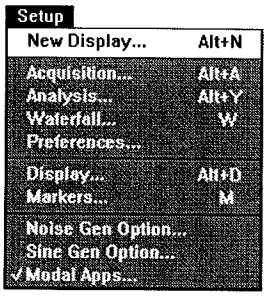


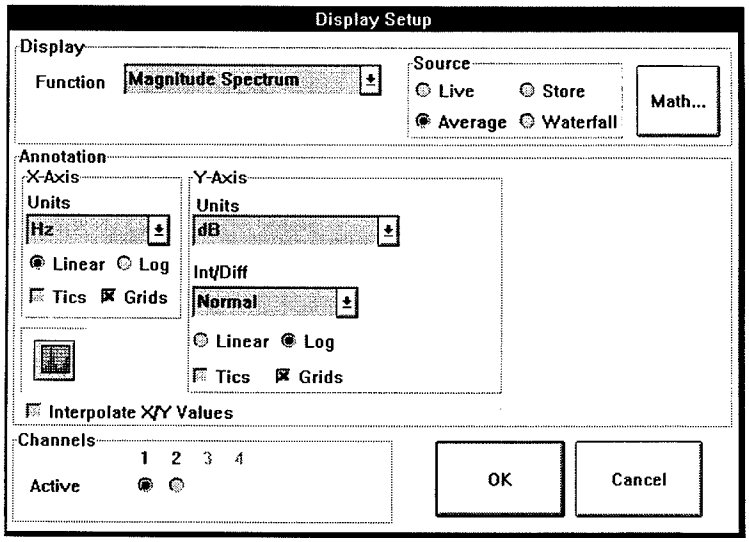
Using this dialog, you can configure the SPS390 input channels setup, trigger conditions, sampling method, etc.

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What Do I Want to Display?

Choose **New Display** on the **Setup** menu to bring up the **Display Setup** dialog, which lets you configure the display to suit your needs.





Here, you specify the display parameters for each window to be used. (Up to 9 windows can be open at once, each with its own distinct set of display parameters.). The **Function** and **Channels** to be displayed, display source, **X**– and **Y–Axis** scale and **Units**, **Interpolation**, and **Math** functions to be performed are all selected here.

At this point, your system is properly configured, and you can begin your measurement, using the control buttons on the screen. (Note that here the control buttons appear at the bottom of the screen; the default screen has the controls at the top. The Preferences dialog under the Setup menu allows you to specify button placement.)

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3–2 GETTING STARTED

To operate the SPS390, use the trackball to move to one of the four function areas of the SPS390.

- Main menus
- Function keys and controls
- Displays
- Status area

Once you have selected a function area, use the trackball selector button to choose the desired operation.

3–2.1 Main Menus

You select functions from these menus by moving the selector cursor (indicated by an arrow) to the desired menu by moving the trackball, then selecting the desired menu function by pressing the trackball selector button. Menu functions may invoke an operation or present a dialog box. Parameter entry into a dialog box is made by using the trackball to scroll through predefined choices, or selecting options, or by entering alphanumeric responses. Parameters are validated, and the SPS390 provides "hints" if you attempt to enter incorrect parameters. All dialogs are then confirmed (OK), or canceled without modification by moving the selector cursor to the appropriate response and pressing the trackball selector button.

3–2.2 Function Keys and Controls

Function keys and controls are accessed by moving the selector cursor over the desired function or control, then pressing the trackball selector button. A visual cue, such as a change in function key color or function name, such as Update to Hold, or specific identifiers, such as a change from the selector cursor to a frequency indicator or line cursor, will result from a valid action.

3–2.3 Displays

Up to nine simultaneous data displays (called traces) can be created in virtually any format, size, and style. You have complete control over the viewing area and can maximize or iconize any trace, and change any trace parameter at any time. Trace windows also contain their own specific display controls that cause specified action local to the selected trace window.

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3–3 OPERATING MODES

The SPS390 can operate from two signal sources:

Live acquisition from analog signal sources,

and

Playback of previously acquired (recorded) digital data residing on internal disk storage. The analyzer can also operate in various analysis Modes allowing selection of the most appropriate method of data collection and analysis.

3–3.1 Data Source

Live Acquisition

The SPS390 is provided with a factory default system configuration which initializes acquisition, analysis, and display parameters. When first turned on, the SPS390 uses this configuration and starts operating in live acquisition mode. You may then control analyzer functions by using the various controls such as Update/Hold, AVG Start, selecting frequency span, or reconfigure any of the SPS390 parameters such as display type, analysis resolution, or acquisition mode to suit your particular requirements.

When in the update mode, time domain data is continually acquired into the SPS390 XRec memory, and processed on a block basis (determined by FFT spectral resolution and overlap), which is controlled by a digitizing clock and trigger. As data is being acquired, LIVE spectral processing and averaging can occur, creating data sources for display. All calculated and displayed data is in 32-bit floating point precision, yielding a dynamic range in excess of 90 dB.

Although the data is acquired into each channel's recorder memory at precisely the same time, data is displayed in each trace display window serially while the SPS390 is in Update. This may result in the appearance of non-coherent data. However, as soon as the system is placed in Hold, all active display windows are updated with synchronous, coherent data from the same instant in time. When using single-triggered mode, the system is placed into Hold after the trigger event is detected.

In the FFT mode, the SPS390 can achieve a sampling rate of 256 kHz for two channels, yielding an effective spectral frequency range of 100 kHz for two channels. For three or more channels, the highest frequency range is 40 kHz. In Octave mode, the maximum center frequency for the top band of the selected analysis is 20 kHz.

Playback

Live acquisition and processing occurs while the SPS390 is in Update mode. When placed in Hold, the SPS390 can enter playback mode in order to review or reanalyze data that has been stored in the XRec memory.

Instead of acquiring live data from a signal source, data is "played back" from the XRec memory, and most analysis and display functions are available as though the data were live. The only restraint is that there has been a finite amount of data recorded, and certain functions stop automatically when the end of data is encountered.

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3–4 EXTENDED RECORDER MEMORY

The SPS390 has a very large DSP dynamic RAM memory, which can be used for different purposes in different analysis modes. The amount of selected memory, in addition to the selected mode, can provide increased performance of the analyzer for particular measurements.

The Extended Recorder (XRec) memory of the SPS390 can contain over 400,000 samples of time domain data (for 1 MB configurations) to 3.6 million samples of time domain data (for 8 MB configurations) depending upon selected analysis parameters. The total amount of available XRec memory is divided by the number of active channels, and is user selectable from 8192 samples to the maximum displayed on the **Analysis** Dialog for a specific setup. In addition to recording time data to internal memory for playback or storage, the selection of the amount of available XRec memory will influence the level of zoom above 10 kHz and the delay for triggering. (For more information on these topics, see More On Extended Recorder Memory in Section 8.)

Incoming signals are digitized and entered into XRec memory on a continuous basis while the SPS390 is in **Update** mode. Extended recorder memory is a circular buffer— meaning that when the last location is filled data wraps around to the beginning of memory so that the XRec memory always contains the most recent data. When the SPS390 is placed in Hold, the XRec memory is unwrapped so that the most recent data appears to the right on a time trace, and block 0 is the least recent block that will be processed.

In the **Free Run Trigger** mode for frequencies less than 40 kHz, data continues to fill the XRec memory until **Hold** is pressed. When the SPS390 is operating at 40 kHz or 100 kHz, only 1 block of data is acquired into XRec memory. In any triggered mode, for ALL frequencies, data is acquired into XRec memory until a trigger event (the trigger plus the specified delay) is detected. For single trigger, acquisition stops when the XRec buffer is full, after the trigger event is detected, and the SPS390 automatically goes into Hold. For Multiple Trigger, the trigger event is processed and acquisition continues.



As trigger events can be random, the XRec memory may contain varying trigger events when the event is less than the size of XRec. You cannot calculate the number of events from the block size and delay, when using multiple trigger.

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3–6 DATA BUFFERS

3–6.1 Overview

In addition to XRec memory and waterfall memory there are three classes of data storage, or memory areas that contain data that has been converted from the XRec memory to the specified units, or calculated quantities:

- Live, or Real Time
- Averaged
- Stored Average, or Store

The number and size of these internal data areas are dynamically allocated based on the selected analysis mode and parameters set on the **Analysis Setup** dialog. The contents of these buffers may be cleared when the mode configuration changes or when particular analysis parameters change.

Just as important, selecting the appropriate analysis mode affects the types of analyses and displays that can be produced and influences the real-time rate of the SPS390. The standard mode selections are:

Correlation

This mode enables auto and cross correlation measurements.

Cross Properties

This is the default mode that results in the most versatile use of the SPS390 in spectrum mode, in that all analyses and displays (except for sync spectra) are available.

Spectrum

This mode is used when only time and spectral data are required. It conserves internal resources, and allows very high real-time rates for Live and averaged spectral processing. Published real-time rates for the SPS390 are for this mode.

Sync Spectrum

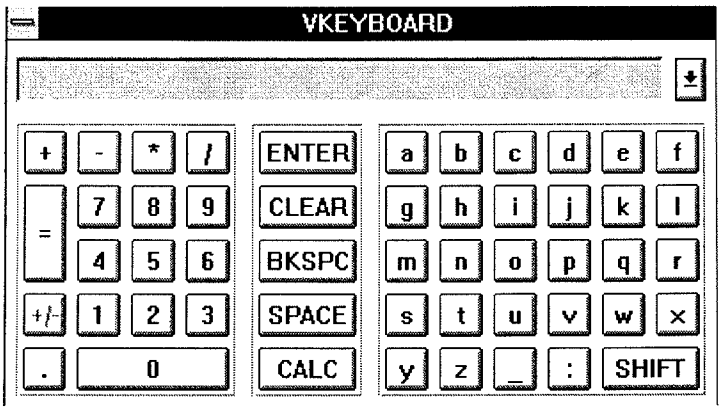
This mode is used when time synchronized averaging is required.

Octave

This mode enables 1/1 and 1/3 octave analysis. Discrete digital filters are used to compute the amplitude levels of the selected bands.

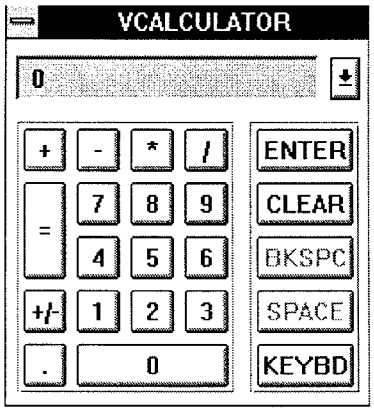
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3–7 VIRTUAL KEYBOARD AND VIRTUAL CALCULATOR



The virtual keyboard is a template of alphanumeric characters that can be selected using the trackball cursor and selector button. It is useful for entering parameters such as transducer sensitivities, Engineering Unit (EU) names, and reference levels. Whenever text entry is required, double click on the text entry box of the dialog to invoke the virtual keyboard (except when storing and retrieving named files — a Windows™ function). Then, position the trackball cursor arrow over the desired character, and press the selector button to select the character. When all the desired characters are selected, place the arrow cursor over the **ENTER** key, and press the selector button to enter the characters. The **SHIFT** key can be used for entering either upper or lower case letters.

You can use **BKSPC** to delete characters, or **CLEAR** to delete all characters. If you want to exit the virtual keyboard without modifying the existing text, click on the virtual keyboard close icon located at the top left of the virtual keyboard window.



Whenever numeric entry is required, the virtual calculator can be used instead of the virtual keyboard. The virtual calculator operates similarly to a desktop calculator, and allows you to enter numeric values, or compute numeric quantities, which can be used as parameters. You may switch between the virtual keyboard and the virtual calculator by using the **KEYBD** and **CALC** buttons on the respective virtual device.

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Extended Recorder Files

Extended recorder files contain binary data of the contents of XRec memory. Also included with the data are the acquisition setup and analysis setup parameters that were in effect when the data was saved. These files can be fairly large, and should be carefully managed.

These files are used by the Save and Load XRec commands. The SPS390 convention is to append **".xrc"** to the name of these files.

Note that the Save command is *global*—all active channels are saved, whether or not they are displayed. Again, it is important to note that large files can be created that require careful management.

Averager Data Files

Averager data files can be used whenever cross properties averaging is performed. These files contain the active and reference channel power spectrums, as well as the real and imaginary parts of the cross spectrum between the active and reference channels. All standard Frequency Response Function (FRF) displays can be formed upon recall of this data. The SPS390 convention is to append "**.avg**" to the name of these files.

The **Save Averager** command is global; all active channels are saved, whether or not they are displayed, which can result in large files.

Waterfall Data Files

Waterfall data files contain binary data of the contents of waterfall memory. Also included with the data are the acquisition setup and analysis setup parameters that were in effect when the data was saved. These files can be fairly large, and should be carefully managed.

These files are used by the **Save** and **Load** waterfall commands. The SPS390 convention is to append **".wfl"** to the name of these files.



All of these files must be managed by DOS or Windows file management utilities. The SPS390 allows creation and use of these files, but you are responsible for deleting, archiving, or transferring these files.



All data files have an ASCII header that can be viewed via the DOS "type" command, or by a Windows utility such as Notepad.

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3–9 DYNAMIC DATA EXCHANGE

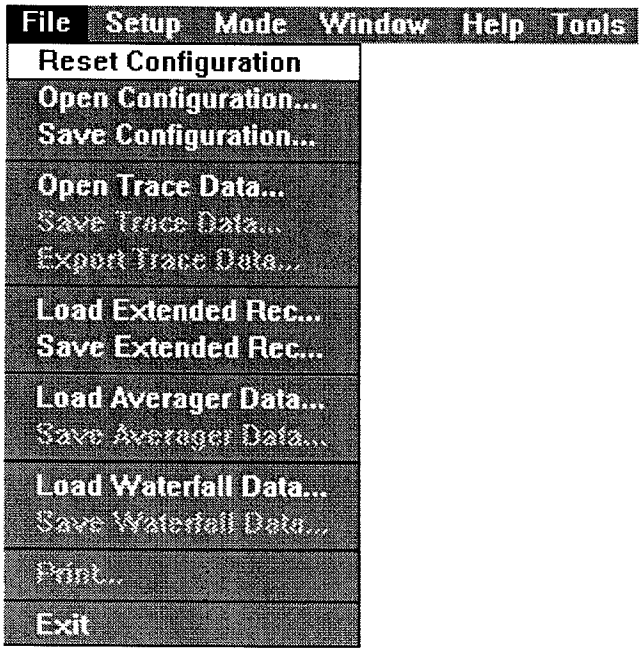
Dynamic Data Exchange (DDE) allows data to be linked between two Windows programs running at the same time. With the DDE linkages incorporated into the SPS390 software, it is possible to transfer SPS390 data in real-time to a program, such as Excel™, which is running simultaneously. This allows the user to take advantage of powerful Excel display capabilities. For example, sometimes data being collected can be compared more easily in a bar graph or pie chart form. In such a case, real-time data can be transferred to Excel using the DDE feature, where it can be viewed as a chart. The values shown in the chart will update automatically in real-time.

☞ *Additional topics on DDE can be found in Section 6*

3–10 MAIN MENUS

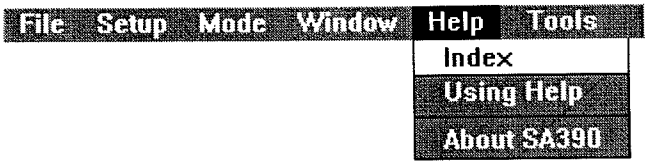
Six main menu items displayed on the top menu band allow accessing of all the features and functions of the SPS390.

➢ The **File** menu contains functions to save and restore system configurations, to save, restore, and export data, and to display data on hard copy devices.



➢ The **Setup** menu accesses dialogs to create and modify acquisition, analysis, and display parameters.

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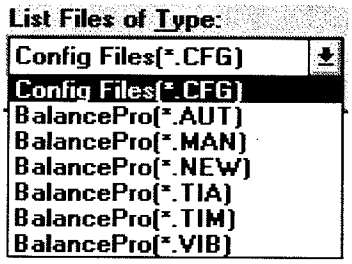
➢ The **Tools** menu allows the user to have quick access to up to four Windows™ programs or routines without leaving the SPS390 application.



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- Settings for the optional Signal Source Generator (SSG), if installed. If not installed this will prompt a notice that the SSG settings were attempted and failed. No adverse operational effects will take place other than there will be no SSG operation.
- All pre-configured display windows.

Under the **List Files of Type**: you may select from a number of configuration files available to the SPS390, SPS610 BalancePRO, and optional vibration survey software packages.



- **Config Files (*CFG)** are user defined SPS390 configuration files
- **BalancePRO (*.AUT)** files are files that support the automatic data acquisition for specific engine types.
- **BalancePRO (*.MAN)** files are files that support the manual data acquisition for specific engine types.
- **BalancePRO (*.NEW)** is a spare file type reserved for a future enhancement of the BalancePRO system.
- **BalancePRO (*.TIA)** files are files that support timed automatic data acquisition runs for vibration surveys without a tach signal.
- **BalancePRO (*.TIM)** files are files that support timed manual data acquisition runs for vibration surveys without a tach signal.
- **BalancePRO (*.VIB)** files are files that support automatic data acquisition for vibration surveys of specific engine types with a tach signal.

If no setup has previously been saved, this command has no effect.

☞ *The **Open Configuration** dialog is used to select a particular configuration file from a selected directory and storage device.*

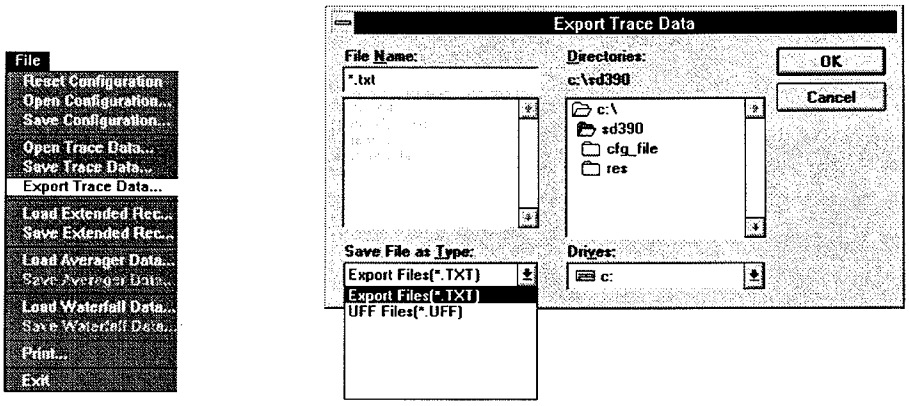
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- The **Config Files (*.CFG)** are user defined SPS390 configuration files. These files are exclusive to the SPS390.
- The BalancePRO (*.**AUT**) file is the file used to perform the automatic data acquisition of a machine run-up. While many of the settings are made for specific machines or engines, generically the **.AUT** files are intended to store magnitude and phase information in a waterfall file that is acquired on a delta RPM basis. All of the changes made are made on the acquisition, analysis, and waterfall pages. Display and screen changes are optional and not mandatory for .AUT files to operate properly. For more information on these files see the SPS610 BalancePRO Installation and Operation Manual, SPS document number 222856.
- The **BalancePRO (*.MAN)** file is the file used to perform the manual data acquisition of a machine or engine run-up. While many of the settings are made for specific machines or engines, generically the **.MAN** files are intended to store magnitude and phase information in a waterfall file that is acquired on a plus (+) one basis at operator selected speed points. All of the changes made are made on the acquisition, analysis, and waterfall pages. Display and screen changes are optional and not mandatory for **.MAN** files to operate properly. For more information on these files see the SPS610 BalancePRO Installation and Operation Manual, SPS document number 222856.
- The **BalancePRO (*.TIA)** file is a file used to perform an automatic acquisition of a machine (or engine) run-up and coast down without a tach signal. While many of the settings are made for specific machines or engines, generically the **.TIA** files are intended to store Magnitude information in a Waterfall file that is acquired on a Delta Time basis within a specified time frame. All of the changes made are made on the Acquisition, Analysis, and Waterfall pages. Display and screen changes will influence the overall level that gets reported for display readout. For more information on these files see the SPS610 BalancePRO Installation and Operation Manual, SPS document number 222856.
- The **BalancePRO (*.TIM)** file is a file used to perform a manual data acquisition of a machine (or engine) run-up or coast down without tach signal within a specified time. While many of the settings are made for specific machines or engines, generically the **.TIM** files are intended to store Magnitude information in a Waterfall file that is acquired at specific operator selected speed points (+1) within a specified time frame. All of the changes made are made on the Acquisition, Analysis, and Waterfall pages. Display and screen changes will influence the overall level that gets reported for display readout. For more information on these files see the SPS610 BalancePRO Installation and Operation Manual, SPS document number 222856.
- The **BalancePRO (*.VIB)** file is the file used to perform the automatic data acquisition of a machine run-up and/or run-down for a vibration survey. While many of the settings are made for specific machines or engines, generically the **.VIB** files are intended to store Magnitude and Phase information in a Waterfall file that is acquired on a Delta RPM basis. All of the changes made are made on the Acquisition, Analysis, and Waterfall pages. Display and screen changes will influence the overall level that gets reported for display readout. For more information on these files see the SPS610 BalancePRO Installation and Operation Manual, SPS document number 222856.

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3–10.1.6 Export Trace Data

Displayed data can be exported to other programs or other systems by using the **Export Trace Data** function. The desired data is selected by moving the arrow cursor to the title bar of the desired display window, and clicking the selector button.



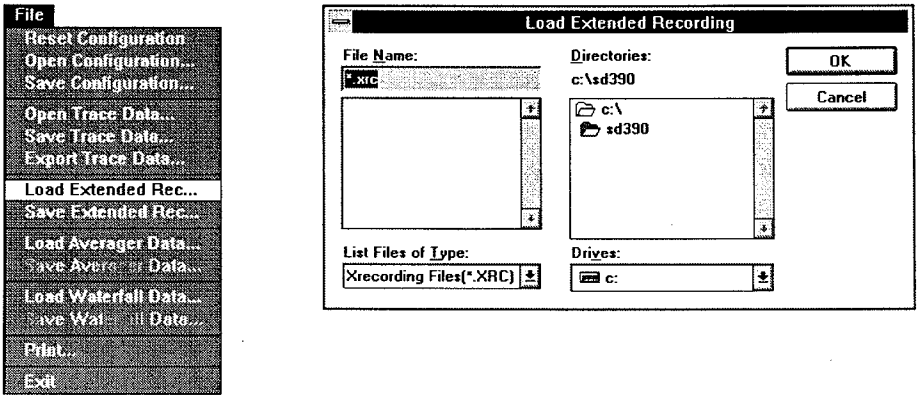
60655-36/32

The **Export Trace Data** Dialog will then allow you to name a file where the data is to be placed. The data is stored on a disk file in ASCII format, in the displayed Units. The format of the Export Files is described in this manual.

☞ *Compressed Time Displays cannot be Exported. The default directory and storage device is the current directory,* ***C:/sd390****.*

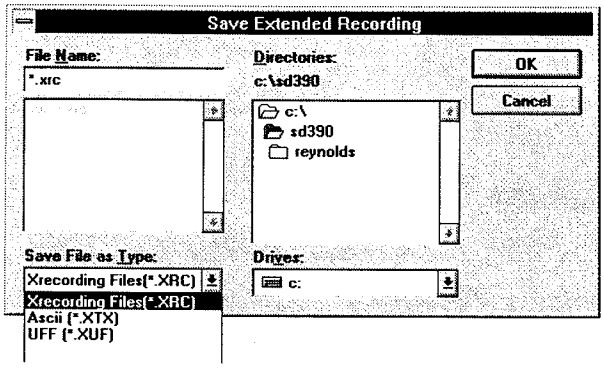
3–10.1.7 Load Extended Recording

Data from the SPS390 extended recorder memory that has been previously saved to a named disk file is retrieved and loaded into extended recorder memory. The acquisition and analysis parameters that were in effect when the data was saved are also restored.



When **Load Extended Rec** is selected, acquisition (and averaging), if active, is stopped. The **Load Extended Recording** dialog will then allow you to name the file from which to retrieve the data.

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When UFF or Text formats are selected, up to 9 separate files are created; 1 file for each active channel, plus a "container" file which is merely a description of the date and number of channels saved in this data set. The container files are:

- <filename>.XUF (UFF format)
- <filename>.XTX (Text format)

The corresponding data files are:

- <filename>.XU1...8 (UFF format)
- <filename>.XT1...8 (Text format)

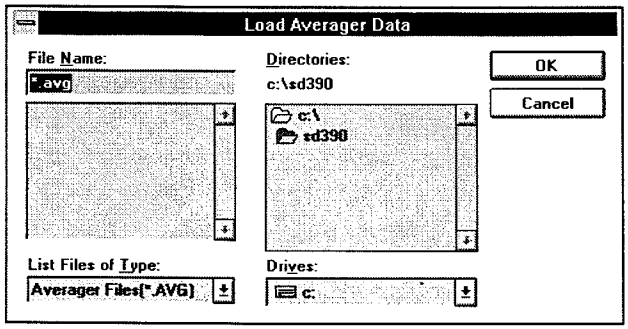
Each data file contains a single channel, in corresponding UFF or TXT Time format.

Whenever a new 'set' is created which will overwrite the existing 'set', the user is prompted, and all previous channel files are deleted if the user wishes to replace a data 'set'. Individual channel data files can not be saved separately.

3–10.1.9 Load Averager Data

Averaged data that was previously saved to a named disk file is retrieved and loaded into averager memory.





When **Load Averager Data** is selected, the Analyzer is first put into HOLD. The **Load Averager Data** dialog will then allow you to name the file from which to retrieve the data.

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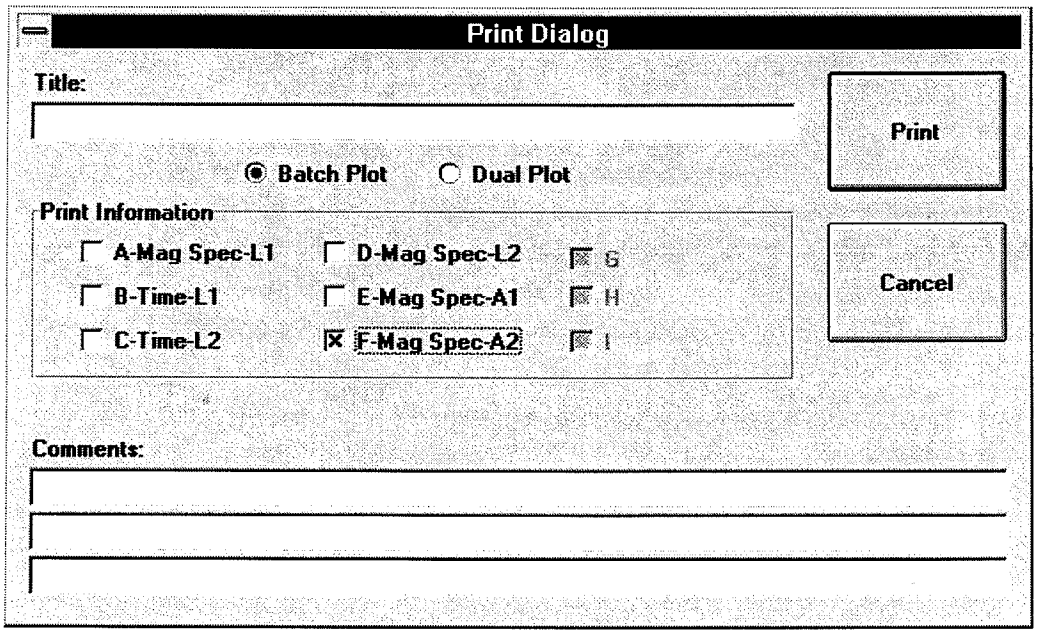
Data from a waterfall data disk file can be loaded at any time. However, all current data and acquisition and analysis parameters are replaced by the saved data and saved parameters. These parameters may not be compatible with the current settings and may invalidate the current averager, and/or waterfall memory and associated displays. Therefore, it's good practice to stop acquisition before Loading this data, although this function will automatically stop all acquisition functions if active.

☞ *Waterfall data cannot be exported.*

☞ *The default directory and storage device is the current directory, C:/sd390.*

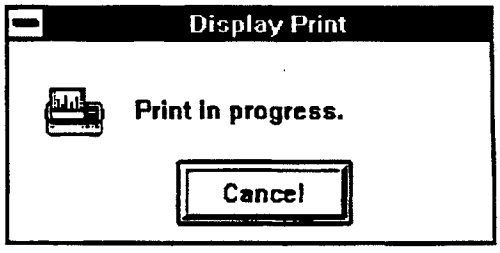
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The SPS390 analyzer display will cease to update at this point. However, internal signal processing functions such as memory loading or averaging will continue behind the scenes. This will allow you to make changes to the **Title** or **Comments** section without stopping the signal processing. However, these signal processing functions will stop when the print command is issued.



60655-33

Make the appropriate selections on the **Print Dialog** and then either select **Print** or **Cancel**. **Cancel** will cancel any entries or selections that were made and the last SPS390 display will be activated again. Selecting **Print** will start the print process.



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Landscape

Batch Plot will plot a single plot per page with the **Title** at the top and the **Comments** on the bottom. This is the largest printed plot available.

Dual Plot is not available in landscape format.

Plot plus List is not available in landscape format.

Title and Comments

Any text entered into the **Title** or **Comments** lines of the **Print Dialog** will remain as entered until changed by the operator. The entered text will even remain in subsequent sessions of SPS390 sessions even if power is removed.

SPS390 HINT *When a number of plots are going to be produced, to document a measurement process on a single item or a series of items, keep the identifiers you enter in the Title and Comments near the beginning of the text so that incremental changes to the sequence can be made easily. i.e. Plot X of Item Y First Production Run Vibration Test. Where X is the number of the plot and Y is the serial number of the item being tested. In this example, the operator only has to retype the X and the Y for all the plots produced.*

Print Date and Time

There is no need to enter the date and time for any printout from the SPS390. Date and Time is an automatic process of the software. The data being printed has a date and time entry as to when the data was taken and the printout has a date and time of when the print is performed. The date and time of when the print is performed shows up on the same line as the Title line on each printed form.

Other Print Capability

The SPS390 and the standard Windows tools allows for screen capture using the standard 101 keyboard print screen command. This action places the entire SPS390 display screen on the Windows clipboard as a bit mapped (.BMP) file. This BMP file can then be imported directly into other Windows programs that support the importation of .BMP files.

There are a number of more elaborate screen capture programs available for Windows programs and allow for more sophisticated screen captures.



It is important to note that printed data from a bitmap file can be altered in programs such as Microsoft Paintbrush, whereas the prints from the SPS390 print selection cannot be altered.

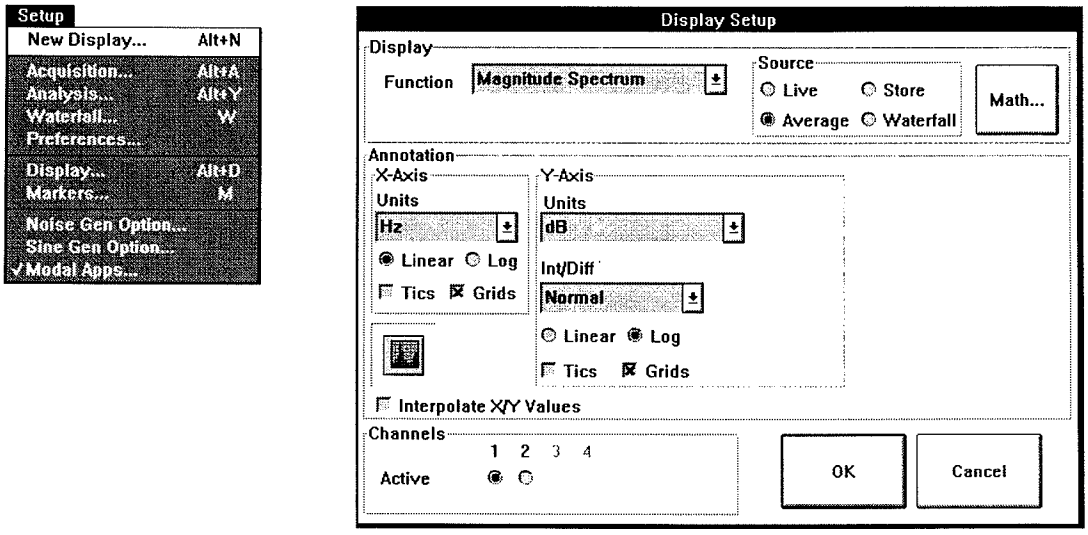
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3–10.2 Setup Menu

The following parameters can be set, modified, and examined by selecting the appropriate topic from the **Setup** Menu.

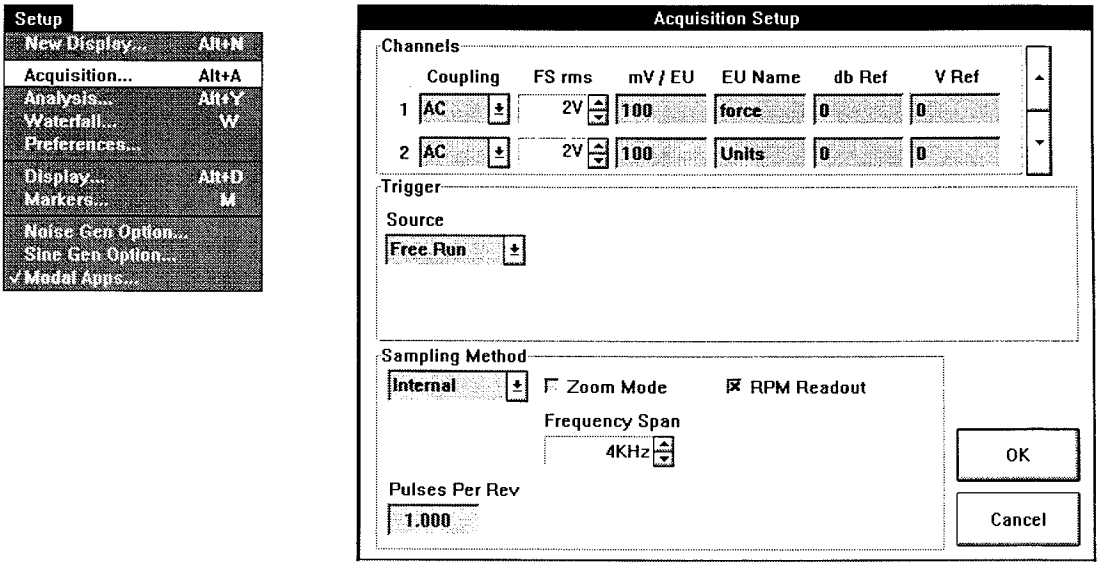
3–10.2.1 New Display

Invokes the **Display Setup** dialog to specify the settings for a new display.



3–10.2.2 Acquisition

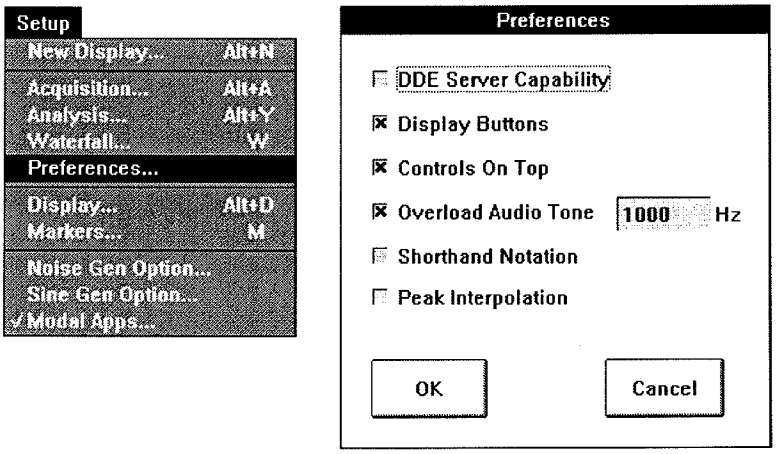
Invokes the **Acquisition Setup** dialog to change the SPS390 data acquisition parameters.



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3–10.2.5 Preferences

Clicking on **Preferences** on the Setup menu invokes the Preferences dialog. This allows the user to control some display configuration elements and other features. For example, control buttons can be displayed at the top or bottom of the screen. (Top is the default.)



DDE Server Capability

Clicking in this box activates the dynamic data exchange server, allowing the exchange of data between the SPS390 and other Windows applications.

☞ *See section on dynamic data exchange.*

Display Buttons

When this box is clicked, the buttons along the right-hand edge of the display are shown. (These buttons are labels for the function keys on the SPS390 front panel, and also function independently as on-screen buttons.) If the box is not clicked, these buttons do not appear. However, the function keys remain active at all times.

Controls on Top

This button determines whether the control buttons are displayed at the top or bottom of the screen. Where these buttons are displayed is a matter of personal preference. The default is to display them at the top.

Overload Audio Tone

When this box is checked, an audio tone is emitted whenever an overload condition occurs. The frequency of this tone can be set by typing in the desired value in the box to the right. (The default tone is 1000 Hz.)

Shorthand Notation

This selection provides a choice of standard or "shorthand" notation on the cursor readouts. Standard cursor notation uses prefixes that present the greatest possible dynamic range (milli-, kilo-, micro-, Mega-, etc.). When shorthand notation is used, "real" values are shown for both X– and Y–axis cursor readouts.

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A-Mag	Spec-L1,	04/03/94	12:32:21,	Harmonic Markers
1	5666	CPM		1.604 Gp
2	11332	CPM		0.782 Gp
3	17004	CPM		0.531 Gp
4	22659	CPM		0.276 Gp
5	28340	CPM		0.47 Gp
6	34004	CPM		0.388 Gp
7	39679	CPM		1.032 Gp
8	45347	CPM		1.168 Gp
9	50935	CPM		0.392 Gp
10	56623	CPM		0.505 Gp
11	62361	CPM		0.404 Gp
12	67993	CPM		0.643 Gp
13	73800	CPM		0.336 Gp
14	79200	CPM		0.192 Gp
15	84778	CPM		0.062 Gp
16	90544	CPM		0.034 Gp
17	96300	CPM		0.011 Gp
18	101860	CPM		0.033 Gp
19	107700	CPM		0.042 Gp
20	113306	CPM		0.048 Gp

Note that here the FFT bin spacing is 300 CPM, yet with **Interpolation** selected, the effective marker resolution is virtually ±1 CPM.

The following Notepad listing shows the same set of harmonic markers, but this time **Interpolation** was turned off. Note that each of these is set on 300 CPM bin-centered values

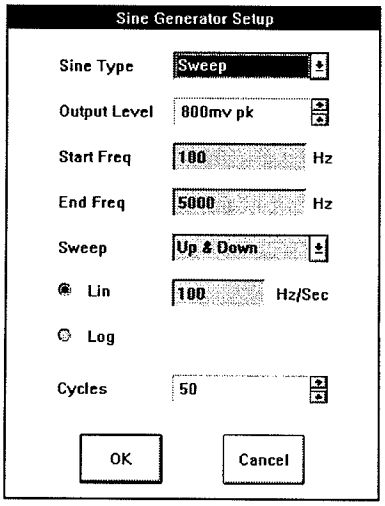
A-Mag	Spec-L1,	04/03/94	12:47:03,	Harmonic Markers
1	5700	CPM		1.59 Gp
2	11400	CPM		0.757 Gp
3	17100	CPM		0.497 Gp
4	22800	CPM		0.239 Gp
5	28500	CPM		0.391 Gp
6	33900	CPM		0.358 Gp
7	39600	CPM		0.987 Gp
8	45300	CPM		1.149 Gp
9	51000	CPM		0.38 Gp
10	56700	CPM		0.484 Gp
11	62400	CPM		0.399 Gp
12	68100	CPM		0.593 Gp
13	73800	CPM		0.336 Gp
14	79500	CPM		0.219 Gp
15	85200	CPM		0.009 Gp
16	90600	CPM		0.033 Gp
17	96300	CPM		0.011 Gp
18	102000	CPM		0.028 Gp
19	107700	CPM		0.042 Gp
20	113400	CPM		0.045 Gp

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3–10.2.9 Sine Generator (Option)

Invokes the **Sine Generator Setup** dialog to set parameters for a swept or dwell sine signal output, and to initialize signal output.

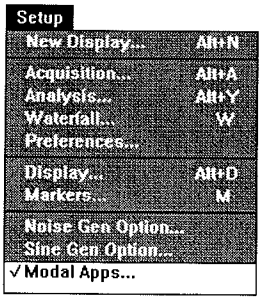


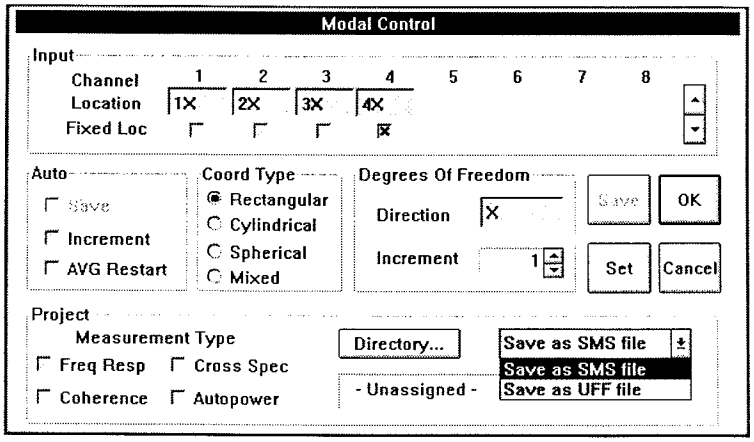


3–10.2.10 Modal Apps (Option)

Invokes the **Modal Control** setup dialog to specify parameters and initiate saving FRF data in SMS modal or UFF format.

When **Modal Apps** is selected, button **F10** in the lower right-hand corner of the display will change to a button labeled **Modal**. Click on that button to bring up the **Modal Control** dialog box.





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Correlation

This mode allows correlation measurements, which can be used to understand certain signal relationships in the time domain and also can give an accurate assessment of signal delay time between two observation points.

Cross Properties

This is the default mode which results in the most versatile use of the SPS390 in spectrum mode, in that power spectrum and cross property data (transfer functions, cross spectrum, etc.) is available, and almost all analyses and displays (except for sync spectra) are available.

Spectrum

This mode is used when only time and power spectral data is required. It conserves internal resources, and allows very high real time rates for live and averaged spectral processing.

Sync Spectrum

This mode is used when time synchronized averaging is required. This mode must be enabled for synchronous spectrum displays as it enables time averaging.

☞ *If the Octave Analysis Option is installed, the Octave Mode selection also appears.*

Octave

This mode enables octave analysis in place of spectrum analysis. Discrete digital filters are used to compute the amplitude levels of the selected bands.

The **Analysis Mode** will also automatically select the averager domain. This determines the types of analyses and displays that can be produced.

☞ *See data sources in the display dialogs for more information.*



The availability of certain trace displays is affected by the current mode. The factory default **Mode** is set for **Cross Properties**. See the table in the description of the **Display Setup** dialog's display type control.

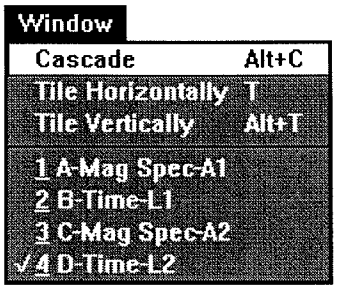
The real time rate of the SPS390 is controlled by careful selection of the analysis mode. For the fastest real time spectrum analysis rates, set the domain to spectrum. Of course, the prime determinant of the domain setting is the type of analysis required.

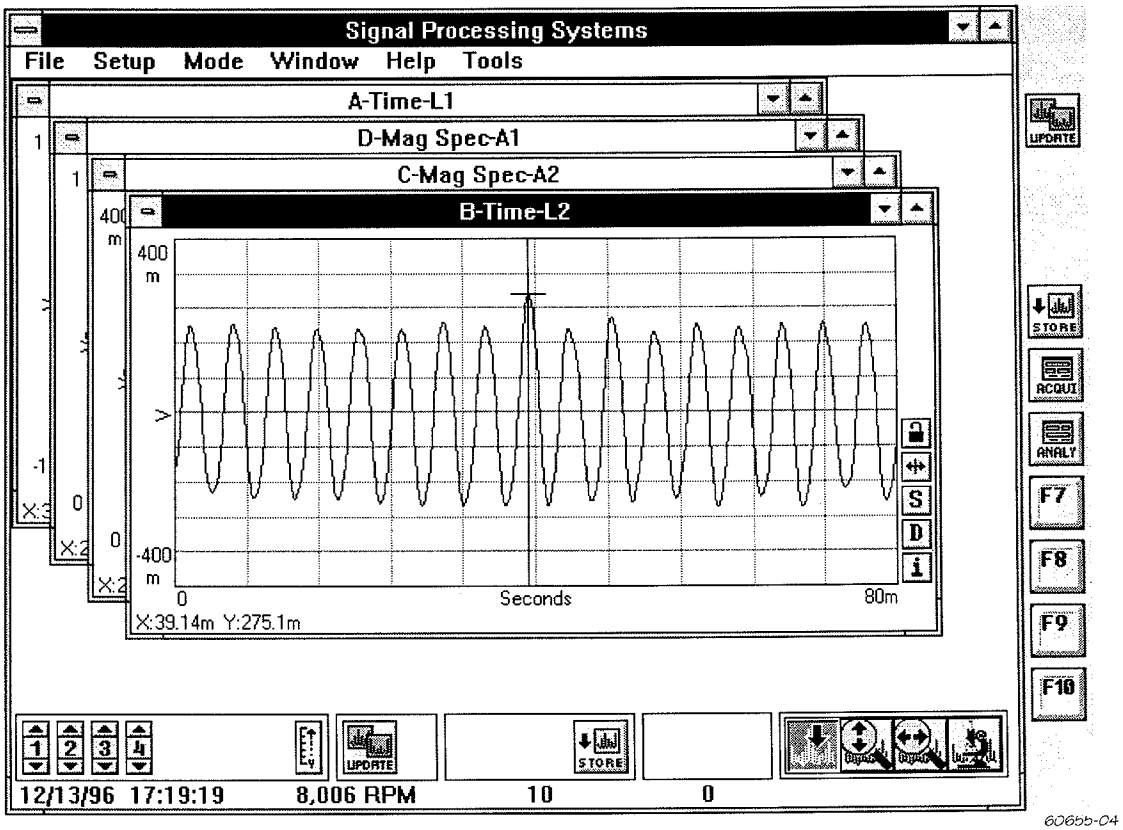
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3–10.4 Window Menu

3–10.4.1 Cascade

Organizes the display windows so that they stack-up one atop another but with the title bar and left-hand edge of each display window being visible as shown.



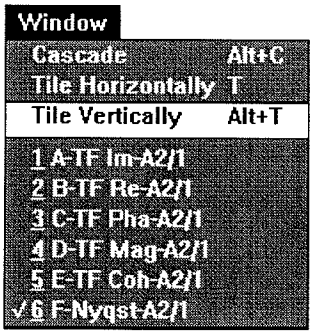


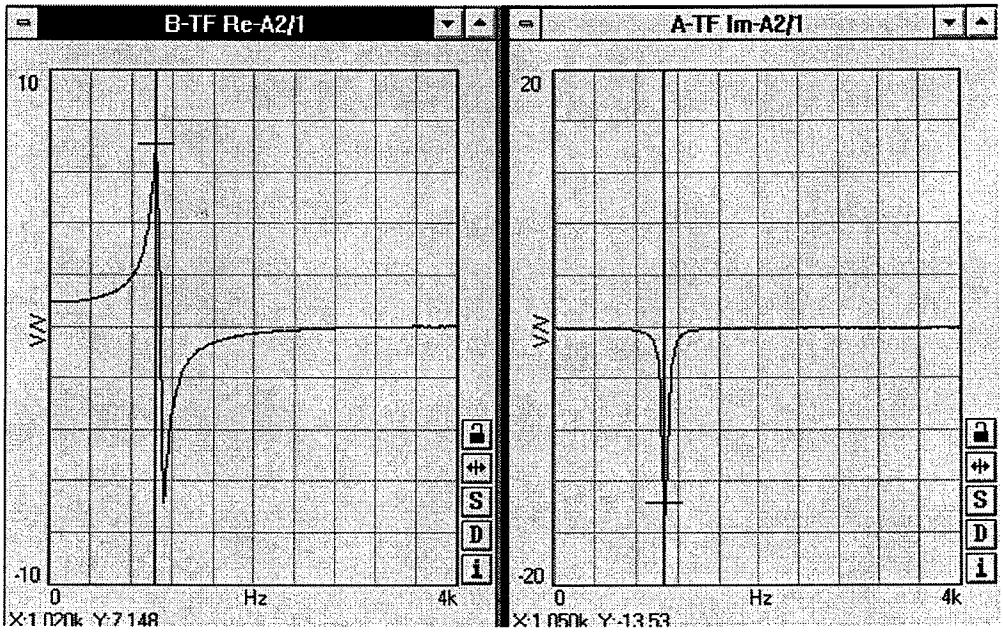
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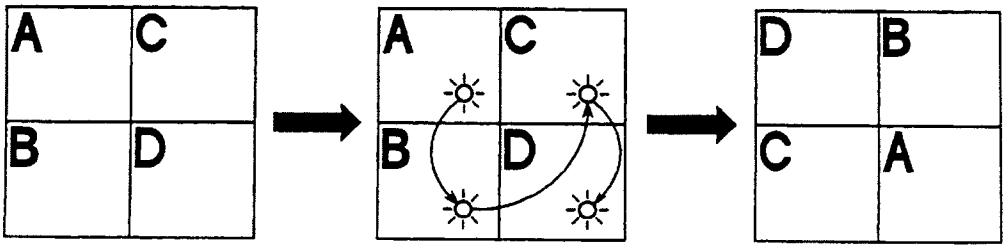
3–10.4.3 Tile Vertically

Tiles all display windows vertically within the frame window by moving and resizing them so that no window overlaps another and all area within the frame window is used. Refer to the following example.





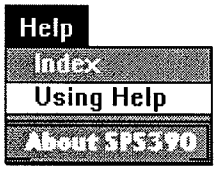
Display windows are tiled in the opposite order in which they are made active (a display window is made active by clicking anywhere on it). The following diagram illustrates this process.



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3–10.5.2 Using Help

The Using Help selection invokes the Microsoft Windows help system user's manual. Use this if you have any questions about the help system.



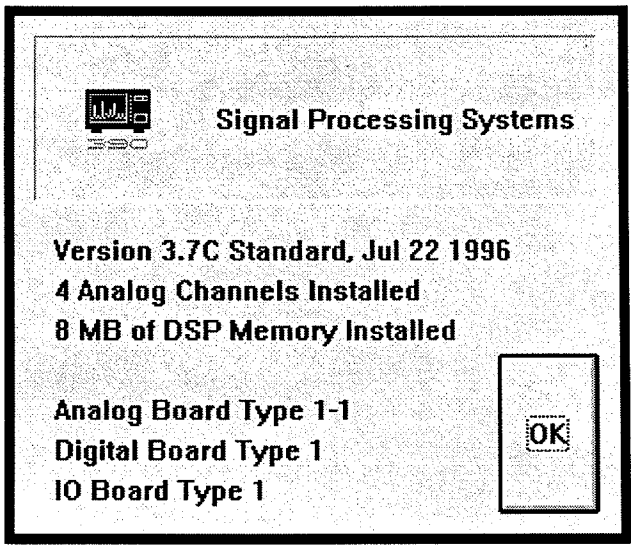
3–10.5.3 About SPS390

The **About SPS390** dialog displays the hardware configuration of the SPS390 plus the application system version number, as well as the date and time the application version was created.

If you have any question about the configuration of your particular SPS390, refer to this dialog. This dialog can also provide useful diagnostic information concerning the operation of the hardware, and can indicate possible incompatibilities when transferring files from one machine to another.

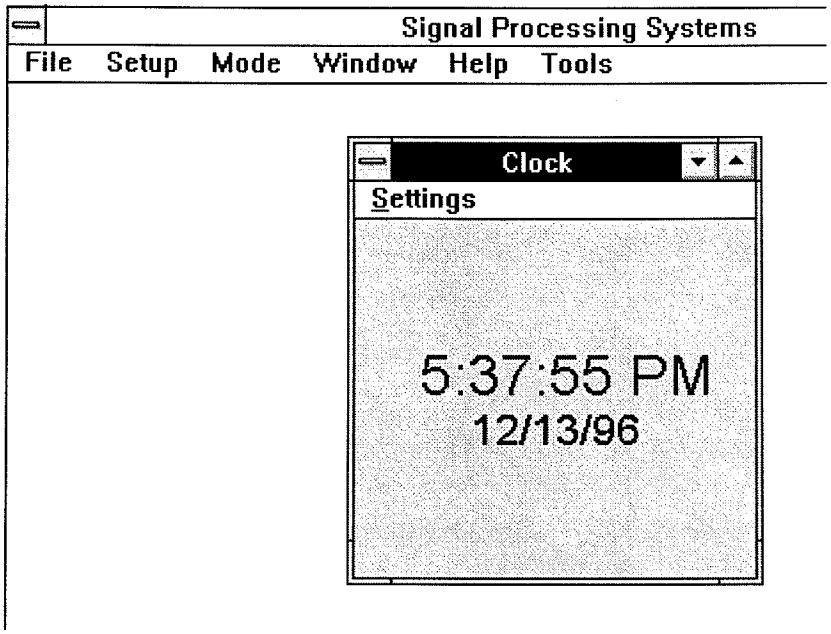
When finished, click on the **OK** button at the bottom right corner of the dialog.





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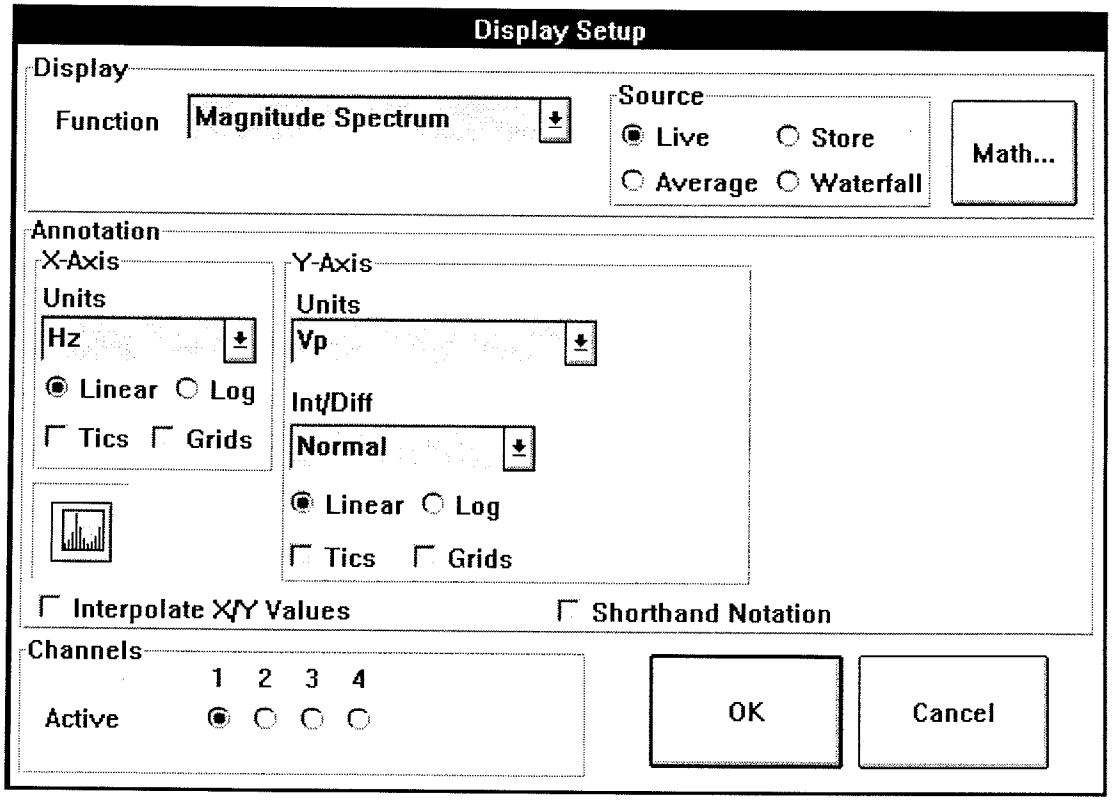
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3–11 DIALOGS

3–11.1 Display Setup

The **Display Setup** dialog box is used to initialize a new display or modify the existing display parameters for an SPS390 display window. These parameters include:

- **Display Function**
- **Display Source**
- **Annotation X-** and **Y-axis Units**
- **X-** and **Y-Axis** scaling
- **Channel**(s) to be displayed
- **Math** functions



Display parameters, as opposed to acquisition and analysis parameters, are local to the display window. Creating a display or changing the parameters of a display has no effect on other displays or on the global SPS390 parameters.

The SPS390 allows up to nine display windows. After nine displays have been created, you cannot create more without first disposing of some of the existing display windows, as described in the display area section of this manual.

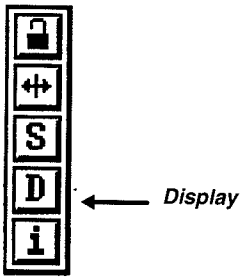
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➢ Or use the keyboard:

Hold down the **ALT** key and press the **D** key.

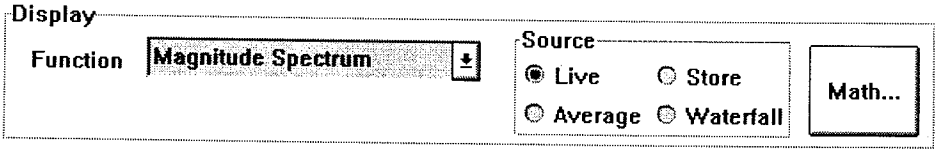
or

Select **D** in the Active Trace Window.



The display parameters for the active display are not changed until the **OK** button at the bottom right corner of the Display Setup Dialog has been pressed. Selecting **Cancel** causes the dialog to disappear without affecting the display parameters for the active display.

3–11.1.2 Display Group

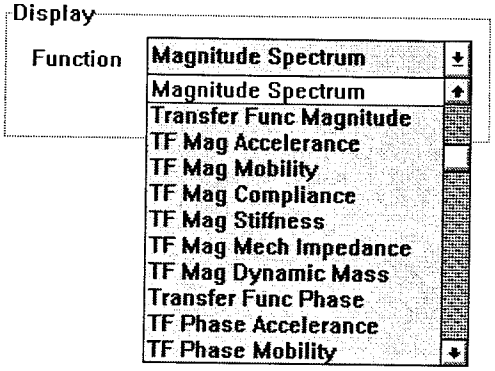


The **Display** group is used to set up the function and data source for SPS390 displays.

There can be up to nine displays simultaneously, with each display showing its own type of trace (for example, time, spectrum, or transfer function). Data for the trace may be either live, from the averager, from store memory, or from a disk file.

Function

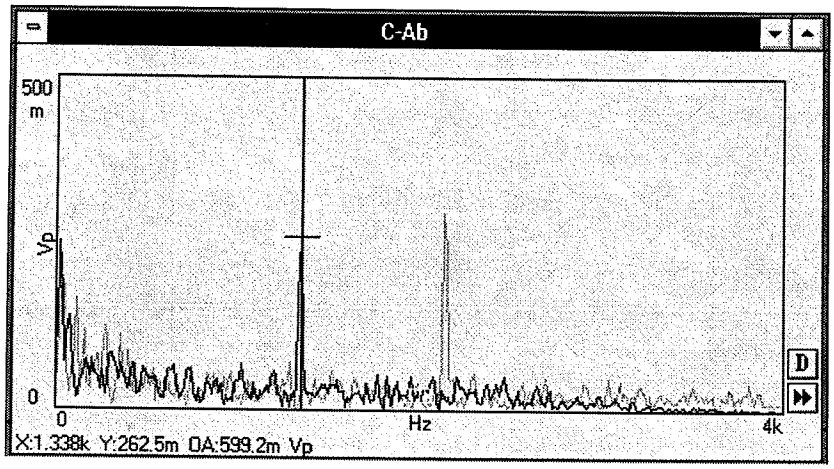
The **Function** combo box allows you to select which type of trace is to be displayed from data currently in the SPS390 memory. Only valid display functions are listed, and these vary depending on the following factors:



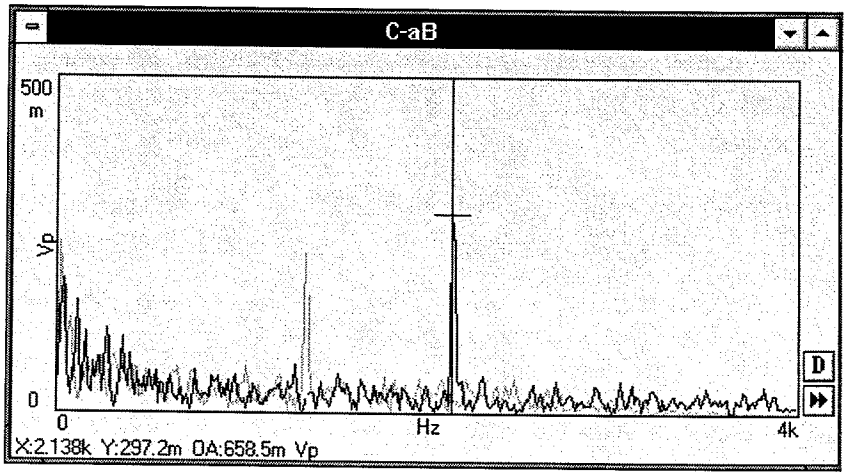
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The traces must be available as individual displays before they can be overlaid into one composite screen.

Click on the boxes next to the displays you wish to overlay. One trace is always the dominant, or "hot" trace. In the display shown below, trace A is the hot trace. It appears darker, and is also identified by a capital letter in the name at the top of the display (**C-Ab**).



The double arrow icon in the lower right-hand corner  permits the user to toggle through the overlaid displays and select the desired "hot" trace. If the double arrow is clicked once, trace B becomes the "hot" trace, as shown in the following display. It is now darker, and the name at the top of the display shows a capitalized B (**C-aB**).



When displaying multiple traces, the input memory must be in the Hold condition.

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Table 1. Display Function, Display Source and Analysis Mode

Display Function	Analysis Mode				
	Sync Spectrum	Spectrum	Cross Properties	Correlation	Octave (Option)
Time Trace	L A S	L	L		
Compressed Time	L	L	L	L	
Orbit	L A S	L	L		
Magnitude Spectrum	L A S	L A S	L A S		
Transfer Function Magnitude	A S (Optional)		A S		
TF Magnitude Accelerance			A S		
TF Magnitude Mobility			A S		
TF Magnitude Compliance			A S		
TF Magnitude Stiffness			A S		
TF Magnitude Mech Impedance			A S		
TF Magnitude Dynamic Mass			A S		
Transfer Function Phase	A S (Optional)		A S		
TF Phase Accelerance			A S		
TF Phase Mobility			A S		
TF Phase Compliance			A S		
TF Phase Stiffness			A S		
TF Phase Mech Impedance			A S		
TF Phase Dynamic Mass			A S		
Transfer Function Coherence			A S		
Transfer Function Real	A S (Optional)		A S		
Transfer Function Imaginary	A S (Optional)		A S		
Nyquist Function	A S (Optional)		A S		
Cross Spectrum Magnitude			A S		
Cross Spectrum Phase			A S		
Cross Spectrum Real			A S		
Cross Spectrum Imaginary			A S		
Multiple Trace	L A S	L A S	L A S	L A S	L A S
Octave Spectrum					L A S
Cross Correlation				A S	
Auto Correlation				A S	

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