Installation and Operation Manual
ProSeries Model SPS390
Dynamic Signal Analyzer
Part Five

Legacy Manual

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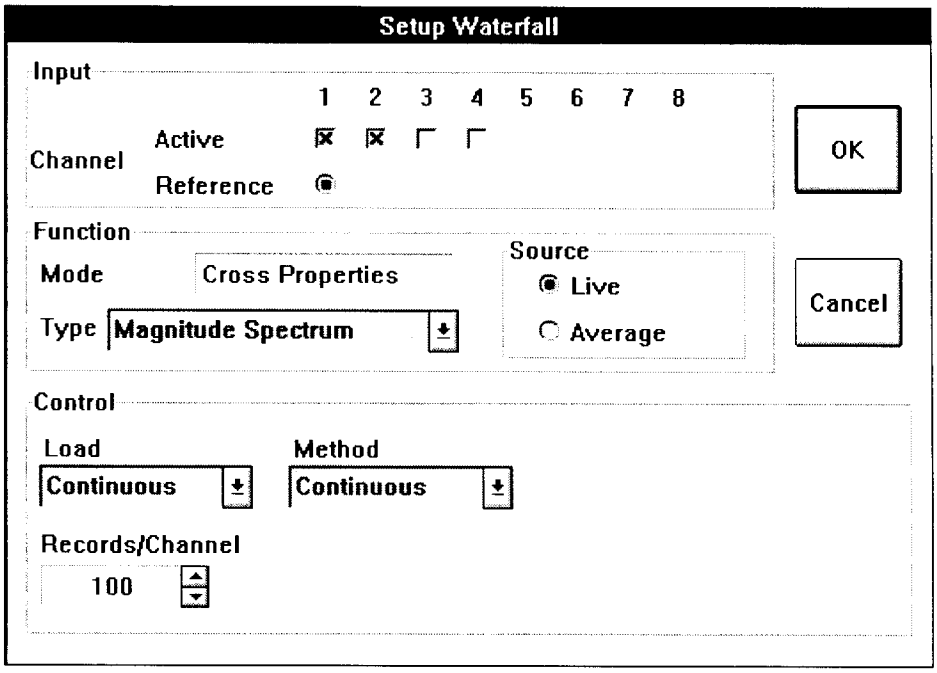
3–11.4 Waterfall Setup



3–11.4.1 How To Invoke Waterfall Setup

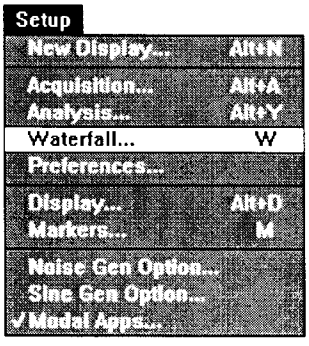
The **Waterfall Setup** dialog box is only available when waterfall is enabled from the **Mode** menu. This dialog is used to set the analyzer's waterfall load parameters.

To invoke the **Waterfall Setup** dialog to set waterfall Load parameters:

- Use the trackball to:

  Select the **Setup** menu

  Select **Waterfall**

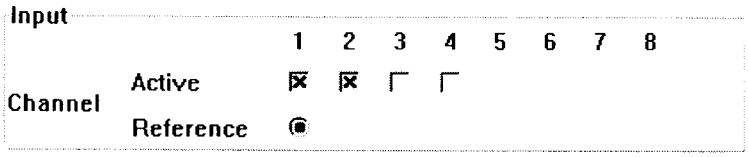


- Or use the keyboard:

  Press the **W** key.

- New waterfall parameters are not created until the OK button at the bottom right corner of the dialog is pressed. Selecting Cancel causes the dialog to disappear without modifying the existing parameters.
- All waterfall setup parameters are global for the selected active channels.

3–11.4.2 Input Group



The **Input Channel** group is used to select all or a subset of the currently active channels as specified on the **Analysis Setup** Dialog. The list of available channels appears as unfilled boxes. To select, or deselect, any channel to use for waterfall analysis, click on the box.

Active Channels

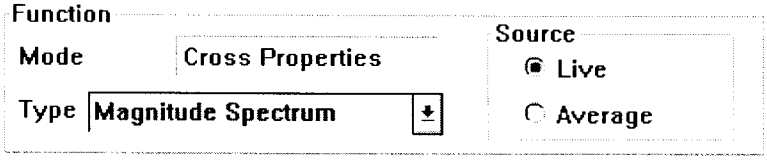
The **Active Channel** checkboxes are used to select which channels will be used for waterfall data collection. Those channels not designated as active will be ignored, thus freeing certain limited resources (such as memory) for use by channels of interest. There must be at least one active channel at any given time, but the number of active channels is limited only by the preselected analysis active channels.

Reference Channel

The **Reference Channel** radio button already designated as an Analysis Input Reference Channel is used as the reference channel for a waterfall function. This selector only appears when **Cross Properties** is selected as the **Analysis** mode.

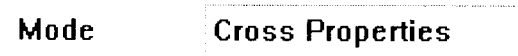
3–11.4.3 Function Group

The **Function** group allows selection of the type of waterfall analysis function that will be loaded into waterfall memory.

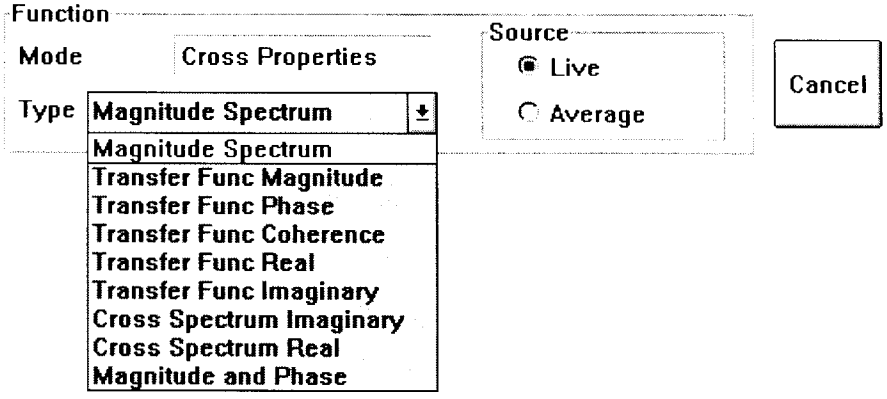


Mode

The **Mode** box is an information field reminding you in which mode the analyzer is operating. The mode will determine which types of analysis functions are available to be waterfalled. This parameter cannot be changed on this dialog; it is accessed from the Mode main menu.

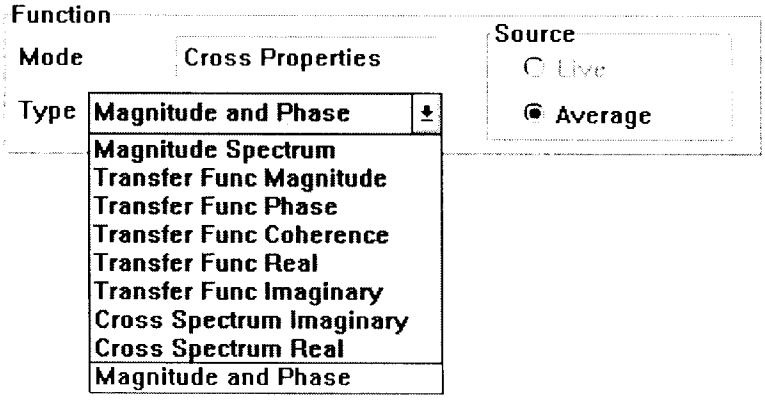


Type



This is a pull-down combo box displaying the types of functions that can be loaded into waterfall memory for the selected mode. Only one function can be selected. The selected function applies to all active channels selected in the **Setup Waterfall Input** group. If a **Magnitude Spectrum** waterfall is selected for **Channel 1**, then other active channels for which a waterfall display is selected must also display a magnitude spectrum waterfall.

The exception to this rule is the **Magnitude and Phase** selection. When this function type is chosen, both the spectrum magnitudes of all active waterfall channels and the phase values between the active waterfall channels and the designated reference channel are simultaneously stored into waterfall memory.



For example, if four active waterfall channels are present and **Channel 1** is the reference, selecting **Magnitude and Phase** as the waterfall function type produces a waterfall memory array of:

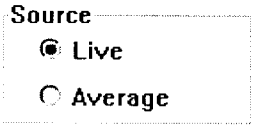
- Channel 1 Spectrum Magnitude
- Channel 2 Spectrum Magnitude
- Channel 3 Spectrum Magnitude
- Channel 4 Spectrum Magnitude

- Phase Ch2/Ch1
- Phase Ch3/Ch1
- Phase Ch4/Ch1

Any or all of these can be displayed. Executing a single **Save Waterfall** command saves all of this data to the selected file name.

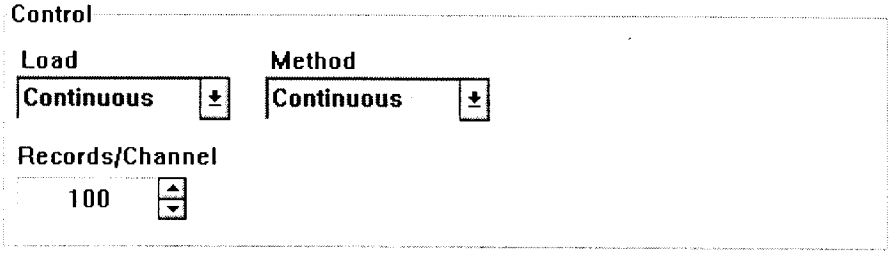
When the analyzer mode changes, you may have to reset the waterfall function to agree with the newly selected mode. If the waterfall control buttons do not appear, make sure the analyzer mode and waterfall function are compatible.

Source



These radio buttons allow selection of the source of the function to be waterfalled: from **Live**, real-time data, or from the **Average**. The choice of the source will determine how the data can be loaded into waterfall memory and determines the contents of the **Control** group **Load** menu.

3–11.4.4 Control Group



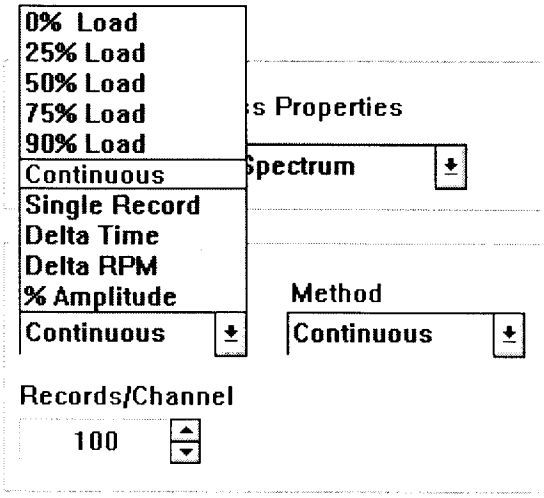
The **Load Control** determines how data is transferred from the source data area to the waterfall memory. The load control choices reflect the selected analyzer mode, data, source, and acquisition choices that have been made. Therefore, only certain load controls may be available for a particular setup. Valid trigger source and waterfall load control combinations are summarized in the table 5.

Figure 5. Valid Trigger Source and Waterfall Load Control Combination

Trigger Source and Waterfall Load Control Combinations		
Trigger Source	**Waterfall Load Control**	**Waterfall Source**
Free Run	0% Load	Live
Free Run	25% Load	Live
Free Run	50% Load	Live
Free Run	75% Load	Live
Free Run	90% Load	Live
Free Run	Continuous	Live
Free Run	Delta Time (increment)	Live
Free Run	Delta RPM (increment, start, stop)	Live
Free Run	% Amplitude	Live
Free Run	Continuous	Avg
Free Run	Avg Recycle	Avg (linear method)
Free Run	Single Record	Avg
Free Run	Delta Time	Avg (expo method)
Free Run	Delta RPM	Avg (expo method)
External	Continuous	Live or Avg
Ch1–Ch8	Single Record	Live or Avg
Note::If External Trigger is used with SRA Sampling, the Delta RPM selection for Waterfall Load Control is located in the Trigger Control box on the Acquisition Setup Menu.		

Load Control (Live Data Source)

The **Load Control** pull-down combo box determines how waterfall memory will be loaded when the **Source** menu selection is **Live**.



➢ **0% Load**

When one complete block of data is collected into Live memory, it is transformed into the desired function and transferred to waterfall memory. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is available for* **Live** *Spectrum or Cross Property data, as well as playback from the Compressed Time Trace memory.*

➢ **25% Load**

When a block of data is collected, it is transformed into the desired function and transferred to waterfall memory. The first 25% of the new block of data is a copy of the last 25% of the old block; the last 75% of the new block consists of new data. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is available for Live Spectrum or Cross Property data, as well as playback from the Compressed Time Trace memory.*

➢ **50% Load**

When a block of data is collected, it is transformed into the desired function and transferred to waterfall memory. The first 50% of the new block of data is a copy of the last 50% of the old block; the last 50% of the new block consists of new data. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is available for Live Spectrum or Cross Property data, as well as playback from the Compressed Time Trace memory.*

➢ **75% Load**

When a block of data is collected, it is transformed into the desired function and transferred to waterfall memory. The first 75% of the new block of data is a copy of the last 75% of the old block; the last 25% of the new block consists of new data. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is available for Live Spectrum or Cross Property data, as well as playback from the Compressed Time Trace memory.*

➢ **90% Load**

When a block of data is collected it is transformed into the desired function and transferred to waterfall memory. The first 90% of the new block of data is a copy of the last 90% of the old block; the last 10% of the new block consists of new data. The size of the data block is determined by the Block Size setting on the Analysis Dialog.

☞ *This control is available for Live Spectrum or Cross Property data, as well as playback from the Compressed Time Trace memory.*

- **Continuous**

  This control has two different functions, based on the data source.

- **Live**

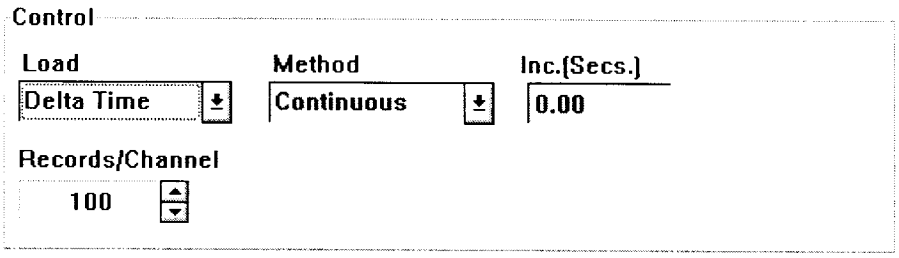
  Data is transformed into the desired function and transferred to waterfall memory as fast as the analyzer can collect and process the data. The rate of processing is dependent upon the function, selected number of channels, and the number of active displays. Data is always processed with Max Overlap for this load criteria.

Single Record

This control allows manual load of the waterfall memory. Each time the Waterfall Start or Single (+1) load control button is pressed, data from the selected source is transformed and transferred to waterfall memory.

Delta Time

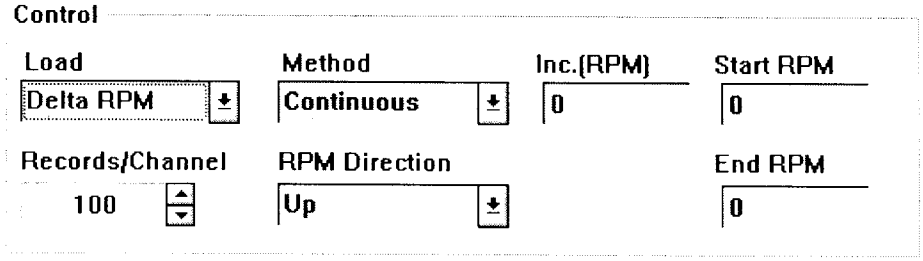
When **Delta Time Control** is selected, the time **Inc (Secs.)** (Increment) field appears to allow the time increment (in seconds) to be entered. When the time increment elapses, data in the source memory will be processed and transferred to waterfall memory. The resolution of the time increment is 0.10 seconds.



☞ *This load control is only available when the Trigger Source is Free Run on the Acquisition Setup dialog.*

Delta RPM

Data can be loaded into waterfall memory at specific RPM intervals, while accelerating, decelerating, or both accelerating and decelerating. Additional parameter fields appear when **Delta RPM** is selected:



- **RPM Direction**

  Up for acceleration only
  Down for deceleration only
  Up or Dn for acceleration and deceleration

- **Inc. (RPM)** — (RPM increment)

  When the system detects an RPM increment change, data is processed and loaded into waterfall memory.

- **Start RPM**

  When the direction is **UP** or **DOWN**, the **Start RPM** can be specified to indicate when the waterfall memory will start being loaded according to the specified increment.

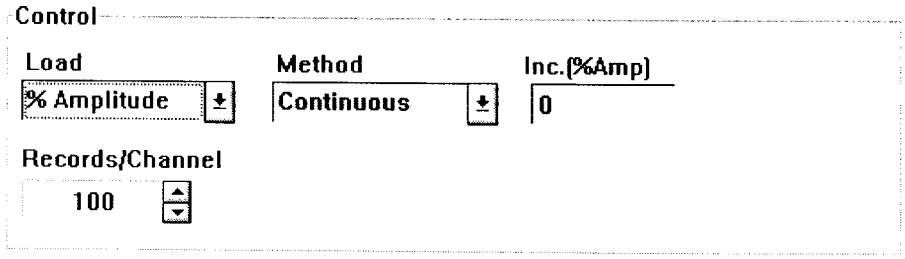
- **End RPM**

  When the direction is **UP** or **DOWN**, **End RPM** can be specified to indicate when the loading of waterfall memory will stop.

☞ *This load control is only available when **RPM** is enabled and the Trigger Source is **Free Run** on the Acquisition Setup Dialog.*

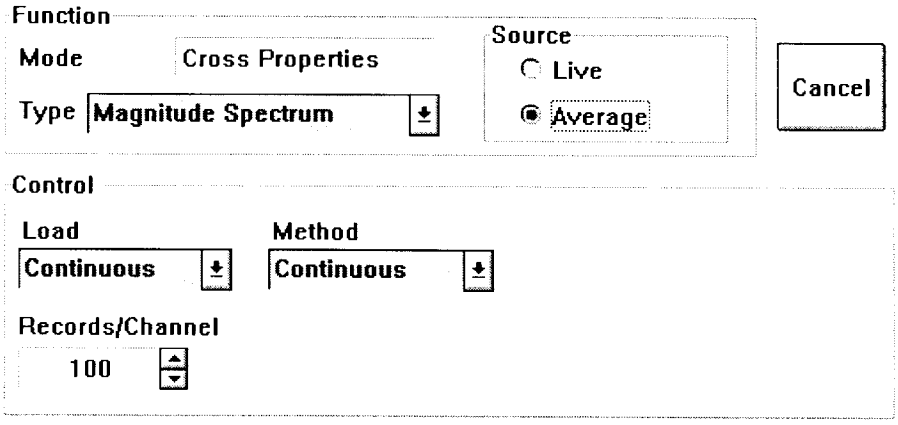
% Amplitude

When **% Amplitude Load** is selected, an amplitude value (in percent of full scale) can be entered that will determine when the data from the selected source will be transformed and transferred to waterfall memory. When the amplitude (rms) of the first selected waterfall channel from the selected waterfall source exceeds the indicated percent full-scale amplitude, data from all channels will be processed and copied to waterfall memory.



Load Control (Average Data Source)

This pull-down combo box determines how Waterfall Memory is loaded when the Source menu selection is Average.



Continuous

This control has two different functions based on the data source.

- **AVG**

  The averager control parameters (overlap, weighting, etc.) are used. When one block of data (according to the Averager overlap factor) is processed, the desired function is transferred to waterfall memory.

Avg Recycle

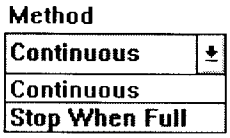
This load control is only available when the data source is from the Averager. Each time the Averager target count reaches the specified number, the data in the averager is copied to waterfall memory. Each copy produces one record for each selected waterfall channel. The averager is cleared, and the process begins again until the requested number of records has been copied to waterfall memory.

☞ *Avg Recycle forces the Averager to linear averaging, and Count Stop Method.*

Single Record

This control allows manual load of the waterfall memory. Each time the Waterfall Start or Single (+1) load control button is pressed, data from the selected source is transformed and transferred to waterfall memory.

Control Method



The load Method determines whether waterfall memory is loaded continuously or whether loading will Stop When waterfall memory is Full. When loading is continuous, data will wrap when waterfall memory is full. You must press the Stop Waterfall Load Control or the HOLD button to stop data from being loaded into waterfall memory.

Records/Channel

This parameter specifies the number of records per channel that will be collected before loading stops (when using the Stop When Full Load Method) or before data wraps (when using the Continuous Load Method. The maximum number of records is set in the Mode Dialog.

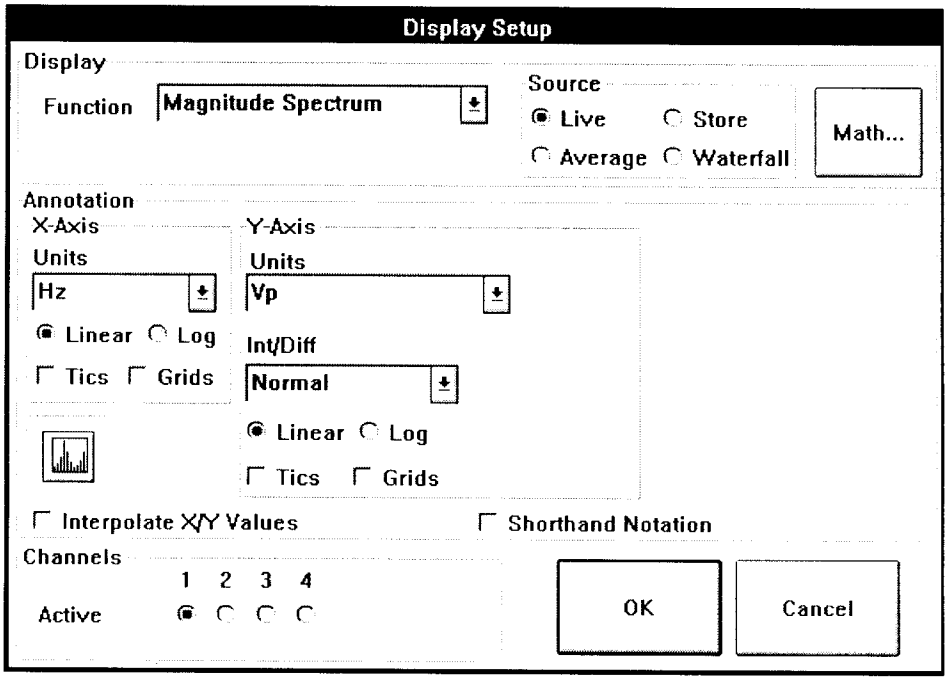
The number of records for this dialog is the number of records per channel. The number of records on the Mode Dialog is the total possible number of records. The number of records per channel is determined by the total possible records, the current block size, and the number of active Waterfall channels.

3–11.5 Waterfall Display Setup

When the **Waterfall** checkbox on the **Mode Configuration** menu is selected, the **Waterfall** radio button on the Display Setup menu will be activated. Selecting **Waterfall** as the display source will allow access to displaying and manipulating data in the waterfall memory.

3–11.5.1 How To Invoke Waterfall Display Setup

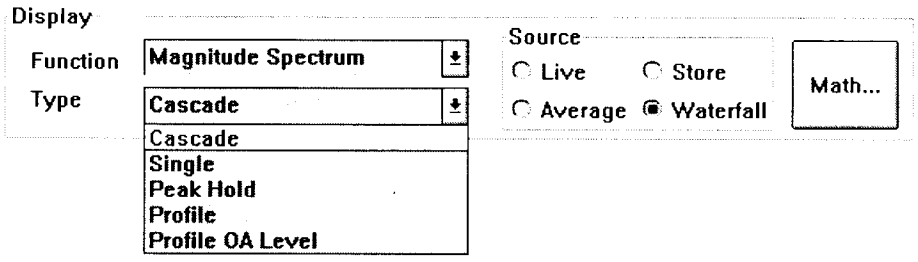
There are a number of fields and choices that are particular to Waterfall Displays. In addition to the previously discussed selections on the Display Setup Dialog, when **Waterfall** is selected from the Source group, there are additional display formats and parameters for selecting Z Axis and other waterfall-specific display features.



A step-by-step example for setting up a waterfall display can be found in the subsection 3–11.6.

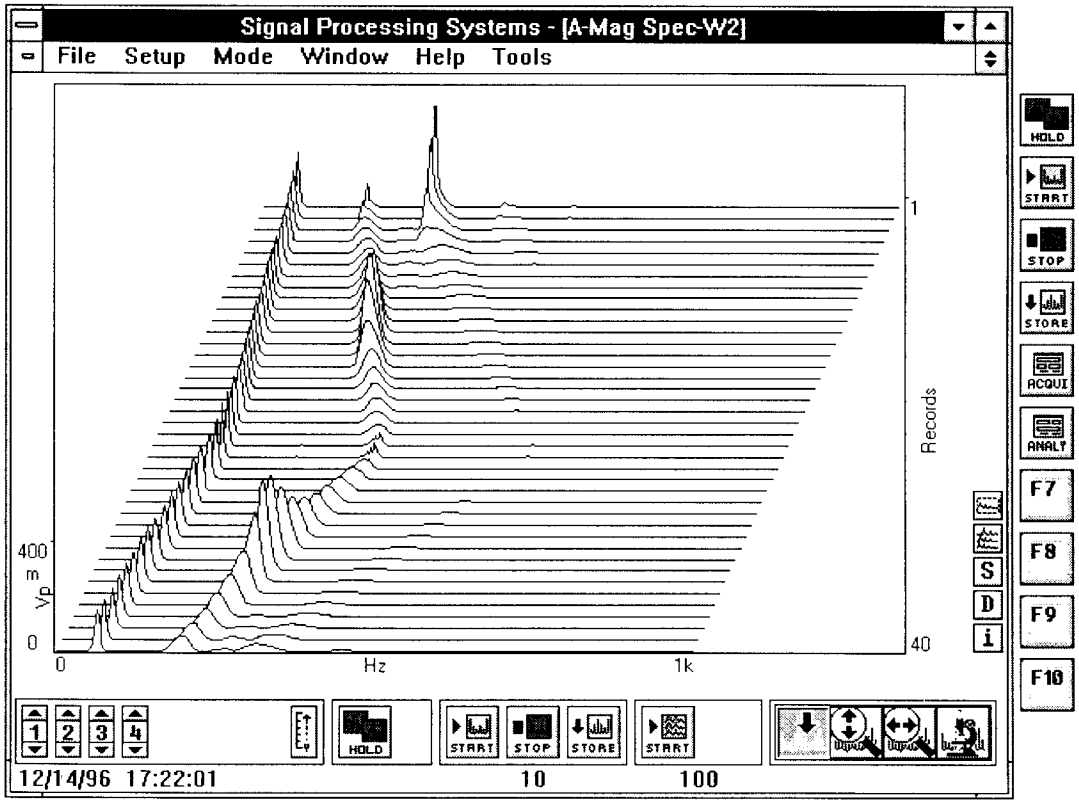
3–11.5.2 Waterfall Display Type

Five waterfall display types are available: cascade, single, peak hold, profile and profile OA level.



Cascade Display

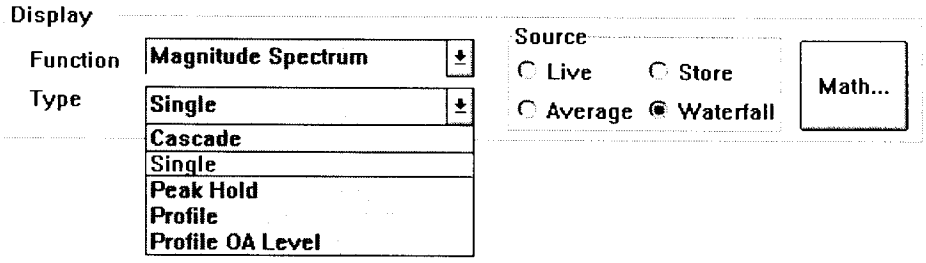
The following figure is a traditional waterfall cascade display, which shows multiple individual Function traces on a single display. Traces can be displayed with the most recent trace on the bottom with older traces scrolling up, or vice-versa by selecting **Down** from the **Z-Axis** control group. Data can be displayed as it is being loaded into waterfall memory, and it will be refreshed when the waterfall load stops.

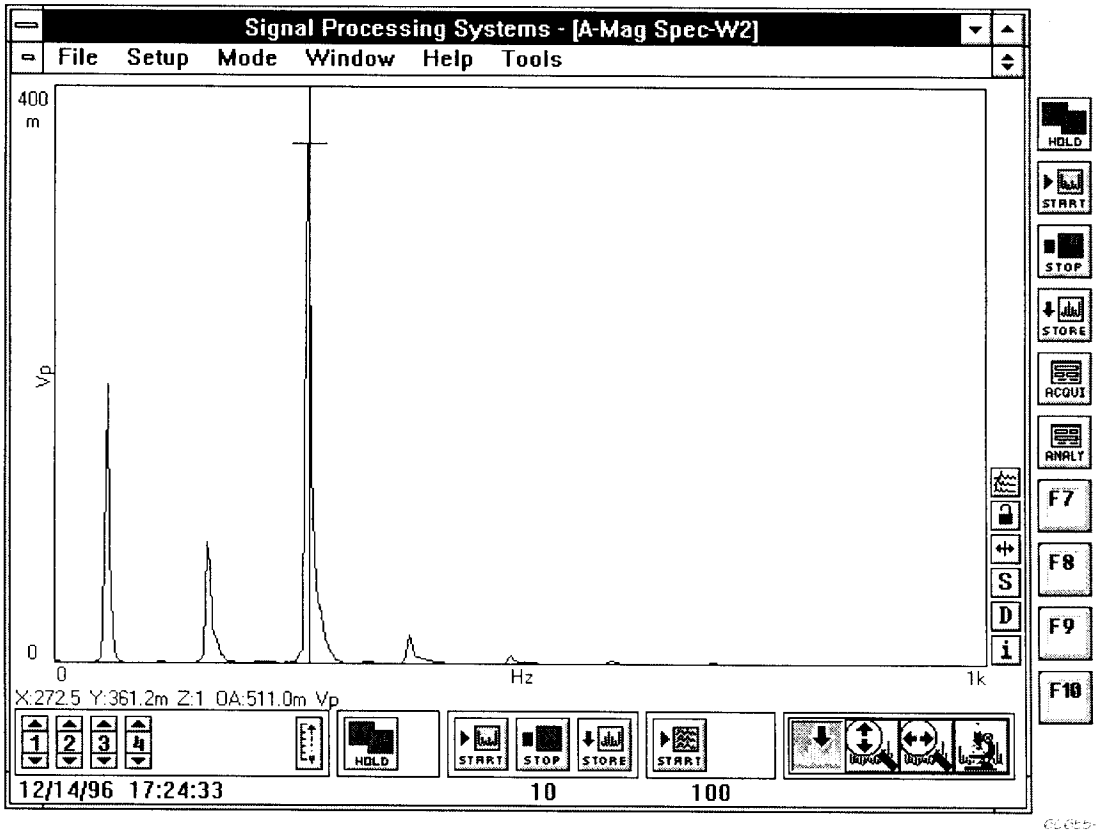


Hidden line removal is always enabled for cascade displays. Selectable amplitude of a single trace, the number of traces to display, skew, and baseline suppression can enhance the viewing of cascaded data.

At fast acquisition rates, every trace that is collected may not be displayed during Live Load (i.e., as data is being collected). When the display is refreshed, all collected displays (within the specified range) will be shown.

Single Display

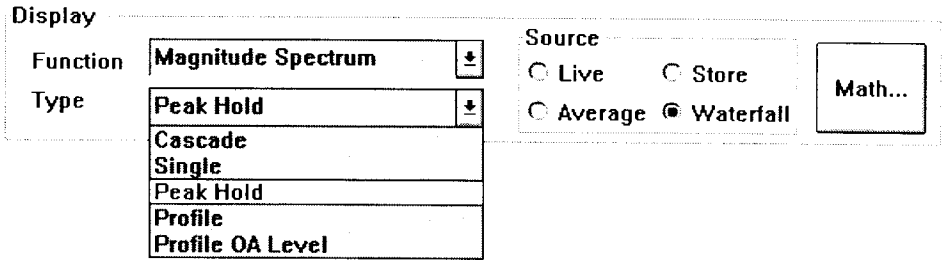


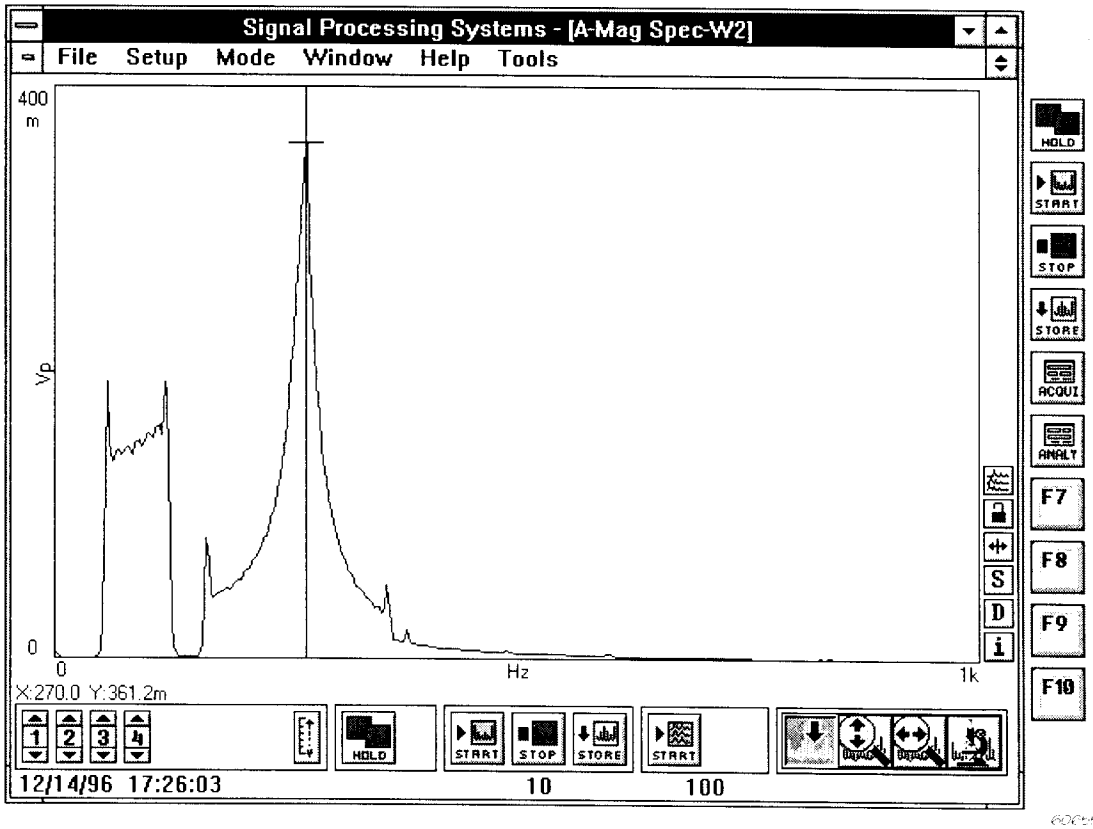


This display type will display a single trace from waterfall memory. It is an accurate representation of the most recent data being loaded into waterfall memory during **Live** load. During waterfall data recall, any individual record can be displayed from waterfall memory by prompting the waterfall icon, located in the display control totem pole to the right of the trace border, and making a record selection.

Peak Hold Display

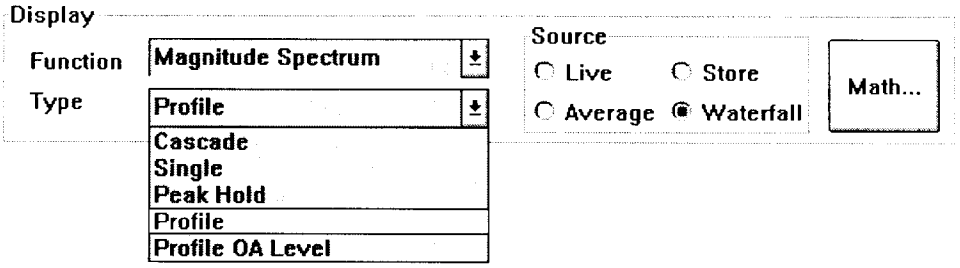
The **Peak Hold** display is the maximum amplitude envelope at every bin of the collected waterfall data. A range of records can be selected using the waterfall record selection feature by prompting the waterfall icon.

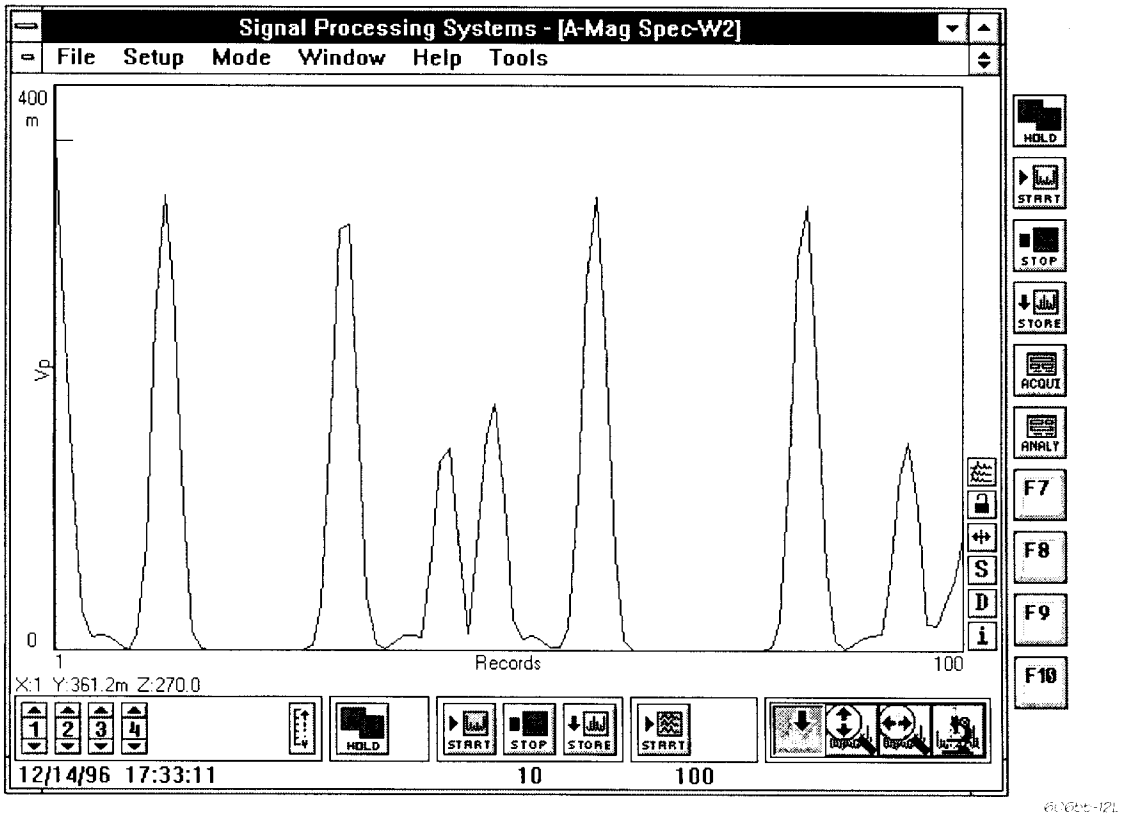




Profile Display

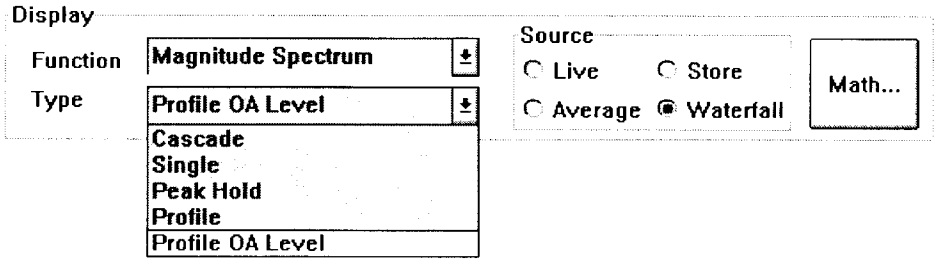
The profile of the waterfall data along any bin (frequency or order) can be displayed by selecting the **Profile Display** type. The profile bin and record range are selected using the waterfall record selection feature, by prompting the waterfall icon.

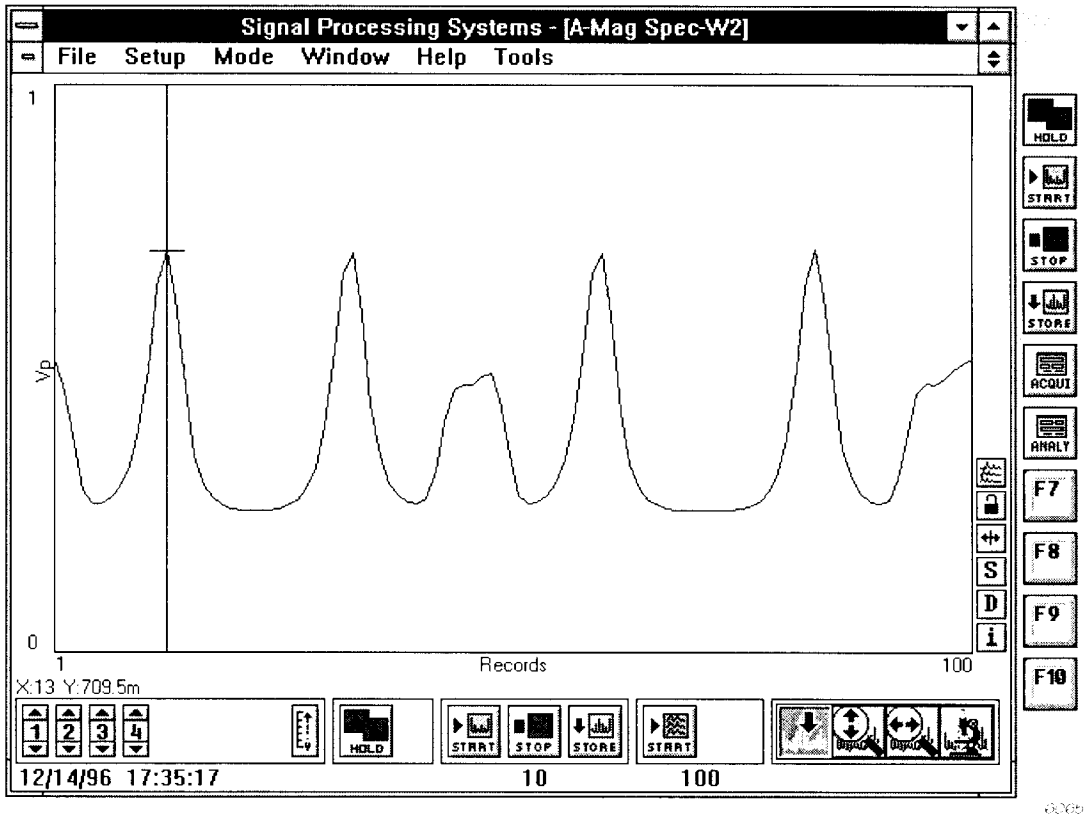




Profile OA Level Display

The profile of the overall amplitude (rms) level of each record within the selected range of waterfall data records is displayed by selecting the Profile OA Level feature. The range of records is selected using the waterfall record selection feature, by prompting the waterfall icon.





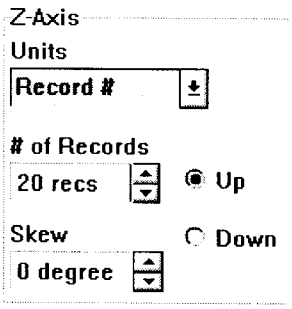
☞ *Profile displays are not available during waterfall load.*

☞ *A minimum of eight records is required for a profile display to be shown.*

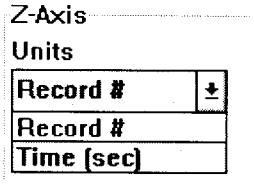
☞ *Any open profile Ampl vs.* ***RPM*** *window will be defaulted to Ampl vs. Record when a new waterfall load is initiated.*

3–11.5.3 Z-Axis Group

Parameters for the Z-Axis can be modified for Cascade and Profile Displays. The Z-Axis group is used to control the annotation and scaling of the display Z-Axis.



Z-Axis Units

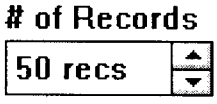


The **Units** combo box allows you to select which units will be used on the Z-Axis of the display. These units depend upon acquisition and waterfall load options that have been previously selected. The Z-Axis is always linear. The possible choices are:

- Record Number
- Time
- RPM (when RPM is enabled during Acquisition)

Number of Records (Cascade Only)

For cascade displays, you can specify the number of records (or traces) to show on one display. The size of the display, the Y–Axis amplitude, and the number of records displayed will each affect the clarity of the individual traces. Fewer traces on a large display will provide the best resolution. The range of data (beginning and ending records) can be specified using the Z-Axis number of records field.

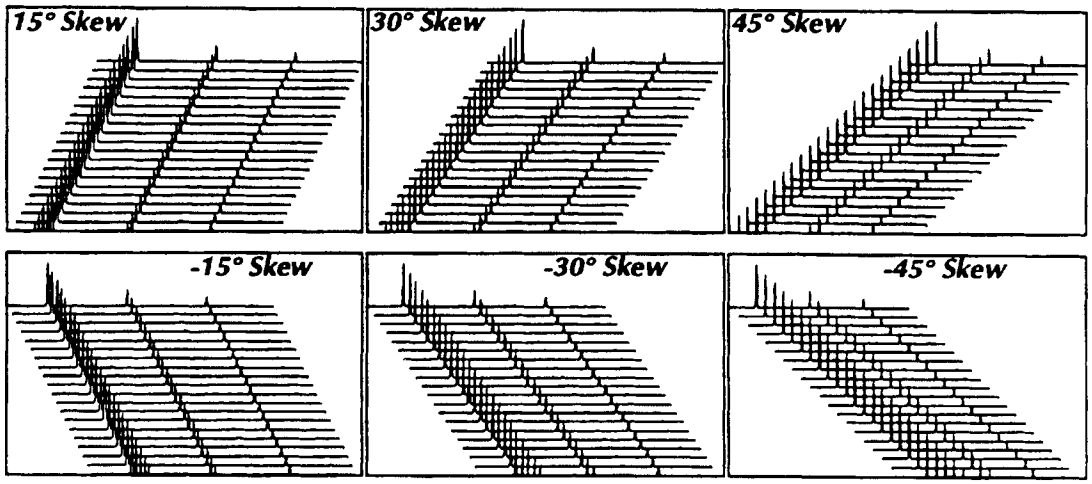


Skew (Cascade Only)

Each trace of a cascade can be offset right or left from the previous trace, with a choice of three levels of skew:

- **+ 15°** — Minimum Skew
- **+ 30°** — More Skew
- **+ 45°** — Most Skew

Left skew is denoted by a (–) sign.



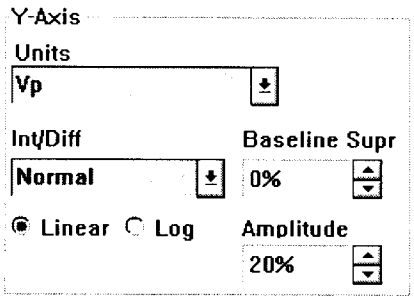
The skew angle is not exactly 15, 30, or 45 degrees. These numbers are merely indicators of the amount of skew. The skew angle is determined by the size of the display, the number of records, and the y-axis amplitude, and is adjusted to provide the optimal viewing skew.

Grids and Tic Marks (Profile and Profile OA Only)

Grids and tic marks for this axis can be independently selected by choosing the desired options:

- **Open**—no grids or tic marks; deselect both grid and tic options.
- **Grids** Only—select the grid option.
- **Tics** Only—select the tics option.
- **Grids** and **Tics**—select both the grid and tic options.

3–11.5.4 Y-Axis Group



There are two additional selections for Y-Axis scaling and presentation that are available for cascade displays. These selections are:

Amplitude

The full-scale amplitude of a single trace relative to the size of the display can be selected from 5% to 50%. The amplitude of a single trace, in conjunction with the number of displayed records and the display size, will affect the ability to discriminate individual traces of the cascade display. A higher amplitude will provide greater resolution of a single trace, but will limit the discrimination among many traces.

Baseline Suppression

Data below a specified amplitude can be visually suppressed on cascade displays. The amplitude is entered in percent of full scale, from 1% to 99%.

The amount of data suppressed is determined by the size of the display, the number of records displayed and the Y-Axis amplitude. The percent of suppression is rounded up to compensate for these parameters. Therefore, more or less suppression can be observed, particularly with small displays or displays with a large number of records.

Whenever a cascade display is moved or resized while waterfall load is not active, all data in the display is refreshed. During refresh, all controls and options are available. During waterfall load, all previously displayed data is erased when the display is moved or resized and new data is added on a fresh display.

When in **Octave** mode, the overall level is not displayed on cascade displays. It is available, however, on the overall profile display.

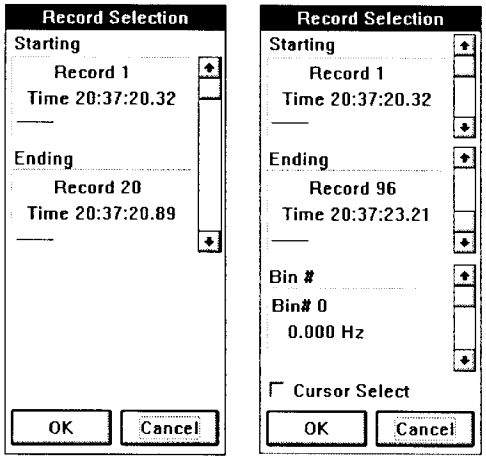
X and Y Cursor movement is not available on Cascade Displays. A Z-Axis, or record cursor, is available. See cascade cursor for information on using the record cursor.

Display expansion and contraction controls for the X and Y axes can be used for all waterfall display types.

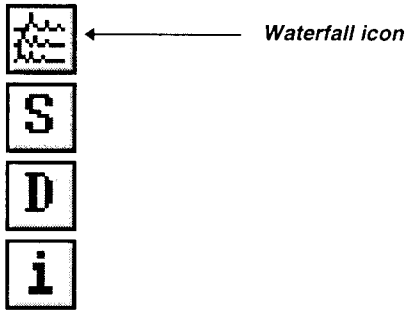
SPS390 HINT: *For faster cascade display updates for playing back data in waterfall memory, place the analyzer in* ***Hold.***

3–11.5.5. Record/Profile Selection

For the various waterfall display types, the Z-Axis range can be selected (or the profile bin for profile displays) by invoking the waterfall record/profile select feature.



This feature is selected from the display controls palette by pressing the trackball button when the cursor is over the waterfall icon. This will present the select dialog, which allows different selections based on the active display type.



Cascade

You can select the starting record (oldest data) by using the up and down arrows. The ending record (most recent data) is automatically determined by the number of records that are to be displayed for this display. The record numbers, times, and RPM (if RPM is available) and RPM readout is enabled on the **Acquisition** dialog box) are displayed for the starting and ending records.

Single

You can select any individual record from all the acquired waterfall data by using the up and down arrows to select the desired record. The record number, time, and RPM (if RPM is available and RPM readout is enabled on the **Acquisition** dialog box) are displayed for the selected record.

Peak Hold

You can select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows to select both the starting record and the ending record. The number of records that are to be displayed is not applicable for this display. The record numbers, times, and RPM (if RPM is available and RPM Readout is enabled on the **Acquisition** dialog box) are displayed for the starting and ending records.

Profile

You can select the bin (or line number) that you wish to profile by using the up and down arrows on the bin select, or by using a cursor value from a similar display by checking the **Cursor** checkbox. When selecting a profile bin, the selected bin number and frequency or order (if SRA is enabled) is displayed. To use a cursor value from a similar display, you must first Lock the cursor in the display from which you wish to use the cursor value, and then check the **Cursor** checkbox on the **Select** dialog box. See the Locked Cursor description for more information on operating Locked Cursors.

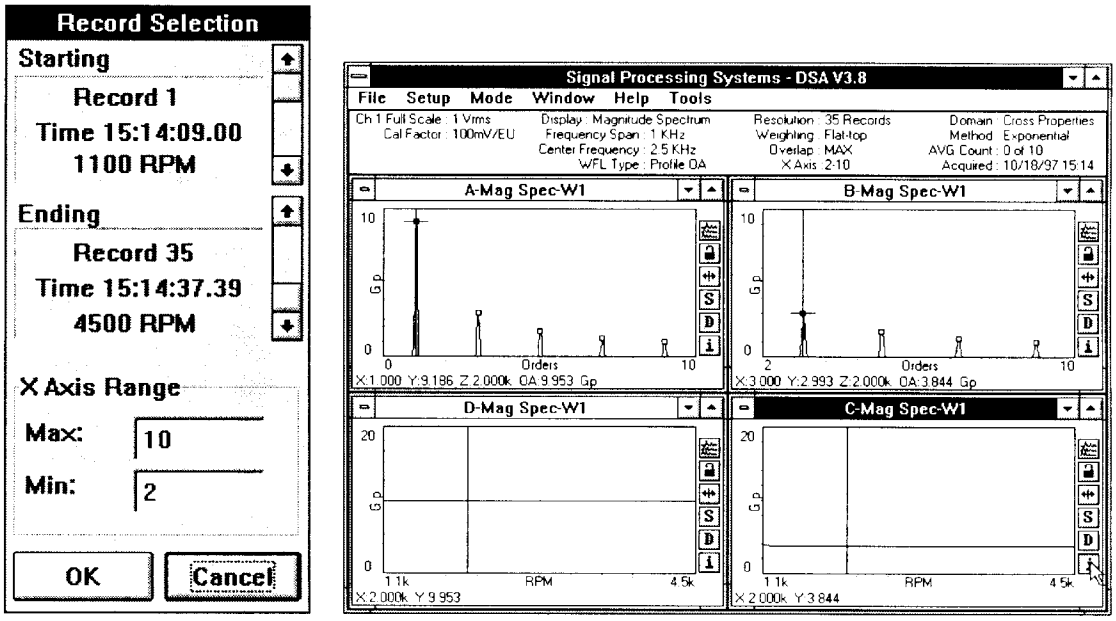
You can also select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows to select both the starting record and the ending record. The number of records that are to be displayed is not applicable for this display. The record numbers, times, and RPM (if RPM is available and RPM Readout is enabled on the Acquisition dialog box) are displayed for the starting and ending records.

Profile OA (Overall) Level

You can select the starting record (oldest data) and ending record (most recent data), by using the up and down arrows. The number of records that are to be displayed is not applicable for this display. The record numbers, times, and RPM (if RPM is available and RPM readout is enabled on the **Acquisition** dialog box) are displayed for the starting and ending records. Z– Axis Display Controls (Cascade Displays Only).

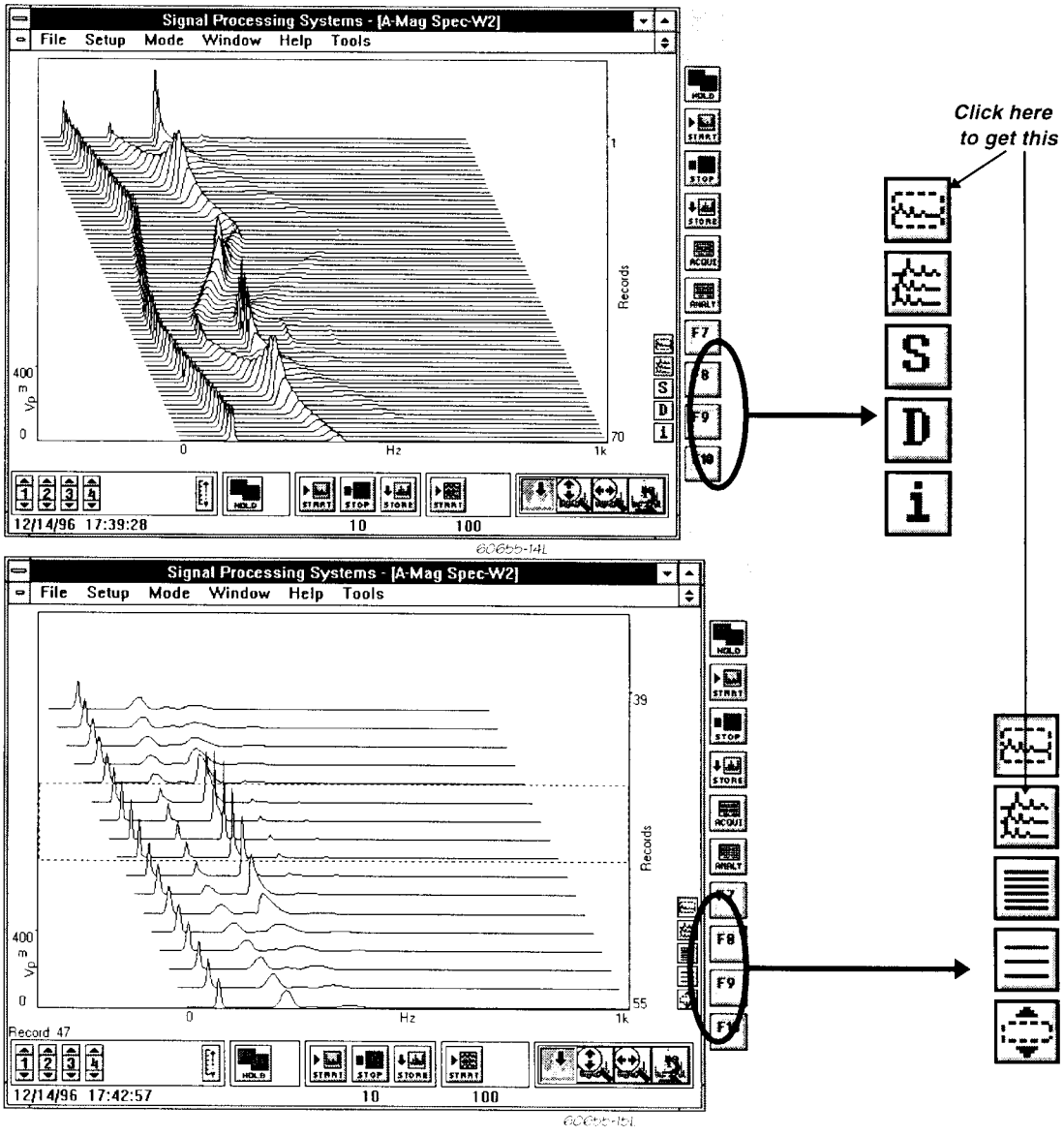
In addition to selecting the **Z-Axis** controls to select which records will be profiled, the operator may also select the **X-Axis** range of the spectrum that will be used in the calculation. This provision is similar to using the scale controls for a normal spectrum display, however it is invoked with the **Record Selection Dialog**. For reference the default **Min** and **Max** X-Axis limits of the waterfall records are shown

in the Info Box (accessible via the "I" icon). The operator may enter new display unique **X-Axis Min** and **Max** for the **OA** calculation in the appropriate text entry boxes of the **Record Selection Dialog**. Any number may be entered however only FFT bin locations are valid. The system will automatically convert the entered number into the next closest FFT bin location value. The valid numbers can be in units of Hz, CPM or Orders depending on the scale values of the display.



3–11.5.6 Z–Axis Display Controls (Cascade Displays Only)

You can graphically zoom in (contract) or pan out (expand) on a selected range of records on waterfall cascade displays by turning on the Z-Axis display controls. When the Z-Axis cursor is enabled, the standard Information, Display, and Scale Display Controls are replaced by three Z-Axis controls.



Select

Clicking on this control allows you to select a record around which you wish to zoom. The record is highlighted by a dotted rectangle, and the record number is annotated on the left bottom of the display window. You can select a specific record by moving the trackball. Clicking on this control again returns the display controls to their normal state.

The dashed-line rectangle is around the Full Scale amplitude of the selected record, and may appear to contain more than one record. The selected record is the record toward the bottom of the rectangle.

Zoom In

Clicking on this control decreases the number of displayed records by a factor of two centered around the selected record. This allows more detail to be shown for each record.

Zoom Out

Clicking on this control increases the number of displayed records by a factor of two centered around the selected record. This allows a better overall view of waterfall memory.

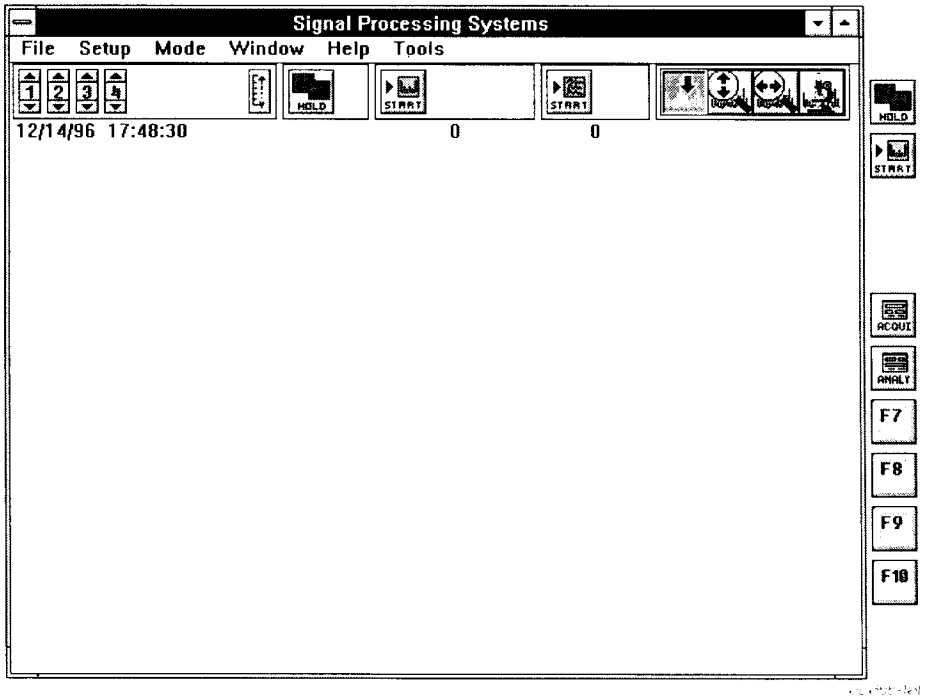
3–11.6 Waterfall Setup

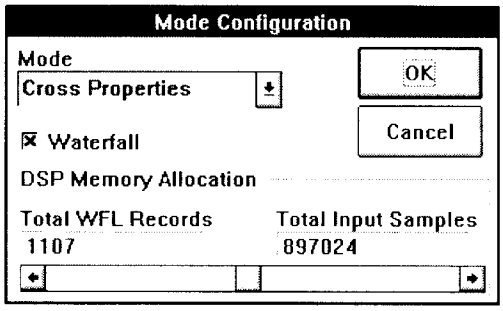
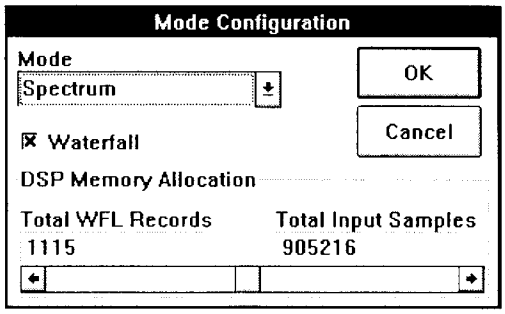
The versatility of the waterfall capabilities in the SPS390 allows for dozens of different displays, and there are almost as many ways of loading the waterfall. However, every waterfall setup begins with these three simple steps:

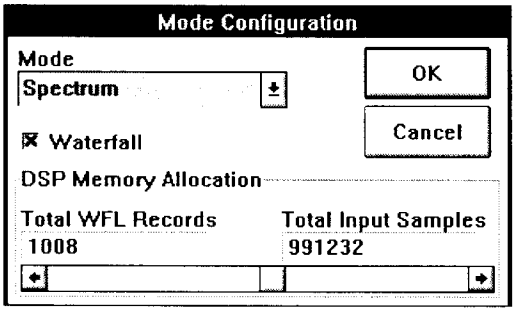
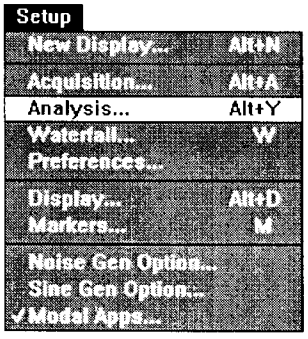
- Enable the waterfall memory;
- Set up the waterfall parameters; and
- Select a waterfall display

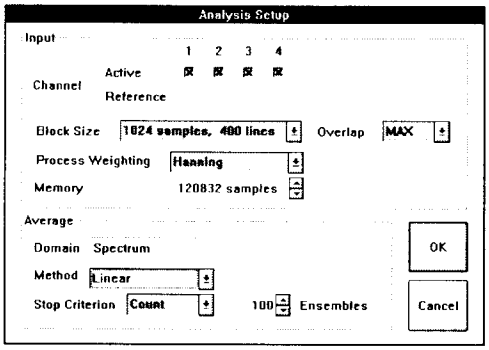
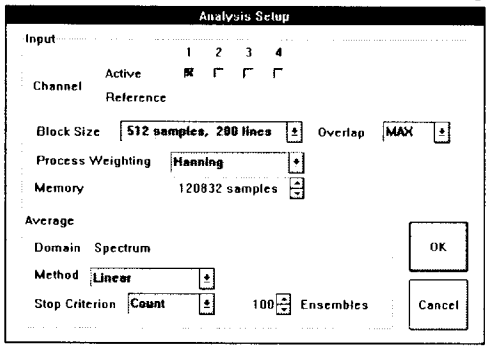
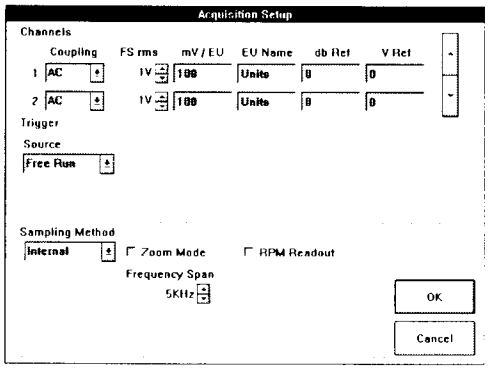
3–11.6.1 Enable the Waterfall Memory

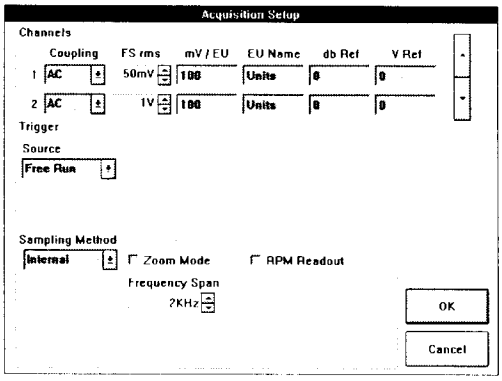
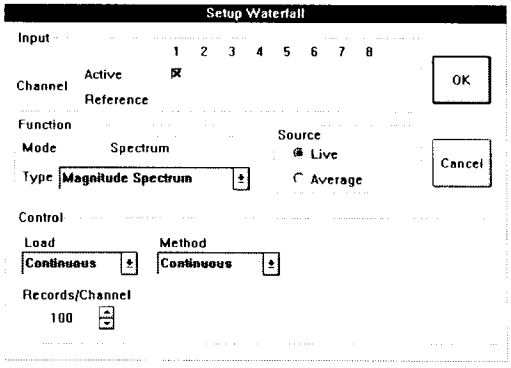
To set up and enable the waterfall memory perform the following steps:

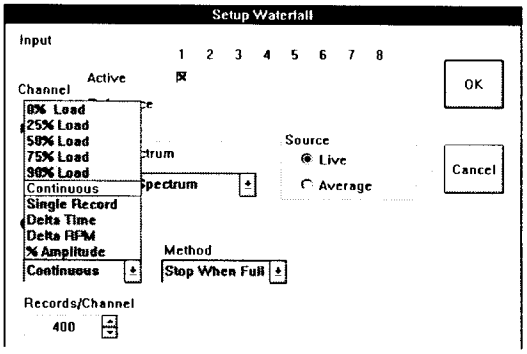
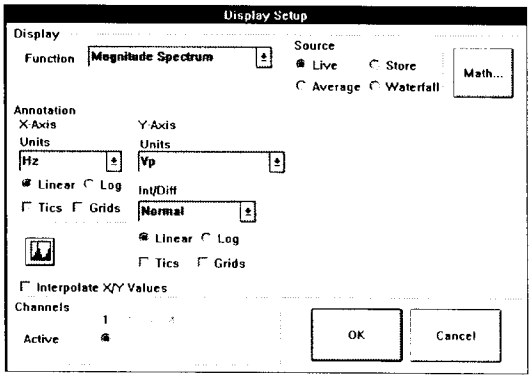
Step	Action
1.	When the analyzer is first turned on, the display will look like the following figure. Note that a waterfall display can be shown on a previously blank screen, such as the following figure, or it can be added to existing displays. ***Typical SPS390 Power-On Default Display*** 
2.	Roll the trackball (or external mouse) so that the arrow points at Mode and click once. The display will appear as shown in the following figure. Keep in mind that the number of Total Input Samples indicated may vary, depending on the size of the DSP memory installed in the analyzer.

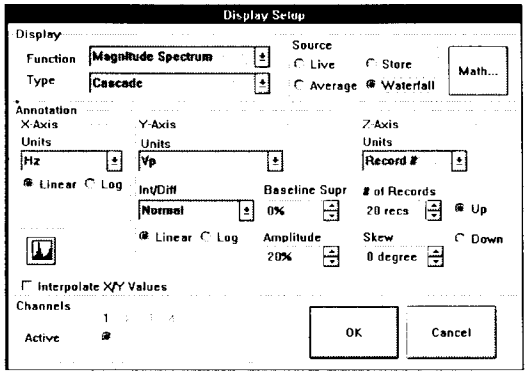
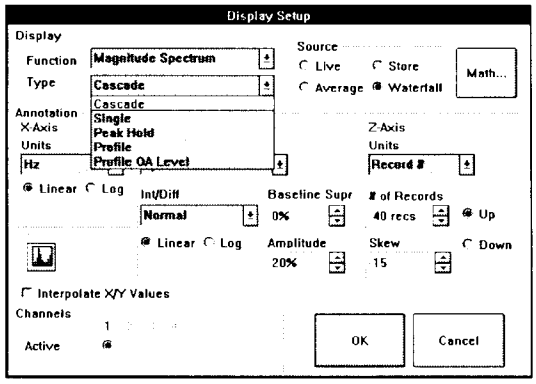
Step	Action
	Typical Default Mode Configuration 
3.	Size the Total WFL Records memory. In addition to the amount of DSP memory installed, this value (Total WFL Records) will vary depending on Mode (**Cross Properties**, etc.) and Block size/number of lines selected. More memory is required to store and display **Cross Properties** (Transfer Function, Coherence, etc.) than to store and display a straight spectrum. Also, a 1600-line analysis will require about eight times as much memory as a corresponding 200-line analysis.  The DSP memory is shared between sampled input signals (Total input samples) and waterfall requirements. The left-right scroll bars can be used to apportion the available memory as you see fit. As you can see from the previous figure, one of the default conditions on the Mode page is **Cross Properties**. If you wish, for example, to create a waterfall display of transfer function or coherence, etc., it will be necessary to leave this selection as **Cross Properties**. For most general spectrum waterfall displays, however, you will want to change this selection.
4.	Place the pointer on the **Cross Properties** line and click and drag until **Spectrum** is highlighted, then release the trackball. The display will appear as shown in the following figure. ***Selecting Spectrum as the Waterfall Mode*** 

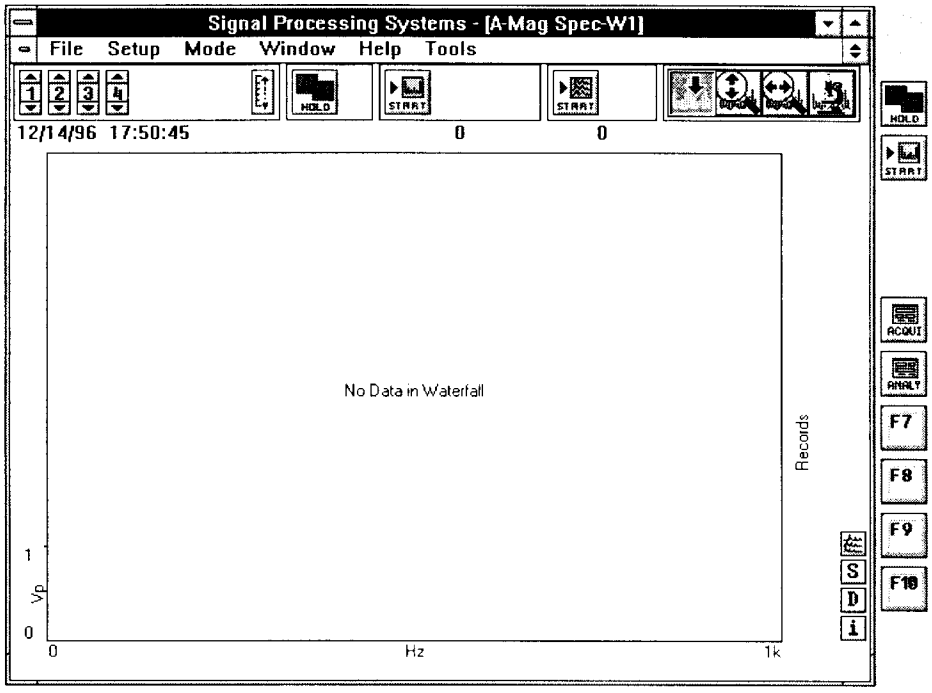
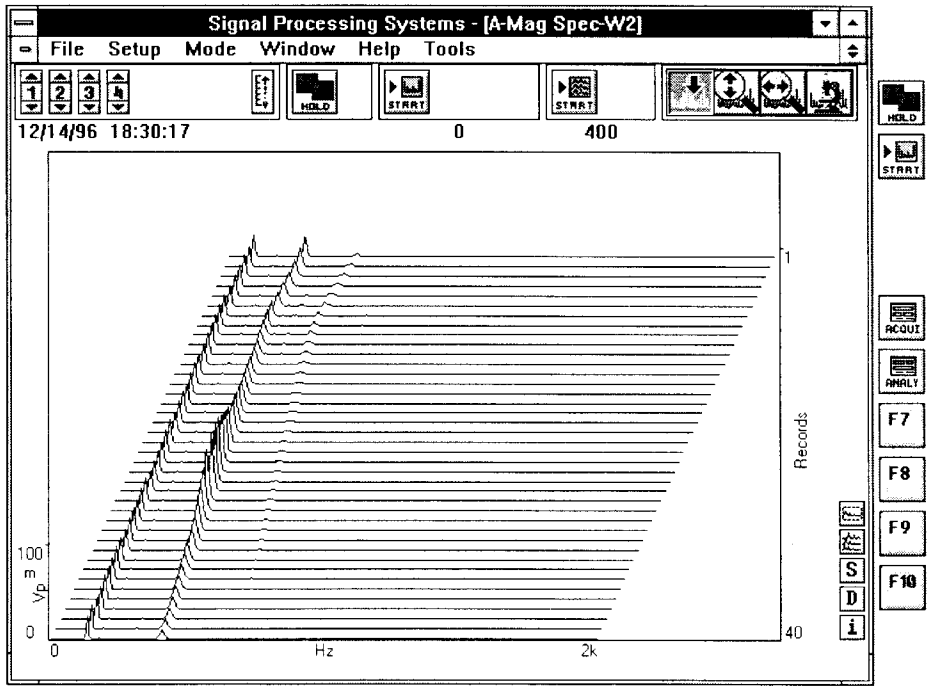
Step	Action
5.	Drag the horizontal scroll bar left or right to select the desired number of **Total Waterfall Records** that can be stored for this setup. For example, memory space for 1008 records was allocated. Note that this is the aggregate or total memory allocated for all channels. Thus, if four channels of waterfall display were established, each channel could have no more than 252 records in this case. ***Scrolling Right to Read 1008 Total Waterfall Records***  The total number of waterfall records which can be stored depends on several factors. Among these are the size of the DSP memory, the data type (cross properties, spectrum, octave, etc.) and the number of spectrum lines per FFT selected. The rate at which records are recorded into the waterfall also depends on the data type and the number of FFT lines. The fastest transfer will take place with 200 lines and single channel Spectrum selected. This combination will be used here. Click **OK**
6.	Click on **Setup**, along the top row of the SPS390, and click again on **Analysis** (Alt + Y). This will bring up the setup listing shown in the following figure, followed by the analysis template as shown in the next figure. ***Default Listing of Setup Choices*** 

Step	Action
	Default Analysis Template for 4-channel Configuration 
7.	Click on **1024 samples, 400 lines**, then click on **512 samples, 200 lines**. Click on the **Channels 2**, **3**, and **4** boxes, deleting the **Xs**. Click **OK**. You have now selected a 200-line spectrum resolution and deactivated all but Channel 1. This is shown in the following figure. ***Analysis Template after Selecting 200 Lines and Channel 1 Only***  The desired frequency range must now be selected as well as input scaling. This can be done from the front panel or through the acquisition template.
8.	Click on **Setup** and select **Acquisition**. ***Default Acquisition Template*** 

Step	Action
9.	Click the **Frequency Span** down arrow two times until it reads 2 kHz, or your desired range. On the top row, for **Channel 1**, choose the appropriate **Coupling** and **Full Scale**. The display should appear as shown in the following figure. Click **OK**. ***Acquisition Template Set Up for This Example***  You are now ready to set up the waterfall parameters in terms of general acquisition. This includes how the waterfall is to be loaded (continuous, delta time, etc.), whether it will be continuous or stop when full, and how many records per channel will be loaded.
10.	Click on **Setup** and select **Waterfall**. ***Default Waterfall Setup Template for 1 Active Channel*** 
11.	Increase or decrease **Records/Channel** to the desired number. Select **Load** and stop **Method** from the choices presented. The display should appear as shown in the following figure. There are ten choices given on how the waterfall will be loaded—five direct actions and five overlap factors. In the current example Continuous loading will be used. Examples of other loading techniques will be given later.

Step	Action
	Waterfall Setup Showing Load Selections and 400 Records/Channel  Now that the Waterfall parameters have been established, it is time to select a waterfall display.
12.	If a keyboard is attached to the SPS390, simply strike the **N** key. If not, click on **Setup** and choose **New Display**. The following figure shows the display choices for **Live** (real-time), **Average**, or **Stored** records. You will now choose a Waterfall display. ***Default Display Setup for 1 Active Channel*** 
13.	Click on waterfall **Source**. A new **Z-Axis** menu is presented together with two new **Y-Axis** choices and a **Display Type** selection. The number of records that can be viewed in the waterfall display can vary from one to over 100. However, the more records viewed, the smaller the Y-Axis display size per record. Typically, 40 to 50 records at a time gives a good indication of data dynamics.

Step	Action
	Default Selections for Waterfall Display Setup 
14.	Click on the desired **# of Records**, **Skew**, **Amplitude**, **Type**, **Lin** or **Log**, etc. Click **OK**. ***Waterfall Display Setup with Display Type Choices Shown***  A display will now be presented with the annotation "No Data in Waterfall." Note that a new START Icon also appears in the top row of the display between the average and Cursor controls. This is the Waterfall START control.

Step	Action
	Initial Waterfall Display before Data Is Stored 
15.	Prepare data for analysis and click Waterfall START. ***Waterfall Display after 400 Records Were Stored*** 

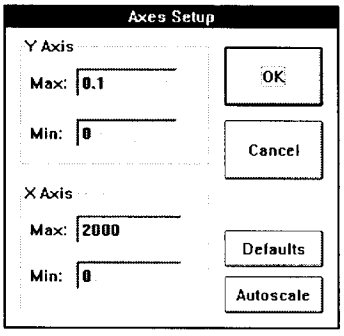
3–11.6.2 Scaling the Waterfall Display

Remember that data stored in the SPS390 waterfall memory is in precision 32-bit floating point format. It can therefore be rescaled after initial display with very little effort. The figures below show the default and rescaled Y-Axis parameters for the current waterfall display.

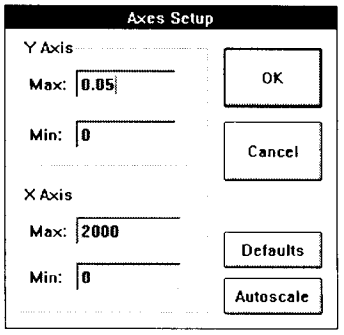
To scale the waterfall display perform the following steps.

Step	Action
1.	Click on the **S** Icon in the Waterfall display "Totem Pole." to optimize the waterfall display. When the **Axes Setup** menu appears, either click on Auto scale or change the Y Axis Max value to a convenient scale. Click **OK**.

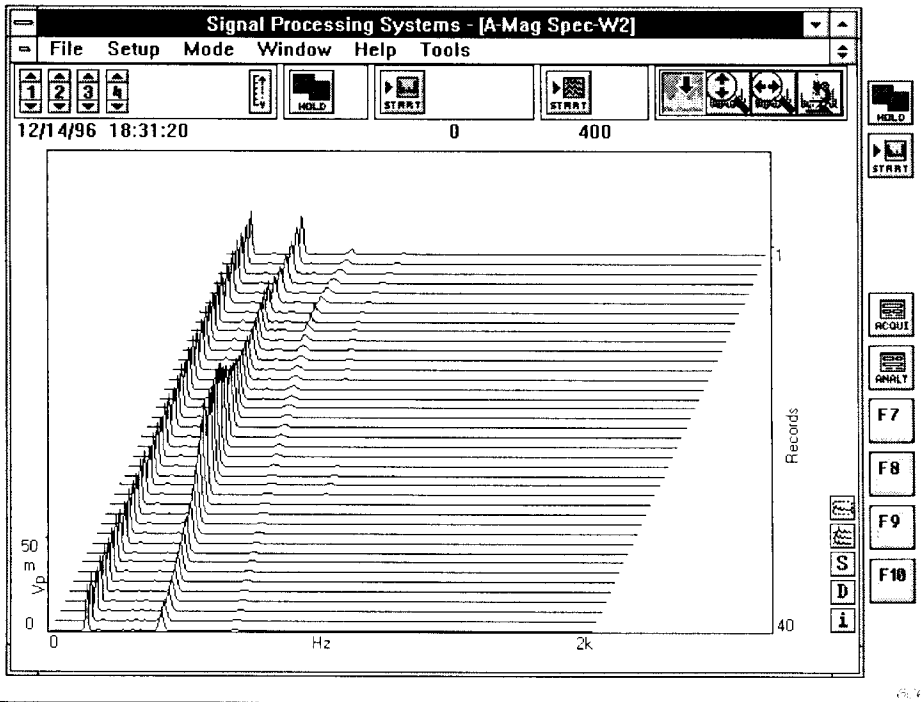
Default Axes Setup



Optimized Axes Setup



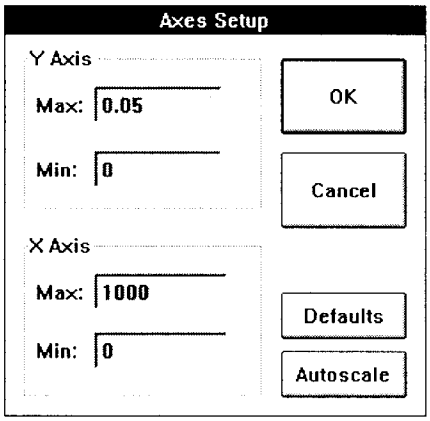
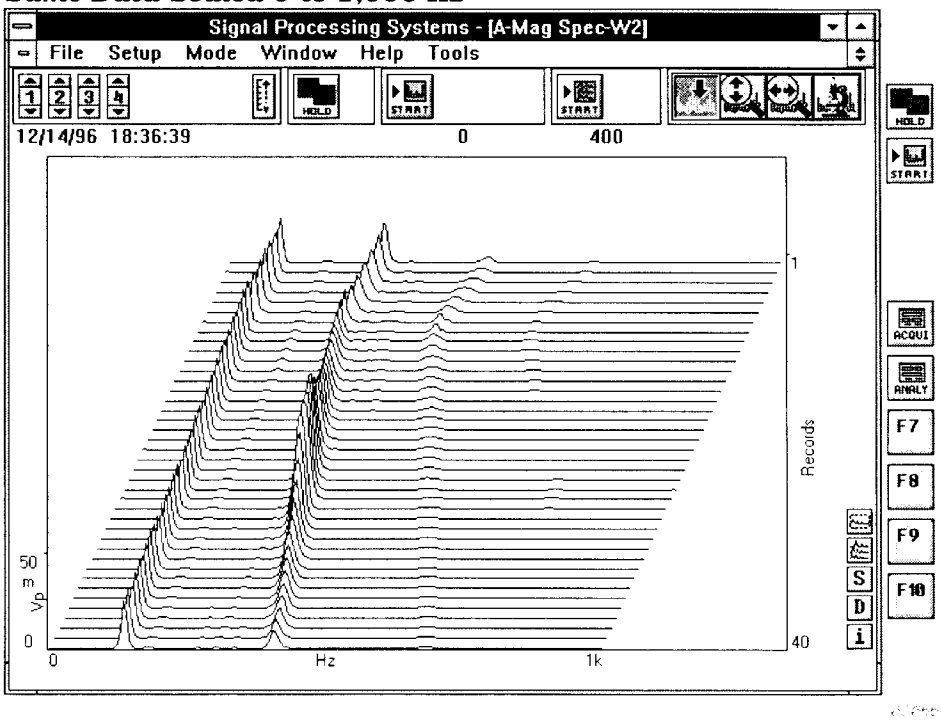
Re-Scaled Waterfall Display Shown Over Whole SPS390 Screen



3–11.6.3 X-Axis Scaling

The waterfall display can also be re-scaled and expanded in the X-Axis. Auto scale does not vary the X-Axis display, regardless of display content. The maximum X-Axis waterfall display expansion allowable should contain at least 16 FFT bins across the display.

To scale to the X-axis perform the following steps.

Step	Action
1.	Click on the scaling Icon and change the value(s) of X-Axis Min, Max, or both. Click OK. ***Axes Setup for Expanded X-Axis Display***  ***Same Data Scaled 0 to 1,000 Hz*** 

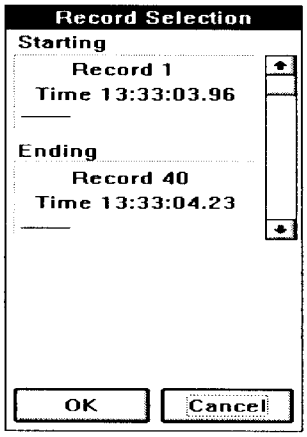
3–11.6.4 Scrolling through the Waterfall Memory

In the preceding steps, 400 spectrum records have been stored in the waterfall memory, but only 40 are being displayed at a time. If you want to change the number of records displayed at one time, there are several methods to choose from. One way is to click on the display setup template and choose a different number of records, such as 33.

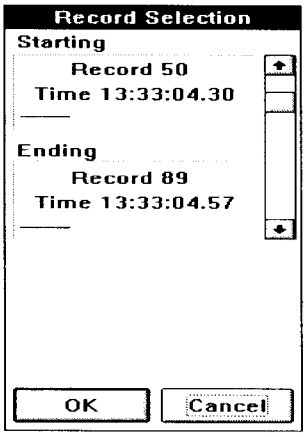
To scroll vertically through the waterfall array perform the following steps.

Step	Action
1.	On the "totem pole" at the side of the display, click on the waterfall symbol just above the S Icon. Roll the scroll bar as shown in the following figures until the desired record numbers appear.

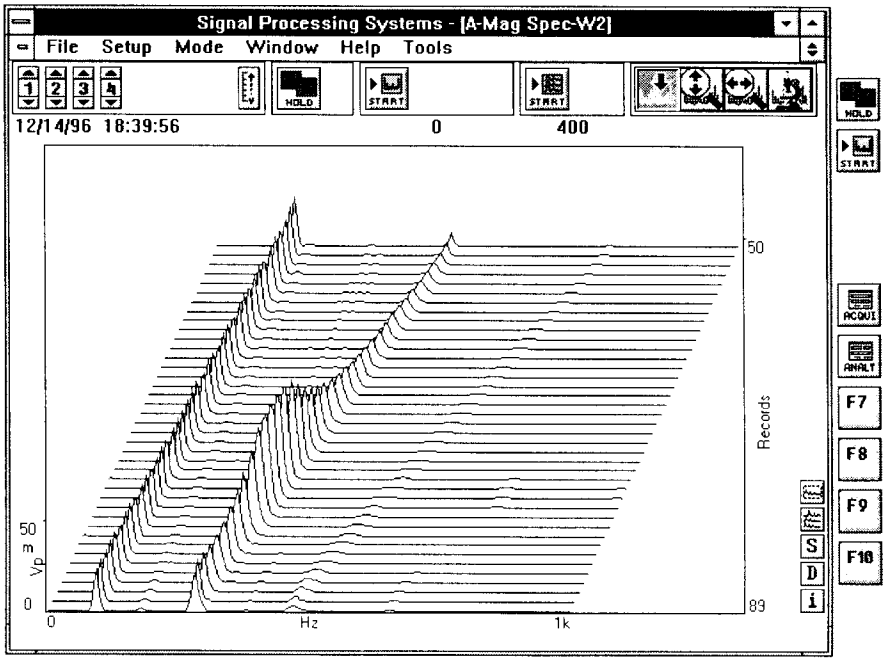
Default Selection Records 1–40



Selection of Records 50–89



Waterfall Display of Records 50-89



3–11.7 Markers Setup

Markers can be placed on data traces to mark significant or calculated points. Six classes of markers are available but not all classes are available to all display types. The class of markers available to each display type are those that are appropriate for that display. For example a Delta Time marker is inappropriate for a Magnitude Spectrum Display, and therefore is not provided.

Display Types

- Time
- Magnitude Spectrum
- Transfer function
- Cross Property
- Octave
- Auto/Cross Correlation
-

Marker Types

- **MaxTrax**

  The marker tracks the maximum amplitude of the signal.

- **Peaks**

  Up to 20 peaks above a specified amplitude threshold can be identified.

- **Harmonics**

  Up to 20 harmonics can be identified.

- **Side Band**

  Up to 10 side bands in each direction can be marked on the display.

- **User Defined**

  Up to 20 independent markers can be placed at any frequency.

- **RPM Lock**

  In addition, RPM Lock markers (or "RPM Tracking") are available if a Tach signal is present and RPM Readout has been selected on the Acquisition dialog.

  These markers will identify the amplitude at the specified (or derived) frequency in real time, or they can be manipulated when the display is in HOLD. The values of these markers plus display identification information can be printed in List format to the screen, printer, or a file. In addition, all markers can be annotated on the display with selected values. These values include amplitude, frequency, and, in many cases, equivalent order, based on a user-entered or cursor-selected 1x reference.

  When the Markers dialog appears, the Class of markers can be selected from a scrolling window. Based upon the Class, specific parameters can be selected to identify where to place the markers. New marker parameters are not used until

the OK button at the bottom right corner of the dialog is pressed. Selecting Cancel causes the dialog to disappear without modifying the existing parameters.

3–11.7.1 How To Invoke Markers

When the active window's display type is available, supported display markers can be placed on the display by invoking the **Marker Setup** dialog.

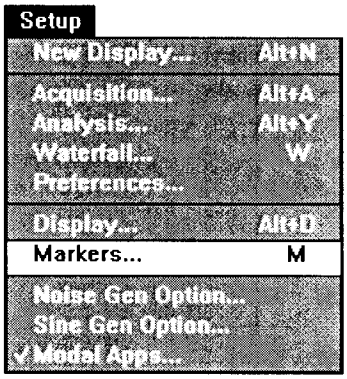
To invoke the **Markers Setup** dialog box for the active window to set specific marker parameters,

➢ Use the trackball to:

Select the **Setup** Menu

and then

➢ Select **Markers**



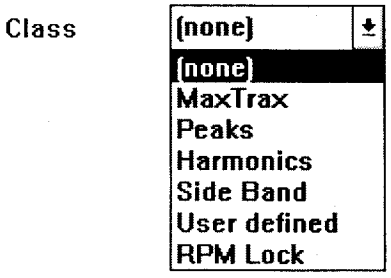
or

Use the Keyboard:

➢ Press the "**M**" key

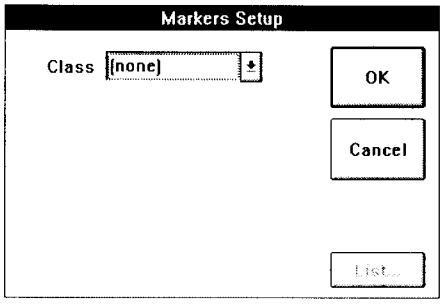
3–11.7.2 Class

The class of markers defines the type of marker to be displayed. The selections are:



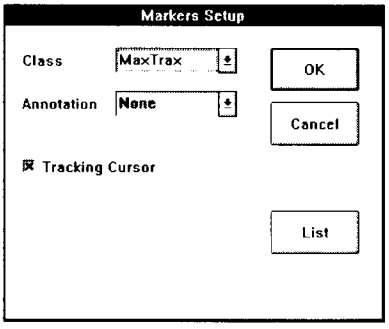
None

The markers are disabled.



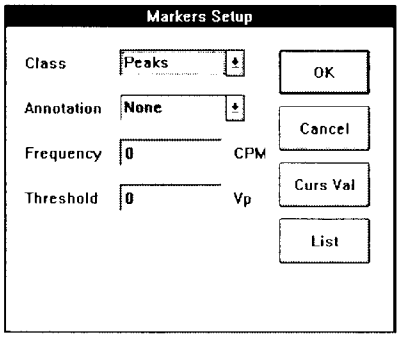
MaxTrax

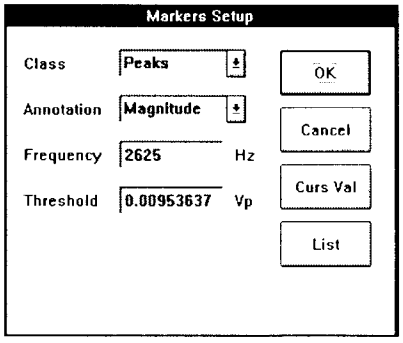
The marker tracks the maximum amplitude of the signal. When this class is selected, a tracking cursor mode is available that allows the cursor readout to lock onto the **MaxTrax** cursor value. In this mode, the user can momentarily read another display value, but the cursor will then automatically switch back to the highest display value. The marker can also be annotated with either magnitude or frequency values.



Peaks

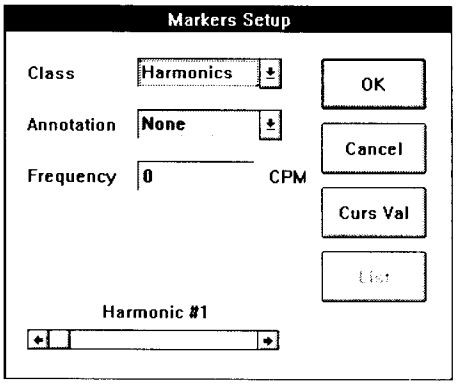
Up to 20 peaks above a specified amplitude threshold can be identified and annotated with magnitude, frequency, or order values. The threshold can be entered into the threshold field by typing the desired amplitude value, or automatically entering the amplitude value from the cursor value field. The number of peaks above the given threshold (up to a maximum of 20) will be calculated, displayed, and annotated with the specified value.





Harmonics

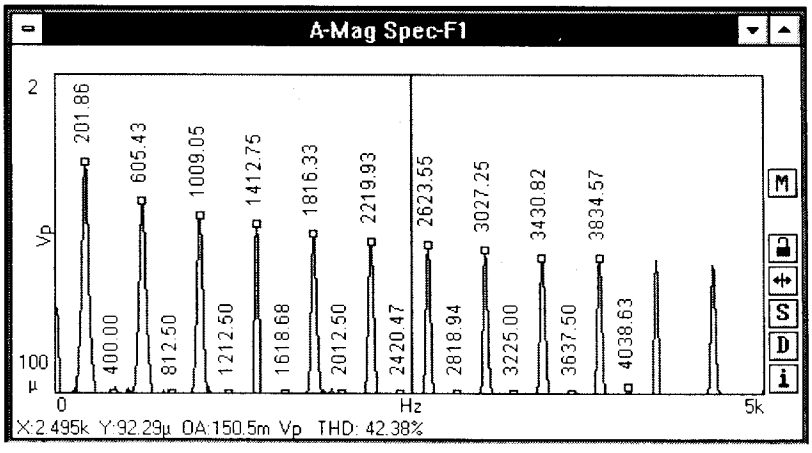
Up to 20 harmonics can be identified by specifying a desired harmonic number and the frequency at that harmonic. Using these two parameters, all other harmonics within the range are calculated and displayed. It is not necessary to identify the first harmonic from which all other harmonics are calculated. In fact, more accuracy can be obtained by selecting a dominant harmonic, and relating all other harmonics to the dominant harmonic. The desired "key" harmonic is selected by sliding the **Harmonic Number** slide bar from 1 to 20. You can then enter the corresponding frequency value in the **Frequency** field by typing the value, or automatically entering the frequency value from the **Cursor Val** field.



In addition, harmonic markers can be annotated with either frequency, magnitude, or equivalent order values by selecting the desired value type. They can also be listed to the Notepad by clicking on the List button.

As seen in the following display, a new icon appears on the "totem pole" to the right of the display whenever Harmonic Markers are selected  .

To activate variable Harmonic tuning, click on this icon. A new icon  , appears. When you click on this "arrow" icon, rolling the external mouse or trackball to the right will increase spacing between markers, and rolling it to the left will decrease the spacing.

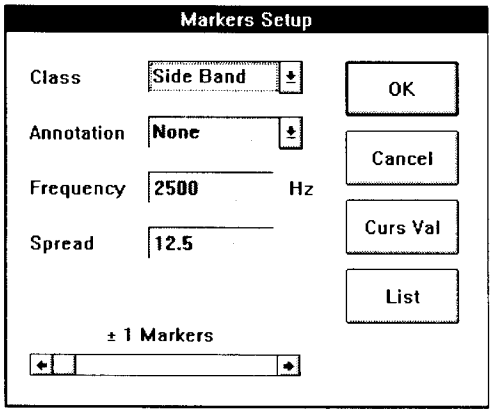


If frequency interpolation is activated before selecting **Harmonic** Markers, the marker "dots" will often line up exactly on the harmonic peaks and no further "fine tuning" is necessary. If fine tuning is necessary, note that alignment of the markers is done with sub-bin resolution.

Note also that activating frequency interpolation before selecting harmonic markers provides much finer resolution than when interpolation is turned off. (This can be seen by listing the markers with Interpolation on and then off, and comparing the results.) The markers can still be tuned to the peaks when Interpolation is turned off, but with far less frequency and amplitude accuracy than when Interpolation is employed.

☞ *See section on **Preferences** for more information in **Peak Interpretation**.*

Side Band

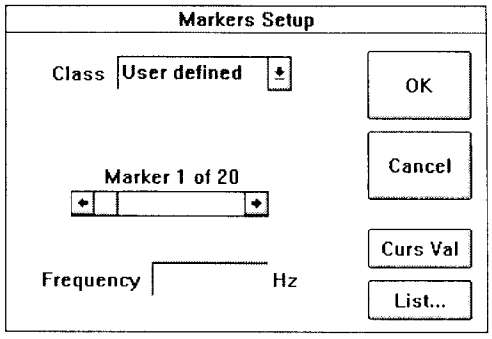


When this type of marker is selected, side bands can be marked on the display. Several additional fields emerge on the **Markers Setup** dialog box, as shown in the figure above. Up to 10 side bands in each direction can be identified; the desired number is set by sliding the marker slide bar from 1 to 10. The desired center frequency is selected either by typing in the value, or by automatically entering the frequency value from the **Cursor Val** field.

As with the harmonics markers, an additional icon appears on the "totem pole" when **Side Band** markers is selected. When clicked, the "fine tuning" arrow icon appears, allowing precise alignment. Marker Spacing (MS) is also shown on the display to simplify interpretation of the cause of side bands.

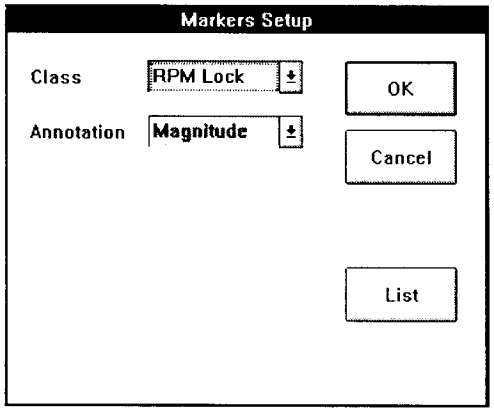
User Defined Marker

Up to 20 independent markers can be placed at any frequency by specifying the marker number and frequency at which to place the marker. The marker number is selected by sliding the **Marker** number slidebar from 1 to 20. You can then enter the corresponding frequency value in the **Frequency** field by typing the value, or by automatically entering the frequency value from the **Cursor Value** field. To erase a displayed marker, enter a frequency value of 0. These markers can also be annotated with either magnitude or frequency values.

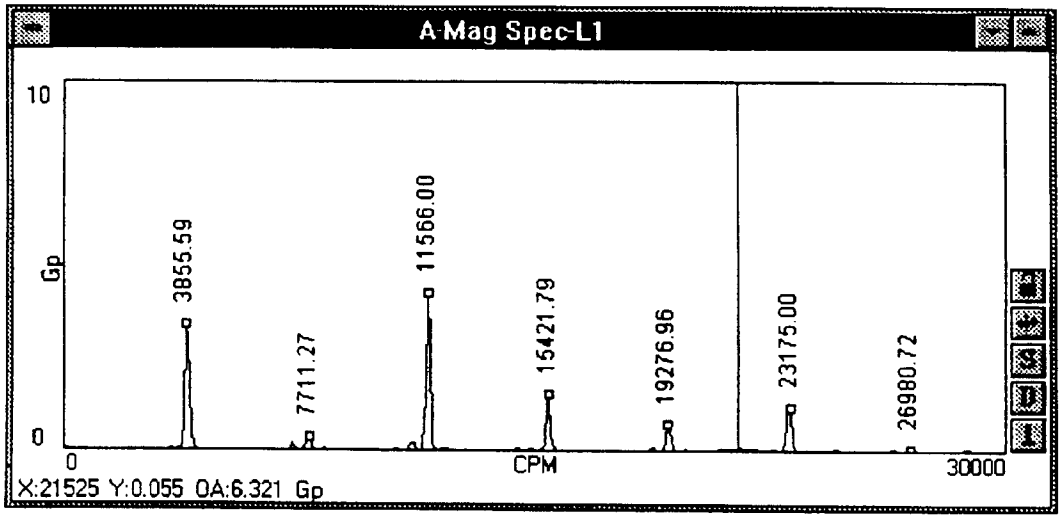


RPM Lock Marker

If a Tach signal is present and RPM Readout is selected on the Acquisition dialog, then an additional marker type, **RPM Lock**, appears on the marker menu. This marker is designed to lock onto the frequency of the external trigger (Tach) input and identify the fundamental and harmonics of this frequency in the selected display. The frequencies can also be annotated by selecting **Frequency** in the **Annotation** menu.



A typical spectrum display with **RPM Lock** markers active is shown here.

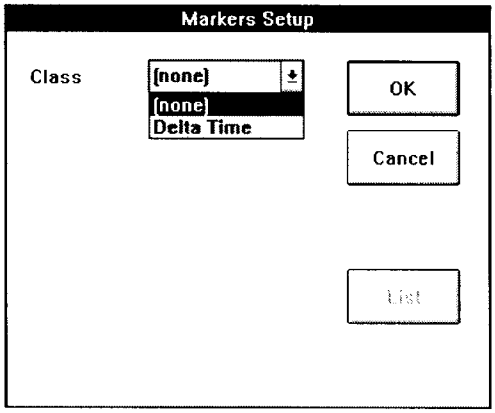


Curs Val

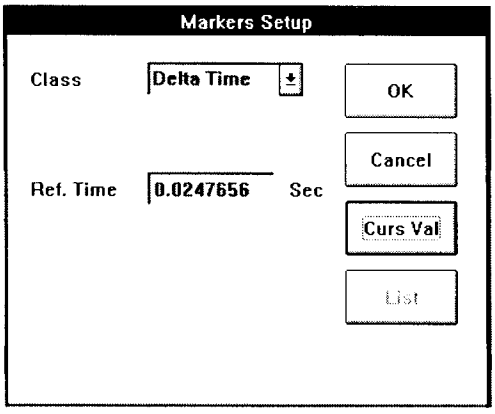
When this option appears, the parameter value for the marker can be obtained from the cursor position in the display. Clicking on the cursor Value button will place the cursor frequency or threshold in the markers frequency value field.

Delta Time Markers

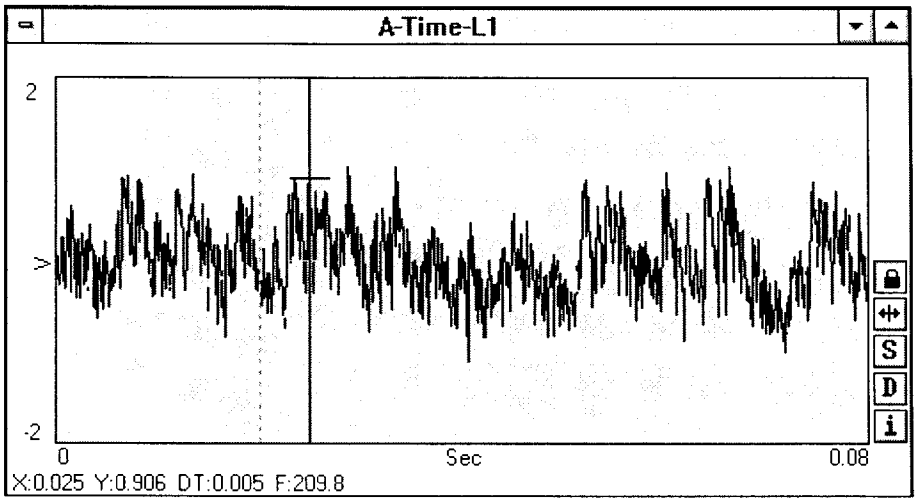
When a standard time trace of 512, 1024, 2048, or 4096 words is displayed, another marker function is available.



The **Delta Time** marker is useful in measuring the spacing of the periodicity of a displayed time trace. First, select a reference point on the display using the cursor pointer. Then, open the **Markers Setup** dialog. A **Ref Time** box will now appear.

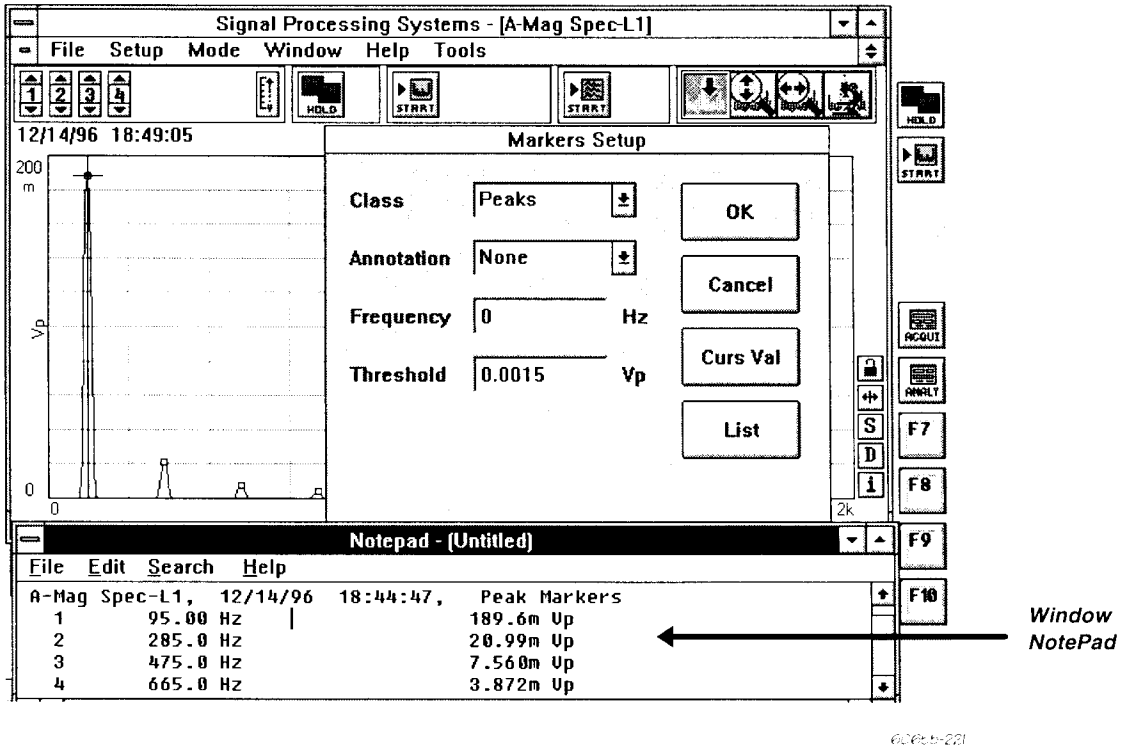


Using the cursor value as a reference time is a convenient way to "lock" a known location. Then use the movable cursor to select the periodicity of interest; the associated readouts move with it. The following display shows the reference point as a dotted line. **Delta Time** (DT) to the cursor point is shown at the bottom of the display along with the frequency (F). The frequency readout is calculated from the marker spacing and represents a good first estimate at the corresponding spectrum value. For a precise measure of the frequency of the selected periodicity, select **Spectrum** display, **Hanning** weighting, and **Interpolation**.



Marker List

Clicking on the **List** Button will cause the displayed Markers to be listed in tabular format to the windows **NotePad**. The frequency and amplitude of each marker is written to the **NotePad**, along with active window information of the display. Each time you list markers, the information is appended to the list in the **NotePad**. You can then use the **NotePad** file features to save the information in a named file, or to print the information to the attached printer. Other **NotePad** options are available for editing the information or adding more annotation or notes.



The first time the markers are listed to the NotePad, the NotePad window will cover the lower part of the main SPS390 window. When you return to the SPS390 window the NotePad will be buried, but listings will still be written to the NotePad. If you wish to see the listings as they are generated, you can resize the main SPS390 window and NotePad window to suit your viewing needs.

3–11.8 Open/Save Configuration

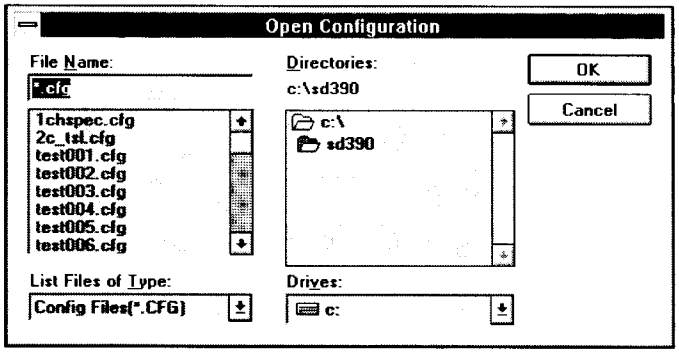
There are two dialogs that allow you to restore and save SPS390 operating configurations.

- Open Configuration
- Save Configuration

These options are accessed from the **File** menu. **Open** and **Save Configuration** prompt you for named files which contain the configuration information.

3–11.8.1 Open Configuration

The wildcard file name template is displayed in the **File Name** entry box, which causes a list of current configuration files to be displayed in the **Files** box. All configuration files have the default extension **.cfg**. You can select one of the existing configuration files by selecting a file in the **Files** box, then pressing **OK**.



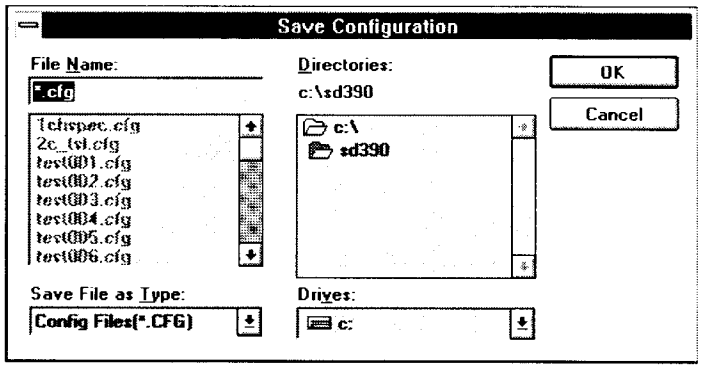
If you have saved a configuration file with a different extension than **.cfg**, you can modify the wildcard search, or directly enter the desired filename in the **File Name** entry box by entering the filename from the keyboard.

The disk drive and directory from which the file will be read can also be changed by selecting the desired drive and directory from the **Directories** entry box.

The title of the recalled configuration file is shown just below the cursor Icons. This title remains on the screen until a significant change is made to the Configuration.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

3–11.8.2 Save Configuration



The wildcard life name template is displayed in the **File Name** entry box, which causes a list of current configuration files to be displayed in the **Files** box. All configuration files have the standard default extension **.cfg**. You can select an existing file to save the current configuration by selecting a file in the **Files** box, then pressing **OK**. You will then be reminded that the configuration previously stored in the existing file will be replaced by the new configuration, and have the chance to cancel the operation.

You can modify the wildcard search, or directly enter the desired filename in the **File Name** entry box by entering the filename from the keyboard.

The **.cfg** extension will automatically become part of the filename.

The disk drive and directory to which the file will be saved can also be changed by selecting the desired drive and directory from the **Directories** entry box.

☞ *This operation can be canceled by clicking on the* **Cancel** *button.*

➲ ***SPS390 HINT:*** *For more information on wild cards, disks, directories and files, see the Microsoft Windows Users Guide provided with this system.*

3–11.9 Open/Save/Export Trace Data

There are three dialogs which allow you to open, save, and export trace data.

- Open Trace Data
- Save Trace Data
- Export Trace Data

Save and open are internal functions. Export allows transferring ASCII data to other applications and/or other systems.

These options are accessed from the **File** Menu. Each function prompts you for named files which contain the data.