SPECTRAL DYNAMICS

# PUMA

## Shock Synthesis
## Operating Manual

**2400-0141A**

# Chapter 1 - Introduction

## 1.1 Introduction

This manual describes the theory and operation of PUMA when running the Shock Synthesis Application. Note that the Receiving Checkout Tests (RCT's) are used as examples and should be referred to often.

This manual is presented in seven chapters relating information about the applicable menus required to set up the operating parameters for the Puma VCS.

## 1.2 Getting Started

Before beginning, read the PUMA *System Description Manual*. This will help familiarize the user with the system, and give required information for unpacking, assembly and operation.

## 1.3 Software and Manuals

Software and manuals (along with vendor manuals, calibration devices and service training) are sold in various combinations.

### 1.3.1 Software

The Shock Synthesis Function closed-loop vibration control program and options are supplied on CD ROM. This CD ROM contains executable code for Shock Synthesis Function, test parameters, schedule parameters and the micro code for peripheral devices. The **software** is **licensed** and **requires** a **key** to activate it. The key and drivers are supplied on diskette.

### 1.3.2 Manuals

The PUMA VCS is supplied with a set of two system manuals and an application manual.

- ***PUMA System Description***
  Part Number 2400-0100

- **PUMA Diagnostic Manual**
  Part Number 2400-0103

  Other manuals may be included as purchase options.

## 1.4 Shock Function Features

The PUMA VCS and the Shock Synthesis Function program provide digital real-time closed loop shaker control for production testing, design qualification and reliability testing applications. The system allows the definition, simulation, and closed loop control of a Shock Synthesis Function vibration excitation shaker system.

The technical specifications of the Shock Synthesis Function software are listed in Table 1-1.

**Table 1-1. Shock Synthesis Function Technical Specifications**

| | |
|---|---|
| **Control Methods** | |
| Control Loop | Patented adaptive control algorithm with transfer function updating and coherence smoothing to accurately and quickly compensate for non-linearity or time varying changes in the dynamic load. |
| **Control Performance** | |
| Dynamic Range | Up to 90 dB. |
| **SRS Reference** | |
| Definition | Can be easily defined with up to 100 frequency breakpoints |
| Reference SRS type | Primary +, Primary -, Maxi-max |
| Reference tolerance bands | Automatically generated, defined in % or dB |
| Frequency range | 25 Hz to 10 kHz; dependent on pulse duration and over sample ratio |
| Over sample ratio | User selectable, 5.12, 10.24, 20.48 times the control frequency range |
| Number of decades | Up to 3 |
| Analysis octave spacing | 1/1, 1/3, 1/6, 1/12, 1/24 Octave (ANSI standard) |
| Shock filter definition | Absolute Acceleration, Relative Displacement |
| SRS damping | User selectable from 0.1 to 99% (% of critical) |
| Units | g-in/s-in; g-m/s-mm, $m/s^2$-m/s-mm |
| **Shock Synthesis** | |
| Reference pulse synthesis | Automatic synthesis from user-defined SRS with selectable average and peak error |
| Reference pulses | Wavelets or damped Sines |
| Wavelet parameters | Polarity, frequency, amplitude, number of half sines, delay; automatically generated, user selectable or both; automatic convergence to reference SRS |
| Damped sine parameters | Polarity, frequency, amplitude, damping, delay; automatically generated, user selectable or both; automatic convergence to reference SRS |
| Pulse optimization | Time, displacement, peak acceleration |
| SRS convergence criteria | Average error, peak error |
| Pulse duration | Minimum 0.4 ms |
| Buffer Duration | 10 ms to 64 seconds |
| Pulse dynamic limits | Maximum input voltage, max/min acceleration, max/min velocity, max/min displacement, calculated and displayed |

## Control Parameters

| | |
|---|---|
| Mode of Operation | Manual, semi-automatic, automatic |
| Number of Control Channels | Any one channel selectable as control |
| Repetitive pulses | 1 to 1,000,000 |
| Delay Between Pulses | 0 to 8,000 ms |

## Control Strategy

| | |
|---|---|
| Pre-stored drive | User selectable, no/yes |
| Drive Update | Off, on (Equalization function updated after every pulse) |
| Output Polarity | + / - |
| Weighting for Averaging | User selectable, 0.05 to 1 |
| Feedback Gain | User selectable, 0.05 to 1 |
| Equalization Method | Transfer function |
| Equalization Level | 0 to –80 dB |
| Input for Equalization | Pulse, random, pseudo random |
| Non-Linear Ampl.Factor | NLAF #set 0.5 to 2.0 |
| Waveform Trend Removal | Disable, enable (Removes DC offset before integrating from Acceleration to Velocity or Displacement) |

## Start-up Parameters

| | |
|---|---|
| Initial Test Level | Equalization level to 0 dB |
| Level Increment | 1 to 20 dB |
| Equalization Delay | 0.0 to 8,000ms |

## Safety Features

| | |
|---|---|
| Shaker Limits | Pretest verification that spectrum dynamic limits are within shaker operational limits (acceleration, velocity, displacement and voltage) |
| Loop Check Max. Drive | User selectable, 1 to 5,000 mVrms |
| Loop Check Max. Noise | User selectable, 1 to 1,000 mVrms |
| Max Average Error Alarm | 0.01 to 100% |
| Max Average Error Abort | 0.01 to 100% |
| Max Peak Error Alarm | 0.01 to 100% |
| Max Peak Error Abort | 0.01 to 100% |
| Control Signal Loss | Continuous automatic detection |
| Maximum Drive Signal | 0.01 to 12V Peak |

## Test Automation

| | |
|---|---|
| Automatic Level Increase | User selectable initial level, level increment, delay between pulses; re-equalization between each pulse |
| Multiple Pulse | User selectable number of full level pulses and delay between pulses |

### Channel Setup

| | |
|---|---|
| Channel Type | Control, auxiliary, inactive |
| Sensitivity | 0.001 to 999,999 mV/g |
| Channel Loop Check | Enabled, disabled |
| Channel Label | Up to 20 characters for each channel |
| Transducer Serial Number | Up to 10 characters for each channel |
| Transducer Power | Constant current source On or Off |

### On-Line Analysis

| | |
|---|---|
| Real-Time Analysis | Pulses and spectra for 1 to all available channels simultaneously displayed |
| Time Functions | Control, drive, error and auxiliary waveforms |
| Display Units | Acceleration, Velocity and Displacement |
| SRS Displays | Maxi-max; Primary and Residual +or - |
| Cursors | X and Y value readout, peak search, trace tagging, multi-window locked positioning |
| Scaling of Display | Log / linear, auto-scaled / fixed, full control |

### Data Storage

| | |
|---|---|
| Data Storage Setup | Every pulse, last pulse, off |
| Playback | Scan through the entire test data file, with adjustable delay |
| Record Annotation | Complete tagging of each record with either static or dynamically changing info |
| Test Summary | Fully documented post-test summary, easily printed or incorporated into any document using standard word processing software |
| Run Message Log | Text file records all system status messages displayed during test run |

## 1.4.1 Safety Features

The Shock Synthesis Function provides the following safety features to protect the operator, the test equipment and the manufacturing operations:

- Tolerance bands for the reference waveform
- Audible Alarm / Abort to indicate abnormal test conditions
- Pre-test loop check to ensure proper operation of the complete drive signal and response signal paths
- Test abort on loss or excessive fluctuation of the control signal
- User-initiated manual test abort
- Password lockout of test modification to prevent unauthorized changes
- Abort documentation for post-test analysis
- Operator limit of drive amplitude

### 1.4.2 Options

The following options may be purchased for use with the system.

#### 1.4.2.1 Security

The Security Option package enables the system administrator to place limits on the system including who has access and what level of access is available to individual users.

#### 1.4.2.2 Automation

The Automation Option package includes Remote Control Interface (RCI), Remote Control Panel (RCP), Print Automation, Test Automation, Mission Simulation and True Networking.

### 1.4.3 Compatible Equipment

The PUMA VCS connects to any commercially available electro-dynamic or electro-hydraulic shaker and amplifier.

### 1.4.4 Reliability

The PUMA VCS is designed and manufactured with state-of-the-art components and processes that improve the reliability of the system.

### 1.4.5 User Interface

The PUMA VCS, runs under a Microsoft Windows 98 or NT operating system. All user interaction is by keyboard and mouse. Test setup, control and data are displayed on a high-resolution color monitor. User help information is available for all program functions.

The color monitor provides real-time displays of:

- Program control menus
- Test definition parameters
- Spectra showing test conditions, with Abort / Alarm information

## 1.5 Starting The Program

PUMA can be started by either a desktop shortcut icon or through the Start button. The path is <Start> ⇨ **PROGRAMS** ⇨ **SPECTRAL TEST SUITE** ⇨ **PUMA.**

### 1.5.1 Log In

If the **Security** option is in place the **{User Log In}** Dialog Box (Figure 1-1) appears. If there is no Security option the PUMA Program Entry Screen will appear as shown in Figure 1-2. To access the features of the PUMA VCS program the user must have a valid users name and password. See the system administrator for proper users name and password.

Enter a [**User Name**] and [**Password**] and click <*LOG IN*>. The PUMA Program Entry Screen shown in Figure 1-2 will appear. The PUMA Version Splash screen will disappear in several seconds (or can be dismissed by clicking on it) leaving the **{New}** Dialog Box (also in Figure 1-2). Click on **SHOCK SYNTHESIS,** and then click **OK**. A screen similar to the Spectral Dynamics Viewer (Graph Tool) Default Screen shown in Figure 1-3 appears. Exact screen layout is dependent on the parameters previously set with the menu options under Puma.

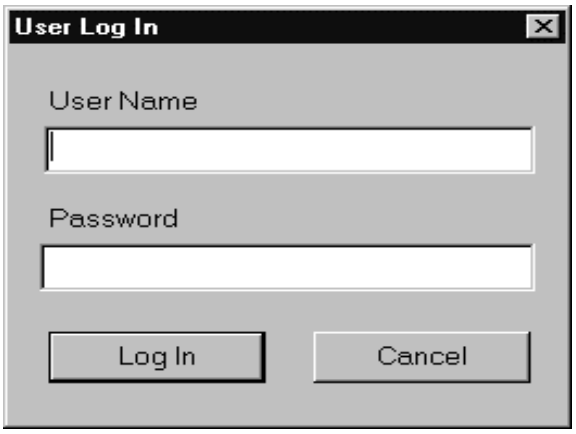



**Figure 1-1. User Log In Dialog Box**


**Figure 1-2. Puma Program Entry Screen**

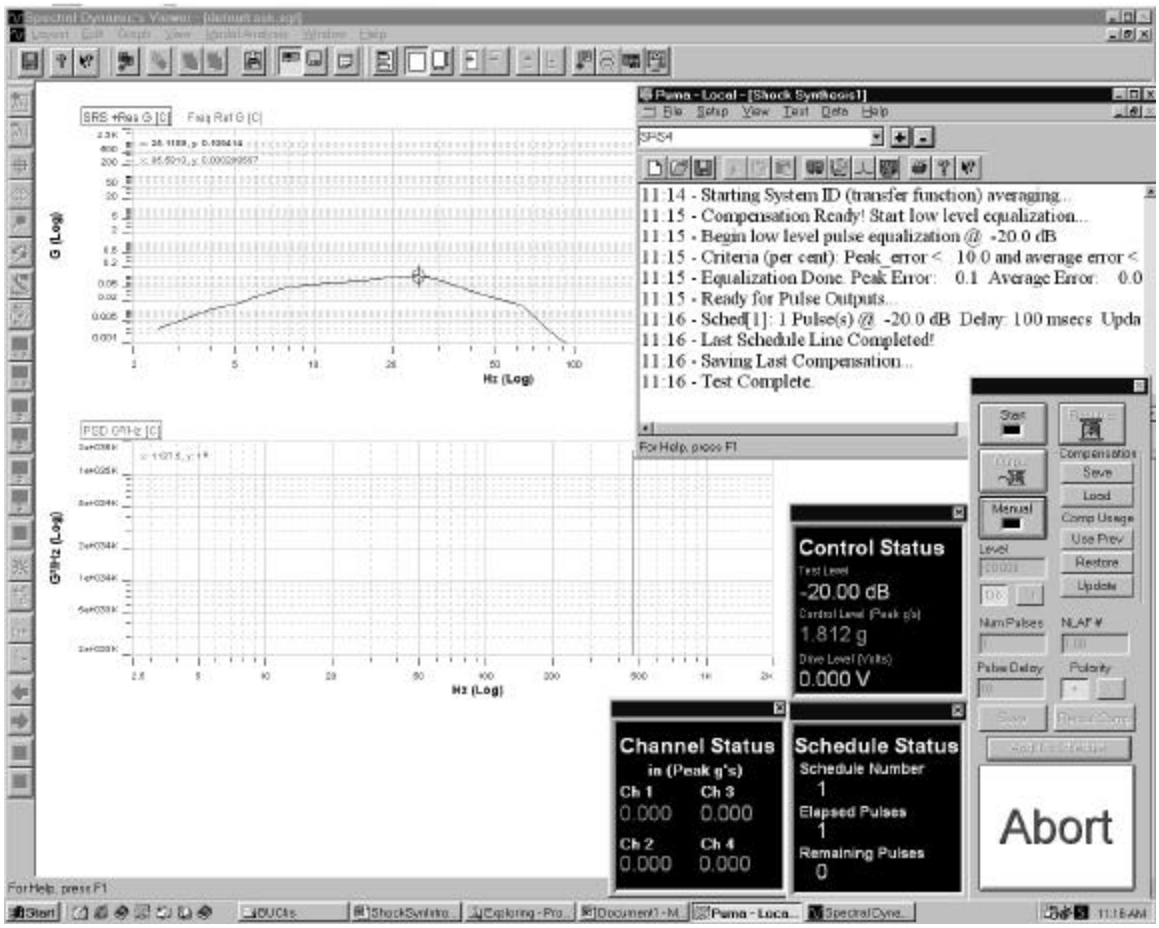



**Figure 1-3. Shock Synthesis Log In Screen**

### 1.5.2 Puma Window

The **Puma** Window's **Title Bar** displays three segments of information:

**Puma — Local — [Shock Synthesis 1]**

**Local** indicates the user is running on a local **Puma** system that is not running remotely across a network. **Shock Synthesis 1** is the name of the currently loaded test. If the **Puma** window is inaccessible minimize or drag the **Spectral Dynamics Viewer** window out of the way. Click on the **Puma** Window to start the process of setting test parameters.

### 1.5.3 Shock Synthesis Function Menus

The **Puma** Window's **Shock Synthesis Function Menu Bar** contains six menu selections used by the PUMA VCS. They are: **FILE, SETUP, VIEW, TEST, DATA**, and **HELP**. Each of these is discussed further within their own chapter.

Using hotkeys can activate many of the menu selections. For instance use <ALT> +<F> to activate the **FILE** menu. An underlined letter indicates a hotkey.

Select **LOG OUT** from the **FILE** menu when the system is unattended, and access to the program is to be restricted. When logged in, the **LOG OUT** menu item is available (**LOG IN** is grayed out).

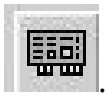
### 1.5.4 Setting Up Test Parameters

Initiating a test is done by starting a new one using the **SETUP** menu or by running one that has already been set up and saved to a file.

#### 1.5.4.1 New Test

The **SETUP** Menu information is presented in Chapter 3. The following procedure will enable the user to access the **SETUP** Menu options.

Procedural Steps

1. On the PUMA Window Screen, click **SETUP** ⇨ **CHANNELS** or click the <Channel Setup> Button  . The Channel Definition Window appears. See Figure 1-4.

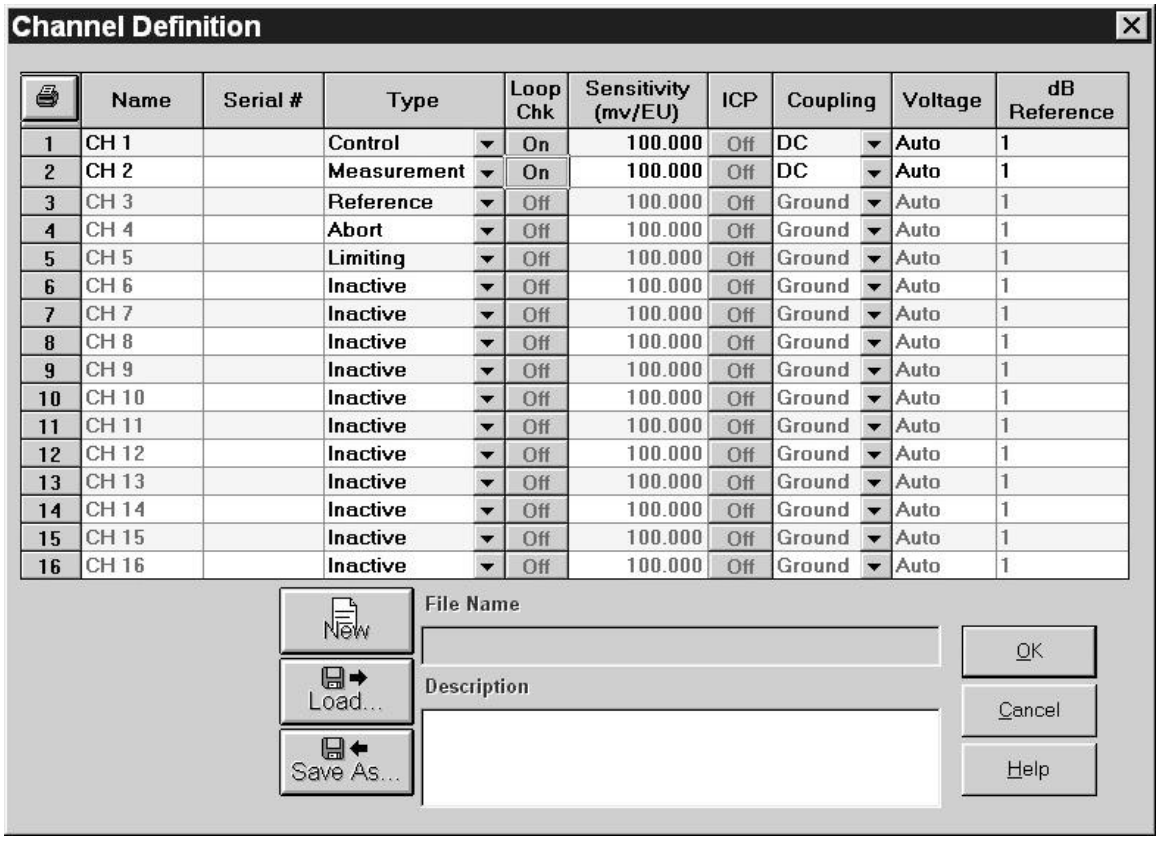



**Figure 1-4. Channel Definition Window**

2. Input the required parameters and save them to a file.

3. Click **SETUP** ⇨ **PROFILE** or click the < Profile Setup > Button  . The Profile Definition Window appears. See Figure 1-5.

4. Input the required parameters and save them to a file. The Synthesis Table is generated from this information. See Figure 1-6.

5. Click **SETUP** ⇨ **SCHEDULE** or the <Setup Schedules> Button  . The Schedule Setup Window appears. See Figures 1-7.

6. Input the required parameters and save them to a file.

The test is now ready to run.

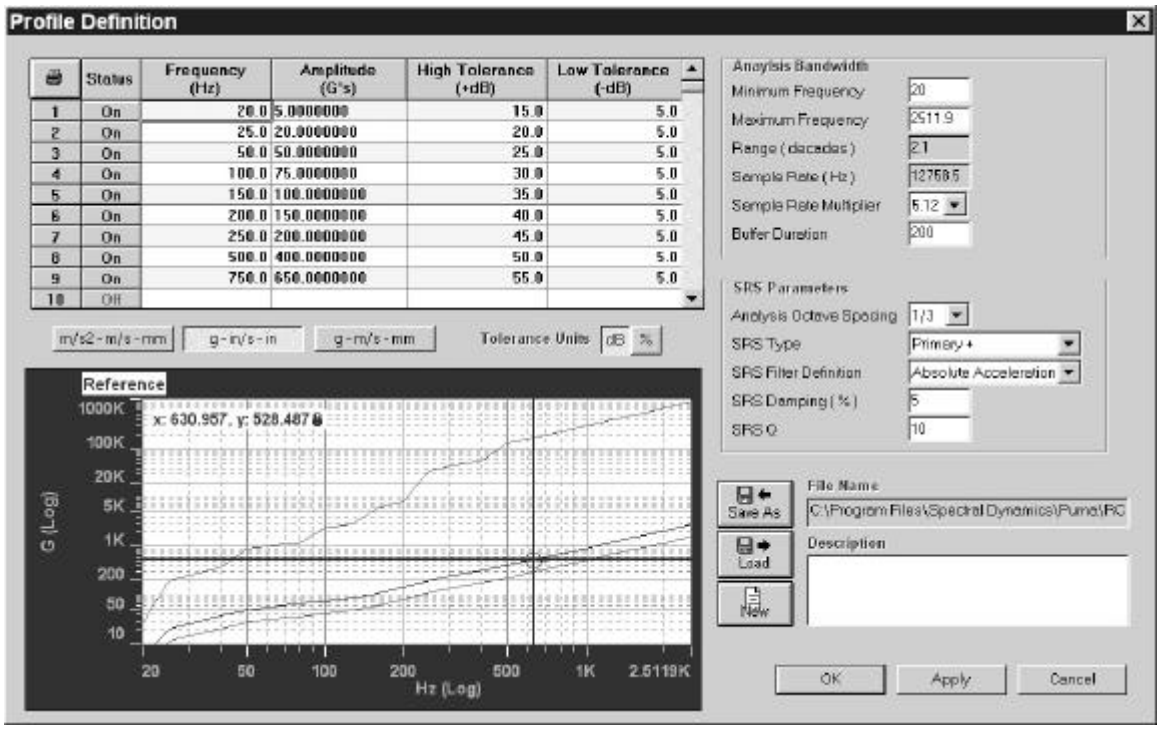



**Figure 1-5. Profile Definition Window**

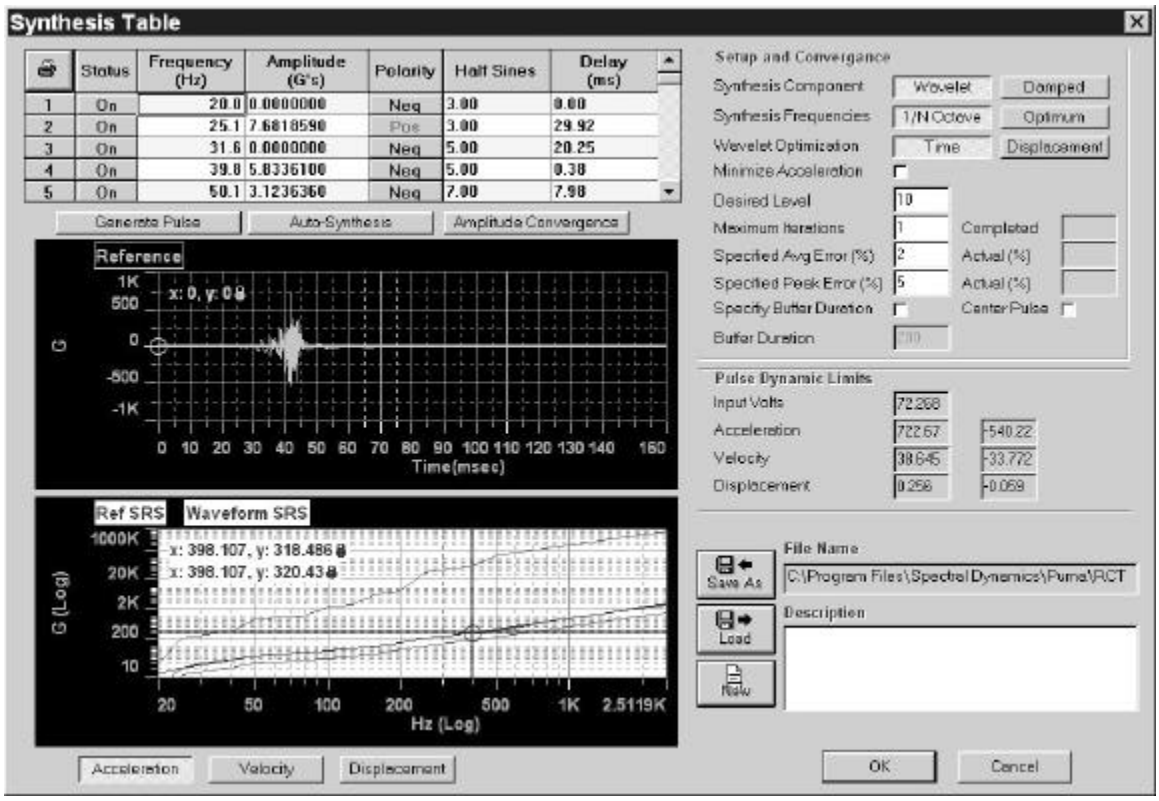



**Figure 1-6. Synthesis Table Window From Synthesis Define Menu Option**

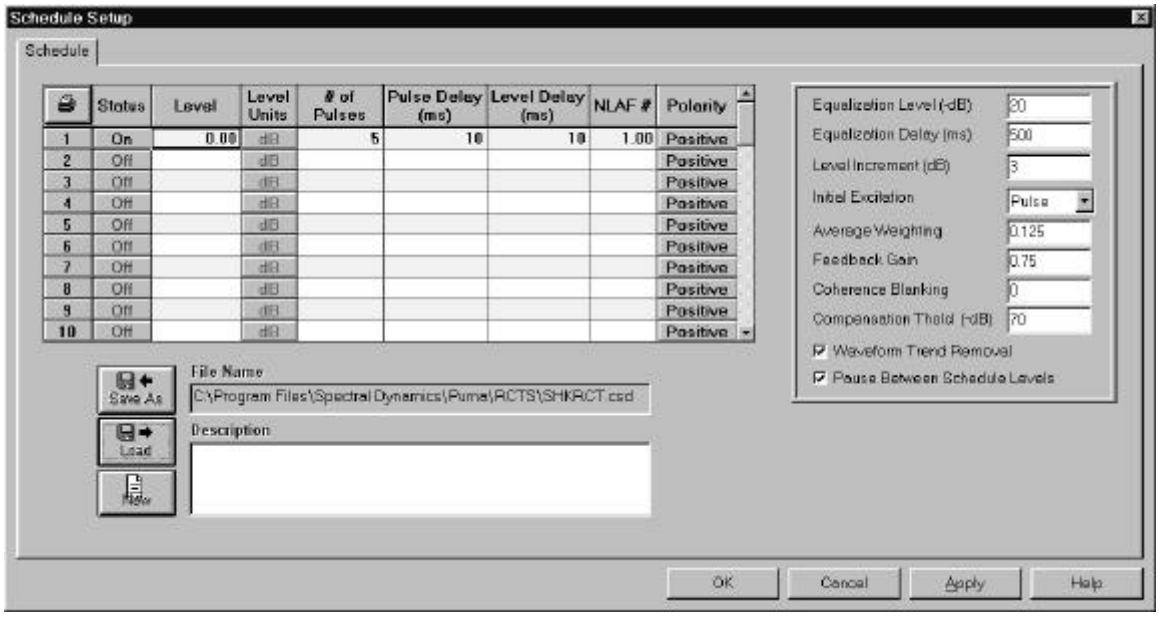



**Figure 1-7. Shock Synthesis Schedule Setup Window**

#### 1.5.4.2 Existing Test

Procedural Steps

1. On the PUMA Window, click **FILE** ⇨ **NEW**. The **{New}** Dialog Box appears. See Figure 1-8.
2. Click **SHOCK SYNTHESIS** ⇨ <OK>.
3. Click **FILE** ⇨ **OPEN**.
4. Select appropriate drive and file.
5. Click <Open> on the standard Windows File {**Open}** Dialog Box.

The test is ready to run.

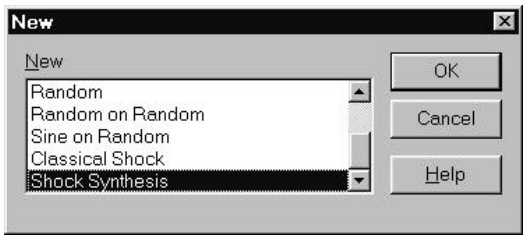



**Figure 1-8. NEW Dialog Box**

## 1.6 Arranging Screen Components

While running PUMA there will always be at least two windows on the screen (**Puma** Window and the **Spectral Dynamics Viewer** Window). There can also be a test control and various status boxes. The location of these components is completely customizable. A toolbar in the Puma Window (Figure 1-9) allows multiple screen layouts to be saved and recalled.

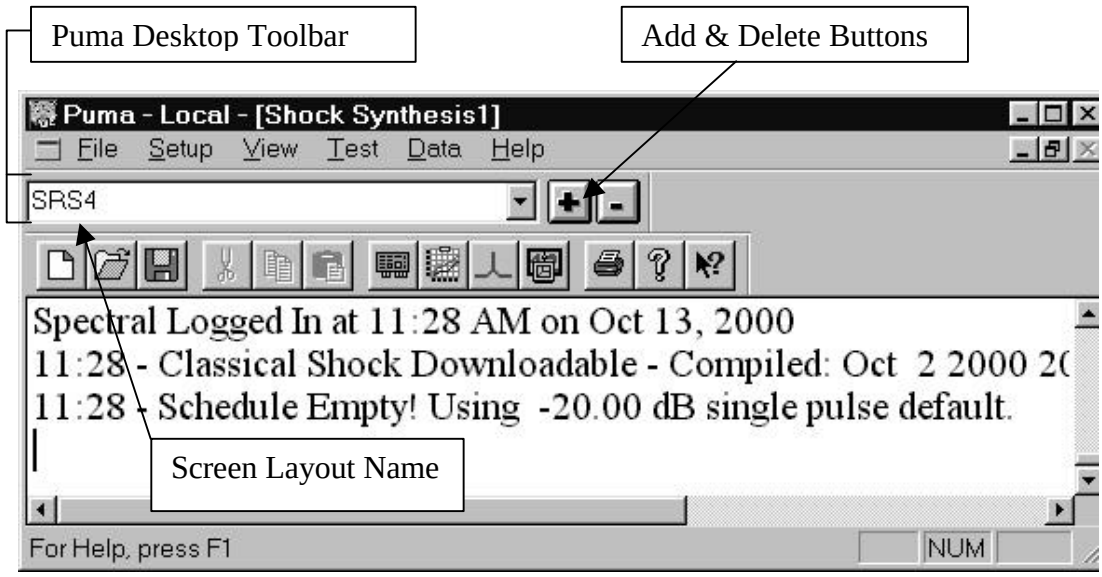



**Figure 1-9. Save Screen Location Toolbar**

In the example in Figure 1-9, SRS4 in the Puma Desktop Toolbar is the screen layout name. After sizing windows and arranging status panels, click on the <+ > button to the right of the screen layout name to save the layout. To create a new layout, enter a new

name in the layout name box and click the <+> button. Saved layouts are available from the pull down menu button in the layout name box.

## 1.7 Common Areas of Host Dialogs

The layout of dialog boxes sometimes differs from one menu option to another. Even though the command buttons may be in a different position, they will work the same from one menu option or function to another.

### 1.7.1 File Selection Box

Throughout PUMA there is a need to save the parameters of tests, load those same parameters for another test or just start on something brand new. The File Selection Box (FSB) (Figure 1-10) is shown in the lower left hand corner of Figures 1-4 and 1-7. It is a common Windows tool and is used throughout the PUMA platform though sometimes the format is somewhat different. The components of the FSB are outlined below for the primary setup areas of Channel Definition, Profile Settings (Pulse Parameters) and Schedule Setup.

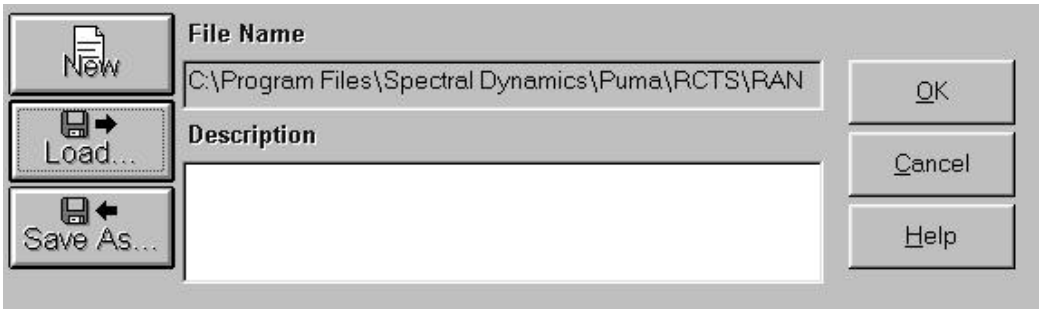



**Figure 1-10. File Selection Box**

#### 1.7.1.1 New Selection Command Button

- Channel Definition — The path / name of the currently open file is deleted from the File Name text box. It does not delete the numbers from any of the columns. It is **not** active during a test.
- Profile Settings — Clears all columns of data. It is **not** active during a test.
- Schedule Setup — Clears all columns of data. The path / name of the currently open file is deleted from the File Name text box. It is **not** active during a test.

#### 1.7.1.2 Load File Command Button

This button reacts the same way in all three parameter input areas. The {**Open**} Dialog Box is displayed for the user to choose a file to be loaded. All three areas are **active** during a test.

#### 1.7.1.3 Save As Command Button

This button also reacts the same way in all three parameter input areas. The {**Save As**} Dialog Box is displayed for the user to save parameter settings to a new file name. All three areas are **not** active during a test.

#### 1.7.1.4 OK Command Button

This button accepts any changes made, applies them and closes the open dialog box.

#### 1.7.1.5 Cancel Command Button

This button closes the open dialog box without applying any changes that may have been made.

#### 1.7.1.6 Help Command Button

This button launches the on-line help. If a dialog box is open it must first be closed to launch the help menus.

## 1.8 Drive Compensation

Drive compensation is used to achieve the reference shock waveform at the control accelerometer. There are two memory areas involved in this function, Dynamic Compensation (DCOMP) and Static Compensation (SCOMP).

The DCOMP is used to compensate the pulse for system dynamics. A DCOMP must be loaded into dynamic memory before it is used for compensating a pulse on the shaker system. The SCOMP is used as a storage area for reading and writing between disk files and the dynamic memory used for compensating the shock pulse for shaker system dynamics.

### 1.8.1 Compensation Threshold

The Compensation Threshold (CT) refers to the effective dynamic range to be compensated based on the system H(f). A CT of –70 dB means that the frequency based corrections will only be applied to those spectral lines that lie within 70 dB from the maximum spectral line at the H(f). Usually, one would try to use as much dynamic range (say up to 120 dB) as possible, but noise and dispersion (like smearing) can cause problems in anti-resonance. For highly resonant structures, or those with high Q’s, a CT of about 100 dB is recommended.

# Chapter 2 - Test Concepts and Definitions

## 2.1 Introduction

This section discusses closed-loop shock testing and introduces the terminology used to describe the shock control capabilities provided by the Shock Synthesis Control and Analysis program.

## 2.2 Closed-Loop Vibration Testing

Vibration testing of a product is conducted by subjecting the product to a stress consisting of a particular type of mechanical vibration. Vibration tests are performed on both prototype and production-line products. If you subject a prototype product to the mechanical stresses that the product will encounter during manufacturing, shipment, and use, then any product failures induced by these stresses allow early identification and correction of design problems. By such testing, you can ensure that the product will survive actual shipping and in-use conditions.
In a production-line environment, vibration testing performs rapid stress-screening of the products, to detect latent mechanical defects before the products are shipped. This allows product repair at minimum cost, and can help identify faulty components and manufacturing problems, thus improving product quality. Vibration tests can be either open-loop or closed-loop. In open-loop testing, the product or unit is excited with mechanical vibrations of the desired type, but the actual vibrations induced in the unit are not measured to determine whether or not they match the desired vibrations in amplitude or frequency content.

In addition to open-loop vibration testing, closed-loop vibration testing includes:

- Measuring the actual vibration generated during the test at selected points on the unit
- Comparing the actual unit vibration with a reference vibration for the unit
- Altering the excitation signal sent to the unit to make sure that the actual vibration is the same as the reference vibration

Closed-loop testing is in general more accurate than open-loop testing, because the actual vibration generated in the test unit closely matches the vibration you wished to produce. Product changes based on the results of a closed-loop test are thus more likely to yield the desired improvements.

**WARNING !**

To protect your test item from excessive vibrations, Spectral Dynamics strongly recommends that all users of the Vibration Control System (VCS) incorporate an independent vibration monitor or limiting device between the measurement channel and the power amplifier.

## 2.3 Shock Synthesis Testing

The objective of shock testing, in general, is to determine whether a test article can survive (retain its structural integrity), and remain operational when subjected to a specific shock environment.

Shock test requirements have historically been adapted from, and performed by, mechanical test equipment (such as drop, impact, and rebound test machines). Many mechanical tests can now be performed with shaker equipment driven by an electrical waveform from a digital controller. This equipment can perform faster, and with better repeatability than mechanical test equipment.

Shock test requirements are usually specified in terms of a classical pulse (such as Half Sine, or Sawtooth), or in terms of a prescribed Shock Response Spectrum (SRS). SRS is the set of peak responses of second order damped mechanical systems, each tuned to a different undamped natural frequency, when subjected to a shock or transient excitation. Each second order oscillator will be excited primarily by frequency components in the shock that correspond to its resonant frequency and will produce a response time history. Puma SRS simulates the second order (single degree of freedom) mechanical systems by a series of recursive digital filters.

The output response histories are divided into primary and residual time periods, where primary denotes the period during the shock, and residual denotes the period from the decay of the shock to the decay of the response. Various peak levels of these response histories are measured, and are tabulated or plotted against their natural frequencies. The output is a frequency spectrum termed the Shock Response Spectrum (SRS).

Shock Synthesis allows the operator to specify a reference SRS. The program will then automatically synthesize a time domain reference waveform, satisfying the SRS requirement. The operator may also generate any arbitrary time domain acceleration waveform to be used as the reference waveform.

**What is the Purpose of Shock Data Analysis?**

Shock data analysis is a type of transient signal analysis that is used to determine relative damage potential of a shock wave upon a physical system.

**What is the Nature of Shock Data?**

Shock data are transient time histories that can be either deterministic or non-stationary random. They can exist within a finite time interval, and in general change rapidly relative to the system subjected to them. Mechanical shock waves are of particular interest, since they impart levels to a structure that are extremely high in comparison to steady state levels. Examples include automotive impacts, pyrotechnic blasts, nuclear explosions and earthquakes.

Because the shaker has a frequency response function of its own that affects the acceleration applied to the test article, we cannot simply drive the equipment with the desired acceleration waveform and expect to get accurate results.

Therefore, the response acceleration must be monitored at the control point on the test article, and the drive waveform must be adjusted according to the system transfer function to produce the required acceleration curve at the response control point.

**How is Shock Data Analyzed?**

The two most commonly used techniques to analyze shock data are the Fourier transform and the SRS, both of which transform time history data into the frequency domain. (It should be noted that unlike a true transform function, such as the Fourier transform, the SRS does not actually *extract* information from a time history and represent it as a spectrum, but synthesizes one based on external mechanical models). Although the Fourier transform completely describes the shock transient in the frequency domain, a mechanical shock is often better described using the SRS which provides results in mechanical units and can be made to vary with mechanical parameters (damping).

Also, the acceleration waveform for shaker equipment must be constructed in a way that restores the shaker to a rest position (at the end of the output pulse, the final velocity and displacement must be at or near zero).

Shock Synthesis generates acceleration waveforms by summing a set of synthesis components. Each wavelet is constructed such that its final velocity and displacement are zero. The waveforms are synthesized to produce zero final velocity and displacement. Unlike classical pulse waveforms, no additional velocity or displacement compensation is necessary.

The Shock Synthesis software sets up and controls shaker equipment in a closed-loop mode so that specified acceleration pulse waveforms can be accurately achieved at the control point on the test article. The software then records and analyzes the results for test documentation. To achieve these purposes, the software provides the means to:

- Define, generate, and store shock pulse (acceleration and drive) waveforms, based on the user defined SRS.

- Compute the external equipment transfer function from the system drive output to the control point response input for H(f) equalization.
- Compensate the waveform to account for the transfer function and then output test pulses.
- Measure the corresponding response from the control point.
- Store the time domain response waveforms to a disk file (if selected).
- Analyze the reference and response waveforms for acceleration, velocity, displacement, spectrum (FFT) and SRS.

## 2.4 Signal and Waveform Definitions

Various signals, real-time waveforms, and computed waveforms are used in the Shock Synthesis program. These are identified by an X in Table 2-1 and are defined as follows:

- A **signal** refers to the time-domain data, either analog or digital, that is input to or output from the vibration controller.
- A **real-time waveform** is a digital, frequency-dependent quantity that is obtained from an input signal or is used to produce an output signal.
- A **computed waveform** is a function that has been created or modified in the program.
- a **User defined waveform** is generated from the values you enter in the setup parameters.

All data generated by accelerometers attached to the external load and connected to the system's analog-to-digital (A/D) converter constitute the input signals.

The A/D channels through which the data enters the system are the input channels. Input signals have units of volts when they enter the system, and are then converted by the program to acceleration levels in units of g's (if appropriate), using accelerometer sensitivities supplied as setup parameters.

**Table 2-1**
**Signals and Waveforms**

| Type | Signal | Real-time Waveform | User Defined Waveform | Computed Waveform |
|---|---|---|---|---|
| Reference | | | X | X |
| Drive (output) | X | X | | X |
| Control (input) | X | X | | X |
| Auxiliary (input) | X | X | | X |
| H(f) | | | | X |
| Error | | | | X |

| | | | | |
|---|---|---|---|---|
| Coherence | | | | X |

### 2.4.1 Reference

The Reference Shock Response Spectrum (SRS) is defined by the user in the SRS Reference Table. The time domain Reference Waveform (pulse) is synthesized by the program, and is used during the execution of the shock test.

### 2.4.2 Drive

The Drive waveform is based on the Reference waveform and the Transfer Function of the system. The Drive waveform is compensated by the response from the control loop; when the Drive waveform is output, the desired Control response is obtained.

### 2.4.3 Control

The control signal (the external load) is the input signal you selected to match (as closely as possible) the Reference. You may choose only one input signal to be the control channel. A control channel cannot be defined as an auxiliary channel, but can be displayed as both the control channel and an auxiliary channel.

### 2.4.4 Auxiliary

You may specify one or more input channels as auxiliary channels. These channels are for the auxiliary data input signals (measurement channels). The auxiliary channels are used for display purposes (no drive signal is generated).

### 2.4.5 H(f)

The Transfer Function of the external equipment, H(f), represents the amplitude and phase response versus the frequency. For H(f) equalization, it is required to compensate or "equalize" the system by modifying the Reference waveform to generate a Drive waveform that produces the desired response at the control point, allowing for the frequency characteristics of the equipment.

### 2.4.6 Error

The Error waveform is the percent (%) difference between the Reference Waveform and the Control response, normalized to the Reference peak.

### 2.4.7 Coherence

The Coherence function is a measure of the degree of causality between the Control response and Drive. A Coherence of 1.0 indicates that the shaker output (Control response) is entirely due to the shaker input (Drive). Anything less indicates the introduction of noise or other spurious signals within the system.

## 2.5 Shock Response Spectrum (SRS)

The SRS process allows the choice of:

- Octave resolution from 1-octave up to 1/24-octave
- Damping selections from 0.1% up to 99% of critical damping
- and a selection of:
  - The absolute acceleration definition of a classical Single Degree of Freedom system

    or
  - The relative displacement definition of a classical Single Degree of Freedom system

**Note** A classical Single Degree of Freedom (SDOF) system is defined as a mass constrained to just one motion along or about a single axis.

These SRS parameters can be selected in the SRS Reference Table. Shock Synthesis provides three types of SRS: Maxi-Max, Primary Positive, and Primary Negative.

The **SRS Tolerance Bands** are the areas both above and below the Reference SRS Waveform that you define in the test parameters These bands display on the test display during test and data review.

## 2.6 Calculated Waveforms

When you select Reference, Control, or Auxiliary for the waveform, you may select the way the waveform is calculated. The following paragraphs describe your choices.

### 2.6.1 Acceleration

This is the response waveform at the control point on the test article. The positive and negative peak values appear as annotation on the display.

By integrating selected waveform Acceleration data, the Velocity may be computed and displayed.

### 2.6.3 Displacement

By using double integration of the selected waveform Acceleration data, the Displacement may be computed and displayed.

### 2.6.4 Spectrum

The Spectrum process computes and displays the Fast Fourier Transform (FFT) spectrum of the time domain waveforms. The Spectrum is a narrow band function with equally spaced fixed-bandwidth filters across the entire frequency range. The frequency resolution (filter spacing) of the Spectrum is the inverse of the time length of the waveform buffers: ÄF = 1 / T. The Spectrum uses a "boxcar" window (i.e. no window).

### 2.6.5 Output Definition

The output responses are broken down into primary and residual time periods, where primary denotes the period during the shock and residual denotes the period from the decay of the shock to the decay of the response. Thus the user can compute different sets of peaks. These peaks or maxima can be:

| | | |
|---|---|---|
| Primary positive | Primary negative | Overall maxima (Maximax) |
| Residual positive | Residual negative | |

The last set of peaks is simply the maximum absolute responses during either primary or residual periods.

### 2.6.6 SRS Maxi-Max

This is the SRS Maxi-Max of the selected waveform Acceleration data. Envelope or maximum of all the response types include:

| | | |
|---|---|---|
| Primary positive | Primary negative | Composite |
| Residual positive | Residual negative | |

It is effectively the "worst case" response.

### 2.6.7 SRS Primary Positive

This is the SRS Primary Positive of the selected waveform Acceleration data. SRS response during the positive portion of the response.

### 2.6.8 SRS Primary Negative

This is the SRS Primary Negative of the selected waveform Acceleration data. SRS response during the positive portion of the response.

### 2.6.9 Residual Positive

SRS response after the waveform max (maximum positive).

### 2.6.10 Residual Negative

SRS response after the waveform minimum (maximum negative).

## 2.7 Control Loop

Figure 2-1 shows the individual steps involved in the closed-loop control process performed by the program. Control loop function is explained by describing the individual steps of the loop, starting with the external load. A description of each step in Figure 2-1, starting with External Load, is given below.

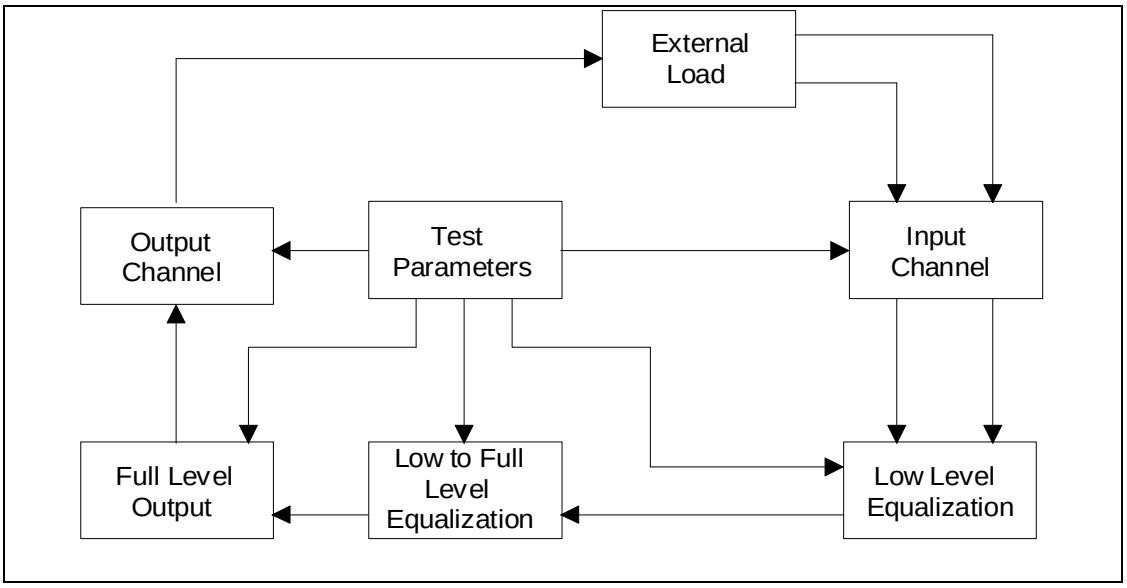



**Figure 2-1. Shock Synthesis Control Loop Diagram**

### 2.7.1 External Load

The external load includes the shaker apparatus and the unit under test. A single output channel from the system carries the drive signal to the shaker power amplifier to excite the load. Accelerometers can be attached to points on the load. The output signals from the accelerometer amplifiers are the input signals that the system acquires via input channels.

### 2.7.2 Input Channels

Each input channel samples the input and supplies the system with digital data. You can specify one input channel to be a control channel, or any of the input channels as auxiliary channels. The control channel affects the drive signal amplitude and thus controls the external load. Auxiliary channels allow display of additional response data.

### 2.7.3 Low Level Equalization

Using very low level random excitation, a Loop Check is performed. Within this process, the Internal DC Offsets are nulled, the Ambient Noise is measured, a search for the "Loop OK" Threshold occurs, and the low level System Gain is computed.

For **H(f)** equalization, a System Identification process is executed where the requested drive excitation is generated (Pulse or Random) and the Control response is measured. This is a loop that occurs N times, where N is the reciprocal of the Weighting Factor for Averaging from the Control Parameters. After N averaging loops, the Frequency Response Function [H(f)] is computed. The compensated Drive is then computed and output for the first equalization loop. An Error function is computed as the difference between the Reference acceleration waveform and the Control response acceleration waveform.

For **SRS Amplitude** equalization, the synthesized drive waveform is output for the first equalization loop. For this case the Error function is computed as the difference between the Reference SRS and the SRS of the Control response.

For both equalization methods the peak and average errors are obtained from their respective Error functions. When the Control Parameters Drive Update selection is On and the computed peak and average errors are less than the Maximum Peak and Average Error Alarm limits from the Safety Parameters, the test proceeds to the next level. If the computed errors are greater than or equal to these Alarm limits, a new Drive is computed and output. The program will repeat this loop up to twelve times. When the program finds the computed errors to be less than the Alarm limits, the test will proceed. If the computed errors are still greater than or equal to these Alarm limits at the end of twelve loops, the test will be aborted.

When the Control Parameters Drive Update selection is Off and the computed peak and average errors are less than the Maximum Peak and Average Error Alarm limits from the Safety Parameters, the test proceeds to the next level. If the computed errors are greater than or equal to these Alarm limits, the same Drive is output. The program will repeat this loop up to five times. When the program finds the computed errors to be less than the Alarm limits, the test will proceed. If the computed errors are greater than or equal to these Alarm limits at the end of five loops, the test will be aborted. Additionally, if the Control Parameters Operation Mode is Manual, then the program will only output the first drive waveform without checking the Alarm limits and proceed directly to the Manual operation mode.

### 2.7.4 Low Level to Full Level Equalization

The output level starts from the Control Parameters Initial Test Level. If the "Automatic Increase to Full Level" feature is enabled, the program computes the next output level, scales and outputs the Drive, and measures the control response. If "Automatic Increase to Full Level" feature is not enabled, the user supplies the next output level (in dB below Full Level) then the program scales and outputs the Drive. The program also measures the control response. The Control response is checked against the Abort limits, and if exceeded, aborts the test. If the alarm limits are exceeded, a warning is sounded and printed on the monitor. If the 'Drive Update" feature is enabled, the Drive is updated, and the loop is started again.

### 2.7.5 Full Test Level Output

If the Test Mode is Manual, the user may output pulses from the Test Display Control Panel.

### 2.7.6 Output Channel

The digital drive signal is converted to analog form. It is attenuated to provide the correct drive amplitude for the current shock pulse, and is output via the system output channel (DAC) to the shaker power amplifier.

### 2.7.7 Test Parameters

As shown in Figure 2-1, the test setup parameters are used to control all of the processes in the control loop. ***These parameters are discussed in Section 9 (Setup Parameters).***

## 2.8 Safety Features

Protection of the external load is of the highest importance. The Shock Synthesis control program contains a number of safeguards for this purpose, designed to ensure that no out-of-tolerance condition in the Drive signal level occurs that might damage the test specimen or actuator equipment.

If during a test any of the safety features are exceeded, the test aborts and shuts down . A list of safety features and the frequency with which each feature is monitored is given below.

| **Feature** | **When Monitored** |
|---|---|
| Loop check function | Once per test |
| Equalization function | Once per test |
| Control abort limits | Once per output pulse |
| Control signal loss | Once per output pulse |
| Operator abort | Continuous |
| Drive signal limit | Once per output pulse |
| Shaker limits | Before test starts |

Each feature is designed to protect the external load under a particular set of circumstances. All features except the user abort are automatic and hence do not add to the user workload.

The safety features minimize any possibility of damage to the unit under test. However, you retain final responsibility for proper preparation and maintenance of the external load and signal connections, appropriate use of the safety features and the selection of associated parameters, and careful selection of all maximum signal levels specified for a test.

### 2.8.1 Loop Check Function

The loop check is a continuity test of the control loop, including all connections to the external load. The loop check verifies that all equipment in the control loop is connected and functioning, using very low drive voltage levels. You can also specify loop check for any Auxiliary channels that are used.

The loop check function should in all cases be applied to an external load before the load undergoes a full test. If the equipment loop is actually open, then control cannot be achieved and the test specimen could be damaged in an unsuccessful attempt to establish control. On the other extreme, if the power or accelerometer amplifier gain settings are too low, the loop may appear open when it is really closed. The loop check presents a means of testing the accelerometer gain settings and the selected loop check maximum drive, to determine that they are appropriate and safe for the external load.

In addition to being an independently executable function, the loop check executes automatically at the beginning of the Test Start function and at the beginning of the Test Resume function. As a pre-test feature, the loop check serves as a final test for loop continuity.

The loop check outputs a very low level drive signal and gradually increases the signal level to the loop check maximum drive level specified in the Test Parameters. The loop check ends successfully when a signal level above a certain threshold is detected on each Control or Auxiliary channel. When this occurs, the drive signal level gradually decreases to zero. The loop check reports an "Open Loop" failure condition (on a channel-by-channel basis) if the drive signal level reaches the specified Loop Check Maximum Drive Level and no signal above the threshold value is detected on one or more channels.

The program will print the System Gain for each defined Control or Auxiliary channel in use. System Gain is the ratio of the drive signal level to the control signal level in decibels.

### 2.8.2 Equalization Function

During this function, the Maximum Average Error and Maximum Peak Error alarm limits are compared to the measured error. If the absolute value of the measured error is not within the specified limits the test is aborted and a is displayed.

### 2.8.3 Control Abort Limits

If the absolute value of the measured error exceeds either the Maximum Average Error abort limit, or Maximum Peak Error abort limit, the test is aborted. Control signal loss is detected when the negative peak error is greater than the peak abort limit.

Control signal loss has several potential causes, such as an accelerometer connection has come loose, the accelerometer power has been interrupted, the amplifier gain has been turned down, etc.

### 2.8.4 Operator Abort

The system keyboard has a specially designated Abort key. The program continuously monitors this key. Pressing the Abort key causes an immediate program shutdown. This safeguards the external load if a dangerous or abnormal situation occurs during a test.

### 2.8.5 Drive Signal Limit

You can define a test parameter that specifies the maximum drive signal voltage to be output during a test. When this maximum signal is detected during a level increase, from initial test level to full level, the program aborts the test and displays a message in the Messages box.

When the maximum drive is detected during the output of full level pulses, the test is placed into a test-hold state.

### 2.8.6 Shaker Limit

Shaker Limits allow you to define the maximum limits you particular environment can sustain. If these limits are exceeded, a test will not run. The limits checked are: Acceleration, Velocity, Displacement and Voltage.

### 2.8.7 Data Review Test Summary

The Data Review function provides summary documentation about the last test function run, and aids in the correct interpretation of any test abort condition that may have occurred. The information in the Test Snyopsis message includes the test ID and test heading of the setup parameters in effect for the test, indicates whether the test completed normally or was aborted, and gives the following data about the last pulse output:

- Pulse Amplitude
- Test Level
- Polarity
- Average Error
- Peak Error
- Pulses Requested
- Pulses Remaining

# Chapter 3 - File Menu

## 3.1 Introduction

There are six menu options in the PUMA Window running the Shock Synthesis function on the PUMA Vibration Control System (VCS). The first menu option is the **FILE** Menu. Refer to the following chapters for other menu options.

## 3.2 The File Menu

When the user selects **FILE** from the Menu Bar, the menu shown in Figure 3-1 will display. The **FILE** menu option has 16 sub-menus and a seven-file list (called a recent-file list) contained in a seven-section drop-down menu list. The recent-file list allows rapid access to files recently worked with.

### 3.2.1 File Sub-Menus

The sub-menus (Figure 3-1) of the File Menu option are outlined below.

#### 3.2.1.1 New Menu Option

When **NEW** is selected, the {**New**} Option List Box will display. See Figure 3-2. This will initialize the test parameter settings for the test application chosen. Only test applications that are licensed for the system will appear in the box. Available test applications are:

- Analyzer
- Multi-Ref Modal Acquisition
- Waveform Replication
- Random
- Sine
- Sine On Random
- Classical shock
- Shock Synthesis

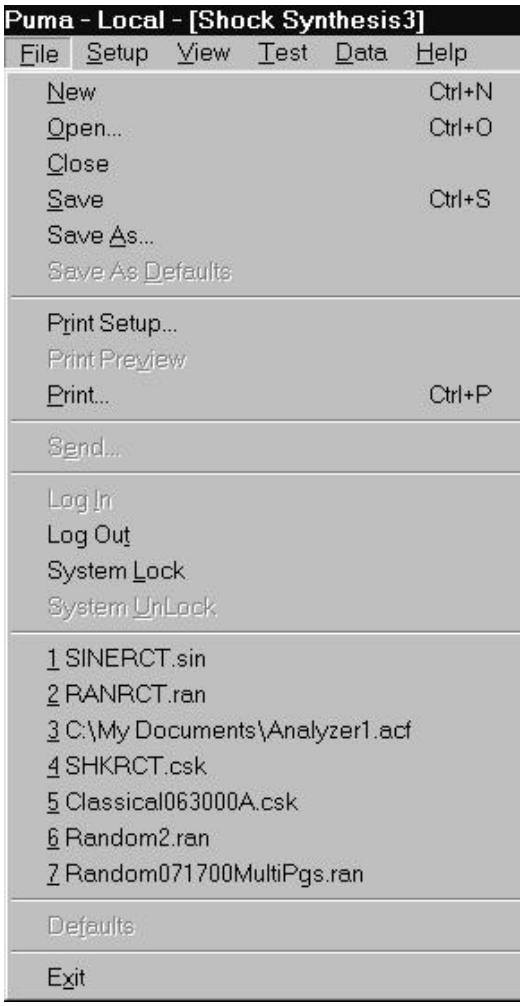



**Figure 3-1. File Menu Prior To Test**

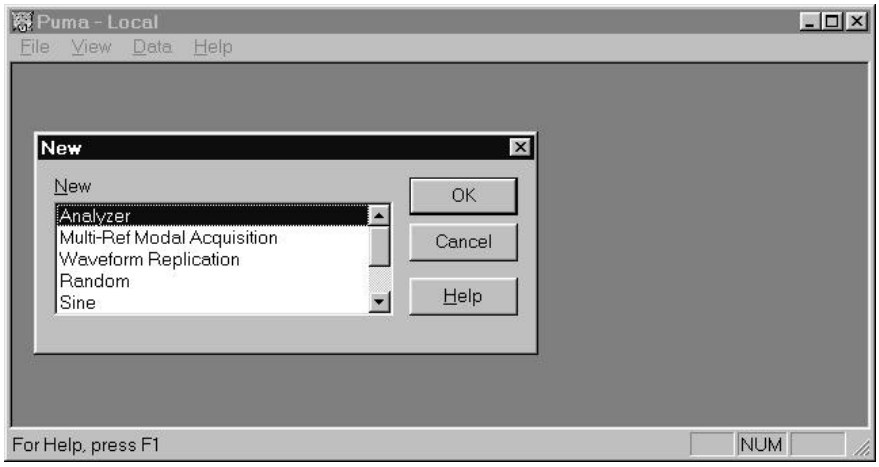



**Figure 3-2. New Option List Box**

#### 3.2.1.1.1 Analyzer

The Analyzer program provides the ability to analyze various types of signals using a variety of frequency domain measurements. Measurements may be made with flexible triggering, windowing, sampling and averaging parameters.

#### 3.2.1.1.2 Multi-Ref Modal Acquisition

This program allows utilization of multiple references while acquiring modal data.

#### 3.2.1.1.3 Waveform Replication

This program is used to replicate and control an arbitrary waveform.

#### 3.2.1.1.4 Random

The Random Test Suite provides digital real-time closed loop shaker control for production testing, design qualification and reliability testing applications. The system allows the definition, simulation and closed loop control for random vibration excitation of a vibration shaker system.

#### 3.2.1.1.5 Sine

The Sine test provides a means of applying continuous swept sine vibration excitation over a wide frequency range.

#### 3.2.1.1.6 Sine On Random

This program allows multiple (up to 10) sine tones on a background broadband random profile.

*3.2.1.1.7 Classical Shock*

Classical Shock provides a means to apply a pulse of specific magnitude, duration and shape to an object under test. The common pulse types are Half Sine, Sawtooth and Trapezoidal.

*3.2.1.1.8 Shock Synthesis*

Shock Synthesis provides a means to define a Shock Response Spectrum (SRS) and then synthesize a time domain waveform with a SRS that matches the reference SRS for transfer function equalization. The reference SRS may also be converted to a suitable drive function for SRS amplitude equalization.

Clicking on the **NEW** menu option and selecting another test while working on a test will initiate the display of a **SAVE** prompt unless there were no changes made to the test that was downloaded to work on. Please note that there are only four menu options instead of six on the PUMA Local window in the background in figure 3-2. The **SETUP** and **TEST** menu options will appear when the new test is launched. Note also that the Analyzer option is the default.

### 3.2.1.2 Open Menu Option

The **OPEN** menu option allows the user to select a previously stored test setup file. It displays a standard Windows {**Open}** (file) Dialog Box. The user can navigate to the desired file and open it. If the user wants to load a different test type (e.g. Sine) simply select the setup and Puma will automatically change to the appropriate application. The user must then select the appropriate display from the Puma Desktop Toolbar (see Figure 1-9).

### 3.2.1.3 Close Menu Option

The **CLOSE** menu option closes the currently loaded test setup. When **CLOSE** is clicked a **SAVE** prompt is displayed if the current test setup has had changes made to it. If no changes were made the currently displayed window will close.

### 3.2.1.4 SAVE Menu Option

When **SAVE** is clicked the currently loaded test setup is saved to its default folder.

### 3.2.1.5 SAVE AS Menu Option

When **SAVE AS** is clicked the standard Windows {**Save As**} Dialog Box appears. It allows the user to save the currently loaded test setup to a different folder / drive with the same or a different file name.

### 3.2.1.6 Print Setup

**PRINT SETUP** is a standard Windows command that allows the user to select a printer, the size and source of paper and the orientation of the page. These selections will affect how things are printed when the **Print** option is used.

#### 3.2.1.7 Print

Click on **PRINT** to launch the standard Windows {**Print}** Dialog Box. From here the user may select a printer, what is to be printed and how many copies are required. The option to print to a file is also available. This will print the text from the test log in the PUMA Window.

#### 3.2.1.8 Send

**SEND** is a standard Windows command for sending files / tests via e-mail.

#### 3.2.1.9 Log In

The **LOG IN** option is not available when the user is already using PUMA. It becomes available after logging out.

#### 3.2.1.10 Log Out

The **LOG OUT** option is only available when the user is logged in to PUMA.

#### 3.2.1.11 System Lock/System Unlock

These two features come with the security options. When **SYSTEM LOCK** is selected, the system is locked and that option becomes disabled. The **SYSTEM UNLOCK** option is then enabled. To regain access to the program, the user must select **SYSTEM UNLOCK**. The {**User Log In}** dialog box will display and allow you to login.

#### 3.2.1.12 Recent File List

The recent file list is a standard Windows feature that has been adopted for Puma. It allows the user quick access to the most recently used setup files that have been opened. These files are also available from the Windows Start menu. The path for usage is:

<Start>⇨**DOCUMENTS**⇨ **File Name**

#### 3.2.1.13 Exit

**EXIT** is a standard Windows command. Clicking on this command will cause the current window to close and the application will terminate.

### 3.2.2 Menus Available During The Test

While a test is running, not all of the **FILE** Menu options are available for use. See Figure 3-3. The available **FILE** Menu options during a test are:

- **PRINT SETUP**
- **PRINT**
- **LOG OUT**
- **SYSTEM LOCK**


**Figure 3-3. File Menu During Test**

# Chapter 4 - Setup Menu

## 4.1 Introduction

The Setup Menu option is where the user enters information to tell PUMA how to run the tests. The parameters of a new test can be input or a previously generated set of guidelines can be activated from a previously filed test result.

## 4.2 Submenus

The following paragraphs give information about the seven **SETUP** submenu options available. See Figure 4-1. The user can input information to enable the test results to reach a predetermined goal or manipulate previously used data to produce a different effect.

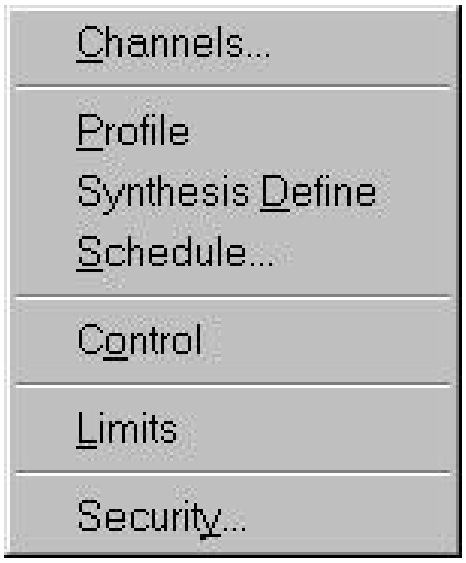



**Figure 4-1. Setup Submenus**

### 4.2.1 Channels

The **CHANNELS** Menu option produces a **Channel Definition** Window (Figure 4-2). The window consists of a 10-column table and a File Selection Box. This window allows the user to:

- Print a listing of the Channel Definition settings
- Change any or all of the Channel Definition parameters
- Open a new file
- Load a previously saved test/file
- Use the {**Save As}** option to name/save a file
- Accept default / user selected file names and initiate selected action
- Cancel selection / window
- Get Help

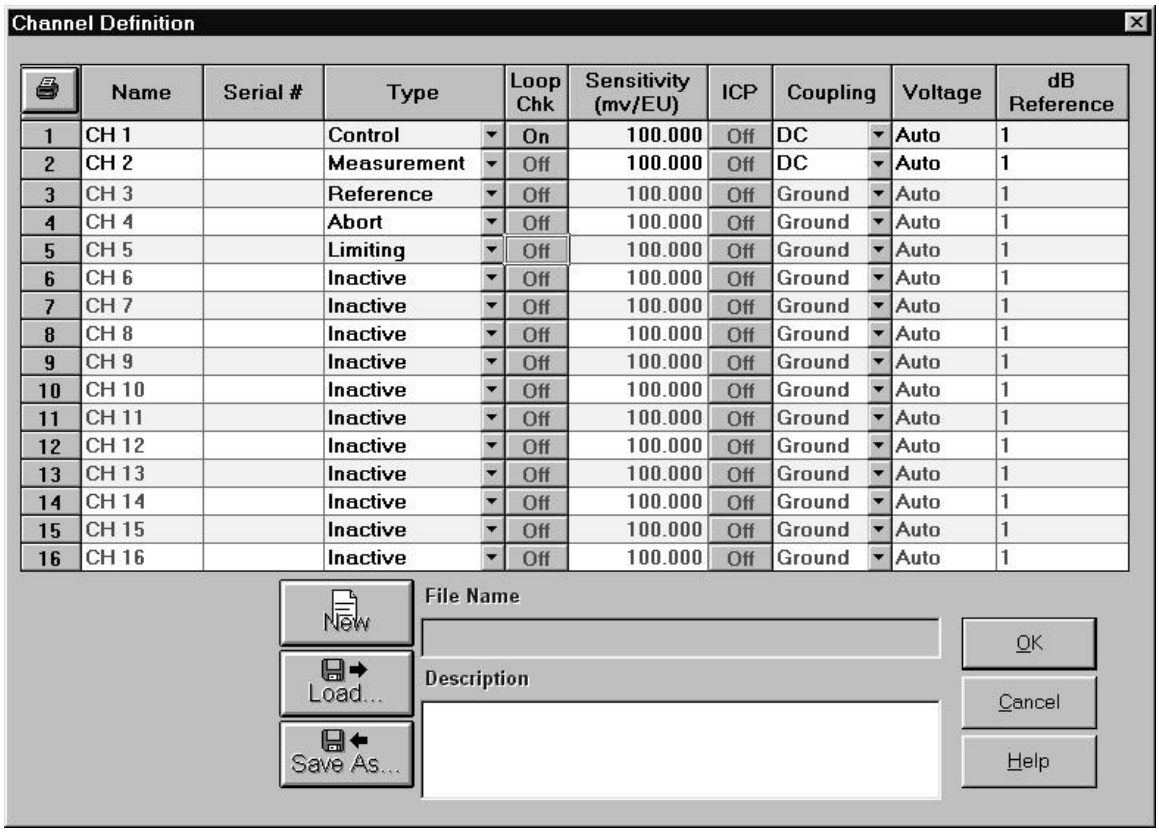



**Figure 4-2. Channel Definition Window**

The table columns and their functions are discussed in the following paragraphs

#### 4.2.1.1 Channel Definition

Any combination of available channels may be defined simultaneously. If all options have been purchased a range between 4 and 32 channels are available.

Setting Channel Definition parameters:

6. Access the **Channel Definition** Window in accordance with the procedure in paragraph 1.5.
7. Load file or set parameters as required.
8. Save to keep changes (choose {**Save As}** if information is to be saved independently from the loaded file).

4.2.1.1.1 Column Headings

**Print Button / Channel Number Column**

Clicking the <Print Button> will print a copy of the window's settings. Also printed is the path for the file holding the Input Channel Setup parameters. See Figure 4-3.The channel numbers are constant placeholders for the channels.

Input Channel Setup: C:\Program Files\Spectral Dynamics\PumaRCTS\

| | Name | Serial # | Type | Loop Chk | Sensitivity (mv/EU) | ICP | Coupling | Voltage | dB Reference |
|---|---|---|---|---|---|---|---|---|---|
| 1 | CH 1 | | Control | On | 100.000 | Off | DC | Auto | 1 |
| 2 | CH 2 | | Inactive | Off | 100.000 | Off | Ground | Auto | 1 |
| 3 | CH 3 | | Inactive | Off | 100.000 | Off | Ground | Auto | 1 |
| 4 | CH 4 | | Inactive | Off | 100.000 | Off | Ground | Auto | 1 |

**Figure 4-3. Channel Definition Print Button Printout**

**Name Column**

A 20-character field enables the user to designate a unique name for the channel. By default, unnamed channels show their channel number.

**Serial # Column**

A 10-character field enables the user to define a serial number for the channel.

**Type Column**

Three entries are allowed in this column. They are:

- Control — Channel is designated as a control channel and the Loop Check is automatically set to ON**.** Control Channels are defined at a control point on the Device Under Test (DUT). A test must have at least one and may have multiple control channels.
- Inactive — Channel is off and no data is acquired.

  Measurement — A control channel designated as a measurement channel (ie: active but not to be regarded as in the control scheme)

**Loop Chk Column**
The Loop Check option can either be ON or OFF. If it is ON, an open channel "Safety" check is performed on Limiting Channels before the test is run. A minimum threshold signal must appear on that channel before a test can proceed.

**Sensitivity (mv/EU) Column**
The parameter for the ratio obtained by dividing mili-volts by the appropriate Engineering Units. The range is 0.001 to 9,999,999.

**ICP Column**
The ICP (Integrated Circuit Piezoelectric)(transducers) function can either be ON or OFF. It provides a constant DC current source to power the accelerometers. The system supplies the necessary bias for the transducer and automatically uses internal AC coupling to remove the bias from the dynamic input signal.

**Coupling Column**
Only three entries are allowed in this column. They are:

- AC– It blocks the DC component of the signal.
- DC– It passes the DC component of the signal.
- Ground– It grounds the input channel.

**Voltage Column**
Any value from 0 to 10 may be entered. Zero is the default for Auto.

**dB Reference Column**
This is the decibel level that this channel will use as a reference. Sixty characters may be entered.

### 4.2.2 Profile

The **PROFILE** Menu Option displays the **Profile Definition** Window. See Figures 4-4.

#### 4.2.2.1 Column Headings

Print Button / Profile Number Column

Clicking the <Print Button> will print a copy of the window's settings. The profile

number column allow the user to insert from 1 to 500 profiles.

Status Column

The status is either ON or OFF.

Frequency (Hz) Column

The profile frequency is listed here. The range is 0.1 to 99,999.9**.**

Amplitude (G's) Column

The profile amplitude is listed here. The range is 0.1 to 99,999.99999**.**

High Tolerance (+dB) Column

The profile high tolerance limit is listed here. The range is 0.2 to 99.9**.**

Low Tolerance (-dB) Column

The profile low tolerance limit is listed here. The range is 0.1 to 99.8**.**

#### 4.2.2.2 Controls and Indicators

- Analysis Bandwidth Group

Five text boxes and a list box allow the user to keep track of settings for:

Minimum Frequency Maximum Frequency Range (decades)

Sample Rate (Hz) Sample Rate Multiplier Buffer Duration

The Sample Rate Multiplier List Box quantities are: 5**.**12, 10**.**24 & 20**.**48

- SRS Parameters Group

Two text boxes allow the user to keep track of settings for:

SRS Damping (%) and SRS Q.

Three list boxes allow the user to keep track of settings for:

Analysis Octave Spacing. Values are:

| 1/1 | 1/3 | 1/6 | 1/12 | 1/24 |
|---|---|---|---|---|

SRS Type – Primary +, Primary - & Maxi Max

SRS Filter Definition – Absolute Acceleration & Relative Displacement

- Measurement Units Buttons

The user may select between **Acceleration**, **Imperial** units of **Velocity** or **Metric** units of **Velocity** to be displayed in each row of the graph.

- Tolerance Units Buttons

The user has a choice of decibel units or percentages.

- Graph Window

A representation of the selected profile is show in the window.

- File Selection Box

The user is allowed to navigate the drives, load existing files or create new ones.

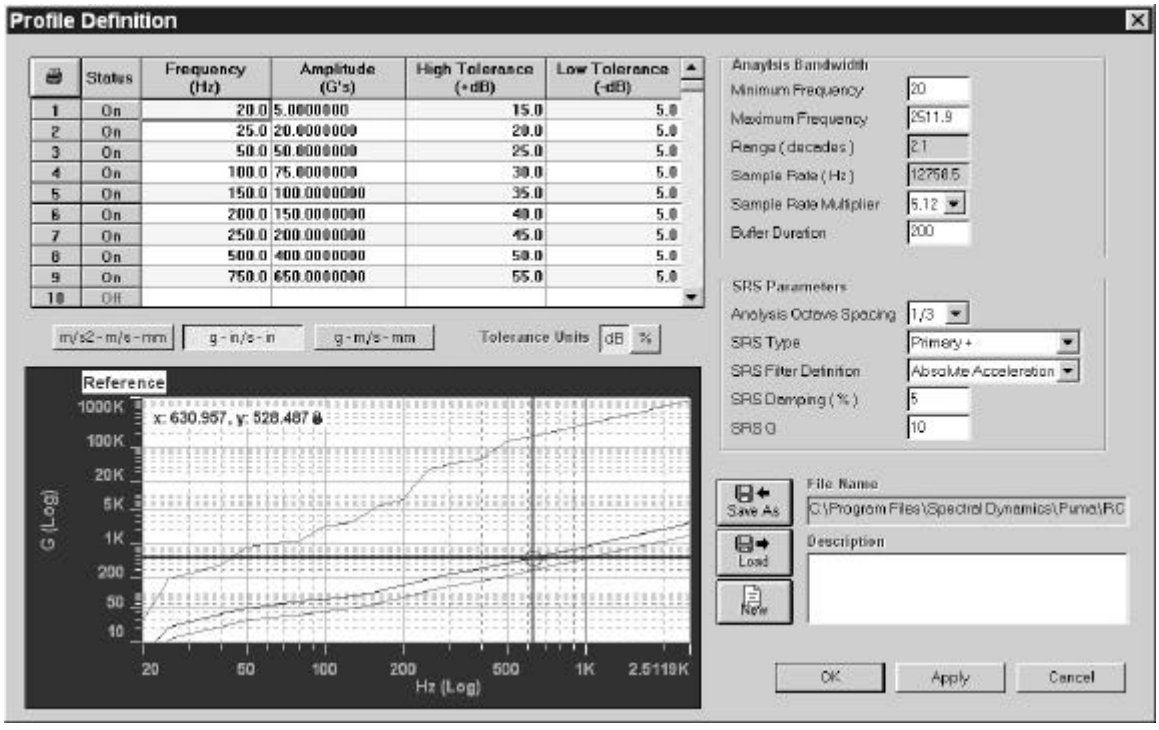



**Figure 4-4. Profile Definition Window**

### 4.2.3 Synthesis Define

The **SYNTHESIS DEFINE** Menu Option displays the **Synthesis Table** Window. See Figures 4-5.

#### 4.2.3.1 Column Headings

The information of the tabular data display may be input here or will be imported from the profile established under the **PROFILE** sub-menu.

Print Button / Setting Number Column

Clicking the <Print Button> will print a copy of the window's settings. The setting numbers (1 to 100) are constant placeholders for the profiles.

Status Column

The status is either ON or OFF.

Frequency (Hz) Column

The profile frequency is listed here. The range is 0.1 to 9999.9**.** Frequencies must be in ascending order and must be between the minimum and maximum frequencies from the SRS Reference Table.

Amplitude (G's) Column

The profile amplitude is listed here. The range is 0.1 to 99,999.9999999**.**

Polarity Column

The user may set the polarity to either positive or negative.

Half Sines Column

The number of half sines may be entered here. The range is 0.1 to 9,999. 99**.**

Delay (ms) Column

The amount of delay is entered here. The range is 0.1 to 9,999. 99**.**

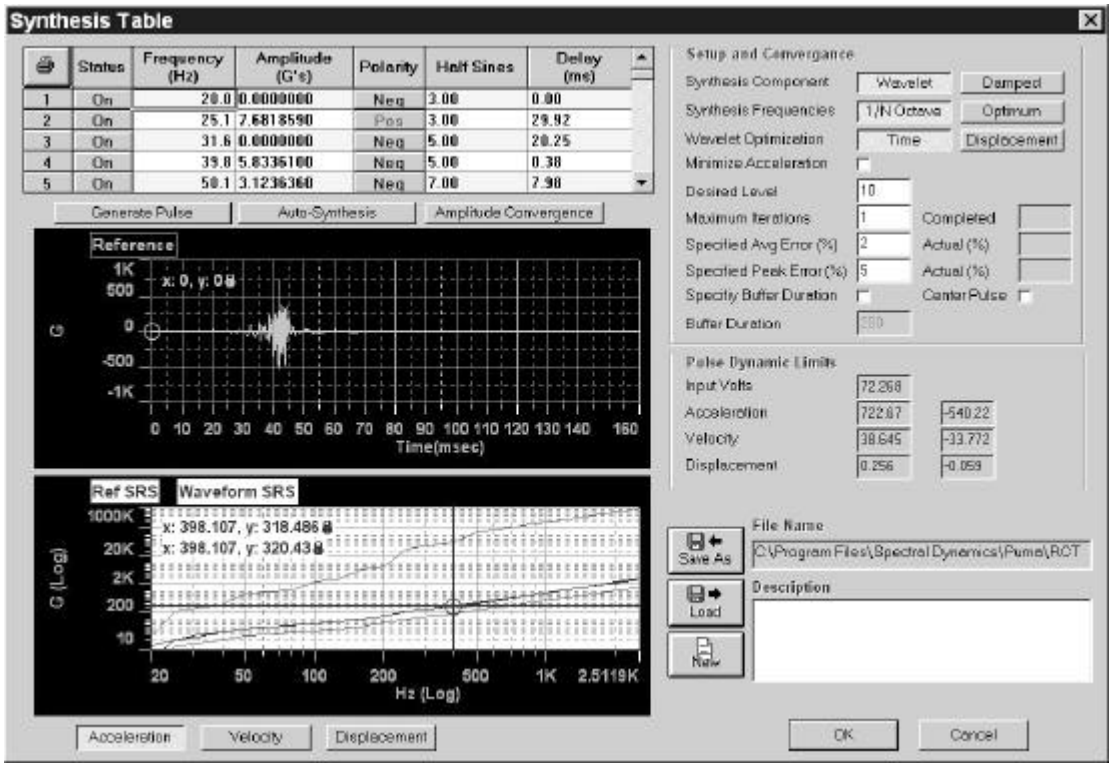



**Figure 4-5.Synthesis Define Window**

### 4.2.3.2 Setup and Convergence Block

This combo-block has three sets of button switches, three check boxes and eight text boxes.

**Synthesis Component** - The switches are: Wavelet and Damped. They toggle the component type between Half Sines and Wavelets.

**Synthesis Frequencies** - The switches are: 1/N Octave and Optimum.

The former forces the algorithm to define a synthesis component for each of the $\frac{1}{n}$ octave frequencies designated in the table. The latter forces the algorithm to define the minimum number of frequencies required to synthesize a waveform that produces a smooth SRS.

**Wavelet Optimization** - The switches are: Time and Displacement.

These switches are used for Auto-Synthesis Table Setup. Time optimization generates shorter pulse duration. Displacement optimization generates a waveform with lower peak displacement.

**Minimize Acceleration** - Select this feature to enable parameters that are used for an iteration process that minimizes the absolute peak value of the resulting time-domain

acceleration waveform. The process will operate faster if larger values for the Automatic Convergence to Reference SRS parameters are used.

**Desired Level** (Number of Units) - The Auto-Synthesis Table Setup Option must be selected to apply this option to the waveform.

**Maximum Iterations** - Enter the maximum number of iterations for the Minimize Acceleration process. The Completed Box indicates iterations completed.

**Specified Avg Error** (%) - Enter the maximum average error desired for the Automatic Table Setup or Automatic Convergence processes. The Actual (%) Box indicates the current percentage.

**Specified Peak Error** (%) - Enter the maximum peak error desired for the Automatic Table Setup or Automatic Convergence processes. The Actual (%) Box indicates the current percentage.

**Specify Buffer Duration** - Check Box: *Yes* = checkmark, *No* = blank.
A *Yes* selection will allow the user to choose the buffer duration. Data is acquired using the next higher power of 2 buffer sizes. The program will only process the data for the buffer duration chosen.

A *No* selection instructs the program to pick the buffer duration. All data in the buffer will be processed.

**Buffer Duration** - This is the reference waveform time domain buffer length in milliseconds. It is a display-only field when the Specify Buffer Duration check box is blank. When checked the entry range is 0.1 - 100,000ms. If the value entered is out of the test range the program determines the entry and a notice/confirm window is displayed.

**Center Pulse** - Check Box: When checked the waveform(s) will be centered in the display(s).

#### 4.2.3.3 Pulse Dynamic Limits Block

Input Volts - Display only. This is the absolute maximum input voltage required for the Control channel to achieve the reference waveform.

Acceleration - Display only. Maximum acceleration for the generated waveform.

Velocity - Display only. Maximum velocity for the generated waveform.

Displacement - Display only. Maximum displacement for the generated waveform.

Pulse Generation Buttons

The following three buttons allow the user to select the type of waveform generation required for the Synthesis Table setup.

**Generate Pulse** - This button creates a reference pulse using the data parameters in the Synthesis Table above then computes the SRS of that pulse.

**CAUTION**

The **Auto-Synthesis** Button initiates overwriting the existing information in the Synthesis Table.

**Auto-Synthesis** - This button synthesizes a time domain pulse using a combination of the data from the Profile Definition Table and the Convergence block of the Synthesis Table Window. The **data in** the Synthesis **Table** is **replaced** with the new values.

**Amplitude Convergence** - This button initiates a comparison of the data in the Profile Definition Table and the data in the Setup and Convergence block of the Synthesis Table Window and averages the data in an attempt to reduce the percentage of error.

Upper Graph Window
This allows the user to display a graph that is different from the lower window.

Lower Graph Window
This allows the user to display a graph that is different from the upper window.

File Selection Box
The user is allowed to navigate the drives, load existing files or create new ones.

Waveform Buttons
The selected button indicates whether to display the reference waveform Acceleration, Velocity or Displacement.

### 4.2.4 Schedule

The **SCHEDULE** Menu Option displays the **Schedule Setup** Window with one tab labeled ***Schedule.*** See Figure 4-6.

#### 4.2.4.1 Schedule Tab

The tab has four standard Windows command buttons visible at the bottom. They are: <*OK*>, <*CANCEL*>, <*APPLY*> and <*HELP*>. Please refer to Windows documentation for the use of these buttons.

The ***Schedule*** Tab format displays three areas of information. On the upper left side is a horizontal tabular display**.** The upper right has a vertical tabular display and on the bottom left side is a standard Windows **File Selection Box**.

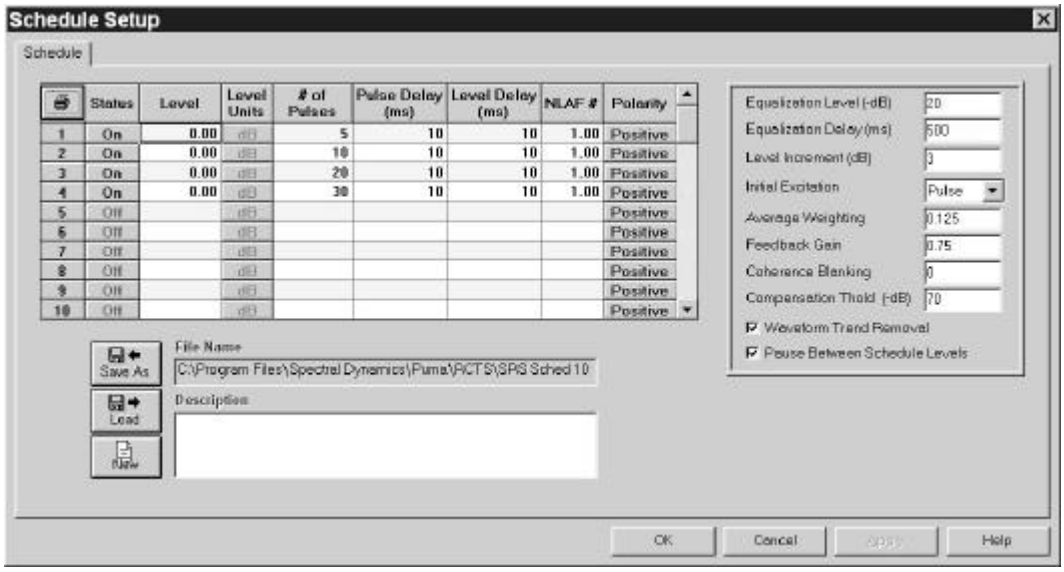



**Figure 4-6. Schedule Tab of the Schedule Setup Window**

The nine column horizontal tabular display has a scroll bar that allows the user to access 50 different schedule levels. The **Status** column indicates whether the level is ON or OFF. At the top of the schedule number column is a printer icon, which enables the user to print out the ***Schedule*** Tab information. The **Level** column has buttons that allow the user to select either **dB** or **G** for the measurement. The **Polarity** column buttons indicate either **Positive** or **Negative** polarity. For a listing of ranges of the columns and text boxes see Table 4-1.

The **Initial Excitation** drop-down list box choices are:

- **Pulse**
- **Random**
- **Pseudo**

The check box labels are:

- **Waveform Trend Removal**
- **Pause Between Schedule Levels**

### 4.2.5 Control

The **CONTROL** Menu option displays the **Test Settings** Window. This window has two tabs. They are:

- ❖ Data Storage
- ❖ Print Automation

**Table 4-1. Schedule Setup Window Range Parameters**

| **Tabular Data Column Listing** | |
|---|---|
| Column | Number of Characters |
| Level | 6 numbers\decimal\2numbers |
| # of Pulses | 6 numbers |
| Pulse Delay (ms) | 3 numbers |
| Level Delay (ms) | 3 numbers |
| NLAF # | 1.99 is maximum |
| **Text Boxes** | |
| Listing | Number of Characters |
| Equal dB | 10 numbers |
| Equal Delay | 10 numbers |
| Level Increment | 10 numbers |
| Average Weighting | 10 numbers or 1 no.\decimal\8 nos. |
| Feedback Gain | 10 numbers or 1 no.\decimal\8 nos. |
| Coherence Blanking | 10 numbers or 1 no.\decimal\8 nos. |

At the bottom of each tab are four standard Windows Command Buttons. They are:

- *<OK>* Command Button

  This button accepts any changes made, applies them and closes the open dialog box.

- *<CANCEL>* Command Button

  This button closes the open dialog box without applying any changes that may have been made.

- *<APPLY>* Command Button

  This button applies any changes that have been made and keeps the dialog box open.

- *<HELP>* Command Button

  This button launches the on-line help. If a dialog box is open it must first be closed to launch the help menus.

#### 4.2.5.1 Test Settings

The two **Test Settings** Window Tabs are described below.

**Data Storage**

The ***Data Storage*** Tab (Figure 4-7) has one radio button box and two toggle button boxes.

Data File Name **Toggle Button Box – Defines the way the file name will be generated.**

The toggle buttons are: *Auto Generate, Query* and *Default*.

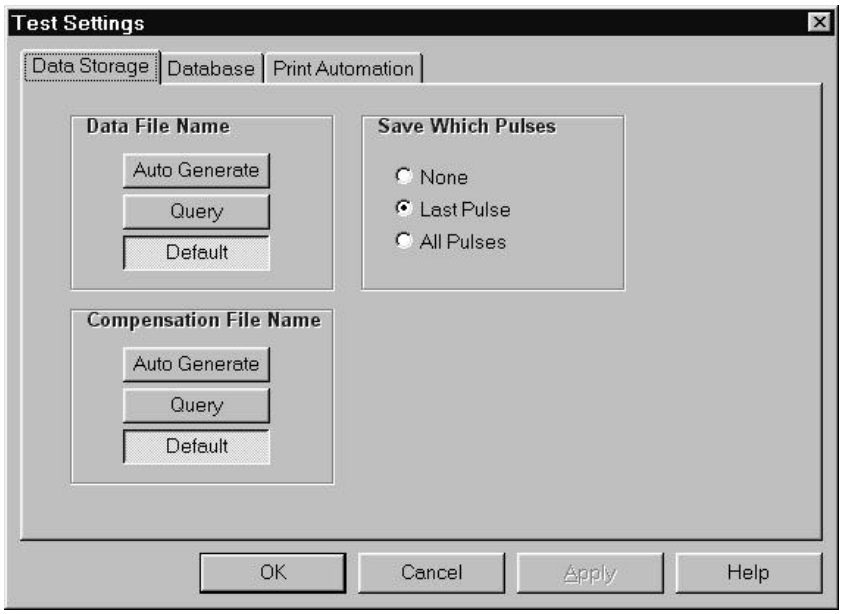



**Figure 4-7. Data Storage Tab of the Test Settings Window**

*Auto Generate* - Creates a unique file name based on the day, date and time that the test started.

*Query* - Prompts user for a file name after starting test.

*Default* – All test data is saved in a default file. The default file is overwritten each time the test starts.

Compensation File Name **Toggle Button Box.**

**Defines the way the file name will be generated.**

The toggle buttons are: *Auto Generate, Query* and *Default*.

**Save Which Pulses** Radio Button Box

This shows which sweeps that the program will save as a frame of data.

### Database Tab (Optional)

The ***Database*** Tab (Figure 4-8) has an Enable Storage check box, three-command buttons and three drop-down list boxes. The command buttons are:

- Refresh
- Next Run
- Setup Database

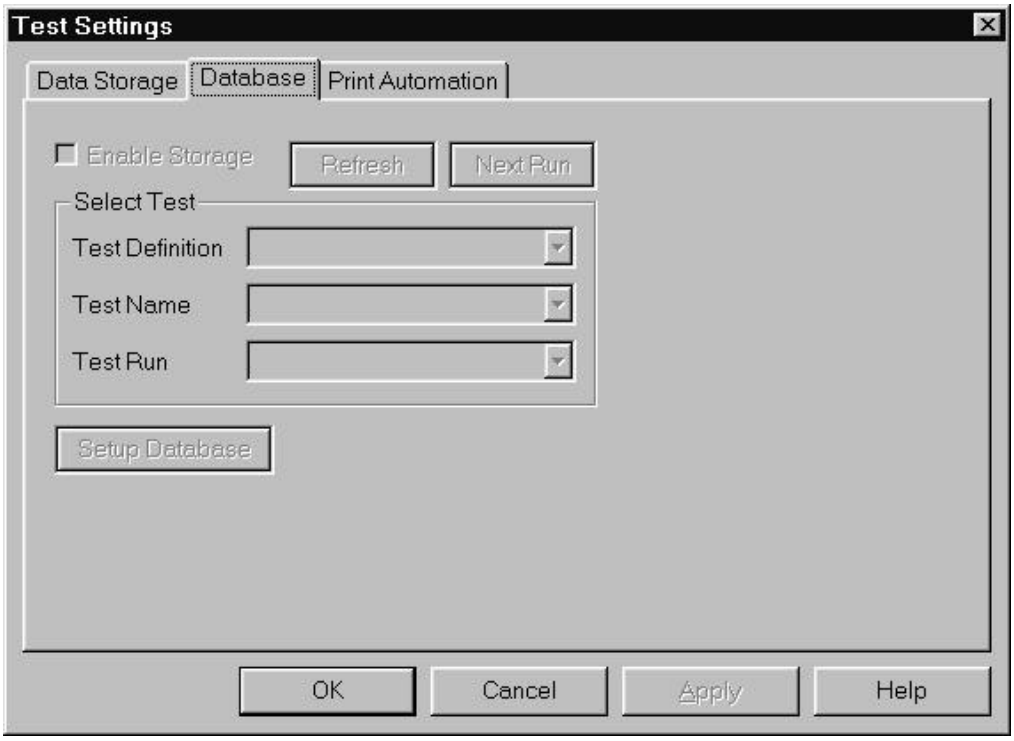



**Figure 4-8. Database Tab of the Test Settings Window**

The **Select Test** drop-down list boxes are:

- Test Definition
- Test Name
- Test Run

### Print Automation Tab (Optional)

The ***Print Automation*** Tab (Figure 4-9) allows the user to define a series of plots to be automatically generated at the end of each test.

**Command Buttons**

The command buttons are <*ADD*>, <*REMOVE*> , <*SAVE*> and <*LOAD*>.

**Check Boxes** - ENABLE PRINTING and AUTOSCALE.

The check box will enable automatic printing or not.

**Radio Buttons**

The radio buttons are labeled ALL FRAMES and LAST FRAME.

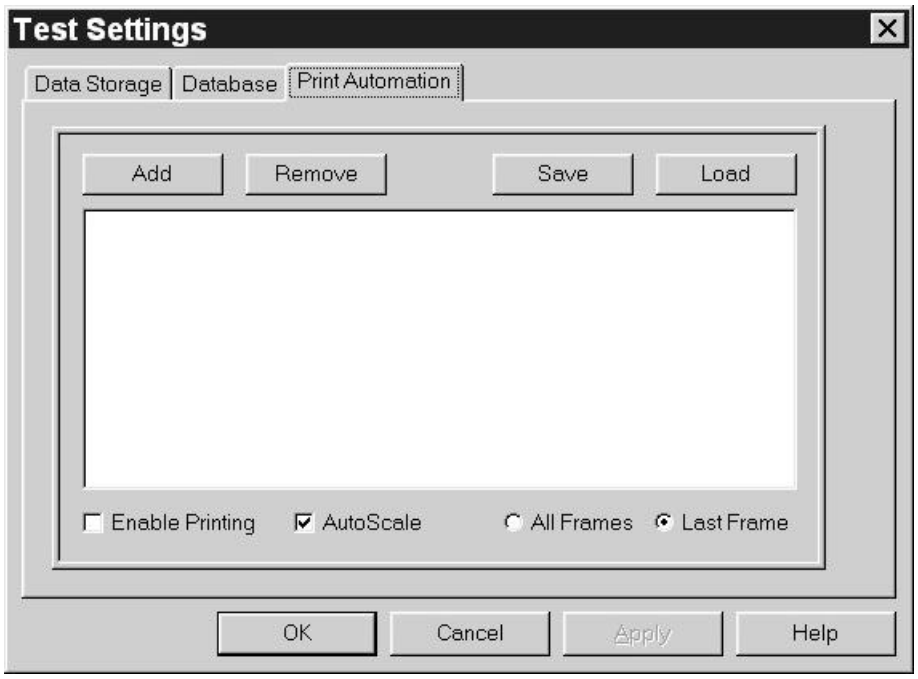



**Figure 4-9. Print Automation Tab of the Test Settings Window**

ALL FRAMES prints each frame of data saved during the test (see Data Storage above).

LAST FRAME prints only the final frame of the test.

### 4.2.6 Limits

The **LIMITS** Menu Option displays the **Limit Settings** Window. It has two tabs labeled ***Safety Limits*** (Figure 4-10) and ***Shaker Limits*** (Figure 4-11). Both are discussed below.

#### 4.2.6.1 Limit Settings

Both tabs of the Limit Settings Window have four standard Windows command buttons visible at the bottom of the tab(s). They are: *<OK>*, *<CANCEL>*, *<APPLY>* and *<HELP>*. Please refer to Windows documentation for the use of these buttons.

4.2.6.1.1 Safety Limits Tab

The ***Safety Limits*** Tab has three group boxes. See Figure 4-10.

**Group Boxes** - The Group Boxes are labeled {Pulse Dynamic Limits}, {Alarm / Abort}, and {Loop Check}. The {Pulse Dynamic Limits} Group Box has seven text boxes with four labels. The labels are:

- **Input Volts**
- **Acceleration**
- **Velocity**
- **Displacement**

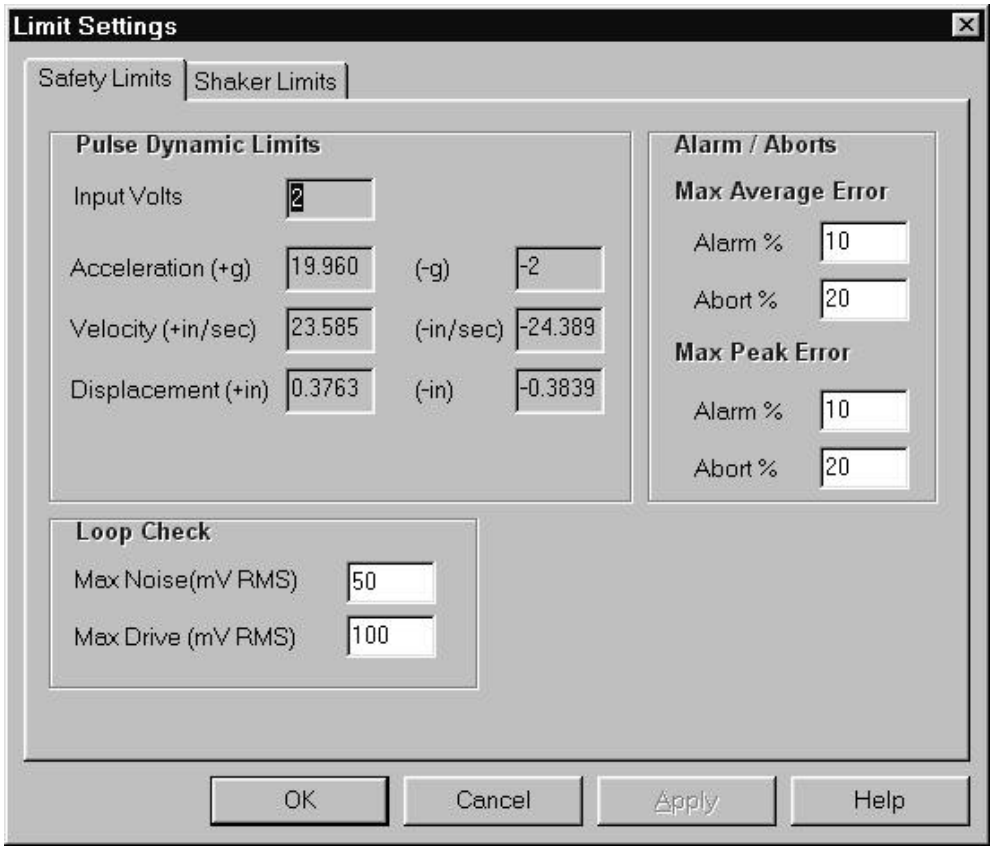



**Figure 4-10. Safety Limits Tab on the Limit Settings Window**

The three types of stress have text boxes for positive and negative values.

The. {Alarm / Abort} Group Box has an **Alarm %** and **Abort %** text box for each of the two fields labeled:

- **Max Average Error**
- **Max Peak Error**

The {Loop Check} Group Box has two text boxes labeled, **Max Noise (mVRMS)** and **Max Drive (mVRMS)**.

4.2.6.1.2 Shaker Limits Tab

The ***Shaker Limits*** Tab of the Limit Settings Window has four sets of text boxes, a check box and a **File Selection Box**. See Figure 4-11.

Each text box set has a box for input of either a positive or negative value. The boxes are labeled:

- **Acceleration (g)**
- **Displacement (in)**
- **Velocity (in/sec)**
- **Voltage (V)**

The check box is labeled **Symmetric Limits**.

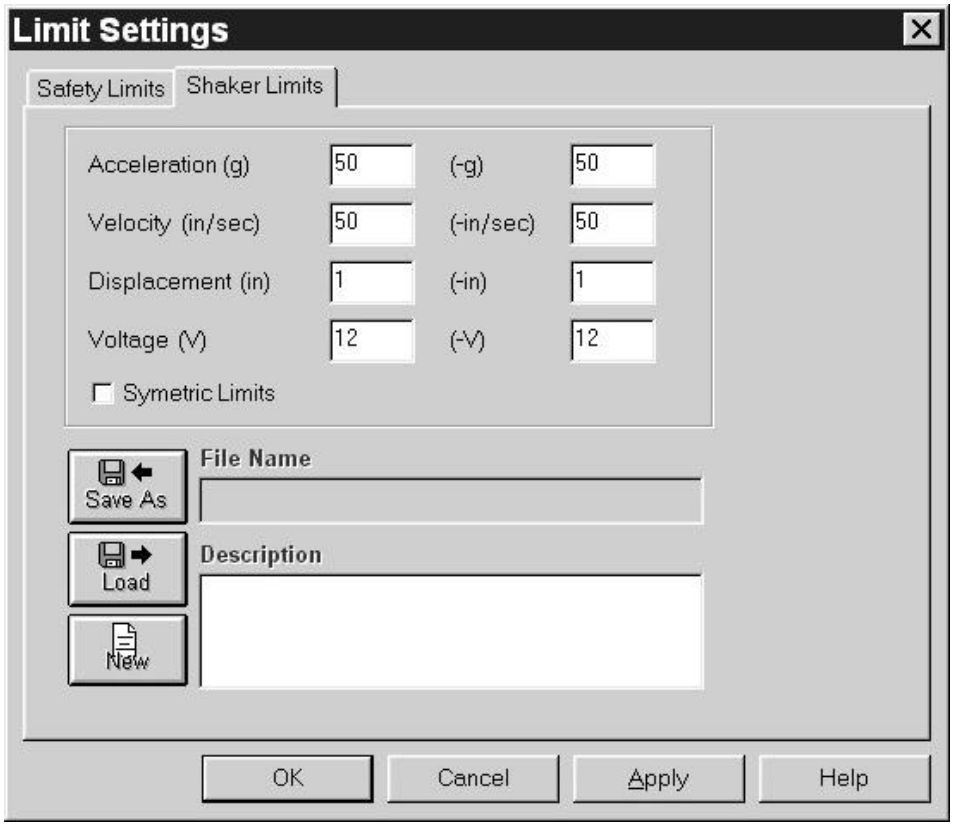



**Figure 4-11. Shaker Limits Tab of the Limit Settings Window**

### 4.2.7 Security

The **SECURITY** Menu Option displays the **Update Security File** Window. See Figure 4-12. This is an option. This window is used to update the security file by either adding or deleting employee's user names, passwords and privileges.

This window has a list box with access to all employees' names, a list box with all the current privileges available to each employee, two text boxes dealing with a password and five command buttons. The <OK> and <CANCEL> are standard Windows buttons and are explained in the Windows documentation.

The other three command buttons are <ADD USER>, <DELETE USER> and <UPDATE>. The first two are self-explanatory and the last one acts like a **SAVE** menu option.

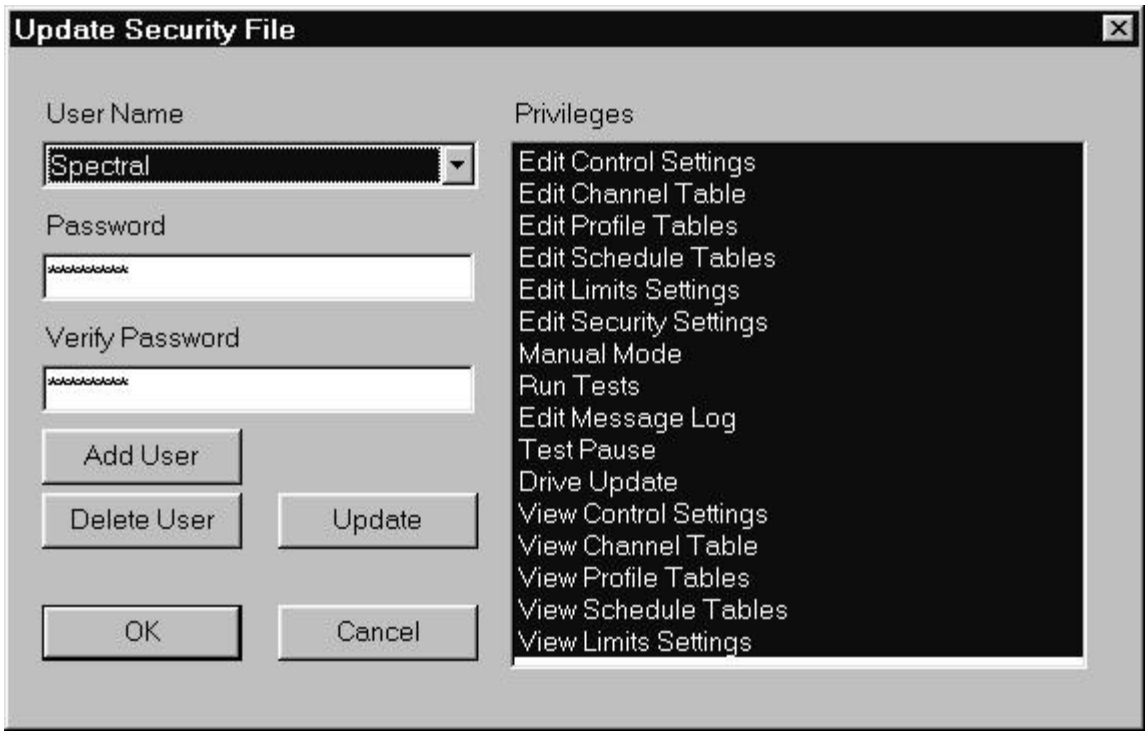



**Figure 4-12. Update Security File Window**

# Chapter 5 - View Menu

## 5.1 Introduction

The **VIEW** Menu Option has 12 sub-menus displayed in a five section drop-down menu.

When **VIEW** is selected from the Menu Bar, the image shown in Figure 5-1 will display. The checkmarks indicate the items that will be seen either in a window or on the desktop during the test.

The number of channels being monitored depends on the package purchased. There can be 4, 10, 16 or 32 channels available. The MESSAGE LOG FONT option displays a standard Windows dialog box that allows editing the font styles. See the Windows documentation for more information about this option.

## 5.2 View Sub-Menus

Each of the remaining **VIEW** sub-menu items are described next

### 5.2.1 Toolbar, Status Bar And Test Control

When the **TOOLBAR** and/or **STATUS BAR** options are selected, as indicated by the check marks, (Figure 5-1), the Toolbar buttons and Status Bar information will display. See Figure 5-2.

When the **TEST CONTROL** (Figure 5-3, 5-4) is checked, it is available for use.

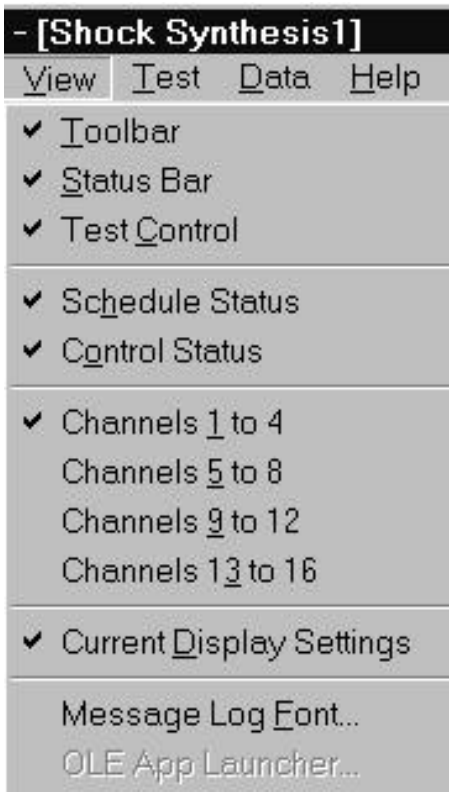



**Figure 5-1. View Menu**

#### 5.2.1.1 Toolbar

The **TOOLBAR** buttons are shortcuts for various menu items. The first six, and the last three, are standard Windows Toolbar buttons. These are described in your Windows documentation. Information for the other four buttons, **CHANNEL SETUP, PROFILE SETUP, SYNTHESIS DEFINE** and **SETUP SCHEDULES**, can be found later in this chapter. A tool tip message displays whenever the cursor touches a shortcut icon.

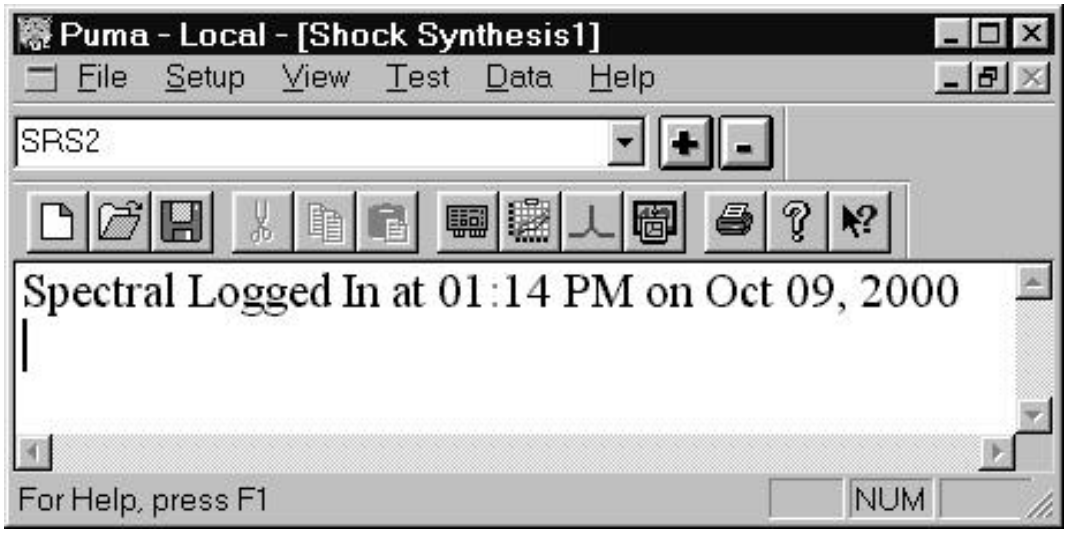



**Figure 5-2. Toolbar, Status Bar and Message Log**

#### 5.2.1.2 Status Bar

The Status bar gives information about various activities currently running in Windows. It also has three boxes that act as message boxes to indicate certain functions are available. In Figure 5-2 the NUM indicates the number locks are on. Also when the cursor contacts a toolbar button an explanation of the button is displayed.

#### 5.2.1.3 Test Control

When **TEST CONTROL** is selected from the **VIEW** menu, the Test Control shown in Figure 5-3 will display. The **TEST CONTROL** has 16 buttons used to control the test and four text boxes giving information about the test. The following paragraphs describe these controls and indicators.

##### 5.2.1.3.1 Start / Stop

Click the <Start> button to begin the currently loaded test. The test begins with a Loop Check and pre-test if required. After starting, the button label changes to read Stop. See Figure 5-4.

##### 5.2.1.3.2 Resume

Click the <Resume> button to restart the test at the same point the test was paused.

##### 5.2.1.3.3 Output

In the Automatic Mode, clicking the <Output> button will run the schedule for the currently loaded test. In Manual Mode, a sequence of pulses as defined by the text boxes on the Test Control will start.

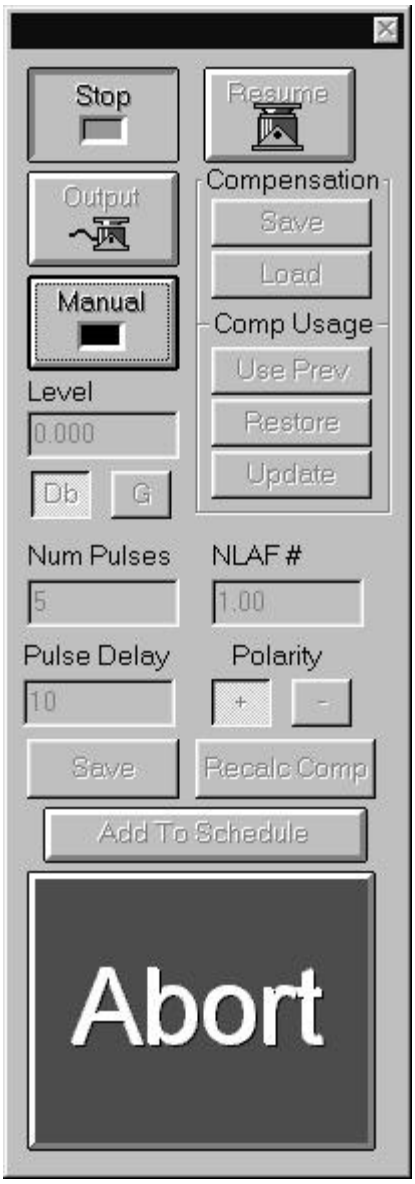



**Figure 5-3. Test Control in Auto Mode During a Test**

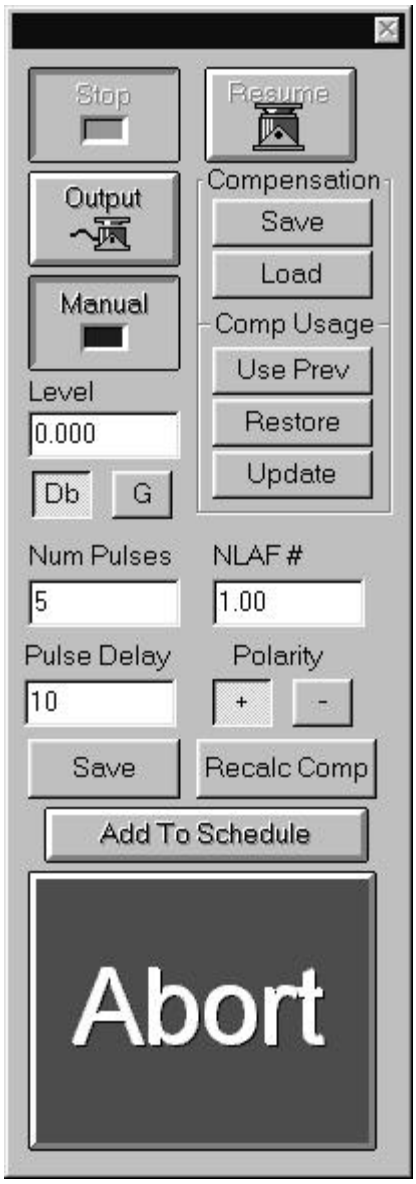



**Figure 5-4. Test Control In Manual Mode During a Test**

5.2.1.3.4 Manual

Select the <Manual> button to run the test in the manual mode. When in Manual Mode the remainder of the Test Control's buttons is enabled as shown in Figure 5-4. The **TEST CONTROL** text boxes will display the numeric values of control levels. The user may now alter the test settings during the test.

**Note**: Manual Mode must be enabled to work any of the following buttons.

5.2.1.3.5 Compensation Buttons

Save - Click the <Save> button to save data to a file. What is saved is defined by the setting selected in the Compensation File Name Group on the Data Storage Tab of the Test Settings Window (Setup ⇒ Control).

Load - Click the <Load> button to load a previously saved file.

5.2.1.3.6 Comp Usage Buttons

**Use Prev**

Clicking this button prior to a test start will move the static compensation data to the dynamic memory area and skip the normal system ID, running the test with a pre-stored compensation.

**Restore**

Clicking this button moves the static compensation data to the dynamic memory area.

**Update**

Clicking this button moves the dynamic compensation data to the static memory area.

5.2.3.1.7 Level Text Box

Allows the user to choose the measurement type of either dB's or G's and shows the numeric value set in the profile.

5.2.3.1.8 Measurement Buttons

dB Button - This button sets the level entry to dB.

G Button - This button sets the level entry to G.

5.2.3.1.9 Num Pulses Test Box

Allows the user to input the number of pulses to be output when the output button is selected.

5.2.3.1.10 NLAF# Text Box

The Non-Linear Adjustment Factor is used when there is a known gain non-linearity on a shaker system to reduce the amount and level of pulses used to equalize the shaker system. For example, a test is equalized at –12 dB. When the test is jumped to 0 dB the result is a time history of the proper shape, but about 10% low. A NLAF of 1.1 can be used the next time to correct for the gain non-linearity and eliminate the need to run more equalization pulses at higher than –12 dB.

5.2.3.1.11 Pulse Delay Text Box

Allows the user to set the time delay between pulses.

5.2.3.1.12 Polarity Buttons

Allows the user to set the polarity of the voltage input.

5.2.3.1.13 Save

This button allows saving the test data into a file.

5.2.3.1.14 Recalc Comp

Using the Recalc Compensation function allows the user to automatically improve the dynamic compensation. This means that the shock pulse at the accelerometer is a more accurate reproduction. If this button is toggled ON, the dynamic compensation is updated after each pulse. This data can be temporarily stored in static memory or saved to a file.

5.2.3.1.15 Add To Schedule

Allows the user to add additional pulses to the test at odd intervals.

5.2.3.1.16 Abort

This stops the test immediately. The log will record that the user aborted the test.

### 5.2.4 Schedule Status

When **SCHEDULE STATUS** is selected from the **VIEW** Menu, the window shown in Figure 5-5 will display. This window gives information about the schedule of the currently loaded test. Information given consists of the current schedule number the test is running, the number of elapsed pulses in the schedule and the remaining pulses in the schedule.

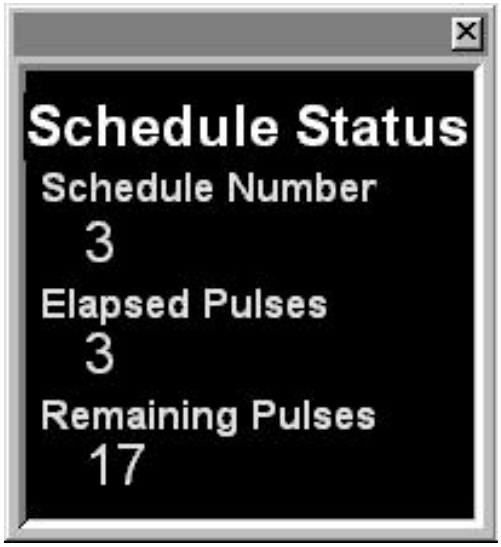



**Figure 5-5. Schedule Status Box**


**Figure 5-6. Control Status Box**

### 5.2.5 Control Status

When **CONTROL STATUS** is selected from the **VIEW** Menu, the window shown in Figure 5-6 will display. This window gives information about the control status of the currently loaded test. Information given consists of the current test level in decibels, the control level in peak g's and the voltage level of the drive.

### 5.2.6 Channel Status Boxes

Channel Status options are displayed in boxes of four channel increments from 1

to 32. When that option is selected, the activated Channel Status Box is displayed. See Figure 5-7. These give G force information about the channels in four channel increments.

The measurement is to the nearest one thousandth. A 10-channel system would have the 11th and 12th channels grayed out.

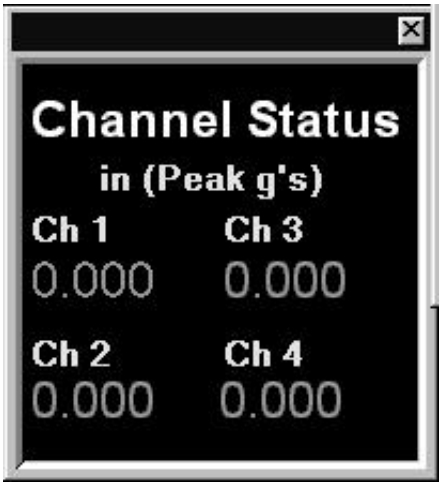



**Figure 5-7. Channel Status Box**

### 5.2.7 Current Display Settings

The **CURRENT DISPLAY SETTINGS** option is a toggle switch to view or hide the Puma Desktop Toolbar first introduced in Figure 1-9. It can also be seen in Figure 5-2. It is situated between the Menu Bar and the Toolbar. The toolbar tells the user what Graph Tool Layout is currently in use.

### 5.2.8 Message Log Font And OLE App Launcher

#### 5.2.8.1 Message Log Font

When **MESSAGE LOG FONT** is selected from the **VIEW** menu, a standard Windows Font Dialog Box appears. See Figure 5-8. Refer to the Windows documentation for further information. The Message Log is shown in Figure 5-2.

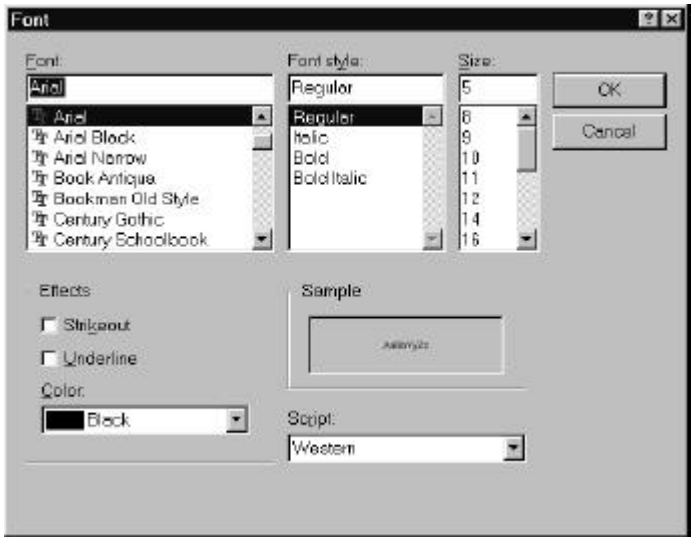



**Figure 5-8. Windows Font Dialog Box**

#### 5.2.8.2 OLE App Launcher

The OLE Application Launcher is an option, which allows the user to write and launch programs and sub-routines complimentary to Puma without having to return to the operating system. This option only works with Active-X Automation.

# Chapter 6 - Test Menu

## 6.1 Introduction

When the **TEST** option is selected from the Shock Synthesis Menu Bar, the image shown in Figure 6-1 displays. These menus duplicate the selections on the Test Control.

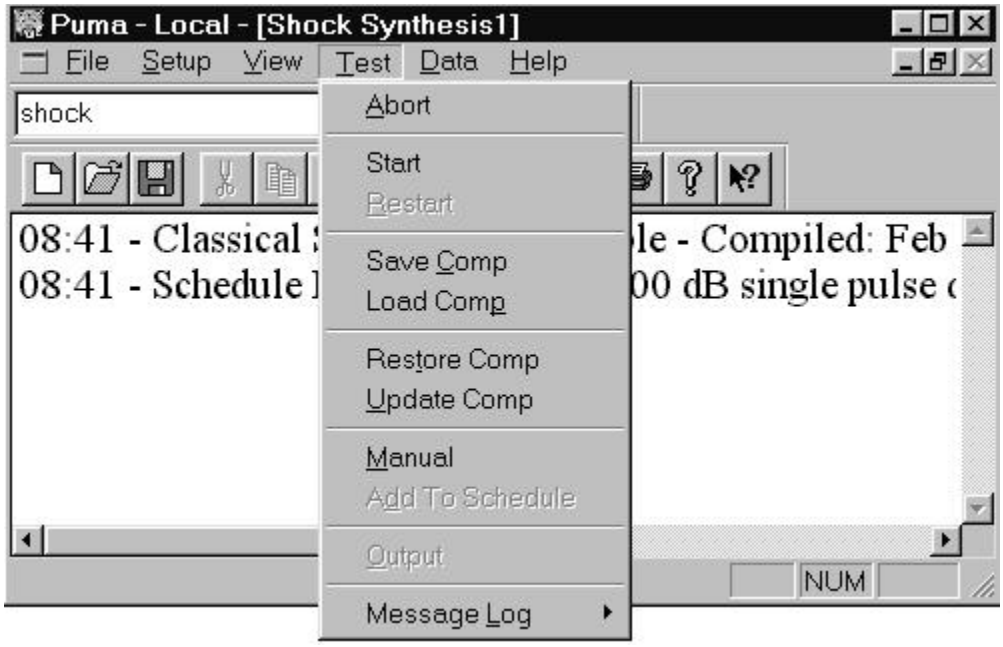



**Figure 6-1. The Test Menu**

## 6.2 Test Submenus

Each of the items on the **TEST** drop down menu is described in the following paragraphs. Use of these sub-menus allows the user to refrain from having to repeatedly hide or recall the Test Control, which is available in the View Menu Option (Chapter 5). Selecting these options is the same as using the Control. When these options are selected they toggle the buttons on the Control.

### 6.2.1 Abort

The **ABORT** menu option allows the user to stop the test immediately. As the program shuts down it writes two entries to the log file. The first is "Time - Abort Key Requested!" and the last entry is "Time - Test Complete." The Schedule and Control Status panels are suspended showing the information at the point of test completion. The Channel Status panel only indicates which channel(s) were active at the time aborted.

### 6.2.2 Start

The **START** menu option becomes available to start the test if either of two criteria has been met:

- A previous test file has been loaded
- Test parameters have manually been input for all phases of the test.

After the test has started, the menu options change and those available are shown in Figure 6-2. The **START** option is changed to read **STOP** but the input is only available from the test control. Stopping the test this way produces the same result as using the **ABORT** button. If the **START** button instead of the **RESTART** button is used to restart a stopped test, the schedule will be reset to include the full schedule.

After the test is completed the menu options default to the original listing. See Figure 6-1.

### 6.2.3 Restart

The **RESTART** Menu Option restarts the test from the same point that the test was stopped with the **STOP** menu option.

### 6.2.4 Save Comp

The **SAVE COMP** menu option saves data to a file. What is saved is defined by the setting selected in the Compensation File Name Group on the Data Storage Tab of the Test Settings Window (Setup ⇒ Control).

### 6.2.5 Load Comp

The **LOAD COMP** menu option loads a previously saved test for reuse.

### 6.2.6 Restore Comp

The **RESTORE COMP** menu option moves the static compensation data to the dynamic memory area.


**Figure 6-2. Test Menu Options During Auto Operation**

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### 6.2.7 Manual

The MANUAL Menu Option allows the user to run the test in the manual mode. The user may now alter the test settings during the test. See Figure 6-3.

### 6.2.8 Add To Schedule

The **ADD TO SCHEDULE** menu option allows the user to add additional pulses to the test at odd intervals.

### 6.2.9 Output

The **OUTPUT** menu option allows the user to send a particular set of pulses to the device under test. In the Automatic Mode, clicking the **Output** option will run the schedule for the currently loaded test. In Manual Mode, a sequence of pulses as defined by the text boxes on the Test Control will start.

### 6.2.10 Message Log

The Message Log is the file of information that being generated and is displayed as the test is running. The Message Log submenu has submenus of its own. There is a Pre-Test Dump, a Post Test Dump and a Message Priority selection with three submenus of its own. The submenus are discussed below.


**Figure 6-3. Menu Options in Manual Mode.**

#### 6.2.10.1 Message Priority

The three levels of Message Priority are High, Medium and All. A High Priority selection would contribute the fewest, though the most important number of messages to the Log File. An example of one of these messages is, *Overload detected on Control Channel*. A Medium Priority selection would post more messages to the Log File. An example of one of these messages is, *Alarm Level Exceeded*. A selection of All will dump all messages into the Log File.

# Chapter 7 - Data Menu

## 7.1 Introduction

When you select **DATA** from the Menu Bar the sub-menu options shown in Figure 7-1 will display.

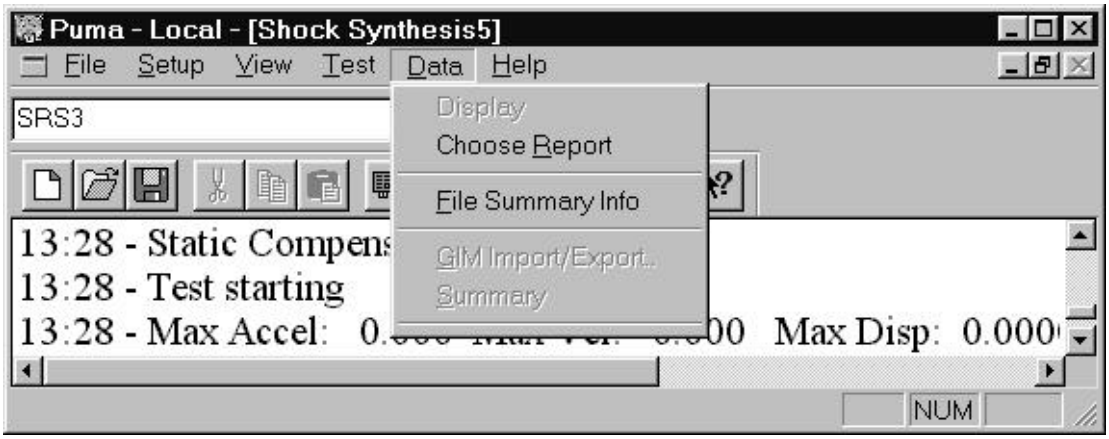



**Figure 7-1. Data Menu Options**

The **DATA** menu consists of:**, DISPLAY, CHOOSE REPORT** and **FILE SUMMARY INFO.** These menu items are described in the following paragraphs.

## 7.2 Data Sub-menus

The **DATA** Menu sub-menus are described below.

### 7.2.1 Display

The **DISPLAY** sub-menu option changes after the required parameters are input and the test has been started. It then reads: **DISPLAY SHOCK TESTDATA.SYN** *(or .test name for a saved test file).* If the parameters have not yet been saved the test name will be a synopsis file (*.syn). See Figure 7-2. At test completion the user may display the Test Data Notepad shown in Figure 7-3

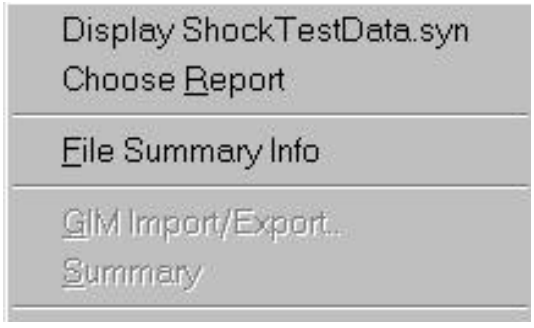
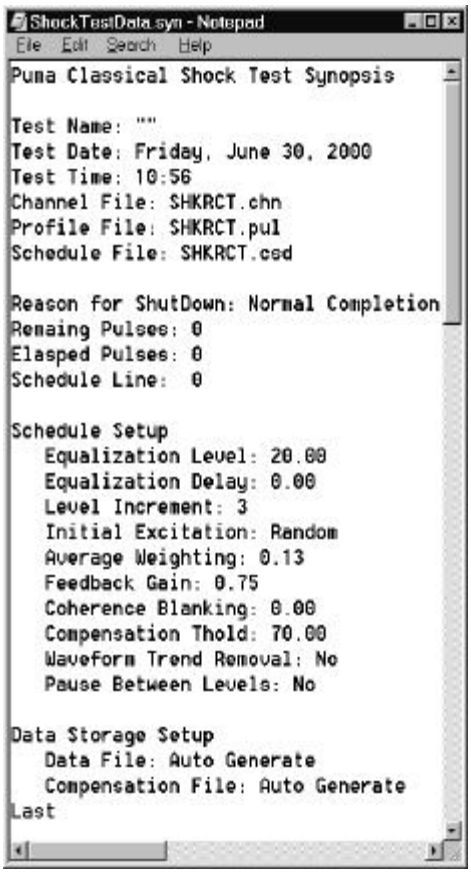
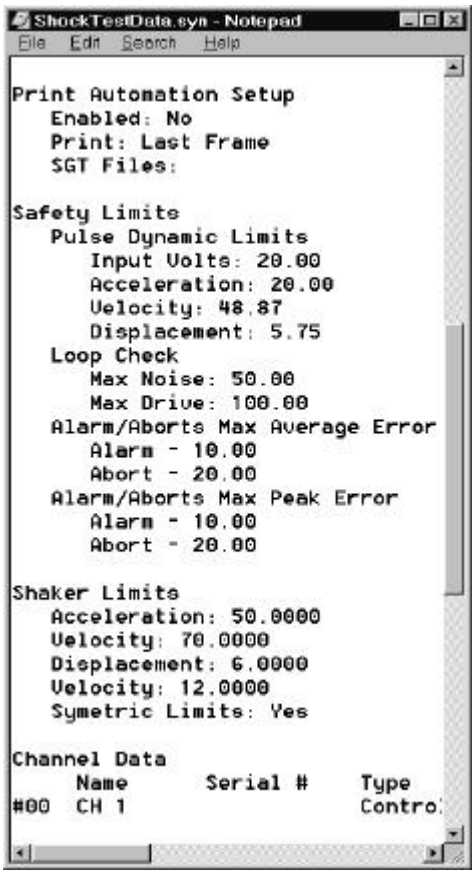



**Figure 7-2. Display Sub-menu After Test Run**



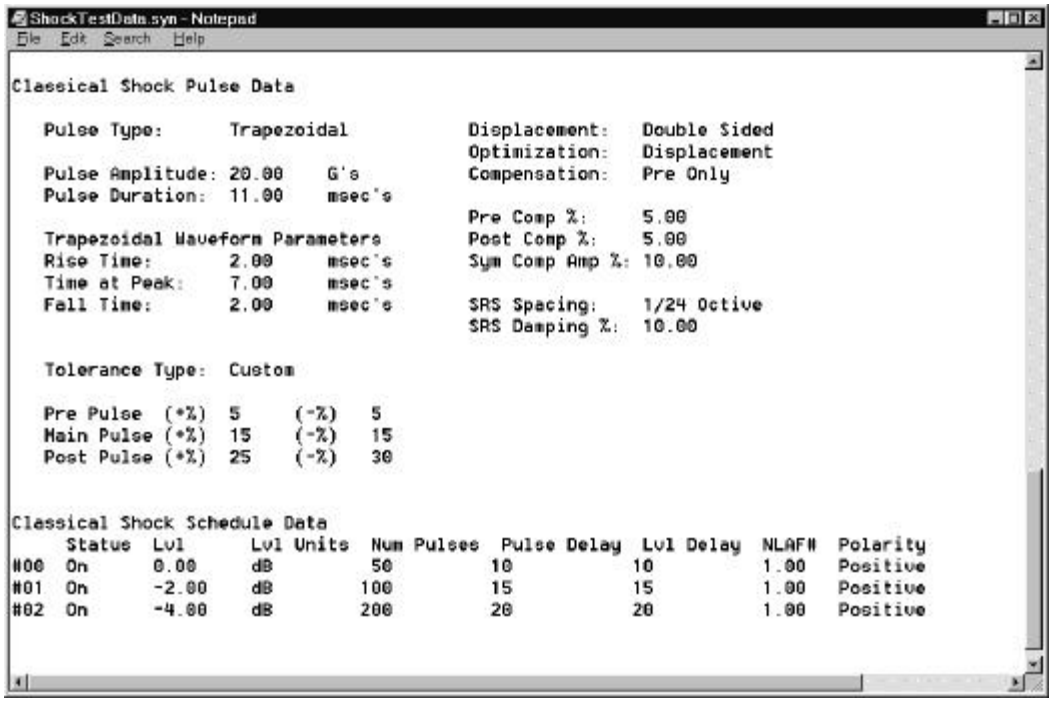




**Figure 7-3. Test Data Notepad of DISPLAY Menu**

### 7.2.2 Choose Report

When the **CHOOSE REPORT** Menu Option is selected, the **OPEN** Dialog Box shown in Figure 7-4 displays. The user is allowed to select the desired synopsis file.

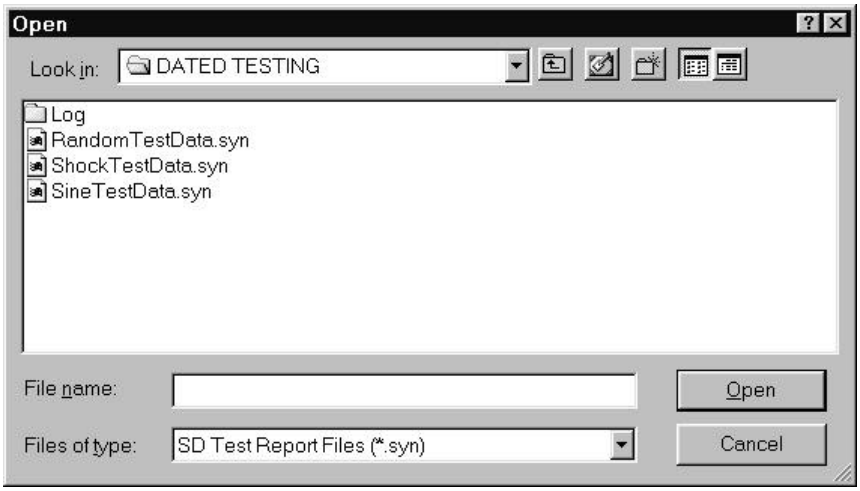



**Figure 7-4. CHOOSE REPORT Menu Option Open Dialog Box**

### 7.2.3 File Summary Info

When the **FILE SUMMARY INFO** option is selected, the {**Document Properties}** Dialog Box shown in Figures 7-5 and 7-6 will display. It has two index tabs, labeled: ***Summary***, and ***Statistics***. At the bottom are the standard Windows buttons <*OK*>, <*Cancel*>, <*Apply*>, and <*Help*>. It is used primarily to annotate the file information. For further information about these buttons see your Windows documentation.

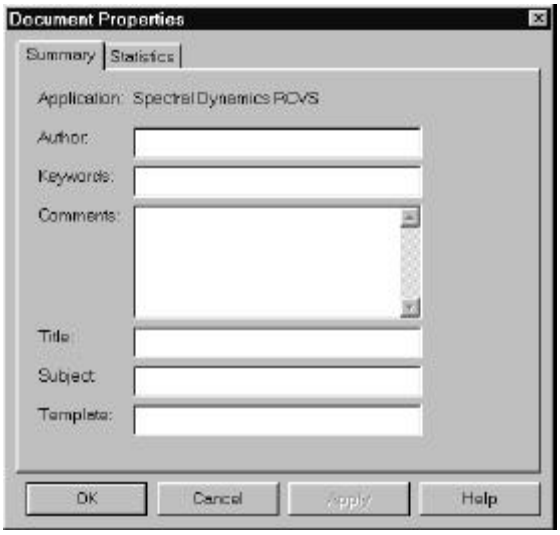



**Figure 7-5. Summary Index Tab**

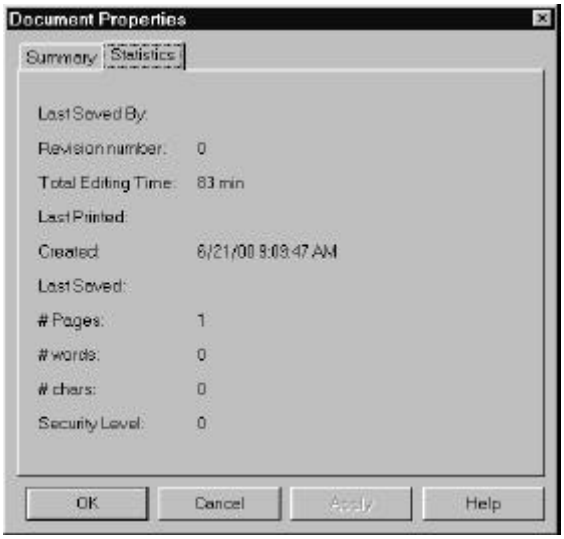



**Figure 7-6. Statistics Index Tab**

#### 7.2.3.1 Summary Tab

The ***Summary*** Index Tab contains seven fields. The first field [Application], names the software program that is currently loaded. The other six fields [**Author**], [**Keywords**], [**Comments**], [**Title**], [**Subject**] and [**Template]** allow you to add summary information**.**

#### 7.2.3.2 Statistics Tab

Figure 7-6 displays. the ***Statistics*** Index Tab information. It lists ten lines of basic information about when the file was created, how large it is, and so forth.

# Chapter 8 - Help Menu

## 8.1 Introduction

When you select the **HELP** Menu Option from the Shock Synthesis menu bar, the menu shown in Figure 8-1 will display. This menu consists of **HELP TOPICS**, **TUTORIAL**, **HINTS**, **SUPPORT**, and **ABOUT PUMA.**

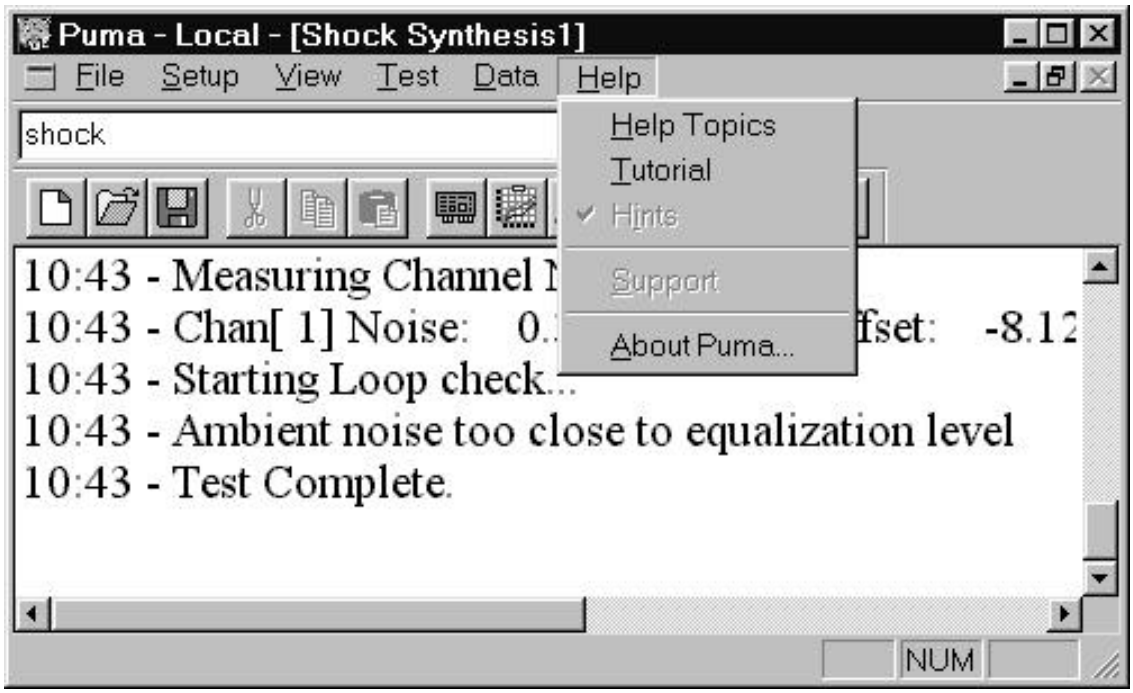



**Figure 8-1. The Help Menu**

## 8.2 Help Sub-Menus

The following paragraphs describe the **HELP** Menu Sub-Menus.

### 8.2.1 Help Topics

The **HELP TOPICS** option works much the same as its Windows counterpart. The window has three tabs labeled ***Contents***, ***Index*** and ***Find***. See Figures 8-2, 8-3 and 8-4.

#### 8.2.1.1 Contents Tab

The ***Contents*** Tab (Figure 8-2) has a list box with a slider bar and three command buttons below it. The buttons are <*DISPLAY*>, <*PRINT*> and <*CANCEL*>.

Each category of information is preceded by a closed book symbol. Double clicking on the category will open the book and can display two types of sub-category options. One is another closed book indicating further sub-categories. The other option is a page with a question mark on it. Double clicking on this will display the information dealing with the subject.

The Shock Synthesis category can display three levels of information. When the ***Contents*** Tab is closed or cancelled the action resets the window to the default.

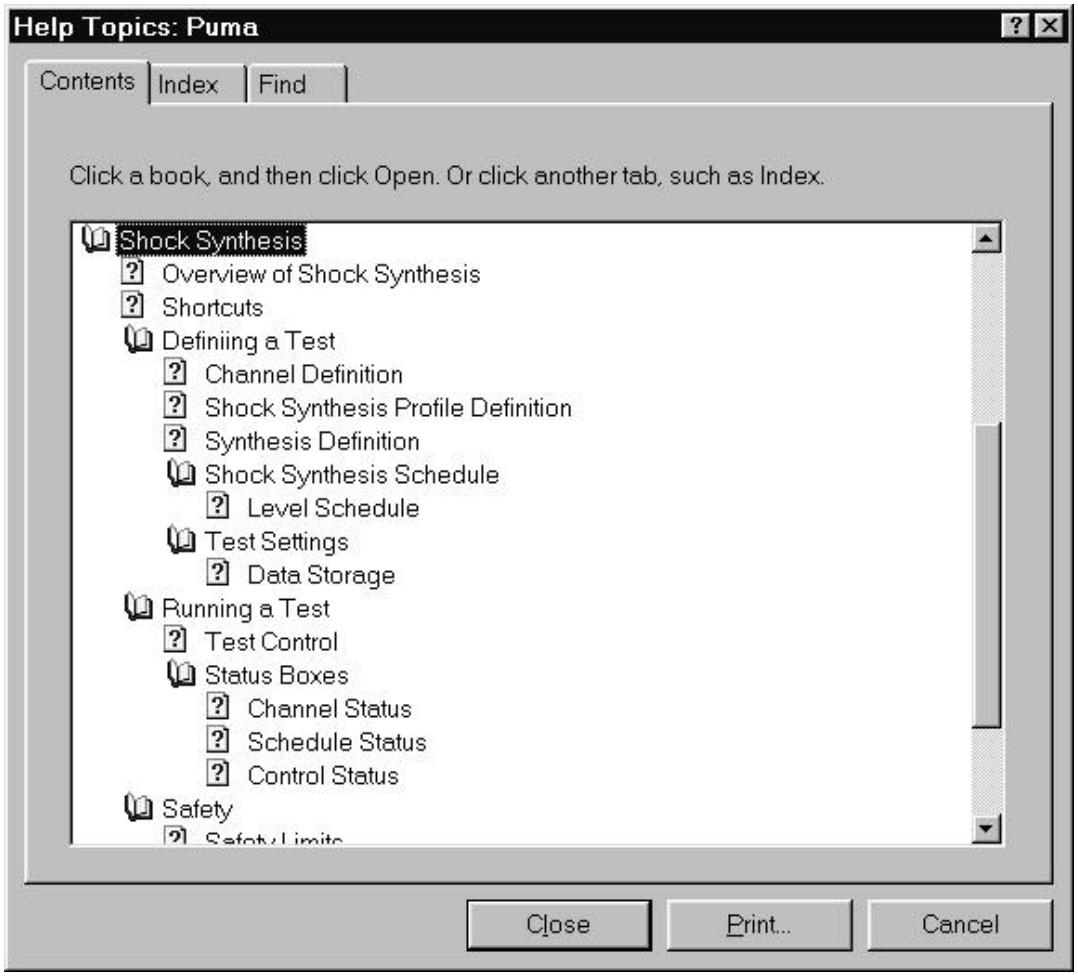



**Figure 8-2. Help Topics Contents Tab**

### 8.2.1.2 Index Tab

The ***Index*** Tab (Figure 8-3) has a text box above the list box. Typing the subject of the search will highlight a category to be opened or display a dialog box prompting a different entry. Below the window are the three command buttons <*DISPLAY*>, <*PRINT*> and <*CANCEL*>. When the ***Index*** Tab is closed or cancelled the action resets the window to the default.

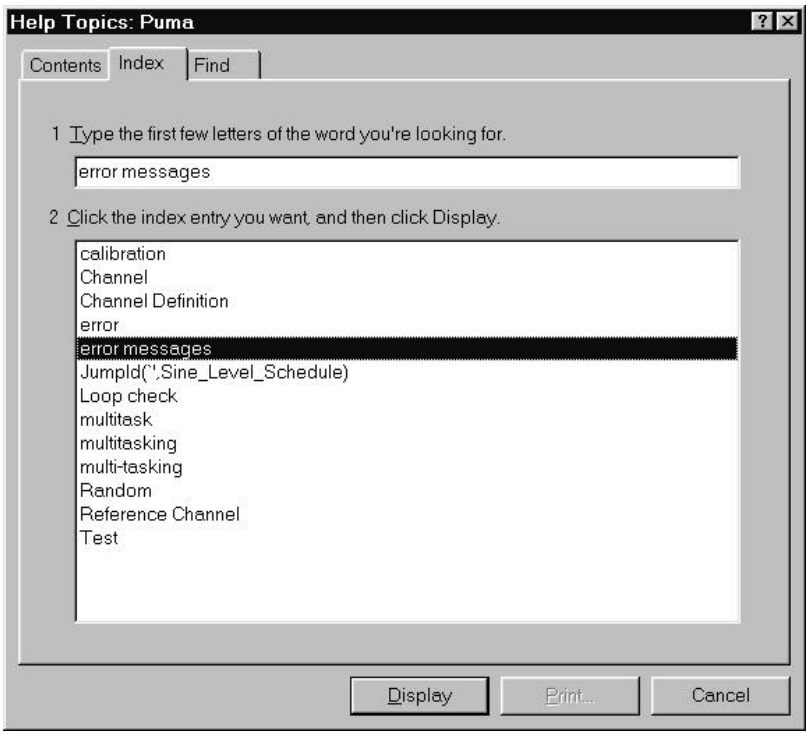



**Figure 8-3. Help Topics Index Tab**

### 8.2.1.3 Find Tab

The ***Find*** Tab allows the user to initiate an advanced search for information. Prior to using this option a new list of words / terminology must be generated. Just follow the prompts to build this listing. When the Find Tab is first opened a Find Setup Wizard Window appears. See Figure 8-4. When the database listing is finished the Find Tab Window appears. See Figure 8-5. When the ***Find*** Tab is closed or cancelled it is **not** reset to the default.

**Figure 8-4. Find Tab Option Setup Wizard**

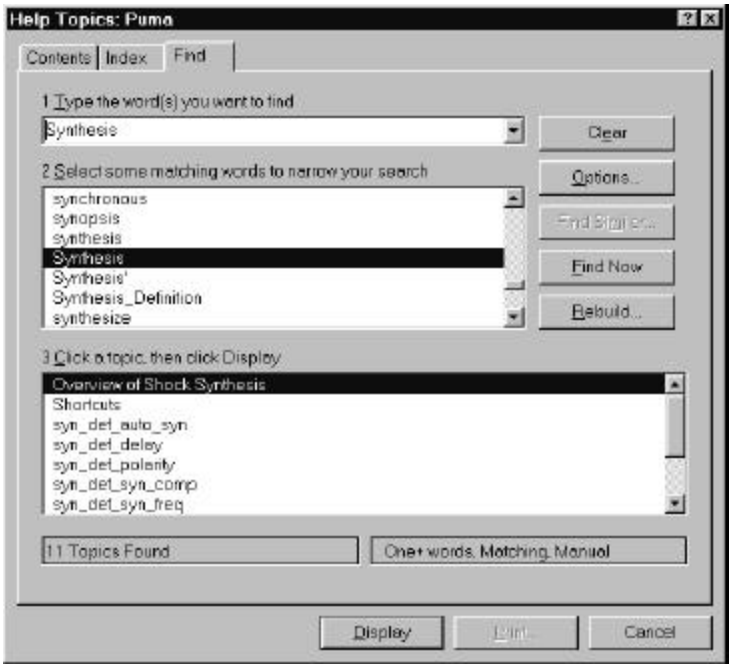



**Figure 8-5. Help Topics Find Tab**

During the course of a search for information, the Find action can be refined with the <*Options*> Command Button. Clicking on it launches the Find Options Dialog shown in Figure 8-6. If the information required is in a file or has to be saved to a file click on the <*Files*> Command Button to launch the File Options Dialog shown in Figure 8-7.

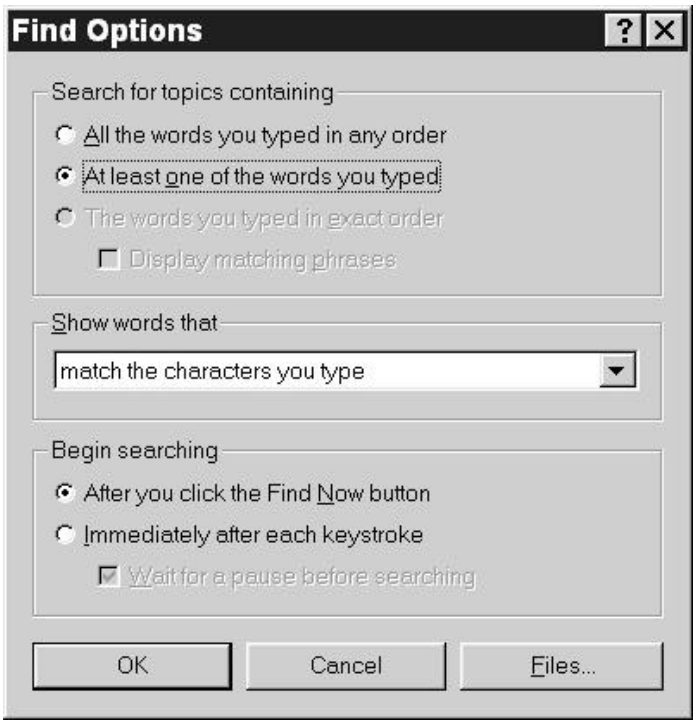



**Figure 8-6. Find Tab Options Dialog**

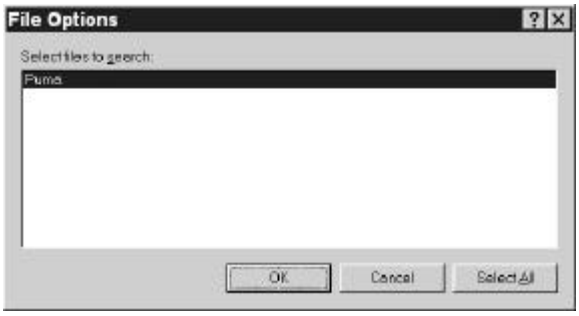



**Figure 8-7. Find Tab File Options Dialog**

### 8.2.2 Tutorial

Some parts of the Tutorial are still being constructed. The Tutorial Screen and  is divided into two sections, a narrow vertical rectangle on the left and a large square on the right. The default dialog contains five grayed out graphic buttons (Figure 8-8). When the cursor arrow is placed on them it changes to a pointing hand and the graphic buttons change color to indicate being active.

The large square contains text messages, two sets of buttons and the link to the Spectral Dynamics Internet Home Page. The top set of three buttons are labeled <Quit>, <Options> and <Begin>. The lower set of six buttons hold the labels that are associated with the particular graphic button in the left-hand rectangle. Each time a graphic is selected the labels on the six buttons change. Figure 8-9 shows the button options for an activated eye graphic.


**Figure 8-8. Default Help Tutorial Screen**

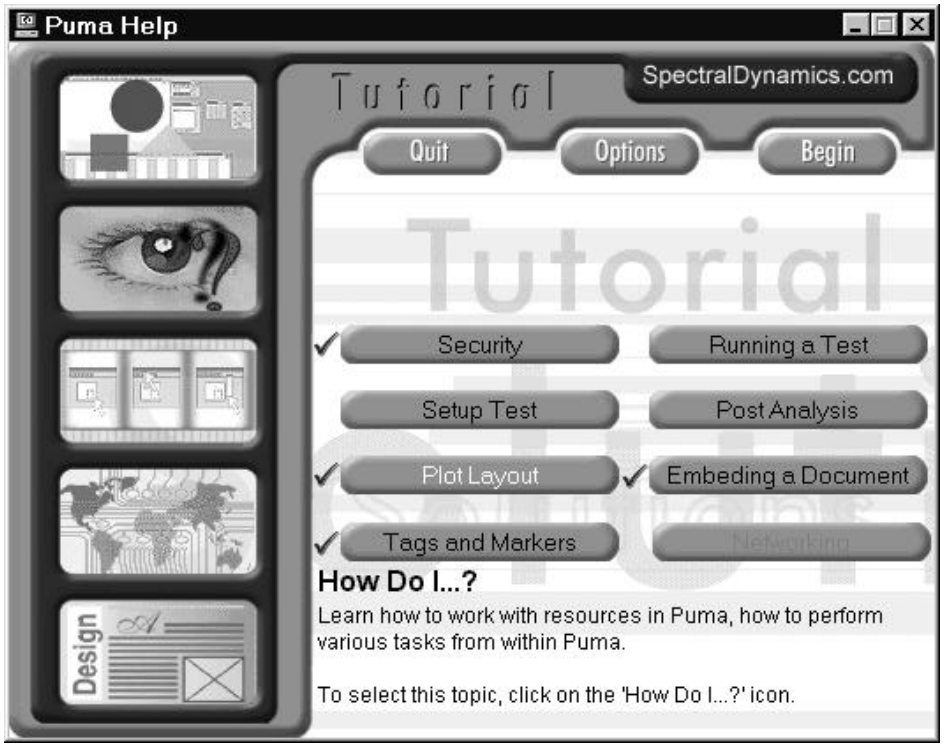



**Figure 8-9. Help Tutorial Window**

### 8.2.3 About PUMA

The About PUMA Window (Figure 8-10) features a rolling, bouncing cube with pictures of a Puma and the CATS PUMA logo. The right side of the window displays version and build and copyright information.

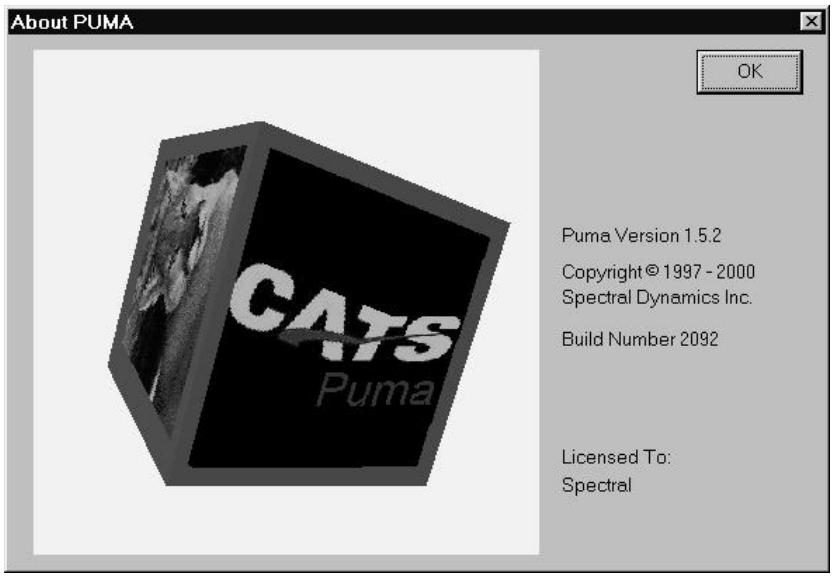



**Figure 8-10. Help Menu's About Puma Screen**